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

WATER COMMISSION

Regular Meeting

January 11, 2024

Updated January 11, 2024 – Item 4

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

Please note: As of March 1, 2023, participation in meetings for City Advisory Bodies is in-person only. Members of the public can continue to stream the audio for the meetings from the City's website, however public comment will no longer be taken virtually and those wishing to address the board must be in attendance at the location provided on the agenda.

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. 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.

Agenda and Agenda Packet Materials: The Water Commission agenda and the complete agenda packet containing public records, which are not exempt from disclosure pursuant to the California Public Records Act, are available for review on the City's website: https://www.cityofsantacruz.com/government/city-departments/water/city-water-commission and at the Water Department located at 212 Locust Street, STE A, Santa Cruz, California, during normal business hours.

Agenda Materials Submitted after Publication of the Agenda Packet: Pursuant to Government Code §54957.5, public records related to an open session agenda item submitted after distribution of the agenda packet are available at the same time they are distributed or made available to the legislative body on the City's website at: https://www.cityofsantacruz.com/government/city-departments/water/city-water-commission and are also available for public inspection at the Water Department, 212 Locust Street, STE A, Santa Cruz, California, during normal business hours, and at the Council meeting.

Need more information? Contact the Water Department at 831-420-5200.

Call to Order

Roll Call

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

Announcements

Consent Agenda (Pages 1.1 – 3.7) 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, 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 Actions Affecting the Water Department (Pages 1.1 – 1.4)

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

2. Water Commission Minutes from November 27, 2023 (Pages 2.1 – 2.8)

   That the Water Commission approve the October 2, 2023 Water Commission Minutes.

3. Fiscal Year 2023 4th Quarter Unaudited Financial Report (Pages 3.1 – 3.7)

   That the Water Commission accept the Fiscal Year 2023 (FY 2023) 4th Quarter Unaudited Financial Report.

Items Removed from the Consent Agenda

General Business (Pages 4.1 – 5.74) 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.

4. Take Action to Support Staff's Recommendation to City Council to Adopt the Anadromous Salmonid Habitat Conservation Plan Final Mitigated Negative Declaration and Mitigation Monitoring and Reporting Program (Pages 4.1 – 4.42)

   That the Water Commission take action to recommend the City Council adopt a resolution adopting the Mitigated Negative Declaration and Mitigation Monitoring and Reporting Program for the Anadromous Salmonid Habitat Conservation Plan.

5. Water Supply Augmentation Implementation Plan (WSAIP): Summary of the November Water Commission Deep Dive Discussion Including Modified Presentation Slides, General Response to Comments and Questions, Additional Findings, and Calendar Year 2024 Work Plan (Pages 5.1 – 5.74)

   That the Water Commission receive an update summarizing November's WSAIP deep dive material, response to comments/questions, and additional findings.

Subcommittee/Advisory Body Oral Reports

6. Santa Cruz Mid-County Groundwater Agency

7. Santa Margarita Groundwater Agency

Director's Oral Report

Information Items

8. Information Items (Pages 8.1 – 8.38)

Adjournment

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CITY OF SANTA CRUZ

WATER COMMISSION
INFORMATION REPORT

DATE: 01/04/2024

AGENDA OF: 01/11/2024

TO: Water Commission

FROM: Rosemary Menard, Water Director

SUBJECT: City Council Actions Affecting the Water Department

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

BACKGROUND/DISCUSSION:

November 28, 2023

Grant of Easement to Pacific Gas and Electric Company (WT/PR)

Resolution No. NS-30,243 was adopted authorizing and directing the City Manager to execute a Grant of Easement in a form to be approved by the City Attorney, located in the City of Santa Cruz and designated as APN 004-321-06, to Pacific Gas and Electric Company, to construct, install, operate, and maintain facilities for distribution of electric energy upon the terms and conditions as set forth to serve the Pure Water Soquel facilities located at the City's Wastewater Treatment Facility.

Approval of the Supervisory Control and Data Acquisition (SCADA) Radio Upgrade Project and Approval of California Environmental Quality Act (CEQA) Exemption and Award of Agreement to Telstar Instruments (WT)

Motion **carried** to:

- **Approve** the SCADA Radio Upgrade Project and find the project exempt under CEQA;

- **Accept** the proposal of Telstar Instruments for the SCADA Radio Upgrade Project in the amount of $199,107.00 and to authorize the City Manager, or designee, to execute an agreement in a form to be approved by the City Attorney and reject all other proposals; and

- **Authorize** the Water Director to approve change orders with Telstar Instruments in a form to be approved by the City Attorney for amounts that are within the approved adjusted budget.

December 12, 2023

Contract Amendment 2024-1.1 with HDR Inc. for Capital Program Management Services (WT)

Motion **carried** authorizing the City Manager to execute Contract Amendment 2024-1.1 in the amount of $1,128,563 with HDR, Inc. in a form to be approved by the City Attorney.

Purchase of Real Property Necessary for Brackney Landslide Area Pipeline Risk Reduction Project: Multiple Properties, Assessor's Parcel Numbers 071-081-03, 072-145-28, 072-145-33, 072-174-04, 072-174-06, 072-181-17, 072-181-25 & 26, 072-182-03, 072-212-36, and 072-221-18, Owned by Rebecchi & Ballauf Trust, Craig, Warwick, Schaaf, Rines Trust, McDonald, McDonald, Mercurio Trust, Gremminger Trust, and Peeler-Randolph Trust, Respectively (WT)

Motion **carried** to:

- **Adopt Resolution No. NS-30,247** authorizing and directing the City Manager or his designee to execute a purchase sale agreement between the City of Santa Cruz and Rebecchi & Ballauf Trust for the easement located in Felton, CA near Highway 9 between Brackney Road and San Lorenzo Way for a temporary easement on APN 071-081-03 for the Brackney Landslide Area Pipeline Risk Reduction Project;

- **Adopt Resolution No. NS-30,248** authorizing and directing the City Manager or his designee to execute a purchase sale agreement between the City of Santa Cruz and Katrin Craig for the easement located in Felton, CA near Highway 9 between Glen Arbor Road and Brackney Road for a permanent easement for APN 072-145-28 for the Brackney Landslide Area Pipeline Risk Reduction Project; **Adopt Resolution No. NS-30,249** authorizing and directing the City Manager or his designee to execute a purchase sale agreement between the City of Santa Cruz and Brian Warwick and Leslee Warwick for the easement located in Felton, CA near Highway 9 between Glen Arbor Road and Brackney Road for a permanent easement for APN 072-145-33 for the Brackney Landslide Area Pipeline Risk Reduction Project;

- **Adopt Resolution No. NS-30,250** authorizing and directing the City Manager or his designee to execute a purchase sale agreement between the City of Santa Cruz and Milburn Schaaf and Cheryl Schaaf for the easement located in Felton, CA near Highway 9 between Glen Arbor Road and Brackney Road for a temporary easement for APN 072-174-04 for the Brackney Landslide Area Pipeline Risk Reduction Project;

- **Adopt Resolution No. NS-30,251** authorizing and directing the City Manager or his designee to execute a purchase sale agreement between the City of Santa Cruz and Susan C. Rines Trust for the easement located in Felton, CA near Highway 9 between Glen Arbor Road and Brackney Road for a temporary easement for APN 072-174-06 for the Brackney Landslide Area Pipeline Risk Reduction Project;

- **Adopt Resolution No. NS-30,252** authorizing and directing the City Manager or his designee to execute a purchase sale agreement between the City of Santa Cruz and Jamie K. McDonald for the easement located in Felton, CA near Highway 9 between Glen Arbor Road and Brackney Road for a permanent easement for APN 072-181-17 for the Brackney Landslide Area Pipeline Risk Reduction Project;

- **Adopt Resolution No. NS-30,253** authorizing and directing the City Manager or his designee to execute a purchase sale agreement between the City of Santa Cruz and Jamie K. McDonald for the easement located in Felton, CA near Highway 9 between Glen Arbor Road and Brackney Road for a permanent easement for APN 072-181-25 & 072-181-26 for the Brackney Landslide Area Pipeline Risk Reduction Project;

- **Adopt Resolution No. NS-30,254** authorizing and directing the City Manager or his designee to execute a purchase sale agreement between the City of Santa Cruz and Cheryl Mercurio Living Trust for the easement located in Felton, CA near Highway 9 between Glen Arbor Road and Brackney Road for a permanent easement for APN 072-182-03 for the Brackney Landslide Area Pipeline Risk Reduction Project;

- **Adopt Resolution No. NS-30,255** authorizing and directing the City Manager or his designee to execute a purchase sale agreement between the City of Santa Cruz and Robert and Judith Gremminger Revocable Trust for the easement located in Felton, CA near Highway 9 between Glen Arbor Road and Brackney Road for a temporary easement for APN 072-212-36 for the Brackney Landslide Area Pipeline Risk Reduction Project; and

- **Adopt Resolution No. NS-30,256** authorizing and directing the City Manager or his designee to execute a purchase sale agreement between the City of Santa Cruz and Peeler-Randolph Trust for the easement located in Felton, CA near Highway 9 between Glen Arbor Road and Brackney Road for a temporary easement for APN 072-221-18 for the Brackney Landslide Area Pipeline Risk Reduction Project.

Resolution of Necessity for Brackney Landslide Area Pipeline Risk Reduction Project: East Side of Fremont Avenue, South of Oak Avenue, Ben Lomond, CA 95005, APN 072-174-02, Owned by Helena H. Chen, Single Tenancy (WT/CA)

Motion **carried to adopt Resolution No. NS-30,260**, finding that public interest and necessity require the acquisition of interests in certain real property on Assessor's Parcel Number 072-174-02, located in the unincorporated area of Santa Cruz County, and authorizing the City Attorney to proceed with eminent domain proceedings to acquire the real property.

Resolution of Necessity for Brackney Landslide Area Pipeline Risk Reduction Project: 321 Brackney Road, Ben Lomond, CA 95005, APN 072-231-12, owned by Julie K. Daniels (WT/CA)

Motion **carried to adopt Resolution No. NS-30,261**, finding that public interest and necessity require the acquisition of interests in certain real property on Assessor's Parcel Number 072-231-12, located in the unincorporated area of Santa Cruz County, and authorizing the City Attorney to proceed with eminent domain proceedings to acquire the real property.

PROPOSED MOTION: Accept the City Council actions affecting the Water Department.

ATTACHMENTS: None.

Water Commission
7:00 p.m. – November 27, 2023
Council Chambers
809 Center Street, Santa Cruz

Summary of a Water Commission Meeting

Call to Order: Chair Burks called the meeting to order at 7:02 PM in the Council Chambers.

Roll Call

Present: J. Burks (Chair); T. Burns; D. Engfer (Vice Chair); M. Goddard, J. Lear, and S. Ryan.

Absent: None

Staff: R. Menard, Water Director; D. Baum, Deputy Director/Chief Financial Officer; C. Borrowman, Associate Planner II; H. Cagliero, Administrative Assistant III; H. Luckenbach, Deputy Director/Engineering Manager; S. Mitchler, Administrative Assistant III; and S. Perez, Principal Planner.

Others: C. Llerandi, Consultant at Kennedy Jenks; C. Tana, Consultant at Mongomery & Associates; P. Wickham, Consultant at Montgomery & Associates; and one member of the public.

Statements of Disqualification: None.

Oral Communications:

At 7:04 p.m. Chair Burks opened Oral Communications and the following person spoke:

Becky Steinbruner

Chair Burks closed Oral Communications at 7:08 p.m.

Announcements: Water Director Menard announced that the 60-day public review for the draft Environmental Impact Report for the Graham Hill Water Treatment Plant Facilities Improvement Project will begin on Thursday, December 7, 2023, and end in early February of 2024. There are two public meetings scheduled, one will be on January 17, 2023, from 5:30 pm to 6:30 pm in the Police Community Room the other will be held virtually on January 18, 2023, from 2:00 pm to 3:00 pm.

Holly Cagliero announced Sarah Mitchler, Administrative Assistant III, who recently joined the Water Department.

Consent Agenda:

1. City Council Items Affecting the Water Department

2. Water Commission Minutes from October 2, 2023

Item 3 was pulled for further discussion.

4. Working Draft – Calendar Year 2024 Water Commission Work Plan

No public comments were received.

Commissioner Lear moved approval of the Consent Agenda as amended. Commissioner Ryan seconded.

VOICE VOTE:	MOTION CARRIED
AYES:	All
NOES:	None
DISQUALIFIED:	None

Items removed from the Consent Agenda:

3. Water Supply Augmentation Implementation Plan Quarterly Report

On page 3.3 of agenda packet, Scotts Valley's "reliable infrastructure capacity" to provide water to the City of Santa Cruz (City) is mentioned. How is reliability being defined for this situation?

- While the project is being designed and constructed for up to 1 million gallons per day (mgd) bi-directional water transfers, with potential to expand to 1.5 mgd bi-directional water transfers, Scotts Valley Water District (SVWD) has constraints with their existing wells that prohibit long-term (more than one or two days) pumping of up to 1 mgd. The constraint is well capacity and concern for significant drawdown in the wells that would cause damage to the well infrastructure. Reliable pumping will require an additional well in SVWD.

Does the failure of the bond issue relating to the new Fire Department facility in Scotts Valley have any impact on the Intertie Project?

- Yes, the impact to the Intertie project is positive because without construction happening at that site, we can get a temporary construction easement to use it for the Intertie 1 project.

Can you describe the level of engagement in conversations on collaboration with the City of Scotts Valley and San Lorenzo Valley Water District (SLVWD)?

- The conversations regarding the Intertie 1 Project have been very collaborative and are working positively for both agencies.

Can you elaborate on what is included in the Request for Proposals (RFP) for SLVWD for the productive use of their allocation out of Loch Lomond?

- In the 2009/2010 timeframe, SLVWD looked into how to access the roughly 100,000,000 gallons per year (313.4 acre feet per year) of their contractual water right to Loch Lomond storage. They examined two options at that time; one was connecting to the Newell Creek Pipeline and piping the water to the Kirby Treatment Plant for treatment, and the other was an interruptible supply of water from the City of Santa Cruz Water Department (SCWD) delivered by an intertie that would need to be constructed. A cost estimate for the two options was completed and used to inform the recommendation to pursue a raw water connection to the Newell Creek Pipeline. The purpose of the new study is to update the cost estimate numbers and to look at a potential non-interruptible, treated water supply arrangement with SCWD, providing updated information on both raw water and treated water options for SLVWD to use in its decision making about how to access its Loch Lomond water entitlement.

When will the report on Riverbank Filtration be completed?

- That report will be completed at the end of January 2024.

Can you please elaborate on the opportunity for collaboration with the City of Scotts Valley on wastewater use?

- The collaboration is going well, and meetings are occurring at least quarterly with the City of Scotts Valley and Scotts Valley Water District. The City of Scotts Valley's wastewater plant does not produce a very high volume of wastewater and the available volume is further reduced by the arrangement the City has with SVWD for non-potable reuse water for irrigation of City medians and parks and their commitment to provide secondary treated water to the Pasatiempo Golf Course for their further treatment and use in golf course irrigation. The ongoing conversations are exploring important questions that need to be answered in order to make this a feasible option.

In this document, it is mentioned that there is a potential for up to 5 million gallons per day treatment capacity at the Beltz well field but that the target production would be 1-3 million gallons per day (mgd). Is the treatment capacity a realistic amount that could be produced daily? 19:46

- The Beltz Treatment Plant currently produces 1 mgd but was sized for 2 mgd capacity. The consultant was asked to find how much treated water could be produced at that site, and they came up with two designs; one which produced a little more than 3 mgd, and another that produced roughly 5 mgd. We are working with the team and our operations group to balance the interest in getting as much Aquifer Storage and Recover (ASR) out of that system with the amount of infrastructure installation required to avoid building another groundwater treatment plant.

Does the Water Department have riverbank filtration wells?

- Yes. The riverbank filtration wells that we have are vertical wells, although riverbank filtration wells are usually related to horizontal wells. Nevertheless, in practice our vertical Tait wells are riverbank filtration wells producing surface water.

What is the Bureau of Reclamation (USBR) Feasibility Study?

To qualify for potential funding from the USBR Title XVI Program, which funds various kinds of recycled water supply projects, a feasibility analysis must be completed that meets USBR's requirements. The requirements are for work that is very similar study to the Phase 1 Recycled Water Study from 2018 that was performed by Kennedy Jenks.

Ultimately, the Department will "repackage" the various recycled water feasibility analyses it has completed into a format that meets USBR's requirements. We're waiting to do that until the WSAIP is complete and can submit the required USBR feasibility analyses and pursue funding for any recommended projects.

Chair Burks opened public comment and the following person spoke:

Becky Steinbruner

Chair Burks closed public comment.

Commissioner Ryan moved approval of the Consent Agenda as amended. Vice Chair Engfer seconded.

VOICE VOTE:	MOTION CARRIED
AYES:	All
NOES:	None
DISQUALIFIED:	None

Chair Burks moved to Item 6 and Item 7 due to technical issues.

General Business

5. Water Supply Augmentation Implementation Plan (WSAIP): Updates on Groundwater Modeling in Mid-County and Santa Margarita Groundwater Basins, and Santa Cruz Water Supply Planning

Water Director R. Menard introduced H. Luckenbach, Deputy Water Director/Engineering Manager, who presented updates on the Water Supply Augmentation Implementation Plan (WSAIP) with assistance from C. Llerandi, Consultant at Kennedy Jenks; C. Tana, Consultant at Mongomery & Associates; and P. Wickham, Consultant at Montgomery & Associates.

For Loch Lomond, is the dead-pool level (the level below which we can't access any water) determined by water supply, not by water quality?

- Water quality data was reviewed for a variety of parameters all the way down to the new intake structures and no water quality constraints were noted. However, when the lake is drawn down to the minimum pool level, it can expose it to the possibility of more challenging algal blooms or turbidity from sediment washing in over exposed banks. But based on looking at over 20 years' worth of water quality data from deeper reservoir elevations, we're not seeing anything alarming.

  The two other constraints on how we operate Loch Lomond are the water rights and the annual yield we are allowed to take from the lake.

Is it true that Pure Water Soquel could be expanded to 3,000 acre-feet per year?

- The capacity of the conveyance that was installed for Pure Water Soquel is sized for 3,000 acre-feet. The current treatment plant capacity is only 1,500 acre-feet and would have to be upgraded to produce 3,000 acre-feet.

Regarding the modeling work for the Intertie 1 Project, can Scotts Valley Water District sustain sending 0.4 mgd for 10 months out of each year to the City during projected sequential dry years?

- Based on this first groundwater model scenario (Scenario 1 in the presentation), the answer is both yes and no. Scotts Valley Water District does have well capacity to provide 0.4 mgd to the City for 10 months, however, Scenario 1 shows groundwater levels falling below minimum thresholds during the multi-year drought period. Future scenarios will modify the assumptions in the model by redistributing pumping amongst existing wells and potentially add new wells to avoid this condition.

It was mentioned that for the Intertie 1 Project modeling scenario, we would be pulling out the same amount as we would be putting in for in lieu, is there any accounting for water loss for that?

- No, it was modeled with a 1-in, 1-out basis.

Can you please explain the term ‘dead pool’?

- Dead pool is standard terminology for the water below the lowest intake that is only accessible by pumping (usually this is only done in emergency situations and requires installation of special equipment).

If Loch Lomond were drawn down to 25% in the summer, does that open up opportunities to capture excess water in the lake during the winter?

- Opening available volume could allow the capture of excess water in the lake during the winter. However, dropping the storage to this low level assumes a big risk in terms of water supply for the following dry season if the winter does not fill or even substantially fill the reservoir. Also, the water rights limit the annual withdrawal from the reservoir to 1.042 million gallons.

Are there still obligations under the Anadromous Salmonid Habitat Conservation Plan (ASHCP) for releases for fish even in those critically dry years?

- Yes. The license agreement requires a 1 cubic foot per second (cfs) release all the time, and that would have to be in place even in critically dry years.

Is SLVWD’s interest in their water right to 313 acre-feet from Loch Lomond per year taken into account in the calculations when looking at drawdowns?

- Yes, this has been taken into account for the calculations when looking at drawdowns and water volume available to the City from Loch Lomond.

How much do you trust the models generated using machine learning?

- The basis of the groundwater model is the physics of groundwater flow. Any machine learning would use the same groundwater model used for the Groundwater Sustainability Plan (GSP), which had been run many times and the data from this can serve as comparison and quality control to test results from machine learning runs against.

  What we are using the machine learning for is guided optimization, and the goal is not to replace the groundwater model and its more human-driven operations, but to augment available results by iteratively running the groundwater model and exploring all the different variations of the project setups that we can imagine.

For ASR, is the idea to expand the project to use unused supply as the source or water to fill unmet demand?

- ASR is a supply augmentation project. Available water during wet winters would be used to store water in local aquifers through planned or expanded ASR or potentially could be transferred to Soquel Creek Water District in addition to the baseline ASR/PWS project volumes.

What is the definition of unused surface water in the context of the Mid-County Basin Optimization Study?

- The unused surface water is the available surface water in the winter from the City's surface water resources which can't be stored in Loch Lomond or elsewhere minus the baseline of the assumed 1 mgd capacity of the Beltz wells for injection. The data provided to generate this calculation is based on the water system source flow models, which looks at each of the flowing sources and applies the water rights, agreed flows, and production demand to generate the amount of water available for augmentation.

On slide 52, can you please explain how the 2.2 MGD purified potential capacity in 2022 was calculated?

- The average amount of wastewater available in the summer from 2015 to 2022 was 4 mgd. The amount of wastewater available in the summer of 2022 was 3 mgd, which is below the average because it was a particularly dry year, and the purified potential capacity for that year was 2.2 MGD.

Is there a benefit for rerunning the hydrology outcomes as we get more real-world climate data?

- It is better to not think of these future hydrologies created using climate models the same way that we think about the historic record for climate. The main purpose of these scenarios is use for future planning and for running projections using historic data sets. The historic data sets used are regularly updated to incorporate actual flow data.

  Work on the surface and groundwater models used for planning will need to continue to develop as we get more data and experience with how the climate is evolving. Monitoring well data will need to be incorporated into the model, which will start to include the Pure Water Soquel Project and ASR Project effects, and attention will need to be given to climate and how successful our projects are. This updated information will help us adjust water supply augmentation plans as needed based on future model runs that reflect updated conditions.

Can you please explain what is meant by the 'average annual basin-wide water budget between baseline and banking scenario does not change over time' on slide 16 of the presentation?

- While using best-operational information, Scenario 1 (the baseline groundwater model scenario) was set up so no banked water was left in the basin at the end of the simulation period (WY2072). The comment on slide 16 reiterates this and has been modified/clarified in the updated presentation slides. As noted elsewhere in the presentation, subsequent model scenarios will modify the assumptions about losses and leave-behind volumes of water.

On slide 21, the data in the precipitation comparison tables is all timestamped in the month of October, is this data the monthly average at the end of the water year?

- Each average value is an average of the previous twelve months (i.e., the annual average). The average value is labeled with October 1st of each year because it is the first day of the water year.

While the pumping from the groundwater basin is not affected by climate, would dry periods impact natural recharge and in turn affect the amount of water available in the basin?
- Yes, you do see some effects from climate because of that situation, and it affects some locations and types of geologic formations that make up our local groundwater basins more than others.

On slide 26, the source to meet the unmet demand would have to come from somewhere else because the baseline includes ASR, correct? For example, in the 1270 climate model scenario, in September there is a 43% shortfall of unmet demand.
- To clarify, in the 1270 climate model scenario, the 43% unmet demand for September indicates that 43% of Septembers will have shortfall; the percentage is not a reflection of the quantity, but a measure of the frequency which shortfall is predicted to occur.

  The unmet demand would have to be met by something other than the baseline ASR and the potential sources that are being looked at to fill that gap is increased capacity of ASR for existing wells, adding new ASR wells, and transfers between the City and other agencies.

What outreach are staff considering to share this information with the public as the WSAIP gets ready to go to City Council?
- A study session with the City Council could be a good way to bring forward this information to them before the solution goes to Council for their consideration and action. Other opportunities include having the video of the study session with Council posted to the website, so it is available to the public, and working with the communications staff to engage with the community on this content.

Chair Burks opened public comment and the following person spoke:

Becky Steinbruner

Chair Burks closed public comment.

No motion was required for this item as it was informational only.

Subcommittee/Advisory Body Oral Reports

6. Santa Cruz Mid-County Groundwater Agency (MGA)

The MGA will meet next on December 14th and the agenda will include an update on the periodic evaluation and preliminary modeling work from the Mid-County Optimization Study that is currently in progress. The next meeting after that will be in March and the agenda will include an update on the initial well registration program.

7. Santa Margarita Groundwater Agency (SMGWA)

The SMGWA met last on October 26^{th}, and the agenda included presentation of information and recommendations by the ad hoc committee for improvements to the annual reporting process for the Groundwater Sustainability Plan (GSP), which were approved by the Board. Discussion during the meeting covered the following topics: some recovery in the basin was noted in the monitoring well network; stage 1 of the project to construct the monitoring well network was completed on time and under budget; and treasury management due to increasing interest rates. The SWGWA is not scheduled to meet again until February.

Chair Burks moved to Item 5.

Director's Oral Report: None.

Information Items: Information items included in the agenda packet were not discussed.

Adjournment: The meeting was adjourned at 9:38 PM.

WATER COMMISSION
INFORMATION REPORT

DATE: 01/04/2024

AGENDA OF:	1/11/2024
TO:	Water Commission
FROM:	David Baum, Chief Financial Officer Malissa Kaping, Principal Management Analyst
SUBJECT:	Fiscal Year 2023 4th Quarter Unaudited Financial Report

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RECOMMENDATION: That the Water Commission accept the Fiscal Year 2023 (FY 2023) 4th Quarter Unaudited Financial Report.

BACKGROUND: On June 6, 2016, the Water Commission approved the Water Department's Long-Range Financial Plan (LRFP) which created a framework to ensure financial stability and maintain the credit rating needed to debt finance major capital investments planned for the utility. An updated LRFP was approved by the Water Commission on August 23, 2021. The LRFP includes financial targets for debt service coverage ratio (1.5x), a combined 180-days cash on hand, $3 million in an Emergency Reserve, and a $10 million Rate Stabilization Reserve.

The data in the Quarterly Financial Report provides a snapshot in time and represents the time period of July 1, 2022, through June 30, 2023. The City operates on a fiscal year basis, which closes on June 30th.

In 2019, an Ad Hoc Subcommittee of the Water Commission and Water Department staff worked together to update the quarterly financial report. The purpose of the update was to provide a clearer picture of financial trends and results to the Water Commission. By conveying better information, we are able to show successes, identify problem areas, and provide information to demonstrate that appropriate responses are being implemented. With each successive financial report, Department staff have updated the report to reflect Commissioners' comments and further refine the information presented.

DISCUSSION: The attached financial report presents the Department's unaudited fiscal outlook through the fourth quarter of FY 2023 and reflects the transactions posted during the time period of July 1, 2022, through June 30, 2023. Page 1 of the attached Financial Report is focused on the Operating budget and Page 2 summarizes the Capital budget. Noteworthy items are discussed on the following pages.

Operating Revenues

Water sales are 4% below budgeted amounts. The FY 2023 water sales totaled $38.2 million. Water sales have not grown since FY 2020 suggesting that customers are motivated by cost and a strong community water use efficiency effort to maintain a low rate of consumption.

For the twelve-month period ending June 30, 2023, consumption was one percent higher compared to the same period last year.

In FY 2023, the Department received $549,799 from a Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant and from the California Office of Emergency Services for the Brackney Landslide Pipeline Risk Reduction project to mitigate potential damage from increasing severe storms. $124,976 was received from FEMA to compensate for losses incurred in the CZU fire in August 2020. $281,881 was received from Scotts Valley Water District (SVWD) from the Department of Water Resources' grant to the Scotts Valley Water District, to reimburse the Water Department for costs associated with the intertie to SVWD.

In the period FY 2021 to December 12, 2023, Water Department staff submitted fifty-eight Drinking Water State Revolving Fund (SRF) disbursement claims to the State Water Resources Control Board (SWRCB) for the Newell Creek Inlet/Outlet Pipeline replacement and Concrete Tanks replacement projects totaling $111 million. Through December 19, 2023, $103 million was received and $8.3 million is owed to Santa Cruz Water Department (SCWD).

A $50 million line of credit (LOC) was obtained on June 15, 2021, to supplement cash flow while SCWD awaits reimbursement from SRF. $21 million was drawn from the line of credit. $5 million was repaid on December 1, 2022, and $16 million remains outstanding.

On May 4, 2023, SCWD received a $127.7 million loan from the United States Environmental Protection Agency (EPA) through its Water Infrastructure Finance and Innovation Act (WIFIA) Loan program. The Loan provides 49% of the funding needed for the Graham Hill Water Treatment Plant improvements, Newell Creek Pipeline Replacement (GHWTP – Felton), University Tank 4 Replacement, and Aquifer Storage and Recovery projects. This loan program has produced loans for other water agencies with more favorable terms than are available in traditional capital markets. The loan to SCWD carries an interest rate of 3.77% and matures in 40 years. Compared to a tax-exempt bond issue, we estimate interest savings of more than $18 million over the life of the loan.

The expected reimbursements, line of credit and grants described above will help improve cash flow and cash reserves contemplated by the LRFP.

Operating Expenses

Operating expenses are 14% below the Adopted Budget. Personnel costs are down 16% due primarily to the 10-14 vacant positions during the fiscal year. The vacancy rate is approximately 10% of budgeted positions; the FY 2023 budget assumed no vacancies. Approximately $1.7 million in personnel expenses were charged to capital projects; the budgeted amount was $1 million, which drove down the operating expenditures. Debt service increased 14% above the budget. This increase reflected the $31.2 million in drawdowns from the SRF during FY 2023. Also, the interest rate on the $16 million LOC increased from 2.28% to 5.85% during FY 2023 as federal interest rates increased as part of the Federal Reserve's strategy to manage inflation.

Services, Supplies and Other expenses decreased 18% compared to the FY 2023 budget. Significant operating expenses which ended the year lower than the budget are as follows:

- Legal, training, printing/binding and postage are under budget by $256,000.

- Electricity cost for the period was $1,162,000, which is under budget by $462,000 compared to the Adopted Budget. Electricity costs were down 15%, when compared to the same period last year. As improvements are designed for the water system, we will be taking additional steps needed to comply with the City's Climate Action Plan, which for example, may involve acquisition of additional zero-emission vehicles.

- Other professional and technical services were $1,355,000, which was under budget by $704,000. The three largest expenses charged to this account were Badger monthly charges for the Advanced Meter Infrastructure service totaling $151,000, charges to JV Lucas Paving totaling $143,000 for road repair for a pipeline project, and charges to Granite Construction's emergency pipeline repair totaling $89,000. Most charges are routine.

- Maintenance for water systems was $1,060,000, which is under budget by $542,000, compared to the Adopted Budget. 90% of this budget is for environmental compliance including habitat conservation, watershed lands restoration, drinking water source protection and water rights maintenance. Our water resources unit was able to perform its duties with much less outside resources than expected.

Operating expenses that were over budget included merchant bank fees, which were $535,000 ($235,000 over budget). These higher fees indicate a dramatic increase in credit card usage by ratepayers. SCWD does not charge a "convenience fee" for paying bills with credit cards. Last year, these fees totaled $357,000.

These highlighted operating expenses are paid from the Services, Supplies and Other line items.

<u>Capital Investment Program (CIP) Highlights</u>

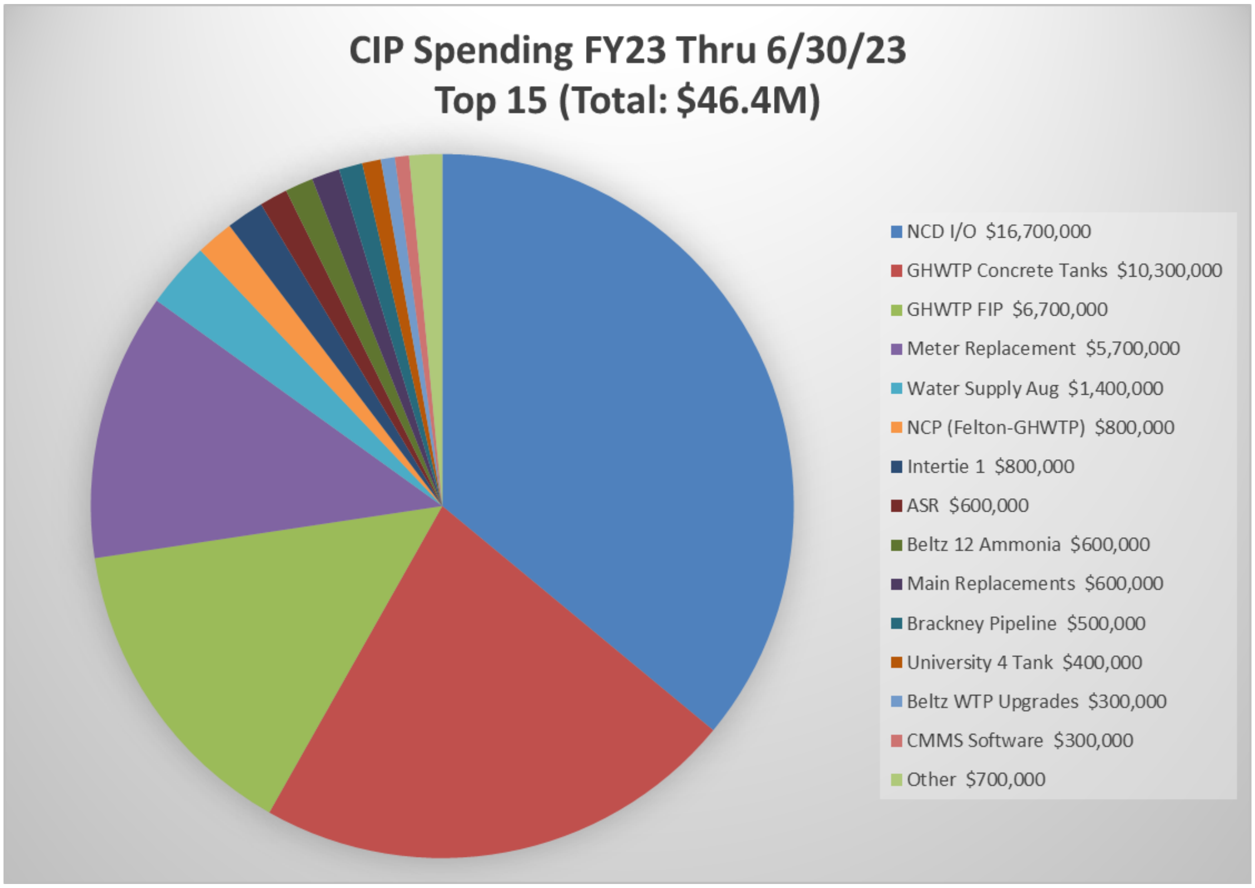
The Department completed $46.4 million in capital improvements during Fiscal Year 2023. 85% percent of spending occurred on four projects: Newell Creek Dam Inlet/Outlet Replacement Project, GHWTP Concrete Tanks Replacement Project, GHWTP Facilities Improvement Project, and the Meter Replacement Project. Progress updates regarding the first three projects were presented at the October 2, 2023 Water Commission meeting.

The Department has forty-three active CIP projects in progress with seven currently under construction/implementation:

1. Newell Creek Dam Inlet/Outlet Replacement
2. GHWTP Concrete Tanks Replacement
3. Meter Replacement
4. Beltz 12 Ammonia Removal
5. ASR Pilot at Beltz 9
6. Felton Diversion Pipeline Emergency Repair
7. CMMS Software Replacement

Figure 1 below shows the total fiscal year spending on the top 15 CIP projects.

Figure 1:



The $46.4 million spent on capital work was well below the FY 2023 Amended Budget of $96.6 million. The FY 2023 budget was developed based on schedules and cost estimates from December 2021 which were revised as projects progressed during the 18-month period of January 2022 through June 2023. Unspent funds remaining in the project budgets will be applied to estimates for FY 2025 spending and will reduce the FY 2025 budget request for ongoing funding for active projects.

As mentioned above, the Department received grant funds from FEMA for the design work needed for the Brackney Landslide Area Pipeline Risk Reduction Project and we continue to pursue additional FEMA grant funds for the construction of that project and the Felton Diversion Pipeline Emergency Repair project. The Department also received Department of Water Resources grant funds for the design work for Intertie 1: SVWD-SCWD.

The Total Project Cost Estimate was reduced by nearly $940,000 between the FY 2023 third quarter report and this FY 2023 year-end report due to the lower costs to complete the six projects shown on the attached CIP summary report.

FISCAL IMPACT: None.

PROPOSED MOTION: Motion to accept the FY 2023 4th Quarter Financial Report.

ATTACHMENTS:
1. Santa Cruz Water Department Financial Report

SANTA CRUZ WATER DEPARTMENT FINANCIAL REPORT

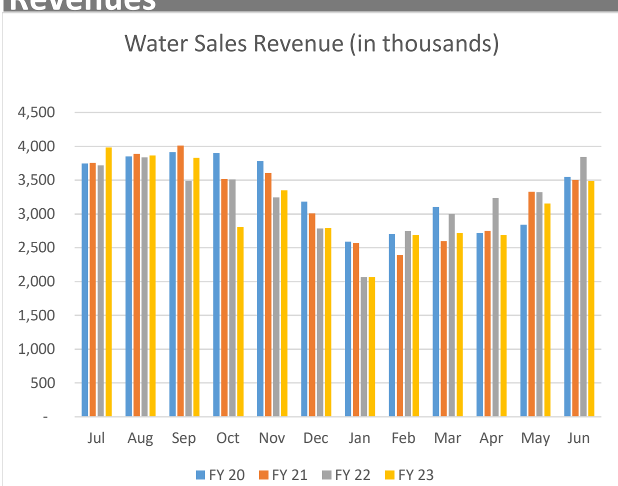
Fiscal Year 2023

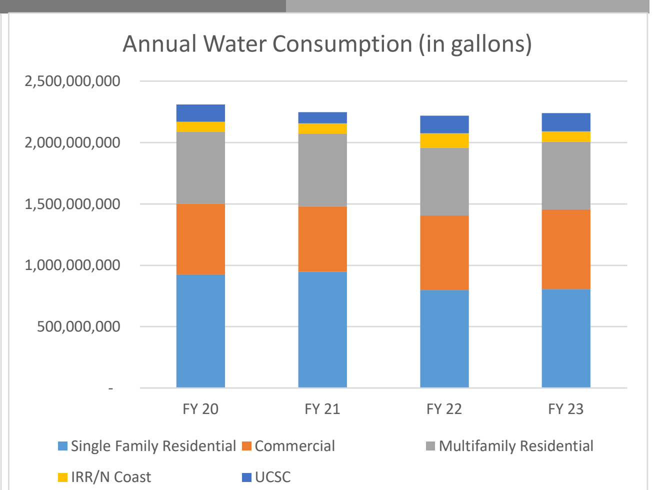
(Unaudited)

Financial Summary

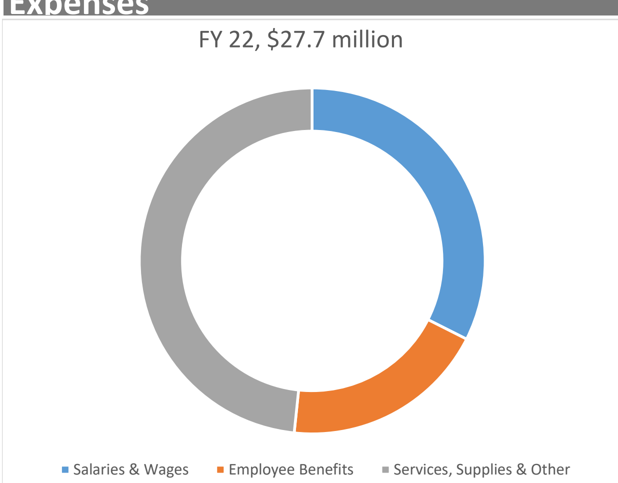
	FY 2023 Adjusted Budget	Actual	Actual vs. YTD Budget Variance $ +/(-)	Actual vs. YTD Budget Variance % +/(-)
Operating Revenues				
Water Sales	39,793,705	38,249,755	(1,543,950)	(4%)
Other Charges for Services	1,219,800	1,461,704	241,904	20%
Other Revenues	575,883	565,769	(10,114)	(2%)
Grants	60,664	971,147	910,483	-
Investment Earnings	6,600	428,680	422,080	-
Total Operating Revenues	41,656,652	41,677,055	20,404	0%
Operating Expenses				
Salaries & Wages	11,440,159	9,545,792	(1,894,367)	(17%)
Employee Benefits	6,471,622	5,582,511	(889,111)	(14%)
Services, Supplies & Other	17,223,256	14,166,870	(3,056,386)	(18%)
Capital Outlay	570,523	494,226	(76,298)	(13%)
Debt Service - long term debt	3,767,981	4,297,265	529,284	14%
Total Operating Expenses	39,473,541	34,086,664	(5,386,878)	(14%)
Net Operating Revenue (Loss)	2,183,110	7,590,391	-	-
Debt Service Coverage (Target >= 1.50x)		2.89		

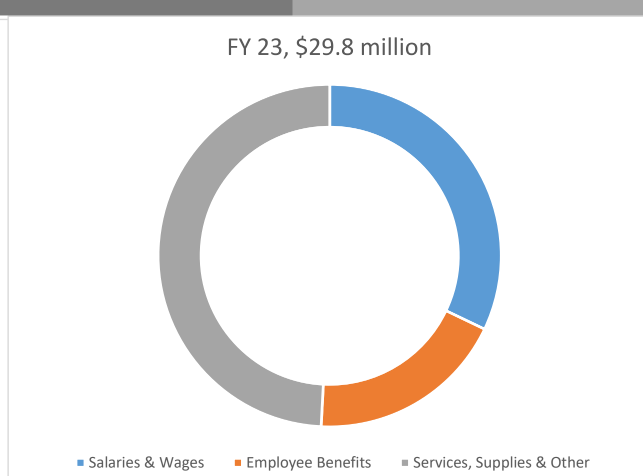
Revenues





Expenses





Cash

Fund Balances	YTD Balance	Year End Target Balance
711 - Enterprise Operations	5,678,109	8,404,931
713 - Rate Stabilization	4,813,063	10,000,000
715 - System Development Charges	7,373,155	n/a
716 - 90 Day Operating Reserve	8,968,008	8,404,931
717 - Emergency Reserve	3,068,949	3,000,000
718 - Mount Hermon June Beetle Endowment	146,151	144,000
719 - Equipment Replacement	590,086	700,000
Total - all funds	30,637,521	
Days' Cash (Includes only Funds 711 & 716)	179	

CIP Summary: Fiscal Year End 2023

Project Titles	Prior Year Actuals	FY23 Actuals	Project Cost Estimate [1] *(escalated dollars)*	Project Schedule
WATER SUPPLY RESILIENCY & CLIMATE ADAPTATION PROJECTS				
Water Supply Augmentation Strategy				
Beltz Wellfield Aquifer Storage and Recovery				
ASR Planning	3,250,079	218,505	5,151,696	2019-2024
ASR Mid County Existing Infrastructure	383,887	343,978	8,971,750	2020-2031
ASR Mid County New Wells	-	-	26,696,860	2021-2027
Santa Margarita Aquifer Storage and Recovery and In Lieu Water Transfers and Exchanges				
ASR Santa Margarita Groundwater	-	23,382	456,381	2020-2027
ASR New Pipelines	-	-	-	2022-2027
In Lieu Transfers and Exchanges	-	-	-	
Studies, Recycled Water, Climate Change, Aquifer Storage and Recovery				
Water Supply Augmentation	1,613,222	1,406,084	89,876,215	2019-2033
Recycled Water Feasibility Study	847,884	67,791	1,792,224	2018-2023
Subtotal Water Supply Augmentation Strategy	**6,095,072**	**2,059,740**	**132,945,127**	
Subtotal Water Supply Resiliency and Climate Adaptation Projects	**6,095,072**	**2,059,740**	**132,945,127**	
INFRASTRUCTURE RESILIENCY AND CLIMATE ADAPTATION				
Raw Water Storage Projects				
NCD I/O Replacement Project	74,224,158	16,723,744	105,378,613	2018-2024
Aerators at Loch Lomond	460,791	186,106	741,911	
Subtotal Raw Water Storage Projects	**74,684,949**	**16,909,850**	**106,120,524**	
Raw Water Diversion and Groundwater System Projects				
Laguna Creek Diversion Retrofit	2,935,396	34,959	3,130,276	2018-2023
Tait Diversion Retrofit	385,639	189,734	7,642,148	2018-2030
Coast Pump Station Rehab/Replacement	-	-	9,777,912	2029-2033
Felton Diversion Pump Station Improvements	351,872	1,667	4,408,650	2020-2029
Beltz 12 Ammonia Removal	177,281	580,090	1,915,818	2021-2025
Beltz WTP Filter Rehabilitation [2] *COMPLETED*	465,370	22,984	488,354	2022-2023
Beltz WTP Upgrades [4]	-	304,628	17,663,985	2022-2028
Subtotal Raw Water Diversion and Groundwater System Projects	**4,315,558**	**1,134,060**	**45,027,143**	
Raw Water Transmission				
Newell Creek Pipeline - Planning [2] *COMPLETED*	1,568,669	2,991	1,571,660	2018-2023
Newell Creek Pipeline Felton/GHWTP	2,555,890	830,115	33,194,375	2019-2027
Newell Creek Pipeline Felton/Loch Lomond	-	-	38,458,126	2027-2033
Newell Creek Pipe - Grant Mgmt [2] *COMPLETED*	10,371	7,498	17,869	2022-2023
Brackney Landslide Area Pipeline Risk Reduction [3]	1,604,376	495,283	11,540,345	2020-2026
North Coast Pipeline - Planning [2] *COMPLETED*	907,956	67	908,023	2018-2022
North Coast Pipeline Repair/Replacement - Ph 4	-	-	90,802,291	2026-2032
Felton Diversion Pipeline Emergency Repair [3] *NEW*	-	181,357	3,164,498	2023
Subtotal Raw Water Transmission	**6,647,262**	**1,517,310**	**179,657,186**	
Surface Water Treatment				
GHWTP Flocculators & Tube Settlers [2] *COMPLETED*	3,285,958	3,077	3,289,035	2018-2022
GHWTP Concrete Tanks Replacement	16,663,399	10,298,665	46,673,142	2018-2026
GHWTP Facilities Improvement Project	9,852,383	6,663,783	151,592,006	2018-2030
River Bank Filtration Study	998,601	5,174	7,028,637	2018-2028
GHWTP SCADA Radio System Replacement	-	2,520	240,000	On-going
GHWTP SCADA IO Hardware & Wiring Upgrade	-	-	230,000	2022-TBD
GHWTP Chlorination Station Improvements [2] *CANCELLED*	-	-	-	Cancelled
Subtotal Surface Water Treatment	**30,800,341**	**16,973,219**	**209,052,820**	
Distribution System Storage, Water Main and Pressure Regulation, and Metering Projects				
University Tank No. 4 Rehab/Replacement	371,278	415,831	6,246,806	2018-2027
Meter Replacement Project	6,901,970	5,655,659	14,910,502	2018-2023
Engineering and Distribution Main Replacement Projects [4]	12,572,235	564,862	37,146,201	On-going
Distribution System Water Quality Improvements	33,725	8,035	107,427	2021-TBD
Facility & Infrastructure Improvements	8,753	1,605	5,020,972	On-going
Intertie 1: Santa Cruz - Scotts Valley [3]	-	788,086	8,720,261	2022-2026
Subtotal Distribution Storage, Wmain Pressure Reg, and Metering	**19,887,961**	**7,434,078**	**72,152,169**	
Subtotal Infrastructure Resiliency and Climate Adaptation	**136,336,071**	**43,968,517**	**612,009,842**	
OTHER RISK MANAGEMENT AND RISK REDUCTION PROJECTS				
Site Safety and Security				
Security Camera & Building Access Upgrades	315,490	9,988	550,996	On-going
GHWTP Gate Entrance Upgrades	878,212	21,689	903,067	2020-2023
CMMS Software Replacement - Water Share	64,479	252,477	390,000	2022-2023
Subtotal Site Safety and Security	**1,258,181**	**284,154**	**1,844,063**	
Staff Augmentation				
Water Program Administration [5]	1	1	16,969,426	On-going
Subtotal Staff Augmentation	**1**	**1**	**16,969,426**	
Contingency				
Management Reserve [6]	-	-	30,291,896	On-going
Subtotal Contingency	**-**	**-**	**30,291,896**	
Storage for Emergency Facility and System Repair Tools and Equipment				
Union/Locust Admin Building Back Up Power Generator	1,970	10,579	110,000	TBD
Subtotal Storage for Emergency and System Repair	**1,970**	**10,579**	**110,000**	
Other Projects				
Branciforte Streambank Restoration [4]	-	86,625	780,143	TBD
Subtotal Other Projects	**-**	**86,625**	**780,143**	
Subtotal Other Risk Management and Risk Reduction Projects	**1,260,152**	**381,359**	**49,995,528**	
GRAND TOTAL	**143,691,295**	**46,409,616**	**794,950,497**	

[1] *Project Cost Estimates are FY23 adopted budget plus FY23 adjustments/carry-forwards plus FY24-32 estimates.*

[2] *Completed projects will be removed from the next report and will reduce the Total Project Cost Estimate.*

[3] *Expenses are not adjusted for grant funding.*

[4] *Prior year actuals for Main Replacements start in FY19.*

[5] *Staff augmentation budget appropriations and actual expenses are transferred to specific projects during fiscal year-end process.*

[6] *Management Reserve budget appropriations are transferred to specific projects upon Change Management approval.*

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WATER COMMISSION
INFORMATION REPORT

DATE: 12/20/2023

AGENDA OF: 01/11/2024

TO: Water Commission

FROM: Chris Berry, Watershed Compliance Manager and Zeke Bean, Associate Planner II

SUBJECT: Take Action to Support Staff's Recommendation to City Council to Adopt the Anadromous Salmonid Habitat Conservation Plan Final Mitigated Negative Declaration and Mitigation Monitoring and Reporting Program

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RECOMMENDATION: That the Water Commission take action to recommend the City Council adopt a resolution adopting the Mitigated Negative Declaration and Mitigation Monitoring and Reporting Program for the Anadromous Salmonid Habitat Conservation Plan.

BACKGROUND: Since 2001, City of Santa Cruz (City) staff, in coordination with staff from the California Department of Fish and Wildlife (CDFW) and the National Marine Fisheries Service (NMFS), have been developing an Anadromous Salmonid Habitat Conservation Plan (ASHCP or Proposed Project) for California Endangered Species Act (CESA) and federal Endangered Species Act (ESA) compliance for various City operation and maintenance activities that may adversely affect special-status anadromous salmonids. The anadromous salmonids covered by the ASHCP include Central California Coast coho salmon (coho) (Oncorhynchus kisutch), a state and federally listed endangered species, and the Central California Coast steelhead (steelhead) (Oncorhynchus mykiss), a federally listed threatened species.

In addition to other impacts, coho and steelhead are listed due to loss and degradation of suitable freshwater and estuarine habitats. Climate-change-driven events such as droughts, excessive rainfall, streambank erosion, and increased water temperatures, as well as activities undertaken by the City and by other entities in the City's source water watersheds such as streamflow diversions, sediment impoundment and release of sediment below diversions, and removal of large woody material from streams all contribute to habitat degradation.

Habitat Conservation Plans (HCPs) are planning documents that are a required component of an incidental take permit (ITP) issued by the National Marine Fisheries Service or the U.S. Fish and Wildlife Service when an entity will conduct activities that result in take of a species listed or likely to be listed under the Endangered Species Act. They describe the affected species, the proposed activities, the effects those activities will have on the species, and how the entity will ensure that the plan implementation will be funded; they also contain conservation strategies that define how the HCP goals will be accomplished.

The ASHCP is a 30-year commitment that, when properly implemented, will provide assurance to the City that no additional restrictions or financial compensation will be required for the mitigation of impacts to covered special status salmonid species in light of unforeseen circumstances. These assurances will allow the City to continue to undertake the essential activities necessary to maintain and operate the City water system and flood control channels.

COVERED ACTIVITIES:

The activities covered under the HCP are largely existing activities that the City has been undertaking for decades. They include the rehabilitation of City water diversion structures and pipelines, diversion and storage of water, operations and maintenance of the City's water system and the flood control channels, the management of City lands and forest roads, and other related activities. Table 1 (Attachment 4) lists the covered activities and a brief description of each activity.

CONSERVATION STRATEGY:

The ASHCP includes a conservation strategy that is designed to avoid, minimize, and fully mitigate to the maximum extent practicable the effects of City activities (Covered Activities) on these special status salmonid species (Covered Species) and their habitat in support of the long-term viability of these populations within streams affected by the Covered Activities. This will primarily be achieved by, amongst other actions, reducing surface water diversions. Any effects remaining after avoidance and mitigation measures (AMMs) have been implemented will be compensated for by contributing to regional, non-flow conservation actions for steelhead and coho.

The conservation strategy is designed to address each stage of the salmonid life cycle, from spawning to incubation and rearing, to migration up and down the stream reaches and in and out of the ocean. It defines a set of key biological goals and objectives (Table 2, Attachment 5) that identifies desired conditions. Additionally, it addresses local limiting conditions such as the effects of diversions, habitat quality, and passage barriers, and it identifies specific measures to achieve these goals and objectives through efforts such as instream flow improvements during each life stage, improvement of City water diversion facilities to reduce sediment impoundment and improve anadromous fish passage, and best-management practices for construction activities.

The conservation strategy includes a non-flow conservation program that will identify, fund, and implement restoration projects to address the remaining effects that cannot be avoided or minimized. It also contains a robust monitoring program to track compliance and effectiveness and allow for adaptive management as needed. Implementation of the HCP and the conservation strategy will support the larger regional effort that is needed to ensure the long-term viability of the species.

DISCUSSION: The Water Department is currently in the process of obtaining related CESA and ESA ITPs that will provide the "take" coverage for these special status anadromous fish species needed to implement the ASHCP and conservation strategy. Because the issuance of an ITP by NMFS under Section 10 of the ESA constitutes a federal action, NMFS has drafted an

Environmental Assessment to comply with the National Environmental Policy Act (NEPA). Additionally, the action by the City to adopt and implement the ASHCP and the subsequent issuance of a Section 2081 ITP by CDFW is a project subject to the California Environmental Quality Act (CEQA). Accordingly, the City has completed the environmental review process and has drafted a Final Mitigated Negative Declaration (MND).

The City prepared the Initial Study, which can be found at:

https://www.cityofsantacruz.com/government/city-departments/water/habitat-conservation-plan

It determined that the Proposed Project may result in potentially significant environmental impacts on biological resources, cultural and tribal cultural resources, geology and soils, hazards and hazardous materials, and noise, but by incorporating the mitigation measures identified in the Mitigation Monitoring and Reporting Program (MMRP), those impacts would either be avoided or mitigated to a point where clearly no significant effect on the environment would occur. The MMRP can be reviewed online at:

https://www.cityofsantacruz.com/home/showpublisheddocument/97239/638398927994316374

Based on those findings, the City prepared the MND for the ASHCP in accordance with CEQA (California Public Resources Code, Section 21000 et seq.) and the CEQA Guidelines (Title 14 of the California Code of Regulations [CCR] 15000 et seq.).

The City distributed the draft Initial Study and Mitigated Negative Declaration (ISMND) for a 30-day public review period from August 25 to September 25, 2023. Based on the Initial Study and the whole record, the City has determined that, with incorporation of Project-specific AMMs in the Initial Study, the Proposed Project would not result in a significant adverse effect on the environment. There is no substantial evidence, considering the whole record before the lead agency, that the Proposed Project may have a significant effect on the environment. Therefore, the preparation of an environmental impact report (EIR) was not required.

While no public comments were received during the public review period, a letter of support from the California Department of Fish and Wildlife was accepted late with prior approval of an extension. The Final MND has been prepared and staff are recommending that the Water Commission take action to recommend that Council adopt the final MND and MMRP.

NMFS initiated a 30-day public comment period for the ASHCP Draft Environmental Assessment (EA) on September 11, 2023, and received no public comments. NMFS is currently preparing the Final EA and Finding of No Significant Impact (FONSI).

With the Water Commission’s recommendation that the City Council adopt the Final MND, the next step would be for City Council to adopt the Final MND. The proposed City Council Agenda Report is attached.

FISCAL IMPACT: Adoption of the Final Mitigated Negative Declaration has no direct fiscal implications. However, implementation of the ASHCP and conservation strategy will have fiscal impacts annually over the 30-year permit period related to the ASHCP monitoring program, non-flow conservation projects, and ongoing project management and oversight needs. Funds to support implementation are included in the Water Department's 2021 Long Range Financial Plan and in the Water Department's Fiscal Year 2025 budget in the Habitat Conservation Programs Project (o700803) to complete the first year of implementation.

PROPOSED MOTION: Motion to support staff's recommendation that City Council adopt a resolution adopting the Final Mitigated Negative Declaration for the Anadromous Salmonid Habitat Conservation Plan.

ATTACHMENT(S):

1. Proposed City Council Agenda Report for January 23, 2024
2. Proposed Resolution
3. California Department of Fish and Wildlife Letter of Support
4. Summary of Covered Activities (Table 1)
5. Biological Goals and Objectives (Table 2)

CITY COUNCIL
AGENDA REPORT

DATE: 12/20/2023

AGENDA OF: 01/23/2024

DEPARTMENT: Water

SUBJECT: Anadromous Salmonid Habitat Conservation Plan – Adoption of a Final Mitigated Negative Declaration and Mitigation Monitoring and Reporting Program (WT)

RECOMMENDATION: Resolution adopting the Mitigated Negative Declaration and Mitigation Monitoring and Reporting Program for the Anadromous Salmonid Habitat Conservation Plan.

BACKGROUND: Since 2001, City of Santa Cruz (City) staff, in coordination with staff from the California Department of Fish and Wildlife (CDFW) and the National Marine Fisheries Service (NMFS) have been developing an Anadromous Salmonid Habitat Conservation Plan (ASHCP) for California Endangered Species Act (CESA) and federal Endangered Species Act (ESA) compliance for various City operation and maintenance activities that may adversely affect special-status anadromous salmonids. The anadromous salmonids covered by the ASHCP include Central California Coast coho salmon (coho) (Oncorhynchus kisutch), a state and federally listed endangered species, and the Central California Coast steelhead (steelhead) (Oncorhynchus mykiss), a federally listed threatened species.

In addition to other impacts, coho and steelhead are listed due to loss and degradation of suitable freshwater and estuarine habitats. Climate change driven events such as droughts, excessive rainfall, streambank erosion, and increased water temperatures, as well as activities undertaken by the City and by other entities in the City's source water watersheds such as streamflow diversions, sediment impoundment and release of sediment below diversions, and removal of large woody material from streams all contribute to habitat degradation.

Habitat Conservation Plans (HCPs) are planning documents that are a required component of an incidental take permit (ITP) issued by the National Marine Fisheries Service or the U.S. Fish and Wildlife Service when an entity will conduct activities that result in take of a species listed or likely to be listed under the Endangered Species Act. They describe the affected species, the proposed activities, the effects those activities will have on the species, and how the entity will ensure that the plan implementation will be funded; and they contain conservation strategies that define how the HCP goals will be accomplished.

The ASHCP is a 30-year commitment that, when properly implemented, will provide assurance to the City that no additional restrictions or financial compensation will be required for the mitigation of impacts to covered special status salmonid species in light of unforeseen circumstances. These assurances will allow the City to continue to undertake the essential activities necessary to maintain and operate the City water system and flood control channels.

COVERED ACTIVITIES:

The activities covered under the HCP are largely existing activities that the City has been undertaking for decades. They include the rehabilitation of City water diversion structures and pipelines, diversion and storage of water, operations and maintenance of the City's water system and the flood control channels, the management of City lands and forest roads, and other related activities. Table 1 (attached) lists the covered activities and a brief description of each activity.

CONSERVATION STRATEGY:

The ASHCP includes a conservation strategy that is designed to avoid, minimize, and fully mitigate to the maximum extent practicable the effects of City activities (Covered Activities) on these special status salmonid species (Covered Species) and their habitat in support of the long-term viability of these populations within streams affected by the Covered Activities. This will primarily be achieved by, amongst other actions, reducing surface water diversions. Any effects remaining after avoidance and mitigation measures (AMMs) have been implemented will be compensated for by contributing to regional, non-flow conservation actions for steelhead and coho.

The conservation strategy is designed to address each stage of the salmonid life cycle, from spawning to incubation and rearing, to migration up and down the stream reaches and in and out of the ocean. It defines a set of key biological goals and objectives (Table 2, attached) that identifies desired conditions. Additionally, it addresses local limiting conditions such as the effects of diversions, habitat quality, and passage barriers, and it identifies specific measures to achieve these goals and objectives through efforts such as instream flow improvements during each life stage, improvement of City water diversion facilities to reduce sediment impoundment and improve anadromous fish passage, and best management practices for construction activities.

The conservation strategy includes a non-flow conservation program that will identify, fund, and implement restoration projects to address the remaining effects that cannot be avoided or minimized. And it contains a robust monitoring program to track compliance and effectiveness and allow for adaptive management as needed. Implementation of the HCP and the conservation strategy will support the larger regional effort that is needed to ensure the long-term viability of the species.

DISCUSSION: The Water Department is currently in the process of obtaining related CESA and ESA ITPs that will provide the "take" coverage for these special status anadromous fish species needed to implement the ASHCP and conservation strategy. Because the issuance of an ITP by NMFS under Section 10 of the ESA constitutes a federal action, NMFS has drafted an Environmental Assessment to comply with the National Environmental Policy Act (NEPA).

Additionally, the action by the City to adopt and implement the ASHCP and the subsequent issuance of a Section 2081 ITP by CDFW is a project subject to the California Environmental Quality Act (CEQA). Accordingly, the City has completed the environmental review process and has drafted a Final Mitigated Negative Declaration (MND).

The City prepared the Initial Study, which can be found at https://www.cityofsantacruz.com/government/city-departments/water/habitat-conservation-plan. It determined that the Proposed Project may result in potentially significant environmental impacts on biological resources, cultural and tribal cultural resources, geology and soils, hazards and hazardous materials, and noise, but by incorporating the mitigation measures identified in the Mitigation Monitoring and Reporting Program (MMRP), those impacts would either be avoided or mitigated to a point where clearly no significant effect on the environment would occur. The MMRP can be reviewed online at https://www.cityofsantacruz.com/home/showpublisheddocument/97239/638398927994316374. Based on those findings, the City prepared the MND for the ASHCP in accordance with CEQA (California Public Resources Code, Section 21000 et seq.) and the CEQA Guidelines (Title 14 of the California Code of Regulations [CCR] 15000 et seq.).

The City distributed the draft Initial Study and Mitigated Negative Declaration (ISMND) for a 30-day public review period from August 25 to September 25, 2023. Based on the Initial Study and the whole record, the City has determined that, with incorporation of Project-specific AMMs in the Initial Study, the Proposed Project would not result in a significant adverse effect on the environment. There is no substantial evidence, considering the whole record before the lead agency, that the Proposed Project may have a significant effect on the environment. Therefore, the preparation of an environmental impact report (EIR) was not required.

While no public comments were received during the public review period, a letter of support from the California Department of Fish and Wildlife was accepted late with prior approval of an extension. The Final MND has been prepared and Staff is recommending that the Water Commission take action to recommend that Council adopt the final MND and MMRP.

NMFS initiated a 30-day public comment period for the ASHCP Draft Environmental Assessment (EA) on September 11, 2023, and received no public comments. NMFS is currently preparing the Final EA and Finding of No Significant Impact (FONSI).

FISCAL IMPACT: Adoption of the Final Mitigated Negative Declaration has no direct fiscal implications. However, implementation of the ASHCP and conservation strategy will have fiscal impacts annually over the 30-year permit period related to the ASHCP monitoring program, non-flow conservation projects, and ongoing project management and oversight needs. Funds to support implementation are included in the Water Department's 2021 Long Range Financial Plan and in the Water Department's Fiscal Year 2025 budget in the Habitat Conservation Programs Project (o700803) to complete the first year of implementation.

ATTACHMENT(S):

1. Resolution

2. California Department of Fish and Wildlife letter of support.
3. Summary of Covered Activities (Table 1).
4. Biological Goals and Objectives (Table 2).

RESOLUTION NO. NS-xx,xxx

RESOLUTION OF THE CITY COUNCIL
OF THE CITY OF SANTA CRUZ ADOPTING THE
FINAL MITIGATED NEGATIVE DECLARATION AND ADOPTING THE
MITIGATION MONITORING AND REPORTING PROGRAM FOR THE
ANADROMOUS SALMONID HABITAT CONSERVATION PLAN

WHEREAS, the City of Santa Cruz (hereinafter "City") through its Water and Public Works functions conducts various operation and maintenance activities that may adversely affect Central California Coast coho salmon (coho) (Oncorhynchus kisutch), a state and federally listed endangered species, and the Central California Coast steelhead (steelhead) (Oncorhynchus mykiss), a federally listed threatened species; and

WHERAS, since 2001, in coordination with staff from the California Department of Fish and Wildlife and the National Marine Fisheries Service the City has been developing an Anadromous Salmonid Habitat Conservation Plan ("ASHCP") for California Endangered Species Act and federal Endangered Species Act compliance; and

WHEREAS, The ASHCP includes a conservation strategy that is designed to avoid, minimize, and fully mitigate the effects of the operation, maintenance, and rehabilitation of the City's water supply and water system facilities, including surface water diversions; operation and maintenance of the City's municipal facilities; and management of City lands (the "Covered Activities") on covered species and their habitat in support of the long-term viability of these populations within streams affected by the ASHCP Covered Activities; and

WHEREAS, the City is pursuing Federal and State Incidental Take Permits that will provide the "take" coverage for these special status anadromous fish species needed to implement the ASHCP and Conservation Strategy and allow the City to operate and maintain critical water supply and flood control facilities and systems providing significant public benefits; and

WHEREAS, the ASHCP is a 30-year commitment that, when implemented, will provide assurance to the City that no additional restrictions or financial compensation will be required for the covered species considering unforeseen circumstances; and

WHEREAS, the City, as lead agency under the California Environmental Quality Act (Pub. Res. Code Section 21000 et seq.) and the State CEQA Guidelines (14 Cal. Code Regs. Section 15000 et seq.) (collectively "CEQA"), has completed the Initial Study and Mitigated Negative Declaration ("IS/MND") for the Anadromous Salmonid Habitat Conservation Plan (incorporated herein by reference as Exhibit A) in compliance with CEQA; and

Whereas, in accordance with Section 15072 of the CEQA Guidelines, the City released a Notice of Intent to Adopt a Mitigated Negative Declaration ("NOI") for the Anadromous Salmonid Habitat Conservation Plan on August 25, 2023, providing for a 30-day public review and comment period ending on September 25, 2023, and on the same day filed the NOI with the

Santa Cruz County Clerk and State Clearinghouse notifying relevant public agencies of the availability of the IS/MND for review and the closing date for receiving comment; and

WHEREAS, the NOI was also posted at the City Planning and Community Development Department, and the Draft MND document was available for review at the City's website and in digital format at the Santa Cruz Public Libraries; and

WHEREAS, the IS/MND considered the potential environmental impact of the Project, including specific impacts to biological resources, cultural and tribal cultural resources, geology and soils, hazards and hazardous materials, and noise; and

WHEREAS, the IS/MND determined that the Proposed Project may result in potentially significant environmental impacts, but that incorporation of the mitigation measures identified in the Mitigation Monitoring and Reporting Program (MMRP) would avoid the effects or mitigate the effects to a point where clearly no significant effect on the environment would occur; and

WHEREAS, two (2) public information meetings were duly noticed and held on September 12, 2023, and September 14, 2023, to solicit public and agency comments on the Draft IS/MND; and

WHEREAS, during the public review period, the City of Santa Cruz received one (1) comment letter on the IS/MND from public agencies and individuals; and

WHEREAS, a final IS/MND has been prepared on or about December 14, 2023, consisting of the Initial Study, all comments received during the public review period, and the MMRP; and

WHEREAS, the final IS/MND included minor revisions but no changes to significance findings of any impact determinations to environmental resources, and did not result in the addition of mitigation measures to offset project impacts on the environment; and

WHEREAS, the City Council is required by Public Resources Code section 21081.6, subdivision (a), to adopt a mitigation monitoring and reporting program to ensure that the mitigation measures adopted by the City Council are carried out; and

WHEREAS, based upon the foregoing, staff has prepared the MMRP (attached hereto as Exhibit B and incorporated herein by reference) that incorporates the mitigation measures identified in the Final MND; and

WHEREAS, the City Council recognizes the City's obligation, pursuant to Public Resources Code section 21081.6, subdivision (a), to ensure the monitoring of all adopted mitigation measures necessary to substantially lessen or avoid the significant effects of the Project; and

WHEREAS, the City of Santa Cruz Water Commission considered the Project at a meeting on January 11, 2024, and has received information on the purpose, need, and environmental impacts of the Project and recommended that the City Council adopt the Mitigated Negative Declaration; and

WHEREAS, the Mitigated Negative Declaration, Initial Study, and Mitigation and Monitoring Reporting Program are, by this reference, incorporated into this Resolution as if fully set forth herein; and

WHEREAS, the City Council considered the finalIS/MND at a duly noticed and agendized public meeting on January 23, 2023;

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Santa Cruz hereby finds and determines the following:

1. The City Council has independently reviewed and analyzed, the Mitigated Negative Declaration together with the Initial Study and supporting documents, as well as the comments, written and oral, received prior to approving this resolution; and

2. The City Council hereby finds that the Mitigated Negative Declaration, the Initial Study and supporting documents, have been completed in compliance with CEQA, the State CEQA Guidelines, and local procedures adopted pursuant thereto.

3. The City Council hereby finds that the Mitigated Negative Declaration reflects the City's independent judgment and analysis, as required by Public Resources Code Section 21082.1.

4. The City Council finds that the Mitigated Negative Declaration identified all potentially significant impacts to the environment, which can and will be avoided or mitigated to less than significant levels through adoption and implementation of the mitigation measures proposed as part of the Project and through implementation of the Mitigation and Monitoring Reporting Program.

5. The City Council finds based on the whole record before it and all information received that there is no substantial evidence that the Project, as mitigated, will have a significant effect on the environment.

6. The City Council hereby adopts the Mitigation Monitoring and Reporting Program attached hereto as Exhibit "B".

7. The City Council hereby adopts the Mitigated Negative Declaration for the Project.

8. The City Council hereby approves the Project and directs City Staff to file within five (5) working days after approval of the Project a Notice of Determination commencing the 30-day statute of limitations for any legal challenge to the Project based on alleged non-compliance with CEQA; and

9. All environmental documents and other materials that constitute the record of proceedings upon which this decision is based, are made available at the City of Santa Cruz Water Department Office, 212 Locust Street, Suite C, Santa Cruz, California 95060.

PASSED AND ADOPTED this______day of______, 2024 by the following vote:

AYES:

NOES:

ABSENT:

DISQUALIFIED:

APPROVED: ______________________________
Mayor

ATTEST: ______________________________
City Clerk Administrator

List of Exhibits (Incorporated by reference and available online at https://www.cityofsantacruz.com/government/city-departments/water/habitat-conservation-plan):

Exhibit A Final Mitigated Negative Declaration Anadromous Salmonid Habitat Conservation Plan

Exhibit B Mitigated Monitoring and Reporting Program

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Bay Delta Region
2825 Cordelia Road, Suite 100
Fairfield, CA 94534
(707) 428-2002
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

September 26, 2023

Mr. Ezekiel Bean
City of Santa Cruz
123 Jewell Street
Santa Cruz, CA 95060
EBean@santacruzca.gov

Subject: Anadromous Salmonid Habitat Conservation Plan (ASHCP), Initial Study/Mitigated Negative Declaration, SCH No. 2023080658, City of Santa Cruz, Santa Cruz County

Dear Mr. Bean:

The California Department of Fish and Wildlife (CDFW) has received and reviewed the Initial Study/Mitigated Negative Declaration (IS/MND) prepared by the City of Santa Cruz (City) for the Anadromous Salmonid Habitat Conservation Plan (ASHCP) (Project), located in Santa Cruz County, pursuant to the California Environmental Quality Act (CEQA) and CEQA Guidelines.[1]

CDFW submits this letter to acknowledge the City's continued coordination with CDFW on development of the Project since 2001. CDFW commends the City for working in partnership with CDFW to provide protective bypass flows for steelhead and coho salmon and for addressing, avoiding and minimizing potentially significant direct impacts from the City's operation and maintenance activities to these species. CDFW appreciates your previous coordination and looks forward to future collaboration on development of the City's Incidental Take Permit (ITP) for coho salmon and Lake and Streambed Alteration (LSA) Notification for activities that may substantially divert or obstruct the natural flow; change or use material from the bed, channel, or bank (including associated riparian or wetland resources); or deposit or dispose of material where it may pass into a river, lake, or stream.

CDFW anticipates that the Project will have an impact on fish and/or wildlife, and assessment of filing fees is necessary (Fish and Game Code, § 711.4; Pub. Resources Code, § 21089). Fees are payable upon filing of the Notice of Determination by the Lead Agency and serve to help defray the cost of environmental review by CDFW.

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[1] CEQA is codified in the California Public Resources Code in section 21000 et seq. The "CEQA Guidelines" are found in Title 14 of the California Code of Regulations, commencing with section 15000.

Thank you for the opportunity to comment on the Project's IS/MND. If you have any questions regarding this letter or for further coordination with CDFW, please contact Ms. Serena Stumpf, Environmental Scientist, at (707) 337-1364 or Serena.Stumpf@wildlife.ca.gov; or Mr. Wesley Stokes, Senior Environmental Scientist (Supervisory), at (707) 339-6066 or Wesley.Stokes@wildlife.ca.gov.

Sincerely,

DocuSigned by:
Erin Chappell
B77E9A6211EF486...

Erin Chappell
Regional Manager
Bay Delta Region

ec: Office of Planning and Research, State Clearinghouse (SCH No. 2023080658)

Table 1. Summary of Covered Activities

General Activity	Description
Rehabilitation of diversion structures and pipeline reaches	▪ Laguna Creek,[1] Majors Creek, and Reggiardo Creek Diversions: Sediment transport and fish screening improvements ▪ Felton Diversion: Fish passage improvements and pump upgrades and replacements ▪ Tait Street Diversion:[2] Fish passage improvements and diversion capacity increase ▪ North Coast System pipeline rehabilitation: Replacement of portions of supply pipelines
Water diversion	▪ Provision of drinking water utilizing existing water rights and pending water rights modifications under consideration by the SWRCB with addition of "Conservation Flows" (also known as Agreed Flows) at Liddell Spring Diversion, Reggiardo Creek Diversion, Laguna Creek Diversion, Majors Creek Diversion, Newell Creek Dam, Felton Diversion, and Tait Street Diversion and Wells
Reservoir operations	▪ Chemical algaecide treatment of reservoir: 1-5 algaecide treatments annually ▪ Testing deluge and gate valves: 1 test annually of 5-10 cubic feet per second (cfs) for several hours. Bigger tests during winter/high flows as possible ▪ Woody debris removal on reservoir face: 10 cubic yards of less than 10-inch-diameter/8-foot-long wood removed annually
Water diversion sediment management	▪ Liddell Spring Diversion: Excavation of up to 3 yards per event, 1-3 events per year. Valve operations: valves operated as needed to maintain natural sediment transport dynamics during storm events ▪ Laguna Creek Diversion: Excavation of 5-10 cubic yards per event, 1-3 events per year. Valve operations (described above). ▪ Majors Creek Diversion: Excavation of 5-10 cubic yards per event, 1-3 events per year. Valve operations (described above).
Fish ladder and screen maintenance	▪ Felton Diversion: 1-3 maintenance events per year to remove up to 1 yard of sediment and wood material from the ladder ▪ Tait Street Diversion: 1-3 maintenance events per year to remove up to 1 yard of sediment and wood material from the intake
Pipeline operations	▪ Conveyance pipeline system inspections and repairs: Inspection and leak response on 19.23 miles of water line and 5.5 miles of leachate line ▪ Finished water pipeline system flushing and repairs: Flushing and leak response on 270 miles of water line ▪ Pumping well return to the San Lorenzo River: Ongoing pumping from clear well to remove sediment during high and moderate flows in winter and spring ▪ North Coast valve blow-off to the San Lorenzo River: 5-10 cfs blow-off to riverbank for 1-4 hours per event occurring during any part of the year once every few years
Dewatering of creeks for maintenance and repairs	▪ Dewatered stream reaches can range from approximately 20-200 feet at 1-10 sites for 1-4 weeks per year
Flood control maintenance	▪ Debris/obstruction removal: 1-3 maintenance events per year to remove up to 100 cubic yards of material in wet years

Table 1. Summary of Covered Activities

General Activity	Description
	▪ Flood control sediment management/removal: Removal of approximately 2 cubic yards of sediment per drainage structure annually or biannually at up to 30 drainage structures ▪ Vegetation management: Thin riparian groves and remove willows greater than 3 inches diameter at breast height (dbh) and alders greater than 6 inches dbh. Retain a 5-10-foot-wide riparian buffer adjacent to the low flow channel, but remove vegetation greater than 6 inches dbh annually
Stormwater maintenance	▪ Inspection and cleaning: Inspect and clean as needed but as frequently as weekly. Sweep 35 miles of streets daily ▪ Structural retrofits of storm drain inlets and basins: As-needed improvements of storm drain infrastructure ▪ Sanitary landfill leachate management: Ongoing maintenance of two leachate ponds, transmission of leachate to wastewater plant and repair of leachate line
Emergency operations and response	▪ Response to flood, fire, spill, or other related incident on an as-needed basis, lasting from a few days to several weeks every couple of years
General vegetation management within riparian corridors	▪ Pruning and limited removal of riparian trees less than 5,000 square feet on an annual basis during the summer/fall months as needed adjacent to pipeline rights-of-way, water diversions, and other utility infrastructure
Land management	▪ Management of Loch Lomond Recreation Area and watershed lands: Operation and management of 180-acre recreation area and 3,880 acres of open space ▪ Trail maintenance and repair: less than 50 yards of trail in non-anadromous watersheds annually ▪ Road maintenance and decommissioning: - Maintenance: Approximately 6.9 miles of road maintained annually - Decommissioning: 0-1 miles of road including up to 3-4 culverts on non-anadromous drainages annually
Habitat management and restoration	▪ Aquatic habitat management and restoration: Fish removal and dewatering of streams, up to 100 cumulative yards for 2-6 weeks annually ▪ Monitoring: Habitat typing up to 20 miles of stream and tagging/handling up to10,000 salmonids annually. Visual census of up to 5,000 feet of stream annually. Maintenance of up to 10 stream gages, 2 pit tag antennas, 10 temperature loggers, 1 fish trap, and 2 water quality data sondes annually

Notes: cfs = cubic feet per second; dbh = diameter at breast height.

1 The Laguna Creek Diversion facility was retrofitted in 2021 in conformance with the ASHCP and is not analyzed in this IS.

2 Tait Street Diversion, also referred to as San Lorenzo River Tait Street Diversion, Tait Diversion, San Lorenzo River Tait Intake, etc., is one of two surface water diversions on the San Lorenzo River and located in Santa Cruz with the other being located in Felton.

- **Biological Goal #1.** Contribute to the conservation of Covered Species by providing flows sufficient to improve habitat conditions and increase the likelihood of persistence of populations within the Plan Area.
  - **Objective 1.1.** Within two (2) years of permit issuance, and for the duration of HCP implementation, increase the quantity and quality of habitat supporting adult migration in terms of average number of days with flow meeting minimum migration criteria during the adult migration period (December through April for steelhead, December and January for coho).
  - **Objective 1.2.** Within two (2) years of permit issuance, and for the duration of Plan implementation, increase the quantity and quality of habitat supporting spawning as measured by average annual weighted usable area (WUA) during potential spawning periods (after migration event in December-May for steelhead, December-March for coho).
  - **Objective 1.3.** Within two (2) years, and for the duration of Plan implementation, increase the quantity and quality of habitat supporting juvenile rearing as measured by seasonal average (winter, spring, summer) rearing WUA.
  - **Objective 1.4.** Smolt Outmigration – Within two (2) years of permit issuance, and for the duration of Plan implementation, increase the quantity and quality of habitat supporting smolt outmigration as measured by annual number of days with flows meeting minimum migration criteria during the smolt migration period (January through May).
  - **Objective 1.5.** Within two (2) years of permit issuance and for the duration of Plan implementation, improve rearing habitat in the San Lorenzo River Lagoon by providing minimum inflow of 8 cubic feet per second (cfs) to improve temperature and dissolved oxygen (DO) levels during periods when the lagoon is closed.
- **Biological Goal #2.** Contribute to the conservation of Covered Species by creating, restoring, or enhancing aquatic habitat in the Plan Area.[1]
  - **Objective 2.1.** Between years 1-10, fund and oversee habitat restoration or enhancement projects worth $2.7M (2018 dollars excluding administration) and potentially including removal of passage obstacles, placement of large wood structures, riparian conservation easements, spawning gravel augmentation, riparian restoration, and sediment control projects.
  - **Objective 2.2.** Between years 11-20, fund and oversee habitat restoration or enhancement projects worth $2.7M (2018 dollars excluding administration) and potentially including removal of passage obstacles, placement of large wood structures, riparian conservation easements, spawning gravel augmentation, riparian restoration, and sediment control projects.
  - **Objective 2.3.** Between years 21-30, fund and oversee habitat restoration or enhancement projects worth $2.7M (2018 dollars excluding administration) and potentially including removal of passage obstacles, placement of large wood structures, riparian conservation easements, spawning gravel augmentation, riparian restoration, and sediment control projects.
- **Biological Goal #3.** Avoid, minimize, and fully mitigate effects to Covered Species resulting from City operations and maintenance activities.

1 The objectives for Biological Goal #2 relate to implementation of the Non-Flow Conservation Fund, as described in the ASHCP.

- **Objective 3.1.** During all years of Plan implementation, operate facilities to avoid stranding Covered Species by implementing a ramping rate during flow changes at the Felton Diversion Dam, Tait Street Diversion, Laguna Creek Diversion, Liddell Spring Diversion, Majors Creek Diversion, and Newell Creek Dam to limit flow reductions such that change in stage is limited.
- **Objective 3.2.** During all years of Plan implementation, operate facilities to reduce introduction of sediment.
- **Objective 3.3.** Within ten (10) years of permit issuance, enhance fish passage through the Felton Diversion Dam by upgrading facilities to meet current NMFS and CDFW criteria for fish screens and passage.
- **Objective 3.4.** Within ten (10) years of permit issuance, enhance fish passage through the Tait Street Diversion by modifying the Tait Street Diversion to prevent entrainment and impingement and provide bypass in accordance with current criteria issued by NMFS and CDFW.

City of Santa Cruz Anadromous Salmonid Habitat Conservation Plan

Final Initial Study & Mitigated Negative Declaration

January 11, 2024

Zeke Bean, Associate Planner II

CITY OF SANTA CRUZ

Photo credit: Morgan Bond

Overview

1. Background Information
2. California Environmental Quality Act (CEQA) Environmental Review Process
3. Initial Study/Mitigated Negative Declaration (IS/MND) Content and Findings
4. Next Steps

CITY OF SANTA CRUZ

1 Background Information

Environmental Review Team

- Dudek – City's Environmental Consultant for Proposed Project
  - Ann Sansevero, Principal
  - Catherine Wade, Project Manager

- City of Santa Cruz
  - Zeke Bean, Water Resources Planner
  - Chris Berry, Watershed Compliance Manager
  - Heidi Luckenbach, Deputy Director/Engineering Manager
  - Sarah Perez, Principal Planner

- Outside Counsel
  - Jim Moose, Remy Moose Manley, LLP
  - Sean Skaggs, Ebbin Moser + Skaggs, LLP

Definitions

- **Take:** Harm, harass, pursue, hunt, etc….applies to species and their habitat
- **Incidental Take Permit (ITP):** Allows for “take” of endangered species due to otherwise legal activities
- **Habitat Conservation Plan (HCP):** A planning document required as part of an Incidental Take Permit under the Endangered Species Act (ESA)
- **Anadromous Salmonid Habitat Conservation Plan (ASHCP):** City HCP designed to avoid, minimize, and fully mitigate adverse effects on steelhead trout and coho salmon and their habitat from various City activities
- **California Environmental Quality Act (CEQA):** a California statute passed in 1970 to institute a statewide policy of environmental protection intended to inform government decisionmakers and the public about the potential environmental effects of proposed activities and to prevent significant, avoidable environmental damage
- **Initial Study:** a preliminary analysis under CEQA prepared by the lead agency (the City) to determine whether a negative declaration (ND), a mitigated negative declaration (MND), or an environmental impact report (EIR) must be prepared
- **Mitigated Negative Declaration (MND):** a finding that a lead agency makes when an initial study shows that the impacts of a project can be reduced to less than significant with mitigation

Draft Anadromous Salmonid Habitat Conservation Plan

- Covered Species: all life stages of Central California Coast steelhead and Central California Coast coho salmon
- Covered Activities: water system operations, storm water / flood control channel operations, various maintenance activities
- Conservation Strategy: The HCP is designed to avoid, minimize, and fully mitigate adverse effects on steelhead and coho and their habitat through a series of biological goals and objectives, avoidance and minimization measures, a non-flow conservation fund for habitat restoration projects, and a robust monitoring program

2

CEQA Environmental Review Process

CITY OF SANTA CRUZ

California Environmental Quality Act (1970)

- CEQA applies to "projects"
  - A **discretionary action** by a **public agency** which has the potential to result in a **physical change in the environment**, either **directly** or **indirectly**
- Purposes
  - Evaluate and disclose physical environmental effects of a project
  - If needed, identify mitigation measures to avoid or minimize significant environmental effects
  - Foster informed public decision-making
  - Ensure transparency in governmental decision-making process
  - Encourage public participation

Lead Agencies and Agency Approvals

Local

- City of Santa Cruz (CEQA Lead Agency)
  - Adoption of MND
  - Project approval/acceptance of ITPs
  - Santa Cruz City Council is the decision-making body

State

- California Department of Fish and Wildlife
  - Responsible Agency
  - Trustee Agency
  - Consideration of City-adopted MND
  - State ITP

Federal

- National Marine Fisheries Service (NEPA Lead Agency)
  - Environmental Assessment prepared on a similar schedule
  - Findings and Recommendations under NEPA
  - Biological Opinion
  - Federal ITP
- USFWS
  - Section 7 Consultation

CEQA Process

1. Prepare Initial Study and Proposed Mitigated Negative Declaration
2. Prepare Notice of Intent to Adopt a Mitigated Negative Declaration
3. Distribute NOI and IS/MND for Public Review (30 days)
4. Prepare Responses to Comments and Final IS/MND
5. Water Commission Meeting
6. City Council Meeting
7. File Notice of Determination (if approved)
8. Statute of Limitations (30 days)

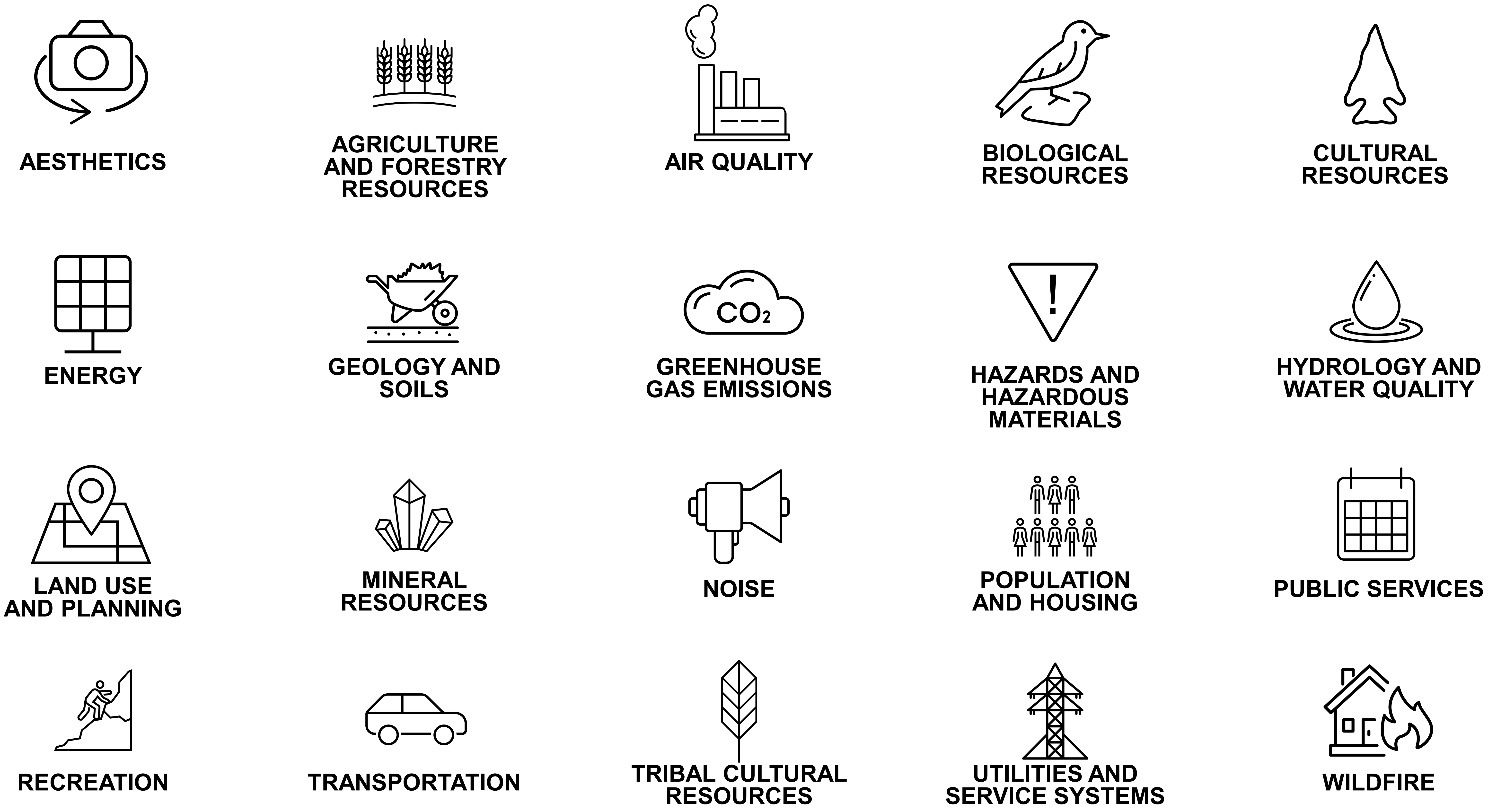
All impacts less than significant with mitigation

Indicates opportunity for public participation

3 IS/MND Content and Findings

CITY OF SANTA CRUZ

Environmental Topics Analyzed



Standard Practices and Mitigation Measures

Standard Construction Practices	Mitigation Measures
• Practices that reduce environmental impacts considered as part of the Proposed Project	• Measures incorporated in the IS/MND to avoid or substantially reduce significant impacts on the environment

Summary of Findings: Less-than-Significant Impacts

- Aesthetics
- Agriculture and Forestry Resources
- Air Quality
- Energy
- Greenhouse Gas Emissions
- Hydrology and Water Quality
- Land Use and Planning
- Mineral Resources
- Population and Housing
- Public Services
- Recreation
- Transportation
- Wildfire

Summary of Findings: Potentially Significant Impacts

All potentially significant impacts could be reduced to less than significant with mitigation

- Biological Resources
- Cultural Resources
- Geology and Soils
- Hazards and Hazardous Materials
- Noise
- Tribal Cultural Resources
- Utilities and Service Systems

Mitigated Impacts: Biological Resources

The Proposed Project could have a substantial adverse effect on special-status species during construction activities.

- Mitigation Measures
  - MM BIO-1: Preconstruction Special-Status Plant Surveys and Compensation
  - MM BIO-2: Preconstruction Special-Status Wildlife Surveys
  - MM BIO-3: Biological Construction Monitoring

Mitigated Impacts: Cultural Resources and Tribal Cultural Resources

The Proposed Project could cause a substantial adverse change in the significance of a historical resource, archaeological resource, or tribal cultural resource; or disturb human remains.

- Mitigation Measures
  - MM CUL-1: Historical Built Environment Resources Identification and Evaluation
  - MM CUL-2: Identification of Unique Archaeological Resources, Historical Resources of an Archaeological Nature, and Subsurface Tribal Cultural Resources

Mitigated Impacts: Geology and Soils

The Proposed Project could directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

- Mitigation Measure
  - MM GEO-1: Paleontological Resources Impact Mitigation Program and Paleontological Monitoring

Mitigated Impacts: Hazards and Hazardous Materials

The Proposed Project could be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5.

- Mitigation Measures
  - MM HAZ-1: Review of Hazardous Materials Site Databases
  - MM HAZ-2: Hazardous Materials Contingency Plan

Mitigated Impacts: Noise

The Proposed Project could have construction-related vibration impacts to a historical resource.

- Mitigation Measure
  - MM NOI-1: Construction Vibration Effects on Historic Structures

Mitigated Impacts: Utilities and Service Systems

The Proposed Project would result in construction of new or expanded water supply facilities and infrastructure which could cause significant environmental effects related to biological resources, cultural resources and tribal cultural resources, paleontological resources, hazardous materials, and construction vibration.

- Mitigation Measures
  - MM BIO-1, MM BIO-2, MM-BIO-3, MM-CUL-1, MM CUL-2, MM GEO-1, MM HAZ-1, MM HAZ-2, MM NOI-1

4 Next Steps

HCP Next Steps

- Adoption of IS/MND by City Council
- Filing of Notice of Determination
- Completion of NEPA Review
- Project approval/acceptance of ITPs
- Implementation

City of Santa Cruz Anadromous Salmonid Habitat Conservation Plan

Recommendation for Adoption of the Final Initial Study/Mitigated Negative Declaration

Zeke Bean, Associate Planner II

January 11, 2024

CITY OF SANTA CRUZ

Photo credit: Morgan Bond

WATER COMMISSION
INFORMATION REPORT

DATE: 01/04/2024

AGENDA OF:	01/11/2024
TO:	Water Commission
FROM:	Heidi Luckenbach, Deputy Director/Engineering Manager
SUBJECT:	Water Supply Augmentation Implementation Plan (WSAIP): Summary of the November Water Commission Deep Dive Discussion Including Modified Presentation Slides, General Response to Comments and Questions, Additional Findings, and Calendar Year 2024 Work Plan

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RECOMMENDATION: That the Water Commission receive an update summarizing November's WSAIP deep dive material, response to comments/questions, and additional findings.

BACKGROUND: In calendar year 2024, the numerous efforts informing the Water Supply Augmentation Implementation Plan (WSAIP) will be finishing up with a draft WSAIP completed in Fall of 2024. These efforts include the grant-funded work in the Mid-County Groundwater Basin (MCGB) including the Optimization Study and design and construction to retrofit two production wells to Aquifer Storage and Recovery (ASR) wells, pilot testing ASR at the City's existing Beltz Well 9, the grant-funded design and construction of the Intertie 1 pipeline and pump station with Scotts Valley Water District (SVWD), and evaluation of recycled water and seawater desalination. The Water Commission's work plan presented at the November 2023 meeting includes information on how staff intends to engage the Commission through the 2024 calendar year with the goal of providing sufficient information to elicit the feedback to complete the WSAIP.

At the Water Commission's November 27, 2023, meeting, staff and several members from the City's water supply augmentation consultant team (namely, staff from Kennedy Jenks and Montgomery & Associates) presented updates on various efforts, focusing on the following four areas:

1. Updates on WSAIP elements, timeline, and climate scenarios;
2. Initial groundwater modeling findings for water transfers between the City and SVWD utilizing the intertie;
3. Initial results from groundwater modeling in the Mid-County Groundwater Basin as part of the Optimization Study; and
4. Updates on WSAIP alternatives including availability of wastewater for the purposes of Indirect or Direct Potable Reuse (IPR and DPR, respectively), modeling results of how different supply projects fill the gap, and how operational changes in the City system may also be beneficial in filling the gap.

Objectives of the November 2023 meeting were as follows:

- Climate Projections: Understand the different climate change projections, how they are similar and different, and how they are being used for various efforts throughout the region;

- City/SVWD Intertie: Gain baseline understanding of how the City/SVWD Intertie could be operated and benefits to the Mid-County Groundwater Basin (MCGB) and each agency;
- Optimization Study: Review current findings and provide feedback on alternatives being considered, including Pure Water Soquel, ASR, and water transfers; and
- WSAIP: Learn how supply projects of different sizes and operating the City's water system differently might fill the supply gap.

The discussion fell generally into a few categories: Optimization Study/MCGB, Intertie with SVWD, Operations of the City's water system, and Other. The following narrative summarizes the discussion including responses to questions and comments and any new information. Finally, several modifications were made to the presentation slides; those modifications are listed below and reflected in the attached updated presentation slides. This narrative is not intended to be a comprehensive summary of the information presented at the November Water Commission meeting; rather it is meant to build on the November meeting materials and will continue to build through the coming year.

DISCUSSION:

Optimization Study/Mid-County Groundwater Basin

The Santa Cruz Mid-County Groundwater Agency was awarded a grant from the State of California Department of Water Resources in 2022 for $7.6 million to advance the Project and Management Actions (PMAs) in the Mid-County Groundwater Sustainability Plan (GSP) that contribute to reaching basin sustainability. Five projects (Components) are being funded including a new production well and transmission main for Soquel Creek Water District (SqCWD), retrofit of two production wells to ASR wells for the City, the Optimization Study, and ongoing support to the Mid-County Groundwater Sustainability Agency.

The Optimization Study includes several activities (groundwater and hydraulic modeling, water quality analyses, economic analysis, financial planning, and environmental assessment) to inform and advance the implementation of high-priority PMAs including the existing and potential expansion of the Pure Water Soquel Project (PWS), development of ASR in the City's portion of the MCGB, and water transfers and exchanges between the two agencies. As described previously, various machinations of these alternatives are being analyzed and optimized.

The City's WSAIP effort is very similar to the Optimization Study and being conducted in parallel. It is similar in its evaluation of PMAs in the MCGB, yet different because of the expanded water supply alternatives being evaluated by the City to fully address the supply gap. These additional alternatives include the Intertie with SVWD, recycled water, and desalination. The findings from the Optimization Study will be integrated into the WSAIP, and the WSAIP will likely include projects recommended from the Optimization Study but may also include other projects such as DPR, for example.

With respect to water transfers/exchanges, several things are being considered as part of the Optimization Study:

- There are three interties with SqCWD, one at the north end of 41st Avenue referred to as the O'Neill Ranch Intertie (because it's located at the site of the Soquel Creek Water District's O'Neill Ranch production well), and two older interties also located on 41st Avenue near Jade Street and Bain Avenue in Capitola. Because it includes a pump station, the O'Neill Ranch Intertie can operate in both directions – City to SqCWD and SqCWD to City; however, the other two interties can only be used to transfer water from the City to the SqCWD because they currently do not have pump stations.
- The hydraulic modeling task of the Optimization Study is evaluating the most efficient way to transfer water between the two service areas and other opportunities related to all three interties. However, these interties were constructed for different purposes and to operate them in both directions or at greater capacities will require evaluation of the capacity of each distribution

system to deliver/receive higher volumes of water, the ability of each agency to use delivered water in terms of meeting demands, and the cost of transferred water compared with other sources of water. Specifically, both agencies have small distribution systems at the southern end of 41st Avenue making transfers more costly to implement due to the scope of system improvements; both agencies have other water resources (groundwater, Loch Lomond, river water) that may be less expensive sources than water transfers; and both agencies have low demands to be met through water transfers. The idea of maximizing transfers may be constrained by these other practical realities.

With respect to the PWS project, a question came up about the ability of the Chanticleer site (PWS's treatment plant for producing 1,500 acre-feet per year (afy) of water treated at an advanced water purification facility (AWPF) for the purpose of groundwater replenishment through three new injection wells), to be expanded to up to 3,000 afy. The production of the AWPF can be expanded through the expansion of treatment components, addition of chemical feed systems, etc. What is being further analyzed from a supply reliability perspective are:

- The reliable supply of source water from the City's Wastewater Treatment Facility (WWTF),
- Ability to source an expanded AWPF and DPR; and
- Specifically for DPR, locating a different site would likely be necessary due to the treatment requirements of DPR.

Intertie with Scotts Valley Water District

The City and SVWD were awarded a grant in 2022 from the State of California Department of Water Resources in the amount of $9.5 million to fund a pipeline and pump station (collectively referred to as the Intertie) as well as a replacement well for SVWD. Once constructed, the Intertie will be bi-directional and can add up to 1 million gallons per day (mgd) to each agency's water resources under drought circumstances or other emergencies. Longer term, the Intertie may support conjunctive use of surface water and groundwater as well as possibly ASR in the Santa Margarita Groundwater Basin (SMGWB).

Constraints and mitigation opportunities include:

- While the City will be able to transfer up to 1 mgd to SVWD, SVWD will only be able to transfer 0.4 mgd to the City for two reasons:
    - The Intertie connects to an isolated zone in the City which has a demand of ~0.4 mgd. To increase beyond this volume of water the zone would need to be expanded through various infrastructure improvements (valves, etc).
    - SVWD does not have sustainable well capacity to transfer more than ~0.4 mgd for a long period of time, although 1-2 day emergencies may be an exception. A new well in SVWD needs to be sited and constructed to be able to reliably transfer 1 mgd to the City.
- The initial/baseline groundwater modeling scenario assumed that all water transferred to SVWD was returned to the City; no losses (or leave behind volume) to the basin were included. Future scenarios will need to account for losses or leave behind volumes to maintain and possibly improve basin sustainability.
- The Intertie is not part of the Santa Margarita Groundwater Sustainability Plan (SMGSP). It will function as drought resiliency until additional well capacity is available as described above and modeling confirms how it can be operated to improve basin sustainability per the SMGSP.

System Operations

The City has been managing the same water supplies since the early 1970s, at which time the Felton Diversion allowed water to be pumped from the San Lorenzo River (SLR) to Loch Lomond Reservoir (LLR). No new supplies have been added since the Beltz groundwater wells in the 1960s, and constraints (such as agreed flow) on the supplies have resulted in less water available to the City and more challenging operations of the system. The integration of new water supplies (e.g., ASR), and the pending water rights modifications, will add flexibility to how the City operates the system. As a result, the various modeling efforts (e.g., Santa Cruz Water Supply Model and groundwater modeling) are incorporating potential changes to the system's operation such as increased water transfers, transfers to SVWD, ASR, and changes to how LLR is managed as a supply source.

While these different operating options will continue to be considered, in the November meeting the topic of changing how we operate Loch Lomond came up specifically with the following topics being discussed:

- Water rights allow the City to withdraw from LLR on a year-round basis; however, the annual limit is and will remain 1,042 million gallons or approximately half the total volume.
- 1 cubic foot per second (cfs) fish flow release from the reservoir is required year-round although during drought we can request a reduction.
- San Lorenzo Valley Water District has an annual allotment from Loch Lomond of 313 acre-feet per year. SLVWD does not currently use this allotment but are evaluating how they might do so moving forward. All supply modeling performed by the City sets this volume aside as unavailable to the City.
- LLR has three intakes, the lowest at 480 ft, beneath which is "dead pool" or an isolated volume of water that is not accessible without pumping, which is not currently part of the system.
- The location of the lowest intake isolates about 4% of the current total volume of the lake, is about 50 ft above the original thalweg, and 10 ft lower than the previous intake. Factors considered for choosing the location of the lowest intake included ample distance from the current mud layer (~20 ft) and ample location from existing landslide material (~10 ft). Taking these factors into consideration when choosing the location of the lowest intake add to the reliable access to the water and the predictable water quality associated with the water.
- Considerations for exploring how the lake could be operated differently include:
    - Water Rights
    - Availability of other stored water (ASR) or water transfers
    - Water quality

<u>Other</u>

- Climate Change Projections:

    As per the adopted Securing Our Water Future policy, the City of Santa Cruz's water supply reliability goal shall be achieved by having an adequate supply to meet customer demand under plausible, worst-case conditions. The initial assessment of plausible worst-case conditions includes the following parameters:

    - Temperature Parameter: 2° C increase in temperature (dT = +2° C);
    - Precipitation Parameter: No change in mean annual precipitation (dP =100% of average); and
    - Coefficient of Variability Parameter: A +10% coefficient of variability (CV = 1.1).

    Climate realization 1270 contains the worst-case drought for the parameters identified above.

    In selecting these initial climate change parameters to use as the basis for near-term planning for supply augmentation projects, staff has considered a wide range of climate scenarios and chosen parameters that are moderate and plausible; staff have attempted to choose parameters that do not either over- or under-estimate the potential implications of near-term impacts of climate change on local water resources and water supply reliability.

    These parameters will be reviewed and updated at a frequency of every five years at minimum as part of the regular update of the City's Urban Water Management Plan. The resulting review and revision may result in modifications to the volume of source water that needs to be developed to meet the water supply reliability goal.

- Machine Learning: How are we using it, do we trust it, what would we do with the findings?

The groundwater modeling team uses a tool called Machine Learning Guided Optimization (MLGO) to look at previously run scenarios, predict a management/operating scenario it thinks might work to meet project goals, and then run that scenario in the groundwater model. Everything produced by this type of modeling reflects something rooted in the physical world via the physical groundwater model. This differs from pure machine learning applications like ChatGPT that are working only in the world of machine learning and aren't constrained by anything physical. While the tool is running, modeling staff examine what's being done and apply 'human learning' to refine strategies suggested by the machine learning model. The big picture is that this is a tool to help us progress towards optimization. Its 'core' is still the physical groundwater model, and staff oversee and perform quality control over everything it produces.

- Outreach: In addition to the Water Commission as a venue for public participation, staff are planning a study session with City Council to aid with public outreach and are also continuously gathering community input through community meetings (a schedule is under development for calendar year 2024) and other means.

Revisions to Presentation Slides

The following modifications were made to the November 2023 presentation slides per the discussion. No substantive changes were made.

- Slide 6: Adjusted scales for consistency. Noted color-coding has no meaning.
- Slides 9-10: Removed reference to specific years, replacing with year number from 1 to 50 or 1-100 depending on the modeling effort.
- Slide 16: Edits to first bullet for clarity.
- Slides 21-23: Removed reference to specific years, replacing with year number. Changed vertical axis to inches instead of millimeters.
- Slide 24: Minor edits to notes.
- Slides 26-27: Minor clarifications to horizontal scale.
- Slide 28: Rounded numbers and added notes to clarify unused surface water and timing of unmet demands.
- Slide 52: To address questions around 2022 numbers, added 2022 data to slides 49-51.
- Slide 70: Changed "LL Draw to Deadpool Level" "LL: Reduce Min Storage Req".

FISCAL IMPACT: None.

PROPOSED MOTION: Receive information and provide any additional feedback to staff.

ATTACHMENT(S):

1. WSAIP Deep Dive Revised Presentation Slides

CITY OF SANTA CRUZ
Water Department

WSAIP Update

November 27, 2023, Updated January 2024

Heidi Luckenbach, City of Santa Cruz

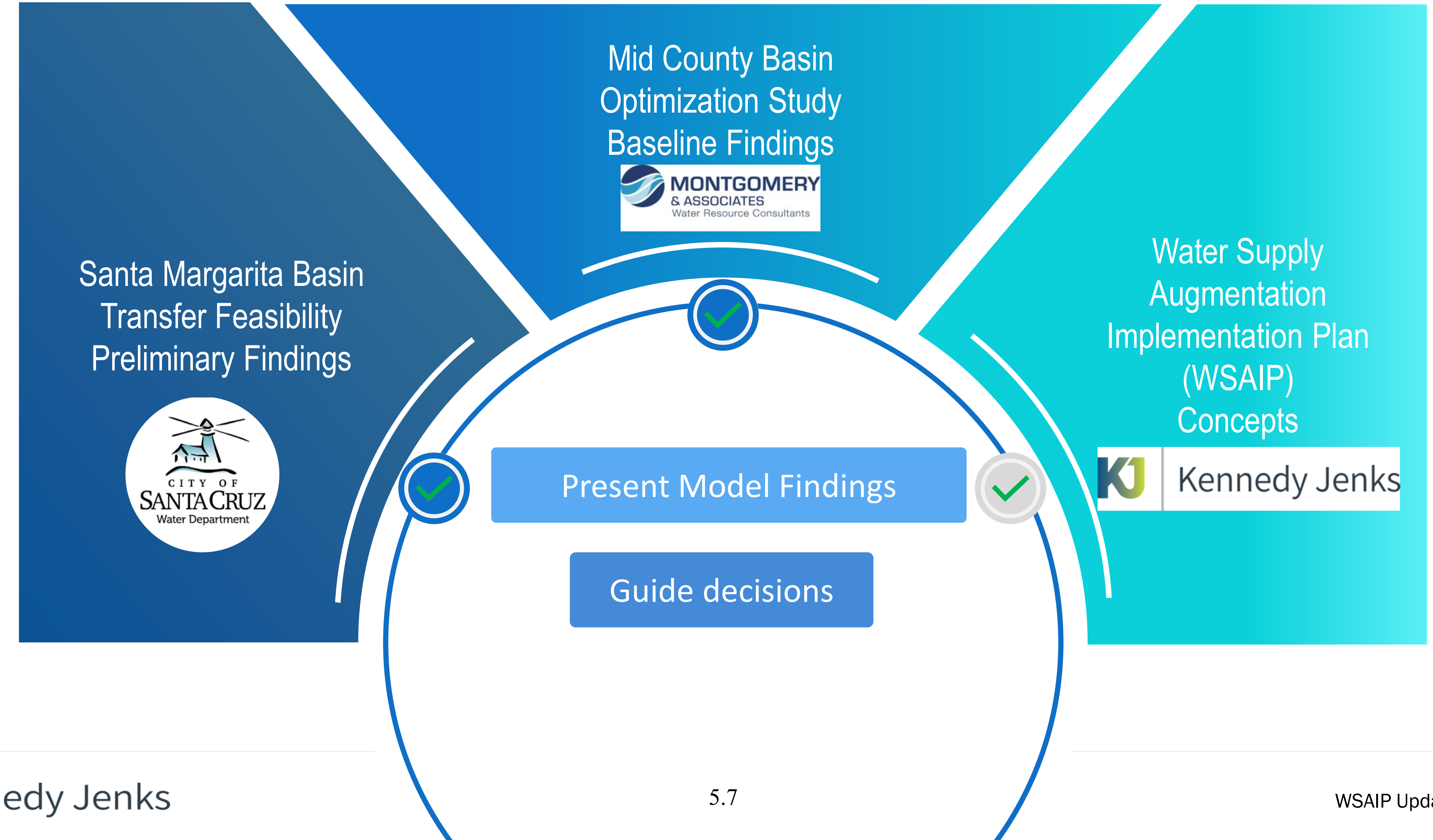
Cameron Tana & Patrick Wickham, Montgomery & Associates

Claudia Llerandi, Kennedy Jenks

MONTGOMERY & ASSOCIATES Water Resource Consultants

Kennedy Jenks

Meeting Objectives



Agenda

Part I	Part II	Part III	Part IV
City Updates:	Santa Margarita Basin	Mid County Basin	WSAIP Updates
WSAIP Goals & Timeline Climate Scenarios & Models	Water Banking & Transfer Feasibility Preliminary Results	Optimization Study Baseline Alternative Preliminary Results	Wastewater Available Supply Concepts Operation Scenarios

CITY OF SANTA CRUZ Water Department

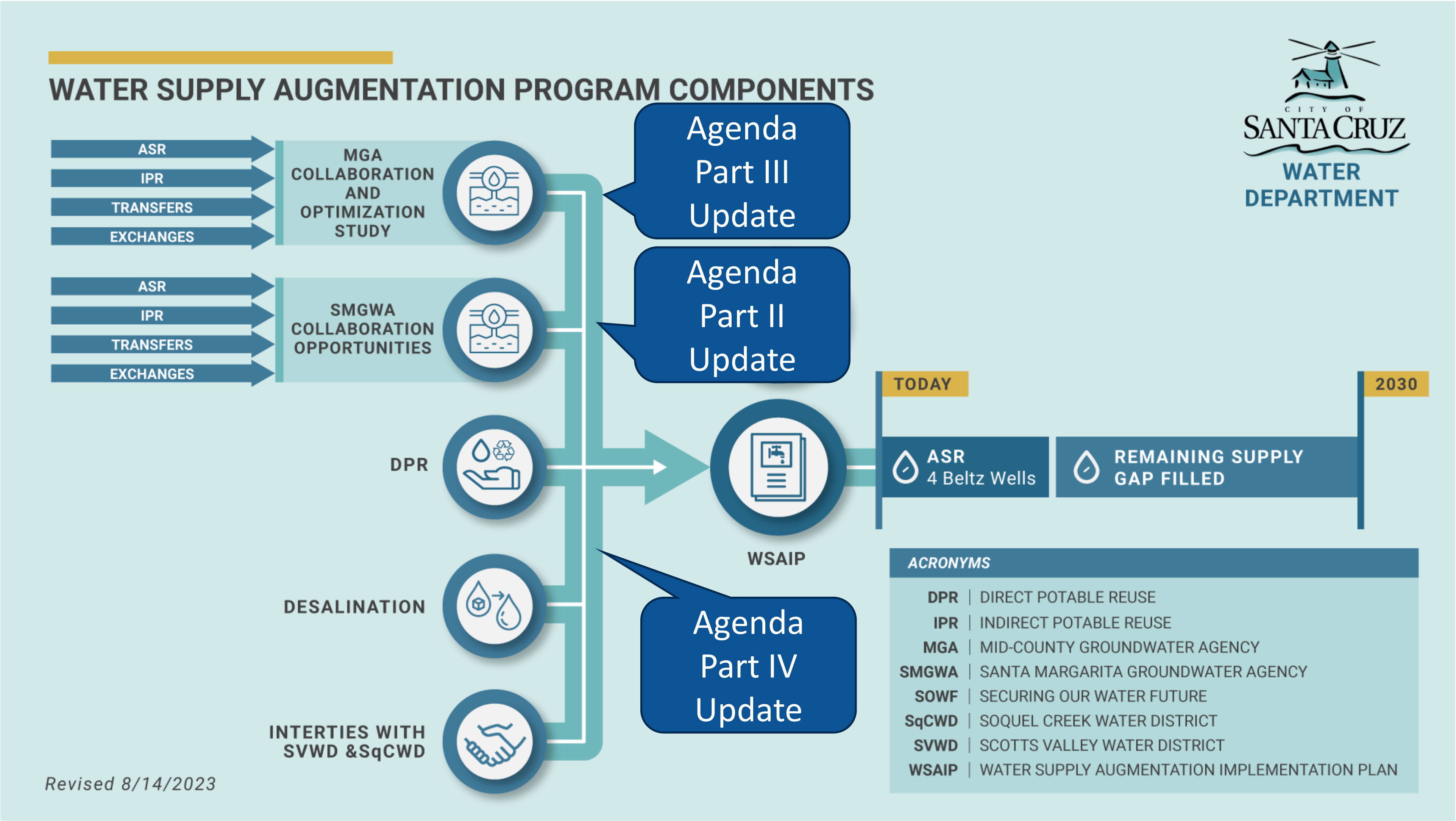
Water Supply Augmentation Implementation Planning (WSAIP)

Part I

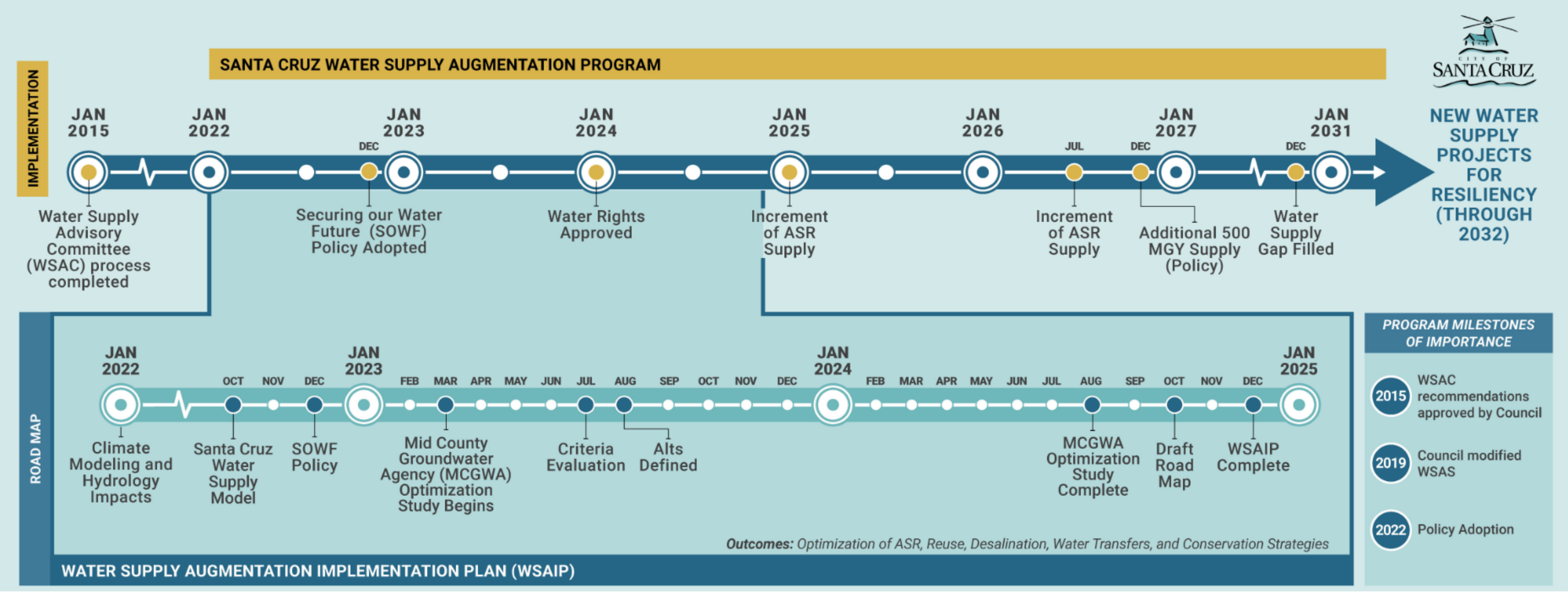
City Updates:

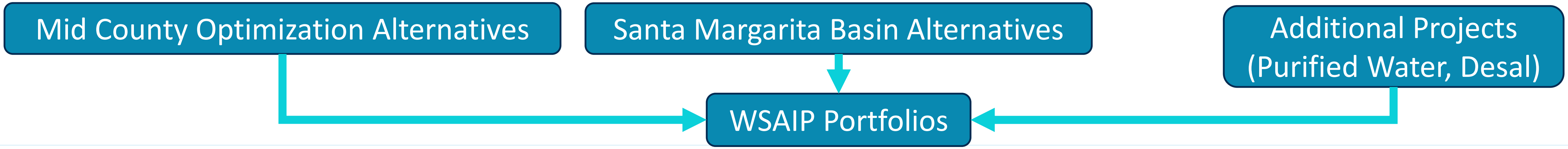
WSAIP Goals & Timeline
Climate Scenarios & Models

City of Santa Cruz Water Department

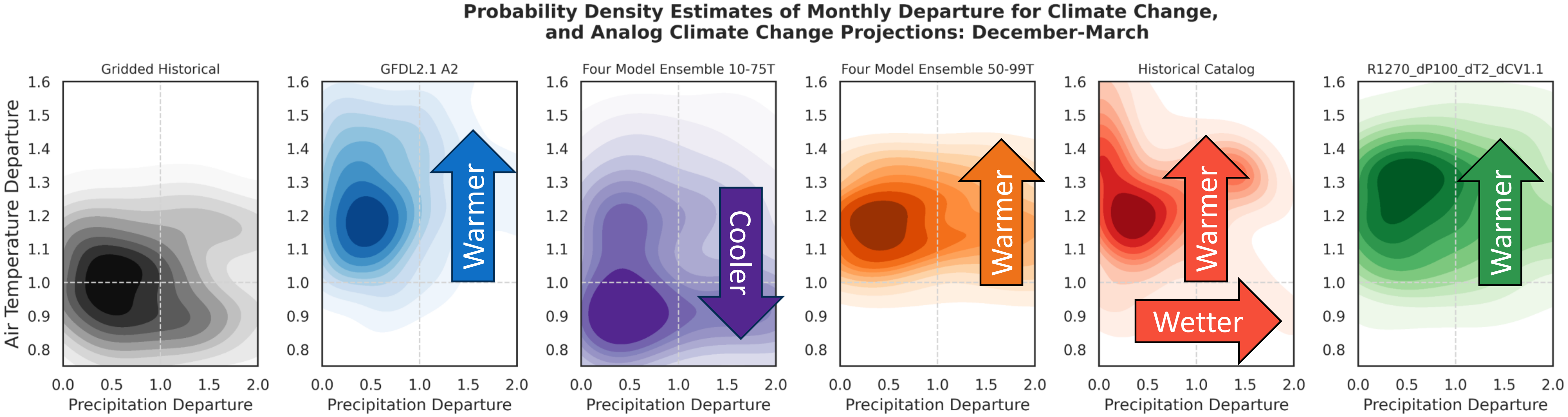


WSAIP Timeline





Climate Scenarios & Models: December - March



Historical
- Greater proportion of months with less rainfall than average
- Wet years depart more strongly from average
- Temperature shows less departure from average

WSAC
- Generally drier & warmer
- Reflects rise in average temperature.
- Lacks an increase in predicted variability in precipitation
- Water Supply Planning reflects dry and warm conditions

Post WSAC
- Generally cooler
- Concentrated periods of cool/dry, cool/wet, warm/dry
- Fewer warm/wet
- Has increased variability
- Water Supply Planning reflects variability with respect to precipitation

SMGSP
- Warmer
- Less variability

Mid County GSP
- Generally wetter and warmer
- Includes the driest and warmest months

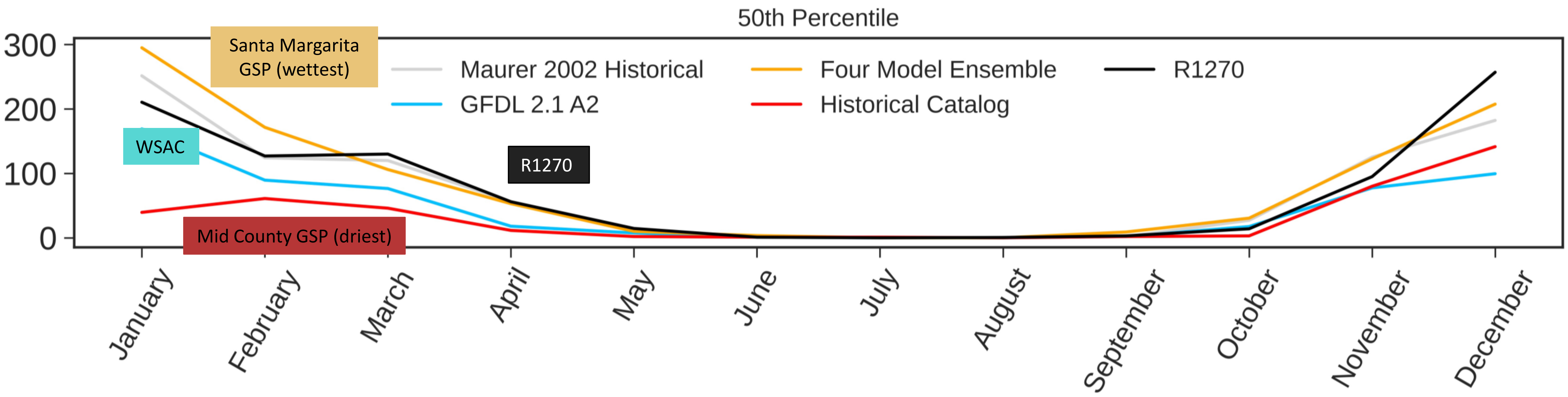
WSAIP
- Warmer and drier

*R1270 with: T: 2 deg C, P: No change in average, CV= 10%

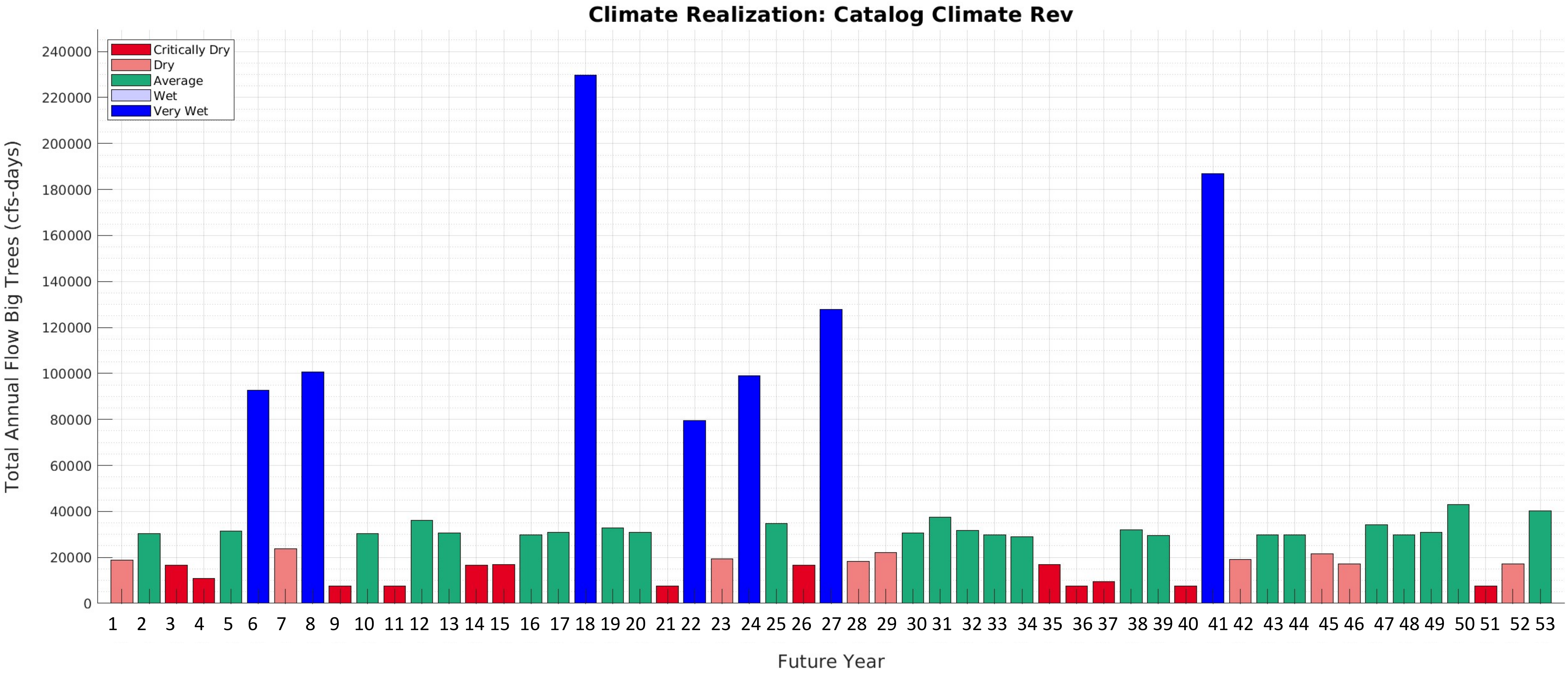
Departures of monthly total precipitation and average air temperature, relative to historical averages.
Courtesy of Dr. Shawn Chartrand, Simon Fraser University

*Color coding has no meaning related to climate conditions.

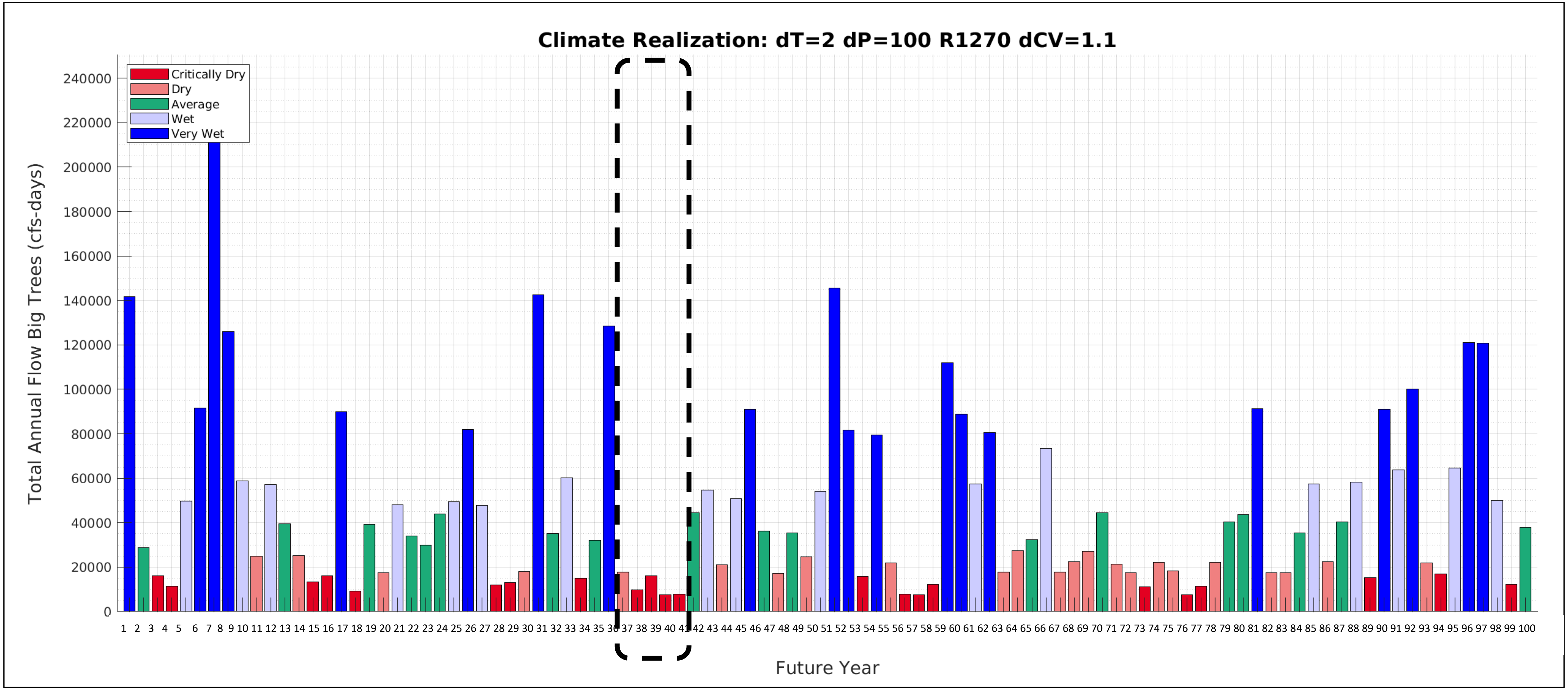
Climate Scenarios & Models



Catalog Climate Hydrology



Realization 1270 Hydrology



Part II

Santa Margarita Basin (City Update)

Water Banking & Transfer Feasibility Preliminary Results

Santa Margarita Basin: City of Santa Cruz & Scotts Valley Water District Intertie

Water Banking and Transfers Scenario

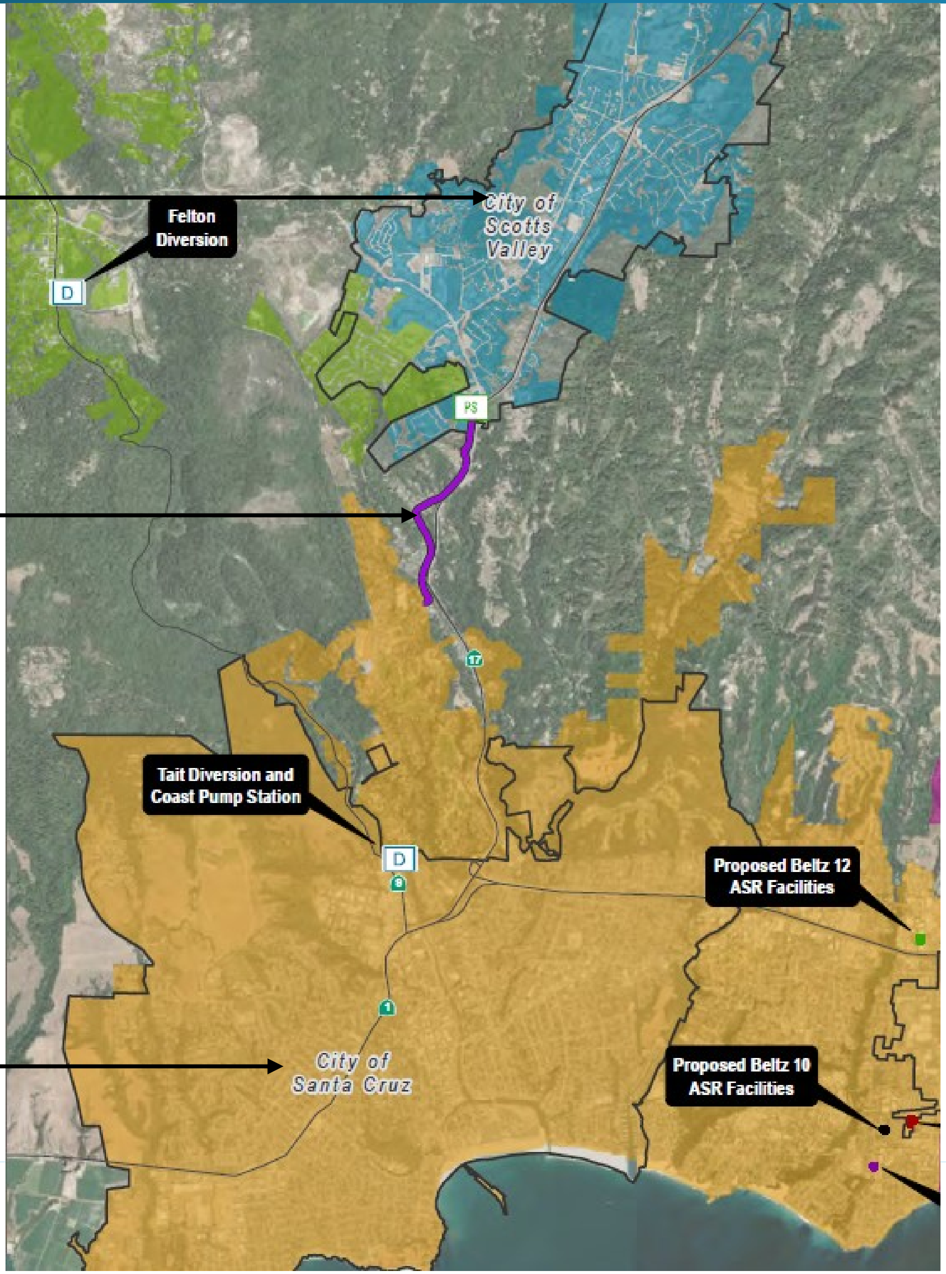
Assumptions and Results

City & Scotts Valley Water District Intertie

SCOTTS VALLEY WATER DISTRICT

Intertie:
1 MGD Transfer Capacity in both directions

CITY OF SANTA CRUZ Water Department



Concept Assumptions

CITY OF SANTA CRUZ Water Department

SCOTTS VALLEY WATER DISTRICT

Water Transfers (Jan – June):
0.75 MGD in wet years
0.5 MGD in normal years

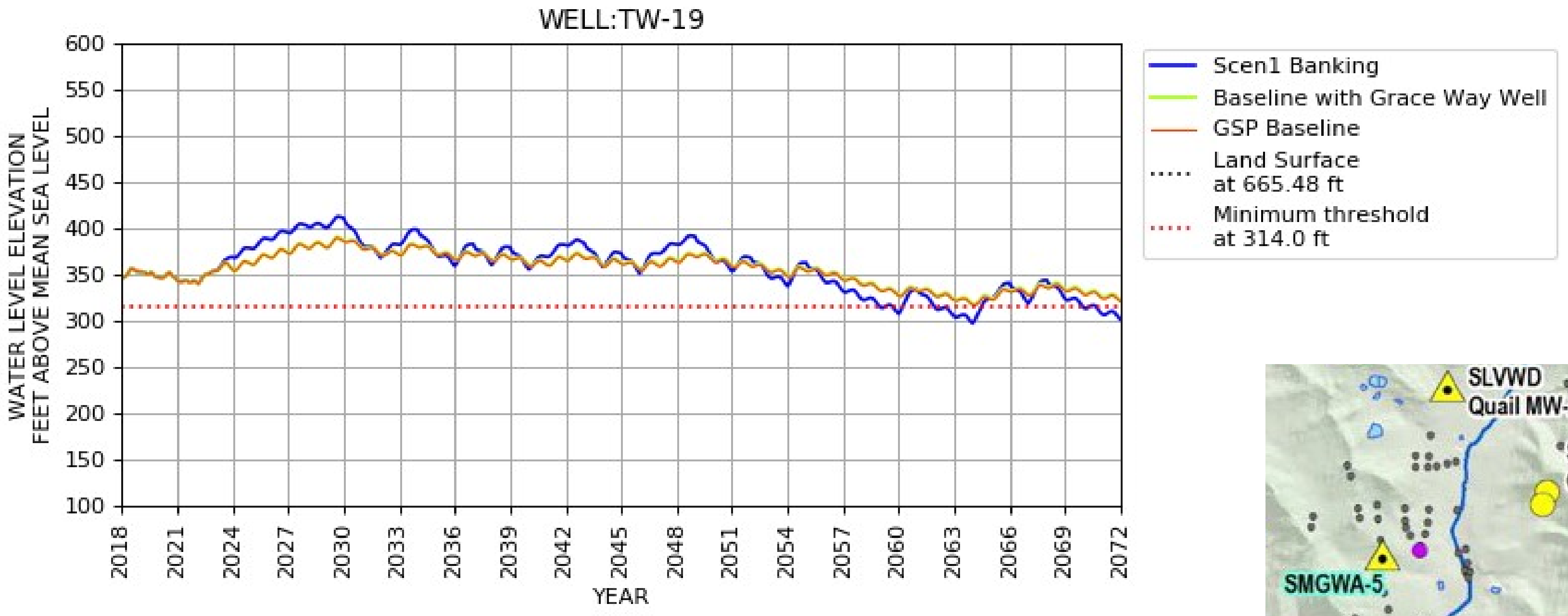
In Lieu Recharge:
SVWD Reduces Groundwater Pumping Below Demands (Jan – June)

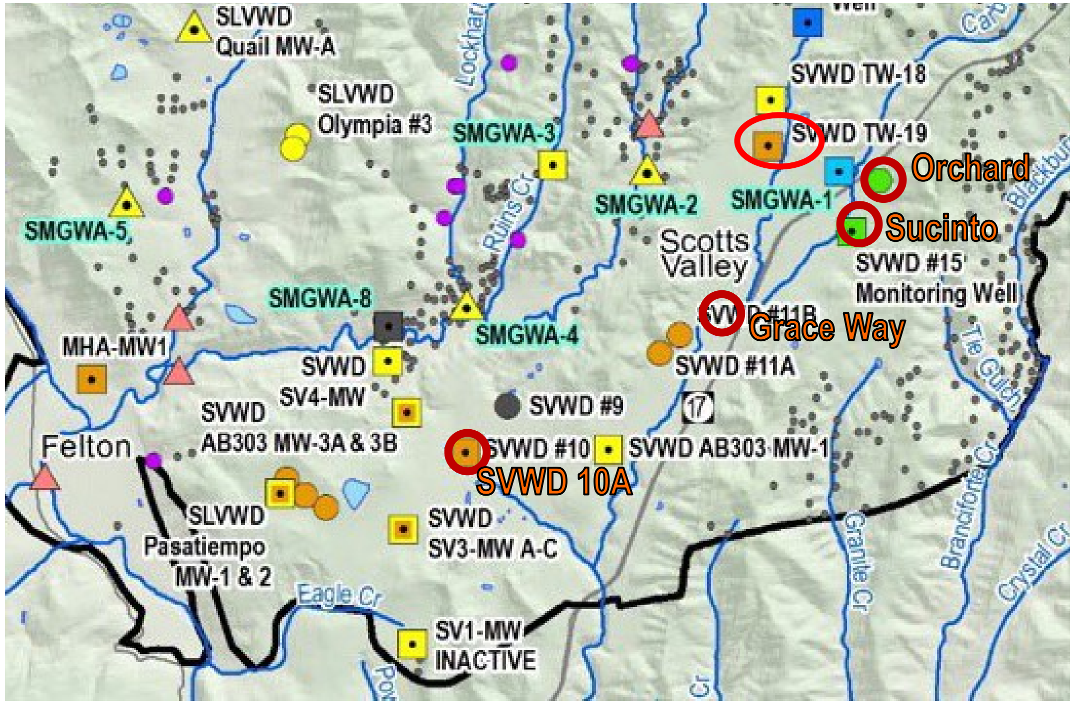
Transfers:
SVWD Increases Groundwater Pumping Above Demands (Mar - Dec)

Water Transfers (Mar - Dec)
120 MG in dry/critically dry years
~0.4 MGD over 10 months

No Banked water left in the Santa Margarita Basin by end of model (WY 2072)

Santa Margarita Basin Storage Comparison





Scenario 1

- Reduces & increases pumping equally amongst Orchard, Sucinto, Grace Way and 10A wells
- Well 10A is screened in the Lompico Aquifer
- Wells Orchard, Sucinto and Grace Way are screened in the Lompico & Butano Aquifers

Findings & Next Steps

- Average Annual Basin-wide Water Budget between baseline and banking scenario does not change over simulation period. (This was an expected outcome with this scenario that assumed what was put in was taken out. Future scenarios will make assumptions about leave-behind pumping strategies for basin restoration.)
- Water Budgets in specific areas change under banking scenario
  - More movement of groundwater through Scotts Valley
  - Slightly more discharge to creeks in south Scotts Valley area in wet years;
  - Reduced discharge to creeks in northern Scotts Valley in wet years;
- Changes to Model Scenario:
  - Leave behind in basin 20% banked water?
  - Redistribute call back pumping?
  - Change transfer rates?
  - Add new well(s)?
  - Include other users?

Part III

Mid County Basin
(by M&A)

Optimization Study
Baseline Alternative
Preliminary Results

Mid County Basin Optimization Study:
Groundwater Modeling

Alternative Climate Evaluation

ASR Baseline Scenario

MONTGOMERY & ASSOCIATES
Water Resource Consultants

Outline

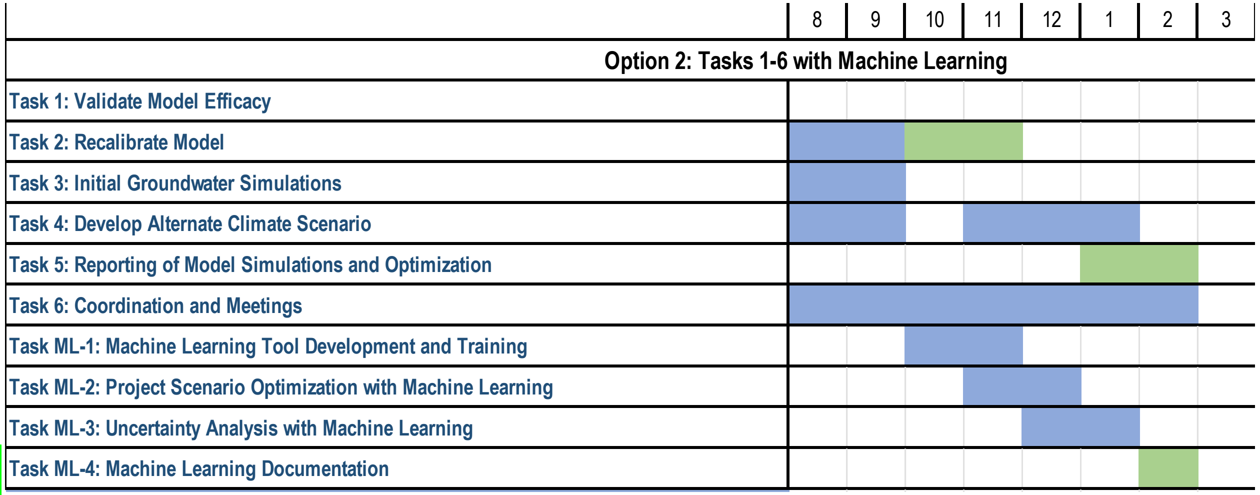
- Comparison of ASR Baseline: 1270 & Catalog Climate
    - Climate timeseries
    - Supply and demand
    - SWI 5 year running averages
    - ASR and PWS well water levels
- Conclusions and Recommendations

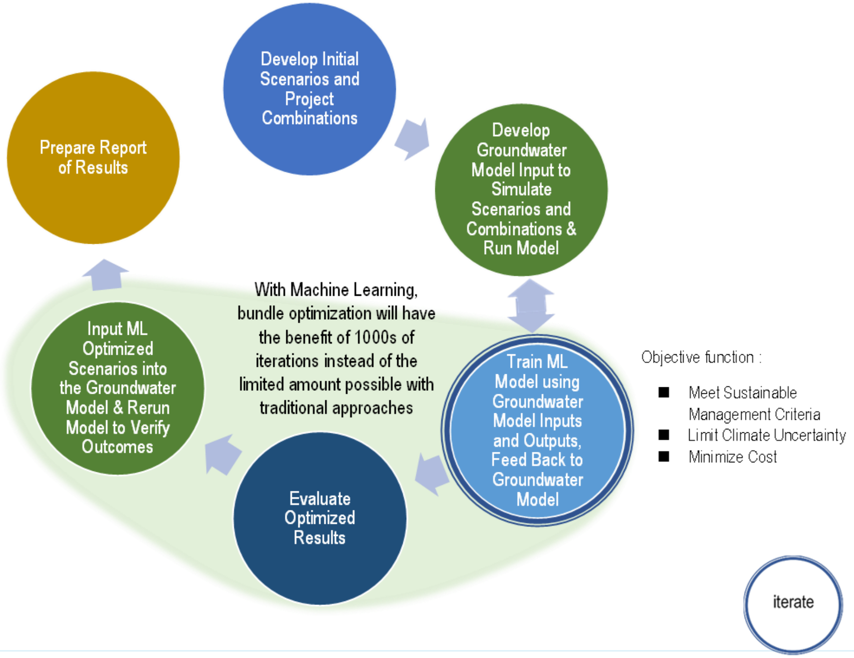
Mid County Study – Groundwater Modeling Scope

1. Model Validation
2. Recalibrate to ASR Tests
3. Initial Simulations
4. Develop Alternate Climate Scenario
5. Reporting
6. Coordination and Meetings

Approved

Machine Learning Optimization





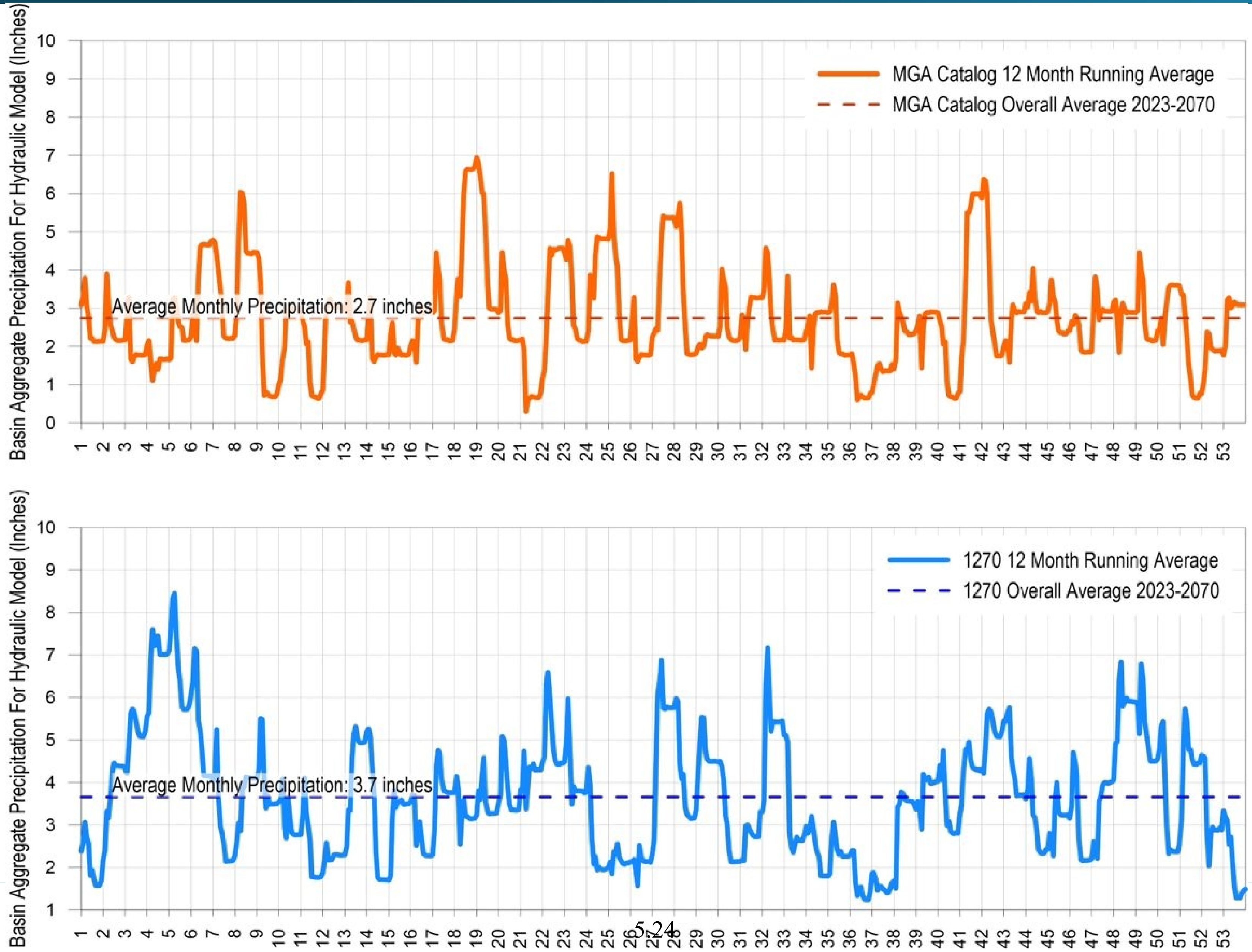
Comparison of 1270 to Catalog Climate, on Baseline

Precipitation

Supply gap

Available Surface Water for ASR and Transfers

Precipitation Comparison



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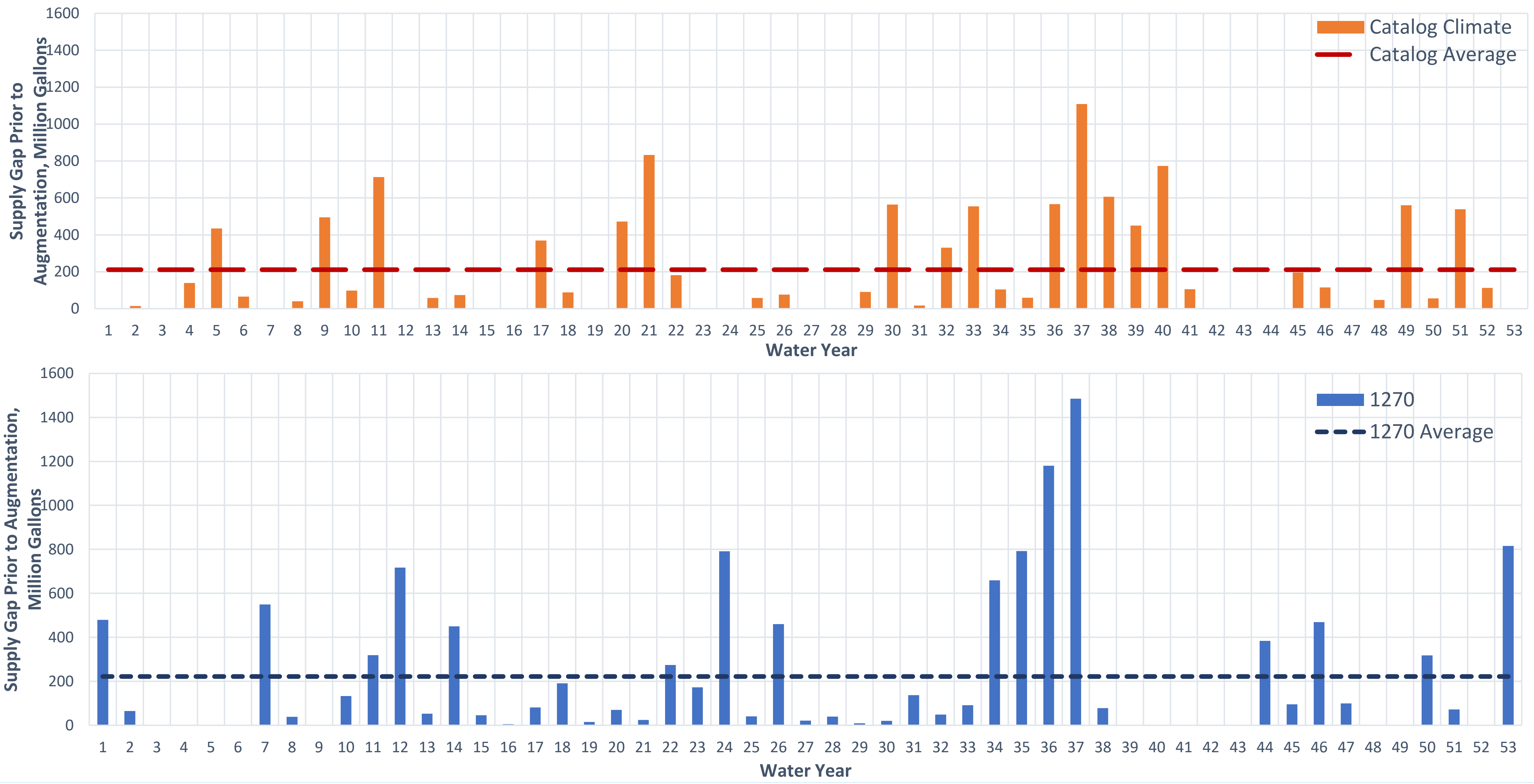
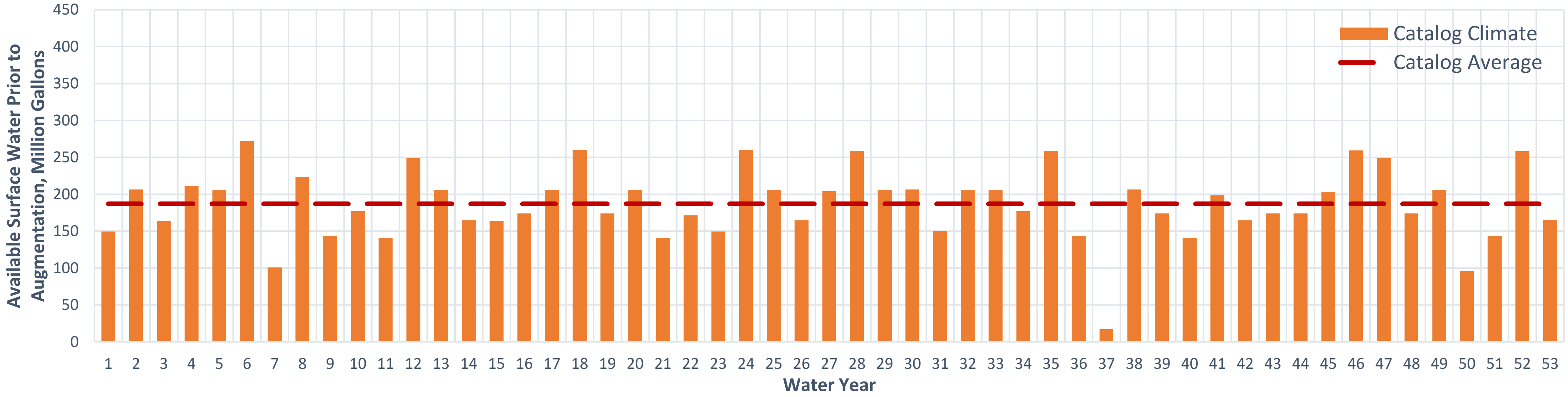
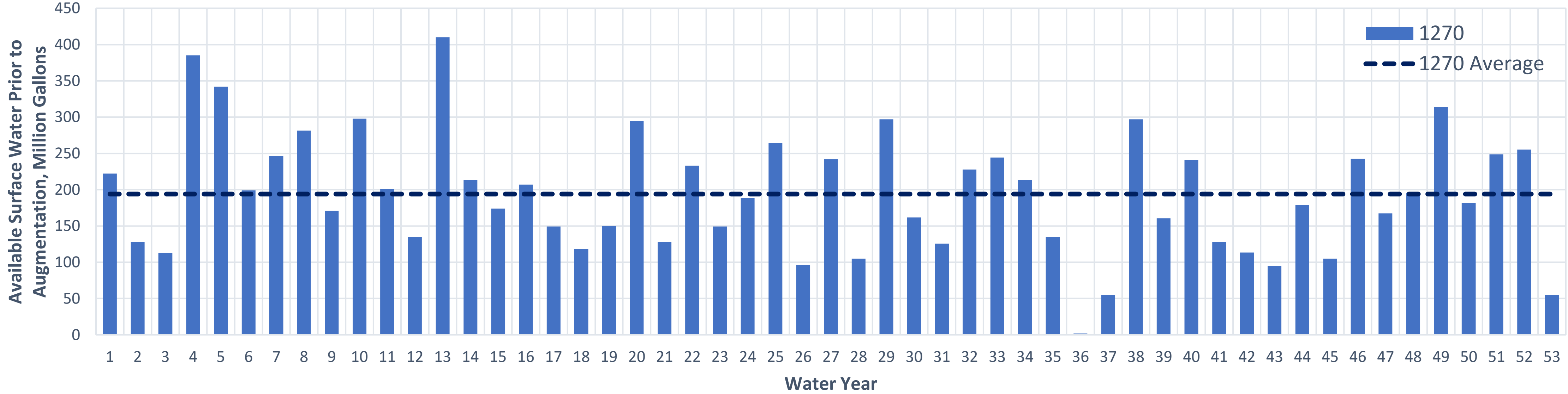
MONTGOMERY & ASSOCIATES

Supply Gap Prior to Augmentation



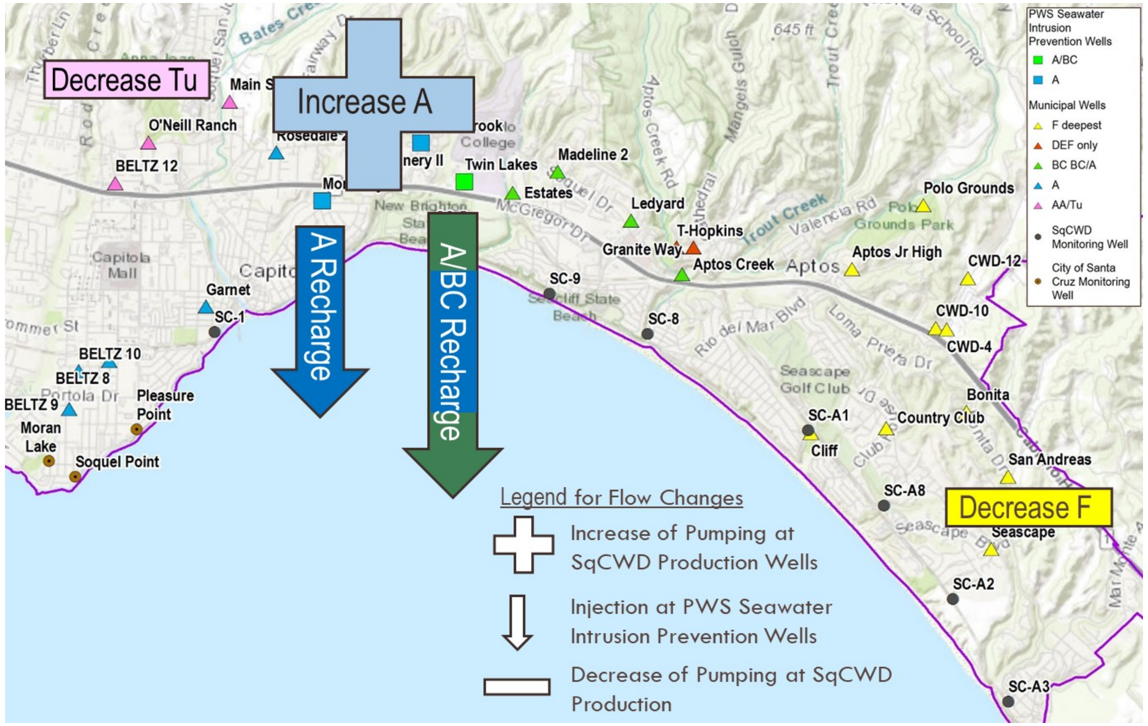
Available Surface Water Prior to Augmentation

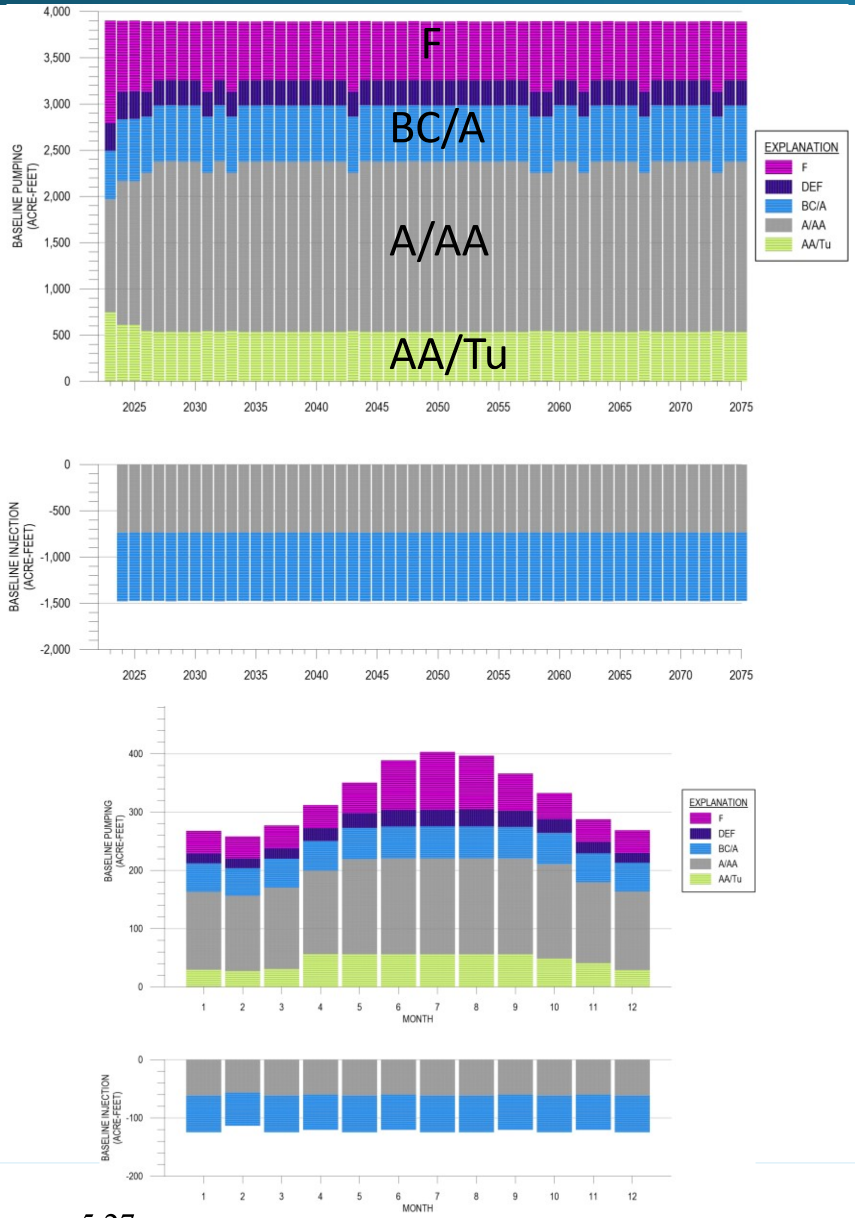




Baseline Pure Water Soquel (PWS)

PWS Designed to Have District-Wide Benefits





5.27

Annual

SqCWD Projected Project Pumping=3900 AFY (max in UWMP and same as GSP) using recent seasonal variation

All Initial Simulations

SqCWD PWS Recharge =1500 AFY (Modified to shift recharge from Willowbrook to Monterey)

Recharge at TLC same as GSP simulations

Monthly

Updated for recent seasonal variation

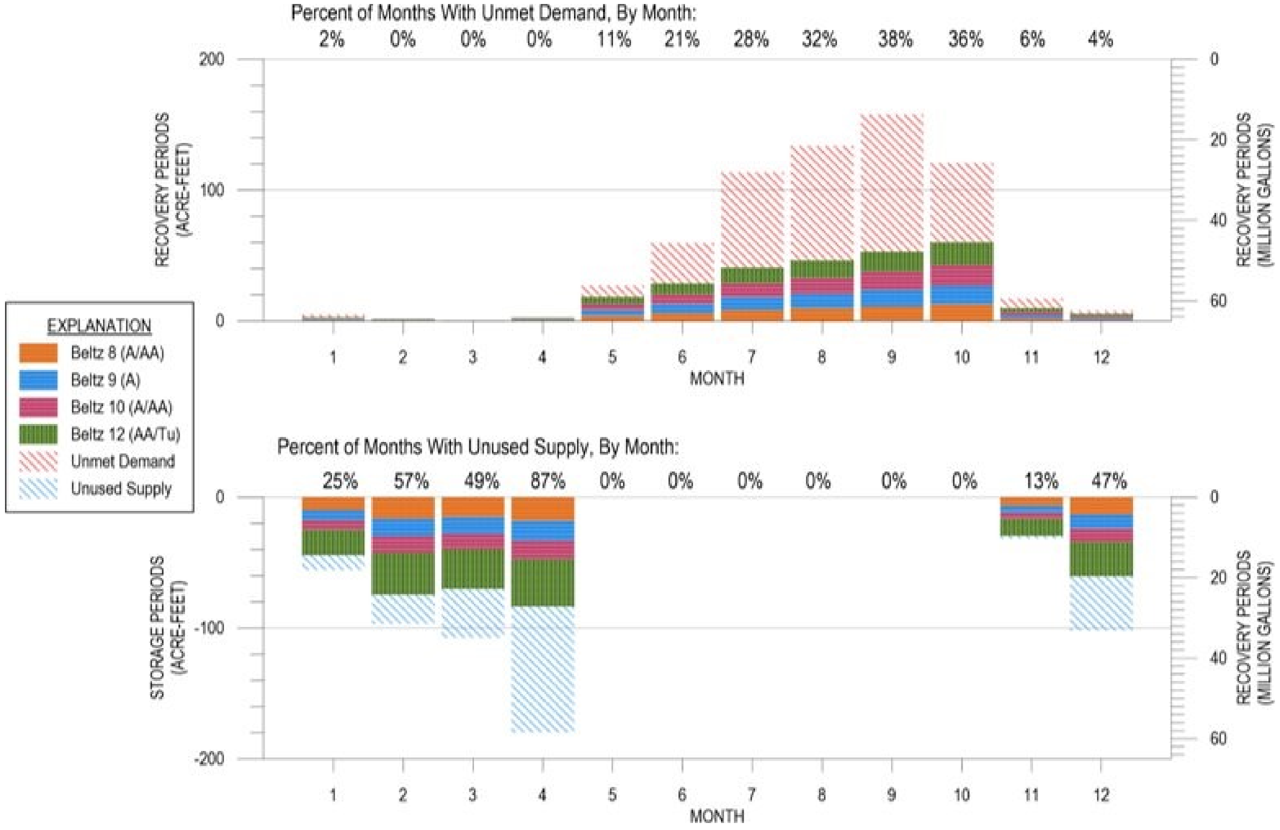
MONTGOMERY & ASSOCIATES

Baseline ASR Revised from GSP

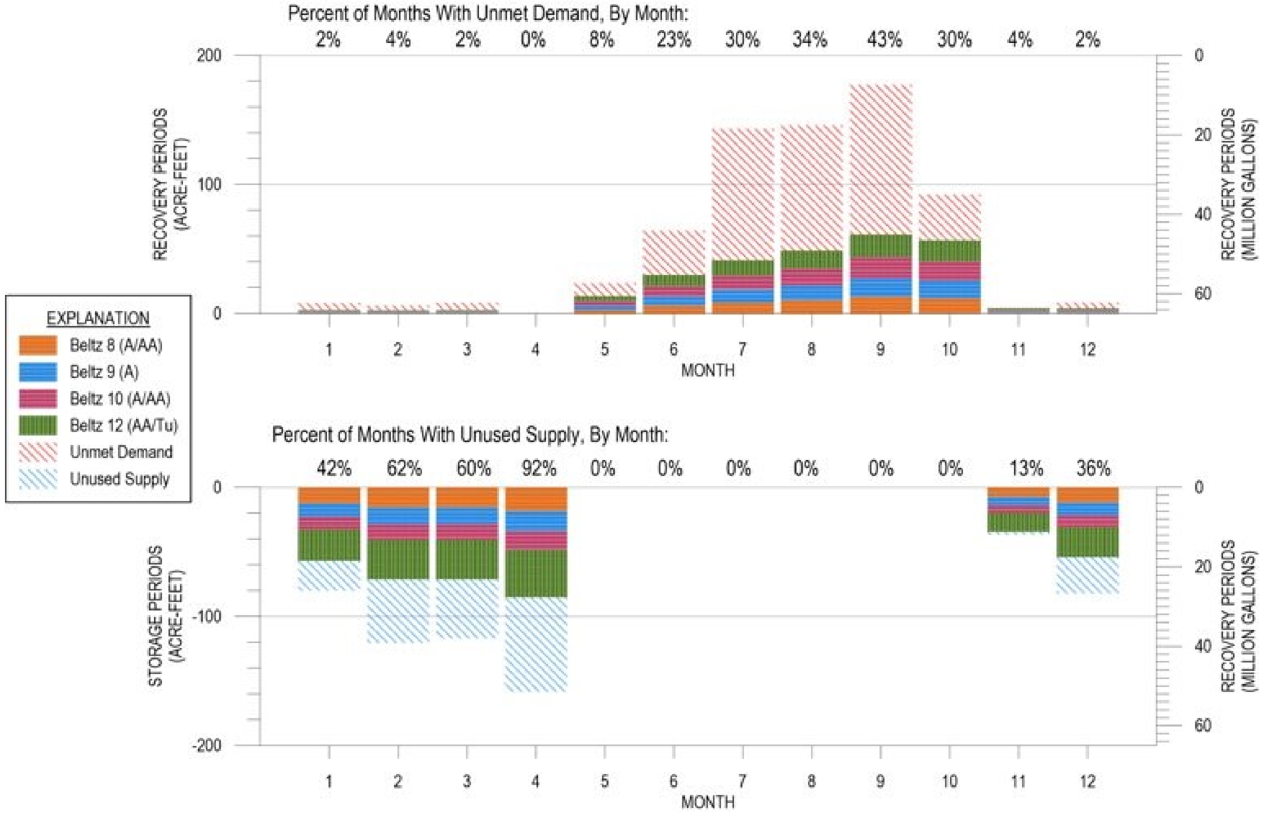
Optimization Study	GSP
Santa Cruz Water System Model (UMass)	Confluence (Fiske)
No Assumptions about Groundwater "Reservoir"	Assumed 20% Aquifer Losses and Aquifer Capacity
2045 Demand (2.9 bgy)	2016-2018 Demand (2.6 bgy)
4 existing Beltz wells: 1 mgd injection 1.5 mgd extraction capacity	
Catalog Climate	
Average 375 AFY injection 230 AFY pumping	Average 340-390 AFY injection 220 AFY pumping

Monthly Averages - Summary of Baseline for Both Climates

Catalog

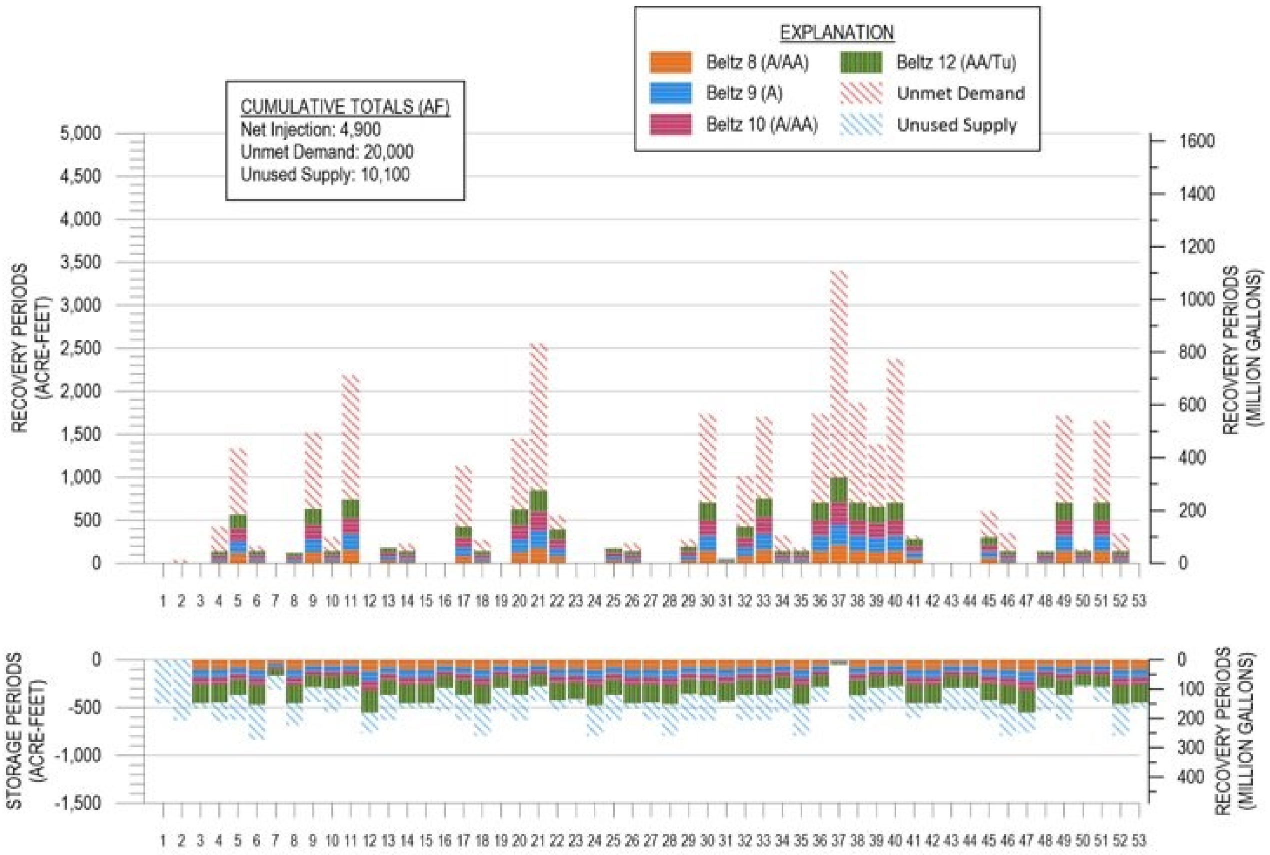


1270

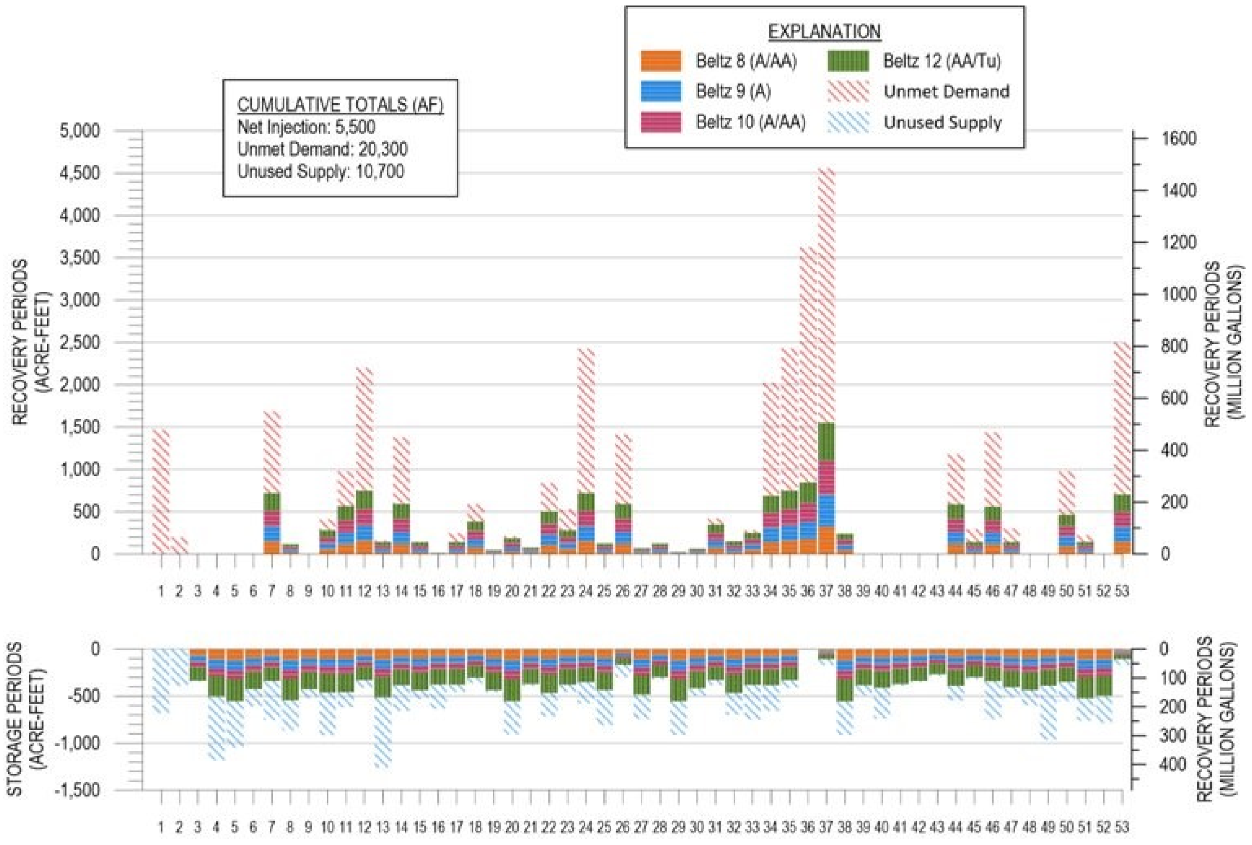


Annual Summary of Baseline for Both Climates

Catalog



1270



Summary of Baseline for Both Climates (Million Gallons)

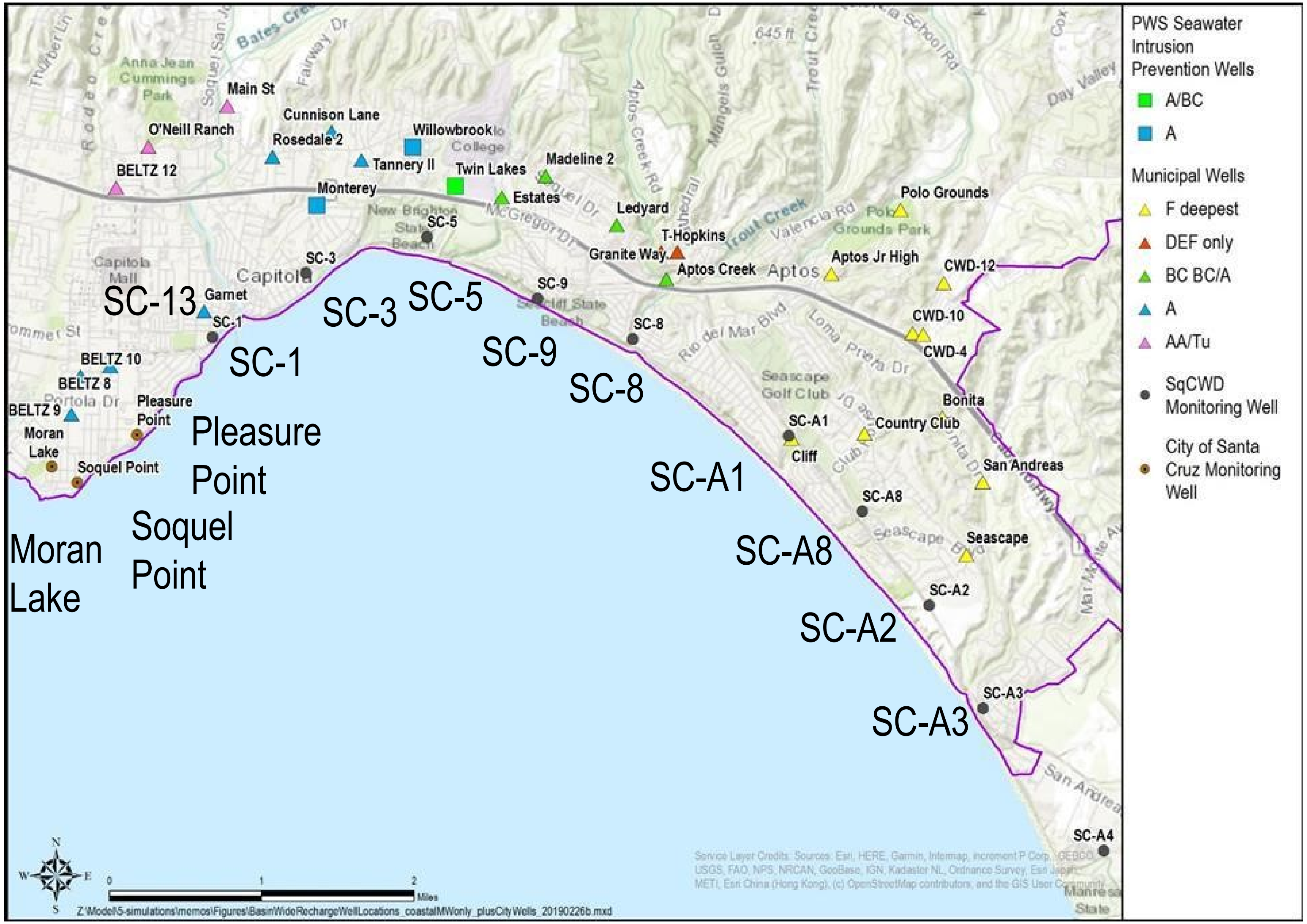
Climate Comparison	**Catalog**	**1270**
Cumulative ASR Injection	6,300	6,400
Cumulative Sent to SqCWD	0	0
Cumulative Unused Surface Water	3,300	3,500
Cumulative ASR Extraction	4,700	4,600
Cumulative Sent to City	0	0
Cumulative Unmet City Demand	6,500	6,600
Max Monthly Unmet Demand	200	200
Max Annual Unmet Demand	800	1,000
Months with Unmet Demand	93	85
Years with Unmet Demand	33	26

Cumulative values reflect simulation period.
Unused surface water is amount of water over the simulation period available for use once customer demands, water rights and agreed flows have been applied.
Unmet demand primarily during summer months (May – October).

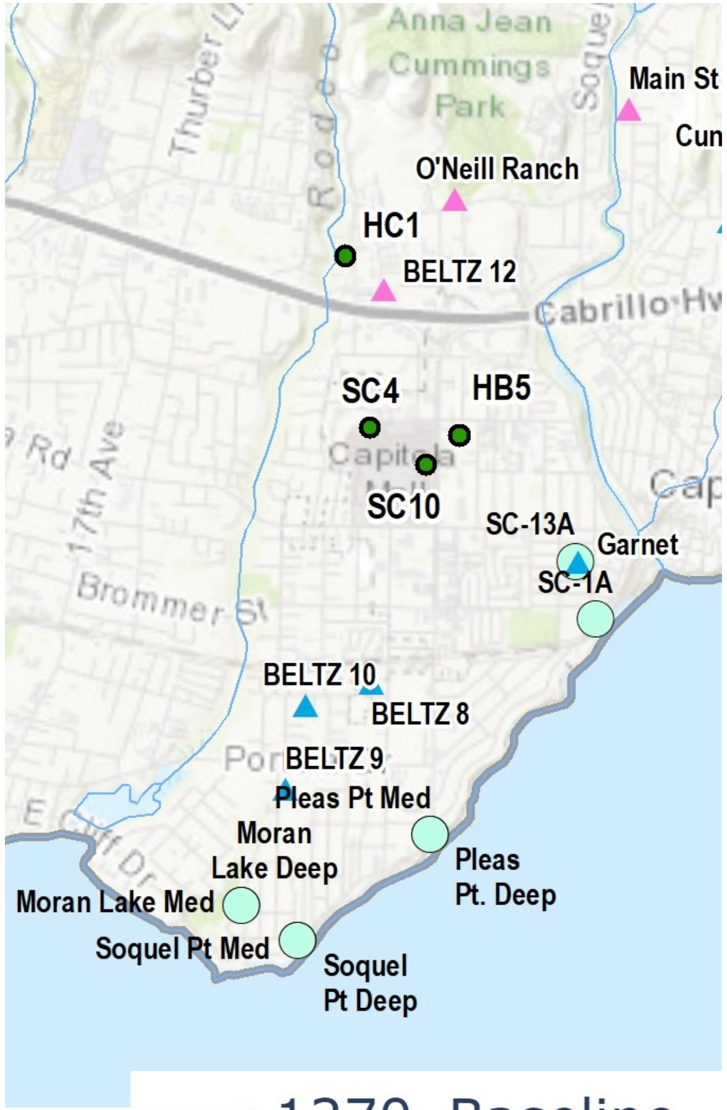
Groundwater Simulation Results

5 Year Averages at Coastal Monitoring Wells

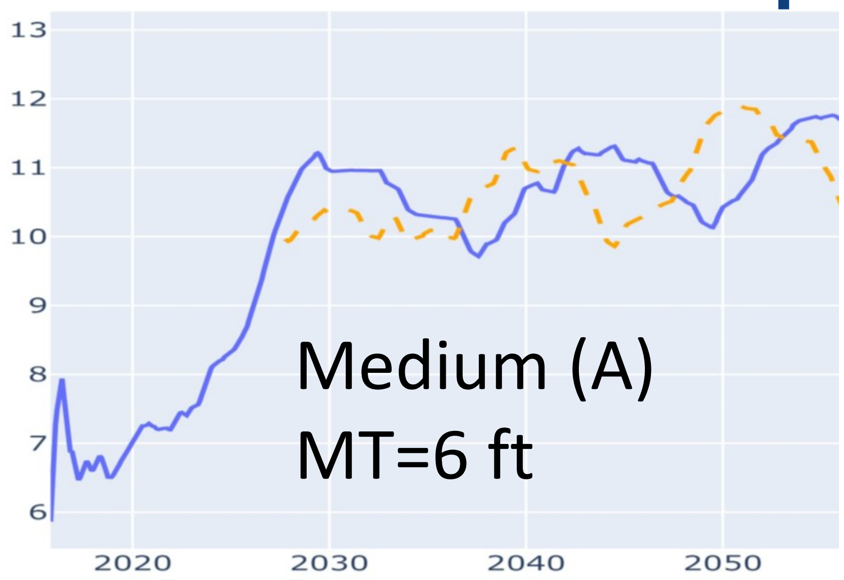
5 Year Average Groundwater Levels at Coastal Wells Evaluated vs. Seawater Intrusion (SWI) SMC Groundwater Elevation Proxies

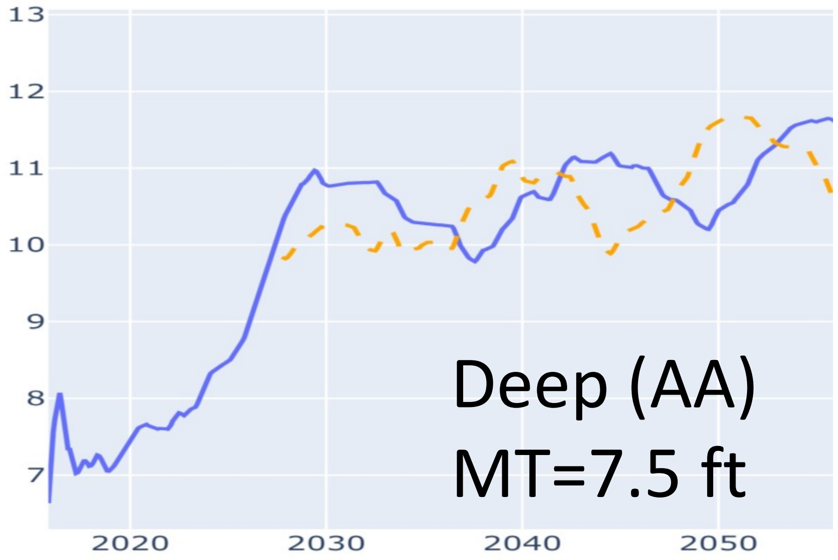


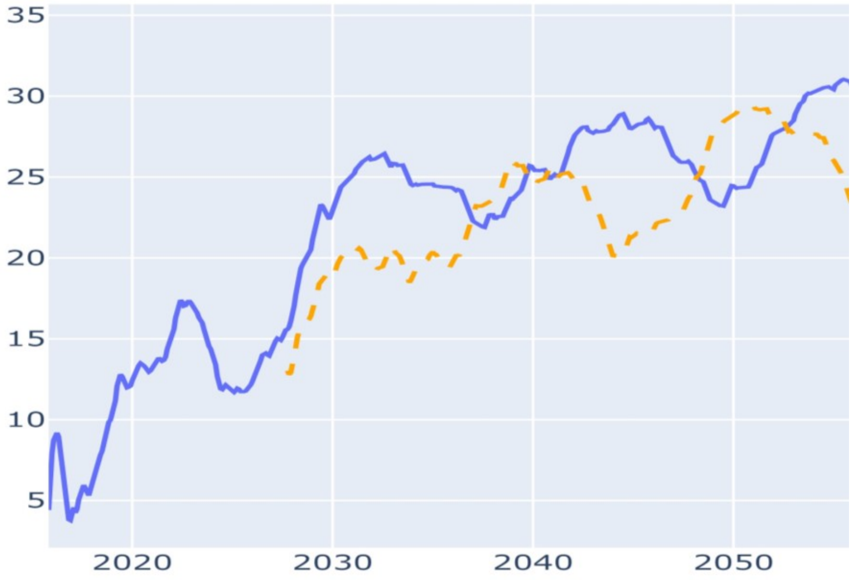
Soquel Point



1270_Baseline
Catalog_Baseline

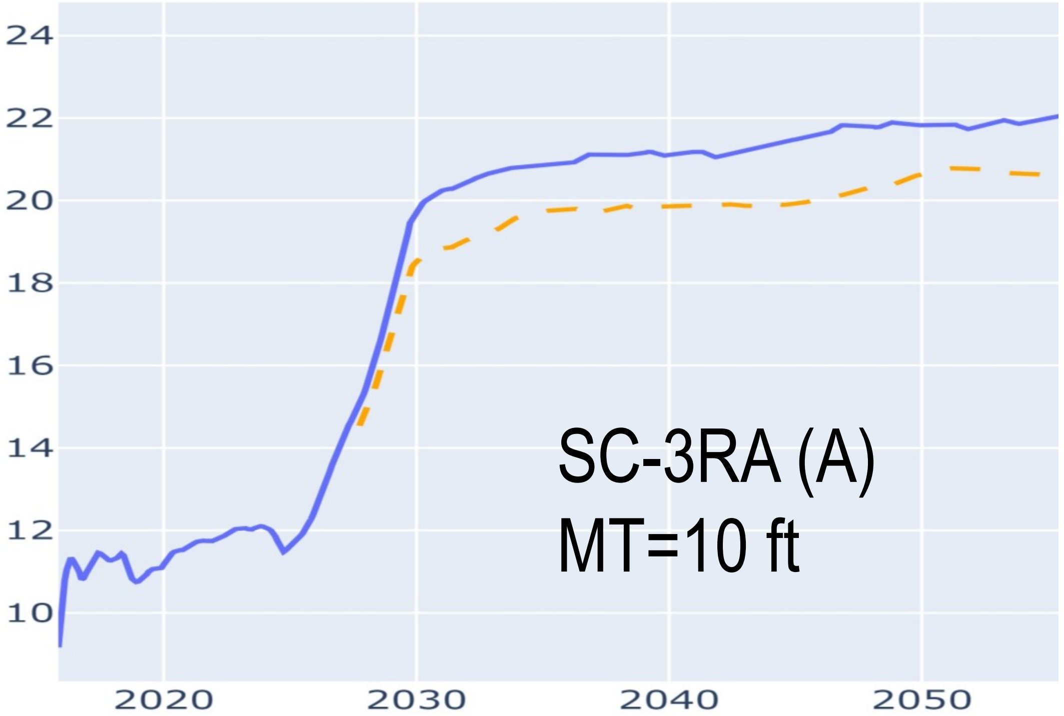


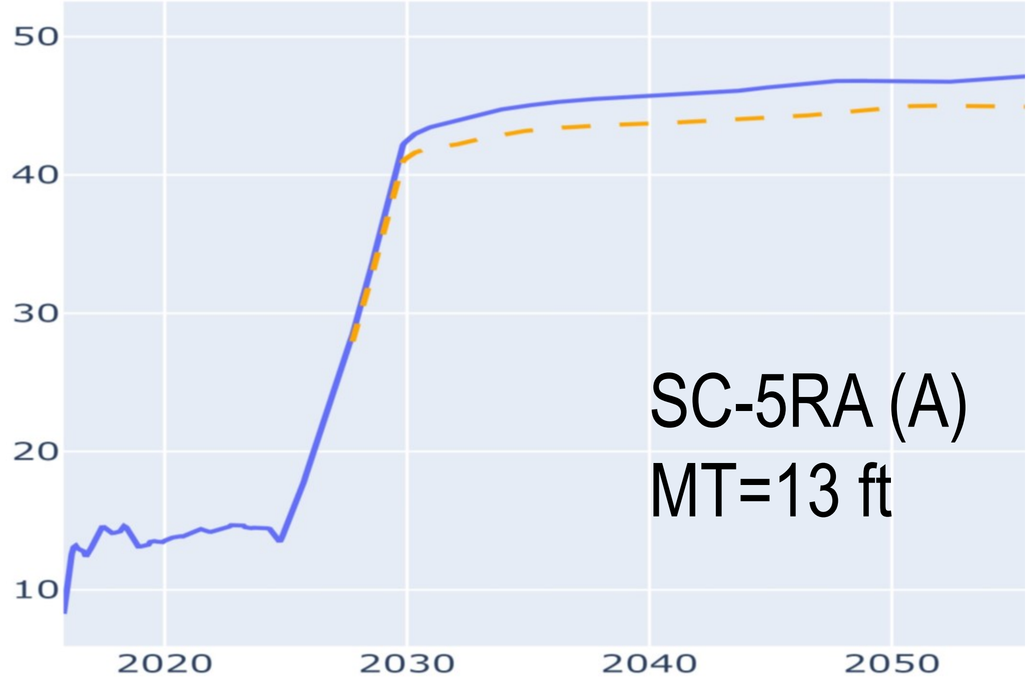




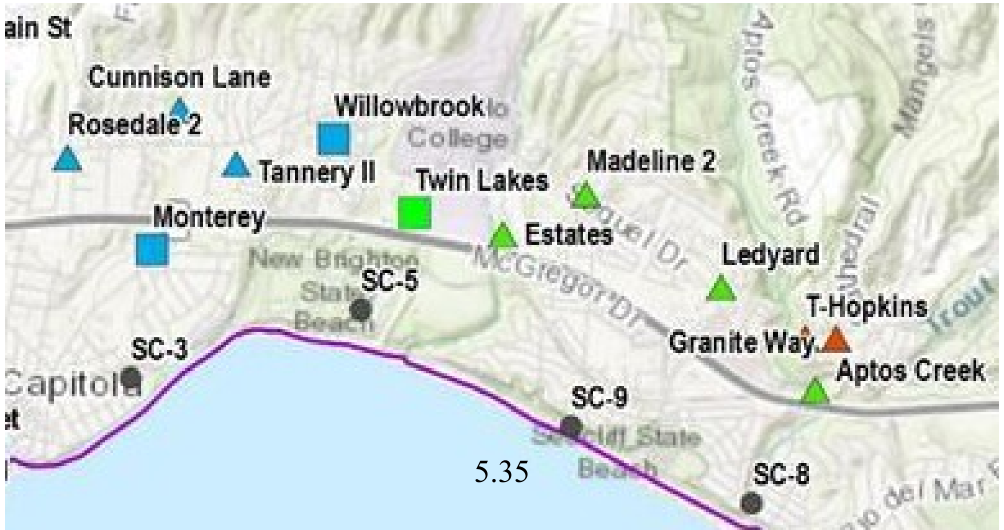
SP-5 (Tu)
Potential MT=25 ft

A Unit Near Pure Water Soquel





1270_Baseline
Catalog_Baseline



Conclusions

- 1270 wetter on average, but has a significant drought ~2055
- Groundwater elevations typically higher with 1270
- Larger supply gap, and more unused surface water supply with 1270
- Following machine learning optimization on Catalog, will be evaluated with 1270 climate.
  - Optimizations successful with Catalog will likely be successful with 1270 climate

Next Steps

- Groundwater Modeling for:
  - ✓ Transfers between City and Soquel District
  - ✓ ASR Baseline + PWS Expanded
  - ✓ ASR Expanded + PWS
  - ✓ ASR Expanded + PWS Expanded
- Mid County Optimized Projects

Questions

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MONTGOMERY & ASSOCIATES
Water Resource Consultants

Part IV

WSAIP Updates
(by KJ)

Wastewater Available
Supply Concepts
Operation Scenarios

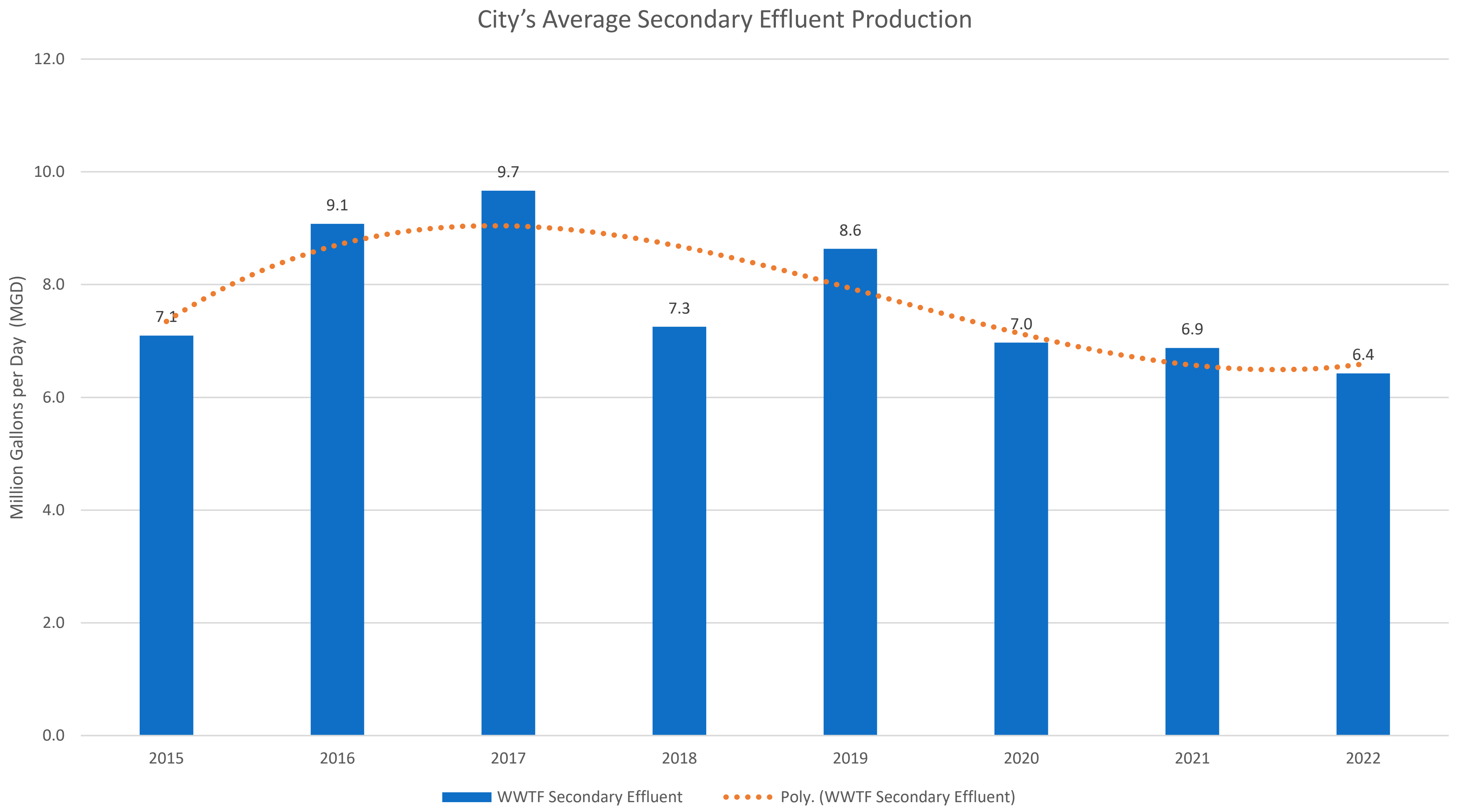
Water Supply Augmentation Implementation Plan WSAIP

Wastewater Availability Update

Supply Concepts

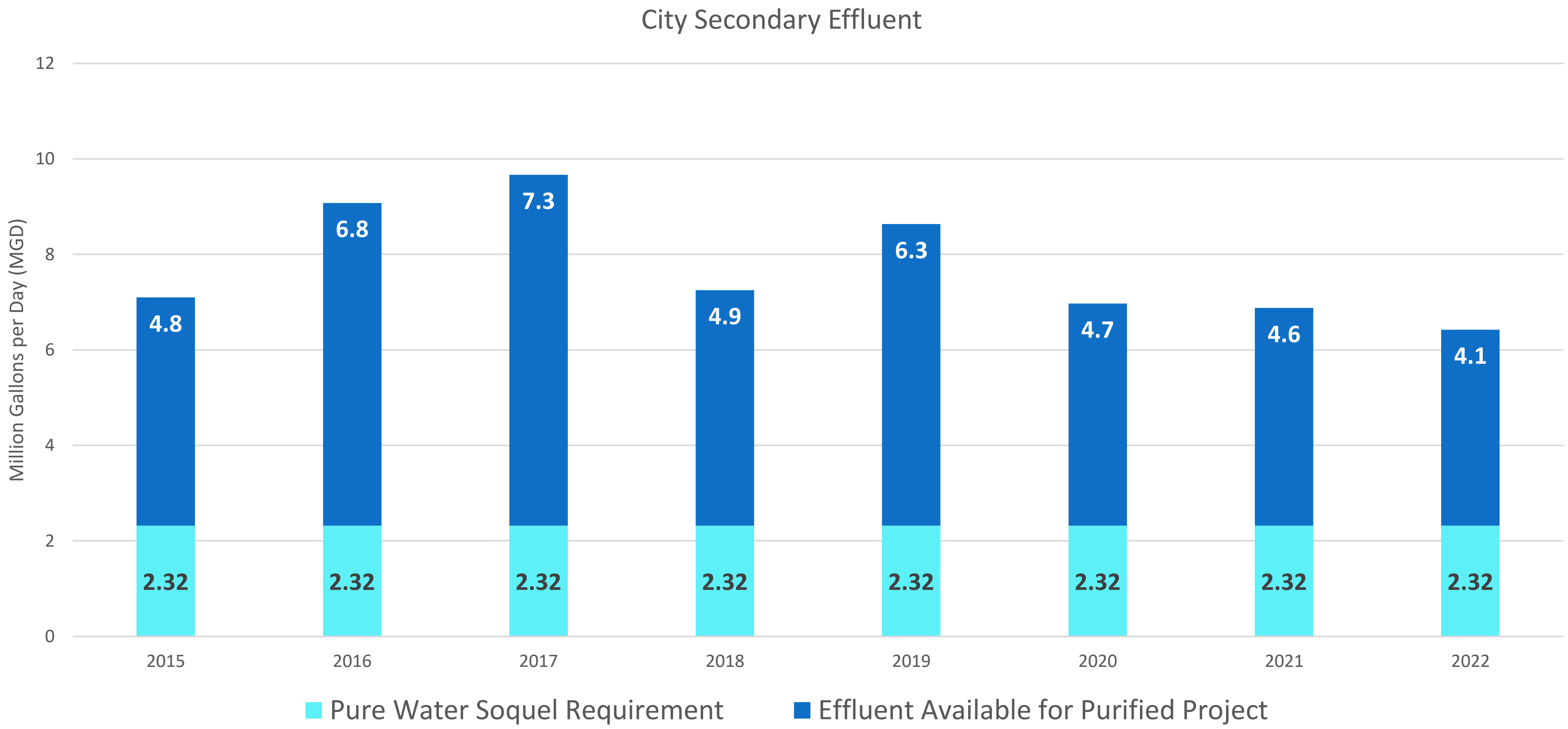
Operational Scenarios

Secondary Effluent Production - Annual

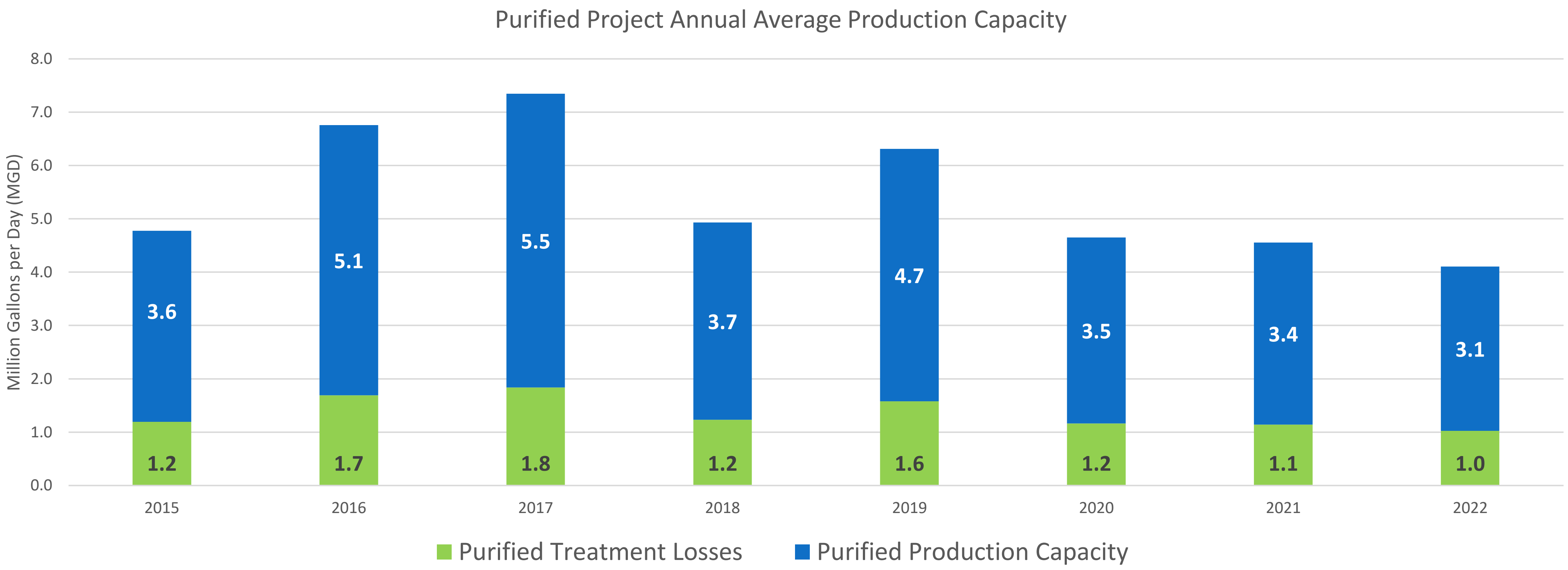


Secondary Effluent Production - Annual

Pure Water Soquel Agreement	MGD
Pure Water Soquel Secondary Effluent Supply	2.32



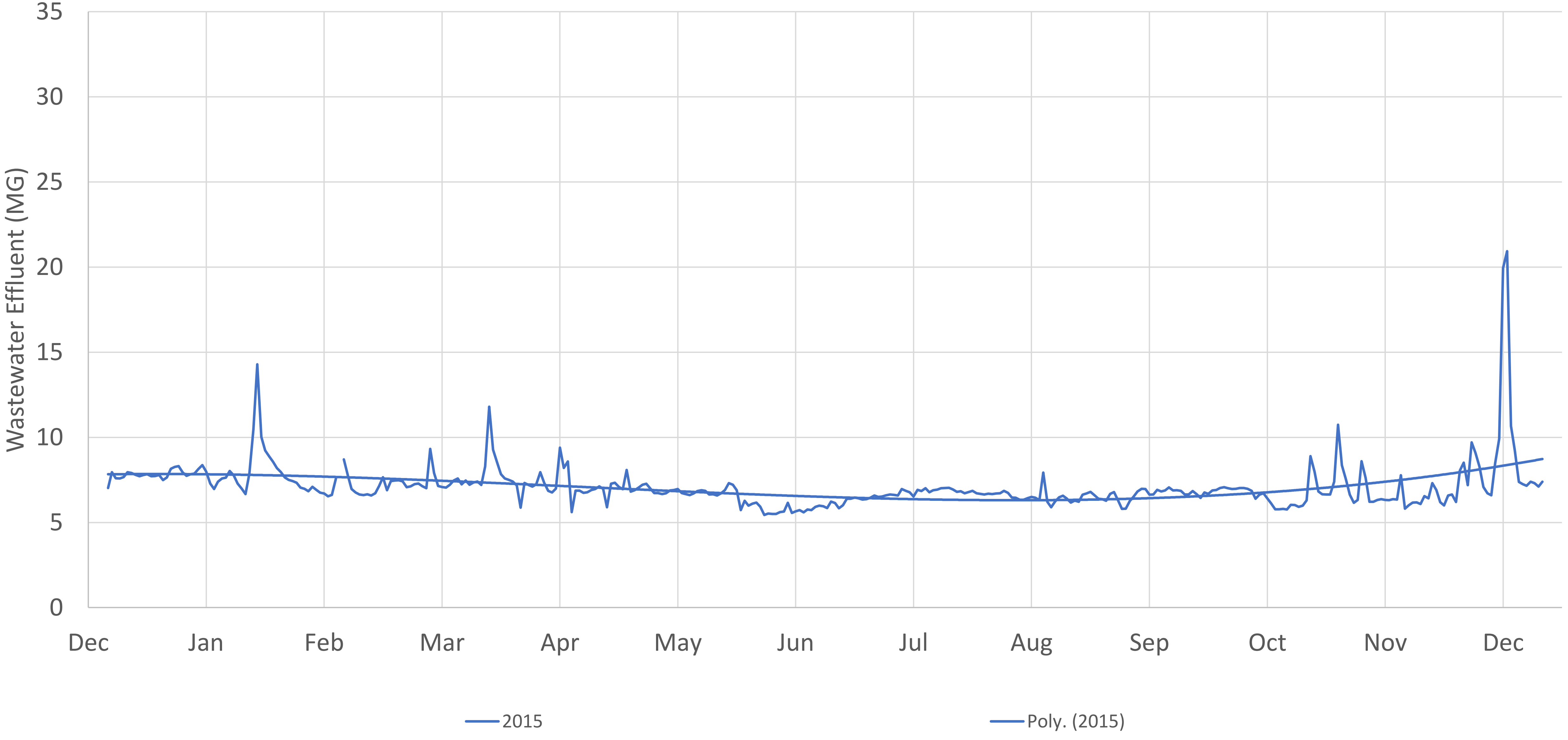
Secondary Effluent Production - Annual



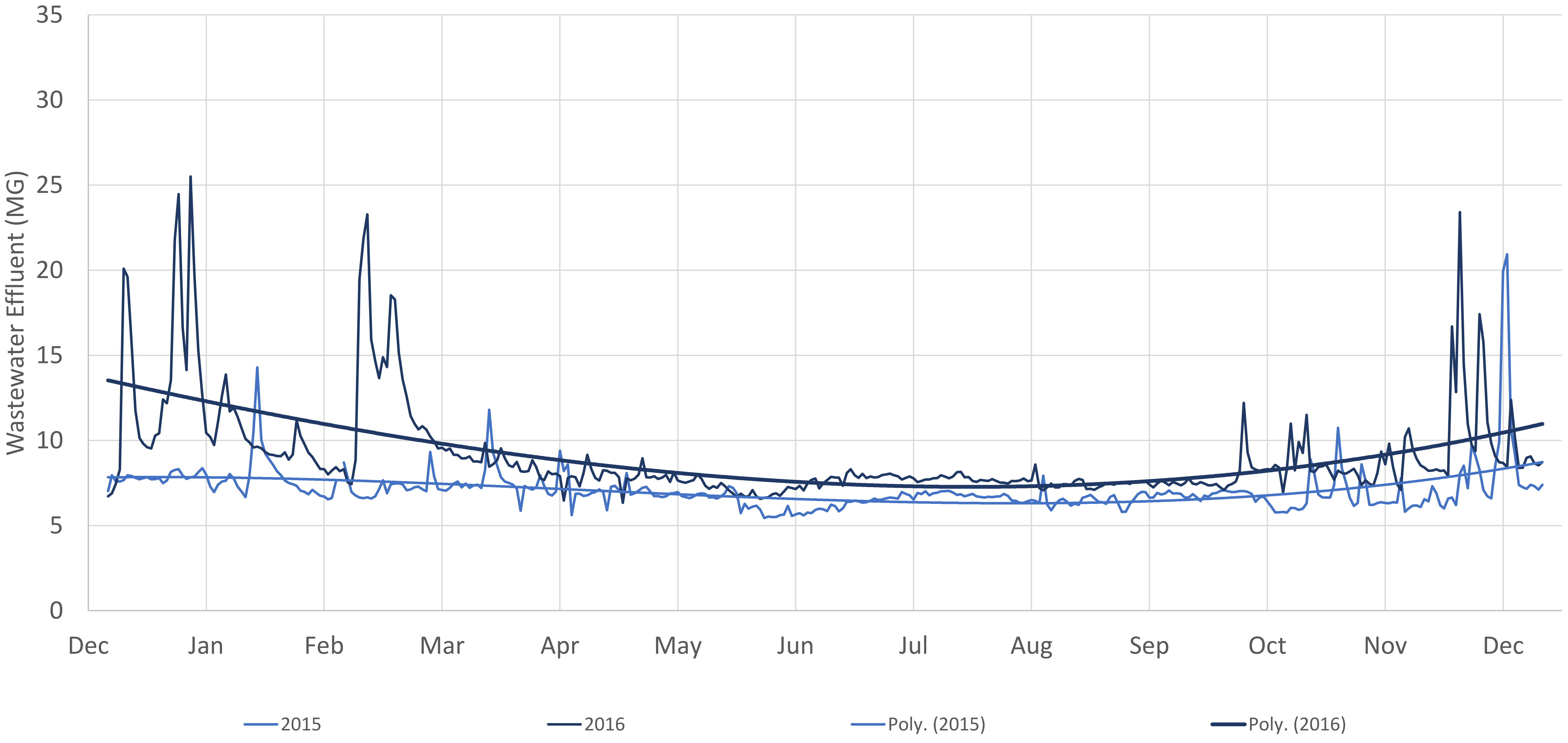
25% treatment losses

75% Treatment Recovery

Secondary Effluent Production - Monthly

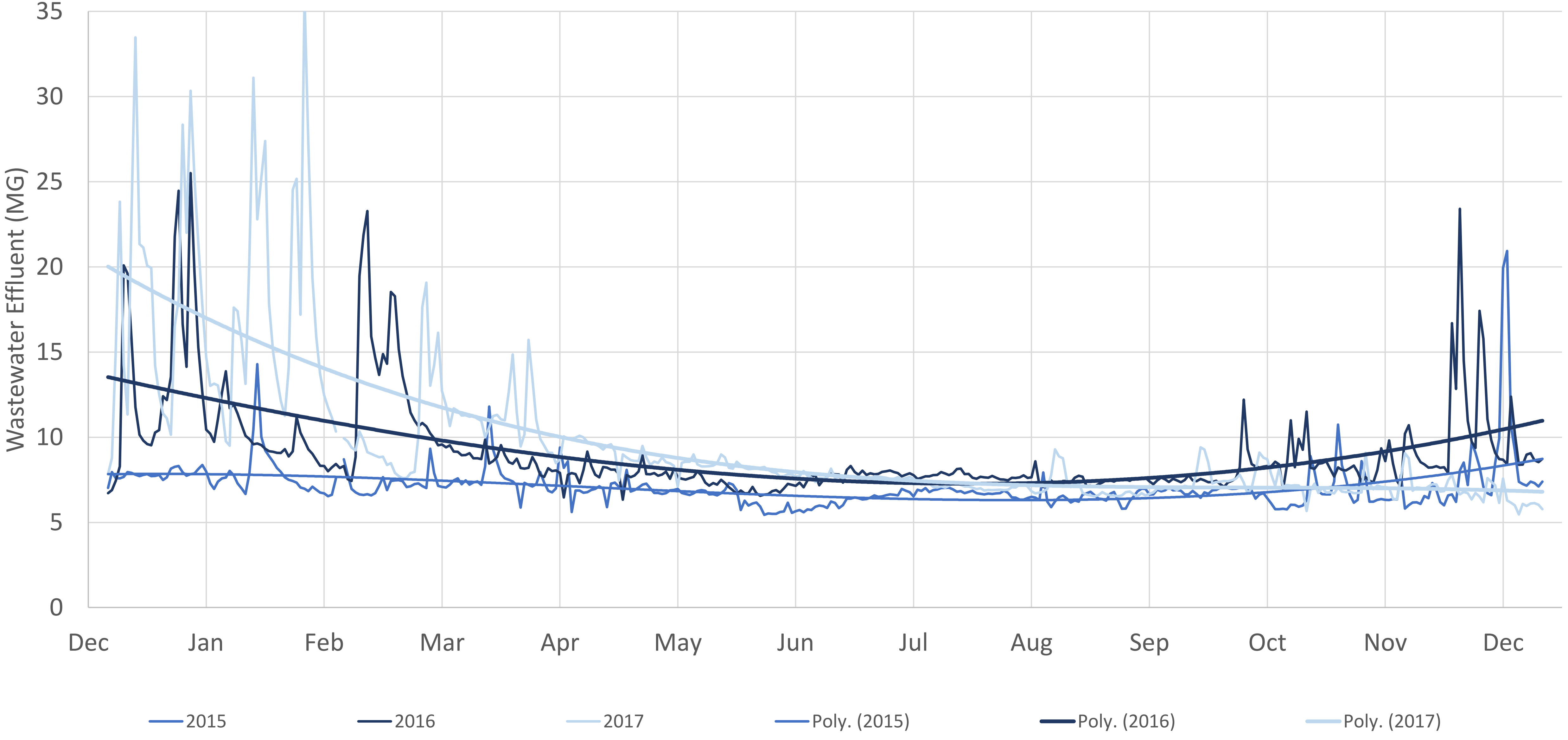


Secondary Effluent Production - Monthly



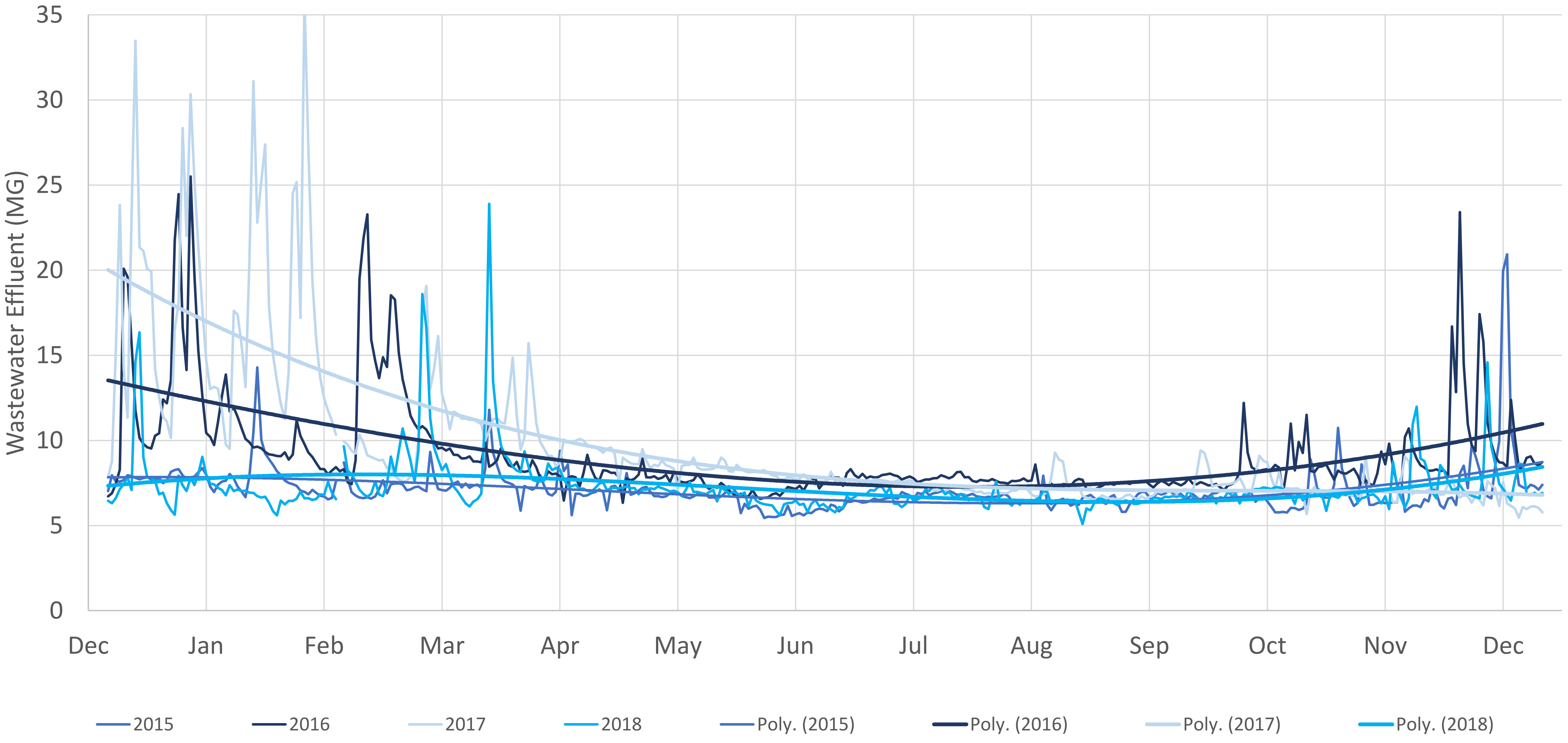
5.44

Secondary Effluent Production - Monthly

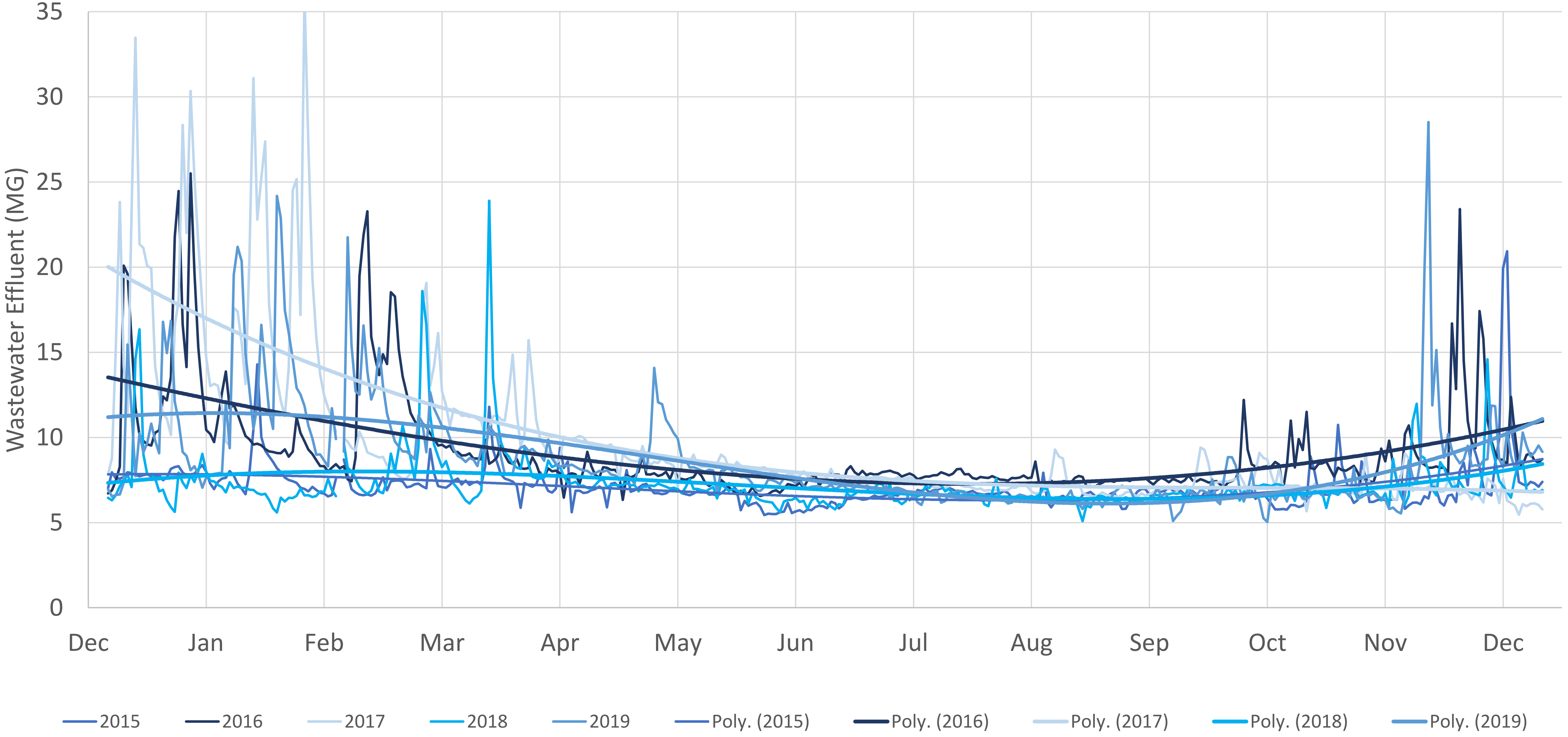


5.45

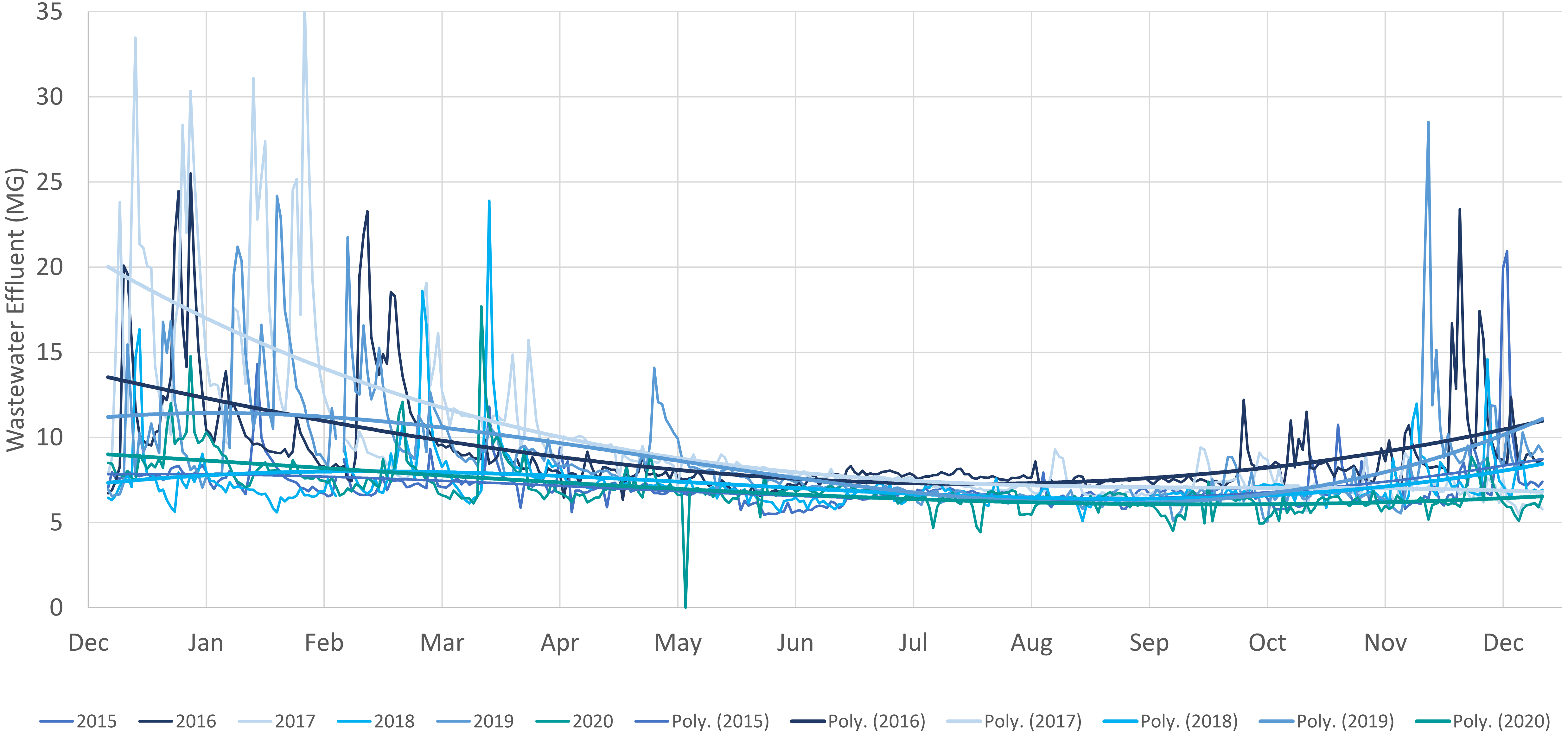
Secondary Effluent Production - Monthly



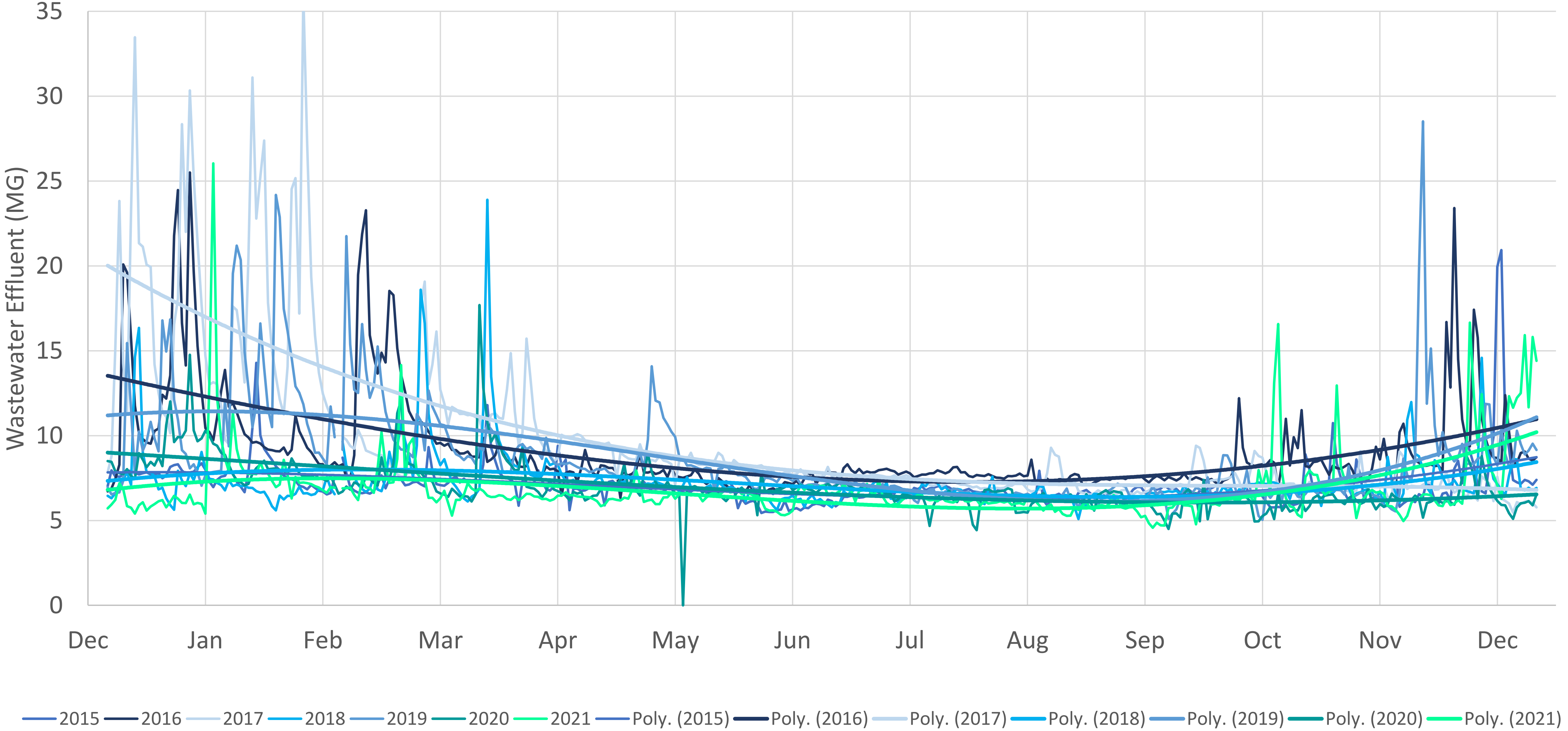
Secondary Effluent Production - Monthly



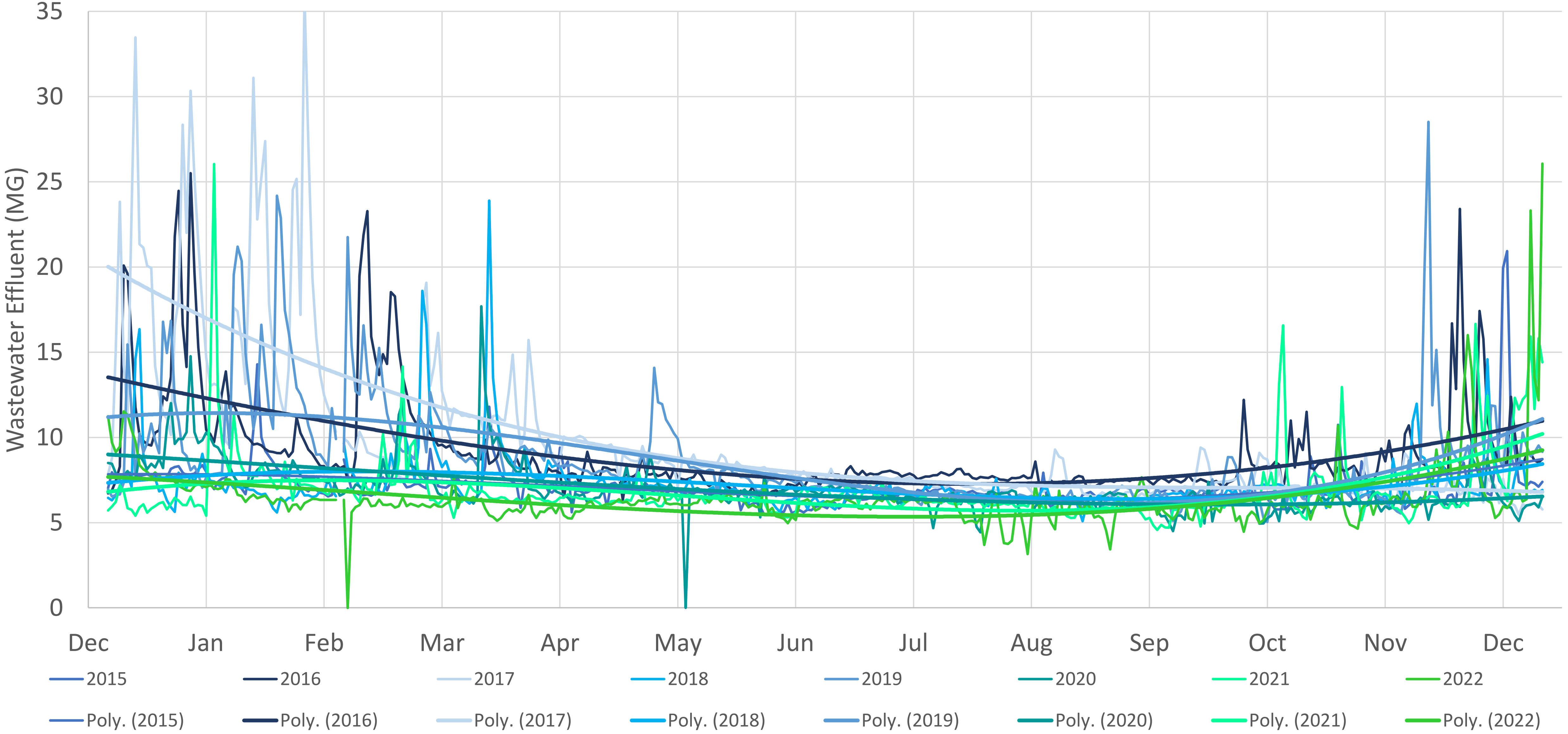
Secondary Effluent Production - Monthly



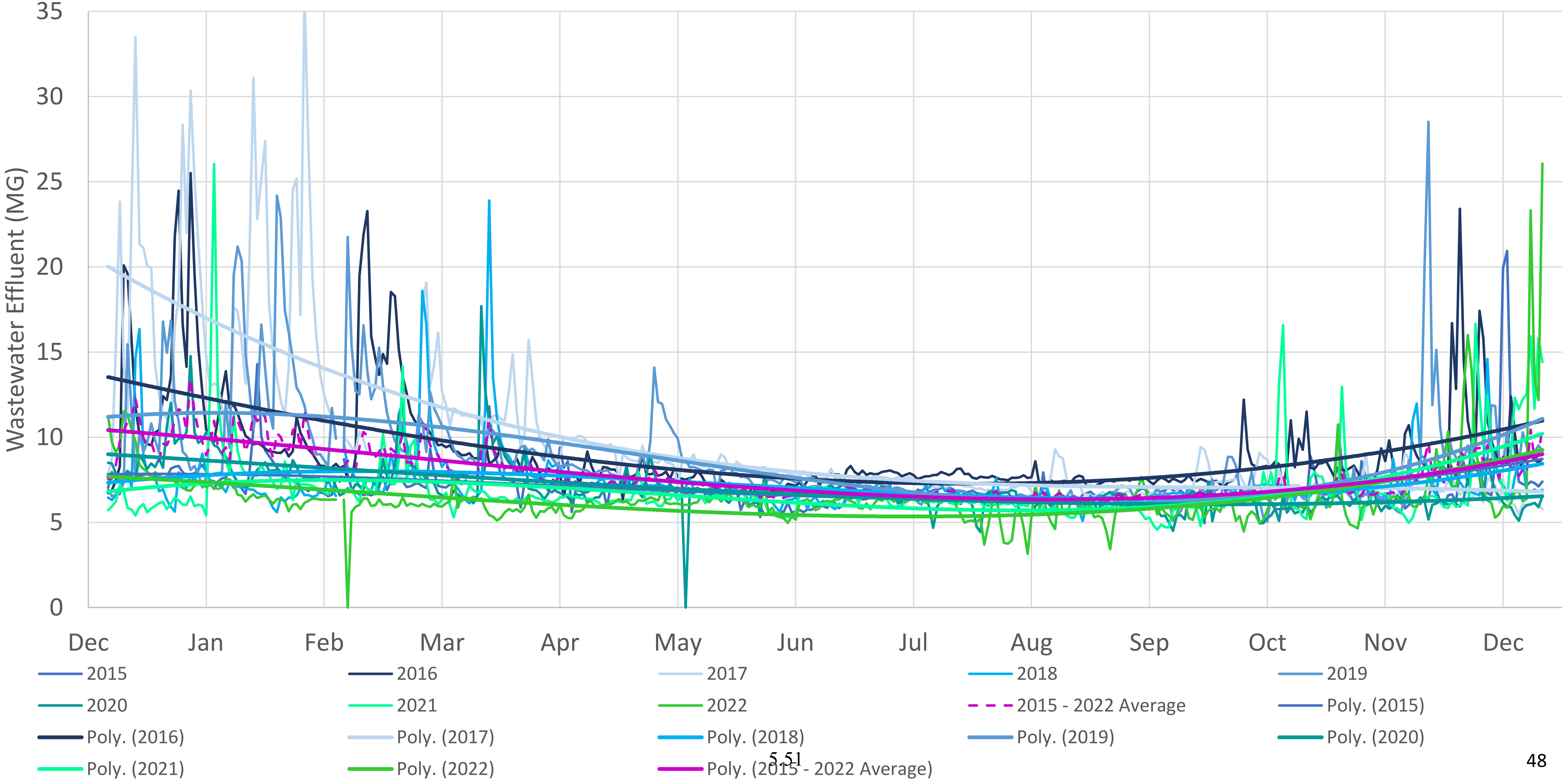
Secondary Effluent Production - Monthly



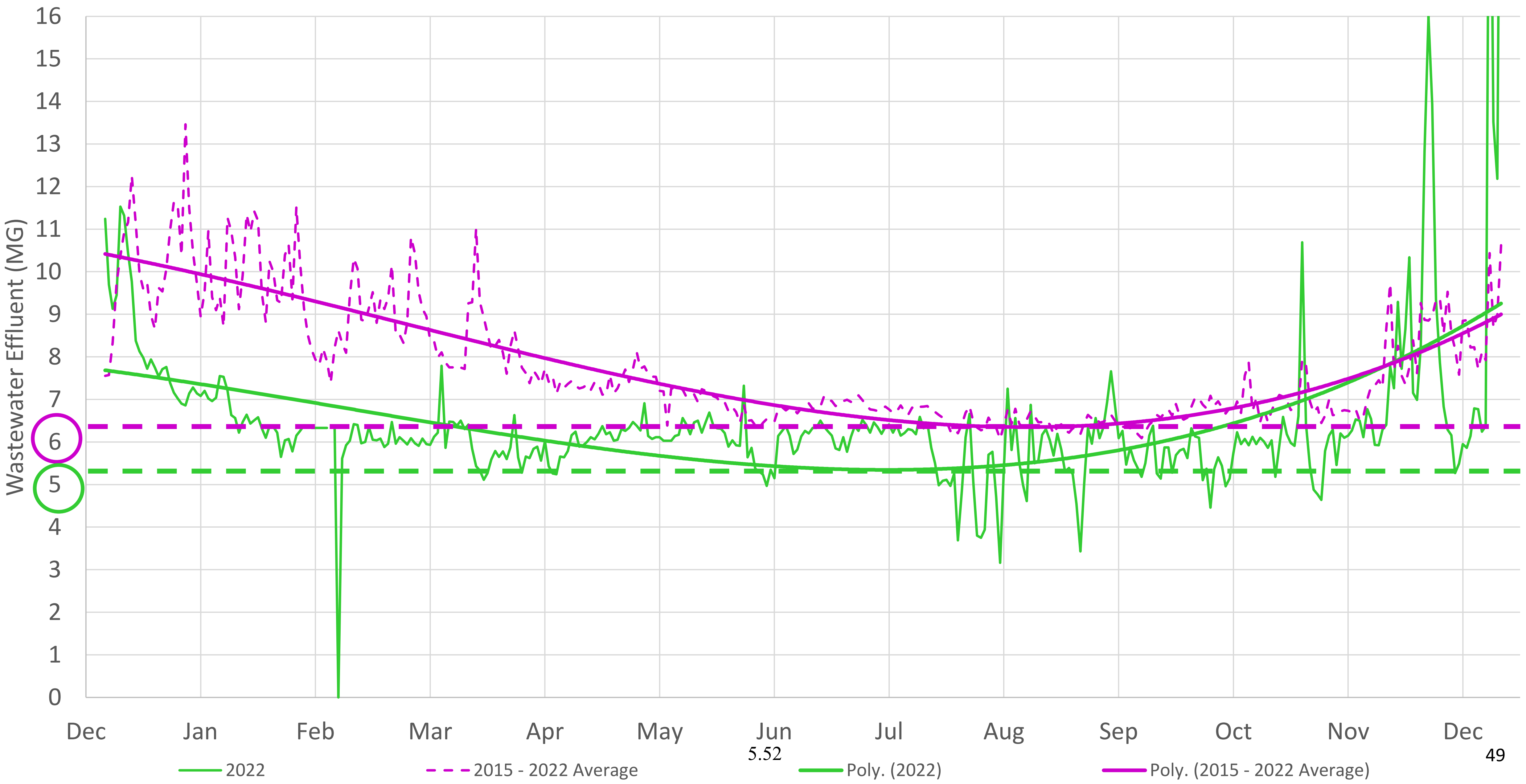
Secondary Effluent Production - Monthly



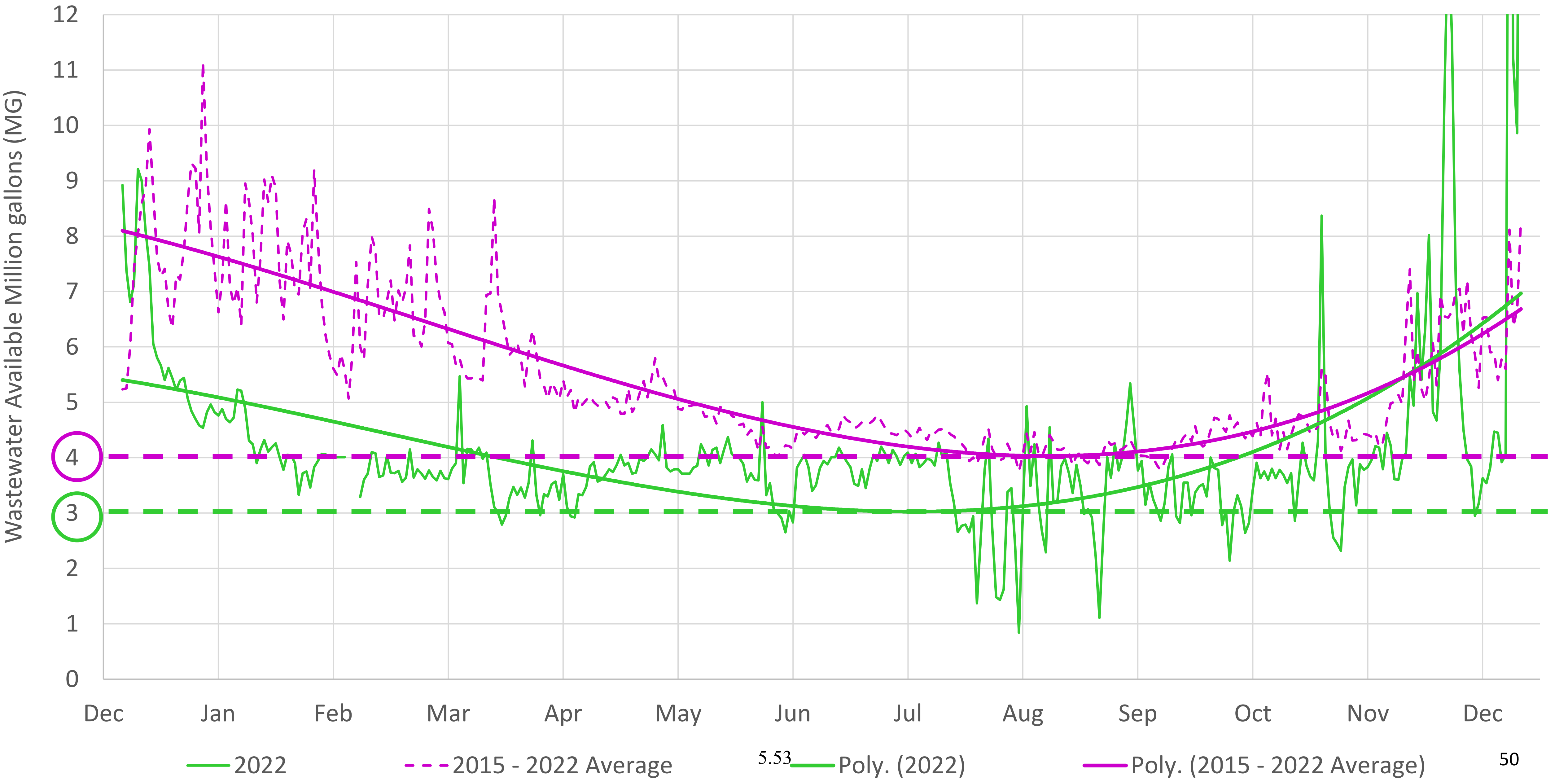
Secondary Effluent Production - Monthly



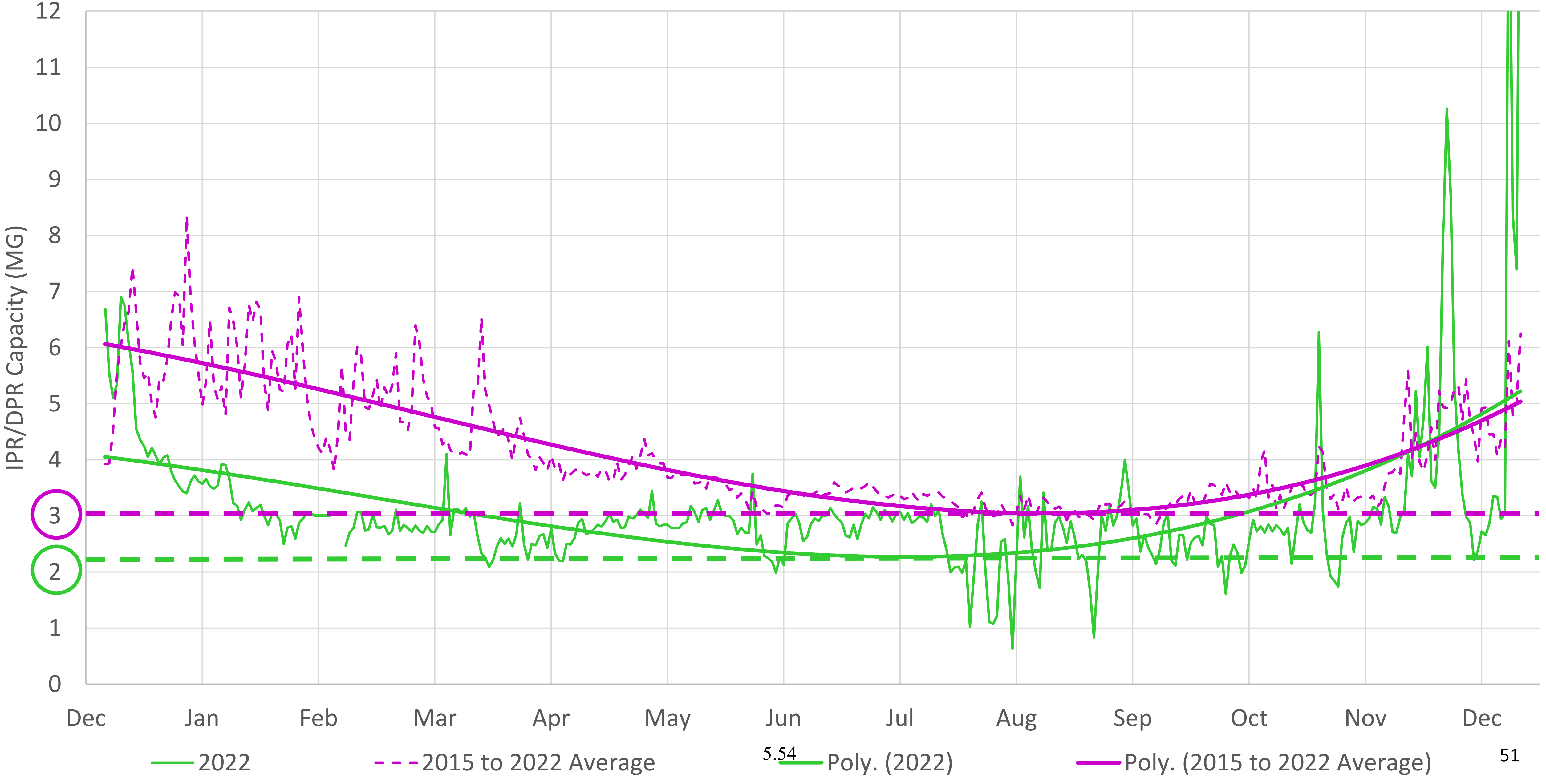
Secondary Effluent Production - Monthly



Effluent Available for Purified Water Project



Purified (IPR/DPR) Project Production Capacity



5.54

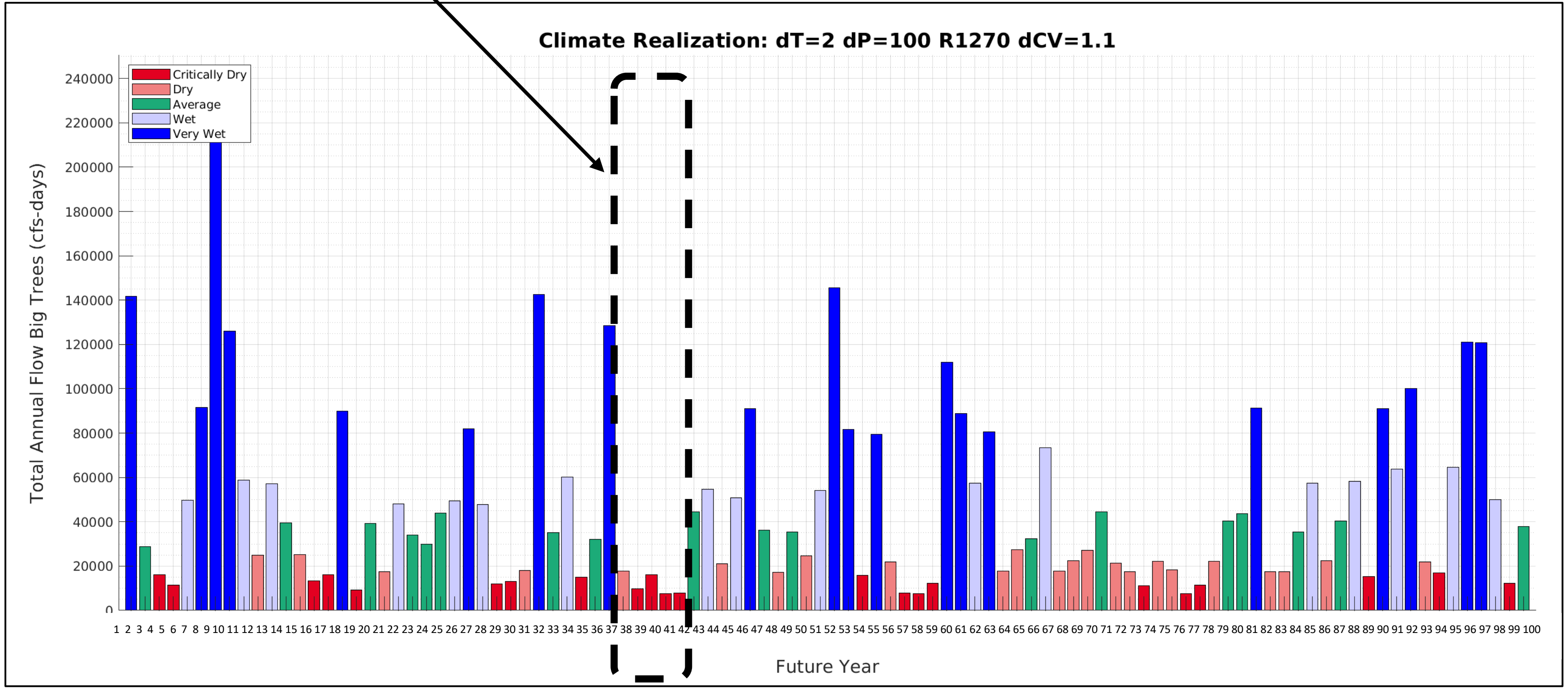
Purified Project Production Capacity (Summer)

Year	Effluent Available [1] (MGD)	Effluent Available for Purified Project [2] (MGD)	Purified Project Capacity [3] (MGD)
2015 to 2022 Average	6.5	4.2	3.2
2019	6.5	4.2	3.1
2020	6.2	3.9	2.9
2021	6.0	3.7	2.8
2022	5.3	3.0	2.3

1. Average Effluent available in August
2. Effluent available after supplying 2.32 MGD for Pure Water Soquel project
3. Purified Production capacity with 25% treatment losses

Water Supply Gap Assessment

1. Climate Scenario 1270 (2 deg C, No change in precipitation, 10% increase CV)
2. 5 year drought



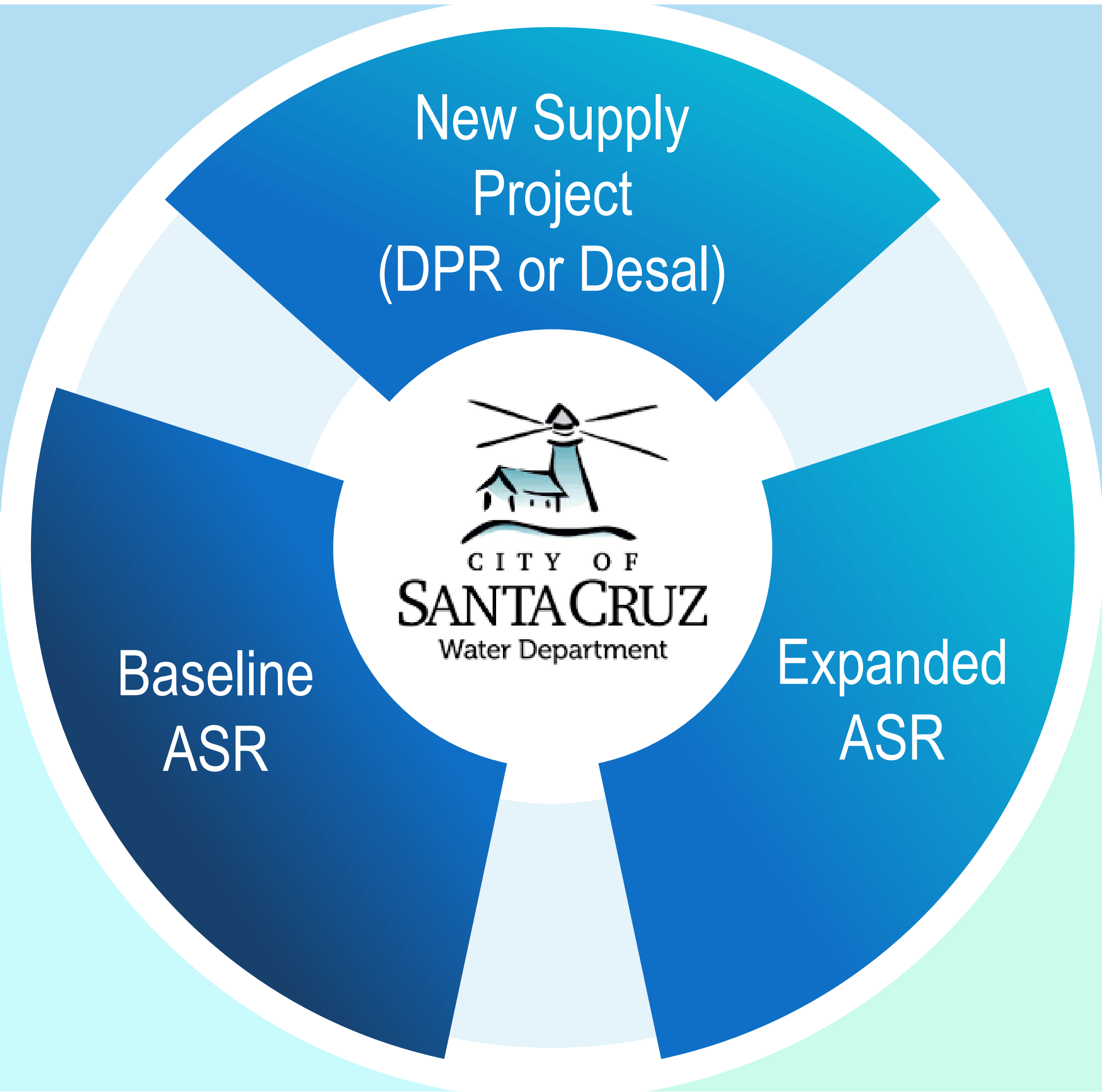
Projection	2045
Water Demands (MGY)	2,900
Water Supply Deficit Projection (MG)	
Year 38	0
Year 39	150
Year 40	1,621
Year 41	1,302
Year 42	72
Total Deficit	3,145
Deficit (Rounded)	3,200

~50% shortage (water year)

Water Supply Concepts

<u>New Supply</u>
New Water Supply Project Capacities Tested:
- ✓ 1 MGD
- ✓ 2 MGD
- ✓ 3 MGD

Next Steps for Supply:
- ✓ Water Transfers
- ✓ Exchanges



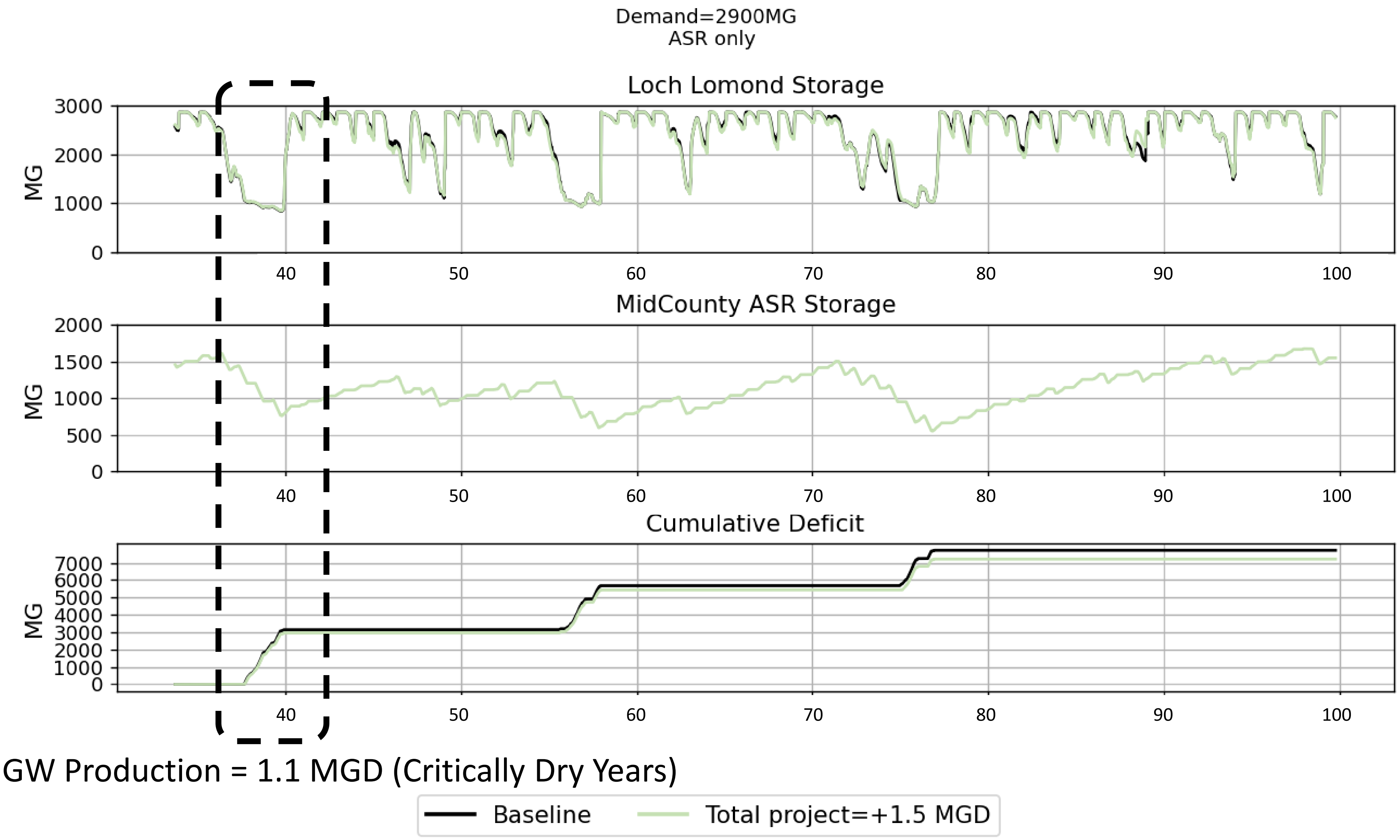
<u>Baseline ASR</u>
4 Beltz Wells
- ✓ 1 MGD Injection
- ✓ 1.5 MGD Extraction

<u>Expanded ASR</u>
4 Beltz Wells
4 New Wells
- ✓ 2 MGD Injection
- ✓ 3 MGD Extraction

Water Supply Concepts

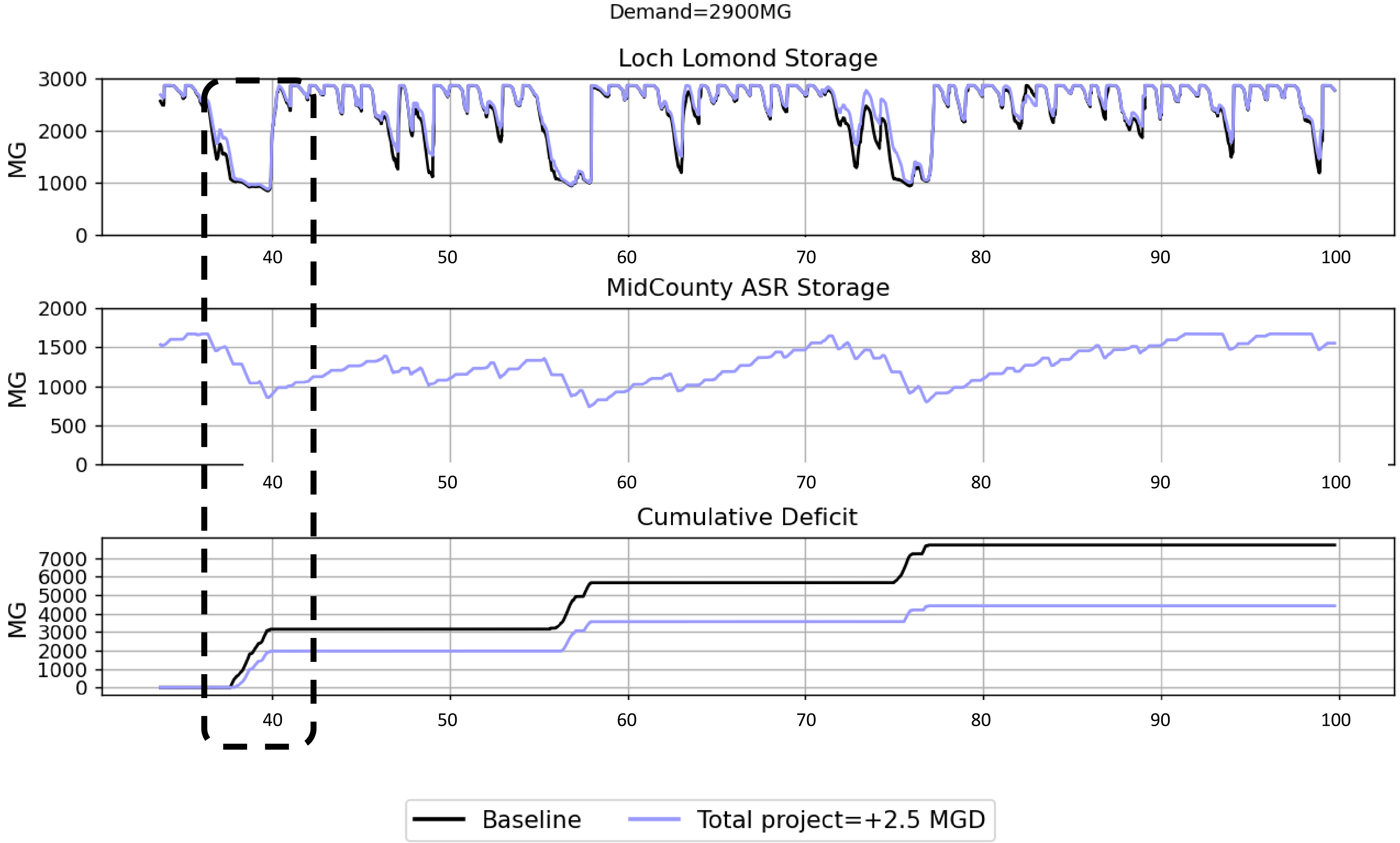
Water Supply Concept	ASR Extraction Capacity (MGD)	New Project Supply Capacity (MGD)	Total Supply Capacity (MGD)
Baseline ASR	1.5	0	1.5
# 1	1.5	1	2.5
# 2	1.5	2	3.5
# 3	1.5	3	4.5
Expanded ASR	3	0	3
# 4	3	1	4
# 5	3	2	5
# 6	3	3	6

Baseline ASR Only

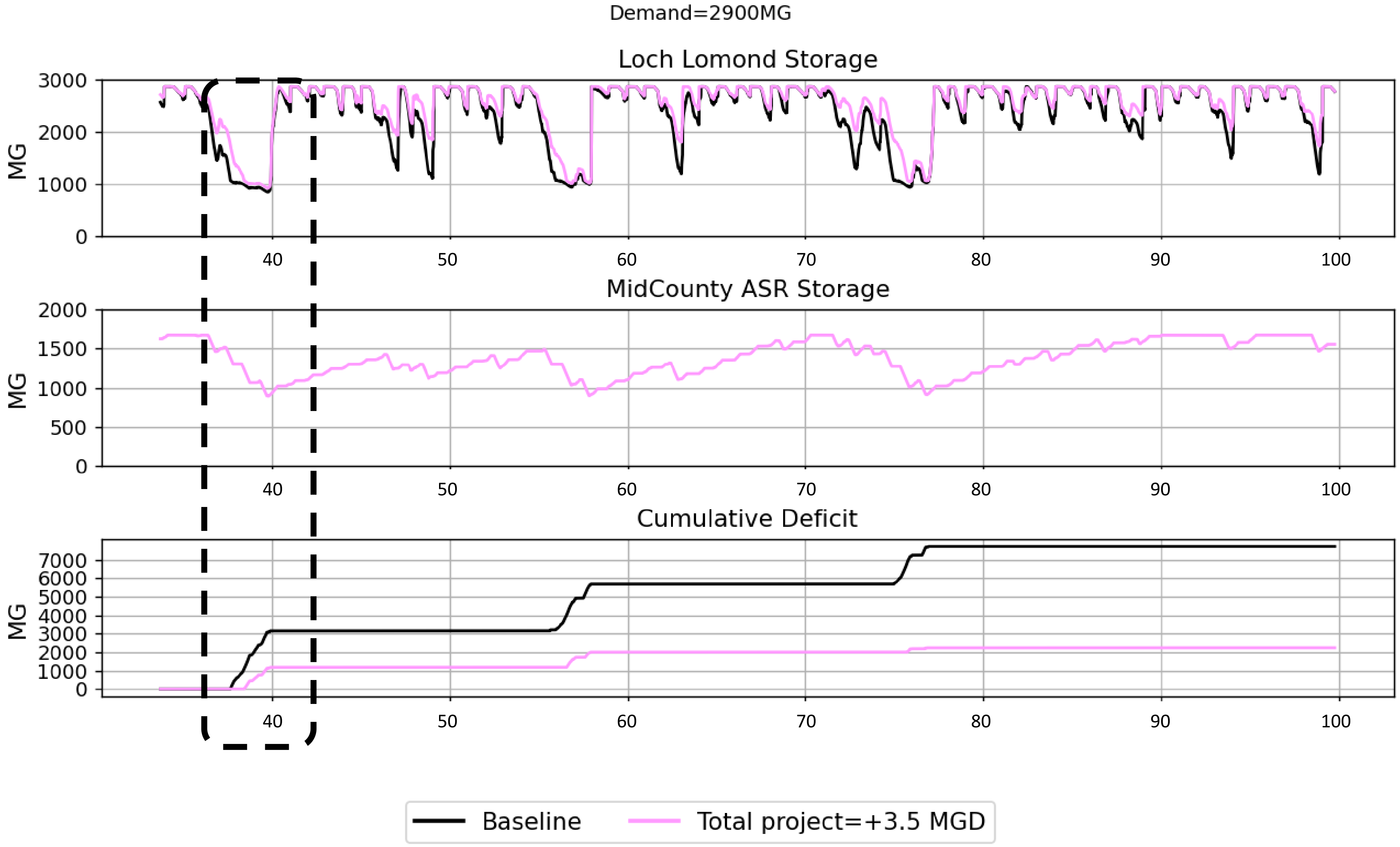


Beltz Wells GW Production = 1.1 MGD (Critically Dry Years)

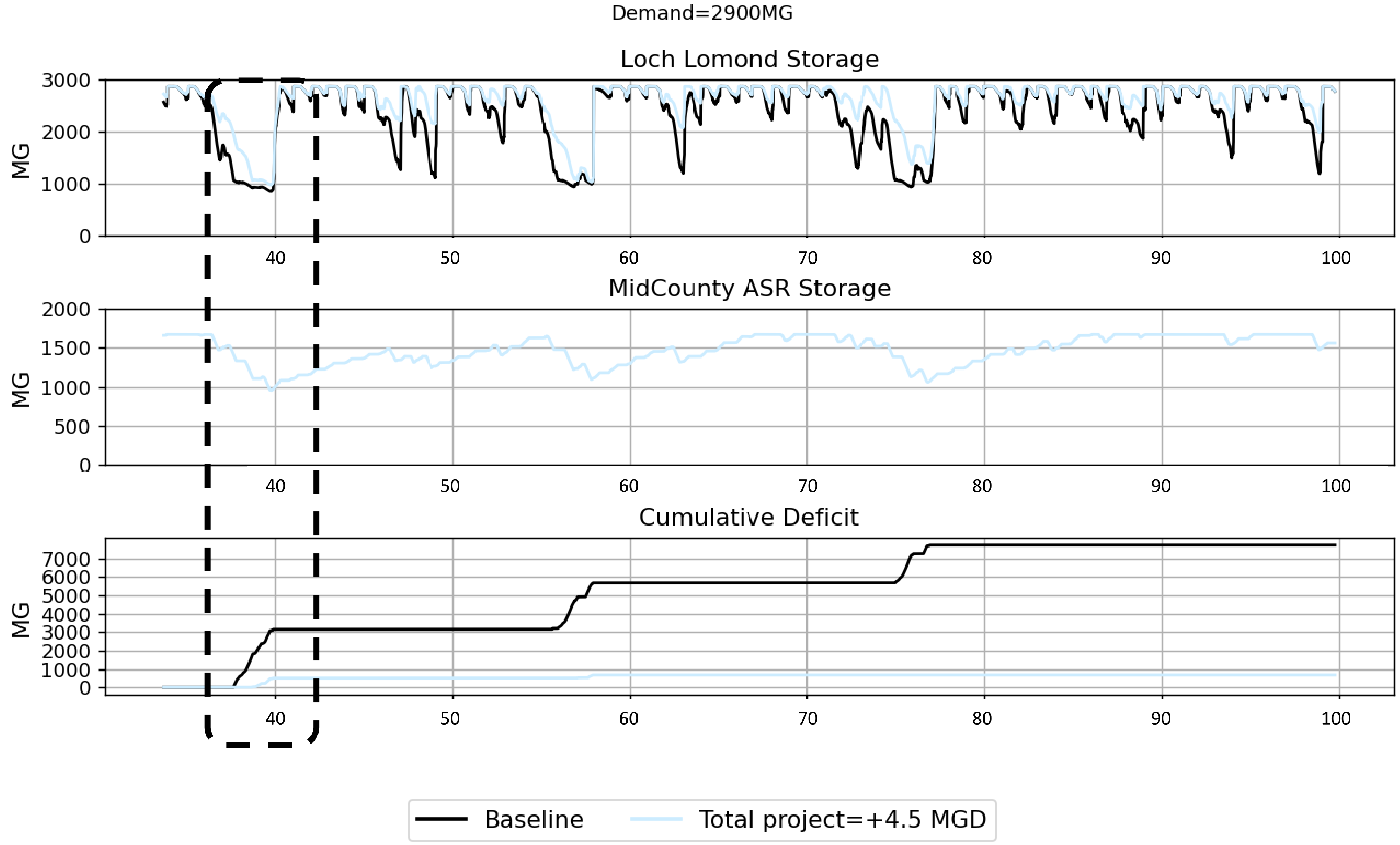
Baseline ASR + 1 MGD Project



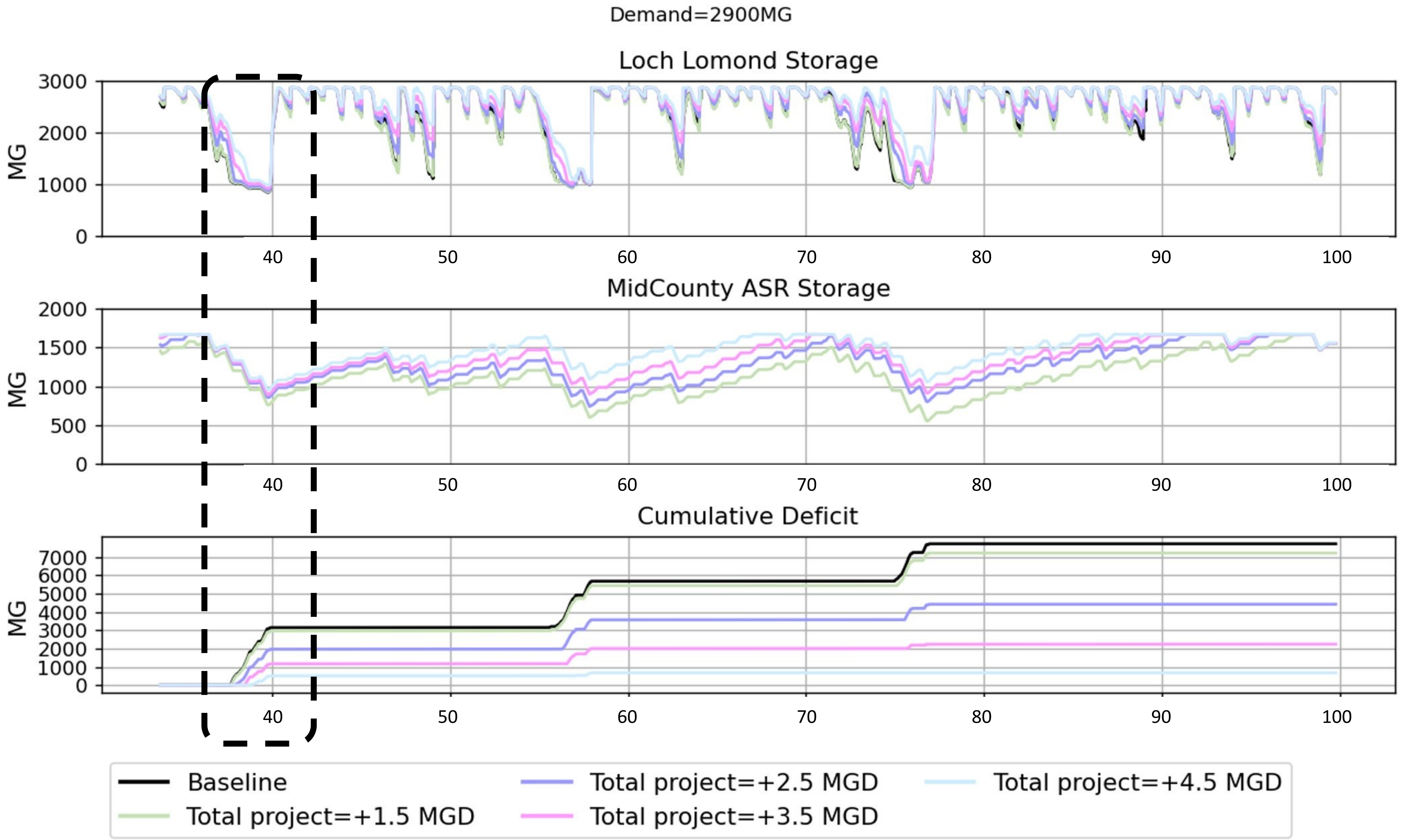
Baseline ASR + 2 MGD Project



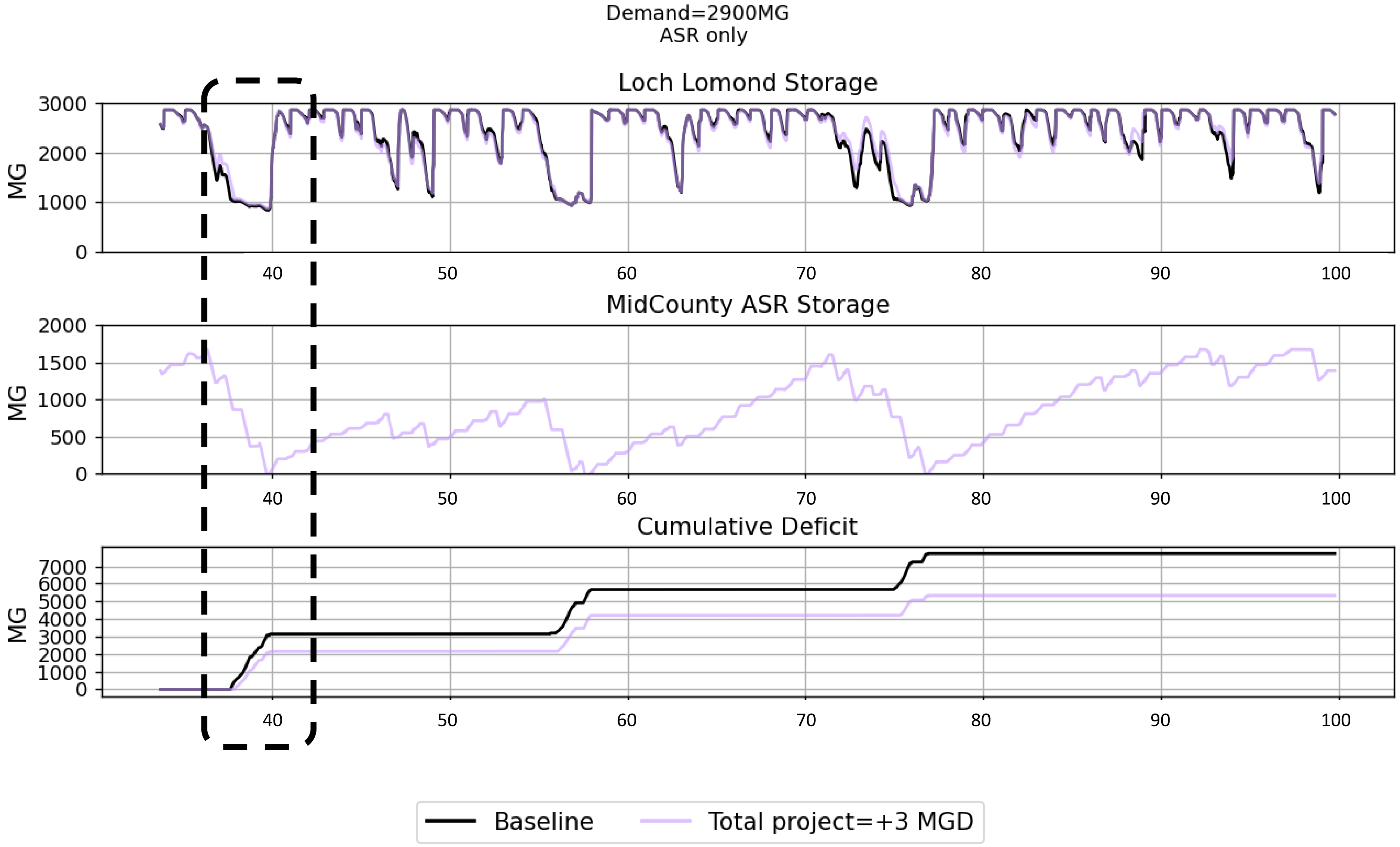
Baseline ASR + 3 MGD Project



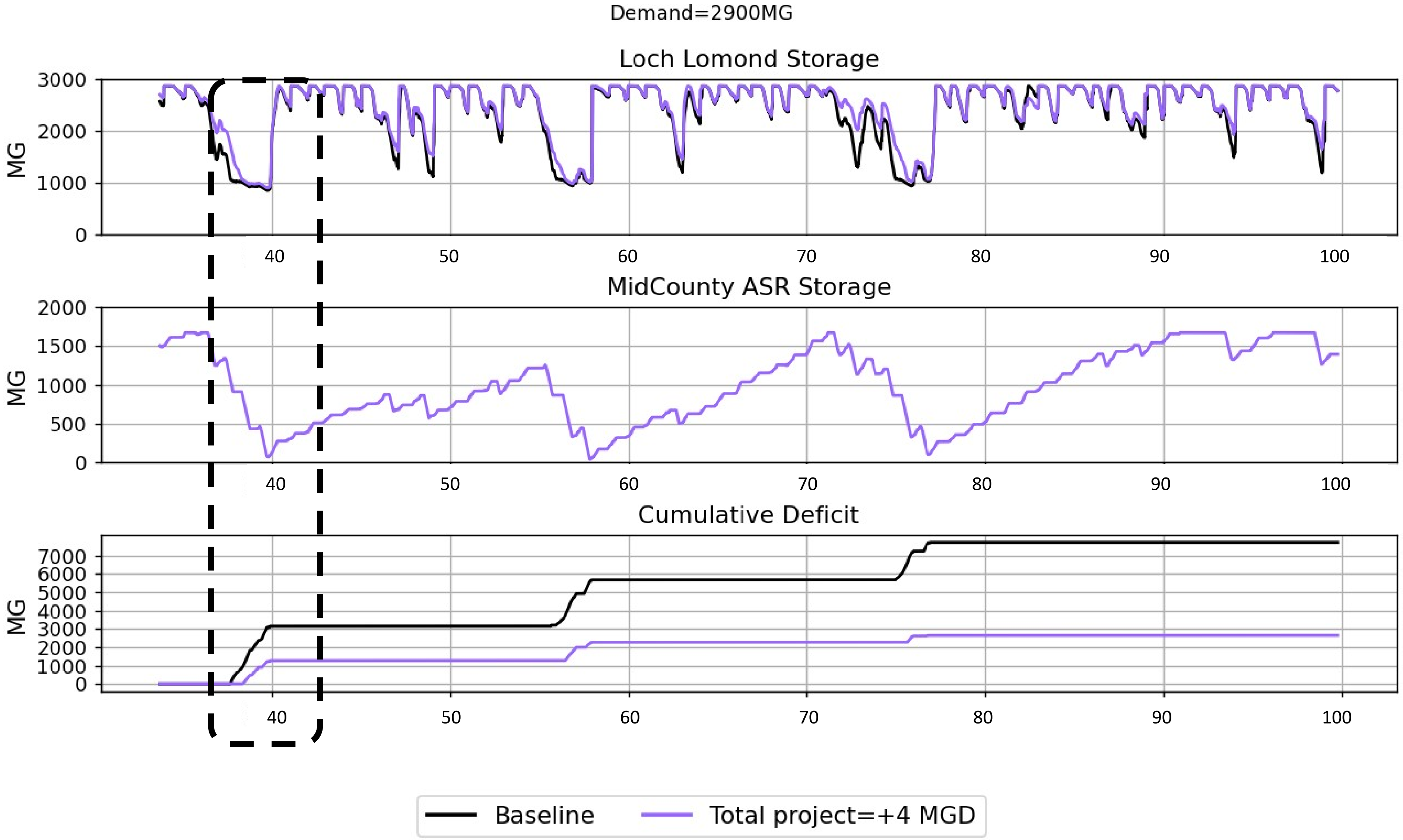
Baseline ASR + (1 to 3) MGD Project



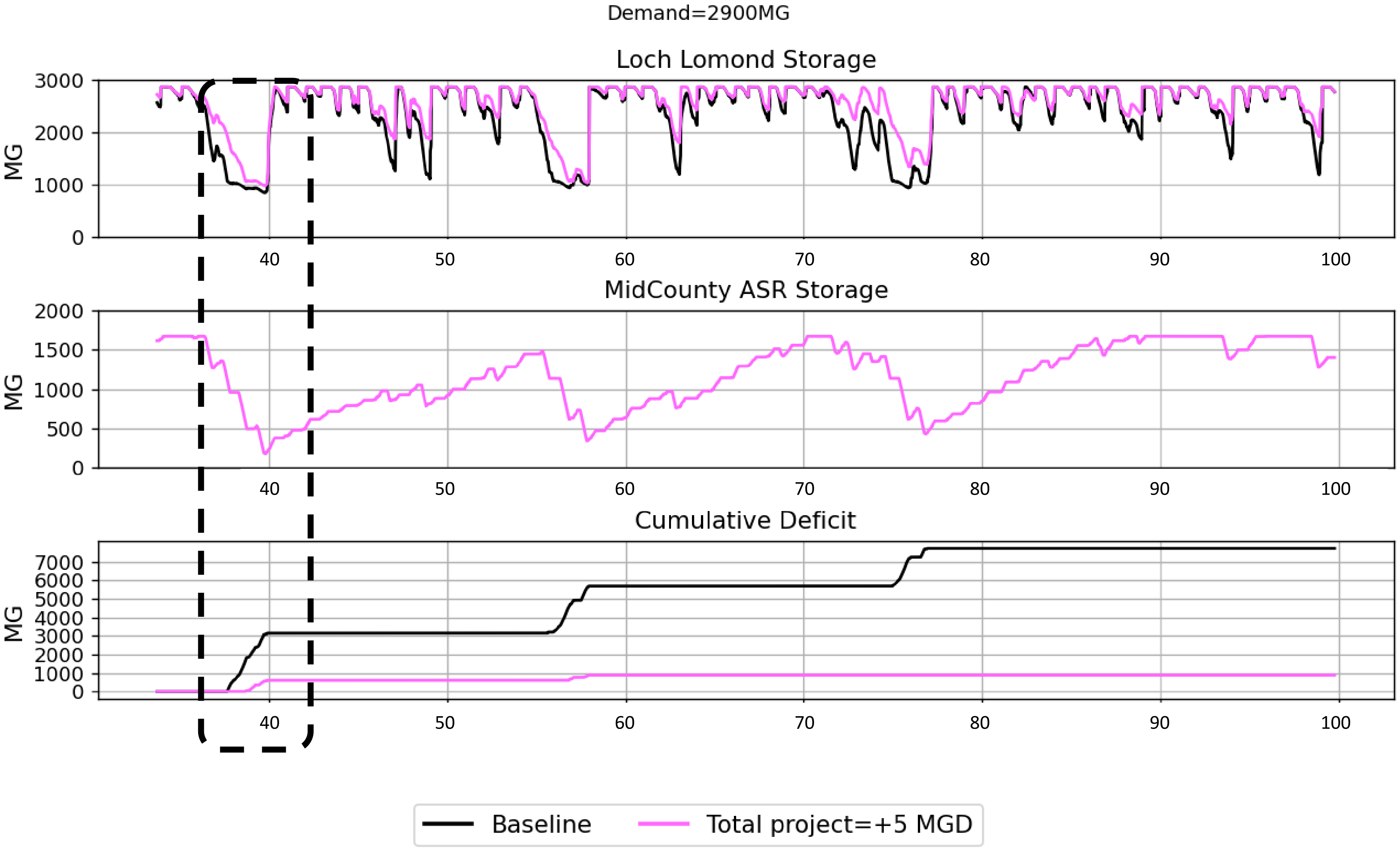
Expanded ASR



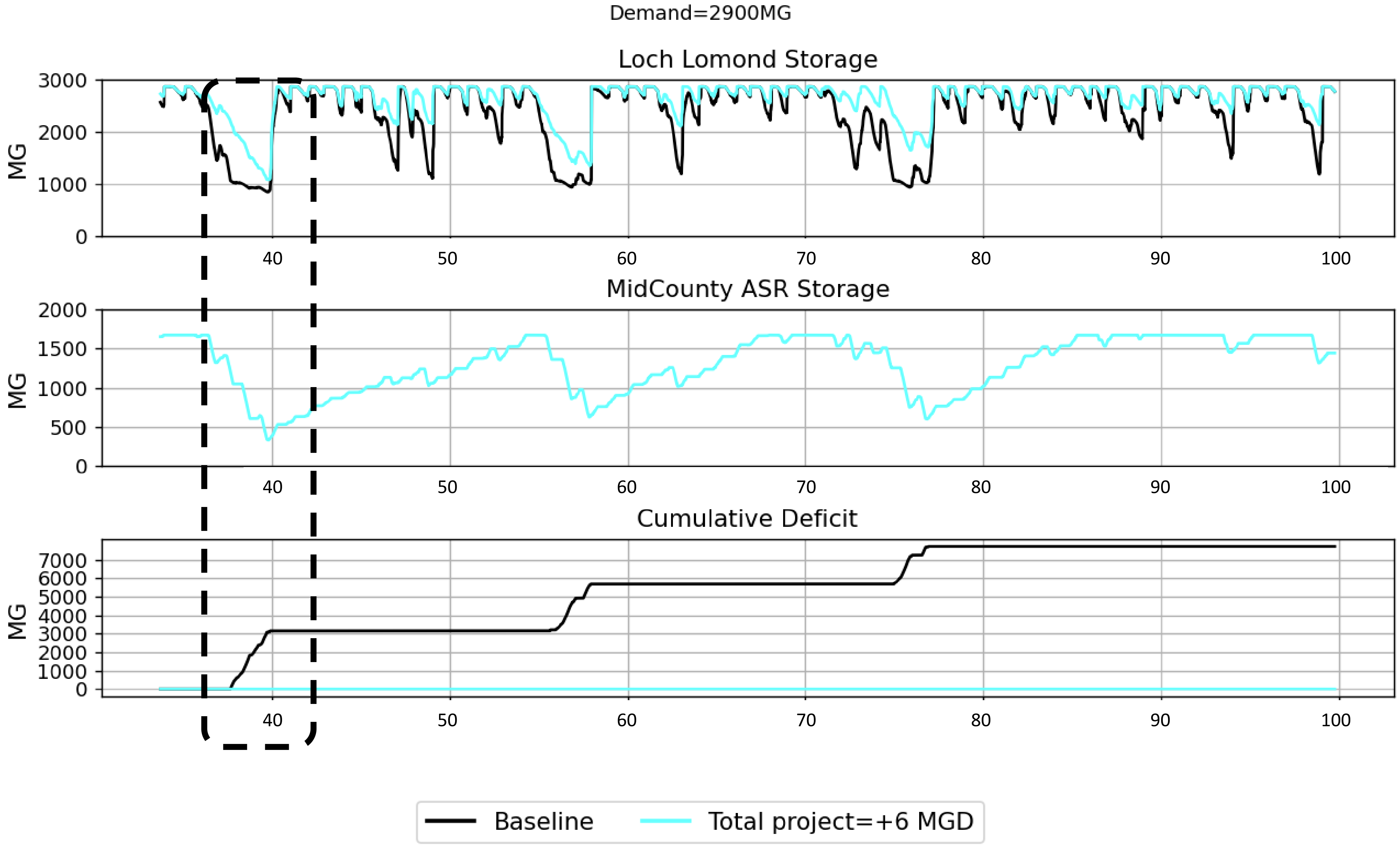
Expanded ASR + 1 MGD Project



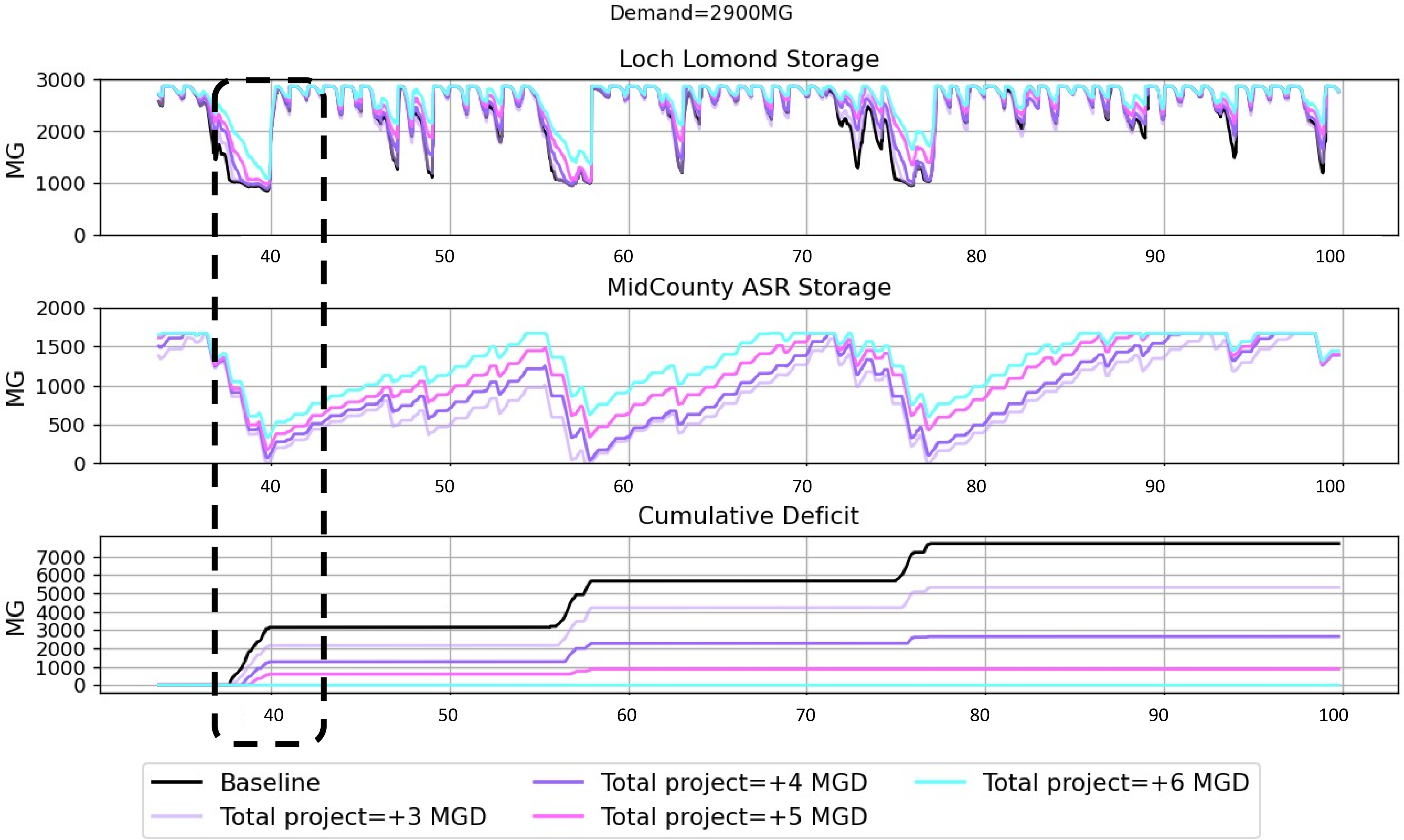
Expanded ASR + 2 MGD Project



Expanded ASR + 3 MGD Project



Expanded ASR + (1 to 3) MGD Project



Water Supply Concepts – Gap Filled

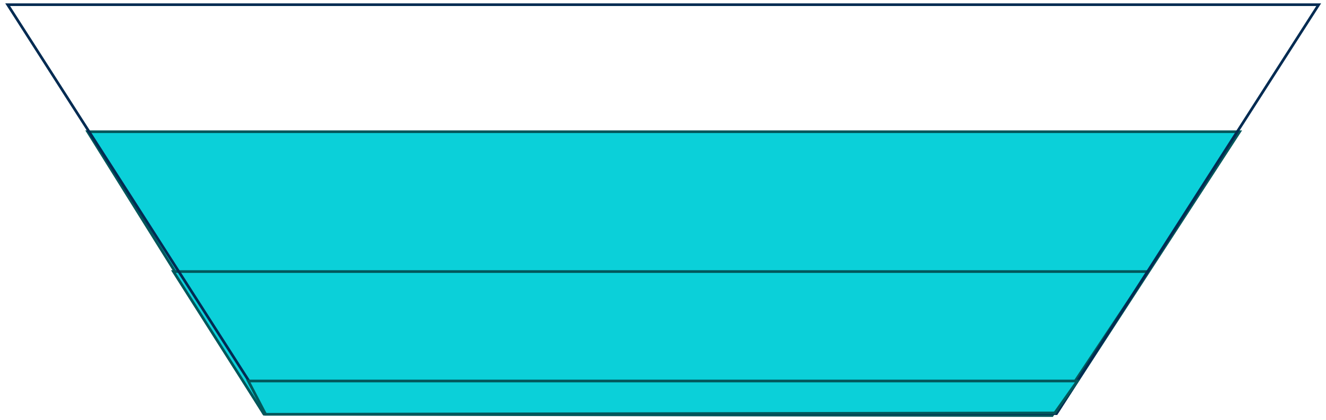
Water Supply Concept	ASR Extraction Capacity (MGD)	New Project Supply Capacity (MGD)	Total Supply Capacity (MGD)	Max Year Water Supply Deficit (MG)	Cumulative Water Supply Deficit (MG)	% Supply Gap Filled
No Project	0	0	0	1,621	3,145	0%
Baseline ASR	1.5	0	1.5	1,552	2,967	6%
# 1	1.5	1	2.5	966	1,968	37%
# 2	1.5	2	3.5	701	1,168	63%
# 3	1.5	3	4.5	456	509	84%
Expanded ASR	3	0	3	1,042	2,160	31%
# 4	3	1	4	525	675	79%
# 5	3	2	5	521	604	81%
# 6	3	3	6	0	0	100%

Over 5 year drought

Operational Scenarios

Loch Lomond Operation:

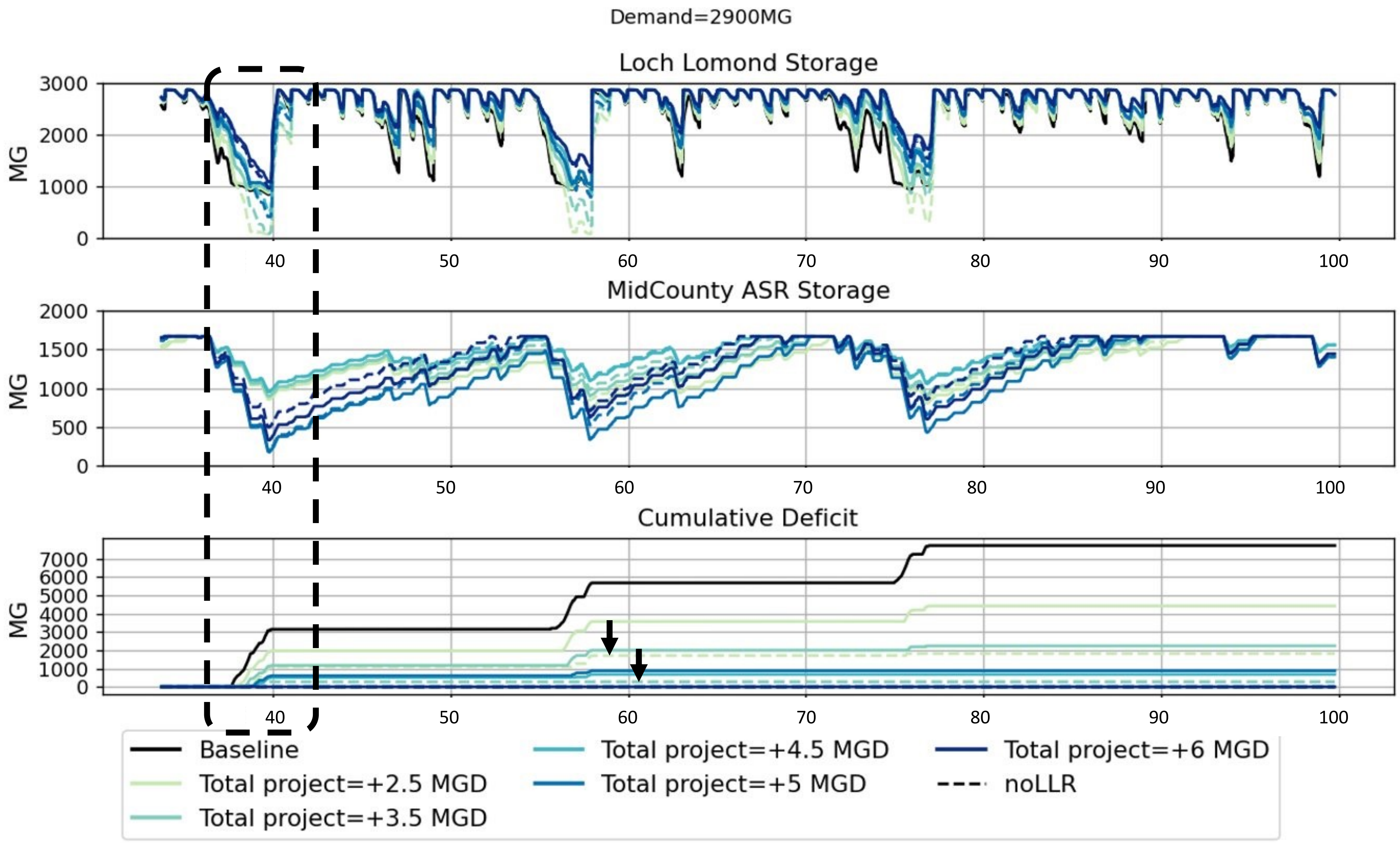
- Current Operations: 1,000 MG minimum storage
- Modified Operations: Remove 1,000 MG constraint (i.e., “Reduce Min Storage Req.”)
- Next: Use different level?



ASR Operation:

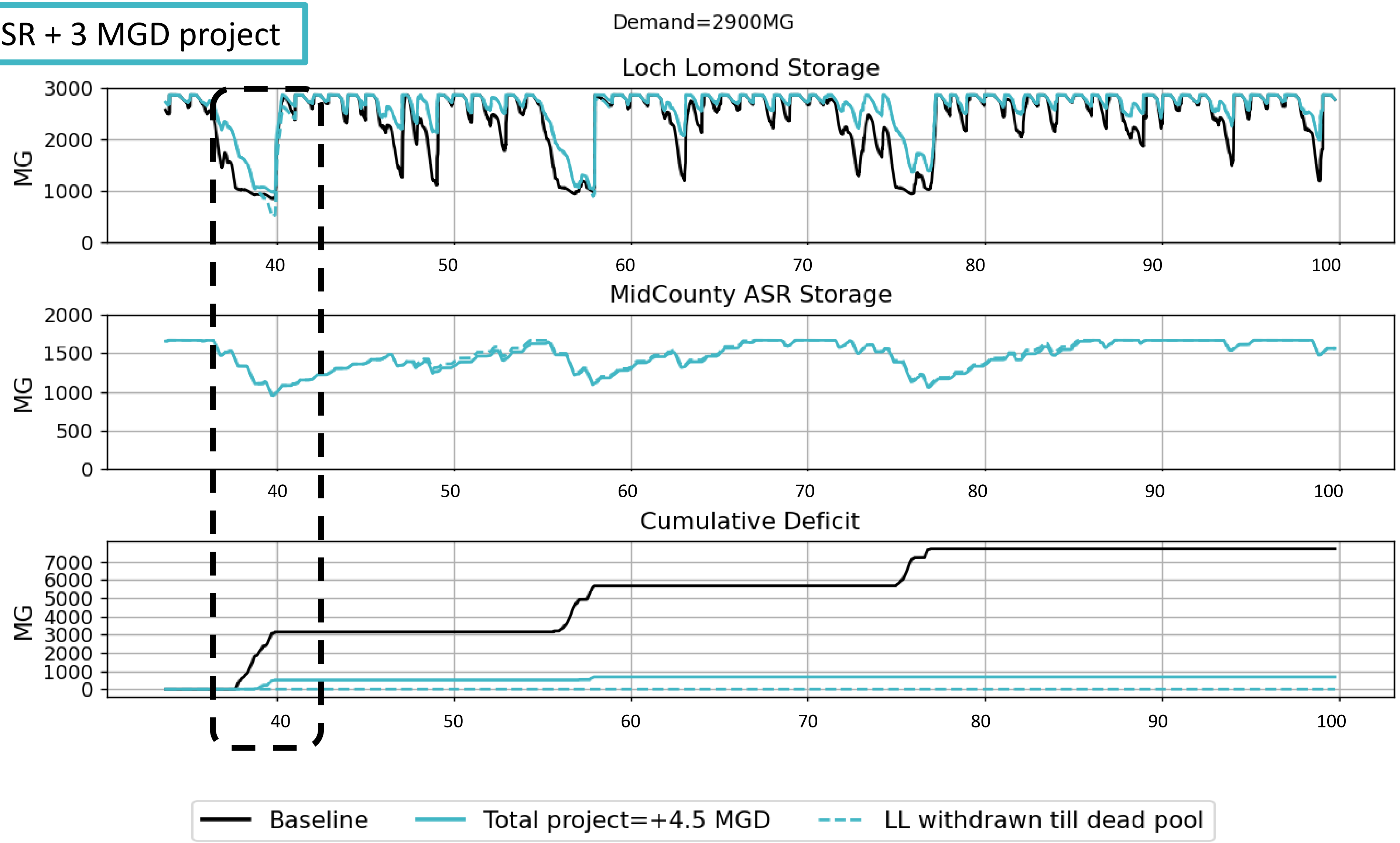
- Delay use of ASR extraction – no significant change in supply capacity
- Next:- Extend ASR extraction season?
- Next: - Increase basin extraction (within basin objectives) and transfer water?

Loch Lomond Reduce Minimum Storage Req.



Loch Lomond Reduced Minimum Storage Req.

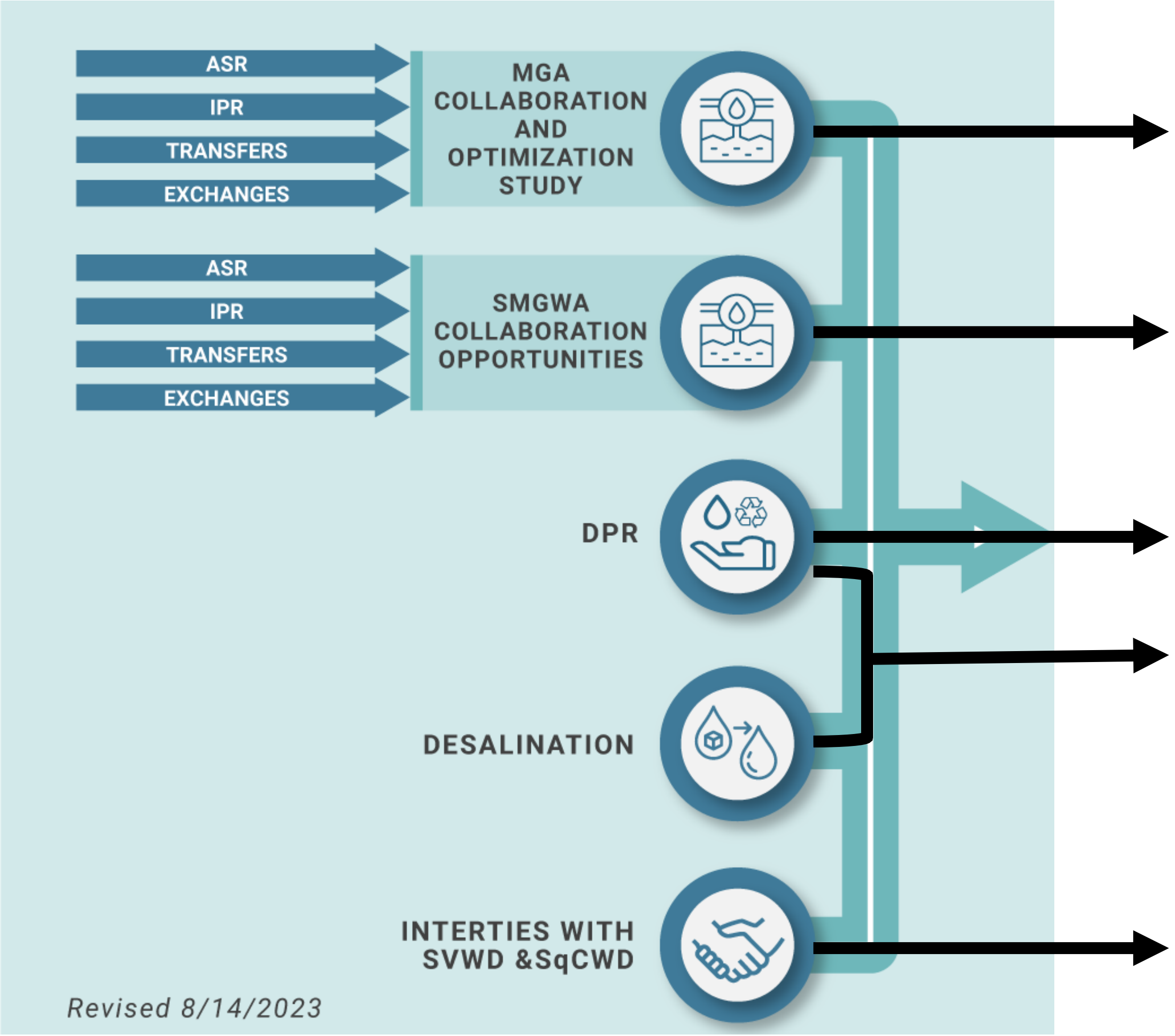
Baseline ASR + 3 MGD project



Water Supply Concepts – Operational Modifications

				LL: Normal Operation		LL: Reduce Min Storage Req	
Water Supply Concept	ASR Extraction Capacity (MGD)	New Project Supply Capacity (MGD)	Total Supply Capacity (MGD)	Cumulative Water Supply Deficit (MG)	% Supply Gap Filled	Cumulative Water Supply Deficit (MG)	% Supply Gap Filled
No Project	0	0	0	3,145	0%	2,240	29%
Baseline ASR	1.5	0	1.5	2,967	6%	2,053	35%
# 1	1.5	1	2.5	1,968	37%	1,086	65%
# 2	1.5	2	3.5	1,168	63%	272	91%
# 3	1.5	3	4.5	509	84%	0	100%
Expanded ASR	3	0	3	2,160	31%	1,265	60%
# 4	3	1	4	675	79%	389	88%
# 5	3	2	5	604	81%	0	100%
# 6	3	3	6	0	100%	0	100%

Conclusions & Next Steps



- ✓ Baseline ASR can fill some of the supply gap
- ✓ Mid County Basin projections above Minimal Thresholds
- ✓ Next – Evaluate Expanded ASR & Transfers

- ✓ Transfers with Scotts Valley could add 0.4 MGD supply
- ✓ No benefits to basin wide water budget
- ✓ Next – Evaluate other transfer and banking assumptions

- ✓ Available Wastewater for a 2 to 3 MGD Purified Project
- ✓ Baseline ASR + 3 MGD = 84% of gap
- ✓ Expanded ASR + 3 MGD = 100% of gap
- ✓ Baseline ASR + 3 MGD = 100% of gap (w/LL lower limit)
- ✓ Expanded ASR + 2 MGD = 100% of gap (w/LL lower limit)
- ✓ Next – Evaluate Reduced LL operational Levels
- ✓ Next – Evaluate other ASR operational scenarios

- ✓ Next – Incorporate transfers with Soquel & Scotts Valley

PPIC PUBLIC POLICY INSTITUTE OF CALIFORNIA

BLOG POST · NOVEMBER 28, 2023

A Better Way to Promote Urban Water Conservation

David Mitchell and Ellen Hanak

Reducing per capita water use in cities and suburbs is key for helping communities get through droughts. And together with strategies to improve water supplies, it can also help build long-term water resilience in the face of our changing climate. In recent decades, Californians have been making great strides in long-term water conservation, and this latest drought showed once again that communities will go the extra mile to save water during droughts if needed.

But while it's often assumed that water conservation is inexpensive, it actually can be very costly. In response to 2018 legislation, the State Water Board is now considering new urban water use regulations whose statewide costs would far exceed their benefits. What's more, these costs would significantly impact affordability, hitting inland, lower-income communities hardest. In this post, we explore some of the proposed regulations' challenges and suggest some better approaches for implementing the law. An accompanying dataset provides further details.

A recap of recent urban conservation law

The 2018 legislation Making Conservation a California Way of Life called for the state to develop long-term water use standards for urban retail water suppliers—the roughly 400 utilities that serve more than 90% of California's residents. The law focused on indoor and outdoor water use and water loss from leaky pipes within distribution systems. In 2022, the State Water Board adopted regulations on reducing water loss, and new legislation set uniform statewide targets for indoor residential use.

The State Water Board is now considering proposed standards for outdoor water use by homes and non-residential water users with large amounts of landscaping. Outdoor use averages close to half of urban use, but the share varies widely across communities. Board staff developed the proposal, and it includes substantially tighter requirements than those recommended by the Department of Water Resources (DWR) following a multi-year technical assessment with extensive stakeholder input.

Once the regulations are adopted, suppliers could be fined if they fail to meet both the water loss standards and the combined indoor and outdoor standards. The board could also mandate specific actions to reduce water use. Crucially, while utilities can directly control their performance on water loss, they will need to rely on their customers to achieve the required indoor and outdoor savings. Achieving long-term water savings generally requires spending both by customers (on landscaping, for instance) and by utilities, which must staff and fund rebates and other programs to help customers use less water.

Major challenges with the State Water Board proposal

Among the issues with the proposal now before the board, three stand out:

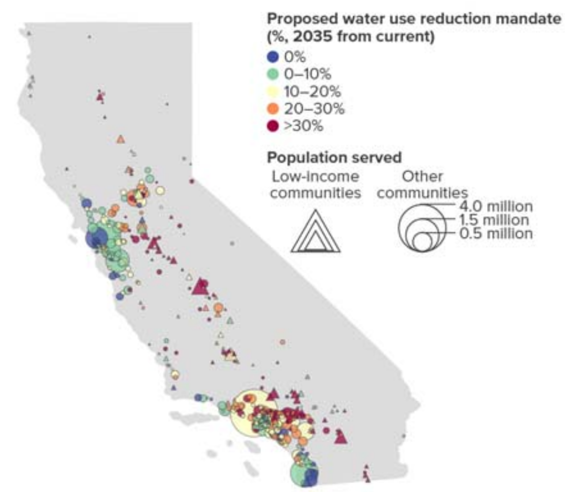
Very high cost for little benefit. Board staff analysis concludes that the regulations would save roughly half a million acre-feet of water annually and would generate a net benefit to California of $2.2 billion between now and 2040—or $1.24 for every dollar spent. But as one of us shows elsewhere, that analysis both overstates the benefits and vastly understates costs. In reality, the regulations are likely to cost utilities and their customers over $15 billion dollars to implement, while providing only $8 billion in benefits. This would result in a *net cost* to California of $7.4

billion to save less than 1.5% of annual water used by communities and farms statewide. In other words, California would see just $0.53 of benefit for every dollar spent.

Major affordability concerns. The staff analysis also asserts that most Californians would see their water bills go down. But given the regulations' high net costs, the reverse is likely to be true. We estimate that at best, only a quarter of communities would save money or face no net costs—and the majority would see costs rise. And the regulations would hit the pocketbooks of inland, low-income, smaller communities hardest.

As the first map shows, the regulations would disproportionately impact smaller, low-income, inland communities, which would face the biggest mandated reductions, given their relatively high outdoor water use. Half of inland communities would need to cut water use by more than 30%, versus just 12% among coastal communities. Communities with the most low-income residents are twice as likely to face high cutbacks as communities with the fewest low-income residents (38% versus 19%). The smallest urban utilities are also twice as likely as the largest ones to face high cutbacks (36% versus 16%).

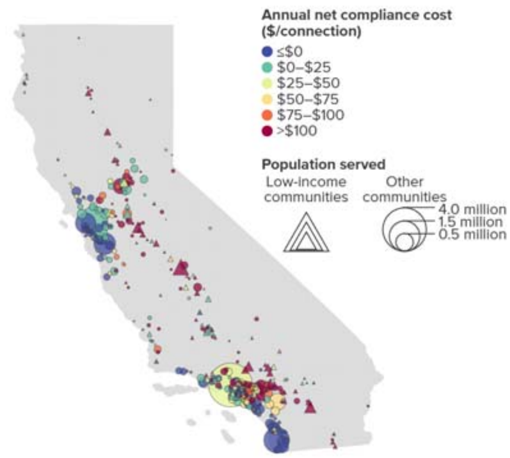
Mandated reductions would be highest in inland, lower-income communities



SOURCE: Author estimates, using DWR's Water Use Objective Analyzer Tool.
NOTES: The reductions are those required by 2035 for water loss and indoor residential use plus the State Water Board's proposed standards for outdoor residential use and commercial, institutional, and industrial outdoor use with dedicated irrigation meters, relative to current levels of these use categories. The sample includes 398 urban utilities. Triangles show the 108 utilities where more than 50% of the population lives in low-income Census block groups, using the state definition of disadvantaged communities as having median household incomes below 80% of the statewide annual median household income. For details by utility, see the accompanying dataset: *PPIC Urban Water Use Standards Analysis*.
FROM: PPIC Blog, November 2023.

As the second map shows, inland, low-income, and smaller communities also will face the biggest net costs of implementing the regulations. This map plots our conservative estimates of annual net implementation costs per connection—the average cost households could face by 2035 when the regulations are in full swing. The statewide average is $101 per year, but the range is wide. On average, coastal communities would pay $54/year to implement the regulations, versus $194/year in inland areas. The communities with the most low-income residents would pay 2.5 times more than those with the fewest. And those served by smaller utilities would also face higher costs. This pattern reflects two things. First, achieving larger reductions is more costly. And second, inland areas such as the Central Valley tend to face relatively low costs for water compared to coastal areas, and thus lower benefits (or "avoided costs") from using less of it.

The proposed regulation would be costly for most communities, and hit inland and lower-income communities hardest



SOURCE: Author estimates, using DWR's Water Use Objective Analyzer Tool.
NOTES: The map shows estimated net costs at full implementation (2035) for the adopted standards for water loss and indoor residential use plus the State Water Board's proposed standards for outdoor residential use and commercial, institutional, and industrial outdoor use with dedicated irrigation meters, relative to current levels of these use categories. These estimates are conservative because they assume implementation costs will be constant, while attaining higher levels of savings often entails higher costs. Also, the avoided costs of saving water are likely lower than the numbers used here because water wholesalers will need to raise prices on remaining sales to cover their fixed costs. The sample includes 398 urban utilities. Triangles show the 108 utilities where more than 50% of the population lives in low-income Census block groups, using the state definition of disadvantaged communities as having median household incomes below 80% of the statewide annual median household income. For details by utility, see the accompanying dataset: *PPIC Urban Water Use Standards Analysis*.
FROM: PPIC Blog, November 2023.

Standards will be hard to meet. As many speakers at a recent board workshop pointed out, the strict standards for outdoor use not only will be costly, they will be hard for many communities to achieve without compromising the health of urban greenery, such as shade-providing trees, and banning residential lawns altogether, including in backyard play areas. Especially in the warmer inland parts of California, the standards could increase the risk of urban heat islands, erode quality of life, and undermine public confidence in government.

In response to concerns raised, the staff's approach so far has been to offer "variances" such as special allowances for communities with a lot of horses, or small delays in implementation for communities that file special requests to protect their trees. Such approaches add to the administrative costs for utilities, and they will tend to amplify the already considerable inequities, because larger, better-resourced utilities will find it easier to avail themselves of these variances.

A better approach

We believe it's possible for the board to meet both the letter and spirit of the Making Conservation a California Way of Life legislation, while limiting the harmful unintended consequences. The following options could be used individually—or ideally in combination:

1. **Revert to the outdoor water use standards proposed by DWR.** Whereas the board staff opted to impose largely untested design standards for outdoor water use efficiency, DWR's proposal includes some room for error, based on expert judgement of what's feasible in large-scale implementation. Applying these standards would reduce average annual implementation costs by 40%—down to $60/connection—and lower the share of communities facing high reductions and high net costs.

2. **Cap required water use reductions.** Past experience has shown that it's both hard—and very costly—for communities to go beyond 20% savings. Capping the reductions at that level would bring average compliance costs down to $57/year, while reducing the gap in costs between inland and coastal regions and lessening the burden on lower-income communities. DWR also recommended including a cap for utilities facing very high reductions.
3. **Conduct benefit-cost assessments at the utility level.** Even with these options, a majority of communities are likely to lose money implementing the new conservation law; nearly a quarter—including many lower-income communities—would still face annual net implementation costs of more than $100 per household. This is especially troubling given growing concerns about water affordability in the state. A reasonable—and feasible—approach would be to limit conservation requirements for each community to levels that can be justified by the data. It is relatively straightforward to obtain credible estimates of supplier-level benefits and costs using the data developed by DWR and board staff; we have done that for our estimates above. The board has already used such an approach to adjust utility water loss standards. To guard against very costly outcomes, something similar could be done to gauge the local cost-effectiveness of the indoor and outdoor urban water use targets.

The bottom line

The proposed regulations show that urban water conservation can indeed be very costly for California's households, with very large expenses for very little payoff. Judicious modifications could meet the legislature's goal of promoting continued progress in urban water use efficiency in ways that are both equitable and wallet-smart. If the regulations go forward as proposed, it will be tempting to look for taxpayer dollars to help keep conservation programs locally affordable. But that would be penny-wise and pound-foolish. In our warming, increasingly volatile climate, California has vast investment needs to safeguard our water supplies and protect people and property from growing flood, heat, and wildfire risks. It's imperative that we spend our water dollars wisely.

TOPICS

climate change | Drought | Water Supply | Water, Land & Air

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With Climate Change, What Will Happen to the Bay Area's Fog?

LISTEN

Dana Cronin KQED

Nov 30

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(Carly Severn/KQED)

Read a transcript of this episode.

Any San Franciscan knows the complex relationship between the city and its pervasive companion — fog.

"I both love and get frustrated by the fog," said long-time resident and Bay Curious listener Lily Drexler. "I appreciate how it freshens the air and changes things up. But when there is fog for weeks on end with no break, that does get frustrating."

What do you wonder about the Bay Area, its culture or people that you want KQED to investigate? Ask Bay Curious.

Drexler is getting ready to put down roots in San Francisco and is starting to look at real estate options in different neighborhoods around the city. But before she does so, she has one big question: what's going to happen to fog in the future?

"Is it going to get more foggy as the sun bakes the ocean and creates the moisture, if that's how fog works? Or is the heat and the warming of the planet going to decrease the fog?"

Where should a fog-averse city dweller choose to settle down? And, more broadly, what would a future look like with less fog? How do we rely on fog now in the Bay Area and how might its absence change us?

As it turns out, the answer to Drexler's question is not simple or straightforward. There's a shroud of mystery surrounding fog — much like the phenomenon itself — that has scientists unsure of what the future may hold.

'A Special Thing to Study'

Even the basic definition of fog is not widely agreed upon.

"There's a few ways to define fog and they're somewhat overlapping, which kind of illustrates the complication when trying to define something like fog," said Daniel Fernandez, an environmental studies professor at CSU Monterey Bay.

According to Fernandez, in order to be considered "fog," this weather phenomenon must have three things:

- Air must consist of tiny water droplets between one and 50 microns — thinner than a piece of hair.

- There must be enough of those tiny droplets that it impede our ability to see beyond a kilometer.
- Fog is a cloud that is in contact with the ground.

In order for that cocktail of ingredients to come together, there must be a temperature gradient over a given area. The cool ocean air and hot Central Valley, for example, is conducive to fog formation. (Bay Curious explained this phenomenon in detail in our episode: Why San Francisco Gets So Windy and Foggy in the Summer)

“I find fog mysterious, fascinating, scary and exciting,” Fernandez said. “I think that’s part of what makes it such a special thing to study.”

Fernandez has been studying fog for over a decade. It started with him wondering whether he could catch fog — as in, pull it out of the air and collect it as a liquid. It turns out you can. He now has dozens of fog collectors deployed all over the state.

Professor Daniel Fernandez examines one of his ‘fog collecting’ screens. On a very foggy day, one of these screens can trap up to 9 gallons of water vapor. *(Dana Cronin/KQED)*

They're essentially big, 4-by-10-foot pieces of mesh reaching into the sky with troughs underneath. The water vapor collects on the mesh and trickles down. The trough feeds into a bucket that contains a data logger, so Fernandez can keep track of how much water each one has collected — as much as nine gallons of water in one day, he said.

While that's not nearly enough to offset California's water shortage during drought years, that water could help farmers with irrigation or assist with state reforestation efforts, Fernandez said.

The fog collectors haven't been established long enough for Fernandez to determine whether there's been an increase or decrease in fog over time. And given the complex set of conditions surrounding it, fog is a difficult thing to predict. It can't be forecasted in the same way that rain can be. And that's why there's some disagreement in the fog science community over how climate change is impacting fog.

But, Fernandez said, there is a small cadre of scientists who believe that fog is on the decline.

"On the whole, I think that we're going to probably be seeing less fog, in general, and that we are currently seeing less than we may have seen a generation ago," he said.

Some studies have shown that, since the 1950s, fog has declined about 30% during the summertime.

Fernandez emphasized there's still a lot of uncertainty in the fog science community. For example, that 30% decline could come from the fact that a lot of cities have cleaned up their air since the 1950s, so these tiny droplets of water vapor have fewer particulates to cling to. In other words, perhaps there's less of it not because of climate change but because of improving air quality standards.

Other studies completely contradict that. At least one used observational notes from ships off the coast of California to suggest fog is getting heavier.

But, according to Dan, there's some level of consensus that fog is on the decline. And, if true, there would be consequences here in northern California.

What Less Fog Would Mean for Northern California

We rely on fog in all kinds of ways, both big and small. One big way is to help us grow food.

A half mile from the ocean in Watsonville, Rod Koda grows strawberries on 15 acres of land. His farm, Shinta Kawahara Company, thrives on fog.

"Here along the coast with the fog, the temperatures are cooler, so the berries ripen slower and get more sugar content," he said on a recent foggy day.

In warmer parts of California where strawberries are grown, like Salinas and Gilroy, strawberries ripen more quickly. One heat wave and the berries have to be picked immediately. Whereas, thanks to the fog, Koda has more flexibility.

Fog even helps with simple tasks, like laying down plastic in preparation for planting strawberries, which Koda's crew is working on the day I visit.

"It comes out really nice because the dirt is a little softer," Koda said.

Rod Koda, owner of the Shinta Kawahara Company, grows strawberries in Watsonville, CA. He says fog helps his berries grow slower and sweeter. *(Dana Cronin/KQED)*

In addition to temperature, strawberries also rely on the moisture from fog.

"Strawberry crops have greater water use efficiency during fog events compared to non-foggy periods," said Sara Baguskas, an environmental professor at San Francisco State University.

Baguskas conducted research in Salinas Valley to find out how strawberry plants interact with fog. Ultimately, she found that strawberries don't need as much water when it's foggy and that they use sunlight more efficiently on foggy days.

"Even though the total amount of light that's used by plants is lower like it's dimmer, the photons are scattered, and so more of the leaves are engaged in photosynthesis in the plant," Baguskas said.

Koda has noticed that on his farm.

"We typically have fog in July and August, and usually our volume is up during those times," he said.

He hasn't really noticed any major changes in the fog patterns in the decades he's been farming. Every year feels different, he said.

But in a future without fog, farmers like Koda would have to compensate. In the future, growing strawberries could require more water, and some farmers might not have the same flexibility they have now when it comes to harvesting. And, for us consumers, the berries might be less tasty and more expensive.

And there are other ways the disappearance of fog would fundamentally change the Bay Area.

Redwood trees, for example, are natural fog catchers. They essentially drink it in, relying on it for survival. It's why they're unique here to Northern California.

Many other species rely on fog, too, including manzanita trees and even certain types of lizards. That can have a ripple effect throughout an ecosystem.

"Because when one element of an ecosystem is impacted, how does that affect others?" said fog scientist Dan Fernandez.

Fog may even protect us from wildfires to some extent. The moisture it provides acts as a fire retardant and without it, Fernandez said many more areas would be susceptible to megafires.

Without fog, life in the Bay Area will change.

The Real Estate of it All

In short, there's no straightforward answer to Bay Curious listener Lily Drexler's question about fog and climate change.

But here's some straightforward advice about what to look for in real estate: buy in a neighborhood that you can see yourself living in now.

"If it's of concern to people, I would literally counsel them and say this house is going to be in the fog. If it's a problem, then we probably need to look elsewhere," said Alexander Clark, owner of Front Steps Real Estate in San Francisco, who has written about this topic before.

Clark said while he's no fog scientist and doesn't know what will happen in the future, his advice for a fog-averse house hunter is to focus your search on sunny neighborhoods. Though, he warns, those tend to be pricier.

Whether or not you want to live in the fog is a critical consideration, he said. "It's a pretty important thing for people to know because it definitely affects people."

DECEMBER 15, 2023BY WFM STAFF

Funding gap for water sector remains despite federal assistance, Fitch says

Despite the significant infusion of funds from the American Rescue Plan Act (ARPA) and the Bipartisan Infrastructure Law (BIL), Fitch Ratings said it estimates a funding gap in excess of $85 billion over the next five years for water and sewer utilities that will need to be covered by paygo or additional debt.

According to Fitch, federal funding under ARPA and the BIL is supportive of water utility credit quality as it helps maintain and improve existing infrastructure, thereby moderating increases in Fitch's life cycle ratio, a measure of the age of capital assets. Federal grants under these laws also offset some of the need for new debt funding and significant rate increases to address capital plans, supporting overall affordability.

Utilities face increasing capex costs given inflation, aging infrastructure, and the U.S. Environmental Protection Agency (EPA) mandates and proposed rules, namely per- and polyfluoroalkyl substances (PFAS) remediation, Lead and Copper Rule Revisions (2021) and Lead and Copper Rule Improvements (2023), which would require most water systems to replace lead service lines within 10 years.

Water supply and sewer construction spending were up 15.3% and 27.2%, respectively, in October 2023 from a year ago, according to Census data. Within the Fitch-rated portfolio, five-year capex/depreciation ratios have been increasing year over year, exceeding 150% since 2019, reflecting sustained, robust capital spending. This spending has kept the Fitch-calculated life cycle ratio relatively stable at around 37% for the last several years.

RELATED — Fitch: Water sector outlook moves to 'neutral' from 'deteriorating'

The EPA estimates $625 billion of total water infrastructure needs over 20 years for states and territories, according to the September 2023 Drinking Water Infrastructure Needs Survey and Assessment (DWINSA), based on 2021 data. This represents an increase of 32% from the last survey based on 2018 data. Distribution and transmission compose the largest need at 67% of total infrastructure needs. Lead line replacement alone is estimated to cost between $50 billion and $80 billion, per the DWINSA.

The BIL provides $35.7 billion in funding through 2026, the majority of which will be grants or principal forgiveness loans, specifically for water infrastructure ($50 billion total inclusive of wastewater funding). ARPA funding separately supports an estimated $55 billion of additional water/sewer investments through 2026. Much of this funding will flow through State Revolving Funds (SRFs). Funding eligibility is not solely based on capital needs, as a significant portion of federal grant amounts are set aside for disadvantaged communities.

The EPA also provides a standard annual SRF allotment via the drinking water ($1.1 billion in 2023) and clean water ($1.6 billion in 2023) SRFs with each receiving an additional 20% state match. Recent use of congressional earmarks benefiting certain states over others and proposals to cut annual SRF funding could limit this resource in the future. However, the proposed cuts do not appear to have broad support and may not make it into the final federal budget.

The funding gap between infrastructure needs as assessed by the EPA and annual SRF allocations (inclusive of state match requirements), ARPA and BIL funding is likely to widen after ARPA and BIL programs expire. It may need to be filled by additional borrowing or deferring discretionary capital projects.

Federal and state financing options may also be available, but most will be in the form of loans instead of grants. This includes low-cost loans provided through the Water Infrastructure Finance and Innovation Act (WIFIA) program and state programs such as the State Water Implementation Fund for Texas. The municipal water systems of Chicago and Philadelphia, for example, received significant WIFIA loans to replace lead pipes, and Orange County Water District in California received funding to address PFAS contamination.

Source: Fitch Ratings

PBS NEWS HOUR

Drought-prone California approves new rules for turning wastewater directly into drinking water

Nation Updated on Dec 19, 2023 3:57 PM EST — Published on Dec 19, 2023 2:36 PM EST

SACRAMENTO, Calif. (AP) — When a toilet is flushed in California, the water can end up in a lot of places: An ice skating rink in Ontario, ski slopes around Lake Tahoe, farmland in the Central Valley.

And — coming soon — kitchen faucets.

California regulators on Tuesday approved new rules to let water agencies recycle wastewater and put it right back into the pipes that carry drinking water to homes, schools and businesses.

It's a big step for a state that has struggled for decades to have a reliable source of drinking water for its more than 39 million residents. And it signals a shift in public opinion on a subject that as recently as two decades ago prompted backlash that scuttled similar projects.

Since then, California has been through **multiple extreme droughts**, including the most recent one that scientists say was the driest three-year period on record and left the state's reservoirs at dangerously low levels.

"Water is so precious in California. It is important that we use it more than once," said Jennifer West, managing director of WateReuse California, a group advocating for recycled water.

READ MORE: Biden to send disaster assistance to Louisiana, as salt water threatens the state's drinking water

California has been using recycled wastewater for decades. The Ontario Reign minor league hockey team has used it to make ice for its rink in Southern California. Soda Springs Ski Resort near Lake Tahoe has used it to make snow. And farmers in the Central Valley, where much of the nation's vegetables, fruits and nuts are grown, use it to water their crops.

But it hasn't been used directly for drinking water. Orange County operates a large water purification system that recycles wastewater and then uses it to refill underground aquifers. The water mingles with the groundwater for months before being pumped up and used for drinking water again.

California's new rules would let — but not require — water agencies to take wastewater, treat it, and then put it right back into the drinking water system. California would be just the second state to allow this, following Colorado.

The new rules require the wastewater be treated for all pathogens and viruses, even if the pathogens and viruses aren't in the wastewater. That's different from regular water treatment rules, which only require treatment for known pathogens, said Darrin Polhemus, deputy director of the division of drinking water for the California Water Resources Control Board.

In fact, the treatment is so stringent it removes all of the minerals that make fresh drinking water taste good — meaning they have to be added back at the end of the process.

READ MORE: How 'solar canals' could help California reach sustainable energy goals

"It's at the same drinking water quality, and probably better in many instances," Polhemus said.

It's expensive and time consuming to build these treatment facilities, so Polhemus said it will only be an option for bigger, well-funded cities — at least initially. That includes San Diego, where city officials have a plan to build a water recycling program that they say would account for nearly half of the city's water by 2035.

Water agencies will need public support to complete these projects. The rules require water agencies to tell customers about the recycled water before they start doing it.

In San Jose, local officials have opened the Silicon Valley Advanced Water Purification Center for public tours “so that people can see that this is a very high tech process that ensures the water is super clean,” said Kirsten Struve, assistant officer for the water supply division at the Santa Clara Valley Water District.

Right now, the agency uses the water for things like irrigating parks and playing fields. But they plan to use it for drinking water in the future.

“We live in California where the drought happens all the time. And with climate change, it will only get worse,” Struve said. “And this is a drought resistant supply that we will need in the future to meet the demands of our communities.”

Associated Press video journalist Terry Chea contributed reporting from San Jose, California.

By – **Adam Beam, Associated Press**

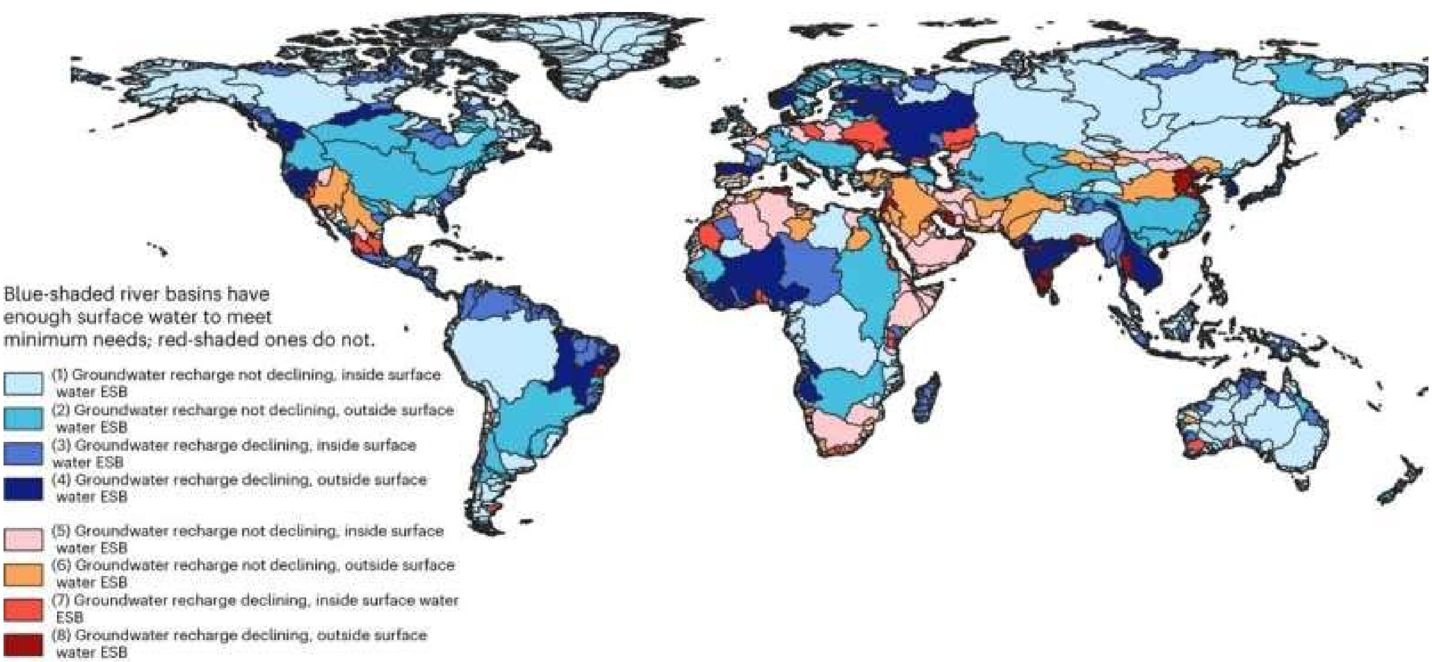
Historically low water levels on the Mississippi River cause shipping woes

Nation Nov 12

NOVEMBER 29, 2023 Editors' notes

Study explores whether basic human water needs can be met while protecting surface and groundwater ecosystems

by Colin Hutchins, Griffith University



Classification of river basins in the context of the ESBs. The eight groups of river basins as defined by the status of their surface water and groundwater with respect to the safe and just ESBs. Credit: *Nature Sustainability* (2023). DOI: 10.1038/s41893-023-01247-w

A Griffith-led study has assessed whether basic human water needs can be met without exceeding safe and just Earth system boundaries (ESBs) for surface and groundwater (blue water), defined to protect people and planet.

Published in *Nature Sustainability*, the study explores whether humans' needs can be met within river basins with surface water alone and, where not possible, estimated how much of the available groundwater would be needed.

"Blue water flows provide the basis for a range of ecosystem services to communities worldwide including cleansing polluted water and recharging groundwater aquifers. Fisheries and aquaculture also depend on freshwater flows; for example, over 70% of the world's coastal and estuarine fish catch comes from species that rely on freshwater flows to oceans," said lead author Dr. Ben Stewart-Koster, a Senior Research Fellow at the Australian Rivers Institute.

Globally surface and groundwater flows (blue water) have been greatly impacted by human-induced changes during the Anthropocene—the geologic time used to describe the most recent period in Earth's history when human activity started to have a significant impact on the planet's climate and ecosystems.

"Withdrawal and consumption of surface water, primarily by irrigation for agriculture and the widespread proliferation of dams has impacted on aquatic and terrestrial ecosystems worldwide, putting natural systems at risk," said co-author Dr. Christopher Ndehedehe, an ARC Fellow at the Australian Rivers Institute.

"Declines in groundwater levels, from climatic variation and overuse by agriculture and water supply, have led to land subsidence, deterioration of groundwater-dependent ecosystems, reduced surface water flows and increasing costs of water extraction. Saltwater intrusion into coastal aquifers and reductions in water quality from groundwater pollution also reduce water availability for domestic and agricultural use.

"Our study found that 2.6 billion people, almost a third of the world's population, live in river basins where groundwater is needed because they are already exceeding the surface water ESBs or have insufficient surface water to meet human needs," Dr. Stewart-Koster said.

"Analysis shows that approximately 1.4 billion people live in river basins where a transformation of water demands is needed as they either exceed the surface water ESBs or face a decline in groundwater recharge and cannot meet minimum needs.

"We see a further 1.5 billion people live in river basins outside the ESBs, with insufficient surface water to meet minimum needs, requiring transformation in both water supply and demand."

These results highlight the challenges and opportunities of meeting even basic human access needs to water and protecting surface and groundwater ecosystems.

"Meeting the safe and just ESBs for blue water offers a unique challenge given that it is essential to human survival and to address current inequalities in water access," said co-author Professor Stuart Bunn from the Australian Rivers Institute.

"It will require radical and systemic transformations of human systems, including renegotiation of international water-sharing agreements and education of the public and policymakers, to ensure that the basic needs of people can be met, while still ensuring freshwater ecosystems and the essential services they provide are protected.

"Given pressing challenges to Earth system stability associated with population growth, overconsumption, and the hydrological impact of climate change on aquatic ecosystems, we must make these necessary transformations to ensure a safe and just future for all people and planet."

More information: Ben Stewart-Koster et al, Living within the safe and just Earth system boundaries for blue water, *Nature Sustainability* (2023). DOI: 10.1038/s41893-023-01247-w

Journal information: Nature Sustainability

Provided by Griffith University

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DECEMBER 6, 2023BY WFM STAFF

Bluefield: Portland, Oregon, tops U.S. cities for highest average monthly water bill

According to a new report from Bluefield Research, the combined water and sewer bill for a typical U.S. household has increased by 56% since 2012, or 4.2% annually.

The report is Bluefield's U.S. Municipal Water & Sewer: Annual Utility Rate Index, 2023, an annual report that examines the water and sewer rates for 50 of the largest cities that provide services to 15% of the U.S. population. The report notes that across 50 of the largest U.S. metropolitan areas, average monthly household water bills increased to $50.61, and monthly sewer bills reached $71.16, based on average household water consumption.

Two cities demonstrating the largest rate increases from 2022–2023 were El Paso, Texas and San Jose, California. El Paso residents recorded a 17% increase in their water and sewer rates to secure future water supplies. In San Jose, California, residents saw an 11% increase due to the utilities' rising costs for purchased water, drought conditions, and planned infrastructure projects. Among the 50 cities analyzed, eight reported rate declines in 2023.

“While the reasons for rate increases vary city by city, many have been in response to rising costs (i.e., inflation, labor) for ongoing system operations and maintenance, along with large capital investments to address aging infrastructure,” noted Charlie Suse, senior analyst at Bluefield Research. “Across the board, higher costs for labor, chemicals, and materials have been among the most cited reasons for water utility rate increases.”

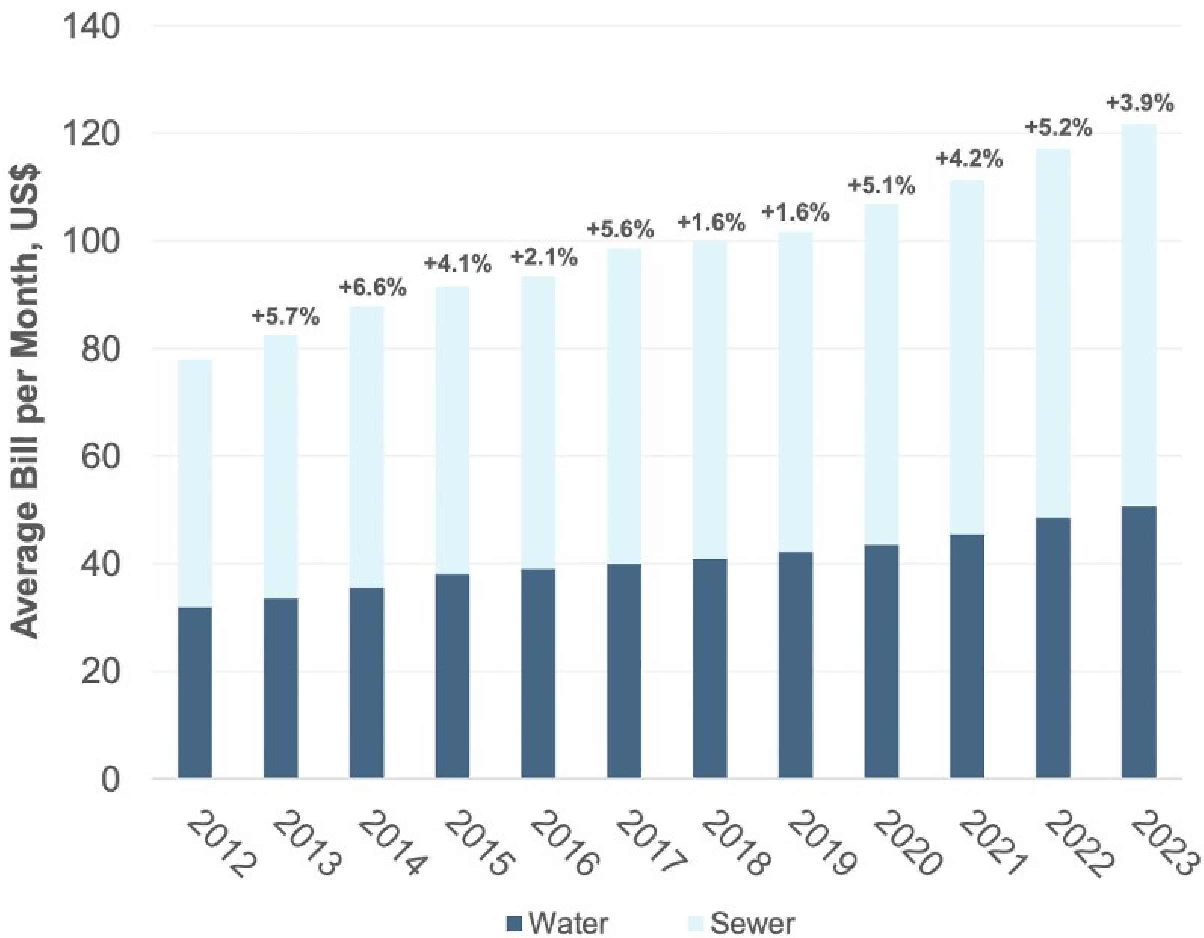

Figure 1: Household Water and Sewer Bills for 50 U.S. Cities, 2012-2023. Source: Bluefield Research.

At a local level, the report notes, the differences become more apparent. Monthly water bills range from a low of $19.51 in San Antonio, Texas, to a high of $121.68 in Portland, Oregon. For sewer bills, monthly charges range from a low of $11.24 in Long Beach, California, to a high of $170.40 in Seattle, Washington.

Bluefield’s analysis highlights new programs targeting drought resiliency in California, as well as debt services for capital programs in Detroit, Michigan and Washington, D.C., that are driving up rates in the near term. In the wake of the COVID-19 pandemic and the end of rate relief programs, cities like Riverside, California, have implemented and resumed new rate schedules after several years of postponements.

“Utilities in the Western U.S. rely more heavily on seasonal rate structures to help stabilize revenues and encourage conservation, particularly in Los Angeles, California and Phoenix, Arizona,” said Suse. “In 2023, households in the Northeast faced the highest average combined water and sewer bills, with an average combined monthly bill of $144.94. This is in part due to the scale of operations and maintenance (O&M) and energy prices.”

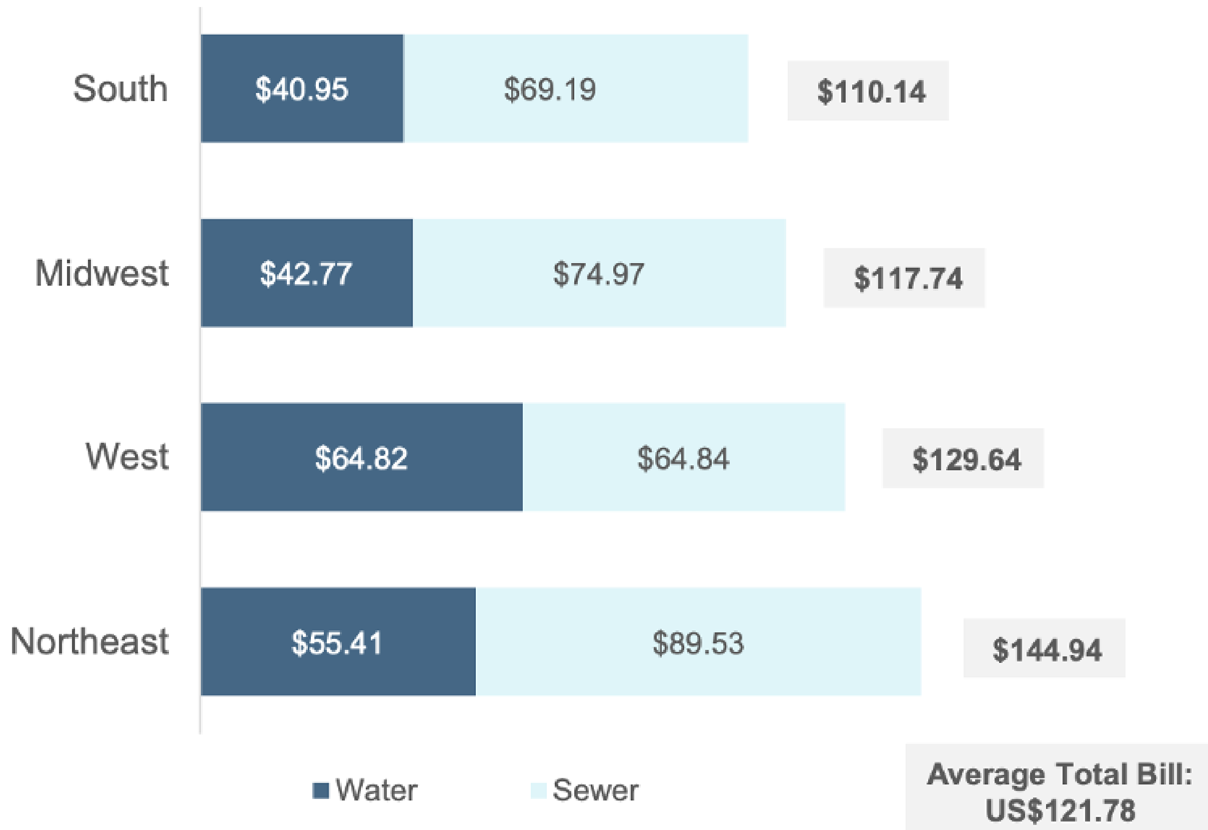

Figure 2. Note: Values based on variable regional consumption rates. Source: Bluefield Research.

The report states that overall, the financial dynamics of water utilities have been changing. The combination of rising capital expenditure (CAPEX), surging operating expenditure (OPEX), and a decrease in federal spending for water infrastructure have created challenges for water utilities. To address aging infrastructure and escalating financial requirements, many utilities have had to make implement rate increases.

Still, amid rising household water and sewer rates, affordability looms large for all utilities and city managers. In many cases, utilities have implemented assistance programs for low-income or elderly resident households, including the cities of Albuquerque, Austin, Seattle, Omaha, Columbus and Memphis.

This is the eighth consecutive year Bluefield has engaged in a comprehensive analysis of water and sewer rates for 50 of the largest cities that provide services to 15% of the U.S. population.

Tags: Affordability, Bluefield Research, water finance, water pricing

Water Resources Research®

RESEARCH ARTICLE
10.1029/2023WR035179

Key Points:

- Consolidations are reducing the number of regulated systems including among underperforming and unrepresentative system types
- Consolidations occur across institutional types and typically involve very small/nonresidential systems, reducing prospects for economies of scale benefits
- Residents served by consolidating and receiving systems tend to be similar but among consolidated systems, low-resource communities are underrepresented

Supporting Information:

Supporting Information may be found in the online version of this article.

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Panacea or Placebo? The Diverse Pathways and Implications of Drinking Water System Consolidation

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Abstract Scholars and policy makers alike frequently promote drinking water system consolidation as a solution to the longstanding struggles of small water systems and the related consequences of service fragmentation, including vulnerability to climate change and persistent racial and economic inequalities in access to safe and affordable drinking water. Despite enthusiasm for the concept, however, our understanding of how, why, and where consolidations occur has remained stubbornly limited such that the promise of drinking water system consolidation remains theoretical at best. This study analyzes all known water system consolidations ($n = 206$) in the state of California over a 7-year period (2015–2021). We find empirical support for certain theoretical claims about consolidation, including an overall reduction in the number of regulated systems, with the largest reductions occurring among particularly underperforming, climate-vulnerable, and unrepresentative system types. Other findings, however, do not align with the literature on the subject. We find limited evidence of either water service privatization or remunicipalization trends and seemingly limited prospects for economies of scale benefits through consolidations. Moreover, roughly half of consolidations during the study period involve non-residential water systems. Among the consolidated community water systems, systems serving higher-resourced communities are overrepresented compared to those serving lower-resourced communities by a margin of two-to-one. It is time to move beyond the blanket assumption of positive consolidation benefits toward a more nuanced understanding of the associated opportunities and limitations. Depending on their goals, policymakers may need to support more specific types of consolidation.

1. Introduction

Drinking water service provision is highly fragmented in the US, with over 150,000 regulated public water systems, defined as systems serving 15 or more service connections or at least 25 people. Among these there are approximately 50,000 community water systems serving year-round residential populations. The remaining non-community water systems (non-transient and transient) service public and private properties such as factories, schools, state parks etc. Both operate under a diverse range of institutional arrangements (Beecher et al., 2020; Dobbin & Fencl, 2021; Grigg, 2018). What many do have in common, however, is their size. The vast majority of all these systems are small. For example, more than 95% of community water systems serve fewer than 10,000 residents. More than 80% serve fewer than 500. Drinking water system fragmentation is unique among utility sub-sectors, with other types of utilities like electricity and natural gas showing far higher degrees of consolidation (Vedachalam et al., 2020), and even wastewater being more consolidated.

This level of fragmentation has significant and ongoing consequences for utilities' health and the communities they serve. Scholars and practitioners alike have highlighted substantial problems stemming from the very small size of most systems. Small systems do not realize economies of scale which water infrastructure, and their customers, can benefit from. Relatedly, they also often lack technical, managerial, and financial capacity (see McFarlane and Harris (2018)). These limitations help explain why small systems disproportionately violate the Safe Drinking Water Act at a rate of more than 13 to one compared to large systems (U.S. EPA, 2023) and are less resilient in the face of water shortages and other challenges resulting from the climate crisis (Ekstrom et al., 2017; Klasic et al., 2022; Mullin, 2020). Low-income, rural, and indigenous communities bear the brunt of these consequences, thereby perpetuating racial and social inequality. Many small systems themselves are artifacts of racist planning, including the exclusion of small communities of color from larger and more well-funded systems (London et al., 2021), the intentional establishment of small systems in wealthy enclaves to avoid footing the infrastructure costs of neighboring communities (Eissinger, 2008, 2017; Purifoy & Seamster, 2021;

Visualization: Kristin B. Dobbin, Justin McBride
Writing – original draft: Kristin B. Dobbin, Justin McBride, Gregory Pierce
Writing – review & editing: Kristin B. Dobbin, Justin McBride, Gregory Pierce

Seamster & Purifoy, 2021), and public disinvestment in infrastructure in rural communities of color (Francis & Firestone, 2010; Pannu, 2012).

In recent years, water system consolidation has gained prominence as a potential solution uniquely capable of addressing these challenges (Bielefeldt et al., 2012; Hansen et al., 2020; Klien & Michaud, 2019; Tran et al., 2019). While the term consolidation is widely used and can refer to many types of institutional collaborations, we use it here to mean the combination of two or more systems into a single shared governing structure, whether through the physical integration of the systems (physical consolidation), or where only management and governance functions are combined (managerial consolidation). In theory, consolidation allows the resulting system to spread large fixed costs, like operating a treatment plant or purchasing better quality water, across a larger customer base (Shih et al., 2006). Similarly, by sharing managerial staff or jointly financing expensive infrastructure, water systems can mitigate technical, managerial and financial issues (U.S. EPA, 2009) and may be more able to recruit and retain qualified staff in local labor markets (Teodoro & Switzer, 2016). Moreover, collaboration between water entities can expand access to safe and affordable drinking water and increase climate resilience by increasing water source diversity (Hansen et al., 2020; Mullin, 2020) and, if structured properly, could expand representation for disadvantaged communities (Balazs & Ray, 2014; Dobbin et al., 2022; Keller & Howe, 2021; Pannu, 2012).

Based on these potential benefits, a wide and increasing menu of policy tools from the local and state level have emerged to incentivize consolidation efforts (Pierce et al., 2019). The federal Environmental Protection Agency's new water system restructuring assessment rule will require primacy agencies—states and Tribes—to assess the feasibility of restructuring for non-compliant systems and provide incentives for implementing changes (U.S. EPA, 2019). In the meantime, some states are already implementing similar programs advancing voluntary and mandatory system consolidations including California, our setting for this research.

In 2015, California passed Senate Bill 88, a law allowing for the State Water Resources Control Board (SWRCB) (the state's Safe Drinking Water Act primacy agency) to mandate water system consolidations when a system consistently fails to provide drinking water to a Disadvantaged Community. Since that time California has also markedly expanded its focus and investment in voluntary consolidation including through the Safe and Affordable drinking water For Equity and Resilience program, launched in 2019, which identified consolidation as a top priority in its first adopted fund expenditure plan, and analyzed physical consolidation potential statewide in its first water system Needs Assessment (State Water Resources Control Board, 2021). Combined, we show that these efforts have reduced the number of public water systems in the state by more than 3% in the last 9 years.

Notably, however, despite major policy progress in California and elsewhere, we still have a relatively constrained empirical understanding of what consolidation looks like in practice, let alone the extent to which it is achieving the projected or desired outcomes. Effectively leveraging new policies and funding to incentivize water system consolidation in ways that meaningfully address small system challenges first requires a grounded understanding of how, when, and where consolidations occur. Our study takes a major step in filling these gaps by compiling and analyzing a comprehensive data set of consolidation projects in California completed between the years 2015 and 2021 to contribute a quantitative understanding of consolidation pathways to the primarily case-study based and large-system focused consolidations literature.

To accomplish this, we ask and answer the following two research questions: Where, how, and why are consolidations occurring in California? What types of systems and communities are involved and in what capacities? Our discussion then explores the implications of these findings for drinking water access and regulation. In doing so we provide new insights regarding the important opportunities posed by water system consolidation and highlight where and how the solution might be falling short of scholarly and policy expectations.

2. What We Know, and Do Not Know, About U.S. Water System Consolidation and Hypotheses

As previously mentioned, US water scholarship and policy circles are replete with proclamations of the many potential benefits of consolidations. For example, a 2019 US Water Alliance briefing paper summarizes the potential benefits of having "fewer, more independent, high capacity utilities" to include the promotion of long-term management, addressing disparities in reliable access to safe water, lower operational costs, improved financial capacity and more robust staffing (US Water Alliance, 2019, p. 10). In the peer-reviewed literature the challenges faced by small systems have received the most attention (McFarlane & Harris, 2018) but the potential for consolidation to address these challenges has also been promoted. For example, Lipka and Deaton (2015) demonstrate how consolidations could lead to improved water quality across Canadian First Nations' and Cho et al. (2005) assess the need to for consolidation to enhance financial capacity. Similarly, Braden and Mankin (2004) and Teodoro and Switzer (2016) highlight important potential gains relating to expertise and staffing. As a result, scholars, like their policy and practitioner counterparts, have argued for decades for a variety of policies and incentives dedicated to advancing consolidation (Baird, 2012; Balazs & Ray, 2014; Cromwell et al., 1992; Pierce et al., 2019).

Notably, however, there has been relatively less empirical evaluation of consolidations and their outcomes. The very small body of such studies, whether looking at system mergers as we do here or more broadly considering system partnerships, derives from a small number of case studies and is biased toward large water systems instead of the very small systems primarily prioritized by policymakers and practitioners. Bielefeldt et al. (2012), for example, draw survey responses from a non-random sample of 45 collaborative efforts nationwide. Each of the included systems served at least half a million people. Tran et al. (2019) drew their 12 in depth case studies from a literature review of previous studies; all but two serve populations well over 1 million customers. Hansen et al. (2020) consider a greater range in service size than the above two studies but include only seven case studies in their evaluation. To our knowledge, only Lee and Braden (2008) have attempted to use quantitative methods to better understand trends in water system consolidations through a large sample size of systems. Nonetheless, based on these findings, in our analysis we expect to find support for claims that consolidation stands to support increased access to safe, sustainable drinking water access by reducing system fragmentation and increasing the capacity of remaining systems via increased economies of scale. And in keeping with Lee and Braden (2008) findings that regulatory compliance is an important factor in promoting small Community Water System consolidations, we expect that water quality will be a primary motivating factor.

What existing literature glosses over is also important. To our knowledge no study preceding ours has addressed patterns in the governance types of systems involved, nor the types of communities these systems serve using a large sample of consolidation projects. While not documented empirically to our knowledge, consolidations are also frequently promoted for their potential to address the racial and economic disparities that are deeply ingrained in our drinking water landscape (US Water Alliance, 2022). Given they suffer disproportionate drinking water challenges as a result of these legacies (Mueller & Gasteyer, 2021; Switzer & Teodoro, 2018), we expect to find support for this proposition demonstrated by systems serving low-income communities and communities of color consolidating at higher rates. Nonetheless, advocates from across the country have highlighted ongoing discrimination as a challenge impeding consolidation, highlighting an important alternative hypothesis that consolidation, like previous safe drinking water solutions, will not be accessed equitably considering need (Metropolitan Planning Council, 2022; Nylen et al., 2018).

The gap regarding institutional change via consolidation is particularly notable given the sizable body of research and theory on local governance and service transitions more broadly. A substantial and lengthy debate has ensued over the ramifications of water system privatization for efficiency, equity, sustainability, and participatory inclusion (Bakker, 2013; Beecher, 2013; Bel et al., 2010; Swyngedouw, 2005; Warner, 2008). The acrimonious debate has generated a large body of conflicting evidence on all sides and, more recently, spurred significant scholarly attention toward the possibilities of undoing past privatization through the insourcing of water service—known as "remunicipilization" projects (Kishimoto et al., 2015; McDonald & Swyngedouw, 2019; Warner & Hefetz, 2012). Specifically for water systems, the outcomes for customers of both transitions are contested (Lyon et al., 2017). These literature, however, focus almost exclusively on large cities and for-profit Investor Owned Utilities with less regard for governance types most common among small water systems, the focal population for consolidation policies (Dobbin & Fencl, 2021).

Thirty-five percent of water systems serving 500 or less customers are ancillary systems (U.S. EPA, 2009), defined as water service tied to a primary activity that is not a public utility service, for example, a water system serving a state prison (an example of a public ancillary system) or a water system serving an industrial park or packing house (examples of private ancillary systems) (Beecher et al., 2020; Grigg, 2018). Another 26% of these systems are private non-profit systems (U.S. EPA, 2009), such as mutual water companies, structured as cooperatives or associations to provide drinking water at-cost to members (Beecher et al., 2020; Dobbin & Fencl, 2021). These smallest systems struggle most with water quality standard compliance, equity, and technical, managerial,

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Table 1
Water System Consolidations Typologies in the Literature

Receiving system	Consolidating system: General purpose public	Special purpose public	Investor owned utility	Non-profit	Ancillary system
General purpose public (ex. city owned water utility)	No study identified	No study identified	Three studies	No study identified	No study identified
Special purpose public (ex. a special district operating a water utility)	No study identified	One study	No study identified	No study identified	No study identified
Investor owned utility (ex. private firm selling water for-profit)	Five studies	No study identified	No study identified	No study identified	No study identified
Non-profit (ex. a land-owner cooperative)	No study identified	No study identified	No study identified	No study identified	No study identified
Ancillary system (ex. a business or K-12 school drawing from its own well)	No study identified	No study identified	No study identified	No study identified	No study identified

and financial capacity and have the least ability to tap into economies of scale, making them among the most prominent and promising candidates for consolidation. Yet as Table 1 demonstrates, neither of these two types of systems are explored in depth in any identified research on water system consolidation or collaboration. Similarly, publicly-owned water systems are the most common type of system for customer bases below 3,300, but we identified only one study that looks at mergers between publicly-owned water districts (Moldogaziev et al., 2019) which includes not just municipalities but other general purpose governments, particularly counties, as well as a diverse array of special purpose districts (Dobbin & Fencl, 2021; Mullin, 2009). Therefore, we expect that most consolidations occurring in California will fall outside of this narrow focus on cities and Investor Owned Utilities, highlighting important gaps in our understanding of these common local service transitions.

3. Data and Methods

Our analysis synthesizes an array of primary data sources to identify and characterize water system consolidations completed in California during the study period, inclusive of small systems and all institutional types. We then analyze these data using descriptive statistics and spatial analysis as described below.

3.1. Sample

We first compiled a data set of cases of water system consolidations from multiple sources for the study period January 2015 through December 2021. The compilation of the California SWRCB water system partnerships map (State Water Resources Control Board, 2022a) and its annual consolidated water system lists (State Water Resources Control Board, 2022b) provided 192 cases. Where related information differed between these two sources, the water system partnerships tool was prioritized given that this source has been more closely validated by the agency. Because both sources are updated in an ongoing fashion, both sources were checked periodically and cases within the study period were added in an ongoing fashion until the analysis was finalized in Summer 2022. We supplemented this data by comparing lists of active community water systems from 2015 to 2021 using the Federal Safe Drinking Water Information System (SDWIS) (U. S. EPA, 2022) to identify systems where the assigned ownership category changed over this period, and to identify cases where system names did not match between the two timepoints. Given that the first data source is focused on California regulated systems (excluding Tribal water systems regulated directly by the US EPA Region 9), we constrained our SDWIS search to California regulated systems as well. We manually investigated the resulting 587 systems to determine if they were associated with a consolidation, which yielded the identification of another 30 cases beyond the SWRCB data sets. Of the remainder, 542 of these cases were judged to reflect insignificant discrepancies (e.g., using a shortened system name) or name changes (particularly among private ancillary systems) rather than consolidations based on a comparison of key system attributes like address and population served or communication with system affiliates or regulators. In another 12 cases consolidations were confirmed but were completed outside our study period. Three additional cases surfaced through research related to this project and were added, resulting in a total of 225 cases. Upon further investigation of the final list, however, 19 cases either did not align with our definition of water system consolidations for this study (two or more systems merged into a single governance structure) or

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were officially completed outside of our study period. These cases were thus removed from our analysis (see Text S1 for more discussion in Supporting Information S1). The final data set analyzed in the remainder of this study contains 206 water systems consolidated into 143 unique "receiving" water systems, the surviving system entity post-consolidation, via 185 unique projects. For various analyses, including the demographic analysis discussed below, we also focus specifically on a subset of the 111 consolidated community water systems. In this category we include the two private well residential communities and the one state small water system given that they serve residential communities not unlike regulated community water systems.

3.2. Variables and Data Sources

The two original SWRCB data sources included the following attributes for each case: county, date of merger, water system names, water system IDs, as well as the primary water source and population served for the consolidated system(s). For cases not included in the two SWRCB data sets, we either requested this information from the SWRCB or queried SDWIS. We added key characteristics about receiving water systems from SDWIS using data points from the fourth quarter of 2021, including: population served, system type and primary water source. Using the unique water system IDs for the consolidated and receiving water systems we then merged water system institutional type from Dobbin and Fencl (2021), which we condensed into nine categories: Domestic wells, general purpose government, Investor Owned Utility, nonprofit private, private—type unknown, private ancillary, public ancillary, special district, and Tribal (as noted in the methods section, Tribal water systems were excluded from our sample. However, in one project, a non-Tribal California-regulated system was consolidated into a Tribal EPA-regulated water system thus Tribal is included in the categories for the purposes of analyzing governance transitions). The two original SWRCB data sets also included information on form and cause of the merger: whether the consolidation was physical or managerial, mandatory or voluntary. For approximately two-thirds of the cases, these sources also provided basic information regarding factors motivating the consolidation (as determined by the SWRCB). For those cases missing this information, we supplemented where possible from internet searches (e.g., media articles, public records).

3.3. Proximity Analysis

We then calculated the distance between the point location for each consolidated system with the nearest edge (rather than the centroid) of the receiving water system service area using the ArcMap Near Table tool. Polygon boundaries for the receiving water system service area came from the System Area Boundary Layer Look-up Tool (State Water Resources Control Board, 2022c). In two cases receiving water system service areas were not available in the System Area Boundary Layer data set but political jurisdiction was, which we used in substitute. The geocoded points for consolidated systems derive from two sources: The SWRCB water system partnership tool includes geocoded locations for consolidated water systems. In cases not included in the partnership tool, we manually vetted and verified the physical address located in SDWIS, and then geocoded them using the Google API. Using points is necessary for this body of systems because service boundary polygons have only been vetted and made publicly available since approximately 2019 and therefore are not available for all consolidated water systems in our sample.

In the proximity analysis we excluded 115 cases where the receiving system polygon was missing or had been updated after the consolidation date. In an effort to include more cases, we subsequently ran the same analysis using the California EnviroScreen 3.0 water system boundary layer, a similar layer but which has not been updated 2017, which resulted in 34 newly calculated distances. In all, our proximity analysis reflects a sample of 119 consolidated systems (58% of the total sample).

3.4. System Demographics

Using the same spatial data employed above we added key demographic attributes for the residential populations served by each consolidated community water system (n = 111) and respective receiving system (88 unique), including race and ethnicity, Median Household Income (MHI), and homeownership/renter rates drawing on 2020 block group estimates from the American Community Survey using the tidycensus package (Walker et al., 2022). Block groups are a smallest geographic unit for the US Census defined to contain between 600 and 3,000 people but do not necessarily align with water system or residential boundaries. Thus, some additional steps are required

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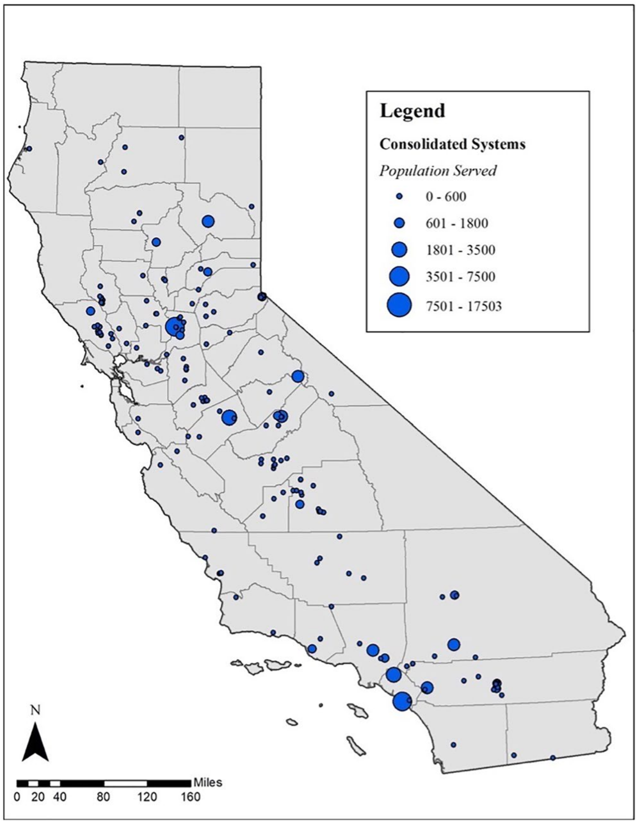

Figure 1. Map of consolidated water systems by population served.

to use this data to characterize the residential populations of water systems. For consolidated systems, this is relatively straightforward, only requiring the joining of geocoded points with their respective block group. For receiving systems, we relied on the spatial interpolation functions within the areal R package (Prener & Revord, 2019) to derive a spatially weighted estimate for each service area. For example, if a 75% of a receiving water system boundary was covered by one block group and the remainder of the boundary overlapped a second block group, the demographics for that water system would be calculated as $0.75X_{\text{blockgroup1}} + 0.25X_{\text{blockgroup2}}$ for each variable of interest. We then calculated descriptive statistics for consolidated and receiving systems overall as well as paired differences for each consolidated system pair. Notably, due to missingness in the American Community Survey data, areal interpolation significantly reduces the sample size among receiving systems, particularly for MHI. The sample is reduced to between 40 and 85 (of 88) for receiving systems. Compared to 101 and 109 (of 111) for consolidated systems. The effect then carries over into the paired differences analysis with a sample of between 48 and 106 (of 111).

4. Results

Using this compilation of data sources and analytical methods, we document the consolidation of 206 unique water systems through 185 separate consolidation projects in California between 2015 and 2021. Twenty-three of these cases (26 systems) represent managerial consolidations, where operation and management responsibility were transferred without physically interconnecting the involved systems, while the remaining 162 (180 systems) were physical consolidations. Only two of the 206 system consolidations were formally mandated under SB 88.

Consolidated water systems are distributed across 47 of California's 58 counties and collectively served an estimated 131,511 residents (see Figure 1). The largest consolidated water system served 17,503 customers yet the median population served by a consolidated water system is just 120, indicating that most consolidated systems are extremely small. One hundred and eleven of these systems were community water systems, or systems serving residential populations of more than 15 connections or 25 people year-round. The remainder are a mix of Transient Non-Community, Non-Transient Non-Community systems (e.g., industrial facilities, seasonal residences), plus one consolidation of a “state small water system” (systems with less than 15 connections that are not regulated under the Safe Drinking Water Act but are minimally regulated at the county level in California) and two instances of consolidating domestic well communities into centralized water systems. Most consolidated systems, 184, relied on groundwater as their primary source, whereas the other 22 relied on surface water.

By contrast, the 143 receiving water systems served much larger populations on average, with a mean population of 80,425, though the median population served is significantly smaller at 7,061. The mean is skewed by the largest receiving system, the Los Angeles Department of Water and Power, which is also the largest drinking water system in the state, serving about 4 million residents in the city of Los Angeles. Yet 45% of the receiving systems serve less than 5,000 people. Like the consolidated water systems, most are groundwater-supplied (87), whereas 55 are reliant on surface water (one receiving system is missing source water data). Of the 143 receiving systems, 20 participated in more than one consolidation project over the study period. One such system, South Tahoe Public Utilities District, participated in nine separate consolidation projects.

Across the 119 cases included in the spatial proximity analysis, the mean distance between the consolidated system and the receiving system was 0.904 miles but varied notably by consolidation type. Among only physical consolidations, the mean was 1.061 miles, but among only managerial consolidations the mean distance was unsurprisingly further, 3.248 miles. In all cases the median distance was much smaller: 0.174 miles for physical consolidations and 0.751 miles for managerial consolidations. Only nine consolidations spanned more than three miles, which is the threshold the SWRCB currently uses to evaluate physical consolidation feasibility.

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Table 2
Institutional Types of Consolidated and Receiving Water Systems Compared to Prevalence Statewide

Institution type	# Of consolidated water systems (n = 206) (%)	# Of receiving water systems (n = 143) (%)	2018 statewide prevalence (n = 2867) (%) (Source: Dobbin & Fencl, 2021)
Private ancillary	102 (50.2%)	3 (2.1%)	855 (29.8%) (including private ancillary and private- unknown together)
Public ancillary	36 (17.5%)	7 (4.9%)	111 (3.9%)
Investor owned utility	22 (10.8%)	37 (25.9%)	211 (7.4%)
Nonprofit private	14 (6.9%)	7 (4.9%)	649 (22.6%)
General purpose government	8 (3.9%)	41 (28.7%)	463 (16.1%)
Special district	13 (6.4%)	47 (32.9%)	578 (20.2%)
Private—type unknown	9 (4.4%)	0	855 (29.8%) (including private ancillary and private- unknown together)
Domestic well community	2 (1%)	NA	Not included in study
Tribal	Not included in study	1 (0.7%)	Not included in study

The 203 consolidated systems span eight governance categories (See Table 2). By far, the most common governance category for consolidated systems comprises private ancillary systems, 31 of which are Mobile Home Parks, a potentially promising trend we elaborate on in our discussion. The second most common type contains public ancillary systems, 20 of which are schools.

Receiving water systems demonstrate similar diversity, despite being quite different with respect to institutional types (See Table 2). Independent special districts are the most common type of receiving system followed by general purpose governments, namely cities (39 of 42 systems). While ancillary systems are the least common type of receiving water system, there are nine cases of such systems acting in this capacity. Interestingly, with respect to the frequency of their participation in consolidation projects, neither the institutional types of consolidated water systems, nor receiving water systems, mirror their statewide prevalence (Table 2).

Combined then we document 30 different combinations of pre-post consolidation governance outcomes. Considering only the cases where community water systems were consolidated, 24 distinct transitions are observed. While Investor Owned Utilities consolidating with other Investor Owned Utilities is most common among community water systems, across all consolidations the most common transition is from a private ancillary system into a general purpose government system. The second most common pathway is from a private ancillary system into a special district (Figure 2).

For those cases for which we have information regarding the motivation for consolidation (66%), clear trends emerged: a high majority (81%) systems cited water quality compliance concerns indicating that the consolidated system was likely already or nearly out of compliance with primary drinking water standards and consolidation was pursued as a solution, by either switching water sources or accessing treatment. But water quality was not the only challenge that motivated consolidation. Fourteen cases cited disaster impacts as a motivating factor, 12 cited technical, managerial, and financial capacity (e.g., insufficient or insecure staffing, insufficient funding for operations and management or needed capital improvements), and nine cited water source capacity challenges (e.g., reduced spring or well production). In five cases state records reflect proactive "supply sustainability" concerns such as concerns about a system's reliance on a single source. Within the 14 disaster-motivated cases, five related to drought outages, another eight related to fire impacts and one related to a landslide. Notably, five of the fire cases were systems impacted by the 2015 Valley fire in northwestern California which decimated their customer bases. To maintain operations with greatly reduced customer bases, the districts opted to consolidate into a regional entity. This example illustrates how many of these motivating factors are interrelated. In 13 cases more than one motivating factor was cited, typically water quality concerns along with one or more additional concern.

Lastly, we consider socioeconomic differences between consolidated community water systems and receiving systems first at across all consolidations and then individually within projects. Across all projects, we estimate that on average consolidated community water systems have a lower MHI ($62,011) than receiving water systems ($70,092), both of which are lower than the statewide average of $78,672. In other respects, however, the average

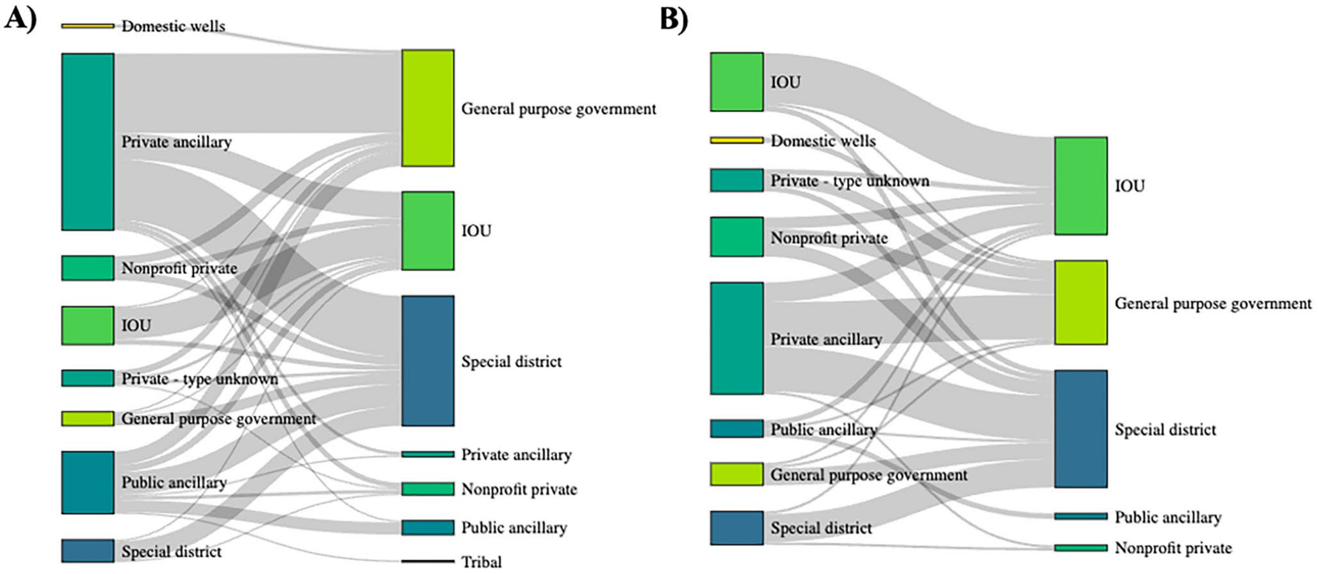

Figure 2. Governance transitions of consolidated water systems by frequency. (a) All consolidation cases ($n = 206$) (b) consolidations of community water systems ($n = 111$).

socioeconomic characteristics of the two population groups affected are nearly indistinguishable. The typical consolidated water system is 53% non-Hispanic white, 34% Latino with 37% of homes renter-occupied whereas the average receiving water system is 54% non-Hispanic white, 32% Latino with 38% of homes renter-occupied (See Table S1 in Supporting Information S1 for demographics of consolidated community water systems and receiving systems respectively).

There is, however, diversity within these groups (see Table S1 in Supporting Information S1). For example, among consolidated systems, 25% percent (52 of 206) fall 20% or more below the statewide average on at least two of the three following demographic characteristics: MHI, percent homeowner and percent non-Hispanic white. In contrast, 49% (101 of 206) fall 20% or more above the statewide average on at least two of these three measures (i.e., significantly more white, more owner-occupied and/or wealthier). In other words, we see high-resourced communities consolidating at nearly double the rate of low-resourced communities.

It is also important to look at potential socioeconomic differences within projects. To do so, we consider the pairwise differences between merged systems (See Table 3). As previously mentioned, across our 206 cases, on average, the MHI of receiving systems is $8,000 higher than the consolidated system it absorbed. Nonetheless the median difference in MHI between merged systems is only $333 and this difference is not significant using paired signed rank tests. Other pairwise differences within cases are all less than 2% and all similarly insignificant except for percent Native American, African American and Pacific Islander which are significant at the $p = 0.05$ level, potentially due to the more urban nature of some receiving systems.

Table 3
Paired Differences Between Receiving Community Water System and Consolidated Community Water System Demographics

Difference between receiving and consolidating systems respectively	Minimum	Mean	Maximum	Standard deviation	Wilcoxon *p*-value
% Non-Hispanic white	−47.72	0.78	55.81	17.29	0.48
% Asian	−46.04	−1.69	15.32	9.58	0.34
% African American	−28.09	0.12	9.52	4.43	0.02
% Latino	−56.76	−0.24	46.27	16.34	0.69
% Native American	−6.67	0.23	16.94	2.19	0.00
% Pacific Islander	−10.86	0.00	1.82	1.16	0.00
% Renter occupied	−79.92	1.20	55.50	20.73	0.59
Median Household Income (MHI)	−77,276.58	7,967.32	70,746.17	29,462.14	0.16

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Despite these null results, Table 3 indicates that, in some cases, consolidated and receiving systems are, in fact, quite distinct. Using the same criteria as above, we identify consolidations where the consolidated and receiving water systems involved differ by 20% or more with respect to (a) the percent of residents that are non-Hispanic white; (b) the percent of renter-occupied households or (c) MHI. While most cases do not meet this threshold, as is indicated by the non-significant paired signed rank tests above, a sizable minority of cases demonstrate this level of difference, 20%, 23% and 18% respectively. By exploring these cases we can better understand the socio-demographic trends of such non-similar outlier cases. In three instances, the population served by the receiving water system was more than 40% more non-Hispanic white than the consolidated system. In contrast, in four cases, the population served by the receiving water system was more than 40% less non-Hispanic white than the consolidated system. With respect to income differences, we find much of the same. In five cases, the MHI of the receiving system exceeded that of the consolidated system by more than $20,000. In another 10 cases, the opposite was true. In otherwards, even excluding more similar cases, we still do not observe the expected trend of low-income communities or communities of color consolidating into more high-resourced systems. Rather, the socio-demographic characteristics of communities involved in specific consolidation roles, like their respective institutional types, is highly variable.

5. Discussion

By compiling and analyzing all water system consolidation activity in the state of California over the study period, we provide an empirical basis for comparing trends in water system consolidation with the expectations articulated in the scholarly and policy literature. In certain respects, our findings align with predictions, highlighting the potential benefits of water system consolidation, including to potentially advance safe drinking water access. Yet we find that many other consolidation-related suppositions are not borne out empirically. Here we discuss these and other findings and their implications while highlighting next steps for future research and policy.

Overall, consolidation is occurring in nearly every county and across nearly every institutional type of water system in the state. This finding is especially salient given our relatively short study period. In total, 11,420,338 residents or nearly 30% of the state's population, was served by a water system involved in one or more consolidations between 2015 and 2021. On the other hand, most of these residents are served by a receiving water system rather than a consolidated one. Just 131,511 Californians, or 0.3% of the state's population, changed water providers because of a consolidation during the study period. Based on these findings, we conclude that consolidations are commonplace in California and that the reach of consolidation as a safe drinking water solution thus far has been relatively modest. While somewhat contradictory, both findings are important. Consolidations are reducing the number of water systems which itself can help reduce strain on state regulators and provide more intensive support and oversight for remaining systems. Whether or not 206 systems meaningfully accomplishes this, or how many more consolidations might be needed to do so, requires future research. But at the same time, the number of Californians without access to safe water remains stubbornly high.

Importantly, we find reductions particularly among specific subsets of high priority, underperforming regulated water systems. Consolidation activity especially reduced the number of very small systems which violate the Safe Drinking Water Act most frequently. These very small systems also typically rely on a single source, and as such are among the most vulnerable to climate impacts (Hansen et al., 2020; Mullin, 2020). Similarly, water systems serving schools represent a particularly large share of consolidated systems compared to their statewide prevalence, which is well aligned with public health and environmental justice goals (Altman et al., 2020). Mobile Home Park water systems, which have shown to systematically underperform in the state and beyond (Pierce & Gonzalez, 2017; Pierce & Jimenez, 2015; Pierce et al., 2018), were also consolidated at higher-than-average rates.

Like Lee and Braden (2007), we find that across all types of systems, water quality challenges, specifically compliance with the federal safe drinking water act, was the primary motivator for consolidation, likely due to regulatory pressures. While in this study we do not consider the performance of receiving water systems and therefore cannot asses the safe water access implications of these projects, combined, these findings indicate that, to the extent receiving water systems are operating in compliance with federal and state drinking water regulations, consolidation likely does have the potential to help advance access to safe drinking water beyond simply reducing system fragmentation (McFarlane & Harris, 2018). That disasters were the second most common motivating factor for consolidation highlights an additionally important role for consolidation in responding to climate change and building community resilience (Dobbin et al., 2023; Mullin, 2020).

But in other regards, our findings deviate from assumptions regarding the benefits of consolidation. Ours results show that not just consolidated systems are generally small, but receiving systems are also commonly small, with 45% of them serving under 5,000 customers. Given existing research on the scale needed to achieve operational efficiencies and related benefits, this reality brings into question the prospect of consolidations resulting in meaningful increases in economies of scale as is generally assumed (Ferro et al., 2011; Klien & Michaud, 2019; Sauer, 2005; Shih et al., 2006). In this context it is possible that overall, consolidation is adding burdens to small systems rather than increasing their capacity. The potential for such local drawbacks or costs has been previous noted (Hansen et al., 2020; Lee & Braden, 2008). As such there is a clear need to quantify and understand the types and distributions of benefits achieved from consolidation, recognizing they are likely case and context dependent (Bielefeldt et al., 2012; Lee & Braden, 2007).

Implicated in the small size of consolidated systems is the fact that roughly half of the consolidated water systems serve non-permanent or non-residential populations (i.e., are not community waters systems). This finding contrasts with the overarching focus on improved *residential* water access among scholars, regulators, and water equity advocates alike in consolidation discussions. It also highlights potential barriers to the consolidation of community water systems that merit future attention. To the extent that customer resistance (Nylen et al., 2018), governance challenges (Dobbin et al., 2022), or other factors impede the consolidation of residential water systems in unique ways, effective community engagement will be key to scaling consolidations to meet state needs (US Water Alliance, 2022).

Our findings also speak to the need for skepticism regarding the potential reach of consolidation as a safe drinking water solution. The median distance between physically consolidated systems in our study was less than 0.2 miles. On average, managerial consolidations span slightly larger distances but still generally only occur between systems within one mile of each other. As a result, consolidation is unlikely to be a viable solution for the most isolated of systems. Depending on the state, the number of non-consolidation eligible systems may outnumber eligible ones (Castillo et al., 1997).

Whereas the scholarly literature has particularly focused on the potential for privatization and municipalization via service transitions, as we expected our analysis reveals much more diversity and nuance in the institutional transitions implicated in system consolidations. More than 20 distinct institutional transition pathways were documented for consolidated systems and consolidated community water systems specifically. Water systems are most frequently consolidated into special districts rather than general purpose governments like cities, although cities do still play a large role representing 27% of unique receiving systems (39 of 143). Overall Investor Owned Utilities constitute 26% of unique receiving systems (37 of 143). Nonetheless, privatization only occurred in approximately five percent of cases (10 of 206) indicating that most systems consolidated into Investor Owned Utilities are privately owned, and in fact, most are themselves Investor Owned Utilities (18). “Remunicipalization” is relatively more common but occurs primarily through the consolidation of private ancillary systems and unknown private systems. We document only four cases where an Investor Owned Utility system consolidated into any publicly-owned system. Whether this is due to regulatory barriers for merging private and non-private systems, customer preferences or to other factors is not clear but should be further investigated. Notably Investor Owned Utilities did play an outsized role among the managerial consolidations documented. Understanding why this is the case could lend important insights as policymakers aim to increase managerial consolidations and broader partnership models (especially where the term “consolidation” is politically anathema) to serve more geographically isolated systems.

Despite the diversity, these findings do reveal important trends related to local water governance in the state. With the exception of a modest increase in the proportion of Investor Owned Utility systems, most consolidation projects exhibit a trend away from less representative community water systems—particularly Mobile Home Parks and Mutual Water Companies which often exhibit patterns of disenfranchisement of customers (McBride, 2022; Pierce & Gonzalez, 2017). Many, though not all, of these consolidated systems' former customers end up being served post-transition by either general purpose or special purpose governments, which provide certain state-mandated standards of transparency and open channels of democratic participation. We believe such gains in representative governance to be an important overlooked potential benefit of consolidation that can and should be actively promoted. Doing so intentionally is essential given the documented cases where the opposite has occurred including in Michigan (Pauli, 2019).

Another important lesson derived from the institutional analysis is that the frequency of system participation in consolidation projects in California does not mirror the prevalence of governance types across the state (see Table 2). This suggests that some types of systems may be more promising candidates than others. This is particularly notable among special districts which are the most common receiving system. We expect that this is due to some unique features of special purpose governments, which can more easily spread their boundaries without the secondary concerns general purpose governments must consider (Bollens, 2021; Mullin, 2009). California special district boundaries are also governed by a special purpose government in each county, the Local Area Formations Commission, which were designed to rationalize basic service provider boundary drawing processes. Further research could help determine how local governance structures and policies help or hinder consolidation projects of different types.

As previously discussed, consolidation is frequently promoted for its potential to increase equity in drinking water access and help address legacies of racism and exclusion. While our findings support the notion that consolidation is effectively reducing the number underperforming and vulnerable systems, thereby potentially supporting increased access to safe, sustainable drinking water overall, we do not find evidence that consolidation is effectively targeting systems serving low-income communities or communities of color in these efforts. In terms of average trends, consolidated systems are fairly similar to their receiving system counterparts when measured by key demographic markers for their respective customers—perhaps unsurprising given their typically close physical proximity. And we find clear evidence of communities of all demographic profiles acting in both receiving and consolidating roles. However, consolidated systems are more likely to serve communities with above average rates of homeownership, proportions of white residents, and incomes. These findings align with those of Lee and Braden (2008), who found that systems serving low-income communities were less likely to be acquired, and calls into question the degree to which consolidation, as currently practiced even in a context such as California, is and can support equity as intended. They also highlight potential socio-political challenges with implementing consolidation projects between communities with distinct socioeconomic makeups (Balazs & Ray, 2014; McFarlane & Harris, 2018).

Such challenges are well demonstrated in at least two of our cases: the consolidation of a small community water system struggling with Arsenic contamination serving the residents of Matheny Tract in 2016, and the consolidation of hundreds of drought-impacted residents without running water in East Porterville in 2017. Both communities were consolidated into neighboring cities immediately adjacent to them, highlighting the long histories of redlining and creative extraction that underpin existing drinking water inequities and can impede their resolution (Pannu, 2012; Purifoy & Seamster, 2021; Seamster & Purifoy, 2021). And in both cases objections to the consolidations were raised based on unfounded race- and class-based stereotypes that residents may not reliably pay their water bills should they be added to the city systems highlighting the social cleavages that often mirror these divisions. We need to further study these challenges, how they impact consolidation project to better understand if, and how, consolidation can be leveraged to advance equitable drinking water access.

Our analysis has several important limitations to note. Our unique data set, while an improvement upon previous compilations, is likely missing consolidations involving previously unregulated systems, given our reliance on the SDWIS to supplement existing state data. Similarly, water systems operated by Tribal governments, an important component of the water provision mosaic in many parts of North America, are not captured in this study outside of a singular receiving system. By focusing only on successful consolidations, we also miss an important opportunity to learn from and compare our findings to failed consolidation efforts as well as areas where consolidation is not pursued despite being an option. Future research should analyze the factors associated with failed or stalled prospective consolidation projects. Relatedly, California's policies promoting consolidation have clearly had an impact, but in this study, we are unable to determine which specific policies are most actively supporting consolidations and of what type including the role of incentives. Nonetheless, the above findings provide unique insights for researchers, practitioners, and policymakers with ample opportunities for future research that can inform future state and federal consolidation efforts.

6. Conclusion

Many small drinking water systems suffer from a myriad of challenges that systematically threaten their performance and sustainability. Water system consolidation, in turn, is increasingly pointed to as a promising solution to address these issues and thereby advance safe and affordable drinking water access long-term. Yet effectively deploying new policies, regulatory powers, and incentives to advance water system consolidations that meaningfully address small system challenges first requires a grounded understanding of how consolidations can and do occur as well as a careful consideration of the real and desired outcomes, all of which existing literature lacks.

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In this study we compile and analyze a novel data set of 206 water system consolidations over the course of 7 years in the state of California, which has made consolidation a policy and equity priority. In doing so we draw attention away from the more notable, exceptional cases of privatization or remunicipalization, toward the more quotidian instances of very small, groundwater reliant systems merging with other small systems, often due to water quality challenges. Rather than primarily featuring Investor Owned Utilities and municipalities, consolidated water systems are most commonly private or public ancillary facilities such as gas stations, industrial sites, or schools.

There are both positive and concerning implications to these findings. The ubiquity of consolidations is encouraging, as is the notably high rate of consolidation of school systems and other high priority, underperforming or climate-vulnerable systems. Further, the trend toward consolidation into publicly owned systems run by elected local government highlights opportunities for increased transparency and representation in local water management. Yet our analysis of residential populations served by consolidated water systems indicates that, as we see in access to infrastructure funding generally (Hansen et al., 2021; Ponder, 2021), communities of color and low-income communities are underrepresented among consolidated systems compared to their higher-resourced counterparts despite disproportionately experiencing drinking water challenges. And given the extremely small size of most consolidated systems, potential gains in economies of scale from consolidations are likely more limited, if not negligible, than is often promoted.

It is time to move beyond the blanket promotion of consolidation toward a more nuanced understanding of the associated opportunities and limits. Our study takes a major step in filling these gaps by documenting how, when, and where consolidations are occurring in California in response to rapid policy innovation. Additional research is needed to understand the driving forces behind these trends including the role of state incentives, regional planning and politics, and local decision-makers themselves. Research is also needed to assess the realized outcomes of consolidations and how they might be mediated by the diversity of consolidation arrangements documented herein. Further study will help policymakers promote system consolidation specifically in ways that best prepare communities for environmental and fiscal challenges, provide clean water, advance environmental justice, and better enable residents to have a voice in the governance practices of their local water systems.

Conflict of Interest

The authors declare no conflicts of interest relevant to this study.

Data Availability Statement

The novel data set compiled for this project as described in the methods section and all analysis scripts are publicly available on Zenodo/GitHub (Dobbin, 2023).

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