CITY OF SANTA CRUZ
City Hall
809 Center Street
Santa Cruz, California 95060

Water Department

WATER COMMISSION

Regular Meeting

October 02, 2017

7:00 P.M. GENERAL BUSINESS AND MATTERS OF PUBLIC INTEREST, COUNCIL CHAMBERS

The City of Santa Cruz does not discriminate against persons with disabilities. Out of consideration for people with chemical sensitivities, please attend the meeting fragrance free. Upon request, the agenda can be provided in a format to accommodate special needs. Additionally, if you wish to attend this public meeting and will require assistance such as an interpreter for American Sign Language, Spanish, or other special equipment, please call Water Administration at 831-420-5200 at least five days in advance so that arrangements can be made. The Cal-Relay system number: 1-800-735-2922.

APPEALS: Any person who believes that a final action of this advisory body has been taken in error may appeal that decision to the City Council. Appeals must be in writing, setting forth the nature of the action and the basis upon which the action is considered to be in error, and addressed to the City Council in care of the City Clerk.

Other - Appeals must be received by the City Clerk within ten (10) calendar days following the date of the action from which such appeal is being taken. An appeal must be accompanied by a fifty dollar ($50) filing fee.

Roll Call

Call to Order

Statements of Disqualification - Section 607 of the City Charter states that ... All members present at any meeting must vote unless disqualified, in which case the disqualification shall be publicly declared and a record thereof made. The City of Santa Cruz has adopted a Conflict of Interest Code, and Section 8 of that Code states that no person shall make or participate in a governmental decision which he or she knows or has reason to know will have a reasonably foreseeable material financial effect distinguishable from its effect on the public generally.

Oral Communications - No action shall be taken on this item.

Announcements - No action shall be taken on this item.

Consent Agenda (Pages 1.1 – 7.10) Items on the consent agenda are considered to

be routine in nature and will be acted upon in one motion. Specific items may be removed by members of the advisory body or public for separate consideration and discussion. Routine items that will be found on the consent agenda are City Council Items Affecting Water, Water Commission Minutes, Information Items, and Documents for Future Meetings, and Items initiated by members for Future Agendas. If one of these categories is not listed on the Consent Agenda then those items are not available for action.

1. City Council items affecting the Water Department

   That the Water Commission accept the City Council items affecting the Water Department.

2. August 7, 2017, Water Commission Minutes.

   Approve August 7, 2017, Water Commission Minutes.

3. Water Department Glossary

   That the Water Commission accept the draft Water Department Glossary.

4. 4th Quarter FY 2017 Financial Report

   That the Water Commission receive the 4th Quarter FY 2017 Financial Report.

5. Source Water Quality Monitoring Program Update

   That the Water Commission receive information on the Water Department's ongoing Source Water Quality Monitoring Program.

6. Update to the 2015 State of the Water System

   That the Water Commission receive an update to the State of the Water System provided to the Water Supply Advisory Committee (April 2015) and provide feedback.

7. Water Supply Augmentation Strategy, Quarterly Work Plan Update

   That the Water Commission receive information regarding the status of the various components of the Water Supply Augmentation Strategy and provide feedback.

General Business (Pages 8.1-8.88) Any document related to an agenda item for the General Business of this meeting distributed to the Water Commission less than 72 hours before this meeting is available for inspection at the Water

Administration Office, 212 Locust Street, Suite A, Santa Cruz, California. These documents will also be available for review at the Water Commission meeting with the display copy at the rear of the Council Chambers.

8. Workshop on Water Supply Modeling and Aquifer Storage and Recovery with Gary Fiske (Gary Fiske and Associates Inc.) and Robert C. Marks (Pueblo Water Resources Inc.)

   That the Water Commission receive information on the evaluation of winter water supply strategies, namely Aquifer Storage and Recovery and In Lieu.

Subcommittee/Advisory Body Oral Reports - No action shall be taken on this item.

Director's Oral Report - No action shall be taken on this item.

Adjournment - The next meeting of the Water Commission is tentatively scheduled for November 6, 2017, at 7:00 p.m. in Council Chambers.

Water Commission
AGENDA REPORT

DATE: 9/28/2017

AGENDA OF: 10/2/2017

SUBJECT: City Council items affecting the Water Department

RECOMMENDATION: That the Water Commission accept the City Council items affecting the Water Department.

BACKGROUND: August 8, 2017
Award of Contract for On-Call Construction Management Services and Approval of Contract Amendment No. 1 for River Street Main Replacement Project – Budget Adjustment (WT)
Motion carried to ratify award of contract for On-Call Construction Management Services to MNS Engineers, Inc. (Santa Barbara, CA) and ratifying approval of Contract Amendment No. 1 for River Street Main Replacement Project and authorizing the Water Director to execute future contract amendments that do not exceed the formal bid limit.

Resolution No. NS-29,280 was adopted appropriating $300,000 from Fund 715, Water System Development Charges, in the FY 2018 budget, to fund qualifying transmission main work included in the River Street Main Replacement Project.

Update on Regional Groundwater Planning and Management Activities and Appointment of a City Representative and Alternate to the Santa Margarita Groundwater Agency Board of Directors (WT)
Motion carried to appoint Water Commissioner Doug Engfer to be the City of Santa Cruz's representative on the Board of the Santa Margarita Groundwater Sustainability Agency and to appoint Water Director Rosemary Menard as Alternate.

August 22, 2017
University Tank No. 5 Replacement Project Contract Amendment No. 2 (WT)
Motion carried to ratify Contract Amendment No. 2 in the amount of $15,800 for the U5 Tank No. 5 Rehabilitation/Replacement Project agreement with Robert W Miles, Consulting Civil Engineer (RWMCE), in a form approved by the City Attorney.
Motion carried authorizing the Water Director to approve future change orders with RWMCE for the U5 Tank No. 5 Rehabilitation/Replacement Project agreement in a form approved by the City Attorney, for amounts that are within the approved project budget for Project c701506.

Cooperative Water Transfer, Groundwater Recharge, and Resource Management Pilot Project: Pipe Loop Study Award of Contract – Budget Adjustment (WT)

Motion carried to accept the proposal of Black & Veatch Corporation (Rancho Cordova, CA) in the amount of $668,626 for the implementation of a Pipe Loop Study and to authorize the City Manager to execute an agreement in a form to be approved by the City Attorney.

Resolution No. NS-29,284 was adopted amending the FY 2018 budget and appropriating $900,000 from Fund 711, Water Enterprise Fund, to fund the Pipe Loop Study, associated construction, and water testing.

September 12, 2017
FY2018 Budget Augmentation (WT)
Resolution Nos NS-29,288, NS-29,289, and NS-29,290 were adopted amending the FY 2018 budget and appropriating $337,917 from the Water Operations Fund (Fund 711) to fund positions and vehicles authorized as part of the FY 2018 budget process.

Bay Street Reservoir Solar PV System Project – Contract with Sandbar Solar – Notice of Completion (WT)
Motion carried to accept the work of Sandbar Solar (Santa Cruz, CA) as complete per the plans and specifications and authorize the filing of a Notice of Completion for the Bay Street Reservoir Solar Photovoltaic System Project.

Tait Wells Replacement Project CWO 2014-002 – Contract with Anderson Pacific Engineering Construction, Inc. – Notice of Completion (WT)
Motion carried to accept the work of Anderson Pacific Engineering Construction, Inc. (Santa Clara, CA) as complete per the plans and specifications and authorize the filing of a Notice of Completion for the Tait Wells Replacement Project.

September 26, 2017
Memorandum of Agreement among the City of Santa Cruz, the San Lorenzo Valley Water District, the Scotts Valley Water District, and the County of Santa Cruz on Exploring Potential Projects for the Conjunctive Use of Surface and Groundwater Resources in the Santa Margarita Groundwater Basin and San Lorenzo River Watershed (WT)
Motion carried to authorize the City Manager to sign the Memorandum of Agreement among the City of Santa Cruz, the San Lorenzo Valley Water District, the Scotts Valley Water District, and the County of Santa Cruz on exploring potential projects for the conjunctive use of surface and groundwater resources in the Santa Margarita Basin and San Lorenzo River Watershed in a form acceptable to the City Attorney.

Corporation Yard Material Storage Bin Roof Project – Contract with APCO-Ettner Inc. – Notice of Completion (WT)
Motion carried to accept the work of APCO-Ettner Inc. (Fresno, CA) as complete per the plans and specifications and authorize the filing of a Notice of Completion for the Corporation Yard Material Storage Bin Roof Project.

Newell Creek Dam Outlet Conduit Rehabilitation/Replacement - Professional Service Contract – Task 6 (50% Design) and Task 8 (100% Design) (WT)
Motion carried authorizing the City Manager to execute an agreement in a form approved by the City Attorney with AECOM (Oakland, CA) in the amount of $3,061,746 to provide professional services related to Phase 2 of the Newell Creek Dam Outlet Conduit Rehabilitation/Replacement Project.

Water Supply Modeling Support from Gary Fiske and Associates, Inc. for the Water Supply Augmentation Strategy and the Anadromous Salmonid Habitat Conservation Plan (WT)
Motion carried authorizing the Water Department to issue annual purchase orders exceeding the formal bid limit to Gary Fiske and Associates, Inc. for ongoing water supply modeling to support the implementation of the City's Water Supply Augmentation Strategy and Habitat Conservation Plan Development.

DISCUSSION: None.

FISCAL IMPACT:

Prepared by:	Approved by:
Amy Poncato	Rosemary Menard
Administrative Assistant III	Water Director

ATTACHMENTS:
None.

Water Commission
AGENDA REPORT

DATE: 9/28/2017

AGENDA OF: 10/2/2017

SUBJECT: August 7, 2017, Water Commission Minutes

RECOMMENDATION:
Approve August 7, 2017, Water Commission Minutes.

BACKGROUND: None.

DISCUSSION: None.

FISCAL IMPACT: None.

Prepared by:	Approved by:
Amy Poncato	Rosemary Menard
Administrative Assistant III	Water Director

ATTACHMENTS:
August 7, 2017, Water Commission Minutes

Water Department

Water Commission
7:00 p.m. –August 7, 2017
Council Chambers
809 Center Street, Santa Cruz

Minutes of a Water Commission Meeting

Call to Order Chair Wilshusen called the meeting to order at 7:02 p.m. in the City Council Chambers.

Roll Call

Present:	L. Wilshusen (Chair), D. Engfer (Vice-Chair), D. Baskin, J. Mekis, D. Schwarm, W. Wadlow
Absent:	A. Schiffrin, with notification
Staff Present:	R. Menard, Water Director; K. Crossley, Senior Professional Engineer; D. Valby, Associate Professional Engineer; D. Kehn, Assistant Engineer II; A. Poncato, Administrative Assistant III.

Others: 1 member of the public.

Announcements: There were no announcements.

Statements of Disqualification: There were no statements of disqualification.

Oral Communications: There were no oral communications.

Consent Agenda

1. Accept the City Council actions affecting the Water Department.
3. Update Water Commission Calendar.

Commissioner Baskin moved the Consent Agenda. Commissioner Mekis seconded.
VOICE VOTE: MOTION CARRIED
AYES: All.
NOES: None.
ABSENT: A. Schiffrin.

Items Removed from the Consent Agenda

2. Approve the June 5, 2017, Water Commission Minutes.

Commissioner Baskin moved the Consent Agenda. Commissioner Mekis seconded.
VOICE VOTE: MOTION CARRIED
AYES: All.

NOES: None.
ABSENT: A. Schiffrin.
ABSTAIN: Walt Wadlow was not present at the June 5, 2017, Water Commission meeting.

General Business

4. Water Supply Augmentation Strategy Recycled Water

Ms. Menard introduced Mr. Kehn who provided an overview of the Water Supply Feasibility Planning Study.

Would the bulk water station that is included in the two non-potable reuse options that were presented be available for use by members of the public?

- There is an option for that, but we only planned a bulk water station for contractors to use at this time.

Are the rates for irrigation the same as the rates for agriculture?

- No, agriculture irrigation rates are lower because the agricultural irrigation customers are taking untreated water directly from the North Coast pipeline. In this situation, very little of the water system's infrastructure is used to provide this service and, as a result, the cost of service basis results in a lower cost per volume.

When do we circle back to the longer-term projects, such as indirect potable reuse, that were discussed during the WSAC process?

- In addition to wrapping up the Recycled Wastewater Feasibility Planning Study this calendar year, staff is working with DUDEK to complete the Desalination Feasibility Update. In the next few months (currently scheduled for November and January) staff will begin to discuss with the Water Commission approaches to comparing project options for addressing water supply shortages. Additional information from the pilot ASR study and groundwater modeling scenarios is needed to begin to evaluate which project or potentially portfolio of projects, would meet the needs of the City Water Department. As an example, a water supply portfolio may include non-potable or indirect potable projects in addition to ASR.

Are the near term recommended projects consistent with work that was completed by the Water Supply Advisory Committee (WSAC)?

- The consistencies with the WSAC work has been our public outreach to help community members understand recycled water, the regulatory framework, and determining how recycled water can be used. The proposed projects, however do not substantially contribute to meeting the water supply gap.

Has there been any public participation process associated with this phase?

- The work we've been doing has been focused on technical feasibility of a very wide range of options. Before proceeding to further develop any potential project

recommendations, a significant public outreach and engagement effort would occur.

Does anyone on the project team have the expertise in chemicals of emerging concern (CECs) and understand the concerns of the community?

- We would rely on Trussell Technologies, Inc, the environmental and engineering firm sub consultant for expertise on water quality.

Have we done any water quality characterization of our wastewater in Santa Cruz as part of any work we have done on the recycled water feasibility work?

- We do not have that documentation here at the Water Department, but Akin Babatola, who is the Laboratory Environmental Compliance Manager at the Wastewater Treatment Facility, probably has this information. We'll do some research and see what is available that would make sense to share.

Who determines what regulations are in place in order to be Title 22 compliant?

- The State Water Resources Control Board is responsible for setting regulations that govern the production and distribution of Title 22 compliant recycled water. There are many steps that we would have to take in order to construct and operate a project that is Title 22 compliant. We would need to establish and maintain the necessary treatment processes and environmental barriers and our staff would require extensive training in order to be certified to operate the project. The project would require an operating permit issued by the State Board and that permit would include any t specific rules and criteria to that would apply to our situation and project.

Wouldn't we save money by collaborating with Soquel Creek Water District (SqCWD) for the groundwater recharge in the midterm?

- There could be some financial benefit if we were to collaborate with SqCWD on their project, but we obviously need to produce more water. Therefore, we would need to build a bigger treatment plant and treatment facility. There could be savings in sharing some pipeline facilities, but treatment facility would need to be scaled up to be substantially larger. So, the typical economy of scale concept doesn't necessarily apply in a linear way, particularly given the site constraints at the Wastewater Treatment plan.

<u>Final Comments and Requests for Follow Up</u>

- Continue to explore whether or not the BayCycle Project would provide irrigation water for University of California, Santa Cruz (UCSC) farm and garden.
- Use gallons as the unit of measure in all future reports.
- Include total construction costs in future tabular presentations.

5. <u>Gravity Trunk Main Pipeline Condition Assessment</u>

Ms. Menard introduced Mr. Valby who provided an overview of the Gravity Trunk Main Pipeline Condition Assessment.

What kind of inspection process did you have or do you have now that would have helped you figure out that the valves were inoperable sooner?

- We do have a valve exercising program which usually goes along with our flushing program. This pipe cannot be flushed like our distribution mains, which is why the problem did not get discovered until 2012. An ongoing valve exercising/valve maintenance program, typically using the valve machine enables us to test the operability of these large diameter valves, which were not able to be operated by hand.

Will the new valves be more resistant to the kinds of failure we've experienced with older valves?

- The new valves are of a modern design with a resilient wedge, do not require maintenance lubrication, have a much larger diameter than the old plug valves, and has an overall better design. The larger diameter opening means less friction losses at higher flow rates and less obstructed passage of inspection tools.

6. Program Management

Ms. Menard introduced Mr. Crossley who provided an overview of the solicitation for Program Management Consulting Services.

Have you received a lot of interest so far?

- Yes, we've completed informal interviews with four firms so far and we received statements of interest from about seven firms.

Do we do a lot of claims management?

- We try not to. Typically we try to handle them at the staff level but, if we don't feel comfortable we reach out to the City of Santa Cruz attorney.

Outsourcing for Project Managers is fine, but shouldn't the Program Manager be a city employee?

- Yes, the program managers we have spoken to have suggested that the head of the entire program should be a city employee. A city employee should always be at the highest level.

Which projects would this program manager be managing?

- The North Coast project, the Newell Creek Pipeline project and, all raw water projects, along with water treatment and eventually the supply augmentation project(s).

Subcommittee/Advisory Body Oral Reports No action shall be taken on this item.

7. Santa Cruz Mid-County Groundwater Agency

- The agency is forming an Advisory Committee to work with the consultants on drafting the groundwater sustainability plan. The Committee will have 13 members and will include one representative of each of the major agencies, one

member to represent the well owners, plus eight additional people who represent a diverse range of interest. Engaging broader interests in the sustainability planning process is dictated by the Sustainable Groundwater Management Act and the regulations that the California Department of Water Resources (DWR) have created for the implementation of the planning process.

Director's Oral Report No action shall be taken on this item.

- The Sentinel reported last week that water levels at Loch Lomond were down 15 feet when in fact water levels are only down 1.5 feet.
- We projected that we would have to go to the lake for water by August, but we have good flows and predict that we will not need to take water from the lake anytime soon.

Adjournment Meeting adjourned at 9:08 p.m. The next meeting of the Water Commission is scheduled for September 11, 2017, at 7:00 p.m. at a location to be determined.

Respectfully submitted,

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Staff

Water Commission
AGENDA REPORT

DATE: 9/28/2017

AGENDA OF: 10/2/2017

SUBJECT: Water Department Glossary

RECOMMENDATION: That the Water Commission accept the draft Water Department Glossary.

BACKGROUND: A glossary of terms was one of the items included in the Water Commission's work plan for 2017. The attached glossary is a work in progress and we plan to finalize it over the next few months. In the interim, suggestions can be directed to Nicole Dennis for inclusion in the final document. We plan to post the Glossary as a link on the Water Commission's webpage.

DISCUSSION: None.

FISCAL IMPACT: None.

Prepared by:	Approved by:
Nicole Dennis	Rosemary Menard
Principal Management Analyst	Water Director

ATTACHMENTS:
Water Department Glossary

List of Commonly Used Acronyms

1) ACWA – Association of California Water Agencies
2) ADA: Americans with Disabilities Act
3) ADU: Accessory Dwelling Unit
4) AMBAG: Association of Monterey Bay Area Governments
5) AFY: Acre Feet per Year
6) ASR: Aquifer Storage and Recovery
7) AV: Air Valve
8) BWP: Bar Wrapped Pipe
9) BSR: Bay Street Reservoir
10) CA-ELAP: California's Environmental Laboratory Accreditation Program
11) CCF: Hundred (Centum) Cubic Feet
12) CEQA: California Environmental Quality Act
13) cfs: cubic feet per second
14) CK: Creek
15) CIP: Capital Improvement Program
16) CWA: California Water Association
17) CWC: Coastal Watershed Council
18) CY: Calendar Year
19) DDW: CA Division of Drinking Water
20) DFG: Department of Fish and Game (now DFW)
21) DFW: CA Department of Fish & Wildlife
22) DPR: Direct Potable Reuse
23) DSCR: Debt Service Coverage Ratio
24) DWR: CA Department of Water Resources
25) FTE: Full Time Equivalency
26) FY: Fiscal Year
27) GHWTP: Graham Hill Water Treatment Plant
28) GRR: Groundwater Replenishment Reuse
29) GSP: Groundwater Sustainability Plan
30) HCP: Habitat Conservation Plan
31) HET: High Efficiency Toilets
32) IBank: California Infrastructure and Economic Development Bank
33) IPR: Indirect Potable Reuse
34) IRWMP: Integrated Regional Water Management Plan
35) JPA: Joint Powers Agreement
36) LF: Lineal Feet
37) LRFP: Long Range Financial Plan
38) MCDS: Multi-Criteria Decision Support
39) MCL: Maximum Contaminant Level
40) MCLG: Maximum Contaminant Level Goal
41) MG: Million Gallons
42) MGA: Santa Cruz Mid-County Groundwater Agency
43) MGY: Million Gallons per Year
44) MHJB: Mount Herman June Beetle
45) MRF: Multi-Family Residential
46) MRLD: Maximum Residual Disinfectant Level
47) MRLDG: Maximum Residual Disinfectant Level Goal
48) MSL: Mean Sea Level
49) MW: Monitoring Well

50) MXU: Multiplex Unit
51) NEPA: National Environmental Policy Act
52) NMFS: National Marine Fisheries Service
53) NPDES: National Pollutant Discharge Elimination System
54) NPR: Non-potable Reuse
55) NTU: Nephelometric Turbidity Units (measure of water clarity)
56) pCi/L: picocuries per liter (a measurement of radioactivity)
57) PCP: Prestressed Concrete Pipe
58) PVC: Polyvinyl Chloride pipe
59) PDWS: Primary Drinking Water Standard
60) ppm: parts per million or milligrams per liter (mg/L)
61) ppb: parts per billion or micrograms per liter (µg/L)
62) RCP: Reinforced Concrete Pipe
63) RWFPS: Recycled Water Facilities Planning Study
64) RWMF: Regional Water Management Foundation
65) SAGMC: Soquel Aptos Groundwater Management Committee (now MGA)
66) SCMU: Santa Cruz Municipal Utilities
67) SCWD: Santa Cruz Water Department
68) SDC: System Development Charges
69) SFR :Single Family Residential
70) SGMA: Sustainable Groundwater Management Act
71) SLR: San Lorenzo River
72) SLVWD: San Lorenzo Valley Water District
73) SqCWD: Soquel Creek Water District
74) SVWD: Scotts Valley Water Department
75) SWRCB: State Water Resources Control Board
76) TTHMs: Total Trihalomethanes
77) TUCP: Temporary Urgency Change Petition
78) UHET: Ultra High Efficiency Toilets
79) Umho/cm: unit of measurement of water's electrical conductivity
80) UWMP: Urban Water Management Plan
81) WSAC: Water Supply Advisory Committee
82) WTP: Water Treatment Plant
83) WWTP: Wastewater Treatment Plant

Glossary of Terms

Active recharge: Regarding aquifer storage, active recharge implies artificially moving water from the surface into ground water systems.

Adaptation framework: General approach to enable the City and Water Department to adjust plans (i.e., to adapt) in the face of key future uncertainties, by taking account of future information as it becomes available.

Adaptive flexibility: The ability of a plan to adjust to changing circumstances and emerging information over time.

Adaptive pathway: The path forward through time, representing where and why plans may need adjustment (adaptation) as new information becomes available.

Adjustment framework: Similar to the adaptation framework, but pertaining to modest-sized adjustments to a path rather than a possible movement from one future path to another.

AFY: acre feet per year: A unit of measurement that demonstrates both water supply and demand on a municipal-wide scale. One acre foot is the volume of one acre of surface area to a depth of one foot. One acre foot is 43,560 cubic feet or 325,851 gallons per year.

Alternatives: Proposed solutions or alleviations to the system's supply shortfall that intend to use new or underutilized sources of water, expanding storage, and/or creating or adapting production methods.

CII: Commercial, institutional and industrial entities; non-residential customers of the Water Department.

CII MF: CII and multi-family residential customers.

Confluence®: An analytical water resources planning tool that simulates current and future water supply and demand scenarios, evaluates the results, and presents them in an understandable fashion. (Confluence was developed by Gary Fiske and Associates.)

Confluence model: The presentation of the Confluence results which provides a vast array of information in a flexible manner.

Conjunctive use: Using groundwater and surface waters together to improved water availability and reliability.

Continuity Agreement: an ongoing or "rolling" service application used by many property management companies to assume responsibility of the account after a tenant discontinues service. Continuity agreements allow utility services to remain active while the dwelling unit is vacant so that property management companies can "clean & show" the apartment while it's for rent.

Debt Service Coverage Ratio: It is a financial ratio that measures the ability of an organization to pay current debt obligations by comparing its net operating income with its total debt service obligations. The Debt Service Coverage Ratio is defined as net operating income divided by total debt service. The ratio states net operating income as a multiple of debt obligations due within one year, including interest, principal and sinking fund obligations.

Decision nodes: Points along an adaptive pathway at which information is anticipated that may support a decision to either proceed as initially planned, or adjust the plan (e.g., switch to a different pathway forward).

Decision space: The factors, information, and time in which a decision is to be made.

Demand management: The guidance of reduced water consumption through conservation and other curtailment methods (e.g., departmental rebate for low-flow toilet installation).

Direct potable reuse: An approach to recycled water where advanced purified wastewater is introduced directly into a potable water supply distribution system.

Drought-resistant: Alternative water supply that is not highly dependent on rainfall for its source.

Econometric: A form of statistical analysis applied in the social sciences (e.g., to explain or forecast water demand).

GL (General Ledger) edit & post: a process by which utility payments are reconciled and posted to the City's main accounting record or "ledger." The general ledger is the City's accounting record of revenue and expense transactions; general ledger financial reports show how utility payments pay for operations & maintenance, capital improvement, emergency reserves, etcetera, as well as your benefits and wages.

Fiscal Year:

Fish flows: Designation of specific stream flows at a particular location for a defined time, and typically follows seasonal variations with the intent of protecting and preserving resources for the surrounding environment and fish. [Ref. http://www.dfg.ca.gov/water/instream_flow.html]

Flow regime: The amount of water that is (or is required to be) found instream, across seasons and hydrologic years.

Forward osmosis (FO): A system of filtering water by using a "draw solution." Water molecules cross a semi-permeable membrane from a less salty liquid to a more salty liquid because of the osmotic pressure differential of the two solutions. Compared to reverse osmosis, forward osmosis is a low pressure-driven system.

Gantt chart: A bar chart that demonstrates components of a project's schedule.

GPCD: Gallons per capita per day, or the average daily water usage per person.

HCP: A Habitat Conservation Plan (HCP) is a required part of an application for permits to continue to take water from the San Lorenzo River and North Coast Streams. The HCP evaluates the impacts the City's water withdrawals have on endangered fish and spells out how they will be avoided or minimized. The HCP establishes an agreed upon amount of water that is needed for fish protection, and therefore how much remains for City consumption.

Indirect potable reuse: An approach to recycled water where advanced purified water is combined with water from a natural water source (often in an aquifer or reservoir) where it can later receive more treatment before being introduced to a potable water supply distribution system.

Interest-based bargaining: A method intended to increase the effectiveness of negotiations to develop consensus. The goal is for every member of the negotiation to win something, and to do so by addressing all interests, maintain a cooperative approach, and focus on the importance of relationships among members. There is usually more than one satisfactory solution in Interest-based bargaining.

Intertie: A connecting pipeline between water systems that allows the transfer of potable water.

Karst: A terrain with distinctive landforms and hydrology created from the dissolution of soluble rocks, principally limestone and dolomite. Karst terrain is characterized by springs, caves, sinkholes, and a unique hydrogeology that results in aquifers that are highly productive but extremely vulnerable to contamination. In the United States, about 40% of the groundwater used for drinking comes from karst aquifers. [http://water.usgs.gov/ogw/karst/pages/whatiskarst]

LRAA: Locational Running Annual Average: The locational average of the most recent 12 months of data.

MCDS: Multi criteria decision system: A framework for organizing, analyzing, and communicating considerations of proposed approaches to water supply and demand. MCDS produces a model that contains criterion and alternatives. Each criterion and alternative has a description, ratings scales, and weights.

MCL: Maximum Contaminant Level: The highest level of a contaminant that is allowed in drinking water. Primary MCLs are set as close to the PHGs (or MCLGs) as is economically and technologically feasible. Secondary MCLs are set to protect the odor, taste, and appearance of drinking water.

MCLG: Maximum Contaminant Level Goal: The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs are set by the U.S. Environmental Protection Agency.

Meter Inventory: a multi-layered record of each meter and its associated parts and attributes. In the utility billing database, each meter is linked to several other unique ID numbers, including the radio ID, register ID, usage point, and route. All ID numbers need to be exact and exactly aligned for meter reads to make it into billing.

MGY: Million gallons per year: A unit of measurement that demonstrates both water supply and demand on a municipal-wide scale.

Modeling and forecasting: Water supply planning and analytical tools used in designing the water system and estimating its performance and demands under various future scenarios.

Mount Herman June Beetle Endowment (Fund 718): Mount Herman June Beetle (MHJB) Endowment was established in 2015 to mitigate the impacts due to normal operations at the Graham Hill Water Treatment Plant. The endowment was required buy a United States Fish and Wildlife permit and, in addition to preserving high quality MHJB habitat at Laguna Creek, we established a 30-year, non-wasting endowment to demonstrate our commitment to fund costs associated with protecting the MHJB.

MRDL: Maximum Residual Disinfectant Level: The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

MRDLG: Maximum Residual Disinfectant Level Goal: The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

NTUs: Nephelometric Turbidity Units: A measure of the level of turbidity, or suspended particles, in a liquid. Drinking water standards require turbidity to be in the range of ~ 0-1NTU.

Passive recharge: Regarding aquifer storage, passive recharge implies moving water naturally from the surface into ground water systems (such as by substituting surface water to supply water users, and thereby resting extraction wells).

PDWS: Primary Drinking Water Standard: MCLs for contaminants that affect health along with their monitoring and reporting requirements, and water treatment requirements.

Peak season: The months between May and October where demand for water is higher than the remaining months due to dry weather conditions and a significant increase in tourist activity.

PHG: Public Health Goal: The level of a contaminant in drinking water below which there is no known or expected risk to health. PHGs are set by the California Environmental Protection Agency.

Portfolio: Collections of potential solutions and alleviations to the system's supply and demand shortfall distributed to the Committee to review, consider, and assess.

Price elasticity: Regarding demand, price elasticity is an economic term that represents the responsiveness of demand when the price of goods and/or services are subjected to changes.

RAL: Regulatory Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.

Ranney collectors: A patented type of radial collector well used to extract water from a direct connection to a surface water source (e.g., a river) by extending radially under the surface floor (e.g., river bed). These radial or horizontal wells flow to a conventional well before being pumped to the surface.

Rating Agency Credit Scale – Credit ratings express risk in relative rank order and are considered a point in time opinion of the rating agencies. Rating agencies (S&P, Fitch) use the same scale with "AAA" at the top and "BBB-" at the bottom of investment grade ratings. Non-investment or speculative grade ratings begin with BB+ to D. Factors used in assigning a water agency credit rating include: system characteristics, financial strength, management and legal provisions.

Rate Sheet: a handout that lists the monthly price (or rate) of each utility service. Rate sheets are not comprehensive—there are too many miscellaneous services to include on one sheet of paper—but instead include the most common utility services.

Remittance: utility payments sent via the mail. Customer Service now processes an average of 300 mail payments each morning. This process includes picking up the mail from the post office, opening it, batching payment stubs with checks, scanning stubs and checks, reconciling discrepancies between stubs,

checks, and accounts, balancing batch payment files, and uploading the receipts into the utility billing system.

Reverse osmosis: A system of filtering dissolved solids from water by driving the water through a semi-permeable membrane. Compared to forward osmosis, reverse osmosis is a high pressure driven system.

Rule curve: As applied to dam operations, for example, indicating the guidelines for how releases from the dam are managed (i.e., when to use the water, and when to store it).

Runoff: The flow of surface water from excess rain or other sources. This occurs when the source of water is distributed faster than the surface is able to absorb it, resulting in the flow of water.

Scalability: The capability to alter a project's plans to meet differing demand scenarios (ex.: adapting the plans regarding the size of a recycled water plant to produce less water for a smaller customer base than what was originally imagined).

Scenario planning: Exercises intended to demonstrate potential future water supply and demand situations (ex.: long periods of drought, lowered demand due to conservation, etc.).

SDWS: Secondary Drinking Water Standards: MCLs for contaminants that may adversely affect the taste, odor or appearance of drinking water. These are aesthetic considerations that are not considered as health concerns.

Supply augmentation: Adding to the water supply.

Supply-demand gap: The difference between a water system's ability to sustainably store and provide water to its customers and the demand on the system. The amount by which demand may exceed supply, such as in the peak demand season.

TT: Treatment Technique: A required process intended to reduce the level of a contaminant in drinking water.

Turbidity: The cloudiness or haziness of a fluid caused by the presence of particulates in the water.

UHET: Ultra high efficiency toilet.

Urban Water Management Plan: A report that fulfills the requirements described in the Urban Water Management Planning Act. The report describes the utility's water resource supplies and projects needs over a twenty-year planning horizon with relation to conservation, water service reliability, water recycling, opportunities for water transfers, and contingency plans for drought events. The latest report was published in 2010.

Water 90 Day Operating Fund (Fund 716) – The Water 90 Day Operating Fund provides financial stability, including supporting the Water Department in addressing cash flow issues which are an inherent result of the seasonability of water revenues. Maintaining a strong cash reserve also helps maintain the utility's bond rating and ensure the lowest possible borrowing costs. Together with the Water Operations Fund (Fund 711), the two funds are designed to meet the Water Department's 180 day operating reserve financial goal.

Water Emergency Reserve (Fund 717) – The Water Emergency Reserve provides resources necessary for any emergency repairs required to ensure continued water service to customers and service areas as the result of events which are impossible to anticipate. The fund shall be used in situations such as natural disasters or other unforeseeable cause of damage to or disruption of the system that require financial resources above those that would normally be available to respond to such a situation.

Water Operations Fund (Fund 711) – The Water Operations Fund includes all expenditures and revenues related to the daily operations of the Water Department including the majority of funding for the Department's CIP. Together with the Water 90 Day Operating Fund (Fund 716), the two funds are designed to meet the Water Department's 180 day operating reserve financial goal.

Water Public Art Fund (**Fund 714)** – The Water Public Art Fund is a set aside for public art projects throughout the City. The Water Department participates in the creation of art which promotes and/or educates the public on the water system. Calculated by fund, 1% is levied on an average of the most recent three-year total eligible capital spending. More information about the City's Public Art program can be found in the Municipal Code Chapter 12.80.

Water Rate Stabilization Fund (Fund 713) – The Water Rate Stabilization Fund is intended to provide a financial buffer for the risks which may result from uncontrollable factors such as cool or rainy weather, and economic downturns. It will also help mitigate the inherent risk of basing so much revenue on the volume of water sold.

Water System Development Charges (**Fund 715)** – The Water System Development Charges (SDC) are one-time fees, collected as a condition of establishing a new connection to the City's water system or the expansion of an existing connection. The purpose of these fees is to pay for the development's share of the costs of new and existing water facilities and infrastructure. These funds support the Department's conservation rebate programs as well as funds a portion of specific CIP projects which improve the system's capacity. Also referred to as "connection fees."

Water-neutral: As applied to development paths (i.e., levels of population or economic growth), signifying an approach that does not change overall demand for water.

Water year: Each water year begins October 1 and extends through September 30.

Calculations

- (#) – negative number
- > - less than
- < - more than
- **Debt Service Coverage Ratio Calculation**: The Water Department financial model calculates the debt coverage ration with reserves and without reserves. The calculation with reserves is:
  - Net Operating Revenues + Ending Total Cash Balance/Debt Service

  For the Debt Service Coverage without reserves the calculation is:

  - Net Operating Revenues - Rate Stabilization (713) & Emergency Reserve (Fund 717)/Debt Service

Source Documents

2016 Annual Report
Annual Budgets
Comprehensive Cost of Service Water Rate Study, August 2016
Consumer Confidence report 2016
Customer Service Glossary, 2017
Long Range Financial Plan, June 2016
Staff Reports, City Council & Water Commission
Water Department Financial Reserve Policy, December 2016
Water System Development Charge Study, April 2015
WSAC Final Report on Agreements and Recommendations, October 2015

Water Commission
AGENDA REPORT

DATE: 9/27/2017

AGENDA OF: 10/2/2017

SUBJECT: 4th Quarter FY 2017 Financial Report

RECOMMENDATION: That the Water Commission receive the 4th Quarter FY 2017 Financial Report.

BACKGROUND: The attached 4th Quarter FY 2017 Financial Report demonstrates that the Water Department is meeting the financial objectives established in the Long Range Financial Plan (LRFP). The report presents the FY 2017 year-end, unaudited, financial expenditures, revenues, and reserve balances.

Water Operations Fund Balance: The Water Operations fund (Fund 711) ended the year on June 30, 2017 with a balance of nearly $10.8M. The FY 2017 Pro-Forma projected an ending balance of nearly $9.6M in Fund 711. The small but positive variance of $1.2M between the Pro-Forma and the actual fund balance is largely due to salary savings and higher than expected revenue at Loch Lomond Reservoir. The target balance of $6.6M for Fund 711 shown in the attached report is the minimum amount needed to maintain 180 days cash on hand when combined with the balance in Water 90-Day Reserve Fund (Fund 716). The other Water Enterprise Funds ended FY 2017 with a fund balance consistent with the targets contained in the FY 2017 Pro-Forma.

Water Sales: The total actual water sales revenue received was $28.4M, 6% less than the $30.3M budgeted. The budget was based on an annual water volume sold of 2.5 BGY (or 3,342,244 CCF) and the total actual volume sold was 2.34 BGY (or 3,131,657 CCF), 6% less than projected. The very wet winter and wet cool spring may explain the lower than expected usage; however, the rate increases and lingering drought effects may also be contributing factors.

Miscellaneous Revenues: As mentioned above, Loch Lomond Recreation Area revenues well exceeded expectations. They had over 47K visitors in calendar year 2016; that amount of visitors has not been seen in nearly 10-years and appears to be continuing into calendar year 2017. Combined with the fee increases implemented for the 2016 season, Loch Lomond Recreation Area revenues accounted for the higher than expected miscellaneous fees.

Grants & Other Financing: The Water Department budgeted the proceeds of the $25M I-Bank loan between two fiscal years, $3M in FY 2016 and $22M in FY 2017, based on the timing of the projected disbursements. However, Finance applied the entire loan proceeds to the FY 2016 actuals.

Expenses: As was expected, the Department spent less than budgeted in personnel, O&M, and capital outlay but exceeded the budget for debt service. The salary savings are due in part to the time it takes to recruit and hire staff. Operational savings are due in part to delays in HCP and water rights work, delays in maintenance projects due to the winter storms, and energy savings after the BSR solar installation. Capital Outlay purchases made through the City's Fleet division were also delayed and such orders were transferred from the FY 2017 budget to the FY 2018 budget. Debt service amounts are budgeted by the Finance Department and should be more accurately budgeted in FY 2018.

DISCUSSION: None

FISCAL IMPACT: None

Prepared by:	Approved by:
Malissa Kaping	Rosemary Menard
Management Analyst	Water Director

ATTACHMENTS:
4th Quarter 2017 Financial Report

4th Quarter FY2017
Preliminary, Unaudited, as of 6/30/17

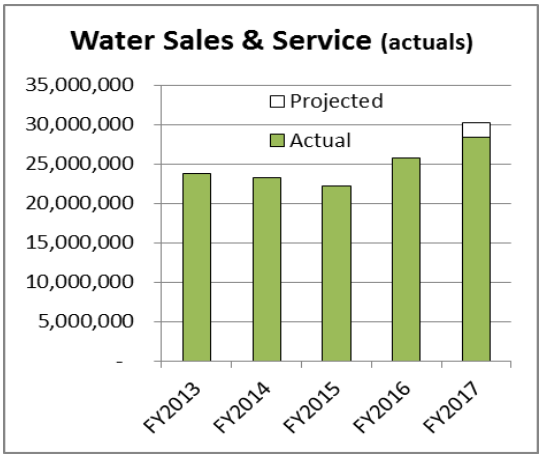
Water Operations, Fund 711

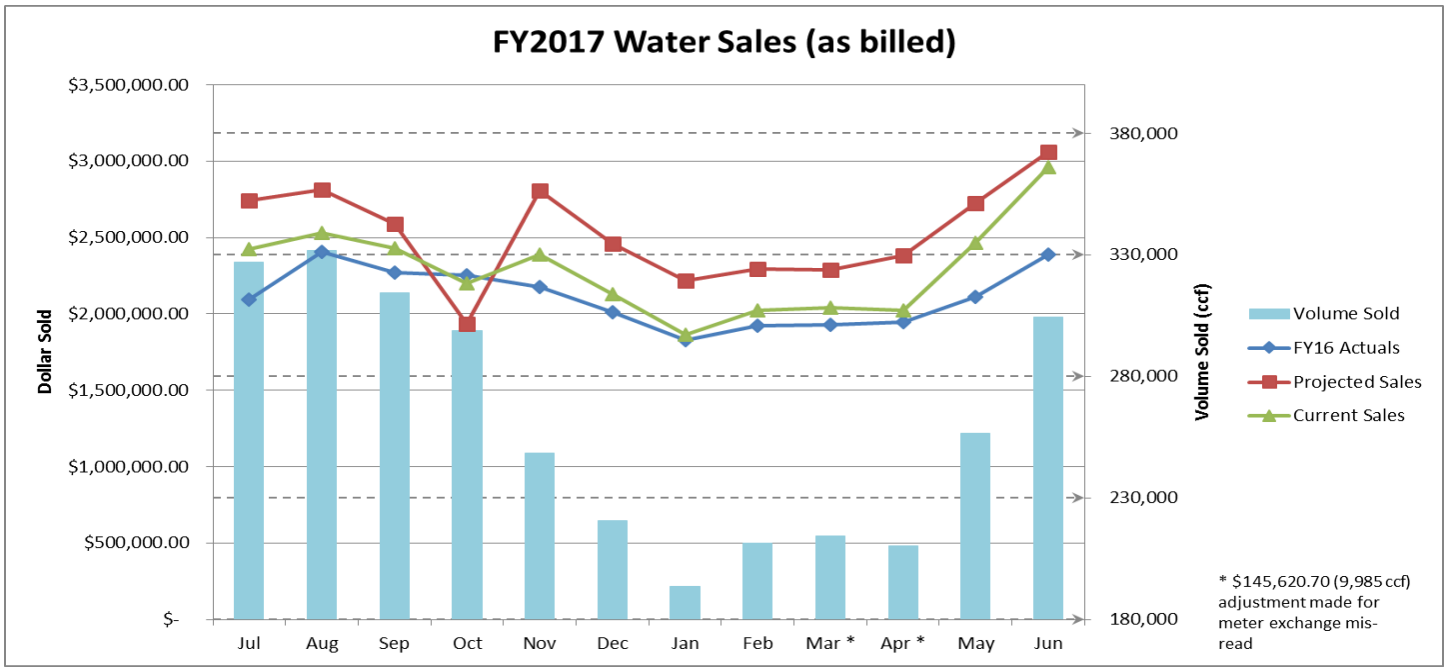
	FY2017 Ado Budget	FY2017 Adj Budget	Actual YTD Thru 6/30/17	Remaining Enc	FY2017 YTD Act + Enc	YTD % of Budget Act + Enc
Revenues						
Water Sales and Service *	30,278,463	30,278,463	28,368,079	-	28,368,079	94%
Miscellaneous	1,045,315	1,045,315	1,325,912	-	1,325,912	127%
Grants & Other Financing	22,008,000	22,008,000	196,400	-	196,400	1%
Total Revenues	**53,331,778**	**53,331,778**	**29,890,391**	**-**	**29,890,391**	**56%**
Expenses			-			
Personnel	12,741,984	12,802,461	11,543,905		11,543,905	90%
Services, Supplies, and Other	20,794,807	30,491,597	19,128,105		19,128,105	63%
Capital Outlay: Other	965,000	1,083,050	369,864		369,864	34%
Debt Service	970,550	1,220,550	1,515,413		1,515,413	124%
Total Expenses	**35,472,341**	**45,597,658**	**32,557,286**	**-**	**32,557,286**	**71%**
Balance		7,734,120	(2,666,895)		(2,666,895)	

FY2017 Fund Balances

	Balance as of 6/30/17	Target Balance
711- Enterprise Operations	10,758,786	6,600,000
713- Rate Stabilization	2,479,026	2,450,000
714- Public Art	288,477	N/A
715-System Devel. Charges	3,321,787	N/A
716- 90-Day Operating Reserve	6,490,700	6,600,000
717- Emergency Reserve	3,042,715	3,100,000
718- MHJB Endowment	143,342	145,000

* Actual revenues received (not as billed)





CIP Projects Overview, as of 6/30/2017

Rehabilitation or Replacement Projects	Project #	Life of Project Total (Projected) **	Spend Thru 6/30/17 *	Project Duration	Current Status
Aerators at Loch Lomond	c701706	350,000	-	2017-2019	Feasibility
Bay Street Reservoir Reconstruction	c700313 & -027	25,934,172	24,428,785	2007-2017	Wrap-up/Phase 4
Beltz 10 & 11 Rehab & Development	c700026	509,243	64,243	2017-2018	Pre-Design
Coast Pump Station Line Repairs	c701707	550,000	-	2018	Feasibility
Felton Diversion Replac. & Pump Station	c701602	1,200,000	92,036	2016-2020	Pre-Design
Gravity Trunk Main Valve Replacement	c701504	640,000	511,019	2014-2017	Construction
Newell Creek Dam Inlet/Outlet Pipeline	c701606	49,940,744	966,872	2016-2021	Design
Newell Creek Pipeline Rehab/Replacement	c701701	19,782,600	-	2016-2020	Feasibility
N. Coast System Rehab- Laguna Diversion	c701801	1,750,000	-	2018-2021	Feasibility
N. Coast System Rehab- Majors Diversion	c701802	1,750,000	-	2018-2021	Feasibility
North Coast System Rehab - Phases 1-4	c709835	28,686,759	12,659,246	2003-2023	Construction
Pressure Regulating Stations	c701703	490,000	41,229	2017-2020	Pre-Design
San Lorenzo River Diversion & Tait Wells	c709872	2,055,014	1,930,344	2002-2017	Project Wrap-up
Tube Settler Replacement	c701708	2,200,000	47,264	2018	Pre-Design
University Tank No. 4 Rehab/Replace	c701505	3,770,000	-	2014 - 2020	Feasibility
University Tank No. 5 Replacement	c701506	4,028,000	189,608	2014 - 2018	Design
Water Treatment Upgrades	c700025 & -1401	815,547	430,620	On-going	Feasibility
Wharf Water Main Replacement	c701613	193,501	158,188	2016	Completed
WTP Concrete Tanks Replacement	c701501	10,563,320	420,388	2014 - 2020	Design
WTP Filter Rehabilitation and Upgrades	c701303	6,037,300	5,749,366	2013 - 2017	Project Wrap-up
WTP Flocculator Improvements	c701502	2,360,000	-	2018-2019	Feasibility
		163,606,200	**47,689,208**		

Upgrades or Improvement Projects	Project #	Life of Project Total (Projected) **	Spend Thru 6/30/17 *	Project Duration	Current Status
Advanced Metering Infrastructure (AMI)	c701603	8,100,000	5,600	TBD	Feasibility
Loch Lomond Facilities Improvements	c701301	385,000	73,626	2013-2020	Design/Construction
Photovoltaic System Evaluation/Construc	c701607	910,000	807,112	2016-2018	Design/Construction
Security Camera & Building Access Upgrades	c701704	645,000	-	2016-2019	Feasibility
Spoils and Stockpile Handling Facilities	c701508	350,000	176,355	2015-2017	Construction
Water Resources Building	c701702	1,100,000	28,007	2016-2018	Design
		11,490,000	1,090,700		

Water Supply Reliability & Studies	Project #	Life of Project Total (Projected) **	Spend Thru 6/30/17 *	Project Duration	Current Status
Aquifer Storage and Recovery	c701609 & -10	3,635,000	263,673	2016 - 2020	Feasibility
Recycled Water	c701611 & -12	575,000	391,494	2016 - TBD	Feasibility
Source Water Evaluation	c701608	1,100,000	181,451	2016 - 2020	Feasibility
Water Supply Reliability - WSAC	c701402 & -03	2,296,250	2,296,249	2014 - 2016	Completed
Water Supply Augmentation Strategy	c701705	105,078,352	13,166	2020 - 2025	Feasibility
		112,684,602	3,146,033		

Water Main Replacements	Project #	Average Spend Per Year	Spend For 7/1/16 - 6/30/17	Project Duration	Current Status
Main Replacements - Engineering Section	c700002 +	1,298,289	1,096,221	Annual - Ongoing Programs	
Main Replacements - Customer Initiated	c700004	35,759	-		
Main Replacements - Distribution Section	c701507	369,643	27,267		
Main Replace.- Outside Agency Initiated	c700003	172,564	27,128		
		1,876,255	1,150,617		

* Amount includes spent funds from the project start through 6/30/17.

** Non-inflated 2015 dollars, will change as projects move through design process.

Water Commission
AGENDA REPORT

DATE: 9/28/2017

AGENDA OF: 10/2/2017

SUBJECT: Source Water Quality Monitoring Program Update

RECOMMENDATION: Receive information on the Water Department's ongoing Source Water Quality Monitoring Program.

BACKGROUND: As the Water Department moves forward with implementation of the Water Supply Augmentation Strategy (WSAS) as developed by the Water Supply Advisory Committee, it is critical for the Department to better understand its existing resources. Various components of the WSAS include the potential for increased use of winter water. Aquifer Storage and Recovery (ASR) and in-lieu water transfers to neighboring water agencies (In Lieu) both have the potential to generate increased demands for treatment and use of winter water.

Both the ASR and In Lieu strategies would rely on treatment of potentially available wintertime surface water from the San Lorenzo River and North Coast sources. From current water quality monitoring, we know that the San Lorenzo River year-round typically has higher levels of bacteria, suspended solids, and natural organic matter than our North Coast surface water sources. These constituents require greater levels of treatment to meet drinking water standards and have the potential to create taste and odor issues in the treated water.

During wintertime storms and high flows, turbidity levels increase significantly in the San Lorenzo River. Historically the Water Department has not treated river water during these high turbidity periods; rather source water is drawn from Loch Lomond until turbidity, color, and suspended solids in the river returns to a treatable level. Because water from the San Lorenzo River is not used during storm events, source water quality data has not been collected. As a result, reliable data is not readily available for these conditions. Understanding the water quality outside of those used as a basis for current operations will be essential to evaluating how greater use of winter water might influence current and future water treatment operations and requirements.

Additionally, the Graham Hill Water Treatment Plant (GHWTP) is aging, and the Department needs to improve treatment processes to keep pace with regulatory requirements and shifting source water availability. The GHWTP was commissioned in 1960 as a conventional surface water treatment plant. Various upgrades have been completed over the years, but the treatment plant continues to face real challenges meeting long term water quality goals.

The relationship between source water data, treatment requirements, and finished water quality goals is shown in attachment Figure 1. Finished water quality goals can be established internally

by the Department or may be set through drinking water standards and regulations. Treatment requirements are the processes and steps necessary to treat source water to a level that meets or exceeds finished water quality goals. To correctly set the treatment requirements at GHWTP, accurate source water quality data is necessary to ensure the plant is properly designed and capable of consistently producing finished water that meets water quality goals.

In order to evaluate options for future improvements to our water quality treatment processes, it is critical to fully understand the year round source water quality of all of our surface sources. In addition to the San Lorenzo River, these sources include the North Coast Streams (Liddell, Laguna, and Majors), and Loch Lomond. We also need to better understand the "raw blend" water created by mixing the source waters upon entering the treatment plant.

DISCUSSION: The purpose of the Source Water Quality Monitoring Program is to collect comprehensive year round water quality data for all the City's surface water sources. Since October 2016, the Department has been implementing a detailed water quality sampling and analysis protocol for all of our surface water sources under this Program. Department staff from the Production, Water Quality Lab, Water Resources and Engineering sections have all participated in the sampling and analysis, with staff stepping up to accommodate additional work load.

The City has contracted with Trussell Technology for assistance in the implementation of the Program. Their scope of work includes support for a review of historical data, organization and management of the data collected during sampling, regular review of the data and updates to the Department, intermediate and final data analysis, and report preparation. The focus of the data analysis is on impacts to treatment performance at the GHWTP.

To develop the Source Water Quality Monitoring Program, Trussell Technologies assisted the Department in developing the sampling protocol, and Kennedy Jenks provided technical review and input. The sampling protocol for the first year includes routine sampling at all surface water sources and event-based (storm-based) sampling for the San Lorenzo River. Routine sampling occurs at yearly, quarterly, monthly, bi-weekly, weekly, and semi-weekly intervals depending on the constituents being tested. Event-based sampling occurs one to three times per day during storm events. Constituents being analyzed include turbidity, organics, inorganics, pH, solids, and microbial. Analyses are conducted both in house and sent to outside laboratories. The full protocol is included as Attachment 1.

Trussell Technologies completed their intermediate analysis of water quality data collected in June. Findings for many constituents followed expected trends across sources such as spikes in turbidity, color, solids, and organics during storm events. Significant preliminary findings show that solids production, rather than disinfection byproduct formation, will likely be the limiting issue for treatment of San Lorenzo River winter water. Improved solids handling capacity at GHWTP may provide a future path to mitigate this issue. A strong correlation between source water organics and disinfection byproduct formation was also observed with San Lorenzo River winter water. Optimizing the source water blend for total organic carbon may provide a means for predictable control of disinfection byproduct formation in the finished water. Attachment 2 provides sample data compilation and analyses of these two issues. Trussell Technologies' final report summarizing the full findings of the Water Year 2017 program is under development.

The Water Department is currently working with Trussell Technologies to refine the sampling protocol for an additional year of water quality analysis for Water Year 2018. The refinement will be based upon trends observed in the first year of sampling with the goal of reducing sampling where constituents are stable and/or predictable and implementing event-based sampling across sources. Continuing the program for the second year will allow the Department to gather additional focused information to support the modeling and design of treatment process improvements and to prepare for the potential increased future demand for winter water.

FISCAL IMPACT: None.

Prepared by:	Prepared by:	Approved by:
Sarah Easley Perez	Kevin Crossley	Rosemary Menard
Associate Planner II	Senior Engineer	Water Director

ATTACHMENTS:
Routine and Event Water Sampling Protocol for 2017
Sample Analyses for Solids Production and Disinfection Byproducts Formation
Figure 1

Attachment 1

Routine Sampling - Water Year 2017

Analysis performed by SCWD
Analysis performed by Eurofins Lab
Analysis performed by operators

Location	North Coast Streams			San Lorenzo River		Loch Lomond (GHWTP)	Raw Blend	Finished Water
	Liddell	Laguna	Majors	Tait	Felton Diversion			
SS I.D.	201	202	203	206	208	204	RB	304
Grab	x	x	x	x	x	x	x	x
On-line (new)				x				
Upgrade required?	No	No	No	Yes	Yes			
Comments	Grab	Grab	Grab	Grab + Install sample pump, add instruments: turbidity+UV254	Grab with Sample pumps	Grab at Plant-Only when source in service	Grabs at lab sink	Grabs at lab sink
In-House Analyses								
Inorganic Constituents[1]								
Alkalinity	B	B	B	W	B	B	W	2x W
Conductivity	B	B	B	W	B	B	W	2x W
Hardness	B	B	B	W	B	B	W	2x W
Total Coliform, E Coli	B	B	B	W	B	B	W	2x W
Color	B	B	B	W	B	B	W	2x W
Dissolved Oxygen				W	B	B		
Odor	B	B	B	W	B	B	W	2x W
Organic Carbon, Total (TOC)	M	M	M	W	B	B	W	W
Organic Carbon, Dissolved (DOC)	M	M	M	W	B	B	W	W
Orthophosphate	Q	Q	Q	M	M	Q	M	2x Bi-W
pH	B	B	B	W	B	B	W	2x W
Silt Density Index	M	M	M	M	M	M		
Temperature	B	B	B	W	B	B	W	2x W
Total Suspended Solids (TSS)	M	M	M	W	B	B		
Turbidity	B	B	B	O & W	O** & B	B	W	2x W
UV254	M	M	M	O & W	B	B	W	W
SUVA	M	M	M	W	B	B	W	W
DBP Formation (Jar Test)				M		M	M	M
Total THMs								M
Eurofins Analyses								
Inorganics								
Alkalinity	M	M	M	M	M	M		Y
Ammonia (as N)	M	M	M	M	M	M		Y
Calcium	M	M	M	M	M	M		Y
Chloride	M	M	M	M	M	M		Y
Conductivity	M	M	M	M	M	M		Y
Fluoride	M	M	M	M	M	M		Y
Hardness	M	M	M	M	M	M		Y
Iron (Total and Dissolved)	M	M	M	M	M	M		Y
Magnesium	M	M	M	M	M	M		Y
Manganese (Total and Dissolved)	M	M	M	M	M	M		Y
Nitrate (as NO3)	M	M	M	M	M	M		Y
Nitrate + Nitrite (as N)	M	M	M	M	M	M		Y
Nitrite (as N)	M	M	M	M	M	M		Y
Potassium	M	M	M	M	M	M		Y
Sodium	M	M	M	M	M	M		Y
Sulfate	M	M	M	M	M	M		Y
Total Dissolved Solids (TDS)	M	M	M	M	M	M		Y
All Other Metals (Title 22)	Y	Y	Y	Y	Y	Y		Y
Bromide	Q	Q	Q	M	M	M	M	
CECs							Q	Q
Crypto, and Giardia (Cel-A Lab)	Q	Q	Q	M	M	Q	M	
Foaming Agents (MBAS)Surfactants	Y	Y	Y	M	M	Q		
MIB and geosmin				M	M	M	M	

[1] These compounds are also being measured monthly as part of Eurofins panel

Monitoring frequency
2x W = 2 times per week
W = Weekly
B = Bi-weekly, twice per month
M = Monthly
Q = Quarterly
Y = Yearly

Event Based Sampling - Water Year 2017

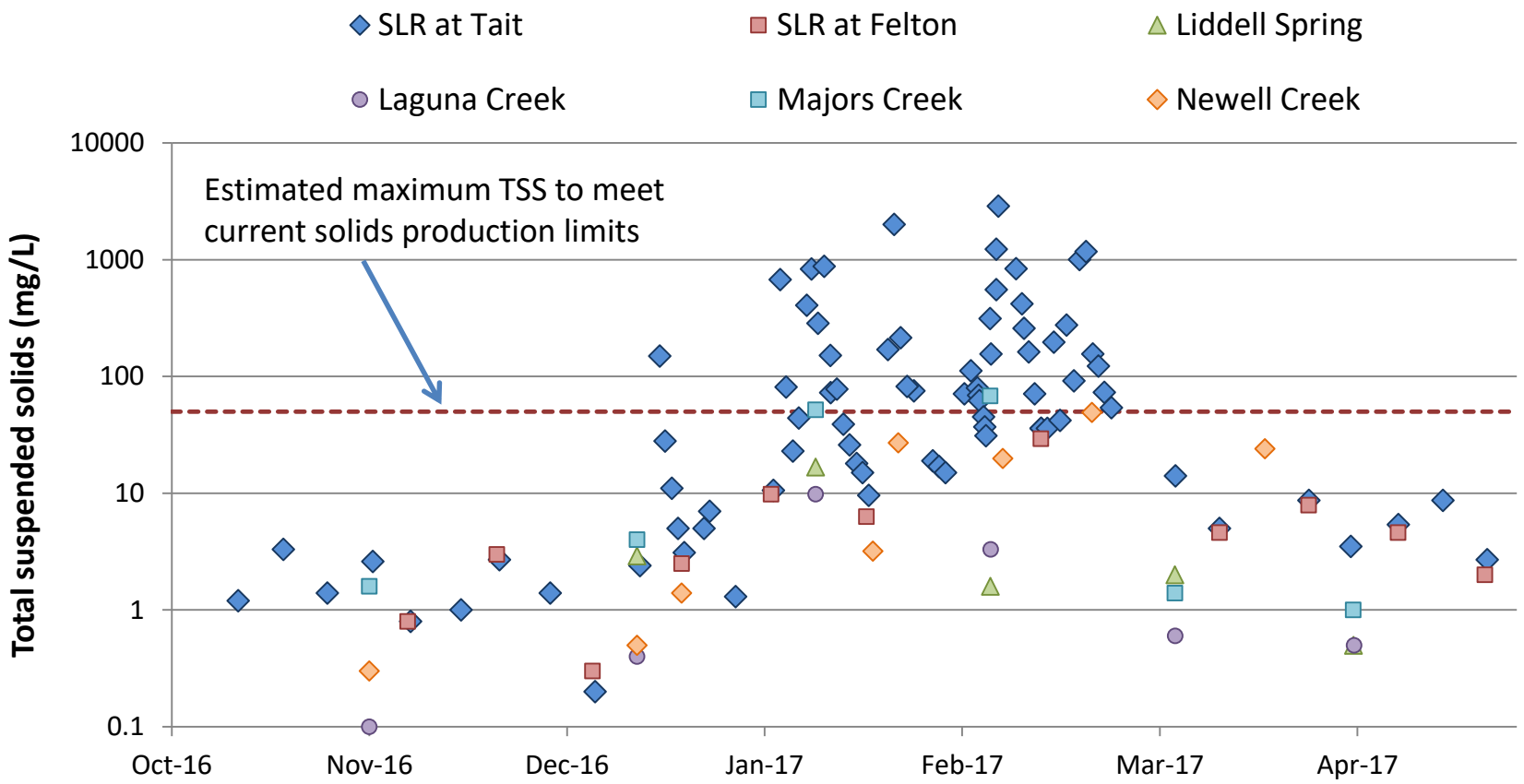
Analysis performed by Lab
Analysis performed by Eurofins Lab
Analysis performed by operators

Location SS I.D.	Tait St. Diversion 206	Raw Blend RB	Finished Water 304	
In-House Analyses				
Alkalinity	1/d	3/d		
Conductivity	1/d			
Hardness	1/d			
Total Coliform, E Coli	1/d			No samples on the weekend
Color	1/d	3/d	3/d	
Odor	1/d	3/d	3/d	
Organic Carbon, Total (TOC)	1/d			
Organic Carbon, Dissolved (DOC)	1/d			
Orthophosphate	1/d			Make change to total phosphate January 2017
pH	1/d	3/d		
Total Suspended Solids (TSS)	1/d			Long hold time/can run as a batch
Turbidity	online & 1/d	online		
UV254	online & 1/d			
SUVA	1/d			
Jar test	1/d	1/d		
SDS DBP test	1/d	1/d	1/d	
Eurofins Analyses				
Inorganics Panel	1/d	1/d		
Alkalinity	1/d	1/d		
Ammonia (as N)	1/d	1/d		
Calcium	1/d	1/d		
Chloride	1/d	1/d		
Conductivity	1/d	1/d		
Fluoride	1/d	1/d		
Hardness	1/d	1/d		
Iron (Total and Dissolved)	1/d	1/d		
Magnesium	1/d	1/d		
Manganese (Total and Dissolved)	1/d	1/d		
Nitrate (as NO3)	1/d	1/d		
Nitrate + Nitrite (as N)	1/d	1/d		
Nitrite (as N)	1/d	1/d		
Potassium	1/d	1/d		
Sodium	1/d	1/d		
Sulfate	1/d	1/d		
Total Dissolved Solids (TDS)	1/d	1/d		
Bromide	1/d	1/d		
Foaming Agents (MBAS)Surfactants	1/d	1/d		

Attachment 2

Source Water Quality Monitoring:
Implications for Solids Production

- *Source water total suspended solids (TSS) is directly related to solids production at the Graham Hill Water Treatment Plant*
- *Information from the monitoring campaign can help determine to what extent San Lorenzo river could be used as source water in the winter*



Source Water Quality Monitoring:
Implications for Disinfection Byproduct Formation

- *Source water organic carbon is closely linked to disinfection byproduct (DBP) formation (trihalomethane or THM) at Graham Hill Water Treatment Plant*
- *Information from the source water monitoring campaign can be used to optimize source water blend for DBP reduction based on total organic carbon (TOC) contributions*

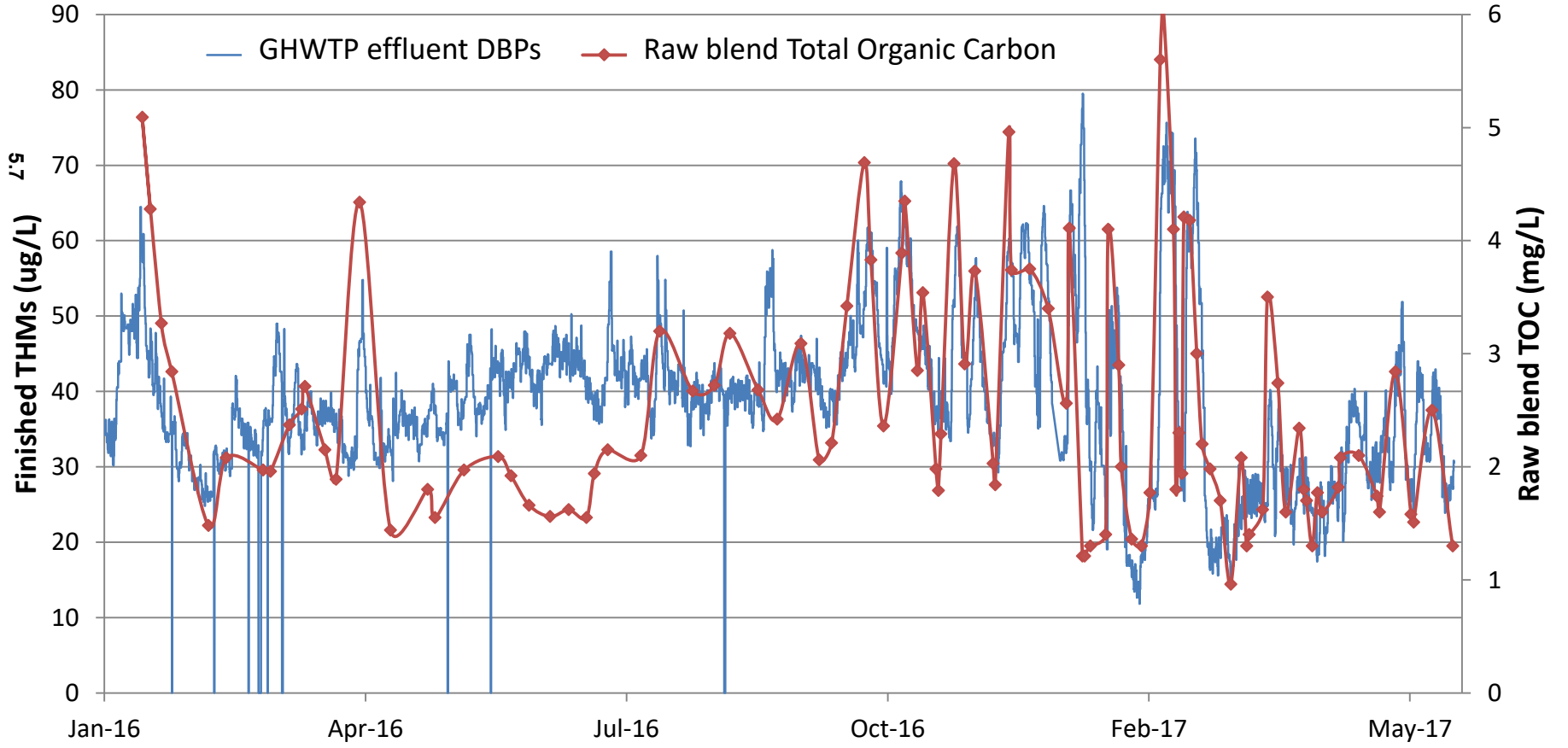
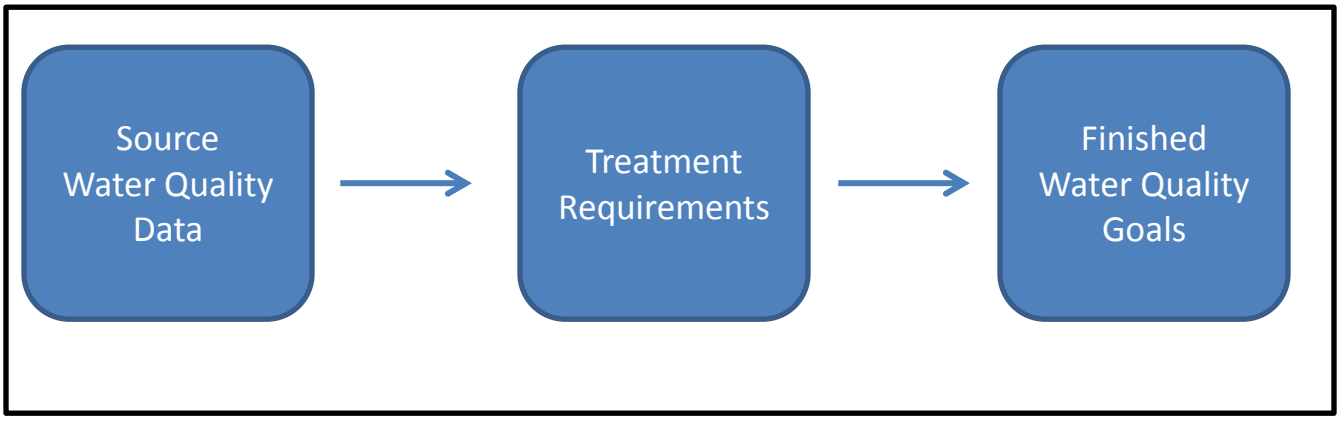


Figure 1-Souce Water Finished Water Relationship



Water Commission
AGENDA REPORT

DATE: 9/28/2017

AGENDA OF: 10/2/2017

SUBJECT: Update to the 2015 State of the Water System

RECOMMENDATION:
That the Water Commission receive an update on the State of the Water System provided to the Water Supply Advisory Committee (April 2015) and provide feedback.

BACKGROUND: In April 2015, the Water Supply Advisory Committee (WSAC) was provided a 10-page memorandum focused on the current condition of raw diversion and transmission water infrastructure, and planned projects contained within the 10-year Capital Improvement Program (CIP). See attached. That document was intended to raise committee awareness surrounding the current condition of the water system and to spur thinking about how existing CIP projects will relate to and intersect with new supply projects.

Noteworthy points made in the 2015 memo were:
- A majority of critical assets, (dams, treatment plants, transmission pipelines) are between 50-100 years old;
- Those assets will require major reinvestment or complete replacement over the 10-15 year horizon; and
- New water supply is just one of many major projects that make up the 10 year CIP.

The quarterly updates to the Commission on the progress of the Water Supply Augmentation Strategy (WSAS) provide a minimal level of detail about these related aspects of the raw water system in the section titled "Other." As progress is made on the WSAS a more detailed update is warranted to 1) provide the Water Commission with a similar frame of reference for how the water supply projects fit with and complement other projects within the CIP; 2) comment on how the various components of the water system performed during the 2017 winter and if this impacts our planning; 3) identify lessons learned during the implementation of several projects over the last two years; and 4) identify any cause for reprioritizing projects such as regulatory drivers.

DISCUSSION: To facilitate the reading, the format and flow of the following is intended to build on and not reiterate the material provided in the attached 2015 report, assets are discussed in a similar order, and new assets or projects are so noted.

North Coast System

North Coast Pipeline: Since 2006, two of the six phases have been completed and a third is nearing completion. Phases 1 and 2 replaced all of the in-city piping, and Phase 3 prioritized the most leak prone section along Highway 1, bringing the installed length of pipe to approximately 6 miles. Despite the progress made the North Coast System continues to experience leaks, and in February 2017, approximately 1,000 feet of pipe was installed on the Liddell Line as part of an emergency repair project. Also during 2017, several landslides damaged the Majors pipeline requiring a second emergency repair project.

The Environmental Impact Report for the North Coast System Replacement Project envisioned reconstruction of the entire system within a 15-20 year time frame or around 2020-25. The Phase 3 Project required nearly 4-years to design, permit, and purchase new right of way from state, local, and private land owners. In addition to the significant work that precedes construction, the North Coast is a challenging environment in which to construct. Most water facilities reside in undeveloped areas, where archeological and biologically protected resources are located, and where access and permits may restrict work to a small seasonal window. In light of the dramatic and numerous leaks that the Newell Creek Pipeline experienced in 2017, staff is revisiting the prioritization of all the raw water main replacement projects. Taken together, North Coast projects competing for priority, funding, and tied to external approvals by regulators, and landowners, means it will likely take at least 10-15 more years to complete replacement the North Coast System.

While the Phase 4 segment has not been defined, it is budgeted in FY2021 – FY2023. The final phases have not been budgeted for in the 10 year CIP.

North Coast Diversions: The North Coast Diversions range from 80 to 120 years in age. Despite the age of the diversion structures, they are in generally good condition. The major known deficiencies are related to sediment accumulation behind the dams and improper sizing on inlet screens. The Laguna diversion, in particular, required significant maintenance this winter to keep the screens clear of sediment.

Evaluation of the Major's and Laguna diversion's condition and development of a work plan is scheduled to start in fiscal year 2018. The purpose of this effort is to establish the scope of work for repair and/or replacement of the diversions to meet future needs that include maintaining fish flow requirements established for the Habitat Conservation Plan. Contained within this work will be how best to utilize the sources so as to meet fish and human needs particularly as the latter relates to maximizing winter flows. The timing of the condition assessment and development of the work plan is currently driven by the Habitat Conservation Plan. The work plan for the diversions will be incorporated into the Habitat Conservation Plan, which will be the overarching regulatory approval document that will cover future operations, maintenance, and capital projects at the diversions. As mentioned above North Coast projects for both pipelines and diversions will be reprioritized within the 10 year CIP, and any diversion projects must happen after completion of the Habitat Conservation Plan.

Loch Lomond Reservoir

Newell Creek Dam Inlet/Outlet Project: This project has been defined in three phases:

- Phase 1 – Data Gathering and Concept Determination (Pre-Design). Completed in October 2016.
- Phase 2 - Design, Permitting, and Bidding. Scheduled for completion in last quarter of 2019.

- Phase 3 – Construction. Scheduled for completion the last quarter of 2021.

Key/Significant milestones:

- October 2016 - Completed preliminary design of the replacement alternative and testing plans for the rehabilitation alternative. The rehabilitation alternative testing was put on hold until the 50% Replacement Design is developed further in an effort to better understand the cost of the two alternatives and the advantages of replacement.
- June 2017 - Completed the 10% Replacement Design of two tunneling methods and alignments and selected one design to develop future.

Staff is in the process of negotiating the next contract with AECOM to develop the 100% Replacement Design and Construction Bid documents and will re-evaluate the rehabilitation alternative later this year. We are currently seeking an Environmental Permitting and CEQA firm and will also be seeking a Construction Manager to provide input on constructability throughout the remaining design process. Throughout this process, we continue to get input from State of California Division of Safety of Dams (DSOD), our technical advisory consulting board, and other water agencies to help guide us through our decision making process based on their experience in similar projects.

Newell Creek Dam Spillway (new): As a result of the recent spillway incidents at Oroville Dam, in a letter dated May 20, 2017, the California Division of Safety of Dams (DSOD) requested that the all dam owners under the jurisdiction of DSOD perform comprehensive condition assessments of their spillways. The City subsequently contracted with AECOM to perform the condition assessment of NCD which includes a review of existing information, detailed visual inspection of the spillway and identification of any damage requiring immediate repair and recommended next steps. The visual inspection of the spillway was conducted by AECOM on July 26, 2017. AECOM did not find anything of major concern, either in the structural or geologic visual inspections. AECOM did find minor deficiencies that will be addressed in the short term as part of annual and routine maintenance activities at the dam such as filling minor cracks in the concrete, coating exposed rebar, cleaning drains, and cutting back trees hanging over the spillway.

Newell Creek Pipeline: The Newell Creek Pipeline is an approximately 12-mile long, 24 to 27-inch pipe that was constructed in the early 1960's concurrently with the Newell Creek Dam. The principal deficiency with the Newell Creek Pipeline is not its condition; rather it's the pipe's alignment, which bisects a number of mapped and unmapped landslides, located in remote, heavily forested settings, sometimes with narrow, unpaved access. The 2017 winter highlighted 1) the pipes susceptibility to damage due to its location, and 2) the City's 100% reliance on the source of water this pipe conveys during heavy rains when all other sources become untreatable.

Preliminary engineering was expected to start in Fiscal Year 2017 but was delayed in large part due to the winter emergency projects. The same condition assessment technique used for the Gravity Trunk main may be used for the Newell Creek Pipeline. Work is set to resume in Fiscal Year 2018 and will be one of the major focus areas of the Program Management Team.

Although climatically opposite conditions, the recent drought followed by the second wettest winter on record made it abundantly clear that the system is unreliable in that surface water makes up 90% of supply. Santa Cruz has many sources of water, but fundamentally the system is heavily reliant on the same type of water pumped relatively long distances to a single water

treatment plant. One large storm in January 2017 simultaneously made one set of sources untreatable and caused a pipeline break that took out the source of last resort and precipitated waters supply emergency. Recent supplemental supply planning has focused heavily on supply during drought, and this winter emphasized the importance of thinking about managing risk and ensuring supply reliably for both the extreme dry and wet periods.

Graham Hill Water Treatment Plant: The Graham Hill Water Treatment Plant (GHWTP) was originally constructed in 1960, and has remained in service nearly continuously since that time. The last major renovation to the plant was completed in 1986. A relatively comprehensive engineering study was completed by the engineering firm CDM circa 2007. The CDM study laid the groundwork for several major projects including an electrical upgrade, and filter replacement project which was implemented to address specific systems or processes. In the 10 years since the CDM study was completed, there have been a number of significant changes that directly affect the direction of future projects at GHWTP. The scwd2 Desalination Project was put on hold, and several other supplemental supply projects were identified: Aquifer Storage and Recovery and in-Lieu will both require a source of treated water during the winter, and the GHWTP does not currently have capacity or capability to support those projects. Surface water treatment regulations have also evolved and strengthened, particularly as they relate to disinfection by-products, and disinfection requirements. During the implementation of several recent projects, staff has gained valuable insight into the significant challenges of implementing major projects while simultaneously keeping the plant online.

Based on those changes, it is time to update the overall plan for rehabilitating and modernizing GHWTP. The Program Management Consultant will lead the update to that plan, which is expected take 6 to 9 months and will include the following: update water quality objectives, siting and cost estimate for a second surface water treatment plant, review source water data, assessment of the physical condition of the plant superstructure, consideration of different treatment process, and definition and scheduling of packages of projects.

Several projects are currently in different phases of design for the GHWTP, including replacement of tube settlers and several tanks. The tube settlers project scope will likely be reduced to address the immediate operational needs in the near term and will defer the remainder of that project until after the facilities plan is completed. The tanks projects are just finishing preliminary design, and will likely move into final design, concurrent with the facilities plan update, or if appropriate the tanks project may be paused until the facilities plan update is finished to ensure the tanks project remains compatible with the overall modernization plan. Concurrently, a feasibility assessment will be prepared for a second surface water treatment plant. A second plant would provide a valuable degree of treatment redundancy, could reduce the potential need for costly process changes at GHWTP, and could avoid the need to operate a surface water plant during logistically challenging, operationally disruptive, and costly construction projects.

Surface Water Diversions

Felton Diversion: The Felton Diversion Project will assess the overall condition of the Felton Diversion Station. Staff has conducted an initial inspection and the inflatable bladder has been prioritized for replacement. An engineering firm inspected the bladder and mounting plates in October 2016, and the bladder is scheduled to be replaced in summer or fall 2018.

The Tait Wells Project (new): In February 2017 the Tait well project was completed. The two new wells have a combined output of 1.5 MGD or roughly 6 times more output than the wells that were abandoned. The wells provide a consistent source of high quality water year round, and especially during the winter when other sources become untreatable. The wells were completed just in time, and despite the wells being flooded, were a significant resource during 2017 when the Newell Creek Pipeline was out of service and numerous heavy storms when the San Lorenzo River was too turbid to treat. The department continues to look at the possibility of additional wells in this area and their ability to extract the highest quality water possible to be applied towards winter flow schemes. Higher quality source water will reduce the amount of treatment required at the Graham Hill Water Treatment Plant (GHWTP).

River Bank Filtration Study (new): The River Bank Filtration study is assessing the feasibility of increasing the Water Department's subsurface extraction capacity, currently represented as the Tait Wells (1.5 MGD) up to 3 MGD. The two study areas are the alluvial aquifers in the near vicinity of the Tait Street Intake and Felton Diversion Intake. If output could be increased to 3 MGD, the GHWTP could continue operating continuously at a low level, during storm events when sources would be otherwise untreatable, and the plant would be required to shut down. The study will start in fall 2017.

Coast Pump Station Hazard Mitigation Project (new): The Coast Pump Station sits immediately adjacent to the Tait St intake on a low-lying bench adjacent to the San Lorenzo River. The pump station lifts water diverted from the San Lorenzo River, as well as the Coast Sources, up to the GHWTP. The pump station's elevation and proximity to the San Lorenzo River make it particularly vulnerable to flooding. Past flooding has been relatively minor, mostly resulting in cleanup and minor equipment repairs. In February 2017, the pump station was flooded and many of the critical pumps, motors, and the emergency backup generator were damaged. Fortunately, repair parts were readily on hand, and staff was able to rapidly return the pumps station to service within 3 days of flooding.

The City has been preliminarily approved for up to $3,000,000 in grant funding to mitigate the threat of flooding at the Coast Pump Station. An engineering study and alternatives analysis are currently in development, and will be submitted to the State in November 2017 as part of the next phase of the grant approval process.

Summary

Although much progress has been made to define and implement projects, there is still a significant amount of work in the future. The Program Management Team will be integral to overall success. The Program Manager will bring new skillsets, additional staff resources, and systems and tools to plan and prioritize projects, and new ways of doing business that are needed to in order to implement a new supply project, concurrent with major reinvestment in the existing system.

The recent drought followed by this winter brought the relative vulnerability and unreliability of the water system into sharp focus. With one reservoir, and one surface water treatment plant, the lack of redundancy was clear. The collection of CIP projects described above, coupled with a new supply project will add new sources of supply, new treatment capability, stronger water transmission pipelines, that will collectively ensure a safe clean reliable supply, into the future.

In conclusion, the key points of the 2017 update are:

- New requirements and regulatory changes set by external agencies (Division of Drinking Water, Division of Safety of Dams) can result in new and unanticipated projects. E.g., the Newell Creek Dam inlet/outlet replacement project.
- The timing of certain projects is linked to other long term efforts. E.g., the finalization of several Habitat Conservation Plans.
- The 2017 winter showed the water systems vulnerabilities and relative fragility. Recently completed projects, e.g., the North Coast Phase 3 Project and Tait Wells Project, replaced aging assets, and help to improve overall system reliability. Future projects focusing on the Newell Creek pipeline will reduce but cannot eliminate this critical pipelines risk of failure.
- The water system lacks redundancy in supply and treatment. A supplemental supply project should change that by improving system resilience both during extreme dry and wet conditions.
- Hiring a Program Manager will add staff capacity to manage and implement larger more complex projects but there will still be funding, permitting, and operational constraints that will affect the timing of certain CIP projects and will govern the overall pace of progress.

FISCAL IMPACT: None

Prepared by:	Approved by:
Kevin Crossley	Rosemary Menard
Senior Engineer	Water Director

ATTACHMENTS:
State of the Water System (April 2015)

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

Loch Lomond Reservoir

- Newell Creek Dam – 1960
- Newell Creek Pipeline - 1960

Intakes

- Tait Street Wells and SLR Diversion – 1960s
- Felton Diversion – 1970s

Water Treatment

- Graham Hill Water Treatment Plant – 1960s
- Beltz Water Treatment Plant - 1964

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.

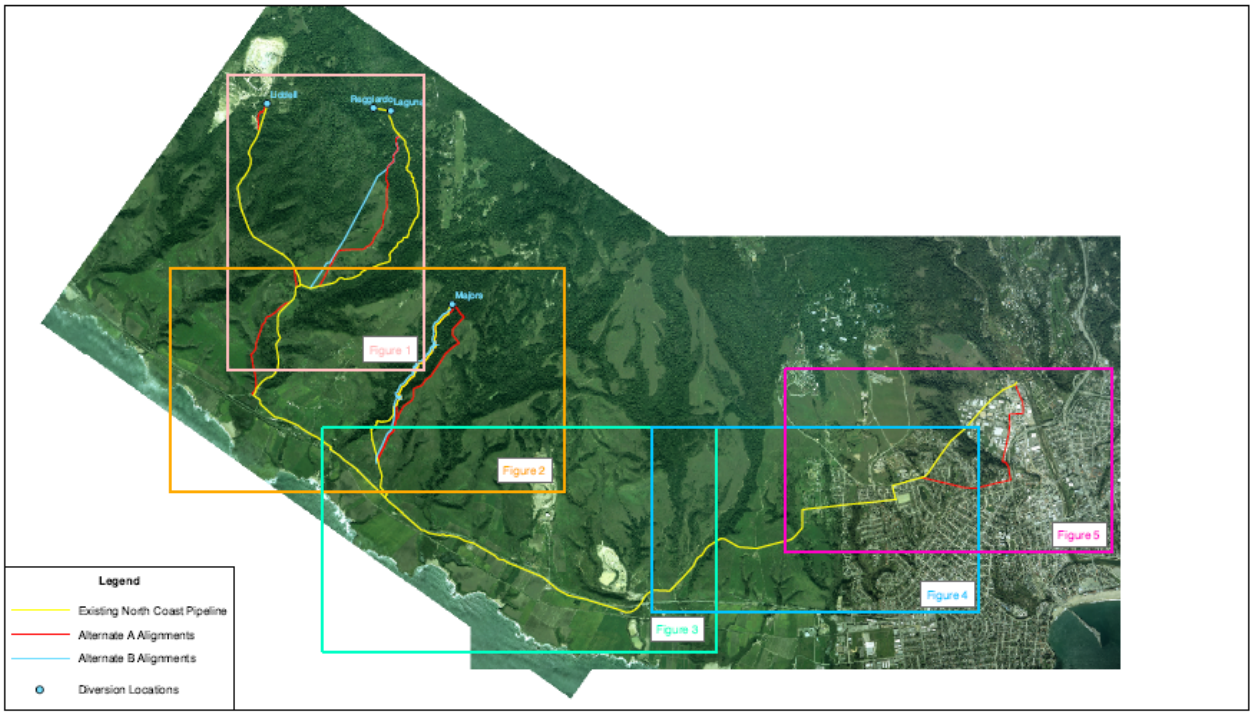


FIGURE 3.1
EXISTING AND ALTERNATE ALIGNMENTS
NORTH COAST SYSTEM REHABILITATION PROJECT
CITY OF SANTA CRUZ

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 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.

Water Commission
AGENDA REPORT

DATE: 9/28/2017

AGENDA OF: 10/2/2017

SUBJECT: Water Supply Augmentation Strategy, Quarterly Work Plan Update

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RECOMMENDATION:
That the Water Commission receive information regarding the status of the various components of the Water Supply Augmentation Strategy and provide feedback.

BACKGROUND: As per the Final Agreements and Recommendations of the Water Supply Advisory Committee (WSAC), the Water Commission shall receive quarterly updates on the status of the various elements of the recommended plan. This is the seventh quarterly update, appearing on the Commission's October agenda due to the cancellation of the September meeting. Elements of the Water Supply Augmentation Strategy (WSAS) include In Lieu water transfers with neighboring agencies, Aquifer Storage and Recovery, Recycled Water, and Seawater Desalination. Demand management, via implementation of the Long Term Water Conservation Master Plan, is foundational to the WSAS. The following report provides an update on the various efforts recommended by the Water Supply Advisory Committee (WSAC), accepted by the City Council in late 2015 and recently incorporated into the approved 2015 Urban Water Management Plan as directed by the Council.

DISCUSSION: Progress and status of the various WSAS-related work is described in detail below as well as that of other projects related to but not specifically articulated in the WSAS.

Demand Management
California Senate Bill 555 passed in October 2015, requires urban water suppliers in the state to submit a completed and validated water loss audit annually to the California Department of Water Resources (DWR) starting October 1, 2017. In this last three months, Water Conservation staff, with active participation from Engineering and Operations sections, completed the 2016 audit, wrapped up a year-long technical assistance program (an agency led effort to train staff with the auditing requirements), and submitted the audit and required supporting documents for validation by an independent contractor.

Status of measures in the Water Conservation Plan

No. 1, System Water Loss Reduction This last quarter included conducting another round of large influent meter tests at the Graham Hill Water Treatment Plant. The annual volume treated for potable water distribution is a key input into the water audit. Besides testing for accuracy of these primary meters, emphasis was placed on developing a streamlined large meter testing

protocol to make future meter testing easier. A summary of the test results is included as Attachment 1.

No. 2, Advanced Metering Infrastructure (AMI) Conservation and Meter Shop staff have successfully completed installation of over 100 cellular-based end-points (replacing existing radios) on irrigation services in the first phase of a pilot AMI project, and have started on the next phase that involves installing an additional 250+ cellular-based end-points along with changing out the water meters. There are now 165 cellular endpoints active on the system, with no reporting issues or problems. Meter reads from the Beacon pilot system have been integrated into the utility billing system. Staff soon will be notifying irrigation account holders how to access their account and view real-time water consumption online on a daily or hourly basis. In the meantime, we have notified several accounts where a customer-side leak or continuous movement on their meter has been detected.

No. 4, General Public Information Staff is finalizing a beautifully illustrated new customer booklet. It includes a profile of the water system, information on water service and billing, water conservation basics, and related resources. It will be printed for distribution to new sign-ups and available at community outreach activities staring this fall.

Finally, it is worth mentioning that the City of Santa Cruz was recognized in July by the Alliance for Water Efficiency (AWE), a national organization dedicated to the efficient and sustainable use of water. The honor was for adopting and complying with 100 percent of the requirements listed in the American Water Works Association Utility Management Standard G-480: Water Conservation Program Operation and Management. AWE reviews and verifies submissions provided by member utilities, and the City is the first ever to achieve its highest level of compliance with the standard.

In Lieu Water Transfers

In June 2017, the Water Department, in coordination with the Soquel Creek Water District (District) issued a Request for Qualifications (RFQ) for the development and implementation of a pipe loop study (Study). The Study will evaluate the compatibility of the City's surface water with the District's distribution system and District customer plumbing. Of the four firms who responded, Black and Veatch was selected to perform the study, and in August 2017, Council approved a contract in the amount of $668,000. The cost will be shared equally between the District and City.

The pipe loop study is organized in two phases. First samples of pipe will be harvested and sent to a lab for "bench top analysis." The bench top analysis allows for a large number of water and pipe combinations to be screened and tested relatively quickly and economically, and will help determine the need and scope of the actual pipe loop study which is the second phase. The bench top testing will take three months to complete. Depending on the findings of the bench top work, the study will either move directly into generating recommendations or implement the full pipe loop study.

The pipe loop study is intended to simulate real world conditions. Intact segments of piping will be installed on racks and water will be circulated through them over a 9-month period. Water samples will be taken on a routine basis, to monitor for corrosion, scale release, and changes color. After completion of one or both phases, a technical memorandum will present the following information:

- Potential for Water Quality Changes:
  - Release of accumulated metals in mains, service lines, and valves
  - Corrosion potential for Asbestos Concrete mains
  - Corrosion potential for galvanized mains, service lines, and customer piping
  - Potential for release of lead and copper
  - Impacts of seasonal cycling between groundwater and surface water
- Evaluate the need for and recommend necessary corrosion control strategies such as:
  - Conditioning requirements at point of delivery of surface water
  - Strategies to prime or prepare groundwater system distribution piping
- Estimate capital and operating expense to implement potential corrosion control systems

The City has also been coordinating with the Scotts Valley Water District and San Lorenzo Valley Water District during the development of the Pipe Loop Study to determine their interest in participation. The Scotts Valley Water District was identified in the WSAS as another potential partner for the in-lieu recharge strategy. The participation of the additional districts in the Pipe Loop Study could provide important information for potential future regional water sharing strategies. Both districts are currently reviewing the possibility of participating; however, the City and District need to move forward with the Pipe Loop Study right away to be able to utilize the City's water year 2018 winter water for the pipe loop corrosion study.

Aquifer Storage and Recovery (ASR) – Phase I Work

Status
- Consultant: Pueblo Water Resources
- Contract Signed: February 2016
- Project Partners: NA
- Engaged Stakeholders: SqCWD, County of Santa Cruz, Scotts Valley Water District
- Amount Spent: $273,047
- Amount Remaining: $550,938
- Contract Amendment No. 1: $377,615
- Status: On schedule.

Key meetings (Meetings of note in the reporting quarter include the following.)
No ASR-specific meetings occurred this quarter; however there were several conference calls related to the development of the Habitat Conservation Plan and any potential impacts to winter flows on the ASR project. This information will come into play with groundwater modeling, as well as during Phases 2 and 3 as the project is being developed. Staff from Pueblo will be at the Water Commission's October meeting to discuss the results of the Phase 1 study, next steps, and any known issue.

Pueblo is currently under contract for Phase 1 of a potentially three phase evaluation process.
- Phase 1 – Paper study/modeling/siting study
- Phase 2 – Pilot study
- Phase 3 – Full Scale Implementation

Task 1.1 Existing Well Screening

The City and Pueblo continue to evaluate the piloting of wells identified in the existing well screening memo. As previously mentioned, the final selection of ASR pilot test wells is an iterative process that will use information from other Phase 1 tasks. This task is ongoing.

Task 1.2 Site Specific Injection Capacity Analyses
No new report.

Task 1.3 Geochemical Interaction Analysis
Pueblo Water Resources has submitted a draft memo with findings of the analysis of samples collected in December 2016, January 2017 and June 2017. Initial findings and results of the geochemical interaction analysis were previously presented by Pueblo to the Commission on May 1, 2017. Although this memo is currently under review by staff, some of the findings indicate that no geochemical interaction-related fatal flaws for the ASR project have been identified. In addition, the treated GHWTP water appears to be an excellent source of ASR recharge water.

Task 1.5 Well Siting Study
The purpose of the well siting study is to identify potential well sites that based on available data, appear to be suitable for development as ASR and/or extraction well facilities. Pueblo has submitted a draft memo of this work with results indicating that there does appear to be a sufficient number of well sites in both the Santa Margarita Groundwater Basin and the Purisima Aquifer that meet the required hydrogeologic and construction logistics criteria for the ASR project. These identified sites will be used in ASR groundwater modeling scenarios that will be simulated with the groundwater models of each basin.

Groundwater Modeling

Modeling scenarios for both the Santa Margarita (SMGB) and Purisima/Mid-County Basin (MGB) models have been developed under both the historical 1985 – 2015 hydrology and potential future climate change hydrology. Current scenarios for the historical hydrology include the following.

1. In-Lieu only: Recharge and recovery flows split between the two basins proportional to the District demands in each basin, with 2 recovery wells each in SMGB and MGB (4 recovery wells total).
2. ASR-only: Flows split equally between the two basins, with 9 ASR wells in SMGB and 6 ASR wells in MGB (15 ASR wells total).
3. In-Lieu plus ASR: In-Lieu flows split the same as Scenario 1, with the remaining ASR flows split equally between the two basins. For this scenario there are 3 ASR wells in SMGB and 2 ASR wells in MGB (5 ASR wells total).

Hydrometrics, under contract to Pueblo, has completed the historical SMGB model runs and are processing the results. Hydrometrics continues work on implementing the MGB scenarios as well as working on development of the 2020 – 2070 climate change hydrologies for both groundwater basin models.

Issue(s)
No issues of note at this time.

Advanced Treated Recycled Water

Recycled Water Feasibility Planning Study (RWFPS) Status

- Consultant: Kennedy/Jenks Consultants
- Contract Signed: February 2016
- Project Partners: Water and Public Works Departments, State Water Resources Control Board (SWRCB)
- Engaged Stakeholders: County of Santa Cruz – Water Resources Division, Santa Cruz County Sanitation District, Scotts Valley Water District, Soquel Creek Water District, University of California Santa Cruz
- Contract Amount: $587,308
- Funding: State of California $75,000*; City Public Works, $35,000; Water, remainder
- Amount Spent: $455,600
- Amount Remaining: $131,708
- Contract Amendment No. 1: $26,357
- Contract Amendment No. 2: $74,951
- Schedule: On schedule, Final Report in Winter 2017
- Report: Draft Sections 1-8 have been submitted for review. Section 9 Recommended Project, Section 10 Construction Financing Plan, and the complete Administrative Draft remain to be submitted.

*Pending award of State Water Resources Control Board grant

Key meetings; in addition to monthly project status meetings, meetings of note include the following:

- June 2017, Scoring and Ranking of Multi-Criteria Decision Analysis Workshop, Kennedy/Jenks Consultants met in person with staff and stakeholders to review developed information and related scoring and ranking. Project Partners and Engaged Stakeholders received information on scoring and ranking and provided feedback which was incorporated into Section 8 Project Alternatives Analysis.
- July 2017, Recommended Projects Webinar, Project Partners, and Engaged Stakeholders were presented the portfolio of recommended projects including financing and revenue considerations. Maps, costs, operational opportunities and challenges, and implementation scenarios were presented, discussed and feedback was provided to the consultant.
- August 2017, Recommended Projects and Financial Considerations were presented at the August 7 public meeting of the Water Commission.

Status of Decision Nodes and Related Milestones (Table 16 WSAC Final Report on Agreements and Recommendations)

Decision Node 3.2: A high-level feasibility study including conceptual designs of preferred projects and definition of the CEQA processes is on schedule to be complete by the end of calendar year 2017. The Water Department continues to observe and learn as Soquel Creek Water District evaluates the environmental impact of a series of groundwater reuse replenishment projects and performs public outreach activities.

Issue(s)

As discussed previously with the Commission, the recommended project from the RWFPS is a collection of short-term non-potable reuse projects that can be utilized for a small potable water demand offset as well as outreach and education, and several long-term indirect potable reuse projects that may have the potential to fill the supply gap. Success of the recommended long term projects is incumbent upon better understanding of the physical and chemical ability of the Santa Cruz Mid-County Groundwater Basin and Santa Margarita Groundwater Basin to perform as needed for a groundwater reuse replenishment project(s), and the willingness/ability (e.g., political, financial, schedule) of neighboring agencies to participate in a long-term regional project

Technical studies can be defined and pursued to better understand the first issue and a portion of this work is being evaluated with the groundwater modeling being completed as part of the ASR study. The second issue has to do with the timing of the various water agencies water supply planning efforts and their interest and willingness to collaborate. Soquel Creek Water District is actively evaluating groundwater reuse replenishment projects in the Santa Cruz Mid-County Groundwater Basin which could provide an opportunity for regional collaboration. However, due to the designation of this basin as critically over-drafted, a more aggressive schedule than the schedule the City is working on to define its supplemental supply project is necessary. Scotts Valley Water District has also been evaluating a groundwater reuse replenishment project in the Santa Margarita Groundwater Basin which also provides an opportunity for regional collaboration. Unlike the Santa Cruz Mid-County Groundwater Basin, however, the Santa Margarita Groundwater Basin is not designated as critically over-drafted, therefore a less aggressive schedule is contemplated. While the agencies are working diligently towards solutions that solve their individual water supply issues while at the same time benefitting from partnerships, such collaborative solutions are not assured at this point in time.

Desalinated Water

- Consultant: DUDEK
- Contract Signed: May 2017
- Project Partners: NA
- Engaged Stakeholders: None at this time
- Contract Amount: $139,669
- Amount Spent: $4,640
- Amount Remaining: $135,029
- Schedule: Currently on schedule.

The recommendations of the Water Supply Advisory Committee included desalination as a backup supply. DUDEK was hired in May 2017 to complete a "Desalination Feasibility Update Review." This evaluation includes increasing the size of the project to allow for apples to apples comparison with the other WSAS alternatives, i.e, analyzing a 3.3 million gallon per day (mgd) desalination facility instead of 2.5 mgd. The project will then be scrutinized under today's regulatory environment which includes, at a minimum, the Amendment to the Water Quality Control Plan for Ocean Waters of California Addressing Desalination Facility Intakes, Brine Discharges, and the Incorporation of Other Non-Substantive Changes. This review will define a viable desalination project given changed conditions, and provide updated cost estimates, a high-level review of CEQA and NEPA compliance and permitting approaches, and an assessment of the timeliness of implementation of such a project.

The kick off meeting for this study was held on June 20 and the team has met twice per month. Tasks 1 through 3 are nearly complete; a meeting with the Monterey Bay National Marine Sanctuary is being set up to help inform Task 4 and 5.

Attachment 2 shows the current tasks and schedule. DUDEK is expected to discuss their findings at the November Water Commission meeting.

Other (Source Water Monitoring, Newell Creek Pipeline, Felton Diversion, Etc.)
Separate agenda items will address the topics normally covered under this section.

Outreach and Communication
Our Water, Our Future progress reports were distributed by email in June and August following Water Commission meetings.

FISCAL IMPACT:

Prepared by:	Approved by:
Heidi Luckenbach	Rosemary Menard
Deputy Director/Engineering Manager	Water Director

ATTACHMENTS:
Santa Cruz GHWTP Influent Meter Test Meter Results
DUDEK Tasks and Schedule

Santa Cruz GHWTP Influent Meter Test Results

Background

The majority of the City of Santa Cruz's water supply is treated at the Graham Hill Water Treatment Plant (GHWTP). Influent raw water passes through two parallel electromagnetic meters, described in Table 1 below.

Table 1: GHWTP Influent Meters

METER	ABBREVIATION	SIZE	MANUFACTURER AND MODEL	TYPE
San Lorenzo River	SLR	18"	Fischer Porter 10D1435A	electromagnetic
Newell Creek	NC	18"	Fischer Porter 10D1435A	electromagnetic

To maintain the accuracy of key meters and inform the water audit, Santa Cruz has established an annual practice of influent meter volumetric testing. In the first two years of testing the SLR and NC meters were tested independently. Future testing may study the meters' accuracy in combined operation.

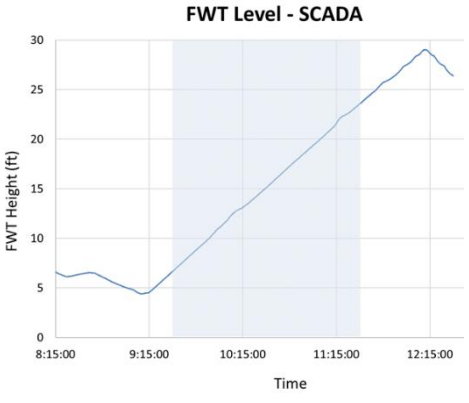
As stipulated by Santa Cruz's established test procedure, the volume of throughput registered by each influent meter is compared to the change in volume in the finished water tank over a specific time span. The finished water tank is located after the treatment process, so volumetric gains and losses due to treatment must be considered when calculating the test reference volume.

In June 2017, the SLR meter was tested at 5.0 MGD and 6.7 MGD (two separate tests) and the NC meter was tested 3.3 MGD (one test). The test flow rates represent typical operating conditions drawn from 2016 production records in order to maximize the applicability of test results to audit period production.

SLR 6.7 MGD Test

Test date	June 13, 2017
Test steady state duration	9:30am – 11:30am

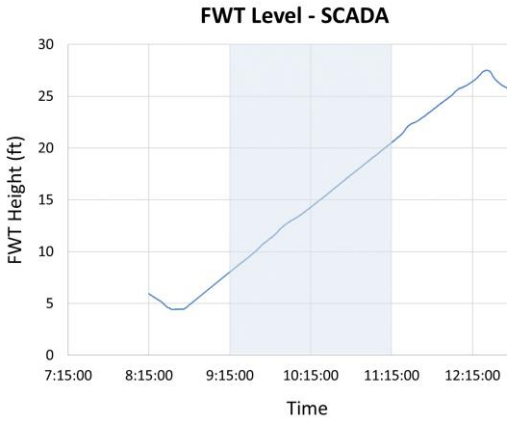
TEST VOLUME				
Starting read	352,127	gal		
Ending read	913,911	gal		
Total registered throughput	**561,784**	**gal**		
REFERENCE VOLUME				
Starting read	220,380	gal	*6.666*	*ft*
Ending read	780,821	gal	*23.560*	*ft*
Net treatment gain	1,056	gal	*8.80*	*gpm*
Total reference volume	**563,135**	**gal**		
SLR 6.7 MGD accuracy	**99.76%**			



SLR 5.0 MGD Test

Test date	June 15, 2017
Test steady state duration	9:15am – 11:15am

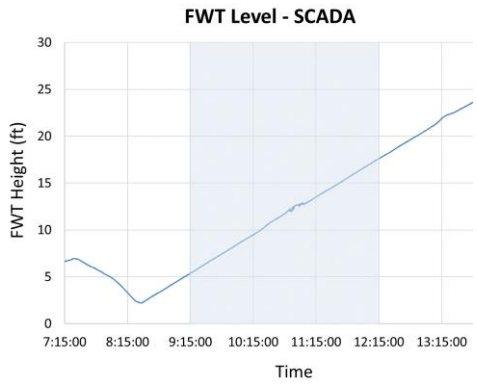
TEST VOLUME				
Starting read	209,606	gal		
Ending read	627,319	gal		
Total registered throughput	**417,712**	**gal**		
REFERENCE VOLUME				
Starting read	265,283	gal	*8.025*	*ft*
Ending read	679,260	gal	*20.513*	*ft*
Net treatment gain	978	gal	*8.15*	*gpm*
Total reference volume	**415,772**	**gal**		
SLR 5.0 MGD accuracy	**100.47%**			



NC 3.3 MGD Test

Test date	June 20, 2017
Test steady state duration	9:15am – 12:15pm

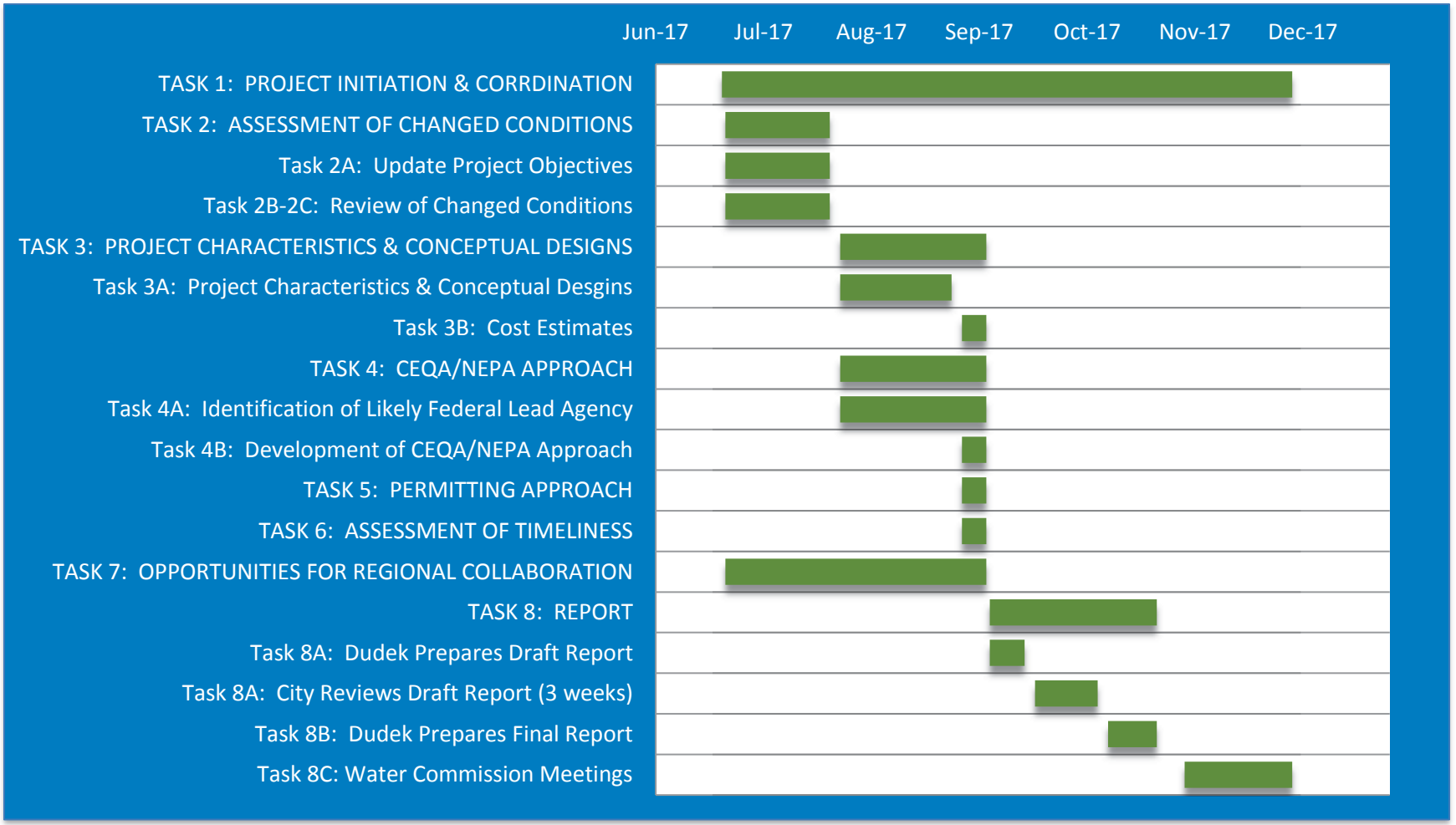
TEST VOLUME				
Starting read	258,825	gal		
Ending read	673,241	gal		
Total registered throughput	**414,416**	**gal**		
REFERENCE VOLUME				
Starting read	178,233	gal	*5.392*	*ft*
Ending read	582,747	gal	*17.614*	*ft*
Net treatment gain	3,103	gal	*17.24*	*gpm*
Total reference volume	**404,124**	**gal**		
NC 3.3 MGD accuracy	**102.55%**			



Potential Sources of Uncertainty

A few primary sources of uncertainty affect test results:

- Specific calibration of the SCADA-connected FWT pressure transducer relative to the floor of the FWT and corresponding alignment with minor changes in tank dimensions corresponding to certain heights
- Exact geometry of a 42” pipe leaving the FWT subject to height change in the FWT
- Accuracy of the SLR and NC meters when operated in tandem, given downstream confluence


Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
TASK 1: PROJECT INITIATION & CORRDINATION
TASK 2: ASSESSMENT OF CHANGED CONDITIONS
Task 2A: Update Project Objectives
Task 2B-2C: Review of Changed Conditions
TASK 3: PROJECT CHARACTERISTICS & CONCEPTUAL DESIGNS
Task 3A: Project Characteristics & Conceptual Desgins
Task 3B: Cost Estimates
TASK 4: CEQA/NEPA APPROACH
Task 4A: Identification of Likely Federal Lead Agency
Task 4B: Development of CEQA/NEPA Approach
TASK 5: PERMITTING APPROACH
TASK 6: ASSESSMENT OF TIMELINESS
TASK 7: OPPORTUNITIES FOR REGIONAL COLLABORATION
TASK 8: REPORT
Task 8A: Dudek Prepares Draft Report
Task 8A: City Reviews Draft Report (3 weeks)
Task 8B: Dudek Prepares Final Report
Task 8C: Water Commission Meetings

Water Commission
AGENDA REPORT

DATE: 9/27/2017

AGENDA OF: 10/2/2017

SUBJECT: Workshop on Water Supply Modeling and Aquifer Storage and Recovery with Gary Fiske (Gary Fiske and Associates Inc.) and Robert C. Marks (Pueblo Water Resources Inc.)

RECOMMENDATION: That the Water Commission receive information on the evaluation of winter water supply strategies, namely Aquifer Storage and Recovery and In Lieu.

BACKGROUND: The City's Water Supply Advisory Committee (WSAC) recommended several strategies in their Final Report on Agreements and Recommendations for how best to address an agreed-upon gap of 1.2 billion gallons between peak-season water supply and water demand during the worst drought. In addition to continued water conservation efforts as described in the Long Term Water Conservation Plan (August, 2016), the committee's recommendations include evaluating the potential to use passive and active storage of available surface water (through In-Lieu water transfers and/or Aquifer Storage and Recovery) followed in preference by the utilization of advanced treated recycled water or desalination.

Staff has been advancing the various elements of the WSAC-recommended work plan as demonstrated by quarterly status report number seven that appears as another item on the agenda. In addition to the quarterly updates, staff provides informational opportunities to the commission to facilitate their evaluation of the work being done, progress being made, and to engage in needed discussions on the opportunities and limitations of the various strategies being evaluated.

This workshop will focus on the winter water strategies of In Lieu water transfers and Aquifer Storage and Recovery. In addition to Water Department staff the two speakers include:

- Gary Fiske (Gary Fiske and Associates Inc.): Gary will provide background information on the Confluence water supply model (what it is, what it is not, how it is structured, nature of the results, etc.), how the model assumptions have been modified over the years of use, and the efforts and progress made during the recent evaluations.
- Robert C. Marks, P.G., C.Hg. (Pueblo Water Resources, Inc.): Robert will discuss the progress on Phase 1 of the ASR project including findings from the Geochemical Interaction study, the Siting Study, and some preliminary groundwater modeling results and recommendations.

DISCUSSION: The recommendations made by the WSAC are being implemented in the Water Supply Augmentation Strategy which lays out the scope, schedule, and budget for the various items. The primary question we are tasked with answering is:

What would it take to develop an In Lieu and/or ASR project in the Mid-County and/or Santa Margarita Groundwater Basin?

It is worth reminding ourselves of the assumptions used during the WSAC process; the analysis process we are using to answer the question above is based on a whole range of key assumptions that need to be both transparent and understood. The following bullets summarize the assumptions used to develop the In Lieu and ASR projects during the WSAC process. More detail is available in Appendix 8 of the WSAC final report.

General Assumptions
1. Demand projections per MCubed work on demand projections (August 2015)
2. Climate change model: GFDL2.1 A2
3. HCP fish flow regime: DFG-5

In Lieu Assumptions
1. Demand was based on those of Soquel Creek Water District (SqCWD) and Scotts Valley Water District (SVWD)
2. Eight extraction wells were assumed, 4 in the Santa Cruz Mid-County Groundwater Basin (MGB) and 4 in the Santa Margarita Groundwater Basin (SMBG)
3. Wells have a peak extraction capacities of 350gpm
4. Loss rate for stored water was 40% (shortly following the conclusion of WSAC this was modified to 20% for consistency with ASR)

Aquifer Storage and Recovery Assumptions
1. Eight wells are assumed: 6 in the MGB and 2 in the SMGB
2. Wells have a peak injection rate of 250gpm and a peak extraction of 350gpm
3. Loss rate for stored water was 20%

Staff has been working closely with Gary Fiske to look at water supply in the context of the Habitat Conservation Planning work and WSAS, with Robert Marks to further the Phase 1 of the ASR study, and with HydroMetrics Water Resources Inc. to complete the groundwater models for the MGB and the SMGB and run the various scenarios. These efforts are intertwined; when an assumption is changed for one of the efforts it invariably has an impact on another. The process of analyzing the feasibility of In Lieu and ASR supply alternatives is iterative and can be complicated by the sometimes-competing priorities: water supply planning, HCP, operational flexibility, infrastructure efficiency, etc. Thus the general flow of the analytical process is as described below:

- Available streamflow for diversion to the water supply at each point of diversion is key to the Confluence model simulation. Confluence relies on data file of daily available flows at each diversion point over the entire period of record. These flows are provided by the biologist and hydrologist working on the HCP.
- Added to this data are operating rules such as water rights and standard operating procedures. The Confluence model scenarios determine the amount of water, in million gallons (MG) and million gallons per day (mgd), required to minimize worst-drought peak-season shortages.

• Pueblo/HydroMetrics uses the Confluence model outputs, specifically the monthly additions/withdrawals from the aquifers in MG and mgd, to design an In Lieu and ASR project in terms of number and location of wells.
• If the groundwater (GW) modeling shows that key Confluence modeling assumptions (e.g. losses, aquifer storage capacity) are incorrect, there must be a second iteration of Confluence/GW modeling.

Gary's presentation will include an overview of the Confluence model, its use in Santa Cruz, and its application to the groundwater modeling work. Work in the last year has included refining the assumptions from which to start, and developing the various scenarios for Gary to do additional modeling work.

The starting assumptions to allow Gary to begin his modeling are shown below. Each assumption is noted as being the "Same" as WSAC, or "Different." For a summary of assumptions used in the Confluence model, see Attachment 2.

Assumptions:
• SVWD, SqCWD and San Lorenzo Valley Water District (SLVWD) will all participate in and in lieu. (Different. WSAC assumptions did not include SLVWD.)
• The max storage capacity of the virtual reservoir is 3BG; 20% is lost in the aquifer; usable storage is 2.4BG. (Same.)
• Graham Hill Water Treatment Plant can treat up to 16.5mgd (Same.)
• Surface water availability is constrained by existing water rights and infrastructure; however, the right of direct diversion from Felton is allowed. (Same.)
• Climate model, GFDL2.1 A2 (Same.)
• HCP fish flow regime, "DFG5" (Same.)
• 3 year aquifer fill cycle (Same.)
• Loss rate for stored water is 20% (.Same.)

Gary's work progresses in a step wise fashion where one, and occasionally two, assumptions or constraints are changed and analyzed prior to proceeding with subsequent modification(s). Each change is typically run using historical hydrology and climate change hydrology. Below is a summary of model scenario and results.

Base Case, using the assumptions above
ASR, and In Lieu plus ASR, will work to reduce the peak season shortage to zero. For example, for an ASR project with historical hydrology, Injection Capacity of 5.5mgd and Extraction Capacity of 4mgd is required to maintain zero peak season shortage. Under no circumstance, however, is In Lieu alone sufficient to reduce city shortage to zero. For example, even with the extraction capacity of 4mgd, there will still be a 400MG peak season shortage.

Extending the assumed fill period to 7 years instead of 3 years.
A longer fill period has a significant effect by reducing required injection/extraction capacities. For example, for an ASR project with historical hydrology, the Injection Capacity is reduced to 3mgd from the 5.5mgd noted above. In the case of In-Lieu only, while the goal of zero shortages in the worst 2-year drought cannot be reached with an assumed 3-year fill period (as noted above in the Base Case), a 7-year fill period enables achievement the zero-shortage goal for the historical streamflow data set.

Modified HCP flows
At the request of DFW and NMFS, the Department has assessed the practicability of several changes to the original DFG-5 flow proposal. Subsequent to this assessment, the Department is currently reviewing biological effects of the following modifications of its most recent flow proposal for the Anadromous Salmonid Habitat Conservation Plan:

- Felton Diversion
- Felton adult migration flow raised to 40 cfs
- Felton spawning 40 cfs for 14 days after any potential migration event
- Laguna Diversion
- Spawning flows in Laguna Creek in December of all years
- Liddell and Majors Diversions
- Spawning flows in Liddell and Majors in December in 0-60% exceedance conditions.
- All diversions
- Adult migration in April in 0-60% exceedance conditions.

The reason for the change at Felton is that among the system operating changes we are considering is significant changes to and direct to diversion from the Felton diversion. The HCP flow changes are more protective of the needs of migrating and spawning salmonids during the higher flow season. This change affects mainly, and then only marginally, the availability of winter water. The reason for the last three bullets is that DFG's (now DFW) proposal either overlooked or left several issues unresolved. However, there are likely substantive biological benefits provided by these changes. For the most part, they do not increase peak season shortages. However, they may increase the frequency of shortage. For example, for an ASR project with historical hydrology under Base Case conditions, Injection Capacity remains 5.5mgd and Extraction Capacity increases to 4.5mgd.

Output data from the various Confluence modeling scenarios is currently being used by Pueblo for use in the groundwater (GW) model. The overall purpose of the GW modeling is to evaluate the capacities of the groundwater basins to support the rates and volumes of recharge, storage, and recovery needed to fill the City's worst-year water supply gap during extended droughts. The scenarios are the same as being modeled in Confluence (In Lieu, ASR, In Lieu plus ASR), for historical and climate change hydrology, in both the MGB and the SMGB. Because GW modeling is often an iterative process, with the initial results informing the development of subsequent scenario simulations, Pueblo's scope of work includes up to two additional interactions of each basic scenario in each basin.

In addition to providing information on the mechanics of the groundwater model and modeling results, Robert Marks will provide updates on geochemical modeling and the well siting study.

With regards to the GW modeling we have asked Robert to provide the following:

- An overview of each model, their inputs, calibration, and outputs
- How the Confluence data is organized and pushed into the GW models
- Descriptions of the initial GW model scenarios developed from the Confluence model runs and how this is an iterative process
- How WSAC assumptions are being validated and challenged
- Additional scenarios being recommended.

Summary, Outstanding Questions and Next Steps

While a lot of progress has been made on the WSAS, a lot of work lies ahead and in some regards, it becomes more complicated. Below is a list of issues that need to be further defined and addressed, along with staff's thoughts on how to do so.

- What is the infrastructure needed to implement an In Lieu and/or ASR project? Staff is preparing a scope of work to have this level of detail applied to a project or projects that are developed by Pueblo in terms of well sites, piping and pump requirements, costs, etc. It is likely this will fall under the Program Manager umbrella.
- How should we incorporate new/different climate change model scenarios? The model referenced above is becoming dated and consideration is being given amongst the technical team as to how to address any differences between a newer model projections.
- The ASR and In Lieu projects make operational assumptions in terms of when wells would be operated and when partners would take water. These require additional discussions and likely modeling. Staff continues to work closely with the neighboring agencies to pursue the interest and operational preferences.
- How is a project or projects optimized? Staff is developing an approach to look at how to develop an effective water supply solution that meets the objectives of the WSAC. Not enough is known at present about how the selection of different basins, number of wells, and/or the participation of other agencies in In Lieu and/or ASR projects could affect cost and amount of supplemental supply that could be generated from these approaches. Additional work will be done in the coming phases of the winter water project to flesh out opportunities and constraints of winter water approaches. At the commissions November meeting staff will revisit the adaptive management concept adopted by the WSAC that will start to clarify the process.

FISCAL IMPACT: None.

Prepared by:	Approved by:
Heidi Luckenbach	Rosemary Menard
Deputy Director/Engineering Manager	Water Director

ATTACHMENTS:
Confluence Model Assumptions Table
Santa Cruz ASR Well Siting Study, Draft (July 2017)

Demands	IWP	IWP Update	HCP pre-2013	Desal EIR	HCP 2015	WSAC Final	Post-WSAC
Service Area Annual Demand (BG)	4.6-5.3	3.5-4.5	3.5-4.0	3.5-4.0	3.5	3.2	→
North Coast Annual Demand (BG)	31	81	81	81	40	→	→
Percent occuring in Peak Season	64%	→	→	→	59%	→	→
Hydrology							
Hydrologic Record	59 years	73 years	→	→	→		
Available Flows	Linsley- Kraeger	Balance	Multiple Scenarios	Tier 2/3 Tier 3	City Proposal (T3/2) & DFG5	Historical, Clim Chg DFG-5	Increased Felton Bypass; Dec/Apr adult migration; Potential revised CC
Diversions							
Turbidity Constraints	25 ntu	Updated 25 ntu	Updated 25 ntu; 200 ntu	Updated 25 ntu	Updated 25 ntu	→	→
Tait Street Buffer (cfs)	0	→	→	→	0.5	→	→
North Coast Transmission losses	15%=>1%	8%=>3%	→	→	→		
Groundwater Availability							
Beltz (mgd)	1.0-2.0	3 scenarios 0.3-1.0 in PS months	0.8 all years + 0.3 dry years in PS months	2 scenarios: (1) 0.8 all years + 0.3 dry years in PS months (2) 0.3 dry years in PS months	0.8 all years + 0.3 dry years in PS months	→	→
Tait Street Well Capacity (cfs)	1.78				1.29 off-pk; 0.78 pk	→	→
Loch Lomond							
Rule curves	Optimize to end of 1977	Optimize to end of 1977	Optimize to end of 1990	Optimize to end of 1977	Optimize to end of 1990	→	Joint with Aquifer
Max/usable capacity (mg)	2810/1710	2810/1740	→	→	→	→	→
Water rights:							
3200 AF withdrawal	Total Newell & Felton	→	→	→	Newell Only	None	→
Allowable diversion months	Oct-May	Nov-May			Sept - Jun		
Aquifer							
Capacity (mg)						3,000	→
Losses						20%	→
Treatment Plants							
GHWTP summer/winter capacity (mgd)	20/20	20/20	16.5/16.5	16.5/16.5	16.5/10	16.5/16.5	→
Desalination		Sharing w/ SqCWD	Sharing w/ SqCWD	Sharing w/ SqCWD & 2 operating modes	N/A	N/A	N/A

WELL SITING STUDY

SANTA CRUZ ASR PROJECT
PHASE 1 FEASIBILITY INVESTIGATION

Prepared for:

SANTA CRUZ WATER DEPARTMENT

JULY 2017
DRAFT

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INTRODUCTION

The City of Santa Cruz Water Department (City) is evaluating of the feasibility of an aquifer storage and recovery (ASR) project as part of its effort to develop additional water supplies for use during extended drought periods. ASR is a method of "banking" water in an aquifer during times when excess surface water is available and recovering of the water from the aquifer when needed during dry periods. An ASR project being considered by the City would involve the capture of seasonally available water from the San Lorenzo River and injection and storage of the water in the aquifer system(s) underlying the City and possibly the neighboring water system services areas of Soquel Creek Water District (SqCWD), Scotts Valley Water District (SVWD) and/or San Lorenzo Valley Water District (SLVWD). These service areas are shown on **Figure 1**.

Pueblo Water Resources, Inc. (PWR) performed an initial reconnaissance-level study (Recon-Study)[1] of the feasibility, potential yields, and costs associated with an ASR project for the City as a sub-consultant to the City's Water Supply Advisory Committee (WSAC). The Recon-Study findings indicated that ASR appeared to be technically feasible with no obvious fatal flaws. If implemented, the program will require the construction of either dual-purpose injection/recovery ASR wells or stand-alone injection and production wells at multiple locations within these service areas. This purpose of this well siting study is to preliminarily evaluate the siting of such wells, which includes considerations regarding hydrogeologic factors, land-use compatibility, construction logistics, regulatory issues, and environmental constraints. This report presents the findings, conclusions, and recommendations of the well siting investigation, including the identification of potential well sites and a ranking of the site with respect to the well siting criteria. The identified sites are intended to be used in groundwater modeling simulations to test well configurations relative to the overall project goals.

BACKGROUND

The proposed ASR project target goal is the storage and recovery of approximately 2.4 billion gallons ([bg] 7,365 acre-feet [sf]) of water during a worst-case two-year drought period (1.2 bg per year [bgy]). Some of this storage may be achieved by direct injection and subsequent recovery via dedicated ASR wells and some may be achieved via "in-lieu" delivery of treated surface water to the SqCWD and/or SVWD and/or SLVWD to be substituted for pumped groundwater, allowing groundwater storage to accrete and be available for later recovery by the City.

[1] Pueblo Water Resources, Inc., *Reconnaissance-Level Evaluation of ASR and IPR*, Technical Memorandum prepared for Stratus Consulting, Inc., dated May 15, 2015.

Recent analyses performed by Gary Fiske and Associates, Inc., utilizing the City's water-supply planning Confluence Model[2] have identified the infrastructural capacities required to meet the City's goals under both historical and future projected climate change hydrologic settings. For the In-Lieu Only scenarios under both historical and future climate change climates, 4 million gallons per day (mgd) of extraction capacity is required to recover the stored water; however, the yield of In-Lieu is limited by the winter-time demands of the other Districts and results in worst-year shortfalls of 400 to 470 mgy, respectively. Fulfilling the worst-year shortages would require In-Lieu to be supplemented with additional ASR capacity. For the In-Lieu plus ASR scenarios, supplemental injection capacities of 1.5 to 2.0 mgd and extraction capacities of 4.0 and 6.5 mgd for the historical and climate change hydrologic settings, respectively, are needed to eliminate the projected shortfall. If the City is unable to reach agreements with the other Districts for In-Lieu projects, an ASR Only project could also eliminate the supply shortfalls with 5.5 to 6.0 mgd of injection capacity and 4.0 to 6.0 of extraction capacity for the historical and climate change scenarios, respectively.

In response to the capacities required as identified through the Confluence Modeling, PWR performed site-specific injection capacity analyses[3] for the areas being considered for ASR. Average per-well injection capacities of approximately 0.5 mgd (350 gpm) are considered feasible in the aquifer system underlying the SCWD and SqCWD service areas (Purisima Formation), and 0.3 mgd (200 gpm) of injection capacities are considered to be feasible in the aquifer system underlying the SVWD and SLVWD service areas (Lompico Sandstone). Accordingly, depending on the eventual distribution of wells between the various service areas and aquifer systems, the total number of new well sites required to achieve the maximum needed injection capacity of 6.0 mgd is between 12 and 20. It is also noted that, as a general rule-of-thumb, injection capacity is typically one-half of a well's pumping/extraction capacity; therefore, the total number of well sites needed is generally controlled by the needed injection capacity for the ASR only scenarios.

FINDINGS

HYDROGEOLOGIC SETTINGS

Given the geographical proximity and similar hydrogeology of SCWD and SqCWD services areas the hydrogeologic setting of these areas will be discussed as one and referred to as the Santa Cruz-Soquel Area. The hydrogeologic setting of the SVWD and SLVWD service areas will be discussed separately because of the geographical separation and differing hydrogeologic features and will be referred to as the Scotts Valley-Pasatiempo Area.

Santa Cruz - Soquel Area

[2] Gary Fiske and Associates, Inc., *ASR, In-Lieu Modeling Results: REVISED*, memorandum to City of Santa Cruz, dated March 8, 2017.
[3] Pueblo Water Resources, Inc., *Santa Cruz ASR Project – Phase 1 Feasibility Investigation; Task 1.2 Site-Specific Injection Capacity Analysis*, Technical Memorandum prepared for City of Santa Cruz Water Department, dated May 11, 2017.

The hydrogeology of the Santa Cruz-Soquel Area has been studied in detail by many investigators in the past, including: Fugro West (1998, 2001); Luhdorff & Scalmanini (2003); Hopkins (2004); Johnson (2004); and Hydrometrics (2007).

In general, the Purisima Aquifer occurs within the western portion of the Santa Cruz Mid-County Groundwater Basin (SCMGB) and underlies the boundary between the SCWD and SqCWD service. The service area boundary between SCWD and SqCWD a jurisdictional as opposed to a physical hydrogeologic barrier, and as such, hydrogeologic connectivity exists between the two service areas.

The Purisima Aquifer comprises the principal aquifer system within the Santa Cruz-Soquel Area and consists of several distinct zones within the geologic Purisima Formation (Tp). The Purisima Formation is a consolidated to semi-consolidated marine sandstone with interbeds of siltstone and claystone. The un-eroded thickness of the Purisima Formation is approximately 2,000 feet. Underlying the Purisima Aquifer are granitic or metamorphic rocks (i.e., bedrock) or fine-grained sedimentary rocks (e.g., Monterey Formation or Santa Cruz Mudstone) that are generally considered to be non-water bearing and constitute the base of the aquifer system.

The Purisima Aquifer has been subdivided by previous investigators into hydrostratigraphic aquifer and aquitard units for purposes of conceptualizing the distribution of hydrogeologic properties and pumping stresses. From youngest to oldest, these units include:

- Aquifer F (> 800 ft. thick)
- Aquifer DEF (330 ft. thick)
- *Aquitard D (80 ft. thick)*
- Aquifer BC (200 ft. thick)
- *Aquitard B (150 ft. thick)*
- Aquifer A (250 ft. thick)
- Aquifer AA (150 – 300 ft. thick)
- *Aquitard "Tp?" (0 – 200 ft. thick)*
- Aquifer Tu (0 – 300 ft. thick)

A geologic map showing the surface outcrops of these units is presented as **Figure 2** and a vertical cross-section showing the orientation and stratigraphic relationship of these units are shown on **Figure 3**.

Scotts Valley – Pasatiempo Areas

The hydrogeology of the Scotts Valley and Pasatiempo sub-areas of the Santa Margarita Groundwater Basin (SMGB) has also been studied in detail by many investigators, including: Clark (1966,1981); Akers and Jackson (1977); Clark, et al (1989); Camp Dresser & McKee Inc., (1994); Todd Engineers (1994, 1997, 2003, 2007); Brabb, et al (1997); Johnson (2002); California Department of Water Resources (2003), and; Kennedy/Jenks Consultants (2014, 2013). In general, the SMGB covers over 30 square miles in the Santa Cruz Mountains forming a roughly triangular area that extends from Scotts Valley in the east, to Boulder Creek in the northwest, and to Felton in the southwest. The basin is bounded by two regional faults, the Ben

Lomond Fault to the west and the Zayante Fault to the north. The SMGB has been divided by previous investigators into two subareas as described below:

- The Scotts Valley Groundwater Subarea including the portion of the SMGB served primarily by SVWD. This subarea is generally bounded by Bean Creek to the north, Hanson Quarry on the west, and the SMGB boundary to the south and east.
- The Pasatiempo Groundwater Subarea includes the portion of the SMGB served primarily by the San Lorenzo Valley Water District. This subarea is generally bounded on the east by the Scotts Valley Groundwater Subarea, by Bean Creek to the north, and by the SMGB boundary to the south and west.

As described, the SMGB consists of a sequence of sandstone, siltstone, and shale with a thickness of up to approximately 1,500 feet. The sedimentary sequence, which is underlain by granite, is divided into several geologic formations on the basis of the rock type and relative geologic age. The sequence has been folded into a down-warped structure known as the Scotts Valley Syncline which generally trends east west through the SMGB. Because of the structure and orientation of the syncline, any given geologic formation can be found at or near the ground surface to depths of several hundred feet below ground surface, depending on location in the basin. The variability of the stratigraphic layers also adds to the geologic complexity within the SMGB.

Geologic formations that contain significant sandstone layers are the primary aquifers in the area. Brief descriptions of the primary aquifers in the basin are presented below (from youngest to oldest):

- Santa Margarita Sandstone (Tsm). The Santa Margarita Sandstone (Santa Margarita) generally consists of a massive, fine- to medium-grained arkosic sandstone that forms distinctive white sand that can be observed in cliffs around Scotts Valley. The Santa Margarita thins from over 400 feet thick in the western part of the basin to being absent on the eastern edge. The Santa Margarita unconformably overlies the Monterey Shale, which has been completely eroded away in the southeast and southern portions of the basin. Where this occurs, the Santa Margarita and Lompico are in direct contact.
- Lompico Sandstone (Tlo). The Lompico Sandstone (Lompico) consists of a massive, fine- to medium-grained sandstone that is typically 200 to 350 feet thick in the area. Most groundwater pumping in the Scotts Valley area is from the Lompico.
- Butano Formation (Tbu). The Butano Formation (Butano) is a thick sandstone unit with interbeds of lower permeability materials (mudstone, shale, and siltstone) that divide the formation into three sandstone members (lower, middle, and upper). The Butano has an uneroded total thickness of approximately 5,000 feet; however, structural deformation and erosion limit its thickness in the Scotts Valley area from several hundred to one thousand feet.

Underlying these deposits are granitic (i.e., bedrock) or fine-grained sedimentary rocks (e.g., Locatelli Formation) that are generally considered non-water bearing and constitute the base of the aquifer system in the area.

A geologic map of the surficial geology in the area is shown on **Figure 4** and a regional cross-section through the study area showing the underlying hydrostratigraphic framework is shown on **Figure 5**.

As shown on **Figure 5**, in the southwest area underlying the SVWD service area, the Santa Margarita and Lompico aquifers combined reach thicknesses of up to approximately 500 feet and the Butano is absent. Towards the northeast, the Santa Margarita thins and becomes absent near the SVWD service area boundary. The maximum thickness of permeable deposits occurs within the Scotts Valley Syncline, where the combined thickness of the Santa Margarita, Lompico, and Butano is as much as approximately 1,000 feet.

TARGET AQUIFER COMPLETIONS

The success of an aquifer recharge project depends on the ability to physically place water into the aquifer, to effectively store the water in the aquifer, and eventually retrieve this previously stored water. The hydrogeology of the aquifer system is the primary factor controlling the rate at which water can be injected, the amount that can be stored, and the ability to recover the stored water. The hydrogeologic factors affecting the feasibility of an ASR program include groundwater basin structure and geometry, hydrostratigraphy, aquifer hydraulic parameters, and water-level conditions.

The results of the Recon-Study's evaluation of hydrogeologic settings, aquifer hydraulic parameters, estimates of available storage capacity, and preliminary injection capacity analyses allowed for general identification of target aquifers for ASR wells. For the Purisima Aquifer underlying the SCWD and SqCWD service areas, it was recommended that aquifer units Tu, AA and A should be targeted for ASR because they are comprised of the most transmissive aquifer zones and because they have the greatest theoretical per-well injection capacities. The overlying aquifers units BC through F appear to be less transmissive and, therefore, considered less favorable for ASR wells.

For the SMGB underlying the SVWD and SLVWD service areas, the Lompico Sandstone (Tlo) was identified as being the most favorable target aquifer for ASR wells, followed by the Butano Formation (Tb) as the second most favorable aquifer in this area for ASR. Again, this determination was based on aquifer hydraulic characteristics and estimated amounts of available storage. The Santa Margarita Sandstone (Tsm) is the least favorable unit for ASR wells in the SMGB due to the limited amount of saturated aquifer materials (which would limit the ability to backflush during ASR operations, which is discussed later in this report).

WELL SITING CRITERIA

The purpose of this well siting study is to identify and evaluate of potential locations for as many as 20 new municipal size water wells. Many factors must be investigated and considered the suitability of a site for well placement and well construction. The numerous criteria established for this well siting investigation fall into one of the following general categories:

- Hydrogeologic Factors
- Site Considerations
- Construction Logistics
- Regulatory Requirements
- Environmental Constraints

A discussion of the criteria associated with each of these considerations is presented below.

Hydrogeologic Factors

Target Aquifers. Injection and recovery water would target the primary aquifers in each of the potential ASR project areas (the Purisima Area for the MCGWB and the SMGB within the SVWD and SLVWD Service Areas). As discussed previously, in the Santa Cruz-Soquel area the target aquifer would be the Purisima Formation. Specifically, the target zones would be the A, AA and Tu units of the Purisima Formation – the most prolific units in this basin. In the Scotts Valley and Pasatiempo areas, the target aquifer would be the Lompico Formation. Relevant to the hydrogeologic evaluation of each site are factors including:

- Elevation of Bottom of Target Aquifer
- Water Level Elevation
- Depth of Well Required
- Depth to Water at Site
- Distance from Ocean/Subsea Outcrop (Purisima Area only)

Well Yield. The extraction capacity of a water well is a function of the aquifer transmissivity and available drawdown. Available drawdown is the difference between the level at which the water stands in a well when idle (static water level) and the top of the producing aquifer. All other things being equal, a well in a given aquifer will produce twice as much water with twice the drawdown. The performance of a well is commonly expressed as specific capacity, which is the ratio of discharge to drawdown with the units of gallons per minute per foot of drawdown (gpm/ft).

Injection well performance can be estimated in a similar manner. Injection capacity is a function of aquifer transmissivity and available drawup, in this case drawup is typically

considered to be the distance from the static water level to ground surface. As is the case for extraction capacity, the injection rate is proportional to available drawup. However, because of hydraulic losses that typically occur in injection wells, injection capacities are typically found to be 50 percent relative to the extraction capacities of the same well.

Given the above, the performance of a well, injection or extraction, can be estimated at any location if the transmissivity and available drawdown or drawup is known. For purposes of evaluating the various well sites, calibrated aquifer parameters of hydraulic conductivity and thickness were extracted from the two existing groundwater models--the SMGB groundwater model and the Santa Cruz MGB groundwater model and used to calculate specific capacity[4]. Additionally, aquifer geometry was extracted from the models to allow calculation of maximum available drawdown for pumping. Water surface elevation data and ground surface elevation were used to calculate maximum available drawup for injection. The specific capacity values, both extraction and injection specific capacity, along with the calculated maximum drawdown and maximum drawup, were utilized as part of a GIS analysis to estimate well capacities for both extraction and injection wells at all locations in the basins.

Figures 6 and 7 show estimated extraction and injection rates, respectively, for the Santa Cruz-Soquel area. **Figures 8 and 9** show estimated extraction and injection rates, respectively, for the Scotts Valley-Pasatiempo area.

It is noted that the rates presented on **Figures 6 through 9** are based on a relatively simplistic equation applied to aquifer parameters derived from the calibrated groundwater models. Accordingly, the values are considered theoretical "first-approximations" suitable for development of initial groundwater modeling scenarios, and will be subject to refinement based on the results of the groundwater modeling and more focused site-specific analyses.

Hydrogeologic Risk. As discussed above, the hydrogeologic features of both potential project areas have been thoroughly investigated and are considered to be relatively well understood. However, there are still locations within both areas where the hydrogeologic conditions are not fully understood. At some locations there is direct knowledge of the underlying hydrogeology from a proximate borehole or well. In other areas, the hydrogeologic understanding is inferred from regional analysis and projection of geologic structure from other locations.

Well Site Considerations

Existing Site Conditions and Current Land Use. Existing site conditions and current land use are important considerations in the siting of wells. Typically, potentially suitable sites occur as excess space on existing properties, undeveloped parcels, and portions of public places. Also, potential sites must be of sufficient size to accommodate well construction activities, and to house permanent well facilities.

[4] Transmissity (T) is the product of hydraulic conductivity and aquifer thickness. Specific Capacity (SC) can be related to transmissivity through the following relationship: SC=T/2000 (Driscoll, 1989).

Ownership. Ownership of the property containing the sites is included as a consideration as it impacts the ability to acquire the site. Means of acquiring site could be by outright purchase, condemnation, or in the case of a publically owned property by permanent easement.

Distance to Distribution System. Although not necessarily a critical concern for well siting, distance to distribution system can contribute to increase overall project costs.

Proximate Land Use. Land use adjacent to the identified sites needs to be considered with regards to both construction and long-term compatibility with neighborhood. Considerations include operational noise, maintenance, traffic and zoning. Issues regarding construction noise are discussed below.

Construction and Permanent Facility Logistics

Size. A suitable site needs to have sufficient space to accommodate well drilling and well construction activities. A space of approximately 10,000 square feet is considered to be the minimum for this purpose, with a minimum width of approximately 60 feet. A minimum amount of space is also required for the housing of permanent well facilities. Adequate space is required for accessing and servicing the well, performing full scale well rehabilitation, and possibly for the siting of on-site percolation or storage vessels for well backflushing.

Noise Impacts. During a well construction project, some activities must be conducted on a 24/7 basis, thus consideration must be given to construction noise and the mitigation of noise impacts. Typically, when construction occurs in an urban/suburban area, noise is mitigated with sound walls to muffle construction noise. In more rural settings, it is possible that sound walls are not necessary or not necessary on all sides of the work area. In some situations, where noise cannot be adequately mitigated, proximate residences may be temporarily relocated.

Water Disposal. Relatively large amounts of water are produced during the drilling, construction, development, and testing of a municipal water well. There must be a suitable location to dispose of produced water at any given site. Discharges typically occur to storm drains, the sanitary sewer, or natural water courses. Discharges to storm drains and natural water courses are regulated by the Regional Water Quality Control Board under a NPDES permit. Discharges to publicly-owned storm facilities can sometimes be permitted under existing NPDES permits.

Water Supply. A suitable site also requires a reliable source of potable water to support well drilling and well construction activities. A minimum instantaneous flow rate of approximately 50 gpm is required. Temporary tanks can be used on-site if the minimum flow of potable water supply is not available.

Overhead Utility Lines. OSHA standards and common sense prohibit the erection of a drill derrick within a specified setback from power lines – the distance being a function of the voltage of the lines. Selected sites either have no overhead lines or they run parallel to the street and can be avoided.

Access. For both construction purposes and on-going well maintenance and servicing a suitable site needs access for equipment and materials. Sites should be accessible from existing streets.

Regulatory Requirements

SWRCB-DDW Standard Compliance. A policy recently adopted State Water Resources Control Board – Division of Drinking Water (SWRCB-DDW) requires all new public water supply wells to have a 50-foot radius land-use control zone. Land-use control must take the form of deed-restriction or similar to regulate the use of land within the control zone to prohibit the occurrence of potential contaminating activities. This new requirement essentially sets minimum size for a permanent well facility at 100 feet by 100 feet.

Sewer Setback. Department of Water Resources and Local Environmental Health Department regulations require a setback from sanitary sewers of 50 feet. However, with the new regulations from the SWRCB-DDW this regulation is built-in to the control zone.

Environmental Constraints

An environmental contamination screening was performed on the areas under consideration for well siting. This consisted of a review of the State of California's GEOTRAKER database compiling all state and federal government databases on ground and surface water contamination in the area. This includes listing of underground storage tanks (UST and LUST), hazardous material generators (RCRIS), Superfund (CERCLIS) sites, and other reported waste sites. The listing revealed numerous sites in various stages of detection, remediation and closure in the study areas. These results are discussed below.

Santa Cruz-Soquel Area. Figure 10 shows the know contamination sites in the area. Most of the sites have been remediated and formally closed. There are three sites on the map that remain open – Bei-Scott Co., Noble Gulch Drain, and McGregor Property. All three of these sites are sites of surficial soil contamination, which have been essentially remediated but remain open due to incompleteness of the regulatory process.

Scotts Valley-Pasatiempo Area. None of the known contaminated sites restricts well siting in the areas under consideration, as localized contamination is limited to the shallow aquifers or soils or the sites have been remediated and closed. Known sites within the Scotts Valley – Pasatiempo area are shown on **Figure 11**. The most significant site in the area is the Watkins-Johnson site, previously a super-fund site contaminated with TCE. The contamination was detected in the shallow perched aquifer and the Santa Margarita Sandstone. Remediation efforts began at the site in 1987 and the site was formally closed in 2016. There are also two dry cleaner sites, Scotts Valley Dry Cleaners and Kings Cleaner, in the area that have had PCE spills into the Santa Margarita and are actively being remediated.

WELL SITE ASSESSMENT

Potential Well Site Identification

Potential well sites in each of the focus areas were identified with the considerations given to each of the issues discussed above. Initial assessment of potential well sites was performed based on review of previous reports, inspection of available satellite imagery (Google Earth), and GIS coverages, with the paramount constraints being that the potential well sites lie within their respective groundwater basin/sub-basin boundary and be within or proximate to the service areas of potential project partners – SCWD, SqCWD, SVWD, and the Pasetiempo portion of SLVWD. Site selection was focused primarily on parcels with sufficient space availability to accommodate well construction and permanent well facilities. Publicly- and privately-owned parcels and portions of parcels were considered in identifying sites. After sites were preliminarily identified, each site was field inspected to assess logistical limitations (overhead lines, access, water supply, water disposal, etc.), categorize adjacent land use and determine overall feasibility. For each identified site, a summary was prepared that shows and describes the well site location and site conditions, and contains information related to each of the well siting considerations described above.

It is noted that the City commissioned a well siting study in 2006 (Hopkins, 2006) to identify potential production well sites within its service area using criteria similar to those under consideration for this well siting study. Based on the analysis by Hopkins, 23 potential well sites were identified and ranked. Of the 23 locations identified in 2006, many of the sites have been developed since the time of the report and municipal groundwater production wells have been constructed at two of the (City Beltz #12 and SqCWD O'Neill Ranch). For the purposes of this well siting investigation, several of the sites identified by Hopkins have been eliminated from consideration because they are considered to be of insufficient size given the new SWRCB-DDW control zone requirements, or because they are considered to be too close to existing wells. Of the 23 sites identified by Hopkins, 7 remained for consideration for this investigation.

An inventory of potential sites identified for this study is presented in **Table 1**. The locations of the potential sites are shown on **Figures 12 and 13**. The individual well site summaries are provided in **Appendix A**.

Well Site Rating and Scoring

Based on the above discussion, each of the sites was rated with regards to the well siting criteria. Each well was assigned a score from 1 to 5 for all ranking criteria, with 1 being the lowest performance or the most challenging constraint. However, certain categories were weighted higher than others. For example, hydrogeologic performance was weighted at 2 times the other factors. While numerical standards were established for the well performance, the rest of the criteria were assigned scores based on the PWRs experience with well projects and well site development. The results of the rating and associated scoring, by area, are presented in **Tables 3 through 5**.

Table 1. Inventory of Potential Well Sites

Map Number	Key	Potential Site	Ground Surface Elevation, approx (ft,msl)	Distance from Ocean(ft)	Target Aquifer	Bottom Elev. (ft, msl)	Depth to Bottom (ft)	WSE (feet, msl) (2014)	DTW (ft)	Site Size (sq ft) Google Earth	Current Use	Ownership	Proximate Land Use	Considerations
		SCWD Service Area												
33	HC1	Hopkins C1	108	6940	*Tp(A,AA) Tu*	*-500*	*608*	47	*61*	151789	Equipment Storage	Private	Industrial	
23	HB5	Hopkins B5	78	3840	*Tp(A,AA) Tu*	*-650*	*728*	25	*53*	25833	Storage Yard	Private	Parking, Res	Near SqCWD MW SC-22
3	HA3	Hopkins A3	63	3650	*Tp(A,AA) Tu*	*-740*	*803*	9	*54*	30209	Constrution Storage Yard	Private		
4	HA4	Hopkins A4	63	3700	*Tp(A,AA) Tu*	*-730*	*793*	12	*51*	28076	Constrution Storage Yard	Private		
13	HA9	Hopkins A9	72	4840	*Tp(A,AA) Tu*	*-680*	*752*	21	*51*	40700	Vacant	Private	Res, all sides	
1	HA1	Hopkins A1	21	4100	*Tp(A,AA) Tu*	*-625*	*646*	10	*11*	39361	Vacant	Private	Res, Indus	
6	HA5	Hopkins A5	68	4590	*Tp(A,AA) Tu*	*-700*	*768*	15	*53*	224737	Brommer County Park	SC County	Res, but at dist	
	SC1	Good Shepherd Sch	123	7980	*Tp(A,AA) Tu*	*-400*	*523*	55	68	10,000	Sch.Playfield	Private	Res,	NE Corner of Property
	SC2	Coffee Land Pk	73	6140	*Tp(A,AA) Tu*	*-600*	780	42	31	10,000	Coffee Lane Park	Private	Res, Rodeo Ck	Site of SC Coffee Lane MW
	SC3	Chanticleer Ave. Park	93	7765	*Tp(A,AA) Tu*	*-490*	780	45	48	10,000	Park			
	SC4	Capitol Shp Cntr	94	4990	*Tp(A,AA) Tu*	*-656*	750	34	60	10,000	Parking Lot	Private	Commercial	Large % of Parking - Maybe have treatment else where
	SC5	Site of SC-22	75	3275	*Tp(A,AA) Tu*	*-675*	750	24	51	10,000	Parking Lot	Private	Com, Res	Site of SqCWD SC-22
	SC6	Winkle Farm Park	131	9710	*Tp(A,AA) Tu*	*-325*	*456*	78	53	10,000	Undeveloped		Mixed Res, Rural	Near SC Thurber MW
	SC7	Drive-In Theater	125	7990	*Tp(A,AA) Tu*	*-400*	*525*	55	70	10,000	Drive-In	Private	Res,	NE Corner of Property
	SC8	2740 Mattison Ln	120	7540	*Tp(A,AA) Tu*	*-470*	*590*	54	66	10,000	Vacant	Private	Res, School, Freeway	Carve out piece new freeway
	SC9	End of Thompson @ RR Tracks	61	2990	*Tp(A,AA) Tu*	*-770*	*831*	10	51	10,000	Idle Warehouse	Private	Industrial, Res across RR	Carve out piece in lot near RR tracks
	SC10	Sears Parking Lot-along 41st	76	3760	*Tp(A,AA) Tu*	*-660*	*736*	25	51	10,000	Parking Lot		Commercial,	Carve out piece along 41st, other locations as well
		SqCWD Service Area												
	Sq1	Bay St. Shopping Cnt Prk Lot	30	4050	*Tp(A,AA) Tu*	*-670*	700	15	15	10,000	Parking Lot	Private	Com, Capitol Cr	
	Sq3	Anna Jean Cummings Park	147	8710	*Tp(A,AA) Tu*	-475	622	65	82	10,000	Parking Lot	Public	Park Parking Lot	
	Sq4	Soquel High School	125	6720	*Tp(A,AA) Tu*	*-525*	650	50	75	10,000	School	Public	Open, Park, Res	
	Sq5	Main Street Elementary	70	6520	*Tp(A,AA) Tu*	*-590*	660	20	50	10,000	School	Public	Res	Large Parking Lots
	Sq6	Cunningson Ln and Soquel	140	3860	*Tp(A,AA) Tu*	*-760*	900	2	138	10,000	Undeveloped	Private	Streets, Res	near pumping depression (close to Tannery, Maplethorpe & C. College)
	Sq7	property across street from ^	125	3175	*Tp(A,AA) Tu*	*-775*	900	1	124	10,000	Storage, Undeveloped	Private	Mixed	also church next door?
	Sq8	Redrill Rosedale	130	4380	*Tp(A,AA) Tu*	*-710*	840	5	125	10,000	SqCWD Yard/Office	Public	Res	Rosedale drilled to 570'
	Sq9	Cunningson Ln 1400' N. of Soquel	184	4870	*Tp(A,AA) Tu*	-760	944	10	174	10,000	Undeveloped	Private	rural, few houses,res on hill	carve out site in SW corner
	Sq10	NE corner Park and Soquel	161	4200	*Tp(A,AA) Tu*	-850	1011	4	157	10,000	Undeveloped	Private	Res	carve out site in NW corner
	Sq11	Behind Beth El Temple	222	5075	*Tp(A,AA) Tu*	-890	1112	8	214	10,000	Undeveloped Space Behind	Private	Res, Temple	carve out site in SE corner, adjacent road
	Sq12	Porter Gultch Rd, 825 ' N of Soquel W side	177	5295	*Tp(A,AA) Tu*	-950	1127	10	167	10,000	Undeveloped	Private	Rural Res	carve out site in NW corner
	Sq13	Twin Lakes Church/School Parking Lot	144	2620	*Tp(A,AA) Tu*	-1000	1144	-4	148	10,000	Parking Lot	Private	Parking Lot, Colledge, Frwy	carve out site in parking lots
		SVWD and SLVWD Service Area (Pasatiempo Subarea)												
	SV1	Mt Hermon Rd, Kaiser Well Site	472	NA	Tlo	-475	947	350	122	10,000	Undeveloped	Private	Res, Road, Undeveloped	
	SV2	Skypark, S of tennis courts	533	NA	Tlo	-600	1133	375	158	10,000	Undeveloped Boundary Area	Public	Res, Rec,Industry	
	SV3	Skypark, NE corner parking lot	529	NA	Tlo	-325	854	350	179	10,000	Parking Lot	Public	Industry, Recrea, Public	near SVWD AB303 MW-3
	SV4	NE of Hanson' Quarry	508	NA	Tlo	-375	883	325	183	10,000	Undeveloped	Private	Res at Distance	near SVWD AB303 MW-3
	SV5	N. of Hanson Quarry pit	553	NA	Tlo	-550	1103	375	178	10,000	Undeveloped	Private	Res at Distance	near SVWD AB303 MW-3
	SV6	Alviso Parking Lot	454	NA	Tlo	-550	1004	375	79	10,000	Parking Lot	Private	Res at distance uphill	previous contamination of Tsm
	SV7	Skypark, NW of Storage Units	521	NA	Tlo	-420	941	360	161	10,000	Playfield	Public	Res, Playield	
	SV8	Alviso Lower Parking Lot	385	NA	Tlo	-625	1010	375	10	10,000	Storage	Private	Industrial, Res on Hill	previous contamination of Tsm
	SV9	NW corner Mt Hermon and Skypark	495	NA	Tlo	-325	820	325	170	10,000	Vacant	Private	Res at distance, Retirement Home	

8.20

Table 2a. Well Site Rating Analysis Summary – SCWD Service Area

Santa Cruz Service Area

Target Aquifer - Purisima Zones A, AA and Tu *Generalized Well Design - 16-inch diameter Stainless Steel Casing, Stainless Steel Wire-Wrapped Screen*

Hydrogeology

Site	Description	Elev. (feet,msl)	Depth to Water (feet)	Water Surface Elevation (feet, msl)	Well Depth (feet)	Production Capacity (gpm)	Injection Capacity (gpm)	Backflush Rqmnt (gpm)	Adjusted Injection Capacity (gpm)	Hydrogeologic Risk/ Control	Rating (Injection)	Rating (Production)
HC1	Hopkins C1 - W side of Rodeo Gluch Rd	108	61	47	608	2000	600	1200	600	Moderate/R	5	5
HB5	Hopkins B5 - Clares St. Storage yard	78	53	25	728	40	880	1760	20	Low/R,W	1	1
HA3	Hopkins A3 - Property behind business	63	54	9	803	500	40	80	40	Low/R,W	1	2
HA4	Hopkins A4 - Property behind business	63	51	12	793	500	40	80	40	Low/R,W	1	2
HA9	Hopkins A9 -Behind House on 30th	72	51	21	752	500	40	80	40	Moderate/R	1	2
HA1	Hopkins A1 - Oversized Lot near Rodeo Cr	21	11	10	646	500	40	80	40	Moderate/R	1	2
HA5	Hopkins A5 - Brommer St Park	68	53	15	768	500	40	80	40	Moderate/R	1	2
SC1	Good Shepherd Sch	123	68	55	523	500	1160	2320	250	Moderate/R	3	2
SC2	Coffee Land Pk	73	31	42	780	4000	880	1760	880	Moderate/R,W	5	5
SC3	Chanticleer Ave. Park	93	48	45	780	1000	320	640	320	Moderate/R	4	5
SC4	Capitol Shp Cntr	94	60	34	750	4000	1440	2880	1440	Low/R	5	5

Rating = Injection Considerations: 1-5; 1= <100 gpm, 2= <200gpm, 3=<300 gpm, 4=<400 gpm, 5= 500+ gpm
Rating = Production Considerations: 1-5; 1= <400 gpm, 2= >200gpm, 3=>300 gpm, 4=>800 gpm, 5= 1000+ gpm

Hydrogeologic Risk/Control: R=Regional Analysis W=Proximate borehole control

Siting Considerations

Site	Current Land Use	Site Size (sq ft)	SWRCB-DDW Wavier?	Ownership	Sewer Setback*	Distance to Distribution System (feet)	Proximate Land Use	Notes	Rating
HC1	Truck Storage/Repair/Parking Lot	151789	N	Private	*NA*	*TBD*	Commercial, Res at dis		3
HB5	Construction Storage Yard	25833	N	Private	*NA*	*TBD*	Res all sides		3
HA3	Service Business/Truck/Material Storage	30209	N	Private	*NA*	*TBD*	Comm E & S, Res N & W		3
HA4	Material Storage	28076	N	Private	*NA*	*TBD*	Comm E & S, Res N & W		2
HA9	Open space behind res, adjacent creek	40700	N	Private	*NA*	*TBD*	Res 3 sides		3
HA1	Pasture, Open	39361	N	Private	*NA*	*TBD*	Res E & S, Corp yard W		4
HA5	Brommer St. Park	224737	N	Public	*NA*	*TBD*	Res W & N, Res at Dis to W		2
SC1	School Yard	10,000	N	Private	*NA*	*TBD*	Res N & E, Playfield/Drivein S & W		3
SC2	Park	10,000	N	Public	*NA*	*TBD*	Res N, E, S, Creek W		4
SC3	Park	10,000	N	Public	*NA*	*TBD*	Mixed, Res, Res at Dis		4
SC4	Parking Lot	10,000	N	Private	*NA*	*TBD*	Commercial		3

* State Law requires 50 foot setback from sewers. However, more recent State policy requires a 100' by 100' control zone. In most cases, this is the controlling policy
Rating = Siting/Acquistion Considerations: 1-5; 5 = Relatively Straight Forward, 1 = Significant Challenges

Construction Logistics

Site	Noise Receptors		Water Disposal	Water Supply	Overhead Lines	Access		Fluid/Cutting Containment Space		Notes	Rating
HC1	R~500' across creek		SD	FH	N	good		in temp. work area		FH & SD across street	5
HB5	Res 3-sides, Comm 1 side		SD	FH	N	limited		in temp. work area		FH on 41st	4
HA3	Res 3 sides, Comm to S		SD	FH	N	limited		in temp. work area		FH & SD at distance down st	4
HA4	Res 2 sides, Comm to S & E		SD	FH	N	limited		in temp. work area		FH & SD at distance down st	3
HA9	Res S, E and N, Creek to W		Creek	FH	N	limited		room on-site		FH across st	3
HA1	Res N, E, W		Creek/SD	FH	N	poor		room on-site		FH on 30th	4
HA5	R to E & N, Res @ dis to W		SD	Meter	N	good		in parking lot			3
SC1	Res N & E, Playfield S & W		SD	FH	N	good		in temp. work area		FH across driveway	4
SC2	2 story Res, 3 sides		SD	Meter	N	good		in temp. work area			3
SC3	Res all sides		SD	FH/Meter	A	good		in temp. work area		park to be upgraded	2
SC4	Comm all sides, Res at Dis.		SD	FH	N	good		room on-site		location flexible	4

A=Avoidable R = Residential; HR=Hillside Residential; I= Industrial C=Commercial DF = Drinking Fountain; FH=Fire Hydrant; SD=Storm Drain; Meter=City Supply
Rating = Construction Logistics: 1-5; 5 = Relatively Straight Forward, 1 = Significant Construction Challenges

Scores

Site	For Production	For Injection
HC1	18	18
HB5	9	9
HA3	11	9
HA4	9	7
HA9	10	8
HA1	12	10
HA5	9	7
SC1	11	13
SC2	17	17
SC3	16	14
SC4	17	17

Weighting:

Hydrogeology	2
Siting	1
Construction	1

Table 2b. Well Site Rating Analysis Summary – SCWD Service Area (continued)

Santa Cruz Service Area (con't)

Target Aquifer - Purisima Zones A, AA and Tu *Generalized Well Design - 16-inch diameter Stainless Steel Casing, Stainless Steel Wire-Wrapped Screen*

Hydrogeology

Site	Description	Elev. (feet,msl)	Depth to Water (feet)	Water Surface Elevation (feet, msl)	Well Depth (feet)	Production Capacity (gpm)	Injection Capacity (gpm)	Backflush Rqmnt (gpm)	Adjusted Injection Capacity (gpm)	Hydrogeologic Risk/ Control	Rating (Injection)	Rating (Production)
SC5	Site of SC-22	75	51	24	750	4000	1160	2320	1160	Low/R,W	5	5
SC6	Winkle Farm Park	131	53	78	456	500	880	1760	250	Moderate/R	3	2
SC7	Drive-In Theater	125	70	55	525	500	880	1760	250	Moderate/R	3	2
SC8	2740 Mattison Ln	120	66	54	590	1000	880	1760	500	Low/R	5	5
SC9	End of Thompson @ RR Tracks	61	51	10	831	500	40	80	40	Low/R,W	1	2
SC10	Sears Parking Lot-along 41st	76	51	25	736	4000	1160	2320	1160	Low/R,W	5	5

Rating = Injection Considerations: 1-5; 1= <100 gpm, 2= <200gpm, 3=<300 gpm, 4=<400 gpm, 5= 500+ gpm
Rating = Production Considerations: 1-5; 1= <400 gpm, 2= >200gpm, 3=>300 gpm, 4=>800 gpm, 5= 1000+ gpm

Hydrogeologic Risk/Control: R=Regional Analysis
W=Proximate borehole control

Siting Considerations

Site	Current Land Use	Site Size (sq ft)	SWRCB-DDW Wavier?	Ownership	Sewer Setback*	Distance to Distribution System (feet)	Proximate Land Use	Notes	Rating
SC5	Parking Lot	10,000	N	Private	*NA*	*TBD*	Commercial, Res at dis		3
SC6	Park	10,000	N	Public	*NA*	*TBD*	Park, Res flanking		3
SC7	Abandoned Drive-In/Swap Meet	10,000	N	Private	*NA*	*TBD*	Comm, Freeway, Res to N		3
SC8	Undeveloped Lot	10,000	N	Private	*NA*	*TBD*	School, Res, Freeway		2
SC9	Idle Industrial Yard	10,000	N	Private	*NA*	*TBD*	Comm/Indus to N&W, Res to S&E		3
SC10	Parking Lot	10,000	N	Private	*NA*	*TBD*	Comm		4

* State Law requires 50 foot setback from sewers. However, more recent State policy requires a 100' by 100' control zone. In most cases, this is the controlling policy
Rating = Siting/Acquistion Considerations: 1-5; 5 = Relatively Straight Forward, 1 = Significant Challenges

Construction Logistics

Site	Noise Receptors		Water Disposal	Water Supply	Overhead Lines	Access		Fluid/Cutting Containment Space			Rating
SC5	Res N & E, Comm W & S		SD	Meter	N	good		in temp work area			5
SC6	Res all sides		SD	DF	N	good		in temp work area			4
SC7	Res to N, Comm to W, Freeway to S		SD	FH	N	good		in temp work area		Noise sensitivity depends on loc	4
SC8	Freeway to S, minor res, school to N		TBD	TBD	N	fair		in temp work area			3
SC9	R to S & E, Comm/Indust N & W		TBD	FH	N	good		in temp work area			3
SC10	Limited: Comm all sides		SD	FH	N	good		in temp work area			4

A=Avoidable R = Residential; HR=Hillside Residential; I= Industrial C=Commercial DF = Drinking Fountain; FH=Fire Hydrant; SD=Storm Drain; Meter=City Supply
Rating = Construction Logistics: 1-5; 5 = Relatively Straight Forward, 1 = Significant Construction Challenges

Scores

Site	For Production	For Injection
SC5	18	18
SC6	11	13
SC7	11	13
SC8	15	15
SC9	10	8
SC10	18	18

Weighting:

Hydrogeology	2
Siting	1
Construction	1

Table 3. Well Site Rating Analysis Summary – SqCWD Service Area

Soquel Creek Service Area

Target Aquifer - Purisima Zones A, AA and Tu *Generalized Well Design - 16-inch diameter Stainless Steel Casing, Stainless Steel Wire-Wrapped Screen*

Hydrogeology

Site	Description	Elev. (feet,msl)	Depth to Water (feet)	Water Surface Elevation (feet, msl)	Well Depth (feet)	Production Capacity (gpm)	Injection Capacity (gpm)	Backflush Rqmnt (gpm)	Adjusted Injection Capacity (gpm)	Hydrogeologic Risk/ Control	Rating (Injection)	Rating (Production)
Sq1	Bay St. Shopping Cnt Prk Lot	30	15	15	700	3000	320	640	320	Low/R	4	5
Sq3	Anna Jean Cummings Park	147	82	65	622	500	320	640	250	Low/R	3	2
Sq4	Soquel High School	125	75	50	650	3000	600	1200	600	Low/R,W	5	5
Sq5	Main Street Elementary	70	50	20	660	2000	600	1200	600	Low/R,W	5	5
Sq6	Cunningson Ln and Soquel	140	138	2	900	2000	600	1200	600	Low/R	5	5
Sq7	property across street from ^	125	124	1	900	3000	880	1760	880	Low/R,W	5	5
Sq8	Deeper SqCWD Rosedale	130	125	5	840	3000	320	640	320	Low/R,W	4	5
Sq9	Cunningson Ln 1400' N. of Soquel	184	174	10	944	1000	320	640	320	Low/R	4	5
Sq10	NE corner Park and Soquel	161	157	4	1011	2000	320	640	320	Low/R	4	5
Sq11	Behind Beth El Temple	222	214	8	1112	500	320	640	250	Low/R	3	2
Sq12	Porter Gultch Rd, 825 ' N of Soquel W side	177	167	10	1127	500	320	640	250	Low/R,W	3	2
Sq13	Twin Lakes Church/School Parking Lot	144	148	-4	1144	2000	600	1200	600	Low/R	5	5

Rating = Injection Considerations: 1-5; 1= <100 gpm, 2= <200gpm, 3=<300 gpm, 4=<400 gpm, 5= 500+ gpm
Rating = Production Considerations: 1-5; 1= <400 gpm, 2= >200gpm, 3=>300 gpm, 4=>800 gpm, 5= 1000+ gpm
Hydrogeologic Risk/Control: R=Regional Analysis
W=Proximate borehole control

Siting Considerations

Site	Current Land Use	Site Size (sq ft)	SWRCB-DDW Wavier?	Ownership	Sewer Setback*	Distance to Distribution System (feet)	Proximate Land Use	Notes	Rating
Sq1	Parking Lot	10,000	N	Private	*NA*	*TBD*	Commercial, Res at dis		3
Sq3	Park Parking Lot	10,000	N	Public	*NA*	*TBD*	Park, Open Space		3
Sq4	H. S. Parking Lot	10,000	N	Public	*NA*	*TBD*	Commerical, HS, Res @ dis		3
Sq5	Playfield/Boundary area	10,000	N	Public	*NA*	*TBD*	Res, Open Space, School		2
Sq6	Partially Developed Park	10,000	N	Public	*NA*	*TBD*	Res, Street		3
Sq7	Storage, Open, Ag	10,000	N	Private	*NA*	*TBD*	Mixed, Res, Storage,		4
Sq8	Parking Lot/Well Lot	10,000	N	Public	*NA*	*TBD*	Water Dst Bldg, Res	Site of SqCWD Rosedall Well	2
Sq9	Open space, pasture	10,000	N	Private	*NA*	*TBD*	Rural Res, Open Space		3
Sq10	Vacant Parcel	10,000	N	Private	*NA*	*TBD*	Res, Commercial, Street		4
Sq11	Church Property	10,000	N	Private	*NA*	*TBD*	Res, Church, Street		4
Sq12	Open space, pasture	10,000	N	Private	*NA*	*TBD*	Rural Res, Open Space		3
Sq13	Private School Parking Lot	10,000	N	Private	*NA*	*TBD*	School, College, Freeway		4

* State Law requires 50 foot setback from sewers. However, more recent State policy requires a 100' by 100' control zone. In most cases, this is the controlling policy
Rating = Siting/Acquistion Considerations: 1-5; 5 = Relatively Straight Forward, 1 = Significant Challenges

Construction Logistics

Site	Noise Receptors		Water Disposal	Water Supply	Overhead Lines	Access		Fluid/Cutting Containment Space			Rating
Sq1	C, R~125' one side		SD	FH	N	good					5
Sq3	HR ~1500'		SD	FH	N	good					4
Sq4	Limited, C downslope, Street		SD	FH	N	good					4
Sq5	R to N, School, R at dis to S		SD	FH	N	good					3
Sq6	R to E, Street, R across Soquel Blvd		SD	FH	N	good				might require driveway	3
Sq7	Some R, New homes under constr		SD	FH	N	good					4
Sq8	R across Rosedale Ave, Rest to S		SD	FH	N	good					3
Sq9	Res, Res on hill		SD	FH	A	good					4
Sq10	Res, 3 sides		SD	FH	A	good					3
Sq11	Res, Church when occupied		?	FH	A	good					2
Sq12	Rural Res, Res on hill		Culvert=> Cr	FH	N	good					4
Sq13	School, College		SD	FH	N	good					3

A=Avoidable R = Residential; HR=Hillside Residential; I= Industrial C=Commercial DF = Drinking Fountain; FH=Fire Hydrant; SD=Storm Drain
Rating = Construction Logistics: 1-5; 5 = Relatively Straight Forward, 1 = Significant Construction Challenges

Scores

Site	For Production	For Injection
Sq1	18	16
Sq3	11	13
Sq4	17	17
Sq5	15	15
Sq6	16	16
Sq7	18	18
Sq8	15	13
Sq9	17	15
Sq10	17	15
Sq11	10	12
Sq12	11	13
Sq13	17	17

Weighting:

Hydrogeology	2
Siting	1
Construction	1

Table 4. Well Site Rating Analysis Summary – SVWD / SLVWD Service Areas

Scotts Valley/Pasatiempo

Target Aquifer - Lompico Sandstone *Generalized Well Design - 16-inch diameter Stainless Steel Casing, Stainless Steel Wire-Wrapped Screen*

Hydrogeology

Site	Description	Elev. (feet,msl)	Depth to Water (feet)	Water Surface Elevation (feet, msl)	Well Depth (feet)	Production Capacity (gpm)	Injection Capacity (gpm)	Backflush Rqmnt (gpm)	Adjusted Injection Capacity (gpm)	Hydrogeologic Risk Control	Rating (Injection)	Rating (Production)
SV1	Mt Hermon Rd, Kaiser Well Site	472	122	350	947	1313	150	300	150	Low/R,W	2	5
SV2	Skypark, S of tennis courts	533	158	375	1133	1688	205	410	205	Low/R	3	5
SV3	Skypark, NE corner parking lot	529	179	350	854	938	200	400	200	Low/R,W	3	4
SV4	NE of Hanson' Quarry	508	183	325	883	1000	430	860	430	Low/R,W	5	5
SV5	N. of Hanson Quarry pit	553	178	375	1103	1563	250	500	250	Low/R,W	3	5
SV6	Alviso Parking Lot	454	79	375	1004	1563	190	380	190	Low/R,W	2	5
SV7	Skypark, NW of Storage Units	521	161	360	941	1200	205	410	205	Low/R,W	3	5
SV8	Alviso Lower Parking Lot	385	10	375	1010	1750	50	100	50	Low/R,W	1	5
SV9	NW corner Mt Hermon and Skypark	495	170	325	820	875	207	414	207	Low/R	3	4

Rating = Injection Considerations: 1-5; 1= <100 gpm, 2= <200gpm, 3=<300 gpm, 4=<400 gpm, 5= 500+ gpm
Rating = Production Considerations: 1-5; 1= <400 gpm, 2= >200gpm, 3=>300 gpm, 4=>800 gpm, 5= 1000+ gpm

Siting Considerations

Site	Current Land Use	Site Size (sq ft)	SWRCB-DDW Wavier?	Ownership	Sewer Setback*	Distance to Distribution System (feet)	Proximate Land Use	Notes	Rating
SV1	Undeveloped, Old Well Site	10,000	N	Private	*TBD*	*TBD*	Res, Road, Undeveloped		4
SV2	Undeveloped Boundary Area	10,000	N	Public	*TBD*	*TBD*	Res, Rec,Industry		4
SV3	Parking Lot	10,000	N	Public	*TBD*	*TBD*	Industry, Recrea, Public	near SVWD AB303 MW-2	3
SV4	Undeveloped	10,000	N	Private	*TBD*	*TBD*	Res at Distance	near SVWD AB303 MW-3	4
SV5	Undeveloped	10,000	N	Private	*TBD*	*TBD*	Res at Distance	near SVWD AB303 MW-3	4
SV6	Parking Lot	10,000	N	Private	*TBD*	*TBD*	Res at distance uphill	previous contam of Tsm, Site Closed	4
SV7	Playfield	10,000	N	Public	*TBD*	*TBD*	Res, Playfield		3
SV8	Storage, Open	10,000	N	Private	*TBD*	*TBD*	Res at distance uphill	previous contam of Tsm, Site Closed	4
SV9	Undeveloped	10,000	N	Private	*TBD*	*TBD*	Res/road	Previous Site of Auto Dismantler	3

* State Law requires 50 foot setback from sewers. However, more recent State policy requires a 100' by 100' control zone. In most cases, this is the controlling policy
Rating = Siting/Acquistion Considerations: 1-5; 5 = Relatively Straight Forward, 1 = Significant Challenges

Construction Logistics

Site	Noise Receptors		Water Disposal	Water Supply	Overhead Lines	Access		Fluid/Cutting Containment Space			Rating
SV1	R~125' one side		TBD	TBD	N	good					3
SV2	R ~ 200'; HR ~1500'; I ~ 300 downslope		Res. Gutter	DF	N	fair					3
SV3	Park, Senior Center, Library~500'		SD	FH	N	good					4
SV4	R~400' upslope		TBD	TBD	N	good					4
SV5	R >2500'		TBD	TBD	N	good					4
SV6	I~100', HR~1000'		SD	FH	N	good				In RV storage area	5
SV7	R~200', Park		SD	FH	N	good				FH across Skypark	4
SV8	I~300', HR~1000'		SD	?	N	limited				SVWD has main thru	3
SV9	R across creek and Mt Hermon		SD	FH	N	good					4

R = Residential; HR=Hillside Residential; I= Industrial DF = Drinking Fountain; FH=Fire Hydrant; SD=Storm Drain
Rating = Construction Logistics: 1-5; 5 = Relatively Straight Forward, 1 = Significant Construction Challenges

Scores

Site	For Production	For Injection
SV1	17	11
SV2	17	13
SV3	15	13
SV4	18	18
SV5	18	14
SV6	19	13
SV7	17	13
SV8	17	9
SV9	15	13

Weighting:

Hydrogeology	2
Siting	1
Construction	1

Well Site Ranking Summary

The resulting well site analysis presented in **Tables 2 through 4** allows for the ranking of individual well sites based on their combined scores for both production and injection capacities. The results of the ranking are summarized in **Table 5** below:

Table 5. Well Site Ranking Summary

Site	Scores			Overall	Capacities (mgd)	
	Production	Injection	Total	Ranking	Production	Injection
SCWD Service Area						
SC10	18	18	36	1	5.76	1.67
SC5	18	18	36	2	5.76	1.67
HC1	18	18	36	3	2.88	0.86
SC2	17	17	34	4	5.76	1.27
SC4	17	17	34	5	5.76	2.07
SC3	16	14	30	6	1.44	0.46
SC8	15	15	30	7	1.44	1.27
SC1	11	13	24	8	0.72	0.36
SC6	11	13	24	9	0.72	1.27
SC7	11	13	24	10	0.72	1.27
HA1	12	10	22	11	0.72	0.06
HA3	11	9	20	12	0.72	0.06
HB5	9	9	18	13	0.06	0.03
HA9	10	8	18	14	0.72	0.06
SC9	10	8	18	15	0.72	0.06
HA4	9	7	16	16	0.72	0.06
HA5	9	7	16	17	0.72	0.06
				Totals	**35.34**	**12.54**
SqCWD Service Area						
Sq7	18	18	36	1	4.32	1.27
Sq9	18	16	34	2	4.32	0.46
Sq10	17	17	34	3	4.32	0.86
Sq12	17	17	34	4	2.88	0.86
Sq1	17	15	32	5	1.44	0.46
Sq6	17	15	32	6	2.88	0.46
Sq3	16	16	32	7	2.88	0.86
Sq4	15	15	30	8	2.88	0.86
Sq8	15	13	28	9	4.32	0.46
Sq11	11	13	24	10	0.72	0.46
Sq13	11	13	24	11	0.72	0.46
Sq5	10	12	22	12	0.72	0.46
				Totals	**32.40**	**7.95**
SVWD and SLVWD (Pasatiempo Subarea) Service Areas						
SV4	18	18	36	1	1.44	0.62
SV5	18	14	32	2	2.25	0.36
SV6	19	13	32	3	2.25	0.27
SV2	17	13	30	4	2.43	0.30
SV7	17	13	30	5	1.73	0.30
SV1	17	11	28	6	1.89	0.22
SV3	15	13	28	7	1.35	0.29
SV9	15	13	28	8	1.26	0.30
SV8	17	9	26	9	2.52	0.07
				Totals	**17.12**	**2.72**

Santa Cruz MGB. As shown in the tables above, a total of 17 potential sites have been identified in the SCWD service area with estimated theoretical injection capacities ranging between approximately 20 to 1440 gpm (0.03 to 2.07 mgd). All 17 of the SCWD sites have an estimated combined injection capacity of approximately 12.5 mgd. A total of 12 potential sites have been identified in the SqCWD service area with estimated injection capacities ranging between approximately 250 to 880 gpm (0.36 to 1.27 mgd) with an estimated combined injection capacity of approximately 7.95 mgd. Combined estimated theoretical injection capacity of all potential sites identified in the Santa Cruz MGB is approximately 20.5 gpm.

SMGB. As shown, a total of 9 potential sites have been identified in the SVWD / SLVWD service areas with estimated injection capacities ranging between approximately 0.07 to 0.62 mgd. All of the sites combined have an estimated combined injection capacity of approximately 2.7 mgd. The estimated injection capacity of the identified sites is insufficient to support the entire 6.0 mgd needed for the ASR only scenarios; however, there are a couple of caveats about the SMGB identified sites and the associated capacities:

- Hanson Quarry: Sites SV4 and SV5 are located on the NE perimeter of the larger Hanson Quarry (refer to **Figure 13** and the Well Site Summaries presented in **Appendix A**), however, the property is privately owned and there was no practical access to the property for us to perform site inspections and identify additional sites as part of this current study; therefore, the sites we did identify were limited to those that could at least be partially inspected (i.e., SV4 and SV5 are on the perimeter of the property). As shown on **Figure 13**, from the satellite image Hanson Quarry appears to be a very large area of open space and could potentially accommodate numerous additional well sites (perhaps a dozen or more).
- Sky Park: Sites SV3 and SV7 are located on the perimeter of the Sky Park area in Scotts Valley. Similar to the Hanson Quarry, as shown on **Figure 13** there are additional large open spaces that could also be potentially developed into additional well sites. For example, the large grassy area where SV7 is located could potentially accommodate several additional wells. Similarly, the large undeveloped space just south of SV3 could also accommodate several additional wells. It is our understanding that the City of Santa Cruz owns the 3 parcels that make up this currently undeveloped area, which at face-value would make these parcels highly desirable for project wells; however, it is also our understanding that the City of Scotts Valley has plans to develop these parcels in the near future. The current status of these plans is unknown as of this writing.

It is important to reiterate that the estimated well capacities presented herein are theoretical, utilizing aquifer parameters derived from the calibrated groundwater models and a relatively simplistic equation. As such, the estimates are considered “first-approximations” for purposes of defining initial groundwater modeling scenarios. The actual capacities of any given site will be necessarily refined based on the results of the groundwater modeling and more focused, site-specific capacity analyses as the investigation progresses.

CONCLUSIONS AND RECOMMENDATIONS

The purpose of the subject well siting study was to identify potential well sites that, based on available data, appear to be suitable for development as ASR and/or extraction well facilities. The identified sites are to be used in ASR groundwater modeling scenarios that will be simulated with existing calibrated groundwater models of each groundwater basin. The results of the well siting study preliminarily indicate that a sufficient number of well sites meeting the required hydrogeologic and construction logistics criteria do appear to exist in the study areas.

It is recommended that initial groundwater modeling simulations focus on the highest-ranking sites to achieve the needed injection and extraction capacities for any given scenario. These simulations will provide additional insight to issues of well spacing and interference, mounding or drawdown, and changes in the overall flow-field in these aquifer systems. Based on the findings of initial simulations, subsequent iterations may involve simulating the use of lower ranking sites in order to improve project performance (e.g., to increase well spacing and/or limit interference effects during injection and/or extraction).

With regards to simulations in the SMGB, we recommend that some simulations include additional wells in both the Hanson Quarry and Sky Park areas that have not been specifically identified herein, but represent areas where potential well sites do exist, as discussed above. The results of those simulations will provide the City information on the potential benefit of these areas for providing needed injection and/or extraction capacity for the project.

CLOSURE

This annual report has been prepared for the exclusive use by the City of Santa Cruz Water Department, for specific application to the Santa Cruz ASR Project Well Siting Study. The findings, conclusions, and recommendations presented herein were prepared in accordance with generally accepted hydrogeologic practices. No other warranty, expressed or implied, is made.

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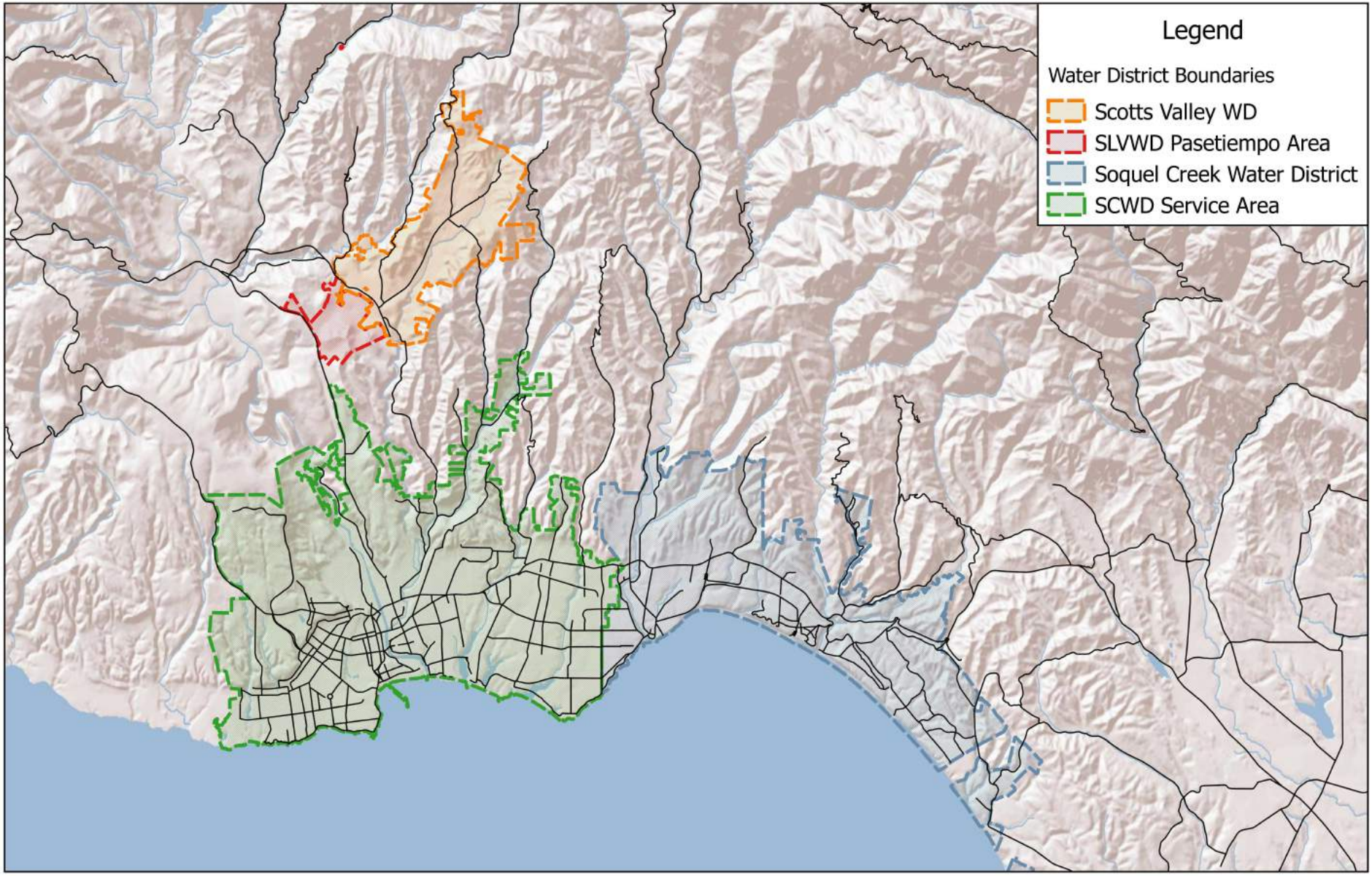
FIGURES

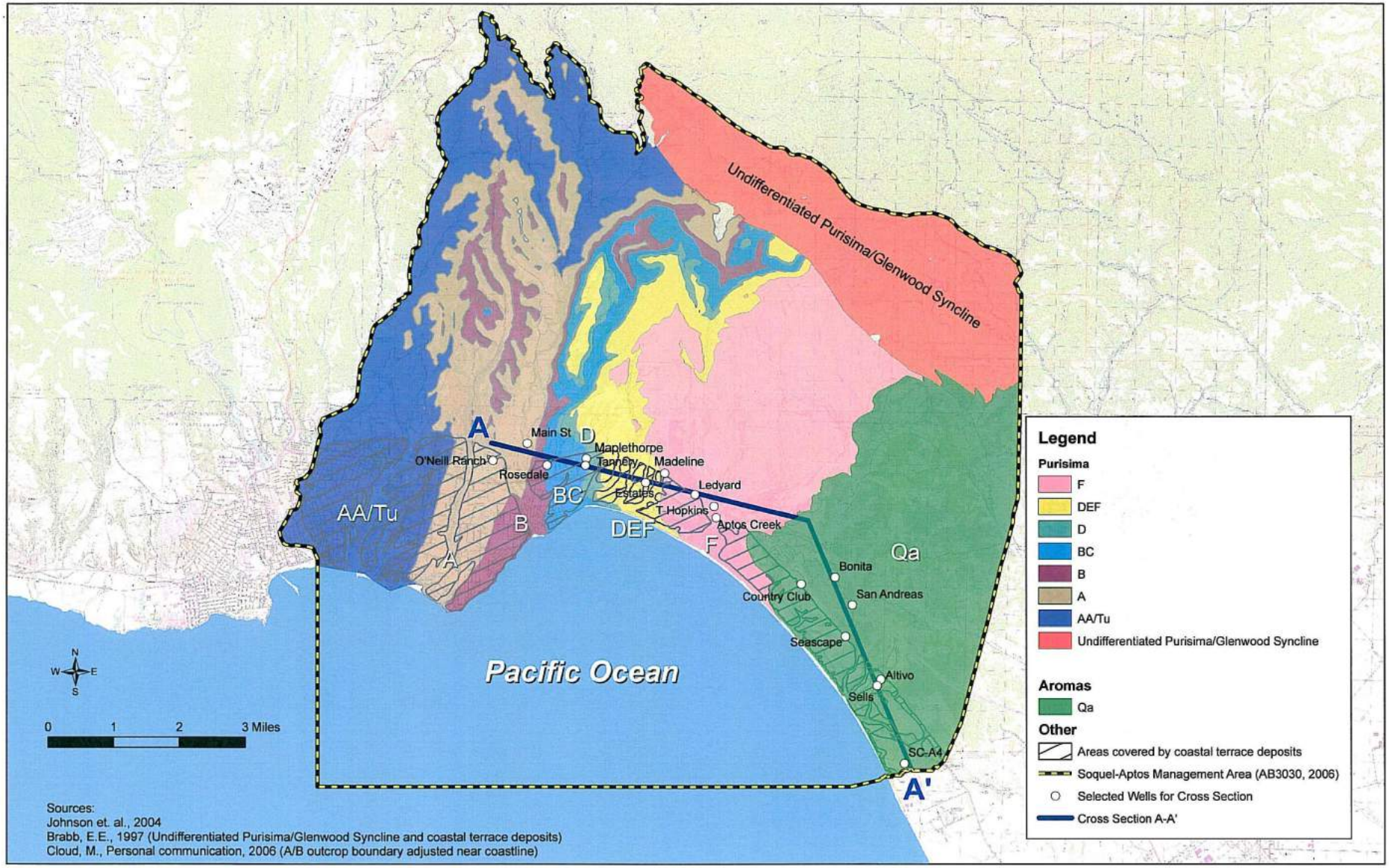


PUEBLO water resources

N W E S

0 6000 12000 18000 24000 30000 ft

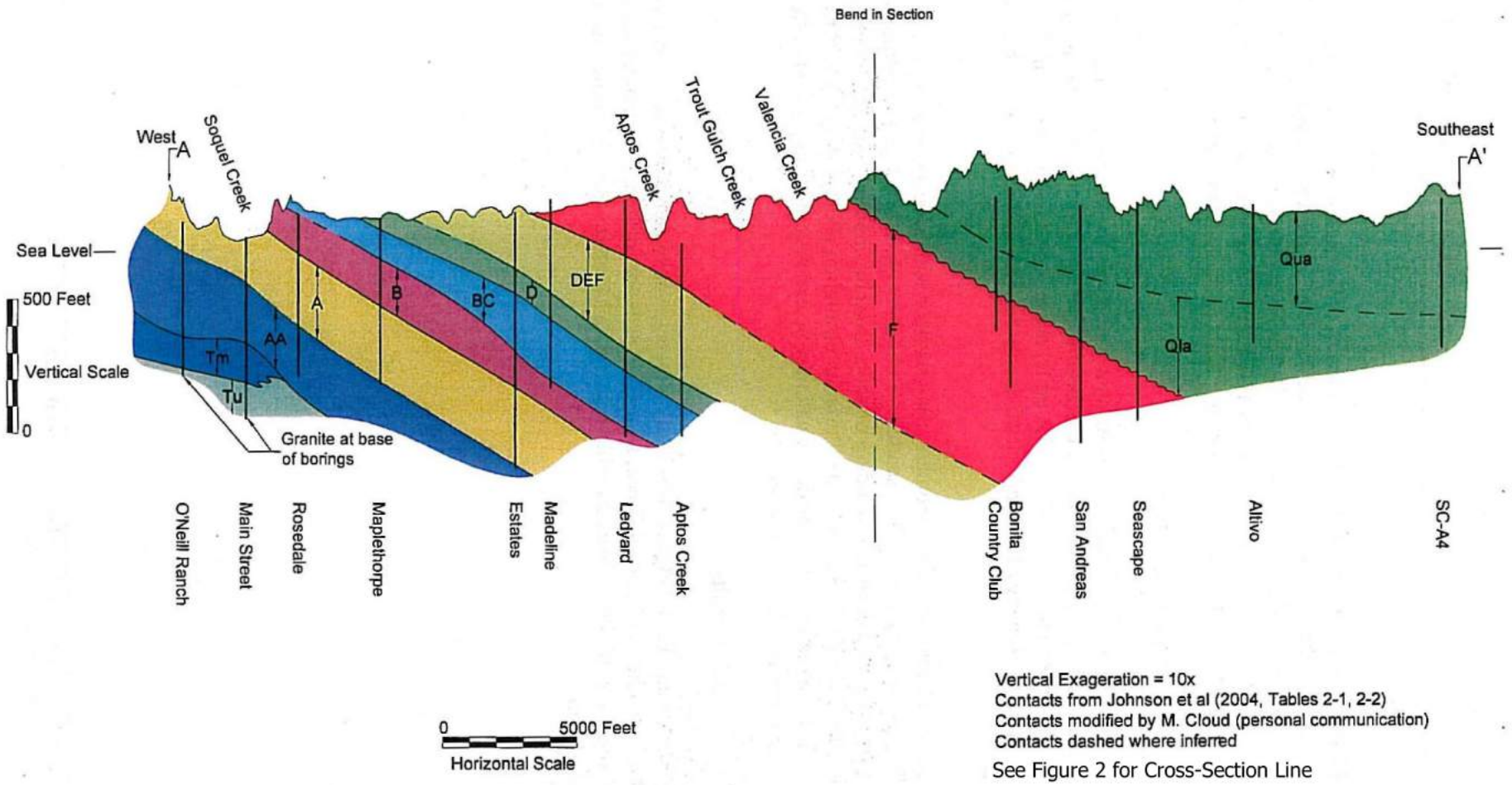
FIGURE 1 - WATER SERVICE AREA BOUNDARIES
Santa Cruz ASR Project - Phase 1 - Well Siting Study
City of Santa Cruz Water Department



From HydroMetrics, Inc 2007

PUEBLO water resources

FIGURE 2 - PURISIMA AQUIFER UNIT OUTCROPS
Santa Cruz ASR Project - Phase 1 - Well Siting Study
City of Santa Cruz Water Department



From HydroMetrics, Inc 2007

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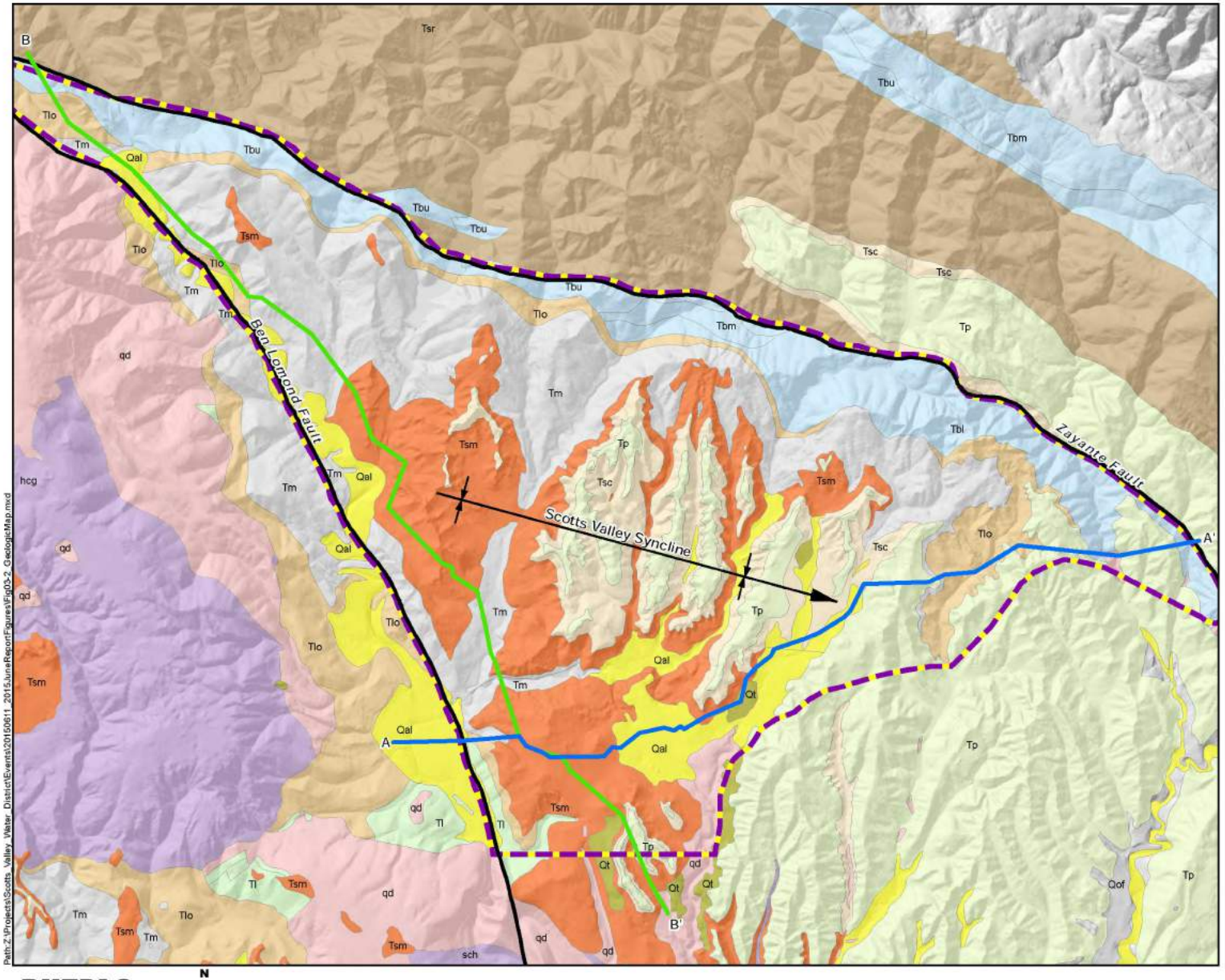
PUEBLO water resources

N W E S

FIGURE 3 - PURISIMA UNIT CROSS-SECTION
Santa Cruz ASR Project - Phase 1 - Well Siting Study
City of Santa Cruz Water Department



LEGEND

- Syncline
- Santa Margarita Groundwater Basin Boundary
- Fault
- Cross Section A-A'
- Cross Section B-B'

Geologic Unit

Qal	Alluvium
Qt	Terrace Deposits
Tp	Purisima Formation
Tsc	Santa Cruz Mudstone
Tsm	Santa Margarita Sandstone
Tm	Monterey Formation
Tlo	Lompico Sandstone
Tsr	Undifferentiated Lambert, Vaqueros, Zayante, and San Lorenzo Formation
Tbu	Butano Formation - Upper Member
Tbm	Butano Formation - Middle Member
Tbl	Butano Formation - Lower Member
Tl	Locatelli Formation
qd	Crystalline Bedrock-Granite
sch	Undifferentiated Plutonic and Metamorphic Rocks

Data Source: Brabb, E.E. (1997) Geologic map of Santa Cruz County, California: a digital database. U.S. Geological Survey, Open-File Report OF-97-489, scale 1:62,500.

N

0 0.5 1

From Kennedy/Jenks Consultants, 2015

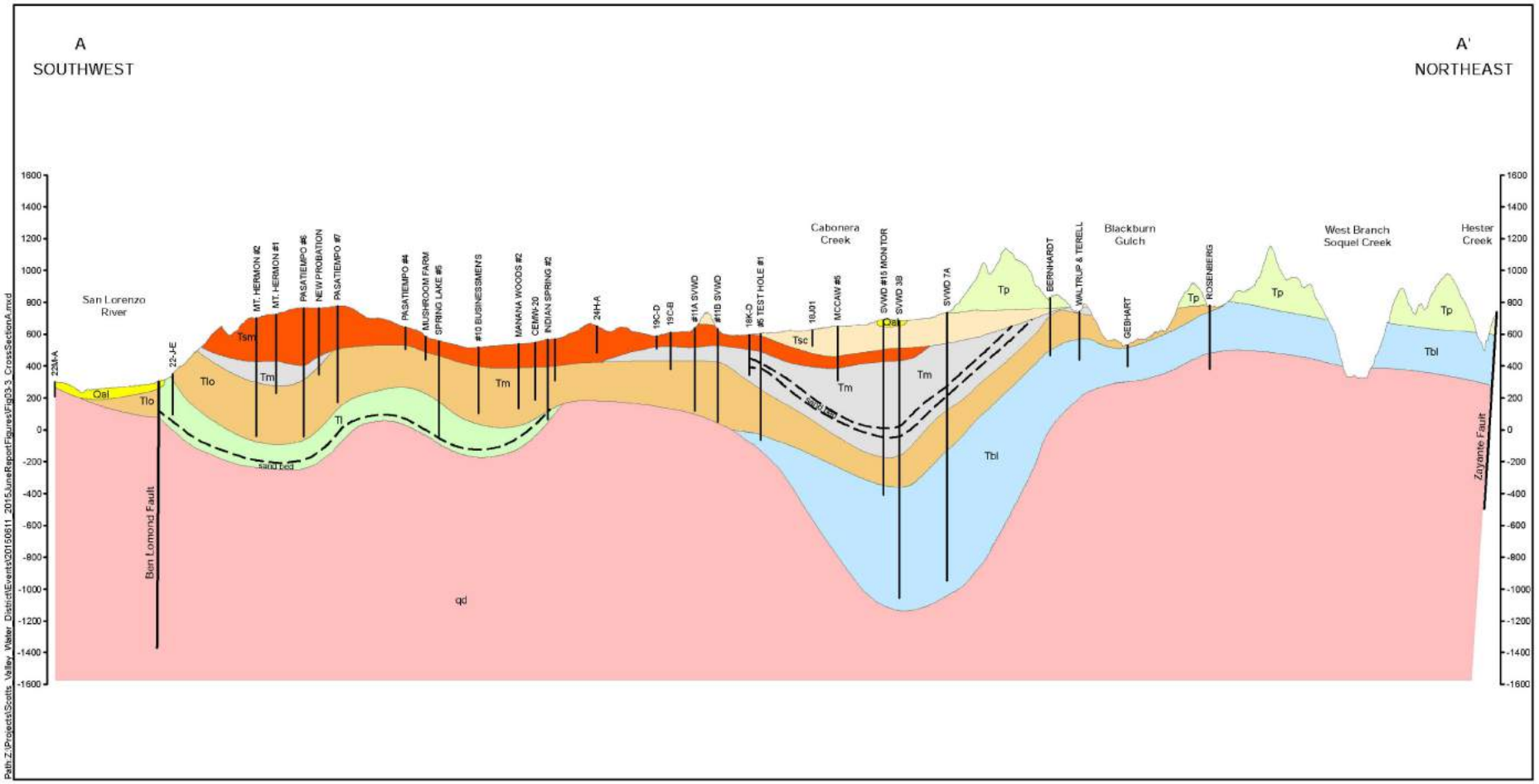
Path: Z:\Projects\Scotts_Valley_Water_District\Events\20150611_2015JuneReport\Figures\Fig03-2_GeologicMap.mxd

8.35

PUEBLO water resources

N W E S

FIGURE 4 - SMGB GEOLOGIC MAP
Santa Cruz ASR Project - Phase 1 - Well Siting Study
City of Santa Cruz Water Department



EXPLANATION

Geologic Unit

Qal	Alluvium	Tbu	Butano Formation - Upper Member
Tp	Purisima Formation	Tbm	Butano Formation - Middle Member
Tsc	Santa Cruz Mudstone	Tbl	Butano Formation - Lower Member
Tsm	Santa Margarita Sandstone	Tl	Locatelli Formation
Tm	Monterey Formation	qd	Crystalline Bedrock-Granite
Tlo	Lompico Sandstone		

SVWD-1 Well and Identifier

Vertical Scale: 600' 300' Feet
Horizontal Scale: 0 1500' 3000' Feet
Exaggeration: 5x

Index Map

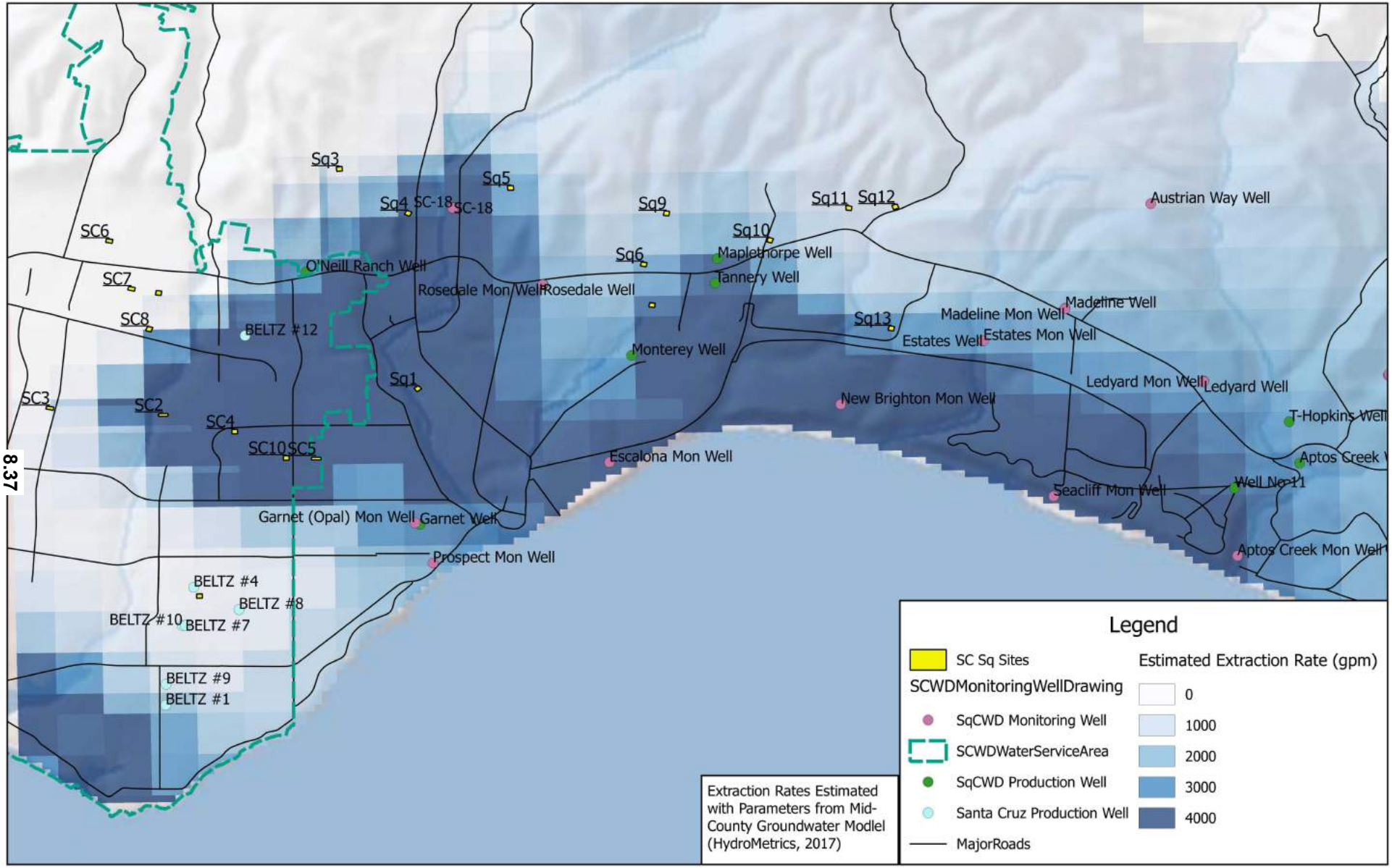
CROSS-SECTION LINE SHOWN ON FIGURE 4

From Kennedy/Jenks Consultants, 2015

PUEBLO water resources

N W E S

FIGURE 5 - SMGB CROSS-SECTION
Santa Cruz ASR Project - Phase 1 - Well Siting Study
City of Santa Cruz Water Department



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PUEBLO water resources

N
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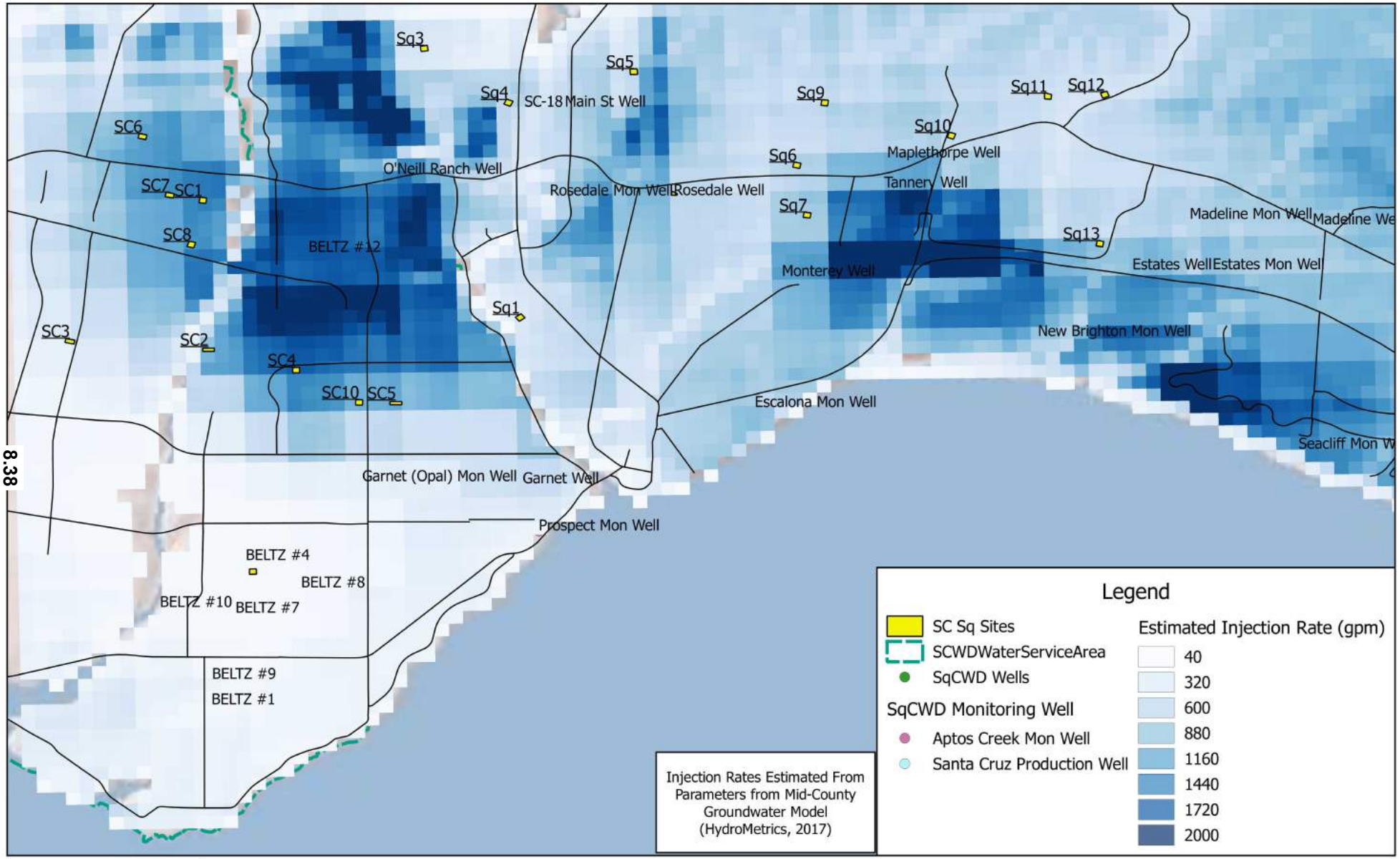
0 0.25 0.5 0.75 1 Miles

FIGURE 6 - SCWD - SqCWD ESTIMATED EXTRACTION RATES MAP
Santa Cruz ASR Project - Phase 1 - Well Siting Study
City of Santa Cruz Water Department



8.38

PUEBLO water resources

N
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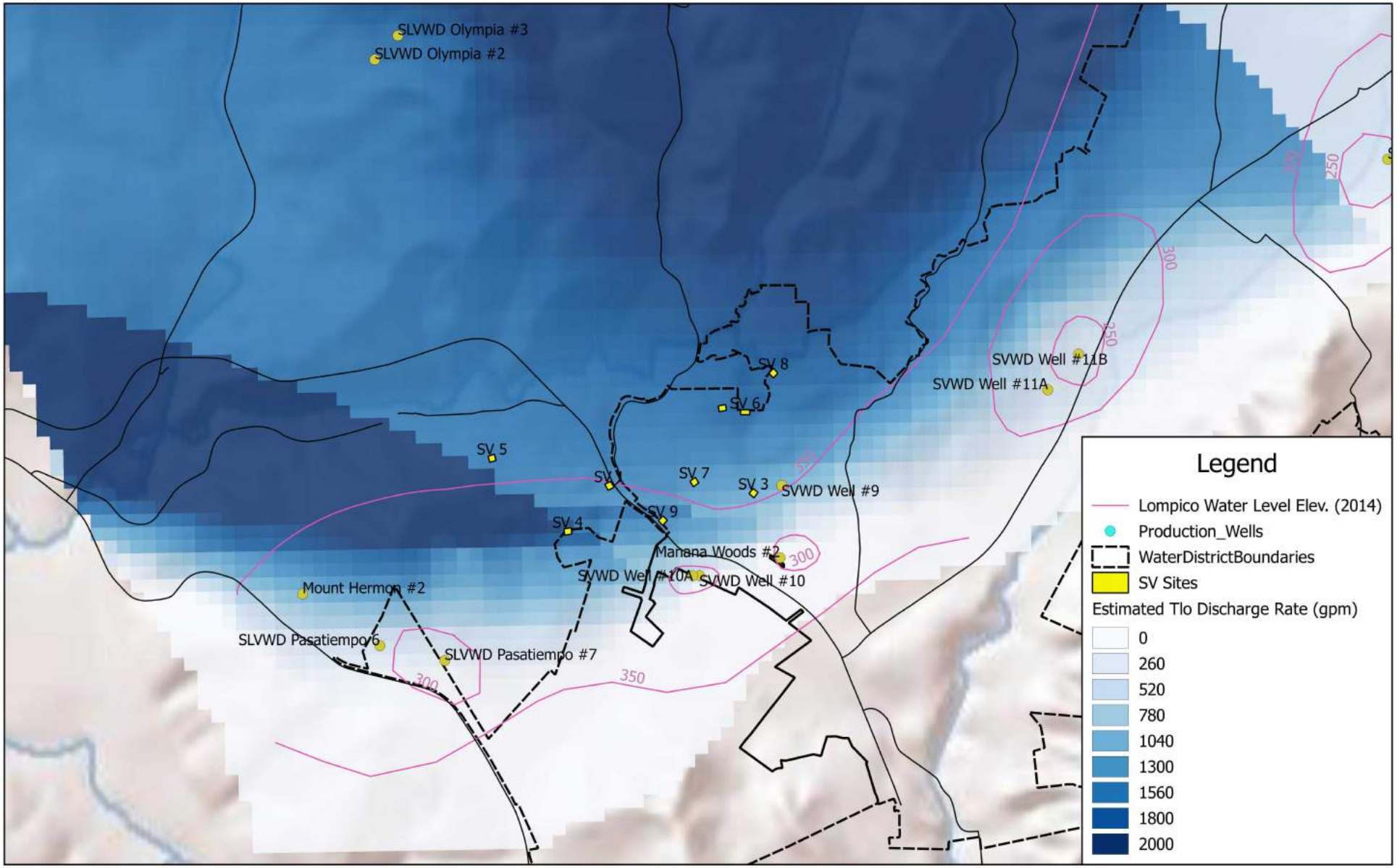
0 200000 400000 600000 800000 feet

FIGURE 7 - SCWD - SqCWD Estimated Injection Rates
Santa Cruz ASR Project - Phase 1 - Well Siting Study
City of Santa Cruz Water Department



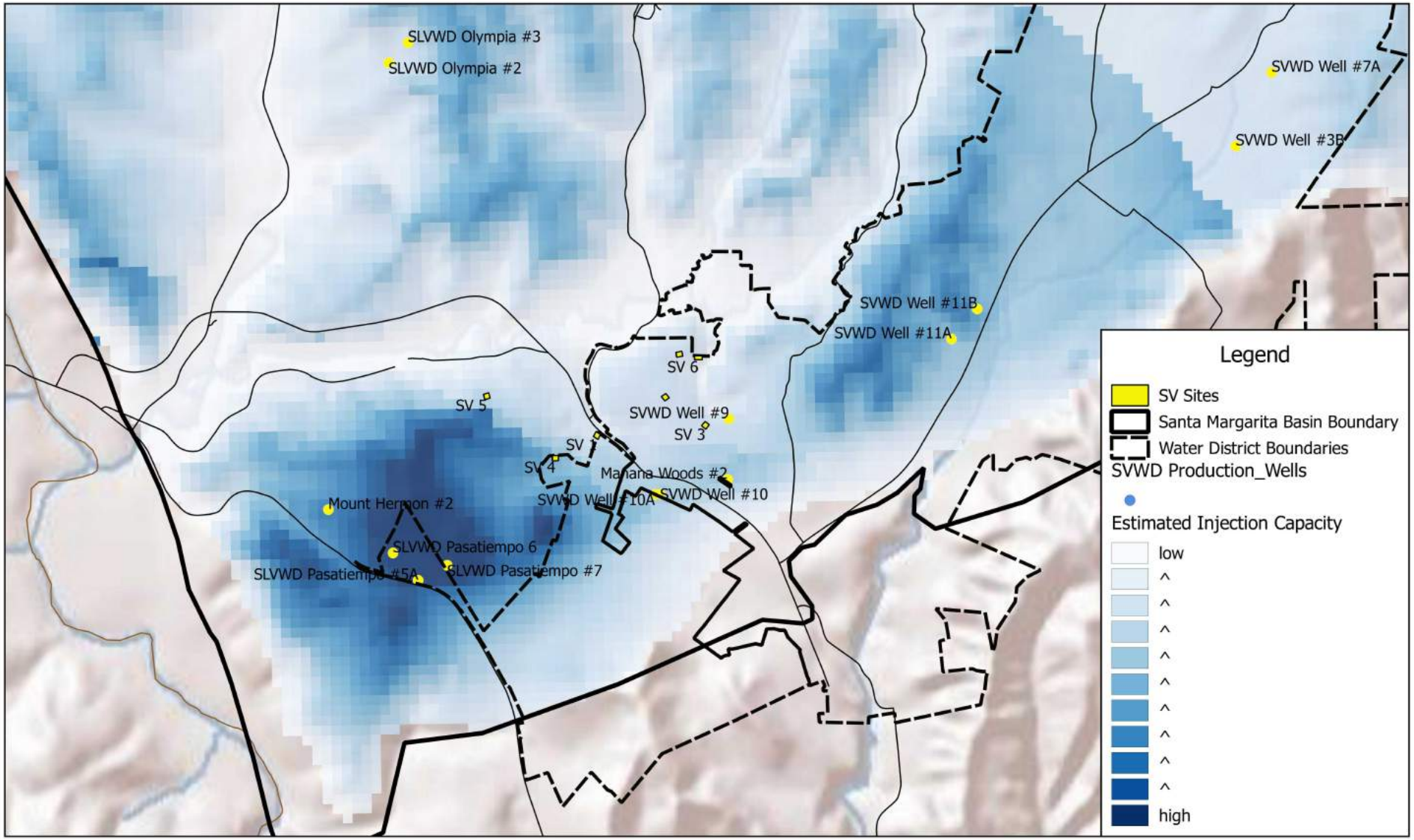
8.39

PUEBLO water resources

N W E S

0 1000 2000 3000 4000 5000 ft

FIGURE 8 - SVWD-SLVWD ESTIMATED DISCHARGE RATE MAP
Santa Cruz ASR Project - Phase 1 - Well Siting Study
City of Santa Cruz Water Department

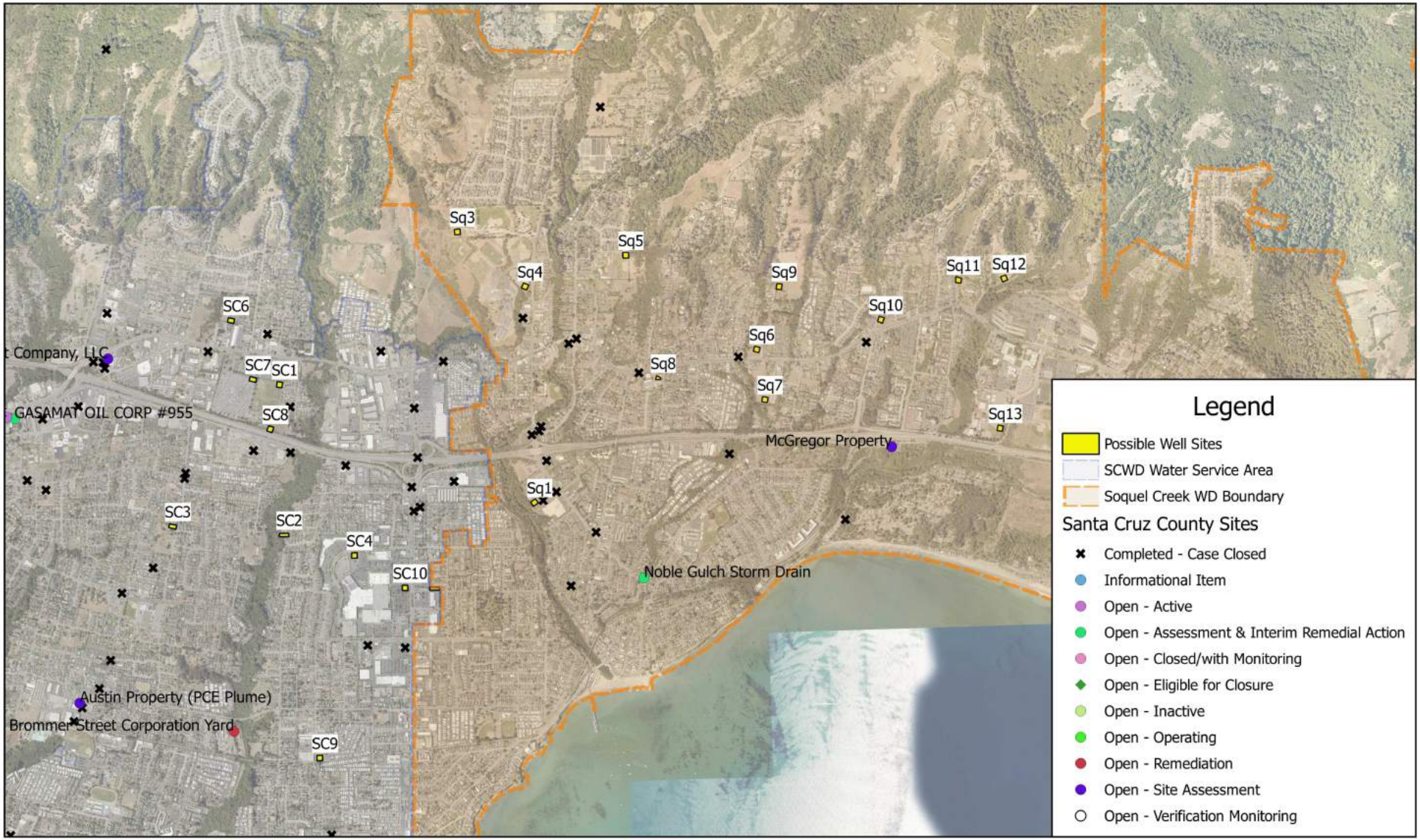


PUEBLO water resources

N W E S

0 1000 2000 3000 4000 5000 ft

FIGURE 9 - SVWD-SLVWD ESTIMATED INJECTION RATE MAP
Santa Cruz ASR Project - Phase 1 - Well Siting Study
City of Santa Cruz Water Department

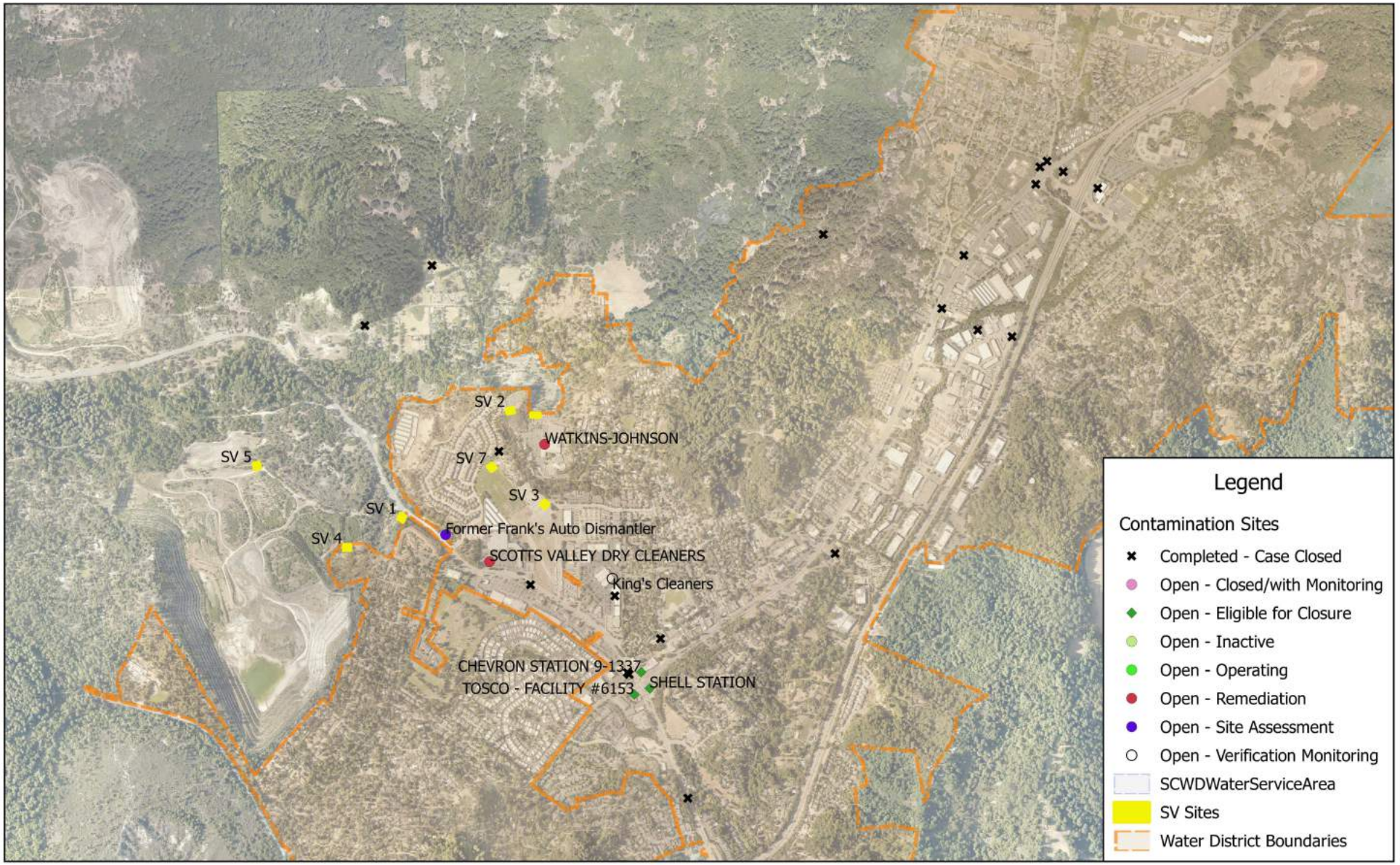


PUEBLO water resources

N W E S

0 1000 2000 3000 4000 5000 ft

FIGURE 10 - SCWD-SqCWD CONTAMINATED SITES MAP
Santa Cruz ASR Project - Phase 1 - Well Siting Study
City of Santa Cruz Water Department

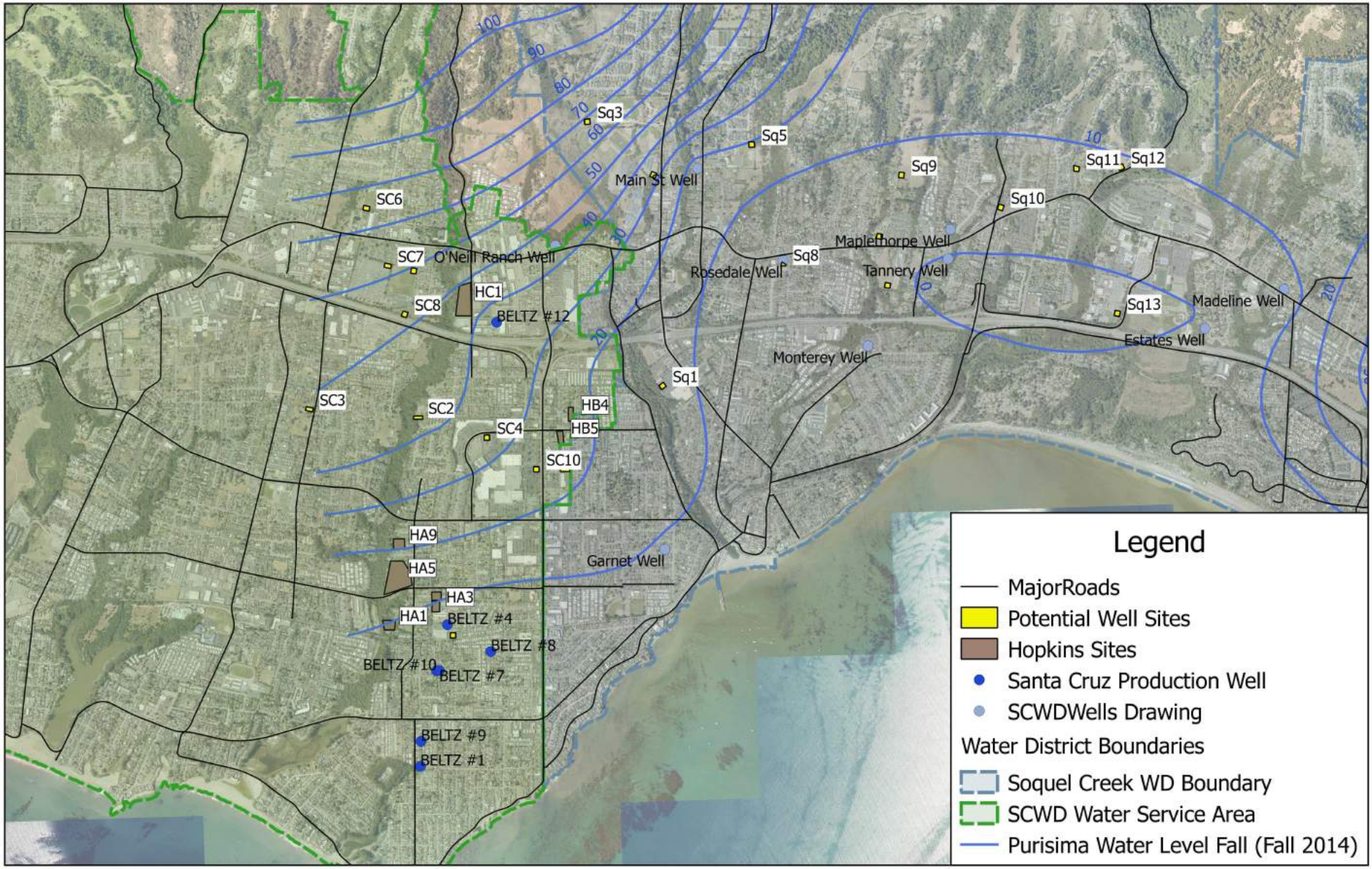


PUEBLO water resources

N W E S

0 1000 2000 3000 4000 5000 ft

FIGURE 11 - SVWD - SLVWD CONTAMINATED SITES MAP
Santa Cruz ASR Project - Phase 1 - Well Siting Study
City of Santa Cruz Water Department



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PUEBLO water resources

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W
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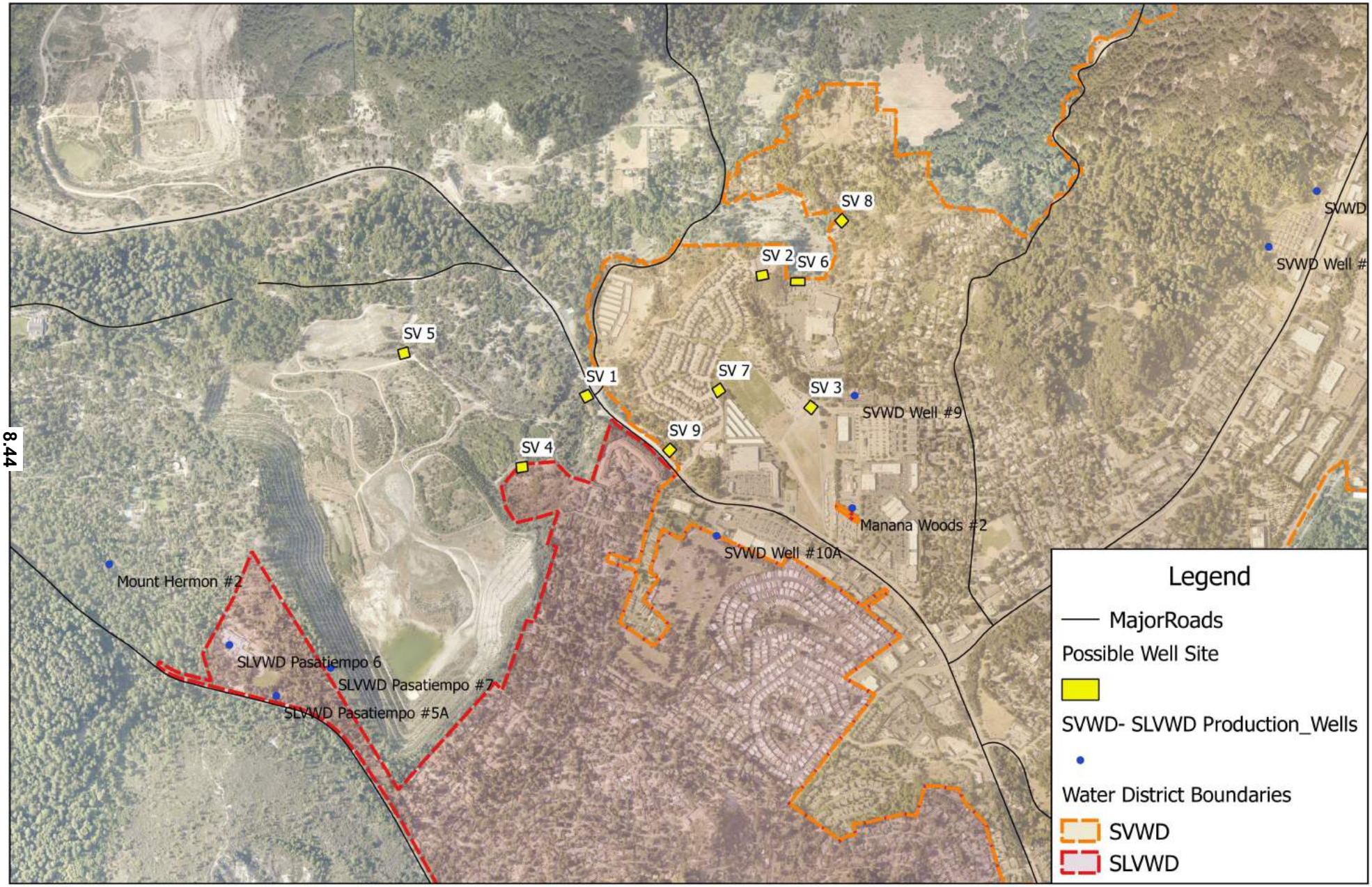
0 1000 2000 3000 4000 5000 ft

FIGURE 12 - SCWD-SqCWD POTENTIAL WELL SITES LOCATION MAP
Santa Cruz ASR Project - Phase 1 - Well Siting Study
City of Santa Cruz Water Department



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PUEBLO water resources

N
W
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0 600 1200 1800 2400 3000 ft

FIGURE 13 - SVWD - SLVWD POTENTIAL WELL SITES
Santa Cruz ASR Project - Phase 1 - Well Siting Study
City of Santa Cruz Water Department

APPENDIX A – WELL SITE SUMMARIES

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Good Shepherd School
Site Map Name:	SC1
Ownership:	Private
Current Land Use:	Playfield
Target Aquifer:	Tp (A, AA)
Well Depth:	523 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH - 150' N (cross driveway)
Fluid Disposal:	Storm Drain 200' W
Neighboring Land Use:	N-Res, E-Res, W-Playfield, S-Playfield
Access:	Off Soquel
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

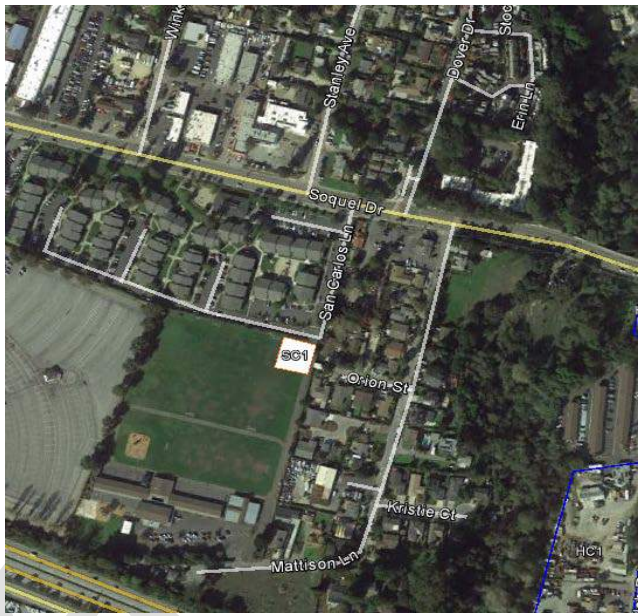
Proposed Well Site:

Northeast corner of Playfield

Required Improvements: none

Siting Trade off:	Loss of Playfield Area
Hydrogeologic Risk:	Regional Analysis ~ Granite at 525'
	No local control - Thurber?

Notes:



PUEBLO water resources

8.46

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Coffee Lane Park
Site Map Name:	SC2
Ownership:	County of Santa Cruz
Current Land Use:	Park
Target Aquifer:	Tp (A, AA)
Well Depth:	780 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Drinking Fountain, Irr. Supply at Entrance
Fluid Disposal:	Storm Drain (drains to Rodeo Creek)
Neighboring Land Use:	N, E, S - 2 story residential, W - Creek w/ Res. Across
Access:	Thru Residential Streets
VRCB-DDW Waiver:	Not Required
nd Wall Required:	Yes

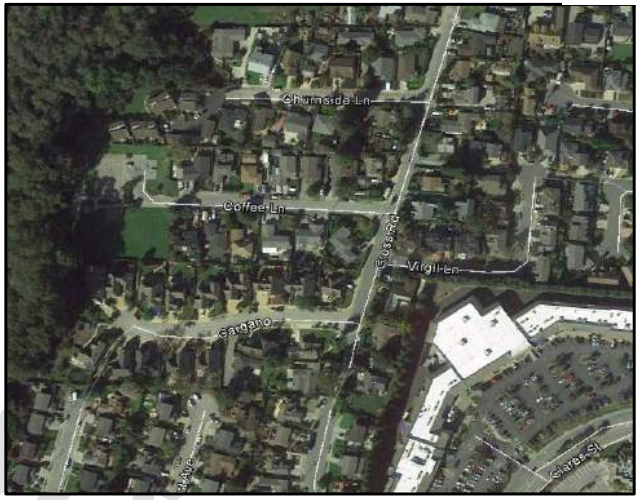
Proposed Well Site:

Located in center of large grass area south of entrance

Required Improvements: Create Level Site/Retaining Wall

Siting Trade off:	Loss of open area
Hydrogeologic Risk:	Regional analysis suggests grainite at ~800 feet
	Local control extends only to 250 feet.

Notes: Site of Nested Monitoring Well. 250 feet deep.



8.47

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Chanicleer Park
Site Map Name:	SC3
Ownership:	County of Santa Cruz
Current Land Use:	Park
Target Aquifer:	Tp (A, AA)
Well Depth:	780 feet

Screening Critera

Overhead Lines:	No (only along Chanicleer Ave)
Water Supply:	Fire Hydrant NE and SE corners
Fluid Disposal:	Storm Drain 100' S- discharge would cross driveway
Neighboring Land Use:	Residential all sides
Access:	Off Chanticleer
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

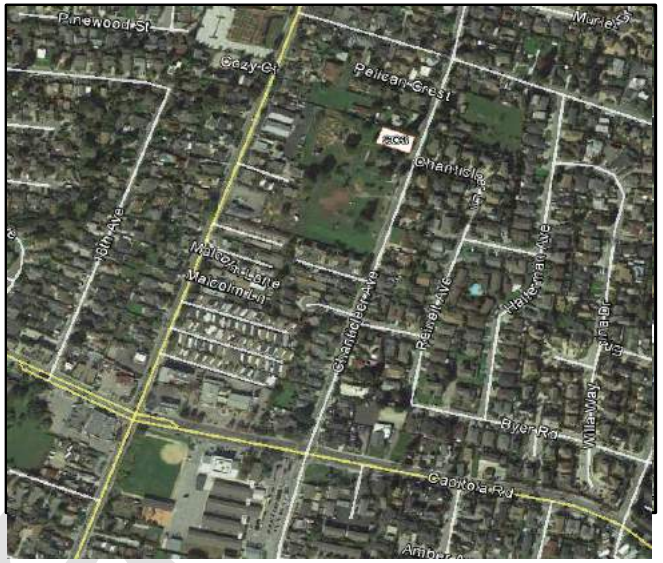
Proposed Well Site:

Depends on proposed park improvements - some flexibility

Required Improvements:

Siting Trade off:	Loss of open area
Hydrogeologic Risk:	Regional analysis suggests grainite at ~800 feet
	No local control

Notes: Park Improvements Pending



8.48

SANTA CRUZ ASR PROJECT

Well Site Evaluation

PUEBLO water resources

Site Description:	Capitola Shopping Center
Site Map Name:	SC4
Ownership:	Private
Current Land Use:	Shopping Center Parking Lot
Target Aquifer:	Tp (A, AA)
Well Depth:	750 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Fire Hydrant (across entrance road)
Fluid Disposal:	Storm Drain 100' S
Neighboring Land Use:	Commercial
Access:	From Clares Street
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Maybe

Proposed Well Site:

In Middle of Center Row of Spaces

Required Improvements:

Siting Trade off:	Loss of Parking Spaces
Hydrogeologic Risk:	Regional analysis suggests grainite at ~750 feet
	No local control

Notes:

8.49

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	41st and Capitola Shopping Cntr/Sq22 Site
Site Map Name:	SC%
Ownership:	Private
Current Land Use:	Shopping Center Parking Lot
Target Aquifer:	Tp (A, AA)
Well Depth:	750 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Water Supply Behind Building
Fluid Disposal:	Storm Drains
Neighboring Land Use:	S, W-Commercial, N, E - Residential
Access:	From 41st
VRCB-DDW Waiver:	Required - 50 foot control zone not possible
Sound Wall Required:	Yes

Proposed Well Site:

Between Center Rows of Parking Spaces

Required Improvements:

Remove Parking Islands

Siting Trade off:	Loss of Parking Spaces
Hydrogeologic Risk:	Site of SqCWD SC22 MW
	Known Geology

Notes:

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Winkle Farm Park
Site Map Name:	SC6
Ownership:	County
Current Land Use:	Park
Target Aquifer:	Tp (A, AA)
Well Depth:	450 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Drinking Fountain in Park/FH across Sequoia
Fluid Disposal:	Storm Drains in entry circle
Neighboring Land Use:	E - Res, W- Rural Res,S-Commercial, N - Res
Access:	From Sequoia or Winkle
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

Proposed Well Site:

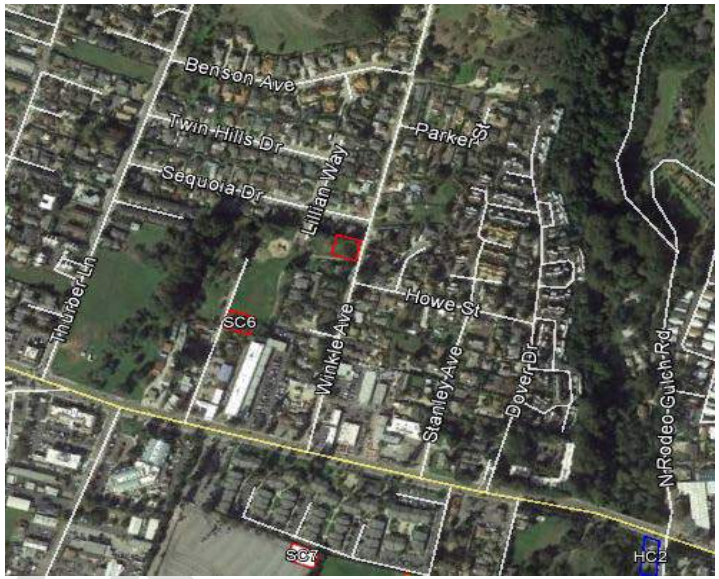
Either in northeastern portion of park or southend

Required Improvements:

Remove Trees for N location

Siting Trade off:	Loss of Open Space/Trees
Hydrogeologic Risk:	Regional Analysis ~ Granite at 450
	No local control - Thurber?

Notes:



SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Drive-In
Site Map Name:	SC7
Ownership:	Private
Current Land Use:	Idle Drive-In (no screen) Swab Meet Weekends
Target Aquifer:	Tp (A, AA)
Well Depth:	525 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH in housing to N
Fluid Disposal:	Thru fence to SD to N
Neighboring Land Use:	N-Res, W-Parking Lot, E-Playfield, S-Parking/Frwy
Access:	Off Soquel
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes - One side

Proposed Well Site:

Northeast corner of Drive-In Paving

Required Improvements:

Siting Trade off:	Loss of Open Space/Trees
Hydrogeologic Risk:	Regional Analysis ~ Granite at 525'
	No local control - Thurber?

Notes:

PUEBLO water resources

8.52

SANTA CRUZ ASR PROJECT

Well Site Evaluation

PUEBLO water resources

Site Description:	Bay Avenue Shopping Center
Site Map Name:	Sq1
Ownership:	Private
Current Land Use:	Parking Lot
Target Aquifer:	Tp (A, AA)
Well Depth:	700 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH in front of Cty of SC Pump Station
Fluid Disposal:	Storm Drain/Sewer in Lot
Neighboring Land Use:	Commericial, Res to W across creek
Access:	Off Bay Ave
VRCB-DDW Waiver:	Maybe
Sound Wall Required:	Yes

Proposed Well Site:

Southwest portion of parking lot, N of pump station, S of Sutter Health

Required Improvements:

Remove Planters in Parking Lot

Siting Trade off:	Loss of parking places
Hydrogeologic Risk:	Regional Analysis ~ Granite at 700' proximate to SC22, Rosedale, Main St, O'Neill

Notes:

8.53

SANTA CRUZ ASR PROJECT

Well Site Evaluation

PUEBLO water resources

Site Description:	Anna Jean Cunningham Park
Site Map Name:	Sq3
Ownership:	County?
Current Land Use:	Park/Parking Lot
Target Aquifer:	Tp (A, AA)
Well Depth:	625 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH 150' E
Fluid Disposal:	Storm Drain in Turn around
Neighboring Land Use:	N-Park W-Open Space, E-Park, S-High School Playfield
Access:	From Porter St
SVRCB-DDW Waiver:	Not Required
Sound Wall Required:	Maybe

Proposed Well Site:

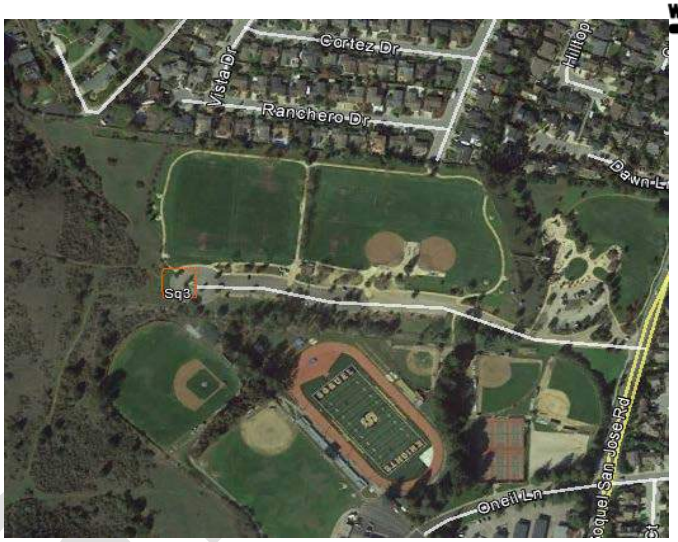
W end of Parking lot turn-around. Extending W into undeveloped land

Required Improvements:

Remove planters in parking lot, move turn-around E

Siting Trade off:	Loss of parking places
Hydrogeologic Risk:	Regional Analysis ~ Granite at 625' proximate to Main St, O'Neill

Notes:



8.54

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Soquel High School Parking Lot
Site Map Name:	Sq4
Ownership:	School district
Current Land Use:	Parking Lot
Target Aquifer:	Tp (A, AA)
Well Depth:	650 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH 150' E
Fluid Disposal:	Storm Drain 150' N in Parking Lot
Neighboring Land Use:	N-School, W-School, S-Commercial, E-Res (down slope)
Access:	From Porter St
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Maybe

Proposed Well Site:

South end of parking lot.

Required Improvements:

None

Siting Trade off:	Loss of parking places
Hydrogeologic Risk:	Regional Analysis ~ Granite at 650' proximate to Main St, O'Neill

Notes:

8.55

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Main St. Elementary
Site Map Name:	Sq5
Ownership:	School district
Current Land Use:	Playfield
Target Aquifer:	Tp (A, AA)
Well Depth:	660 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH 150' W
Fluid Disposal:	Storm Drain 200' W in School Driveway
Neighboring Land Use:	N-Res, W-School, S-Playfield, E-Open Space
Access:	From Main St, then Via Gatos
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

Proposed Well Site:

Northeast corner of playfield

Required Improvements:

Site Leveling into slope, retaining wall

Siting Trade off:	Loss of playfield, move/shorten baseball diamond
Hydrogeologic Risk:	Regional Analysis ~ Granite at 660' proximate to Main St, O'Neill

Notes:

8.56

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Cunninston & Soquel
Site Map Name:	Sq6
Ownership:	?
Current Land Use:	Partially Develop Park
Target Aquifer:	Tp (A, AA)
Well Depth:	900 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH on corner of Cunningston and Soquel
Fluid Disposal:	Storm Drain on Cunninston, 100' N of Soquel
Neighboring Land Use:	N-Res, W-Res, S-Street/Res, E-Res
Access:	From Soquel
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

Proposed Well Site:

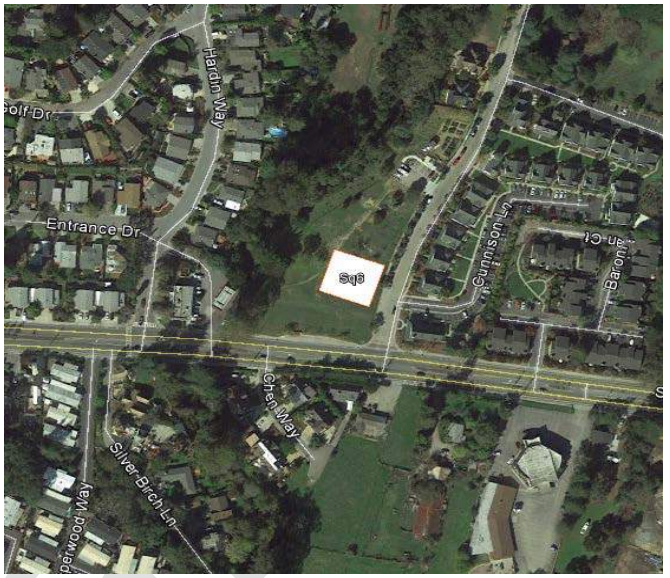
Large undeveloped area N of Soquel

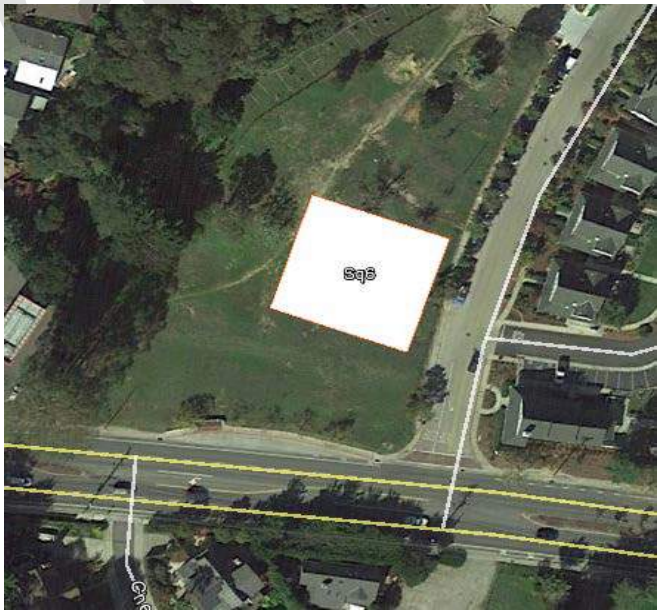
Required Improvements:

Improve access from parking lot

Siting Trade off:	Loss of developable park space
Hydrogeologic Risk:	Regional Analysis ~ Granite at 900' proximate to Rosedale, Tannerey

Notes:





SANTA CRUZ ASR PROJECT

Well Site Evaluation

PUEBLO water resources

Site Description: South of Cunninston & Soquel
Site Map Name: Sq7
Ownership: ?
Current Land Use: Partially Develop Park

Target Aquifer: Tp (A, AA)
Well Depth: 900 feet

Screening Critera

Overhead Lines: No
Water Supply: FH on corner of Cunningston and Soquel
Fluid Disposal: Storm Drain on Cunninston, 100' N of Soquel
Neighboring Land Use: N-Res, W-Res, S-Street/Res, E-Res
Access: From Soquel
SWRCB-DDW Waiver: Not Required
Sound Wall Required: Yes

Proposed Well Site:
Large undeveloped area N of Soquel
Required Improvements:
Improve access from parking lot

Siting Trade off: Loss of developable park space
Hydrogeologic Risk: Regional Analysis ~ Granite at 900' proximate to Rosedale, Tannerey
Notes:

SANTA CRUZ ASR PROJECT

Well Site Evaluation

PUEBLO water resources

Site Description:	Deep Rosedale
Site Map Name:	Sq8
Ownership:	?
Current Land Use:	Partially Develop Park
Target Aquifer:	Tp (A, AA)
Well Depth:	900 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH on corner of Cunningston and Soquel
Fluid Disposal:	Storm Drain on Cunninston, 100' N of Soque
Neighboring Land Use:	N-Res, W-Res, S-Street/Res, E-Res
Access:	From Soquel
SWRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

8.59

Proposed Well Site:

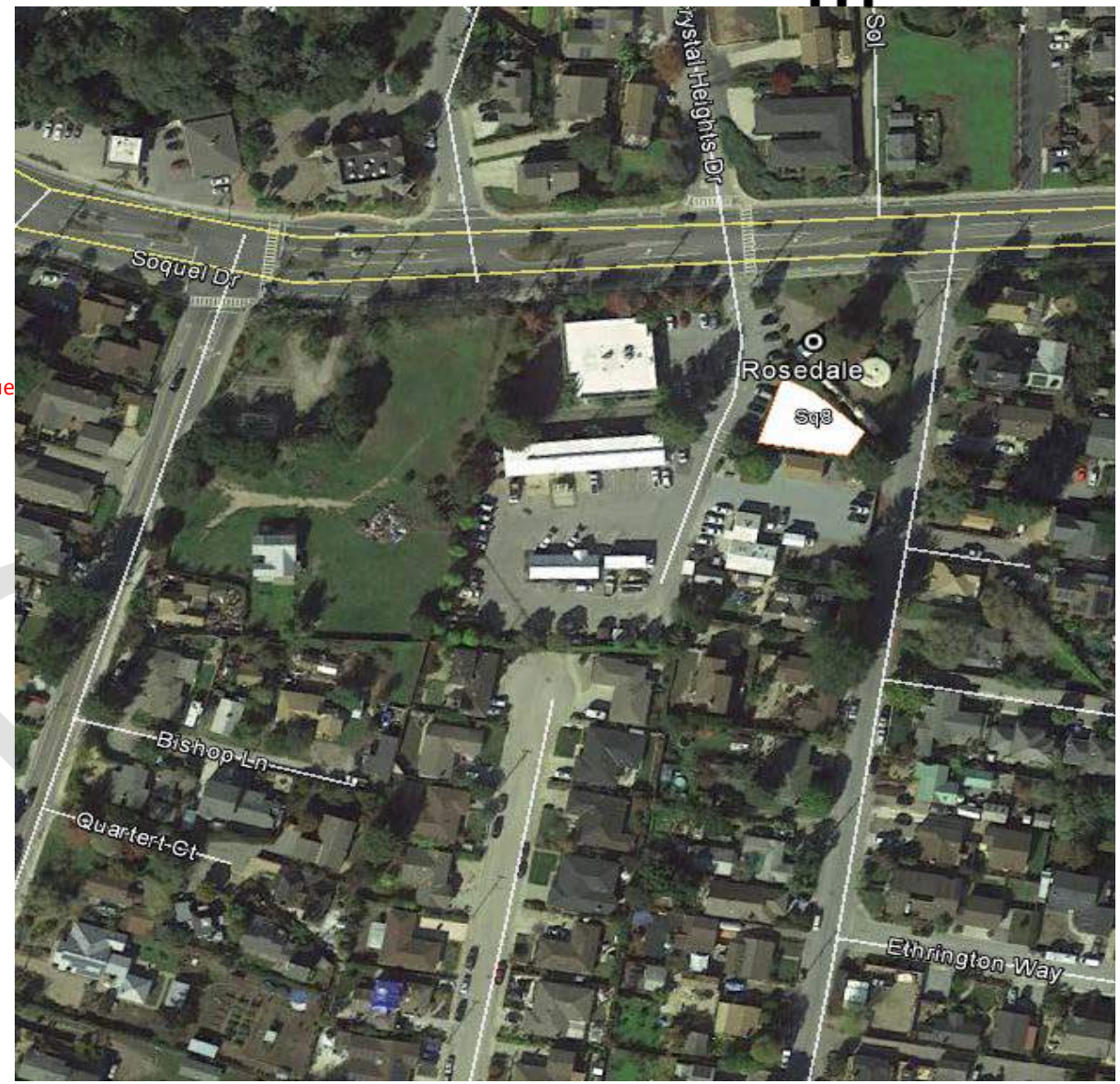
Large undeveloped area N of Soquel

Required Improvements:

Improve access from parking lot

Siting Trade off:	Loss of developable park space
Hydrogeologic Risk:	Regional Analysis ~ Granite at 900' proximate to Rosedale, Tannerey

Notes:



SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Mt. Hermon Dr. @ Quarry Rd
Site Map Name:	SV1
Ownership:	TBD
Current Land Use:	Undeveloped
Target Aquifer:	Tlo
Well Depth:	920 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH 150' E
Fluid Disposal:	Storm Drain 150' N in Parking Lot
Neighboring Land Use:	N-Street, W-Quarry, S-Undeveloped, E-Res
Access:	From Mt. Hermon or Quarry
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	East and South Sides

Proposed Well Site:

South end of parking lot.

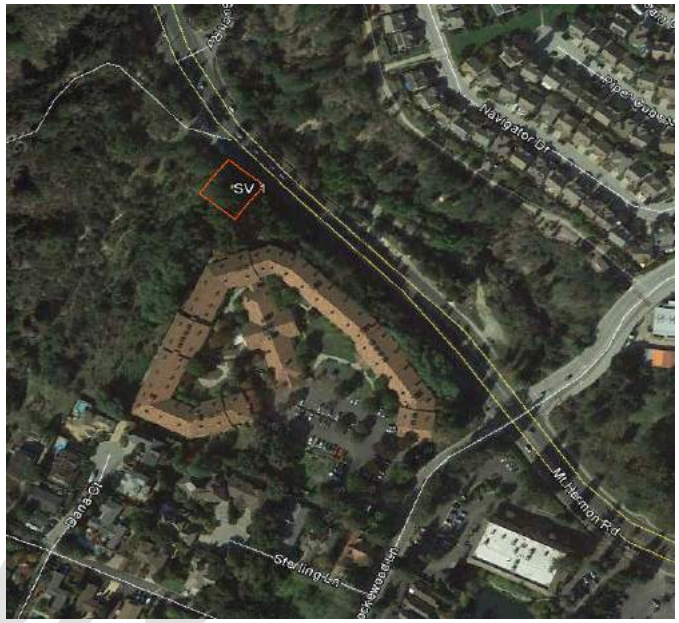
Required Improvements:

Land clearing

Siting Trade off:

Hydrogeologic Risk: Regional Analysis ~ Base of Tlo at 920' proximate to AB 303 MW-3

Notes:



8.60

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Tennis Courts SkyPark
Site Map Name:	SV2
Ownership:	City?
Current Land Use:	Undeveloped
Target Aquifer:	Tlo
Well Depth:	1130 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Drinking Fountain
Fluid Disposal:	Storm Drain @ Coast Range and Aviator
Neighboring Land Use:	N-Courts, W-Res, S-Undeveloped Slope, E-Industrial
Access:	From Coast Range then Parking Lot
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

Proposed Well Site:
South of Courts
Required Improvements:
Land leveling

Siting Trade off:

Hydrogeologic Risk:	Regional Analysis ~ Base of Tlo at 1130'
	2 Monitoring Wells on Site (Tsm)
Notes:	Residences to NE on hill

SANTA CRUZ ASR PROJECT

Well Site Evaluation

PUEBLO water resources

Site Description:	Skypark Skate Park Pk Lot
Site Map Name:	SV3
Ownership:	City?
Current Land Use:	Parking Lot/Undeveloped
Target Aquifer:	Tlo
Well Depth:	854 feet

Screening Critera

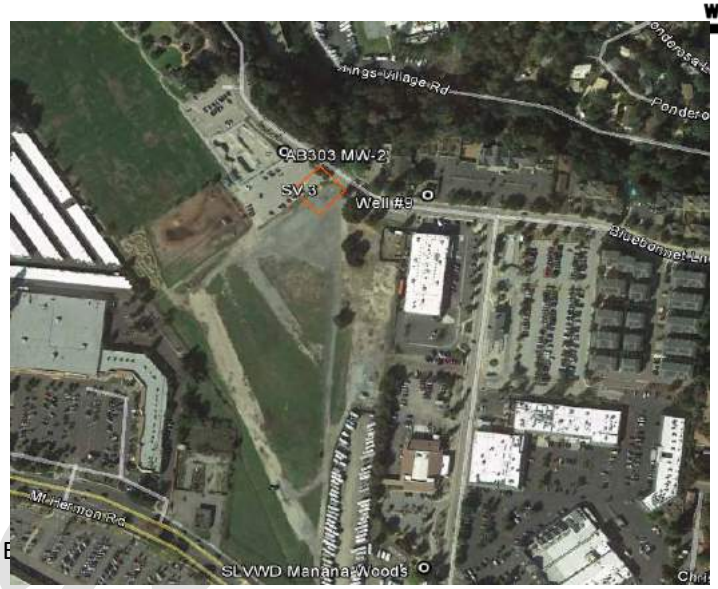
Overhead Lines:	No
Water Supply:	Drinking Fountain
Fluid Disposal:	Storm Drain in Bluebonnet (to Bean Cr)
Neighboring Land Use:	N-Senior Center, W-Parking Lot/Skatepark, S-Undeveloped, E
Access:	From Bluebonnet Ln
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

Proposed Well Site:

Straddling Property Line between Parking Lot and Kings Village Land

Required Improvements:

Siting Trade off:	Loss of Parking Spaces/Impacts Kings Village Dev.
Hydrogeologic Risk:	Regional Analysis ~ Base of Tlo at 854'
	Site of AB 303 MW-2
Notes:	Senior Center Across Street
	Library 300 feet to E



8.62

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Hanson's Quarry
Site Map Name:	SV4
Ownership:	Cemex
Current Land Use:	Undeveloped/Idle Quarry
Target Aquifer:	Tlo
Well Depth:	883 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Drinking Fountain
Fluid Disposal:	Storm Drain in Bluebonnet (to Bean Cr)
Neighboring Land Use:	N,S,E,W-Undeveloped/Idle Quarry
Access:	From Mt. Hermon, then Quarry Road
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Maybe, 1- side

Proposed Well Site:

Off established road in turn

Required Improvements:

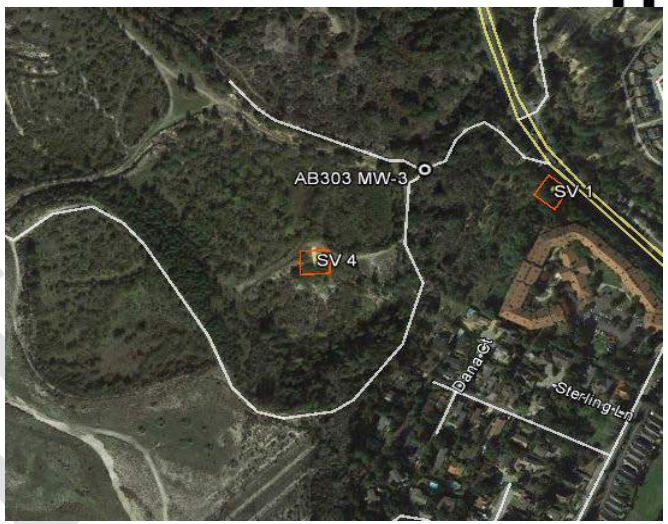
Site Leveling

Siting Trade off:

Hydrogeologic Risk: Regional Analysis ~ Base of Tlo at 833'

Near AB 303 MW-3, Prox to SLVWD Paso Wells

Notes:



8.63

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Hanson's Quarry
Site Map Name:	SV5
Ownership:	Cemex
Current Land Use:	Undeveloped/Idle Quarry
Target Aquifer:	Tlo
Well Depth:	1103 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Drinking Fountain
Fluid Disposal:	Storm Drain in Bluebonnet (to Bean Cr)
Neighboring Land Use:	N,S,E,W-Undeveloped/Idle Quarry
Access:	From Mt. Hermon, then Quarry Road
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Maybe, 1- side?

Proposed Well Site:

Off established road in turn

Required Improvements:

Site Leveling

Siting Trade off:

Hydrogeologic Risk: Regional Analysis ~ Base of Tlo at 1103'

Near AB 303 MW-3, Prox to SLVWD Paso Wells

Notes:

Long distance to established infrastucture

8.64

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Watkins Johnson (Aliviso)
Site Map Name:	SV6
Ownership:	Aliviso
Current Land Use:	Industrial
Target Aquifer:	Tlo
Well Depth:	1000 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH in 300' across parking lot
Fluid Disposal:	Storm Drain in parking lot (to Bean Cr)
Neighboring Land Use:	N,S,E,W-Industrial, Res at dis to NE and SW
Access:	From Bluebonnet
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Maybe

Proposed Well Site:
In RV storage area

Required Improvements:
None

Siting Trade off:	Loss of RV storage
Hydrogeologic Risk:	Regional Analysis ~ Base of Tlo at 1000'
	Near AB 303 MW-2

Notes:

Superfund Site - Contamination in Tsm
Site Essentially Remediated and Closed

8.65

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Skypark -NW of Storage Units
Site Map Name:	SV7
Ownership:	City of Scotts Valley
Current Land Use:	Park/Playfield
Target Aquifer:	Tlo
Well Depth:	1000 feet

Screening Critera

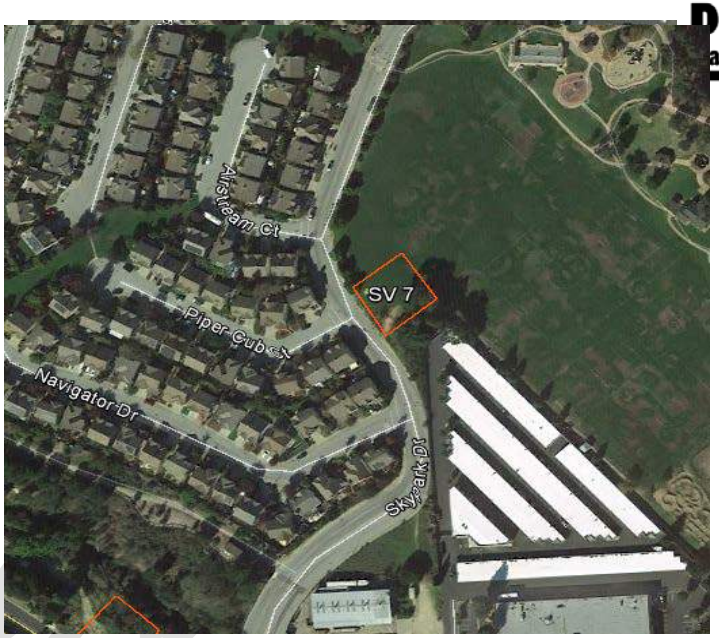
Overhead Lines:	No
Water Supply:	FH across Skypark Drive
Fluid Disposal:	Storm Drain 100' NE (to Bean Cr)
Neighboring Land Use:	N-Res,W- Res, S-Playfield,E-Park Playground, etc
Access:	From Skypark
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

Proposed Well Site:
NW of Stoarge Units

Required Improvements:
None

Siting Trade off:	Loss of Park area.
Hydrogeologic Risk:	Regional Analysis ~ Base of Tlo at 1000' 800' SW of AB 303 MW-2

Notes:



SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Alviso - Lower Parking Lot
Site Map Name:	SV8
Ownership:	Private
Current Land Use:	Equip/ Vehicle Storage
Target Aquifer:	Tlo
Well Depth:	950 feet

Screening Critera

Overhead Lines:	No
Water Supply:	SVWD turnout
Fluid Disposal:	TBD
Neighboring Land Use:	N-Rural Res,W- Undeveloped, S-Industrial,E-Res on Hill
Access:	From Green Valley
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Maybe

Proposed Well Site:

In exising vehicle storage area

Required Improvements:

None

Siting Trade off:	Loss of vehicle storage area
Hydrogeologic Risk:	Regional Analysis ~ Base of Tlo at 950'

Notes:

8.67

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	NW corner of Mt Hermon and Skypark
Site Map Name:	SV9
Ownership:	Private
Current Land Use:	Undeveloped
Target Aquifer:	Tlo
Well Depth:	850 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Fire Hydrant
Fluid Disposal:	TBD
Neighboring Land Use:	N-Res,W- Undeveloped, S-Res at dis,E-commercial
Access:	Mt Hermon
CVRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

Proposed Well Site:

50 feet from property line, 50 feet from drainage

Required Improvements:

Minor Grading

Siting Trade off:

Hydrogeologic Risk: Regional Analysis ~ Base of Tlo at 950'

Notes:

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Drive-In
Site Map Name:	SC7
Ownership:	Private
Current Land Use:	Idle Drive-In (no screen) Swab Meet Weekends
Target Aquifer:	Tp (A, AA)
Well Depth:	525 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH in housing to N
Fluid Disposal:	Thru fence to SD to N
Neighboring Land Use:	N-Res, W-Parking Lot, E-Playfield, S-Parking/Frwy
Access:	Off Soquel
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes - One side

Proposed Well Site:

Northeast corner of Drive-In Paving

Required Improvements:

Siting Trade off:	Loss of Open Space/Trees
Hydrogeologic Risk:	Regional Analysis ~ Granite at 525'
	No local control - Thurber?

Notes:

PUEBLO water resources

8.69

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Good Shepherd School
Site Map Name:	SC1
Ownership:	Private
Current Land Use:	Playfield
Target Aquifer:	Tp (A, AA)
Well Depth:	523 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH - 150' N (cross driveway)
Fluid Disposal:	Storm Drain 200' W
Neighboring Land Use:	N-Res, E-Res, W-Playfield, S-Playfield
Access:	Off Soquel
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

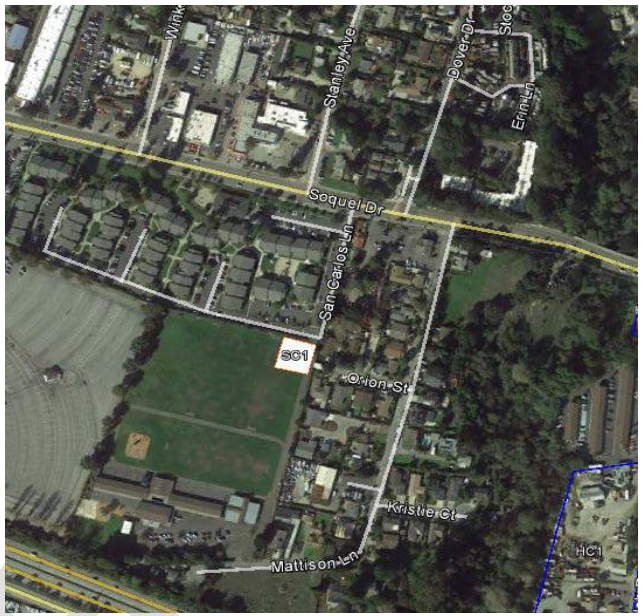
Proposed Well Site:

Northeast corner of Playfield

Required Improvements: none

Siting Trade off:	Loss of Playfield Area
Hydrogeologic Risk:	Regional Analysis ~ Granite at 525'
	No local control - Thurber?

Notes:



8.70

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Coffee Lane Park
Site Map Name:	SC2
Ownership:	County of Santa Cruz
Current Land Use:	Park
Target Aquifer:	Tp (A, AA)
Well Depth:	780 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Drinking Fountain, Irr. Supply at Entrance
Fluid Disposal:	Storm Drain (drains to Rodeo Creek)
Neighboring Land Use:	N, E, S - 2 story residential, W - Creek w/ Res. Across
Access:	Thru Residential Streets
VRCB-DDW Waiver:	Not Required
and Wall Required:	Yes

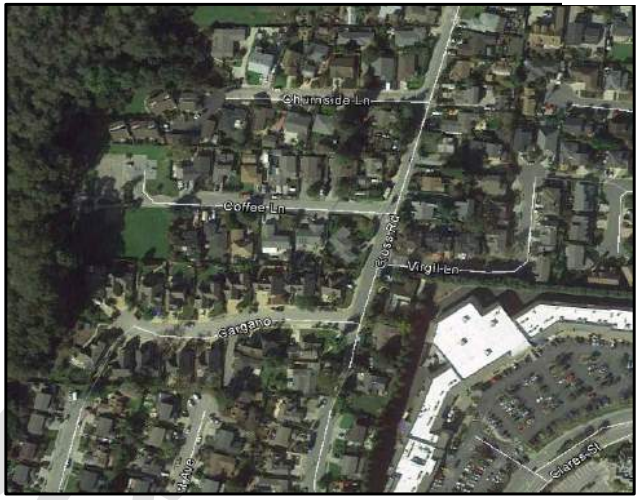
Proposed Well Site:

Located in center of large grass area south of entrance

Required Improvements: Create Level Site/Retaining Wall

Siting Trade off:	Loss of open area
Hydrogeologic Risk:	Regional analysis suggests grainite at ~800 feet
	Local control extends only to 250 feet.

Notes: Site of Nested Monitoring Well. 250 feet deep.



8.71

SANTA CRUZ ASR PROJECT

Well Site Evaluation

PUEBLO water resources

Site Description:	Chanicleer Park
Site Map Name:	SC3
Ownership:	County of Santa Cruz
Current Land Use:	Park
Target Aquifer:	Tp (A, AA)
Well Depth:	780 feet

Screening Critera

Overhead Lines:	No (only along Chanicleer Ave)
Water Supply:	Fire Hydrant NE and SE corners
Fluid Disposal:	Storm Drain 100' S- discharge would cross driveway
Neighboring Land Use:	Residential all sides
Access:	Off Chanticleer
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

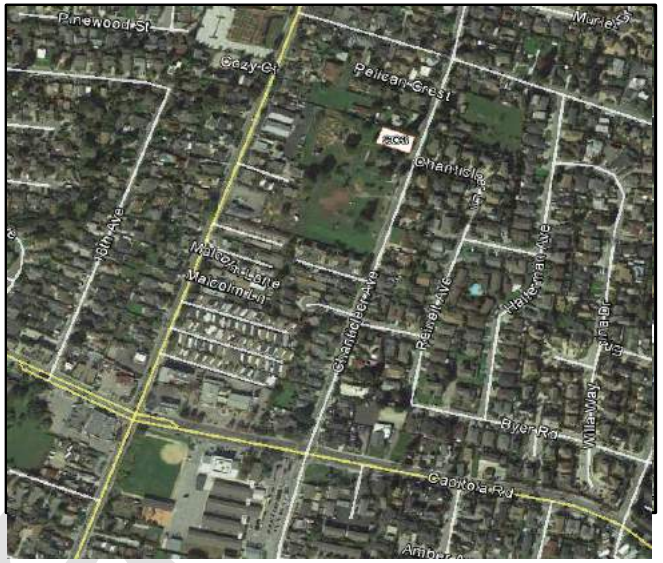
Proposed Well Site:

Depends on proposed park improvements - some flexibility

Required Improvements:

Siting Trade off:	Loss of open area
Hydrogeologic Risk:	Regional analysis suggests grainite at ~800 feet
	No local control

Notes: Park Improvements Pending



8.72

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Capitola Shopping Center
Site Map Name:	SC4
Ownership:	Private
Current Land Use:	Shopping Center Parking Lot
Target Aquifer:	Tp (A, AA)
Well Depth:	750 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Fire Hydrant (across entrance road)
Fluid Disposal:	Storm Drain 100' S
Neighboring Land Use:	Commercial
Access:	From Clares Street
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Maybe

Proposed Well Site:

In Middle of Center Row of Spaces

Required Improvements:

Siting Trade off:	Loss of Parking Spaces
Hydrogeologic Risk:	Regional analysis suggests grainite at ~750 feet No local control

Notes:

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	41st and Capitola Shopping Cntr/Sq22 Site
Site Map Name:	SC%
Ownership:	Private
Current Land Use:	Shopping Center Parking Lot
Target Aquifer:	Tp (A, AA)
Well Depth:	750 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Water Supply Behind Building
Fluid Disposal:	Storm Drains
Neighboring Land Use:	S, W-Commercial, N, E - Residential
Access:	From 41st
VRCB-DDW Waiver:	Required - 50 foot control zone not possible
Sound Wall Required:	Yes

Proposed Well Site:

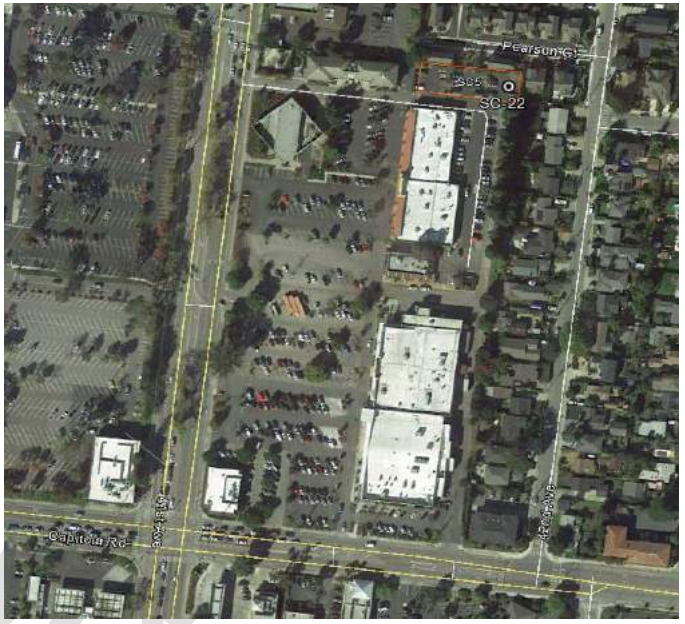
Between Center Rows of Parking Spaces

Required Improvements:

Remove Parking Islands

Siting Trade off:	Loss of Parking Spaces
Hydrogeologic Risk:	Site of SqCWD SC22 MW
	Known Geology

Notes:



SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Winkle Farm Park
Site Map Name:	SC6
Ownership:	County
Current Land Use:	Park
Target Aquifer:	Tp (A, AA)
Well Depth:	450 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Drinking Fountain in Park/FH across Sequoia
Fluid Disposal:	Storm Drains in entry circle
Neighboring Land Use:	E - Res, W- Rural Res,S-Commercial, N - Res
Access:	From Sequoia or Winkle
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

Proposed Well Site:

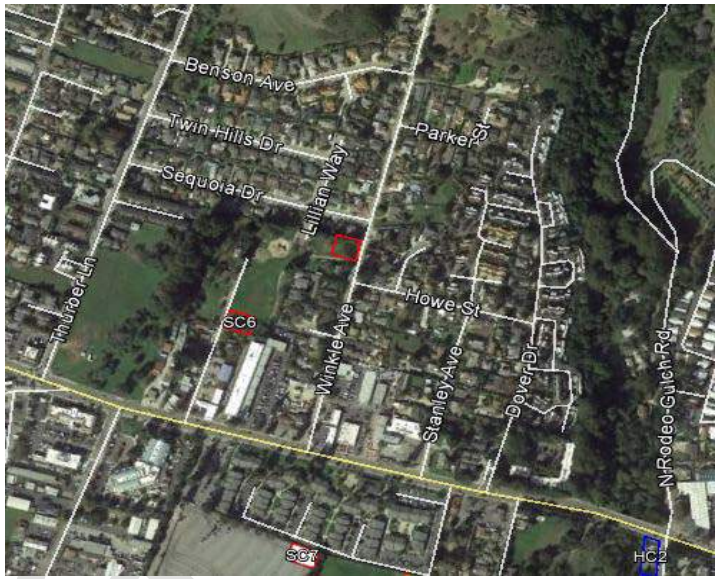
Either in northeastern portion of park or southend

Required Improvements:

Remove Trees for N location

Siting Trade off:	Loss of Open Space/Trees
Hydrogeologic Risk:	Regional Analysis ~ Granite at 450
	No local control - Thurber?

Notes:



8.75

SANTA CRUZ ASR PROJECT

Well Site Evaluation

PUEBLO water resources

Site Description:	Bay Avenue Shopping Center
Site Map Name:	Sq1
Ownership:	Private
Current Land Use:	Parking Lot
Target Aquifer:	Tp (A, AA)
Well Depth:	700 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH in front of Cty of SC Pump Station
Fluid Disposal:	Storm Drain/Sewer in Lot
Neighboring Land Use:	Commericial, Res to W across creek
Access:	Off Bay Ave
VRCB-DDW Waiver:	Maybe
Sound Wall Required:	Yes

Proposed Well Site:

Southwest portion of parking lot, N of pump station, S of Sutter Health

Required Improvements:

Remove Planters in Parking Lot

Siting Trade off:	Loss of parking places
Hydrogeologic Risk:	Regional Analysis ~ Granite at 700' proximate to SC22, Rosedale, Main St, O'Neill

Notes:

8.76

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Anna Jean Cunningham Park
Site Map Name:	Sq3
Ownership:	County?
Current Land Use:	Park/Parking Lot
Target Aquifer:	Tp (A, AA)
Well Depth:	625 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH 150' E
Fluid Disposal:	Storm Drain in Turn around
Neighboring Land Use:	N-Park W-Open Space, E-Park, S-High School Playfield
Access:	From Porter St
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Maybe

Proposed Well Site:

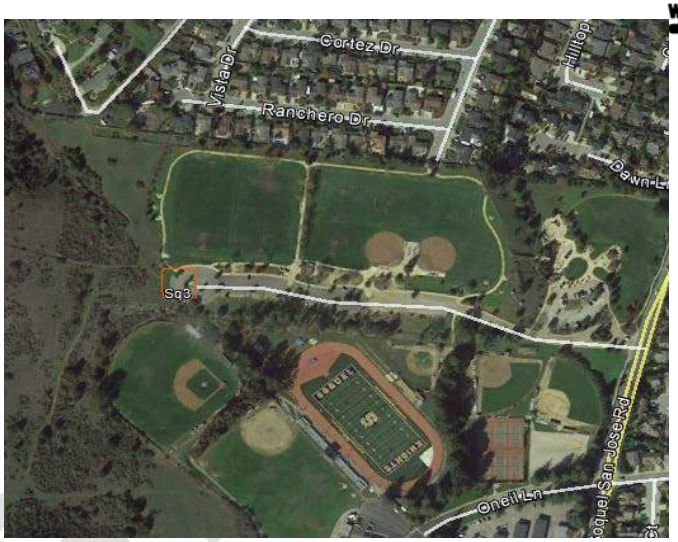
W end of Parking lot turn-around. Extending W into undeveloped land

Required Improvements:

Remove planters in parking lot, move turn-around E

Siting Trade off:	Loss of parking places
Hydrogeologic Risk:	Regional Analysis ~ Granite at 625' proximate to Main St, O'Neill

Notes:



SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Soquel High School Parking Lot
Site Map Name:	Sq4
Ownership:	School district
Current Land Use:	Parking Lot
Target Aquifer:	Tp (A, AA)
Well Depth:	650 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH 150' E
Fluid Disposal:	Storm Drain 150' N in Parking Lot
Neighboring Land Use:	N-School, W-School, S-Commercial, E-Res (down slope)
Access:	From Porter St
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Maybe

Proposed Well Site:

South end of parking lot.

Required Improvements:

None

Siting Trade off:	Loss of parking places
Hydrogeologic Risk:	Regional Analysis ~ Granite at 650' proximate to Main St, O'Neill

Notes:

8.78

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Main St. Elementary
Site Map Name:	Sq5
Ownership:	School district
Current Land Use:	Playfield
Target Aquifer:	Tp (A, AA)
Well Depth:	660 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH 150' W
Fluid Disposal:	Storm Drain 200' W in School Driveway
Neighboring Land Use:	N-Res, W-School, S-Playfield, E-Open Space
Access:	From Main St, then Via Gatos
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

Proposed Well Site:

Northeast corner of playfield

Required Improvements:

Site Leveling into slope, retaining wall

Siting Trade off:	Loss of playfield, move/shorten baseball diamond
Hydrogeologic Risk:	Regional Analysis ~ Granite at 660' proximate to Main St, O'Neill

Notes:

8.79

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Cunninston & Soquel
Site Map Name:	Sq6
Ownership:	?
Current Land Use:	Partially Develop Park
Target Aquifer:	Tp (A, AA)
Well Depth:	900 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH on corner of Cunningston and Soquel
Fluid Disposal:	Storm Drain on Cunninston, 100' N of Soquel
Neighboring Land Use:	N-Res, W-Res, S-Street/Res, E-Res
Access:	From Soquel
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

Proposed Well Site:

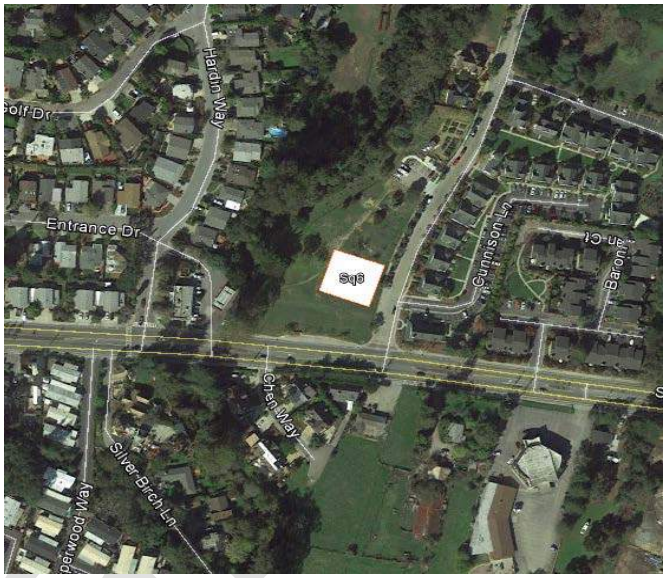
Large undeveloped area N of Soquel

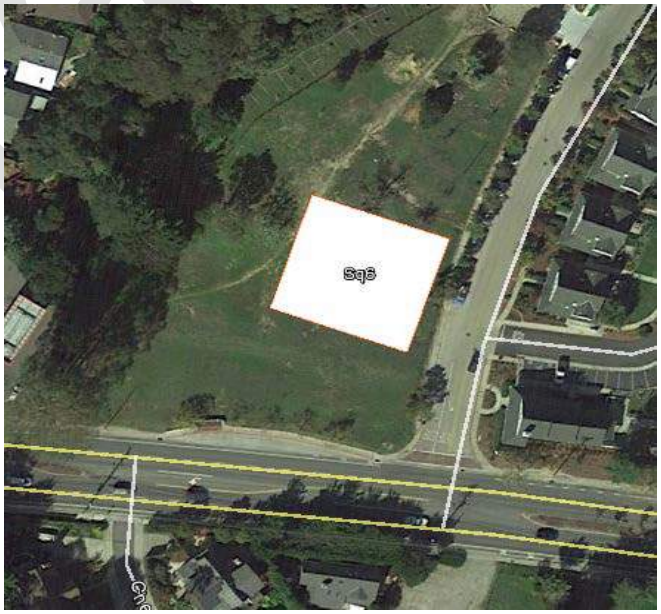
Required Improvements:

Improve access from parking lot

Siting Trade off:	Loss of developable park space
Hydrogeologic Risk:	Regional Analysis ~ Granite at 900' proximate to Rosedale, Tannerey

Notes:





8.8.80

SANTA CRUZ ASR PROJECT

Well Site Evaluation

PUEBLO water resources

Site Description: South of Cunninston & Soquel
Site Map Name: Sq7
Ownership: ?
Current Land Use: Partially Develop Park

Target Aquifer: Tp (A, AA)
Well Depth: 900 feet

Screening Critera

Overhead Lines: No
Water Supply: FH on corner of Cunningston and Soquel
Fluid Disposal: Storm Drain on Cunninston, 100' N of Soquel
Neighboring Land Use: N-Res, W-Res, S-Street/Res, E-Res
Access: From Soquel
SWRCB-DDW Waiver: Not Required
Sound Wall Required: Yes

Proposed Well Site:
Large undeveloped area N of Soquel
Required Improvements:
Improve access from parking lot

Siting Trade off: Loss of developable park space
Hydrogeologic Risk: Regional Analysis ~ Granite at 900' proximate to Rosedale, Tannerey
Notes:

SANTA CRUZ ASR PROJECT

Well Site Evaluation

PUEBLO water resources

Site Description:	Deep Rosedale
Site Map Name:	Sq8
Ownership:	?
Current Land Use:	Partially Develop Park
Target Aquifer:	Tp (A, AA)
Well Depth:	900 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH on corner of Cunningston and Soquel
Fluid Disposal:	Storm Drain on Cunninston, 100' N of Soque
Neighboring Land Use:	N-Res, W-Res, S-Street/Res, E-Res
Access:	From Soquel
SWRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

8.82

Proposed Well Site:

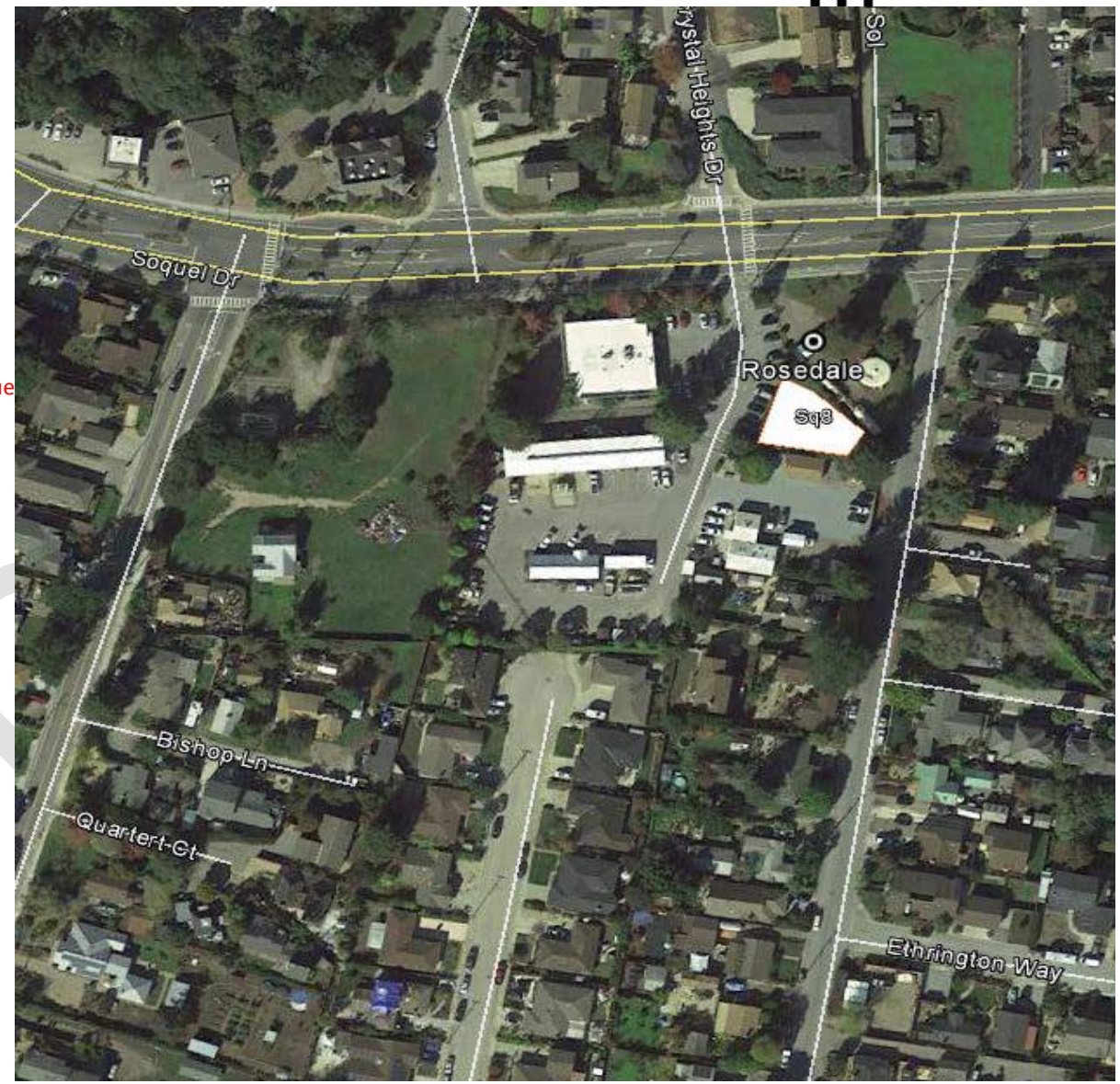
Large undeveloped area N of Soquel

Required Improvements:

Improve access from parking lot

Siting Trade off:	Loss of developable park space
Hydrogeologic Risk:	Regional Analysis ~ Granite at 900' proximate to Rosedale, Tannerey

Notes:



SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Mt. Hermon Dr. @ Quarry Rd
Site Map Name:	SV1
Ownership:	TBD
Current Land Use:	Undeveloped
Target Aquifer:	Tlo
Well Depth:	920 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH 150' E
Fluid Disposal:	Storm Drain 150' N in Parking Lot
Neighboring Land Use:	N-Street, W-Quarry, S-Undeveloped, E-Res
Access:	From Mt. Hermon or Quarry
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	East and South Sides

Proposed Well Site:

South end of parking lot.

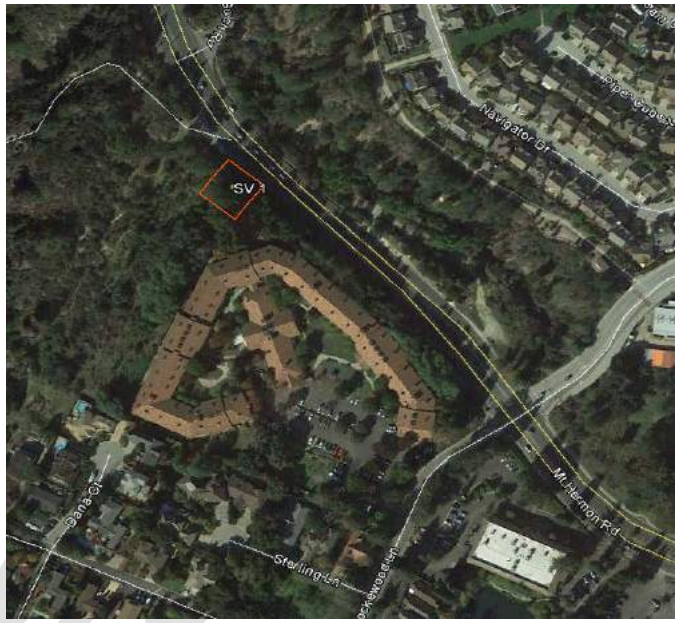
Required Improvements:

Land clearing

Siting Trade off:

Hydrogeologic Risk: Regional Analysis ~ Base of Tlo at 920' proximate to AB 303 MW-3

Notes:



8.83

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Tennis Courts SkyPark
Site Map Name:	SV2
Ownership:	City?
Current Land Use:	Undeveloped
Target Aquifer:	Tlo
Well Depth:	1130 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Drinking Fountain
Fluid Disposal:	Storm Drain @ Coast Range and Aviator
Neighboring Land Use:	N-Courts, W-Res, S-Undeveloped Slope, E-Industrial
Access:	From Coast Range then Parking Lot
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

Proposed Well Site:
South of Courts
Required Improvements:
Land leveling

Siting Trade off:

Hydrogeologic Risk:	Regional Analysis ~ Base of Tlo at 1130'
	2 Monitoring Wells on Site (Tsm)
Notes:	Residences to NE on hill

8.84

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Skypark Skate Park Pk Lot
Site Map Name:	SV3
Ownership:	City?
Current Land Use:	Parking Lot/Undeveloped
Target Aquifer:	Tlo
Well Depth:	854 feet

Screening Critera

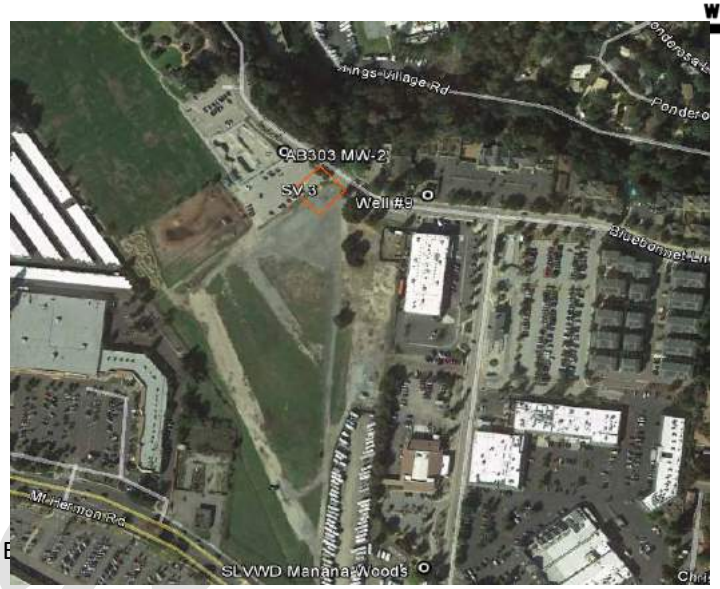
Overhead Lines:	No
Water Supply:	Drinking Fountain
Fluid Disposal:	Storm Drain in Bluebonnet (to Bean Cr)
Neighboring Land Use:	N-Senior Center, W-Parking Lot/Skatepark, S-Undeveloped, E
Access:	From Bluebonnet Ln
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Yes

Proposed Well Site:

Straddling Property Line between Parking Lot and Kings Village Land

Required Improvements:

Siting Trade off:	Loss of Parking Spaces/Impacts Kings Village Dev.
Hydrogeologic Risk:	Regional Analysis ~ Base of Tlo at 854'
	Site of AB 303 MW-2
Notes:	Senior Center Across Street
	Library 300 feet to E



8.8.85

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Hanson's Quarry
Site Map Name:	SV4
Ownership:	Cemex
Current Land Use:	Undeveloped/Idle Quarry
Target Aquifer:	Tlo
Well Depth:	883 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Drinking Fountain
Fluid Disposal:	Storm Drain in Bluebonnet (to Bean Cr)
Neighboring Land Use:	N,S,E,W-Undeveloped/Idle Quarry
Access:	From Mt. Hermon, then Quarry Road
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Maybe, 1- side

Proposed Well Site:

Off established road in turn

Required Improvements:

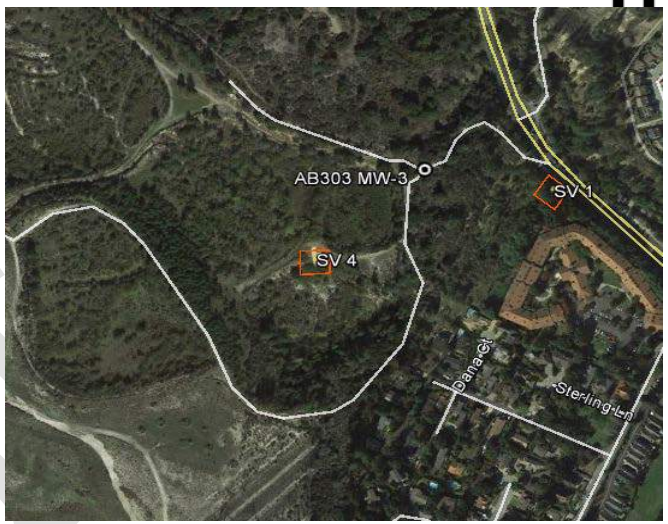
Site Leveling

Siting Trade off:

Hydrogeologic Risk: Regional Analysis ~ Base of Tlo at 833'

Near AB 303 MW-3, Prox to SLVWD Paso Wells

Notes:



8.8.86

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Hanson's Quarry
Site Map Name:	SV5
Ownership:	Cemex
Current Land Use:	Undeveloped/Idle Quarry
Target Aquifer:	Tlo
Well Depth:	1103 feet

Screening Critera

Overhead Lines:	No
Water Supply:	Drinking Fountain
Fluid Disposal:	Storm Drain in Bluebonnet (to Bean Cr)
Neighboring Land Use:	N,S,E,W-Undeveloped/Idle Quarry
Access:	From Mt. Hermon, then Quarry Road
VRCB-DDW Waiver:	Not Required
Sound Wall Required:	Maybe, 1- side?

Proposed Well Site:

Off established road in turn

Required Improvements:

Site Leveling

Siting Trade off:

Hydrogeologic Risk: Regional Analysis ~ Base of Tlo at 1103'

Near AB 303 MW-3, Prox to SLVWD Paso Wells

Notes:

Long distance to established infrastucture

8.8.87

SANTA CRUZ ASR PROJECT

Well Site Evaluation

Site Description:	Watkins Johnson (Aliviso)
Site Map Name:	SV6
Ownership:	Aliviso
Current Land Use:	Industrial
Target Aquifer:	Tlo
Well Depth:	1000 feet

Screening Critera

Overhead Lines:	No
Water Supply:	FH in 300' across parking lot
Fluid Disposal:	Storm Drain in parking lot (to Bean Cr)
Neighboring Land Use:	N,S,E,W-Industrial, Res at dis to NE and SW
Access:	From Bluebonnet
RWQCB-DDW Waiver:	Not Required
Sound Wall Required:	Maybe

Proposed Well Site:
In RV storage area

Required Improvements:
None

Siting Trade off:	Loss of RV storage
Hydrogeologic Risk:	Regional Analysis ~ Base of Tlo at 1000'
	Near AB 303 MW-2

Notes:

Superfund Site - Contamination in Tsm
Site Essentially Remediated and Closed