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CITY OF SANTA CRUZ
APPLICATION FOR AN INCIDENTAL TAKE PERMIT UNDER SECTION 2081 OF THE CALIFORNIA FISH AND GAME CODE
FOR
INCIDENTAL TAKE OF COHO SALMON

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APPLICATION FOR AN INCIDENTAL TAKE PERMIT UNDER SECTION 2081 OF THE CALIFORNIA FISH AND GAME CODE
FOR
INCIDENTAL TAKE OF COHO SALMON

Date of Application:

1.0 Applicant Information (CCR Title 14 § 783.2(a)(1))

Name and Address: City of Santa Cruz
715 Graham Hill Rd. Building A
Santa Cruz, CA 95060
Telephone:
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Type of Applicant: Municipality

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2.0 Species to be Covered by this Permit (CCR Title 14 § 783.2(a)(2))

The City of Santa Cruz (City) is seeking an Incidental Take Permit (Permit) under Section 2081 (b) of the California Endangered Species Act (CESA) for incidental take of state-listed species that could occur within the Plan Area (see Section 4) as a result of proposed City Project Activities (see Section 3).1 A full species account of the Covered Species is provided in Appendix 13: *Coho (Oncorhynchus kisutch) Species Account.*

Species	CESA Status
Coho salmon (*Oncorhynchus kisutch*)	Endangered (CCR Title 14 § 670.5(a)(2)(N))

1 The Covered Activities and Conservation Strategy for coho set forth in this application are the same as contained in the 2022 City of Santa Cruz Anadromous Salmonid Habitat Conservation Plan (HCP) developed with the National Marine Fisheries Service (NMFS) under the federal Endangered Species Act.

3.0 Project Description (CCR Title 14 § 783.2(a)(3))

This section describes the proposed Project Activities including rehabilitation of water system facilities, operations and maintenance activities that the City routinely performs including operation, maintenance and repair of the City's water supply and water system facilities, operation and maintenance of the City's municipal facilities such as the San Lorenzo River flood control channel, management of City open space and other lands and emergency response. These activities will be referred to as Covered Activities throughout this application. More detail on these activities is provided below. See Figure 3-1: City of Santa Cruz Water System map.

Figure 3-1: City of Santa Cruz Water System Map

3.1 Rehabilitation of Diversion Structures and Pipeline Reaches

The North Coast System (NCS) is the part of the City's water system that diverts water from Liddell Spring, Laguna Creek, Reggiardo Creek and Majors Creek and delivers that water to the Coast Pump Station; located along the San Lorenzo River just upstream of Highway 1 in Santa Cruz. The NCS is located within the Coastal Zone of Santa Cruz County (Figure 4-1). The NCS includes five distinct pipeline reaches (Liddell, Laguna, Laguna/Liddell, Majors, and the North Coast Pipeline Reach [NCP Reach]). The system extends above ground and underground through developed and undeveloped areas, and traverses along, above, or beneath roadways and waterways from Bonny Doon to the west side of Santa Cruz. See Figure 3-1: City of Santa Cruz Water System map. Rehabilitation work on the NCS entails replacement of portions of the supply pipelines and rehabilitation of the diversion structures. The pipeline replacement work includes replacement of the pipelines in their current alignments or the construction of new alternative alignments, designed to avoid sensitive habitats (e.g., potentially sensitive riparian areas). Due to the size of the NCS and funding limitations, work on each of the five pipeline reaches will occur in phases and includes a mix of existing and new alignments. It is also possible that the pipeline routing may require a change from the present "gravity-flow" system to a "pumped" system for the Laguna and/or Majors reaches.

Rehabilitation of the two 120+-year old diversion structures at Majors and Laguna Creeks, which are located above the anadromous reaches on the creeks, would likely include dewatering by way of the installation of a cofferdam and a temporary bypass system, earthwork, reinforced concrete demolition and construction, metal work fabrication and installation, bank armoring, and miscellaneous electrical and mechanical services, including a pneumatically operated spillway gate. This work would enable the diversion structures to facilitate bypass flows and passage of suspended sediment and bed load downstream in a more natural manner, minimizing the need for manual clearing of these materials and deposition in downstream habitat. Rehabilitation of the Tait Street and Felton Diversions on the San Lorenzo River would also occur and primarily involve improvements for fish passage, screening and pumping capacity (at Tait Street only) to take advantage of high winter flows, thereby allowing deferral of winter pumping at North Coast diversions and improvements in groundwater storage that can serve water system demand during low flow periods.

The City maintains an 8- to 10-foot right-of-way (ROW) along the existing pipeline route in most areas. Specifically, the 18-mile NCS includes:

- approximately 5.5 miles of the system located within developed areas (mountain residential and City of Santa Cruz)
- approximately 1.5 miles of the system extending beneath City surface streets from the Meder Street extension to High Street
- approximately 4 miles of the system running along Highway 1 from Laguna Creek on the west to Wilder Ranch State Park entrance on the east (Jones & Stokes 2000)

- the remaining 12.5 miles of the system running through undeveloped areas (Cotoni-Coast Dairies National Monument, Wilder Ranch State Park, and Moore Creek Preserve)

3.2 Water Supply Operations

3.2.1 Water Diversions

The City has several sources of water supply in its system. These include the North Coast Diversions (including Liddell Spring, Reggiardo Creek, Laguna Creek and Majors Creek), the San Lorenzo River (including Felton and Tait Street Diversions), Newell Creek Dam and Reservoir (commonly referred to as Loch Lomond Reservoir) and the Live Oak Wells. While drought-period demand is substantially lower, the historic and projected future water demand in the service area averages about 3.2 billion gallons annually, of which the majority occurs in the six-month May-October peak season. Historically, only the Felton Diversion and Newell Creek Dam had requirements for bypass flows. The Live Oak Wells draw from deep groundwater with no clear, direct connection to surface water dynamics and are not addressed in this Permit application (Montgomery and Associates 2020).

The Permit will provide coverage for existing water diversion facilities including operation, rehabilitation, replacement, repair and maintenance of existing infrastructure and related facilities such as water measurement devices, scientific measuring devices, and water quality monitoring stations. The level of diversion for each facility is based on bypass flows ("Conservation Flows") negotiated for anadromous salmonids. Conservation Flows for minimization of biological effects resulting from water diversion will be discussed in detail in the conservation strategy (See Section 7).

<u>Liddell Spring Diversion</u>

The Liddell Spring Diversion was developed in 1913 and is a natural spring located at the headwaters of the East Branch of Liddell Creek, approximately 2.5 miles upstream from the mouth of Liddell Creek and 1.34 miles from the anadromous limit (See Figure 3-1: City of Santa Cruz Water System Map). The spring box/diversion structure consists of a concrete box with a corrugated locking door. The structure sits on top of the natural spring and is approximately 25 feet above Liddell Creek. Because the water right for the diversion is a pre-1914 right there are no specified limits on diversion rates or quantities and a bypass flow is not required.

The Liddell Spring Diversion operates year-round and historically produced approximately 1.2 to 1.7 million gallons per day (mgd) with a maximum facility diversion capacity of approximately 2.5 cfs prior to recent implementation of bypass flows. Future diversion capacity increases are not proposed for coverage under the Permit. Water is diverted directly from the spring into a 10-inch pipeline that then connects to the North Coast Pipeline via the Laguna Creek pipeline. The flow is controlled by an inline slide gate valve. The valve may be shut during storms and a separate drain valve is most often cracked open to allow sediment transport and passing of the peak of the hydrograph. Sediment is also removed via pumping when it inundates the drain valves during significant storms. When not diverted,

the spring flow passes under the access road adjacent to the spring through a culvert and discharges into a tributary to the East Branch of Liddell Creek. See Figure 3-2: Liddell Diversion Schematic and Figure 3-3: Laguna Diversion photo.

Figure 3-2: Liddell Diversion Schematic

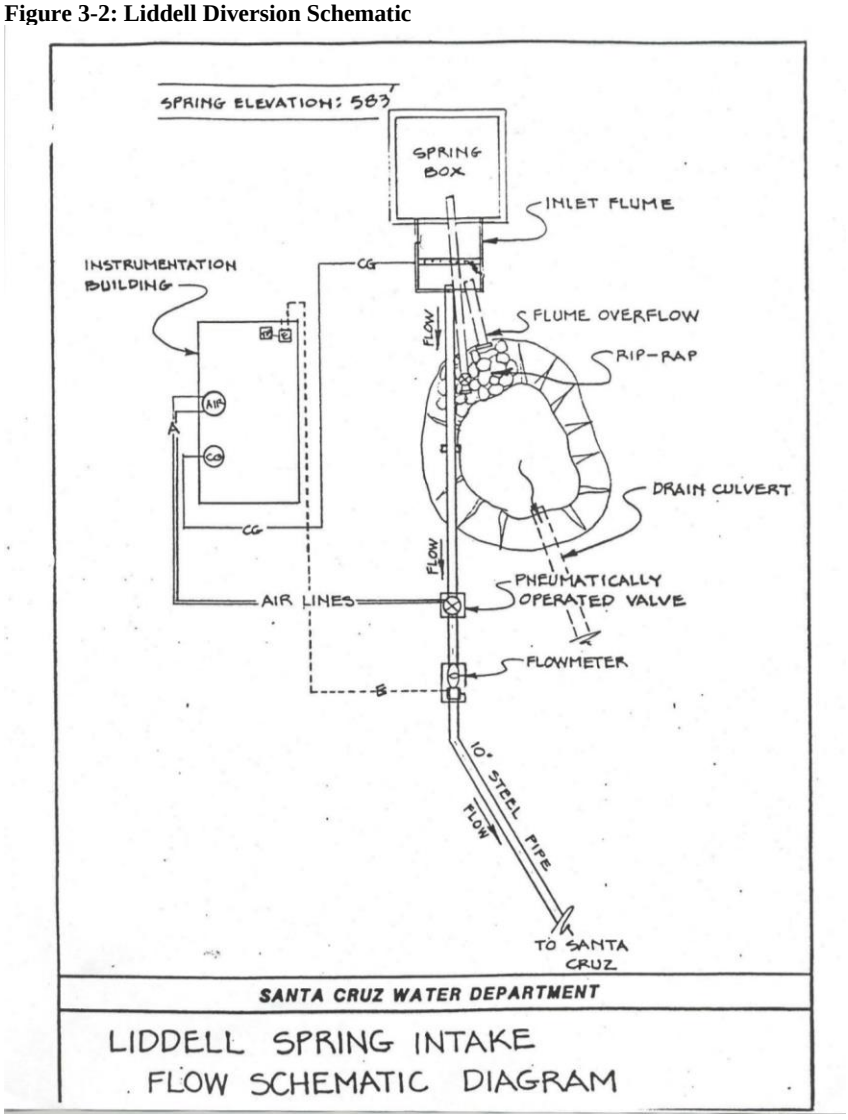


Figure 3-3: Liddell Diversion

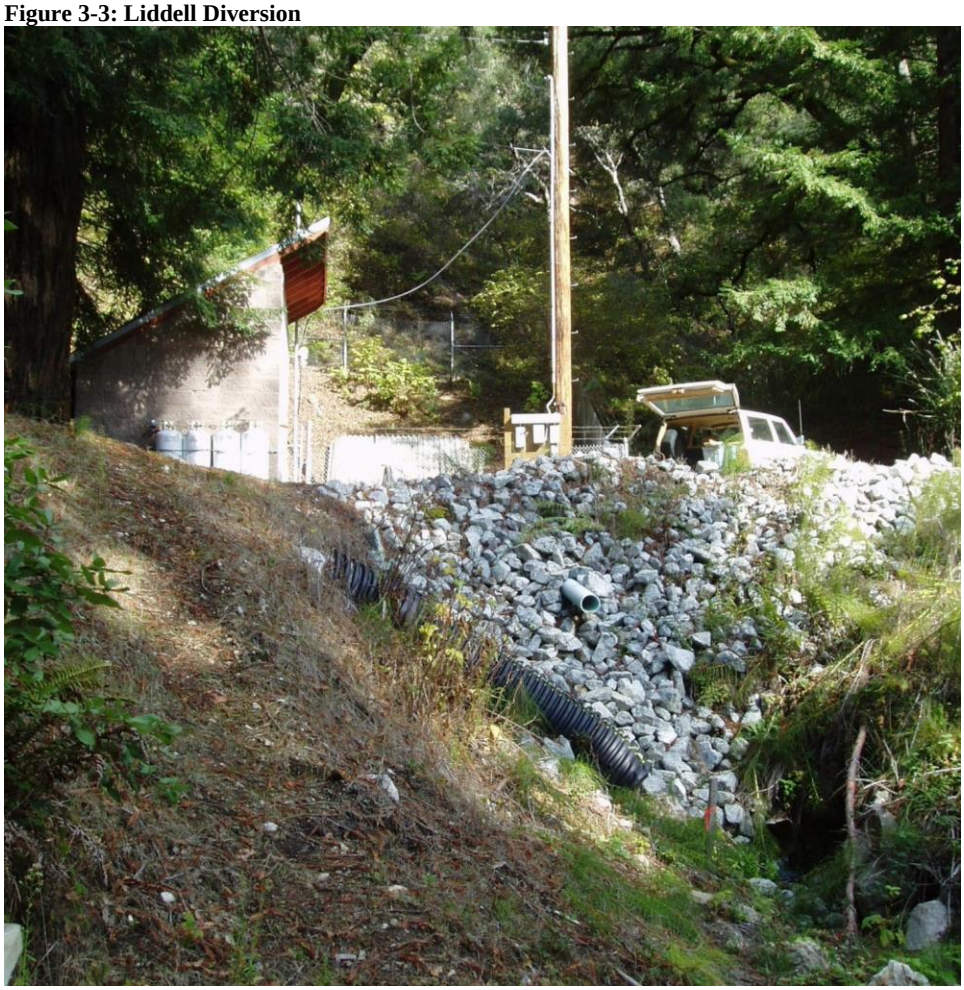


Photo: Looking upstream from right bank toward the Liddell Diversion

Reggiardo Creek Diversion

The Reggiardo Creek Diversion is located on Reggiardo Creek approximately 300 feet above its confluence with Laguna Creek (See Figure 3-1: Water System map). Water rights for the Reggiardo Creek Diversion were acquired along with Laguna Creek in about 1912 (Camp, Dresser & McKee 1996). Since the diversion is part of a pre-1914 water right, there are currently no legal restrictions on

diversion rates or quantity from the diversion nor is there a bypass flow requirement. A concrete dam spans the full width of the creek and is approximately 10 feet high. Immediately behind the concrete dam, the channel is filled with sediment. A small pond is created at the crest of the concrete dam.

The Reggiardo Creek Diversion typically operates year-round, 24 hours a day. However, due to recent inundation by sediment, the diversion is currently inoperable. Historic maximum facility diversion capacity ranged from 1.6-2.8 cfs. Surface water diverted from Reggiardo Creek enters a 14-inch pipe and flows by gravity approximately 850 feet into the upstream side of the Laguna Creek Diversion pond. A valve is located at the discharge of the pipe allowing flow to be regulated or shut off completely. Future diversion capacity increases are not proposed for coverage under the Permit. See Figure 3-4: Laguna/Reggiardo Diversion Schematic, Figure 3-5 Reggiardo Diversion Schematic and Figure 3-6 Reggiardo Diversion photo.

Figure 3-4: Reggiardo and Laguna Creeks Diversions Schematic

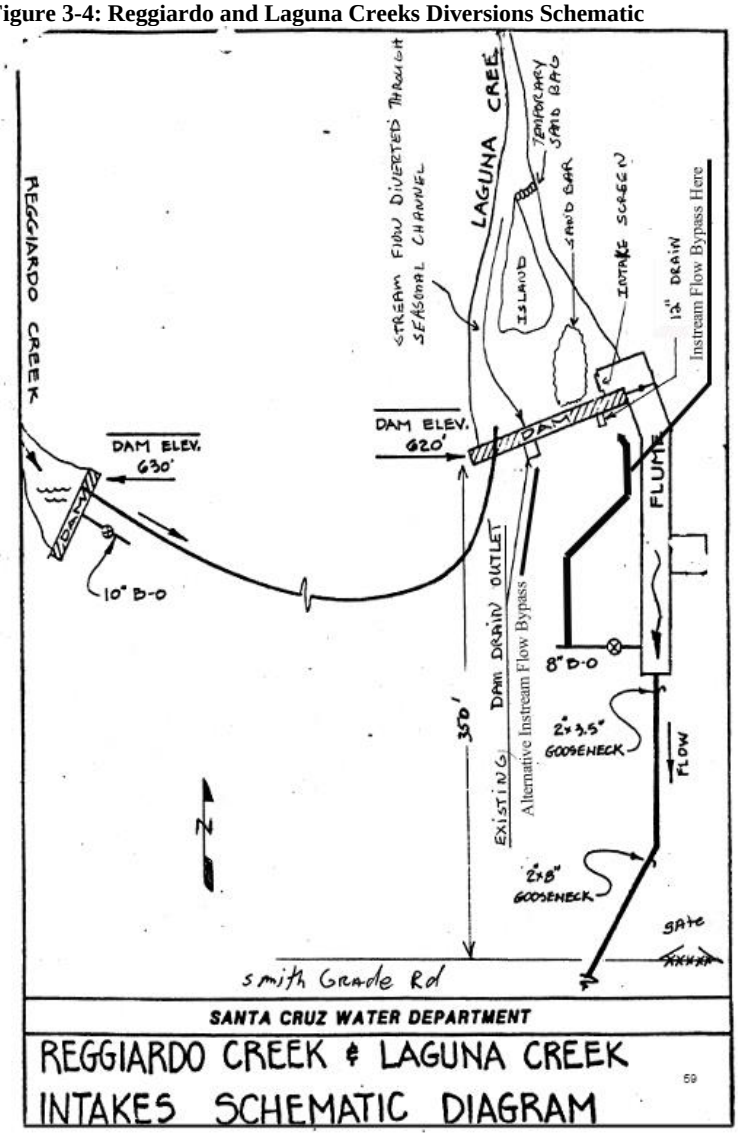


Figure 3-5: Reggiardo Diversion Schematic

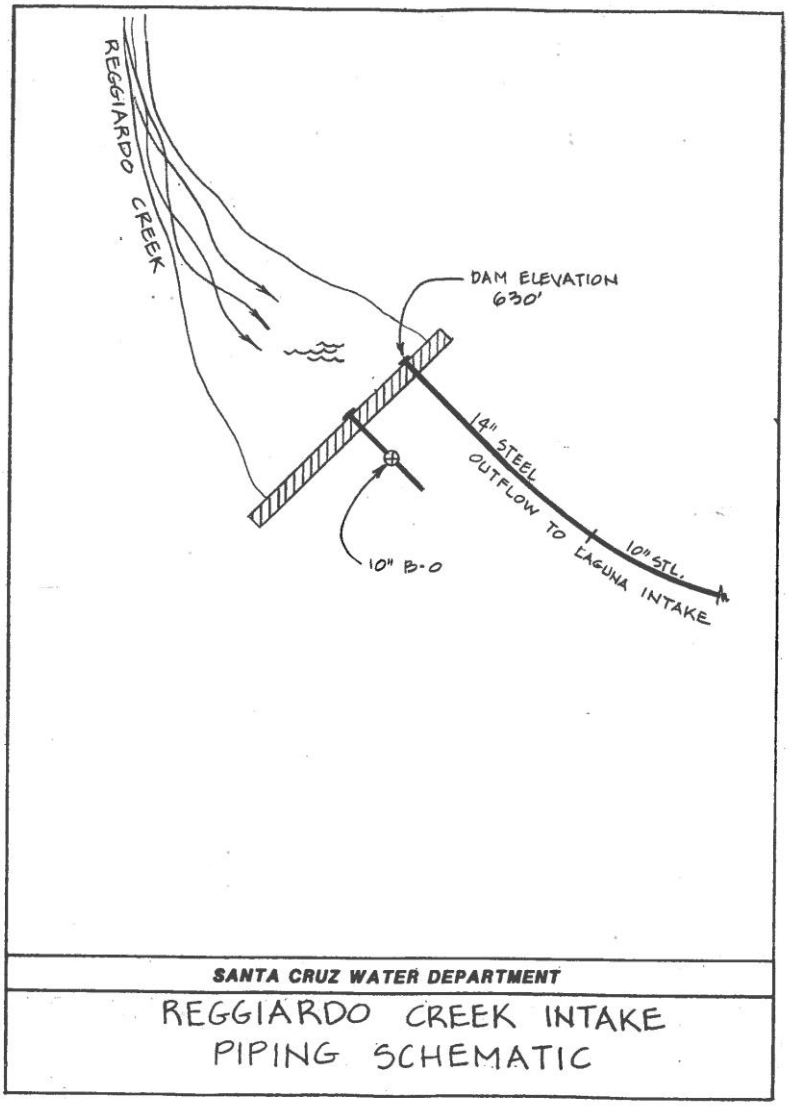


Figure 3-6: Reggiardo Diversion

Photo: Reggiardo Diversion from right bank downstream looking across the channel

Laguna Creek Diversion

The Laguna Creek Diversion is located 4.23 miles upstream from the mouth and 2.8 miles upstream from the anadromous limit (See Figure 3-1: Water System map). It was developed as a water source in 1890 and remains in use currently. Since the diversion is part of a pre-1914 water right, there are currently no legal restrictions on diversion rates or quantity from the diversion nor is there a bypass flow requirement. The concrete dam limit spans the full width of the creek and is approximately 12 feet high. Immediately behind and below the dam are small pools, however sediment has substantially filled the upstream pool.

The diversion operates year-round and has no seasonal restrictions nor bypass requirements. The maximum diversion capacity is approximately 6.3 cfs. Future diversion capacity increases are not proposed for coverage in the Permit. The intake passively diverts water from the impoundment pool

through a 5/32 inch woven-wire intake screen. This screen acts to keep debris from entering the intake pipeline and is periodically cleaned of debris by hand. Water enters a flume that conveys flow to the14-inch pipeline. A pneumatically operated (air pressure) slide gate at the inlet of the pipe is used to open or close the inlet. During storm events the diversion intake is shut down as turbidity rises above 25 Nephelometric Turbidity Units (NTU). When turbidity begins to fall below 25 NTU the diversion is turned back on. Water from the diversion is transported through a 14-inch pipeline to the junction of the transmission pipeline from Liddell Spring. After joining at the Liddell junction, the raw water is transferred via the North Coast Pipeline to the water system. See Figure 3-7: Laguna Diversion Schematic and Figure 3-8 Laguna Diversion photo.

Figure 3-7: Laguna Diversion Schematic

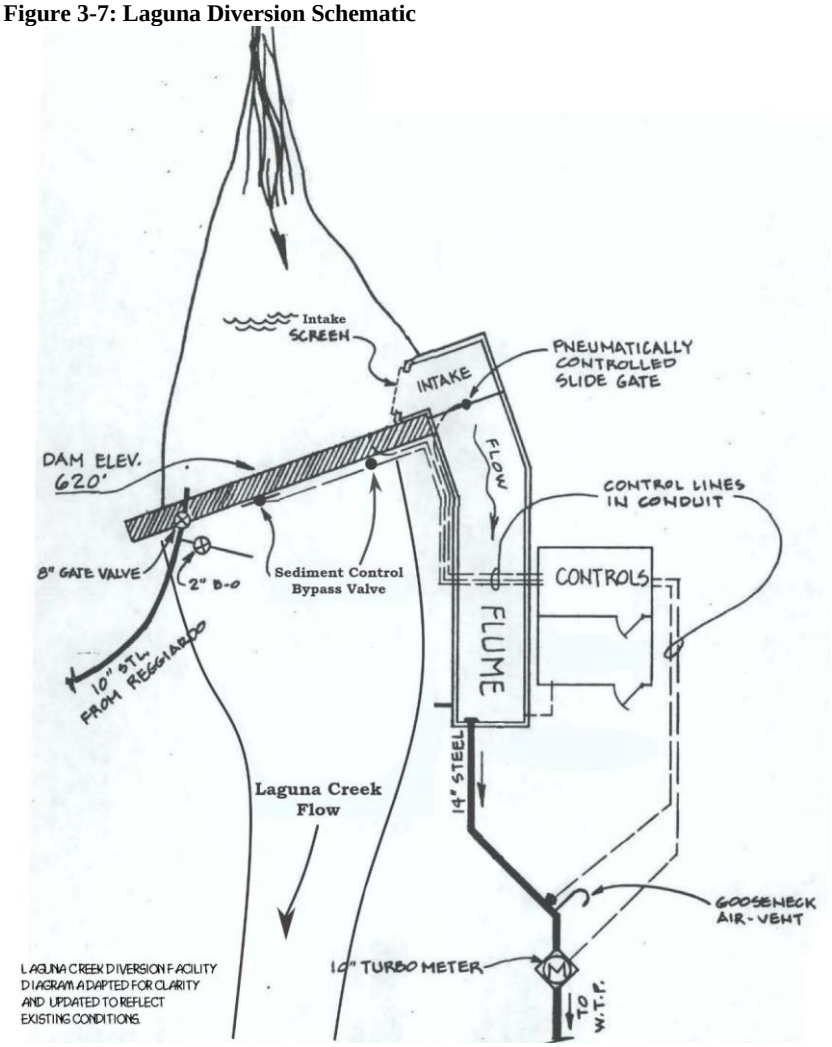


Figure 3-8: Laguna Diversion

Photo: Laguna Creek Diversion from right bank downstream looking across the channel

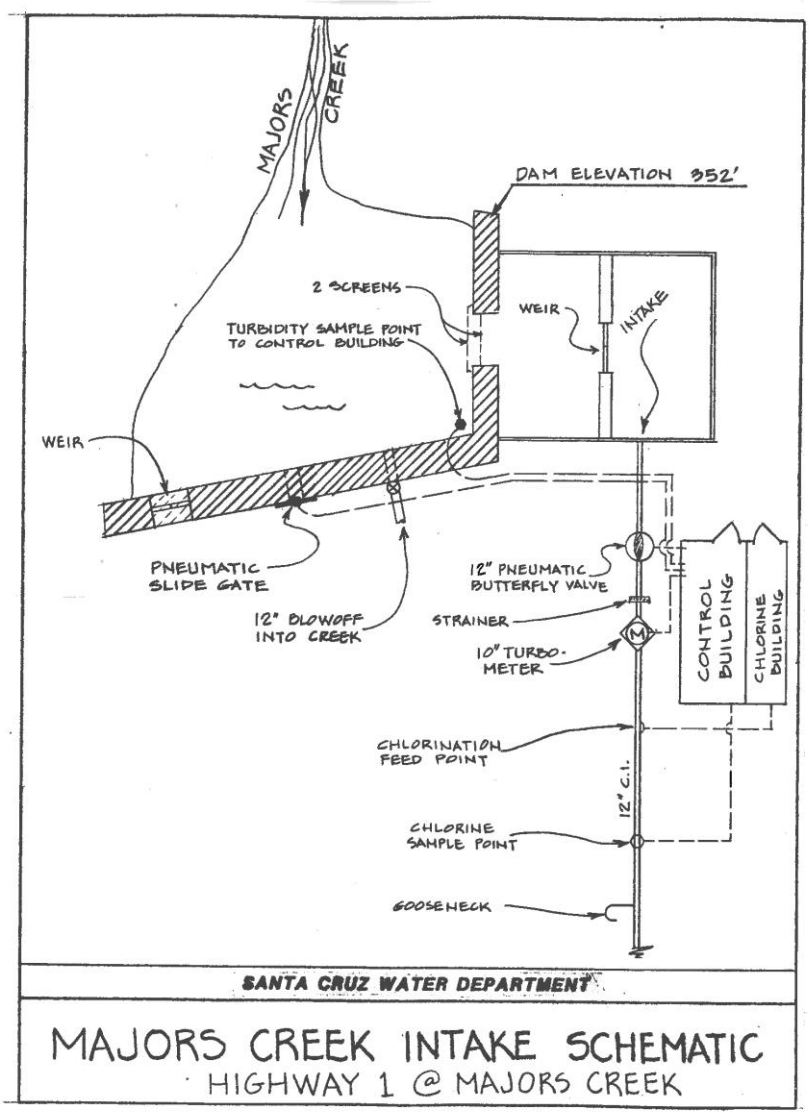
Majors Creek Diversion

The Majors Creek Diversion is located 2.2 miles upstream from the mouth and 1.5 miles upstream from the anadromous limit (See Figure 3-1: Water System map). Diversion on Majors Creek has occurred since 1882. The water right for the diversion was established in 1881 and the City operates the diversion under the pre-1914 water right (Camp, Dresser & McKee 1996). The Majors Creek Diversion operates year-round and has no seasonal restrictions nor bypass requirements. The concrete dam spans the full width of the creek and is approximately 12 feet high. Immediately behind and below the dam are small pools which are periodically inundated by the high sediment loads present in Majors Creek.

The diversion operates year-round and has no seasonal restrictions nor bypass requirements. The maximum diversion capacity is approximately 2.1 cfs. Future diversion capacity increases are not

proposed for coverage in the Permit. The intake passively diverts water from the impoundment pool through a 1/4 inch woven-wire intake screen. This screen acts to keep debris from entering the intake pipeline and is periodically cleaned of debris by hand. Water enters a flume that conveys flow to the - inch pipeline. A pneumatically operated (air pressure) slide gate at the inlet of the pipe is used to open or close the inlet. During storm events the diversion intake is shut down as turbidity rises above 25 NTU. When turbidity begins to fall below 25 NTU the diversion is turned back on. Water from the diversion is conveyed through a 12-inch pipeline to the North Coast Pipeline. The Majors Creek Diversion is located approximately 300 feet lower in elevation than the other North Coast diversions, thus use of the Majors Creek Diversion is presently limited by the hydraulic loading from the other north coast sources. This hydraulic condition affects the influence that this diversion has on hydrology downstream by limiting Majors Creek diversion potential when production from the Liddell and Laguna diversions is relatively high. See Figure 3-9: Majors Diversion Schematic and Figure 3-10: Majors Diversion photo.

Figure 3-9: Majors Diversion Schematic[2]



[2] Chlorine is no longer used at the diversion.

Figure 3-10: Majors Diversion

Photo: Majors Diversion from left bank downstream looking across the channel

Newell Creek Diversion and Loch Lomond Reservoir

The Newell Creek Diversion consists of the Loch Lomond Reservoir impounded by the Newell Creek Dam (commonly referred to as Loch Lomond). Loch Lomond Reservoir is located on Newell Creek approximately 1.7 miles upstream from the confluence with the San Lorenzo River and 0.7 miles upstream of a significant migration barrier (See Figure 3-1: Water System map). Loch Lomond Reservoir is a drinking water reservoir and is the City's only water storage facility. Loch Lomond Reservoir is approximately 2.5 miles long with an approximate width of 1,500 feet. Newell Creek extends 3 miles upstream of the upper end of the reservoir. In 2009 the maximum volume of Loch Lomond Reservoir was determined to be 8,646 acre-feet (McPherson et al. 2011).

The Newell Creek Diversion (License No. 9847) is an appropriative right for diversion to storage not direct diversion to use. This license allows for a maximum of 5,600 acre-feet or 1,825 million gallons

per year to be collected from September 1 to July 1 and requires a year-round release of 1 cfs to Newell Creek downstream of the reservoir and release of the natural flow during July/August (due to the fully appropriated status of the San Lorenzo watershed) if the natural inflow exceeds 1cfs. Withdrawals from Loch Lomond Reservoir under the Newell Creek water right can occur from January 1 through December 31 and is limited to 3,200-acre feet or 1,042 million gallons per year. Water that is removed from storage is passed through a valve on the dam face and flows by gravity to the Felton Booster Pump Station for delivery to the Graham Hill Water Treatment Plant.

Legal action taken by the SLVWD subsequent to the date the City obtained the Newell Creek license, resulted in a court decision that provides SLVWD up to 313 acre-feet or 102 million gallons per year from Loch Lomond Reservoir. This leaves a maximum withdrawal for the City of approximately 2,890 acre-feet or 940 million gallons per year from Newell Creek Reservoir.

The Felton Diversion on the San Lorenzo River also provides water to Loch Lomond Reservoir under two separate diversion to storage water rights permits. This water does not count against the provision in the Newell Creek license nor the SLVWD court decision. Details on the Felton Diversion are provided below.

Newell Creek Dam has five water intakes spaced at 20-foot intervals from 550 to 470 feet above sea level respectively, allowing withdrawals from the level with the best water quality, usually either 510 or 490 feet. Loch Lomond Reservoir is oxygenated by a hypolimnetic aerator[3] during the summer/fall months. The Newell Creek Diversion bypass is provided through a valve at the base of the Newell Creek Dam located approximately 10 feet from the toe of the dam.[4] The water released from this bypass is from the level of draw that is also used for production – which is aerated by the aforementioned hypolimnetic aerator, as well as by the diffuser at the outlet from the dam to Newell Creek just below the dam. Due to the small size of Loch Lomond Reservoir, spilling often occurs in years of average to above average rainfall. See Figure 3-11: Newell Creek Diversion Schematic and Figure 3-12: Newell Creek Diversion photo.

[3] Hypolimnetic aeration, involves the oxygen demand of deep water being provided by oxygen from the atmosphere via mechanical methods without destroying the lake's natural stratification. As the deep water becomes aerobic, the phosphate dissolution is reduced significantly and the mineralization of sediments improves - thereby improving water quality and conditions for cold water fish species.

[4] The future location of this release will be adjacent to the spillway pond.

Figure 3-11: Newell Creek Diversion Schematic

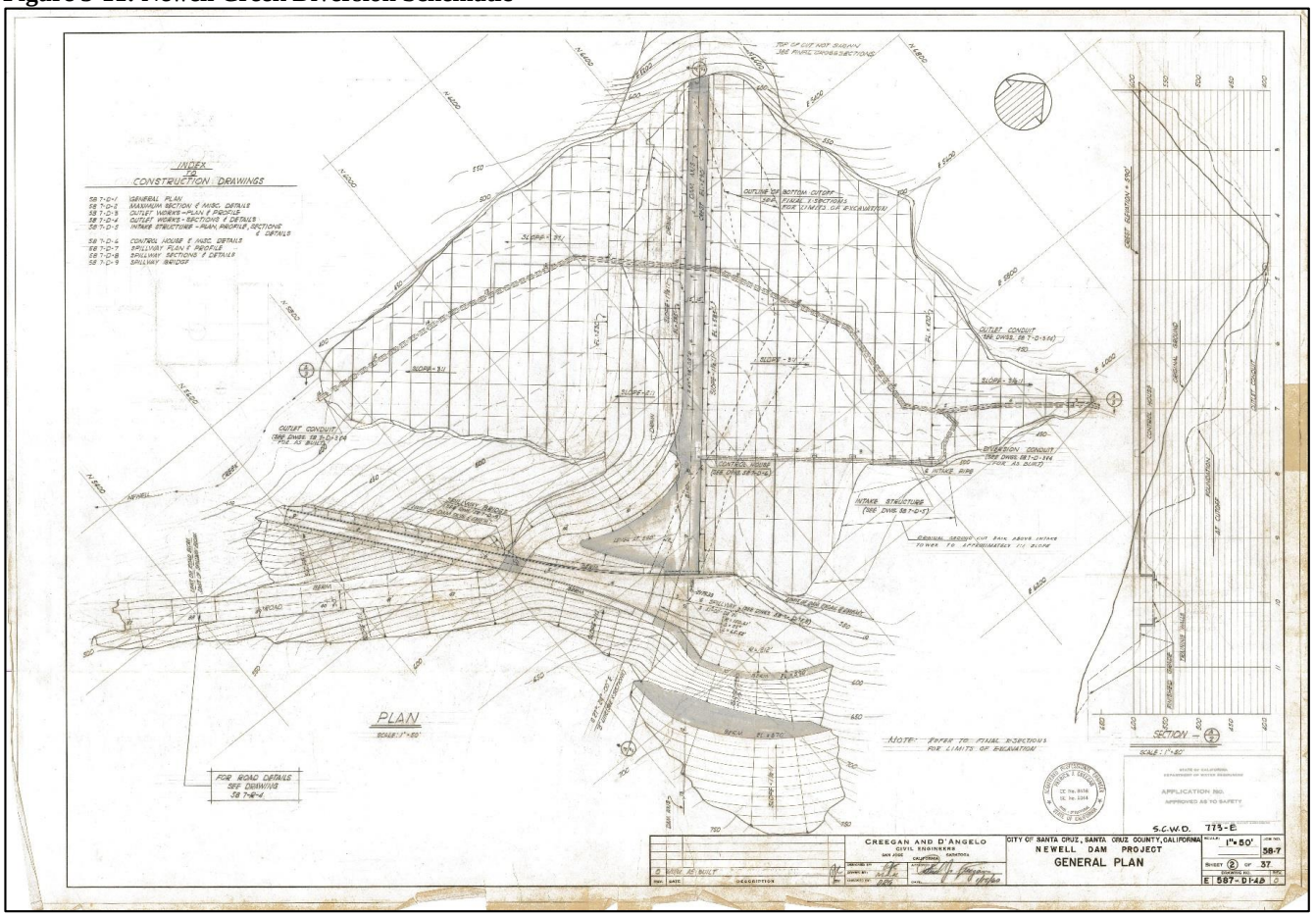


Figure 3-12: Newell Creek Diversion

Photo: Newell Creek Diversion from above left bank downstream looking upstream

Felton Surface Water Diversion at San Lorenzo River

The Felton Diversion is located on the San Lorenzo River just downstream of the Zayante Creek confluence and approximately five miles upstream of the Tait Street Diversion on the San Lorenzo River (See Figure 3-1: Water System map). The Felton Diversion consists of a three-foot-high

concrete weir spanning the stream channel with an inflatable rubber dam attached to the top of the weir structure. The rubber dam is inflated after flushing flows (approximately >100 cfs) have occurred and antecedent precipitation is sufficient to keep river flows elevated above 40 cfs for a several weeks. When flows approach approximately 40 cfs, the dam is typically deflated. The dam is automatically deflated during channel-forming flows to avoid infrastructure damage and exacerbating upstream flood hazards. When not in operation, the dam is completely deflated and lays flat against the riverbed. The dam is eight feet high when fully inflated. A pump station is located on the west bank adjacent to the dam and weir structure. Water from the diversion is diverted into a screened intake sump and transferred via a pipeline to the Felton Booster Station located near Graham Hill Road. The flows are transferred via the Felton Booster Station to Loch Lomond Reservoir for storage and later use.

The City has appropriative water rights at the Felton Diversion. The Felton Diversion is implemented by two permits (Nos. 16123 and 16601) which allow a maximum annual diversion of 3,000-acre feet to Loch Lomond Reservoir for storage and later use.

The Felton Diversion operates according to two Memorandum of Agreements (MOAs) signed with the CDFW (Agreement Between City of Santa Cruz and CDFW for Streamflow Maintenance and Operation of Fishway at Felton Diversion Project on San Lorenzo River for the Protection and Preservation of the Fish and Wildlife Resources, CDFW 1971 (Appendix 4: *Felton Diversion Memoranda of Agreement*) and Memorandum of Agreement between CDFW and the City of Santa Cruz Regarding Operation of the Felton Water Diversion, 1998 (Appendix 4: *Felton Diversion Memoranda of Agreement*). These MOAs primarily focus on preservation of downstream instream flows and fish passage through the diversion. The maximum rate of withdrawal for October 1 to May 31 is 20 cfs with a minimum bypass flow of 25 cfs for October and 20 cfs for the period November 1 through May 31. In September, the diversion rate is 7.8 cfs with a 10 cfs bypass requirement – though diversion in September is often impossible and unnecessary. The Felton Diversion does not operate June through August. The City will continue to operate the Felton Diversion in accordance with the existing MOAs. See Appendix 4: *Felton Diversion Memoranda of Agreement*.

Future rehabilitation of the Felton Diversion will include pump, screen, and ladder improvements, though no pumping capacity increases are currently planned. The hydraulic performance evaluations conducted by Entrix in 2001 and Borcalli and Associates in 2006 indicate approach and sweeping velocities at the two existing screen panels are virtually all within criteria for continuously cleaned screens. Accordingly, no suggestions are warranted for improvements to the fish screen arrangement from the standpoint of impingement velocities, velocity distribution, or exposure duration. However, the existing screen material requires replacement with either wedge wire with a 1.75 mm slot width or perforated plate with 3/32” diameter perforations to account for the presence of fry-sized salmonids within the water course. To keep the fish screens operating at optimum efficiency and since no means are currently employed at the site for continuous screen cleaning, a mechanical traveling brush system is also recommended to minimize screen clogging. Additionally, provision of a continuous bypass route for escapement of juvenile out-migrants would reduce effects of this diversion on special-status fisheries. The existing intake currently maintains connectivity between the forebay and tailwater pool only when the MOA dictates the existing sluice gate be opened at the terminal end of the structure.

Under most operating conditions the intake structure functions as a “blind alley” which requires fish that have entered the intake to return upstream past the fish screen panels in order to exit the structure and locate an alternative downstream migration route. These improvements will be included in future rehabilitation of this facility associated with implementation of the water rights modifications included in the proposed Santa Cruz Water Rights Project. See Figure 3-13: Preliminary Future Felton Diversion Plan Profile, Figure 3-14: Preliminary Future Felton Diversion Plan Profile, and Figure 3-15: Felton Diversion photo.

Figure 3-13: Preliminary Future Felton Diversion Plan Profile

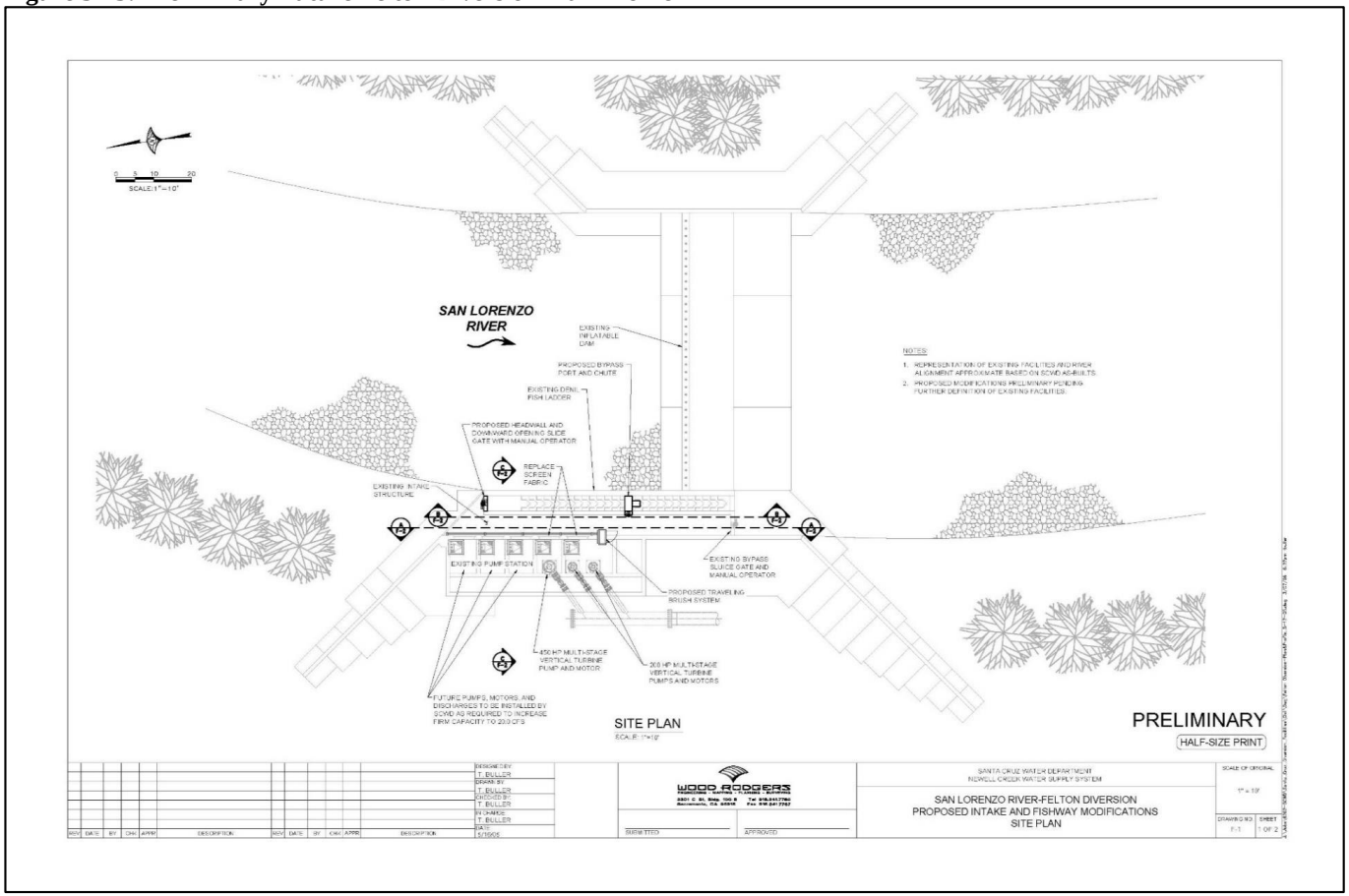


Figure 3-14: Preliminary Future Felton Diversion Plan Profile

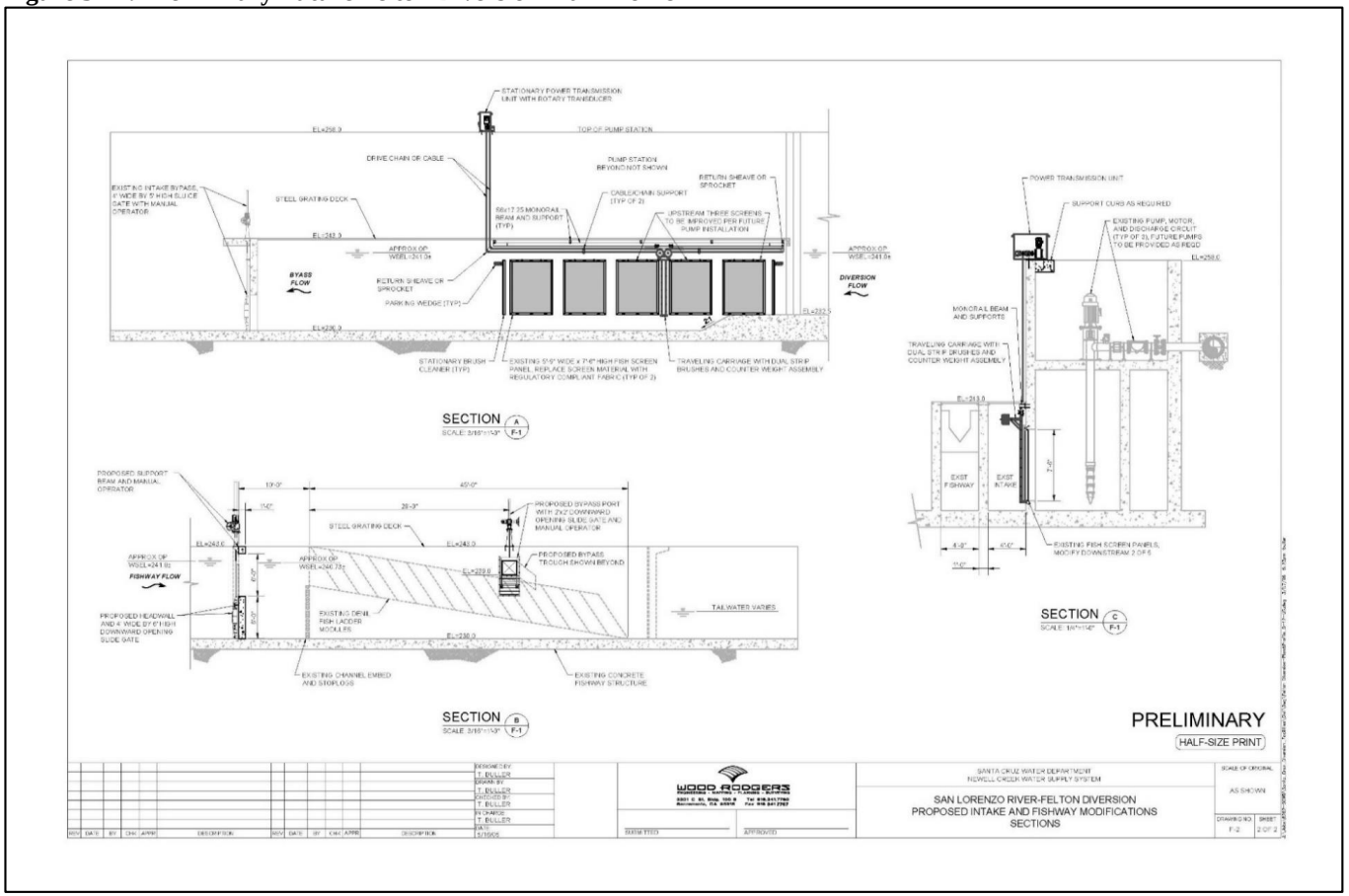


Figure 3-15: Felton Diversion

Photo: Felton Diversion from left bank downstream looking across the channel

Tait Street Diversion and Wells[5]

The Tait Street Diversion is located approximately 1 mile north of Highway One on the west bank of the San Lorenzo River at the terminus of Crossing Street (*aka Tait Street*) (See Figure 3-1: Water System map). The diversion consists of a low diversion dam (approximately three feet in height) that spans the width of the river and a concrete intake structure. The Tait Street Diversion also includes several wells located on the east side of the river. The wells range in depth from 71 - 89 feet and are considered to be under the influence of surface water.

Current water rights at the Tait Street Diversion and Wells consist of two licenses (Nos. 1553 and 7200) for appropriative rights to a maximum combined diversion rate of 12.2 cfs year-round. There is no annual limit specified in the licenses nor are there downstream release requirements included in the licenses. The future diversion rate at this facility may increase to up to 27.85 cfs during high winter flow periods to support water supply reliability. Water is diverted on a continuous basis, interrupted only for excessive turbidity due to storms, short term water quality degradation resulting from spills of potentially harmful materials, mechanical breakdown, or routine maintenance.

Surface water is directed to the intake by the low diversion dam. The intake structure is concrete, built parallel to the stream bank, and extends downstream from the dam. The intake structure is protected by a debris rack and the downstream end of the intake is fitted with a hydraulic slide gate that is normally open during high flows and closed during low flows. This ensures the intake screens remain submerged and also maintains a continuous flow of water through the intake back into the river. A pipeline carries water from the intake to the pumping clearwell, where three vertical turbine pumps pump the water to the Graham Hill Water Treatment Plant. The diversion does not currently have a fish ladder, however fish passage and screening improvements are being considered currently in the context of overall facility rehabilitation. All improvements will be informed by discussion with CDFW and NMFS and will abide by NMFS criteria as applicable.

The wells operate in the summer and fall to reduce surface water diversion effects on instream flows and during the winter to improve the quality of unfinished/raw water coming from the facility. Water is delivered to the pumping clear well on the west side of the river. The groundwater is then pumped into a common transmission line to the Graham Hill Water Treatment Plant. These wells account for about five percent of total volume of water diverted at this San Lorenzo River facility and less than three percent of total annual production from all water sources. See Figure 3-16: Tait Street Diversion Schematic, Figure 3-17: Tait Street Well #1b photo, and Figure 3-18: Tait Street Diversion photo.

[5] This facility is generally called “Tait Street Diversion” but is also called “San Lorenzo River Diversion” on occasion.

Figure 3-16: Tait Street Diversion Schematic

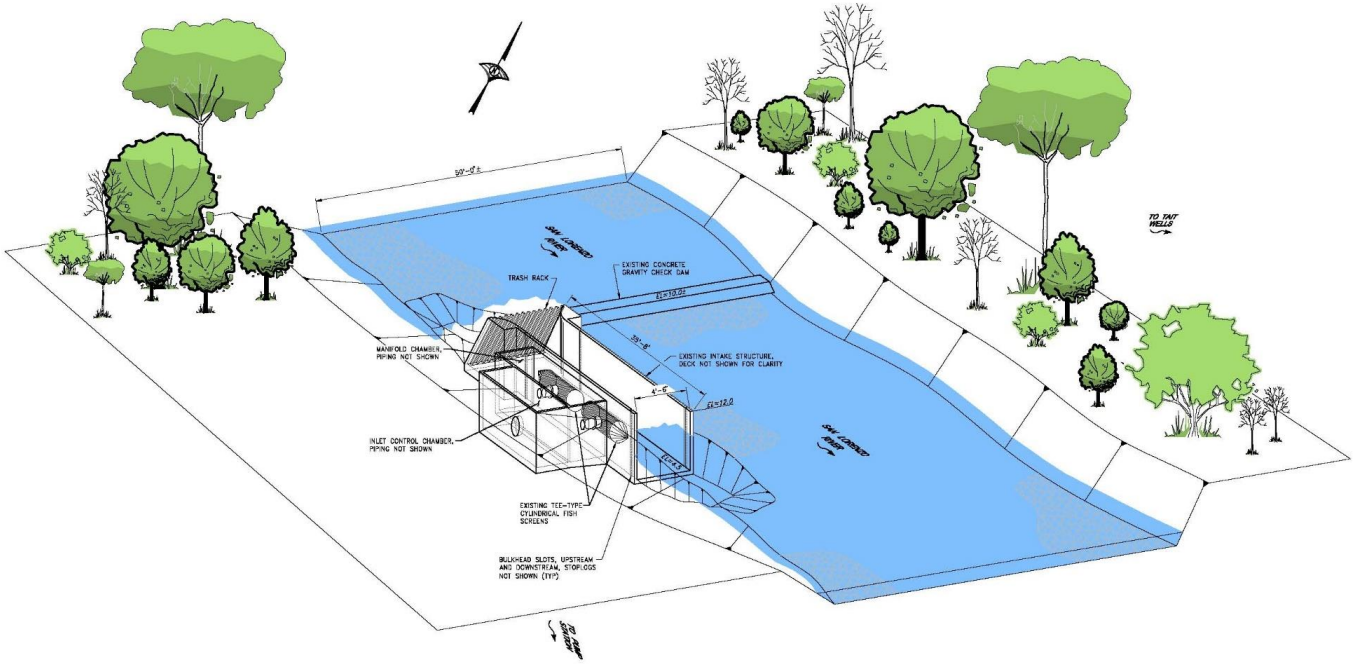


Figure 3-17: Tait Street Well #1b

Photo: Tait Well #1b

Figure 3-18:Tait Street Diversion

Photo: Tait Street Diversion from left bank downstream looking across the channel

3.2.2 Reservoir Operations

Reservoir operations focus on activities that occur at the Loch Lomond Reservoir to provide a safe, reliable source of water for water customers. The activities are required by either the California Division of Dam Safety or the California Safe Drinking Water Act through the California Department of Health and Safety. Covered activities include reservoir water quality treatment and dam facility maintenance.

Chemical Algaecide Treatment of Reservoir

Loch Lomond Reservoir is a lacustrine environment and although not nutrient enriched, nevertheless annually experiences blue green algal blooms during the late spring-early fall months due to available nutrients, warm water temperatures, and abundant sunlight. When algal blooms do occur or are predicted to occur, chemical algaecide applications are made to the Loch Lomond Reservoir to protect

against degradation of beneficial uses (e.g., objectionable taste and odor, production of disinfection by-product precursors and cyanotoxins, and oxygen depletion and subsequent fish kills). Algaecides used include copper carbonate or hydrogen peroxide. These algaecide applications are regulated by a National Pollutant Discharge Elimination System (NPDES) permit issued by the State Water Resources Control Board and implementation is described in the City's Aquatic Pesticide Application Plan. See Appendix 6: *Loch Lomond Aquatic Pesticide Application Plan and SWRCB Aquatic Pesticide General Permit*.

The Water Department conducts weekly water quality sampling at one station in the lake to assess overall algae population. Species present at the surface and at the levels of the two upper water intakes (elevations 550 and 530 feet respectively) are identified and counted and may be analyzed for chlorophyll. When known nuisance species are on the increase (i.e., *Anabaena, Aphanizomenon, etc.*), sampling is increased to daily and when the counts and chlorophyll values indicate a bloom appears certain, algaecide is applied.

The applications generally occur once or twice between the months of April through September. Annual frequency of applications ranges from as low as 1 time/year to as high as 5x/year. A private applicator or City staff under the direction of a licensed applicator may conduct the application. The lake shallows are surveyed by staff prior to application to identify any Western Pond Turtle, fish breeding or early fish life stage presence. If located, these areas are not treated or treated at a reduced concentration, per direction of the City's SWRCB NPDES permit for aquatic algaecide application. The treatment area is tested the day after treatment to confirm that no high levels of algaecide are present. Hydrogen peroxide is not persistent in the environment and is not discharged to Newell Creek below the dam, so monitoring is primarily focused on copper carbonate. Weekly copper monitoring is continued at the surface and 20-foot depth intervals until copper returns to near pre-treatment levels. The fish release below the dam into Newell Creek is also sampled weekly. Upstream and downstream, copper sampling may occur on a regional scale to provide context for the copper dynamics observed in the reservoir and feedback on permit compliance. The Central Coast Regional Water Quality Control Board Basin Plan objective for copper is 30 ug/l.[6] The downstream permitted limit of copper discharge is 13 ug/l under the California Toxics Rule,[7] though temporary exceedances of this value – if below the Basin Plan objective – are allowed under the SWRCB NPDES permit during the algaecide application season of April - September. Copper may be discharged for weeks or months at low levels (< 13 ug/l) subsequent to a treatment. The discharge point is 0.7 miles upstream of the typical limit of anadromy and 1725 feet upstream of the confluence with an unnamed tributary which contributes significant flow to Newell Creek (and thereby dilution of the discharge). Copper levels observed at the barrier 0.7 miles below the dam are an average of 3.7 ug/l while data collected further downstream at the Glen Arbor Bridge shows an average value of 2.1 ug/l.

6 https://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/docs2017/2017_basin_plan_r3_complete.pdf

7 Future downstream permitted limits may be contingent on a site-specific Biotic Ligand Model rather than the California Toxics Rule

Testing Deluge and Gate Valves

Testing of the deluge and gate valves on the dam involves opening the deluge valve located on the downstream side of the dam face approximately 0.7 miles above the typical limit of anadromy and seeing water released and then closing the valve and not seeing water released. Additionally, the five intake gates in the lake on the upstream side of the dam face are closed and the pipeline in the dam is drained to determine that the gates are holding as determined by no water passing through them. This testing is done at the direction of the Division of Safety of Dams (DSOD) and occurs in both the dry season and wet season in an alternating fashion annually (i.e. one year will be done in the dry season and the next year will be done in the wet season). The testing typically occurs for a period of several hours at a rate of discharge of approximately 5-10 cfs during the testing period. Future DSOD-required testing may involve a higher rate of discharge but will be coordinated with higher flows to mitigate potential effects on instream habitat and water quality. The procedures can result in the discharge of approximately 100,000 gallons of moderate to low oxygen (1-6 parts per million (ppm) at a range of 9-17 C˚ approximately) water discharged to Newell Creek immediately below the dam when done in the dry season. During the wet season when the reservoir is fully mixed, discharge water is well-oxygenated and <14 C˚.

Woody Debris Removal on Reservoir Face

Woody debris removal is conducted annually in the late fall when the fire hazard is low (after rains and during burn season). The work requires approximately 4-10 days to complete. A log boom is used to remove the wood at the top of the spillway and a boat, rubber-tired skidder and hand crews are used to remove the woody debris from the inside of the dam face. Wood removed is typically less than 10” in diameter and 8’ long. Average total volume of wood removed is approximately 10 cubic yards, annually. Bigger pieces are set aside for later use in instream restoration projects. Heavy equipment is excluded from the dam face to minimize soil disturbance. The wood is then piled on the inside face of the dam, cut up with a chainsaw, and burned. Large woody debris pulled from the lake is retained in the wood lot below the dam for restoration projects if possible.

3.3 Water System Operation and Maintenance

Water system operation and maintenance includes activities conducted to maintain operations of the water diversions and water transmission lines, and associated diversion features such as fish screens and fish ladders.

These activities are covered under the Permit application and include operation, rehabilitation, replacement, repair and maintenance of existing infrastructure and related facilities such as water measurement devices, scientific measuring devices, and water quality monitoring stations.

3.3.1 Water Diversion Sediment Management

Laguna, Reggiardo, and Majors Creek diversions on the North Coast are concrete impoundments that can collect sediment and debris during storm flows. Sediment management at these diversions primarily focuses on managing bedload and suspended sediment during storm flows with an attempt to mimic the natural hydrograph as much as possible. Each diversion has a dual slide gate valve mechanism in the dam face. The upper gate is opened during the ascending limbs of sediment-transporting storms (generally speaking, storms that are predicted by the National Weather Service (NWS) to result in 2" of precipitation in 24 hours or result in turbidity over 25 NTU) if it is free of sediment prior to the storms, and then closed on the receding limb of the storm or following storms if several storms follow in succession. The receding limb is identified either onsite with staff plates, or through real-time dataloggers installed at the Laguna and Liddell diversions, with these gages serving as a surrogate for Majors and Reggiardo Creek – which have no real time communications. If sediment does collect behind the impoundments, the impoundments are dredged. Dredging is conducted during the dry season (August – October) if possible, but always during low flows with heavy equipment and/or hand tools and the material is removed from the site as soon as possible. If excavation is necessary, the volume of sediment involved will range from 5-10 cubic yards per event up to 1-3x/year. The instream work area is limited to the area immediately adjacent to the intake screens and is isolated from the wetted channel with sandbag diversions, turbidity curtains or related materials. Fish removal in the work area is performed by an agency-approved biologist if necessary. The work area typically involves less than 50 linear feet of stream immediately adjacent to the intakes.

The Laguna Creek and Majors Creek diversions will be rehabilitated in order to allow more natural passage of sediment, avoid instream maintenance work and more effective implementation of instream bypass flows in the future. The rehabilitation will make part of the dam face movable or otherwise improved with wedge wire screens so that during stormflows sediment transport occurs in an unimpeded fashion and impacts associated with dredging will be reduced in the future. It is likely that the Reggiardo Diversion will be removed in the future.

Although the Liddell Spring Diversion is located on top of a natural spring and is not an in-channel diversion structure, sediment can still accumulate in the spring box during large storm events. When needed (up to 3x annually), the City removes up to 3 yards of sediment with hand tools, suction pumps or vacuum equipment and removes the material from the site immediately or after brief temporary storage. As previously mentioned, sediment is also allowed to "meter out" continuously by leaving the drain valve slightly ajar – thereby preventing accumulation in the spring box and providing an informal small instream flow to an unnamed, non-fish bearing tributary to the east branch of Liddell Creek.

3.3.2 Fish Ladder and Screen Maintenance

The only City facility with a fish ladder is the Felton Diversion on the San Lorenzo River.[8] The ladder is a standard removable Denil fish ladder located at the western side of the weir that operates when the

[8] Fish ladder maintenance procedures for a future, rehabilitated Tait Street Diversion are expected to involve similar activities.

dam is inflated. The ladder consists of a fishway with a removable fish trap. The fish ladder is operated according to the MOA described in Section 3.2.1. The ladder is approximately 60' long x 3.5' wide and has a floor slope of 6:1. The ladder is inspected 2-3 times per week and manually cleaned and cleared of debris as needed. A log boom at the upstream end of the ladder reduces accumulation of debris in the ladder, but 1-3 times per winter up to a cubic yard of sediment and woody material needs to be removed from the ladder. Debris removed from the ladder is removed from the site or is mobilized downstream during high flow events. Future improvement of the ladder includes installation of improved outmigration features. The fish screens at all the diversions are inspected regularly and cleaned by hand of any debris. The San Lorenzo River at the Tait Street Diversion has two Johnson-type well screens that are cleaned by compressed air back flush at intervals ranging from 10 minutes to 2 hours when the diversion is on. The screens are protected by a debris rack that is inspected daily and manually cleaned as needed. Future screening improvements at diversions described in Section 3.2.1 will reduce maintenance needs in the future.

3.3.3 Pipeline Operations

Adequate operation of the water transmission lines requires system flushing and repairs and specialized operations, including pumping well return to prevent sand accumulation and valve blow-offs to prevent breaks in the transmission lines.

Conveyance Pipeline System Inspections and Repairs

The City's two major unfinished water (raw, unchlorinated water) conveyance lines are the Newell Creek Conveyance Pipeline and the North Coast Conveyance Pipeline. These lines are 9.57 and 9.66 miles long, respectively. See Figure 3-1: City of Santa Cruz Water System map. Additionally, the City has 6.8 miles of finished (chlorinated) water line that runs from the City limits west to North Coast customers. These lines are part of the City's existing infrastructure and are critical to safe and reliable transmission of water to customers. While the Newell Creek pipeline is located primarily in upland areas, it does cross several streams and run adjacent to both Newell Creek below Loch Lomond Reservoir and the mainstem San Lorenzo River from Ben Lomond to Henry Cowell State Park. Similarly, the North Coast pipeline crosses several streams between Bonny Doon and the west side of the City. Pipeline routes are regularly inspected for leaks and pipeline rights of way are maintained to allow for inspection of the pipeline. Usually an eight-foot swath of predominantly upland vegetation is mowed to allow inspection of rights of way in rural areas. Clearing in riparian corridors is done by hand on an as-needed, infrequent basis. Inspection occurs in the fall and spring of each year, and when decreases in flow indicate a leak. Inspection includes walking the route by foot or traveling the route with an all-terrain vehicle.

Pipeline repairs are conducted on an as-needed basis. Repairs may result from damage to the pipeline through natural causes (earthquakes, landslides, etc.) or through deterioration of infrastructure over time. Staging areas for repair projects may be required depending on the location of the repair and may include areas for storage of construction materials and construction equipment. Pipeline repairs

may also require trenching and construction of temporary access ways. Standard avoidance and minimization measures are employed for pipeline repairs to reduce or eliminate instream effects from this work, as described in Section 7, *Measures to Minimize and Fully Mitigate the Take*.

The approximately 3.28-mile sanitary landfill leachate line which runs from the solid waste recovery center on Dimeo Lane to the City's wastewater treatment plant near Neary Lagoon has similar maintenance needs. While it is located in the proximity of only one known anadromous salmonid stream (Wilder Creek), standard avoidance and minimization measures are also employed for this work to reduce or eliminate instream effects, as described in Section 7, *Measures to Minimize and Fully Mitigate the Take.*

Finished Water Pipeline System Flushing and Repairs

The finished water pipeline distribution and conveyance system includes approximately 263 miles of pipeline in the water distribution area which includes the entire City, as well as a portion of unincorporated Santa Cruz County and a small portion of the City of Capitola. These pipes are generally located within streets and may include stream crossings or be located adjacent to water bodies. The distribution line must be kept clean of bacteria and contaminants and requires testing for hydrant capacity as well as pipeline repairs. See Figure 3-1: City of Santa Cruz Water System map.

Regular maintenance activities that occur on the distribution system may include the flushing of the line for fire hydrant testing; repair of main breaks; sediment removal; taste and odor control; control of color, high turbidity, low chlorine residuals, or bacterial growth; corrosion control; or response to customer complaints. Flushing is a water quality practice required by the California State Water Resources Control Board – Division of Drinking Water under the Safe Drinking Water Act. These maintenance activities occur year-round on various parts of the distribution system according to management priorities. Most repairs do not involve sensitive habitat, but those that do include standard avoidance and minimization measures to reduce or eliminate instream effects from this work, as described in Section 7, *Measures to Minimize and Fully Mitigate the Take.*

Pumping Well Return to the San Lorenzo River

At high and moderate flows, sand accumulates in the pumping clearwell of the San Lorenzo Wells located at the Tait Street Diversion (aka Crossing Street) adjacent to the San Lorenzo River just upstream of Highway 1. To reduce damage to equipment and prevent re-deposition in the Graham Hill Water Treatment Plant, sump pumps remove sand from the clear well, pump it to an adjacent decanting basin located in the parking lot of the Coast Pump Station and ultimately returns decanted water to the river immediately downstream through a riparian vegetation buffer without any elevation in turbidity. This activity typically occurs routinely in the winter and spring when flows are elevated and sediment is being transported by the river. The discharge from the decanting basin through the riparian corridor to the river results in no change in receiving water quality or changes in habitat.

North Coast Valve Blow Off to the San Lorenzo River

The North Coast Pipeline delivers unfinished/raw (non-chlorinated) water from the North Coast sources to the Coast Pump Station, which ultimately delivers water to the Graham Hill Treatment Plant. At the Coast Pump Station (at Tait Street) water from the pipeline is discharged to the San Lorenzo River when pressure within the pipeline threatens to rupture the line. The discharge prevents pressure from blowing out the North Coast Pipeline (subsequently preventing environmental impacts related to such blowouts) when sources are changed and during situations such as emergencies. Recently installed pressure relief valves minimize the potential for this occurrence.

The North Coast Pipeline Blow Off may occur year-round but only when the North Coast sources are on. This activity occurs rarely (less than 1 time annually) and only under special circumstances where dewatering the main elsewhere is not possible. The approximate amount of discharge during this operation ranges from 5-10 cfs and could persist for approximately 1-4 hours. The water is discharged over rip rap to the San Lorenzo River downstream of the intake located at the Coast Pump Station at Tait Street just upstream of Highway 1.

3.3.4 Dewatering of Creeks for Maintenance and Repairs

The City performs various types of instream work including, repair and maintenance of diversion facilities, sediment management, fish ladder and fish screen maintenance and repair, pipeline operations and maintenance, flood control and stormwater maintenance, vegetation management, and aquatic habitat management. During the course of these activities it is often necessary to dewater and otherwise disturb portions of stream channels. Dewatered stream reaches can range from approximately 20-200 feet and dewatering may occur for up to several weeks in any given year or not at all at 1-10 sites annually. In order to minimize effects of these activities on aquatic species, including protected species, the City captures aquatic species in the project area and relocates them to suitable habitat outside the project area. Additionally, other standard best practices are employed during dewatering such that effects on special-status fish species are limited to relocation. (Section 7, *Measures to Minimize and Fully Mitigate the Take*).

3.4 Municipal Facility Operations and Maintenance

Municipal facility operations and maintenance activities include flood control maintenance, stormwater maintenance, emergency repairs and response, and vegetation management. These activities occur on City facilities and properties. These activities include operation, rehabilitation, replacement, repair and maintenance of existing infrastructure and related facilities.

3.4.1 Flood Control Maintenance

Flood control maintenance is conducted to prevent flooding of city waterways and damage to public and private property. Flood control preventative activities are conducted in July through October on an as-needed basis. Emergency response during storms is conducted if damage to life, property, or public safety is imminent. Flood control maintenance includes debris/obstruction removal, sediment management/removal, and vegetation management. This work has historically been covered by Section 7 consultations due to the federal nexus with the U. S. Army Corps of Engineers (Corps). However, for the purposes of expediting permitting in the future and ensuring alignment between the diversity of City operations that affect the San Lorenzo River, Flood Control Maintenance is included as a Covered Activity in this Permit application. Historic Section 7 consultations are provided for reference in Appendix 7: *Example Historic Flood Control Biological Opinions.*

Debris/Obstruction Removal

Debris/obstruction removal is necessary when a material is either deposited or washes downstream into a waterway and creates a hazard to property or infrastructure. Under these hazardous conditions, the City may conduct debris/obstruction removal, including log jam modification (cutting larger logs into smaller segments that may float downstream in larger flows, moving with cranes, etc.) and vegetation removal. Typically, these events happen 1-3 times in wet water years but may not be necessary during drier conditions. These wet conditions may occur anywhere from 10-50% of the time during the life of the permit (Shawn Chartrand, personal communication with Chris Berry, 2020). Volume of debris removed may range from 0-100s of cubic yards depending on the magnitude of storm events and upstream delivery of instream wood. These activities are only conducted in an emergency setting where property, life, or public safety is threatened and are done in consultation with NMFS, USFWS, and CDFW staff as appropriate. During and immediately after flood events, City staff inspects conditions at bridges, road culverts, diversions, pipelines, and other public infrastructure to ascertain whether threat to structures are imminent and will only take action if the structure or property is in immediate danger. Such work is typically overseen by environmental monitors and involves standard avoidance and minimization measures for streamside projects as described in Section 7.3.

Flood Control Sediment Management/Removal

The City takes a preventative approach to sediment management by implementing best management practices (BMPs) for stormwater facilities including vacuuming storm drains before the winter season and cleaning culverts, vaults, and ditches before winter, usually from August through October. See Section 7.4.2. Work is completed with mechanized equipment and hand tools. Mechanized equipment used for this work is kept outside of the wetted stream channel.

The San Lorenzo River Flood Control Project includes 18 drainage discharge structures which are maintained to prevent flood waters from backing into neighboring areas and to prevent spills from entering the river. See Figure 3-19, Figure 3-20, Figure 3-21, Figure 3-22, and Figure 3-23: City of Santa Cruz Stormwater System. Branciforte Creek also has several drainage discharge structures to be

cleaned. The drainage discharge structures are cleaned on an annual or biannual basis. An excavator is used to remove sediment that has built up near the drainage gates. The amount of sediment averages 2 cubic yards per drainage discharge structure. The sediment is dewatered on site and the dried sediment is spread above ordinary high water on the riverbank to be removed by storm flows during the winter. See Figure 3-24: Flood Control Drainage Structure Example.

Sediment removal is only done as necessary to maintain and/or restore capacity of stormwater conveyance facilities or to prevent flood events. The nature and exact location of sediment removal in flood control areas is not know from season to season and is dependent on variation of winter storms flows, upper watershed events that produce sediment, and flood control monitoring data that documents aggraded areas that may not meet flood control standards established by the Corps. The flood control management prescriptions for the lower San Lorenzo River entail managing sediment outside of the wetted channel within the levees to facilitate transport of sediment and maintenance of adequate levee freeboard for flood control purposes. This work entails disking of dry sand bars during dry periods with heavy equipment as described in Table 3-1. This work is typically overseen by environmental monitors and involves standard avoidance and minimization measures for streamside projects as described in Section 7.3.

Sediment management in the Branciforte FCC is mostly limited to the lower reaches of the FCC from May Street to Water Street and is performed annually. The work occurs outside the wetted channel and is performed with a long-reach excavator from the top of the FCC. Approximately 270 cubic yards of sediment is removed with each maintenance event. The FCC is currently being evaluated for rehabilitation that will provide both additional flood control reliability as well as improved fish passage.

Figure 3-19: City of Santa Cruz Stormwater System

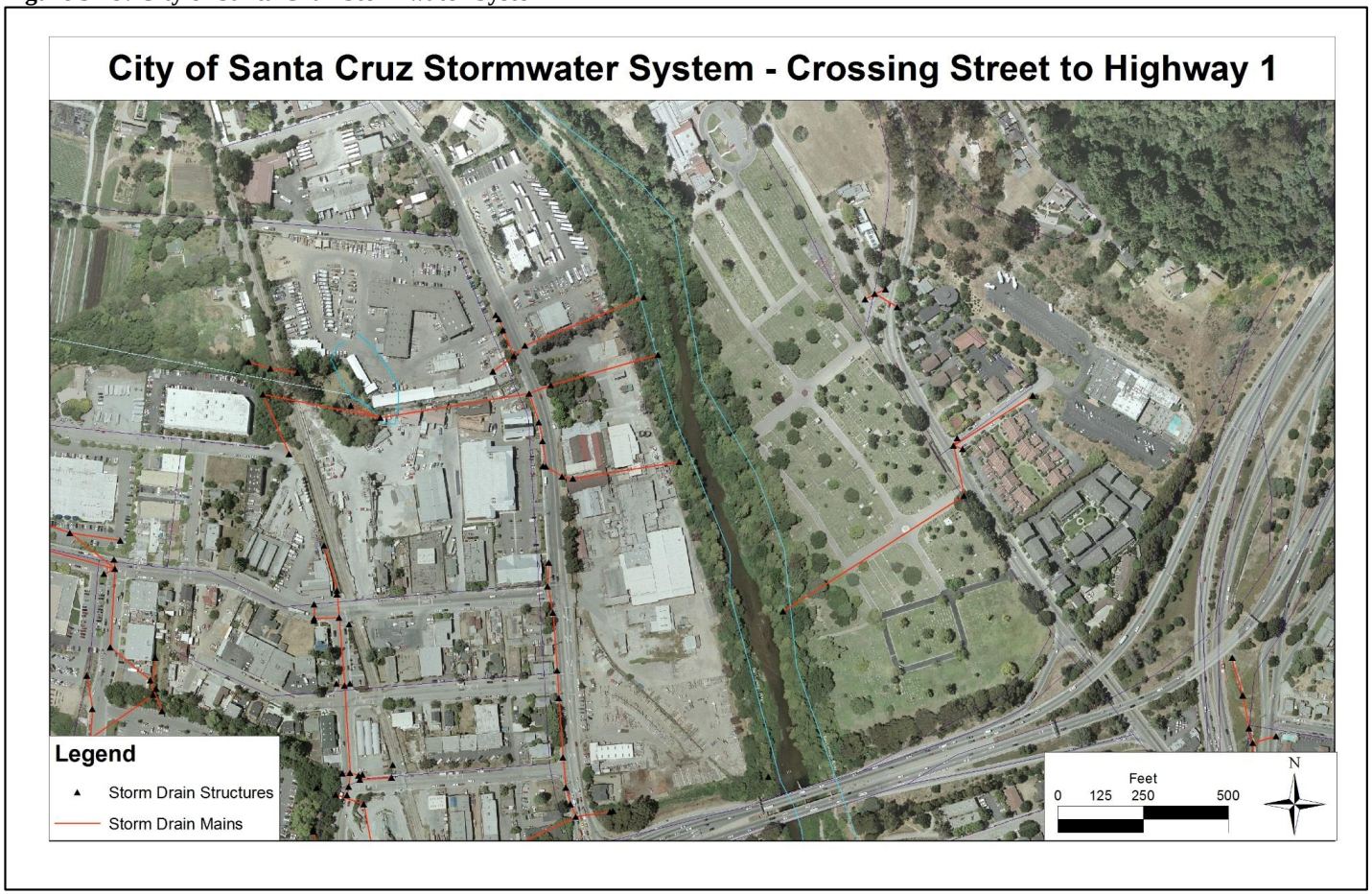


Figure 3-20: City of Santa Cruz Stormwater System

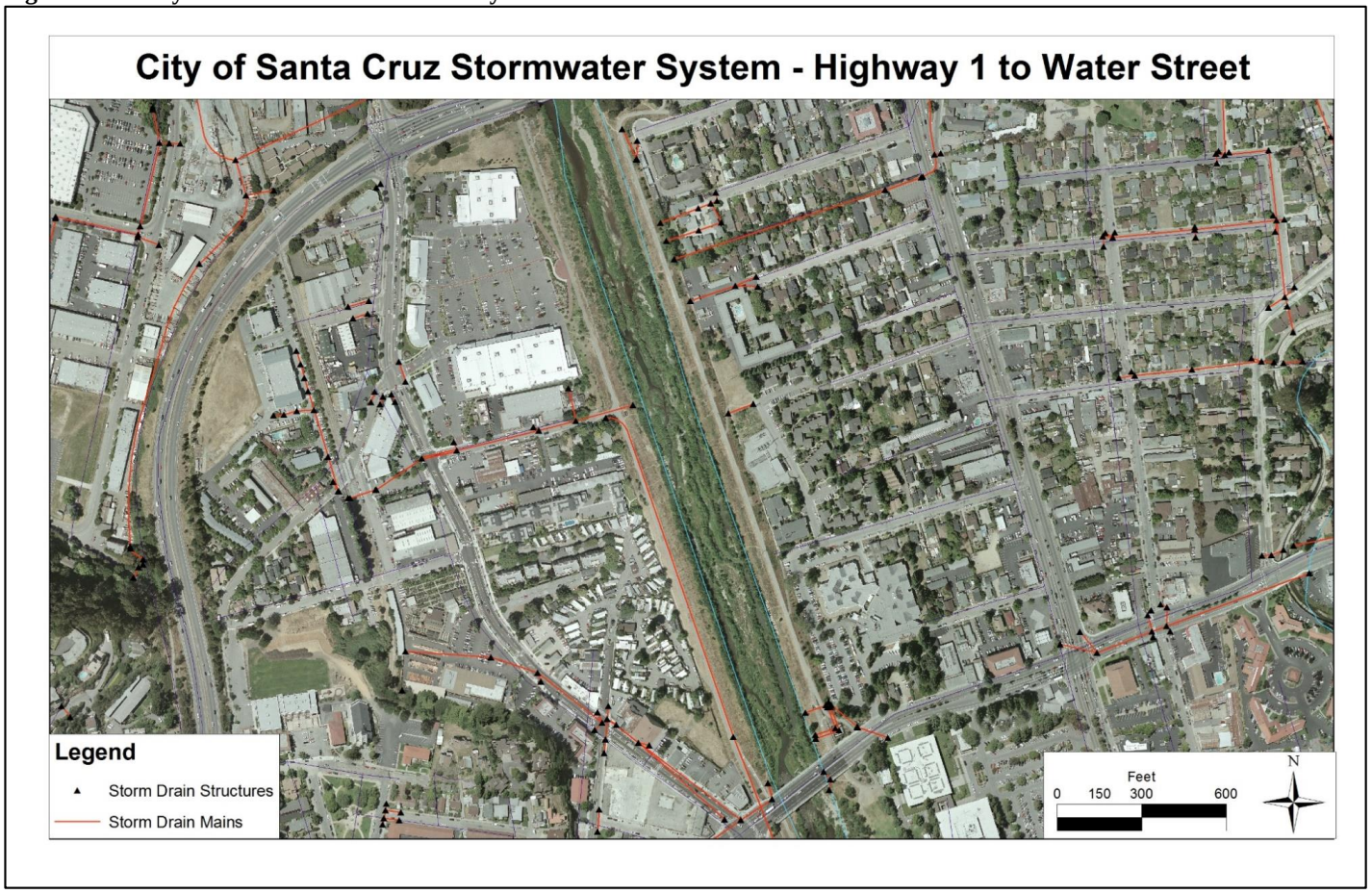


Figure 3-21: City of Santa Cruz Stormwater System

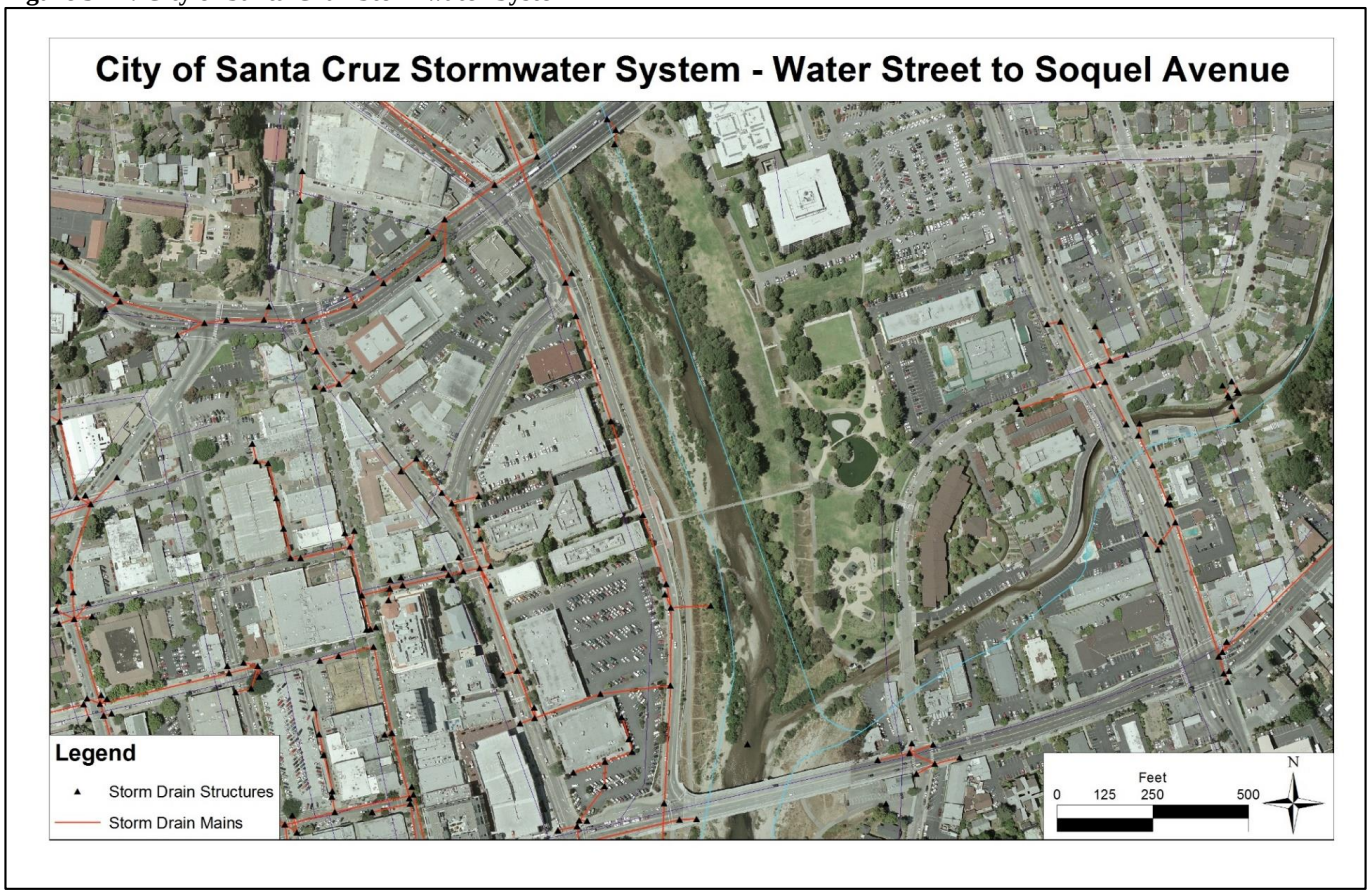


Figure 3-22: City of Santa Cruz Stormwater System

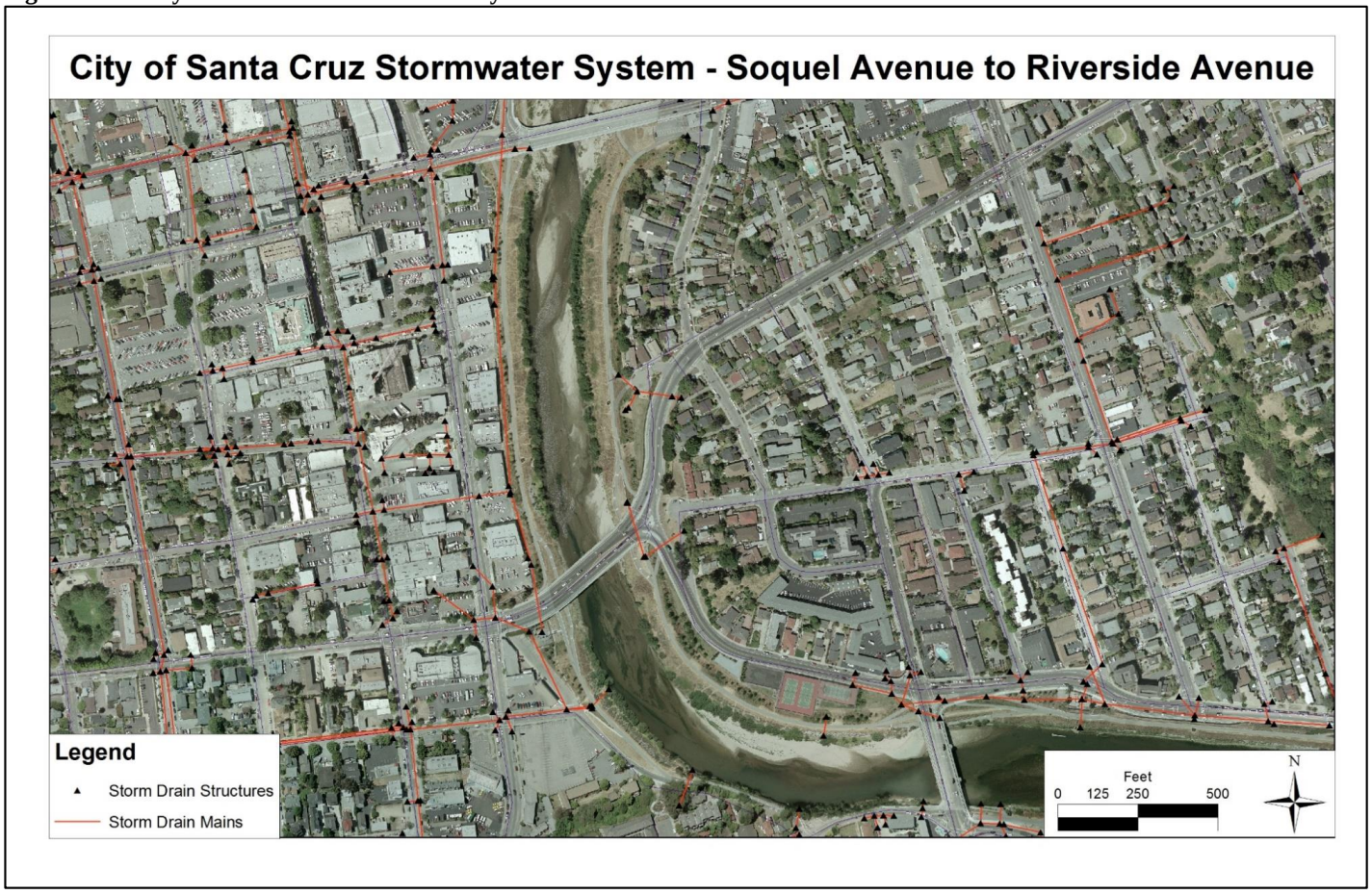


Figure 3-23: City of Santa Cruz Stormwater System

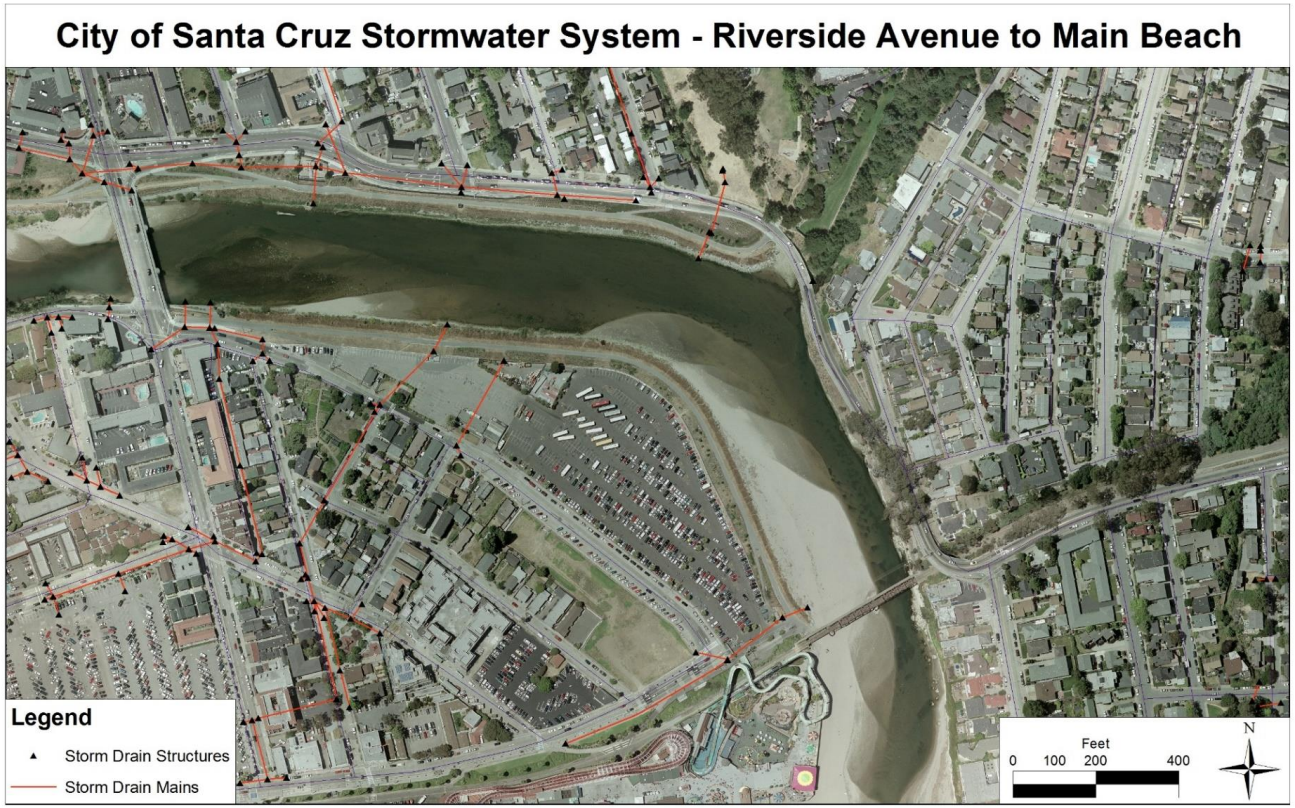


Figure 3-24: Flood Control Drainage Structure Example

Vegetation Management

Vegetation management focuses on trimming or removing riparian vegetation that may impede storm flows, result in bank erosion, or result in damage to property. In the majority of waterways other than the San Lorenzo River and Branciforte Creek FCCs, mature riparian trees are not removed, but riparian shrubs may be trimmed from ground level to 6-8 feet in height. Mature riparian trees are removed in the San Lorenzo FCC and Branciforte Creek FCC per maintenance requirements of the Corps to reduce roughness and ensure that the FCCs can pass design flows. Branciforte FCC maintenance typically occurs in the transitional reach below Water Street only and occurs as needed. Design criteria for the channel dictates that the channel be kept entirely clear of sediment and vegetation at all times, but resource limitations result in maintenance occurring infrequently (1 – 2x every 10 years). Cuttings are removed from the work area and recycled as green waste at the landfill or chipped and left on the outboard side of the FCCs. A 5 – 10-foot-wide buffer of vegetation is typically retained adjacent to the wetted channel. Work is generally conducted in late August and may last from a few days to a few weeks depending on the area. The vegetation management prescriptions are set out in Table 3-2. Such work is typically overseen by environmental monitors and involves standard avoidance and minimization measures for streamside projects as described in Section 7.3.

Table 3-1: Flood Control Sediment Management Prescriptions by San Lorenzo River Stream Reach*

Reach	Sediment Management Prescription	Frequency
Riverine Reach	Instream bars outside the wetted channel should be disked annually to loosen root materials and promote scour. Existing cross-channel scour areas should be encouraged through disking and manipulation of discarded root wads/vegetation material. Sediment removal areas should be defined by cross section and HEC-6 analysis and should avoid important salmonid habitat areas including riffles, pools, and runs.	1-3x Annually
Transitional Reach	Disking on the west bank should occur east of levee toe up until outside edge of 5-foot vegetation buffer. Existing cross-channel scour areas should be encouraged through disking and manipulation of discarded root wads/vegetation material.	As determined by cross-section monitoring. Will occur less frequently than every other year dependent on previous winter's sediment transport dynamics.
Estuarine Reach	Sediment management or removal is not necessary in this reach.	NA[9]

*See Figure 3-25: Urban San Lorenzo River Stream Reaches

[9] This reach typically meets FCC design criteria without maintenance and sediment management is not currently proposed as a Covered Activity.

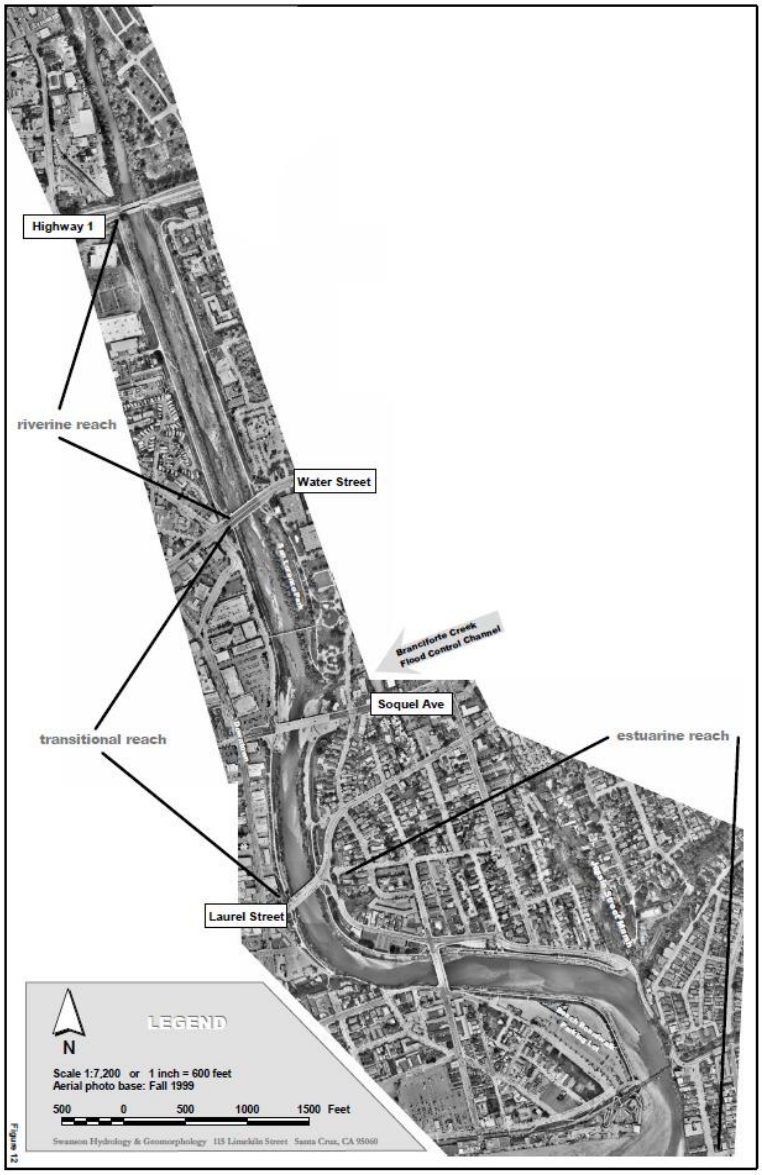
Table 3-2: Vegetation Management Prescriptions by Stream Reach*

Reach	Vegetation Management Prescription	Frequency
Bankfull Channel Area and **Instream Channel Bed**	Remove riparian vegetation that exceeds accepted Corps Manning's "n" roughness coefficient for the FCC.[10] A 5-foot edge of stream buffer area should be maintained on either side of the wetted edge.	1x Annually
Riverine Reach	Allow 10-foot-wide strip of willow and alder along toe of levee. Willows allowed to grow to 3" diameter at breast height (dbh). Alders allowed to grow to 6" dbh. The lower limbs of the alder trees should be trimmed. The willows should be thinned to favor providing overhanging cover to the low flow channel. Maintain a 5-foot buffer along wetted edges of channel, but thin groves and limb up trees. Remove any trees in 5-foot buffer area that are greater than 6" dbh.	1x Annually
Transitional Reach	A 10-foot-wide strip of woody riparian vegetation and tules and cattails should be maintained on the west bank. The east bank should be maintained to keep trees overhanging water. Trees or branches that fall in the water should be assessed for cutting into smaller pieces and may be removed entirely if they cause an immediate safety hazard. Sandbars should be maintained to allow volunteer groves to establish but remove all trees greater than 6" dbh.	1x Annually
Estuarine Reach	A 5-foot-wide strip of willow, cattail and tule should be maintained at the levee toe. Willows should have stem diameter of no greater than 0.5 inches and be limbed up and periodically thinned to create defined groves.	1x Annually

*See Figure 3-25: Urban San Lorenzo River Stream Reaches

[10] Roughness coefficient targets can vary by stream reach and change depending on channel morphology dynamics with an overall goal of maintaining flood capacity for (at minimum) 100-year events.

Figure 3-25: Urban San Lorenzo River Stream Reaches



3.4.2 Stormwater Maintenance

Stormwater maintenance is conducted on the City's stormwater conveyance system and at the sanitary landfill. The City has an adopted Stormwater Management Program and has fulfilled the requirements for the NPDES Phase II General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems. The Stormwater Management Program is designed to reduce discharge of pollutants to the maximum extent practical and to protect water quality. The Stormwater Maintenance Program includes inspection and cleaning of streets, storm drains, public areas such as alley ways, parks and other City facilities, and structural retrofits of the storm drain inlets and basins as needed.

The City's stormwater system serves the entire City limits. The City assesses and prioritizes maintenance of the storm drain system, including the following: catch basins, pipelines, five San Lorenzo River pump stations, the Neary Lagoon pump station, two CDS (hydrodynamic pollution separator) units, and above-ground conveyances. See Figures 3-10, 3-11, 3-12, 3-13, and 3-14 for stormwater infrastructure adjacent to the San Lorenzo River.

The City has determined that the lower Ocean Street, Beach Flat and Downtown areas are the highest priorities for storm drain system maintenance based upon the following factors:

1. High or intensive use,
2. High density, and
3. Direct impact or proximity to receiving waters such as the San Lorenzo River, San Lorenzo River pump stations, and Monterey Bay/Pacific Ocean.

In addition to the catch basins in the high priority areas above in the high/intensive use or high-density areas, which tend to have accumulation of sediment, trash and debris, catch basin meeting any of the following criteria will also be considered high priority:

1. Catch basins known to accumulate a significant amount of sediment, trash, and/or debris;
2. Catch basins collecting large volumes of runoff;
3. Catch basin collecting runoff from area that do not receive regular sweet sweeping;
4. Catch basins collecting runoff from drainage areas with exposed or disturbed soil; or
5. Catch basins that receive citizen complaints/reports.

Staff also reviews the storm system areas that needed attention during the previous year and adds these areas to the priority list as necessary.

<u>Inspection and Cleaning</u>

Inspection and cleaning of streets and storm drains are a key component of the Stormwater Maintenance Covered Activity. The City implements an annual storm drain inspection and cleaning program, "Team Clean", to remove pollutants transported by stormwaters to receiving waters such as

streams and the San Lorenzo River. The City is currently developing a Geographic Information System (GIS) for storm drains to further refine cleaning frequency for catch basins and inlets. A maintenance tracking software system is also under development and will help with scheduling and tracking inspections, cleanings, upgrades, and tracking flooding of stormwater facilities. The City also conducts TV camera inspections of at least 5,000 feet of storm drain line each year. These inspections are very helpful in evaluating the conditions of storm drain lines and identifying repair needs. Cleaning is completed both through the use of a Vactor truck and through hand cleaning. Storm drain lines are plugged at both ends and the Vactor truck, using reclaimed water, "jets" the line and then vacuums the line to remove sediment and material. The resulting sediment and material are disposed of in the sanitary sewer or landfill after dewatering at the Wastewater Treatment Plant. In general, the City operates according to the following schedule for inspecting and cleaning all inlets, catch basins, pipelines, pump stations, and other portions of the storm drain system.

- Problem basins (known basins that collect sediment and trash): Inspect and clean at least monthly or more frequently during wet season.
- Intensive use basins (located in high use areas of the City): Inspect and clean semi-annually. Clean monthly during September and October.
- Commercial basins (located in commercial areas): Inspect and clean annually.
- Residential basins (located in residential areas): Inspect on an eight-year cycle and clean, as necessary.
- Pump stations along San Lorenzo River: inspect weekly and cleaned at least annually.
- Large diameter stormwater pipelines (including inlets, culverts, and vaults): Inspected annually and cleaned at least on a five-year cycle.
- Small diameter stormwater pipelines (including inlets, culverts, and vaults): Inspected on a two-year cycle, cleaned as needed or on a fifteen-year cycle.

The street sweeping program is conducted daily and covers approximately 35 miles of streets daily. Manual hand sweeping is conducted "on call" in order to clean up after a particular event or accident. Cleaning of City-owned areas (such as alleys) is conducted with a garden hose, without the use of soap. Prior to hosing, spills and large debris are cleaned or picked up. Also, aluminum grates with small mesh size are inserted into nearby storm drains inlets to prevent small debris from entering the storm drain system. Catch basins in public parking lots are cleaned with a Vactor truck annually. Wastewater from the cleaning is collected and disposed into a sanitary sewer line. City staff oversees these cleaning events to ensure proper disposal of the wastewater.

The City also maintains numerous public areas and facilities, including medians, parks and other landscape areas with hand crews and standard landscaping equipment (lawn mowers, trowels, shovels, string trimmers, etc.). The primary pollutants of concern from these properties are sediment from erosion, nutrients from fertilizer use and organic matter, and heavy metals and toxic organics from pesticides/herbicide use. The City has an active Integrated Pest Management (IPM) program and pesticide/herbicide use is very limited, conducted according to label instructions when they are used

and generally avoided adjacent to waterways. Medians and embankments are planted with vegetation and maintained for both aesthetics and erosion control or hard-scaped in situations where maintenance and safety concerns warrant it.

Structural Retrofits of Storm Drain Inlets and Basins

The City selects structural retrofit projects of storm drain inlets and basins in the interest of improving performance of said infrastructure and reducing transport of stormwater pollutants to adjacent waterbodies. The City focuses on two types of structural controls to improve water quality associated with the storm drain system. The first are dry-weather diversion systems to divert flow to the sanitary sewer for treatment at the Wastewater Treatment Facility. The second are in-line treatment systems such as sediment basins and oil/water separators. Additional projects such as sealing slide/flap tide gates along the San Lorenzo River to prevent spills from entering the river have been identified as a priority for implementation in the future. This work typically occurs within street rights of way and standard best practices are employed during construction to prevent runoff and degradation of water quality in adjacent waterways. Any streamside work is also isolated from the water with coffer dams. See 7.3 for detail on best practices for water quality protection during stream work.

Leachate Management

The goal of the operation of the Leachate Collection and Removal System (LCRS) is to prevent leachate from entering into Lombardi Creek from the City's sanitary landfill and prevent the public from coming into contact with leachate. The LCRS consists of four major components: a groundwater interceptor trench-barrier wall at the toe of the RRF, two Class II surface ponds; a leachate transport pumping station and electric control building; and a transport pipeline.

There are two leachate collection ponds located at the south toe of the RRF, up gradient of the groundwater interceptor trench-barrier wall. These ponds do not support coho. These ponds serve to collect leachate resulting from rainfall and underground springs and prevent the leachate from entering into Lombardi Creek. The ponds are operated in a sedimentation and overflow scheme. The ponds are approximately 11 feet deep including 2 feet of freeboard. The primary and overflow ponds have nominal capacities of 100,000 and 175,000 gallons, respectively. The leachate sediments settle in the primary collection pond and the leachate overflows to the transfer pump station manhole. At the base of this pond is a 4-inch clean-out where operations vacuum out the sediments on an as needed basis.

The leachate transport pumping station was built between the two ponds, and houses three submersible 200 gallons per minute (gpm) wastewater pumps. Leachate flows by gravity to the pumping station or into the overflow pond when storage is required. Pumping to the Wastewater Treatment Plant is frequent enough so that the overflow pond is empty most of the time. The pump station was designed so that one pump could meet the peak month flow requirements; the third pump was provided as a backup. Most of the solids in the leachate settle out in the sedimentation pond, minimizing cleaning of the overflow pond and leachate transport line.

In the case that the leachate line would require repair due to a natural disaster (e.g., earthquake), the City would undertake repairs as expeditiously as possible, normally within 24-48 hours depending on damage. The process by which the line repair would be undertaken would include assessment by City engineers for fixing the break, assessment of equipment and operation needs, obtaining necessary permits and building the repair. Conveyance of leachate is discussed under the Conveyance Pipeline System Inspections and Repairs Covered Activity description. Work on the leachate system employs standard best practices for protection of water quality and aquatic habitat. See Section 7.3 for detail on best practices for water quality and aquatic habitat protection.

3.4.3 Emergency Operations and Response

Emergency operations are developed in response to specific emergency incidents of a scale that are smaller than those that trigger "Changed Circumstances". Anticipated types of incidents that may occur in the Plan Area include localized storms, floods, fire, earthquakes, and hazardous spills that are of a short (days – weeks) time period. These incidents may result in log jams, flooding, damage to pipelines, bridges and levees, mudslides, structures damaged by high surf, and spills into waterways.

The incidence of these types of events is highly variable and unpredictable. They are likely to occur less frequently than annually and involve special-status species or designated critical habitat on an even less frequent basis. In the case emergency response is required, operations may include the use of heavy equipment near waterways and removal of debris and structures in waterways, drainage improvements, pipeline repairs, erosion control and revegetation. Operations are completed according to the City's Emergency Management Plan. The overall Project Manager during emergency situations is the City Manager with support from Fire and Public Works departments and may involve activation of the City's Emergency Operations Center. Field work is guided by authorized environmental monitors and in consultation with NMFS and CDFW as needed. Standard best practices for the protection of water quality and aquatic habitat will be employed for this activity as well. See Section 4.4.3 for detail on best practices for water quality and aquatic habitat protection.

3.4.4 General Vegetation Management Within Riparian Corridors

Vegetation management is generally conducted at City properties and facilities, pipeline rights-of-way, water diversions, tanks, pump stations, and open space and watershed lands. Vegetation management is conducted to provide access to City facilities, provide protection from fire, prevent proliferation of non-natives and illicit activity, and to improve habitat and water quality at some facilities. Vegetation removal is generally done through cutting, flaming, pulling, mowing or targeted herbicide application consistent with the City's IPM Program. Removal areas are targeted based on facility maintenance needs, safety, non-native plant invasion potential, available resources and funds, and other natural resource management priorities. Planting may also occur for landscaping or restoration purposes and

is typically focused on native or drought tolerant species. Generally speaking, vegetation removal is limited to the dry months, while planting is limited to the early winter period when rooting potential is maximized. However, these activities may not occur on a regular or seasonal schedule, nor occur at a specific time of day or rate of frequency, and may occur at any time as needed.

Vegetation management for pipeline ROW access is done primarily through hand trimming and mowing on an annual basis. An eight-foot right of way along the pipeline right of way is maintained the length of pipelines and involves up to five stream crossings annually. Pruning in riparian corridors along pipeline ROWs and adjacent to other utility infrastructure is typically limited <5,000 square feet on annual basis and mostly occurs along non-anadromous stream reaches. Trimming in riparian areas is done by hand and maintains canopy, downed trees and snags to the extent possible. Mature trees are typically retained unless they are failing and threaten infrastructure. All mature trees are inspected by a certified arborist or registered professional forester before being felled and downed wood is left and not lopped as possible. All tree work is done outside of the nesting season if possible, and trees are inspected for nests prior to felling if felled within the nesting season.

3.5 Land Management

Land management activities include recreation, facility maintenance and management, and sensitive habitat management. These activities occur on City Water Department watershed lands, including the LLRA in Newell Creek watershed, and the Zayante and Laguna watershed properties in the Plan Area. The Permit application seeks coverage for operation, rehabilitation, replacement, repair and maintenance of existing infrastructure and related facilities. Activities associated with facility maintenance and management include facility repair, trail maintenance and management, trail construction, and road maintenance and decommissioning. These activities occur on all the watershed lands and open space properties owned by the City Water Department, particularly in the Newell Creek and Zayante Creek watersheds.

3.5.1 Management of Loch Lomond Recreation Area and Watershed Lands

The City operates the LLRA Area in the Newell Creek watershed as a condition of approval for construction of the Newell Creek Dam. Loch Lomond Recreation area is approximately 180 acres. The Water Department operates this facility with a staff of planners, rangers, and maintenance personnel. The area is operated to provide appropriate recreational opportunities for the public, to preserve and maintain habitat areas and to provide drinking water source (i.e. watershed) protection at Loch Lomond Reservoir and surrounding Newell Creek watershed lands. The City also manages approximately 3,880 acres of watershed lands in the Newell, Zayante and Laguna watersheds solely for the purpose of drinking water source protection. These lands are not open to the public and the Laguna property has no road or trail network but does include an offsite mitigation area in upslope areas for the

conservation of Mount Hermon June Beetle. See Figure 4-3, Figure 4-5, and Figure 4-6 for location of Loch Lomond Recreation Area and watershed lands and associated roads.

Trail Maintenance and Repair

This activity includes repair to 7.5 miles of trails during or after natural events such as winter storms, earthquakes, or landslides. The City does not undertake this activity on a regular basis, only on an as needed basis. It typically involves less than 50 yards of trail in any given year. In cases where a project has been identified as needed to ensure public safety and prevent degradation to sensitive resources, the City prepares a project description, obtains repair specifications, obtains project specific approvals from NMFS, CDFW if riparian corridor or stream work is involved and constructs the project. Trail maintenance and management occurs year-round on open space properties and watershed lands. Trail maintenance and management is a preventative activity to keep trails in good physical conditions to avoid blow-outs due to natural events. Trail maintenance can include installing drainage improvements such as culverts, dips and bars and realigning trail segments outside of stream channels and geologically unstable areas and steep slopes and otherwise avoid other sensitive habitats. Culverts are not installed on salmonid streams. Remediation of existing erosion areas is implemented annually as needed. Informal and unauthorized trails are discouraged or removed as resources permit. Ranger patrols are provided to ensure appropriate use of trails and adherence to closures or restrictions. Areas that have sensitive resources (such as riparian areas) are also closed to public use to prevent disturbance to those resources. Standard BMPs are required for facility repair work near riparian corridors and streams. More detail on such measures can be found in Section 7, *Measures to Minimize and Fully Mitigate the Take.*

Road Maintenance and Decommissioning

Road maintenance and decommissioning occurs on the Newell Creek and Zayante Watershed properties owned and operated by the Water Department. Road maintenance and decommissioning is conducted on the watershed lands to maintain access on vital roads. Road maintenance occurs annually on the property, from May-September and can take a few days to several weeks to complete. Road decommissioning is a new activity for the Department and is in its initial stages of planning and implementation but is expected to continue over the next 20 years. All road work is conducted with the support of a Registered Professional Forester and Certified Erosion Control Specialist, with engineers also being involved on more difficult road projects.

Roads are maintained to provide access for patrolling the properties for security and trespass concerns (off road vehicles, poaching, camping, etc.), for fire access, resource management and restoration, and for maintenance of drainage infrastructure. Roads not necessary for these purposes, or which are significant sediment sources which cannot be treated by maintenance activities, will be decommissioned.

Road maintenance takes place on “restricted use” or seasonal roads within the Newell Creek and Zayante watershed lands and on City park properties. Maintenance is done on the paved maintenance road to the LLRA and unpaved roads in the watershed lands. Maintenance activities focus on maintaining 117 culverts and associated trash racks, maintaining proper energy dissipation at outlets, clearing bank slough, and conducting bank stabilization, and hand digging rolling dips and/or water bars as necessary to maintain appropriate drainage. This work does not occur in salmonid streams but may occur in ephemeral or perennial tributaries to salmonid streams. Drainage maintenance is usually done with hand tools and bank slough is accomplished with hand tools or a small tractor or loader. Large fill failures or crossing failures are emergency repairs and are not considered standard maintenance.

Unpaved roads are managed as “restricted use” roads. The restricted use refers to roads that are not appropriate for driving in the winter under saturated conditions. These roads are generally maintained as out-sloped dirt roads, with rolling dips and/or water bars to manage drainage. Culverts are utilized to route drainages that the road would otherwise intercept, through the road prism, or in a few areas where in-sloping had to be maintained to pick up bank seepage, or control drainage away from a landslide or road fill failure. These roads have been historically maintained as dirt surface roads, with no wet season use. In an attempt to reduce road surface sediment production, to improve access for patrols or emergencies, and to extend the season that the roads can be traveled, these roads can be rocked. At this time, the main road on the Newell Creek watershed lands, from the dam to the Bear Creek access is envisioned for rocking. The east side road in the recreation area may be treated with drain rock at stream crossings, or at road segments which could introduce sediment into water courses but is not as vital to upgrade for patrol.

Additional maintenance activities for roads would include culvert replacement and road reshaping. These activities would not occur annually as the prescriptions described above, but would rather be done according to management priorities. Culvert replacement or upgrades would occur in July – September with hand tools and heavy equipment. Projects could take several days to several weeks to complete. The Water Department is planning for a 30-year rotational schedule for culvert replacement and upgrades. Road maintenance on the 34 miles of watershed lands forest roads would occur approximately every five years and would include reshaping roads to maintain outslope drainage as appropriate for the road and topography. Effectively, this means that approximately 136-170 miles of forest roads are reshaped every 20 years and an average of 6.9 miles of road will be maintained annually. Reshaping work is done within the existing road width and cut fill area for most roads and no additional disturbance is done to adjacent areas. After reshaping, the roadbed is rocked and straw and seed are applied to bare soil areas as necessary. Once reshaping has been accomplished for identified roads, the frequency of repeat treatment would be approximately every 8-10 years.

Road decommissioning may occur for up to 5 miles of roads in the Newell Creek and Zayante Creek watershed lands in the future. Road decommissioning varies according to topography, road placement and construction technique when the road was built. Many segments of the roads proposed for

decommissioning traverse relatively mild slopes and have few drainage structures (culverts). These road segments would be more severely out-sloped than a drivable road, or sloped as close to natural grade as possible without generating excessive levels of disturbance. Where water may still concentrate on the road, frequent, large water bars will also be constructed. A small bulldozer (D-6) could adequately decommission these roads, possibly with the assistance of an excavator or backhoe.

These road segments would require all fill to be removed from the down slope portion of the road. This material would then be placed on top of the roadbed cut surface (keyway) and compacted against the existing cut bank. Compaction could be track walking or tamping with excavator in more benign areas. In the more difficult, steep areas, the fill would be engineered (with compactor, sheepsfoot, etc.) and watered per geotechnical recommendations. A severe out-slope would be constructed to bring the contour to as close as natural grade as possible. The area of disturbance associated with road decommissioning is the 14-16 foot width of the roadbed plus an additional 15-20 feet for the recontouring of the more benign roads, and 20-30 feet for the more difficult ones. The number of culverts involved in any given road segment could range from 15-20 culverts (average of 3.4 culverts/mile of road) on either perennial or ephemeral drainages. These drainages do not support the presence of steelhead or coho but may support resident trout.

Culvert removal will consist of excavating the culvert fill with an excavator or backhoe, down to native grade, and removal of the culvert. The area of disturbance associated with culvert removal would typically consist of the 14-16 foot wide roadbed, plus the area to the outer edge of the fill (10-20 feet). The road length at a particular crossing would typically vary from 20-50 feet. Depending on the grade of the channel to be reestablished, and other channel conditions, additional work may be necessary for grade control and energy dissipation above and below the culvert removal site. It is anticipated that most channel adjustments from culvert removal would occur within 30-50 feet of the existing crossing. Gabion sized rock to small rip-rap, or placement of large wood in the channel, may be necessary for channel stabilization upstream and/or downstream of the removed crossing. Erosion control measures for surface stabilization following removal would be required (straw, seed, straw rolls, blankets etc.), and the area replanted with native species, particularly conifer and riparian species.

Road decommissioning would take place during June – September. Road segments would be chosen so that they could be decommissioned, stabilized for erosion, and replanted within one season. Once decommissioned, maintenance would be reduced to any follow-up erosion control and further planting/care necessary for an additional period of one to two years until the area is stabilized and growing.

3.5.2 Habitat Management and Restoration

Habitat management includes resource management activities to improve, preserve and maintain existing sensitive habitats and species. Activities include habitat management and restoration, and public education.

Aquatic Habitat Management and Restoration

Aquatic habitat management is conducted to protect and enhance aquatic habitat for fish, amphibians, and reptiles and will be a fundamental component of the non-flow components of the conservation strategy. Fisheries restoration projects focus on adding or protecting fisheries habitat, stabilizing streambank erosion problems when it benefits salmonid habitat, protecting riparian corridors, removing fish passage barriers and related actions within the Santa Cruz Mountains coho diversity stratum. Projects are completed in accordance with the methods detailed in the California Salmonid Stream Habitat Restoration Manual (Flossi et al. 1998) and appropriate state and federal authorizations will be obtained prior to doing the work. Project priorities will be made with the assistance of a Technical Advisory Committee (TAC) as described in the Non-flow Conservation Fund (NFCF) (Appendix 1: *Summary of Approach to Non-Flow Mitigation of Biological Effects of the City Diversions*). Project types and respective equipment details are variable. For example, equipment used may range from chainsaws (for dropping trees into the streams), to excavators and log skidders for placement of large wood/boulders/gravel and related materials which must be brought into an area where there is existing access from roads. Hand crews are also typically involved in instream projects.

These activities take place during the summer/ fall period, when work conditions are dry, and the critical spawning and smolting periods are over. These projects could occur annually for smaller focused projects to every few years for larger projects (longer stream reaches, more complex construction). Typically, streams are dewatered for this work though they may not be for more simple projects where dewatering would be more impactful than working within the wetted channel. It is estimated that these types of projects would involve dewatering and fish removal in < 100 yards of stream per year. It is estimated that the time length of the projects will vary from 2 to 6 weeks. Standard BMPs are required for work near riparian corridors and streams. More detail on such measures can be found in Section 7, *Measures to Minimize and Fully Mitigate the Take*.

Monitoring

The monitoring program will provide the information necessary to assess compliance, validate effectiveness of habitat management and restoration actions, and implement a feedback loop to ensure that management/mitigation measures can be changed as needed in response to changing conditions and new knowledge. The monitoring program is summarized here and more fully described in Section 6.4. The monitoring program will be overseen by the HCP/2081 Permit Administrator and methods and results will be reported in an annual monitoring Covered Species report.

The monitoring program outlined below will provide data on the distribution and abundance of their habitats, and potential threats. Using these data, the City will be able to assess changes in the quality and quantity of the specific habitat of the Covered Species, identify significant changes in the populations of the Covered Species, and decide if changes in management or monitoring are

warranted. The results of the annual monitoring activities will also inform management decisions, including selection of projects to be funded from the mitigation fund.

All monitoring activities will be performed under the HCP Administrator's guidance and supervision, or under the guidance and supervision of a designated Conservation Program Manager. Prior to the implementation of the Permit, the Conservation Program Manager will prepare a monitoring manual that specifies the methods and protocols to be used in the Monitoring Program. Monitoring objectives, methods, and specific protocols will be developed in close coordination with NMFS and CDFW through a TAC to reflect the state of the art in regional salmonid assessment and to ensure consistency with regional efforts as they develop. Training will be provided for all individuals performing monitoring activities and these individuals will have qualifications, knowledge, and experience relevant to the type of research and monitoring activities that are being performed. The HCP Administrator may engage third parties (such as biological consultants with specific technical expertise regarding a Covered Species) who are qualified and authorized by NMFS and CDFW to conduct, or to directly supervise, activities conducted under the monitoring program.

Monitoring program coordination with NMFS and CDFW will be achieved through regular meetings (at least one to two per year) of the TAC. Meetings will include a review of results of the past seasons monitoring and finalization of plans for the upcoming monitoring season. The value of existing studies will be appraised, and monitoring elements may be revised accordingly. An annual report will be prepared to document all monitoring activities and results. The three elements of the monitoring program (Compliance Monitoring, Population and Habitat Monitoring, Mitigation Effectiveness Monitoring) are summarized below. A full description of the monitoring plan is provided in Section 8: *Monitoring Plan*.

Compliance monitoring will include the following:

- Incidental take tracking
- Instream flow targets
- Felton Diversion operations
- Copper monitoring at Loch Lomond Reservoir
- Testing deluge and gate valves
- Relocation of LWD downstream of Loch Lomond Reservoir
- Installation of Sediment Management upgrades at Laguna, Reggiardo, and Majors Diversions
- Installation of Felton Diversion and Tait Street Diversion Fish Screen upgrades and juvenile bypass improvements
- Water System Operations and Maintenance avoidance and minimization measures
- Municipal Facilities Operations and Maintenance effects on listed species and habitat (debris/obstruction removal, sediment removal, and vegetation removal)

Covered species population and habitat monitoring will include:

- Juvenile population abundance in covered stream reaches
- Juvenile population abundance in San Lorenzo and Laguna Creek lagoons
- Adult population abundance at the Felton Diversion Dam
- PIT tag antenna array in the San Lorenzo River
- Stream habitat quality
- Instream temperature
- Passage obstacles
- Lagoon habitat quality

Monitoring activity specifically requiring take authorization includes habitat typing of up to 20 miles of streams and tagging/handling of <10,000 fish annually, visual census of up to 5,000 feet of stream annually and maintenance of up to 10 stream gages, 2 pit tag readers, 10 temperature loggers, 1 fish trap and 2 water quality data sondes annually. Monitoring will utilize typical best practices for working in streams as described in Section 7.3 and be covered under the 10(a)(1)(B) and related Scientific Collector's permit.

Mitigation effectiveness monitoring will be completed for each mitigation project after 1, 3, 5, and 10 years. Monitoring objectives and methods, and specific protocols will be specified for each mitigation project by the TAC as part of the mitigation planning process. The mitigation strategy is based on a stepwise process of habitat enhancement that will occur over the life of the Permit. The City will provide annual funding for projects, and the TAC will decide on projects and allocate funds (see Section 7 for a description of the conservation strategy).

Reporting for each mitigation project will be provided in the annual and five-year mitigation summary reports and will include information on attainment of project-specific success criteria (via review of assessment variables to be prescribed for each project by the TAC), responsible party, specific monitoring methods, a schedule of monitoring activities, analytical methods, and reporting requirements.

Table 3-3: Covered Activities Summary

General Activity	Sub-Activity	Notes
Rehabilitation of Diversion Structures and Pipeline Reaches	1. Laguna Diversion 2. Majors Diversion 3. Felton Diversion 4. Tait Street Diversion	1. Sediment transport improvements 2. Fish screening improvements 3. Fish passage improvements at the Tait Street and Felton diversions 4. Diversion capacity increase at the Tait Street Diversion.
Water Diversion	1. Liddell Diversion 2. Reggiardo Diversion 3. Laguna Diversion 4. Majors Diversion 5. Newell Creek Dam 6. Felton Diversion 7. Tait Street Diversion and Wells	Provision of drinking water utilizing existing water rights (as described in the proposed Santa Cruz Water Rights Project) with addition of "Conservation Flows"
Reservoir Operations	1. Chemical Algaecide Treatment of Reservoir 2. Testing Deluge and Gate Valves 3. Woody Debris Removal on Reservoir Face	1. 1-5 algaecide treatments annually 2. 1 test annually of 5-10 cfs for several hours. Bigger tests during winter/high flows as possible. 3. 10 cubic yards of < 10" diameter/8' long wood removed annually
Water Diversion Sediment Management	1. Liddell Spring 2. Laguna Diversion 3. Majors Diversion	1. Excavation of up to 3 yards per event up to 1-3x/year. Valve operations. 2. Excavation of 5-10 cubic yards per event up to 1-3x/year. Valve operations. 3. Excavation of 5-10 cubic yards per event up to 1-3x/year. Valve operations.
Fish Ladder and Screen Maintenance	1. Felton Diversion 2. Tait Street Diversion	1. 1-3 x/year up to a yard of sediment and woody material needs to be removed from the ladder.

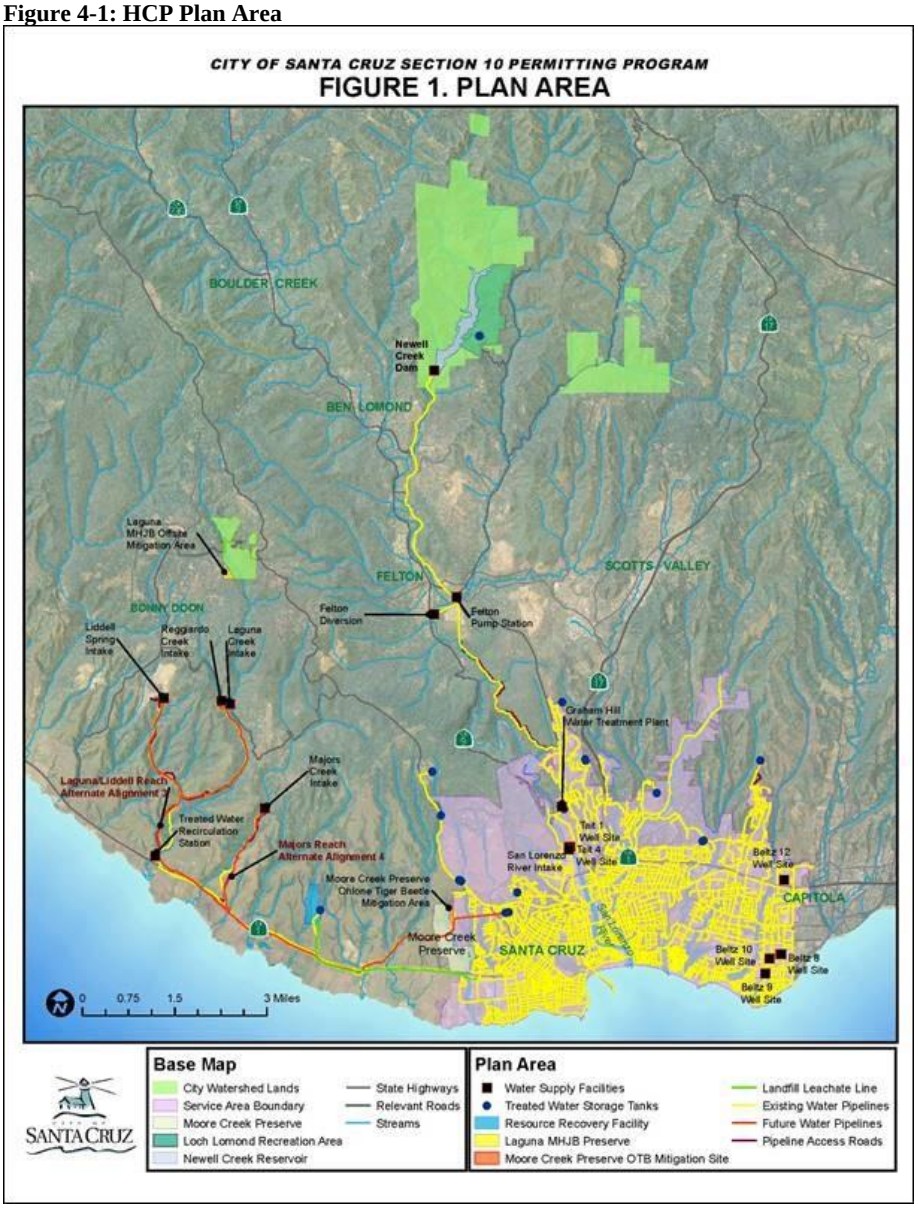
		2. 1-3x/year up to a yard of sediment and woody material needs to be removed from intake.
Pipeline Operations	1. Conveyance Pipeline System Inspections and Repairs 2. Finished Water Pipeline System Flushing and Repairs 3. Pumping Well Return to the San Lorenzo River 4. North Coast Valve Blow Off to the San Lorenzo River	1. Inspection and leak response on 19.23 miles of water line and 5.5 miles of leachate line. 2. Flushing and leak response on 270 miles of water line. 3. Ongoing pumping from clear well to remove sediment during high and moderate flows in winter and spring. 4. 5-10 cfs blow off to riverbank occurring < 1x time/year during any part of the year for 1-4 hours.
Dewatering of Creeks for Maintenance and Repairs	1. NA	1. Dewatered stream reaches can range from approximately 20-200 feet at 1-10 sites for 1-4 weeks in any given year.
Flood Control Maintenance	1. Debris/Obstruction Removal 2. Flood Control Sediment Management/Removal 3. Vegetation Management	1. 1-3x/year in wet water years up to 100 cubic yards of material. 2. Removal of approximately 2 cubic yards of sediment per drainage structure/annually or biannually for up to 30 drainage structures. 3. Thin riparian groves and remove willows >3" dbh and alders >6" dbh. Retain 5-10 foot wide riparian buffer adjacent to low flow channel, but remove vegetation >6" dbh annually.
Stormwater Maintenance	1. Inspection and Cleaning 2. Structural Retrofits of Storm Drain Inlets and Basins 3. Sanitary Landfill Leachate Management	1. Inspect and clean as needed but as frequently as weekly. Sweep 35 miles of streets daily. 2. As needed improvements of storm drain infrastructure. 3. Ongoing maintenance of two leachate ponds, transmission of leachate to

		wastewater plant and repair of leachate line.
Emergency Operations and Response	1. NA	1. Response to flood, fire, spill, or other related incident on a <1 time/year basis and lasting from a few days to several weeks.
General Vegetation Management Within Riparian Corridors	1. NA	1. Pruning and limited removal of riparian trees <5,000 square feet on an annual basis during the summer/fall months as needed adjacent to pipeline ROWs, water diversions and other utility infrastructure.
Land Management	1. Management of Loch Lomond Recreation Area and Watershed Lands 2. Trail Maintenance and Repair 3. Road Maintenance and Decommissioning	1. Operation and management of 180-acre recreation area and 3,880 acres of open space. 2. <50 yards of trail in non-anadromous watersheds annually. 3. Maintenance: Approximately 6.9 miles of road maintained annually. Decommissioning: 0-1 miles of road including up to 3.4 culverts on non-anadromous drainages annually
Habitat Management and Restoration	1. Aquatic Habitat Management and Restoration 2. Monitoring	1. Dewatering and fish removal in <100 yard stream reach annually 2. Habitat typing up to 20 miles of stream and tagging/handling of <10,000 fish annually. Visual census of up to 5,000 feet of stream annually. Maintenance of up to 10 stream gages, 2 pit tag antennas, 10 temperature loggers, 1 fish trap and 2 water quality data sondes annually

4.0 Project Location (CCR Title 14 § 783.2(a)(4))

Proposed Project activities are located in Santa Cruz County on the central coast of California, approximately 70 miles south of San Francisco. The proposed Project activities will be implemented within an approximately 176 square mile Plan Area that was developed for the HCP. The HCP Plan Area includes four geographically distinct areas: the North Coast Unit, the San Lorenzo River Unit, the City Urban Center Unit, and the water service areas outside of the City limits. The Plan Area is shown on Figure 4-1. The Plan Area is contained on the Davenport, Santa Cruz, and Felton U.S. Geological Survey 7.5-minute quadrangles. The regional topography ranges from sea level to greater than 1,200 feet above sea level. See Figure 4-1: HCP Plan Area.

Figure 4-1: HCP Plan Area



The North Coast Unit is located north of the City along Highway 1 and includes Majors Creek, Laguna Creek, Reggiardo Creek, Liddell Creek, and Lombardi Gulch. The 18-square mile North Coast watersheds serve as drinking water source watersheds for the City and comprise a series of small coastal watersheds that drain the west and south-facing slopes of the Santa Cruz Mountains directly to the Pacific Ocean. These watersheds include forested slopes in the upper reaches and canyon portions of the watershed, coastal foothill terraces, agricultural lands on the coastal plain, and streams that drain to the Pacific Ocean. See Figure 4-2, Figure 4-3, and Figure 4-4 for Liddell, Laguna and Majors Watershed maps respectively.

Figure 4-2: Liddell Watershed Map

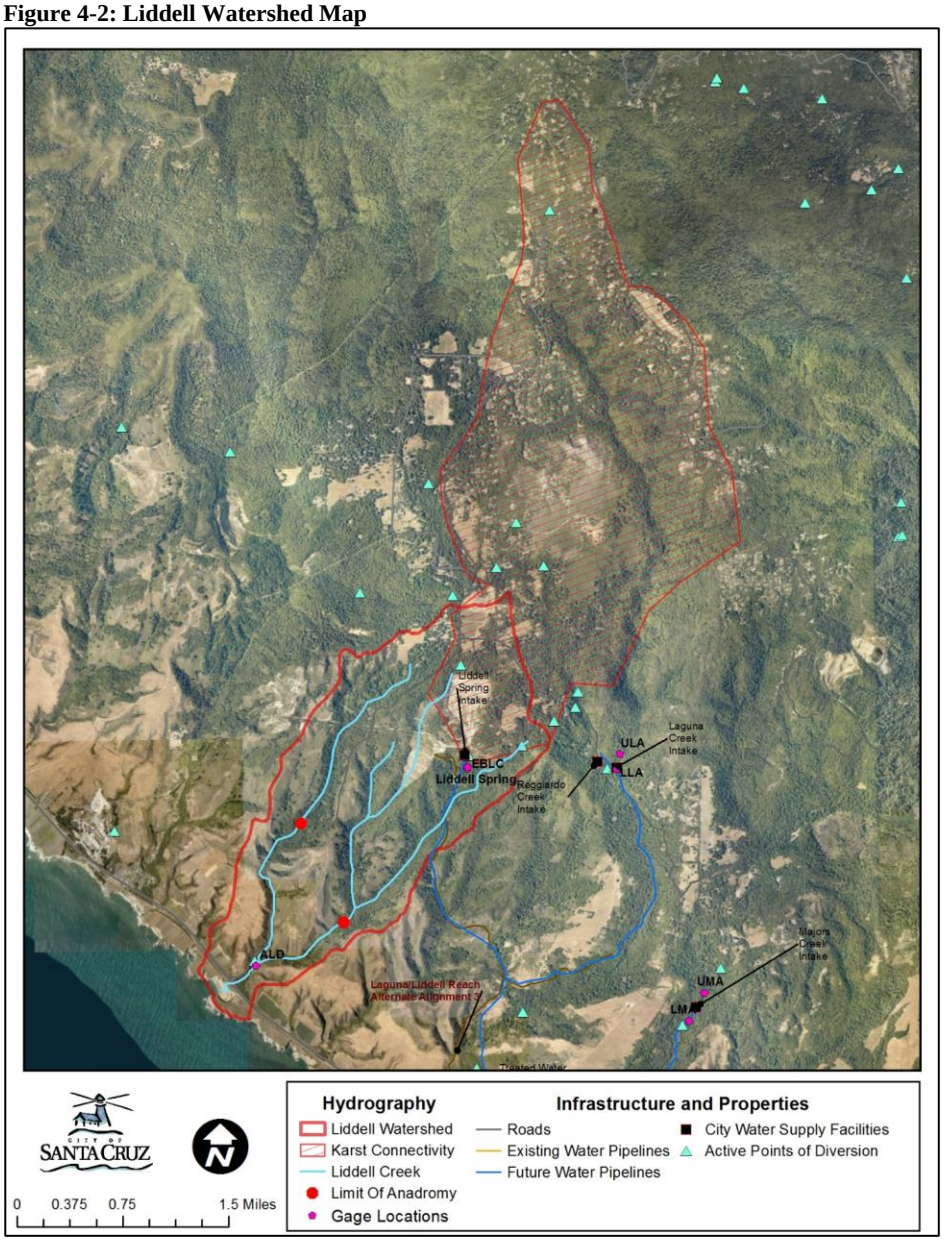


Figure 4-3: Laguna Watershed Map

Figure 4-4: Majors Watershed Map

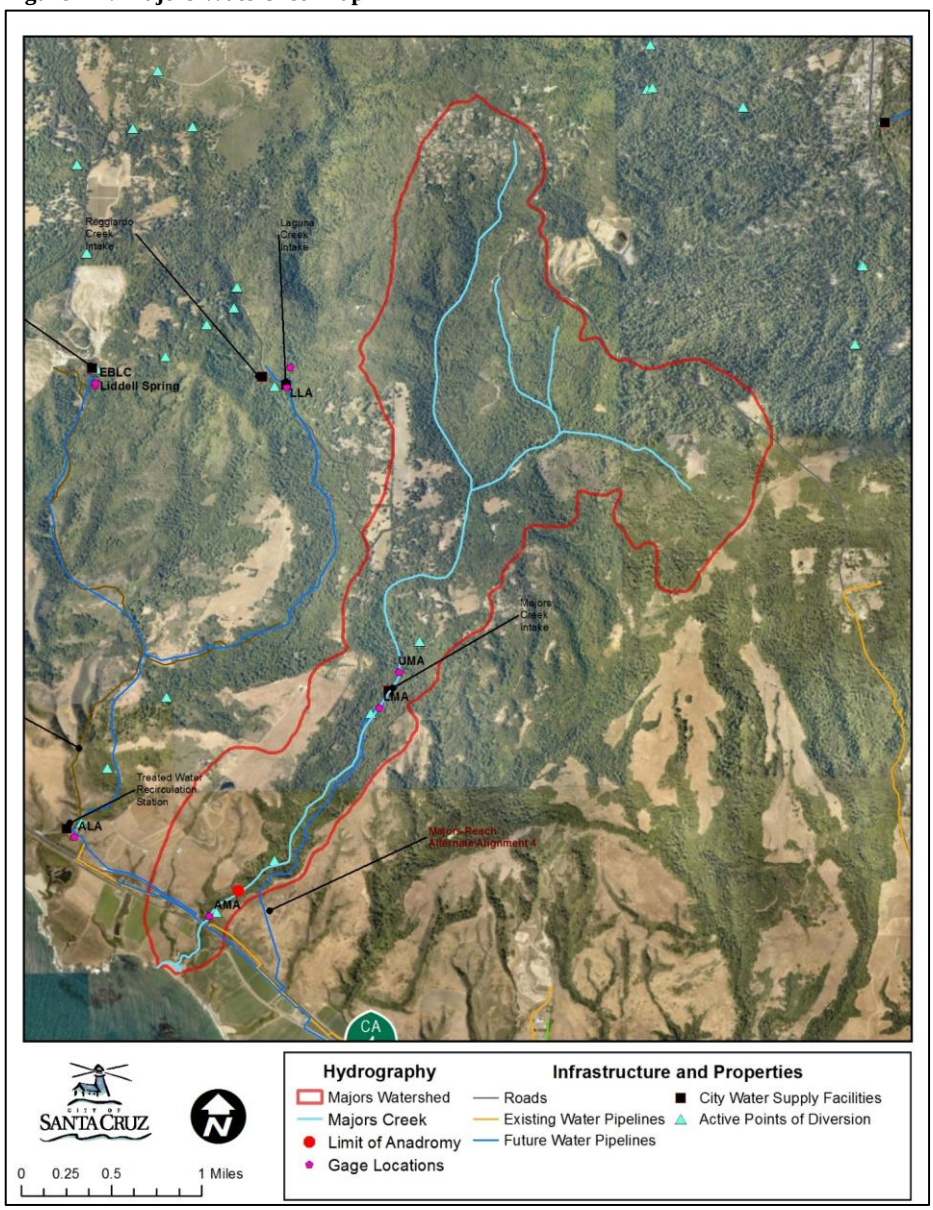


Figure 4-5: Newell Creek Watershed Map

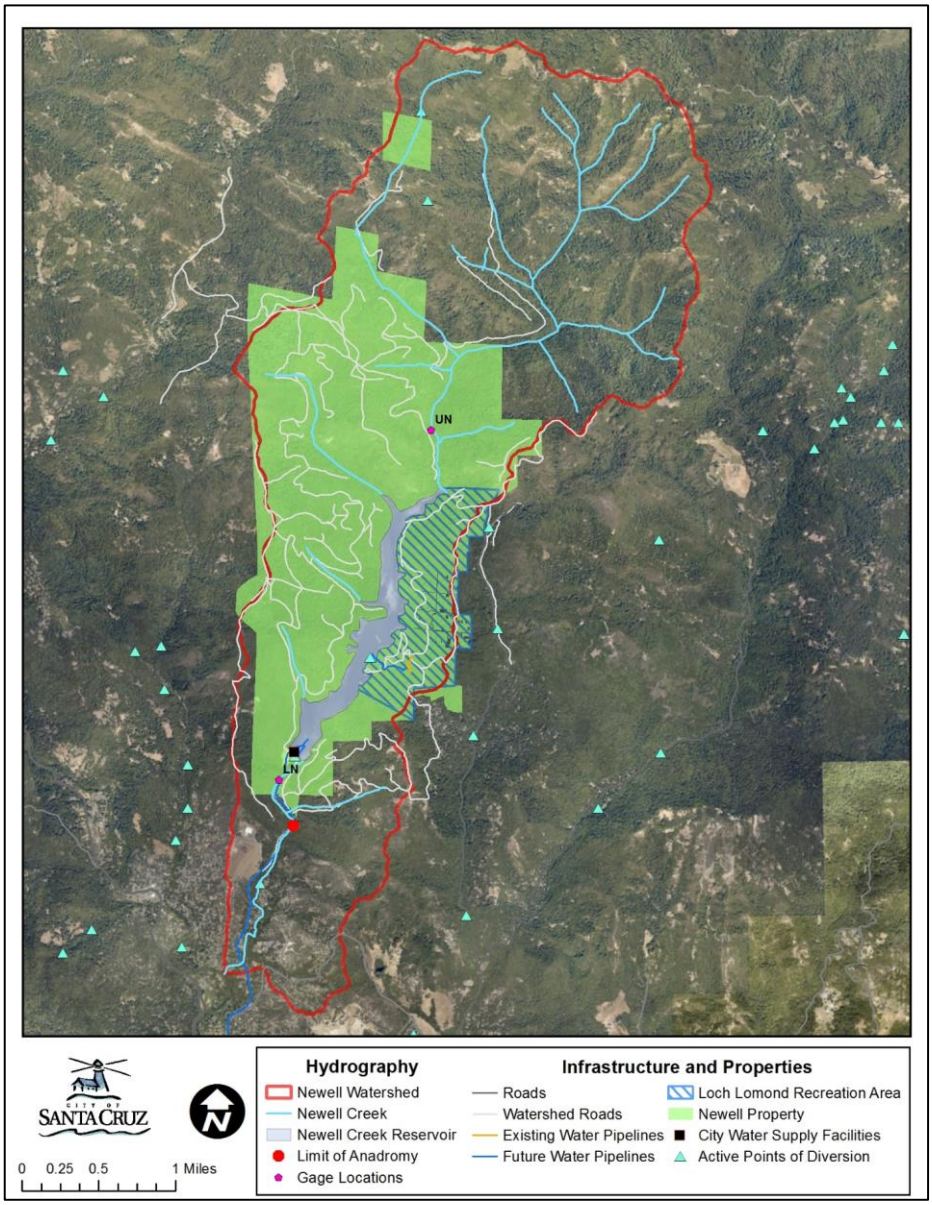


Figure 4-6: Zayante Watershed Map

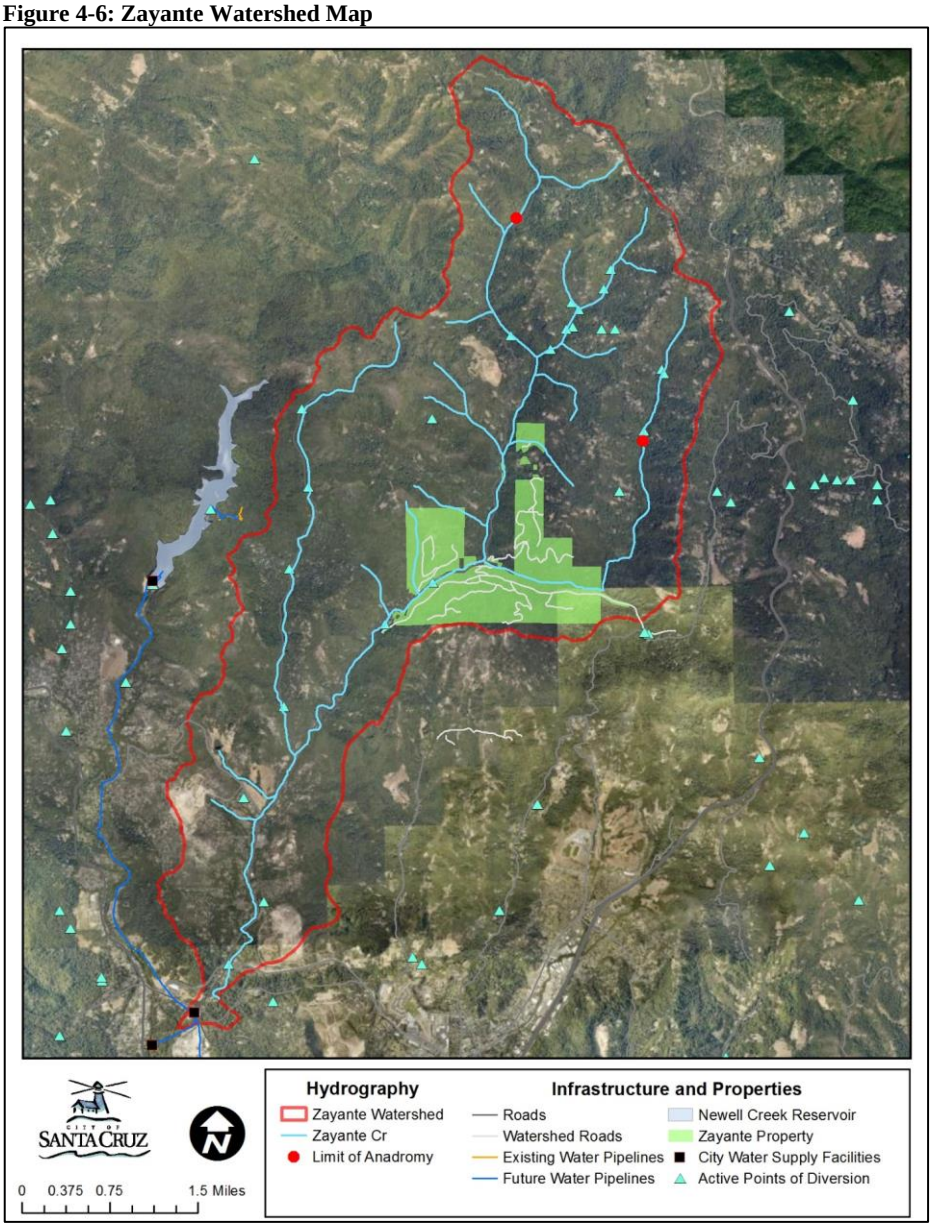
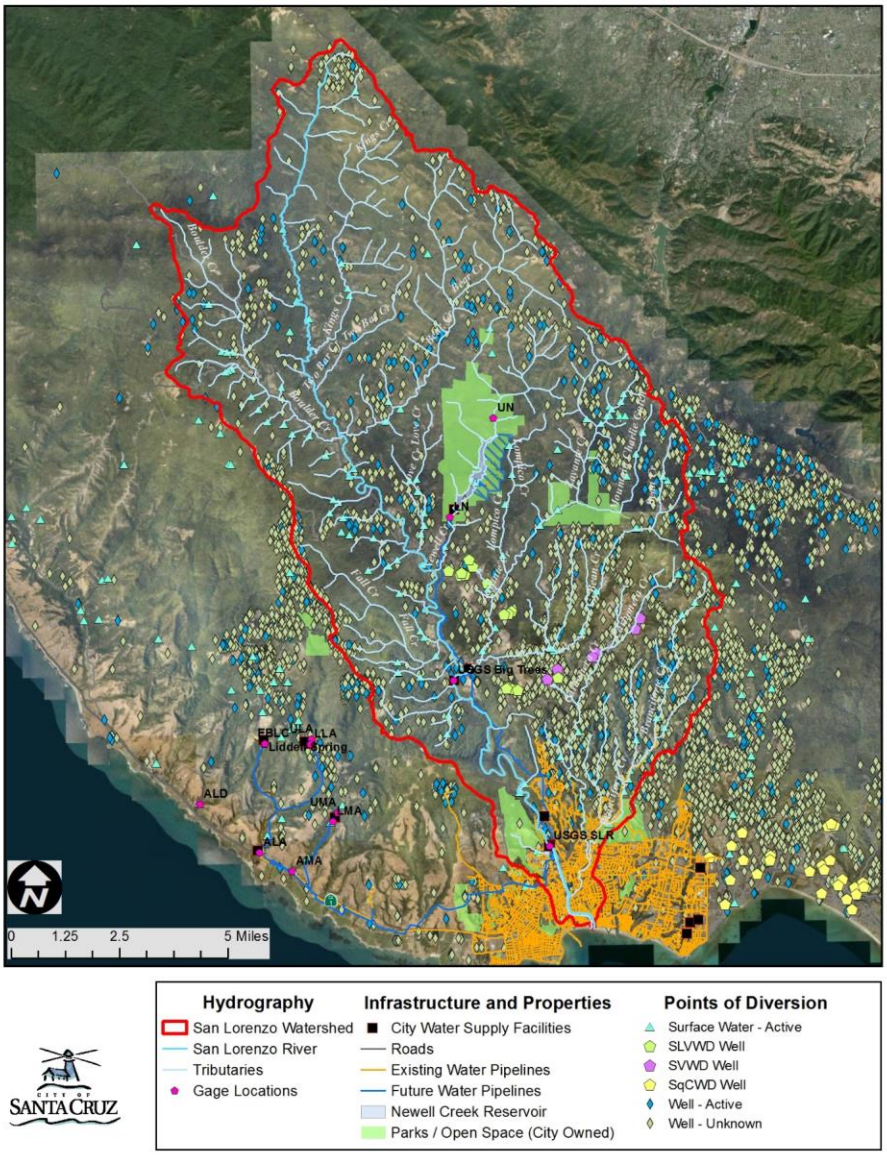


Figure 4-7: San Lorenzo Watershed Map



The 138-square-mile San Lorenzo River watershed drains west and east-facing slopes in the Santa Cruz Mountains that do not receive as much rain as their west-facing counterparts. The San Lorenzo River has a much longer run to the ocean than other Plan Area streams, and is fed by many tributaries including Branciforte, Zayante, Bean, Newell, Bear, Boulder and Fall Creeks. While many of the tributaries exhibit the physical characteristics of coastal streams (e.g., steep gradients, forested slopes), the San Lorenzo River runs through a comparably deep, wide canyon. Finally, the San Lorenzo River is densely developed throughout the floodplain and watershed.

The City's urban center encompasses approximately 12 square miles centered around the mouth of the San Lorenzo River. The Water Department provides service to the City as well as an area outside of the City limits that is approximately 8 square miles. The City is the largest city in Santa Cruz County, and is home to more than 65,021 residents. Major industries include tourism, manufacturing, food processing, and technology. The University of California, Santa Cruz (UCSC), a world-class university of approximately 19,457 students, is also located within the City. Streams within the City Urban Center Unit are the lower San Lorenzo River and tributaries, and the smaller urban drainages and aquatic resources potentially influenced by Covered Activities, including Neary Lagoon, Laurel Creek, Moore Creek, and Arana Creek. The streams listed under the City Urban Center Unit are located either partially or wholly within the City limits and are influenced by urban land management activities such as vegetation management, flood control and stormwater management activities, rather than or in addition to surface water diversions. Therefore, the lower San Lorenzo River (from the City limits to the river mouth), Branciforte Creek, Carbonera Creek, and Pogonip Creek, although part of the San Lorenzo River watershed, are discussed under the City Urban Center Unit in this Permit application.

The additional area covered by the water service area is located on the North Coast of unincorporated Santa Cruz County to the west of the City of Santa Cruz along the Highway 1 corridor, to the north of the City of Santa Cruz in the suburban areas of the lower San Lorenzo River watershed in the unincorporated areas of Santa Cruz County and to the east of the City of Santa Cruz in the urban unincorporated area of Santa Cruz County in Live Oak.

The City either has regulatory jurisdiction over areas in the Plan Area or has a property interest on lands where Project activities occur. As such, the City has sufficient control over the lands subject to Project activities to implement the provisions of the 2081 Incidental Take Permit.

5.0 Take Potential (CCR Title 14 § 783.2(a)(5)) and Impact Analysis (CCR Title 14 § 783.2(a)(6))

The California Endangered Species Act (CESA) requires that an 2081 Incidental Take Permit Application provide an estimate of the effects anticipated to result from the proposed Covered Activities. This chapter provides an estimate of the effects anticipated to occur to coho from

implementation of the conservation strategy and the Covered Activities. Effects were evaluated in the context of existing habitat conditions and conditions expected over the life of the Permit under changing climate scenarios.

Incidental take is estimated in terms of numbers of individuals for activities that potentially result in take of coho life-stages and where there is an estimate of abundance for relevant life-stages and a rational basis for estimating potential effects. An example of such a situation would be related to the monitoring program which proposes seining surveys in the San Lorenzo and Laguna Creek lagoons. It is possible to estimate average or maximum numbers that may be caught and to assume an average mortality rate related to this activity. Other activities where this approach may be appropriate include such activities as sediment removal in the flood-control channel where the work area is dewatered and fish are relocated.

Incidental take can be quantified in a number ways, such as numbers of affected individuals, nesting groups, or a surrogate measure like acres of habitat or stream miles. Numbers of individuals, nesting territories, breeding pairs, etc. often come to mind first, but it is not always practical to survey and count affected wildlife populations directly. More often a surrogate measure, such as acres of habitat or a measurable ecological condition, is defined and used to express incidental take authorized by a permit (USFWS and NMFS 2016). The majority of potential effects of the City's activities involve modification of stream flows below diversion facilities. Take related to this activity is indirect and, in many cases temporary or transient. For example, reduction of flow during the rearing period in dry years may hypothetically result in lower feeding rates at certain times and locations, reduced growth rates, and increased risk of predation due to smaller size at ocean entry. None of these hypothetical processes is sufficiently understood or quantified to provide meaningful estimation of take. It is possible to provide quantitative estimates for changes in length of potential migration periods and changes in habitat quantity/quality for spawning and rearing (WUA) but there is not, at this time, a rationally defensible method to convert these metrics into numbers of fish. The best scientific and commercial data available are not sufficient to enable the City to estimate a specific amount of incidental take of CCC coho related to operation of the diversion facilities. Therefore, the habitat conditions (expressed as WUA for spawning or rearing and migration days) for various coho life stages that would result from implementation of the covered activities shall serve as an ecological surrogate for the anticipated amount of incidental take associated with the on-going operation of the City's diversions.

5.1 Effects of Covered Activities on Coho

Residual effects of Covered Activities that could occur to coho, after application of avoidance and mitigation measures, are summarized in Table 5-8. Coho do not currently maintain viable, self-sustaining populations in the Plan Area. However, to inform the goals and objectives that are designed to provide conditions that would support the reestablishment of coho populations in the

Plan Area, effects on coho are described hypothetically and are dependent on re-establishment of coho in the Plan Area. Potential residual effects are limited to habitat effects downstream of the Tait Street diversion in critically dry years, habitat effects in Newell Creek, effects of capture and relocation during instream projects, and monitoring. Residual effects are quantified in Section 5.2.

Table 5-1: City Activities, Avoidance and Minimization Measures, and Remaining Effects to be Mitigated for Coho. Remaining Effects are Relative to No City Diversion

City Activity	Potential Effect	Avoidance and Minimization Measures	Residual Effects to be Mitigated in NFCF
Water Supply Operations: Water Diversions			
Liddell Spring Diversion	N/A Liddell Creek is not considered coho habitat		None
Laguna/Reggiardo Creek Diversion	Flow reduction	• Implement minimum stream-flow targets • Implement ramping rates	• Reduction in average spawning index of up to 2% in normal years • Less than 1 day average reduction in smolt migration index in all year types
	Lagoon not considered coho habitat	• Implement minimum stream-flow targets	None
Majors Creek Diversion	N/A Majors Creek is not considered coho habitat		None
Newell Creek Diversion	Flow reduction	• Existing instream flow requirements • Implement ramping rates	• Reduction by 2-4 days annually in average adult migration index: 3 days in normal years; from 3.5 days to 1.2 days in dry years; and from 2 days to 0 days (100%) in critically dry years • Reduction in average spawning habitat index by 15% in dry years and 36% in critically dry years • Increase in average rearing habitat index in critically dry spring by 2%; increase in summer by 3%, 5%, and 7% in normal, dry, and critically dry years respectively • Reduction in smolt migration index by 23% in dry years (21 days to 13.5) and by 80% in critically dry years (from 5 days to 1 day)

Felton Surface Water Diversion at San Lorenzo River	Flow reduction	• Existing instream flow requirements • Implement ramping rates	None
	Sedimentation	• Existing operating agreements	None
	Fish Passage at diversion	• Existing operating agreements, BMPs, and SOPs • Install fish screen and passage upgrades	None
Tait Street Diversion and Wells	Flow reduction	• Implement minimum stream-flow targets • Implement ramping rates	• Reduction in average adult migration index of up to 10% in critically dry years • Reduction in average smolt migration index by up to 8.5% in critically dry years
	Lagoon water quality	• Implement minimum stream-flow targets	None
	Fish Passage	• Install fish screen and passage upgrades	None

Table 5-1: City Activities, Avoidance and Minimization Measures, and Remaining Effects to be Mitigated for Coho. Remaining effects are relative to no City diversion (Continued)

City Activity	Potential Effect	Avoidance and Minimization Measures	Residual Effects to be Mitigated in NFCF
Water Supply Operations: Reservoir Operations			
Chemical Algaecide Treatment of Reservoir	Copper Toxicity	• Follow label instructions • Aquatic Pesticide Application Plan • Treatment SOPs and BMPs • Adherence to SWRCB NPDES permit • Monitoring plan in place	In compliance with Basin Plan, negligible effect
Testing Deluge and Gate Valves	Low dissolved oxygen Erosion	SOPs and BMPs including: • Aeration at release point • Erosion control measures	None
Woody Debris Removal on Reservoir Face	Eliminate downstream recruitment	• Stockpile larger pieces for habitat restoration projects	Average annual loss of 10 cubic yards woody debris

Table 5-1: City Activities, Avoidance and Minimization Measures, and Remaining Effects to be Mitigated for Coho. Remaining effects are relative to no City diversion (Continued)

City Activity	Potential Effect	Avoidance and Minimization Measures	Residual Effects to be Mitigated in NFCF
Water System Operations and Maintenance			
Water Diversion Sediment Management (North Coast)	Sedimentation of downstream habitat	• Sediment removal BMPs and SOPs • Install sediment management upgrades	None
Fish Ladder and Screen Maintenance	None	Fish screen upgrades	None
Conveyance Pipeline System Inspection and Repairs	Turbidity and sedimentation of downstream habitat	Construction SOPs and BMPs	None
Finished Water Pipeline System Flushing and Repairs	Disinfection toxicity (chlorine) Turbidity	• Dechlorination • SOP nos. 7102-01 and 7102-02 • Supervision by environmental monitor	None
Pumping Well Return to San Lorenzo River	Turbidity and sedimentation	Discharge to decanting basin	None
North Coast Valve Blow Off to San Lorenzo River	Turbidity and sedimentation	Discharge onto rip-rap	None
Dewatering of Creeks for Maintenance and Repairs	Injury or mortality to fish as a result of relocation activities	SOPs for dewatering and fish relocation	Temporary dewatering with capture and relocation of undefined number of juvenile coho, if re-established; incidental direct mortality of up to 3%

Table 5-1: City Activities, Avoidance and Minimization Measures, and Remaining Effects to be Mitigated for Coho. Remaining effects are relative to no City diversion (Continued)

City Activity	Potential Effect	Avoidance and Minimization Measures	Residual Effects to be Mitigated in NFCF
Municipal Facility Operations and Maintenance			
Flood Control Debris/Obstruction Removal	Habitat simplification	• Supervision by environmental monitor • BMPs and SOPs for streamside projects	None, habitat not suitable for coho even if re-established
Flood Control Sediment Management/Removal	Temporary habitat disruption, Turbidity, Direct mortality	• Fish removal and protection during operations. • SOPs for dewatering and fish relocation. • Preventive maintenance for storm drains.	None, habitat not suitable for coho even if re-established
Flood Control Vegetation Management	Loss of habitat components- cover, shading; increased temperature; reduced productivity	• Avoid work in wetted channel • Avoid removal of mature trees except in FCCs • Buffer strips in FCC	• Minor degradation of riparian habitat • May affect migrating smolts if re-established
Stormwater Maintenance	Discharge of pollutants Increased peak storm flows	• SWMP, Measure E, Stormwater BMPs	None

	Reduced infiltration to ground	• Storm drain inspection and cleaning • Structural retrofits and storm drain inlets and basins	
Stormwater BMPs	Discharge of pollutants	• Stormwater Management Program • Stormwater BMPs	None
Storm Drain Inspection and Cleaning	Discharge of pollutants	• Storm drain inspection and cleaning	None
Structural Retrofits of Storm Drain Inlets and Basins	Discharge of pollutants	• Dry weather diversion to WTP • Inline treatment systems	None

Table 5-1: City Activities, Avoidance and Minimization Measures, and Remaining Effects to be Mitigated for Coho. Remaining effects are relative to no City diversion (Continued)

City Activity	Potential Effect	Avoidance and Minimization Measures	Residual Effects to be Mitigated in NFCF
Municipal Facility Operations and Maintenance (continued)			
Sanitary Landfill Stormwater Management	Discharge of pollutants	• Bypass system and stormwater outfall • Sediment management of bypass ponds • Leachate management	None
Emergency Operations and Response	Negligible potential effects on anadromous fish		None
Vegetation Management Within Riparian Corridors	Negligible potential effects on anadromous fish	• Integrated Pest Management program	None

Table 5-1: City Activities, Avoidance and Minimization Measures, and Remaining Effects to be Mitigated for Coho. Remaining effects are relative to no City diversion (Continued)

City Activity	Potential Effect	Avoidance and Minimization Measures	Residual Effects to be Mitigated in NFCF
Land Management			
Loch Lomond Recreation Area and Watershed Lands	Negligible potential effects on anadromous fish	BMPs for work near streams	None
Trail Maintenance and Repair	Negligible potential effects on anadromous fish	BMPs for work near streams	None
Road Maintenance and Decommissioning	Sediment delivery	• Work in dry season • Work supported by Certified Erosion Control Specialist • Maintenance of appropriate drainage to avoid erosion potential • Out-sloping, rolling dips, water bars, winter closures, rocking • Road decommissioning • Conduct timber harvest solely for restoration or forest resiliency purposes	None
Aquatic Habitat Management	Temporary habitat disturbance, fish relocation	• Work under Permit conditions • BMPs and SOPs for work near streams • Work conducted during dry season with SOPs and BMPs for in-channel work • Post-project monitoring	Beneficial effects of habitat improvement; Temporary dewatering with capture and relocation of up to 750 juvenile coho, if re-established; incidental direct mortality of up to 3%

Table 5-1: City Activities, Avoidance and Minimization Measures, and Remaining Effects to be Mitigated for Coho. Remaining effects are relative to no City diversion (Continued)

City Activity	Potential Effect	Avoidance and Minimization Measures	Residual Effects to be Mitigated in NFCF
Monitoring Program			
Compliance Monitoring	No potential effects on anadromous fish	None needed	None
Juvenile Abundance-Riverine	Potential effects from capture by electrofishing, examination, holding, tagging	Standard fish sampling protection measures	If re-established: • Observation of up to 100 juvenile coho annually in snorkel surveys • Capture and tagging of up to 500 juvenile coho annually in electrofishing surveys with incidental mortality of up to 15 coho
Juvenile Abundance-Lagoons	Potential effects from capture by seine, examination, holding, tagging	Standard fish sampling protection measures	If re-established: capture and tagging of up to 200 juvenile coho annually in lagoon abundance surveys with incidental mortality of up to 4 coho
Adult Abundance	Potential effects from capture in the Felton Diversion fish trap, holding, examination, tagging	Standard fish sampling protection measures	• Capture and tagging of up to 10 adult coho If re-established, capture and tagging of up to 200 coho with incidental mortality of up to 2 adult coho
PIT Tag Monitoring Antenna	No potential effects	None needed	None
Habitat Assessment	No potential effects	None needed	None

5.2 Effects of Water Supply Operations – Water Diversions

Potential habitat for coho is limited to the San Lorenzo River watershed and possibly Laguna Creek. This section describes the effects to coho resulting from the proposed bypass flows at the City's diversions. Hydrologic model results were evaluated for effects on each life stage of coho below each applicable City diversion.

Laguna Creek

Habitat exists for coho in Laguna Creek and all life stages are potentially supported in the 1.4 miles of anadromous habitat. Habitat effects for coho are substantially avoided in Laguna Creek by providing bypass flows that result in habitat index values that are close to levels that would occur with no City diversions. The adult migration index under the conservation flows is changed by less than 1 day annually on average compared with No Diversions (Figure 5-1). Similarly, there is minimal change in the spawning habitat index with the conservation flow index at least 98% of the level with No-Diversion (Figure 5-2). The rearing habitat index for coho in Laguna Creek equals or slightly exceeds no-diversion levels (Figure 5-3). Coho have a preference for lower velocities than steelhead and diversions during the highest flow periods can actually improve the index. The smolt migration index is also greatly improved from existing conditions and averages at least 98% of no-diversion levels in all year types (Figure 5-4) with less than 1 day reduction on average in any year type. Habitat index values represent significant improvement relative to the Existing Condition. The effects of the Laguna Creek Diversion on coho are fully avoided and there are no residual effects (Table 5-2).

Figure 5-1: Effects of Water Diversions on Coho Adult Migration in Laguna Creek

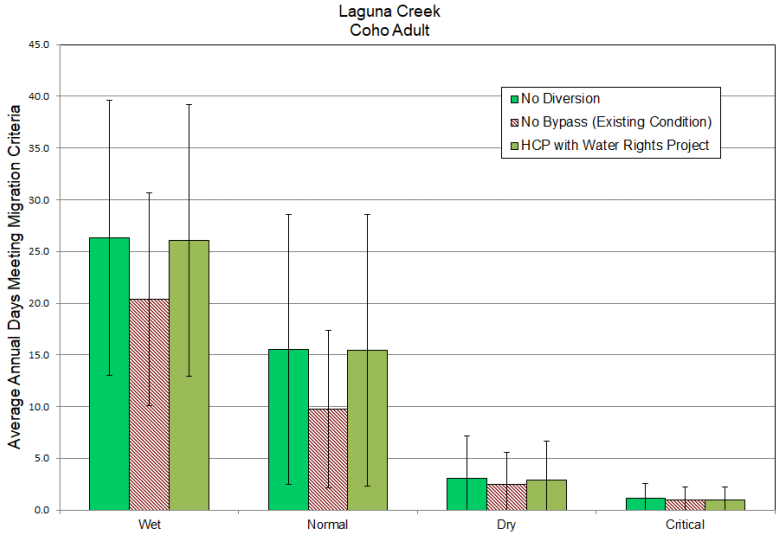


Figure 5-2: Effects of Water Diversions on Coho Spawning Habitat in Laguna Creek

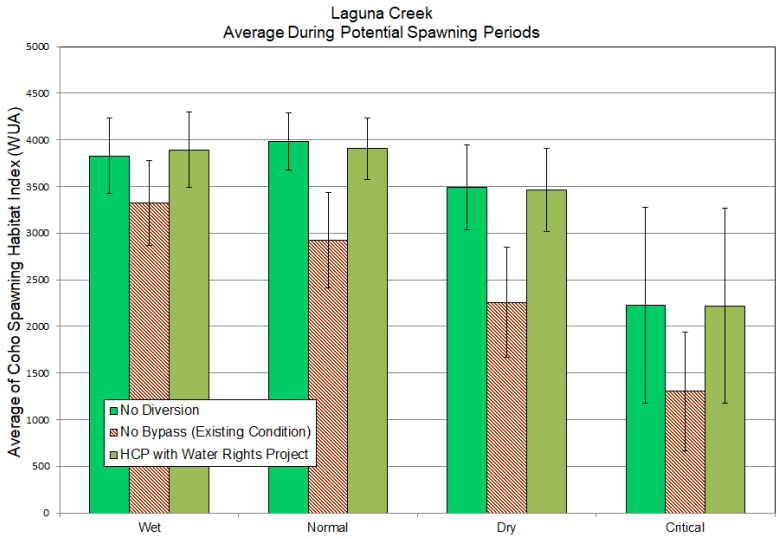


Figure 5-3: Effects of Water Diversions on Coho Rearing Habitat in Laguna Creek

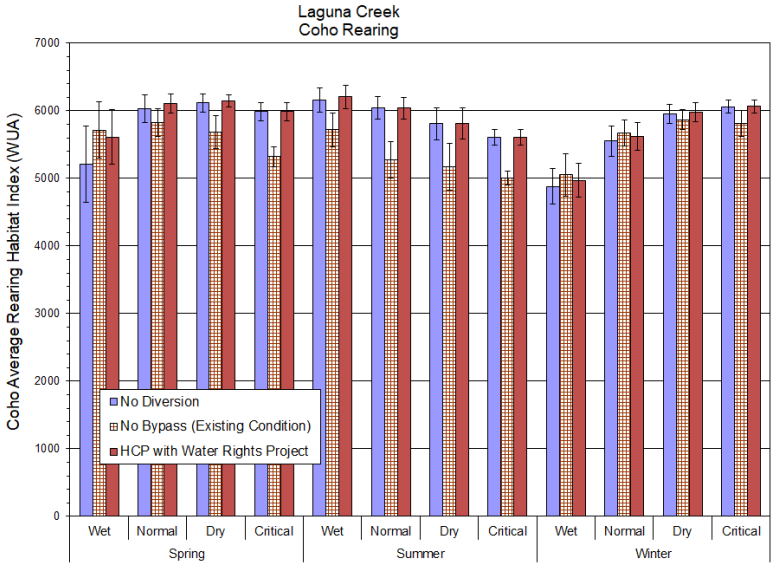


Figure 5-4: Effects of Water Diversions on Coho Smolt Migration in Laguna Creek

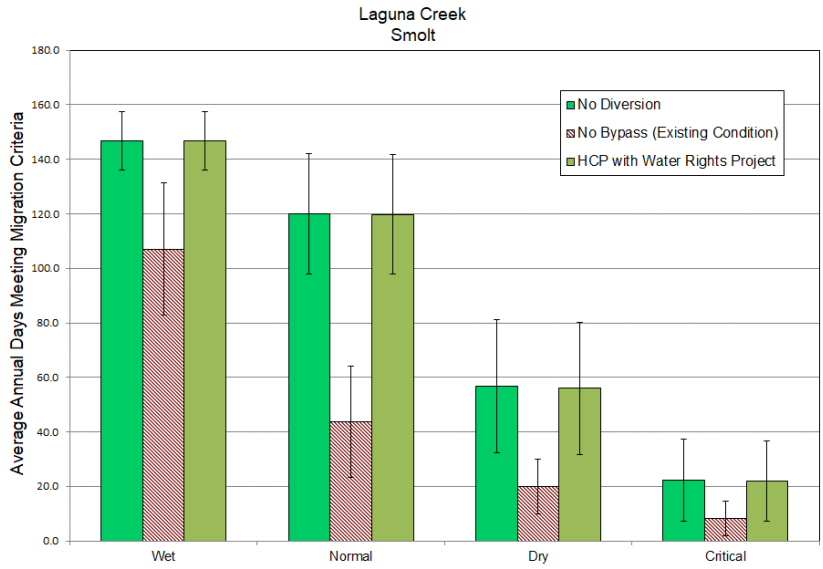


Table 5-2: Residual Effects of Bypass Flows on Coho in Laguna Creek

	Coho			
	Adult migration	**Spawning/ incubation**	**Rearing**	**Smolt migration**
Wet	*	1.6%	0.6%	*
Normal	*	-2.0%	-0.1%	*
Dry	*	-0.8%	0.0%	*
Critically dry	*	-0.3%	0.0%	*

* Difference of 1 day or less

Newell Creek

Implementation of conservation flows results in somewhat greater fluctuation in storage in Loch Lomond Reservoir with higher storage and slightly greater spill frequency in wetter years and lower frequency and duration of reservoir spill in drier years, influencing about 1 mile of anadromous habitat

in Newell Creek downstream of Newell Creek Dam. Frequency of flows sufficient for adult coho migration are reduced compared to no-diversion levels by 2 to 4 days on average corresponding to changes of 5 % (3.6 days) in wet years, 10 % (3 days) in normal years, 44% in dry years (from 3.5 days to 1.2 days), and 100% (from 2 days to 0 days) in critically dry years (Figure 5-5). The spawning habitat index is increased slightly in wet years (+1.0%) and normal years (+0.6%), but decreases 15% in dry years, and 36% in critically dry years (Figure 5-6). Coho are more affected than steelhead by reduced spills from Loch Lomond Reservoir because they migrate and spawn early in the winter, while the reservoir is more likely to spill in the late winter after more runoff has accumulated.

Habitat conditions for rearing coho have relatively high index values at all times as a result of juvenile coho preference for lower velocities. The lowest index values occur in wet winters when flow velocity is greatest (Figure 5-7). There is some benefit from the 1 cfs minimum release during drier summers under both existing conditions and conservation flows. Overall, the conservation flows have beneficial effects on coho rearing habitat in Newell Creek and beneficial residual effects.

Habitat conditions for smolt migration are the same as for steelhead since both species migrate during the same time period. Flows suitable for smolt migration are reduced by 2 to 7 days from no-diversion levels (Figure 5-8). The greatest reductions in percentage terms are in dry years (23% reduction from 21 days to 13.5 on average) and critically dry years when the average number of days with suitable migration conditions is reduced from 5 days with no diversions to 1 day with conservation flows, an 80% reduction.

The greatest residual effects, in terms of percentage change for coho in Newell Creek are the reductions in adult migration and spawning indices in critically dry years of up to 100 % for migration and 36 % for spawning; the increase in rearing index in summer and critically dry springs; and reduction in the average smolt migration index of up to 80% in critically dry years (Table 5-3). The migration and spawning effects are not likely to be biologically significant since they involve a relatively small magnitude of actual habitat change and very low habitat values even with no diversions. In the case of adult migration, the change in the actual number of days with suitable migration conditions averages between 3.6 days in wet years to 1.9 days in critically dry years. For smolt migration, the maximum change in percentage terms of 80% in critically dry years corresponds with a potential migration index of only 5 days based on No-Diversion levels during the 150-day potential migration period. The 30% reduction in the spawning habitat index in critically dry years is also not likely to be biologically significant since the habitat indices are quite low even without the reservoir (No Diversion).

Figure 5-5: Effects of Water Diversions on Coho Adult Migration in Newell Creek

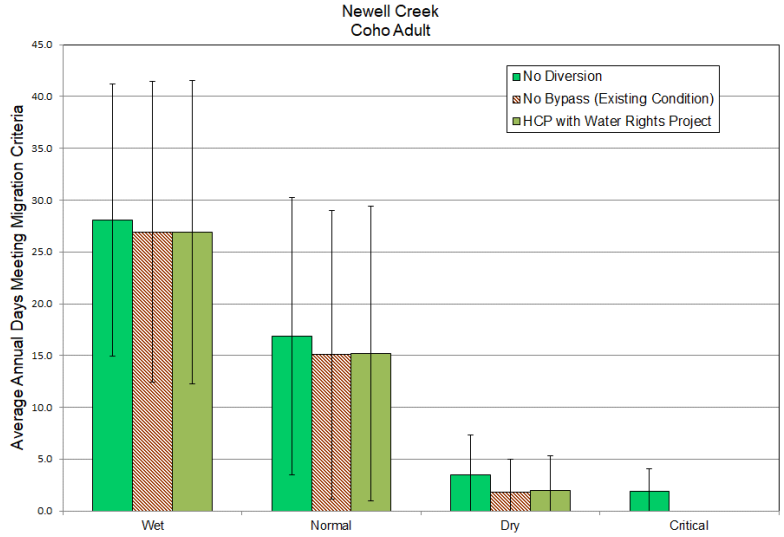


Figure 5-6: Effects of Water Diversions on Coho Spawning Habitat in Newell Creek

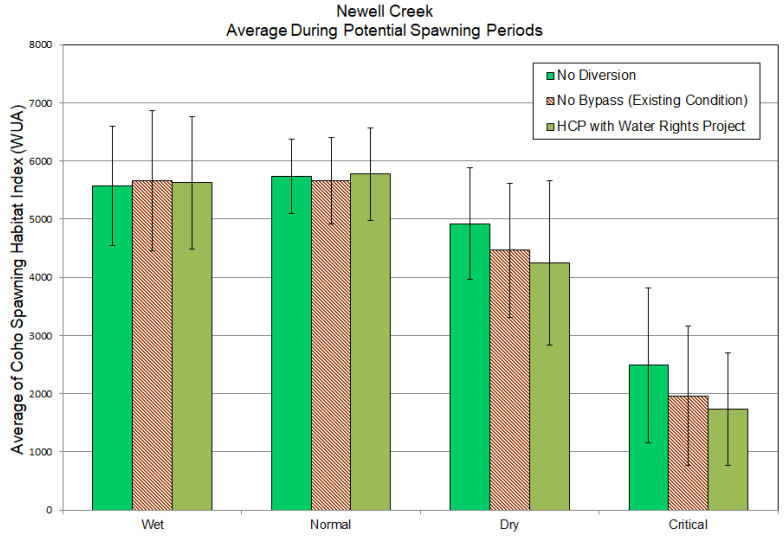


Figure 5-7: Effects of Water Diversions on Coho Rearing Habitat in Newell Creek

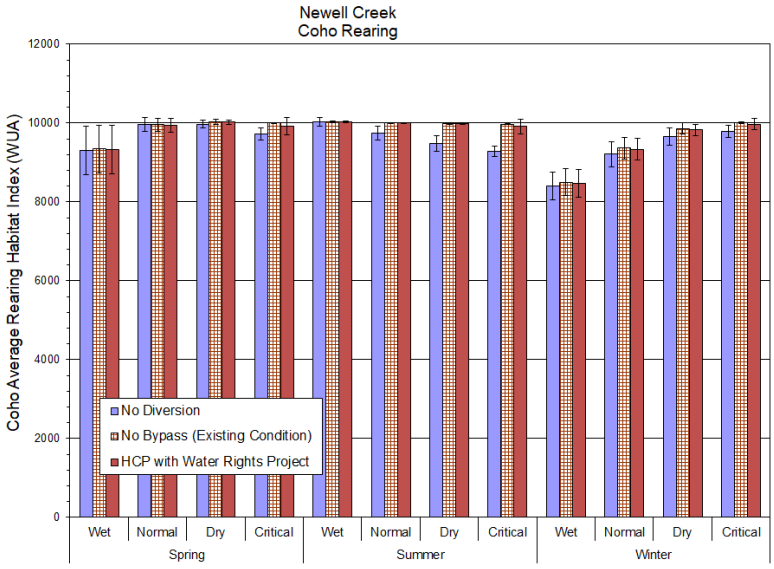


Figure 5-8: Effects of Water Diversions on Coho Smolt Migration in Newell

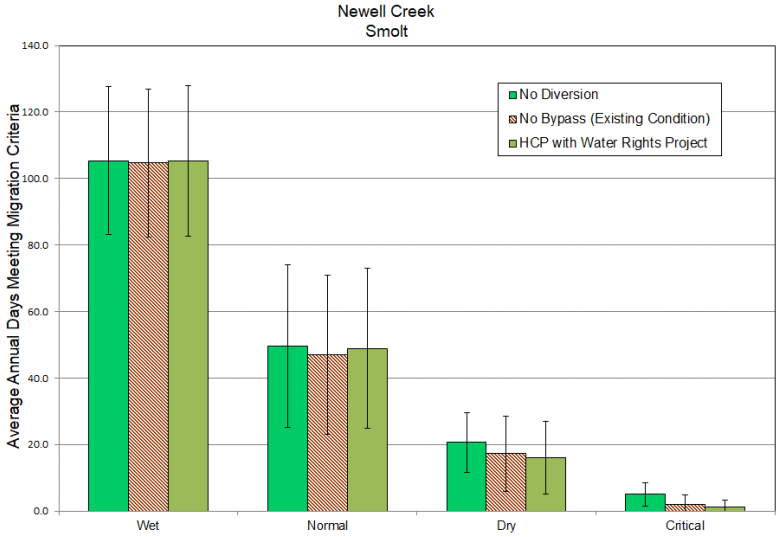


Table 5-3: Residual Effects of Bypass Flows on Coho in Newell Creek

	Coho				
	Adult migration	**Spawning/ incubation**	**Rearing-spring**	**Rearing-summer**	**Smolt migration**
Wet	-5.2%	1.0%	0.3%	0.0%	-0.2%
Normal	-10.0%	0.6%	-0.1%	2.7%	-2.1%
Dry	-44.2%	-14.9%	0.5%	5.3%	-23.3%
Critically dry	-100.0%	-36.0%	2.0%	6.8%	-80.0%

San Lorenzo River Downstream of the Felton Diversion

Coho potentially use the San Lorenzo River mainstem downstream of the Felton Diversion for adult and smolt migration. It is expected that, due primarily to temperature considerations, the majority of potential spawning and rearing habitat for coho is in the tributaries and upper mainstem. As was the case for steelhead, and assuming a flow of 40 cfs or more is required for adult migration (Section 7.2.1), average annual migration potential for coho is the same as what it would be with no City diversions (Figure 5-9). The conservation flow of 40 cfs provides 100% of the average number of migration days for coho below the Felton Diversion as with no City diversion. To estimate the effect of flows on smolt migration, a minimum migration threshold of 20 cfs was used. While estimates for minimum migration flow for smolts in this reach are not available, there is evidence that smolts can migrate at flows at least as low as 26 cfs. During the summer of 2016, several smolt sized O. mykiss tagged in the lagoon in mid-June were observed at the Felton Diversion in July and August (HES 2017). The highest flow at Big Trees during that period was 26 cfs in mid-June. Flow declined to 11 cfs by late September so these fish migrated upstream at flows of no more than 26 cfs. Downstream migration would likely be easier and could presumably be accomplished at even lower flow. Comparison of minimum flows for smolt migration to minimum flows for adult migration from the other reaches yields an average estimate of smolt flows at 0.27 times the adult migration flow ((See Appendix 12: *Environmental Setting*). For the Felton reach this would yield an estimate of 11 cfs based on Berry's (2016) estimate for adult migration flows. The minimum threshold of 20 cfs used in this analysis is intermediate between the other two estimates. The Conservation Flows during the smolt migration period that meet minimum migration criteria an average of 100% of the time that they

would be met with no City diversions for both steelhead and coho. The conservation flows meet minimum migration criteria for coho smolts 100 % of the time that they are met with no City diversions (Figure 5-10).

Based on these analyses, there are no residual effects of the conservation flows on coho downstream of the Felton Diversion (Table 5-4).

Figure 5-9: Effects of Water Diversions on Coho Adult Migration in the San Lorenzo River below the Felton Diversion

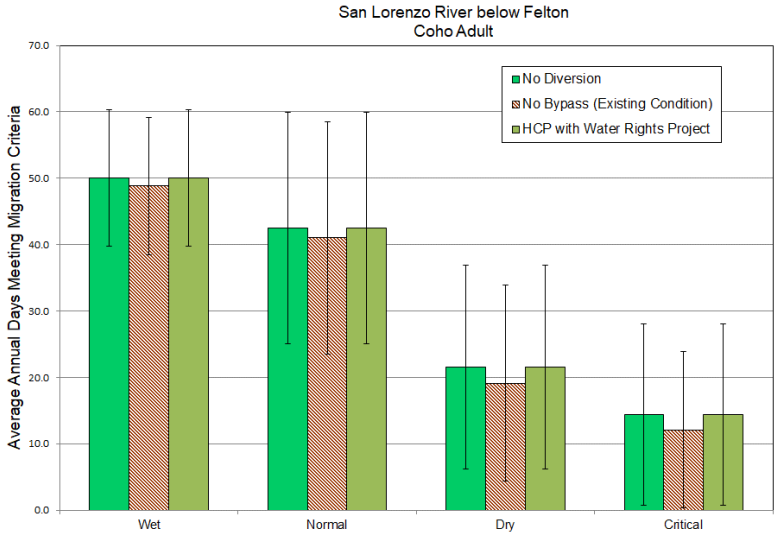


Figure 5-10: Effects of Water Diversions on Coho Smolt Migration in the San Lorenzo River Downstream of the Felton Diversion

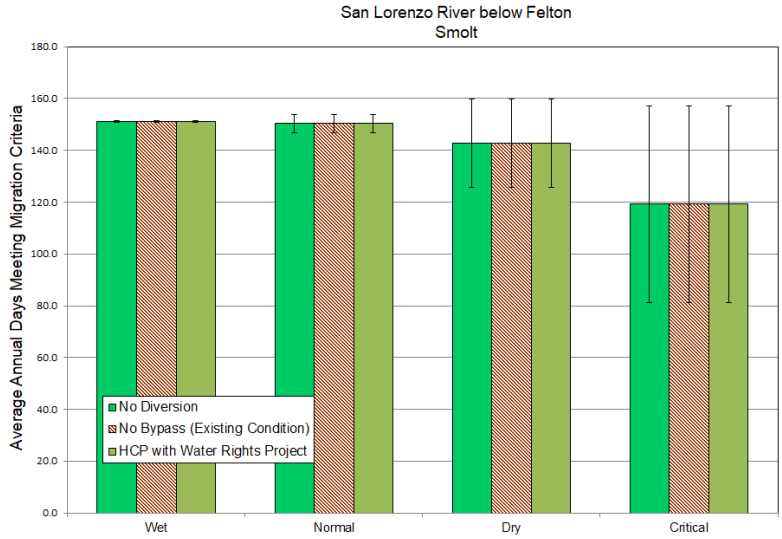


Table 5-4: Residual Effects of Bypass Flows on Coho in the San Lorenzo River Downstream of the Felton Diversion

	Coho			
	Adult migration	**Spawning/ incubation**	**Rearing**	**Smolt migration**
Wet	0.0%			0.0%
Normal	0.0%			0.0%
Dry	0.0%			0.0%
Critically dry	0.0%			0.0%

San Lorenzo River Downstream of Tait Street

Coho potentially use the San Lorenzo River mainstem below the Tait Street Diversion for adult and smolt migration. There is no spawning habitat for coho in this reach and temperature and other habitat

conditions are not suitable for rearing. Unlike steelhead, coho do not appear to use estuaries for rearing in this part of their range (See Appendix 13: *Coho (Oncorhynchus kisutch) Species Account*). The effect of the Tait Street diversion on coho adult migration is very similar to the effects on steelhead. There are no declines in adult migration periods of more than 1 day in wet, normal, or dry years compared to no-diversion levels. In critically dry years, adult migration periods average 9.8% less than no-diversion levels. Conservation flows result in an average number of days with suitable migration conditions for coho that is 100% of no-diversion levels in wet years, 98 % in normal years and dry years, and 90% in critically dry years (Figure 5-11). The critically dry year reductions in the migration index may not have a biologically significant effect on coho since there are still a significant amount of migration opportunities. There are an average of 45 days when migration conditions are suitable out of the 60 possible during the December-January migration period for coho in critically dry years.

The residual effect on smolt migration is the same as that for steelhead since both species migrate at the same time. The conservation flows result in passage conditions for smolts that are nearly the same as no-diversion levels except in critically dry years when they occur at 91% of no-diversion levels, a reduction from 151 days with suitable conditions to 138 days (Figure 5-12).

Maximum residual effects of the conservation flows on coho habitat downstream of Tait Street include a reduction in the number of days with suitable conditions for adult migration of 20% in critically dry years and a maximum reduction of 8.5% in the index for smolt migration, also in critically dry years (Table 5-5).

Figure 5-11: Effects of Water Diversions on Coho Adult Migration in the San Lorenzo River below Tait Street

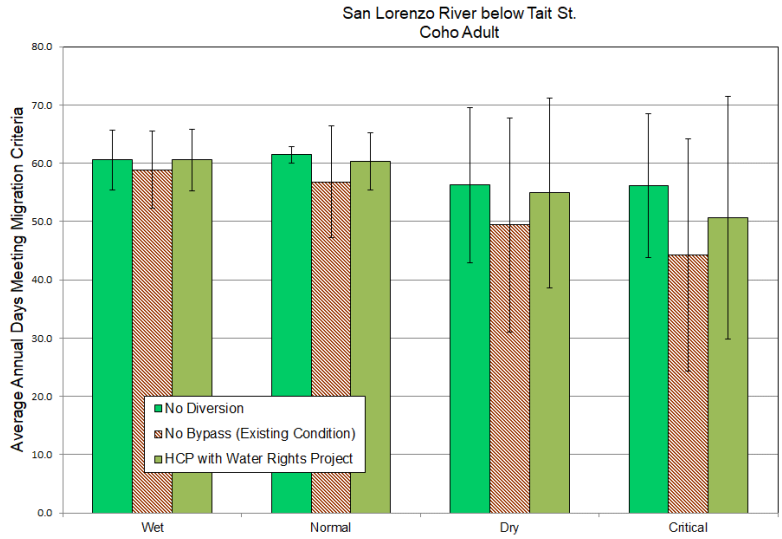


Figure 5-12: Effects of Water Diversions on Coho Smolt Migration in the San Lorenzo River below Tait Street

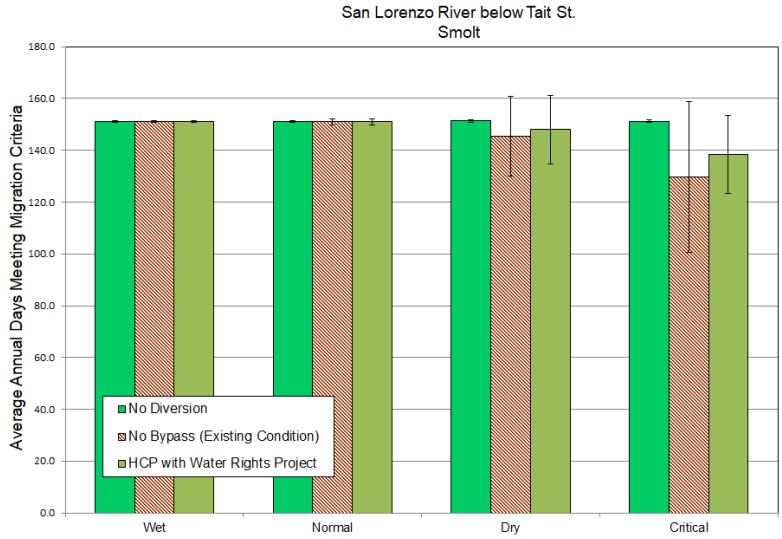


Table 5-5: Residual Effects of Bypass Flows on Coho in the San Lorenzo River Downstream of Tait Street

	Coho			
	Adult migration	**Spawning/ incubation**	**Rearing**	**Smolt migration**
Wet	*			*
Normal	*			*
Dry	*			-2.3%
Critically dry	-9.8%			-8.5%

* Difference of 1 day or less

5.2.2.1 Consideration of Climate Change Scenarios

Coho have been rated as "critically vulnerable" to the effects of climate change. Coho have a relatively fixed life-history pattern with an approximate 1.5-year freshwater rearing period and a 1.5-year ocean maturation period. This means that weakness in any year-class cascades from generation to generation and weak year-classes are not readily rebuilt. Coho lack the diversity in life-history strategies characteristic of steelhead and do not do as well with excessive variability in environmental conditions. In that sense, they are less adaptable and will have more difficulty adapting to changing climatic conditions that are projected for the Plan Area under various climate change scenarios. Increasing air temperatures have the potential to limit the quality and availability of summer rearing habitat for juvenile coho by increasing water temperatures. Increases in fall and winter temperature regimes might shorten incubation and emergence times for developing eggs, which has been predicted to lead to lower survival rates. Increases in summer temperatures will lead to thermal stress, decreased growth and affect survival of out-migrating juveniles (NMFS 2012b).

In addition, coho spawning activity is concentrated early in the wet season (primarily in December and January). This makes their redds and fry vulnerable to damage from storms during the peak runoff months of February and March that follow. The possibility of more extreme flooding under climate change scenarios modeled for the region suggests that it will be difficult to reestablish coho populations in the Plan Area. In analyzing the rangewide data for coho, NMFS determined the San

Lorenzo River population of coho to be at a high or very high risk of threat from climate change (NMFS 2012b).

The Plan Area is at the southern end of the coho range. Coho have lower thermal tolerance and preferences than steelhead and any increase from present levels could be problematic for coho. In fact, existing variability in hydrologic patterns and peak storm flows, combined with warmer thermal regimes that have developed to date may in large part explain the absence of coho from the Plan Area at the present time, and may severely limit the potential for their re-establishment and recovery in the Plan Area despite the efforts of the City, as set forth in the conservation strategy, and conservation efforts of the fishery agencies and other conservation partners.

5.3 Effects of Water System Operation and Maintenance

The majority of potential effects from this activity are avoided by application of BMPs and SOPs already incorporated in Covered Activities (Chapter 3). The exception is the incidental take associated with capturing and relocating Covered Species from work areas when instream work is conducted. The level of effect is dependent on the frequency of projects requiring instream work, the location and areal extent of the projects, and the numbers of Covered Species present in the work area that need to be relocated. Activities that may generate the need to relocate Covered Species include repair and maintenance of diversion facilities; sediment management; fish ladder and fish screen maintenance and repair; and pipeline operations and maintenance.

Sediment removal is occasionally necessary at the Laguna Creek and Majors Creek diversions; however, both diversions are located well upstream of the limit of anadromy and would not require relocation of Covered Species. Maintenance or repair of fish screens and ladders at the Felton Diversion and the Tait Street Diversion as well as planned rehabilitation of fish screens at both fish facilities may require dewatering and relocation of Covered Species. It is likely that this activity would only occur once or twice at each facility during the life of the Permit. A limited length of stream would be affected, probably not more than 300 feet. Effects of relocation may include temporary interruption in feeding activity, increased exposure to predation, traumatic injury, and mortality. These effects can be minimized by protective measures (Section 7.3.4).

5.3.1 Coho

No coho have been observed in the mainstem San Lorenzo River downstream of the Felton Diversion in annual juvenile salmonid surveys in recent years and even if coho become re-established in the San Lorenzo River they are more likely to be found rearing in the tributaries. Based on current low abundance of coho, no coho are expected to be relocated. If coho become re-established, relocation

efforts may affect a small number of individuals. Relocations conducted by professional biologists using protective measures typically results in direct mortality that is less than 3%.

5.4 Effects of Municipal Facility Operation and Maintenance

The majority of potential effects from this activity are avoided by BMPs and SOPs incorporated into the Covered Activities (Chapter 7). Potential residual effects are related to sediment removal activities conducted in the San Lorenzo and Branciforte FCCs. This activity could involve dewatering sections of the FCCs and relocation of Covered Species. Effects are described in the following Section and summarized in Table 5-1 (coho).

5.4.1 Coho

The San Lorenzo and Branciforte FCCs do not provide suitable habitat for coho and juvenile coho are not expected to be found there. Therefore, this activity is unlikely to have any effect on coho.

5.5 Effects of Land Management

The majority of effects related to Covered Activities in this category are avoided through application of BMPs and SOPs (Chapter 7). Aquatic habitat management has the potential for residual effects if Covered Species need to be relocated during construction of instream habitat improvement projects. The species and numbers affected will depend on the location and areal extent of the projects. It is assumed that up to 30 locations may be affected over the term of the Permit and that the average areal extent will involve 300 feet of stream channel that requires dewatering. Effects are described below and summarized in Table 5-1 (coho).

5.5.1 Coho

Some of these activities could occur in the tributaries where rearing coho may be present. Average densities are expected to be very low in the near term, but effects could occur if coho become re-established in the Plan Area. Under such future conditions coho may be found at up to one-third of the project locations, likely at densities not more than half those of rearing steelhead. Therefore, it is

possible that, under these assumptions, as many as 750 coho may need to be relocated over the term of the Permit and there may be direct mortality of up to 23 juvenile coho.

5.6 Effects of the Monitoring Program

The monitoring program is described in detail in Chapter 8. Effects of the monitoring program are described in detail in the following Section and summarized in Table 5-1 (coho).

5.6.1 Coho

The monitoring program is described in detail in Chapter 8. The three elements of the monitoring program that have the potential to affect coho are juvenile abundance-riverine, juvenile abundance-lagoons, and adult abundance at the Felton Diversion. Juvenile abundance based on snorkel surveys has the potential to effect up to 100 juvenile coho based on the results of past surveys conducted by the City in the north coast streams. Juvenile abundance monitoring involving electrofishing has the potential to affect coho if they become re-established in the San Lorenzo River and Laguna Creek. In that case, they may occur in half the eight sample reaches, primarily in San Lorenzo River tributaries. Assuming they would occur at a density of 25 per 100 feet of stream, it is estimated that up to 500 coho may be captured each year with incidental mortality of 15 individuals.

Coho do not appear to use lagoon habitat for rearing as steelhead do and are less likely to be captured in lagoon monitoring surveys. In annual surveys from 2004 to present coho have been captured in only one year in Laguna Creek and never in the San Lorenzo River Lagoon. That could change if coho become re-established in the Plan Area. Based on past surveys it is possible that up to 200 coho might be captured in a season in both lagoons with incidental mortality as high as 4 individuals.

Upstream migrating coho have been trapped at the Felton Diversion by the Monterey Bay Salmon and Trout Project and peaked at 183 adults in 1989-1990 (Brown et al. 1994); however, in most years, few coho were captured (ENTRIX, Inc. 2004). A few coho have occasionally been observed in the trap since that time, with the most recent in the winter of 2012-2013 (Alley 2015). It is expected that few coho will be encountered in the adult monitoring trap at the Felton Diversion, likely less than 10 per year. If coho become re-established in the San Lorenzo River, numbers would increase but would not be likely to exceed 200 adults in a season.

6.0 Analysis of Jeopardy to the Continued Existence of the Species Resulting from Issuance of Permit (CCR Title 14 § 783.2(a)(7))

The Conservation Strategy in Chapter 7 will maintain instream flow conditions in a manner that adequately protects and conserves habitat downstream of the City's water diversions. The bypass flows adopted as part of the avoidance and minimization measures for the diversion activities will have an associated level of take. The consensus of the HCP team including NOAA, CDFW, and the City, is that the bypass flows agreed to as part of the Conservation Strategy represent a level of incidental take that is sufficiently protective of the species and will not lead to jeopardy.

7.0 Measures to Minimize and Fully Mitigate the Take (CCR Title 14 § 783.2(a)(8))

The City has reviewed the Covered Activities and their possible effect on coho life stages and has identified avoidance and minimization measures to eliminate or reduce effects to the extent practical. These avoidance and minimization measures include existing standard practices and SOPs previously put into place by the City to avoid or minimize effects on habitat and species and include approaches such as work area and work period restrictions.

Avoidance and minimization measures also include City programs that provide environmental benefits through reducing pollutants and conserving water. Avoidance and minimization measures are an important part of the conservation strategy for coho because they provide either complete protection for the species from the activity or provide for minimization of effects through implementing practices that reduce effects on life cycle stages or habitat.

This section describes measures that will be adopted to avoid and minimize effects on coho applicable to each City Covered Activity. City activities with the potential to affect coho include: rehabilitation of diversion structures and pipelines, water supply operations, including diversion of streamflows and reservoir management; water system operations and maintenance including sediment management, fish ladder and fish screen maintenance, and pipeline operations and maintenance; municipal facility operations and maintenance, including maintenance of flood control facilities in the Lower San Lorenzo River and Branciforte Creek; and management of watershed lands in the Mountain Charlie/Zayante Creek and Newell Creek watersheds.

7.1 Rehabilitation of Diversion Structures and Pipeline Reaches

The NCS pipeline reaches extend above and below ground, through developed and undeveloped areas, and traverses along, above or beneath roadways and waterways from Bonny Doon to the west side of Santa Cruz (Section 3.1). Rehabilitation work entails replacement of portions of the supply pipelines, rehabilitation of the Majors Creek and Laguna Creek diversion structures, and rehabilitation of the Tait Street and Felton Diversions on the San Lorenzo River.

The potential for effects to coho from pipeline rehabilitation is very low. Construction practices and measures to minimize and avoid sediment discharge to water courses, and contain sediment and spills are expected to result in negligible residual effects of this activity to coho (Section 7.3), Measures WO-1 through WO-14). Work in and around stream channels will incorporate avoidance and minimization measures associated with pipeline repair (Section 7.3.3) and dewatering of creeks for maintenance and repairs (Section 7.3.4).

The Majors Creek and Laguna Creek diversion structures are located upstream of the anadromous reaches on the creeks and potential construction effects would be limited to the local non-anadromous sites. Neither rehabilitation project would affect established bypass flows for fish and both would result in more natural sediment transport in the stream channels. Rehabilitation of the Tait Street and Felton Diversions are addressed in Section 7.2.1.

7.2 Water Supply Operations

This section describes the overall approach to minimizing the effects of water diversions on the Covered Species.

7.2.1 Water Diversions

This section describes the potential effects of water diversions on the Covered Species and presents specific measures to avoid or minimize those effects. Flow reductions due to diversion of water at the six City diversion facilities is the Covered Activity with the greatest potential to affect coho in the Plan Area. There are currently no instream or bypass flow requirements for the Tait Street or North Coast diversions, although diversion amounts are limited by water rights and facilities limitations. In this section, minimum instream flows are specified for each of these sources that would be maintained through flow bypasses at the City diversions.

Early work in developing the conservation strategy focused on understanding the relationships between flow and habitat quality downstream of each of the diversions (HES 2014b, Appendix 3: *Flow Studies*). Streamflow-habitat relationships were developed using the PHABSIM model of the Instream Flow Incremental Methodology (Bovee et al. 1998), and other analytical techniques (Thompson 1972, Powers and Orsborn 1985). This allowed quantification of habitat metrics (such as number of days with streamflow levels suitable for migration, spawning area, and rearing area) as a function of streamflows. Bypass flow scenarios were developed and evaluated using the City's operations model (Confluence), historical hydrologic data, and habitat models to optimize instream habitat conditions for covered species and City water supply needs. This process was the combined effort of a technical working group convened by the City beginning in 2005 and composed of resource agency personnel

representing NMFS and CDFW, City staff, and consultants. A more detailed description of the overall approach to minimizing the effects of the City diversions and the common rationale for determining minimum instream flow targets is provided in Appendix 9: *Rationale for Determining Minimum Instream Flow Targets*. Avoidance and minimization measures, including bypass flow schedules, is provided for each of the City diversions in the following sections.

Due to the extreme range of seasonal and inter-annual flow variation occurring in the streams and the inability to predict flow conditions from month to month during the wet season, the bypass flows are specified on a month-by-month basis for each of five different hydrologic exceedance conditions. The hydrologic conditions (HC) are based on the record of cumulative daily average flow at the Big Trees gage on the San Lorenzo River (see Appendix 9: *Rationale for Determining Minimum Instream Flow Targets*). Cumulative water-year flow was calculated for each month in the record (water-years 1937-2015) and sorted from lowest to highest. This record was split into five equal parts representing a range of exceedance categories from 100% (flow exceeded 100% of the time) to 0% (flow never exceeded). This results in five HC classes for very dry, dry, normal, wet, and very wet conditions as HC 5, 4, 3, 2, and 1, respectively). Hydrologic condition limits by month are shown in Table 7-1. Over time, and particularly with changing climate conditions, frequency of occurrence in each Category may diverge from historical frequencies.

Operationally, the hydrologic category is determined each month based on the cumulative water year flow at Big Trees for the preceding month. This approach is not intended to replace, and is not incompatible with, the forecasting model used by the City, which is based on four year-types with a determination made in March for the current water-year. Rather, it provides an additional tool for dealing with the complexity of species habitat needs. Using the water-year type to define bypass flow requirements means that the water-year type is undefined until March and there would be no basis for provision of bypass flows during the important and dynamic winter months. Bypass flows based on the previous seasons runoff result in the potential for in-stream flows that can be too low in wetter winters following a dry year (negatively impacting habitat), or too high in dryer winters following a wetter year (negatively impacting City supply). Although bypass flows are determined based on the HC system, results are still presented by water-year type for consistency with other City programs. The hydrologic condition changes from month to month while the water year applies to a complete annual cycle. Each water year may be composed of months having a variety of hydrologic conditions. For example, a wet water year may start with a dry fall and early winter with HC-4 or HC-5 from October through January, then have a very wet February ending in HC-2 or HC-3 and a wet March ending in HC-1 or 2.

Table 7-1: Hydrologic Condition Limits for End of Month Cumulative Daily Flow (cfs) for Water Year at San Lorenzo River Big Trees Gage, Period of Record 1 October, 1936 to 30 September, 2015*

Hydrologic Condition Limits (End of Month Cumulative Daily Flow from October 1 in cfs)					
	Category 5 80-100 %	**Category 4 60-80%**	**Category 3 40-60%**	**Category 2 20-40%**	**Category 1 0-20%**
Oct	<=459	460 to 539	540 to 709	710 to 875	>875
Nov	<=1186	1187 to 1497	1498 to 1827	1828 to 2485	>2485
Dec	<=2397	2398 to 3134	3135 to 5642	5643 to 10196	>10196
Jan	<=4322	4323 to 8456	8457 to 16694	16695 to 28019	>28019
Feb	<=8442	8443 to 16368	16369 to 29140	29141 to 42995	>42995
Mar	<=13004	13005 to 22948	22949 to 35371	35372 to 57968	>57968
Apr	<=14203	14204 to 24491	24492 to 39487	39488 to 67884	>67884
May	<=15448	15449 to 25279	25280 to 41659	41660 to 71412	>71412
June	<=16005	16006 to 26116	26117 to 43123	43124 to 73420	>73420
Jul	<=16364	16365 to 26819	26820 to 44073	44074 to 74718	>74718
Aug	<=16653	16654 to 27355	27356 to 44799	44800 to 75591	>75591
Sep	<=16978	16979 to 27843	27844 to 45398	45399 to 76368	>76368

* Hydrologic condition limits are set by the historical record period as indicated. These limits will be applied over the life of the Permit to maintain consistency with effects analyses. Over time, and particularly with changing climate conditions, frequency of occurrence in each Category may diverge from historical frequencies.

Minimum instream flow targets are presented in the following sections in tables for each diversion (e.g. Table 7-2).[11] Bypass flows are presented by month, life stage, and hydrologic condition. In any month, the bypass flow is driven by the life stage having the highest flow requirement. Rearing baseflows are provided when other life stages are not controlling. Flows for adult migration are provided when natural flow (i.e. without City diversions) would be at that level. Adult migration flows are presented as an upper and lower threshold with diversion halted when the lower threshold is reached and not resumed until natural flows exceed the upper threshold or recede below the lower threshold. Only the amount of flow in excess of the upper threshold is available for diversion. If flow drops below the lower threshold, the life stage with the next highest flow requirement would determine the minimum bypass level. Spawning flows are provided for a period of 14 days following the last occurrence of a migration flow. Incubation flows are provided for a period of 60 days following the last spawning flow or until May 31st, whichever occurs first. These general provisions may be relaxed

[11] The City has committed to a number of measures for steelhead through the HCP developed for steelhead and coho under the federal Endangered Species Act. The steelhead measures and supporting data are included in this application for the potential benefit provided to coho.

in specific circumstances noted in the Tables. A more detailed description of the development and application of the bypass flows is provided in Appendix 9: *Rationale for Determining Minimum Instream Flow Targets*.

Liddell Spring Diversion

The Liddell Spring diversion may affect coho by flow reduction that impairs ability of adult fish to migrate upstream in the winter and for smolts to migrate downstream in the spring; limits suitability of habitat for spawning, egg incubation, and juvenile rearing; reduces the productivity of benthic macro-invertebrates in the stream; and causes stranding, particularly of fry, when abrupt flow changes result from changes in diversion rates.

Restoration of flow in Liddell Creek was given lower priority than Laguna Creek and the San Lorenzo River due to unsuitability of habitat for coho, relatively short anadromous length, and relatively small size of the diversion relative to Laguna Creek and the San Lorenzo River. Productive capacity is limited due to excessive amounts of fine sediment and lack of a functional lagoon (See Appendix 12: *Environmental Setting*). A schedule of instream flow targets to minimize effects for the Liddell Spring Diversion is presented in Table 7-2 and described as specific measures as follows.[12]

Measure WS-1: Provide 0.25 cfs minimum bypass flow for rearing juvenile steelhead in Liddell Creek in the two driest hydrologic conditions (80%-100% exceedance and 60%-80% exceedance). A flow of 0.25 cfs provides approximately 27% of the maximum habitat index for steelhead rearing in the reach (HES 2014b).

Measure WS-2: Provide up to 5.2 cfs minimum bypass flow for rearing juvenile steelhead in the anadromous reach of Liddell Creek in normal, wet, and very wet hydrologic conditions (0%-60% exceedance). This provides approximately 76% of the maximum habitat index for steelhead rearing in the reach (HES 2014b).

Measure WS-3: Provide minimum bypass flows for adult migration in the anadromous reach in December through April of 0%-60% hydrologic conditions with a lower flow threshold of 4.9 cfs and an upper threshold of 11.3 cfs whenever flow would be at this level without City diversions.

Measure WS-4: Provide minimum bypass flows for spawning in the anadromous reach in December through May of 0%-60% hydrologic conditions of 7.4 cfs for 14 days following any adult migration period (provides estimated 97% of the peak for coho).

[12] The City has committed to a number of measures for steelhead through the HCP developed for steelhead and coho under the federal Endangered Species Act. The steelhead measures and supporting data are included in this application for the potential benefit provided to coho.

Measure WS-5: Provide bypass flows for egg incubation in January through May of 0%-60% hydrologic conditions. The incubation flow in Liddell Creek is 2.0 cfs. Incubation flows are provided for 60 days after the last spawning day or until May 30, whichever is earliest.

Measure WS-6: Provide bypass flows for smolt migration in the anadromous reach during January through May in 0-60% hydrologic conditions (hydrologic conditions 1-3), and for at least 3 consecutive days per week in March, April, and May in 60%-100% conditions (hydrologic conditions 4 and 5). The smolt migration minimum is 2 cfs.

Measure WS-7: Implement a ramping rate during flow changes at Liddell Spring Diversion to limit flow reductions such that change in stage is no greater than 0.16 feet per hour when fry may be present (January 15 through May 31) and no greater than 0.3 feet per hour at other times.

The instream flow targets in Table 7-2 apply to the City maintained stream gage in the anadromous reach of Liddell Creek, a short distance upstream of Highway 1.[13] The point of diversion is approximately 2 miles upstream of the anadromous gage and there is accretion of flows from other sources, including the Middle Branch and West Branch of Liddell Creek. There are also other diverters in the watershed, including the former CEMEX quarry, numerous wells in the recharge area for the creek, two alluvial wells near the confluence of the West and East Branches owned by the Bureau of Land Management and an agricultural diversion just upstream of Highway 1 (See Appendix 13: *Coho (Oncorhynchus kisutch) Species Account*). The magnitude and timing of other diversions is not known with any certainty and cannot be predicted. The point of compliance is at the Anadromous Liddell gage; other gages will also be used to ascertain effects of these other diversions on flows and habitat availability in the anadromous reach.

[13] The City has committed to a number of measures for steelhead through the HCP developed for steelhead and coho under the federal Endangered Species Act. The steelhead measures and supporting data are included in this application for the potential benefit provided to coho.

Table 7-2: Minimum instream flow targets for avoidance and minimization of effects on steelhead due to the Liddell Spring Diversion[14]

	Minimum Flow at Liddell Creek Anadromous Gage (cfs)								
	Rearing Base flow					Migration		Spawning	
	Hydrologic Condition 5 80-100% (driest)	Hydrologic Condition 4 60-80% (dry)	Hydrologic Condition 3 40-60% (normal)	Hydrologic Condition 2 20-40% (wet)	Hydrologic Condition 1 0-20% (very wet)	Adult[1]	Smolt[2]	Spawn[3]	Incubate[4]
Jan	0.25	0.25	2.9	3.6	4.7	4.9/11.3	2.0	7.4	2
Feb	0.25	0.25	4.6	3.9	5.1	4.9/11.3	2.0	7.4	2
Mar	0.25	0.25	3.5	4.8	5.2	4.9/11.3	2.0	7.4	2
Apr	0.25	0.25	3.0	4.3	4.6	4.9/11.3	2.0	7.4	2
May	0.25	0.25	2.6	3.3	4.0		2.0	7.4	2
June	0.25	0.25	2.0	2.4	2.9				
Jul	0.25	0.25	1.6	1.9	2.2				
Aug	0.25	0.25	1.4	1.7	1.8				
Sep	0.25	0.25	1.3	1.5	1.6				
Oct	0.25	0.25	1.5	1.5	1.6				
Nov	0.25	0.25	1.8	1.9	1.9				
Dec	0.25	0.25	2.1	2.6	3.0	4.9/11.3		7.4	

[1] Provided in 0%-60% hydrologic conditions only.
[2] Smolt migration flows provided in 0-60% (hydrologic conditions 1-3), and for 3 consecutive days per week in March, April, and May in 60%-100% (hydrologic conditions 4 and 5).
[3] 80% of peak steelhead spawning WUA for 14-day period after any potential migration event in 0-60% hydrologic conditions; not provided in 60-100% hydrologic conditions.
[4] Provided in 0-60% hydrologic conditions for 60-day period following occurrence of last spawning flow or May 30, whichever occurs first; not provided in 60-100% hydrologic conditions.

[14] The City has committed to a number of measures for steelhead through the HCP developed for steelhead and coho under the federal Endangered Species Act. The steelhead measures and supporting data are included in this application for the potential benefit provided to coho.

Reggiardo Creek Diversion

The Reggiardo Creek Diversion, while currently inoperable, historically diverted from 1.6-2.8 cfs continuously with conveyance through an 850 foot gravity pipeline to the Laguna Creek Diversion pond (Section 3.2.1). The Reggiardo Diversion is approximately 300 feet upstream of the confluence with Laguna Creek. As such, any effect of the Reggiardo Creek Diversion on species in the anadromous reach of Laguna Creek is incorporated in the operation of the Laguna Creek Diversion (see following section).

Laguna Creek Diversion

The Laguna Creek diversion may affect coho by flow reduction that impairs ability of adult fish to migrate upstream in the winter and for smolts to migrate downstream in the spring; limits suitability of habitat for spawning, egg incubation, and juvenile rearing; degrades water quality conditions in the lagoon at the mouth of the creek; reduces the productivity of benthic macro-invertebrates in the stream; and causes stranding, particularly of fry, when abrupt flow changes result from changes in diversion rates.

The City/TAC has assigned Laguna Creek a high priority for restoration of flows relative to the other North Coast streams covered in this Permit application due to underlying habitat conditions that have a higher potential to support recovery of salmonids. It is the largest watershed and has the longest reach of anadromous habitat of all the North Coast streams where the City diverts water. Laguna Creek also has the potential to support coho as evidenced by recent observations of juveniles there (See: Appendix 13: *Coho (Oncorhynchus kisutch) Species Account*). A schedule of instream flow targets to minimize effects of the Laguna/Reggiardo Diversion[15] is presented in Table 7-3 and described as specific measures as follows.[16]

Measure WS-8: Provide 2 cfs minimum bypass flow for rearing juvenile steelhead in the anadromous reach of Laguna Creek at all times. This is approximately the 44% exceedance flow for August in the historical hydrologic record and equates to about 70% of the maximum habitat index for steelhead rearing in August in the reach and approximately 99% of the maximum habitat index for coho rearing (HES 2014).

Measure WS-9: Provide minimum bypass flows for adult migration in the anadromous reach with a lower flow threshold of 10.6 cfs and an upper threshold of 15.5 cfs in December through March of all

[15] Instream flow targets for the Reggiardo Diversion are included in the Laguna Creek bypass flow targets. The Reggiardo and Laguna Creeks Diversions operate in tandem and are miles above the Laguna Creek limit of anadromy. Therefore, they have a cumulative effect on anadromous reach flows.
[16] *Id*.

hydrologic conditions and April when hydrologic condition is 0-60% whenever flow would be at this level without City diversions.

Measure WS-10: Provide minimum bypass flows for spawning in the anadromous reach of 9.4 cfs during December through May for 14 days following any adult migration period (providing 97% of the peak for coho).

Measure WS-11: Provide bypass flows for egg incubation in January through May in all hydrologic conditions. The incubation flow in Laguna Creek is 4.0 cfs. Incubation flows are provided for 60 days after the last spawning day or until May 30, whichever is earliest.

Measure WS-12: Provide bypass flows for smolt migration in the anadromous reach during January through May in 0-80% hydrologic conditions (hydrologic conditions 1-4), and for at least 3 consecutive days per week in 80%-100% conditions (hydrologic condition 5). The smolt migration minimum is 3.8 cfs. For background on the various hydrologic conditions, see *Appendix 8: Hydrologic, Water Supply, and Fisheries Habitat Effects Modeling*.

Measure WS-13: Implement a ramping rate during flow changes at Laguna Creek Diversion to limit flow reductions such that change in stage is no greater than 0.16 feet per hour when fry may be present (January 15 through May 31) and no greater than 0.3 feet per hour at other times.

The instream flow targets in Table 7-3 apply to the City maintained stream gage in the anadromous reach of Laguna Creek, a short distance upstream of Highway 1. The point of diversion is approximately 4 miles upstream of the anadromous gage and there is accretion of flows from other sources, including Y Creek. Although the point of compliance is at the anadromous gage, other gages will also be used to ascertain effects of these other diversions on flows and habitat availability in the anadromous reach.

Table 7-3: Minimum Instream Flow Targets for Avoidance and Minimization of Effects on Steelhead Due to the Laguna Creek Diversion

	Minimum Flow at Laguna Creek Anadromous Gage (cfs)								
	Rearing Base flow					Migration		Spawning	
	Hydrologic condition 5 80-100% (driest)	Hydrologic condition 4 60-80% (dry)	Hydrologic condition 3 40-60% (normal)	Hydrologic condition 2 20-40% (wet)	Hydrologic condition 1 0-20% (very wet)	Adult	Smolt Migration[1]	Spawn[2]	Incubate[3]
Jan	2	2	2	2	2	11.3/15.5	3.8	9.4	4
Feb	2	2	2	2	2	11.3/15.5	3.8	9.4	4
Mar	2	2	2	2	2	11.3/15.5	3.8	9.4	4
Apr	2	2	2	2	2	11.3/15.5[4]	3.8	9.4	4
May	2	2	2	2	2		3.8	9.4	4
June	2	2	2	2	2				
Jul	2	2	2	2	2				
Aug	2	2	2	2	2				
Sep	2	2	2	2	2				
Oct	2	2	2	2	2				
Nov	2	2	2	2	2				
Dec	2	2	2	2	2	11.3/15.5		9.4	

[1] Smolt migration flows shall be provided in 0-80% (hydrologic conditions 1-4), and for 3 consecutive days per week in 80%-100% (hydrologic condition5) in March, April, and May.
[2] 80% of peak steelhead spawning WUA for 14-day period after any potential migration event.
[3] For 60-day period following occurrence of last spawning flow or May 30, whichever occurs first.
[4] April adult migration flows provided in 0-60% exceedance conditions/hydrologic conditions 1-3.

Majors Creek Diversion

The Majors Creek diversion may affect coho by flow reduction that impairs ability of adult fish to migrate upstream in the winter and for smolts to migrate downstream in the spring; limits suitability of habitat for spawning, egg incubation, and juvenile rearing; reduces the productivity of benthic macro-invertebrates in the stream; and causes stranding, particularly of fry, when abrupt flow changes result from changes in diversion rates.

Restoration of flow in Majors Creek was given lower priority than Laguna Creek and the San Lorenzo River due to the short anadromous reach length (0.6 miles) and lack of a developed lagoon (See Appendix 12: *Environmental Setting*). It also has a relatively small diversion capacity (2.1 cfs) relative to Laguna Creek (6.3 cfs) and the San Lorenzo River at the Tait Street Diversion (12.2 cfs). A schedule of instream flow targets to minimize effects of the Majors Creek diversion is presented in Table 7-4. Comparisons of actual habitat values that would occur under Conservation Flows are provided in Chapter 5.[17]

Measure WS-14: Provide 0.25 cfs minimum bypass flow for rearing juvenile steelhead in Majors Creek in the two driest hydrologic conditions (80%-100% and 60%-80%). A flow of 0.25 cfs equates with approximately 27% of the maximum WUA for rearing juvenile steelhead occurring in Majors Creek.

Measure WS-15: Provide up to 4.7 cfs minimum bypass flow for rearing juvenile steelhead in the anadromous reach of Majors Creek in normal, wet, and very wet hydrologic conditions (0%-60%). This is more than the maximum August flow and approximately the 10% exceedance flow for June in the historical hydrologic record and equates to about 86% of the maximum habitat index for steelhead in June (HES 2014b).

Measure WS-16: Provide minimum bypass flows for adult migration in the anadromous reach in December through April of 0%-60% hydrologic conditions with a lower flow threshold of 9 cfs and an upper threshold of 16 cfs whenever flow would be at this level without City diversions.

Measure WS-17: Provide minimum bypass flows for spawning in the anadromous reach in December through May of 0%-60% hydrologic conditions of 12.1 cfs for 14 days following any adult migration period (provides estimated 97% of the peak for coho).

[17] The City has committed to a number of measures for steelhead through the HCP developed for steelhead and coho under the federal Endangered Species Act. The steelhead measures and supporting data are included in this application for the potential benefit provided to coho.

Measure WS-18: Provide bypass flows for egg incubation in January through May of 0%-60% hydrologic conditions. The incubation flow in Majors Creek is 2.9 cfs. Incubation flows are provided for 60 days after the last spawning day or until May 30, whichever is earliest.

Measure WS-19: Provide bypass flows for smolt migration in the anadromous reach during January through May in 0-60% hydrologic conditions (hydrologic conditions 1-3), and for at least 3 consecutive days per week in March, April, and May in 60%-100% conditions (hydrologic conditions 4 and 5). The smolt migration minimum is 3.4 cfs.

Measure WS-20: Implement a ramping rate during flow changes at Majors Creek Diversion to limit flow reductions such that change in stage is no greater than 0.16 feet per hour when fry may be present (January 15 through May 31) and no greater than 0.3 feet per hour at other times.

The instream flow targets in Table 7-4 apply to the City-maintained stream gage in the anadromous reach of Majors Creek, immediately upstream of Highway 1. The point of diversion is approximately 2 miles upstream of the anadromous gage and there is accretion of flows in the intervening reach. There are at least four known non-City operated diversions on Majors Creek (ENTRIX, Inc. 2004c), including three diversions operated by Edwards, two of which are located in the anadromous reach just upstream of the Highway 1 crossing. There are also several diversions upstream of the City diversion (Chris Berry, personal communication to Kindra Loomis, 2004, cited in ENTRIX, Inc. 2004c). Production numbers and season of diversion for the non-City diversions are unavailable and their impacts on Majors Creek hydrology are unclear. The point of compliance is at the anadromous gage; other gages will also be used to ascertain effects of other diversions on flows and habitat availability in the anadromous reach.

Table 7-4: Minimum Instream Flow Targets for Avoidance and Minimization of Effects on Steelhead Due to the Majors Creek Diversion

	Minimum Flow at Majors Creek Anadromous Gage (cfs)								
	Rearing Base flow					Migration		Spawning	
	Hydrologic condition 5 80-100% (driest)	Hydrologic condition 4 60-80% (dry)	Hydrologic condition 3 40-60% (normal)	Hydrologic condition 2 20-40% (wet)	Hydrologic condition 1 0-20% (very wet)	Adult[1]	Smolt[2]	Spawn[3]	Incubate[4]
Jan	0.25	0.25	2.2	2.7	4.1	9/16	3.4	12.1	2.9
Feb	0.25	0.25	4.1	3.0	4.4	9/16	3.4	12.1	2.9
Mar	0.25	0.25	2.4	4.3	4.7	9/16	3.4	12.1	2.9
Apr	0.25	0.25	1.7	3.1	3.2	9/16	3.4	12.1	2.9
May	0.25	0.25	1.4	1.8	2.4		3.4	12.1	2.9
June	0.25	0.25	1.0	1.2	1.6				
Jul	0.25	0.25	0.8	1.0	1.1				
Aug	0.25	0.25	0.7	0.8	0.9				
Sep	0.25	0.25	0.6	0.7	0.7				
Oct	0.25	0.25	0.8	0.9	0.8				
Nov	0.25	0.25	1.1	1.2	1.2				
Dec	0.25	0.25	1.5	1.9	2.1	9/16		12.1	

[1] Provided in 0%-60% hydrologic conditions only.
[2] Smolt migration flows provided in 0-60% (hydrologic conditions 1-3), and for 3 consecutive days per week in March, April, and May in 60%-100% (hydrologic conditions 4 and 5).
[3] 80% of peak steelhead spawning WUA for 14-day period after any potential migration event in 0-60% hydrologic conditions; not provided in 60-100% hydrologic conditions.
[4] Provided in 0-60% hydrologic conditions for 60-day period following occurrence of last spawning flow or May 30, whichever occurs first; not provided in 60-100% hydrologic conditions.

Newell Creek Diversion

Operation of Loch Lomond Reservoir and the Newell Creek Diversion alters the natural hydrograph of Newell Creek except during periods when the reservoir is spilling. During non-spill periods flow reduction may impair the ability of adult fish to migrate upstream in the winter and for smolts to migrate downstream in the spring; limit the suitability of habitat for spawning, egg incubation, and juvenile rearing; reduce the productivity of benthic macro-invertebrates in the stream. There are generally not abrupt changes in flow since the creek is either influenced by the 1 cfs minimum release or the natural pattern of reservoir spill. The presence of Newell Creek Dam also prevents transport of sediment and LWD potentially impairing the recruitment of spawning gravels and LWD as a source of potential cover (Holley 2010). While these effects cannot be avoided or minimized, they can be mitigated under the non-flow conservation fund (Section 7.6) through programs such as gravel replenishment and LWD placement.

Management actions to replace spawning gravels may improve conditions but would not be naturally sustainable as the smaller gravels would be transported downstream and not replaced from upstream. Only a sustained effort to replace gravel could improve conditions indefinitely. Wherever possible bank protection measures should be restricted to allow lateral migration of the creek. Incised channels should be allowed to evolve into a more stable stage where the creek is free to erode banks and migrate within its floodplain, actively recruiting LWD. Management actions that include adding LWD to the stream could help to create scour pools where LWD recruitment is limited by riparian encroachment by development or immature vegetation. The most immediate and effective action to improve salmonid habitat is to stop removal of LWD in the channel. Evidence of large logs being removed from the channel can be seen in all reaches (Holley 2010).

Passage above Newell Dam is not part of the Permit application because passage conditions downstream of the dam are marginal and, even if fish could routinely pass the bedrock chute identified as the current limit of anadromy, bathymetry studies of the reservoir indicate that anadromy likely historically ended at a very steep reach of channel that is now beneath the reservoir (located close to the dam). Thus, the reservoir does not impede passage to significant amounts of historic above-reservoir habitat.

Streamflows

Standard facility operations related to the City's water right for Newell Creek (license # 9847) include a year-round minimum release requirement of 1 cfs below Newell Creek Dam. During the fully appropriated season, the license requires that the greater of 1 cfs or the natural flow of Newell Creek must be released.

Restoration of flow in Newell Creek was given lower priority than Laguna Creek and the San Lorenzo River. The anadromous reach length is relatively short and habitat conditions in the majority of the anadromous reach are degraded due to close proximity of residential development on both sides of the creek (See Appendix 12: *Environmental Setting*). Providing flow for migration and spawning would severely constrain storage in the reservoir and increase reliance on other diversions. Adult migration, spawning, incubation, and smolt migration bypass flows have not been specified for Newell Creek however flows sufficient for these uses occur during periods of reservoir spill. Existing agreements attached to the aforementioned water right specify a minimum bypass flow of 1 cfs at all times.

Hydrologic modeling indicates that the operation of the reservoir results in a slight reduction in median flows through the anadromous reach (compared to reservoir inflows) during the early part of the spring rearing period in wet, normal and dry years, and an augmentation of median flows during the latter part of the rearing period due to the 1 cfs minimum release (ENTRIX, Inc. 2004c). Flow augmentation is highest (begins earlier) in dry years, and lowest in wet years. During critical dry years, the 1 cfs release requirement augments the natural flow throughout the rearing period and essentially doubles the flow downstream of the dam relative to median reservoir inflow from July through October.

Since the 1 cfs minimum release is above unimpaired levels at certain times and in order to preserve storage in Loch Lomond Reservoir an exception minimum of 0.25 cfs would be instituted when storage is low enough to result in supply shortages (Table 7-5). The City, in consultation with NMFS and CDFW, implemented a release of 0.2 cfs during recent drought conditions from February 2014 to February 2016 under a Temporary Urgency Change Petition with the State Water Resources Control Board. The 0.2 cfs flow level (68% of the habitat index at 1.0 cfs flow) provided reasonable habitat conditions during that period based on observations made by the City Water Department and reviewed by NMFS and CDFW (Chris Berry, personal communication to Jeff Hagar, 2014). Provision of a slightly higher flow during exception years in the future should ensure that this continues to be the case. Exception minimum flows would be provided when Loch Lomond Reservoir storage falls below the following storage conditions:

Table 7-5: Storage Conditions in Loch Lomond Reservoir Triggering Exception Minimum Flows

	Minimum storage for 1 cfs release (mg)	Percent of Capacity
Nov	1,500	53%
Dec	1,700	60%
Jan	2,000	70%
Feb	2,000	70%
Mar	2,000	70%
Apr	2,000	70%
May	2,000	70%
June	2,000	70%
Jul	1,800	64%
Aug	1,500	53%
Sep	1,500	53%
Oct	1,500	53%

In Confluence modeling results for the proposed Water Rights Project, exception minimum flows would be applied in portions of 9 years (27 out of 948 months or 3% of the time) during the 79-year model period. This compares with modeled existing demand and infrastructure with interim bypass flows (2018 tolling agreement flows before Conservation Flows are in place) predicting exception minimum flows during 87 months (9% of the time) in portions of 16 years. Duration of exception minimum flows was between 1 and 5 months for the proposed project except for one model year (1977) with 12 months. Exception minimum flows are primarily imposed during October through April and are most frequent in December and January. The exception minimum flows would most likely be implemented in Newell Creek in years when there has been no spill. Adult migration and spawning are less likely to occur in the absence of higher flows that result from spill conditions and rearing abundances are therefore likely to be lower. Comparisons of actual habitat values that would occur under Conservation Flows are provided in Chapter 5. Model results show that, even with the exception minimum flows, the 1 cfs bypass flow requirement at Newell Creek Dam provides improved summer rearing habitat value as compared to no City diversion in all hydrologic year types (Chapter 5). The base hydrology (no diversion) shows 31 years with flow less than 0.33 cfs below Newell Creek Dam during portions of the June through October period (24% of the time during this period overall). The 1 cfs instream flow requirement also results in flow augmentation in the main stem San Lorenzo River downstream of Newell Creek, although the proportional increase is much smaller. A schedule of instream flow targets to minimize effects of the Newell Creek Diversion is presented in Table 7-6.

Water Temperature

Due to the presence of the reservoir, temperature in Lower Newell Creek below the dam is warmer than Upper Newell Creek during winter and spring and cooler in the summer by up to 4°C on average (See Appendix 12: *Environmental Setting*). Warmer water in the spring can enhance salmonid growth rates if food resources are sufficient. The cooling influence in summer can extend downstream as far as the San Lorenzo River (City of Santa Cruz monitoring data, HES 2014b). Although the cooling influence in summer may depress growth rates, this effect would be strongest closest to the dam.

Reservoir spill can result in increased temperature downstream of the dam during periods when the reservoir surface temperature is high. The majority of spill occurs during or after precipitation events in the winter when Loch Lomond temperature is cool. The period when temperature effects are most likely is during the spring and early summer (May through July) when the lake surface is warming and there is still a potential for spill, at least in wetter years when storage is high. Potential effects on coho can be avoided by ensuring that sufficient cool water is released through the fish release to blend with and moderate warm flows through the spillway (Measure WS-24).

Measures for avoiding and minimizing the effect of Loch Lomond Reservoir operations on habitat for Covered Species in Newell Creek include the following:[18]

Measure WS-21: Provide 0.25 cfs minimum bypass flow for rearing juvenile steelhead in the anadromous reach of Newell Creek when Loch Lomond Reservoir storage is less than specified storage levels (Table 4-5).

Measure WS-22: Provide 1 cfs minimum bypass flow for rearing juvenile steelhead in the anadromous reach of Newell Creek at all other times.

Measure WS-23: During changes in bypass rates downstream of Newell Creek Dam, a ramping rate will be implemented to limit flow reductions in Newell Creek such that the change in stage is no greater than 0.16 feet per hour when fry may be present (January 15 through May 31) and no greater than 0.3 feet per hour at all other times.

Measure WS-24: At times when the Loch Lomond Reservoir is spilling during late spring and summer when surface temperatures in the reservoir are warmer and the cooler 1 cfs fish release below the dam (generally between 11°C and 14°C) may not be sufficient to maintain temperature in Newell Creek below 21°C, which is within the suitable range for coho, the City will release additional flow through the fish release to achieve a maximum instantaneous temperature of less than 21°C as

[18] The City has committed to a number of measures for steelhead through the HCP developed for steelhead and coho under the federal Endangered Species Act. The steelhead measures and supporting data are included in this application for the potential benefit provided to coho.

measured in the anadromous reach of Newell Creek and verified at the City stream gage in Newell Creek below the dam.

The point of compliance for minimum bypass flows is the City maintained stream gauge in Newell Creek immediately downstream of Newell Creek Dam.

Table 7-6: Minimum Instream Flow Targets for Avoidance and Minimization of Effects on Steelhead Due to the Newell Creek Diversion

		Minimum Flow at Newell Creek below Dam (cfs)								
		Rearing Baseflow					Migration		Spawning	
	Exception Minimum	Hydrologic Condition 5 80-100% (driest)	Hydrologic Condition 4 60-80% (dry)	Hydrologic Condition 3 40-60% (normal)	Hydrologic Condition 2 20-40% (wet)	Hydrologic Condition 1 0-20% (very wet)	Adult	Smolt Migration	Spawn	Incubate
Jan	0.25	1.0	1.0	1.0	1.0	1.0				
Feb	0.25	1.0	1.0	1.0	1.0	1.0				
Mar	0.25	1.0	1.0	1.0	1.0	1.0				
Apr	0.25	1.0	1.0	1.0	1.0	1.0				
May	0.25	1.0	1.0	1.0	1.0	1.0				
June	0.25	1.0	1.0	1.0	1.0	1.0				
Jul	0.25	1.0	1.0	1.0	1.0	1.0				
Aug	0.25	1.0	1.0	1.0	1.0	1.0				
Sep	0.25	1.0	1.0	1.0	1.0	1.0				
Oct	0.25	1.0	1.0	1.0	1.0	1.0				
Nov	0.25	1.0	1.0	1.0	1.0	1.0				
Dec	0.25	1.0	1.0	1.0	1.0	1.0				

Felton Surface Water Diversion at San Lorenzo River

Operation of the Felton Diversion potentially influences sediment transport, fish passage, and streamflow in the San Lorenzo River. Constraints on operation of the Felton Diversion under existing agreements and planned upgrades avoid and minimize effects of this activity to migration, spawning, and rearing of Covered Species.

Sediment Transport

Sediment may collect behind the dam during periods when the dam is inflated and be released when the dam is deflated. The following measures are adapted from current SOPs for the dam and will result in minor alterations to storm hydrographs due to facility operations and avoid any potential effects on sediment transport:

Measure WS-25: Deflate dam during the first one or two rainstorms of the season to flush sediments and organic matter from the channel,

Measure WS-26: Deflate dam during high flows when the majority of sediment is being transported.

Fish Passage

Under the 1998 MOA with CDFW (Chapter 3), operations are managed to allow adult steelhead and coho to migrate upstream. Operations are based on streamflow conditions during winter months and include specific operational changes based on low, moderate, and high streamflow conditions as outlined below. The following measures maintain the provisions of the 1998 MOA but are altered to accommodate new winter bypass flows for adult migration and spawning.

Measure WS-27: During November 1 through March 31 when the mouth of the San Lorenzo River is open and streamflow is less than 40 cfs and the City is diverting water, the dam will be inflated to allow 20 cfs bypass flow through the fish ladder. During the same period, if the City is not diverting, the City will inflate small air bladders beneath the deflated dam or employ similar, comparable measures for the purpose of facilitating fish passage over or around the facility. If passage over the deflated dam is provided, the depth of flow within the zone of concentrated flow crossing the dam will be 8 inches or greater. Similarly, if passage is provided around the dam through the pumping channel, 8 inches of depth or greater will be provided.

Measure WS-28: During December 1 through April 30 when the mouth of the San Lorenzo River is open and streamflow is 40 cfs or more configure the dam to bypass 40 cfs with a minimum of 20 cfs through the fish ladder.

Measure WS-29: For moderate streamflow conditions, during November 1 through March 31 when the mouth of the San Lorenzo River is open and streamflows are between 40 and 200 cfs, the City will divert water by inflating the dam and allowing a minimum 40 cfs bypass flow. During these moderate streamflow conditions, the City will keep the dam deflated during the first one or two rainstorms to flush sediments and organic matter from the channel. During these conditions of winter operation, migrating fish can pass over the deflated dam.

Measure WS-30: In high streamflow conditions (exceeding 200 cfs) from November 1 through March 31, when the City is diverting, the dam will be inflated such that the fish ladder is operational. When streamflow exceeds approximately 300 cfs, the slide gate on the fish ladder will be opened approximately 8 inches to increase attraction flow to the ladder entrance. When streamflows have equaled or exceeded 300 cfs for five consecutive days and adult steelhead or coho are observed holding downstream of the dam, on the following day the dam will be partially deflated and the slidegate closed in the evening and overnight. This allows the steelhead and coho the opportunity to jump and swim over the partially deflated dam. When streamflows exceed 2,000 cfs the City will fully deflate the dam.

The Felton Diversion intake is screened and provides adequate average approach and sweeping velocities, although it does not meet all current NMFS criteria for screen openings, cleaning frequency and bypass systems (Borcalli and Associates 2001). The City operates under specific BMPs for fish ladder and fish screen maintenance (see Section 7.3.2) and those measures are incorporated here as well.

Measure WS-31: Inspect fish ladder 2-3 times per week and manually clean and remove debris as needed. Remove debris from site and dispose at approved waste disposal facility.

Measure WS-32: Inspect all fish screens regularly (daily) and manually clean and remove debris from screens and debris racks as needed.

Measure WS-33: Upon implementation of the proposed Santa Cruz Water Rights Project, the City will undertake a facility upgrade at the Felton Diversion. Planning for the facility upgrade will include a comprehensive evaluation of existing fish migration conditions at the facility and potential improvements for upstream and downstream migration of both juvenile and adult steelhead. Findings of this evaluation will be used to design state of the art fish passage components that may include revisions to the pumping channel, the Denil fish ladder, or both. The evaluation will consider the potential for channel changes downstream of the diversion and revisions will be designed to accommodate possible channel changes. Any revisions based on these findings will be incorporated in the upgrade project. The upgrade will include screen replacement, continuous cleaning system, and juvenile passage modifications to meet current fish screen and fish passage criteria. The fish screen

material will be replaced with either wedge wire with a 1.75 mm slot width or a perforated plate with 3/32" diameter perforations. A mechanical traveling brush system will be installed for continuous screen cleaning. The brush system will provide a 5-minute continuous cleaning cycle. A continuous bypass route will be installed so that out-migrants entrained in the intake structure can continue their movement downstream. Ladder upgrades to improve passage will be evaluated and incorporated as appropriate as well.

These measures will be incorporated into future operations of the Felton Diversion Dam and together with planned facility upgrades will fully avoid the effects of facility operation on migration of Covered Species.

Streamflows

Diversion of flow at the Felton Diversion Dam potentially influences migration, spawning, and rearing of Covered Species in downstream reaches. Current agreements specify diversion rates and bypass flows to minimize these potential effects. In addition, new bypass flows for adult migration and spawning have been adopted under as part of the Conservation Flows based on recent information provided by Berry (2016).

Berry (2016), using the R2 approach estimated that a flow of 39 cfs appears to be a reasonable adult migration flow estimate for the San Lorenzo River below the Felton Diversion (See Appendix 12: *Environmental Setting*). This estimate was vetted with NMFS and CDFW in meetings of the technical review team and it was decided that bypass flows for the Felton Diversion would be determined consistent with the other diversions (HCP Technical Team Draft Minutes, 12/13/2016; HCP Technical Team Meeting #5 Minutes 1/17/2017). Specifically, 40 cfs would be used as the adult migration minimum and would be provided whenever it would occur in the absence of the diversion. Optimum spawning flows are typically slightly below migration flows and are provided for two weeks following the most recent occurrence of migration flows. Rearing flows are usually on the order of about half of migration flow levels. These flows are generally consistent with data and recommendations provided in Ricker and Butler (1979) and HES (2014) (See Appendix 12: *Environmental Setting*).

The 40 cfs bypass flow for adult migration (rounded up from 39 cfs) will be extended to provide for spawning for 14 days after potential passage events. The existing winter bypass flow of 20 cfs is half the recommended adult migration flow and is consistent with the proportional relationship between optimum rearing flow and adult migration flow derived through PHABSIM studies in other streams (See Appendix 12: *Environmental Setting*, HES 2014b). This bypass flow regime should also be protective of incubation and smolt migration based on these same results. A schedule of instream flow targets to minimize effects of the Felton Diversion under the Permit are presented in Table 7-7 and described as specific measures as follows.

Raising and lowering of the Felton Diversion Dam has the potential to result in stage changes in the San Lorenzo River downstream of the dam. The Dam may be raised or lowered at flows up to 2,000 cfs but must be fully deflated at flows above 2,000 cfs. This Permit application includes criteria for levels of stage change at North Coast diversions that are protective of juvenile salmonid life stages based on review of the literature and standards developed by fisheries resource Agencies (Hagar 2014). The criteria call for change in stage no greater than 0.16 feet per hour when fry may be present (January 15 through May 31) and no greater than 0.3 feet per hour at all other times. However, the San Lorenzo River at Felton exhibits rapid changes in stream flow and stage under winter storm flow conditions that can exceed those criteria. The greatest changes in stage occur at flows over 2,000 cfs. Still, stage changes during storm flows less than 2,000 cfs, even without operation of the diversion dam, can exceed established criteria. For example, during the winter of 2016-2017 when the diversion dam was not operated and rainfall and streamflow was above normal, stage change during the ascending limb of the hydrograph (increasing flows) at flows less than 2,000 cfs peaked at 1.68 feet per hour during storm flows and exceeded 0.30 feet per hour on 195 occasions during 23 days between December and April (USGS streamflow monitoring data for the San Lorenzo River at Big Trees gage, located just downstream of the Felton Diversion). Stage declines ranged as high as -0.55 feet per hour during the descending limb of the hydrograph (decreasing flow) and exceeded -0.30 feet per hour on 42 occasions and exceeded -0.16 feet per hour on 178 occasions during 14 days between December and April. Stage decrease is more of a concern than stage increase for juvenile salmonids because of the potential to strand sensitive life-stages in areas of the channel margin that are relatively low-gradient, or where pockets or side channels exist in the stream channel.

Existing MOAs for operation of the Felton Diversion and new bypass flows for migration and spawning are incorporated into the following measures that fully avoid effects to Covered Species from diversion related flow changes below the Felton Diversion.

Measure WS-34: Do not divert at the Felton Diversion during June through August.

Measure WS-35: Provide 20 cfs minimum bypass flow for rearing and smolt migration during November 1 through May 31 in all hydrologic categories.

Measure WS-36: Provide 10 cfs minimum bypass flow during September and 25 cfs minimum bypass in October in all hydrologic categories.

Measure WS-37: Provide 40 cfs minimum bypass flow for adult migration in December through April whenever natural flow would occur at this level in the absence of a diversion.

Measure WS-38: Provide 40 cfs minimum bypass flow for spawning in December through April for 14 days after potential passage events (i.e. 40 cfs flow and mouth of the river is open).

Measure WS-39: The City will manage inflation and deflation of the Felton Diversion Dam to maintain stage increase of less than 1.68 feet per hour during deflation of the dam and stage decrease of no more than -0.55 feet per hour during inflation of the dam. This will be accomplished through manual operation of the dam bladders by a trained operator. Inflation and deflation of the dam in response to anticipated changes in the hydrograph from forecast storms will be planned in advance in consultation with staff hydrologists to minimize stage changes to the maximum extent practicable.

Table 7-7: Minimum Instream Flows for Avoidance and Minimization of Effects on ~~Steelhead~~ and Coho due to Operation of the Felton Diversion

	Minimum Flow below the Felton Diversion (cfs)								
	All Life Stages					Migration		Spawning	
	Hydrologic Condition 5 80-100% (driest)	Hydrologic Condition 4 60-80% (dry)	Hydrologic Condition 3 40-60% (normal)	Hydrologic Condition 2 20-40% (wet)	Hydrologic Condition 1 0-20% (very wet)	Adult[1]	Smolt Migration	Spawn[2]	Incubate
Jan	20	20	20	20	20	40		40	
Feb	20	20	20	20	20	40		40	
Mar	20	20	20	20	20	40		40	
Apr	20	20	20	20	20	40		40	
May	20	20	20	20	20			40	
June	No Diversion								
Jul									
Aug									
Sep	10	10	10	10	10				
Oct	25	25	25	25	25				
Nov	20	20	20	20	20				
Dec	20	20	20	20	20	40		40	

[1] Provided in all hydrologic conditions when mouth has been open and natural flow would occur at this level without diversion.
[2] Provided for 14 days following any potential migration event.

Tait Street Diversion and Wells

The primary potential effects on coho from the Tait Street Diversion are related to deterioration of migration and rearing habitat from reduction instream flow. At most times, except when water quality is poor during storm runoff periods, the City relies on the full amount of the diversion authorization. It is assumed that maximum diversion rate capacity for the diversion, as modified under the proposed Santa Cruz Water Rights Project, will remain unchanged over the period of the Permit.

The Tait Street Diversion dam and screens also potentially influences fish passage though no issues with either delay of adult upstream migration, juvenile migration, or entrainment or impingement of juveniles have been noted.

The Tait Street diversion neither creates nor discharges sediments. In the reach of river where the facility is located, the predominant substrate is sand. During high flows, suspended sediments and bedload pass the facility relatively unobstructed. Some sand, entrained by the inflow to the pumps, settles in a chamber before the pumps and is later removed by suction to the parking lot. Water from this process is allowed to flow back to the river downstream of the diversion (Section 7.3.3).

Fish Passage

The Tait Street Diversion is a run-of-river facility without a ladder. Juvenile fish can currently swim through holes in the diversion dam. Migrating fish can swim past the intakes or over the dam in the main channel at moderate to high flows. At lower flows, a moderate jump is required to pass this facility (Jon Jankovitz, CDFW, personal communication to Chris Berry, 2020). Although no issues related to the intake fish screens have been identified, the City will undertake a facility upgrade at the Tait Street Diversion to meet current fish screen criteria during the term of the Permit.

Measure WS-40: Modify the Tait Street Diversion to prevent entrainment and impingement and provide bypass per criteria issued by NMFS and/or CDFW. This may include: screens aligned parallel to river flow and composed of either perforated plate with screen openings not exceeding 3/32 inches (2.38 mm), measured in diameter; profile bar with screen openings not exceeding 0.0689 inches (1.75 mm) in width; or woven wire with screen openings not exceeding 3/32 inches (2.38 mm), measured diagonally (e.g. 6-14 mesh). Screen material shall provide a minimum of 27% open area. The screen material shall be corrosion resistant and sufficiently durable to maintain a smooth and uniform surface with long-term use. Design features will also include: uniform flow across the screens; approach velocities not exceeding 0.33 f/s; sweeping velocities that exceed approach velocities; provision for appropriate juvenile bypass; and provision for continuous cleaning. Fish Screens shall be automatically cleaned as frequently as necessary to prevent accumulation of debris. Open channel intakes shall include a trash rack in the screen facility design which shall be kept free of debris. In

certain cases, a satisfactory profile bar screen design can substitute for a trash rack. The head differential to trigger screen cleaning for intermittent type systems shall be a maximum of 0.1 feet (0.03 m), unless otherwise agreed to by NMFS. It should be noted that, because the Tait Street Diversion currently has a "drum" type screen, the alternative CDFW/NOAA criteria for diversions under 40 cfs may apply. Final retrofit will be determined pending ongoing feasibility studies. Additionally, a feasibility analysis for horizontal wells, which also will prevent take of listed salmonids at this location, is also ongoing. Upgrades to improve passage will be evaluated and incorporated as appropriate.

In addition to this measure, the City operates under specific BMPs for fish ladder and fish screen maintenance (see Section 7.3.2). These measures, together with planned facility upgrades and bypass flow provisions, will avoid the effects of facility operation on migration of Covered Species.

Stream flows

Diversion of flow at the Tait Street Diversion potentially influences migration and rearing of Covered Species in downstream reaches. There is no suitable spawning habitat downstream of the Tait Street Diversion for coho. Rearing habitat is too warm for coho.

The San Lorenzo River is a high priority for restoration. It is a large watershed with extensive anadromous habitat (approximately 26 miles of anadromous habitat in the mainstem and 57 miles in the tributaries) (ENTRIX, Inc. 2004b). The San Lorenzo River potentially supports coho.

The strategy for streamflow restoration below Tait Street emphasized improving rearing conditions, particularly as inflow to the lagoon during the summer. This entails preserving storage in Loch Lomond Reservoir to support reduced summer diversions, particularly in drier years. As a result, winter bypasses for adult migration were more limited, also in part since ample opportunities for migration could still be achieved. A schedule of instream flow targets to minimize effects of the Tait Street Diversion under the Permit is presented in Table 7-8 and described as specific measures as follows.[19]

Measure WS-41: Provide 8 cfs minimum bypass flow for rearing juvenile steelhead and lagoon inflows in the San Lorenzo River below the Tait Street diversion in dry and very dry hydrologic conditions (Table 4-8). This is approximately 60% of the maximum habitat index for steelhead rearing in the reach (HES 2014b).

[19] The City has committed to a number of measures for steelhead through the HCP developed for steelhead and coho under the federal Endangered Species Act. The steelhead measures and supporting data are included in this application for the potential benefit provided to coho.

Measure WS-42: Provide up to 18 cfs minimum bypass flow for rearing juvenile steelhead in the San Lorenzo River below the Tait Street diversion and for inflow to the lagoon in normal, wet, and very wet hydrologic conditions (Table 4-8). This is approximately 80% of the maximum habitat index for steelhead rearing in the reach (HES 2014b).

Measure WS-43: Provide minimum bypass flows for adult migration downstream of Tait Street with a lower flow threshold of 17 cfs and an upper threshold is 25.2 cfs in December through March of dry and very dry years. Adult migration bypass flows are to be provided whenever flow would be at this level without City diversions and when storage in Loch Lomond Reservoir is sufficient (Table 7-8), otherwise provide bypass flow for 3 consecutive days per week or 5 consecutive days depending on Loch Lomond Reservoir storage levels (Table 7-8).

Measure WS-44: Provide minimum bypass flows for adult migration downstream of Tait Street with a lower flow threshold of 17 cfs and an upper threshold is 25.2 cfs in December through April of normal, wet, and very wet years whenever flow would be at this level without City diversions (Table 7-8).

Measure WS-45: Provide minimum smolt migration flows of 10 cfs during January through May in dry, normal, wet, and very wet hydrologic conditions, and for at least 3 consecutive days per week in very dry conditions during March through May (Table 7-8). If the City determines that conditions will require diversion of stored water from Loch Lomond Reservoir that cannot be offset by diversions at Felton, or from Liddell and Majors Creeks, the City may further reduce smolt outmigration requirements at the Tait Street Diversion provided that: (a) drought has been officially declared; and (b) this reduction in smolt outmigration opportunities will not reduce smolt migration more than one full day/week in the lower San Lorenzo River system or there is evidence from the San Lorenzo River or neighboring watersheds (i.e. Scott Creek) indicating that smolt migration is no longer occurring.

Measure WS-46: Implement a ramping rate during flow changes at the Tait Street Diversion to limit flow reductions such that change in stage is no greater than 0.16 feet per hour when fry may be present (January 15 through May 31) and no greater than 0.3 feet per hour at other times.

The point of compliance for these flows is the City maintained stream gage immediately downstream of the Tait Street Diversion. Tributaries contribute additional flow below the diversion though this contribution is limited, particularly in the dry season. These include Pogonip Creek, Branciforte Creek, Pasatiempo Creek, Arroyo de San Pedro Regaldo, and Ocean Villa Creek.

Table 7-8: Minimum Instream Flows for Avoidance and Minimization of Effects on Steelhead and Coho Due to Operation of the Tait Street Diversion

	Minimum Flow in the San Lorenzo River below Tait Street (cfs)								
	Rearing Baseflow					Migration		Spawning[1]	
	Hydrologic condition 5 80-100% (driest)	Hydrologic condition 4 60-80% (dry)	Hydrologic condition 3 40-60% (normal)	Hydrologic condition 2 20-40% (wet)	Hydrologic condition 1 0-20% (very wet)	Adult[2]	Smolt Migration[3]	Spawn	Incubate
Jan	8	8	15.8	16.4	17.5	17/25.2	10		
Feb	8	8	15.9	16.7	18.0	17/25.2	10		
Mar	8	8	16.3	17.3	18.2	17/25.2	10		
Apr	8	8	17.2	17.9	18.4	17/25.2[4]	10		
May	8	8	17.7	18.2	18.5		10		
Jun	8	8	16.6	18.1	18.5				
Jul	8	8	12.4	15.8	18.2				
Aug	8	8	9.8	11.9	16.4				
Sep	8	8	9.0	11.1	13.3				
Oct	8	8	9.8	11.4	13.3				
Nov	8	8	12.5	14.1	16.4				
Dec	8	8	15.1	16.2	17.6	17/25.2			

[1] No spawning occurs in this reach.
[2] Adult migration flows may be reduced to 3 consecutive days a week if storage levels in Loch Lomond Reservoir fall below the following levels (MG): Dec-1900 MG; Jan-2,000 MG; Feb-2,100 (MG); Mar-2,200 (MG). Further, adult migration flows may be reduced to 5 consecutive days after each storm event that exceeds 17 cfs if storage levels in Loch Lomond Reservoir fall below the following levels: Dec-1600 (MG); Jan-1700 (MG); Feb-1800 (MG); Mar-1900 (MG).
[3] During critically dry conditions (80%-100% Hydrologic condition) smolt outmigration flows shall be provided at least 3 days per week in March, April, and May. If additional water is determined to be required, the City may further reduce smolt outmigration requirements at the Tait Street Diversion provided that: (a) drought has been officially declared; and (b) this reduction in smolt outmigration opportunities will not reduce smolt migration more than one full day/week in

the lower San Lorenzo River system or there is evidence from the San Lorenzo River or neighboring watersheds (i.e. Scott Creek) indicating that smolt migration is no longer occurring.

[4] April adult migration flows provided in hydrologic conditions 1-3.

7.2.2 Reservoir Operations

This section describes the overall approach to minimizing the effects of the City reservoir operations.

Chemical Algaecide Treatment of the Reservoir

Operation of Newell Reservoir has the potential to indirectly affect Covered Species habitat related to treatment of the reservoir with algaecide containing copper but is expected to have minimal effects. Monitoring of copper levels below the reservoir has shown that copper levels are in compliance with applicable limits of the State Water Resources Control Board Basin Plan. Reservoir releases are further diluted in the San Lorenzo River and by additional downstream tributaries, including the Zayante Creek and Branciforte Creek watersheds. The following measures are meant to avoid or minimize effects of this activity to negligible levels.

Measure WS-47: Avoid application of algaecide except when algae blooms occur. In the case where reservoir overflow cannot be prevented or is imminent, allow algae to bloom and do not apply copper-containing aquatic pesticides.

Measure WS-48: Minimize copper application through use of peroxide-based algaecides whenever possible and GPS-guided application.

Measure WS-49: Adhere to the Aquatic Pesticide Application Plan.

Measure WS-50: Avoid release of treated surface water by application of algaecide at least 50 days before there is any potential for the Reservoir to spill (City of Santa Cruz Water Department 2005)

Measure WS-51: Lower the lake level prior to application of copper-containing aquatic pesticides if there is a risk of rain by drawing more water to the plant for treatment, releasing reservoir water from the deluge valve, and/or increasing release through the creek flow maintenance system.

Measure WS-52: Implement a monitoring program to assess the copper application, verify that application control goals are met, and to monitor copper discharges to Newell Creek through the fish water release.

Testing Deluge and Gate Valves

Testing of the deluge and gate valves on the dam can result in the discharge of approximately 100,000 gallons of moderate to low oxygen (1-6 ppm) at a range of 9-17˚C approximately) water to

Newell Creek immediately below the dam. The following measures should reduce the potential for effects to negligible levels (below the threshold for take):

Measure WS-53: Do not release water warmer than 18 ˚C.

Measure WS-54: Release discharge into boulders/broken concrete below the dam to prevent scour of the streambed and provide aeration.

Measure WS-55: Monitor DO and turbidity levels just below the Newell Creek Dam road crossing to confirm aeration of released water and control of turbidity. Discontinue releases if adverse levels are observed.

Measure WS-56: Meter out releases so that changes in streamflow are minimized and mimic the natural rise and fall of a natural hydrograph. Record flows at the stream gaging station located several hundred feet downstream of the dam.

Measure WS-57: Conduct releases at times when lake coppering is not occurring, or otherwise ensure that releases do not have copper levels higher than that allowable by the Basin Plan.

Woody Debris Removal on Reservoir Face

The presence of Newell Creek Dam prevents the movement of woody debris to downstream reaches. Woody debris can be an important component of habitat for coho. On average, there are 10 cubic yards of wood removed annually. Larger pieces are set aside for later use in instream restoration projects. Effects of this activity cannot be completely avoided but could be mitigated through projects that install large woody structures in downstream reaches, possibly in combination with gravel enhancement.

Measure WS-58: Continue the practice of reserving larger pieces of wood for use in restoration projects.

7.3 Water System Operations and Maintenance

This section describes the overall approach to minimizing the effects of the City's operations and maintenance activities related to water systems operations and maintenance. There are general measures in place that apply to work around water bodies and avoid or minimize effects to Covered Species and their habitats. These measures include:

Measure WO-1: Conduct activities outside of the wetted channel whenever feasible by timing work to the low flow season or by utilizing equipment or methods that do not require access in the channel.

Measure WO-2: Conduct activities during the low flow season (June through October) whenever possible.

Measure WO-3: Minimize sediment input into the channel by installing erosion control devices and fencing as appropriate.

Measure WO-4: Store construction materials outside of the stream channel area and cover loose soils and materials while stored.

Measure WO-5: Minimize disturbance to banks and riparian vegetation. Proactively restore impacted riparian vegetation with native species.

Measure WO-6: Minimize removal of overstory/canopy trees that provide shade to the stream channel or banks through marking trees to not be removed.

Measure WO-7: Limit management of vegetation that is stabilizing the stream banks to trimming and pruning.

Measure WO-8: Remove non-native vegetation where accessible and where removal would have demonstrable habitat benefits.

If work within the wetted channel cannot be avoided, the following measures will be implemented.

Measure WO-9: Isolate the work area and bypass flowing water around the work site.

Measure WO-10: Relocate fish from areas to be dewatered to nearby suitable habitat (see Measures WO-24 through WO-32 for fish relocation measures).

Measure WO-11: Remove any foreign materials from the channel before re-watering.

Measure WO-12: Minimize potential for hazardous spill from heavy equipment by not storing equipment in the channel and equipping vehicles with spill kits.

Measure WO-13: Refuel vehicles a minimum of 50 feet outside the channel.

Measure WO-14: Develop staff training manual for working in waterways and protecting water quality. The manual will describe applicable conservation measures, agency and permitting authorities, biological issues, and habitat types and for conducting work in waterways and for protecting water quality. This manual will be distributed to field staff and via the City's intranet system. Annual field training will accompany the manual.

These general measures apply whenever work is performed near water. Avoidance and minimization measures for specific activities conducted under Water System Operation and Maintenance are described in the following sections.

7.3.1 Water Diversion Sediment Management

Laguna, Reggiardo and Majors Creek diversions on the North Coast are concrete impoundments that can collect sediment and debris during storm flows. The Reggiardo impoundment has filled with sediment and is only minimally functional (Chapter 3). The City diversions do not create sediment, but sediment may accumulate behind the dams during storm flows and if the diversion is not properly operated this sediment may be passed downstream in a concentrated plug. These sediment plugs may impair habitat for production of benthic macro-invertebrates as a food source for Covered Species, and impair habitat for spawning, egg incubation, and juvenile rearing. Implementation of the following measures will avoid effects to coho habitat in the North Coast streams.

Measure WO-15: Until completion of rehabilitation projects provided in WO-17, operate diversions to pass the bedload and suspended sediment through the impoundment on stormflows by opening a slide gate in the dam face during the ascending hydrograph and then closing it again on the receding limb. At the Liddell Spring Diversion crack the valve to allow sediment to pass through without accumulating in the spring box and to allow transport of the peak of the hydrograph when necessary.

Measure WO-16: Remove any sediment that does collect behind the dams or in the Liddell Spring Box using hand tools, suction pumps, backhoes or vacuum equipment during the dry season (August – October) or in occasional emergency conditions in the winter time during low flow conditions. Remove sediment from site immediately or store it temporarily on site with appropriate sediment and turbidity containment.

Measure WO-17: Rehabilitate Laguna Creek diversion, Reggiardo Creek diversion, and Majors Creek diversion to allow flow and sediment to move naturally down the stream channel during high flows and avoid any potential for "pulsing" of sediment to downstream habitat (Chapter 3).

7.3.2 Fish Ladder and Screen Maintenance

The only City facility with a fish ladder is the Felton Diversion on the San Lorenzo River.[20] If the ladder becomes clogged with debris it can impair migration of Covered Species. There are fish screens at each of the diversions. Design screen face velocities can be altered by accumulation of debris on the screens, increasing the potential for impingement of smaller fish. Damage to the screens or seals can result in entrainment of susceptible life stages into the diversion. Although no issues with impingement or entrainment of fish have been observed at any of these facilities, inspection and maintenance measures will ensure such effects are avoided or minimized.

Measure WO-18: Inspect fish ladder 2-3 times per week or daily during storm flows and manually clean and remove debris as needed. Remove debris from site and dispose at approved waste disposal facility.

Measure WO-19: Inspect all fish screens daily and manually clean and remove debris from screens and debris racks as needed.

7.3.3 Pipeline Operations

Adequate operation of the water transmission lines requires system flushing and repairs and specialized operations, including pumping from clearwells to prevent sand accumulation and valve blow-offs to prevent breaks in the transmission lines.

Conveyance Pipeline System Inspection and Repairs

The City's two major raw water conveyance lines are the Newell Creek Conveyance Pipeline and the North Coast Conveyance Pipeline (Chapter 3). Discharges from leaks on these pipelines may cause erosion and turbid runoff to surface waters when located adjacent to waterways. Pipeline routes are regularly inspected for leaks and pipeline rights of way are maintained to allow for inspection of the pipeline. Repairs are conducted under the oversight of environmental monitors, and include relevant avoidance and minimization measures as provided in Chapter 7 and standard City SOPs (Appendix 10: *Pipeline Repair and Flushing Standard Operating Procedures*).

The potential for effects to coho from pipeline maintenance and repair is very low. Major pipeline leaks are an isolated and infrequent occurrence. Construction practices and BMPs to minimize and avoid sediment discharge to water courses, and contain sediment and spills are expected to result in negligible effects of this activity to coho (Measures WO-1 through WO-14, Section 7.3).

[20] Should the future rehabilitated Tait Street Diversion include a fish ladder, similar activities will also occur there.

Finished Water Pipeline System Flushing and Repairs

The finished water pipeline distribution and conveyance system includes approximately 300 miles of pipeline in the water distribution area (Chapter 3). The distribution line must be kept clean of bacteria and contaminants and requires testing for hydrant capacity as well as pipeline repairs. As described in Chapter 5, flushing at high velocities can erode soil and cause instability, uproot vegetation and cause drainage problems. Chlorine is toxic to nitrifying bacteria and other aquatic life, including the Covered Species. Spikes of ammonia and nitrite result in gill damage in fish, which can cause respiratory failure and suffocation.

Three SOPs (SOP nos. 7102-01, 7102-02 and 7105-01) describe the procedures to be followed when flushing any part or portion of the distribution system for the reduction of impacts of potential chlorine and sediment discharges. The SOPs provide details on dechlorination and flushing procedures as well as follow-up water quality testing for turbidity, chlorine residual, temperature, and pH. In addition, the Department's coverage under the Statewide General NPDES Permit for planned and emergency Drinking Water System Discharges (order WQ 2014-0194) describes procedures for BMPs and monitoring to be followed when flushing and repairs result in discharges to waters of the United States. Dechlorination is accomplished by addition of sodium sulfite tablets or ascorbic acid solution to the discharge flow. For main flushing, hydrant testing, or main dewatering through a blow off, a dechlorinating diffuser assembly is typically used. Additionally, Vactor trucks or flushing directly to the sewer line are used to prevent discharges when feasible. See Appendix 10: *Pipeline Repair and Flushing Standard Operating Procedures* for SOP details. See Appendix 11: *Drinking Water Discharge General NPDES Permit.*

Other measures may include preventing riparian erosion and hydromodification by implementing flow dissipation, erosion control, and hydromodification-prevention measures; and minimizing sediment discharge, turbidity, and color impacts by implementing sediment, turbidity, erosion, and color control measures.

Measure WO-20: Follow Stormwater SOPs, including SOP 7102-01 Superchlorinated Potable Water Discharges, SOP 7102-02 Low-Chlorine Potable Water Discharges, and SOP 7105-01 Sediment and Turbidity Control During Open Channel Water Discharges.

Measure WO-21: Follow Sediment Control for Open Water Channel Discharges – Water Department SOP #8300-01, including procedures for controlling sediment during main or service break repair activities and any other activities that involve open channel discharges to the storm drain system or receiving waters. This includes use of vacuum truck to eliminate discharge; filtration with pea gravel bags before discharge to storm drain; and overland filtration.

Pumping Well Return to San Lorenzo River

As described in Chapter 5, there is virtually no effect from this activity on Covered Species and no avoidance or minimization measures are required.

North Coast Valve Blow Off to San Lorenzo River

When pressure in the North Coast Pipeline threatens to rupture the line, water is discharged to the San Lorenzo River at the Coast Pump Station at the Tait Street Diversion (Chapter 3). The approximate amount of discharge during this operation ranges from 5-10 cfs. The water is discharged over rip-rap to the San Lorenzo River downstream of the intake. Recently installed pressure relief valves minimize the potential for this occurrence. There is very little potential for effects from this activity on Covered Species and no avoidance or minimization measures are required.

7.3.4 Dewatering of Creeks for Maintenance and Repairs

The City performs various types of instream work including, repair and maintenance of diversion facilities, sediment management, fish ladder and fish screen maintenance and repair, pipeline operations and maintenance, flood control and stormwater maintenance, vegetation management, and aquatic habitat management. During the course of instream work for various purposes (Chapter 3) it is often necessary to dewater up to 200 feet and otherwise disturb portions of stream channels. In order to minimize effects of these activities on aquatic species, including Covered Species, the City captures aquatic species in the project area and relocates them to suitable habitat outside the project area. The following measures will be implemented to minimize and avoid effects to Covered Species from these activities.

Measure WO-22: If work areas are to be de-watered, as many individuals of the Covered Species as possible will be captured and relocated prior to draining the site. The work area will be isolated with block nets and Covered Species will be captured, transported in buckets, and released in the most appropriate habitat (i.e., similar habitat conditions) immediately adjacent to the de-watered area. Methods will be determined based on the site conditions but may include electrofishing, dipnet, or seine. The number of individuals relocated will be estimated for each species prior to release. As the work site is de-watered, the remaining pools will be inspected for presence of Covered Species. Handling and holding time will be minimized to the maximum extent practicable.

Measure WO-23: Only NMFS-approved biologists will participate in activities associated with the capture, handling, and monitoring of Covered Species. The City will provide NMFS with the names and credentials of personnel proposed to conduct these activities for review and approval at least 15

days prior to the onset of the activities. No capture, handling, or monitoring activities will begin until NMFS notifies the City in writing that the biologist(s) is approved.

Measure WO-24: Prior to the onset of activities that result in disturbance of potential Covered Species habitat or individuals, a NMFS-approved biologist will conduct a training session for all construction personnel. At a minimum, the training will include: a description of the Covered Species and their' habitat; the importance of the species and their habitat; the general measures that are being implemented to conserve the species as they relate to the project; and the boundaries within which the project may be accomplished. Brochures, books, and briefings may be used in the training session.

Measure WO-25: A NMFS-approved biologist will monitor the work site until all removal of Covered Species, and habitat disturbance have been completed. After this time, the City will designate a person to monitor on-site compliance with all minimization measures. The approved biologist will ensure that this individual receives training in the identification of Covered Species and on the topics outlined above in Measure WO-26. The monitor and the approved biologist will have the authority to halt activities to avoid death or injury to individuals of the Covered Species. If work is stopped, the City will notify NMFS of the event within 48 hours.

Measure WO-26: If a work site is to be temporarily de-watered by pumping, intakes will be completely screened with wire mesh not larger than five millimeters (mm) to prevent Covered Species from entering the pump system. Water will be released or pumped downstream at an appropriate rate to maintain instream flows during construction. Upon completion of construction activities, any barriers to flow will be removed in a manner that would allow flow to resume with the least disturbance to the substrate.

Measure WO-27: If project activities could degrade water quality, the existing water quality parameters will be determined (e.g., temperature, DO, pH, and turbidity) prior to the onset of work. Water samples will be taken in a manner that minimizes disturbance, injury, or mortality of Covered Species. Results will be used to monitor water quality parameters during and after maintenance and sediment removal activities.

Measure WO-28: Work activities will be conducted between July 1 and October 31 to the maximum extent practicable. Should the City need to conduct activities outside this period, it will notify NMFS.

Measure WO-29: If the substrate of the natural stream channel is altered during work activities, it will be graded or otherwise restored to approximate natural conditions after the work is completed.

Measure WO-30: The number of access routes, number and size of staging areas, and the total area of the activity will be limited to the minimum necessary to achieve the project goal. Routes and boundaries will be clearly demarcated, and these areas will be outside of sensitive riparian and wetland areas.

Measure WO-31: To mitigate for the small residual effects of this activity, the City will incorporate habitat improvement features with any scheduled (non-emergency) instream repair work whenever feasible. This could be relatively efficient since there will likely be heavy equipment on site for the repair work and habitat features (e.g. LWD, boulder placement, or additional riparian plantings beyond what is needed for bank stabilization) could be efficiently added. If installation of habitat features at the work site is judged to be impractical or not particularly beneficial, an offsite installation of similar dimensions will be installed elsewhere to achieve a 1:1 mitigation ratio.

7.4 Municipal Facility Operations and Maintenance

Municipal facility operations and maintenance activities include operation, rehabilitation, replacement, repair and maintenance of existing infrastructure and related facilities, flood control maintenance, stormwater maintenance, and vegetation management. This section describes the overall approach to minimizing the effects of the City's operations and maintenance activities related to municipal facilities.

7.4.1 Flood Control Maintenance

This section describes the overall approach to minimizing the effects of the City's flood control maintenance activities which are conducted to prevent flooding of city waterways and damage to public and private property. These activities can occur anywhere on City facilities and properties in the HCP Plan Area but are largely centered on the San Lorenzo River and Branciforte Creek FCC.

The major effect of the FCCs has been through extreme habitat alteration as a result of its construction. Given the scale of alteration through construction, maintenance has relatively contained effects. The City has worked with the Corps of Engineers to incorporate growth of limited riparian vegetation into the maintenance parameters for the FCC. Flood control maintenance includes debris/obstruction removal, sediment management/removal, and vegetation management (Chapter 3). The San Lorenzo River FCC has habitat components that support salmonid adult migration, smolt migration, and rearing. Sediment and vegetation management has the potential to alter this habitat to the detriment of salmonids. The Branciforte Creek FCC has structural components that likely impede adult salmonid migration and diminish suitability for smolt migration and juvenile rearing (bare concrete rectangular channel with minimal central low-flow channel).

Accumulation of sediment in the Branciforte FCC can lead to development of minimal habitat features including riffle-pool sequences and colonization of cover producing vegetation. When sediment bars and vegetation are present, fish species including juvenile steelhead and lamprey, can occupy the habitat in low numbers and there is potential for improved conditions for migration (HES 2003b).

Debris/Obstruction Removal

Debris/obstruction removal has the potential to damage aquatic habitat and even cause direct injury or mortality to Covered Species. Removal of logs, root wads, and other large woody material removes potential habitat elements and can result in simplification of the habitat and loss of material that would have provided valuable cover. Instream work with heavy equipment may directly impact Covered Species if they are present in the area and contacted by machinery or moving objects.

The following measures, in addition to WO-1 through WO-14, will avoid and minimize effects of this activity.

Measure MF-1: Only remove material that creates a hazard to life, property, infrastructure, or public safety.

Measure MF-2: Involve a biologist with knowledge of Covered Species habitat needs as part of the team that evaluates need to remove materials and methods to be used. Have work overseen by environmental monitors and implement standard measures for instream work (See preceding).

Measure MF-3: Whenever possible leave natural habitat-forming material in the stream by moving it downstream of structures to be protected or cutting larger material into smaller segments that may float downstream in larger flows, as long as these segments retain habitat forming characteristics.

Measure MF-4: Allow retention of up to 3-foot square root wads in the channel every 500 feet for habitat value, provided there are no undesirable changes in channel hydraulics and provided such root wads do not show signs of developing into larger log jam structures in the future.

Flood Control Sediment Management/Removal

Accumulation of sediment in City waterways can provide habitat for benthic invertebrates and certain vertebrate species such as larval Pacific lamprey. Accumulated sediment also forms a matrix for establishment of rooted aquatic, emergent aquatic, and riparian vegetation including shrubs and trees. Together these features have the potential to create habitat suitable for Covered Species. Although this habitat is somewhat degraded and transient, its removal has the potential to effect

Covered Species that are using it, both through removal of habitat and potential direct harm resulting from use of equipment for removal of vegetation and sediment.

Sediment removal in the FCCs is conducted in habitat that is degraded by construction of the channel. Few Covered Species are present in much of the area where sediment is to be removed. Sediment removal in the Branciforte FCC occurs annually, primarily in the lower part of the channel. Sediment accumulation in this reach forms limited amounts of low-quality potential rearing habitat in a short section of the channel (HES 2014c). The potential habitat in the FCC represents an insignificant component of the total rearing habitat in the watershed. The 2004 Biological Opinion for sediment removal from the project concluded that the steelhead rearing capacity of Branciforte Creek was reduced with construction of the concrete FCC and remains reduced with ongoing channel maintenance activities (NMFS 2004). Branciforte Creek upstream of the concrete FCC provides 10.5 miles of salmonid spawning and rearing habitat and another 8 miles in three major tributaries. Salmonid spawning in Brancifote Creek occurs upstream of the FCC as does higher quality summer rearing habitat (NMFS 2004). The value of any habitat that forms in the FCC via sediment accumulation and establishment of vegetation is limited and much larger areas of higher value habitat exist in the Creek and San Lorenzo River watershed (NMFS 2004). Impacts to Covered Species potentially rearing in areas where sediment removal will occur will be minimized by capturing and relocating them prior to sediment removal activities (Section 7.3.1).

The FCC reach of Branciforte Creek also provides migration habitat for access to the rest of the watershed. Removal of sediment and vegetation has the potential to change migration conditions but only in the lower part of the FCC where it occurs. If the presence of sediment and vegetation improves conditions for migration in the lower part of the FCC migration would still be limited by conditions in the remaining, upper part of the FCC. In the Biological Opinion for FCC Maintenance, NMFS did not expect that the quality of adult steelhead migration habitat would be reduced as a result of sediment and vegetation removal activities (NMFS 2004). Presumably this finding would apply to coho as well.

Measure MF-5: Conduct sediment removal only as necessary to maintain and/or restore capacity of stormwater conveyance facilities or to prevent flood events; define sediment removal areas in the San Lorenzo River FCC by cross section and HEC-6 analysis.

Measure MF-6: Conduct a pre-project survey to define important salmonid habitat areas, including riffles, pools, and runs, and avoid sediment removal in these areas.

Measure MF-7: Conduct annual surveys to identify vegetation characteristics and sediment aggradation within the San Lorenzo River FCC between Highway 1 and Soquel Avenue, and in the Branciforte Creek FCC.

Measure MF-8: In the San Lorenzo River FCC maintain a 5-foot vegetation no-work buffer along both sides of the wetted channel where sediment removal activities will not occur.

Measure MF-9: In the San Lorenzo River FCC disk bars annually during dry season to loosen root materials and promote scour. Encourage existing cross-channel scour areas through disking and manipulation of discarded root wads/vegetation material.

Measure MF-10: Do not conduct sediment removal in San Lorenzo River FCC downstream of Laurel Street.

Vegetation Management

Under current management practices vegetation management focuses on trimming or removing riparian vegetation that may impede storm flows, result in bank erosion, or result in damage to property. Growth of riparian vegetation in the San Lorenzo River FCC is allowed as long as the Army Corps of Engineers requirements for channel capacity and roughness criteria are met. Removal of aquatic and riparian vegetation has the potential to diminish habitat value for covered species and to directly harm Covered Species if work is conducted instream.

Measure MF-11: Do not remove mature riparian trees except in the San Lorenzo River FCC and Branciforte Creek FCC; riparian shrubs may be trimmed from ground level up to 6-8 feet in height. Remove cuttings from the work area and recycle as green waste at the landfill or chip and leave in place.

Measure MF-12: Avoid vegetation management in the wetted channel to the maximum extent practicable. For work in the wetted channel follow measures for in-channel work (WO-9 through WO-14).

Measure MF-13: Conduct vegetation management late in the dry season, preferably August.

Measure MF-14: Selectively remove riparian vegetation that could possibly undermine the stability of the levees or exceeds accepted Army Corps of Engineers' "Manning's n roughness coefficient" for the FCC. Retain a minimum 5-foot vegetated buffer on either side of the wetted channel.

Measure MF-15: In the reach from Highway 1 to Water St., allow 10-foot-wide strip of willow and alder along toe of levee. Willows allowed to grow to 3 inches dbh; alders allowed to grow to 6 inches dbh. Trim lower limbs of the alder trees to reduce flood impacts. Thin willows to favor providing overhanging cover to the low flow channel. Maintain a 5-foot buffer along wetted edges of channel, but thin groves and limb-up trees. Remove any trees in 5-foot buffer area that are greater than 6 inches dbh.

Measure MF-16: In the reach from Water St. to Laurel St. maintain a 10-foot-wide strip of woody riparian vegetation and tules and cattails on the west bank. Maintain east bank to keep trees overhanging water. Trees or branches that fall in the water may be left, cut into smaller pieces, or removed entirely if they cause an immediate safety hazard. Maintain sandbars to allow volunteer groves to establish but remove all trees greater than 6 inches dbh.

Measure MF-17: In the reach downstream of Laurel St. maintain a 5-foot-wide strip of willow, cattail and tule at the levee toe. Willows will be maintained with stem diameter of no greater than 0.5 inches and be limbed-up and periodically thinned to create defined groves.

7.4.2 Stormwater Maintenance

The City's Public Works Department maintains a system of drains, conduits, and pumps for the purpose of draining storm flows. The system can be a source of pollutants, increases peak storm flows in receiving waters, and minimizes percolation of rainfall into the ground.

The City developed and is implementing a Stormwater Management Plan (SWMP) in compliance with the NPDES Phase II General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) and for general reduction of pollutants in urban runoff. The City has also developed implementation plans for TMDLs for pathogens (Fecal Indicator Bacteria, (FIBs)) and sediment in the San Lorenzo River Watershed. The SWMP21 includes the following measures that avoid and minimize effects of stormwater discharges.

Measure MF-18: Continue to implement Municipal Operations/Pollution Prevention and Good Housekeeping Program to prevent pollutants generated by municipal operations and activities from entering the storm drain system by implementing measures to prevent or reduce pollutant runoff from municipal operations.

Measure MF-19: Continue Illicit Discharge Detection and Elimination Program is to detect and eliminate illicit connections and illegal discharges to the storm drain system from a variety of sources, including industrial facilities, commercial establishments, residential areas, and construction sites.

Measure MF-20: Continue Public Education Program to increase public awareness on urban runoff pollution issues, to educate the community about specific sources of pollutants and what people can do to reduce them, to foster participation through community-based projects or volunteer activities

[21] http://www.cityofsantacruz.com/government/city-departments/public-works/stormwater/storm-water-management-plan

focused on pollution prevention, and to decrease the amount of illegal dumping and polluted urban runoff that is discharged into the storm drain system.

Measure MF-21: Continue "Construction Site Stormwater Runoff Control Program" to protect the City's storm drain system and receiving waters from pollutants that may be discharged as a result of construction activities, including clearing, grading, excavation, landscaping, building, and remodeling of existing buildings. Minimize land disturbance at all permitted construction sites, protect water quality from pollutants generated by construction activities, and require measures to be implemented at all permitted construction sites.

Measure MF-22: Continue Post-Construction Stormwater Management to ensure that new developments and remodeled sites are designed and constructed in a manner that minimizes the alteration of natural watercourses and drainage patterns, as well as alleviating the impact of new developments or remodeling projects on a site's and surrounding natural hydrology.

Measure MF-23: Continue the Industrial Facilities Program to reduce urban runoff pollution generated by industrial facility operations and activities and to ensure that industrial facilities comply with the City's Stormwater Ordinance, mandatory measures, and Industrial Waste Discharge Permit requirements (as applicable).

Measure MF-24: Continue the Program Effectiveness Assessment and Improvement Plan to track annual and long-term effectiveness of the Stormwater Program at protecting water quality. Use results of the assessment to adaptively manage Stormwater Program by providing supporting documentation for proposed modifications.

Measure MF-25: Reduce pollutant loading from multiple City sources to the maximum extent practicable in the San Lorenzo River, San Lorenzo River Lagoon, Branciforte Creek and Carbonera Creek consistent with Implementation Plans for TMDLs for sediments and pathogens.22

Storm Drain Inspection and Cleaning

A variety of urban pollutants can flow to and accumulate in the storm drain system. These pollutants could ultimately be washed into receiving waters occupied by Covered Species. In response to this, the City implements an annual storm drain inspection and cleaning program, "Team Clean," to remove pollutants prior to them being transported by stormwaters (Chapter 3). The following

22 https://www.waterboards.ca.gov/rwqcb3/water_issues/programs/tmdl/docs/san_lorenzo/sediment/slr_sed_tmdl_proj_rpt.pdf
https://www.waterboards.ca.gov/rwqcb3/board_decisions/adopted_orders/2008/2008_0001_slr_path_tmdl_att_2_proj_rept_21mar08.pdf

elements of this program avoid and minimize effects of the storm drain system on Covered Species to the maximum extent practicable.

Measure MF-26: Use City developed GIS layer for storm drains to create preventative maintenance schedules for catch basins and inlets and maintenance tracking software system, CMMS Maintenance Connection, to help with scheduling and tracking inspections, cleanings, and upgrades of stormwater facilities.

Measure MF-27: Conduct CCTV camera inspections of storm drain lines as needed each year to help evaluate the condition of storm drain lines and identify repair needs.

Measure MF-28: Use Combination Sewer Cleaning unit23 or similar appropriate tool and hand cleaning to clean storm drains. Plug lines at both ends and employ combination unit, using reclaimed water, to "hydro-jet" the line, and then vacuum the line to remove sediment and other material. Dispose of resulting sediment and other material at the Resource Recovery Facility (landfill) after dewatering at the Wastewater Treatment Plant.

Measure MF-29: Inspect sediment basins and clean known problem basins (basins that collect large amounts of sediment and trash) at least monthly or more frequently during wet season. Dispose of collected debris at the Resource Recovery Facility.

Measure MF-30: Inspect and clean intensive-use basins semi-annually using a combination unit. Clean monthly during September and October. Dispose of collected debris at the Resource Recovery Facility.

Measure MF-31: Inspect and clean commercial basins annually.

Measure MF-32: Inspect residential basins on an eight-year cycle and clean, as necessary.

Measure MF-33: Inspect pump stations along San Lorenzo River weekly and clean at least bi-annually and after large storm events.

Measure MF-34: Inspect large diameter stormwater pipelines (including inlets, culverts, bar racks, screens, and vaults) annually, and clean at least on a five-year cycle.

Measure MF-35: Inspect small diameter stormwater pipelines (including inlets, culverts, and vaults) on a two-year cycle, and clean as needed or on a fifteen-year cycle.

[23] https://cdn2.hubspot.net/hubfs/6860826/FED12-Impact%20Brochure_1.20_WEB.pdf

Structural Retrofits and Storm Drain Inlets and Basins

The City focuses on two types of structural controls to improve water quality associated with the storm drain system: dry-weather diversion systems to divert flow to the sanitary sewer for treatment at the Wastewater Treatment Facility and sewer replacement projects in the Beach Flats area in order to reduce inflow/infiltration, including installation of Tideflex valves on multiple storm drain outlets along the San Lorenzo River. The valves open to release storm drain water through gravity flow into the river and close to prevent high river levels from back-flowing into the storm drain lines (Chapter 3).

There may be very limited potential for this activity to temporarily adversely affect Covered Species during project construction. These effects can be avoided and minimized through implementation of Measures WO-1 through WO-14 (Section 7.3).

Sanitary Landfill Stormwater Management

As described in Chapter 5, operation of the Santa Cruz Landfill has no effect on Covered Species and no avoidance or minimization measures are required.

7.4.3 Emergency Operations and Response

Emergency operations are developed in response to specific emergency incidents such as storms, floods, fire, earthquakes, and hazardous spills. Response may include the use of heavy equipment near waterways and removal of debris and structures in waterways, placement of bank revetment, excavation of sediment which occludes valves and pipelines, patching and shoring of pipelines and related actions to preserve the functions of City infrastructure. Measures discussed under Water System Operations and Management and Municipal Facilities Operations and Management for these activities are applicable to emergency situations as well.

7.4.4 General Vegetation Management Within Riparian Corridors

The vast majority of vegetation management activities occur on land with only limited proximity to stream courses supporting coho. For vegetation management in riparian areas refer to Measures WO-1 through WO-8. In addition, the following measures avoid and minimize the effects of this activity on Covered Species to the maximum extent practicable.

Measure MF-36: Trim vegetation using hand tools and maintain canopy, downed trees, and snags to the extent possible. Leave downed wood on the ground and lop only as required for fire safety or to facilitate moving downed wood off of roads and trails.

Measure MF-37: Remove non-native invasive plants through hand trimming and limited herbicide application according to the City's Integrated Pest Management Program.

7.5 Land Management

This section describes the overall approach to minimizing the effects of the City's land management activities.

7.5.1 Management of Loch Lomond Recreation Area and Watershed Lands

Activities associated with facility maintenance and management include facility repair, trail maintenance and management, trail construction, and road maintenance and decommissioning. These activities occur on all the open space properties owned by the City and in the Newell Creek and Zayante Creek watershed properties.

Trail Maintenance and Repair

City maintained trails can result in generation of sediments that find their way into watercourses inhabited by Covered Species. The City practices trail maintenance and management on open space and watershed lands to keep trails in good physical conditions and avoid mobilization of sediments. The following measures ensure that effects of this activity are fully avoided.

Measure LM-1: Restrict vehicle access during wet weather (except for emergency access); require use of ATVs for winter access.

Measure LM-2: Install drainage improvements such as culverts, dips, and bars; and realign trail segments to avoid sensitive habitats and steep slopes.

Measure LM-3: Remediate existing erosion areas on an annual basis.

Measure LM-4: Conduct ranger patrols to ensure appropriate use of trails and adherence to closures or restrictions. Remove unauthorized trails as resources permit.

7.5.2 Road Maintenance and Decommissioning

The City maintains roads on the watershed lands it manages. These roads potentially contribute increased sediment loads to water courses that may support Covered Species through erosion from road surfaces, slope failures, and culvert malfunction or failure. The following measures will be implemented to avoid and minimize effects of this activity on Covered Species.

Measure LM-5: Conduct all road work with the support of a Registered Professional Forester and Certified Erosion Control Specialist, with engineers also being involved on more difficult road projects (City of Santa Cruz 2010).

Measure LM-6: Use culverts: (1) to route drainages through the road prism; (2) where in-sloping has to be maintained to pick up bank seepage; or (3) to control drainage away from a landslide or road fill failure. Maintain culverts and trash racks; maintain proper energy dissipation at outlets; clear bank slough; conduct bank stabilization; and hand dig rolling dips and/or water bars as necessary to maintain appropriate drainage. Conduct culvert replacement or upgrades in July – September with hand tools and heavy equipment.

Measure LM-7: Maintain unpaved roads as out-sloped dirt roads, with rolling dips and/or water bars to manage drainage. Manage unpaved roads as "restricted use" roads that are not used in winter under saturated conditions. These roads may be rocked to reduce road surface sediment production, to improve access for patrols or emergencies, and to extend the season that the roads can be traveled.

Measure LM-8: Reshape roads periodically as needed to maintain out-slope drainage and as appropriate for the road and topography. Complete reshaping work within the existing road width and cut fill area for most roads to avoid additional disturbance to adjacent areas. Apply rock, straw, and seed to bare soil areas, as necessary.

Measure LM-9: Decommission roads that are not necessary for patrolling the properties for security and trespass concerns (off-road vehicles, poaching, camping, etc.); fire access, resource management and habitat restoration; and maintenance of drainage infrastructure. To the extent practicable, decommission roads that are significant sediment sources and that cannot be treated by maintenance activities (Chapter 3).

Measure LM-10: To the extent practicable, roads no longer required for Covered Activities in the Newell Creek and Zayante Creek watershed lands will be decommissioned. For roads traversing relatively mild slopes with few drainage structures (culverts), complete more severe out-slope or slope as close to natural grade as possible without generating excessive levels of disturbance. Construct frequent, large water bars where water may still concentrate on the road. For roads in steeper topography, remove all fill from the down slope portion of the road and place this material

on top of the roadbed cut surface (keyway) and compact against the existing cut bank. Construct a severe out-slope to bring the contour to as close to natural grade as possible. Restrict the area of disturbance associated with road decommissioning to the 14-16 foot width of the roadbed, plus an additional 15-20 feet for re-contouring of more benign roads, and 20-30 feet for the more difficult ones.

Measure LM-11: Install erosion control as necessary, including straw wattles, native duff, straw, jute netting, etc.

Measure LM-12: During road decommissioning, remove culverts by excavating the culvert fill with an excavator or backhoe, down to native grade, and removing the culvert. Restrict the area of disturbance associated with culvert removal to the 14-16 foot wide roadbed, plus the area to the outer edge of the fill (10-20 feet). Conduct additional work as needed for grade control and energy dissipation above and below the culvert removal site. Use gabion-sized rock to small rip-rap, or placement of large wood in the channel, as needed for channel stabilization upstream and/or downstream of the removed culvert. Restrict majority of channel adjustments from culvert removal to within 30-50 feet of the existing crossing.

Measure LM-13: Install erosion control measures for surface stabilization following culvert removal (straw, seed, straw rolls, blankets, etc.), and replant the disturbed area with native species, particularly conifer and riparian species.

Measure LM-14: Complete road decommissioning during June – September; select road segments that can be decommissioned, stabilized for erosion, and replanted with native species within one season. Conduct follow-up erosion control and further planting/care until the area is stabilized and growing.

7.5.3 Habitat Management and Restoration

Habitat management includes resource management activities to improve, preserve and maintain existing sensitive habitats and species on City properties. Activities include habitat management and restoration, and public education.

Aquatic Habitat Management and Restoration

Aquatic habitat management protects and enhances habitat for Covered Species by adding or protecting fisheries habitat features, stabilizing stream bank erosion problems, and removing fish passage barriers. This results in a long-term beneficial effect on Covered Species. Short-term

effects related to project construction will be avoided and minimized through implementation of WO-1 through WO-14 and the following measures.

Measure LM-15: Obtain appropriate state and federal permits prior to doing the work.

Measure LM-16: Complete projects in accordance with methods detailed in the California Salmonid Stream Habitat Restoration Manual (Flossi et al. 1998).

Measure LM-17: Complete work during the summer/ fall period (and before October 15), when streamflows are lower and work conditions are dry to minimize soil disturbance and mobilization, and the critical spawning and smolting periods are over.

Measure LM-18: Retain services of geomorphologists and aquatic biologists as necessary to consult on projects for design and implementation. Conduct ongoing physical profiling and biological surveys of project sites post-implementation to demonstrate effectiveness and provide feedback for future projects.

Monitoring

Monitoring activities involve access to sensitive instream and riparian habitat and capture and handling of protected species. The following measures are intended to avoid and minimize potential effects on coho and their habitat from monitoring activities.

Measure LM-19: Perform all monitoring activities under the guidance and supervision of the HCP Administrator or Conservation Program Manager in compliance with a Monitoring Manual prepared by the Conservation Program Manager. All individuals performing monitoring will have qualifying knowledge and experience and will be trained in implementation of the Monitoring Manual.

Measure LM-20: The monitoring program will be conducted in coordination with NMFS and CDFW through regular meetings (one to two per year) of an HCP Technical Advisory Committee.

Measure LM-21: Monitoring will be conducted under applicable Section 10, Scientific Collector's Permit, or other required authorizations. Standard practices for minimizing effects to protected species will be implemented.

7.6 Non-flow Conservation Fund

The application of avoidance and minimization measures will eliminate the effects of many of the Covered Activities on Covered Species. Some residual effects are unavoidable, however, including

diversion-related effects at most diversions, effects of sediment and vegetation management in the FCCs, and repairs conducted instream that involve dewatering. These effects are described in Chapter 5. To ensure that effects remaining after the implementation of avoidance and minimization measures are fully mitigated, the City will implement a compensatory mitigation program to fund enhancement and restoration of Covered Species habitat. This section describes the approach to compensate for the residual effects of Covered Activities through the funding of non-flow habitat improvement projects. Mitigation will focus on actions that improve salmonid habitat in the North Coast and San Lorenzo watersheds.

The mitigation program is designed to address key limiting factors in watersheds where Covered Activities take place. The mitigation program will prioritize measures that address the life-stage and/or location directly affected by a specific activity. In some cases, however, direct on-site conservation actions may be impracticable or of limited benefit to the species. As such, conservation actions funded may include areas outside the Plan Area or be focused on other life-stages than those directly affected by Covered Activities.

7.6.1 Program Need and Goals

7.6.1.1 Program Need

Adoption of bypass flows under the Permit will minimize and avoid many of the existing sources of potential incidental take related to City activities. Nevertheless, some residual effects to Covered Species remain after implementation of bypass flows. The NFCF will provide funding for restoration and enhancement projects that will fully mitigate for the effects of Covered Activities.

7.6.1.2 Program Goals

The goal of the NFCF is to mitigate for residual effects of Covered Activities after implementation of BMPs and avoidance and minimization measures previously outlined in the Plan. Because most other Covered Activities do not have residual effects on Covered Species, once BMPs and avoidance and minimization measures are implemented, the NFCF analysis focuses primarily on water operations. The NFCF program has been designed to:

- engender collaboration between the City and NMFS to address new conservation issues and opportunities as they arise – maximizing the impact of funds from the NFCF;
- enable the City to work with NMFS to identify and implement projects that directly address residual effects to Covered Species, and also provide benefits to species habitat more generally and result in more resilient watersheds.

- create a program that balances administrative oversight and procedures for accountability with flexibility so that funding can be directed to projects that will provide the greatest conservation benefit.

7.6.2 Program Oversight and Decision-making

While implementation of the NFCF will require collaboration between the City and the agencies, the City will be responsible for implementing the program. The NFCF will be managed by the HCP Administrator.

The City will work with NMFS, CDFW, and an array of local partners (including private landowners) to develop a working list of potential NFCF projects. The City will propose projects from this list for approval by NMFS and CDFW. The City, NMFS, and CDFW will form a TAC to collaboratively develop the working NFCF project list, to review project concepts, and to provide design-level review of selected projects at key milestones (e.g. conceptual designs, 60% designs, etc.) during the planning process. Suggested projects can come from the agencies and others, including through a call for proposals. After review of potential project opportunities, the City will propose a project or suite of projects to NMFS and CDFW members of the TAC for approval. Projects that cannot garner support from both agencies will not be funded.

The TAC will use the following metrics to assess a given project for funding[24]:

- Does the project have the potential to benefit coho recovery?
- Does the project address a known residual impact resulting from implementation of the Permit?
- Does the project address a known limiting factor (as articulated in the Coho Recovery Plan) for the Covered Species?
- Does the project enhance watershed conditions that lead to ecological resilience and healthy aquatic environments?
- Does the project have landowner support and stakeholder support necessary to ensure implementation?
- Are there any known constraints (stakeholders, technical, etc.) that are likely to significantly impede the ability of this project to be completed?
- Do the costs, in terms of financial commitment from the NFCF, and benefits to covered species compare favorably to other potential project opportunities?

[24] Projects may include actions that remediate adverse effects to habitat caused by third-party violations of natural resource laws. Recovery hatchery support will be prioritized as appropriate and in consultation with the TAC. Timing of projects is contingent upon TAC priorities and financial projections described in Chapter 9.

- Is the estimated timeline for design, permitting, and construction within a 1-3 year window based on expected complexity of the project?

Potential projects will be evaluated over a planning cycle of 5 years. The 5-year project list can be revisited, as needed, during the planning cycle to address changed conditions or new opportunities. The number of projects selected for funding through the NFCF will vary for each 5-year planning cycle based on the size and complexity of projects. It is expected that most projects funded through the NFCF will require a 1-3 year project timeline from initial planning to construction.

7.6.3 Quantifying and Linking Impacts and Benefits

Ideally, impacts can be translated into a transparent, meaningful, and accurate common spatial metric such as acres, linear feet, etc. to enable translation into adequate mitigation. Creating this common variable for this process is particularly complex in light of the fact that the residual impacts identified through the Plan (such as those resulting from ongoing water diversion) utilizes comparative metrics or metrics of "change" (e.g., relative passability) versus specific spatial metrics. While the comparative metric approach makes sense for understanding the relative effects of the City's water diversions and operations, it does not enable simple translation to an absolute quantity of residual impact on physical habitat features. Moreover, the temporal nature of the impacts (impacts appearing only in certain water years) and biological scope of the impacts (impacts affecting only a specific life history stage) further complicate the calculus of developing an absolute (versus relative) spatial metric. Without a clear precedent in the literature or template for translating these impacts into a common spatial metric, the "Ecological Portfolio Method" was developed to translate residual impacts into a hybrid quantitative-qualitative mitigation metric (ecological portfolio) and then into a purely quantitative mitigation metric (dollars).

One of the most critical tasks for development of the NFCF has been creating a clear and direct link between the potential project types that could be funded and the specific residual impacts identified. Table 7-9 displays this linkage by providing both a summary of the modeled residual impacts and a linked ecological portfolio of potential NFCF projects that would directly off-set these impacts. It is important to note that while the residual impacts are generally limited to a specific life history stage and/or water year type, many of the potential projects that would be implemented through the NFCF provide benefits across life history and water year types. An example of this might be placement of LWD structures to offset impacts to rearing in dry years. While these structures will provide deeper pools and pool tail-outs, which will increase summer rearing opportunities, if designed correctly they can also provide high flow refuge during wet winters and improve spawning opportunities through better substrate sorting.

Table 7-9 represents a conceptual approach for identifying the appropriate level of non-flow conservation. The Ecological Portfolio concepts identified in this table for the purpose of estimating the financial size of the NFCF may or may not become the actual projects funded under the Plan. The actual projects selected for funding will be determined by the TAC based on restoration opportunities and priorities during Plan implementation. In Chapter 9, Table 9-3 sets out the schedule and cost allocation of the $8 million to fund twenty-two proposed projects over the thirty-year term of the Plan.

The following description of conservation projects and cost summaries is for both steelhead and coho because it was initially developed by the City for the HCP for both species. Conservation projects applicable to coho are clearly noted for this application.

Table 7-9: NFCF Linkage between Residual Impacts and Ecological Portfolios[25]

	Residual Effect after Avoidance and Minimization			Possible Ecological Portfolios to Mitigate Residual Impacts		
Reach	***Steelhead***	***Coho[3]***	***Areal Extent***	***Action***	***Unit***	***Estimated Cost***
Laguna Anadromous	Small decrease in habitat suitability index (WUA) for spawning in normal (6% reduction) and wet (6% reduction) years	NA	1.4 mile anadromous reach with estimated 180 ft^2 of spawning gravel (2 square feet per 100 feet of stream) (ENTRIX, Inc. 2004)	Expand lower floodplain by 0.5 acres and complete Riparian corridor restoration along ~1.8 acres of SP property	2.3	$ 555,036
				Remove defunct bridge, abutments, and restore slope on Coast Rd (cost equivalent to small dam removal)	1	$ 151,650
	Moderate reduction in the habitat suitability index (WUA) for rearing by 16% in wet years and 6% in normal years	NA	1.4 mile anadromous reach	Install 14 anchored LWD structures in low 3/4 miles (~ every 200 ft)	14	$ 257,497
Liddell Anadromous	Decrease in number of days with suitable conditions for adult migration in normal (9% reduction to 86 days), dry (42% reduction to 23 days) and critical dry years (31% reduction to 9 days)	NA	1.2 mile anadromous reach	San Vicente Creek as a proxy for Liddell and Majors[1]		

[25] Residual effects due to reduced wetted habitat resulting from water diversion at stream cross sections is translated from left to right in the table above more broadly into areal extent of habitat impacts in the respective stream and then into compensatory actions in the ecological portfolio. Unit refers to the number of project elements (i.e. one bridge, 2.3 acres, etc.). Costs estimated from comparable projects that have been recently planned or completed and include permitting/administrative costs.

	Decrease in WUA for spawning in normal (10% reduction), dry (31% reduction) and critical dry years (38% reduction)	NA	1.2 mile anadromous reach with estimated 716 square feet of spawning gravel (11 square feet per 100 feet of stream)			
	Decrease in WUA for rearing in wet (20% reduction), normal (23% reduction), dry (40% reduction) and critical dry years (44% reduction)	NA	1.2 mile anadromous reach	Cost share with County of Santa Cruz Sanitation District and others in the effort to develop a new, more sustainable water source for Davenport, which would improve instream flows for Covered Species.	lump sum	$ 500,000
	Decrease in number of days with suitable conditions for smolt migration in normal (6% reduction to 141 days), dry (35% reduction to 99 days) and critical dry years (57% reduction to 61 days)	NA	1.2 mile anadromous reach	Remove or modify 2 Mill Creek dams for fish passage and develop a new back-up intake for Davenport that enables fish passage to ~0.5 mile of stream and add 10 unanchored LWD structure in Mill Cr to improve rearing and spawning.	2 & 10	$ 587,883
Majors Anadromous	Decrease in WUA for spawning in normal (5% reduction), dry (23% reduction) and critical dry years (17% reduction)	NA	0.7 mile anadromous reach with estimated 49 square feet of spawning gravel (1.3 square feet per 100 feet of stream)	Restore downstream floodplain/backwater, remove historic spoils, and reconnect to mainstem (~1 acre) to improve rearing conditions for both species.	1	$ 895,695
	Decrease in WUA for rearing in all year types (20% to 24% reduction)	NA	0.7 mile anadromous reach	Cost-Share continue Cape Ivy and Clematis eradication efforts for 5 years to reduce overall potential impacts to riparian corridor, shade, and future LWD recruitment.	lump sum	$ 250,000

	Decrease in number of days with suitable conditions for smolt migration by 3 days in dry years (12% reduction) and 1 day in critical dry years (11% reduction)	NA	0.7 mile anadromous reach			
	Residual Effect after Avoidance and Minimization			**Possible Ecological Portfolios to Mitigate Residual Impacts[2]**		
Reach	*Steelhead*	*Coho[3]*	*Areal Extent*	*Action*	*Unit*	*Estimated Cost*
San Lorenzo below the Tait Street Diversion[4]	Decrease in WUA for rearing in wet (9% reduction), normal (15% reduction), dry (16% reduction) and critical dry years (15% reduction)	NA	Up to 1.4 miles of riverine habitat, including 0.9 miles of FCC, depending on lagoon stage, and up to 1.5 miles of lagoon habitat	Create shade, scour and refugia for rearing in lagoon/tidal areas downstream of Laurel Street through installation of 10 dynamic anchored LWD clusters	10	$ 390,237
	Decrease in number of days with suitable conditions for adult migration in dry (8% reduction to 133 days) and critical dry years (28% reduction to 105 days)	Decrease in number of days with suitable conditions for adult migration in normal (11% reduction to 55 days), dry (20% reduction to 47 days) and critical dry years (32% reduction to 40 days)	Access to 25.8 miles of anadromous steelhead habitat in the mainstem and substantial additional miles in tributaries; up to 6 miles in the mainstem for coho and 20.8 in tributaries	Install 20 "notched" rock weirs, anchored LWD and/or off-set wood or rock structures to focus low flows, and improve conditions for resting and rearing, along ~1 mile between Tait Street and Water Street	20	$ 1,202,941
	Decrease in number of days with suitable conditions for smolt migration in critical dry years (28% reduction to 105 days)	Decrease in number of days with suitable conditions for smolt migration in critical dry years (28%		Remove or modify 2 mainstem San Lorenzo River dams (Lewis & Barker) plus 1 tributary dam to improve movement throughout the system during dry years.	3	$ 682,425

		reduction to 105 days)				
San Lorenzo downstream of the Felton Diversion[5]	Flow reductions during early rearing period (April, May) in dry years (7.5% reduction)	Flow reductions during early rearing period (April, May) in dry years (7.5% reduction)	Up to 7 miles of riverine habitat down to Tait Street could be affected in dry years	Work with partners to identify, design, and implement 5 permanent instream flow improvement projects on the middle reach of the San Lorenzo River to increase instream flows during April, May and into the summer to improve rearing.	5	$ 500,000
Newell Anadromous[6]	Decrease in number of days with suitable conditions for adult migration in normal (15% reduction to 37 days), dry (44% reduction to 9 days) and critical dry years (76% reduction to 1 day)	Decrease in number of days with suitable conditions for adult migration in wet (21% reduction to 24 days), normal (38% reduction to 14 days), dry (52% reduction to 1 day) and critical dry years (67% reduction to 0 days)	About 1 mile of anadromous habitat	<u>Branciforte Creek as a Proxy for Newell Creek</u>		
				Remove Casa de Montgomery dams and develop a fish friendly replacement diversion to open up passage to 4-5 miles of anadromous stream.	2	$ 606,600
	Decrease in WUA for spawning in normal (9% reduction), dry (21% reduction) and critical dry years (34% reduction)	Decrease in WUA for spawning in dry (20% reduction) and critical dry years (42% reduction)	Total of 21 potential spawning locations with maximum 1095 square feet of useable habitat (24 sq. ft. per 100 ft. of stream)	Install 12 anchored LWD structures at appropriate locations to improve spawning gravel sorting and increase square footage of spawning by ~100 sf per site (1200 sf in total)	12	$ 220,712

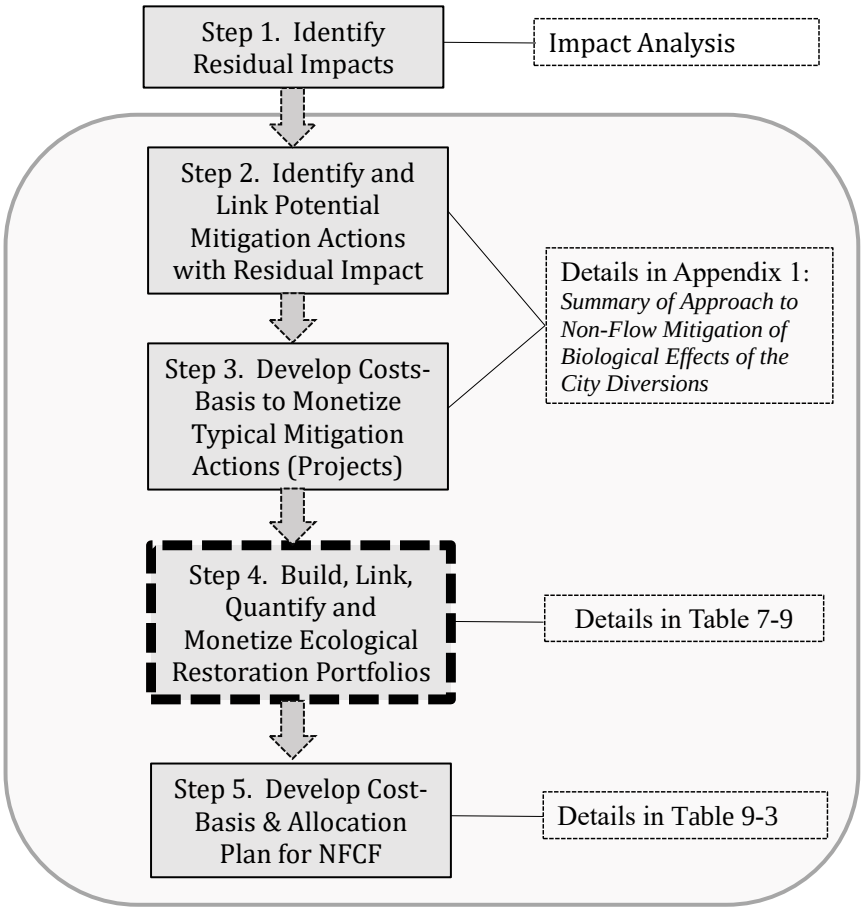
					Remove 4 additional high and medium priority passage obstructions (all small) along Branciforte Cr to enable unimpeded passage	4	$ 210,804
	Decrease in number of days with suitable conditions for smolt migration in normal (13% reduction to 42 days), dry (35% reduction to 14 days) and critical dry years (80% reduction to 1 day)	Decrease in number of days with suitable conditions for smolt migration in normal (13% reduction to 42 days), dry (35% reduction to 14 days) and critical dry years (80% reduction to 1 day)	About 1 mile of anadromous habitat		Cost-share planning and implementation of passage improvement on upper 1/3 of FCC to enable access across a range of migration flows through the channel	flat fee	$ 1,000,000
						TOTAL	***$8,011,479***[7]

[1] A proxy is used to firstly, put conservation effort into streams that are higher recovery priorities and secondly, provide options for conservation work when those opportunities may be limited in the watershed where the residual biological effect occurs. Proxies are intended to be adjacent, similar watersheds when possible.
[2] Ecological Portfolios are designed as concepts and are not meant to be interpreted as prescriptive, NFCF projects will be determined by the TAC based on opportunities available and perceived benefits in real time.
[3] No residual effects on coho in Laguna Creek of 5% or more; no suitable habitat for coho in Liddell and Majors Creeks; no suitable rearing habitat for coho downstream of the Tait Street Diversion.
[4] Reductions in adult and smolt migration opportunities at this location may not translate into significant biological effects since there is still a substantial period when migration criteria are still met.
[5] Spawning and rearing values downstream of the Felton Diversion based on hydrology only.
[6] All residual effects largely determined by spill frequency.
[7] Includes administrative and permitting costs.

7.6.4 Developing the Process and Data to Support the NFCF

Figure 7-1 describes the 5-step process utilized to develop the NFCF, which starts with identifying residual impacts and culminates with a translation of appropriate mitigation into a quantitative metric – dollars. Appendix 1: *Summary of Approach to Non-Flow Mitigation of Biological Effects of the City Diversions* provides a series of tables that were used to support development of the NFCF. The two critical components that provide the foundation for the NFCF are the development of the ecological portfolios and the translation of the portfolios into dollars.

Figure 7-1: Flowchart for Quantifying and Monetizing Impacts and Mitigation through the Ecological Restoration Portfolio Approach



7.6.4.1 Developing Ecological Portfolios

Creating the portfolio requires identification of a suite of projects or actions that would directly mitigate for potential residual impacts. The portfolios were developed using a combination of quantitative tools (e.g. relative size or location of the residual impacts) and qualitative tools. The qualitative tools are based on known site conditions, opportunities for meaningful improvement of conditions for fisheries, and professional judgement. While most of the portfolios are focused on

directly mitigating residual impacts in the impacted reaches, for Newell Creek the mitigation could occur in Branciforte Creek, and for Liddell Creek and Majors Creek, the mitigation would occur in San Vicente Creek. These particular streams were used as proxies for the impacted reaches because (a) the level of potential residual impact resulting from implementation of the Permit in Newell Creek makes it a more difficult stream for implementing meaningful mitigation actions and (b) higher priority recovery streams exist in nearby watersheds that may provide greater mitigation opportunities and benefits for coho. The replacement portfolio streams either currently support coho (San Vicente Creek) and are a priority for coho recovery (Branciforte Creek).

It is critical to emphasize that these portfolios were designed to enable a realistic quantification and monetization of mitigation costs and they were not designed to be prescriptive as to exactly what mitigation should be implemented with the NFCF funding. While the projects within each portfolio have been identified based on the residual impacts, local conditions, and known limiting factors, they do not take into consideration a number of critical externalities (e.g. flood management, access, ownership, recovery priority, etc.) that could affect the ability or the desire to implement a given conservation project.

7.6.4.2 Translating Ecological Portfolios into Dollars

Development of locally appropriate costs for implementing the ecological portfolios is a critical step for monetizing each portfolio in 2018 dollars. While there are a number of sources in the literature that provide ranges of costs for an array of restoration practices, this effort focused on using locally and regionally available data from 15 years of the Integrated Watershed Restoration Program (IWRP). Finally, in situations where IWRP data was not available, the database has been completed with additional data compiled through (a) personal communication with local experts; (b) professional experience; and (c) consulting and cross-referencing with NOAA's 2008 Technical Memorandum Habitat Restoration Cost References for Salmon Recovery Planning by Thomson and Pinkerton. Appendix 1: *Summary of Approach to Non-Flow Mitigation of Biological Effects of the City Diversions* contains tables with known costs and an average cost-basis for a suite of restoration actions that could be implemented as part of the NFCF.

8.0 Monitoring Plan (CCR Title 14 § 783.2(a)(9))

The monitoring program will provide the information necessary to assess compliance with the terms of the Permit, verify progress toward the biological goals and objectives, and implement a feedback loop to ensure that management/mitigation measures can be changed as needed in response to changing conditions and new knowledge. The monitoring program will be flexible to allow addition of new monitoring techniques or modification of monitoring methods that are not obtaining needed

information. The monitoring program will be overseen by the City's HCP Administrator and methods and results will be reported in an annual monitoring report.

The monitoring program outlined below will provide data on the distribution and abundance of the Covered Species, their habitats, and potential threats within the Plan Area. Using these data, the City will be able to assess changes in the quality and quantity of the specific habitat of the Covered Species, identify significant changes in the populations of the Covered Species, measure progress towards meeting the objectives of the Conservation Strategy, and decide if changes in management or monitoring are warranted. The results of the annual monitoring activities will also inform management decisions, including selection of projects to be funded from the NFCF.

All monitoring activities will be performed under the HCP Administrator's guidance and supervision, or under the guidance and supervision of a designated Conservation Program Manager. Prior to the implementation of the Permit, the Conservation Program Manager will prepare a monitoring manual that specifies the methods and protocols to be used in the Monitoring Program. Training will be provided for all individuals performing monitoring activities and these individuals will have qualifications, knowledge, and experience relevant to the type of research and monitoring activities that are being performed. A list of all individuals who participate in the monitoring activities and copies of training materials will be submitted to NMFS with the Annual Monitoring Report. The HCP Administrator may engage third parties (such as biological consultants with specific technical expertise regarding a Covered Species) who are qualified and authorized by NMFS to conduct, or to directly supervise, activities conducted under the monitoring program.

Monitoring program coordination with NMFS and CDFW will be achieved through regular meetings (at least one to two per year) of a Monitoring Technical Committee (MTC). Meetings will include a review of results of the past seasons monitoring and finalization of plans for the upcoming monitoring season. The value of existing studies will be appraised and monitoring elements may be revised accordingly.

8.1 Compliance Monitoring

The City is committing to meeting instream flow targets, operational constraints, and facility upgrades as avoidance and minimization measures under the terms of the Permit. The compliance monitoring element addresses these commitments. Annual monitoring and reporting will be completed to demonstrate compliance with the terms and conditions of the Permit, including incidental take limits (see Chapter 5 for determination of incidental take under the Permit). An annual compliance monitoring report will be completed with monitoring procedures and results as specified in the following areas:

- Incidental take tracking: The major effect of Covered Activities on listed salmonid species is alteration of habitat related to the City diversions and water supply facilities (Chapter 5). It is anticipated that operation of the City's diversion facilities and performance of other activities in conformance with the associated operating procedures and bypass flow requirements will maintain instream flow conditions in a manner that adequately protects and conserves habitat downstream of City water diversions. If operation of the City's facilities creates flow conditions which deviate from the bypass flow requirements, the anticipated level of incidental take caused by the proposed action will be exceeded. Therefore, tracking of incidental take will primarily involve documentation of flows and operating procedures as a surrogate for habitat. The annual compliance monitoring report will include an accounting of incidental take for each of the Covered Activities, including take associated with capture and including total number and any incidental mortality.
- Instream flow targets: The City will continue to maintain a streamflow monitoring network and to report anadromous gage daily flow records for Liddell (anadromous and upper), Laguna (anadromous, below diversion, above diversion), Majors (anadromous, below diversion, above diversion), Newell (upper and below dam), Felton (below the diversion), and Tait Street (below the diversion). The monthly exceedance category based on cumulative flow at the Big Trees gage[26] will be calculated and compared to the flow record at each gage to document compliance with appropriate instream bypass flows. Results of streamflow monitoring and analysis to document compliance with flow targets will be provided in the annual monitoring report. Interim reporting will occur on an as-needed basis whenever the City determines that it is out of compliance with provision of bypass flows or is expecting to be out of compliance at some point in the future. This could result from facility outages, extreme weather conditions, or other unforeseen circumstances. Specific criteria and procedures for notification will be established by the MTC as part of implementation of the terms and conditions of the Permit.
- Felton Diversion operations: A description of the Felton Diversion operations is provided in Section 3.2 and minimization and avoidance of effects are described in Chapter 7. The City will provide a record of dam operations (Operations Log), including dates when fully inflated, deflated, partially inflated; position of slide gate, dates of operation and counts at the fish trap. Any issues involving fish ladder maintenance; fish screen maintenance; observation of sediment accumulations or sediment transport issues will also be reported with a focus on what did not work rather than details of what was done. These records will be included in an annual monitoring report.
- Copper monitoring at Newell Creek Reservoir (Section 3.2.2, Section 7.2.2): The City will include an annual monitoring report as specified in the Aquatic Pesticide Application Plan, including dates of treatment and copper concentrations at standard measurement sites in the annual monitoring report.

[26] See Chapter 7for description of exceedance categories and bypass flow prescriptions.

- Testing deluge and gate valves (Section 3.2.2, Section 7.2.2): The City will provide an annual report documenting the dates of testing, flows, and quality of water released to Newell Creek (temperature, turbidity, DO concentrations) measured at standard sampling points downstream.
- Relocation of LWD downstream of Loch Lomond Reservoir (Section 3.2.2, Section 7.2.2): During the dry season the City will remove tree trunks and limbs that collect at the dam and place them in areas downstream of Newell Creek where they can provide habitat for rearing juvenile salmonids. The City will include an annual report documenting the number and dimensions of material moved, dates, and locations of placement in the annual monitoring reports.
- Installation of Sediment Management upgrades at Laguna, Reggiardo, and Majors Diversions (Section 3.4.1, Section 9.2.1): The City will install sediment management upgrades and sediment removal practices as specified in Streambed Alteration Agreements reached with CDFW. The City will include documentation of sediment management activities including dates, amount of sediment removed, etc., and dates for installation of upgrades in the annual monitoring reports.
- As part of the Covered Activities, Fish Screen Upgrades and juvenile bypass improvements will be installed at the Felton and Tait Street Diversions. These activities will be documented in the annual monitoring report, including a project description and date for installation. Monitoring of screen operation after installation will be provided under the Felton Diversion Operations Log (see previous).
- Water System Operations and Maintenance (Section 3.3, Section 7.2): The City will document operations completed for conveyance pipeline repair, finished pipeline flushing or repair, well return to San Lorenzo River, NC blow off to San Lorenzo River in the annual monitoring report. This will include dates, description of the activity, and possible effects on coho or habitat. The intent of this element is to demonstrate compliance with the terms of the Permit, and specifically to demonstrate that the avoidance and minimization measures are followed and completed.
- Municipal Facilities Operations and Maintenance (Section 3.4, Section 7.4): The City will provide a report on operations completed for debris/obstruction removal, sediment removal, and vegetation removal in the annual monitoring report. Any fish protection operations completed will be described along with the numbers and species of fish captured, their disposition, and any losses encountered. There will also be a narrative description of potential effects on coho or its habitat.

8.2 Mitigation Effectiveness Monitoring

The mitigation effectiveness monitoring element addresses the non-flow component of the conservation strategy. The mitigation strategy is based on a stepwise process of habitat enhancement that will occur over the life of the Permit. The City will provide annual funding for projects, and a TAC will decide on projects and allocate funds (see Section 7.6 for a description of the mitigation program). Ongoing monitoring of mitigation efforts is important to verify or correct current assumptions, choose the best course of action to ensure that future efforts are based on the best available science, ascertain whether the Plan is achieving its biological goals and objectives, and provide information used to revise methods if necessary to improve attainment of biological goals and objectives. The proposed mitigation strategy is compatible with an adaptive management approach in that funding decisions for mitigation measures will be made on an annual basis and will reflect the current knowledge base and status of the species. Decisions on implementation of specific projects will be informed by the success of past measures as determined through specific monitoring studies addressing the mitigation measures. Monitoring and reporting will be conducted for each mitigation project implemented (see Individual Project Monitoring, below), and annual and five-year reporting of the overall mitigation program will be provided.

8.2.1 Individual Project Monitoring

Each mitigation project will be monitored after 1, 3, 5, and 10 years. Reporting for each mitigation project will be provided in the annual and five-year mitigation summary reports and will include information on attainment of project-specific success criteria (via review of assessment variables to be prescribed for each project by the TAC), responsible party, specific monitoring methods, a schedule of monitoring activities, analytical methods, and reporting requirements.

8.2.2 Annual and 5-Year Summary Report

Annual reporting for the mitigation effectiveness monitoring will include the level of funding provided to the TAC for the year and a description of the projects implemented with that funding. The rationale for project selection and its relationship to effects to be mitigated under the Permit will be described. The annual report will also incorporate a listing of all mitigation projects involving City funding implemented to-date together with their status as complete or not, an assessment of their success, and an accounting of City funds allocated to each project to date. Every five-year update report will include a synopsis of effectiveness monitoring results for each project completed during the five-year period.

8.2.3 Population and Habitat Monitoring

This monitoring element addresses the status of Covered Species populations and habitat. Population and habitat monitoring will be consistent with the CMP (Adams et. al 2011). The CMP is a coordinated effort involving CDFW and NMFS with the goal of measuring progress to recovery of listed species under CESA and ESA listings. The City's Permit will require monitoring to evaluate levels of take and effects of the City's activities on populations and habitat of covered species. To the extent that these efforts have common goals, the City's monitoring program can contribute to the wider evaluation of population status at the regional level.

The methodology of the CMP is still under development and implementation of the program is ongoing. There are limitations to monitoring capabilities and differing priorities between the CMP and City monitoring goals that still need to be resolved. For example, the CMP design calls for different objectives and methods in Northern Area (Aptos Creek and north) and Southern Area (Pajaro River and south). The HCP Plan Area, and especially the San Lorenzo River, is on the boundary and though technically in the Northern Area, it has much in common with the Southern Areas and may be better approached from that perspective. Methodological limitations in the Permit area streams will need to be addressed as well. The most problematic of these include: diver health considerations for snorkel surveys in the San Lorenzo River; effects of high stream flow and poor visibility for conducting redd surveys; and security of remote monitoring equipment installations, especially on the San Lorenzo River.

It is anticipated that there will be a period of initial development of the monitoring program that is best accomplished through a MTC composed of both Agency (CDFW and NOAA) and City representatives. The MTC may be a sub-committee of the HCP TAC. The MTC will ensure consistency with the CMP and this process will yield the most rigorous approach to resolving monitoring issues identified. For this reason, the monitoring program presented here should be viewed as an initial representation of the program that will be refined as it is implemented. It should be recognized that there needs to be some flexibility in the design to allow for incorporation of improvements resulting from better definition of the CMP and possible technological advances in monitoring methods over time. The monitoring elements are described here from the perspective of current monitoring efforts, modifications consistent with the CMP, and recognition that the final design will come under the guidance of a MTC to reflect the state of the art in regional salmonid assessment and to ensure consistency with regional efforts as they develop. Details for each monitoring element, including key measurement variables, methods, location, frequency, and timing, are also provided in Table 8-1.

Unless noted otherwise, field monitoring programs will follow established protocols from published sources including the Salmonid Field Protocols Handbook (Johnson et al 2007), California Salmonid Stream Habitat Restoration Manual (Flossi et al. 1998), California Coastal Salmonid Population

Monitoring: Strategy, Design, and Methods (Adams et. al 2011), the Central California Coast Coho Salmon Recovery Plan (NMFS 2012), and other peer-reviewed scientific literature. Detailed monitoring protocols will be developed and refined within the context of the MTC. At five-year intervals the City will review the monitoring program in association with representatives of NOAA and CDFW and the value of existing studies will be appraised and monitoring elements may be revised accordingly.

8.2.3.1 Coho Population Viability

The CMP uses the Viable Salmonid Population (VSP) (McElhany et. al. 2000) concept as the framework for plan development. The VSP conceptual framework assesses salmonid viability in terms of four key population characteristics: abundance, productivity, spatial structure, and diversity (Adams et al. 2011). The City's monitoring program, as described below, is designed to be consistent with this framework. The City will also collaborate on an informal basis with other agencies to share information providing population abundance monitoring over a wider area, including areas outside the Plan Area and wider Evolutionarily Significant Unit (ESU) level trends. For example, NMFS has operated a life-cycle research station in Scott Creek where detailed information is collected on rearing abundance, smolt migration, and adult return rates of steelhead and coho. This research provides valuable information for addressing the effects of marine survival on salmonid populations and distinguishing these effects from those derived from freshwater survival and productivity. The City will refer to the information from this and other stations to make inferences and comparisons and interpret the abundance data it collects.

Abundance and Productivity

The CMP uses adult population size as the key measure of abundance and productivity (trend in abundance over time). Adult abundance monitoring is approached differently in the Northern and Southern Areas with expanded redd surveys in the North and counts at fixed stations in the South (Adams et al. 2011).

Current abundance monitoring in the Permit area involves annual snorkeling surveys for juvenile abundance in the anadromous reaches of Liddell Creek, Laguna Creek, and Majors Creek and annual quantitative electrofishing in the San Lorenzo River watershed. In order to be consistent with the CMP, abundance monitoring would be shifted to adults and the emphasis of juvenile monitoring would be shifted to measuring spatial structure and diversity (see below).

The CMP uses a combination of fixed station total adult census in selected intensively monitored watersheds (Life-cycle monitoring stations), and regional redd surveys to estimate total salmon and steelhead abundance on a region wide scale. CDFW has previously conducted regional adult

spawner surveys in Santa Cruz Mtn streams although this monitoring is no longer occurring (Sean Cochran, CDFW, personal communication, January 2021). For the San Lorenzo River, total adult population is the monitoring objective and therefore a fixed station count is the most appropriate method. Redd surveys in the San Lorenzo River may have some utility as a complement to fixed station counts, particularly in parts of the watershed that may be missed by fixed station counts. The potential for redd surveys in Liddell, Laguna, and Majors Creeks should be explored though the small size and complex habitat in these streams may be problematic in terms of disturbance to spawning fish, damage from walking on redds, and ability to observe redds and/or spawning fish, especially with the small run sizes likely to occur in the short anadromous reaches.

The trap at the Felton Diversion Dam offers a potential opportunity for a fixed station counting location. The trap would have to be combined with other methods such as a DIDSON[27] camera or PIT tag monitoring to achieve an estimate of the adult population passing Felton. Adult trapping can be used to enumerate; tag (external spaghetti or PIT); identify species and sex; examine for scars, parasites, and body condition; and collect tissue samples for genetic analysis and scales for life history analysis from captured listed species. The Monterey Bay Salmon and Trout Project is a potential partner for this work. A drawback of the Felton location is that any fish spawning lower in the watershed (Gorge, Branciforte Creek) would not be counted. A fixed station count lower in the watershed, such as at the Tait Diversion, would be necessary to overcome this limitation. This could be accomplished by a resistance weir in the lower river, possibly in conjunction with the Tait Diversion structure; a trap at the diversion; or a DIDSON installation. DIDSON has the advantage of being operable at higher flows than a resistance weir and avoiding the elaborate structure and equipment requirements of a trap or weir. The drawback is that it is unable to accurately distinguish species, steelhead and coho for example. Any count at the Tait Diversion would also fail to incorporate fish using the Branciforte watershed.

Spatial Structure and Diversity

The CMP uses spatial structure and diversity as measures of population viability. Spatial structure refers to the geographical and ecological distribution of salmonids across the landscape. Broad spatial distribution and connectivity among populations are important traits that protect against the effects of catastrophic events and buffer extinction risk, particularly at low abundance. Although some information on spatial structure can come from adult surveys where redd surveys are conducted, the CMP proposes using visual (snorkel) surveys for juvenile salmonids as the most efficient means to monitor spatial structure (Adams et al. 2011). A larger number of juvenile surveys can be accomplished in less time and expense than adult surveys because it is simpler and can occur at a more operationally favorable time of the year. Snorkel surveys are also more efficient

[27] Dual-Frequency Identification Sonar (DIDSON) is an acoustic "camera" that has been adapted to fisheries monitoring (Maxwell and Gove 2004). The device is a high-frequency sonar system with a lens capable of focusing sound waves onto a high-resolution sensor array.

than electrofishing surveys, allowing a wide geographic area to be surveyed. Under the CMP, the key elements of measuring spatial structure are distribution and relative abundance on a regional scale, not population abundance quantification per se.

The City currently conducts snorkel surveys in the fall of the year to estimate the abundance of juvenile steelhead and coho in Liddell Creek, Laguna Creek, and Majors Creek. The City also contributes funding to Santa Cruz County and research partners for annual surveys of juvenile abundance in the San Lorenzo River system including Newell Creek. The San Lorenzo River survey has been implemented since 1997 and develops population abundance data using a combination of depletion electrofishing (DW Alley and Associates 2010) and visual (snorkel) surveys in larger, deeper pools that are not effectively sampled by electrofishing. The San Lorenzo surveys emphasize a basinwide abundance estimate for both young-of-year and older juveniles but also allow for comparisons between defined subreaches within the watershed. The City also conducts abundance surveys in Laguna Creek Lagoon and the San Lorenzo River Lagoon using beach seines. The beach seining surveys employ mark-recapture techniques and PIT tagging to estimate population size in each of the lagoons.

City snorkel surveys in the North Coast streams are consistent with the CMP as currently conducted. Although the CMP sampling scheme may not select these reaches in any given year, the data would be available for incorporation whenever selected. Annual data provides a finer grain than required under the CMP but it is useful under the Permit as an indicator of status and trends relative to operation of the City diversions.

The current annual electrofishing/visual surveys in the San Lorenzo River and Newell Creek are not consistent with the CMP due to 1) different definition of reaches, 2) primary use of electrofishing instead of snorkeling and, 3) use of a subjective representative site selection method instead of random sampling. The lack of random sampling under the current surveys prevents rigorous statistical analysis for comparison of annual or spatial differences in abundance. Nevertheless, the current surveys include a long term, consistently sampled dataset that has value even if not consistent with the CMP methods and should not be abandoned lightly. A comparison of the non-random methodology with a more rigorous randomized sampling scheme conducted in 2002 found that both methods gave generally comparable results in terms of parameter estimates for both habitat features and steelhead abundance (H.T. Harvey & Associates 2003a). The chief advantage of the randomized sampling is that it provides a statistically rigorous basis for spatial and temporal comparisons that the non-randomized design does not.

The City will monitor juvenile salmonid spatial structure and distribution by conducting annual juvenile surveys during the late summer or fall by either snorkeling or electrofishing. The juvenile surveys will be conducted within a statistically valid spatially balanced sampling design, consistent with the CMP (Adams et al. 2011), using established sampling protocol in salmonid monitoring

literature (Johnson et al. 2007; Boughton 2010, Hankin and Reeves 1988). Snorkel surveys are generally preferred as they can cover a wider area for a given level of effort than electrofishing. On the other hand, electrofishing is advantageous for collecting more precise size data and providing an opportunity for PIT tagging. Snorkel surveys may be precluded in some areas due to lack of landowner approval for access, excessively deep pools, dense cover, concerns for diver health due to poor water quality, and other safety concerns. The general random tessellation stratified (GRTS) sampling scheme can easily accommodate unusable sample reaches (Adams et al. 2011). It is also likely that the City will add samples in segments of the San Lorenzo River that are influenced by City water diversions in order to allow evaluation of status and trends within the sub-watershed areas affected by altered flow regimes. The GRTS framework also allows for augmented sampling for domain estimates (Adams et al. 2011). The City monitoring program will be more fully defined by the MTC before full implementation and may change in response to evolution of the CMP. Any changes will be addressed through the MTC.

The City sampling frame will include all reaches in the San Lorenzo watershed downstream of operations (San Lorenzo River downstream of the Newell Creek confluence and Newell Creek below the Newell Creek Dam), and the anadromous reaches of Laguna Creek, Majors Creek, and Liddell Creek. To provide statistical integrity, the City surveys will conform with spatially balanced reaches designated by CDFW using a GRTS sampling scheme (McDonald 2004; Adams et al. 2011). The use of a common spatial sample scheme is to provide consistency in the sampling universe, so that data gathered is spatially comparable (Adams et al. 2011). This will allow for future coordination with other conservation partners and the fishery agencies for a complete assessment of the watershed. Juvenile surveys conducted under the Permit will be more intensive than envisioned in the CMP and will likely include the entire reaches affected by City operations. Consistency with the CMP will be maintained by structuring sampling within the GRTS reaches identified in the CMP and by developing and reporting data with the same methodologies employed in the CMP.

Juvenile Abundance and Spatial Distribution- Lagoons

The City will monitor rearing populations of juvenile coho in Laguna Creek Lagoon and the San Lorenzo River Lagoon (the only two streams with functional lagoon systems) on an annual basis using seining surveys. Population abundance in each lagoon will be estimated from Petersen mark-recapture methods (Ricker 1975) using PIT tag technology and catch per unit effort (CPUE). Population abundance will be estimated in June and September at a minimum and intervening status checks may also be conducted, with or without tagging and population estimates. Seining is conducted at standard sampling sites within each lagoon which are largely determined by accessibility and suitability for use of seine equipment (HES 2009a, HES 2010, HES 2011, HES 2012, HES 2013, HES 2014a, HES 2015, HES 2016, HES 2017).

PIT Tag Monitoring Antenna

Although not specifically identified as a component of the CMP, PIT tag monitoring can provide valuable supplemental information and will be performed in the San Lorenzo River. A PIT tag monitoring antenna is currently maintained by the NOAA Southwest Fisheries Science Center below the Felton Diversion. The City will install an additional antenna in the lower river, potentially at the Tait Street Diversion and/or Branciforte Creek. This supports both juvenile monitoring and adult monitoring. PIT tags will be placed in juveniles during electrofishing and seining surveys and in adults during trapping at the Felton Diversion Dam (see above). Installation and maintenance of a PIT tag antenna array in the San Lorenzo River will allow the City to passively monitor movement of tagged individuals (Johnson et al. 2007; Boughton 2010) including movement of juveniles or smolts tagged during stream electrofishing surveys, movement of juveniles tagged in lagoon seining surveys, and movement of adults tagged in the Felton Diversion Dam trap. Using PIT antenna data, the City can identify life history strategies, identify movement and migration timing across habitats, and quantify trap capture efficiency. The NOAA Southwest Fisheries Science Center is a potential partner for this work.

8.2.3.2 Coho Habitat Quality

Instream flow targets are keyed to existing channel structure and habitat conditions. Habitat conditions may shift in response to flow management under the Permit and due to a variety of other factors, including altered hydrology and vegetation under climate change, wildfires, drought, and increased development. Changes in habitat quality will be monitored to better understand any observed changes in population abundance. Habitat monitoring will involve both instream habitat and lagoon habitat. Habitat assessment methods should be consistent with existing accepted methods (Flossi et al. 1998) or with the CMP which have not currently been developed. The City monitoring program may change in response to evolution of the CMP. Any changes will be addressed through the MTC.

Instream Habitat

Instream habitat will be surveyed by the City following the occurrence of a 5 year or larger flow event (as measured at the Big Trees USGS gage) in the anadromous reaches of Liddell Creek, Laguna Creek, Majors Creek, Newell Creek, and the San Lorenzo River downstream of Newell Creek Dam. The habitat survey will include detailed characterization of stream habitat conditions in accordance with the California Salmonid Stream Habitat Restoration Manual (CDFW Method) (Flossi et al. 1998) or other appropriate methodology determined by the MTC. Surveys will include: channel instream habitat typing, quantification of stream habitat by mesohabitat type (riffle, pool, flatwater, etc.) including length, width, depth, substrate characteristics (embeddedness and dominant substrate), instream shelter characteristics, and canopy characteristics. Habitat surveys will occur

with reference to the CMP GRTS reaches. Habitat monitoring will also include periodic evaluation of passage obstacles including critical riffles and other obstacles to ensure that minimum passage flow levels previously estimated remain valid. Critical riffles will be evaluated using methodology agreed upon by the MTC (e.g. the Standard Operating Procedure for Critical Riffle Analysis for Fish Passage in California (CDFW 2012)). Reports will include a compilation of results and summary of trends over the previous reporting period. The SLVWD, Scotts Valley Water District (SVWD), and County of Santa Cruz are potential partners for this work.

Instream Temperature

Current water temperature conditions are well within suitable ranges for steelhead and coho in North Coast streams but may be limiting in parts of the San Lorenzo River, particularly for coho (See Appendix 12: *Environmental Setting*). Global climate change may alter temperature regimes in all these streams. A water temperature monitoring network will be established using continuous instream recorders set to record at 30-minute intervals. Recorders will be placed annually during the period of maximum thermal loading (May 1 through September 30). Recorders will be placed to avoid discovery and will be downloaded on a monthly basis. Recorders will be maintained at the following locations:

- Laguna Creek (2): Below diversion and anadromous
- Liddell Creek (2): Below diversion and anadromous
- Major Creek (2): Below diversion and anadromous
- San Lorenzo River (4): Upstream of Water St in the riverine reach, Tait Street, Gorge, Ben Lomond upstream and downstream of Newell Creek confluence
- Newell Creek (2): Below dam (fish release outlet) and anadromous (Glen Arbor)

Water temperature monitoring protocols will be developed in advance and approved by the TAC. Protocols for monitoring and analysis will follow accepted methods as presented in the scientific literature (e.g. US EPA 2014, Toohey et al. 2014, Dunham et al. 2005). The temperature monitoring plan will specify standardized protocols and data-quality standards to produce generally consistent, unbiased, and reproducible data. The program will include definition of data-quality objectives, site selection criteria, selection of instrumentation, protocols for installation of sensors, schedule of periodic site visits to maintain sensors and download data, pre- and post-deployment verification against an NIST-certified thermometer, potential data corrections, database management and proper documentation, review, and approval procedures.

Lagoon Habitat

Lagoon habitat quality conditions will be monitored annually by the City in both the Laguna Creek and San Lorenzo River lagoons[28] consistent with previous surveys conducted since 2004 (2NDNATURE 2017, 2NDNATURE 2006). Water quality monitoring will document patterns of DO, temperature, salinity, tidal and freshwater inflow, climate, lagoon stage, lagoon volume, and nutrients throughout the water column and along the length of both lagoons during the late spring, summer and fall months. Data will continue to be collected at two standard monitoring locations as well as periodic profiles of these same parameters at an additional 6 standard sampling locations at regular intervals throughout each lagoon. Winter water surface elevation data will also be collected and assessed annually to help evaluate lagoon breach dynamics.

[28] Majors Creek and Liddell Creek do not have functional lagoons.

Table 8-1: Salmonid Population and Habitat Monitoring Elements

Monitoring Element	Source	Key Measurement Variable(s)	Method	Location	Frequency	Timing
Population Abundance-Juvenile	City of Santa Cruz	Count per 100 ft. of stream by age class	Spatially balanced snorkel survey and per CDFW CMP protocol.	Liddell Creek Laguna Creek Majors Creek	Annually	Fall
Population Abundance-Juvenile	City of Santa Cruz	Count per 100 ft. of stream by age class	Spatially balanced electrofishing/ snorkel survey per CDFW CMP protocol.	Newell Creek Dam downstream to Water St.	Annually	Fall
Population Abundance-Juvenile	City of Santa Cruz	Total population estimate	Seine: Petersen Mark-recapture with PIT tags	Laguna Creek Lagoon San Lorenzo River Lagoon	Annually	Early Summer/Fall
Population Abundance Adult	City of Santa Cruz	Adult Escapement Sex ratio	Trap/DIDSON/PIT counting station	Felton Diversion Dam	Annually	December-April
PIT tag antenna array	City of Santa Cruz	Juvenile and adult movement	Passive antenna	San Lorenzo River-specific location to be determined	Constant	Year around
Stream Habitat	City of Santa Cruz	Channel cross-section Habitat type composition Wetted width Mean and maximum depth Instream cover Spawning area Gravel embeddedness Dominant substrate	California Salmonid Stream Restoration Manual, Level IV	Anadromous reach: Liddell Creek Laguna Creek Majors Creek Newell Creek Dam downstream to Water St.	Subsequent to each 5-year flood event as measured at Big Trees USGS gage	Late Summer

Table 8-1: Salmonid Population and Habitat Monitoring Elements (continued)

Monitoring Element	Source	Key Measurement Variable(s)	Method	Location	Frequency	Timing
Instream temperature	City of Santa Cruz	Water temperature (°C) accuracy +/- 0.1 °C	Instream continuous temperature recorder	Below Laguna Diversion Anadromous Laguna Below Liddell Diversion Anadromous Liddell Below Majors Diversion Anadromous Majors San Lorenzo River above Water St. in riverine reach San Lorenzo River at the Tait Street Diversion San Lorenzo River Gorge San Lorenzo River upstream and downstream of Newell Creek Newell below Dam Anadromous Newell (Glen Arbor)	30 minutes	May 1-September 30
Passage Obstacles	City of Santa Cruz	Minimum passage flow estimate	CDFW Critical Riffle Analysis Powers and Orsborn California Salmonid Stream Restoration Manual	Anadromous reach: Liddell Creek Laguna Creek Majors Creek Newell Creek San Lorenzo River below Tait Street San Lorenzo River gorge	Subsequent to each 5-year or larger flood event as measured at Big Trees USGS gage	Winter high flows and summer low flows
Lagoon Habitat	City of Santa Cruz	Dates open and closed Depth/Water surface elevation (WSE) Thermal record DO record Salinity Nutrient concentrations Aquatic veg. types and area	Continuous recorder at mid-point; monthly profiles at set stations	Laguna Creek Lagoon San Lorenzo River Lagoon	Annually	May-November WSE Year-round

8.2.4 Adaptive Management Process and Options

Monitoring results will be used to guide management activities to help ensure attainment of the Conservation Strategy Coho life cycles are typically completed in three to five years. The City's adaptive management planning will be completed in five-year review periods. This time period allows for data capture covering different life-stages and inherent population fluctuations due to timing of fish maturity and annual weather cycles. Each five-year review will be based on a summary report for the preceding five-year period. The report will integrate information in the annual reports for the review period and describe population abundance trends and habitat quality changes since the last review. Biological parameters will be compared with any observed changes in physical parameters or project operations to identify possible linkages.

The conservation strategy is designed to support improved habitat conditions relative to the current condition with the implication that populations coho will be benefited and that population parameters would also respond in a positive fashion. The key evaluation factor triggering the need for adaptive management under the Permit is a lack of improvement in habitat values for Covered Species. Habitat indices (average spawning or rearing WUA, annual number of days meeting adult or smolt migration criteria) provide logical assessment variables and lack of improvement in any of these indices, relative to conditions existing before implementation of Permit related improvements, could trigger adaptive management actions. Declining habitat values may also be indicated by trends in lagoon habitat parameters (depth, temperature, oxygen, salinity, and vegetation characteristics); trends in stream temperatures; or trends in stream habitat parameters (channel cross-sections, critical riffle analysis; mesohabitat proportions; substrate composition; instream cover characteristics, etc.). Parameter values are assessed over appropriate time frames using valid statistical approaches. A minimum period of three to five years will likely be necessary for identifying significant trends.

The Plan Area is only a subset of the wider geographic areas that are the basis for population recovery under the ESA. It is anticipated that others (NMFS, CDFW) will be conducting monitoring programs that address population viability over these wider geographic areas (Crawford and Rumsey 2011). Monitoring conducted by the City under the Permit and within its limited geographic range may augment but will not replace these efforts. Data from the wider recovery area must be considered in addressing long-term viability and this data will provide an important context for evaluating monitoring data collected by the City within the HCP Plan Area.

The monitoring program will produce a large amount of data from which habitat indicators may be drawn. These may include:

Instream Habitat

- Average life-stage WUA for spawning and rearing (based on streamflow monitoring and existing habitat models)
- Days with suitable passage conditions for adults and smolts
- Maximum seven-day moving average of daily maximum temperature
- Maximum seven-day moving average of daily average temperature
- Quantification of stream habitat by mesohabitat type (riffle, pool, flatwater, etc.) including length, width, depth, substrate characteristics, instream shelter characteristics
- Channel type definition
- Channel cross-section
- Stream bank and canopy characteristics
- Instream cover characteristics
- Spawning area
- Dominant substrate and gravel embeddedness

Lagoon Habitat:

- August average daily inflow (cfs)
- Dates of sandbar closure (initial and final)
- Number of days of sandbar closure between May 15 and October 1
- Number of days of microtidal conditions between May 15 and October 1
- Mean of daily average water depth or lagoon stage (July and August)
- Minimum water depth or lagoon stage (July and August)
- Seven-day moving average of daily maximum air temperature (July and August)
- Seven-day moving average of daily maximum surface water temperature (July and August)
- Number of days with daily maximum surface temperature exceeding 25°C
- Number of days with daily maximum surface temperature exceeding 21°C

Should the monitoring data indicate a consistent declining trend or lack of improvement in habitat conditions relative to conditions existing before implementation of Permit related improvements, the City will implement adaptive management responses. The need for adaptive management decisions and actions will be an ongoing process best pursued within the TAC and will be based on trends in the monitoring data and in consideration of the objectives of the Conservation Strategy. Adaptive management actions may be based on declines in habitat indicators or lack of improvement in those indicators. Many of the indicators have been measured during development of the Permit application and some have long-term datasets of 10 years or more. These indicators will be used as a baseline for comparison of the first five years of Permit implementation. For other indicators with shorter data histories or no previous monitoring, trends will be evaluated during the first five years of monitoring

and this period will serve as a baseline for future monitoring. For a number of reasons, including that coho numbers in the Plan Area are essentially zero due to local extirpation and very low, sporadic abundance in recent years, habitat indicators have been selected for understanding baseline conditions instead of population counts.

Outcomes of the adaptive management decision making process can include, within the limits set by Permit, changes to choice of mitigation projects, monitoring programs, analytical tools, and targets. There are other factors in addition to controlling streamflows and improving stream and lagoon habitat that contribute to the long-term persistence and viability of coho populations in the Permit area, including:

- ESU/Distinct Population Segment (DPS) wide and regional trends in target species populations
- Climate change, precipitation patterns, temperature trends, ocean productivity
- Fish health / disease factors
- Invasive species
- Watershed conditions, surface water/groundwater interactions

Changes in any of these factors may trigger adaptive management decisions under the Permit. These factors, many not fully understood, are being monitored by other agencies. Through monitoring and continued information exchange with the fishery agencies, and in coordination with NMFS review and approval, the City may modify non-flow mitigation and monitoring programs to address new information in these areas.

9.0 Funding and Funding Sources (CCR Title 14 § 783.2(a)(10))

9.1 Financial Summary

The City's Permit application involves four programs to be funded by the City:

1) Habitat Conservation Program (Section 9.2.1);
2) Monitoring Program (Section 9.2.2);
3) Adaptive Management program (Section 9.2.3); and,
4) Program Administration (Section 9.2.4).

The habitat conservation strategy described in this chapter includes a suite of potential NFCF measures to be implemented in the Santa Cruz Mountains Ecoregion. These measures focus on key independent and dependent watersheds in southern San Mateo County south to Aptos Creek in Santa Cruz County. Additionally, a Take Avoidance and Minimization Fund (TAMF) will be instituted for measures

related to operations and maintenance and Capital Improvement Program (CIP) related habitat conservation measures. Chapter 8 describes the compliance, effectiveness, and research monitoring programs.

The adaptive management program, also described in Chapter 8, includes provisions to select, fund, and implement additional measures if the measures described in Chapter 4 do not achieve the expected biological results. Program administration is described in Section 9.2.4 of this chapter. The total 30-year estimated cost of Permit implementation is $36,674,500 in 2018 dollars. Figure 9-1 and Figure 9-2 show how the forecasted Permit implementation costs are spread over the 30-year term. The total cost for each of the four program areas and their respective subcategories is provided in Table 9-1. Additional detail is provided later in this chapter.

Table 9-1: Habitat Conservation Plan Financial Summary

Program	Estimated Cost (2018 dollars)
Habitat Conservation (see Table 9- 2) NFCF TAMF[29]	 $ 8,000,000 *$ 157,400,000*
Monitoring (see Table 9-4 & Table 9-5) Compliance Effectiveness Research	$18,377,500
Adaptive Management (see Table 9-6) Contingency Account Insurance Account	 $ 1,600,000 $ 2,640,000
Administration (see Section 9.2.4)	$ 6,057,000
TOTAL COST	**$36,674,500**[30]

9.2 Program Costs

9.2.1 Habitat Conservation Programs Costs

The estimated habitat conservation program costs are primarily associated with NFCF habitat conservation measures. TAMF costs are not included in the analysis of Permit implementation funding because many of the projects associated with those costs have independent utility in that they are necessary for future water system reliability but also have conservation benefit in most cases. Nonetheless, the total cost is shown here to provide context. Totals are provided in Table 9-2 below.

[29] TAMF costs include supplemental water supply development, Majors, Laguna, Tait Street and Felton Diversions rehabilitation, treatment improvements, construction best practices implementation and related take avoidance and minimization measures.

[30] TAMF costs are not included in the analysis of Permit implementation funding because many of the projects associated with those costs have independent utility.

Table 9-2: Habitat Conservation Programs Estimated Costs

Habitat Conservation Program Measure Category	Estimated Cost in 2018 Dollars (30-year total)
NFCF	$8,000,000
TAMF	$157,400,000
TOTAL COSTS	**$165,400,000**[31]

TAMF - related operations and maintenance costs are mainly associated with staff time and therefore are also not included in this analysis. TAMF related CIP costs include measures such as supplemental water supply development, Felton Diversion fish screen improvements, North Coast Diversion sediment management improvements, operational and infrastructure improvements as well as standard best practices for protection of natural resources employed during operations and maintenance of the water system. These improvements and system rehabilitation are not entirely precipitated by the ESA or CESA; however, significant system-wide improvements are required for a variety of reasons and have independent utility, with regard to water operations beyond compliance with the ESA. This improvements and rehabilitation work will, in many cases, require mitigation of impacts caused by historical operations. While these improvements have not been fully evaluated to the extent that firm budget estimates are possible, it is likely that their costs will be in the range of $100-150 million dollars (2018 dollars) and be implemented within the first 10 years of issuance of the permit. Most TAMF costs are associated with implementation of these projects.

Habitat Conservation Program Measures

Table 7-9 provides a clear linkage between residual impacts and potential mitigation projects presented through the ecological portfolios. Table 7-9 also associates each of the potential portfolio projects with an estimated cost in 2018 dollars. Based on this two-phase process of linking impacts to projects in a portfolio and developing costs for projects in the portfolio, the level of funding required for the NFCF can be quantified.

Once the ecological portfolios have been completed and this hybrid quantitative-qualitative metric has been translated into dollars, the final step is to develop a cost allocation plan for implementation of the NFCF. The costs allocation plan is a 30-year budget for the NFCF that is divided into six 5-year planning cycles with associated work plans. The allocation is further divided into annual expenditures. The cost allocation plan is presented in 2018 dollars and provides a snapshot of annual funding as well as a realistic view of what can be accomplished with the NFCF funding currently recommended. The

[31] TAMF costs are not included in the analysis of Permit implementation funding.

cost allocation is included in Table 9-3. See also Appendix 1: *Summary of Approach to Non-Flow Mitigation of Biological Effects of the City Diversions*). Most of the planning, permitting, and project management for these measures will be done by 1.0 new full-time equivalent Water Department staff, and related costs are included in the staff time subtotal shown in Table 9-3.

If measures are not implemented as planned and substitute measures are implemented (per the Adaptive Management Programs described in Chapter 8), the funding will come from the amounts allocated to the original measures (with inflation if implemented at a later date).

If NFCF projects require minor maintenance, such as replanting or invasive plant removal, costs will be paid from the 20% contingency funds in the Adaptive Management Program – as approved in consultation with the TAC. Five-year funding increments for the NFCF are described further in Table 9-3 below.

Table 9-3: Estimated NFCF Habitat Conservation Measure Costs[32]

Fiscal Year	Task	Amount (In Fiscal Year 2019 dollars)
HCP Years 1 - 5	Develop 5 yr. project list	$ 55,000
	Project 1 Permit	$ 15,000
	Project 1 Design	$ 60,000
	Project 1 Construction	$ 15,000
	Project 1 Implementation	$ 200,000
	Project 2 & 3 Permit	$ 35,000
	Project 2 Design	$ 70,000
	Project 3 Design	$ 65,000
	Project 2 & 3 Construction	$ 70,000
	Project 2 & 3 Implementation	$ 350,000
	Project 4 Permit	$ 20,000
	Project 4 Design	$ 60,000
	Project 4 Construction	$ 15,000
	Project 4 Implementation	$ 270,000
	Project 5 Permit	$ 65,000
	Project 5 Design	$ 100,000
	HCP Years 1 - 5 Subtotal	**$ 1,465,000**
HCP Years 6 - 10	5 yr. NFMP Review	$ 30,000
	Develop 5 yr. project list	$ 20,000
	Project 9 Design	$ 60,000
	Project 5 Implementation	$ 500,000
	Project 6 Permit	$ 15,000
	Project 6 Design	$ 60,000
	Project 6 Construction	$ 15,000
	Project 6 Implementation	$ 200,000

[32] Specific habitat conservation measure priorities have not been identified or committed to. However, support for coho recovery hatchery development and operations is a high priority.

	Project 7 & 8 Permit	$ 30,000
	Project 7 Design	$ 60,000
	Project 8 Design	$ 75,000
	Project 7 Construction	$ 20,000
	Project 8 Construction	$ 20,000
	Project 7 Implementation	$ 200,000
	HCP Years 6 - 10 Subtotal	**$ 1,305,000**
HCP Years 11 - 15	Develop 5 yr. project list	$ 55,000
	Project 8 Implementation	$ 275,000
	Project 9 Permit	$ 20,000
	Project 9 Design	$ 10,000
	Project 9 Implementation	$ 220,000
	Project 9 Construction	$ 15,000
	Project 10 & 11 Permit	$ 25,000
	Project 10 Design	$ 65,000
	Project 11 Design	$ 70,000
	Project 10 & 11 Construction	$ 20,000
	Project 10 & 11 Implementation	$ 300,000
	Project 12 Permit	$ 55,000
	Project 12 Design	$ 125,000
	Project 12 Construction	$ 25,000
	Project 13 Design	$ 60,000
	HCP Years 11 - 15 Subtotal	**$ 1,340,000**
HCP Years 16 - 20	5 yr. NFMP Review	$ 30,000
	Develop 5 yr. project list	$ 20,000
	Project 12 Implementation	$ 475,000
	Project 13 Permit	$ 20,000
	Project 13 Construction	$ 15,000
	Project 13 Implementation	$ 220,000

	Project 14 Permit	$ 20,000
	Project 14 Design	$ 50,000
	Project 14 Construction	$ 15,000
	Project 14 Implementation	$ 220,000
	Project 15 & 16 Permit	$ 25,000
	Project 15 Design	$ 60,000
	Project 16 Design	$ 70,000
	Project 17 Permit	$ 20,000
	Project 17 Design	$ 120,000
	HCP Years 16 - 20 Subtotal	**$ 1,380,000**
HCP Years 21 - 25	5 yr. NFMP Review	$ 30,000
	Develop 5 yr. project list	$ 30,000
	Project 15 & 16 Construction	$ 20,000
	Project 15 & 16 Implementation	$ 250,000
	Project 17 Permit	$ 50,000
	Project 17 Construction	$ 20,000
	Project 17 Implementation	$ 500,000
	Project 18 & 19 Permit	$ 25,000
	Project 18 & 19 Construction	$ 15,000
	Project 18 & 19 Implementation	$ 275,000
	Project 18 Design	$ 60,000
	Project 19 Design	$ 70,000
	Project 20 Design	$ 30,000
	HCP Years 21 - 25 Subtotal	**$ 1,375,000**
HCP Years 26 - 30	5 yr. NFMP Review	$ 30,000
	Project 22 Implementation	$ 450,000
	Project 20 & 21 Permit	$ 30,000
	Project 20 & 21 Construction	$ 15,000
	Project 20 & 21 Implementation	$ 250,000

	Project 20 Design	$ 40,000
	Project 21 Design	$ 70,000
	Project 22 Permit	$ 75,000
	Project 22 Design	$ 120,000
	Project 22 Construction	$ 25,000
	Final Project Review	$ 30,000
	HCP Years 26 - 30 Subtotal	**$ 1,135,000**
Total Cost		**$ 8,000,000**

9.2.2 Monitoring Programs Estimated Costs

Costs for the monitoring program are shown in Table 9-4. The monitoring activities included are described in Chapter 8.

Table 9-4: Monitoring Programs Estimated Costs

Monitoring Measure Category	Estimated Cost in 2018 Dollars (30-year total)
Compliance	$ 3,000,000
Effectiveness	$ 800,000
Research	$ 14,577,500
$18,377,500	$18,377,500

9.2.2.1 Research Program Estimated Costs

The estimated costs to implement the research measures described in Chapter 8 are shown in Table 9-5. Some of these dollar amounts are part of larger partnership programs (see details in Chapter 8). The City has committed to a research monitoring program that is significantly broader in scope than many comparable habitat conservation plans / 2081 permits.

Table 9-5: Research Monitoring Estimated Costs

Monitoring Measure	Estimated Cost in 2018 Dollars (30-year total)
Riverine Juvenile Abundance and Spatial Distribution Monitoring	$4,033,500
Estuarine Juvenile Abundance	$ 3,000,000
Riverine Habitat Monitoring	$ 330,000
Estuarine Habitat Monitoring	$ 1,674,000
Felton Diversion Adult Migration Monitoring	$ 310,0000
Temperature Monitoring	$ 420,000
Pit Tag Monitoring	$ 410,000
Reporting and Equipment	$ 660,000
Data Management	$ 950,000
TOTAL COST	**$ 14,577,500**

9.2.3 Adaptive Management Programs Estimated Costs

Costs involved in the Adaptive Management Program include:

1) Unanticipated maintenance needs of NFCF projects;
2) Responses to monitoring of measures if effectiveness monitoring indicates original measures have not met their stated objectives;
3) Responses to assessments of the overall effectiveness of the Conservation Strategy; and,
4) Changes in research monitoring priorities and methodologies that would exceed the cost estimate in Table 9-5.

Elements of the adaptive management programs are described in Chapter 8. Actual future costs associated with adaptive management are dependent on information not yet available. (See Program Funding - Section 9.3 below for total dollars allocated). The adaptive management funding allocations are shown in Table 9-6 and total $4,240,000 over 30 years. These amounts are capped totals (with inflation adjustment), except as affected by provisions for coho and steelhead in Section 6.5 of the HCP, Changed and Unforeseen Circumstances. To fund the planned responses to address changed circumstances, an "insurance account" will be established concurrent with HCP/2081 permit adoption as a component of the adaptive management funding. A total of $2,640,000 will be deposited into the insurance account over 30 years. (Table 9-6 insurance account).

9.2.4 Administration Program Estimated Costs

Costs associated with program administration include staffing for overall implementation of the HCP/2081 Permit, including indirect costs for support of all activities.

The indirect cost for implementation of the HCP is comprised of 15% of the fully loaded ongoing salary costs for monitoring, data management, and compliance reporting, as well as the fully loaded cost of the salary plus 15% indirect costs of 1.0 new full time equivalent (FTE) position for implementation of the NFCF.

The overall administration costs are approximately $6,057,000.

9.3 Program Funding

The City will pay the costs of the HCP/2081 Permit from water rate revenues. Each spring, the City Council adopts an annual budget for the Water Department based on anticipated costs and revenues. The annual budget is a public document and is available on the City's web site. Commitments made in the HCP/2081 Permit will be included in the annual budget requests to the Council. Although the City Council will not automatically fund these expenses, adoption of the 2081 Permit demonstrates the City's commitment to fund and implement it. Further, the City understands that permit coverage would be at risk, and federal and state enforcement measures would be possible, if adequate budgets are not approved and measures are not implemented as planned.

City Constraints Associated with Funding

The City recognizes that changes in the allocation of funds from one project or action to another might be necessary during the 30-year term of the HCP/2081 Permit. Reallocation decisions will be made by the City, but will take into account advice given by the HCP TAC. To allow flexibility, the City will accommodate reallocation of funds within the following constraints:

- The total funding must adhere to the schedule in Figure 9-1.
- The annual increments of funding must adhere to the schedule in Figure 9-2.
- Funds can be reallocated within programs and categories, but not between programs and categories; some category totals are capped.

Details of these constraints are described in the sections below.

Scheduled Funding Increments

The City has carefully spread HCP/2081 Permit investments over the 30-year timeframe to achieve habitat conservation benefits, to accommodate adaptive management contingencies, and to manage the impact on water ratepayers. The total funding allocated for the life of the Permit by category is shown in Figure 9-1, while annual increments of investment by category are shown in Figure 9-2. The City's analysis has shown that shifting funds forward or backward in time from the defined increments will have unacceptable effects on water rates. For this reason, the funding allocations are confined to the time periods shown. Shifts in the allocation of project costs can occur only within, not between, the allocated time periods.

Limits on City's Financial Commitments

The City's total financial commitments to all elements of the HCP/2081 Permit are capped at the totals previously shown in Table 9-1. These capped amounts will be inflation-adjusted (see Section 9.4). Details are provided in Section 9.3.1.

Figure 9-1: Total Habitat Conservation Plan Funding by Program Area in 2018 Dollars

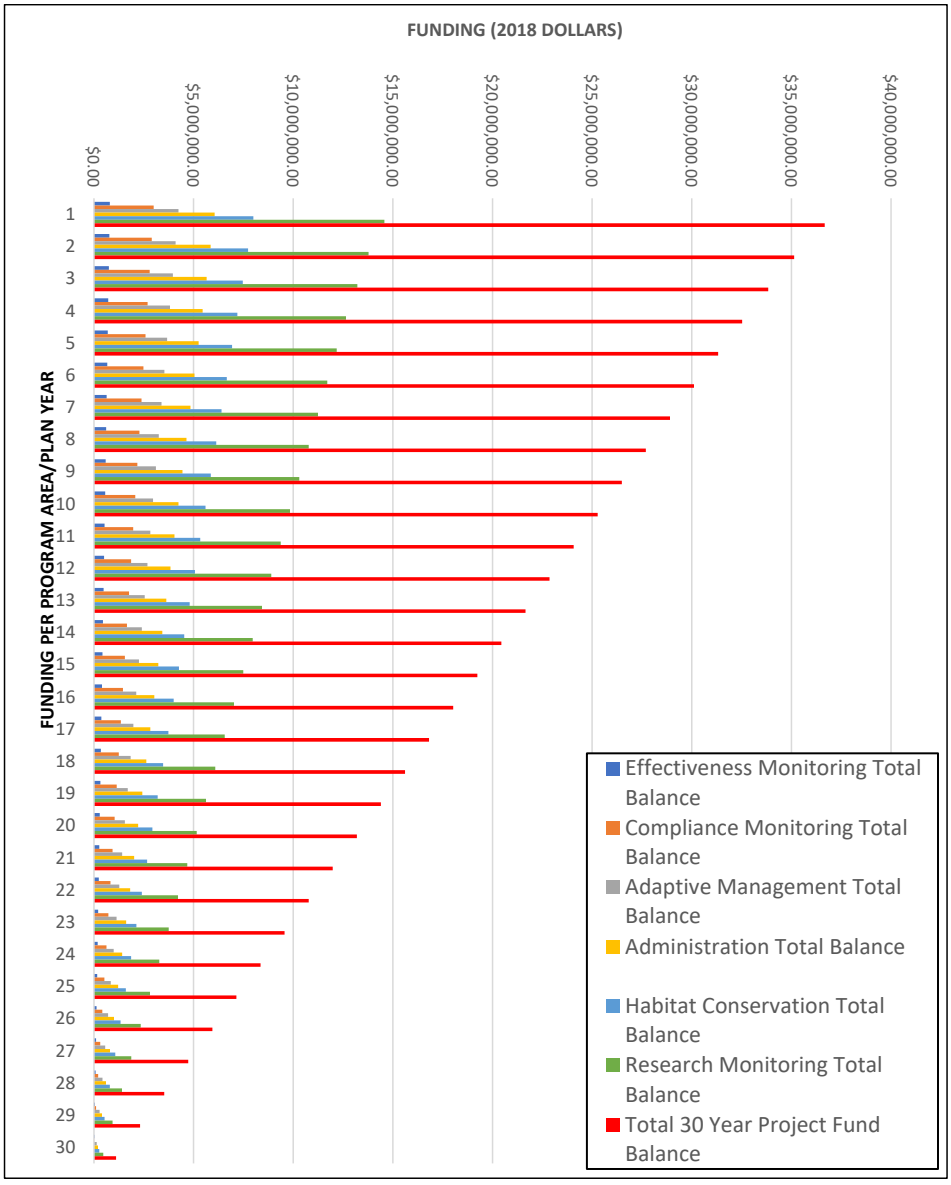
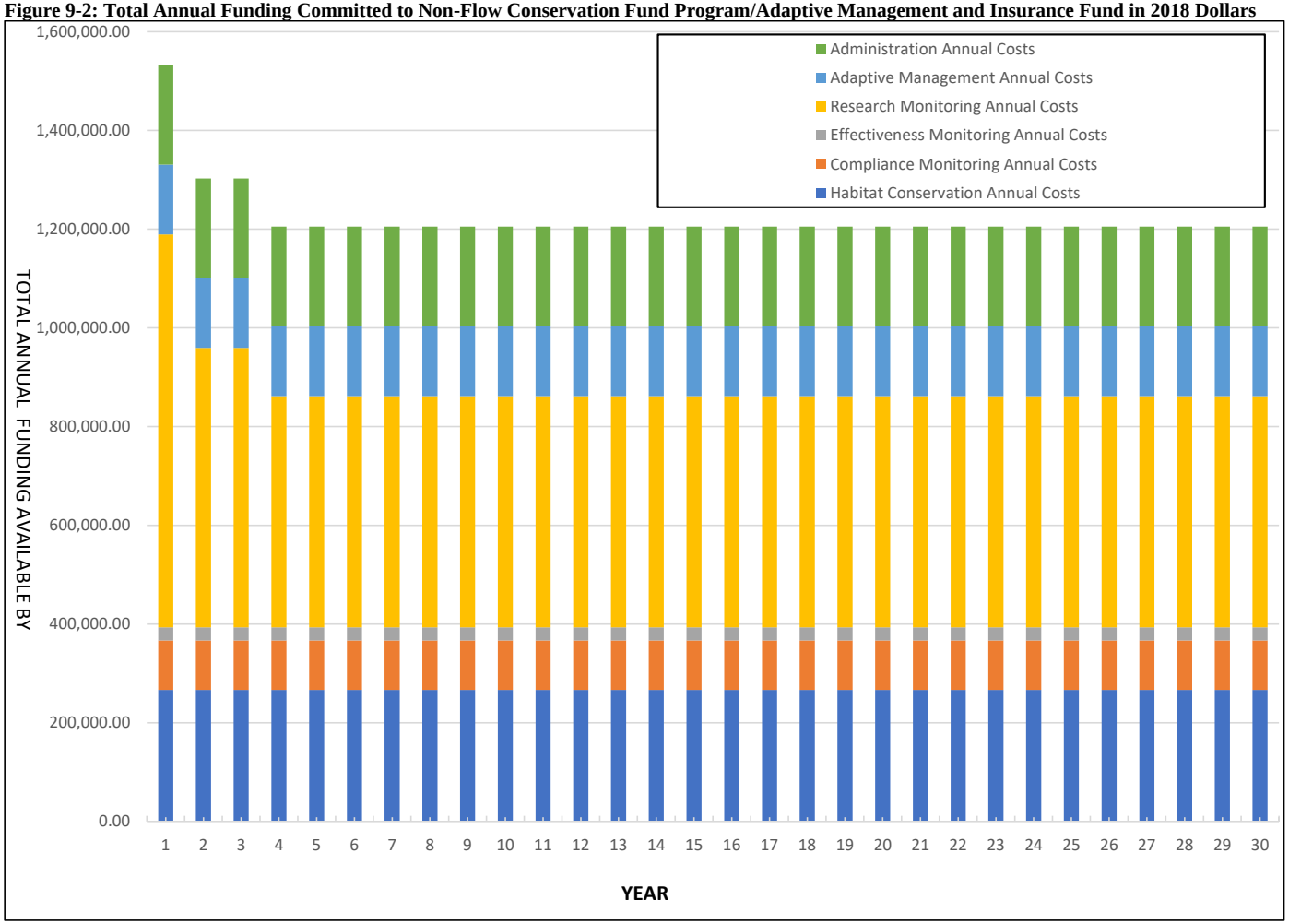


Figure 9-2: Total Annual Funding Committed to Non-Flow Conservation Fund Program/Adaptive Management and Insurance Fund in 2018 Dollars



9.3.1 Habitat Conservation Programs Funding

The City has allocated $8 million to the NFCF.[33] Funding will be available in the scheduled increments as shown in Figure 9-1 and Figure 9-2. The amounts shown in Table 9-3 are the estimated cost of each habitat conservation measure, not including a 20 percent contingency allowance. The City will pay up to the amount shown in Table 9-4 for each measure plus additional costs accounting for inflation by utilizing the national implicit price deflator (deflator) up to the date of implementation. The deflator measure is used to apply the effects of inflation for state and local government expenditures according to the California Department of Finance.[34] For example, the funding for a measure implemented in 2025 would be inflated from the 2018 estimate to 2025 based on the total rate of inflation between these periods as measured by the deflator. The deflator inflated amount represents the financial limit of the City's commitments for each project.

Annual spending on design, permitting, and implementation is expected to average approximately $275,000 per year (in 2018 dollars) within each 5-yr planning cycle over the 30-year lifetime of the HCP. The City may also, at its discretion, choose to allocate the total funding for the program either equally throughout the 30-year Permit term or front-load funding in the early years of the Plan.

The City is confident the dollar amounts allocated will be adequate to implement the Conservation Strategy. If, however, after detailed project planning, the measure is shown to cost more than the amount shown in Table 9-3 (inflated to the implementation date), the City will consult with the TAC about how to proceed. A variety of options are possible, including the following:

- The extra cost, above the amount shown in Table 9-3 plus the deflator rate of inflation, could be paid with savings from NFCF habitat measures that cost less than expected.
- The extra cost, above the amount shown in Table 9-3 plus deflator rate of inflation, could be deducted from remaining unallocated dollars in the NFCF.
- An alternative funding source could be found to supplement City funding for the project.
- A lower-cost measure with similar habitat benefits could be identified and implemented.
- The scope of the project could be modified.

[33] The NFCF analysis presented in Appendix 1 estimated a range of approximately $8,011,479 to $8,250,000 specifically for habitat conservation spending over the permit term. $8 million is used for simplicity's sake in this discussion and future planning purposes.

[34] Economic Research Unit, "How to Use CPI Data" State of California Department of Finance, Economic Research Unit, 2018, http://www.dof.ca.gov/Forecasting/Economics/Documents/How_to_Use_CPI_Data.pdf .

The City will not pay for expenses that exceed the per-project totals shown in Table 9-3 (as inflated to implementation date), except as provided in the Adaptive Management Program or in Chapter 8, or the HCP's Changed and Unforeseen Circumstances provisions. The scheduling of the offsite measures is also constrained by the availability of the funding increments shown in Table 9-3.

If needed, effectiveness monitoring for NFCF projects will be paid from the total allocated to the NFCF if funds are available there. Concurrent with adoption of the HCP/2081 Permit, the City will establish a "contingency account" and over the 30-year term will deposit a $1.6 million subset of the Adaptive Management Program funding into the contingency account to cover unanticipated costs of NFCF projects and related effectiveness monitoring. In addition, a $2.64 million subset of the Adaptive Management Program funding will be deposited into a separate "insurance account" specifically set aside for adaptive management and changed circumstances responses in accordance with the schedule in Figure 9-2. If needed, research monitoring can be funded from this insurance account as well. If the $2.64 million is not needed for adaptive management or changed circumstances responses, it will remain available to fund additional habitat conservation measures through the NFCF.

9.3.2 Monitoring Programs Funding

The City will fund the monitoring programs as shown in Table 9-4. The amounts defined in Table 9-4 are capped totals. The City will accommodate reallocation of funds within the categories shown in the table, but will not pay more than the totals shown for each category, as adjusted for inflation unless needed for adaptive management purposes (see Section 9.2 and Section 9.4).

9.3.3 Adaptive Management Programs Funding

The adaptive management funding allocations are shown in Table 9-6. These amounts are capped totals (with inflation adjustment, see Section 9.4), except as affected by provisions of Section 6.5 in the HCP, Changed and Unforeseen Circumstances.

As mentioned above, up to $1.6 million representing a 20% contingency of the NFCF as well as the insurance account of $2.64 million are available for adaptive management and changed circumstances responses, according to the framework described in Chapter 8 and shown in Figure 9-1 and Figure 9-2. If needed, research monitoring can be funded from the $2.64 million insurance account and effectiveness monitoring can be funded by the $1.6 million contingency account. If the funds in the contingency account are not needed for adaptive management or changed circumstances

at the milestones described in Chapter 8 and shown in Figure 9-2, they will revert to the City and not be available for other HCP costs.

Table 9-6: Adaptive Management Program Funding Allocations

Adaptive Management Programs Funding Category	Allocation in 2018 Dollars (30-year total)
NFCF Contingency Account	$1,600,000
Insurance Account	$2,640,000
TOTAL COST	**$4,240,000**

9.3.4 Jump Start and Stay Ahead Provision

To jump start non-flow conservation actions, the City will implement funding for year 1 projects in fiscal year 2024. Subsequent to permit issuance, the City will implement funding of year 2 projects, monitoring, adaptive management and administrative costs. This is anticipated to occur in fiscal year 2025. As discussed in Section 5 and Appendix 1, impacts to coho are limited because they are currently present in the permit area in very low numbers. Based upon the implementation of the Conservation Flows upon permit issuance, residual effects to coho habitat will be relatively minor, and the level of impact on individuals of the species using the habitat even more minor due to the low population numbers. As such, early implementation of projects will more than fully offset impacts to coho during the initial phases of HCP/2081 Permit implementation. Subsequent implementation of NFCF projects in accordance with the schedule set out in Table 9-3 over the 30-year term will ensure that mitigation stays well ahead of impacts from Covered Activities.

9.4 Adjustments for Inflation or Deflation

All cost estimates and commitments are shown in 2018 dollars. These dollar commitments will be adjusted annually for inflation or deflation using the historical deflator rates of change for state and local governments published by the U.S. Department of Commerce, which measures price changes in goods and services purchased by government programs on behalf of consumers. Deflators are not available below the national level so regional modifications are not possible.

10.0 Certification (CCR Title 14 § 783.2(a)(11))

I certify that the information submitted in this application is complete and accurate to the best of my knowledge and belief. I understand that any false statement herein may subject me to suspension or revocation of this Permit and to civil and criminal penalties under the laws of the State of California.

11.0 Literature Cited

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Personal Communication

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