

TO: WATER SUPPLY ADVISORY COMMITTEE
FROM: HEIDI LUCKENBACH & BILL FAISST
SUBJECT: STATUS OF THE CITY OF SANTA CRUZ WATER SYSTEM & INTEGRATION OF CONSOLIDATED ALTERNATIVES
DATE: APRIL 23, 2015

BACKGROUND

This memo and subsequent presentation outlines to the Water Supply Advisory Committee (WSAC) the status of existing water supply infrastructure including intakes, dams, pipelines, and pump stations. Additionally, the 10-year Capital Improvement Program (CIP) is attached and will be discussed. Both these items will be used to facilitate the thinking about the future water supply options and the opportunity to combine and/or prioritize projects to improve cost effectiveness or leverage needed investments.

Portions of the existing system date back to the early 1900s. While some significant investments have been made over the last century (replacement of portions of the North Coast Pipeline, upgrades to the Graham Hill Water Treatment Plant, and installation of new groundwater wells) along with routine operations and maintenance, a large capital improvement program remains and includes the majority of the system's components. The following list includes the dates of initial construction of the various raw water components. Further below is a description of most of these components, their current condition, and scope/schedule/budget for improvements.

The presentation to the WSAC at their April 30th meeting will include a discussion of the various water supply alternatives (the Consolidated Alternatives, or CAs) and how they may coincide with improvements within the CIP.

North Coast System

Laguna Creek Diversion – 1890

Liddell Spring – 1913

Majors Creek – 1884

Reggiardo Creek – 1912

North Coast Pipeline – early 1900s - 1950s

Intakes

Tait Street Wells and SLR Diversion – 1960s

Felton Diversion – 1970s

Water Treatment

Graham Hill Water Treatment Plant – 1960s

Beltz Water Treatment Plant - 1964

Loch Lomond Reservoir

Newell Creek Dam – 1960

Newell Creek Pipeline - 1960

DISCUSSION

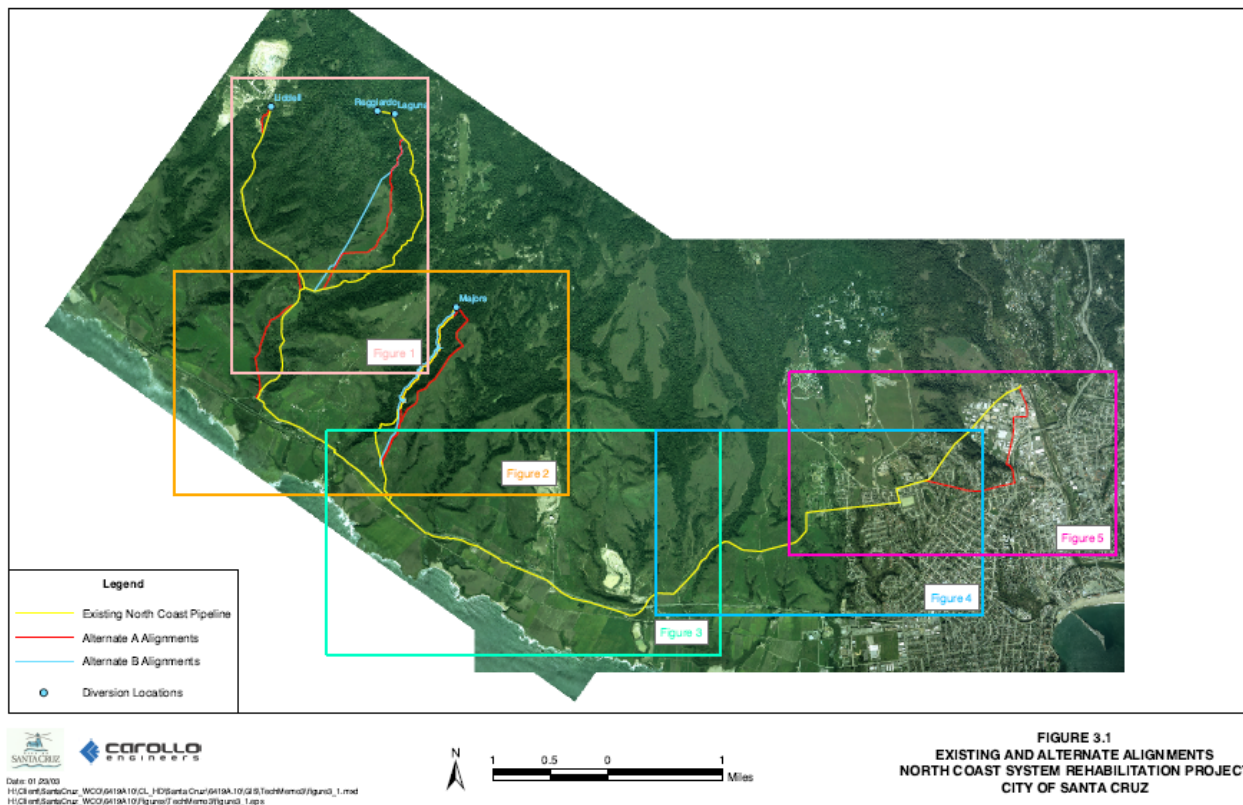
Generally speaking, each major component of the raw water system is contained in the 10-year CIP in some form, and as can be seen in the attached table, the finished water system also requires a lot of capital investment. Some components require minimal repair or rehabilitation, some require full replacement, and the condition of some is still unknown and requires a condition assessment. The department is aware of the potential synergy between existing system components and the process currently being undertaken by the Water

Supply Advisory Committee (WSAC). In other words there may be potential to combine future water supply projects with the CIP to be efficient as possible with resources.

The major components are shown below with a preliminary budget estimate and implementation schedule. These planning-level numbers likely will change as more is learned about the project need, funding opportunities, staffing resources, project delivery method, and outcome(s) of the WSAC process.

North Coast System

The Santa Cruz Water Department (SCWD) operates and maintains an 18-mile long pipe network and stream diversion structures, called the North Coast System (NCS). Diversion structures ranging in age from approximately 80 years to over 120 years direct flows from Liddell Spring, Reggiardo, Laguna and Majors creeks into a pipe system, which conveys water, by gravity, to the Coast Pump Station adjacent to the City's San Lorenzo River intake. The Coast Pump Station lifts water up to the Graham Hill Water Treatment Plant (GHWTP) where it is treated and then delivered to SCWD customers. The NCS relies entirely on rainfall runoff and emergent groundwater to furnish up to 30% of the City's water supply.



While much of the 18-miles of transmission pipeline was replaced in the 1950s, a significant portion is approaching, or has exceeded its design life, and must be replaced. The diversion and pipeline facilities have historically provided adequate service for the SCWD, however the aging facilities are increasingly prone to leakage and failure, and now require increased routine maintenance and emergency repairs.

Existing Deficiencies and Limitations include:

- Age/Condition – Due to age of the pipelines, deterioration of pipe materials has resulted in increased frequency of leaks and need of emergency repairs.
- Access Constraints – Limited access to many of the pipeline in their current alignments has resulted in increased maintenance requirements, potential damage to the environment, and in some cases, more costly and complicated repairs.

- **Hydraulic Constraints:** The current configuration of the system limits the diversion capacity during certain operating conditions.



Section Of Phase 3 North Coast Pipeline Project

Key Findings and Recommendations for rehabilitation/replacement of the pipeline are:

- A majority of the piping system needs to be replaced or rehabilitated in the next ~15 years.
- In select locations, the existing pipeline alignment encroaches on environmentally and culturally sensitive areas.
- Certain segments could be replaced in alternate alignments; however easement/access issues, environmental impacts, may limit the viability of the alternate alignments.
- In difficult to access, environmentally sensitive, and geologically active areas, new pipe may need to be installed above ground.
- To preserve system capacity, in most locations, existing piping should be replaced with a similar pipe size.
- System pressure and capacity requirements will reduce the number of choices for pipe material, and the feasibility of trenchless rehabilitation methods such as pipebursting, sleeving, and lining.

Two portions of the NC pipeline were completed between 2006 and 2012, and replaced a majority of the raw water system within the City limits. Sequencing of the six phases takes into consideration the following criteria: Environmental/Jurisdictional Setting, Project Cost, Construction Method, Permitting Synergies,

System Importance, and Leak History. For practical purposes, each phase has been capped at \$10 million total budget, and projects of a similar construction type or with similar permitting needs were grouped into the same phase, where possible. The current project, Phase 3, experiences the highest pressure making it most prone to leakage, is located almost entirely in two jurisdictions: State Parks or Caltrans right of way (ROW), and will be constructed predominantly by a single construction type-open-trench construction.

Construction of Phase 3 is schedule to start summer 2015 with a duration of two years and engineers estimate of approximately \$8,000,000. The remaining phases of the North Coast pipeline project is scheduled in fiscal years 2019 – 2032 for an additional ~\$30M.

North Coast Diversions

The City maintains diversions on four coastal sources (Liddell Spring, Reggiardo, Laguna and Majors creeks) which range in age from approximately 80 years to over 120 years. Like the pipeline, the diversion structures have historically provided adequate service for the City, but have been increasingly prone to leakage and failure in recent years and have increased routine maintenance and emergency repairs owing to their age and condition.



Creek Diversion Structure

Limitations of the existing diversion structures include:

- Sediment Accumulation – The original design of the diversion structures does not provide sufficient sediment flushing/transport capabilities, resulting in a buildup of rock, sand, and debris, reduction of the upstream pool size, and restrictions to the flow of water into the inlet pipe.
- Lack of Remote Operating and Monitoring Capability – The original design and current configuration of the diversion structures do not provide remote operation and monitoring capability at Reggiardo, Laguna, and Majors creek diversions. Hence, operating these diversions requires considerable staff time and travel.
- Structural Integrity – Despite their age, the main structural elements of the diversion structures are in generally good condition, except for minimal damage at the end wall abutments. However, modifications are necessary for the structures to remain viable into the future.
- Improper Sizing of Inlet Screens – Majors and Laguna creeks support native populations of rainbow trout. The intake screens at Majors and Laguna creeks are too large to eliminate the potential for

entrainment of juvenile fish and other aquatic organisms, potentially causing adverse environmental effects and allowing undesirable material to enter the pipeline.

- Fish Passage – The Majors, Laguna and Reggiardo diversions prevent upstream passage of resident fish. Downstream movement of fish may occur through the slide gate or over the crest of the dam of Laguna and Majors diversions when the water is spilling over it. Downstream flow through the slide gate and from most areas over the dam crest falls into shallow pools, potentially causing stress or injury to fish migrating downstream.

In June 2004, the City undertook the preparation of a program EIR (PEIR) for the project. The City Council certified the PEIR at a Public Hearing held on November 8, 2005.

The CIP now includes two projects, one for Laguna Dam and another Majors Dam. They are separate from the North Coast pipeline replacement for ease of budget tracking; they may be included with a pipeline phase as future phases are developed. Evaluation of each diversion's condition and development of a rehabilitation plan is scheduled to start in fiscal year 2019. Construction work is currently in fiscal year 2021.

Loch Lomond Reservoir

In the early 1960s, the City completed the construction of Newell Creek Dam. The City monitors the dam on a routine basis for overall structural and performance stability and also carries out special monitoring based on various triggers such as earthquakes and high rain events. The dam remains in excellent condition. The California Division of Safety of Dams (DSOD) adopted new seismic stability requirements several years ago requiring dam owners to demonstrate to DSOD that their dams were in compliance with these more stringent requirements. The City collected additional data on the construction materials used and demonstrated that Newell Creek Dam met the new seismic requirements.



Downstream Face of Newell Creek Dam (view from crest)



Downstream Face of Newell Creek Dam (view from toe)

The inlet/outlet pipe that fills and draws from the reservoir is located within the dam, at the bottom of the structural section. This pipeline is a steel-lined concrete encasement structure. At the toe of the dam a large diameter valve called a deluge valve allows the City to dewater the reservoir at a rapid rate under emergency conditions. Several years ago this valve became inoperable and in contemplating a repair the City also discovered that the pipeline within the dam is in questionable condition. The City has worked with DSOD and, while there is no immediate danger or concern with safety (dewatering is met with other valves), the City plans to evaluate the pipeline and valve further and make repairs or fully replace this pipeline.

Based on the experience of other dam owners, budget numbers in the CIP are for full replacement as follows: \$1,500,000 starting in fiscal year 2017 for the design, environmental and regulatory work associated with a repair, and \$50,000,000 in fiscal year 2019 for the repair. As the City learns more about the condition of the pipeline, it will update these numbers and timeframe.



Outlet vault including deluge valve at Newell Creek Dam.
(Continuous flow of water from reservoir is maintained for downstream environment.)

Newell Creek Pipeline

The pipeline from Loch Lomond Reservoir to the Graham Hill Treatment Plant dates back to 1960s, coincident with the construction of these two facilities. There is approximately 12 miles of large diameter pipe of varying physical condition. While performance issues related to age are an issue (i.e., some sections have required multiple repairs), the primary issue with this pipeline is its physical location. The pipeline is within some existing paved right of way such as Graham Hill Road, but also covers a significant amount of distance in unpaved and/or otherwise undisturbed areas such as Henry Cowell State Park. Similar to the North Coast Pipeline, the pipeline encroaches in some locations on environmentally sensitive areas, and areas that are difficult to access and geologically active.

This project requires further definition and either a program or project level Environmental Impact Report prior to any construction efforts. This work is schedule to begin in fiscal year 2017, with placeholders for construction (either rehabilitation of existing pipeline or replacement) starting in fiscal year 2019. An estimated budget is ~\$12,000,000.



Landslide along Newell Creek Pipeline

Graham Hill Water Treatment Plant

The GHWTP is a conventional treatment plant that was commissioned in 1960 as a 12 million gallon per day (mgd) plant and has undergone an expansion to 24 mgd and numerous plant improvements over that last 51 years.

The most recent improvements to the GHWTP were initially identified in the 2007 Water Quality & System Improvements Study (WQ&SIS). The WQ&SIS developed water quality and system reliability goals to meet the City's concerns regarding anticipated water quality regulations, and WTP reliability related to complex water demand and supply issues, along with aging equipment and infrastructure.

Several required improvements include:

- Rehabilitation of existing granular media filters
- Rehabilitation/replacement of existing concrete tanks
- Upgrades to the flocculation/sedimentation basins
- Upgrades or replacement of the existing chemical dosing systems; replacement of the existing chlorine gas system with an onsite sodium hypochlorite generation system
- Replacement of the existing sludge discharge line with a larger diameter pipeline.

The filter rehabilitation project is currently underway and will be completed this calendar year. Subsequent projects as bulleted above are schedule between the current fiscal year and fiscal year 2019. The City has budgeted approximately \$14,000,000 for these projects.

Felton Diversion

The City constructed the Felton Diversion structure and pump station in the 1970s. Studies prior to the 1970s, in the vein of continuing development of sources of water supply, opined that the diversion could divert water to Loch Lomond Reservoir, to a yet to be constructed Zayante Dam, a yet to be constructed Doyle Gulch Reservoir, and a pipeline for direct diversion from Felton Diversion to the GHWTP via Scotts Valley. Subsequent decisions resulted in no further consideration of Doyle Gulch Reservoir or the direct diversion pipeline and the ultimate project at Felton Diversion was sized to pump San Lorenzo River water to either Loch Lomond or Zayante, although pumps for the later were never completed.



Felton Diversion, Inflatable Dam

The project currently in the CIP will evaluate the condition of the inflatable dam and the possibility of installing a different type of intake structure to minimize operation and maintenance issues and maximizing total yield from this facility.

Evaluation of the facility is scheduled to start in fiscal year 2016 with construction in 2019. Until the evaluation is complete, it is difficult to put a value to the construction. As a placeholder, \$1,200,000 has been put into the CIP.

Summary

As can be seen on the attached table, the projects described above are the major components embedded in a larger list of projects. There are over \$200M of projects including placeholders of \$45M for a potential new water supply project.

The work of the WSAC will undoubtedly have an impact on the CIP and to the extent contemplated at this time; the CAs relating to each CIP project is included in the attached table. As the CAs are further vetted, the relationship between CAs and the CIP will be better understood and decisions will be made in a more informed way.