United States Department of the Interior
FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In Reply Refer To:
81420-2009-F-0203-1

NOV 01 2010

Ms. Jane M. Hicks
Regulatory Branch (Attn: Bob Smith)
San Francisco District
U. S. Army Corps of Engineers
1455 Market Street
San Francisco, California 94103-1398

Subject: Biological Opinion on the San Francisco Public Utilities Commission (SFPUC) Crystal Springs/San Andreas (CS/SA) Transmission Upgrade Project, San Mateo County, California (Corps file number 400143S)

Dear Ms. Hicks:

This letter is in response to the December 1, 2009, request for the initiation of formal consultation with the U.S. Fish and Wildlife Service (Service) for the San Francisco Public Utilities Commission (SFPUC) Crystal Springs/San Andreas (CS/SA) Transmission Upgrade Project (proposed project) in San Mateo County, California (U.S. Army Corps of Engineers (Corps) file number 400143S). Your request for formal consultation was received by this office on December 2, 2009. At issue are the potential effects of the proposed project on the threatened California red-legged frog (*Rana draytonii*) and its designated critical habitat, the endangered San Francisco garter snake (*Thamnophis sirtalis tetrataenia*), the endangered mission blue butterfly (*Icaricia icarioides missionensis*), and the threatened Marin dwarf-flax (*Hesperolinon congestum*). This biological opinion is issued under the authority of the Endangered Species Act, as amended (16 U.S.C. 1531 *et seq.*) (Act).

This biological opinion is based on: (1) the September 2009 *Crystal Springs/San Andreas Transmission Upgrade Project Biological Assessment for the U.S. Fish and Wildlife Service* prepared by ICF Jones & Stokes, Oakland, California; (2) the October 2010 *Crystal Springs/San Andreas Transmission Upgrade Project Conceptual Restoration, Revegetation and Enhancement Plan* prepared by May & Associates, San Francisco, California, and ICF International, Oakland, California; (3) various discussions and correspondence between the Service and SFPUC; (4) site visits on November 25, 2008, and July 15, 2010, to the proposed project area; and (5) other information available to the Service.

Consultation History

November 25, 2008:	The Service attended a site visit of the proposed project along with SFPUC and ICF Jones and Stokes.
February 3, 2009:	The Service attended an Interagency Permitting Task Force (IATF) meeting with SFPUC, the Corps, the Regional Water Quality Control Board (RWQCB), and California Department of Fish and Game (CDFG) to discuss a proposal to compensate for effects to listed species by the proposed project by converting non-native vegetation to native vegetation on lands within and adjacent to the action area.
June 11, 2009:	The Service met with SFPUC and ICF Jones & Stokes at the Sacramento Fish and Wildlife Office to review the proposed project, species effects, and proposed mitigation/compensation.
September 23, 2009:	The Service received the *Crystal Springs/San Andreas Transmission Upgrade Project Biological Assessment for the U.S. Fish and Wildlife Service* prepared by ICF Jones & Stokes, Oakland, California.
November 6, 2009:	The Service received the *Crystal Springs/San Andreas Transmission Upgrade Project Draft Environmental Impact Report* prepared by ICF Jones & Stokes, San Francisco, California.
December 2, 2009:	The Service received the letter from the Corps requesting initiation of formal consultation for the proposed project.
April 12, 2010:	The Service received the *Crystal Springs/San Andreas Transmission Upgrade Project Environmental Impact Report* Response to Comments.
June 30, 2010:	The Service received the June 2010 *Crystal Springs/San Andreas Transmission Upgrade Project Conceptual Restoration, Revegetation and Enhancement Plan* prepared by May & Associates, San Francisco, California, and ICF International, Oakland, California
July 14, 2010:	The Service attended a site visit of the proposed project along with SFPUC.
August 17, 2010:	The Service and SFPUC discussed the proposed measures to minimize impacts to California red-legged frog during the breeding season.
August 23, 2010:	The Service received via email from SFPUC the revised estimates of habitat disturbance and proposed compensation for the proposed project.
September 16, 2010:	The Service received via email from SFPUC approval of the proposed changes to the conservation measures for the mission blue butterfly.

BIOLOGICAL OPINION

Description of the Proposed Project

The proposed project is located on City and County of San Francisco-owned lands in unincorporated portions of San Mateo County, California, near the Town of Hillsborough and the cities of San Bruno, Burlingame, and San Mateo. The proposed project covers about 146 acres and is composed of five distinct project components that are oriented southeast to northwest, running about 7.6 miles across the Peninsula Watershed.

The proposed project includes upgrades, repairs, and in some instances replacement of the aging facilities that comprise the CS/SA Transmission Upgrade Project as part of the Water System Improvement Program (WSIP). The WSIP program goals were developed to increase the reliability and level of service of the regional water system with respect to water quality, seismic reliability, delivery reliability, and water supply through the year 2030.

To meet the overall goals of the WSIP, the primary objectives of the proposed project are to:

1. Improve the seismic reliability of the CS/SA Transmission System by reducing facility vulnerability to earthquake-related damage to ensure continued operation following a seismic event.

2. Ensure that the CS/SA Transmission System provides transmission flexibility to the regional water system in a manner that will enable the SFPUC to meet its delivery reliability goals in the event of an emergency or during major water system maintenance.

3. Ensure delivery reliability of the CS/SA Transmission System by providing a means to access and repair CS/SA Transmission System facilities, including culverts, adits, and the CS/SA Pipeline.

4. Meet California Division of Safety of Dams requirements for dam facilities in an emergency drawdown scenario.

To provide context for the components of the proposed project, a description of the existing facilities and operations is included below.

<u>Existing Crystal Springs/San Andreas Transmission System</u>

The existing CS/SA Transmission System is composed of raw water storage reservoirs and water conveyance (or delivery) facilities. Water storage facilities include Upper and Lower Crystal Springs Reservoirs and San Andreas Reservoir. The water conveyance facilities include the culverts (upper and lower) between Upper and Lower Crystal Springs Reservoirs within the Upper Crystal Springs Dam; the Crystal Springs Outlet Structures 1 and 2 leading to the Crystal Springs Pump Station; the CS/SA Pipeline between the Crystal Springs Pump Station and San Andreas Reservoir; and the San Andreas Outlet Structures 2 and 3 leading to the Harry Tracy

Water Treatment Plant (WTP) Raw Water Pump Station. A summary description of these facilities and their existing operation within the CS/SA Transmission System is provided below.

Upper and Lower Crystal Spring Reservoirs

Crystal Springs Reservoir, composed of Upper and Lower Crystal Springs Reservoirs, is located at the southern end of the action area. Upper and Lower Crystal Springs Reservoirs receive water from the Hetch Hetchy System, treated Alameda Watershed supplies, and water from local watershed sources including Pilarcitos and San Mateo creeks (both within the Peninsula Watershed). Local water supplies diverted from Stone Dam, located west of the proposed project, are also conveyed to and stored in Crystal Springs Reservoir.

From the Pulgas Water Temple, the majority of the flow goes directly into the 3.4-mile-long Crystal Springs Bypass Tunnel and the 4,500-foot-long Crystal Springs Bypass Pipeline that connects to the Crystal Springs Pipeline and the Sunset Supply Pipeline, conveying water to users in northern San Mateo County and San Francisco. The conveyance of the remaining water to Upper Crystal Springs Reservoir is determined by the flow rate of the source waters from the Hetch Hetchy System and Alameda Watersheds and the demand on the system. If the water from these sources is in excess of the demand, the excess flows are conveyed into Upper Crystal Springs Reservoir. Prior to entry into the reservoir the combined Hetch Hetchy System and Alameda Watershed supplies are treated at the Pulgas Dechloramination Facility in order to meet regulatory discharge requirements and to protect the water quality in the reservoir (SFPUC 2004).

Upper Crystal Springs Dam Culverts

The Upper Crystal Springs Dam divides Crystal Springs Reservoir into Upper and Lower Crystal Springs Reservoirs. Water generally flows freely through two culverts (Upper and Lower) located within the face of the dam and between both reservoirs. The Upper Culvert is located within the west side of the dam and the Lower Culvert is located within the east side of the dam.

The Upper Culvert is composed of an inlet on the south side of the Upper Crystal Springs Dam consisting of four reinforced concrete inlet tunnels that merge into two reinforced concrete tunnels running through the dam abutment and discharge through a twin-opening outlet. The Upper Culvert originally had a wooden-timber gate trestle housing four gate valves at the inlet portal that could be closed, shutting off or isolating flow between Upper and Lower Crystal Springs Reservoirs. The gate trestle has been demolished and functioning gate valves no longer exist.

The Lower Culvert is comprised of an inlet tower, a tunnel with inlet and outlet portals, and a gate valve shaft housing an isolation gate valve. A trash screen covers the inlet tower. The inlet tower is constructed of bricks. The inlet portal is composed of riveted cast iron pipe encased in brick. The outlet portal is composed of a brick tunnel, a small portion of which is lined with a cast iron pipe, which terminates into Lower Crystal Springs Reservoir. The Lower Culvert gate valve shaft is located approximately midway between the inlet and outlet portals, and extends vertically up to a manhole located in the westbound lane of State Route 92 atop the Upper

Crystal Springs Dam. The isolation gate valve within the shaft is no longer functional; therefore, flow within the Lower Culvert is unrestricted between Upper and Lower Crystal Springs Reservoir. The Lower Culvert crosses the San Andreas Fault.

The adjacent shorelines at the Upper and Lower Culverts are fenced and not publicly accessible. No exterior nighttime lighting exists at either the Upper or Lower Culvert.

Crystal Springs Outlet Structures 1 and 2

The Crystal Springs Outlet Structure 1 (constructed ca. 1890) and Crystal Springs Outlet Structure 2 (constructed ca. 1936), are located along the eastern bank of Lower Crystal Springs Reservoir, about 200 feet apart, on the upstream side of the Lower Crystal Springs Dam. Both outlet structures convey water from Lower Crystal Springs Reservoir to the Crystal Springs Pump Station, which is located northeast and below the Lower Crystal Springs Dam. Each outlet structure consists of three inlet adits (horizontal water intake openings located at depth below the normal operating level), a tower (that houses the adit valving), a pedestrian access bridge between the shore and tower for maintenance access, and a connecting tunnel and pipeline to the Crystal Springs Pump Station. The Crystal Springs Outlet Structures 1 and 2 tower structures extend about 30 and 43 feet above the average reservoir waterline, respectively. For both outlet structures, water is drawn through the adits into the tower and gravity fed through a tunnel to the Crystal Springs Pump Station. The adit intakes are covered by fish screens.

The components of the Crystal Springs Outlet Structure 1 are constructed of brick masonry housing steel pipes and valves. Its tower is about 130 feet in height, of which about 43 feet is freestanding above the reservoir embankment. A total of three steel intake adit pipes connect to a standpipe (a vertical pipe used to connect piping and/or secure uniform pressure in a water-supply system within the tower that leads to a pipeline running within a 370-foot long tunnel), ultimately connecting to the Crystal Springs Pump Station. Because of its age and material type, structural weaknesses in the Crystal Springs Outlet Structure 1 have led to leaks within the tower and tunnel. The resulting standing water restricts maintenance access within this facility.

The components of the Crystal Springs Outlet Structure 2 are similar in nature to the Crystal Springs Outlet Structure 1. However, the Crystal Springs Outlet Structure 2 is constructed of reinforced concrete. Its tower is about 110 feet high, of which about 30 feet is freestanding above the reservoir embankment. Internal workings of the intake adits, including valving and piping, are generally comparable to the Crystal Springs Outlet Structure 1 in design and function. Each adit feeds into the tower standpipe, which then feeds into a pipeline running through an approximately 640-foot-long tunnel connecting to the Crystal Springs Pump Station. Unlike the Crystal Springs Outlet Structure 1, the Crystal Springs Outlet Structure 2 components do not leak substantially; therefore, unrestricted access is provided for operations, maintenance, and repair within this facility.

Both outlet structures are restricted from public access by a fenced/gated entry. Vehicle access is through a gated entry from the Sawyer Camp Trail. Pedestrian access is also through a gated entry from the adjacent parking lot north of the Lower Crystal Springs Dam. No exterior nighttime lighting exists at the Crystal Springs Outlet Structures 1 and 2.

Crystal Springs Pump Station

The Crystal Springs Pump Station (built in 1933 with later additions in 1968) pumps water stored in Lower Crystal Springs Reservoir through the CS/SA Pipeline to San Andreas Reservoir. The Crystal Springs Pump Station is located northeast of and below the Lower Crystal Springs Dam, within a small flat valley situated in a general east-west orientation. The Crystal Springs Pump Station is southeast of the intersection of Skyline Boulevard and Crystal Springs Road, and partially underneath the Interstate 280 Eugene A. Doran Memorial Bridge. San Mateo Creek runs along the southern boundary of the Crystal Springs Pump Station facility site. The Crystal Springs Pump Station site includes the Crystal Springs Pump Station building, a chlorine/fluoride building, an electrical substation, an electrical enclosure (housing the switchgear connecting the substation to the Crystal Springs Pump Station), a generator, a propane tank, and an abandoned gauge house. The Crystal Springs Pump Station building (about 34 feet by 120 feet) contains mechanical and electrical equipment (e.g., pumps, motors, electrical conduits, light fixtures, etc.) and a 6-ton bridge crane. The chlorine/fluoride building (about 34 feet by 94 feet) houses an emergency chemical injection system for disinfection of raw water and a 300-kilovolt emergency generator. Onsite power for the Crystal Springs Pump Station facilities is provided by an onsite 3-megavolt-ampere (MVA) 50-year-old electrical substation owned by the Pacific Gas & Electric Company (PG&E), and a 60-kilovolt (kV) which is fed by a transmission line from the PG&E Jefferson-Martin Transmission System. The Crystal Springs Pump Station facility also includes the associated water supply piping and valves necessary to send water to San Andreas Reservoir, or in an emergency, directly into the water supply distribution system via the Crystal Springs Pipeline No. 2 and Sunset Supply Pipeline. Existing access around the site consists of gravel and paved roads. Parking onsite is informal.

The majority of the Crystal Springs Pump Station facility perimeter is fenced, with restricted access provided by a 0.25-mile-long narrow road from a gated entrance off Crystal Springs Road. Exterior nighttime lighting at the Crystal Springs Pump Station consists of building-mounted fixtures at entrances to the pump station building and the chlorine/fluoride building.

Crystal Springs/San Andreas Pipeline

The CS/SA Pipeline is an existing 60-inch steel pipe that conveys water about 25,000 feet (4.7 miles) from the Crystal Springs Pump Station northwest to San Andreas Reservoir. The maximum capacity that the Pipeline could currently handle is 127 million gallons per day.

The pipeline has 36 valves: 18 air vacuum valves and 18 blow-off valves. Each air vacuum valve is housed in a 6-foot-diameter concrete manhole riser. The design of the manhole riser can also accommodate an access manhole adjacent to the air valve. The top cover of the manhole riser is typically a hinged, lightweight aluminum cover. The exact height of the manhole protrusion above the ground varies depending on the field condition (typically between 2 and 3 feet above the ground surface).

These valves accommodate drainage of pipeline segments by allowing air to enter the pipe as the water is drained from low spots in the pipeline via blow-off valves (similar to how a straw releases liquid when you remove your finger from the opposite end). Conversely, these same valves allow air to escape the pipe as it fills back up with water. Blow-off valves drain into creeks and other drainage channels along the CS/SA Pipeline via feed pipes connecting to the main pipeline.

The last 1,400 linear feet of the CS/SA Pipeline approaching San Andreas Reservoir is known as the San Andreas Inlet Structure. The San Andreas Inlet Structure includes a 66-inch-diameter steel pipe crossing an unnamed ephemeral drainage on supports (circa 1940s), a concrete tunnel (referred to as Tunnel 3, circa 1860s), a concrete flume (channel) with a side-flow weir (circa 1930s), a concrete siphon (circa 1940s), and a concrete chute/spillway (circa 1940s). The remaining 23,600 feet of the CS/SA Pipeline between the Crystal Springs Pump Station and the San Andreas Inlet Structure were installed in 1968.

The CS/SA Pipeline has ten raw water service connections, including to the Crystal Springs Golf Course, to fire hydrants along the Sawyer Camp Trail, and to SFPUC Watershed Keeper residences.

The CS/SA Pipeline is exposed at four locations where it crosses drainages but is otherwise buried below creek crossings. A total of 36 drainages cross the CS/SA Pipeline alignment (four perennial, 22 intermittent, and 10 ephemeral), of which 15 have existing culvert crossings in varying condition.

The CS/SA Pipeline is located within restricted fenced-off portions of the watershed that are not publically accessible. Several existing footpaths and roadways in the watershed provide access to portions of the pipeline alignment, including the publicly accessible Sawyer Camp Trail and other existing paved, gravel, dirt, and ungraded (i.e., vegetation removal only) service roads. However, access directly onto the pipeline alignment is restricted.

An area about 30 feet wide, centered on the pipeline alignment for much of its length, has been partially cleared of brush and trees for pipeline maintenance and repair access. No exterior nighttime lighting exists along the CS/SA Pipeline alignment. However, there are a few instances of adjacent lighting, including at the intersection of Crystal Springs Road and Skyline Boulevard, near a Watershed Keeper's house, and by the San Andreas Reservoir Inlet Structure.

San Andreas Reservoir

San Andreas Reservoir was originally constructed in 1870 to collect drainage from the watershed of San Andreas Creek. The reservoir also receives flows from Pilarcitos Reservoir and water pumped from Crystal Springs Reservoir. The collected water is pumped through the CS/SA Pipeline into the reservoir, and is transported to the Harry Tracy WTP through the San Andreas Outlet Structures 2 and 3 (described below). The collected water is treated at the Harry Tracy WTP before being conveyed to the regional system for delivery to customers.

San Andreas Outlet Structures 2 and 3

Built in 1938 and 1944, respectively, the San Andreas Outlet Structures 2 and 3 are located about 2,000 feet apart on the northeastern shore of San Andreas Reservoir (above the high water line).

Restricted access to these structures is provided by watershed maintenance access roads. Components of each outlet structure include adits covered with fish screens, a reinforced concrete tower housing adit valving, and a connecting tunnel and pipeline that run northeast from the outlet structures at the reservoir shoreline to the Harry Tracy WTP.

The San Andreas Outlet Structures 2 and 3 towers are 58 and 66 feet tall, respectively, with about 8 feet of each tower visible above the reservoir shore. Both towers are dry and function as access points for internal repairs, inspections, and other maintenance activities. The San Andreas Outlet Structure 2 Tunnel is about 800 feet long and contains a buried pipeline. The San Andreas Outlet Structure 3 Tunnel is about 1,300 feet long with about 1,200 feet of buried and exposed pipeline.

The San Andreas Outlet Structure 2 has one operable lower adit and one inoperable upper adit that is abandoned and plugged with concrete. The San Andreas Outlet Structure 3 has two operable adits (lower and middle) and one inoperable upper adit that is abandoned and plugged with concrete. Water is generally drawn through the adits into the tower and gravity fed through tunnels to the Harry Tracy WTP. The San Andreas Outlet Structure 2 Tunnel ends at the San Andreas Outlet Structure 2 Tunnel Portal, at the northern end of the Harry Tracy WTP, where it connects to piping conveying water to the Raw Water Pump Station, also located at the Harry Tracy WTP. The San Andreas Outlet Structure 3 Tunnel ends at the San Andreas Outlet Structure 3 Tunnel Portal at the southern end of the Harry Tracy WTP where water is also conveyed to the Raw Water Pump Station.

The San Andreas Outlet Structures 2 and 3 are located within restricted, fenced portions of the watershed that are not publically accessible. No exterior nighttime lighting exists at the outlet structures. However, the utility building adjacent to the San Andreas Outlet Structure 3 has low-level security lights on a photocell timer at its primary entry.

Existing Operations

This section discusses the existing operations associated with the CS/SA Transmission System facilities described above. Existing operations are susceptible to the total disruption of Hetch Hetchy System and Sunol Valley water supplies following a seismic event, to maintenance shutdowns of the Pulgas Tunnel, and to drought conditions. To minimize water shortages that could occur in droughts, or if the conveyance system had to be taken out of service for maintenance or in an earthquake or other emergency, the SFPUC stores as much water as possible in its local reservoirs in the San Francisco Bay Area.

Upper and Lower Crystal Springs Reservoirs

The full combined capacity of Upper and Lower Crystal Springs Reservoirs is about 69,000 acre-feet, which is the maximum historic capacity when the reservoirs are filled to a maximum normal surface elevation of 291.78 feet. Since 1983, the Division of Safety of Dams has placed operational restrictions on the Lower Crystal Springs Dam due to concerns regarding the ability of the dam spillway to meet current standards for major flood events. The Division of Safety of Dams operational restrictions have reduced the historical capacity of the combined reservoirs by about 16 percent, for a current maximum capacity of 58,400 acre-feet at a maximum normal water surface elevation of 283.8 feet. The reservoirs typically fluctuate between 33,000 and 58,400 acre-feet.

Historically, control of water flow and elevation between the reservoirs was conducted through isolation gate valves on the Upper Crystal Springs Dam Culverts. However, the gate valves have been demolished or are no longer operable. As a result, water flow between the reservoirs cannot be isolated to allow varying water levels and controllable water exchange between the reservoirs.

The SFPUC aims to fill the Crystal Springs Reservoirs to maximum capacity by the end of each rainy season in the San Francisco Bay Area and each snowmelt season in the Sierra Nevada. Tuolumne River water enters the reservoir at its south end through the Pulgas Discharge Channel. Water also enters the reservoir as runoff from the surrounding watershed. Storage in the reservoir typically reaches the maximum normal water surface elevation at the end of May and is then drawn down in June, July, and August when stored water is used to meet high summertime water demand. Water withdrawn from Crystal Springs Reservoir is pumped to San Andreas Reservoir where it is withdrawn, treated at the Harry Tracy WTP, and conveyed to San Francisco Peninsula users.

Between November and March, the SFPUC keeps the water surface elevation at Crystal Springs Reservoir several feet below the maximum normal water surface elevations so that operators can accommodate runoff from the reservoir watershed without releasing water to San Mateo Creek. A wintertime spare reservoir capacity of 6,138 acre-feet is maintained for this purpose. Releases to San Mateo Creek occur infrequently; either as the result of a single very large storm or a series of large storms in the Crystal Springs Reservoir watershed.

Emergency drawdown of Upper and Lower Crystal Springs Reservoirs through releases at the Lower Crystal Springs Dam into San Mateo Creek could occur in any of the following highly unlikely scenarios: 1) a Division of Safety of Dams-mandated drawdown of the reservoirs due to a major fracture/damage to the Lower Crystal Springs Dam (i.e., drawdown requirement of 10 percent of Lower Crystal Springs Reservoir in 10 days); 2) a major storm event while the reservoirs are already full necessitating a spill over the Lower Crystal Springs Dam (extremely rare event); or 3) a catastrophic failure of the Lower Crystal Springs Dam (i.e., the dam cannot hold back water in Lower Crystal Springs Reservoir).

Upper Crystal Springs Dam Culverts

The Upper and Lower Culverts convey water by gravity from Upper Crystal Springs Reservoir to Lower Crystal Springs Reservoir. Currently, neither culvert is equipped with functional isolation gate valves; the ability to shut down the Upper and Lower Culverts does not exist, and flows between the upper and lower reservoirs are uncontrolled. In the event of a Division of Safety of Dams-mandated emergency drawdown, the reservoir water surface elevation would drop below the Upper Culvert's inlet elevation, resulting in focused flow through the Lower Culvert. This condition would exceed the hydraulic capacity of the Lower Culvert, resulting in the degradation of the Lower Culvert's brick outlet tunnel, and potentially compromising the integrity of both the Lower Culvert and the Upper Crystal Springs Dam abutment (SFPUC 2007b).

Crystal Springs Outlet Structures 1 and 2

As mentioned above, the Crystal Springs Outlet Structures 1 and 2 transfer water from Lower Crystal Springs Reservoir to the Crystal Springs Pump Station. Water is drawn through the adits, into the tower and through a tunnel to the Crystal Springs Pump Station. In addition to conveying water to the Crystal Springs Pump Station, the Crystal Springs Outlet Structures 1 and 2 serve two additional emergency operational functions including 1) emergency drawdown of reservoir water under the scenarios described above for Crystal Springs Reservoir, and 2) delivery of partially treated water directly into the San Francisco water supply system through Crystal Springs Pump Station connections to the existing Crystal Springs Pipeline No. 2 and Sunset Supply Pipeline that connect to the northern San Mateo County distribution system. The towers associated with these structures serve as access points during outlet operation, maintenance, and repair activities. In the event of an earthquake, the freestanding portions of both outlet towers are vulnerable to collapse. The collapse of one of these towers could result in an uncontrolled release of water stored within the reservoir or restrict flow into the Crystal Springs Pump Station.

Crystal Springs Pump Station

The primary function of the Crystal Springs Pump Station is to pump water into the CS/SA Pipeline, providing enough lift to convey water from Lower Crystal Springs Reservoir (approximate elevation of 280 feet) to San Andreas Reservoir (approximate elevation of 450 feet). Under normal operations, the Crystal Springs Pump Station pumping capacity is 80 million gallons per day. A small pump is used when the Crystal Springs Pump Station is not in operation so that the CS/SA Pipeline remains full in order to provide water for Crystal Springs Golf Course irrigation and service to the Watershed Keeper residences. In an emergency, the Crystal Springs Pump Station can provide booster capability for direct delivery to the broader distribution system through the Crystal Springs Pipeline No. 2 and the Sunset Supply Pipeline.

Water in Lower Crystal Springs Reservoir may be released into lower San Mateo Creek through release valves located at the Crystal Springs Pump Station. Operational releases include annual exercising of the valves as well as occasional controlled releases. Approximately every 5 to 10 years, as conditions necessitate, controlled releases occur during high reservoir events to avoid spilling over the Lower Crystal Springs Dam. Releases in these circumstances typically range between 400 and 600 cubic feet per second for three to five days. An emergency release would occur if an emergency drawdown of reservoir water under the scenarios described above for Crystal Springs Reservoir was required. Such a release has not occurred, and the probability of a catastrophic event that would require the drawdown of the reservoir is extremely low because the dam has been determined to be seismically sound and not vulnerable to a reasonably foreseeable earthquake event.

In addition to operational releases, minor discharges into San Mateo Creek occur regularly from leaky pipes and valves at the Crystal Springs Pump Station. Based on preliminary documentation developed by Philip Williams Associates (2009), various Crystal Springs Pump Station outlet pipes contribute a majority of the 0.68 cubic feet per second of streamflow at this upper reach of San Mateo Creek.

An emergency release may occur if an emergency drawdown of reservoir water under the scenarios described above for Crystal Springs Reservoir was required. Such a release has not occurred, and the probability of a catastrophic event that would require the drawdown of the reservoir is extremely low because the dam has been determined to be seismically sound and not vulnerable to a reasonably foreseeable earthquake event.

Crystal Springs/San Andreas Pipeline

The CS/SA Pipeline conveys water from the Crystal Springs Pump Station north to San Andreas Reservoir. The CS/SA Pipeline also provides water to Crystal Springs Golf Course, fire hydrants along the Sawyer Camp Trail, and to SFPUC watershed facilities.

Maintenance activities include annual exercise of valves and repair as needed; monitoring and repair of erosion or exposed CS/SA Pipeline areas including recoating of exposed pipe segments; and dewatering the pipeline for planned internal inspections. Periodic maintenance is likely to increase over time as the pipeline ages. Access to the pipeline is via Sawyer Camp Trail, watershed roads, and via the pipeline alignment using pickup trucks. Vegetation clearing (i.e., mowing, removal of stump sprouts) occurs bi-annually within a 30-foot wide area (15 feet from the centerline of the CS/SA Pipeline on each side) along the CS/SA Pipeline alignment, along the sides of existing access roads, and around all appurtenance structures. Culvert maintenance includes annual inspections and cleaning/repair as needed.

When maintenance is necessary on the CS/SA Pipeline, the SFPUC uses valves located at all low points along the pipeline that serve as the means to drain the pipeline. The pipeline water is then discharged back into Lower Crystal Springs Reservoir via existing natural, unlined drainages. Because the pipeline water comes from the reservoir, treatment of the water, such as dechlorination, is not necessary prior to discharge.

The CS/SA Pipeline currently shows cracks, spalling (the flaking off of material that is broken off a larger solid body, likely the result of corrosion or weathering), delamination (the separation of layers, which come apart as a result of repeated stress or failure), corrosion, chips, and other visible surface damage. The pipeline's proximity to the San Andreas Fault increases its susceptibility to significant damage and failure during an earthquake. In addition, the aged condition of the San Andreas Inlet Structure makes it an unreliable facility within the transmission system. If the San Andreas Inlet Structure was damaged during an earthquake event, repair would be difficult and lengthy, resulting in several months during which conveyance of water into San Andreas Reservoir would not be possible (SFPUC 2007b, 2008).

San Andreas Reservoir

San Andreas Reservoir receives flows from Pilarcitos Reservoir and Crystal Springs Reservoir via the CS/SA Pipeline. The collected water is treated at the Harry Tracy WTP before being conveyed to the regional system for delivery to San Francisco Peninsula customers. At full capacity San Andreas Reservoir storage volume is approximately 19,000 acre-feet when the reservoir is filled to a maximum normal surface elevation of 449.76 feet. The typical storage volume of San Andreas Reservoir fluctuates between 17,200 and 19,000 acre-feet. San Andreas Reservoir is lowered during the winter to maximize catchment of local runoff (SFPUC 2007a).

San Andreas Outlet Structures 2 and 3

As mentioned above, the San Andreas Outlet Structures 2 and 3 include the components necessary to draw water from San Andreas Reservoir into the Harry Tracy WTP. In an emergency scenario, the San Andreas Outlet Structures 2 and 3 have the ability to deliver water directly into the San Francisco water supply through existing connections to the San Andreas Pipeline No. 2. The San Andreas Outlet Structure 3 also has the ability to deliver water directly into the San Francisco water supply through existing connections to the San Andreas Pipeline No. 3.

The towers associated with these structures serve as access points during outlet operation, maintenance, and repair activities. The lower intake adits and associated piping for the San Andreas Outlet Structures 2 and 3 are within the fault rupture zone of the San Andreas Fault (SFPUC 2007a). In the event of an earthquake, the intake adits could be damaged, substantially restricting or eliminating the ability to convey water from San Andreas Reservoir into the Harry Tracy WTP. Additionally, the tunnel from the San Andreas Outlet Structure 3 has been found to be located over the Serra Fault trace (SFPUC 2009). This tunnel was built in the 1940s of unreinforced concrete. During a seismic event, the structural integrity of the tunnel could fail, preventing water conveyance between the San Andreas Outlet Structure 3 and the Harry Tracy WTP.

Components of the Proposed Project

A description of the proposed improvements for each project component is provided below. The improvements are described from south to north, and are not necessarily represented in the order or phasing of construction. Construction details and scheduling and phasing of construction are discussed in separate sections after the descriptions of the project components. Table 1 below summarizes the locations and total estimated land area of each of the project components.

Upper Crystal Springs Dam Culverts

The first project component includes seismic and functional upgrades to the Upper Crystal Springs Dam Culverts. Proposed improvements include installation of isolation devices at both the Upper Culvert and the Lower Culvert, and seismic improvements to ensure continued integrity and operability of the culverts following an earthquake. In addition, existing boat ramps in Upper and Lower Crystal Springs Reservoirs would be upgraded as needed to accommodate on-water construction (i,e., deployment and use of barges in the reservoir). Temporary staging areas would be constructed at both the Upper Culvert and Lower Culvert and the boat ramps to allow offloading and storage of materials and loading of the barges.

Table 1. Locations and Total Area of the CS/SA Transmission Upgrade Project Components

Project Component	Location	Approximate Area (acres)[a]
Upper Crystal Springs Dam Culverts [Upper and Lower Culverts]	Culverts located on the west side and east side of the Upper Crystal Springs Dam (State Route 92), which divides Upper and Lower Crystal Springs Reservoirs. This component also includes boat ramp access improvements in Lower Crystal Springs Reservoir.	20.1
Crystal Springs Outlet Structures 1 and 2	Located along the eastern bank of Lower Crystal Springs Reservoir on the upstream side of the Lower Crystal Springs Dam	2.5
Crystal Springs Pump Station	Located on the downstream side of the Lower Crystal Springs Dam near the intersection of Skyline Boulevard and Crystal Springs Road	4.3
Crystal Springs/San Andreas Pipeline (CS/SA Pipeline)	Runs from the Crystal Springs Pump Station by Lower Crystal Springs Reservoir to the San Andreas Inlet Structure by San Andreas Reservoir	92.8
San Andreas Outlet Structures 2 and 3	Outlet Structure towers located on the northeastern shore of San Andreas Reservoir. Tunnel Portals located at the Harry Tracy Water Treatment Plant (WTP).	15.3
Total Area		**135.0**

[a] Acreage estimates include land area only. Area within reservoirs has been excluded.

The following activities comprise the proposed improvements at the upper and lower culverts:

1. Relining the downstream portion of the Lower Culvert and construction of a new vertical portal within Lower Crystal Springs Reservoir (downstream side of the Upper Crystal Springs Dam).

2. Construction of an isolation valve and trash rack (a structural device used to prevent debris from entering a hydraulic structure) at the inlet portal on the Lower Culvert (upstream side of the Upper Crystal Springs Dam).

3. Installation of isolation slide gates and an operating platform on the upstream side of the Upper Culvert.

Lower Culvert Relining and New Vertical Portal

The entire Lower Culvert outlet portal would be relined with a new high-density polyethylene liner from about 22 feet downstream of the existing gate shaft to the outlet in Lower Crystal Springs Reservoir (about 328 feet). In addition, a portion of the liner would be encased in lowstrength concrete to reduce the potential for collapse of the brick tunnel during a major seismic event.

The relined outlet portal would continue to cross the San Andreas Fault rupture zone. In order to minimize the potential for failure of the improved outlet portal following a major seismic event, a new vertical portal would be added to the outlet portal on the east side of the San Andreas Fault rupture zone (i.e., before crossing the fault rupture zone). The vertical portal would release water into Lower Crystal Springs Reservoir upstream of the fault rupture zone, ensuring that water could continue to be transferred from Upper Crystal Springs Reservoir to Lower Crystal Springs Reservoir following an earthquake should the portion of the outlet portal crossing the fault rupture zone be damaged.

Excavation for the new vertical portal would include 17,000 cubic yards of dredged or wet material removal within the reservoir below the normal maximum water level, and 5,000 cubic yards of dry material removal from along the shoreline. These excavated materials, referred to as spoils, would be re-deposited in deeper locations within Lower Crystal Springs Reservoir. A portion of the excavated dry material could be utilized elsewhere for the proposed project (such as the Crystal Springs Pump Station or the CS/SA Pipeline) in the event there is a shortfall in acceptable local cut material (see *Spoils Disposal* section below).

Lower Culvert Inlet Portal

Construction of a new inlet portal on the Lower Culvert would require underwater work including a limited amount of excavation (i.e., about 10 cubic yards of material removal). The existing inoperable valve in the gate shaft would be secured in place. A new upstream hydraulic-operated isolation valve would be installed together with a new debris screen. The existing brick inlet tower would be modified to accommodate the new isolation valve and lining. The isolation valve would have stainless steel control lines supported on brackets running up the shoreline where they would then transition into a trench and covered utility box. The control lines would carry water to hydraulically operate the isolation valve in an emergency.

Excavation supporting this work would include the immediate area around the inlet during the modification to the brick structure, installing posts to support the hydraulic lines, and the trench and utility box.

Upper Culvert Isolation Valve Gates and Operating Platform

Isolation valve gates would be installed on the Upper Culvert inlet. Additionally, a 16-foot-by-25-foot steel operating platform and walkway, approximately 70 feet long by 3.8 feet wide, would be constructed on top of the Upper Culvert about 17.5 feet above the existing Upper Culvert inlet. The operating platform and walkway would allow above-water access to the valve gates for manual operation and for maintenance. Excavation would be limited to that necessary for construction of the platform and walkway footings.

Construction Sequencing

Construction of improvements at the Lower Culvert would occur first, followed by construction of improvements at the Upper Culvert inlet.

Crystal Springs Outlet Structures 1 and 2

The second project component includes the seismic upgrade of the Crystal Springs Outlet Structures 1 and 2 located immediately northwest of the Lower Crystal Springs Dam. An essential purpose of this upgrade is to install a control system to selectively withdraw water from different depths to maximize the quality of water transferred to San Andreas Reservoir. The seismic retrofit of the Crystal Springs Outlet Structures 1 and 2 towers and tunnels would also ensure their continued operation following an earthquake.

Improvements for both outlet structures would entail removal of the freestanding portions of their towers and the pedestrian access bridges, as well as removing the internal workings (e.g., standpipes, valves) within each tower. The freestanding concrete portions of the towers would be disposed of in a deep location within Lower Crystal Springs Reservoir. The freestanding brick masonry portion of the Crystal Springs Outlet Structure 1 tower would be disposed of in a permitted landfill or recycled. The pedestrian access bridges would also be disposed of in an appropriate landfill or hazardous waste facility, or recycled if recycling would be determined feasible.

The remaining submerged sections of the towers would be lined with a reinforced concrete structural liner to provide additional structural stability and improve water conveyance. A removable steel plate with access hatch would be installed on top of the remaining tower sections. Following these improvements and removal of the freestanding elements, the structures would be flooded, allowing for direct water transfer from the adits into the tunnel. New replacement fish screens would be installed on each adit. Upgraded adit shutoff valves would be incorporated into both of the structures.

A new on-shore 15-foot-by-25-foot utility building would be constructed adjacent to the Crystal Springs Outlet Structures 1 and 2 to house the electrical supply and hydraulic controls for valve operation within both outlet structures. The design of the utility building would conform to the Peninsula Watershed Management Plan guidelines. Finished surfaces of the building would be constructed of non-reflective metals. Hydraulic control lines supported on brackets would run up the shoreline where they would then transition into a trench before entering the utility building. Power to the utility building would be supplied by a new buried conduit from the Crystal Springs Pump Station routed over the Lower Crystal Springs Dam (under the Skyline Boulevard bridge overpass). A new 15-foot-wide gravel access road (about 75 feet in length) would be constructed between the utility building and Skyline Boulevard.

Excavation supporting this work would include removal of about 300 cubic yards of material in conjunction with retrofitting the adit intake foundations of the Crystal Springs Outlet Structure 1. This material would most likely be removed by hand by underwater divers. Excavated material would be deposited in the reservoir about 45 feet south of the lowest adit intake.

Security Fencing and Lighting

New security fencing would be installed around the Crystal Springs Outlet Structures 1 and 2, including the utility building and related appurtenances. Security fencing would typically be 8-foot-tall galvanized or PVC coated wire chain-link fencing with a 1-inch mesh pattern, topped with 3-strand barbed wire on standard outriggers. Fence foundations would be constructed of concrete and designed to prevent tunneling underneath the fence. Double-leaf gates would be provided for vehicular access where needed; a pedestrian gate would be included adjacent to every vehicular gate. Vehicular gates would have a card reader pedestal outside the fenced perimeter. Where deemed necessary, security cameras would be mounted on poles within the enclosed facility.

New nighttime lighting would include placement of motion-sensor security lighting on the exterior of the proposed utility building.

Construction Sequencing

The Crystal Springs Outlet Structures 1 and 2 would be retrofitted in succession: the Crystal Springs Outlet Structure 2 would be retrofitted first, followed by the Crystal Springs Outlet Structure 1.

Crystal Springs Pump Station

The third project component includes construction of a new Crystal Springs Pump Station and related facility upgrades. To meet the delivery reliability goals, the booster capability and supporting appurtenance equipment would be upgraded to 120 million gallons per day. All major facilities, pipelines, and pipeline connections at the Crystal Springs Pump Station would be replaced, with the exception of the existing Crystal Springs Pump Station building, which would be retained as an unoccupied storage structure. All other existing on-site structures and appurtenances would be demolished and replaced. The design of new on-site structures would conform to the Peninsula Watershed Management Plan guidelines. All work would be completed within the existing footprint of the Crystal Springs Pump Station facility. Existing roads within the Crystal Springs Pump Station site would be modified and/or relocated around the proposed new pump station building. Access to the Crystal Springs Pump Station would remain in its current location off Crystal Springs Road.

New facilities at the Crystal Springs Pump Station would consist of the following:

1. A pump station.

2. A replacement backup generator and propane/natural gas fuel tank for the auxiliary pump.

3. Electrical substation and vicinity piping and power lines.

4. A dissipation structure for operational releases into San Mateo Creek.

5. A surge suppression system to protect the pipeline and pump from surge pressure caused by sudden water stoppage during a power failure.

6. Pipelines and valves for suction and discharge of water at the pump station, isolation from the Crystal Springs Outlet Structures 1 and 2, connection of the dissipation structure, and connections through an air gap to the distribution system on the Crystal Springs Pipeline No. 2 and the Sunset Supply Pipeline.

7. A chemical injection system near the air gap that would include an awning or other structure for weather protection.

8. Drainage improvements including one new air gap/storm drain outfall structure located south of the Crystal Springs Pump Station along San Mateo Creek.

9. Security fencing and exterior motion-sensor lighting.

10. Site landscaping and habitat restoration along San Mateo Creek.

Key improvements are described further below.

Pump Station

The new pump station measuring about 52 feet by 160 feet would be erected within the existing maintained grounds, where the existing chlorine/fluoride building is located. The new pump station would house four main pumps and one auxiliary pump; each main pump would have a capacity of 30 million gallons per day, increasing the new pump station flow capacity to 120 million gallons per day. The smaller auxiliary pump, with a capacity of 1 million gallons per day, would be incorporated into the Crystal Springs Pump Station to support service connections along the CS/SA Pipeline when the main pumps are offline. Emergency chemical injection capabilities would be retained for the Crystal Springs Pipeline No. 2 and the Sunset Supply Pipeline.

Due to the presence of liquefiable soils at the site, the proposed Crystal Springs Pump Station would be supported on a deep foundation system consisting of drilled piers that would underlie the potentially liquefiable soils. Additionally, several proposed pipeline replacements that would run along the southern side of the proposed Crystal Springs Pump Station and along the north bank of San Mateo Creek would be supported on drilled-shaft-supported saddles to mitigate excessive pipe stresses that could be caused by seismic settlements. A site-specific probabilistic ground motion study also would be conducted for any facilities located over liquefiable soils prior to construction. Recommendations from this study, including treatment of the substrate (such as by over-excavation of liquefiable soils or compaction/densification), would be incorporated into the final designs for the proposed project.

The existing pump station would remain operational during the construction of the new pump station facility improvements, with the exception of shutdowns during tie-ins between old and new facilities. The ability to handle an emergency drawdown of Lower Crystal Springs Reservoir would be maintained throughout project construction.

Electrical Substation

A new 10 MVA PG&E electrical substation housing two 5 MVA transformers would be built within the existing maintained grounds to support the increased pumping capacity and auxiliary loads at the Crystal Springs Pump Station. Given the Crystal Springs Pump Station load increase, the existing PG&E electrical substation (3 MVA) would likely be exceeded, particularly in an earthquake-related emergency. Therefore, the proposed project includes the construction of a new electrical substation that would satisfy the normal (4.5 MVA) and emergency (9 MVA) pumping loads to ensure a reliable water supply. The proposed electrical substation would be located northwest of the Crystal Springs Pump Station, and would be about 98 feet by 50 feet in size.

The existing PG&E electrical substation would remain operational during construction, but would be dismantled and removed following construction. A new transmission route would connect from an existing 60 kV line off the Jefferson Martin transmission system located about 170 feet west of the new electrical substation. PG&E would also provide a secondary backup 60 kV transmission line from their Jefferson Hillsdale transmission system so that in the event that the primary 60 kV transmission line goes down, the Crystal Springs Pump Station could be switched via a remotely controlled flip flop switch to the backup line. A new power pole and flip-flop switch would be installed at the connection point to the Jefferson Hillsdale transmission system off of Lakeview Drive in the Town of Hillsborough. PG&E could also require removal of vegetation in the transmission corridor. After the new electrical substation and the Crystal Springs Pump Station are operational, PG&E would remove the idled facilities at the existing electrical substation.

Dissipation Structure

The existing facility outfall pipes would be removed and a new concrete energy dissipater and outfall would be constructed in their place. The dissipation structure would serve as the outlet for release valves during normal operation, and provide a means to safely draw down Lower Crystal Springs Reservoir if required in an emergency.

The new dissipation structure would be about 55 feet long and 30 feet wide, with two 25-foot-by-25-foot chambers. Each chamber would be about 30 feet deep. The walls of each chamber would be made of 18- to 30-inch-thick reinforced concrete. Each chamber would receive a new 60-inch reservoir discharge pipe that would be fitted to a sleeve valve with an electric actuator. Within each chamber, the discharge pipe would bend 90 degrees toward the ground, releasing discharge flows at the bottom of the chamber. Water filling the chambers would flow out of the front of the structure and down the bank into San Mateo Creek. Rock slope protection would be placed on the bank at the toe of the dissipation structure and keyed into the creek bed to provide erosion protection. Approximately 125 cubic yards of rock would be placed on the bank. Construction of the dissipation structure would require limited encroachment into the San Mateo Creek streambank and channel bed.

To compensate for stream flow within San Mateo Creek lost from the replacement of leaky pipes, a new low-flow valve would be installed at the dissipation structure to maintain the pre-project base stream flow condition. Because the low-flow valve would be incorporated into the design of the dissipation structure, installation of the low-flow valve would not result in any additional impacts on San Mateo Creek than would occur as a result of construction of the dissipation structure. Rock slope protection installed as part of the dissipation structure would prevent the release of water from the low-flow valve from causing erosion of the streambed and bank.

Air Gap Outfall Structure

One new 42-inch air gap valve would be installed using conventional cut-and-cover techniques, and would drain via a new outfall pipe daylighting on the bank of San Mateo Creek immediately to the east of Interstate 280 as it runs on the Eugene A. Doran Memorial Bridge. The pipe would discharge stormwater and air gap valve releases onto a 12-foot-by-4-foot concrete outfall structure. The air gap valve prevents backflow into the potable water system and would intermittently discharge approximately 2,000 cubic feet of water per year into San Mateo Creek. The new outlet structure also would accommodate discharges from an existing 36-inch stormwater pipe.

Stormwater Outfall Structure

One new 42-inch pipe would be installed using conventional cut and cover technique to daylight on the bank of San Mateo Creek under the Interstate 280 overpass. The pipe would discharge onto a 12-foot by 4-foot concrete outfall structure constructed similar to the air gap outfall. The pipe would discharge stormwater from the Crystal Springs Pump Station site.

Security Fencing and Lighting

New continuous security fencing would be installed around the Crystal Springs Pump Station and all related appurtenances. Security fencing would typically be 8-foot-tall galvanized or PVC coated wire chain-link fencing with a 1-inch mesh pattern, topped with three-strand barbed wire on standard outriggers. Fence foundations would be constructed of concrete and designed to prevent tunneling underneath the fence. Along San Mateo Creek, security fencing would be constructed outside of riparian areas and generally parallel to the existing creek bank. Double-leaf gates would be provided for vehicular access where needed; a pedestrian gate would be included adjacent to every vehicular gate. Vehicular gates would have a card reader pedestal outside the fenced perimeter. Security cameras would be mounted on buildings and/or poles within the Crystal Springs Pump Station site.

New nighttime lighting would include 13 outdoor 50-watt high-pressure sodium fixtures mounted on aluminum poles at a height of 16 feet. These pole lights would be located along the access road surrounding the new pump station building, along the access to the old pump station building (to be used for storage), and at the new PG&E electrical substation. The 13 pole lights would be motion-sensor activated. Exterior lighting would also include placement of low-level security motion-sensor lighting at the entrances of the proposed structures.

Site Access Improvements

Existing roads within the Crystal Springs Pump Station site would be modified and relocated as needed, specifically to accommodate large delivery trucks, such as for equipment maintenance and emergency delivery of chlorine. On-site parking at the Crystal Springs Pump Station would provide one space for vehicles displaying disabled-person placards or plates, and five other parking spaces.

Construction Sequencing

Construction of the Crystal Springs Pump Station would occur in two major phases. The first phase would be focused on construction of new facilities. The second phase would be focused on demolition of the old pumping equipment and site restoration. Initial construction mobilization would include site preparation activities such as establishment of construction trailer offices, heavy equipment and materials delivery, and related activities.

Phase 1 construction would proceed in the following order:

1. Shutdown No. 1: Bypass piping and valves for the Crystal Springs No. 2 and the Sunset Supply Pipelines would be installed. The Crystal Springs Outlet Structure 2 would be shut down and isolated at this time.

2. Demolition: Chlorine and fluoride buildings would be demolished, and grout would be removed from existing pipelines that are scheduled to be abandoned.

3. Earthwork: Earthwork would include establishment of new site grades, installation of site drainage improvements, and excavation for the new dissipation structure.

4. Facility Construction: Concrete foundations and structural installations for the new pump station and electrical substation (e.g., building, piping, valves, pumps, transformers, etc.), and the new dissipation structure would be completed. Access improvements would be initiated and completed.

5. System Tie-in: Connections to the Crystal Springs Outlet Structure No. 2 would be completed and the system tested before operations resume.

Phase 2 construction would proceed in the following order:

1. Shutdown No. 2: The Crystal Springs Outlet Structure 1 would be shut down and isolated.

2. Demolition: Internal workings of the old pump station (e.g., valves, pumps, etc.) and antiquated electrical substation would be demolished.

3. System Tie-in: Connections to the Crystal Springs Outlet Structure No. 1 would be completed and the system tested before operations resume.

Crystal Springs/San Andreas Pipeline

The fourth project component includes seismic upgrades to the CS/SA Pipeline. As described above, the CS/SA Pipeline is an existing 60-inch diameter (mostly) steel pipe that conveys water approximately 25,000 feet (4.7 miles) from the Crystal Springs Pump Station north to San Andreas Reservoir where it terminates. Proposed improvements to the CS/SA Pipeline consist of the following:

1. Reinforcement of the first 1,100 feet of pipeline leaving the Crystal Springs Pump Station.

2. Replacement of the final 1,500 feet of pipeline and inlet to San Andreas Reservoir.

3. Pipeline improvements, including repair of cement mortar lining, repair of exterior coatings on exposed segments and addition of corrosion protection, repair of pipeline supports at stream crossings, replacement of air vacuum and blow-off valves, replacement of manhole access risers, and installation of seismic pipe joints at lateral service connections.

4. New and improved access roads to and along the CS/SA Pipeline.

These improvements are described further below.

<u>Pipeline Reinforcement</u>

The first 1,100 feet of the CS/SA Pipeline leaving (northwest of) the Crystal Springs Pump Station would be reinforced by application of reinforced carbon fiber liner. This section of the CS/SA Pipeline requires reinforcement to tolerate the higher pumping pressures from the new Crystal Springs Pump Station. Since the application of carbon fiber liner would be on the interior of the pipeline, the improvement would not require trenching of the entire portion of pipeline, but instead at key access points. Pipeline reinforcement activities would require two 45-day and two 30-day shutdowns.

<u>Pipeline Replacement</u>

Near San Andreas Reservoir, about 1,500 feet of the CS/SA Pipeline (including the existing San Andreas Inlet Structure) would be replaced with a new welded steel pipe and reservoir outlet located outside of the San Andreas Fault rupture zone. The existing San Andreas Inlet Structure would be abandoned and left in place. Pipeline replacement activities would occur with the same two 45-day and two 30-day shutdowns noted above, to accommodate four required tie-ins between the old and new facilities.

<u>Cement Mortar Lining Repair</u>

Any surface damage (e.g., cracks, spalls, chips, or delamination) in the CS/SA Pipeline's cement mortar lining would be repaired. To accomplish this, the existing lining would be removed, the inside of the pipe would be cleaned and dried, and a new layer of concrete mortar would be applied. Most of the internal improvements to the CS/SA Pipeline would be spot repairs. Depending on the degree of internal surface damage and the sensitivity of particular pipeline segments to failure in a seismic event, an entirely new pipe lining may be installed. This would be accomplished using two coats of a two-component liquid epoxy with fusion-bonded materials.

Exterior Coatings Repair and Corrosion Protection

Aboveground exposed sections of steel pipe would be recoated using multiple coats of a coal-tar application or using an extruded polyolefin coating system consisting of an adhesive layer and a polyethylene sheath. Additionally, corrosion protection (protection from corrosive soils and stray electrical currents) would be added to the entire CS/SA Pipeline. A combination of coating, lining, mechanical isolation, and cathodic protection (a technique commonly used to control corrosion of metal infrastructure by placing galvanic anodes along the metal surface to direct the corrosion activity) would be used for corrosion protection of existing and new sections of the CS/SA Pipeline.

Pipeline Support Repair

Repairs would be made to the piers supporting the CS/SA Pipeline at exposed drainage crossings, including replacement of pipe saddles as necessary, stabilization of soils and erosion control around individual piers, and retrofitting pier foundations to increase resistance to overturning (i.e., overturning capacity).

Valve and Manhole Access Replacement

All 36 air vacuum and blow-off valves would be replaced with new or retrofitted valve assemblies of similar size. Replacement valve assemblies would be designed with special attention to avoid failures between the valve assembly and the main pipe during severe ground motion or deformation. The manhole risers containing each valve assembly also would be replaced with new risers meeting current SFPUC standards. In addition, all manhole access risers along the CS/SA Pipeline would be replaced with new risers meeting current SFPUC standards.

Seismic Pipe Joint Installation

All lateral service connections to the CS/SA Pipeline would be retrofitted or replaced as part of the seismic upgrade.

Pipeline Access Roads

While access to some segments along the pipeline alignment is provided through existing SFPUC watershed access roads, Crystal Springs Golf Course maintenance roads, the Sawyer Camp Trail, and a portion of the pipeline alignment maintained by mowing and clearing, approximately half of the existing CS/SA Pipeline is remotely located and can be accessed only on foot. Under the proposed project, about 21,890 feet of 15-foot-wide vehicle access roads would be created or improved; 10,814 feet would be new gravel roads and 11,076 feet would be new or rehabilitated grassland roads. The grassland roads would be maintained according to current vegetation management practices (i.e., annual or biannual mowing and clearing). An additional 9,507 feet of 10-foot-wide foot paths would be created to allow non-vehicle or small utility truck access to maintenance sites in difficult locations. Access roads would be constructed within a 30-foot-wide limit of disturbance.

Proposed access road improvements include work at 28 drainage crossing locations along the CS/SA Pipeline alignment. Of these, 13 drainage crossings have existing culverts. Three existing culverts would be cleaned out, seven existing culverts that are deteriorated would be replaced to meet seismic standards, two existing culverts would be replaced with gravel ford crossings, and one drainage with an existing culvert would have a saddle repair (Table 2). At the remaining 15 unimproved drainages, four new culverts would be installed, including two natural-bottom culverts and two concrete-bottomed culverts, six new gravel fords would be constructed, and one foot bridge would be replaced with a maintenance access bridge. In addition, at four drainages, only bank stabilization and/or saddle repair activities would occur.

<u>*Construction Sequencing*</u>

Construction of access road improvements along the CS/SA Pipeline alignment would occur prior to work on the pipeline itself. Pipeline and appurtenance replacement and repair activities would be timed to reduce the number and length of shutdowns (see *Construction Schedule* section below).

San Andreas Outlet Structures

The fifth project component includes the seismic upgrade of the San Andreas Outlet Structures 2 and 3 located on the eastern bank of San Andreas Reservoir and related structures. An essential purpose of this upgrade is to relocate the intake adits for each outlet structure outside of the San Andreas Fault rupture zone. The seismic retrofit of the San Andreas Outlet Structures 2 and 3 Tunnel Portals would also ensure their continued operation following an earthquake.

<u>*Intake Adits Retrofit*</u>

In order to relocate the intake adits outside of the San Andreas Fault rupture zone, preventing the potential for damage following an earthquake, permanent retaining walls would be built along the shoreline about 10 feet west of each outlet structure along the reservoir shoreline. Each retaining wall would house new intake adits and fish screens on the wall itself, replacing the adit piping that currently extends across the fault rupture zone. The retaining walls would be constructed of concrete secant piles (formed by constructing intersecting reinforced concrete piles) and measure about 150 feet in length at the San Andreas Outlet Structure 2 and 190 feet at the San Andreas Outlet Structure 3. The finished walls would stand about 2.5 feet above the ground surface and would extend to a depth of about 55–60 feet.

Open channel approaches would be excavated within the side slope of San Andreas Reservoir below the shoreline at each outlet structure. The excavated channel approaches would be 29 feet

Table 2. Access Road Drainage Crossings

Drainage Number	Pipeline Station Number	Existing culvert? (Yes/No)	Drainage Type	Improvement
1	N/A	Yes	Intermittent	Replace 36" culvert
7	53+60	No	Perennial	New 36" culvert
8a	61+20	No	Intermittent	Gravel ford
8b	69+30	Yes	Ephemeral	Gravel ford; clean out existing culvert
8c	71+00	Yes	Ephemeral	Clean out existing culvert
9	74+52	Yes	Ephemeral	Gravel ford
10a	76+60	Yes	Intermittent	Clean out existing culvert
10b	80+00	No	Perennial	Gravel ford
11	82+75	Yes	Intermittent	Replace 24" culvert
12	89+50	Yes	Intermittent	Replace 24" culvert; bank stabilization
13	94+92	Yes	Intermittent	Replace 36" culvert; bank stabilization
14	101+00	No	Ephemeral	New 24" culvert
15a	104+40	Yes	Intermittent	Replace 36" culvert; bank stabilization
15b	110+56	No	Intermittent	Bank stabilization and saddle repair
18	129+40	Yes	Intermittent	Replace 36" culvert
19	134+40	No	Intermittent	New 24" culvert
21	155+50	No	Intermittent	Repair bridge crossing at existing footbridge
23	164+45	Yes	Intermittent	Clean out existing culvert
24	168+40	No	Intermittent	Bank stabilization
25	175+20	No	Intermittent	Bank stabilization
26	176+00	No	Intermittent	Bank stabilization
27	183+00	No	Intermittent	Gravel ford
28	186+62	No	Perennial	New 36" culvert; bank stabilization
29	192+50	No	Ephemeral	Gravel ford
30	199+50	Yes	Intermittent	Replace 36" culvert; saddle repair
31	202+00	No	Ephemeral	Gravel ford
32	210+50	No	Ephemeral	Gravel ford
33	232+20	Yes	Ephemeral	Saddle repair

wide by 180 feet long at the San Andreas Outlet Structure 2 and 38 feet wide by 240 feet long at the San Andreas Outlet Structure 3, and would allow for reservoir water to flow unimpeded into the new intake adits located in the retaining wall. The sides of the channel approaches would be sloped at a 1:1 ratio (1 horizontal foot for every 1 vertical foot). The upper 10–15 feet would be sloped at a 1.5:1 ratio and protected with rip rap slope protection.

At San Andreas Outlet Structure 2, one new screened intake adit would replace two existing adits (upper and lower). At San Andreas Outlet Structure 3, two new screened intake adits would replace three existing adits (upper, middle, and lower).

Excavation for the in-water open channel approaches and the shoreline retaining walls at the San Andreas Outlet Structures 2 and 3 would include 21,000 cubic yards of dredged or wet material removal within San Andreas Reservoir below the normal maximum water level, and 25,000 cubic yards of dry material removal from along the shoreline during construction-related reservoir drawdown periods (see *Project Construction* below). These spoils would be re-deposited in deeper locations within San Andreas Reservoir. A portion of the excavated dry material could be used elsewhere for the proposed project (the Crystal Springs Pump Station or the CS/SA Pipeline) in the event there is a shortfall in acceptable local cut material (see *Spoils Disposal* below).

Other Outlet Structure Tower Improvements

Other seismic-related improvements to the San Andreas Outlet Structures 2 and 3 towers and appurtenant facilities include removal and replacement of all mechanical, electrical, pipes, valves, platform, and roof frame components inside the outlet structure towers. The steel pipelines and their connector tunnels located between the outlet structure towers and the Harry Tracy WTP would be upgraded or replaced. For the San Andreas Outlet Structure 2, the approximately 800-foot-long steel pipeline within the connector tunnel to the Harry Tracy WTP and related appurtenances (e.g., pressure gages) would be replaced. For the San Andreas Outlet Structure 3, the approximately 1,300-foot-long pipeline may be replaced or, alternatively, may be encased in concrete within the tunnel. Upon completion of all internal workings of the outlet structures, the tower structures would remain dry and accessible for valve operation and maintenance.

Tunnel Portal Upgrades

The San Andreas Outlet Structure 2 Tunnel Portal, located at the northern end of the Harry Tracy WTP, would be used as an access and staging area for removal and replacement of the steel pipeline in the connector tunnel. Additionally, replacement concrete encasements, manhole access, flow meters and valves would be installed at the Harry Tracy WTP, including replacement of the bypass valve box components that provides connection to the Raw Water Pump Station at the Harry Tracy WTP, and bypass connection to the San Andreas Pipelines No. 2 and No. 3.

The San Andreas Outlet Structure 3 Tunnel Portal, located at the southern end of the Harry Tracy WTP, would be used as an access and staging area for pipeline replacement or encasement activities, and for the structural retrofit of the concrete tunnel itself, including additional steel or concrete support at the San Andreas Outlet Structure 3 Tunnel Portal.

San Andreas Boat Ramp

A new permanent reinforced concrete boat ramp (approximately 25 feet wide by 105 feet long) would be constructed about 145 feet southeast of the San Andreas Outlet Structure 2 along the shoreline. The new boat ramp would not be accessible to the public.

Security Communications and Power

A new 20-foot pole would be installed immediately adjacent to each of the San Andreas Outlet Structures supporting a Yagi antenna (a directional antenna system) for wireless communications. A security camera may also be mounted on each pole. A power line would be installed through a trench in the shoulder of the existing watershed road between the outlet structures, providing power and communication to the San Andreas Outlet Structure 3 from the San Andreas Outlet Structure 2.

Construction Sequencing

The San Andreas Outlet Structures 2 and 3 would be retrofitted in succession; the San Andreas Outlet Structure 2 would be retrofitted first, followed by the San Andreas Outlet Structure 3.

Construction Activities

This section discusses the construction activities that would take place to implement the proposed action. These construction activities include:

1. Establishment of easements for temporary work areas.
2. Creation of site access and staging during construction.
3. Dewatering.
4. Reservoir drawdown.
5. Excavation and dredging.
6. Spoils disposal.
7. Removal of construction and demolition debris.
8. Stream crossing improvements.
9. Nighttime construction and lighting.
10. Site restoration.

Each of these activities is discussed in further detail in the subsequent subsections.

Temporary Work Areas and Easements

Temporary work areas would be located predominantly within the proposed project construction limits. Temporary work areas also may include: use of State Route 92 road shoulders and/or closure of the west-bound travel lane (California Department of Transportation [Caltrans] right-of-way) for construction access to the Upper Crystal Springs Dam Lower Culvert gate valve shaft; use and/or closure of portions of the Sawyer Camp Trail (the easement is managed by San Mateo County Parks and Recreation Department) for CS/SA Pipeline access and construction; use of Skyline Boulevard road shoulders for queuing of equipment/materials delivery trucks into adjacent staging areas or the Lower Crystal Springs Reservoir boat ramp; and access within PG&E utility easements (e.g., the Jefferson-Martin Transmission Line Corridor) for construction activities along State Route 92, at the Crystal Springs Pump Station, or at the San Andreas Outlet Structures 2 and 3. Coordination with San Mateo County, PG&E and Caltrans to obtain any needed easement access permits or agreements would be completed by the SFPUC prior to construction.

Site Access during Construction

Numerous paved and gravel dirt roads that exist within the project area would be used for construction-related access. Gated access points along the eastern boundary of the Peninsula Watershed include Hillcrest Boulevard, Trousdale Drive, Black Mountain Road, the Sawyer Camp Trail, Skyline Boulevard, Crystal Springs Road, and the Crystal Springs Pump Station. Construction vehicles would primarily access the Upper Crystal Springs Dam Culverts via State Route 92. The Crystal Springs Outlet Structures 1 and 2, the Crystal Springs Pump Station, and the southern portion of the CS/SA Pipeline would be accessed via Polhemus Road, Crystal Springs Road, Skyline Boulevard (also known as State Route 35 but referred to in this report as Skyline Boulevard), and Golf Course Drive. The northern portion of the CS/SA Pipeline would be primarily accessed via the Interstate 280 exits at Trousdale Drive and Hillcrest Road. The San Andreas Outlet Structures 2 and 3 would be accessed via the Interstate 280 exits at Larkspur Drive and Skyline Boulevard.

The Sawyer Camp Trail, a paved, approximately 15-foot-wide recreational trail that runs adjacent to Lower Crystal Springs Reservoir, would be used as a haul road for the southern section of the CS/SA Pipeline. Pipeline improvements and related construction traffic are anticipated to require segments of the first 2.0 to 2.5 miles from the Sawyer Camp Trail southern trailhead, and 6 miles from the southern trailhead near San Andreas Reservoir to be intermittently shut down for up to 25 total days over the course of the three-year construction period; any trail disruption would be up to five consecutive days at any one time. Roads within Crystal Springs Golf Course would also be utilized for temporary access during construction as needed. Haul routes would be used to deliver construction materials, equipment, vehicles, personnel, and excavated materials to and from project component sites.

In addition to existing roads, access improvements (clearing and/or grading) and new gravel roads would be established at the onset of construction along the CS/SA Pipeline alignment.

Where temporary roads would be retained for maintenance access, or would be located on steep terrain, a gravel layer would be provided for added soil and topographic stability. These access improvements would be used during construction and would remain for long-term maintenance access.

Staging Areas

At the Upper Crystal Springs Dam Culverts, the Crystal Springs Outlet Structures 1 and 2, the Crystal Springs Pump Station, and the San Andreas Outlet Structures 2 and 3, temporary construction staging areas would encompass much of the entire construction limits. The area required for construction staging within these construction limits would be determined by the contractor based on numerous factors such as vehicle access, available storage and staging area, construction sequencing, and the required construction methods. For the CS/SA Pipeline, temporary staging areas would be established in discreet locations along the pipeline alignment to facilitate construction while limiting potential adverse effects on biological resources. These locations may be used for material and equipment staging, access, or storage. Staging areas at the southern end of the CS/SA Pipeline would be used for staging construction management trailers as well as material and equipment staging and storage.

Before these areas could be functional, most of the proposed construction staging areas would require preliminary work, such as vegetation removal, minor grading, soil stabilization with gravel (or other method), temporary fencing, and placement of silt fences.

Construction staging also would occur on barges in Upper and Lower Crystal Springs Reservoirs at the Upper Crystal Springs Dam Culverts, in Lower Crystal Springs Reservoir at the Crystal Springs Outlet Structures 1 and 2, and in San Andreas Reservoir at the San Andreas Outlet Structures 2 and 3. Temporary moorings would be established within the Lower Crystal Springs Reservoir to secure the barges near the Upper Crystal Springs Dam Lower Culvert, barges near Crystal Springs Outlet Structures 1 and 2, and within the San Andreas Reservoir to secure the barges near San Andreas Outlet Structures 2 and 3 during construction. Moorings would be constructed of piles (e.g., steel H-beam, rods, or similar) driven into the bottom of the reservoir.

Barges would consist of a series of floating blocks that can be connected and locked together to form a large floating platform for construction purposes. Barge assembly and launching would occur at one of three boat ramps (one located within each reservoir; the San Andreas Reservoir boat ramp being constructed as part of the project).

Regional Office

The existing Watershed Keeper's house located at the southern end of the CS/SA Pipeline would be modified to accommodate the regional construction management staff. Alterations and additions to the property would include repairing the kitchen floor, painting, replacing extant single-pane windows with double-pane windows, replacing the extant propane-fired heating unit, fitting the property with a new septic receiving tank to be located outside the building, repairing the roofs of the residence and garage, and installing a new electrical panel and wiring. After approximately four years of use as an office space, the property would be converted back to a residence.

Reservoir Drawdown

Reservoir water elevations at Crystal Springs Reservoir and San Andreas Reservoir may need to be lowered for select periods of time to accommodate construction access for improvements at the Upper Crystal Springs Dam Culverts, the Crystal Springs Outlet Structures 1 and 2, and the San Andreas Outlet Structures 2 and 3. If not already at the necessary elevation for construction activities, Crystal Springs Reservoir would be lowered to an elevation of 270 feet (1929 NGVD) for up to 120 days. San Andreas Reservoir would be lowered to an elevation of 435 feet (1929 NGVD) one year and 430 feet (1929 NGVD) another year, for 90-120 days each year, in association with work on the individual San Andreas Outlet Structures. The lowering of the reservoirs, however, would be within normal operating levels.

Dewatering during Excavation

Dewatering would be required during excavations for the construction of the San Andreas Outlet Structures 2 and 3, and the dissipation structure at the Crystal Springs Pump Station.

Crystal Springs Pump Station Dissipation Structure

An approximately 70-foot-long temporary cofferdam would be constructed approximately 5 feet from the dissipation structure construction area. The cofferdam would be constructed of approximately 50 cubic yards of imported clean fill material over approximately 420 square feet of creek bed, or of sheet piles. This area would then be dewatered during excavation and construction of the dissipation structure. Water pumped during dewatering operations would be directed to a settling basin to allow suspended solids to settle before being discharged to San Mateo Creek.

During dewatering, a screened pump meeting CDFG and National Marine Fisheries Service screening criteria would be used to prevent entrainment of steelhead and other aquatic organisms by the pump. Additionally, water discharged to San Mateo Creek would meet the discharge requirements of the San Francisco Bay RWQCB.

San Andreas Outlet Structures 2 and 3

Drawdown of San Andreas Reservoir, described above, would allow the excavation for the central portions of the retaining walls (where the intake adits would be located) for the San Andreas Outlet Structures 2 and 3 to be excavated during the dry season. Dewatering of the excavation pit would be necessary given immediate proximity to the reservoir and is estimated to be on the order of 1,200 gallons per minute for 90 days at each outlet structure. Water pumped during dewatering would be discharged to San Andreas Reservoir, allowing suspended solids to settle out in the reservoir. The turbidity of water entering the Harry Tracy WTP would be reduced to acceptable levels through the placement of silt curtains surrounding the active outlet structure while the inactive outlet structure is renovated.

As an alternative to dewatering, the SFPUC also is considering the use of ground freezing technology. Ground freezing involves the placement of a series of close-ended steel pipes in the ground along the perimeter of the excavation. Liquid nitrogen, calcium chloride brine, or carbon dioxide is circulated through the pipes, freezing the soil around the pipes. The frozen soil creates an impermeable layer and acts as a cofferdam, preventing groundwater from entering the excavated pit. This technique would greatly reduce, if not eliminate, the need for dewatering during construction at the San Andreas Outlet Structures 2 and 3.

Pipeline Dewatering

Pipeline dewatering would be required to drain the CS/SA Pipeline during pipeline shutdowns, to drain sections of pipes at the Crystal Springs Pump Station prior to removal, abandonment, or tie-in to connections such as the Crystal Springs Pipeline No. 2 and the Sunset Supply Pipeline, and to drain the connecting pipelines at each outlet structure.

Crystal Springs Outlet Structures

The internal pipelines associated with the Crystal Springs Outlet Structures would be drained prior to construction. This would total approximately 100,000 gallons for the Crystal Springs Outlet Structure 1 and 14,000 gallons for the Crystal Springs Outlet Structure 2.

Crystal Springs/San Andreas Pipeline

Dewatering of the CS/SA Pipeline during construction would be similar to current operations and maintenance procedures. Blow-off valves located at all low points along the CS/SA Pipeline would serve as the means to drain individual pipeline segments. Water through these valves would be manually released. The pipeline water would be discharged into tributary drainages that ultimately flow into Lower Crystal Springs Reservoir. Because this is the water's point of origin (i.e., it is raw, untreated water), no dechloramination would be required. Dewatering would occur at the commencement of each of the pipeline shutdowns. Table 3 provides estimates of the water volumes discharged from each blow-off valve within the system to dewater each section of the CS/SA Pipeline. Pipeline dewatering would be conducted by implementing SFPUC standard operating procedures for pipeline discharges to ensure the receiving drainage is not affected (e.g., energy dissipation measures would be implemented). Prior to putting the proposed new pipeline segments into service, the segments would be filled and pressure tested with raw water from the reservoirs. This water would be discharged directly to the system, either through the dewatering procedure described above, or through conveyance to San Andreas Reservoir.

Crystal Springs Pump Station

The internal pipelines at the Crystal Springs Pump Station would be drained as they are shut down and replaced. The drainage could result in more than 44,000 gallons of water being

Table 3. CS/SA Pipeline Summary of Construction Dewatering Blow-Off Locations and Discharge Volumes

Blow-Off Station	Drainage ID	Volume (cubic feet)
21+40	OW-3	12,513
27+75	OW-4	38,928
53+55	OW-7	11,782
60+90	OW-8	17,251
76+60	OW-10a	32,523
83+25	OW-11	21,494
94+90	OW-13	30,694
110+56	OW-15b	10,441
124+77	OW-17	29,733
129+70	OW-18	11,064
134+85	OW-19	7,648
139+65	OW-20	15,374
155+70	OW-21	28,882
161+30	OW-22	14,953
168+70	OW-24	12,228
176+40	OW-26	16,585
187+40	OW-28	32,012
210+90	OW-32	70,299

Source: SFPUC 2008.

discharged to San Mateo Creek at the Crystal Springs Pump Station. Individual discharges to the creek would be less than 10,000 gallons.

<u>*San Andreas Outlet Structures*</u>

The internal pipelines associated with the San Andreas Outlet Structures would be drained prior to construction. This drainage would total approximately 200,000 gallons for each outlet structure. This water would be pumped directly into the Harry Tracy WTP.

Excavation and Dredging

Excavation work would be required for all project components. Excavation at the Upper Crystal Springs Dam Culverts and at the San Andreas Outlet Structures would utilize both onshore excavators and offshore barge-mounted dredge equipment. Onshore excavated materials would be loaded into haul trucks and transported to locations within the project for reuse, or disposed of at the landfill (see *Soils Disposal* section below). Dredging within reservoirs would be accomplished using either a hydraulic suction dredge or a clamshell (i.e., bucket) dredge. If a hydraulic suction dredge is used, excavated materials could be discharged via pipe directly to the proposed disposal locations. Alternatively, dredged materials could be stockpiled on a barge for transport to the disposal location in the reservoir where materials would be dumped. If a clamshell dredge is used, excavated materials would be stockpiled and transferred via barge to the reservoir disposal location. Excavation at the Crystal Springs Outlet Structure 1 would be accomplished by divers using hand equipment.

Silt curtains would be placed in the reservoirs to manage the turbidity of reservoir water resulting from in-water dredging or excavation. In Lower Crystal Springs Reservoir, silt curtains would be used at the Crystal Springs Outlet Structures 1 and 2, and would be placed around each outlet structure during its retrofit (starting with the Crystal Springs Outlet Structure 2). In San Andreas Reservoir, silt curtains would be used at the Crystal Springs Outlet Structures 2 and 3, and would be placed around the actively operating outlet structure (starting with the San Andreas Outlet Structure 2). Silt curtains would not be placed around the Upper Crystal Springs Dam Lower Culvert outlet excavation, nor would silt curtains be placed around the disposal locations within Lower Crystal Springs Reservoir or San Andreas Reservoir. Turbidity within the reservoirs would be monitored at various points in relation to excavation and disposal locations. Should turbidity levels exceed allowable thresholds as determined by SFPUC for water supply management, additional silt curtains would be employed around either areas of active excavation or disposal in conjunction with other turbidity reduction measures (e.g., reduced rate or period of excavation or dredging).

Soil stockpiling would occur onsite in many of the noted construction staging areas or alongside pipeline installation and be reused as needed under construction of the proposed project components.

New Pipe Installation

Pipeline installation would occur primarily through an open trench construction method. Trench excavations would generally be 9 feet deep by 13 feet wide, but could be more than 20 feet in some limited areas due to existing topography at the site. Open trench construction involves: (1) vegetation removal and grading (within 30 feet of the pipeline alignment, or 15 feet on either side of the centerline) prior to construction, and may include removal of trees, shrubs, and grassland; (2) trench excavation and shoring (stabilizing the sides of the trench), as necessary; (3) pipe installation; (4) trench backfilling and compacting; and (5) surface restoration. Equipment would include excavators, graders, loaders, dump trucks, and backhoes. Excavated soil of suitable quality (i.e., not contaminated and without rock) would be stockpiled for later reuse as backfill. Excess soil would be hauled off the site (see *Spoils Disposal* section below).

Spoils Disposal

Construction activities (i.e., excavation and dredging) would generate excess quantities of rock and soil as spoils. Dredged or wet spoils would be disposed of in either Lower Crystal Springs Reservoir or San Andreas Reservoir, as noted in the project construction descriptions. Dry spoils may also be disposed of in the reservoirs, reused onsite, reused at other project component sites, or disposed offsite. Where feasible, spoils handling and offsite disposal would be minimized through onsite disposal or reuse.

For purposes of estimating the amount of generated spoils that may require offsite disposal, it is assumed that approximately 15 percent of the total spoils generated, or 13,773 cubic yards, would be transported offsite to a licensed disposal facility (Sivyer 2009). Most of these spoils would be generated as a result of excavation and cut-and-fill activities from the work areas for the San Andreas Outlet Structures 2 and 3. Construction and demolition materials that could not be reused onsite, such as concrete, asphalt, pipeline segments, and other materials and construction debris, are estimated to be approximately 1,020 cubic yards (275 tons) for the entire study area (Sivyer 2009).

Spoils would be tested for hazardous materials; if hazardous materials are found through testing, the soils would be disposed of at a licensed disposal site. Potential hazardous material disposal sites include Waste Management's Kettleman Hills Disposal Site in Kettleman City, California, and the Waste Solutions Yard in San Francisco.

Construction Demolition and Debris Removal

The majority of demolished structures, as well as all of the steel components associated with these structures, would be hauled offsite. Construction debris (e.g., concrete) may be hauled to recycling facilities if deemed acceptable for reuse. The exposed portions of the Crystal Springs Outlet Structures 1 and 2 towers would be among the excavated materials placed at depth in Lower Crystal Springs Reservoir. All hazardous materials would be disposed of at appropriate locations in accordance with Federal, State, and local regulations.

Stream Crossing Improvements

Stream crossing improvements would include either the construction of culverts or gravel fords. Both are described further here.

<u>Culverts</u>

At six locations, existing culverts would be removed and replaced with reinforced concrete culverts. Following removal of the old culvert and prior to new reinforced concrete culvert placement, a trench would be excavated to a depth that would allow a minimum 3 feet of cover between the top of the culvert and the top of the road. The reinforced concrete culvert would be placed on top of a minimum of 6 inches of aggregate base material within the trench. The upstream and downstream ends of the pipe would be fitted with concrete headwalls or flared ends set at the natural channel elevation. Riprap would be placed upstream and downstream of the headwalls or flared ends for additional energy dissipation and scour protection. Fill material placed over the new culverts would be stabilized using erosion control fabric and hydroseeded to protect water quality. Other disturbed areas would be stabilized with mulch, hydroseed, fiber rolls, and other measures.

Fords

Ford construction would consist of riprap placed in the streambed from top of bank to top of bank, and extending 3 feet laterally on either side of the roadway. Clean rock aggregate would be laid on top of the riprap and extended a minimum of 5 feet beyond the top of bank along the access roadway.

Nighttime Construction and Lighting

Nighttime construction would be required during 24-hour work, such as shutdowns for tie-ins, and as other circumstances dictate the need for 24-hour work. It is anticipated that nighttime lighting would be used for construction activities at the Upper Crystal Springs Dam Culverts for possible nighttime gate valve shaft access within State Route 92, the Crystal Springs Pump Station, along the CS/SA Pipeline for pipeline tie-ins, and at the San Andreas Outlet Structures 2 and 3 (including work at the tunnel portals). Nighttime lighting would consist of mobile light towers with four 1,000-watt lamps. A 5- to 7-acre area can be lighted at 0.5 foot candles when all four lamps are turned on.

Site Restoration

At the conclusion of construction within each of the project component sites, disturbed natural areas would be revegetated (i.e., graded to match existing surrounding contours and revegetated with suitable native habitats such as oak woodland, perennial grassland, riparian woodland and wetlands). Native vegetated areas temporarily disturbed would be restored, and nonnative woodland vegetation areas would be converted to native grassland and oak woodland upland habitat. Site restoration would also include the conversion of nonnative blackwood acacia areas adjacent to the CS/SA Pipeline project footprint to native woodland or grassland habitats. The methods for restoring and monitoring revegetated areas are described in the *Crystal Springs/San Andreas Transmission Upgrade Project Conceptual Restoration, Revegetation and Enhancement Plan* (May & Associates and ICF International 2010).

Project Workforce

The number of workers necessary for construction activities at all project components ranges from 30–105. It is estimated that the following number of workers would be needed: 10–50 for CS/SA Pipeline and Crystal Springs Pump Station construction; and 10–30 workers for the Crystal Springs Outlet Structures 1 and 2, the Upper Crystal Springs Dam Culverts, and the San Andreas Outlet Structures 2 and 3. Worker parking would occur within the construction limits. Any additional parking needed for peak construction activities would be minimized by shuttling workers to and from the project component sites from the overflow parking at Crystal Springs Golf Course.

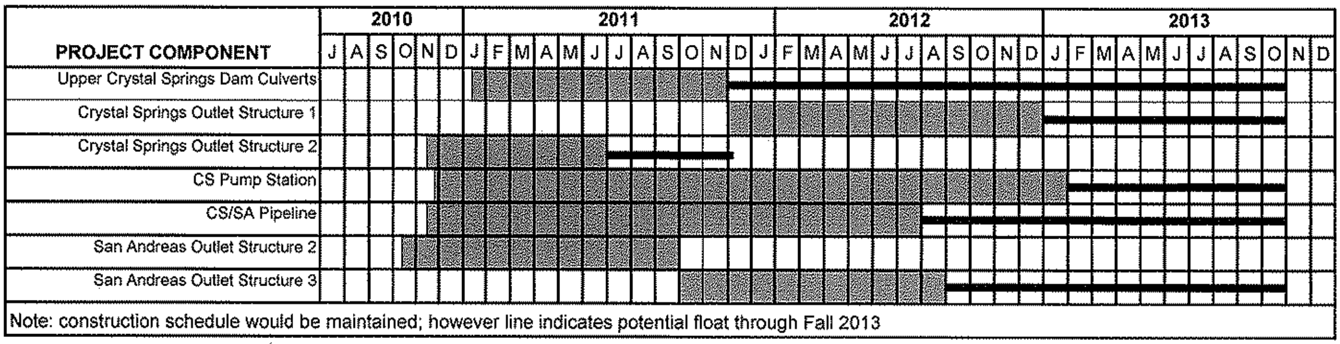
Construction Equipment

Construction equipment would likely include, but is not limited to: pile drivers (impact), water trucks, barges, boats, decompression chambers, rigging and winches, dive equipment, remotelyoperated underwater vehicles, hydraulic jacks, water trucks, fuel and lubrication trucks, street sweepers, concrete trucks, stationary concrete pumps and hoses, Baker tanks, drill rigs, lighting, crane trucks, flatbed trailer, low-boy trailer, dump trucks, bulldozers, backhoes, excavators, front loaders, graders, dewatering pumps, welding machines, multipurpose saws, wood saws, towable light stand/generator, drills (pneumatic), compressors, and jack hammers.

Construction Schedule

Construction of the proposed project is estimated to require upwards of three years, beginning in fall of 2010 and ending in fall of 2013. The construction of the proposed project would be phased based on location and time of year, with some activities occurring concurrently over the five project component sites, and other activities requiring sequential implementation (Table 4). Each phase would include pre-construction (surveys, etc.) and post-construction activities (surface restoration, testing, etc.).

Table 4. Construction Schedule.



In general, construction hours would be from dawn till dusk (7:00 a.m. to 6:00 p.m.), Monday through Friday, and 9:00 a.m. to 5:00 p.m. on Saturday. Construction hours would be unrestricted in parts of the watershed located at least 700 feet away from residential areas such as at the Upper Crystal Springs Dam Culverts or portions of the CS/SA Pipeline. Nighttime work could also be required (see *Nighttime Construction and Lighting* section above). Shutdowns of the water system may require construction work on a 24 hours/day basis to minimize impacts to the operation of the water system. The shutdown period for delivering water from Crystal Springs to San Andreas Reservoirs is not expected to be longer than 45 days at any one time. Approximate construction durations by project component are shown in Table 5 below.

Operations and Maintenance

There would be no substantial changes to the normal operation of the CS/SA Transmission System, with the exception of the improved reservoir drawdown capabilities within Lower Crystal Springs Reservoir and the ability to isolate Upper Crystal Springs Reservoir. Existing operational practices would continue at all other project component facilities upon project completion. Emergency operations would be improved with the increased capacities of the Crystal Springs Pump Station and the CS/SA Pipeline allowing 120 million gallons per day to be delivered to San Andreas Reservoir.

Table 5. Approximate Construction Durations by Project Component

Project Component[a]	Construction Activities	Approximate Duration (months)
Upper Crystal Springs Dam Culverts	Lower Culvert Inlet	4.5
	Upper Culvert Inlet	2
	Lower Culvert Outlet	3.5
Crystal Springs Outlet Structure 1	Lower Adit Work	2
	Middle Adit Work	2
	Upper Adit Work	1.5
	Tower Work	4
	Tunnel Work	7.5
Crystal Springs Outlet Structure 2	Lower Adit Work	0.5
	Middle Adit Work	0.5
	Upper Adit Work	0.5
	Tower Work	3
	Tunnel Work	4.5
Crystal Springs Pump Station	Shutdown No. 1	5 days
	Phase 1 Demolition	2
	Phase 1 Earthwork	2
	Pump Station Construction	5.5
	Electrical Substation Construction	2.5
	Dissipation Structure Construction	4.5
	Shutdown No. 2	1 day
	Phase 2 Demolition	1
CS/SA Pipeline	Access Road Work	4
	Pipeline Work (without shutdown)	2
	Pipeline Work (with shutdown)	7
	Existing Pipeline Demolition	1
San Andreas Outlet Structure 2	Retaining Wall and Channel Approach	8.5
	Tower Work	3
	Tunnel Work	8
	Tunnel Portal Work	1.5
San Andreas Outlet Structure 3	Retaining Wall and Channel Approach	11
	Tower Work	3
	Tunnel Portal Work	4

[a] The Crystal Springs Outlet Structures 1 and 2 as well as the Crystal Springs Pump Station would be constructed concurrently. The current schedule would include upgrades to the CS/SA Pipeline at the same time; however, the seasonal restraints anticipated for the pipeline may require the construction activities to be performed independently from the Crystal Springs Pump Station and the Crystal Springs Outlet Structures 1 and 2.

Maintenance activities would continue to include annual exercise and repair of valves as needed; monitoring and repair of exposed CS/SA Pipeline areas including recoating of exposed pipe segments and erosion control in these areas; and dewatering the pipeline for planned internal inspections and maintenance. Because of the addition of submerged control valves at the Crystal Springs Outlet Structures 1 and 2, and the Upper Crystal Springs Dam Lower Culvert, there would be an increased need for divers to perform underwater inspections of submerged facilities.

Additionally, maintenance access to all valves and stream crossings along the alignment would continue via pickup trucks. New access roads along the CS/SA Pipeline alignment would require routine maintenance. Vegetation clearing (i.e., mowing, removal of stump sprouts) would occur bi-annually within a 30-foot wide area (15 feet from the centerline of the CS/SA Pipeline on each side) along the CS/SA Pipeline alignment, along the sides of all new and existing access roads, and around all appurtenance structures. Culvert and gravel ford maintenance would include annual inspections, and cleaning/repair as needed. Crushed base rock would be applied to access roads to maintain an all-weather surface. Access roads also would be graded as needed with a tractor and scraper box to fill in ruts and washouts.

Conservation Measures

Conservation Measure 1: Conduct an Environmental Education Program for Construction Crews

Before any work occurs in designated construction areas, a Service-approved biologist will conduct a mandatory environmental education program for construction personnel regarding federally and State-listed species that could potentially occur on-site (i.e., mission blue butterfly, California red-legged frog, San Francisco garter snake, and Marin dwarf-flax). The environmental education program will include a description, representative photographs, and legal status of each listed species; terms and conditions of the biological opinion; and the penalties for not complying with biological conservation measures.

The program will cover the restrictions and guidelines that must be followed by all construction personnel to avoid or reduce effects on federally listed species during project construction. The SFPUC will ensure that the contractor is responsible for ensuring that construction personnel adhere to the guidelines and restrictions. If new construction personnel are added to the project, the crew foreman will ensure that the personnel receive the mandatory training before starting work. This may take the form of written instruction and/or use of a video prepared by the qualified biologist covering the same material presented in the initial education program. Restrictions and guidelines that must be followed by construction personnel include:

1. Construction personnel will adhere to designated work zones and will not go outside these boundaries.

2. All vehicles will observe the posted speed limit on hard-surfaced roads and a 15-mile-per-hour speed limit on unpaved roads in the project area (all watershed roads, paved and unpaved, already restrict vehicles to no more than 15 miles per hour).

3. Off-road vehicle traffic outside the designated construction area will be prohibited.

4. The contractor will provide closed garbage containers for the disposal of all food-related trash items (e.g., wrappers, cans, bottles, food scraps). All garbage will be removed daily from the project site. Construction personnel will not feed or otherwise attract wildlife to the project area.

5. No pets or firearms will be allowed in the project area.

6. To prevent possible resource damage from hazardous materials such as motor oil or gasoline, construction personnel will not service vehicles or construction equipment outside designated staging areas, with the exception of work via barges on the reservoir. Refueling may occur on barges with implementation of best management practices to ensure that reservoirs are not contaminated.

7. Construction personnel will be instructed to notify the onsite or on-call biologist if wildlife is found within the construction area. Construction personnel will not be allowed to handle listed wildlife.

8. Any worker who inadvertently injures or kills a federally-listed species or finds one dead, injured, or entrapped will immediately report the incident to the environmental inspector or biological monitor (or resident engineer who will immediately notify the environmental inspector or biological monitor). The environmental inspector or biological monitor will immediately notify the SFPUC, who will provide verbal notification to the Service's Endangered Species Program at the Sacramento Fish and Wildlife Office in Sacramento, California, and to the local CDFG warden or biologist within 24 hours of the discovery of the death of or injury to a listed species due to project related activities. Notification must include the date, time, and location of the incident or finding.

Conservation Measure 2: Monitor Construction in Mission Blue Butterfly Habitat during the Adult's Flight Season (March – July)

To protect mission blue butterflies during the adult flight season (March - July), a Service-approved biological monitor that is familiar with the adult mission blue butterfly will be present during construction activities within areas identified as dispersal habitat. If one or more adult mission blue butterflies are observed in the work area, work activities will temporarily cease unless the biological monitor determines that work activities will not directly affect the individual(s).

Conservation Measure 3: Fence/Flag and Monitor Mission Blue Butterfly Habitat

A qualified biologist will supervise the installation of flagging or fencing around stands of known mission blue butterfly host/food plants and species sightings in the northern portion of the pipeline alignment that can be avoided within the limits of work. Fencing/flagging will be installed prior to any ground disturbing or vegetation removal activities. The fencing/flagging will be placed the maximum distance from the plants possible (up to 100 feet), while still allowing work to occur in the adjacent area. The location of the flagging/fencing will be field adjusted by the biological monitor as necessary. The temporary fencing/flagging will be furnished, constructed, maintained, and later removed as shown on the construction plans, as specified in the special provisions, and as directed by the SFPUC. Temporary fencing/flagging will be at least 4-foot-high and constructed of high visibility material (e.g., orange, commercial-quality woven polypropylene or similar material). No construction activities will be permitted within the fenced/flagged area. Warning signs indicating the sensitivity of the area will be attached to the fencing/flagging.

A biological monitor that is familiar with the mission blue butterfly, its life stages, and food plants will be present when construction activities occur in or within 100 feet of suitable habitat (dispersal habitat as well as areas containing the larval host plant and adult food plants). The monitor will inspect the buffer fencing/flagging each day monitoring is conducted for mission blue butterfly and will notify the resident engineer (or their designated contact), to address any necessary fencing/flagging repairs. A biological monitoring log of construction site conditions and observations will be maintained and kept on file at the SFPUC and provided to the Service upon request.

Conservation Measure 4: Avoid Dust Accumulation on Mission Blue Butterfly Habitat and Marin Dwarf-flax

SFPUC or its contractor will ensure that dust is controlled during construction by periodically watering down construction areas within 100 feet of mission blue butterfly habitat and Marin dwarf-flax plants as necessary. Watering down the construction area will prevent dirt from becoming air borne and accumulating on larval host plants and adult food source plants for mission blue butterfly and on Marin dwarf-flax plants.

Conservation Measure 5: Minimize the Introduction and Spread of Invasive Plants

To avoid or minimize the introduction or spread of invasive plants during construction activities, the following measures will be implemented:

1. Weed-free, erosion-control materials (or rice straw in upland areas) will be used exclusively.

2. The biological monitor will educate the construction supervisors and managers about problems created by noxious weeds and the importance of controlling and preventing their spread. The biological monitor will conduct a tailgate meeting before construction begins and will distribute handouts identifying noxious weeds and describe the techniques used to prevent their spread. Noxious weed education could be conducted at the same time the biological resources education program (Conservation Measure 1) is conducted.

3. To reduce the spread of invasive plants into uninfested areas, the contractor will stockpile and cover topsoil removed during excavation.

4. Equipment will be cleaned to minimize spread of invasive species when moving from offsite to the watershed.

To reduce the likelihood of the introduction or spread of invasive plants during operations and routine maintenance activities, the SFPUC will implement the following operations and maintenance protocol:

1. Crews will receive training regarding problems created by invasive plants and the importance of controlling and preventing their spread.

2. Activities will be limited to as small a footprint as possible.

3. Vehicles will stay on designated access roads. Off-road vehicle traffic will be prohibited unless required in an emergency.

Conservation Measure 6: Compensate for Permanent and Temporary Losses of Mission Blue Butterfly Habitat

To compensate for the temporary loss of 13.24 acres of suitable dispersal habitat for mission blue butterfly (annual grassland, perennial grassland, coyote brush, and unvegetated shore), SFPUC will restore onsite 13.24 acres of habitat within the area designated as suitable mission blue butterfly habitat. The 13.24 acres of restored habitat would include perennial grassland, coyote brush, and unvegetated shore. These restored areas, however, would not be placed under a conservation easement or managed for the mission blue butterfly.

To compensate for the permanent loss of 0.83 acre of suitable dispersal habitat for mission blue butterfly (annual grassland, perennial grassland, and coyote brush), the SFPUC would propagate and plant *Lupinus formosus*, the larval food source, and nectar plants in 2.60 acres of suitable habitat adjacent to existing mission blue butterfly occurrences in the action area such that the habitat containing larval food plants and nectar plants would be expanded. Areas that will be targeted for mission blue butterfly vegetation enhancement will consist of perennial or annual grassland on Fagan loam soil. The 2.60-acre mission blue butterfly enhancement area will be placed under a conservation easement and managed and protected in perpetuity for the benefit of the species. The methods for restoring and monitoring revegetated areas are described in the *Crystal Springs/San Andreas Transmission Upgrade Project Conceptual Restoration, Revegetation and Enhancement Plan* (May & Associates and ICF International 2010). The conservation easement will follow the guidelines in the *Sacramento Fish and Wildlife Office Selected Review Criteria for Section 7 Off-Site Compensation* (Service 2009) which is enclosed with this biological opinion. SFPUC anticipates that the onsite mission blue butterfly habitat enhancement area will be implemented and a conservation easement in place by December 2012 (Craven-Green, pers. comm. 2010). The details of the restoration plan may be changed with Service approval.

SFPUC also proposes to establish additional dispersal habitat for the mission blue butterfly within the action area by removing non-native trees and restoring these areas to grassland (discussed in Conservation Measure 15). SFPUC proposes to remove non-native trees from approximately 1-3 acres within about 400 feet of known sightings of mission blue butterfly eggs and restore these areas to grassland (Craven-Green, pers. comm. 2010; Arnold 2008; May & Associates and ICF International 2010), thus opening up dispersal corridors and potentially allowing the mission blue butterflies to colonize other grassland areas. These restored areas, however, would not be placed under a conservation easement or managed for the mission blue butterfly.

Conservation Measure 7: Conduct Preconstruction Surveys for California Red-legged Frog and San Francisco Garter Snake

Prior to any grading or earthwork in areas identified as suitable habitat, a Service-approved biological monitor will conduct preconstruction surveys of the area to be affected (see also Conservation Measure 1). The name and credentials of the biologist(s) will be submitted to the Service at least 15 days prior to the commencement of work. Preconstruction surveys will be conducted before exclusion fences (discussed in Conservation Measure 8) are installed around work areas.

If California red-legged frogs are found, the approved biologist will remove and relocate the frogs to the nearest suitable aquatic or upland habitat that is at least 1,000 feet outside of the construction area boundary. If a San Francisco garter snake is found, it will be allowed to leave the area of its own volition.

Conservation Measure 8: Install Temporary Exclusion Fencing

To prevent the California red-legged frog and San Francisco garter snake from moving through active construction areas, exclusion fencing will be installed along the work area boundaries (staging areas and work areas) where suitable aquatic and upland habitat are present. Locations of temporary fences will be shown on the construction plans and will be reviewed by a qualified biologist and field adjusted as necessary. Fencing will be installed prior to construction activities.

Because project components would be spread out over a wide area and construction would be phased over a period of three years, only those portions of the construction area where work is currently occurring would be fenced in order to minimize the amount of fencing in use at any given time and minimize barriers to species dispersal. Additionally, in order to minimize barriers to species dispersal during construction along the CS/SA Pipeline and associated access roads, SFPUC has committed to installing at any given time no more than 2,000 linear feet of exclusion fencing without a 50-foot gap for species dispersal.

To minimize the effects of construction activities on California red-legged frog during the breeding season, SFPUC proposes to install exclusion fencing prior to December 1 in order to exclude the California red-legged frog from the work areas before the start of the primary breeding season. However, fencing may be installed after December 1 (i.e., after the start of the primary breeding season) as long as the work area either: 1) does not encompass potential breeding habitat for the California red-legged frog (i.e., wetlands, perennial creeks, and intermittent creeks) that contains sufficient water to allow breeding; or 2) is not within 250 feet of potential breeding habitat for the California red-legged frog.

For the Upper Crystal Springs Dam, San Antonio Outlet Structures 2 and 3, and Crystal Springs Outlet Structures 1 and 2, exclusion fencing will enclose the entire upland work area with fencing leading down to approximately the expected low water line of the reservoirs. However, these work areas would not be fenced along the shoreline but would remain open in order to allow construction crews to access the work areas from the reservoirs by barge. In order to minimize the potential for listed species entering the work area from the reservoirs, the exclusion fencing would be flared out at the water's edge, and 20 feet of floating boom would be extended into the reservoir to deter the California red-legged frog and San Francisco garter snake from entering the work area. The work area would also be monitored to ensure that the California red-legged frog and San Francisco garter snake do not enter the work area (see Conservation Measure 11). If California red-legged frogs are found within the work area, the Service-approved biologist will remove and relocate the frogs to the nearest suitable aquatic or upland habitat that is at least 1,000 feet outside of the construction area boundary. If a San Francisco garter snake is found, it will be allowed to leave the area of its own volition.

Construction activities at the Crystal Springs Pump Station and San Mateo Creek work areas (e.g., construction of the new dissipation structure) may occur during the breeding season for the California red-legged frog, but the work areas would be completely enclosed by exclusion fencing to prevent the California red-legged frog and San Francisco garter snake from entering the work area. SFPUC proposes to install the exclusion fencing around the Crystal Springs Pump Station and San Mateo Creek work areas prior to December 1 (i.e., before the start of the primary breeding season for the California red-legged frog) unless it is a dry year (i.e., the wet season begins later than usual) in which case SFPUC might ask the Service for permission to install the exclusion fencing later in December. Work within San Mateo Creek and the associated riparian habitat will require six months or less of work.

Upland habitat would be fenced for the following durations at each project component:

1. Less than one year at Upper Crystal Springs Dam

2. Up to three years at Crystal Springs Pump Station

3. Two years at Crystal Springs Outlet Structures 1 and 2 (Note: work at the Crystal Springs Outlet Structure 1 would be about 13 months but construction at Crystal Springs Outlet Structure 2 would be less than one year)

4. Less than one year each at San Andreas Outlet Structures 2 and 3

5. Variable along the CS/SA Pipeline (SFPUC anticipates less than one year at any given location)

Areas where vegetation would be cleared, trimmed, or mowed to establish access roads (i.e., no grading/ground disturbance) will not be fenced. Instead, activities to establish access roads in

these areas will be monitored (see Conservation Measure 11). In areas where grading (or other ground disturbance) must occur to develop access roads, exclusion fencing will be temporarily installed along the limits of work (located outside of the clearing/grading limits). Once the access roads are established, the exclusion fencing will be removed and flagging will be placed along the access roads to ensure that construction vehicles stay on the access roads.
The exclusion fence will be constructed of material (such as ¼ inch hardware cloth or Propex Geotex) that would prevent California red-legged frogs and San Francisco garter snakes from entering the work area. The fences will be a minimum of 4-feet tall with the bottom 4 to 6 inches buried such that these species could not enter the work area from under the fence. Alternative design not requiring the bottom of the fence to be buried may be employed if acceptable to the Service and CDFG. If necessary, the exclusion fencing will be marked to ensure it is highly visible to construction personnel (e.g., flagging or marked with paint). In addition, the fence will include one way funnels every 100 feet to allow federally listed species to escape if they become trapped within the site.

A Service-approved biologist will be onsite during installation of the fencing to ensure that no California red-legged frogs and San Francisco garter snakes are harmed during fence installation and to relocate any California red-legged frogs out of the fenced area if found. If a San Francisco garter snake is found, it will be allowed to leave the area of its own volition. As necessary, the Service-approved biologist will field adjust the exclusion fencing during installation.

No construction activities will be permitted outside the designated construction area other than the limited activities necessary to erect the fencing. The onsite Service-approved biological monitor, other trained onsite biological monitor or environmental inspector will inspect the exclusion fence at the start of each construction day and will ensure it is properly maintained to exclude federally listed species from work areas (see Conservation Measure 11). The SFPUC will ensure that the exclusion fencing is maintained until all construction activities are completed and that construction equipment is confined to the designated work areas. After construction is complete, the exclusion fencing will be removed.

Conservation Measure 9: Install Erosion Control Measures and Preventing Spills near Aquatic Habitat for California Red-legged Frog and San Francisco Garter Snake

Erosion control measures will be implemented in areas where disturbance will occur adjacent to suitable aquatic habitat for California red-legged frog and San Francisco garter snake to prevent any soil or other materials from entering aquatic habitat. Tightly woven fiber netting or similar material will be used for erosion control or other purposes in the action area to ensure that San Francisco garter snake and California red-legged frog do not get trapped, injured, or killed. Plastic monofilament netting or similar material will not be used in the action area because these species can become entangled in this type of material.

Additionally, SFPUC proposes implementing a Stormwater Pollution Prevention Plan (SWPPP) including the following best management practices (BMPs) to minimize the potential for sedimentation or spills from degrading aquatic habitat. The below measures may be altered with approval from the Service and RWQCB:

1. Check construction equipment for leaks daily.

2. Prohibit washing of vehicles and equipment within 100 feet of storm drain inlets, San Mateo Creek, wetlands, swales, and other waters of the U.S. or the State.

3. Contain fueling areas with berms and/or dikes or secondary containment to prevent run-on, runoff, and to contain spills.

4. Preserve existing vegetation where no construction activity is planned.

5. Stabilize and revegetate disturbed areas as soon as possible after construction with planting, seeding, and/or mulch (e.g., straw or hay, erosion control blankets, hydromulch, or other similar material).

6. Install silt fences, fiber rolls or other suitable measures around the perimeter of the project site and staging areas, riparian buffers, storm drainages, temporary stockpiles, spoil areas, stream channels, swales, and down-slope of all exposed soil areas where offsite sedimentation may occur.

7. Install temporary slope breakers on slopes greater than 5 percent where the base of the slope is less than 50 feet from a water body, wetland, or road crossing at the following spacing. Based on field conditions (e.g., minimal vegetative cover or loose soils) it may be necessary to install slope breakers in areas where the base of the slope is greater than 50 feet from a water body or wetland.

8. Install and operate sedimentation basin(s), sediment trap(s), or other appropriate sediment control BMPs to ensure compliance with San Francisco Bay Basin Plan water quality objectives.

9. Sequence construction activities to minimize the amount of time that soils remain disturbed.

10. Stabilize all disturbed soils as soon as possible following the completion of ground disturbing work in any area of the project site.

11. Plan sufficient time before rainfall begins to stabilize soil with vegetation or physical means.

12. Install sediment control BMPs around the perimeter of the site prior to the start of any ground disturbing activities, unless prior approval is received by the RWQCB.

13. Grade and stabilize construction site entrances and exits to prevent runoff from construction sites and erosion.

14. Sweep streets as necessary to remove any soil or sediment tracked offsite by construction or spoils hauling equipment or vehicles.

15. Collect trash and construction debris daily and remove from the project site weekly at minimum.

16. Locate all portable sanitary facilities at a minimum of 100 feet from waters of the U.S. or the State.

17. Maintain portable sanitary facilities at least weekly.

18. Store all hazardous materials and/or chemicals in areas protected from rain and stormwater run-off, and that have adequate secondary containment volume to prevent the offsite discharge of leaks or spills.

19. Maintain hazardous materials spill containment and cleanup materials and equipment on site at all construction sites during construction. Contain and cleanup all hazardous materials spills immediately.

20. Label all hazardous waste containers.

21. Dispose of all hazardous wastes, including any used spill cleanup materials, only at authorized disposal sites.

22. Locate waste collection areas away from storm drains, drainages and all waters of the U.S. or the State.

23. Inspect dumpsters and other waste or debris containers daily for leaks and remove and properly disposed of any hazardous materials or liquid wastes placed in such containers.

24. Train all construction personnel in proper material delivery, handling, storage, cleanup, and disposal procedures.

25. Inspect BMPs before and after storm events and once each 24-hour period during extended storm events (storms lasting longer than 24 hours) to identify BMP effectiveness and implement repairs as soon as safe to do so.

26. Inspect sediment basins, sediment traps, and other detention and treatment facilities daily throughout the construction period.

27. Maintain sufficient devices and materials (e.g., silt fence, fiber rolls, erosion blankets, etc.) on site throughout project construction to enable immediate repair or replacement of failed BMPs.

28. Inspect all seeded areas regularly for failures and repair immediately by temporary mulching or other approved revegetation practices.

29. Keep records of all inspections, reportable spills, BMP-related maintenance activities, corrective actions, and visual observations of offsite discharge of sediment or other pollutants.

30. Revegetate all temporarily disturbed areas as soon as practicable after construction activities are completed.

31. Remove construction debris and trash from the project site and area upon project completion.

32. Phase the removal of temporary BMPs as necessary to ensure revegetation and site stabilization.

33. Ensure that the post-construction site conditions do not result in the creation of any unintended drainage channels, erosion, or areas of sedimentation.

34. Correct any site conditions resulting from the project to comply with the SWPPP and any other pertinent RWQCB requirements.

35. A SWPPP will be developed and implemented that identifies all pollutant sources, including sediments, that may affect waters and BMPs to reduce or eliminate the pollutants from entering any water body.

36. Sediment control devices would include placing silt fencing, straw wattles, check dams, and/or gravel bag berms below areas of planned disturbance.

37. A sampling and analysis strategy will be implemented to monitor turbidity during excavation and deposition of materials in the reservoirs.

Conservation Measure 10: Avoid Entrapment of California Red-legged Frog and San Francisco Garter Snake

To avoid inadvertent entrapment of California red-legged frog and San Francisco garter snake during construction, all excavated areas more than 1 foot deep will be completely covered at the end of each work day with plywood or similar materials, or provided with one or more escape ramps constructed of earth fill or wooden planks. The biological monitor or environmental inspector designated by the SFPUC will be responsible for inspecting trenches for the presence of federally listed species at the beginning of each workday. If any listed species become trapped, escape ramps or other appropriate structures will be set in place to allow the animal to escape or the Service and/or CDFG will be immediately contacted by phone for guidance. The Service and CDFG will be notified of the incident by telephone and electronic mail within 1 business day of the discovery of the trapped animal.

Conservation Measure 11: Monitor Construction Activities in Suitable Habitat for California Red-Legged Frog and San Francisco Garter Snake

A Service-approved biologist will be onsite during initial ground disturbance activities, including grading, excavation, and vegetation-removal activities (including when vegetation is cleared, trimmed, or mowed to establish access roads). At the start of each work day, the Service-approved biologist, biological monitor, environmental inspector or other trained personnel will check all open trenches/holes, underneath construction vehicles that were parked overnight, and any construction pipe, culvert or similar structure with a diameter of 2-inches or greater for the presence of federally listed species. After initial ground disturbing activities have concluded, the biologist will conduct weekly visits to the construction site to inspect the condition of fences and make sure that all other required biological protection measures are being complied with. The Service-approved biologist will train construction staff that will be at each work site to check the fences daily and conduct the checks for federally listed species (as described above) prior to the start of work each day.

The biologist will remain on-call in case any California red-legged frogs or San Francisco garter snakes are discovered during construction activities. In the absence of the biologist, the environmental inspector will serve as the point of contact in the event that a federally listed species (or unidentified species) is discovered onsite when the biological monitor is not present. If a California red-legged frog is found by the biologist or construction personnel within the project area, construction activities will cease in the immediate vicinity of the individual until the frog has been removed from the project area by the approved biologist and released near a suitable burrow or other suitable habitat at least 1,000 feet away from the project area, or until the frog moves on its own away from the project area. If a San Francisco garter snake is found by the biologist or construction personnel within the project area, construction activities will cease in the immediate vicinity of the individual until the snake leaves the area on its own.

Conservation Measure 12: Minimize the Effect of Temporary Nighttime Lighting on California Red-legged Frog and San Francisco Garter Snake

Construction may result in a temporary source of lighting in an area that is not currently illuminated. To minimize the effects of lighting on the California red-legged frog and San Francisco garter snake, the SFPUC will incorporate the following elements into the construction design plans, to the extent that human safety is not compromised:

1. Lights will be pointed downward and shielded to minimize spillover.

2. Lights will be aimed toward the center of the staging/work area and away from natural habitat areas.

3. The lowest wattage possible will be used such that safety can still be maintained.

4. Alternative lighting (e.g., orange colored) will be used in place of incandescent light where possible.

Conservation Measure 13: Avoid and Minimize Potential Stranding of California Red-legged Frog Eggs and Larvae during Reservoir Drawdowns

In order to avoid the stranding and desiccation of California red-legged frog eggs and minimize potential stranding of larvae within emergent wetland areas surrounding Upper and Lower Crystal Springs Reservoirs and San Andreas Reservoir, SFPUC will restrict any necessary reservoir drawdowns associated with project construction to between May 1 and November 30. Reservoir drawdowns would be within normal operating levels.

Conservation Measure 14: Compensate for the Permanent Loss and Temporary Disturbance of Aquatic Habitat for California Red-legged Frog and San Francisco Garter Snake

SFPUC will compensate for the permanent loss of 0.19 acre and the temporary disturbance of 2.85 acres of California red-legged frog and San Francisco garter snake aquatic habitat through onsite restoration and additional compensation. SFPUC will restore onsite the 2.85 acres of temporarily disturbed aquatic habitat and will provide 0.60 acre of additional compensation. Additional compensation would be provided through the creation/enhancement of 0.60 acre of wetland habitat within the San Andreas watershed at the San Andreas Reservoir Wetland Creation Site, or other similar feasible location. The details of the creation/enhancement of suitable aquatic habitat are described in the *San Andreas Reservoir Wetland Creation (Site 27) Mitigation and Monitoring Plan* (Winzler & Kelly 2010a). Creation/enhancement would be implemented prior to or concurrent with project effects. Created/enhanced or preserved areas will be permanently restricted from development through binding conditions incorporated into a legal instrument such as a conservation easement (Note: restored areas immediately adjacent to facilities and associated appurtenances would not be included in the conservation easement in order to allow necessary ongoing maintenance activities). The conservation easement will follow the guidelines in the *Sacramento Fish and Wildlife Office Selected Review Criteria for Section 7 Off-Site Compensation* (Service 2009) which is enclosed with this biological opinion. SFPUC anticipates that the offsite wetland creation will be implemented by January 2012 and the conservation easement in place by July 2012 (Craven-Green, pers. comm. 2010). The location and details of the 0.60-acre offsite wetland compensation area may be changed with Service approval.

Conservation Measure 15: Compensate for Permanent Loss and Temporary Disturbance of Upland Habitat for California Red-legged Frog and San Francisco Garter Snake

SFPUC will compensate for the permanent loss of about 5.27 acres of upland habitat and the temporary clearing and/or grading of about 82.2 acres of upland habitat for the California red-legged frog and San Francisco garter snake through the restoration and creation of suitable upland habitat within the action area or by preserving suitable habitat offsite within the Peninsula Watershed. About 53.2 acres of temporarily disturbed upland habitat (grassland, oak woodland, coyote brush) would be restored onsite. Another 29.0 acres of lower quality upland habitat within the action area dominated by non-native trees (e.g., blackwood acacia, Monterey pine, Monterey cypress, and eucalyptus) would be enhanced for the benefit of the California red-legged frog and San Francisco garter snake by removing the non-native trees and converting to grassland or an open oak woodland habitat. About 7 acres of the non-native tree removal enhancement area would be placed under a conservation easement and preserved onsite and managed for the benefit of the California red-legged frog and San Francisco garter snake (Craven-Green, pers. comm. 2010). The conservation easement will follow the guidelines in the *Sacramento Fish and Wildlife Office Selected Review Criteria for Section 7 Off-Site Compensation* (Service 2009) which is enclosed with this biological opinion.

Additionally, 2.6 acres of upland grassland habitat within the mission blue butterfly enhancement area (Conservation Measure 6) would be placed under a conservation easement and preserved onsite and managed for the benefit of the mission blue butterfly, California red-legged frog, and San Francisco garter snake. The methods for restoring and monitoring revegetated areas within the action area are described in the *Crystal Springs/San Andreas Transmission Upgrade Project Conceptual Restoration, Revegetation and Enhancement Plan* (May & Associates and ICF International 2010). The conservation easement will also follow the guidelines in the *Sacramento Fish and Wildlife Office Selected Review Criteria for Section 7 Off-Site Compensation* (Service 2009). SFPUC anticipates that the onsite habitat enhancement will be implemented and a conservation easement in place by December 2012 (Craven-Green, pers. comm. 2010). The details of the restoration plan may be changed with Service approval.

Another 2.8 acres of upland habitat for the California red-legged frog and San Francisco garter snake would be preserved offsite at the Adobe Gulch Grasslands (or another Service-approved location) and placed under a conservation easement. Created/enhanced or preserved areas will be permanently restricted from development through binding conditions incorporated into a legal instrument such as a conservation easement. The details of the preservation and management of upland habitat for the California red-legged frog and San Francisco garter snake at the Adobe Gulch Grasslands site are described in the *Mitigation and Monitoring Plan, Adobe Gulch Grassland Restoration Site, San Mateo County, California* (Winzler & Kelly 2010b). The conservation easement will follow the guidelines in the *Sacramento Fish and Wildlife Office Selected Review Criteria for Section 7 Off-Site Compensation* (Service 2009). SFPUC anticipates that the offsite upland preservation will be implemented by January 2012 and the conservation easement in place by July 2012 (Craven-Green, pers. comm. 2010). The location and details of the 2.8-acre offsite upland preservation area may be changed with Service approval.

About 25.6 acres of upland habitat outside of clearing/grading areas would not be disturbed but would be temporarily inaccessible to the California red-legged frog and San Francisco garter snake due to exclusion fencing; thus restoration would not be required in these areas.

Conservation Measure 16: Protect Marin Dwarf-flax

If construction activity is located within 100 feet of known Marin dwarf-flax populations, high visibility fencing or flagging will be installed at the limits of work closest to the Marin dwarf-flax population, or at a minimum 5-foot buffer, whichever is greater. A qualified botanist will supervise the installation of the fencing or flagging. The fencing/flagging will be furnished, constructed, maintained, and later removed as shown on the construction plans. Warning signs indicating the sensitivity of the area will be attached to the fences.

The biological monitor, or other trained inspector, will inspect the fencing/flagging around the Marin dwarf-flax plants daily during construction to ensure that the fencing/flagging is secure. If the fencing/flagging is compromised, the monitor/inspector will bring this to the attention of appropriate construction personnel, and the fencing/flagging will be repaired within 24 hours.

For the staging areas at the southern end of the CS/SA Pipeline, planned for use as trailer staging, pre-construction surveys would be conducted during the appropriate blooming period (late summer to early fall) to confirm presence or absence of the Marin dwarf-flax. If the species is identified in this area, the measures noted in the paragraphs above would apply.

SFPUC proposes the following measures to minimize the impacts of construction vehicular traffic on Marin dwarf-flax plants that occur adjacent to the existing gravel and grassland access roads near the staging areas at the southern end of the CS/SA Pipeline (Craven-Green, pers. comm. 2010): periodically watering down the roads as needed to minimize impacts from dust (Conservation Measure 4); and installing silt fencing along the access roads near the Marin dwarf-flax plants to prevent gravel and dust from accumulating on the listed plants (the silt fence may serve the purpose of the high visibility fencing identified above). The biological monitor, or other trained inspector, will inspect the silt fencing around the Marin dwarf-flax plants daily during use of the access roads to ensure that the fencing is secure and that the periodic watering of the roads does not result in the pooling of water near the Marin dwarf-flax plants. If the silt fencing is compromised, the monitor will bring this to the attention of appropriate construction personnel, and the fencing will be repaired within 24 hours. The areas containing the Marin dwarf-flax plants would also be surrounded by fencing/flagging and warning signs to keep vehicles and construction workers from entering these areas as described above.

Conservation Measure 17: Compensate for Disturbance of Marin Dwarf-flax

SFPUC will compensate for the potential disturbance of Marin dwarf-flax plants within a total of about 0.0005 acre of serpentine grassland that occurs adjacent to existing access roads to be used by the proposed project by enhancing and/or re-establishing and preserving in perpetuity 0.05 acre of serpentine grassland habitat for the Marin dwarf-flax at the Boat Ramp Fountain Thistle Habitat Reserve Program site near the eastern shoreline of Lower Crystal Springs Reservoir (Craven-Green, pers. comm. 2010). The details of the Boat Ramp Fountain Thistle Habitat Reserve Program are described in Winzler & Kelly (2010c). The conservation easement will follow the guidelines in the *Sacramento Fish and Wildlife Office Selected Review Criteria for Section 7 Off-Site Compensation* (Service 2009) which is enclosed with this biological opinion. SFPUC anticipates that the offsite enhancement will be implemented by January 2012 and the conservation easement in place by July 2012 (Craven-Green, pers. comm. 2010). The location and details of the 0.05-acre offsite preservation area may be changed with Service approval.

Analytical Framework for the Jeopardy Analysis

In accordance with policy and regulation, the jeopardy analysis in this biological opinion relies on three components: (1) the *Status of the Species* and *Environmental Baseline*, which evaluates the range-wide conditions of the California red-legged frog, San Francisco garter snake, mission blue butterfly, and Marin dwarf-flax, the factors responsible for that condition, and their survival and recovery needs; and evaluates the condition of these listed species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of these listed species; (2) the *Effects of the Proposed Project*, which determines the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on these species; and (3) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on them.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the California red-legged frog's, San Francisco garter snake's, mission blue butterfly's, and Marin dwarf-flax's current status, taking into account any cumulative effects, to determine if implementation of the proposed project is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of these listed species in the wild.

The jeopardy analysis in this biological opinion places an emphasis on consideration of the range-wide survival and recovery needs of the California red-legged frog, San Francisco garter snake, mission blue butterfly, and Marin dwarf-flax, and the role of the action area in the survival and recovery of these listed species as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Adverse Modification Determination

This Biological Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this Biological Opinion relies on four components: (1) the *Status of Critical Habitat*, which evaluates the range-wide condition of designated critical habitat for the California red-legged frog in terms of primary constituent elements (PCEs), the factors responsible for that condition, and the intended recovery function of the critical habitat overall; (2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the *Effects of the Proposed Project*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units.

For purposes of the adverse modification determination, the effects of the proposed Federal action on the California red-legged frog critical habitat are evaluated in the context of the range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the California red-legged frog.

The analysis in this opinion places an emphasis on using the intended range-wide recovery function of the California red-legged frog critical habitat and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

Action Area

The Service defines the action area as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (50 Code of Federal Regulations [CFR]). For the proposed project, the action area is defined as all areas within the construction footprint, as well as immediately adjacent habitats which could support federally listed species, including a distance of 500 feet downstream of the construction footprint in drainages, 100 feet from the edge of the reservoirs into open water, and 200 feet beyond the project area to account for potential effects such as effects on water quality, or due to noise, light, and dust. This is the area in which the proposed action could result in direct or indirect effects on federally listed species.

Status of Species and Critical Habitat

<u>California Red-legged Frog</u>

The California red-legged frog was listed as a threatened species on May 23, 1996 (Service 1996). Critical habitat was designated for this species on April 13, 2006 (Service 2006a) and a proposed revision was published on September 16, 2008 (Service 2008). On March 17, 2010, the designated critical habitat for the California red-legged frog was revised, and the species name for the frog was changed from *Rana aurora draytonii* to *Rana draytonii* (Service 2010). A recovery plan was published for the California red-legged frog on September 12, 2002 (Service 2002).

The California red-legged frog is the largest native frog in the western United States (Wright and Wright 1949), ranging from 1.5 to 5.1 inches in length (Stebbins 2003). The abdomen and hind legs of adults are largely red, while the back is characterized by small black flecks and larger irregular dark blotches with indistinct outlines on a brown, gray, olive, or reddish background color. Dorsal spots usually have light centers (Stebbins 2003), and dorsolateral folds are prominent on the back. Larvae (tadpoles) range from 0.6 to 3.1 inches in length, and the background color of the body is dark brown and yellow with darker spots (Storer 1925).

The historic range of the California red-legged frog extended coastally from the vicinity of Elk Creek in Mendocino County, California, and inland from the vicinity of Redding, Shasta County, California, southward to northwestern Baja California, Mexico (Fellers 2005; Jennings and Hayes 1985; Hayes and Krempels 1986). The California red-legged frog was historically documented in 46 counties but the taxa now remains in 238 streams or drainages within 23 counties, representing a loss of 70 percent of its former range (Service 2002). California red-legged frogs are still locally abundant within portions of the San Francisco Bay area and the central coast. Within the remaining distribution of the species, only isolated populations have been documented in the Sierra Nevada, northern Coast, and northern Transverse Ranges. The species is believed to be extirpated from the southern Transverse and Peninsular ranges, but is still present in Baja California, Mexico (California Department of Fish and Game (CDFG) 2010).

California red-legged frogs predominately inhabit permanent water sources such as streams, lakes, marshes, natural and manmade ponds, and ephemeral drainages in valley bottoms and foothills up to 1,500 meters in elevation (Jennings and Hayes 1994, Bulger *et al.* 2003, Stebbins 2003). However, California red-legged frogs also have been found in ephemeral creeks and drainages and in ponds that may or may not have riparian vegetation. California red-legged frogs breed between November and April in still or slow-moving water at least 2.5 feet in depth with emergent vegetation, such as cattails (*Typha* species), tules (*Scirpus* species) or overhanging willows (*Salix* species) (Hayes and Jennings 1988). California red-legged frogs have paired vocal sacs and vocalize in air (Hayes and Krempels 1986). Female frogs deposit egg masses on emergent vegetation so that the egg mass floats on or near the surface of the water (Hayes and Miyamoto 1984). Individuals occurring in coastal drainages are active year-round (Jennings *et al.* 1992), whereas those found in interior sites are normally less active during the cold season.

During other parts of the year, habitat includes nearly any area within 1-2 miles of a breeding site that stays moist and cool through the summer (Fellers 2005). According to Fellers (2005), this can include vegetated areas with coyote brush (*Baccharis pilularis*), California blackberry thickets (*Rubus ursinus*), and root masses associated with willow and California bay (*Umbellularia californica*) trees. Sometimes the non-breeding habitat used by California red-legged frogs is extremely limited in size. For example, non-breeding California red-legged frogs have been found in a 6 foot wide coyote brush thicket growing along a tiny intermittent creek surrounded by heavily grazed grassland (Fellers 2005). Sheltering habitat for California red-legged frogs is potentially all aquatic, riparian, and upland areas within the range of the species and includes any landscape features that provide cover, such as existing animal burrows, boulders or rocks, organic debris such as downed trees or logs, and industrial debris. Agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hay stacks may also be used. Incised stream channels with portions narrower and depths greater than 18 inches also may provide important summer sheltering habitat. Accessibility to sheltering habitat is essential for the survival of California red-legged frogs within a watershed, and can be a factor limiting frog population numbers and survival.

California red-legged frogs do not have a distinct breeding migration (Fellers 2005). Adult frogs are often associated with permanent bodies of water. Some frogs remain at breeding sites all year while others disperse. Dispersal distances are typically less than 0.5 mile, with a few individuals moving up to 1-2 miles (Fellers 2005). Movements are typically along riparian corridors, but some individuals, especially on rainy nights, move directly from one site to another through normally inhospitable habitats, such as heavily grazed pastures or oak-grassland savannas (Fellers 2005).

In a study of California red-legged frog terrestrial activity in a mesic area of the Santa Cruz Mountains, Bulger *et al.* (2003) categorized terrestrial use as migratory and non-migratory. The latter occurred from one to several days and was associated with precipitation events. Migratory movements were characterized as the movement between aquatic sites and were most often associated with breeding activities. Bulger reported that non-migrating frogs typically stayed within 200 feet (60 meters) of aquatic habitat 90 percent of the time and were most often associated with dense vegetative cover, *i.e.,* California blackberry, poison oak and coyote brush. Dispersing frogs in northern Santa Cruz County traveled distances from 0.25 mile to more than 2 miles without apparent regard to topography, vegetation type, or riparian corridors (Bulger *et al.* 2003).

In a study of California red-legged frog terrestrial activity in a xeric environment, Tatarian (2008) noted that a 57 percent majority of frogs fitted with radio transmitters in the Round Valley study area in eastern Contra Costa County stayed at their breeding pools, whereas 43 percent moved into adjacent upland habitat or to other aquatic sites. This study reported a peak of seasonal terrestrial movement occurring in the fall months, with movement commencing with the first 0.2 inch of precipitation. Movements away from the source pools tapered off into spring. Upland movement activities ranged from 3 to 233 feet, averaging 80 feet, and were associated with a variety of refugia including grass thatch, crevices, cow hoof prints, ground squirrel burrows at the bases of trees or rocks, logs, and a downed barn door; others were associated with upland sites lacking refugia (Tatarian 2008). The majority of terrestrial movements lasted from 1 to 4 days; however, one adult female was reported to remain in upland habitat for 50 days (Tatarian 2008). Uplands closer to aquatic sites were used more often and frog refugia were more commonly associated with areas exhibiting higher object cover, e.g., woody debris, rocks, and vegetative cover. Subterranean cover was not significantly different between occupied upland habitat and non-occupied upland habitat.

California red-legged frogs are often prolific breeders, laying their eggs during or shortly after large rainfall events in late winter and early spring (Hayes and Miyamoto 1984). Egg masses containing 2,000 to 5,000 eggs are attached to vegetation below the surface and hatch after 6 to 14 days (Storer 1925, Jennings and Hayes 1994). In coastal lagoons, the most significant mortality factor in the pre-hatching stage is water salinity (Jennings *et al.* 1992). Eggs exposed to salinity levels greater than 4.5 parts per thousand results in 100 percent mortality (Jennings and Hayes 1990). Increased siltation during the breeding season can cause asphyxiation of eggs and small larvae. Larvae undergo metamorphosis 3½ to 7 months following hatching and reach sexual maturity 2 to 3 years of age (Storer 1925; Wright and Wright 1949; Jennings and Hayes 1985, 1990, 1994). Of the various life stages, larvae probably experience the highest mortality rates, with less than 1 percent of eggs laid reaching metamorphosis (Jennings *et al.* 1992). Sexual maturity normally is reached at 3 to 4 years of age (Storer 1925; Jennings and Hayes 1985). California red-legged frogs may live 8 to 10 years (Jennings *et al.* 1992). Populations of California red-legged frogs fluctuate from year to year. When conditions are favorable California red-legged frogs can experience extremely high rates of reproduction and thus produce large numbers of dispersing young and a concomitant increase in the number of occupied sites. In contrast, California red-legged frogs may temporarily disappear from an area when conditions are stressful (*e.g.,* drought).

The diet of California red-legged frogs is highly variable and changes with the life history stage. The diet of larval California red-legged frogs is not well studied, but is likely similar to that of other ranid frogs, feeding on algae, diatoms, and detritus by grazing on the surface of rocks and vegetation (Fellers 2005; Kupferberg 1996a, 1996b, 1997). Hayes and Tennant (1985) analyzed the diets of California red-legged frogs from Cañada de la Gaviota in Santa Barbara County during the winter of 1981 and found invertebrates (comprising 42 taxa) to be the most common prey item consumed; however, they speculated that this was opportunistic and varied based on prey availability. They ascertained that larger frogs consumed larger prey and were recorded to have preyed on Pacific tree frogs, three-spined stickleback (*Gasterosteus aculeatus*) and to a limited extent, California mice (*Peromyscus californicus*), which were abundant at the study site (Hayes and Tennant 1985, Fellers 2005). Although larger vertebrate prey was consumed less frequently, it represented over half of the prey mass eaten by larger frogs suggesting that such prey may play an energetically important role in their diets (Hayes and Tennant 1985). Juvenile and subadult/adult frogs varied in their feeding activity periods; juveniles fed for longer periods throughout the day and night, while subadult/adults fed nocturnally (Hayes and Tennant 1985). Juveniles were significantly less successful at capturing prey and all life history stages exhibited poor prey discrimination, feeding on several inanimate objects that moved through their field of view (Hayes and Tennant 1985).

Habitat loss, non-native species introduction, and urban encroachment are the primary factors that have adversely affected the red-legged frog throughout its range. Several researchers in central California have noted the decline and eventual local disappearance of California and northern red-legged frogs (*Rana aurora aurora*) in systems supporting bullfrogs (Jennings and Hayes 1990; Twedt 1993), red swamp crayfish (*Procambarus clarkii*), signal crayfish (*Pacifastacus leniusculus*), and several species of warm water fish including sunfish (*Lepomis* species), goldfish (*Carassius auratus*), common carp (*Cyprinus carpio*), and mosquitofish (*Gambusia affinis*) (Moyle 1976, Barry 1992, Hunt 1993, Fisher and Schaffer 1996). This has been attributed to predation, competition, and reproduction interference. Twedt (1993) documented bullfrog predation of juvenile northern red-legged frogs, and suggested that bullfrogs could prey on subadult California red-legged frogs as well. Bullfrogs may also have a competitive advantage over California red-legged frogs. For instance, bullfrogs are larger and possess more generalized food habits (Bury and Whelan 1984). In addition, bullfrogs have an extended breeding season (Storer 1933) during which an individual female can produce as many as 20,000 eggs (Emlen 1977). Furthermore, bullfrog larvae are unpalatable to predatory fish (Kruse and Francis 1977). Bullfrogs also interfere with California red-legged frog reproduction; researchers have observed on many occasions adult male California and northern red-legged frogs attempting to mate with bullfrogs instead of their own species. Both California and northern red-legged frogs have been observed in amplexus (mounted on) with both male and female bullfrogs (Jennings and Hayes 1990; Twedt 1993; Jennings 1993). During a six-month period, Twedt (1993) observed in 31 cases interspecific amplexus of male northern red-legged frogs with bullfrogs but never with other northern red-legged frogs. Thus bullfrogs are able to prey upon and out-compete California red-legged frogs, especially in sub-optimal habitat.

The urbanization of land within and adjacent to California red-legged frog habitat has also impacted California red-legged frogs. These declines are attributed to channelization of riparian areas, enclosure of the channels by urban development that blocks red-legged frog dispersal, and the introduction of predatory fishes and bullfrogs.

Diseases may also pose a significant threat though the specific effects of disease on the California red-legged frog are not known. Pathogens are suspected of causing global amphibian declines (Davidson *et al.* 2003). Chytridiomycosis and ranaviruses are a potential threat to the red-legged frog because these diseases have been found to adversely affect other amphibians, including the listed species (Davidson *et al.* 2003; Lips *et al.* 2006). Non-native species, such as bullfrogs and non-native tiger salamanders that live within the range of the California red-legged frog have been identified as potential carriers of these diseases (Garner *et al.* 2006). Human activities can facilitate the spread of disease by encouraging the further introduction of non-native carriers and by acting as carriers themselves (i.e., contaminated boots or fishing equipment). Human activities can also introduce stress by other means, such as habitat fragmentation, that results in the listed species being more susceptible to the effects of disease.

San Francisco Garter Snake

The San Francisco garter snake was listed as an endangered species on March 11, 1967 (Service 1967) and was listed as endangered by the State of California in 1971. A detailed species account can be found in the *San Francisco Garter Snake 5-year Review: Summary and Evaluation* (Service 2006b). Critical habitat has not been proposed or designated for the species.

The San Francisco garter snake is a slender, colorful snake, with a burnt orange head, greenish-yellow dorsal stripe edged in black, bordered by a red stripe, which may be continuous or broken with black blotches, and then a black stripe. The belly color varies from greenish-blue to blue. The eyes are relatively large, and usually seven upper and ten lower labial scales are present. The body scales are in 19 rows and the dorsal scales are weakly to strongly keeled (Fox 1951). Large adults can reach 36 inches or more in length. Females give live birth from June through September, with litters averaging 16 newborn (Stebbins 2003). The snakes are extremely shy, difficult to locate and capture, and quick to flee to water or cover when disturbed.

There are two significant components to San Francisco garter snake habitat: ponds that support the California red-legged frog and Pacific tree frog (*Pseudacris regilla*), and the surrounding upland that support burrowing mammals such as Botta's pocket gopher (*Thomomys bottae*) and California vole (*Microtus californicus*). The preferred habitat of the San Francisco garter snake is vegetated ponds with an open water component near open hillsides where they can sun themselves, feed, and find cover in rodent burrows (Larsen 1994). However, considerably less ideal habitats can be successfully occupied by the snakes, including ditches and waterways in the City of Half Moon Bay (McGinnis 1988; S. McGinnis, University of California, Hayward, pers. comm. 2007). The animals also utilize temporary ponds and other seasonal freshwater bodies. They avoid brackish marsh areas because their preferred prey base comprised primarily of California red-legged frogs and Pacific tree frogs, cannot survive in saline water. Emergent and bankside vegetation such as cattails (*Typha* species), bulrushes (*Scirpus* species), and spike rushes (*Juncus* species and *Eleocharis* species) apparently are preferred and used for cover. However, in the absence of these species, dense stands of coyote bush (*Baccharis pilularis)* or blackberry (*Rubus* species) may substitute as adequate cover (Barry 1994). The interface between stream and pond habitats and grasslands or bank sides is used for basking while nearby dense vegetation or water often provides escape cover. Barry (1994) noted that scattered, as opposed to dense brush was preferred basking habitat for San Francisco garter snakes. The snakes also use floating algal or rush mats, if available. Sag ponds, small seasonal freshwater ponds formed along the San Andreas rift, historically supported this snake, but much of these habitats have been destroyed by urbanization and high intensity agriculture (Barry 1994). Barry (1994) reported that the San Francisco garter snake was abundant in the sag ponds that were eliminated by the construction of Skyline Boulevard. Additional loss of suitable habitat has occurred due to the reduction in recent years of traditional ranching operations (San Mateo County Department of Agriculture 2004), resulting in seral succession of grasslands and leading to the loss of breeding and hibernation habitat for San Francisco garter snakes (H. McQuillen, Service, pers. comm. 2006). With the loss of ecological disturbance that grazing provides, upland areas become less suitable for burrowing mammals, thereby reducing the quality of these areas for the species. Additionally, declines in livestock production may lead to the elimination of stock ponds, either through intentional filling or natural siltation through lack of maintenance. The elimination of aquatic habitat used by the anuran prey base of the San Francisco garter snake, such as these stock ponds, negatively impacts the San Francisco garter snake by removing both its prey and its suitable habitat (McGinnis 1987).

San Francisco garter snakes forage extensively in aquatic habitats. Adult snakes feed primarily on California red-legged frogs and Pacific tree frogs (Larsen 1994). Adults may also feed on juvenile bullfrogs, but they are unable to feed on larger adult bullfrogs (Larsen 1994; Barry 2005, undated). Additionally, San Francisco garter snakes have been observed regurgitating bullfrogs in experiments performed by Larsen (1994) and may therefore not be a suitable prey item for the San Francisco garter snake in the wild. Adult San Francisco garter snakes are known to gorge on tadpoles of both the California red-legged frog and Pacific tree frog, when ponds dry prior to metamorphosis (McGinnis 1989). Newborn and juvenile San Francisco garter snakes depend heavily upon juvenile Pacific tree frogs as prey. Young San Francisco garter snakes make not survive if newly metamorphosed Pacific tree frogs are not available. Adult bullfrogs likely prey on smaller garter snakes, and may be a contributing factor in their decline (A. Willy, Service, pers. comm. 2006). However, some biologists question the level of adverse effect caused by this predation (Barry 2005). Newborn and juvenile San Francisco garter snakes depend heavily upon Pacific tree frogs as prey (Larsen 1994). San Francisco garter snakes are one of the few animals able to eat the toxic California newt (*Taricha torosa*) without suffering serious side effects. Although primarily diurnal, captive San Francisco garter snakes housed in an outside enclosure were observed foraging after dark on warm evenings (S. Larsen, Service, pers. comm. 2006).

Adult San Francisco garter snakes sometimes aestivate in rodent burrows during summer months when the ponds are dry. On the coast, the snakes hibernate during the winter, but further inland, if the weather is suitable, snakes may be active year-round. Female San Francisco garter snakes exhibit a high level of site fidelity (McGinnis *et al.* 1987; McGinnis 1989; Keel *et al.* 1991), particularly to burrows that are used for aestivation. Females can be found daily at the entrance to their burrow, and may travel to wetland areas once or twice a day. The mean measured distance of female hibernacula to the Headquarters Pond at Año Nuevo State Park is 459 feet with a maximum measured distance of 637 feet (Brown 2000). Distances of greater than 637 feet have been reported, but have not been confirmed by direct measurement. One of these unconfirmed distances was reported to be approximately 1000 feet from Headquarters Pond (P. Keel, California State Parks, pers. comm. 2006).

Historically, San Francisco garter snakes occurred in scattered wetland areas on the San Francisco Peninsula from approximately the San Francisco County line south along the eastern and western bases of the Santa Cruz Mountains, at least to the Upper Crystal Springs Reservoir, and along the coast south to Año Nuevo Point, San Mateo County, and Waddell Creek, Santa Cruz County, California (Barry 1994; Service 1985). Currently, the species has been reduced to only six significant populations in San Mateo County and northern Santa Cruz County.
The recovery plan for the San Francisco garter snake identified threats to the species as loss of habitat from agricultural, commercial and urban development, and collection by amateur herpetologists (Service 1985). The historical threats to the species remain, but there are now additional threats to the species, such as: (1) the California red-legged frog, the primary prey for the San Francisco garter snake, is a threatened species; (2) introduction of bullfrogs which prey on both the San Francisco garter snake and California red-legged frog; (3) possible hybridization with other species; (4) aquatic habitat removal for flood control; (5) seral succession of the remaining breeding habitat to the level that much of it has become unsuitable for the species; (6) potential illegal collection; and (7) rapid global climate change which may increase the Pacific Ocean tidal zone, eliminating many of the fresh water marshes essential for the survival of the species (Sloan *in litt.* 2007).

The most closely monitored population of the San Francisco garter snake is the population located on the West of Bayshore property. Although historically the property consisted of a sizable brackish wetland, a series of dredging and filling activities throughout the 1940's and 1950's transformed the area to its present state. These changes enabled the development of suitable upland and fresh water marsh habitat for the garter snake, allowing for large increases in the population during the next three decades (Larsen 1994). Although it was believed that this population was in rapid decline, recent trapping studies on the property have shown this population to be more robust than previously believed (Swaim *in litt.* 2007). There continues to be concerns however regarding the genetic fecundity of the species at this location as the morphology of individuals from the property has changed since Wharton *et al.* (1989) performed their initial research on the species at this location. This suggests to some experts that hybridization may be occurring at the site with another species or subspecies introduced in recent years to the area (Barry *in litt.* 2006; K. Swaim, Swaim Biological Incorporated, pers. comm. 2007). However, these color discrepancies may simply be a fuller expression of the natural phenotype (Larsen pers. comm. 2006; McGinnis pers. comm. 2007).

Population estimates for western San Mateo County remain to be fully investigated. However, San Francisco garter snake populations along the Pacific Coast may be more extensive than previously believed as well. In recent years, San Francisco garter snakes were observed within the Denniston Creek system, which, though historically present, were believed to have been extirpated from the area in the 1980s (Barry 1994, Swaim *in litt.* 2007). This area is currently being transferred to the Golden Gate National Recreation Area where it will be managed for both the San Francisco garter snake and the California red-legged frog as it is believed by experts to contain excellent potential habitat for both of these species (Swaim *in litt.* 2007). San Francisco garter snakes have also been observed in Pillar Point Marsh, on the west side of State Highway One (Swaim pers. comm. 2007). However, this population is currently being threatened by recreational and residential development proposed on open space lands adjacent to the marsh.

San Francisco garter snakes are known from within the City of Half Moon Bay. The extent of this population is uncertain as few focused surveys have been performed within the area but there is connectivity between the City and known occupied properties. Further, no barriers to movement exist within the City that would prohibit the presence or movement of the species within the region or associated waterways (Swaim *in litt.* 2007). In 1988, McGinnis observed two San Francisco garter snakes at the Pilarcitos Terminal Lagoon in Pilarcitos Creek which he believes may represent the remnants of a much larger population that has since been reduced by habitat loss and continued development (McGinnis 1988, McGinnis pers. comm. 2007). This prompted McGinnis to suggest that San Francisco garter snakes were using Pilarcitos Creek as a movement corridor between the Pilarcitos Terminal Lagoon and the Apanolio Pond. The Pilarcitos Terminal Lagoon is approximately 0.5 mile from the mouth of Frenchman's Creek during the driest seasons. During wetter periods however, these two stream corridors are joined by a small lagoon.

Mission Blue Butterfly

The mission blue butterfly was listed as endangered in 1976 (Service 1976). The mission blue butterfly was described by Hovanitz in 1937 based on specimens collected at Twin Peaks in San Francisco. The butterfly has not been observed at that location in a number of years. The butterfly inhabits grasslands and coastal shrub in southern Marin, San Francisco, and San Mateo counties in California that contain one or all three of its larvae foodplants (*Lupinus albifrons*, *L. formosus*, and *L. variicolor*).

The wingspan of the adult mission blue butterfly is about an inch. The uppersides of the wings of the males are bright blue with white margins; the undersides are pale grey with two rows of irregular white-ringed black spots. The upperside of the wings of the female are brown, usually with a flush of blue scales at the base of the forewing.

The mission blue butterfly is univoltine and has a flight period that extends from late March to mid-June. On San Bruno Mountain, discrete populations of the butterfly near the mountain's peak and on the western and southern-facing slopes generally are the first to emerge each year (Service 1984). These are followed by populations on the Northeast Ridge and the main ridge. Mission blue butterflies in Owl and Buckeye canyons are the last to emerge, perhaps due to their northern exposure and intermittent creeks which keep these areas cooler and moister than other areas of San Bruno Mountain.

After they have mated, the females lay their eggs throughout their flight period. Single eggs are deposited on the leaves, stems, flowers, and seed pods of the *Lupinus* foodplants. The eggs are green overlaid by white papillae of the chorion (Comstock and Dammers 1935). The majority of eggs are laid on new growth, primarily the upper surfaces of the leaflets (Service 1984), and they hatch in about 4-10 days (Downey 1957; Guppy and Shepard 2001; Service 1984). The mature larvae are reddish purple or green with three purple or inconspicuous diagonal white lines on each body segment and the body is covered with short white hairs (Layberry *et al.* 1998; Guppy and Shepard 2001). The first and second instar larvae feed on the mesophyll of the *Lupinus* foodplant. About three weeks after eclosion, the second instar larvae begin an obligate diapause; most diapause in the leaf litter at the base of the foodplants. The following spring, the larvae break diapause and resume feeding. Cessation of diapause varies widely, even among sibling larvae. Under laboratory conditions, this period may be as great as one month. This protracted cessation of diapause and the variation in microclimate is why newly emerged adults can be observed throughout the 8-10 week flight period. The last instar larvae pupate on or near the base of the *Lupinus* foodplant rather than in the ground or in ant nests as suggested by Downey (1957). The pupal stage lasts approximately three weeks (Guppy and Shepard 2001). The pupa is green, and the abdomen is green or reddish-brown with green blotches (Scott 1986; Guppy and Shepard 2001).

The mission blue butterfly is a facultative myrmecophile; presumably specific ant species protect the larvae from parasites, parasitoids, and predators in return for honeydew secreted from special glands on the caterpillars' bodies. Downey (1962a) recorded 11 species of ants that tended Boisduval's blue butterfly (*Icaricia icarioides*), of which the mission blue butterfly is a subspecies. Third and fourth instar larvae are tended by ants, primarily *Prenolepis imparis* (Service 1984). Downey (1957) found that the ant *Formica lasioides* tended the mission blue butterfly on Twin Peaks. Howe (1975) stated that larvae of the mission blue butterfly may sometimes be found on leaves or in the lupine blossoms by looking for the more conspicuous ants in attendance. Ants may construct chambers at the base of the foodplants just beneath the surface of the soil for access to the resting larvae, as diurnal resting places for the larvae, or both (Howe 1975).

In one study, 35 percent of field collected eggs of the mission blue butterfly were parasitized by an unidentified species of encyrtid wasp (Service 1984). Downey (1962b) recorded parasitic wasps of the genus *Trichogramma* as an egg parasite from 50 percent of the 53 populations that he examined of Boisduval's blue butterfly. Third and fourth instar larvae were parasitized by a tachnid fly or braconid wasp. According to Howe (1975), there is a high incidence of parasitism in mature larvae of Boisduval's blue butterfly located on the foodplants during the daytime; he stated that healthy larvae tend to be nocturnal feeders. Rodents also may prey on the early stages (Service 1984).

The grassland and to a lesser degree the coastal scrub habitat are disclimax communities. That is, maintenance and regeneration of the plants characteristic of these ecosystems are dependent upon irregular perturbation processes that preclude normal succession. The *Lupinus* foodplants are dependent upon natural disturbance processes, such as rockslides, mudslides and fires to establish their seedlings. Thus, the survival and recovery of the mission blue butterfly requires not only sufficient tracts of natural habitat, but also maintenance of the natural disturbance factors.

One of the most significant threats to the listed butterfly is loss of habitat due to succession and invasive exotic plant species. Ecosystems are dynamic, fluctuating through time in structure, composition and areal extent. Dynamics are initiated by environmental fluctuation, natural disturbance, species senescence or other intra-community characteristics. The *Lupinus* foodplants of the mission blue butterfly are dependent upon natural perturbations to establish seedlings. Under natural conditions, adults of the mission blue butterfly are widely distributed at relatively low densities. *Lupinus albifrons*, *L. formosus*, and *L. variicolor* also are widely distributed at low densities. These three plants are "pioneer" species (i.e., they grow best in areas of recent localized disturbance or in early stages of grassland succession). Patchily distributed dense colonies of these *Lupinus* are found at sites of natural disturbance, such as rodent burrows, mudslides, rock slides, fire, etc. throughout the grassland. These colonies eventually senesce as other successional plants and weeds invade these sites, unless an irregular disturbance regime occurs that allows the *Lupinus* to propagate.

Non-native grasses and forbs that have invaded California grasslands are a serious threat to the mission blue butterfly due to their ability to become more abundant at the expense of the animal's larval foodplants and adult nectar sources. European annual grasses and forbs have displaced native forbs in native California grasslands, and in turn, have contributed to the decline of the mission blue butterfly (Biswell 1956; Murphy and Ehrlich 1989). This invasion was facilitated by widespread and intensive grazing (Fleischner 1994). Some of the exotic grasses that have invaded grasslands of the San Francisco Bay area are Italian ryegrass (*Lolium multiflorum*), slender oats (*Avena barbata*), ripgut (*Bromus diandrus*), red brome (*B. madritensis rubens*), and softchess (*B. hordaceus*). Some of the exotic forbs that have invaded these grasslands are Italian thistle (*Carduus pycnocephalus*), star thistle (*Centaurea solstitialis*), bull thistle (*Cirsium vulgare*), ehrharta (*Ehrharta erecta*), filaree (*Erodium* species), cat's ears (*Hypochaeris radicata*), burclover (*Medicago polymorpha*), yellow oxalis (*Oxalis pes-capraes*), plantain (*Plantago lanceolata*), sheep sorel (*Rumex acetosella*), blessed milk thistle (*Silybum marianum*), and mustards (*Brassica* and *Sisymbrium* species). Although many exotic forbs are used by the mission blue butterfly as nectar sources, they outcompete and replace native nectar plants, and replace their larval foodplants. A number of shrub species have also invaded grassland habitats in the Bay Area over the past 40 years. These include gorse (*Ulex europaeus*), various brooms (*Genista monspessulana* and *Cytisus scoparius*), and even native shrubs. For example, gorse increased in acreage 140 percent from 1972 to 1986 on San Bruno Mountain (Thomas Reid Associates 1987). Shrubs shade out native grassland forbs and grasses, including the lupine foodplants of the mission blue butterfly. Some California grasslands are subject to reversion to shrubland habitats in the absence of a mechanism to prevent it. Fire and grazing may reverse shrub invasion. While exotic grasses, forbs, and shrubs have displaced the three *Lupinus* species, and various nectar sources from grasslands, some exotic trees have created forests that have replaced the grassland ecosystem inhabited by the mission blue butterfly. For instance, forests of gum trees = eucalyptus (*Eucalyptus* species) at San Bruno Mountain have displaced grassland habitat that likely were used by this species.

<u>Marin Dwarf-flax</u>

Marin dwarf-flax was federally listed as threatened in 1995 (Service 1995). The species was listed as threatened by the State of California in 1992 (CDFG 1992). A detailed account of the taxonomy, ecology, and biology of the Marin dwarf-flax is presented in the *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area* (Service 1998).

Marin dwarf-flax is an annual herb that occurs on serpentine soils from Marin County south to San Mateo County, a range of about 50 miles (Service 1998). Currently, there are 22 presumed extant populations of Marin dwarf-flax throughout the range of the species, 11 of which occur in Marin County, 10 occur in San Mateo County, and one in San Francisco County (California Natural Diversity Database [CNDDB], CDFG 2010).

Marin dwarf-flax flowers from May to July, and is pollinated by insects such as bee flies and pollen beetles (Robison and Morey 1992). The species occurs in serpentine chaparral or serpentine bunchgrass habitat (Robison and Morey 1992). Populations range in size from one plant to thousands of plants (CDFG 2010). Population sizes can fluctuate greatly from year to year (Smith *in litt.* 1998). It is speculated that late rains may provide the most suitable growing conditions for Marin dwarf-flax. The Marin dwarf-flax is threatened by residential and recreational development, foot traffic, and competition with non-native species.

Marin County

Currently, there are 11 presumed extant populations of the Marin dwarf-flax in Marin County: three presumed extant populations occur on the Tiburon Peninsula (CNDDB occurrence numbers 6, 8, and 9), two occur at Mt. Burdell Open Space (CNDDB occurrence numbers 25 and 26), two occur at Big Rock (CNDDB occurrence numbers 13 and 32), two occur on Carson Ridge (CNDDB occurrence numbers 12 and 23), one occurs at Point Reyes National Seashore (CNDDB occurrence number 28), and one occurs near San Rafael (CNDDB occurrence number 11). One population of the Marin dwarf-flax on the Tiburon Peninsula west of the Marin County Day School may have been extirpated (CNDDB occurrence number 10; CDFG 2010).

On the Tiburon Peninsula, one population of the Marin dwarf-flax occurs on Ring Mountain Preserve (CNDDB occurrence number 9), formerly managed by The Nature Conservancy and currently managed by Marin County (L. Serpa, pers. comm., 1996). The preserve is fenced to reduce the incidence of four-wheel drive vehicle and motorcycle use, but is still accessible to bicycles, equestrians, and hikers (C. Bramham, pers. comm., 1997). Thousands of Marin dwarf-flax plants were observed within this population in 1998 (CDFG 2010), though no population surveys have been conducted for this occurrence recently. Another population on the Tiburon Peninsula (CNDDB occurrence number 6) occurs partially on a small preserve at St. Hilary's Church (Robison and Morey 1992; D. Smith, pers. comm., 1997) and partially on private land which has been proposed for development (Easton Point) (Robison and Morey 1992, Service *in litt.* 1996, D. Watrous, pers. comm., 1997). The site is threatened by the proposed development, trampling by people and dogs walking off of established trails, and competition from non-native species (CDFG 2010; CDFG 1997; Buxton, *in litt.,* 1998). There were only 16 plants observed at the site in 1997, but hundreds were observed in 1998 (CDFG 2010); the site has not been surveyed since. A few scattered groups of Marin dwarf-flax plants occur in the Middle Ridge area of the Tiburon Peninsula (CNDDB occurrence number 8). Some of these plants grow on land designated as open space by the Town of Tiburon. The remainder of the plants in the Middle Ridge area occur on private land and are threatened by ongoing or proposed residential development and trampling by hikers (CDFG 2010).

Off of the Tiburon Peninsula, the Carson Ridge populations of Marin County (CNDDB occurrence numbers 12 and 23) occur on Marin Municipal Water District land. The Mt. Burdell Open Space populations (CNDDB occurrence numbers 25 and 26) occur on lands managed by Marin County. One of the Carson Ridge populations (CNDDB occurrence number 23) may be threatened by trail maintenance, trampling by hikers and bikes, and competition from non-native barbed goatgrass *(Aegilops triuncialis).* No threats have been identified for the other Carson Ridge population or the Mt. Burdell Open Space populations (CDFG 2010).

One of the two Big Rock populations of the Marin dwarf-flax (CNDDB occurrence number 13) occurs on land managed by Marin County while the other population (CNDDB occurrence number 32) occurs on private land. The population on County-managed land may be threatened by highway maintenance or roadside spraying (CDFG 2010). The population on private land may be threatened by hillside erosion due to grazing and pedestrians (CDFG 2010). About 200,000 Marin dwarf-flax plants were observed within the Big Rock population on private land in 2000, but the area has not been surveyed since (CDFG 2010).

The Point Reyes National Seashore population (CNDDB occurrence number 28) is protected within the Golden Gate National Recreation Area on land managed by the National Park Service (Norris 1995). The Marin dwarf-flax occurs on land that is being grazed; the impact of grazing on the species is unknown (Nelson *in litt.* 1996).

The status of the Marin dwarf-flax population near San Rafael (CNDDB occurrence number 11) is unknown. Information on this occurrence is limited to specimens collected from the general area in the 1880s.

San Mateo County

Currently, there are 10 presumed extant populations of the Marin dwarf-flax in San Mateo County: four presumed extant populations occur near Crystal Springs Reservoir on land owned by the City and County of San Francisco and managed by SFPUC (CNDDB occurrence numbers 1, 3, 22, and 30), two occur at Edgewood County Park (CNDDB occurrence numbers 4 and 17), one occurs on land owned by San Mateo County at the Hillcrest Detention Home (CNDDB occurrence number 31), one occurs on private land in Woodside Glens (CNDDB occurrence number 5), one occurs on private land on the west-southwest slope of Black Mountain (CNDDB occurrence number 21), and one occurs at Stulsaft Park in Redwood City (CNDDB occurrence number 29) (CDFG 2010). Two populations of the Marin dwarf-flax within San Mateo County have been extirpated: one near Redwood City (CNDDB occurrence number 18) and one near Crystal Springs Dam (CNDDB occurrence number 2) (CDFG 2010).

The four populations of the Marin dwarf-flax near Crystal Springs Reservoir (CNDDB occurrence numbers 1, 3, 22, and 30) are currently protected from development on land owned by the City and County of San Francisco and managed by SFPUC. However, these populations are threatened by continued use of hiking and biking trails, the proposed development of new trails in the watershed, competition from non-native plants (e.g., yellow star thistle (*Centaurea solstitialis*) and non-native grasses), trash dumping, the proposed enlargement of the Lower Crystal Springs Reservoir (SFPUC 2010), the construction and maintenance of access roads, pipeline maintenance, and other operations and maintenance activities conducted by SFPUC in the watershed (CDFG 2010).

The two populations of the Marin dwarf-flax at Edgewood County Park (CNDDB occurrence numbers 4 and 17) may be threatened by trail use (CDFG 2010). The populations were previously threatened by the proposed development of a golf course, but the proposal was abandoned (CDFG 2010).

The population near Woodside Glen (CNDDB occurrence number 5) occurs on land set aside as compensation for impacts to the federally listed as threatened bay checkerspot butterfly (*Euphydryas editha bayensis*). The site is threatened by non-native grasses, water runoff from homes upslope, erosion, and trash dumping (CDFG 2010).

The population of the Marin dwarf-flax on the west-southwest slope of Black Mountain (occurrence number 21) occurs on the privately owned lands of the Hillsborough Highlands Estates between a driveway and a road. This population may be threatened by development and is subject to erosion (CDFG 2010).

The population of the Marin dwarf-flax at Stulsaft Park in Redwood City (CNDDB occurrence number 29) is threatened by competition from non-native plants (e.g., Italian ryegrass (*Lolium multiflorum*)) and erosion from off-trail use (CDFG 2010). About 500 Marin dwarf-flax plants were observed at this site in 2000, but the site has not been surveyed since (CDFG 2010).

San Francisco County

Within San Francisco County, the only known extant population of the Marin dwarf-flax occurs within the Golden Gate National Recreation Area near the World War II Memorial at the San Francisco Presidio (CNDDB occurrence number 16). This population is currently protected on lands managed by the National Park Service. The site, however, is threatened by trampling due to its location adjacent to a well-used trail (CDFG 2010) and the encroachment of coastal scrub, especially blue blossom ceanothus (*Ceanothus thyrsiflorus*), into the coastal prairie habitat (Chassé *et al.* 2009). San Francisco Presidio natural resources staff manage the site for the benefit of the Marin dwarf-flax by trimming back blue blossom ceanothus where it encroaches upon areas of Marin dwarf-flax and removing by hand non-native plant species such as big quakinggrass (*Briza maxima*) and common catchfly (*Silene gallica*) (Chassé *et al.* 2009). Threats from non-native plant species appeared negligible during surveys in 2008 (Chassé *et al.* 2009). The Marin dwarf-flax occurs within two subpopulations at this site in coastal serpentine prairie and scrub habitat. In 2008, there were a total of 1,086 Marin dwarf-flax plants within this population (Chassé *et al.* 2009).

Two populations of the Marin dwarf-flax within San Francisco County have been extirpated (CNDDB occurrence numbers 14 and 15). Another occurrence of the Marin dwarf-flax at Inspiration Point at the San Francisco Presidio may have been extirpated despite the availability of suitable habitat (CNDDB occurrence number 20); the species has not been seen at this site since 1985 (CDFG 2010).

<u>California Red-legged Frog Critical Habitat</u>

Critical habitat for the California red-legged frog was designated on April 13, 2006 (Service 2006a). On September 16, 2008, the Service published a proposed rule revising critical habitat for the listed amphibian (Service 2008). On March 16, 2010, the Service designated the additional critical habitat for the California red-legged frog (Service 2010). When designating critical habitat, the Service is required to list the known PCEs essential to the conservation of the species, and that may require special management considerations and protection (50 CFR §

424.14). Such physical and biological features include, but are not limited to, space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing or development of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species (Service 2006a).

Within areas essential for the conservation and recovery of the California red-legged frog, the Service has determined the following PCEs:

> PCE 1: aquatic breeding habitat defined as standing bodies of fresh water (with salinities less than 7.0 parts per thousand), including natural and manmade ponds, slow moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks in all but the driest of years;
>
> PCE 2: non-breeding aquatic habitat defined as freshwater habitats, as described in PCE 1, that may or may not hold water long enough for the subspecies to hatch and complete its aquatic life cycle but that do provide for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult California red-legged frogs;
>
> PCE 3: upland habitat defined as upland areas within 200 feet of the edge of the riparian vegetation or dripline surrounding aquatic and riparian habitat and comprised of various vegetational series such as grasslands, woodlands, and/or wetland/riparian plant species that provides the California red-legged frog shelter, forage, and predator avoidance;
>
> PCE 4: dispersal habitat defined as accessible upland or riparian dispersal habitat within designated units and between occupied locations within 0.7 mile of each other that allows for movement between such sites and can include various natural habitats and altered habitats such as agricultural fields, which do not contain barriers to dispersal.

Environmental Baseline

<u>California Red-legged Frog</u>

The action area is located within the Recovery Plan's South and East San Francisco Bay Recovery Unit and near the Central Coast Recovery Unit for the California red-legged frog (Service 2002, 2006a). The recovery status for these recovery units is considered high due to many existing populations and many areas with high habitat suitability (Service 2002). The action area is also located within the South San Francisco Bay Core Area for the California red-legged frog (Service 2002, 2006a). The recovery action guidelines provide recommendations for minimizing the effects of various land and water uses, non-native species/predators, and air and water contamination in addition to outlining recommendations for habitat preservation. These recommendations assist in the conservation and recovery of the species, protect high quality habitat within core areas and priority watersheds, increase opportunities for dispersal, population expansion and recolonization, and provide connectivity between core areas and occupied watersheds. The conservation needs for the South San Francisco Bay Core Area are: (1) protect existing populations; (2) control non-native predators; (3) increase connectivity between populations; (4) reduce erosion; (5) implement guidelines for recreation activities to reduce impacts; (6) implement forest practice guidelines; and (7) reduce impacts of urbanization (Service 2002).

Suitable aquatic and upland habitats for California red-legged frog are present in the action area. Suitable breeding habitat is present in portions of San Mateo Creek and some of the streams that drain into Upper Crystal Springs, Lower Crystal Springs, and San Andreas reservoirs. Suitable breeding habitat is also present in some of the wetlands that occur along the shorelines of these reservoirs. Suitable non-breeding habitat is present in intermittent drainages in the project area, and portions of San Mateo Creek. Ephemeral drainages were not considered suitable aquatic habitat because they carry water for only brief periods during rain events, and California red-legged frogs are associated with drainages that carry water for longer periods of time. Portions of San Mateo Creek are unlikely to be used for breeding because these areas have shallow pools (about 1 foot deep) and very limited amounts of emergent vegetation (grasses and sedges) that could provide a substrate for egg laying. Rocky substrate and presence of predatory fish species may also discourage breeding by California red-legged frogs. In addition, all land cover types within the action area were considered suitable upland habitat for California red-legged frog except for landscaped/ developed and ornamental planting areas.

California red-legged frogs have been documented breeding within emergent marsh habitats around the perimeter of Lower Crystal Springs Reservoir and San Andreas Reservoir (CDFG 2010; Entrix 2006). There has also been documented breeding of California red-legged frogs near Crystal Springs Pump Station in San Mateo Creek (CDFG 2010). Based on the availability of suitable breeding, non-breeding, and upland habitat for the California red-legged frog in the action area and the documented occurrence of the species within the action area, the California red-legged frog is assumed to present within the action area.

<u>San Francisco Garter Snake</u>

Suitable aquatic and upland habitats for San Francisco garter snake are present in the action area. Suitable aquatic habitat is present in Upper Crystal Springs Reservoir, Lower Crystal Springs Reservoir, San Andreas Reservoir, San Mateo Creek, and possibly intermittent drainages during portions of the year. Ephemeral drainages were not considered suitable aquatic habitat because they carry water for only brief periods during rain events, and San Francisco garter snakes are associated with drainages that carry water for longer periods of time. In addition, all land cover types within the action area were considered suitable upland habitat for San Francisco garter snake except for landscaped/developed and ornamental planting areas.

Populations of San Francisco garter snake have been documented at Lower Crystal Springs Reservoir, San Andreas Reservoir, and in other areas throughout the entire Crystal Springs watershed (CDFG 2010; Entrix 2006; California Public Utilities Commission 2004). Upland habitats in the project area may be used by San Francisco garter snake for movement, dispersal, and cover, especially sites near suitable aquatic foraging habitats.

Because the location information for San Francisco garter snake is sensitive, this information has been suppressed in the CNDDB and the distances of other known occurrences from the action area cannot be described. There are, however, at least six records for San Francisco garter snake within a maximum of approximately 5 miles of the action area (CDFG 2010), as well as other currently undocumented sightings near Upper and Lower Crystal Springs Reservoirs (Swaim pers. comm.). Based on the availability of suitable habitat for the San Francisco garter snake in the action area and the documented occurrence of the species within and near the action area, the San Francisco garter snake is assumed to present within the action area.

Mission Blue Butterfly

During butterfly surveys in the spring of 2008 (Arnold 2008), eggs, larvae, and adults of the mission blue butterfly were observed at eight locations within, immediately adjacent to, or near the action area for the proposed project. These eight new locations represent a geographic range extension of the species to the south and east. A total of 151 adult mission blue butterflies were observed between April and July. Also during the surveys, 895 mission blue butterfly eggs and 18 post-diapause larvae were observed. The numbers of mission blue butterfly life stages at these locations are comparable to or exceed numbers at other known locations in the watershed (Arnold 2007).

One of the eight mission blue butterfly sites (#3) is located well to the north of the action area and would not be affected by the proposed project. Of the remaining seven sites, six sites are located within the action area (#1, 4, 5, 6, 7, and 8) between staging area A9 and the San Andreas Outlet Structure 2, and one site (#2) is located 230 feet outside of the action area (between San Andreas Outlet Structure 2 and 3). Summer lupine (*Lupinus formosus*), the mission blue butterfly's larval host plant, was associated with all eight of these mission blue butterfly locations. One patch of *L. formosus* (with no mission blue butterfly observed) was mapped approximately 400 feet from the action area (north of staging area A9). In addition, grassland and sparse coyote brush habitats surrounding the larval host plants provide dispersal habitat for the mission blue butterfly to move between lupine areas.

One of the eight mission blue butterfly sites (#1) is a restoration site that was restored as compensation for the PG&E Jefferson-Martin Transmission Line Project (Arnold 2008). This site includes both naturally occurring *L. formosus* plus a number of mitigation plantings. A second site (#2) is a new location since the PG&E project. A third site (#3) formerly supported a limited amount of *L. formosus*, but since the PG&E project was completed, it has increased substantially both through restoration efforts and natural colonization. All three of the sites benefited from brush and tree clearing, which opened up dispersal corridors for the mission blue butterfly to find these new or abundant stands of *L. formosus* (Arnold 2008). Prior to PG&E's transmission line project, surveys indicated that the mission blue butterfly did not occur at these three locations. Thus, the mission blue butterfly was able to swiftly colonize these areas upon restoration and the opening up of corridors for dispersal (Arnold 2008). Sites #1 and #2 lie immediately adjacent to the boundaries of the action area for the proposed project. Site #3 occurs outside but near the action area. The five remaining sites (#4, 5, 6, 7, and 8) occur within the action area (Arnold 2008).

L. formosus was observed growing in the northern approximately one-half of the action area for the proposed project (i.e., north of station P145+00) and was not observed growing in the southern portion of the action area even though grasslands, rock outcrops, and other habitats that might support it occur in that region (Arnold 2008). Fagan loam was common to all eight sites where the mission blue butterfly and its larval host plant were observed. In the southern half of the action area, Fagan loam occurs somewhat more sporadically, and the vegetation is often coastal scrub or another vegetation type rather than annual grassland. Arnold (2008) suspects that these factors may at least partially explain the absence of *L. formosus* in the southern portion of the action area.

Marin Dwarf-flax

Two subpopulations of the Marin dwarf-flax were documented in the action area near proposed staging area A1 northwest of the Crystal Springs Pump Station during surveys in April 2008. The larger subpopulation occurs within about 5 feet of an existing gravel access road that is proposed to be used by construction vehicular traffic for the proposed project. The smaller subpopulation occurs within about 20 feet of an existing vague grassland access road that may or may not be used by the proposed project. The two Marin dwarf-flax subpopulations occur within a total area of about 20 square feet (0.0005 acre) in disturbed annual grassland with a component of serpentine material in the soil. Associated plant species included California oatgrass (*Danthonia californica*), Crystal Springs lessingia (*Lessingia arachnoidea*), California plantain (*Plantago erecta*), rose clover (*Trifolium hirtum*), slender wild oats (*Avena barbata*), and small fescue (*Vulpia microstachys*).

During plant surveys in April 2008, 10 Marin dwarf-flax plants were observed within the subpopulation within 5 feet of the gravel access road while only three Marin dwarf-flax plants were observed within the subpopulation within 20 feet of the grassland access road. During surveys in April 2010, hundreds of Marin dwarf-flax plants were observed within the subpopulation within 5 feet of the gravel access road while no Marin dwarf-flax plants were observed within the subpopulation within 20 feet of the grassland access road (Craven-Green, pers. comm. 2010).

California Red-legged Frog Critical Habitat

The action area is located within the Cahill Ridge (SNM-1) designated critical habitat unit for the California red-legged frog (75 FR 12815-12959; March 17, 2010). Critical habitat unit SNM-1 is comprised of approximately 34,952 acres of land and is located in north central San Mateo County, west of Interstate 280 and south of Pacifica, California. SNM-1 contains the features that are essential for the conservation of the species. The unit contains aquatic habitat for breeding and non-breeding activities (PCE 1 and PCE 2), and upland habitat for foraging and dispersal activities (PCE 3 and PCE 4). SNM-1 was known to be occupied at the time of listing and is currently occupied. The unit contains high-quality permanent and ephemeral aquatic habitats consisting of ponds and streams surrounded by riparian and emergent vegetation that provides for breeding and upland areas for dispersal, shelter, and food. The unit represents the only unit in the San Francisco peninsula, and would assist in maintaining the distribution of the California red-legged frog population within the San Francisco area, and provide connectivity to units farther south into Santa Cruz County. The unit consists of State (12 acres), private (32,844 acres), and local government (2,096 acres) lands and is mapped from occurrences recorded at the time of listing and subsequent to the time of listing. The physical and biological features essential to the conservation of California red-legged frog in the SNM-1 unit may require special management considerations or protection due to development and nonnative invasive plants, which may alter aquatic and upland habitats and thereby result in the direct or indirect loss of egg masses or adults.

Critical habitat encompasses all of the action area west of Interstate 280, to the Upper Crystal Springs Reservoir, Lower Crystal Springs Reservoir, and San Andreas Reservoir shorelines, but excludes the reservoirs themselves. The action area contains aquatic habitat for breeding and non-breeding activities (PCE 1 and PCE 2), and upland habitat for foraging and dispersal activities (PCE 3 and PCE 4). Suitable breeding habitat is present in portions of San Mateo Creek. Suitable non-breeding habitat is present in intermittent drainages in the action area, and portions of San Mateo Creek. Ephemeral drainages were not considered suitable aquatic habitat because they carry water for only brief periods during rain events, and California red-legged frogs are associated with drainages that carry water for longer periods of time. Portions of San Mateo Creek are unlikely to be used for breeding because these areas have shallow pools (about 1 foot deep) and very limited amounts of emergent vegetation (grasses and sedges) that could provide a substrate for egg laying. Rocky substrate and presence of predatory fish species may also discourage breeding by California red-legged frogs. In addition, all land cover types within the action area were considered suitable upland and dispersal habitat for California red-legged frog except for landscaped/developed and ornamental planting areas. These features of the critical habitat which are present at the site are essential to the recovery of the species.

Effects of the Proposed Project

The following activities that are part of the proposed project could result in direct or indirect effects on federally listed species:

1. Creating staging areas to provide storage of equipment, fuel and supplies;

2. Construction relating to structural improvements at the Upper Crystal Springs Dam Culverts, including some underwater work;

3. Improvements of Crystal Springs Outlet Structures 1 and 2;

4. Construction of new facilities at the Crystal Springs Pump Station, including modification of a portion of San Mateo Creek;

5. Vegetation removal and trenching for two new sections of pipeline at either end of the existing CS/SA Pipeline including replacement of the San Andreas Inlet Structure;

6. Pipeline access improvements including installation, repair, or replacement of eight culverts, eight gravel fords, one bridge, and clean out of three culverts along the CS/SA Pipeline;

7. Bank stabilization activities;

8. Operating equipment and other construction activities, including clearing and grading access roads;

9. Construction of a new boat ramp at San Andreas Outlet Structure 2;

10. Construction at San Andreas Outlet Structures 2 and 3, including installation of retaining walls and underwater work; and

11. Performing operations and maintenance activities necessary to maintain infrastructure.

Temporary and permanent effects on habitat for federally listed species are summarized in Tables 6 and 7 below. Table 6 summarizes temporary and permanent effects on habitat for federally listed species categorized by land cover types and project features. Table 7 summarizes the overall temporary and permanent effects on habitat for federally listed species and the proposed restoration/compensation to offset the effects. Temporary effects are effects to habitat lasting for less than one year with the habitat being restored by the following year. Any effects to habitat lasting for more than one year are categorized as permanent effects. Acreages of temporary or permanent habitat losses were calculated for areas that would be cleared of vegetation or experience ground disturbance, with additional acreage to allow flexibility to the contractor when developing access roads (e.g., for equipment maneuverability and to provide the contractor flexibility to shift a road slightly in order to avoid tree removal). Temporary habitat losses were also calculated for all areas that would be temporarily inaccessible to California red-legged frog and San Francisco garter snake due to the installation of exclusion fencing around proposed work areas. Temporary or permanent habitat losses were not calculated for areas that would be affected by noise, light, or dust (except in the case where Marin dwarf-flax plants occur adjacent to existing access roads proposed to be used by construction vehicular traffic).

<u>California Red-legged Frog and San Francisco Garter Snake</u>

Because effects to California red-legged frog and San Francisco garter snake are similar, these species are discussed together in this section. For the purpose of the effects discussion, perennial and intermittent drainages, emergent wetlands, and portions of the reservoirs within 100 feet of the shore are considered suitable aquatic habitat for both species. The effects of each of the proposed project components on suitable aquatic habitat for the California red-legged frog and San Francisco garter snake are summarized in Table 8 below. The intermittent and perennial drainages that would be affected by the proposed project are summarized in Table 9 below. All land cover types within the action area were considered suitable upland habitat for California red-legged frog and San Francisco garter snake except for landscaped/developed and ornamental planting areas.

Table 6. Temporary and Permanent Effects on Land Cover Types in the Project Area.

Land Cover Type	Federally Listed Species Potential Use[a]	Project Location/Features[b]	Permanent Effects (acres)	Temporary Effects (acres)
Woodlands (native)	CRLF, SFGS	CSPS, CS/SA PL, UCSD	1.86	26.64
Woodlands (non-native)	CRLF, SFGS	CSPS, CS/SA PL, SAOS-2, SAOS-3, UCSD	0.92	15.91
Woodlands (mixed native and non-native)	CRLF, SFGS	CS/SA PL, UCSD	0.26	5.84
Coyote brush	MBB, CRLF, SFGS	CS/SA PL, SAOS-3	0.29	10.64
Grassland	MBB, CRLF, SFGS	CS/SA PL, SAOS-3, UCSD	1.83	34.32
Riparian	CRLF, SFGS	CS/SA PL	0.07	0.34
Emergent wetland	CRLF, SFGS	CS/SA PL, SAOS-3, UCSD	0.12	0.38
Reservoir	CRLF, SFGS	SAOS-2, SAOS-3, UCSD	6.26	2.35
Ephemeral drainage	N/A	CS/SA PL	0.01	0.01
Intermittent drainage	CRLF, SFGS	CS/SA PL	0.01	0.05
Perennial drainage	CRLF, SFGS	CSPS, CS/SA PL	0.04	0.07
Unvegetated shore	MBB, CRLF, SFGS	CS/SA PL, SAOS-2, SAOS-3, UCSD	0.06	2.56
Landscaped/Developed	N/A	CSPS, CS/SA PL, UCSD	3.73	13.92
Ornamental Plantings	N/A	CS/SA PL	0.05	0.38
Total Acres	**N/A**	**N/A**	**15.51**	**113.41**

Source: Based on field surveys and geographic information systems (GIS) analyses conducted for the Crystal Springs San Andreas transmission System Upgrade Project.

[a] MBB = mission blue butterfly; CRLF = California red-legged frog; SFGS = San Francisco garter snake; N/A = not applicable/not habitat.

[b] CSPS = Crystal Springs Pump Station; CS/SA PL = Crystal Springs/San Andreas Pipeline; SAOS-2 = San Andreas Outlet Structure 2; SAOS-3 = San Andreas Outlet Structure 3; UCSD = Upper Crystal Springs Dam

Table 7. Summary of Effects on Habitat for Federally Listed Species and Proposed Restoration and Compensation.

Species/ Critical Habitat	Habitat Types Affected	Habitat Affected (acres)		Compensation (acres)		
		Permanent	**Temporary**	**Restoration On-Site**	**Non-Native to Native Habitat Enhancement**[d]	**Creation/ Enhancement**[a]
Mission blue butterfly	Grassland, coyote brush, unvegetated shoreline	0.83	13.24	13.24	~1-3[d]	2.6 acres onsite/adjacent enhancement with Conservation Easement[h]
California red-legged frog and San Francisco garter snake	Aquatic habitat-drainages, wetlands, and reservoir	0.19	2.85	2.85	not applicable	0.60 acre offsite wetland creation at San Andreas Reservoir Site[e] with Conservation Easement
California red-legged frog and San Francisco garter snake	Upland habitat - all grassland, woodland, and shrub habitats	5.27	107.8[b]	78.8[c]	29.0[d] (about 7 acres will be placed under a Conservation Easement)	2.8 acres offsite preservation at Adobe Gulch Grasslands[f] with Conservation Easement; 2.6 acres onsite/adjacent preservation with Conservation Easement within the mission blue butterfly enhancement area[h]
California red-legged frog designated critical habitat	Aquatic habitat - drainages and wetlands	0.17	0.50	0.50	not applicable	0.60 acre offsite wetland creation at San Andreas Reservoir Site[e] with Conservation Easement
California red-legged frog designated critical habitat	Upland habitat - all grassland, woodland, and shrub habitats	5.27	107.8[b]	78.8[c]	29.0[d] (about 7 acres will be placed under a Conservation Easement)	2.8 acres offsite preservation at Adobe Gulch Grasslands[f] with Conservation Easement; 2.6 acres onsite/adjacent preservation with Conservation Easement within the mission blue butterfly enhancement area[h]
Marin dwarf-flax	Serpentine grassland	0.0005[i]	0.00	0.00	0.00	0.05 acre offsite preservation by Boat Ramp MMP[g] with Conservation Easement

Footnotes on next page.

a Offsite compensation will be provided ahead of or concurrent with effects. The details of offsite habitat creation/enhancement are described in Winzler & Kelly (2010a,b,c). All conservation easements will follow the guidelines in the *Sacramento Fish and Wildlife Office Selected Review Criteria for Section 7 Off-Site Compensation* (Service 2009) which is enclosed with this biological opinion. The location and details of offsite and onsite compensation sites may be changed with Service approval.

b. A total of about 107.8 acres of suitable upland habitat would be temporarily affected. Of this total, about 82.2 acres would be temporarily disturbed by clearing and/or grading (including removal of non-native trees) while the remaining 25.6 acres beyond the clear/grade limits would not be disturbed but would be temporarily inaccessible due to exclusion fencing erected to minimize the potential for harm or injury to federally listed species near the work area.

c. The 78.8 acres of suitable upland habitat restored on-site includes 53.2 acres temporarily disturbed by clearing and/or grading that would be restored onsite (without enhancement) to pre-project conditions or better and 25.6 acres outside of the clearing/grading limits but within the exclusion fencing areas that would not require restoration.

d. The removal of 29.0 acres of lower quality non-native woodland (e.g., blackwood acacia, Monterey pine, Monterey cypress, and eucalyptus) and restoring to higher quality open native oak woodland/savanna upland habitat for the California red-legged frog and San Francisco garter snake. The mission blue butterfly could also potentially benefit from the conversion of about 1-3 acres of non-native woodland to grasslands within 400 feet of known occurrences of the listed butterfly. About 7 acres of the non-native tree removal area will be placed under a conservation easement with long-term management. The details of the onsite revegetation and habitat enhancement plan are described in the *Crystal Springs/San Andreas Transmission Upgrade Project Conceptual Restoration, Revegetation and Enhancement Plan* (May & Associates and ICF International 2010). The conservation easement will follow the guidelines in the *Sacramento Fish and Wildlife Office Selected Review Criteria for Section 7 Off-Site Compensation* (Service 2009).

e. The offsite creation of 0.60 acre of wetland habitat for the California red-legged frog and San Francisco garter snake at the San Andreas Reservoir Wetland site is described in Winzler & Kelly (2010a); it will be implemented by January 2012 and a conservation easement in place by July 2012. The conservation easement will follow the guidelines in the *Sacramento Fish and Wildlife Office Selected Review Criteria for Section 7 Off-Site Compensation* (Service 2009).

f. The offsite preservation of upland habitat for the California red-legged frog and San Francisco garter snake at the Adobe Gulch Grasslands site is described in Winzler & Kelly (2010b); it will be implemented by January 2012 and a conservation easement in place by July 2012. The conservation easement will follow the guidelines in the *Sacramento Fish and Wildlife Office Selected Review Criteria for Section 7 Off-Site Compensation* (Service 2009).

g. The offsite enhancing/re-establishing and preservation of serpentine grassland habitat for the Marin dwarf-flax at the Boat Ramp Fountain Thistle Mitigation and Monitoring Plan (MMP) site is described in Winzler & Kelly (2010c); it will be implemented by January 2012 and a conservation easement in place by July 2012. The conservation easement will follow the guidelines in Service (2009).

h. The details of the onsite mission blue butterfly habitat enhancement plan are described in May & Associates and ICF International (2010). The 2.6-acre onsite habitat enhancement will be implemented and a conservation easement in place by December 2012. The conservation easement will follow the guidelines in the *Sacramento Fish and Wildlife Office Selected Review Criteria for Section 7 Off-Site Compensation* (Service 2009).

i. No Marin dwarf-flax plants occur within the proposed project construction footprint, but about 0.0005 acre of serpentine grassland habitat containing Marin dwarf-flax plants that occurs within 5 feet of an existing gravel access road and within 20 feet of an existing grassland access road may be disturbed by construction vehicular traffic.

Table 8. Permanent and Temporary Effects on Aquatic Habitat for California Red-legged Frog and San Francisco Garter Snake.

Project Component	**Activity**	**Permanent Effects (acres)**	**Temporary Effects (acres)**
Upper Crystal Springs Dam Culverts	Lower culvert excavation area	0.1	0
	Staging areas	0	0.1
	Reservoir disturbance	0	0.44
Crystal Springs Outlet Structures 1 and 2	Reservoir disturbance	0	0
Crystal Springs Pump Station	Air gap outfall	0.001	0.002
	Storm water outfall	0.001	0.002
	Outfall dissipation structure	0.03	0.07
CS/SA Pipeline	Culvert replacement, new culverts, cleaning out culverts, and construct of gravel ford crossings[a]	0.02	0.05
San Andreas Reservoir Inlet Structure	Reservoir disturbance	0	0.8
San Andreas Outlet Structure 2	Boat ramp	0.02	0.04
	Reservoir disturbance	0	0.44
San Andreas Outlet Structures 3	Retaining wall	0.02	0
	Staging area	0	0.28
	Reservoir disturbance	0	0.63
Total		**0.19**	**2.85**

[a] See Table 9 for breakdown of activities and effect acreages for each drainage.

Table 9. Effects from Construction of Features at Drainages that Provide Suitable Aquatic Habitat for California Red-legged Frog and San Francisco Garter Snake.

Drainage ID[a, b]	Drainage Type	Activity	Effects (ft^2)	
			Permanent	**Temporary**
OW-1	Intermittent	Replace culvert	60	96
OW-7	Perennial	Install new culvert	195	60
OW-8a	Intermittent	Construct gravel Ford	30	20
OW-10a	Intermittent	Clean out culvert	0	40
OW-10b	Perennial	Construct gravel Ford	120	80
OW-12	Intermittent	Replace culvert; bank stabilization	48	372
OW-13	Intermittent	Replace culvert; bank stabilization	20	60
OW-15a	Intermittent	Replace culvert; bank stabilization	60	195
OW-15b	Intermittent	Bank stabilization and repair support foundation (saddle)	0	360
OW-18	Intermittent	Replace culvert	60	222
OW-19	Intermittent	Install new culvert	204	80
OW-21	Intermittent	Replace foot bridge with larger bridge	0	40
OW-23	Intermittent	Clean out culvert	0	20
OW-24	Intermittent	Bank stabilization	0	20
OW-25	Intermittent	Bank stabilization	0	48
OW-26	Intermittent	Bank stabilization	0	75
OW-27	Intermittent	Construct gravel ford	30	20
OW-28	Perennial	Install new culvert; bank stabilization	153	60
OW-30	Intermittent	Replace culvert; bank stabilization	40	180
OW-33	Intermittent	Replace pipeline footings on top of culvert fill	0	60
Total (ft^2)			**1020**	**2108**
Total (acres)			**0.02[c]**	**0.05[c]**

[a] Ephemeral drainages were not considered to provide aquatic habitat for California red-legged frog or San Francisco garter snake because they carry water for only brief periods during rain events, and these species are associated with drainages that carry water for longer periods of time. Therefore, ephemeral drainages are not included in this table.

[b] No features would be constructed at intermittent and perennial drainages OW-3, OW-4, OW-5, OW-16, OW-17, OW-20, OW-22, and OW-34. Therefore, there would be no effects on these drainages and they are not included in the table.

[c] These acreages do not include the 0.03 acre of permanent effects and 0.07 acre of temporary effects at San Mateo Creek from construction of outfall structures.

Direct Effects

Potential Harassment, Injury, or Mortality of California Red-legged Frogs and San Francisco Garter Snakes

Potential mortality or injury of California red-legged frogs and San Francisco garter snakes could occur during work within aquatic habitat or if soil or other materials are sidecast or fall into aquatic habitat. Fuel or oil spills adjacent to aquatic habitat could also cause mortality of California red-legged frogs or San Francisco garter snakes.

Mortality or injury of California red-legged frogs and San Francisco garter snakes in upland habitat could occur if burrows containing these species are crushed by construction equipment or California red-legged frogs are displaced from burrows, exposing them to predators and desiccation. Trenches left open during the night could trap California red-legged frogs and San Francisco garter snakes that are moving through the construction area. Moreover, construction activities could temporarily impede the movement of juvenile and adult California red-legged frogs dispersing between breeding areas and upland refuge sites. Noise, vibrations from construction equipment, human activity during construction, and night-lighting may also disturb individuals within or near the project area. The following conservation measures have been incorporated into the proposed project and would avoid or minimize the potential for injury or mortality of California red-legged frog and San Francisco garter snake:

1. *Conservation Measure 1*: Conduct an Environmental Education Program for Construction Crews

2. *Conservation Measure 7*: Conduct Preconstruction Surveys for California Red-legged Frog and San Francisco Garter Snake

3. *Conservation Measure 8*: Install Temporary Exclusion Fencing

4. *Conservation Measure 10*: Avoid Entrapment of California Red-legged Frog and San Francisco Garter Snake

5. *Conservation Measure 11*: Monitor Construction Activities in Suitable Habitat for California Red-legged Frog and San Francisco Garter Snake

6. *Conservation Measure 12*: Minimize the Effect of Temporary Nighttime Lighting on California Red-legged Frog and San Francisco Garter Snake

Potential Stranding of California Red-legged Frog Eggs and Larvae and Subsequent Mortality

The Crystal Springs Reservoir and San Andreas Reservoir are dynamic systems, subject to seasonal fluctuations based on customer demand, system operations and water availability. The reservoir levels are typically at their lowest in early winter, and gain water due to local winter storms and snowmelt runoff from the Sierras in late spring/early summer, the latter representing the bulk of the reservoir water. Reservoir drawdowns associated with construction at the Upper

Crystal Springs Dam Culverts, the Crystal Springs Outlet Structures 1 and 2, and the San Andreas Outlet Structures 2 and 3 during the breeding season of California red-legged frog (November 1 through April 30) could result in the stranding of eggs located in emergent wetlands in and along the reservoirs if the reservoirs are drawn down during the breeding season. Eggs that are exposed to air during reservoir lowering would die. In addition, larvae could be stranded or forced into deeper water where they could be more easily preyed upon by fish. Reservoir drawdowns would also result in the temporary loss of suitable breeding habitat in the fringe wetlands along the reservoirs' shorelines. However, due to the dynamic nature of the reservoir systems, aquatic/breeding habitat along the reservoir fringe is not static in nature, and as such wetland vegetation is not limited to a specific elevation of the reservoirs, but instead frequently spans a wider range of elevations due to operational fluctuations. If the reservoirs must be lowered for construction activities, submerged vegetation in deeper areas may become exposed (or develop) as the reservoir level is lowered, which could provide larvae new areas of cover from predators.

The following conservation measure has been incorporated into the proposed project and would minimize stranding and potential mortality of California red-legged frogs: Avoid and Minimize Potential Stranding of California Red-legged Frog Eggs and Larvae during Reservoir Drawdowns. Any reservoir drawdowns would minimize the potential for stranding of eggs or larvae by restricting drawdowns to between May 1 and November 30 which is outside of the November 1 – April 30 breeding season except for the month of November. The majority of California red-legged frog breeding, however, does not occur until after December; therefore, the potential for stranding of eggs and larvae due to reservoir drawdowns in November would be small. Additionally, the proposed reservoir drawdowns would be within normal reservoir operating levels, and therefore, should not result in any additional effects to California red-legged frogs above existing conditions.

Temporary Disturbance or Degradation and Permanent Loss of Suitable Aquatic Habitat for California Red-legged Frog and San Francisco Garter Snake

Approximately 0.19 acre of suitable aquatic habitat (wetlands, intermittent and perennial drainages, and reservoir) would be permanently lost from the following activities (Table 8):

1. Lower Culvert excavation area at Upper Crystal Springs Dam;

2. Air gap outfall storm water outfall, outfall dissipation structure and placement of rip rap within San Mateo Creek at Crystal Springs Pump Station;

3. Installation of new culverts and gravel ford crossings at intermittent and perennial drainages (Table 9);

4. Construction of a boat ramp at San Andreas Outlet Structure 2; and

5. Construction of a retaining wall at the San Andreas Outlet Structure 3.

Approximately 2.85 acres of suitable aquatic habitat (wetlands, intermittent and perennial drainages, and reservoir) would be temporarily disturbed by the following activities:

1. Work areas around the air gap outfall and storm water outfall, installation of cofferdam and dewatering a portion of San Mateo Creek for construction of the outfall dissipation structure;

2. Constructing the San Andreas Reservoir Inlet Structure and associated work area within the San Andreas Reservoir;

3. Use of the boat ramp, Upper Crystal Springs Dam, and San Andreas Outlet Structure 3 staging areas;

4. Construction activities and work areas within the reservoirs; and

5. Temporary disturbance associated with the work areas for culvert repair and replacement, new culverts, cleaning out culverts, and construction of gravel ford crossings.

Work areas for culvert work and construction of fords were estimated based on the type of activity at each drainage (Table 9). Although construction along the reservoir shore was assumed to temporarily affect aquatic habitat to 100 feet from the shoreline (because of noise and activity, and potential erosion and sedimentation), temporary losses of reservoir habitat were only calculated for work areas within the reservoirs. Degradation of aquatic habitat could occur through erosion and/or sedimentation, or oil and fuel spills. The following conservation measures have been incorporated into the proposed project and would avoid, minimize, and compensate for disturbance and degradation of aquatic habitat for California red-legged frog and San Francisco garter snake.

1. *Conservation Measure 9*: Install Erosion Control Measures and Preventing Spills near Aquatic Habitat

2. *Conservation Measure 14*: Compensate for the Permanent Loss and Temporary Disturbance of Aquatic Habitat for California Red-legged Frog and San Francisco Garter Snake

SFPUC will compensate for the permanent loss of 0.19 acre of suitable aquatic habitat for the California red-legged frog and San Francisco garter snake by creating offsite 0.60 acre of wetlands at the San Andreas Reservoir site (Winzler & Kelly 2010a) and protecting the wetlands in perpetuity under a conservation easement (Table 7). The 2.85 acres of suitable aquatic habitat temporarily disturbed by the proposed project would be restored onsite.

<u>*Temporary Disturbance and Permanent Loss of Suitable Upland Habitat for California Red-legged Frog and San Francisco Garter Snake*</u>

Approximately 5.27 acres of suitable upland habitat for the California red-legged frog and San Francisco garter snake (Table 7) would be permanently lost (effects lasting for more than one year) due to excavation at Upper Crystal Springs Dam, fencing of the Crystal Springs Outlet Structures 1 and 2 (2 years), fencing of the Crystal Springs Pump Station construction areas (3 years), construction of the gravel access roads along the pipeline (15 foot wide corridor), and from construction of retaining walls at the San Andreas Outlet Structure 1 and 3. Approximately 0.92 acre of the 5.27 acres permanently affected upland habitat is non-native woodland habitat that is considered lower quality upland habitat for California red-legged frog and San Francisco garter snake.

Approximately 82.2 acres of suitable upland habitat for the California red-legged frog and San Francisco garter snake would be temporarily disturbed by clearing and/or grading (including non-native tree removal) by the proposed project (Table 7). An additional 25.6 acres of suitable upland habitat beyond the clearing and grading limit would not be disturbed but would be temporarily inaccessible to the California red-legged frog and San Francisco garter snake due to the installation of exclusion fencing around the work areas to protect the species from harassment, harm, injury, or mortality. Thus, a total of 107.8 acres of suitable upland habitat for the California red-legged frog and San Francisco garter snake would be temporarily disturbed or temporarily inaccessible to the California red-legged frog and San Francisco garter snake due to the proposed project.

SFPUC will compensate for the permanent loss of 5.27 acres and temporary disturbance or inaccessibility of 107.8 acres of suitable upland habitat for the California red-legged frog and San Francisco garter snake by (Table 7):

1. Restoring onsite to pre-project conditions or better 53.2 acres of suitable upland habitat (grassland, native oak woodland, or native shrub) for the California red-legged frog and San Francisco garter snake temporarily disturbed by clearing or grading (May & Associates and ICF International 2010);

2. Making the 25.6 acres of suitable upland habitat beyond the clearing/grading limit but temporarily inaccessible to the California red-legged frog and San Francisco garter snake due to exclusion fencing accessible to the species again immediately after completion of work along each segment of the pipeline and access roads (work in each segment would typically take 3 – 6 months but no more than 1 year);

3. Enhancing onsite and in adjacent areas 29.0 acres of lower quality upland habitat for the California red-legged frog and San Francisco garter snake by removing non-native trees (e.g., blackwood acacia, Monterey pine, Monterey cypress, and eucalyptus) and restoring to grassland or an open oak woodland/savanna (May & Associates and ICF International 2010); about 7 acres of the non-native tree removal enhancement area would be placed under a conservation easement and protected in perpetuity and managed for the California red-legged frog and San Francisco garter snake;

4. Preserving onsite in perpetuity under a conservation easement 2.6 acres of suitable upland habitat for the California red-legged frog and San Francisco garter snake within the proposed mission blue butterfly habitat enhancement area (May & Associates and ICF International 2010); and

5. Preserving offsite in perpetuity under a conservation easement 2.8 acres of suitable upland habitat for the California red-legged frog and San Francisco garter snake within the Adobe Gulch Grasslands site near San Andreas Reservoir (Winzler & Kelly 2010b) or at another Service-approved site.

Indirect Effects

The only indirect effects on California red-legged frog and San Francisco garter snake that is expected to occur is the continued operation and maintenance of the reservoirs, associated structures, access roads, and the pipeline. Some routine maintenance would be required but would be similar to existing activities, including intermittent inspection by SFPUC personnel. These routine inspections would involve driving trucks to sites via grassland, gravel, or paved roadways, and inspecting facilities on foot; exercising and repairing valves; monitoring and repairing erosion or exposed pipeline areas; dewatering the pipeline for planned internal inspections; using divers and barges for underwater inspections of submerged facilities at Crystal Springs Reservoir and San Andreas Reservoir; maintaining service valves, pipes, and removing vegetation to maintain access to exposed pipeline. Culvert maintenance would include annual inspections and potential cleaning.

Vegetation management would include annual trimming of vegetation around pipeline appurtenances, bi-annual trimming of vertical vegetation growth, bi-annual removal of poison oak and other heavy brush, and removal of stump sprouts from previously cleared areas. In addition, new access roads along the pipeline alignment would require routine maintenance similar to existing access roads. Maintenance would include mowing portions of access roads that are restored as perennial grassland once per year. Mowing would typically occur in late summer/fall to minimize effects on federally listed and other special-status species. Although routine inspections would be similar to current activities, a larger area would need to be maintained, such as the new access roads.

<u>Mission Blue Butterfly</u>

For the purpose of the effects discussion, grassland, coyote brush, and unvegetated shore adjacent to known mission blue butterfly observations were considered suitable habitats for mission blue butterfly in the action area.

Direct Effects

<u>*Temporary Disturbance, Injury or Mortality of Mission Blue Butterflies*</u>

Adults and/or eggs of the mission blue butterfly were observed at six sites (#1, 4, 5, 6, 7 and 8) within the action area and one site (#2) 230 feet from the action area. In addition, one patch of *L. formosus* (with no mission blue butterfly observed) was mapped approximately 400 feet from the action area. Because the life cycle of this species is closely tied to their habitat, the removal of suitable habitat could prevent the mission blue butterfly from inhabiting the action area or harm individuals currently occupying suitable habitat. Ground disturbing activities and movement of construction equipment in and near occupied and suitable habitat (including dispersal habitat) could result in the injury or mortality of individuals. In addition, excessive dust from construction could negatively affect the mission blue butterfly larvae or adults or the larval host plants and adult food plants. The following conservation measures have been incorporated into the proposed project and would avoid and minimize the potential for injury or mortality of the mission blue butterfly:

1. *Conservation Measure 1*: Conduct an Environmental Education Program for Construction Crews

2. *Conservation Measure 2*: Monitor Construction in Mission Blue Butterfly Habitat during the Adult's Flight Season (March–July)

3. *Conservation Measure 3*: Fence or Flag and Monitor Mission Blue Butterfly Habitat.

4. *Conservation Measure 4*: Avoid Dust Accumulation on Mission Blue Butterfly Habitat and Marin Dwarf-flax

<u>*Temporary and Permanent Loss and Potential Degradation of Suitable Habitat for Mission Blue Butterfly*</u>

All occupied and unoccupied patches of lupines within the project area that can be avoided will be fenced and protected to minimize effects to mission blue butterfly and its larval host plant. It is assumed, however, that construction activities in close proximity to the lupine patches could degrade this habitat, especially sites #1, 4, and 8, which are located within or immediately outside the limit of temporary effects. In addition, grassland and sparse coyote brush habitats adjacent to known mission blue butterfly observations that provide suitable dispersal habitat will be temporarily and permanently lost. Approximately 0.83 acre of suitable dispersal habitat (annual and perennial grassland, and sparse coyote brush adjacent to occupied lupines) would be permanently lost as a result of construction of the CS/SA pipeline and access road construction along the pipeline. Approximately 13.24 acres of suitable dispersal habitat would be temporarily affected (less than one year) by construction activities (Table 7). Habitat could also be degraded by introduction of invasive plants during construction. The following conservation measures have been incorporated into the proposed project and would restore and compensate for effects on habitat for the mission blue butterfly:

1. *Conservation Measure 5*: Minimize the Introduction and Spread of Invasive Plants

2. *Conservation Measure 6*: Compensate for Permanent and Temporary Losses of Mission Blue Butterfly Habitat

SFPUC will compensate for the permanent loss of 0.83 acre and temporary disturbance of 13.24 acres of suitable dispersal habitat for the mission blue butterfly (Table 7) by:

1. Restoring onsite to pre-project conditions or better the 13.24 acres of suitable dispersal habitat temporarily disturbed (May & Associates and ICF International 2010);

2. Enhancing and protecting under a conservation easement 2.6 acres of suitable dispersal habitat near known occurrences of the mission blue butterfly within the action area by removing trees and shrubs, opening up dispersal corridors, and revegetating with its larval host plant and other native grasses and forbs (May & Associates and ICF International 2010); and

3. Creating an additional approximately 1-3 acres of dispersal habitat for the mission blue butterfly within about 400 feet of known occurrences of the species in the action area by removing non-native trees and shrubs, opening up dispersal corridors, and revegetating with native grasses and forbs (May & Associates and ICF International 2010; Craven-Green, pers. comm. 2010). This action is not likely to result in any short-term adverse effects to the mission blue butterfly because the areas that would be temporarily disturbed by non-native tree and shrub removal are not currently suitable habitat for this species (i.e., non-native woodland).

Indirect Effects

Construction activities have the potential to introduce invasive non-native plant species which could spread into other areas over time. These weeds could degrade suitable habitat for mission blue butterfly by competing with the listed butterfly's larval host plants and adult nectar sources. In addition, routine operation and maintenance activities could introduce weeds upon project completion. Some routine maintenance would be required but would be similar to existing activities, including intermittent inspection by SFPUC personnel. These routine inspections would involve driving trucks to the sites via grassland, gravel, or paved roadways, and inspecting facilities on foot; exercising and repairing valves; monitoring and repairing erosion or exposed pipeline areas; dewatering the pipeline for planned internal inspections; maintaining service valves, pipes, and removing vegetation to maintain access to exposed pipeline. Culvert maintenance would include annual inspections. Invasive weeds may be introduced and spread via vehicle tires. Although routine inspections would be similar to current activities, a larger area would need to be maintained, such as the new access roads. Areas that are repeatedly disturbed are more likely to be colonized by weeds, and these can spread into other areas. The following Conservation Measure would avoid and minimize these potential indirect effects:

Conservation Measure 5: Minimize the Introduction and Spread of Invasive Plants

Additionally, in the short-term, all areas containing non-native plant species that are temporarily disturbed by the proposed project would be revegetated with native grasses and forbs upon restoration. However, these areas would not be managed to permanently remove non-native plant species; thus, without proper management, non-native species are likely to reinfest these areas in the future.

Marin Dwarf-Flax

No Marin dwarf-flax plants occur within the construction footprint of the proposed project. Thus, no Marin dwarf-flax plants would be directly disturbed by clearing/grading and need to be salvaged. However, two subpopulations of the Marin dwarf-flax that occur adjacent to existing gravel and grassland access roads may be disturbed by construction vehicular traffic associated with the proposed project. One subpopulation containing hundreds of Marin dwarf-flax plants (during surveys in April 2010) occurs within about 5 feet of an existing gravel access road that would be utilized by the proposed project. The second subpopulation containing only three Marin dwarf-flax plants (during surveys in 2008 but no plants observed in 2010) occurs within about 20 feet of an existing vague grassland access road that may or may not be used by construction vehicular traffic associated with the proposed project. The two subpopulations combined cover about 20 square feet (0.0005 acre) of serpentine grassland adjacent to the two access roads.

Without implementation of Conservation Measure 16 (Protect Marin Dwarf-flax Plants), the Marin dwarf-flax plants within the two subpopulations and their habitat would become covered by dust or gravel kicked up by construction vehicular traffic along the two access roads. However, with implementation of Conservation Measure 16, the potential for dust and gravel accumulation on the Marin dwarf-flax plants and their habitat would be minimized by the installation of silt fencing along the access roads near the two subpopulations and the periodic watering down of the roads as needed. A biological monitor, or trained inspector, would inspect the silt fencing around the Marin dwarf-flax plants daily during use of the access roads to ensure that the fencing is secure and that the periodic watering of the roads does not result in the pooling of water near the Marin dwarf-flax plants. If the silt fencing is compromised, the monitor will bring this to the attention of appropriate construction personnel, and the fencing will be repaired within 24 hours. The areas containing the Marin dwarf-flax plants would also be surrounded by fencing/flagging (or the previously mentioned silt fencing) and warning signs to keep vehicles and construction workers from entering the areas containing the listed plants. Also, pre-construction surveys would be conducted to identify any other occurrences of the Marin dwarf-flax within the action area; if any additional Marin dwarf-flax plants are found, then these plants would also be fenced/flagged and avoided.

Additionally, SFPUC will compensate for the potential disturbance of about 0.0005 acre of serpentine grassland habitat containing Marin dwarf-flax plants adjacent to two access roads by protecting in perpetuity under a conservation easement offsite (but near the action area) 0.05 acre of suitable habitat containing the Marin dwarf-flax plant at the Boat Ramp Fountain Thistle Mitigation and Monitoring Plan (MMP) site as described in Winzler & Kelly (2010c).

Indirect Effects

Construction activities have the potential to introduce invasive non-native plant species which could spread into other areas over time. These weeds could degrade suitable habitat for the Marin dwarf-flax by outcompeting the species. In addition, routine operation and maintenance activities could introduce weeds upon project completion. Some routine maintenance would be required but would be similar to existing activities, including intermittent inspection by SFPUC personnel. These routine inspections would involve driving trucks to the sites via grassland, gravel, or paved roadways, and inspecting facilities on foot; exercising and repairing valves; monitoring and repairing erosion or exposed pipeline areas; dewatering the pipeline for planned internal inspections; maintaining service valves, pipes, and removing vegetation to maintain access to exposed pipeline. Culvert maintenance would include annual inspections. Invasive weeds may be introduced and spread via vehicle tires. Although routine inspections would be similar to current activities, a larger area would need to be maintained, such as the new access roads. Areas that are repeatedly disturbed are more likely to be colonized by weeds and these can spread into other areas. The following Conservation Measure would avoid and minimize these potential indirect effects:

Conservation Measure 5: Minimize the Introduction and Spread of Invasive Plants

Additionally, in the short-term, all areas containing non-native plant species that are temporarily disturbed by the proposed project would be revegetated with native grasses and forbs upon restoration. However, these areas would not be managed to permanently remove non-native plant species; thus, without proper management, non-native species are likely to reinfest these areas in the future.

Traffic along the access roads adjacent to the two subpopulations of the Marin dwarf-flax in the action area would significantly decrease after construction of the proposed project is completed; however, these two subpopulations would continue to be threatened by infrequent traffic along these access roads associated with operation and maintenance activities. The silt fencing installed along the access roads to protect the two subpopulations from gravel and dust kicked up by construction traffic associated with the proposed project would be removed following completion of the proposed project, thus leaving the two subpopulations exposed to continued degradation and disturbance by operation and maintenance activities. The effects of continued disturbance of the two subpopulations due to operation and maintenance activities would be offset by the protecting in perpetuity under a conservation easement offsite (but near the action area) 0.05 acre of suitable habitat containing the Marin dwarf-flax plant at the Boat Ramp Fountain Thistle MMP site as described in Winzler & Kelly (2010c).

<u>California Red-legged Frog Critical Habitat</u>

The total amount of suitable upland and aquatic habitat within designated critical habitat for the California red-legged frog that would be permanently or temporarily affected by the proposed project was summarized previously in Table 7. The effects of each of the individual project components on suitable aquatic habitat that occurs within designated critical habitat for the California red-legged frog is summarized in Table 10 below. The majority of the action area is located within and has the PCEs of designated critical habitat for California red-legged frog. Specifically, breeding habitat and cover (PCE 1) are present in San Mateo Creek near Crystal Springs Pump Station (Upper Crystal Springs Reservoir, Lower Crystal Springs Reservoir, San Andreas Reservoir are not included within the designated critical habitat area). Non-breeding aquatic habitat and cover (PCE 2) are present in drainages that intersect the pipeline (Table 9). These aquatic habitats also provide food, water, and minerals. The surrounding habitat within the action area provides shelter/cover (e.g., ground squirrel burrows, soil cracks) and dispersal habitat (PCE 3 and PCE 4). The aquatic and upland habitats are relatively undisturbed and are representative of the ecological distribution of the taxon.

Primary Constituent Elements 1 and 2

The proposed project would result in the permanent loss of 0.17 acre of suitable aquatic habitat (PCE 1 and PCE 2) within the California red-legged frog designated critical habitat unit SNM-1, due to Upper Crystal Springs Dam Lower Culvert excavation, construction of outfalls at the Crystal Springs Pump Station, construction of a retaining wall at San Andreas Outlet Structure 3, and installation of new culverts and ford crossings along the CS/SA pipeline route (Table 10). SFPUC will compensate for the permanent loss of aquatic habitat, as described in Conservation Measure 14 (and Table 7), by creating offsite (but within designated critical habitat unit SNM-1) and protecting in perpetuity under a conservation easement approximately 0.60 acre of aquatic habitat containing PCE 1 and PCE 2 at the San Andreas Reservoir Wetland Creation site (Winzler & Kelly 2010a).

Approximately 0.50 acre of aquatic habitat (PCE 1 and PCE 2) within designated critical habitat unit SNM-1 would be temporarily disturbed by dewatering portions of San Mateo Creek for outfall construction and removing and capping the existing reservoir outlet pipe; use of the boat ramp, Upper Crystal Springs Dam, and San Andreas Outlet Structure 3 staging areas; and temporary disturbance from work areas at drainage crossings (acreages of effects to the reservoirs are not included in this discussion because they are not within designated critical habitat) (Table 10 above). There could be temporary disturbance or degradation of aquatic habitat in areas where construction activities would occur upslope of or in close proximity to aquatic habitat. However, conservation measures that would be implemented as part of the proposed project would avoid and minimize these temporary effects, and disturbed habitat would be restored. The permanent loss of a small amount of suitable aquatic habitat (which would be compensated by restoring a greater amount of habitat nearby) and the temporary loss of a small amount of aquatic habitat (which would be restored onsite) by the proposed project would not appreciably diminish or preclude the survival and recovery of California red-legged frog.

Primary Constituent Elements 3 and 4

Approximately 5.27 acres of suitable upland habitat for the California red-legged frog (PCE 3 and PCE 4) within designated critical habitat unit SNM-1 would be permanently lost (effects lasting for more than one year) due to excavation at Upper Crystal Springs Dam, fencing of the Crystal Springs Outlet Structures 1 and 2 (2 years), fencing of the Crystal Springs Pump Station construction areas (3 years), construction of the gravel access roads along the pipeline (15 foot wide corridor), and from construction of retaining walls at the San Andreas Outlet Structure 1 and 3 (Table 7).

Approximately 82.2 acres of suitable upland habitat for the California red-legged frog (PCE 3 and PCE 4) within designated critical habitat unit SNM-1 would be temporarily disturbed by clearing and/or grading (including non-native tree removal) by the proposed project (Table 7). An additional 25.6 acres of suitable upland habitat beyond the clearing and grading limit would not be disturbed but would be temporarily inaccessible to the California red-legged frog due to the installation of exclusion fencing around the work areas to protect the species from harassment, harm, injury, or mortality. Thus, a total of 107.8 acres of suitable upland habitat

Table 10. Permanent and Temporary Effects on Aquatic Habitat with Critical Habitat for California Red-Legged Frog

Project Component	**Activity**	**Permanent Effects (acres)**	**Temporary Effects (acres)**
Upper Crystal Springs Dam Culverts	Lower culvert excavation area	0.1	0
	Staging areas	0	0.1
Crystal Springs Pump Station	Air gap outfall	0.001	0.002
	Storm water outfall	0.001	0.002
	Outfall dissipation structure	0.03	0.07
CS/SA Pipeline	Culvert replacement, new culverts, cleaning out culverts, and construct of gravel ford crossings[a]	0.02	0.05
San Andreas Outlet Structures 3	Retaining wall	0.02	0
	Staging area	0	0.28
Total		**0.17**	**0.50**

[a] See Table 9 for breakdown of activities and effect acreages for each drainage.

(PCE 3 and PCE 4) for the California red-legged frog would be temporarily disturbed or temporarily inaccessible to the California red-legged frog due to the proposed project.

SFPUC will compensate for the permanent loss of 5.27 acres and temporary disturbance or inaccessibility of 107.8 acres of suitable upland habitat for the California red-legged frog within designated critical habitat by restoring, enhancing, and/or preserving suitable upland habitat within designated critical habitat unit SNM-1 that contains PCE 3 and PCE 4 as described below and in Table 7:

1. Restoring onsite to pre-project conditions or better 53.2 acres of suitable upland habitat (grassland, native oak woodland, or native shrub) for the California red-legged frog temporarily disturbed by clearing or grading (May & Associates and ICF International 2010);

2. Making the 25.6 acres of suitable upland habitat beyond the clearing/grading limit but temporarily inaccessible to the California red-legged frog due to exclusion fencing accessible to the species again immediately after completion of work along each segment of the pipeline and access roads (work in each segment would typically take 3 – 6 months but no more than 1 year);

3. Enhancing onsite and in adjacent areas 29.0 acres of lower quality upland habitat for the California red-legged frog by removing non-native trees (e.g., blackwood acacia, Monterey pine, Monterey cypress, and eucalyptus) and restoring to grassland or an open oak woodland/savanna (May & Associates and ICF International 2010); about 7 acres of the non-native tree removal enhancement area would be placed under a conservation easement and protected in perpetuity and managed for the California red-legged frog;

4. Preserving onsite in perpetuity under a conservation easement 2.6 acres of suitable upland habitat for the California red-legged frog within the proposed mission blue butterfly habitat enhancement area (May & Associates and ICF International 2010); and

5. Preserving offsite in perpetuity under a conservation easement 2.8 acres of suitable upland habitat for the California red-legged frog within the Adobe Gulch Grasslands site near San Andreas Reservoir (Winzler & Kelly 2010b) or at another Service-approved site.

The temporary disturbance of upland habitat would not adversely modify critical habitat because disturbed upland habitat would be restored or improved upon project completion. Although the permanent removal of 5.27 acres of upland habitat would affect a portion of designated critical habitat (and PCEs of upland habitat would be lost), the loss of this acreage of upland habitat would not appreciably diminish or preclude the survival and recovery of California red-legged frog. A large amount of upland habitat within and adjacent to the project area would be improved through habitat restoration and would be available for use as aestivation and dispersal habitat for California red-legged frogs that occur in the vicinity of the site. This area, with its PCEs, would support the existing California red-legged frog population in the area.

Indirect Effects

The only indirect effects on designated critical habitat for California red-legged frog that is expected to occur is the continued operation and maintenance of the reservoirs, associated structures, access roads, and the pipeline. Some routine maintenance would be required but would be similar to existing activities, including intermittent inspection by SFPUC personnel. These routine inspections would involve driving trucks to sites via grassland, gravel, or paved roadways, and inspecting facilities on foot; exercising and repairing valves; monitoring and repairing erosion or exposed pipeline areas; dewatering the pipeline for planned internal inspections; using divers and barges for underwater inspections of submerged facilities at Crystal Springs Reservoir and San Andreas Reservoir; maintaining service valves, pipes, and removing vegetation to maintain access to exposed pipeline. Culvert maintenance would include annual inspections and potential cleaning.

Vegetation management would include annual trimming of vegetation around pipeline appurtenances, bi-annual trimming of vertical vegetation growth, bi-annual removal of poison oak and other heavy brush, and removal of stump sprouts from previously cleared areas. In addition, new access roads along the pipeline alignment would require routine maintenance similar to existing access roads. Maintenance would include mowing portions of access roads that are restored as perennial grassland once per year. Mowing would typically occur in late summer/fall to minimize effects on federally listed and other special-status species. Although routine inspections would be similar to current activities, a larger area would need to be maintained, such as the new access roads. Operation and maintenance activities would not significantly affect the PCEs within designated critical habitat for the California red-legged frog or the ability of the PCEs to support the existing California red-legged frog population in the area.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The potential for project-generated effects to contribute to cumulative effects on listed species would arise if any additional project not involving a Federal action were to be constructed within the action area in the foreseeable future. All of the projects within the action area that are known at this time (New Crystal Springs Bypass Tunnel, Lower Crystal Springs Dam Improvements, Crystal Springs Pipeline No. 2 Replacement, and the Bridge Replacement across Lower Crystal Springs Dam) would require a permit from the Corps and would require consultation with the Service. Therefore, these future Federal actions are not considered cumulative to the proposed project.

The action area is located within State- and SFPUC-owned lands and a CDFG reserve. Therefore, the action area is not expected to be threatened by residential or urban development. Public access within the action area is limited to two hiking trails, and the public does not have access to the reservoirs. Therefore, degradation of the action area from excessive public use would be limited to the areas accessible by the two hiking trails. Water quality within the action area is not expected to be degraded because of the public interest in protecting the quality of the water within the watershed for human consumption.

Annual operation and maintenance activities by SFPUC within the action area (e.g., mowing, vegetation clearing, and maintenance of access roads) would be similar to current activities, but a larger area would need to be maintained, such as the new access roads. These annual maintenance activities have the potential to harass or harm California red-legged frogs, San Francisco garter snakes, and mission blue butterflies or degrade the habitat quality for these species and the Marin dwarf-flax within the action area. However, SFPUC has committed to notifying the Service and CDFG before starting any maintenance activities (e.g., maintaining access roads) that have the potential to affect federally listed species.

Climate Change

The global average temperature has risen by approximately 0.6 degrees Centigrade during the 20th Century (International Panel on Climate Change [IPCC] 2001, 2007a, 2007b; Adger *et al.* 2007). There is an international scientific consensus that most of the warming observed has been caused by human activities (IPCC 2001, 2007a, 2007b; Adger *et al.* 2007), and that it is "very likely" that it is largely due to man-made emissions of carbon dioxide and other greenhouse gases (Adger *et al.* 2007). Ongoing climate change (Inkley *et al.* 2004; Adger *et al.* 2007; Kanter 2007) likely imperils the California red-legged frog, San Francisco garter snake, mission blue butterfly, and Marin dwarf-flax and the resources necessary for their survival, since climate change threatens to disrupt annual weather patterns, it may result in a loss of their habitats and/or prey, and/or increased numbers of their predators, parasites, diseases, and non-native competitors. Where populations are isolated, a changing climate may result in local extinction, with range shifts precluded by lack of habitat. Narrowly endemic species such as the San Francisco garter snake, mission blue butterfly, and Marin dwarf-flax are at the greatest risk of extinction due to climate change.

Conclusion

After reviewing the current status of the California red-legged frog, the San Francisco garter snake, the mission blue butterfly, and the Marin dwarf-flax, the environmental baseline for the action area, the effects of the proposed project and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of these four listed species. We based these determinations on the following: (1) the implementation of avoidance and minimization measures as described in the *Description of the Proposed Project* of this biological opinion that minimize the potential for harassment, harm, injury, and mortality of the California red-legged frog, San Francisco garter snake, and mission blue butterfly and minimize the potential for adverse effects to the Marin dwarf-flax; (2) the relocation of California red-legged frogs to suitable habitat outside of the work area; (3) the restoration on-site of all areas temporarily disturbed; and (4) the creation, enhancement, and preservation of habitat both on-site and off-site for all four of the listed species.

After reviewing the current status of the designated critical habitat for the California red-legged frog, the environmental baseline for the action area, the effects of the proposed project and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to result in adverse modification of critical habitat for the California red-legged frog. We based this determination on the following: (1) the restoration on-site of all areas temporarily disturbed; and (2) the creation, enhancement, and preservation of upland and aquatic habitat for the California red-legged frog both on-site and off-site within the affected critical habitat unit.

INCIDENTAL TAKE STATEMENT

Section 9 of the Endangered Species Act and Federal regulations pursuant to section 4(d) of the Act, prohibit take of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. The Service defines harassment as an intentional or negligent act or omission that creates the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. The Service defines harm to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), take that is incidental to and not intended as part of the agency action is not considered to be prohibited, provided such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of State criminal trespass law.

The measures described below are nondiscretionary, and must be implemented by the Corps so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption under section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity that is covered by this incidental take statement. If the Corps (1) fails to require the applicant or any of its contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

<u>California Red-legged Frog</u>

The Service anticipates that incidental take of the California red-legged frog will be difficult to detect for the following reasons: their relatively small body size makes the finding of a dead specimen unlikely; the cryptic nature of the species; losses may be masked by seasonal fluctuations in numbers or other causes; and the species occurs in aquatic, riparian and upland habitats that makes it difficult to detect. Due to the difficulty in quantifying the number of California red-legged frogs that will be taken as a result of the proposed project, the Service is quantifying take incidental to the proposed project as the following:

1. The harassment, harm, capture, injury, and mortality of all egg, larval, juvenile, and adult life history stages of the California red-legged frog within the 3.04 acres of suitable aquatic habitat and the 87.5 acres of suitable upland habitat disturbed during construction of the proposed project.

2. The harassment, capture, and harm of all juvenile, subadult, and adult life history stages of the California red-legged frog within the 25.6 acres of suitable upland habitat outside of the clearing/grading limits but temporarily inaccessible to the California red-legged frog due to the temporary installation of exclusion fencing.

Upon implementation of the following Reasonable and Prudent Measures, all eggs, larvae, juvenile, subadult or adult California red-legged frogs within the action area will become exempt from the prohibitions described under section 9 of the Act resulting from the proposed project. No other forms of take are authorized under this opinion.

San Francisco Garter Snake

The Service anticipates that incidental take of the San Francisco garter snake will be difficult to detect for the following reasons: the cryptic nature of the species; losses may be masked by seasonal fluctuations in numbers or other causes; and the species occurs in aquatic, riparian and upland habitats that makes it difficult to detect. Due to the difficulty in quantifying the number of San Francisco garter snakes that will be taken as a result of the proposed project, the Service is quantifying take incidental to the proposed project as the following:

1. The harassment and harm of all San Francisco garter snakes within the 3.04 acres of suitable aquatic habitat and the 87.5 acres of suitable upland habitat disturbed during construction of the proposed project.

2. The harassment and harm of all San Francisco garter snakes within the 25.6 acres of suitable upland habitat outside of the clearing/grading limits but temporarily inaccessible to the San Francisco garter snake due to the temporary installation of exclusion fencing.

Upon implementation of the following Reasonable and Prudent Measures, all San Francisco garter snakes within the action area will become exempt from the prohibitions described under section 9 of the Act resulting from the proposed project. No other forms of take are authorized under this opinion.

Mission Blue Butterfly

The Service anticipates that incidental take of the mission blue butterfly will be difficult to detect because these insects are difficult to locate in their early life history stages due to the cryptic appearance of the eggs, larvae, and pupae, and their small size and because their larvae diapause in the soil below host plants. Adults may be difficult to observe due to environmental conditions or the field experience of the observers. Losses of these species also may be difficult to quantify due to seasonal fluctuations in their numbers, random environmental events, change in the amount of larvae food plants or adult nectar sources, or additional environmental disturbances. Due to the difficulty in quantifying the number of mission blue butterflies that may be taken as a result of the proposed project, the Service is quantifying take incidental to the proposed project as the following:

1. The harassment, harm, capture, injury, and mortality of all mission blue butterflies, including larvae, inhabiting the 14.07 acres of suitable habitat disturbed during construction of the proposed project.

Upon implementation of the Reasonable and Prudent Measures, incidental take associated with the proposed project in the form of harm, harassment, injury, and mortality of the mission blue butterfly caused by construction activities will become exempt from the prohibitions described under section 9 of the Act.

Effect of the Take

In the accompanying biological opinion, the Service determined that the level of anticipated take is not likely to result in jeopardy to the California red-legged frog, San Francisco garter snake, or mission blue butterfly.

Reasonable and Prudent Measures

The Service has determined that the following reasonable and prudent measures are necessary and appropriate to minimize the effects of the proposed project on the California red-legged frog, San Francisco garter snake, mission blue butterfly, and Marin dwarf-flax:

1. The Corps through the applicant will implement the Conservation Measures in the *Description of the Proposed Project* in this biological opinion.

2. The Corps through the applicant will ensure compliance with this biological opinion.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. The following Terms and Conditions implement Reasonable and Prudent Measure Number One (1):

   a. The Corps through the applicant shall minimize the potential for harm, harassment, injury, and killing of the California red-legged frog, San Francisco garter snake, and mission blue butterfly resulting from project related activities by implementation of the Conservation Measures in this biological opinion.

   b. The Corps through the applicant shall minimize the potential for adverse effects to the Marin dwarf-flax resulting from project related activities by implementation of the Conservation Measures in this biological opinion.

2. The following Term and Condition implements Reasonable and Prudent Measure Number Two (2):

   a. The Corps shall ensure that the applicant complies with the reporting requirements of this biological opinion, including a post construction report outlining how the Conservation Measures were implemented for this project.

Reporting Requirements

The Service must be notified within 24 hours of the finding of any injured or dead California red-legged frog, San Francisco garter snake, or mission blue butterfly, or any unanticipated damage to their habitats associated with the proposed project. Injured California red-legged frogs, San Francisco garter snakes, and mission blue butterflies shall be cared by a licensed veterinarian or other qualified person, such as the Service-approved biologist for the proposed action. Notification must include the date, time, and precise location of the specimen/incident, and any other pertinent information. Dead animals should be sealed in a zip lock bag containing a piece of paper indicating the location, date and time when it was found, and the name of the person who found it; and the bag should be frozen in a freezer in a secure location. The Service contact persons are Division Chief, Endangered Species Program, at the Sacramento Fish and Wildlife Office at telephone (916) 414-6600 and Resident Agent-in-Charge of the Service's Law Enforcement Division at telephone (916) 414-6660.

The applicant shall submit a post-construction compliance report prepared by the on-site biologist to the Sacramento Fish and Wildlife Office within sixty (60) calendar days of the date of the completion of construction activity. This report shall detail (i) dates that construction occurred; (ii) pertinent information concerning the success of the project in meeting the avoidance and minimization measures; (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on the California red-legged frog, San Francisco garter snake, mission blue butterfly, and Marin dwarf-flax, if any; (v) occurrences of incidental take of these listed species, if any; (vi) documentation of employee environmental education; and (vii) other pertinent information.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities that can be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and databases.

1. The Corps and SFPUC should incorporate in their projects the creation of suitable aquatic breeding habitat for the California red-legged frog and San Francisco garter snake while eradicating non-native species such as bullfrogs, non-native fish, and non-native tiger salamanders that threaten the listed species or their prey.

2. The Corps and SFPUC should encourage or require the use of appropriate California native species in revegetation and habitat enhancement efforts and plant willows in appropriate riparian habitat for the benefit of the California red-legged frog.

3. The Corps and SFPUC should decommission access roads in serpentine grassland areas containing the Marin dwarf-flax and other listed plant species and listed butterflies and restore native grasses and forbs to these areas.

4. The Corps and SFPUC should consult with the Service under the Act to minimize the effects of operation and maintenance activities within the Crystal Springs Reservoir and San Andreas Reservoir watersheds on federally listed species.

5. The Corps and SFPUC should incorporate culverts, tunnels, or bridges on highways and other roadways that allow safe passage by California red-legged frogs, San Francisco garter snake, and other listed animals and wildlife.

6. The Corps and SFPUC should minimize the impacts of light pollution on California red-legged frogs, San Francisco garter snake, California tiger salamanders, San Joaquin kit foxes, bats, and other species that migrate primarily at night.

7. The Corps and SFPUC should plant larval host plants and adult nectar sources for the mission blue butterfly and other listed butterflies in suitable habitat within the range of these species and control invasive plant species that threaten their larval host plants. The Corps and SFPUC should monitor the effectiveness of removing non-native trees and shrubs near known occurrences of listed butterflies in opening up dispersal corridors for the listed butterflies.

8. The Corps and SFPUC should minimize the use of rodenticides in suitable upland habitat for the California red-legged frog, San Francisco garter snake, California tiger salamander, San Joaquin kit fox, and other listed species that rely on small mammals for creating burrows or as a prey source.

9. The Corps and SFPUC should incorporate avoidance and minimization measures for migratory birds into their projects.

10. The Corps should comply with Executive Order 13186 by ensuring "that agency plans and actions promote programs and recommendations of comprehensive migratory bird planning efforts such as Partners-in-Flight, U.S. National Shorebird Plan, North American Waterfowl Management Plan, North American Colonial Waterbird Plan, and other planning efforts, as well as guidance from other sources" (66 FR 3853). The Corps and SFPUC should follow the recommendations in the bird conservation plans developed by California Partners in Flight, Central Valley Joint Venture, and Riparian Habitat Joint Venture for restoring and managing wetland, riparian, grassland, oak woodland, chaparral, and coniferous forest habitats for migratory birds (*e.g.*, Central Valley Joint Venture 2006; Riparian Habitat Joint Venture 2004; River Partners and Riparian Habitat Joint Venture 2009; California Partners in Flight 2000, 2002a, 2002b, 2004). The Corps should also develop a Memorandum of Understanding with the Service for the protection of migratory birds as required by Executive Order 13186.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION—CLOSING STATEMENT

This concludes formal consultation on the proposed San Francisco Public Utilities Commission Crystal Springs/San Andreas Transmission Upgrade Project in San Mateo County, California. As provided in 50 CFR 402.16, reinitiating of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must immediately cease, pending reinitiating.

If you have any questions regarding this biological opinion on the San Francisco Public Utilities Commission Crystal Springs/San Andreas Transmission Upgrade Project, please contact Joseph Terry or Ryan Olah at the letterhead address, electronic mail (Joseph_Terry@fws.gov; Ryan_Olah@fws.gov), or at telephone (916) 414-6600.

Sincerely,

Susan K Moore

Susan K. Moore
Field Supervisor

cc:
Wes Stokes, California Department of Fish and Game, Yountville, California
Xavier Fernandez, Regional Water Quality Control Board, Oakland, California
Deborah Craven-Green, San Francisco Public Utilities Commission, San Francisco, California

Enclosure

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Sacramento Fish and Wildlife Office
Selected Review Criteria for Section 7 Off-Site Compensation
Revised Oct. 2009

Property Assurances and Conservation Easement

- ☐ Title Report (preliminary at proposal, and Final Title Insurance at recordation), shall be no older than six months;
- ☐ Property Assessment and Warranty;
- ☐ Subordination Agreement **[if there is any outstanding debt on the property]**;
- ☐ Legal Description and Parcel Map;
- ☐ Conservation Easement (should use the current multi-agency standardized CE template document); or
- ☐ Non-Template Conservation Easement;

Site Assessment and Development

- ☐ Phase I Environmental Site Assessment;
- ☐ Restoration or Development Plan;
- ☐ Construction Security ***[if applicable]***;
- ☐ Performance Security;

Site Management

- ☐ Interim Management Plan;
- ☐ Interim Management Security Analysis and Schedule;
- ☐ Long-Term Management Plan;
- ☐ Endowment Fund Analysis and Schedule;

**Guidelines to assist in understanding what is required are detailed on pages 2–7.

Guidelines

Property Assurances and Conservation Easement (CE)

Title Report

1. Who holds fee title to property? Should be the Project Applicant. If not, there may be liability and contracting issues.
2. Are there any liens or encumbrances (existing debts or easements) on the property?
   a. Review necessary supporting instruments to evaluate liens and encumbrances. Property owner should submit a "*Property Assessment and Warranty*," which discusses each and every exception listed on the Preliminary and Final Title Insurance Policies, evaluating any potential impacts to the conservation value that could result from the exceptions (see below).
   b. The *Property Assessment and Warranty* template is available at http://www.fws.gov/sacramento/es/cons_bank.htm, and should include a summary and full explanation of all exceptions remaining on the title, with a statement that the owner/Grantor accepts responsibility for all lands being placed under the CE as available for the primary purposes of the easement, as stated in the easement, and assures that these lands have a free and clear title and are available to be placed under the CE.
3. Could any of these liens or encumbrances potentially interfere with either biological habitat values or ownership? If existing easements can potentially interfere with the conservation values/habitat of the property, those portions of the land should be deducted from the total compensation acreage (or number of credits) available on the site.
4. A *Subordination Agreement* is necessary if there is any outstanding debt on the property. Review *Subordination Agreement* for adequacy—the lending bank or other lien holder must agree to fully subordinate each lien or encumbrance.

Legal Description and Parcel Map

1. Ensure accuracy of map, and location and acreage protected under the CE.
2. Both the map and the legal description should explain the boundaries of the individual project compensation site. The site should *not* have 'leftover' areas for later use.

Conservation Easement from Template

1. The current CE template can be found at http://www.fws.gov/sacramento/es/cons_bank.htm.
2. Who will hold the easement?
   a. Must have third-party oversight by a qualified non-profit or government agency. Qualifications include:
      i. Organized under IRC 501(c)(3);

ii. Qualified under CA Civil Code § 815;
iii. Bylaws, Articles of Incorporation, and biographies of Board of Directors on file at, and approved, by USFWS.
1. Must meet requirements of USFWS, including 51% disinterested parties on the Board of Directors;

b. Must have satisfactorily completed the CDFG due diligence process for easement/endowment holders and/or be accredited by the Land Trust Accreditation Commission http://www.landtrustaccreditation.org/home.

3. If not using the multi-agency template, applicant should specify objections they have to the template as provided, and may substantially delay processing as they will require Solicitor review. Alternate CEs must be approved by the USFWS prior to recording.

Non-Template Conservation Easements

1. You must either 1) add USFWS as a third-party beneficiary, or 2) add language throughout the document, in all appropriate places, that will assure USFWS the right to enforce, inspect, and approve any and all uses and/or changes under the CE prior to occurrence (including land use, biological management or ownership).
2. Include, at a minimum, language to:
   a. Reserve all mineral, air, and water rights under the CE as necessary to maintain and operate the site in perpetuity;
   b. Ensure all future development rights are forfeited;
   c. Ensure all prohibited uses contained in the multi-agency conservation agreement template are addressed; and
   d. Link the CE, Management Plan, and the Endowment Trust Fund within the document (e.g., note that each exists to support the others, and where each of the documents can be located if a copy is required).
3. Insert necessary language, particularly, but not exclusively, per: (can compare to multi-agency CE template)
   a. Rights of Grantee
   b. Grantee's Duties
   c. Reserved Rights
   d. Enforcement
   e. Remedies
   f. Access
   g. Costs and Liabilities
   h. Assignment and Transfer
   i. Merger
   j. Notices

Site Assessment and Development

Phase I Environmental Site Assessment

1. The Assessment must show that the compensation site is not subject to any recognized environmental conditions as defined by the American Society for Testing and Materials (ASTM) Standard E1527-05 "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, available at http://www.astm.org/Standards/E1527.htm, (i.e., the presence or likely presence of any Hazardous Substances or petroleum products).
2. If the Phase I Environmental Site Assessment identifies any recognized environmental conditions, the Project Applicant must represent and warrant to the USFWS that all appropriate assessment, clean-up, remedial, or removal action has been completed.

Development Plan *[not required if doing preservation only]*

1. The overall plan governing construction and habitat establishment activities required to be conducted on the Property, including, without limitation, creation, restoration, and enhancement of habitat.
   a. This plan should include the baseline conditions of the Property including biological resources, geographic location and features, topography, hydrology, vegetation, past, present, and adjacent land uses, verified *Waters of the U.S. Jurisdictional Determination,* if applicable, species and habitats occurring on the property, a description of the activities and methodologies for creating, restoring, or enhancing habitat types, a map of the approved modifications, overall habitat establishment goals, objectives and Performance Standards, monitoring methodologies required to evaluate and meet the Performance Standards, an approved schedule for reporting monitoring results, a discussion of possible remedial actions, and any other information deemed necessary by the USFWS.
2. Any permits and other authorizations needed to construct and maintain the site shall be included and in place prior to the start of construction of the habitat.
3. Full construction plans for any habitat construction must be *USFWS-approved prior* to the start of construction of the habitat.

Construction Security

a. The Project Applicant shall furnish a Construction Security in the amount of 100% of a reasonable third party estimate or contract to create, restore, or enhance habitats on the property in accordance with the Development Plan.
b. The Construction Security shall be in the form of an irrevocable standby letter of credit, or a cashier's check.
   i. The letter of credit, if chosen, shall be issued for a period of at least one year, and shall provide that the expiration date will be

automatically extended for at least one year on each successive expiration date unless, until extension is no longer necessary.

Performance Security

c. The Project Applicant shall furnish a Performance Security in the amount of 20% of the Construction Security.
d. The Performance Security shall be in the form of an irrevocable standby letter of credit, or a cashier's check.
    i. The letter of credit, if chosen, shall be issued for a period of at least one year, and shall provide that the expiration date will be automatically extended for at least one year on each successive expiration date unless, until extension is no longer necessary.

4. The Construction and Performance Securities must:
    a. Be held by a qualified, Service-approved, non-profit organization or government agency [see requirements under CE above], and
    b. Be held according to minimum standards for assuring maximum success in earning potential, and will include assurances for no loss of principle, and
    c. Disbursements or releases from each of the funds must be for documented expenditures, as they occur.

Site Management

Interim Management Plan

1. The Interim Management Plan should identify the short-term management, monitoring, and reporting activities to be conducted from the time construction ends until the Endowment Fund has been fully funded for one year and all the Performance Standards in the Development Plan have been met.

Interim Management Security Analysis and Schedule

a. The Project Applicant shall furnish an Interim Management Security (in the form of a standby letter of credit) in the amount equal to the estimated cost to implement the Interim Management Plan during the first year of the Interim Management Period, as set for in the Interim Management Security Analysis and Schedule
b. The Interim Management Security Analysis and Schedule shall consist of a table and/or spreadsheet that shows all of the tasks (management, monitoring, reporting), task descriptions, labor (hours), cost per unit, cost frequency, timing or scheduling of the tasks, the total annual funding necessary for each task, and any associated assumptions for each task required by the Interim Management Plan. The total annual expenses should include administration and contingency costs.
c. The Interim Management Security must:

i. Be held by a qualified, Service-approved, non-profit organization or government agency [see requirements under CE above], and
ii. Be held according to minimum standards for assuring maximum success in earning potential, and will assurances for no loss of principle.
iii. Disbursements or releases from the fund must be for documented expenditures, as they occur.

Long-Term Management Plan (LTMP)

1. The LTMP template can be found at http://www.fws.gov/sacramento/es/cons_bank.htm and identifies the long-term management, monitoring and reporting activities to be conducted after the interim Management Period.
2. The LTMP should include at minimum:
   a. Purpose of the Project and purpose of the LTMP;
   b. A baseline description of the setting, location, history, and types of land use activities, geology, soils, climate, hydrology, habitats present (once project meets Performance Standards), and species descriptions;
   c. Overall management, maintenance and monitoring goals; specific tasks and timing of implementation; and discussion of any constraints, which may affect goals;
   d. The Endowment Fund Analysis and Schedule (see below),
   e. Discussion of Adaptive Management actions for reasonably foreseeable events and possible thresholds for evaluating and implementing Adaptive Management;
   f. Rights of access to the Property and prohibited uses of the Property as provided in the CE; and
   g. Procedures for Property transfer, land manager replacement, amendments, and notices.
3. A copy of the LTMP must be either recorded with the CE, or the CE must state in its body that the current management plan can be obtained upon request from the USFWS, if not using the CE template.

Endowment Fund Analysis and Schedule

a. Can use a PAR or PAR-like analysis that must be based upon the final, approved LTMP.
b. The analysis and schedule shall consist of a table and/or spreadsheet that shows all of the tasks (management, monitoring, reporting), task descriptions, labor (hours), cost per unit, cost frequency, timing or scheduling of the tasks, the total annual funding necessary for each task, and any associated assumptions for each task required by the Interim Management Plan. The total annual expenses should include administration and contingency costs.
c. The Endowment Fund must:

i. Be held by a qualified, Service-approved, non-profit organization or government agency [see requirements under CE above], and
ii. Be held according to minimum standards for assuring maximum success in earning potential, and will include assurances for no loss of principle.
iii. Disbursements or releases from the fund must be for documented expenditures, as they occur.