Agenda

Santa Cruz Mid-County Groundwater Sustainability Plan (GSP)

Advisory Committee Meeting #11

Wednesday, September 26, 2018, 5:00 – 8:30 p.m.
Simpkins Family Swim Center
Room B - 979 17th Avenue Santa Cruz CA 95062

Meeting Objectives

- Share and discuss what the model tells us about pumping impacts by use type and location.
- Share and discuss proposed minimum thresholds for chronic lowering of Groundwater Levels and receive initial input from Advisory Committee.
- Discuss and provide Advisory Committee input on a draft proposal for developing measurable objectives.

Agenda

Item No.	Time[1]	Topic	Presenter & Materials
	4:30 p.m.	*Arrivals/Committee members collect food for dinner*	
1.	5:00 p.m.	Welcome, Introductions, Meeting Objectives, and Agenda Review • Review updated project timeline • Update on site visit	• Executive Team member – Ron Duncan • Eric Poncelet, Facilitator *Materials:* *1.1 Agenda* *1.2 Groundwater Sustainability Plan Process Overview Timeline* *1.3 Process Funnel Diagram* *Refer to PowerPoint Presentation*
2.	5:10 p.m.	Public Comment • *Members of the public to comment on non-agenda items*	• Oral Communications • Written Communication and Submitted Materials (included in packet)
3.	5:20 p.m.	Pumping Impacts on Key Sustainability Indicators • Presentation • Discussion o Staff recommendations on problem statement	• Georgina King, Montgomery & Associates • Advisory Committee

[1] The times allotted on this agenda are approximate and are subject to change

Item No.	Time[1]	Topic	Presenter & Materials
		o What else to model for?	*Materials:* *Refer to PowerPoint Presentation*
4.	6:35 p.m.	Public comment	• Public
5.	*6:45 p.m.*	*Break*	
6.	7:00 p.m.	Proposed Minimum Thresholds for Chronic Lowering of Groundwater Levels • Presentation • Initial Input from Advisory Committee	• Georgina King, Montgomery & Associates • Advisory Committee *6.1 Proposed Draft Chronic Lowering of Groundwater Level Sustainable Management Criteria* *Refer to the PowerPoint Presentation*
7.	7:20 p.m.	Draft Proposal for Developing Measurable Objectives • Presentation and discussion	• Georgina King, Montgomery & Associates • Advisory Committee *Materials:* 7.1 *Approach for Developing Measurable Objectives for All Sustainability Indicators* *Refer to PowerPoint Presentation*
8.	8:10 p.m.	Public Comment	• Public
9.	8:20 p.m.	Confirm: • August 22, 2018 GSP Advisory Committee Meeting Summary	• Advisory Committee • Eric Poncelet, Facilitator *Materials:* *9.1 Draft Meeting Summary Groundwater Sustainability Plan Advisory Committee Meeting # 10, August 22, 2018*
10.	8:25 p.m.	Recap and Next Steps	• Eric Poncelet, Facilitator
	8:30 p.m.	*Adjourn*	

Santa Cruz Mid-County Groundwater Basin Groundwater Sustainability Plan Process Overview — July–December 2018

2018 PHASE 2: GSP ADVISORY COMMITTEE POLICY DEVELOPMENT

7/18 8/18 9/18 10/18 11/18 12/18

Phase 2b. July – December 2018: Projects, Management Actions and Groundwater Modeling

July 19, 2018 *(Joint Advisory Committee/MGA Board Meeting)*

- Discuss projects and management actions and how they relate to GSP.

August 22, 2018

- Describe groundwater model and what goes into the model, including discussion of assumptions for historic and predictive simulations.
- Discuss groundwater modeling results for sample projects and management actions; evaluate project impacts against minimum thresholds.

September 26, 2018

- Discuss model results – pumping impacts by use type and location.
- Review proposed minimum thresholds for chronic lowering of groundwater levels.
- Discuss proposal for developing measurable objectives.

October 24, 2018

- Present groundwater modeling results for sustainability strategies; evaluate results against minimum thresholds and measurable objectives.
- Review of federal and state statutory and regulatory framework governing potential GSP management actions and projects related to water quality.

November 15, 2018

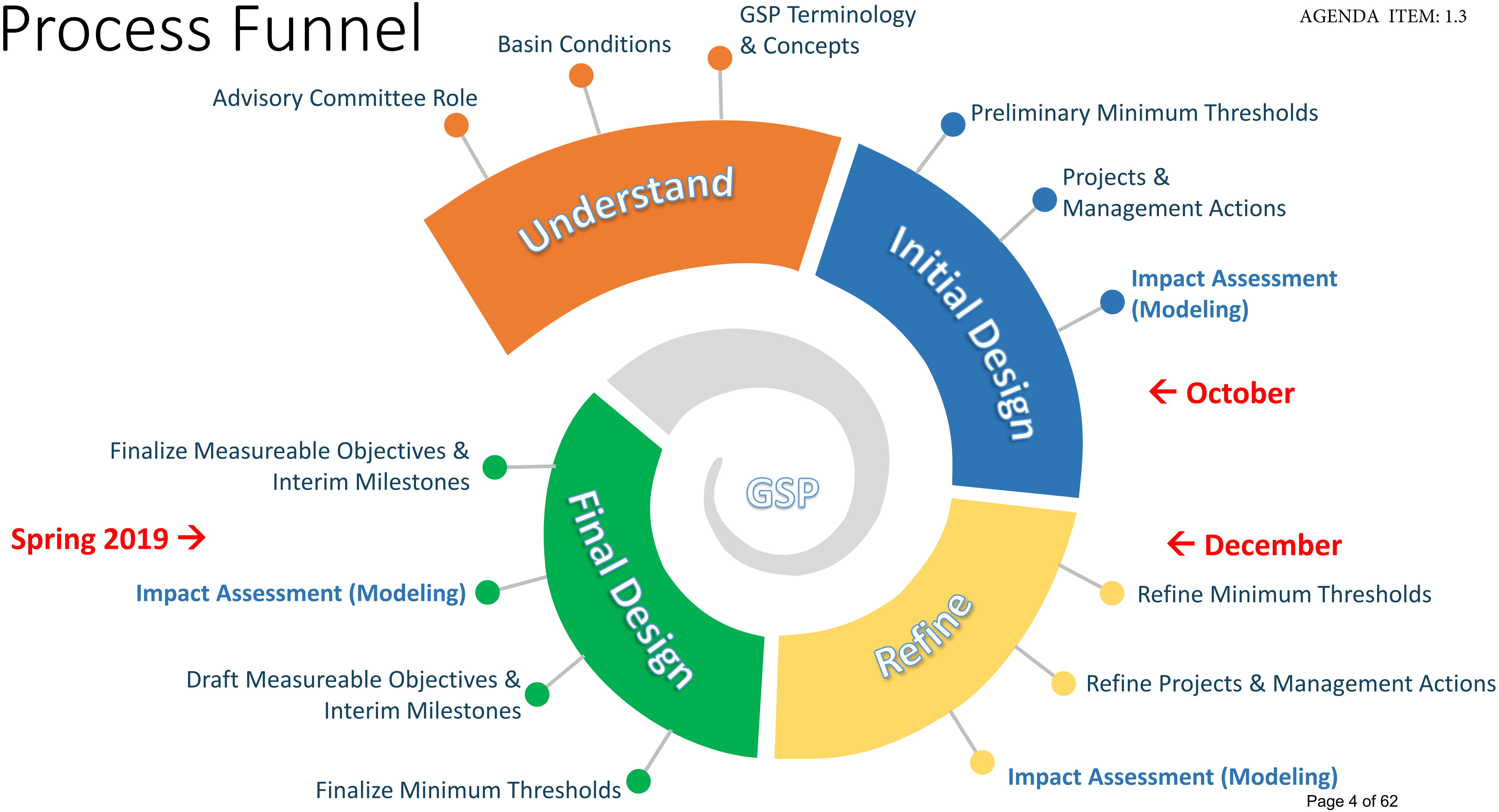
- MGA Board meeting only (no Advisory Committee meeting).

December 12, 2018

- Discuss next iteration of groundwater modeling results.
- Discuss projects and management actions, and measurable objectives for analysis (e.g., cost allocation, legal issues) in 2019.
- Revisit sustainability goal.
- Discuss management areas.

7/18 8/18 9/18 10/18 11/18 12/18

Process Funnel



Santa Cruz Mid-County Basin
Proposed Draft Chronic Lowering of Groundwater Level
Sustainable Management Criteria

This document is a proposed draft that documents preliminary development of some of the Sustainable Management Criteria to be included in the Groundwater Sustainability Plan (GSP). Specifically, the Sustainable Management Criteria included in this document are:

- Chronic lowering of groundwater level conditions that are considered significant and unreasonable,
- The set of conditions that cause undesirable results that will lead to significant and unreasonable chronic lowering of groundwater levels, and
- Proposed Minimum Thresholds.

For the first two bullets listed above, this document covers the following:

1. Recap the initial staff proposal presented at the May 23, 2018 GSP Advisory Committee meeting.
2. Summary of Committee input provided at the May 23 meeting.
3. Revised technical recommendations to original staff proposal, with a rationale for each specific recommendation, taking into account Committee input.

The recommendations are used to develop proposed draft minimum thresholds needed as metrics against which to evaluate future projects and management actions using the groundwater model.

Chronic Lowering of Groundwater Levels - Significant and Unreasonable Conditions

Technical Staff Proposal Discussed at the May 23, 2018 Advisory Committee Meeting

Staff's initial proposal was that **lowering of groundwater levels that cause 5% or more of all groundwater pumping well's to fall below 20 feet from the bottom of wells** would be considered significant and unreasonable.

Summary of Advisory Committee Discussion

The Advisory Committee, in general, felt that the proposed statement was too numerical and needed to be more qualitative. Additionally, as we do not know where all the private wells are in the basin, this would make it impossible to determine the 5% or more measure in the staff proposal. There is also not yet enough statistical information on the depth of wells in relation to the well screens to come up with a defendable distance above the bottom of wells. However, in general, the Advisory Committee agreed with the concept of not allowing wells to go dry (i.e., groundwater levels falling below the bottom of the well) but allowing groundwater levels to remain some distance above the bottom of the well.

There was a suggestion that lowering of groundwater levels be correlated with overlying land use rather than groundwater levels in wells. This would mean setting the lowest groundwater level acceptable in an area to support the existing/desired land use. Thus, minimum thresholds would vary regionally within the basin based on land use or beneficial user. There was concern that it might be difficult to set a qualitative minimum threshold when geology and land use water demands vary across the basin.

Revised Statement of Significant and Unreasonable Conditions
~~Lowering of groundwater levels that cause 5% or more of all groundwater pumping well's to fall below 20 feet from the bottom of wells~~.
A significant number of private, agricultural, industrial, and municipal production wells can no longer provide enough groundwater to supply beneficial uses.

Rationale: Groundwater levels should be managed to support existing and/or proposed overlying land uses and environmental water user's beneficial needs.

Chronic Lowering of Groundwater Level Undesirable Results

Technical Staff Proposal at April Advisory Committee Meeting
Staff's initial proposal was that undesirable results will occur if **the average Representative Monitoring Well groundwater elevation over one month falls below the <Minimum Threshold>.**

Summary of Advisory Committee Discussion
Generally, the Advisory Committee thought the staff proposal using an average monthly groundwater level to identify when undesirable lowering of groundwater levels is occurring was adequate. The Committee requested clarification on how the "monthly average" would be determined and what back-up monitoring measurements will be implemented in case a well's data logger were to fail.

Revised Technical Recommendation: Undesirable Results for Chronic Lowering of Groundwater Levels

The average monthly Representative Monitoring Well groundwater elevation ~~over one month~~ falls below the <Minimum Threshold>. All Representative Monitoring Wells to be equipped with data loggers.

Rationale: Monthly average groundwater levels will adequately monitor and identify seasonal low groundwater elevations.

"Average monthly" means all groundwater levels recorded by the data logger over each month (at least daily measurements) will be averaged to result in an average groundwater level for each month. For each Representative Monitoring Well, a chart will be created annually showing 12 average groundwater elevations compared to the minimum threshold for each well. We will provide theses charts in our annual GSP report to DWR. An undesirable result will occur if the average monthly groundwater level falls below the minimum threshold for any Representative Monitoring Well.

Chronic Lowering of Groundwater Level Minimum Thresholds

Staff's initial proposal to the Advisory Committee was to define Minimum Thresholds as being 20 feet from the bottom of wells. Although pumps for private wells are often placed 20 feet from the bottom of wells, this is not a suitable metric as some pumps are placed higher. There also needs to be some groundwater above the pump for it to pump water without being damaged. The Advisory Committee suggested an approach to develop Minimum Thresholds that considers the overlying land use and beneficial users of groundwater.

Approach for Developing Minimum Thresholds

The general premise for determining Minimum Thresholds for chronic lowering of groundwater levels is that groundwater levels cannot go below a level which prevents overlying groundwater users from meeting their typical water demand. Overlying water demand is determined from land use and by the well use indicated on well driller logs in the vicinity of the Representative Monitoring Wells (RMW).

The saturated thickness of an aquifer is an important factor that can limit well yields. When groundwater levels decline, the saturated thickness of the aquifer decreases. The saturated thickness may decrease to a point at which the aquifer can no longer produce water to the well at the minimum rate of pumping needed to meet typical demands.

The pump rate and aquifer properties control how much saturated aquifer thickness (distance between the bottom of the well and the groundwater level) is needed to meet water demands. Water demands by municipal wells are known as municipal agencies have detailed records of each well's pump capacity and volumes pumped. Private domestic and agricultural well users generally do not have this information, and therefore assumptions were made to estimate their water usage. For domestic use, average rates of 10 gpm were provided by a local pump contractor. For purposes of estimating the minimum saturated thickness (MST) needed, a more conservative rate of 15 gpm was used as this needs more saturated thickness than a well pumping at 10 gpm (i.e. the groundwater level needs to be higher for 15 gpm). For agricultural wells, the estimated capacity provided on the well driller's logs available indicated 250 gpm is typical.

A theoretical MST for each RMW is estimated using a spreadsheet tool developed by the Kansas Geological Survey based on the overlying water demand. The tool considers well efficiency, nearby pumping wells, and drawdown in the well due to pumping at a given rate. To consider uncertainties in the MST estimation, a 20% safety factor is added to the MST obtained from the spreadsheet tool. It is also assumed that a well pump can be placed no deeper than 20 feet from the bottom of the well to prevent the pump from being damaged by settled sediment in the bottom of the well. This is the industry standard depth well pumps are set in domestic wells. To account for this, a further 20 feet is added to the estimated MST. Figure 1 provides a generalized schematic that illustrates the method described above. The resultant adjusted MST is the minimum thickness of saturated aquifer that is needed for overlying groundwater users to meet their typical demand. In some areas there may be two overlying uses, such as agricultural and domestic, or municipal and domestic. For these cases, the adjusted MST of the use type that results in the shallowest groundwater level is used.

As a conservative measure and to ensure the Minimum Threshold groundwater elevations set are based on the majority of nearby wells, the approach assumes the RMW has a depth equal to either the shallowest nearby wells screened in the same aquifer as the RMW, or if the shallowest well results in a Minimum Threshold above the groundwater level in the RMW, up to the 15th percentile shallowest well depth is used (i.e. up to 85% of wells are deeper than this depth).

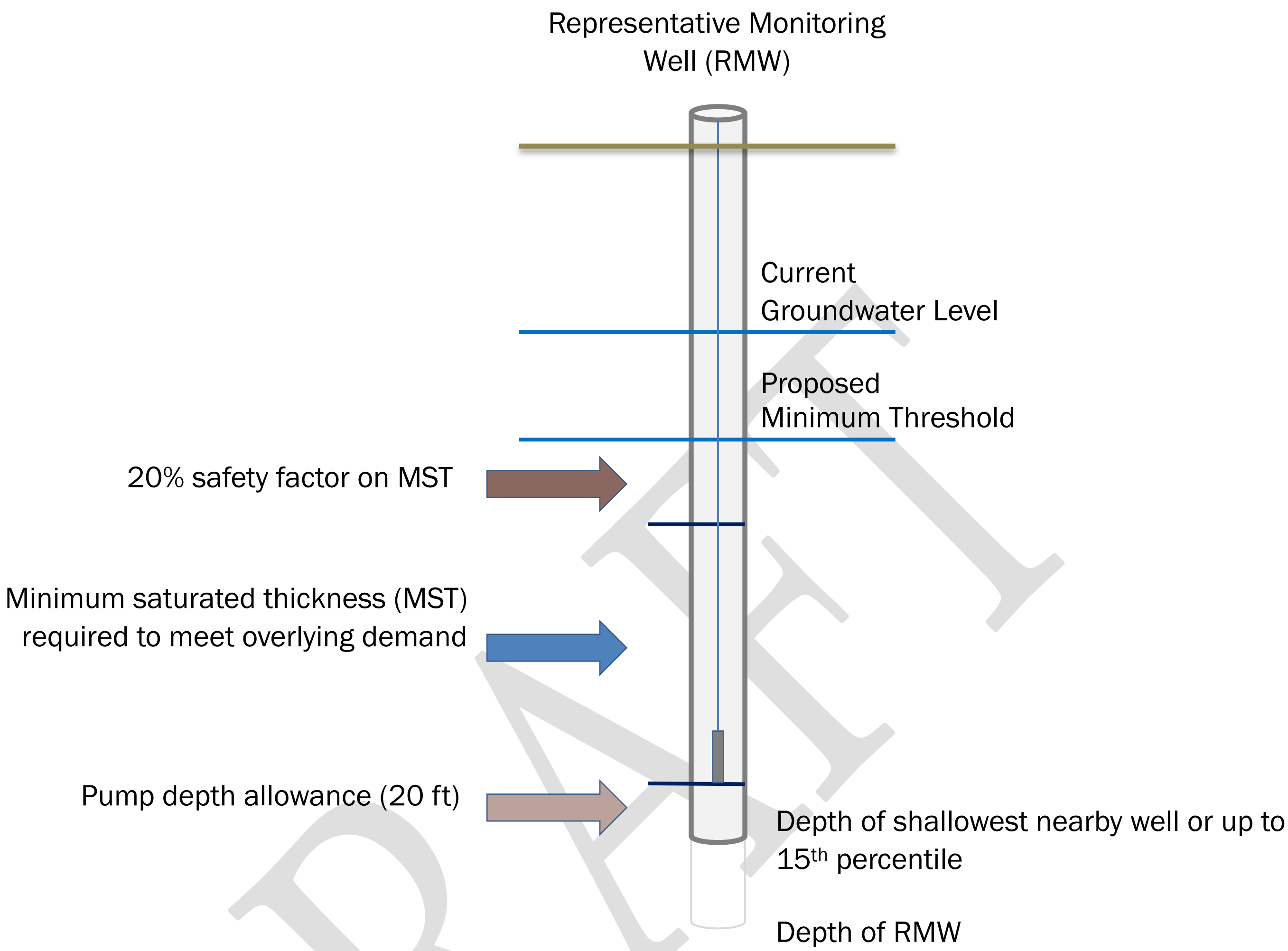


Figure 1. Schematic of Development of Minimum Thresholds based on Overlying Demand

<u>Proposed Minimum Thresholds</u>

Figure 2 shows the locations of the 18 RMWs within the Basin with their proposed Minimum Thresholds, and Table 1 summarizes the proposed Minimum Thresholds. The hydrographs that follow provide historical groundwater level data for each RMW, along with the proposed Minimum Threshold indicated as a dashed line. There were six wells that had adjusted MSTs that were more than 50 feet below historic low groundwater levels. For these wells, the proposed Minimum Threshold was raised to 30 feet below historic low groundwater levels. This was done because, although the wells could meet their demand with a much lower groundwater level, having groundwater levels drop to these depths may influence other Sustainability Indicators. There are three wells where the Minimum Threshold was raised to sea level as these are close to protective elevation coastal monitoring wells and having groundwater levels below sea level will make it difficult to achieve protective elevations at the coast.

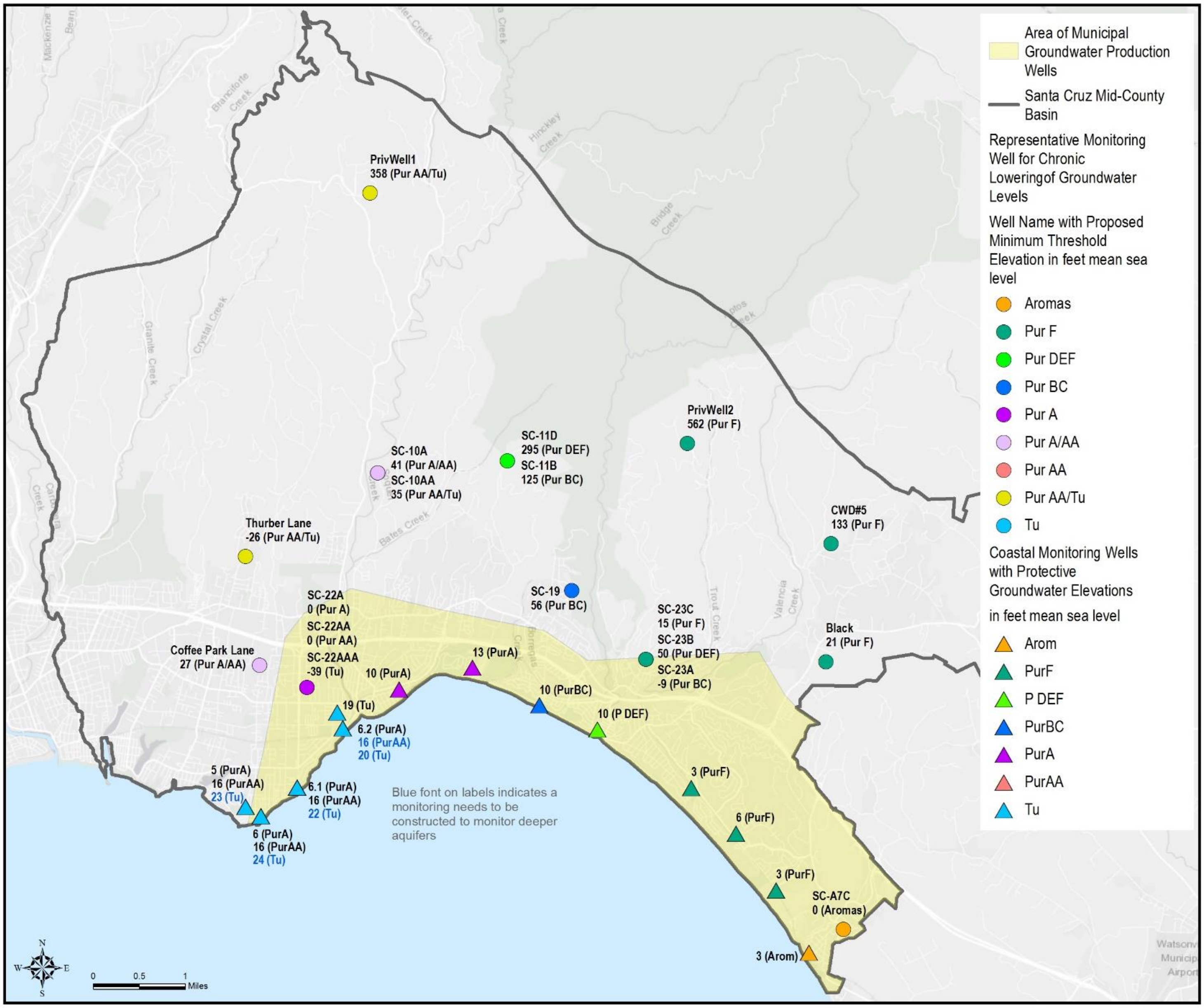


Figure 2. Representative Monitoring Wells for Chronic Lowering of Groundwater Levels with Proposed Minimum Thresholds by Aquifer

Table 1. Summary of Representative Monitoring Wells with Proposed Minimum Thresholds

RMW Name	Overlying Demand Type	Aquifer	Proposed Minimum Threshold Elevation (feet amsl)	Minimum Saturated Thickness (MST) Assumptions And Adjustments made to Minimum Thresholds (MT)
SC-22AAA	Municipal	Tu	-39	Shallowest municipal well depth, adjusted MST at -326 ft amsl, MT set to 30 ft below historic low
Thurber Lane Deep	Private Domestic	Pur AA/Tu	-26	10th percentile shallowest domestic well
SC-10RAA	Private Domestic	Pur AA/Tu	35	Shallowest domestic well depth, adjusted MST at -275 ft amsl, MT set to30 ft below historic low
Private Well #1	Private Domestic	Pur AA/Tu	358	Shallowest domestic well depth that is greater than 100 ft
SC-22AA	Municipal	Pur AA	0	Shallowest municipal well depth and municipal well MST, MT set at sea level
Coffee Lane Shallow	Municipal	Pur A/AA	27	Shallowest domestic well depth
SC-10RA	Private Domestic	Pur A/AA	41	Shallowest domestic well depth that is greater than 100 ft
SC-22A	Municipal/Private Domestic	Pur A	0	Shallowest domestic well depth, adjusted MST at muni well MST is -3 ft amsl, MT set at sea level
SC-11RB	Private Domestic	Pur BC	125	15th percentile shallowest domestic well
SC-19	Private Domestic	Pur BC	56	Shallowest domestic well depth
SC-23A	Municipal	Pur BC	-9	Shallowest municipal well depth, adjusted MST at -255 ft amsl, MT set to 30 ft below historic low
SC-11RD	Private Domestic	Pur DEF	295	Shallowest domestic well depth
SC-23B	Small Water System/ Private	Pur DEF	50	Shallowest domestic well depth, SWS K too high reduced it to 10 ft/d, increased MT to 50 from -137ft amsl
SC-23C	Municipal	Pur F	15	Shallowest domestic well depth adjusted MST at -43 ft amsl, MT set to 30 ft below historic low
Cox 5	Private Domestic	Pur F	133	adjusted MST at 97 ft amsl, so just make it 30 ft below historic low
Private Well #2	Private Domestic	Pur F	562	Shallowest domestic well depth, adjusted MST at 373 ft amsl, MT set to 30 ft below historic low
Black	Private Domestic	Pur F	21	15th percentile of shallowest domestic well depths
SC-A7C	Ag/Municipal	Aromas	0	Shallowest Ag well depth, set to sea level zero because it is near SC-A3 with protective elevation of 3 ft amsl

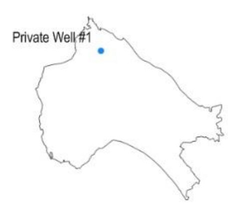


FIGURE 1. Private Well #1 (Pur AA/Tu)

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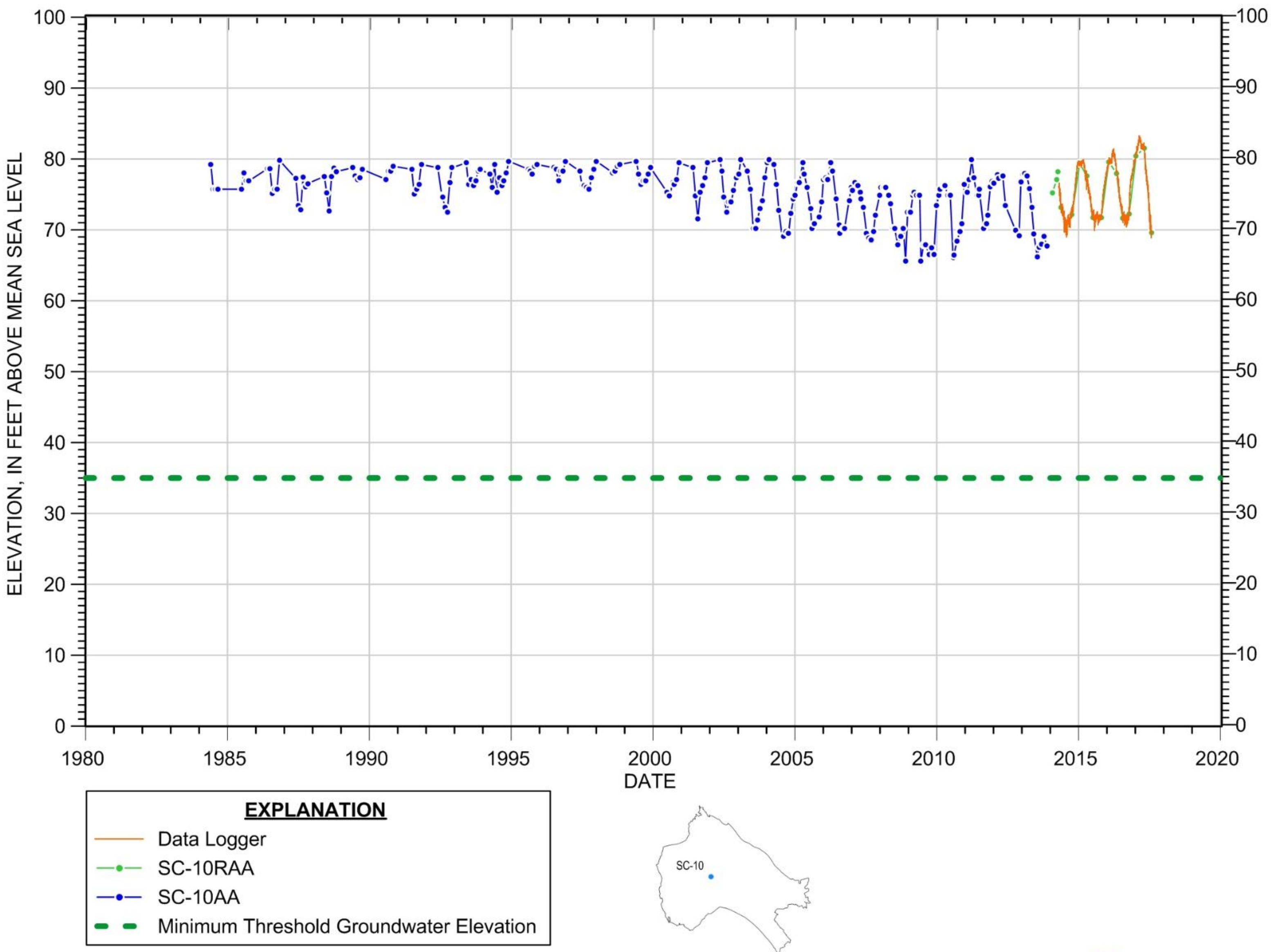

FIGURE 2. SC-10AA (Pur AA/Tu)

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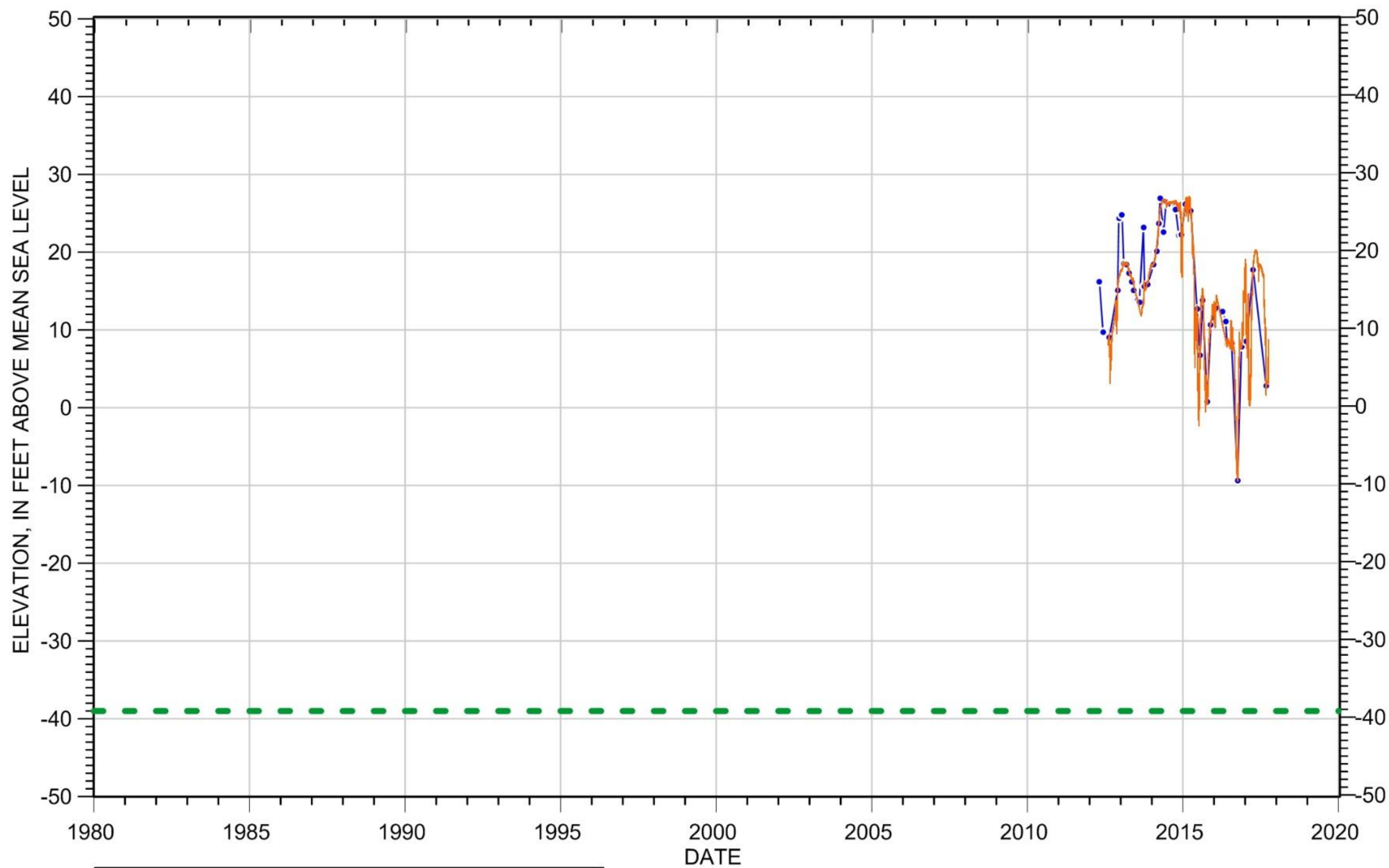

FIGURE 3. SC-22AAA (Pur AA/Tu)

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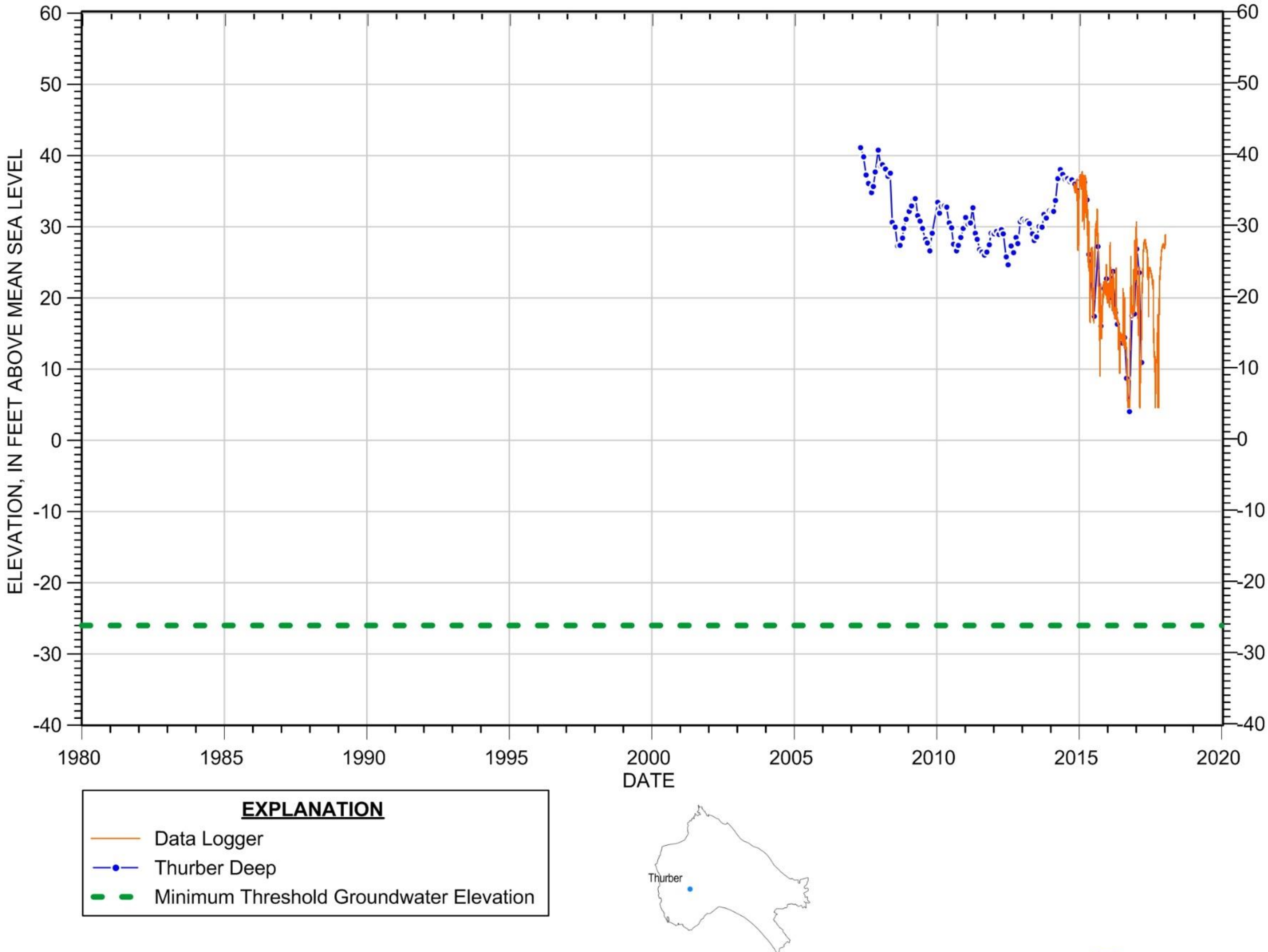

FIGURE 4. Thurber Deep (Pur AA/Tu)

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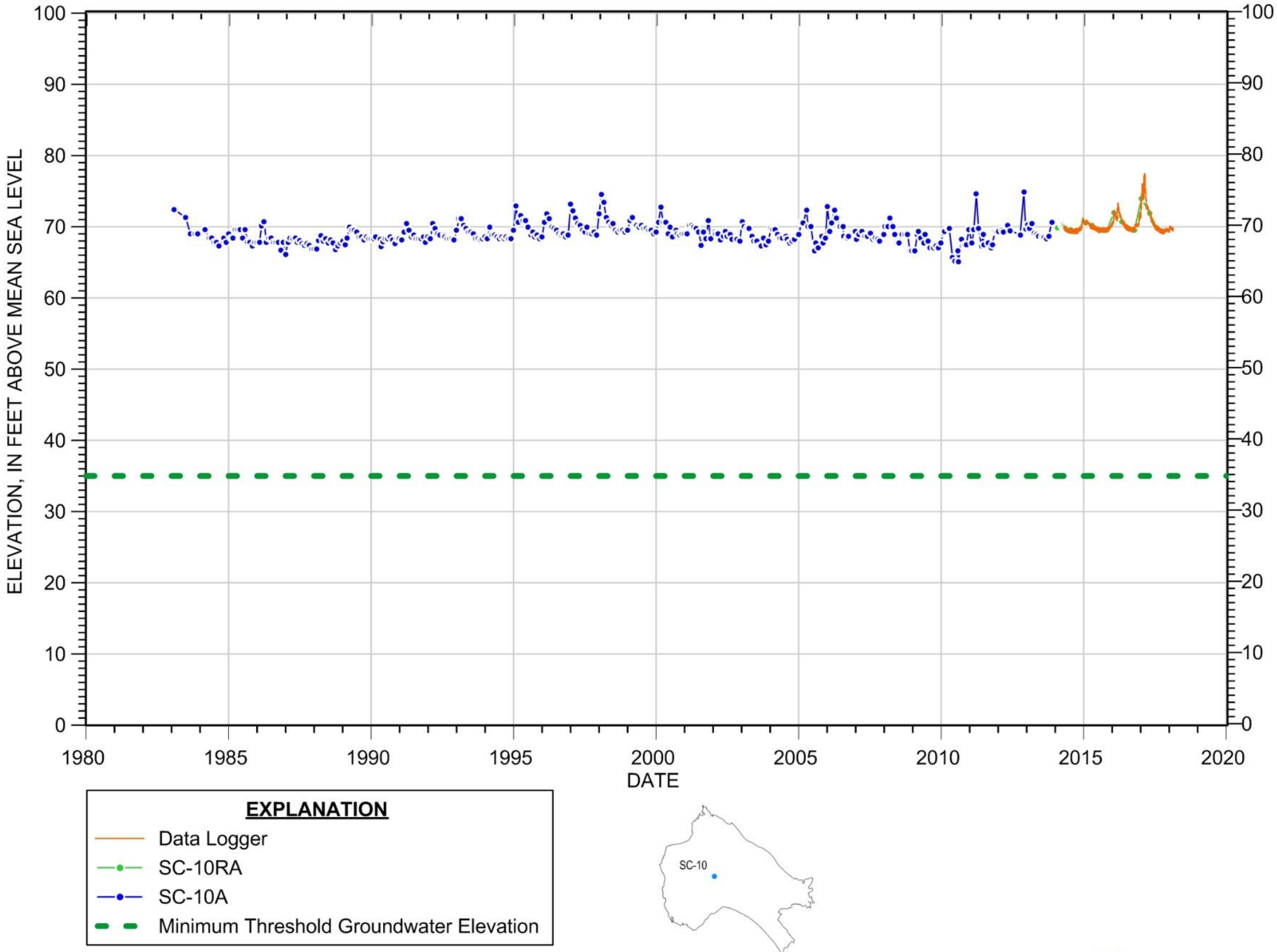

FIGURE 5. SC-10A (Pur A/AA)

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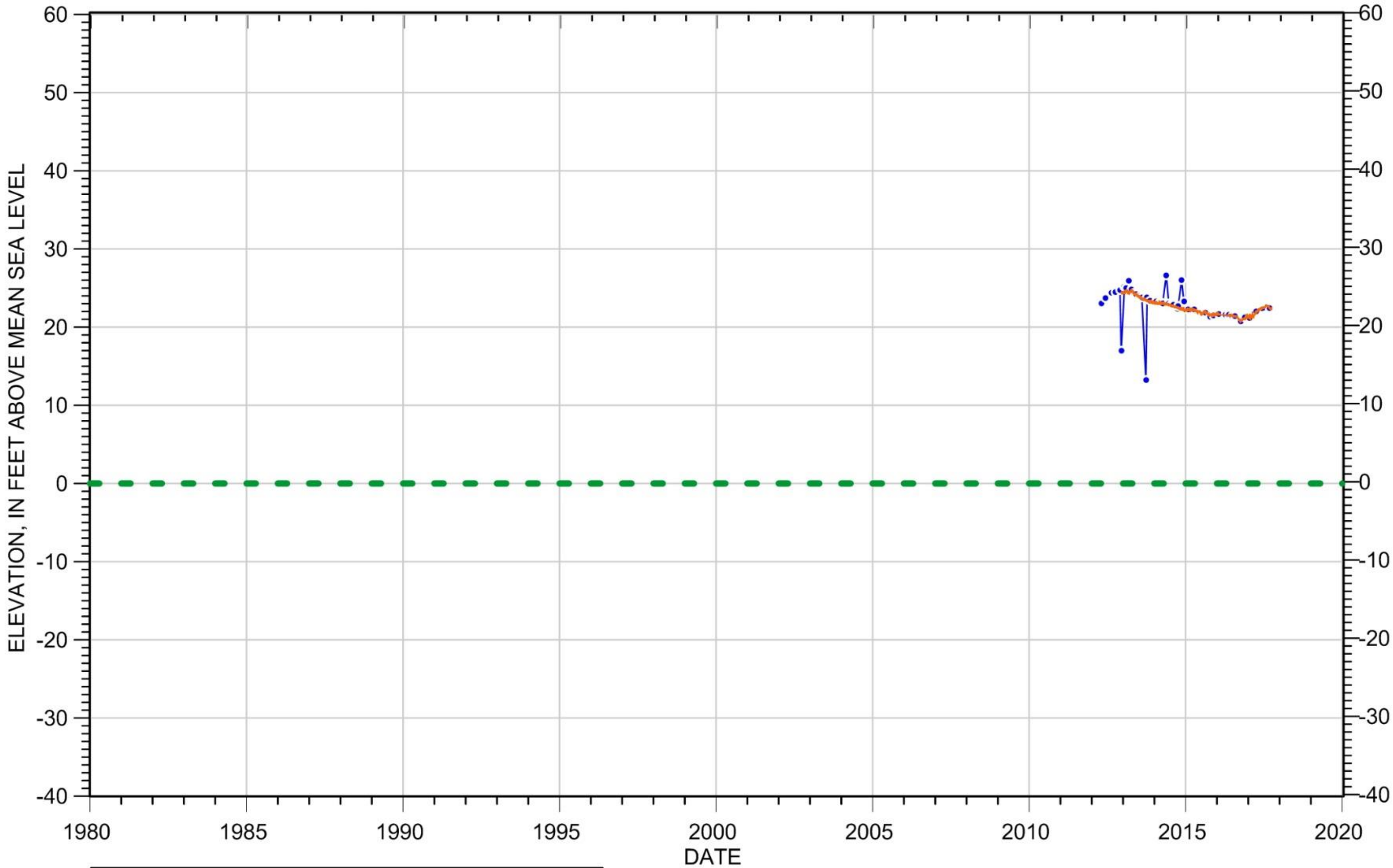

FIGURE 6. SC-22A (Pur A)

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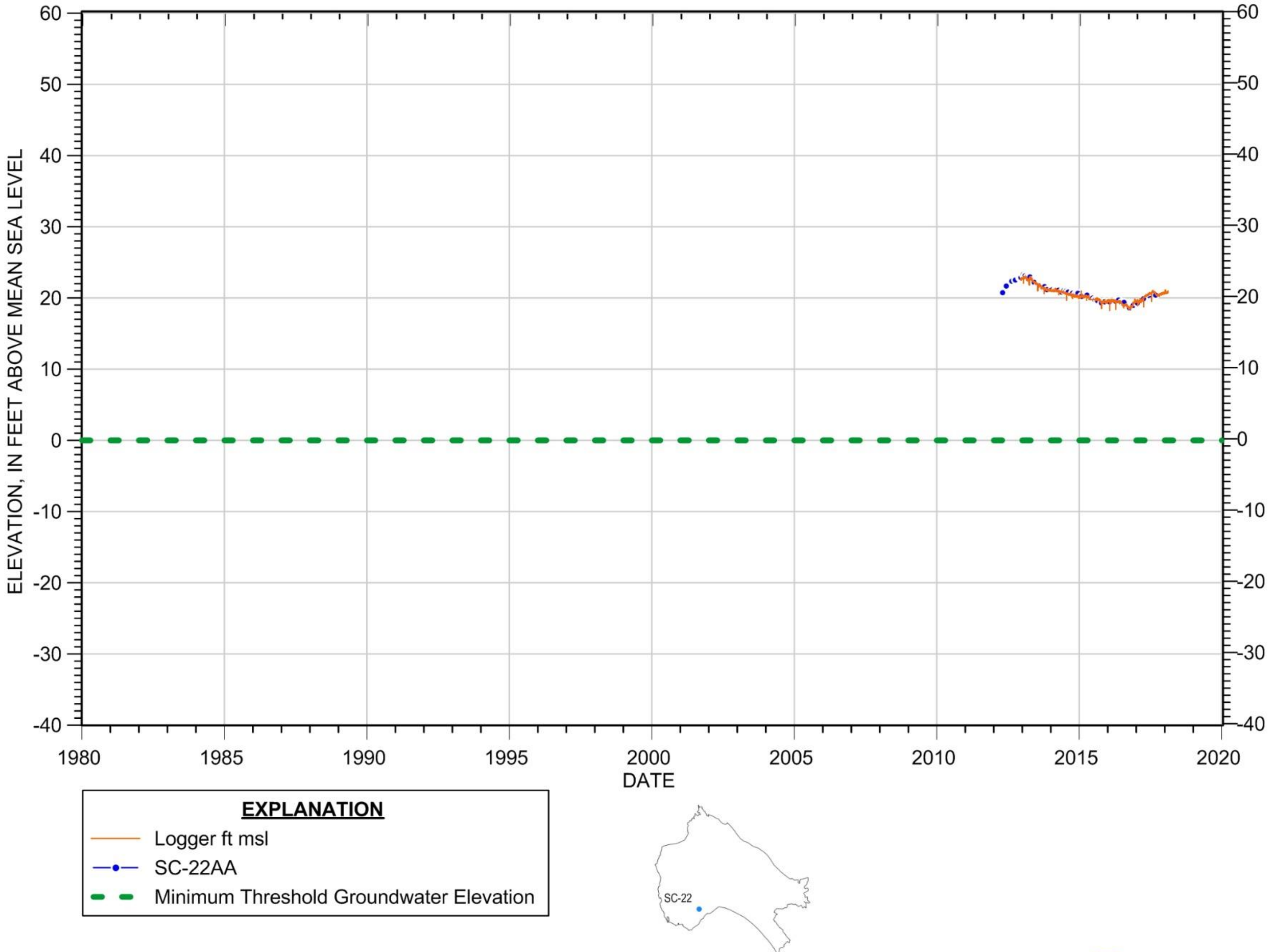

FIGURE 7. SC-22AA (Pur A/AA)

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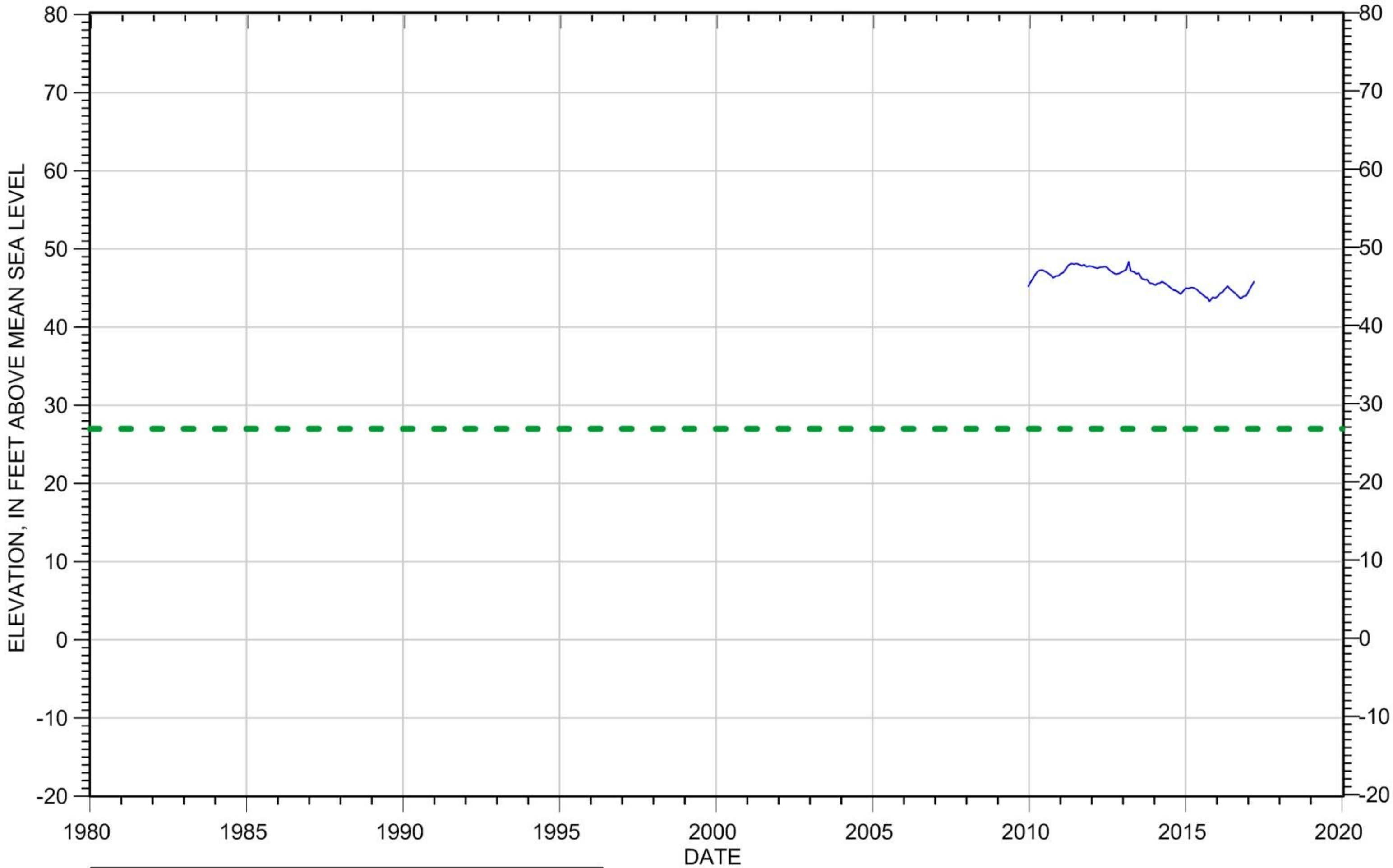

FIGURE 8. Coffee Shallow (Pur A/AA)

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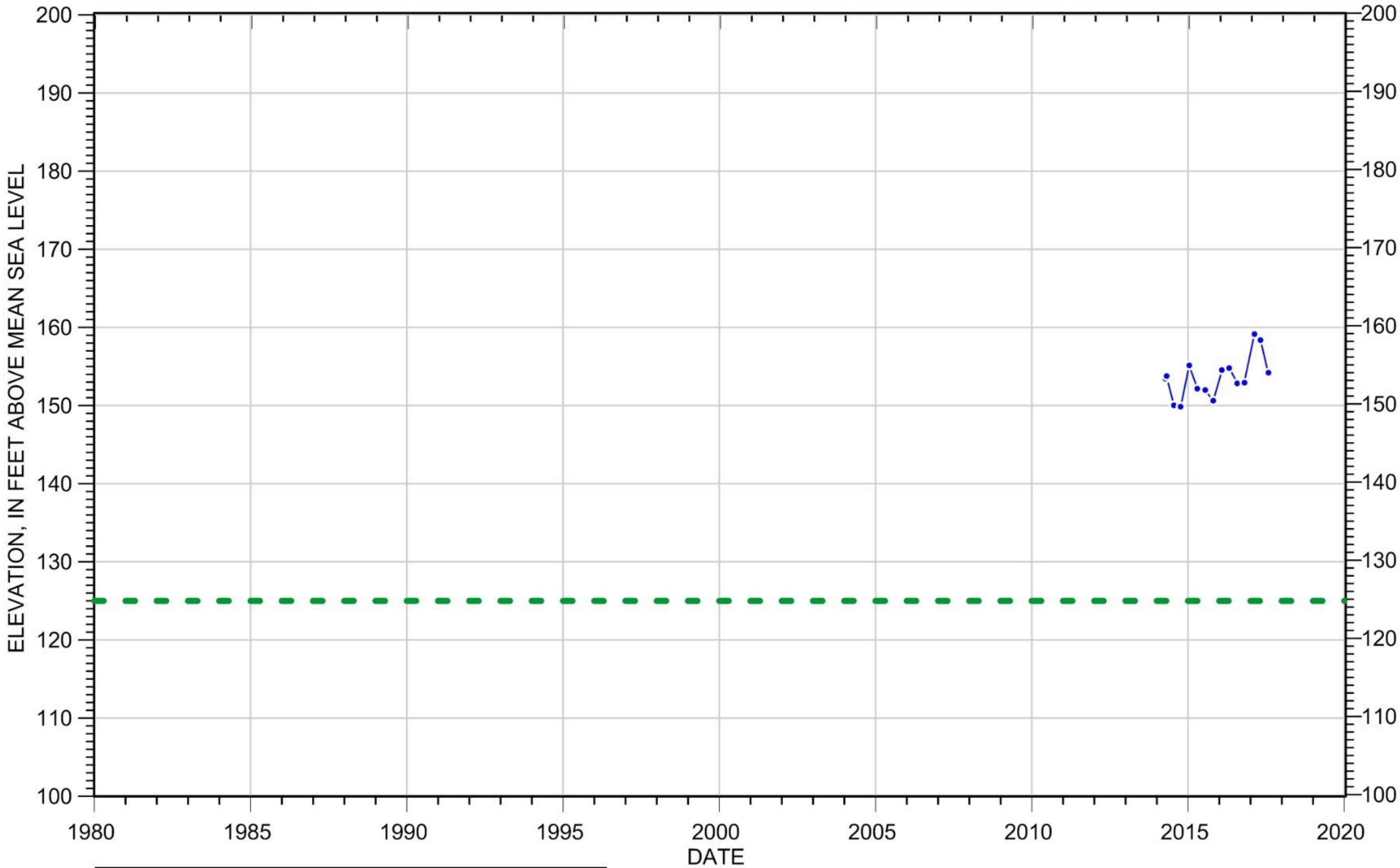

FIGURE 9. SC-11B (Pur BC)

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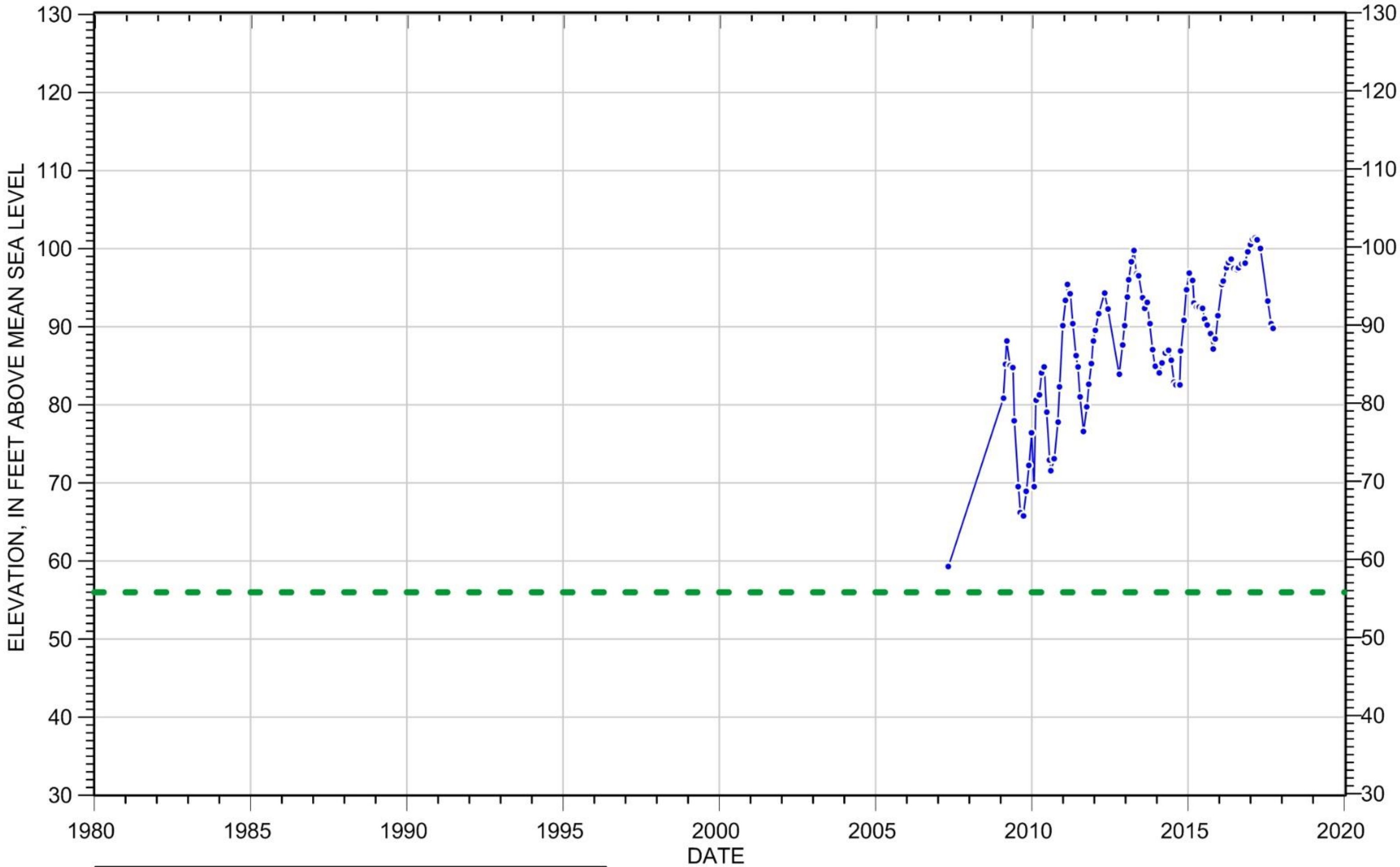

EXPLANATION

SC-19

Minimum Threshold Groundwater Elevation

FIGURE 10. SC-19 (Pur BC)

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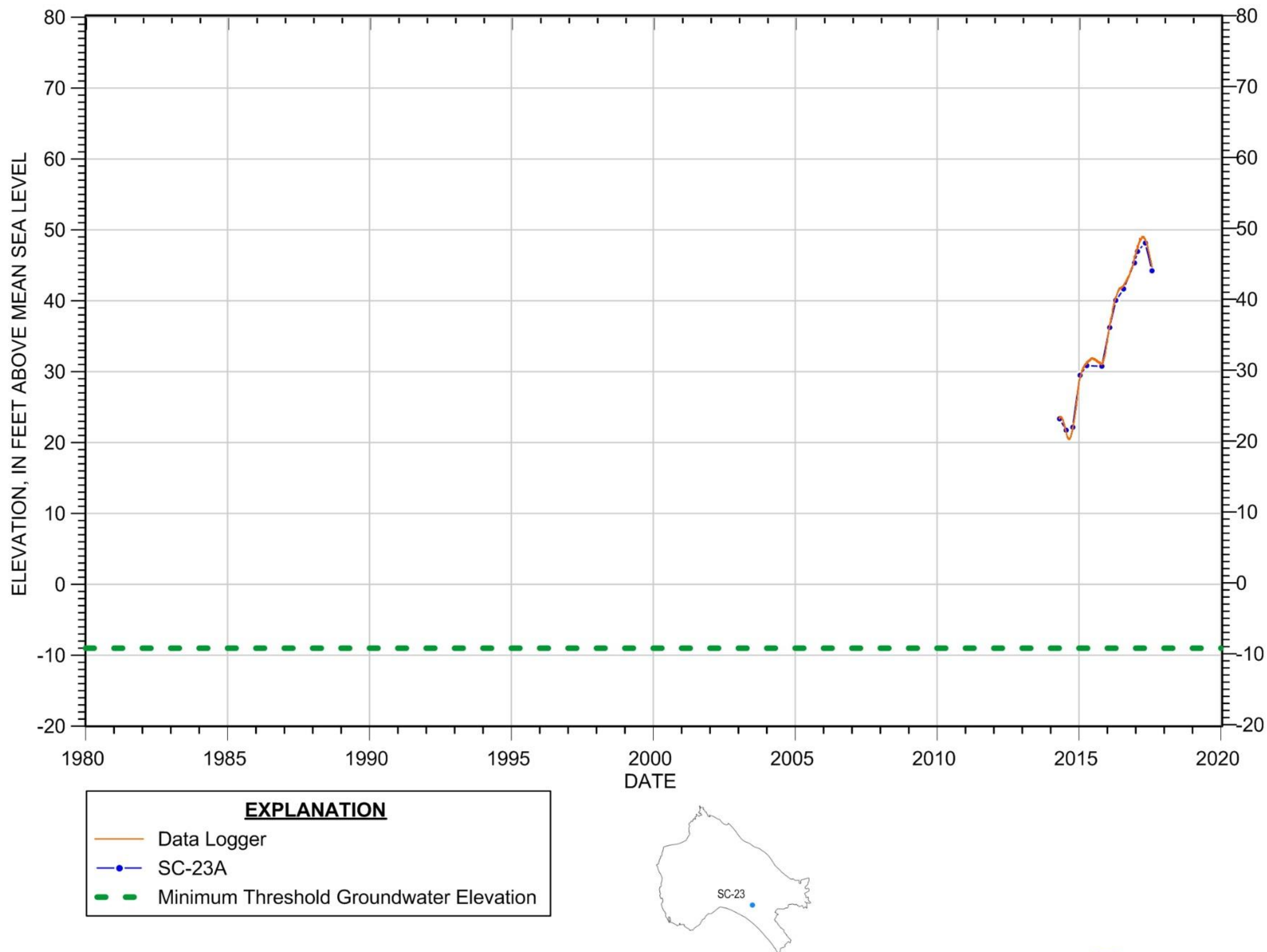

FIGURE 11. SC-23A (Pur BC)

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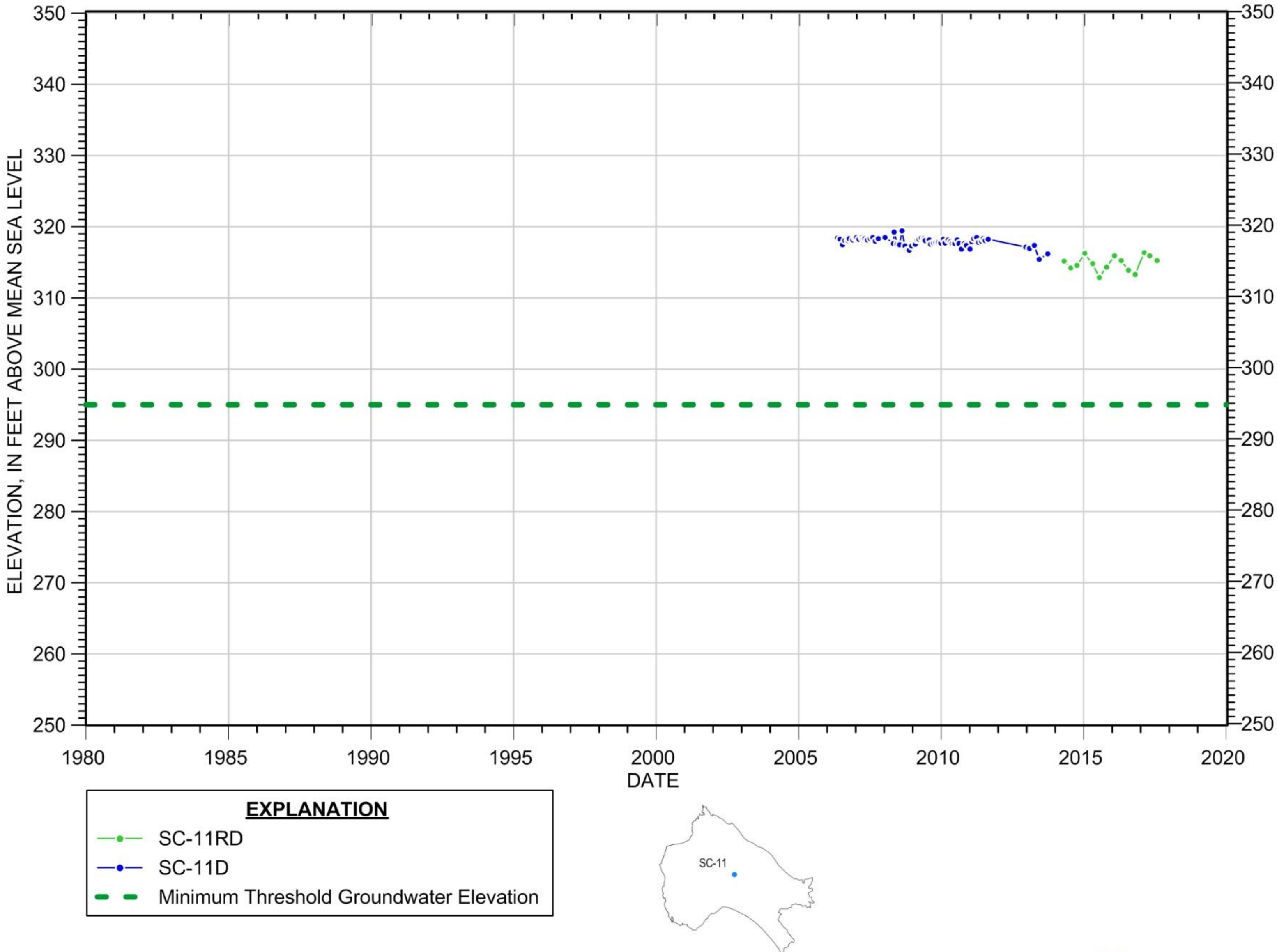

FIGURE 12. SC-11D (Pur DEF)

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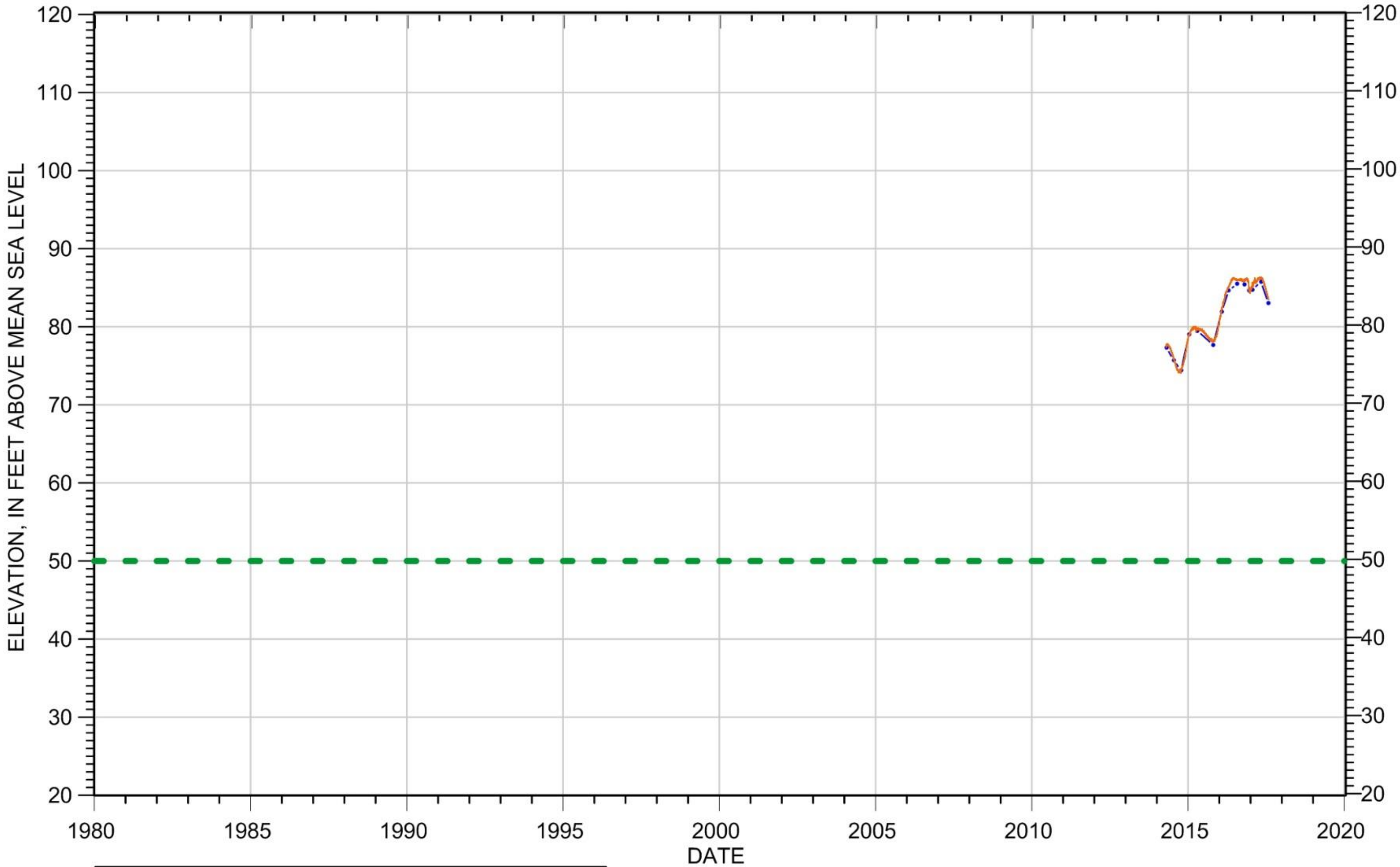

FIGURE 13. SC-23B (Pur DEF)

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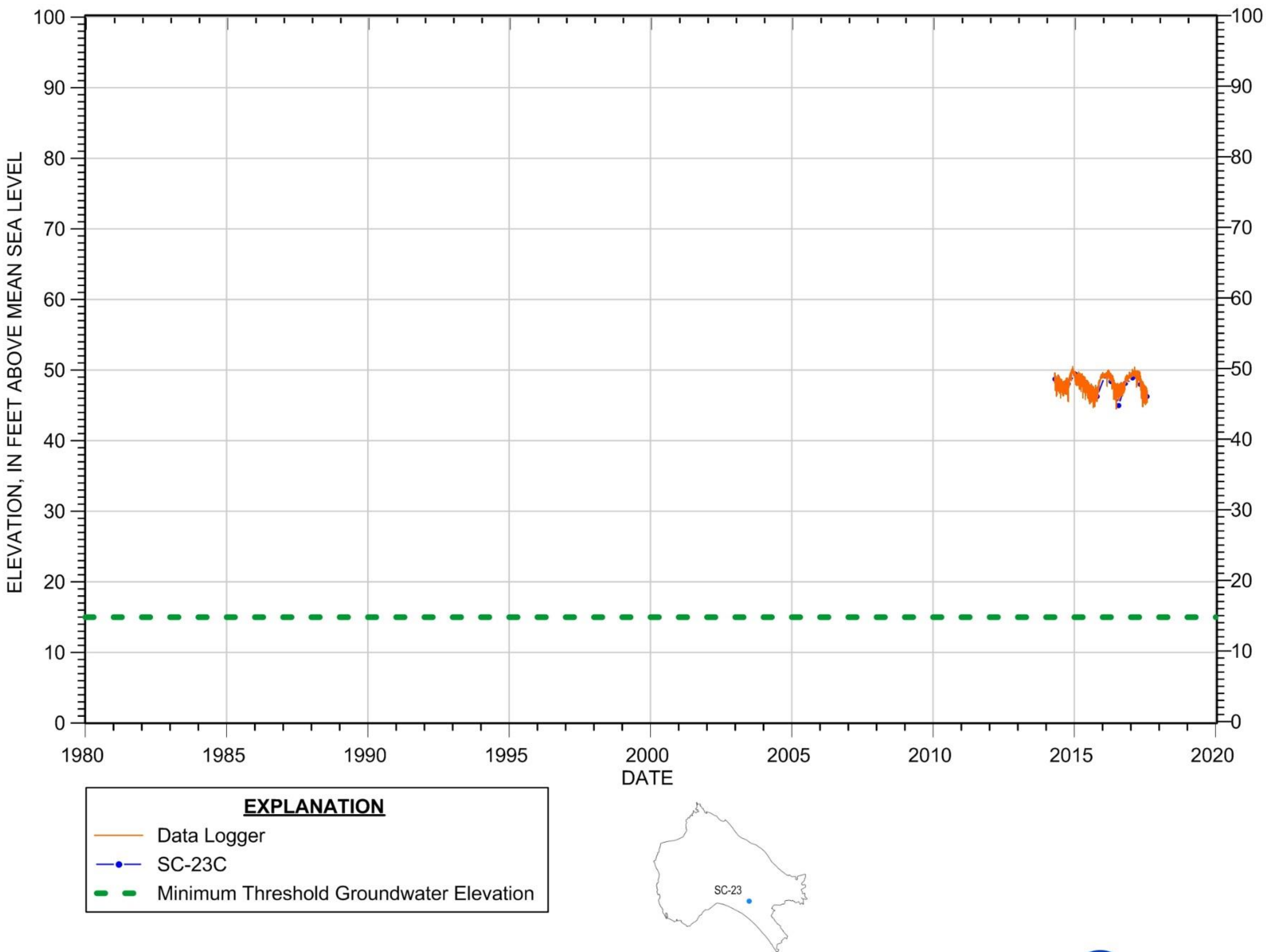

FIGURE 14. SC-23C (Pur F)

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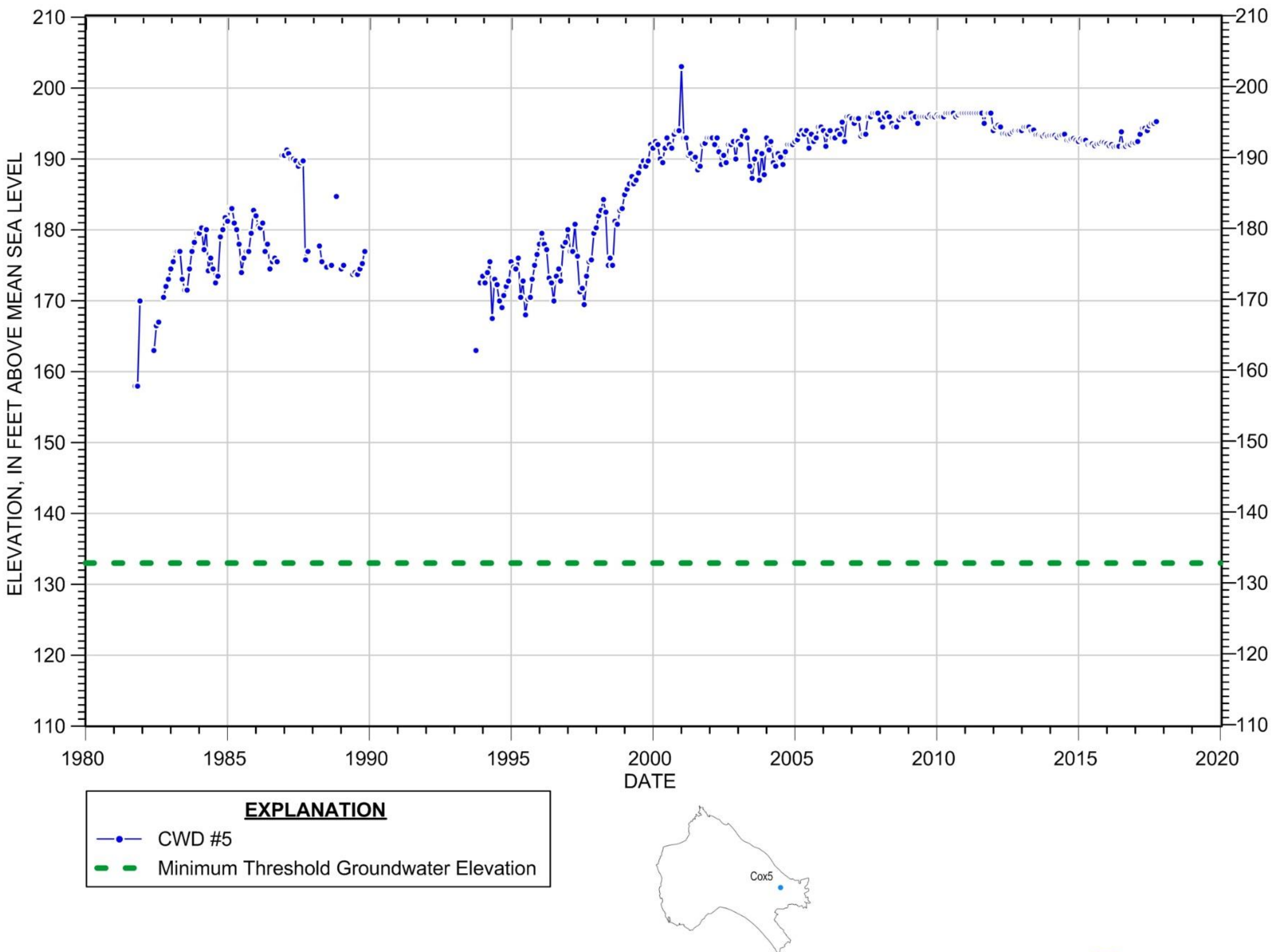

FIGURE 15. CWD #5 (Pur F)

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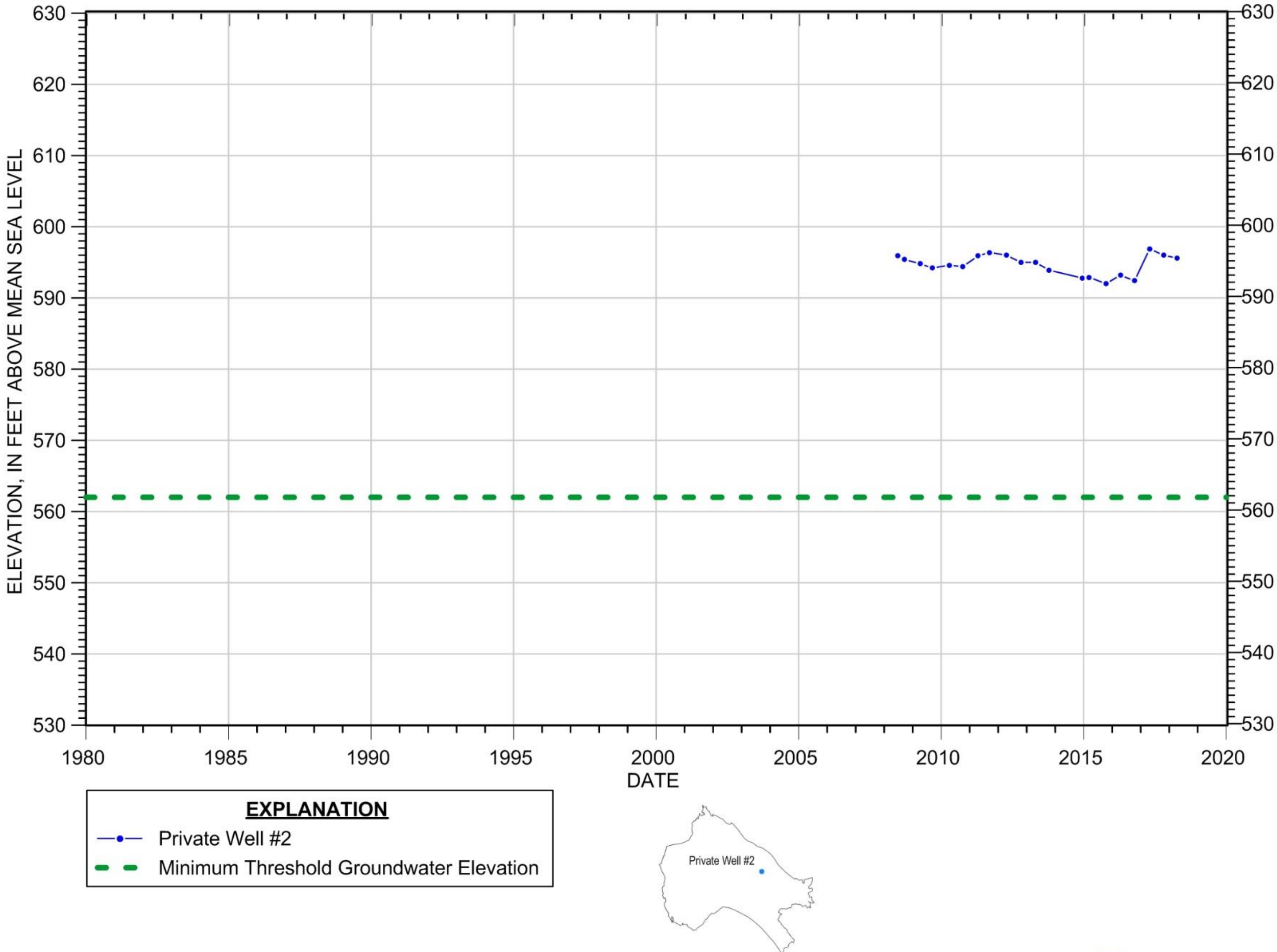

FIGURE 16. Private Well #2 (Pur F)

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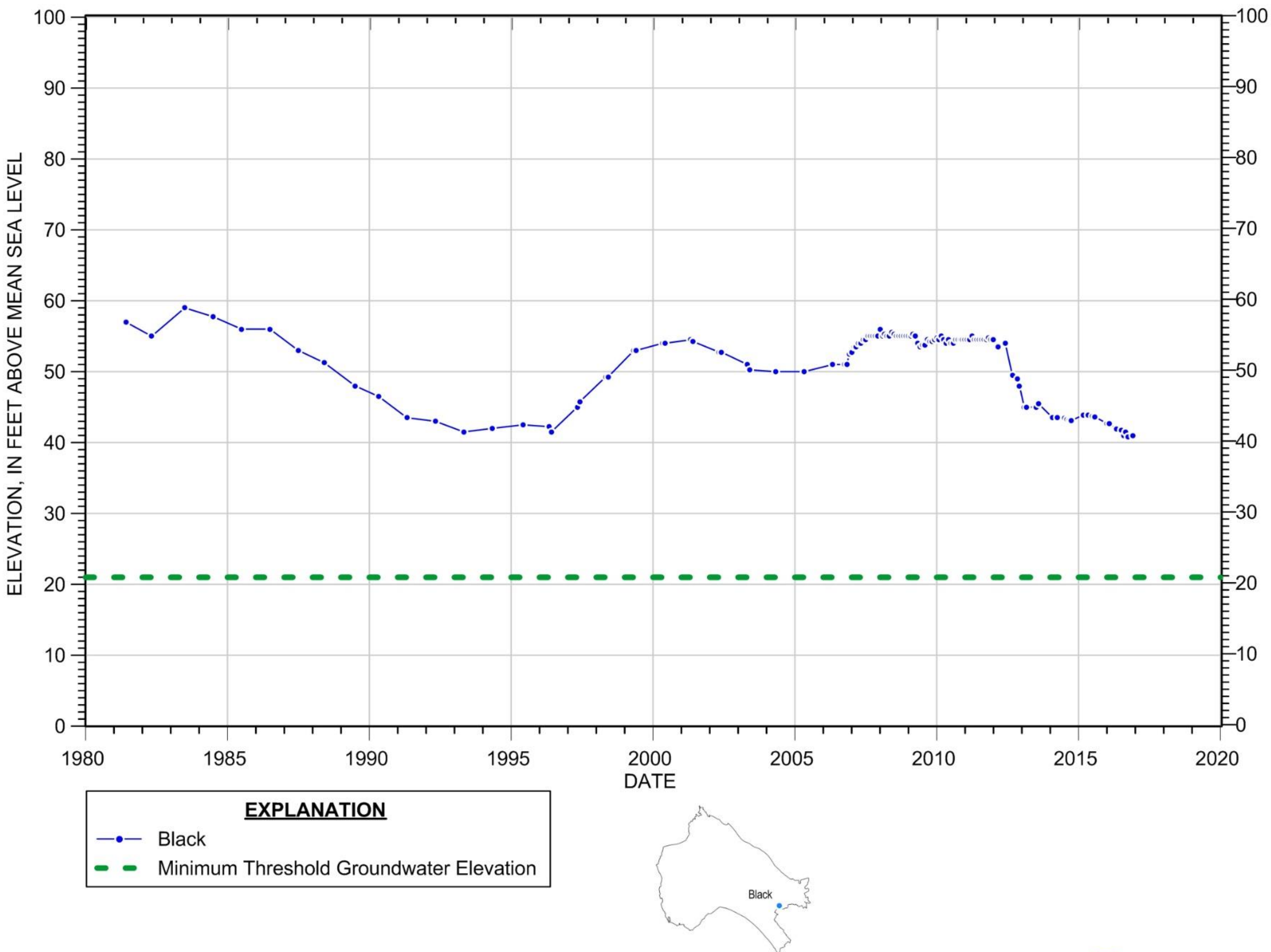

FIGURE 17. Black (Pur F)

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Technical Staff Proposal
Approach for Developing Measurable Objectives for All Sustainability Indicators

This document is organized into the following sections:

1. Background – Description of what Measurable Objectives and Interim Milestones are and how they fit into Sustainable Management Criteria.
2. Technical staff proposal for an approach to develop Measurable Objectives for each Sustainability Indicator.
3. Technical staff proposal for an approach to develop Interim Milestones.

1. Background Information on Measurable Objectives & Interim Milestones

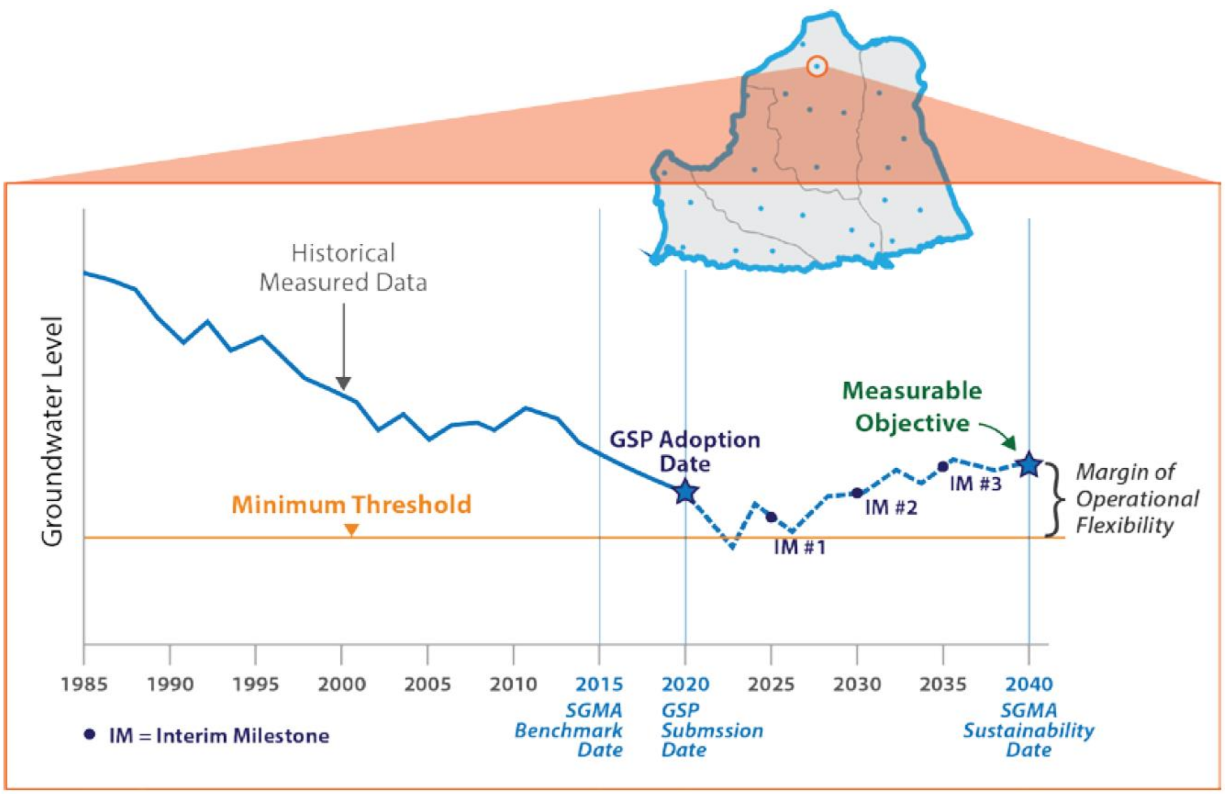


Figure 1. Relationship between Minimum Thresholds, Measurable Objectives, Interim Milestones (IM), and Margin of Operational Flexibility for a Representative Monitoring Well

Measurable Objectives are quantitative goals that reflect the Santa Cruz Mid-County Groundwater Sustainability Agency's (MGA) desired groundwater conditions in the Basin and will guide the MGA to achieve its sustainability goal within 20 years. Measurable Objectives are set for each Sustainability Indicator at the same Representative Monitoring Wells and using the same metrics as Minimum Thresholds.

Measurable Objectives should be set so there is a reasonable margin of operational flexibility (Figure 1) between the Minimum Threshold and Measurable Objective that will accommodate droughts, climate change, conjunctive use operations, or other groundwater management activities. Projects and management actions included in Groundwater Sustainability Plans (GSPs) should be designed to meet the Measurable Objective, with specific descriptions of how those projects and management actions will achieve their desired goals. Measurable Objective are required in the GSP but are not enforceable during implementation of the GSP. The GSP, however, has to demonstrate that there is a planned path toward achieving Measurable Objectives.

Interim Milestones must be defined in five-year increments at each representative monitoring site using the same metrics as the Measurable Objective, as illustrated in Figure 1. Interim milestones will be used by the MGA and the Department of Water Resources (DWR) to track progress toward meeting the Basin's Sustainability Goal. Interim Milestones must be coordinated with projects and management actions proposed by the MGA to achieve the Sustainability Goal. The schedule for implementing projects and management actions will influence how rapidly the Interim Milestones approach the Measurable Objectives.

Measurable Objectives can be set a few different ways. They can be set before impacts from projects and management actions are simulated by modeling. Projects and management actions are then designed to meet those predetermined Measurable Objectives. Or Measurable Objectives can be set based on results of modeling projects and management actions. This will only apply to the Sustainability Indicators that use groundwater level as a direct or proxy metric (i.e. Seawater Intrusion, Chronic Lowering of Groundwater Levels, Reduction in Groundwater in Storage, Depletion of Interconnected Surface Water). Technical staff's recommendation is that Sustainable Management Criteria are set within an iterative process where both Measurable Objectives and/or management actions are adjusted as the effects of potential projects and management actions are better quantified by modeling. The Measurable Objectives that will be developed by the approaches discussed in this proposal are initial Measurable Objectives that will likely be refined as part of the iterative process that takes into account projects and management actions to be implemented as part of the GSP.

2. Approach for Developing Measurable Objectives

Advisory Committee Objective: Provide feedback on whether you feel the approaches proposed below for each Sustainability Indicator will allow for enough operational flexibility and result in beneficial users' desired groundwater conditions in the Basin.

2.1. Seawater Intrusion

As tentatively agreed to by the Santa Cruz Mid-County GSP Advisory Committee, Minimum Thresholds for seawater intrusion are the current protective groundwater elevations set at coastal monitoring wells. Current protective groundwater elevations[1] were developed based on a 30% risk factor. A 30% risk factor means that the protective groundwater elevation at each protective elevation well is the groundwater level that is protective in at least 70% of 100 cross-sectional model simulations for the well.

For development of Measurable Objectives, technical staff proposes that the protective groundwater elevations be raised by ensuring 100% of 100 cross-sectional model simulations for each protective elevation well are protective against seawater intrusion at those wells. Important to note is that the risk factors used above relate only to the protective elevation wells and is not associated with risk for the Basin's entire coastline. Because coastal monitoring wells are not closely spaced along the entire coast, the possibility exists that seawater intrusion may still occur between the coastal monitoring wells.

In addition to protective groundwater elevations as Minimum Thresholds for seawater intrusion, chloride concentrations at coastal monitoring wells used to determine the location of the chloride isocontours (Figure 2) were proposed at an earlier Advisory Committee meeting (Table 1). This means a chloride isocontour representing the Measurable Objective for seawater intrusion needs to be

[1] The cross-sectional modeling to develop protective groundwater elevations could not use specific hydrogeologic properties (properties that influence how groundwater flows) with any certainty because there are insufficient data to calibrate the models to groundwater level or concentration data. Additionally, there are limited data for hydrogeologic parameter values offshore, adding further uncertainty. To develop reliable protective groundwater levels, it was necessary to perform an uncertainty analysis that evaluates the range of reasonable outcomes given the lack of precise hydrogeologic property/parameter data.

Each coastal monitoring well location where protective groundwater elevations were developed included 99 randomized parameters model simulations Parameters varied are horizontal hydraulic conductivities of the production unit and underlying unit, and vertical conductivities of the aquitards above the production unit developed. Table 1 lists the historical maximum, 2013-2017 average, and current concentrations alongside the proposed Minimum Threshold concentrations for each coastal monitoring well. Given the chloride data in Table 1, the isocontour location shown in Figure 2 could be used for the Measurable Objective isocontour but the concentration reduced from 250 mg/L to 100 mg/L, as all historical unintruded coastal monitoring well concentrations are below 100 mg/L.

Table 1. Summary Coastal Monitoring Well Chloride Concentrations in mg/L

Monitoring Well	Historical Maximum Chloride	2013-2017 Average Chloride	Current Chloride	Minimum Threshold Chloride
Intruded				
Moran Lake Med	700	147	78	250
Soquel Point Med	1,300	1,104	1,000	1,200
SC-A8A	8,000	7,258	7,200	8,000
SC-A2RA	18,480	14,259	14,000	16,000
SC-A3A	22,000	17,955	17,000	20,000
Unintruded				
Pleasure Point Med	38	34	35	250
SC-1A	51	41	35	250
SC-3A	66	39	55	250
SC-5A	94	55	51	250
SC-9C	63	28	36	250
SC-8B	32	14	17	250
SC-8D	65	28	21	250

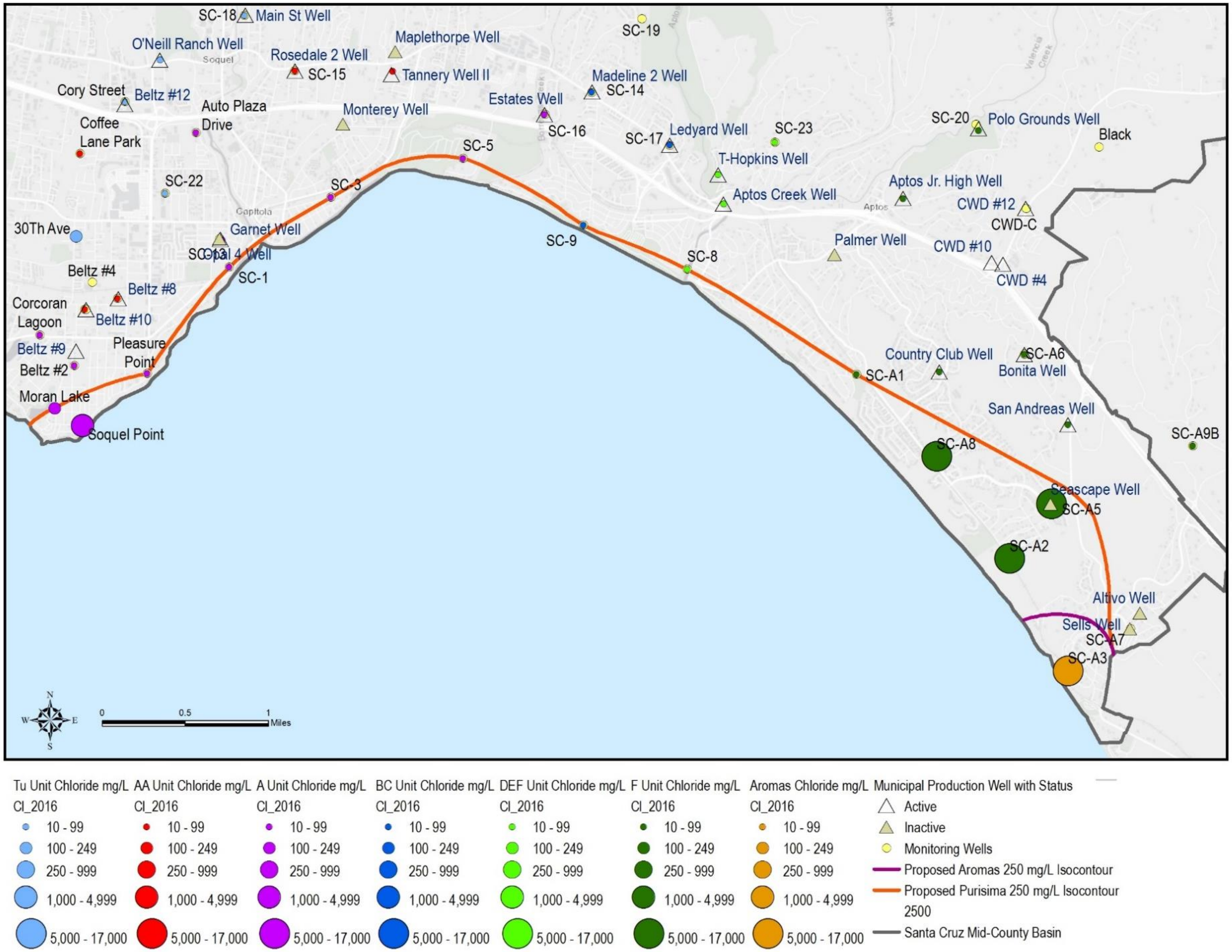


Figure 2: 250 mg/L Chloride Isocontours for the Aromas and Purisima Aquifers

2.2. Chronic Lowering of Groundwater Levels

Although chronic lowering of groundwater levels in the Basin has historically occurred that has lowered groundwater elevations below sea level in much of the area of municipal pumping, over the past 10 years groundwater levels have recovered to early 1980's levels in most areas. In both the Purisima A and AA units (western portion of the Basin) and Purisima BC units (central portion of the Basin) there is one small inland area north of Highway 1 in each aquifer that still has groundwater elevations below sea level. The Aromas area has no groundwater elevations below sea level.

Currently, the Basin is not experiencing any chronic lowering of groundwater levels. Because 4 of 12 coastal monitoring wells have not reached protective elevations, does not imply the Basin currently has chronically lowered groundwater levels. Many of these wells have groundwater levels that have recovered to the point where they are within a foot or two of reaching protective elevations.

The Representative Monitoring Wells that were proposed at the May Advisory Committee meeting are located inland of the area of municipal pumping. No Representative Monitoring Wells were proposed in the area of municipal pumping because the protective elevations set for the coastal wells are higher than what would be established using the overlying demand approach.

Proposed Minimum Thresholds for chronic lowering of groundwater levels are typically between 20 and 30 feet lower than historic low groundwater levels at each Representative Monitoring Well. As there is no chronic lowering of groundwater levels currently occurring within the Basin, this suggests that groundwater users may be satisfied with groundwater levels where they are and that the vast majority can meet their typical water demand at current groundwater levels. If this is the case, technical staff's proposed approach for developing Measurable Objectives would be to select from either:

a. Current groundwater levels,
b. Average groundwater levels over a certain period for each Representative Monitoring Well (e.g., the past five years where levels have recovered), or
c. Groundwater levels at some specific time in the past.

Staff would like Advisory Committee feedback on what they think is a reasonable option for initial Measurable Objectives for this Sustainable Indicator. Figure 3 shows an example hydrograph from one of the Representative Monitoring Wells. September 2018 Advisory Committee meeting materials include hydrographs and proposed hydrographs for all Representative Monitoring Wells. Note that many wells exhibit seasonal fluctuation in groundwater levels, with lower levels in the summer/fall and high level in winter/spring). Technical staff recommends that Measurable Objectives are set as the recent (2013 – 2017) average groundwater elevations, which account for seasonal fluctuations.

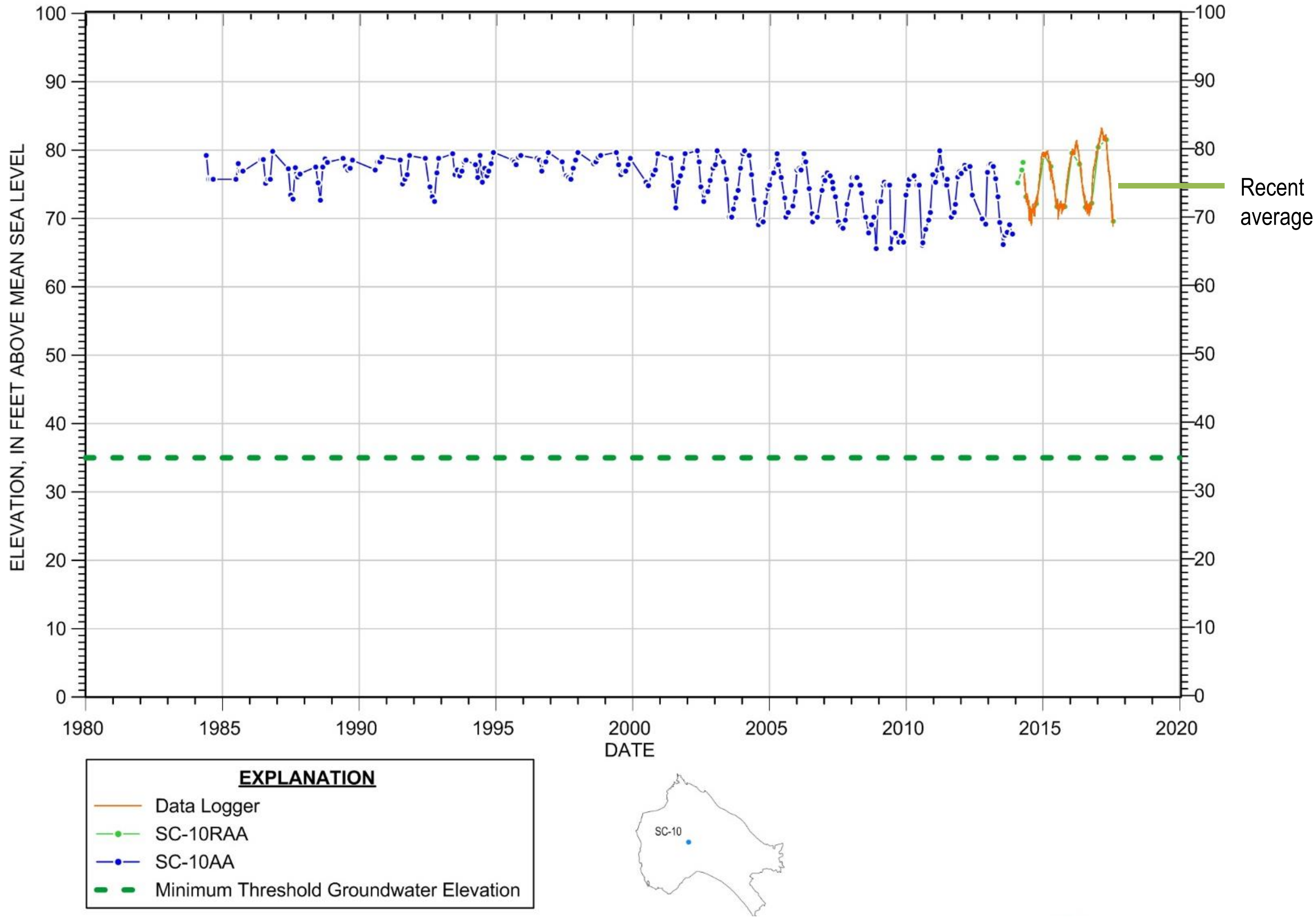


Figure 3. Example of a Representative Monitoring Well Hydrograph with Proposed Minimum Threshold

2.3. Depletion of Interconnected Surface Water

The Minimum Thresholds for this Sustainability Indicator have not been developed yet as the model is being refined to be able to model shallow groundwater levels near creeks more effectively. As discussed at the Streamflow Working Group, groundwater level proxies for streamflow will be used as the metric for depletion of interconnected surface water.

The premise for development of Measurable Objectives for depletion of interconnected surface water should provide for more groundwater flow into relevant creeks, streams, and water bodies than Minimum Thresholds. As groundwater levels will be the proxy for streamflow, an increase in groundwater levels that equates to some increase in streamflow from groundwater could be developed as Measurable Objectives. This needs to be discussed further at the next Streamflow Working Group.

2.4. Reduction of Groundwater in Storage

This Sustainability Indicator has not been considered yet by the Advisory Committee. It is expected that once Minimum Thresholds are set for the Basin's other Sustainability Indicators, the resultant Basin groundwater in storage changes will be a sufficient Minimum Threshold for reduction in groundwater in storage. Changes in groundwater in storage will be estimated using the groundwater model. A groundwater budget from predictive modeling of projects and management actions needed to avoid Undesirable Results will provide the metrics for the reduction of groundwater in storage Minimum Threshold. Note that the metric for a reduction in groundwater in storage is a single volume for the entire basin. An example of a significant and unreasonable condition for the reduction in groundwater in storage is a net long-term reduction in groundwater in storage.

Similarly, once final Measurable Objectives are set for the Basin's other Sustainability Indicators, the resultant Basin groundwater in storage changes will provide the information needed to establish Measurable Objectives for reduction of groundwater in storage.

2.5. Degraded Groundwater Quality

The Basin has good native groundwater quality, with the exception of elevated iron, manganese, arsenic, and chromium VI from naturally occurring sources, and seawater intrusion at certain locations along the coast. Groundwater distributed by municipal agencies meets all drinking water standards. Minimum Thresholds are drinking water standards, with exceptions for naturally elevated concentrations of iron, manganese, arsenic, and total chromium[2]. Measurable Objectives should preserve native groundwater quality equal to or better than drinking water standards.

[2] There is currently no drinking water standard for chromium VI. It is expected that the state will adopt a chromium VI drinking water standard in the near future.

There are no planned projects or management actions that specifically target improvement of groundwater quality in the Basin. However, there are a number of management actions already in place that protect groundwater quality. These include:

- Source water protection programs;
- Regulation of overlying land uses with the potential to release contaminants;
- Sanitary seal requirements for new wells;
- Well abandonment requirements;
- Public education; and
- Enforcing standards and reporting.

Additionally, the County is updating their septic system requirements to meet statewide standards (SWRCB, 2012). In particular, the statewide standards are more stringent on the use of seepage pits, which are the primary method of sewage disposal in the La Selva area where nitrate contamination of the shallow Aromas aquifer occurs. The new requirements will only pertain to new or replacement systems, existing systems that are found to be failing, or when a permit for a remodel is sought. The goals of improved septic system requirements are to continue the use of septic systems, while increasing protection of water quality and public health.

The Advisory Committee has established that new projects and management actions that are implemented as part of the GSP must not allow groundwater quality to fail drinking water standards. Measurable Objectives should reflect the already expressed desire by the Advisory Committee that GSP implemented projects and management actions preserve groundwater quality in the Basin.

Because there are no planned projects or management actions that specifically target improvement of groundwater quality in the Basin, it is important to select Measurable Objectives that are achievable while preserving the Basin's groundwater quality. It is proposed that Measurable Objectives for TDS, chloride, nitrate as N, iron, manganese, arsenic, and chromium VI are based on:

a. Current groundwater quality,
b. Average groundwater quality over period of record, or
c. Quality at some specific time in the past.

Figure 4 provides an example of historic chloride concentrations over time at one of the proposed Representative Monitoring Wells (a production well).

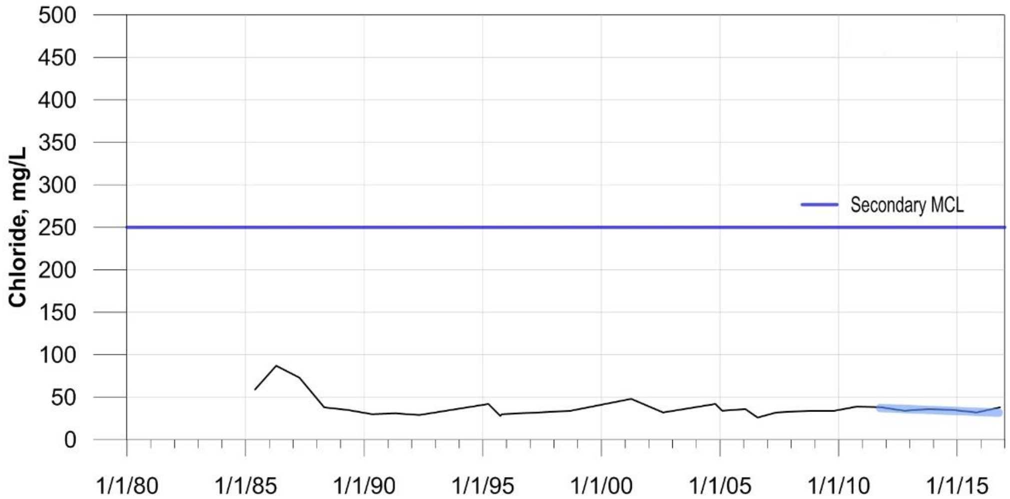


Figure 4. Example Chloride Concentration Chart from a Municipal Production Well

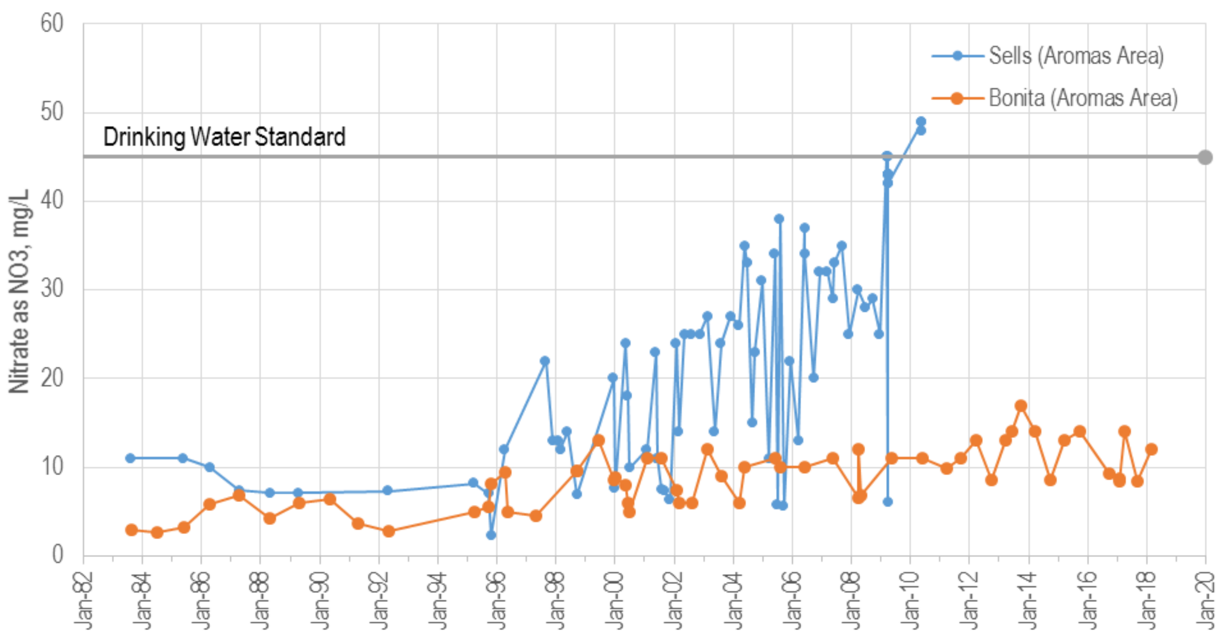


Figure 5. Example of Nitrate Concentrations in Two Municipal Production Wells in the Aromas Area

Technical staff's recommendations:

- Chloride and TDS: these constituents are currently below drinking water standards (except where seawater intrusion occurs). Use the average concentration for current conditions (2013-2017) at each RMW as Measurable Objectives. The recent average concentrations include fluctuations that occur naturally and are proven to be achievable.

- Nitrate as N in the Purisima: Wells in the Purisima aquifers have nitrates well below drinking water standards. Use the average concentration for current conditions (2013-2017) at each RMW as Measurable Objectives (typically non-detect).
- Nitrate as N in the Aromas Area: Wells in the Aromas area have some concentrations above drinking water standards. Use the minimum concentration for current conditions (2013-2017) at each RMW as Measurable Objectives.
- Chromium: Wells rarely have natural concentrations above drinking water standards. Use the minimum concentrations at each RMW as Measurable Objectives.
- Arsenic: Wells in both Purisima and Aromas areas have naturally low concentrations. Use Maximum Contaminant Level Goal of zero as Measurable Objective.
- Iron and manganese in the Purisima: No Minimum Threshold or Measurable Objective can be set because most groundwater is well over secondary drinking water standards, natural concentrations in a well can vary over three orders of magnitude, and can vary significantly between samples.
- Iron and manganese in the Aromas Area: Production wells generally have concentrations below the secondary drinking water standards. Use the average concentration for current conditions (2013-2017) at each RMW as Measurable Objectives

For groundwater quality associated with contamination from human activities, excluding nitrates, we propose that Measurable Objectives be set at the Maximum Contaminant Level Goal (MCLG). The MCLG is the maximum level of a contaminant in drinking water below which there is no known or expected risk to health, and allow for a margin of safety. MCLGs are set by the U.S. Environmental Protection Agency and are non-enforceable public health goals. MCLG's that have been established are provided in Appendix A: EPA's National Primary Drinking Water Regulations, in the last column of the table with the header Public Health Goal. EPA assigns any constituent that causes cancer a MCLG of zero.

Staff would like Advisory Committee feedback on what they think is a reasonable option for initial Measurable Objectives for this Sustainability Indicator.

2.6. Subsidence

No Sustainable Management Criteria will be developed for this Sustainability Indicator because if its inapplicability as an indicator of sustainability in the Santa Cruz Mid-County Groundwater Basin. The primary pieces of evidence supporting the inapplicability of subsidence as a sustainability indicator are: 1) there have been no historical reports of subsidence related to lowered groundwater levels in the basin, 2) basin geology does not include the sediment types associated with aquifer compaction as a result of declining groundwater levels, and 3) the basin's aquifers and aquitards where historic declines in groundwater levels have been documented show no evidence of subsidence.

3. APPROACH FOR DEVELOPING INTERIM MILESTONES

Advisory Committee Objective: Provide feedback on whether you feel the approach proposed for developing Interim Milestones is suitable.

Groundwater model simulations with planned projects and management actions will be used to develop five-year Interim Milestones for Sustainability Indicators that use groundwater level as direct or proxy metrics (i.e., Seawater Intrusion, Chronic Lowering of Groundwater Levels, Reduction in Groundwater in Storage, Depletion of Interconnected Surface Water).

No Interim Milestones can be set for groundwater quality because there is no groundwater transport model to predict groundwater quality as projects and management actions are implemented.

Reference

State Water Resources Control Board, 2012, Water quality control policy for siting, design, operation, and maintenance of onsite wastewater treatment systems. June 19.

Appendix A
EPA's National Primary Drinking Water Regulations

National Primary Drinking Water Regulations

EPA

Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
Acrylamide	TT[4]	Nervous system or blood problems; increased risk of cancer	Added to water during sewage/ wastewater treatment	**zero**
Alachlor	0.002	Eye, liver, kidney, or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops	**zero**
Alpha/photon emitters	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation	**zero**
Antimony	0.006	Increase in blood cholesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder	**0.006**
Arsenic	0.010	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Erosion of natural deposits; runoff from orchards; runoff from glass & electronics production wastes	**0**
Asbestos (fibers >10 micrometers)	7 million fibers per Liter (MFL)	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits	**7 MFL**
Atrazine	0.003	Cardiovascular system or reproductive problems	Runoff from herbicide used on row crops	**0.003**
Barium	2	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits	**2**
Benzene	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills	**zero**
Benzo(a)pyrene (PAHs)	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines	**zero**
Beryllium	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries	**0.004**
Beta photon emitters	4 millirems per year	Increased risk of cancer	Decay of natural and man-made deposits of certain minerals that are radioactive and may emit forms of radiation known as photons and beta radiation	**zero**
Bromate	0.010	Increased risk of cancer	Byproduct of drinking water disinfection	**zero**
Cadmium	0.005	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints	**0.005**
Carbofuran	0.04	Problems with blood, nervous system, or reproductive system	Leaching of soil fumigant used on rice and alfalfa	**0.04**

LEGEND DISINFECTANT | DISINFECTION BYPRODUCT | INORGANIC CHEMICAL | MICROORGANISM | ORGANIC CHEMICAL | RADIONUCLIDES

Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
Carbon tetrachloride	0.005	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities	**zero**
Chloramines (as Cl_2)	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort; anemia	Water additive used to control microbes	**MRDLG=4[1]**
Chlordane	0.002	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide	**zero**
Chlorine (as Cl_2)	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort	Water additive used to control microbes	**MRDLG=4[1]**
Chlorine dioxide (as ClO_2)	MRDL=0.8[1]	Anemia; infants, young children, and fetuses of pregnant women: nervous system effects	Water additive used to control microbes	**MRDLG=0.8[1]**
Chlorite	1.0	Anemia; infants, young children, and fetuses of pregnant women: nervous system effects	Byproduct of drinking water disinfection	**0.8**
Chlorobenzene	0.1	Liver or kidney problems	Discharge from chemical and agricultural chemical factories	**0.1**
Chromium (total)	0.1	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits	**0.1**
Copper	TT[5]; Action Level=1.3	Short-term exposure: Gastrointestinal distress. Long-term exposure: Liver or kidney damage. People with Wilson's Disease should consult their personal doctor if the amount of copper in their water exceeds the action level	Corrosion of household plumbing systems; erosion of natural deposits	**1.3**
Cryptosporidium	TT[7]	Short-term exposure: Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	**zero**
Cyanide (as free cyanide)	0.2	Nerve damage or thyroid problems	Discharge from steel/metal factories; discharge from plastic and fertilizer factories	**0.2**
2,4-D	0.07	Kidney, liver, or adrenal gland problems	Runoff from herbicide used on row crops	**0.07**
Dalapon	0.2	Minor kidney changes	Runoff from herbicide used on rights of way	**0.2**
1,2-Dibromo-3-chloropropane (DBCP)	0.0002	Reproductive difficulties; increased risk of cancer	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards	**zero**
o-Dichlorobenzene	0.6	Liver, kidney, or circulatory system problems	Discharge from industrial chemical factories	**0.6**
p-Dichlorobenzene	0.075	Anemia; liver, kidney, or spleen damage; changes in blood	Discharge from industrial chemical factories	**0.075**
1,2-Dichloroethane	0.005	Increased risk of cancer	Discharge from industrial chemical factories	**zero**

LEGEND

DISINFECTANT

DISINFECTION BYPRODUCT

INORGANIC CHEMICAL

MICROORGANISM

ORGANIC CHEMICAL

RADIONUCLIDES

Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
1,1-Dichloroethylene	0.007	Liver problems	Discharge from industrial chemical factories	**0.007**
cis-1,2-Dichloroethylene	0.07	Liver problems	Discharge from industrial chemical factories	**0.07**
trans-1,2, Dichloroethylene	0.1	Liver problems	Discharge from industrial chemical factories	**0.1**
Dichloromethane	0.005	Liver problems; increased risk of cancer	Discharge from industrial chemical factories	**zero**
1,2-Dichloropropane	0.005	Increased risk of cancer	Discharge from industrial chemical factories	**zero**
Di(2-ethylhexyl) adipate	0.4	Weight loss, liver problems, or possible reproductive difficulties	Discharge from chemical factories	**0.4**
Di(2-ethylhexyl) phthalate	0.006	Reproductive difficulties; liver problems; increased risk of cancer	Discharge from rubber and chemical factories	**zero**
Dinoseb	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables	**0.007**
Dioxin (2,3,7,8-TCDD)	0.00000003	Reproductive difficulties; increased risk of cancer	Emissions from waste incineration and other combustion; discharge from chemical factories	**zero**
Diquat	0.02	Cataracts	Runoff from herbicide use	**0.02**
Endothall	0.1	Stomach and intestinal problems	Runoff from herbicide use	**0.1**
Endrin	0.002	Liver problems	Residue of banned insecticide	**0.002**
Epichlorohydrin	TT[4]	Increased cancer risk; stomach problems	Discharge from industrial chemical factories; an impurity of some water treatment chemicals	**zero**
Ethylbenzene	0.7	Liver or kidney problems	Discharge from petroleum refineries	**0.7**
Ethylene dibromide	0.00005	Problems with liver, stomach, reproductive system, or kidneys; increased risk of cancer	Discharge from petroleum refineries	**zero**
Fecal coliform and *E. coli*	MCL[6]	Fecal coliforms and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes may cause short term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, and people with severely compromised immune systems.	Human and animal fecal waste	**zero[6]**

LEGEND

DISINFECTANT | DISINFECTION BYPRODUCT | INORGANIC CHEMICAL | MICROORGANISM | ORGANIC CHEMICAL | RADIONUCLIDES

Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
Fluoride	4.0	Bone disease (pain and tenderness of the bones); children may get mottled teeth	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories	**4.0**
Giardia lamblia	TT[7]	Short-term exposure: Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	**zero**
Glyphosate	0.7	Kidney problems; reproductive difficulties	Runoff from herbicide use	**0.7**
Haloacetic acids (HAA5)	0.060	Increased risk of cancer	Byproduct of drinking water disinfection	**n/a[9]**
Heptachlor	0.0004	Liver damage; increased risk of cancer	Residue of banned termiticide	**zero**
Heptachlor epoxide	0.0002	Liver damage; increased risk of cancer	Breakdown of heptachlor	**zero**
Heterotrophic plate count (HPC)	TT[7]	HPC has no health effects; it is an analytic method used to measure the variety of bacteria that are common in water. The lower the concentration of bacteria in drinking water, the better maintained the water system is.	HPC measures a range of bacteria that are naturally present in the environment	**n/a**
Hexachlorobenzene	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories	**zero**
Hexachloro-cyclopentadiene	0.05	Kidney or stomach problems	Discharge from chemical factories	**0.05**
Lead	TT[5]; Action Level=0.015	Infants and children: Delays in physical or mental development; children could show slight deficits in attention span and learning abilities; Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits	**zero**
Legionella	TT[7]	Legionnaire's Disease, a type of pneumonia	Found naturally in water; multiplies in heating systems	**zero**
Lindane	0.0002	Liver or kidney problems	Runoff/leaching from insecticide used on cattle, lumber, and gardens	**0.0002**
Mercury (inorganic)	0.002	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and croplands	**0.002**
Methoxychlor	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetables, alfalfa, and livestock	**0.04**
Nitrate (measured as Nitrogen)	10	Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	**10**

LEGEND

DISINFECTANT | DISINFECTION BYPRODUCT | INORGANIC CHEMICAL | MICROORGANISM | ORGANIC CHEMICAL | RADIONUCLIDES

Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
Nitrite (measured as Nitrogen)	1	Infants below the age of six months who drink water containing nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	**1**
Oxamyl (Vydate)	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, and tomatoes	**0.2**
Pentachlorophenol	0.001	Liver or kidney problems; increased cancer risk	Discharge from wood-preserving factories	**zero**
Picloram	0.5	Liver problems	Herbicide runoff	**0.5**
Polychlorinated biphenyls (PCBs)	0.0005	Skin changes; thymus gland problems; immune deficiencies; reproductive or nervous system difficulties; increased risk of cancer	Runoff from landfills; discharge of waste chemicals	**zero**
Radium 226 and Radium 228 (combined)	5 pCi/L	Increased risk of cancer	Erosion of natural deposits	**zero**
Selenium	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems	Discharge from petroleum and metal refineries; erosion of natural deposits; discharge from mines	**0.05**
Simazine	0.004	Problems with blood	Herbicide runoff	**0.004**
Styrene	0.1	Liver, kidney, or circulatory system problems	Discharge from rubber and plastic factories; leaching from landfills	**0.1**
Tetrachloroethylene	0.005	Liver problems; increased risk of cancer	Discharge from factories and dry cleaners	**zero**
Thallium	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems	Leaching from ore-processing sites; discharge from electronics, glass, and drug factories	**0.0005**
Toluene	1	Nervous system, kidney, or liver problems	Discharge from petroleum factories	**1**
Total Coliforms	5.0 percent[8]	Coliforms are bacteria that indicate that other, potentially harmful bacteria may be present. See fecal coliforms and *E. coli*	Naturally present in the environment	**zero**
Total Trihalomethanes (TTHMs)	0.080	Liver, kidney, or central nervous system problems; increased risk of cancer	Byproduct of drinking water disinfection	**n/a[9]**
Toxaphene	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Runoff/leaching from insecticide used on cotton and cattle	**zero**
2,4,5-TP (Silvex)	0.05	Liver problems	Residue of banned herbicide	**0.05**
1,2,4-Trichlorobenzene	0.07	Changes in adrenal glands	Discharge from textile finishing factories	**0.07**

LEGEND DISINFECTANT | DISINFECTION BYPRODUCT | INORGANIC CHEMICAL | MICROORGANISM | ORGANIC CHEMICAL | RADIONUCLIDES

Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
1,1,1-Trichloroethane	0.2	Liver, nervous system, or circulatory problems	Discharge from metal degreasing sites and other factories	**0.2**
1,1,2-Trichloroethane	0.005	Liver, kidney, or immune system problems	Discharge from industrial chemical factories	**0.003**
Trichloroethylene	0.005	Liver problems; increased risk of cancer	Discharge from metal degreasing sites and other factories	**zero**
Turbidity	TT[7]	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (e.g., whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites, and some bacteria. These organisms can cause short term symptoms such as nausea, cramps, diarrhea, and associated headaches.	Soil runoff	**n/a**
Uranium	30μg/L	Increased risk of cancer, kidney toxicity	Erosion of natural deposits	**zero**
Vinyl chloride	0.002	Increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories	**zero**
Viruses (enteric)	TT[7]	Short-term exposure: Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	**zero**
Xylenes (total)	10	Nervous system damage	Discharge from petroleum factories; discharge from chemical factories	**10**

LEGEND

DISINFECTANT | DISINFECTION BYPRODUCT | INORGANIC CHEMICAL | MICROORGANISM | ORGANIC CHEMICAL | RADIONUCLIDES

NOTES

1 Definitions

- **Maximum Contaminant Level Goal (MCLG):** The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.
- **Maximum Contaminant Level (MCL):** The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.
- **Maximum Residual Disinfectant Level Goal (MRDLG):** The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
- **Maximum Residual Disinfectant Level (MRDL):** The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
- **Treatment Technique (TT):** A required process intended to reduce the level of a contaminant in drinking water.

2 Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million (ppm).

3 Health effects are from long-term exposure unless specified as short-term exposure.

4 Each water system must certify annually, in writing, to the state (using third-party or manufacturers certification) that when it uses acrylamide and/or epichlorohydrin to treat water, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows: Acrylamide = 0.05 percent dosed at 1 mg/L (or equivalent); Epichlorohydrin = 0.01 percent dosed at 20 mg/L (or equivalent).

5 Lead and copper are regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10 percent of tap water samples exceed the action level, water systems must take additional steps. For copper, the action level is 1.3 mg/L, and for lead is 0.015 mg/L.

6 A routine sample that is fecal coliform-positive or E. coli-positive triggers repeat samples--if any repeat sample is total coliform-positive, the system has an acute MCL violation. A routine sample that is total coliform-positive and fecal coliform-negative or E. coli-negative triggers repeat samples--if any repeat sample is fecal coliform-positive or E. coli-positive, the system has an acute MCL violation. See also Total Coliforms.

7 EPA's surface water treatment rules require systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water or meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels:

- ***Cryptosporidium*:** 99 percent removal for systems that filter. Unfiltered systems are required to include Cryptosporidium in their existing watershed control provisions.
- **Giardia lamblia:** 99.9 percent removal/inactivation
- **Viruses:** 99.9 percent removal/inactivation
- ***Legionella*:** No limit, but EPA believes that if *Giardia* and viruses are removed/inactivated, according to the treatment techniques in the surface water treatment rule, *Legionella* will also be controlled.
- **Turbidity:** For systems that use conventional or direct filtration, at no time can turbidity (cloudiness of water) go higher than 1 nephelometric turbidity unit (NTU), and samples for turbidity must be less than or equal to 0.3 NTU in at least 95 percent of the samples in any month. Systems that use filtration other than the conventional or direct filtration must follow state limits, which must include turbidity at no time exceeding 5 NTU.
- **HPC:** No more than 500 bacterial colonies per milliliter
- **Long Term 1 Enhanced Surface Water Treatment:** Surface water systems or ground water systems under the direct influence of surface water serving fewer than 10,000 people must comply with the applicable Long Term 1 Enhanced Surface Water Treatment Rule provisions (e.g. turbidity standards, individual filter monitoring, *Cryptosporidium* removal requirements, updated watershed control requirements for unfiltered systems).
- **Long Term 2 Enhanced Surface Water Treatment:** This rule applies to all surface water systems or ground water systems under the direct influence of surface water. The rule targets additional *Cryptosporidium* treatment requirements for higher risk systems and includes provisions to reduce risks from uncovered finished water storages facilities and to ensure that the systems maintain microbial protection as they take steps to reduce the formation of disinfection byproducts. (Monitoring start dates are staggered by system size. The largest systems (serving at least 100,000 people) will begin monitoring in October 2006 and the smallest systems (serving fewer than 10,000 people) will not begin monitoring until October 2008. After completing monitoring and determining their treatment bin, systems generally have three years to comply with any additional treatment requirements.)
- **Filter Backwash Recycling:** The Filter Backwash Recycling Rule requires systems that recycle to return specific recycle flows through all processes of the system's existing conventional or direct filtration system or at an alternate location approved by the state.

8 No more than 5.0 percent samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month.) Every sample that has total coliform must be analyzed for either fecal coliforms or E. coli. If two consecutive TC-positive samples, and one is also positive for E. coli or fecal coliforms, system has an acute MCL violation.

9 Although there is no collective MCLG for this contaminant group, there are individual MCLGs for some of the individual contaminants:

- **Haloacetic acids:** dichloroacetic acid (zero); trichloroacetic acid (0.3 mg/L)
- **Trihalomethanes:** bromodichloromethane (zero); bromoform (zero); dibromochloromethane (0.06 mg/L)

NATIONAL SECONDARY DRINKING WATER REGULATION

National Secondary Drinking Water Regulations are non-enforceable guidelines regarding contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply. However, some states may choose to adopt them as enforceable standards.

Contaminant	Secondary Maximum Contaminant Level
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	Noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

FOR MORE INFORMATION ON EPA'S SAFE DRINKING WATER:

visit: **epa.gov/safewater**

call: **(800) 426-4791**

ADDITIONAL INFORMATION:

To order additional posters or other ground water and drinking water publications, please contact the National Service Center for Environmental Publications at: **(800) 490-9198**, or email: **nscep@bps-lmit.com**.

SANTA CRUZ MID-COUNTY GROUNDWATER AGENCY

Groundwater is a vital resource, together let's protect it.

5180 Soquel Drive • Soquel, CA 95073 • (831) 454-3133 • midcountygroundwater.org

Draft Meeting Summary

Santa Cruz Mid-County Groundwater Sustainability Planning (GSP) Advisory Committee Meeting #10

August 22, 2018, 5:00 – 8:30 pm

This meeting was the tenth convening of the Groundwater Sustainability Planning (GSP) Advisory Committee. It took place on August 22, 2018 from 5:00-8:30 p.m. at the Simpkins Family Swim Center in Santa Cruz. This document summarizes key outcomes from Advisory Committee and staff discussions on the following topics: project updates; initial presentation on the role of groundwater modeling, describing the Santa Cruz Mid-County Basin model; groundwater model predictive simulations and relevant Committee questions and feedback on additional questions the model needs to address; and Committee review of draft Sustainable Management Criteria proposals for Subsidence and Groundwater Quality. It also provides an overview of public comment received. It is not intended to serve as a detailed transcript of the meeting.

Meeting Objectives

The primary objectives for the meeting were to:

- Build Advisory Committee familiarity with and understanding of:
  - the role of groundwater modeling in the GSP;
  - the use of groundwater models to explain complex local hydrogeology;
  - model data input, assumptions, and calibration;
  - assumptions used in predictive modeling;
  - predictive model scenarios developed to date and what is still to be modeled; and
  - the types of model results and how they will be used to evaluate Sustainable Management Criteria.
- Provide Advisory Committee input on questions to address through the groundwater model.

Action Items

Key action items from the meeting include the following:

- Ms. Darcy Pruitt to re-distribute the draft Seawater Intrusion management criteria proposal to the Committee members for their review.

- Regional Water Management Foundation (RWMF) to post the draft model data calibration report on the Mid-County Groundwater Agency (MGA) website once submitted to the MGA Board.
- Committee members to propose additional scenarios/questions to be incorporated into the groundwater modeling, and share with Ms. Pruitt.
- Committee members to review the Seawater Intrusion management criteria proposal by the end of August.
- Committee members to review the Subsidence and Groundwater Quality management criteria proposals by the September 26 Committee meeting.
  - Committee members to consider role of the MGA Board in addressing Groundwater Quality regulations and oversight already provided by state agencies).
- Kearns & West (K&W) to make edits to the June 27 and July 19 meeting summaries as directed by the Committee and forward to RWMF/MGA.
- Executive Team to forward June and July meeting summaries to the MGA Board for consideration.
- K&W to prepare meeting summary for August 22 Advisory Committee meeting.
- Ms. Georgina King to provide Committee members with a spreadsheet containing the underlying data representing the cumulative change in groundwater in storage for the entire Basin.
  - Also, provide members with a simplified version of data.

<u>Meeting attendance</u>

Committee members in attendance included:

1. Kate Anderton, Environmental Representative
2. John Bargetto, Agricultural Representative
3. David Baskin, City of Santa Cruz
4. Rich Casale, Small Water System Management
5. Keith Gudger, At-Large Representative
6. Dana Katofsky McCarthy, Water Utility Rate Payer
7. Jonathan Lear, At-Large Representative
8. Charlie Rous, At-Large Representative
9. Allyson Violante, County of Santa Cruz
10. Thomas Wyner for Cabrillo College, Institutional Representative

Committee members who were absent included:

1. Bruce Jaffe, Soquel Creek Water District
2. Jon Kennedy, Private Well Representative
3. Douglas P. Ley, Business Representative
4. Marco Romanini, Central Water District

Meeting Key Outcomes (linked to agenda items)

1. Introduction and Discussion of GSP Process Timeline and Project Updates

Ralph Bracamonte, Central Water District, opened the meeting and welcomed participants. Mr. Bracamonte asked the GSP Advisory Committee members, Santa Cruz Mid-County Groundwater Agency (MGA) Executive Team, and the consultant support team around the room to introduce themselves. He also addressed members of the public in attendance and asked them for self-introductions.

Eric Poncelet, Facilitator, reviewed the agenda, meeting objectives, and the updated GSP process timeline, and asked staff to provide the following project updates:

- **Advisory Committee Field Trip**
  Darcy Pruitt, RWMF, gave a brief update on the field trip and requested that the Committee members hold open both October 23rd and 24th from 9:00 AM to 1:00 PM. Ms. Pruitt indicated that she will confirm the date and details with the Committee in short order.

- **December 2018 Advisory Committee Meeting**
  Ms. Pruitt confirmed that the December 2018 Advisory Committee Meeting has been rescheduled from its original date, December 26, 2018 to December 12, 2018, due to the holiday schedule.

2. Oral Communications (for items *not* on the agenda)

Members of the public provided comments on non-agenda items during this session.

One speaker asked whether the field trip is open to the public. The same speaker also requested that Advisory Committee members review the written communication she submitted in advance of the meeting, encouraging the Committee members to invite Dr. Andrew Fisher to a future meeting to speak on the topic of groundwater recharge. Further, the speaker encouraged Committee members to use a water transfer model that limits restrictions on stream diversions, that reduces groundwater pumping, and transfers water from outside of the Basin. Finally, the speaker reminded the Committee and other members of the public that the public comment period for Pure Water Soquel ended on August 13 and that an extension was requested, but denied.

3. Role of Groundwater Modeling and Description of the Mid-County Model

Georgina King, Montgomery & Associates, presented on: the role of groundwater modeling in Basin management as well as for the groundwater sustainability plan (GSP), how it works in calculating water budgets and predicting change in storage, and using model data inputs and outputs and calibrations as predictors. Ms. King emphasized that modeling is a critical tool for making better management decisions for the Basin, which can be complex and constantly changing.

Following Ms. King's presentation, Committee members and staff discussed clarifying questions on the following topics:

- Participants discussed the role of return flow from irrigation in modeling groundwater levels, considering the many other variables. The key takeaway from this discussion is that return flow from irrigation does not result in a total loss of water.
- Participants discussed whether horizontal and vertical hydraulic conductivity figures are informed by geology and whether the model modifications due to the geology in various locations turned up any unexpected results other than the fault leakage that Ms. King discussed in her presentation.
- The surface water flow component is complex, and staff is working on how best to characterize and understand stream/groundwater interactions better.
- What is the margin of error for the model and the risks involved in using models to develop management decisions in groundwater sustainability planning? Staff noted that there is a section in the Department of Water Resources' (DWR) GSP guidelines dedicated to the issue of uncertainty. The final GSP can address risk by explaining the application of an iterative process to adaptively address likely scenarios in a range of management actions, and by doing all this with the consideration of best available information at a given point in time.
- Isotope studies may help identify sources of water and linkages between injections and extractions with flows, and the model can be adapted to reflect these linkages.
- The groundwater flow model is a predictive model and therefore does not model pumping in other areas (e.g., Pajaro Valley). However, the model does extend into the Pajaro Valley and thus can take some factors into account. Staff noted that Pajaro Valley is an area that needs to be addressed in collaboration with Pajaro Valley Water Management Agency (PV Water); there is regular communication amongst the MGA member agency managers and PV Water.
- Committee members asked staff about their level of confidence in the model. Staff members responded that, given the level of expertise of the staff members and Technical Advisory Team members working on the model and its use of modeling standards, they have a relatively high level of confidence with the groundwater flow model.

Members of the public had the opportunity at the end of this session to ask questions regarding the role of the groundwater model. Their questions and staff responses are summarized below:

- A member of the public asked whether the groundwater model is available on the MGA website.

    - Ms. King explained that the model is still under MGA review and is not yet available to the public.
- Another member of the public asked how the groundwater model represents lower levels of the aquifer and whether it can show sea level interactions. Further, the participant asked whether SkyTem data is being used in the model.
    - Ms. King indicated that groundwater flows only go (one way) out to the sea, and those areas that have been intruded by seawater will be represented by denser seawater indicators. Ms. King explained that although inflow data tie in well with SkyTem data, the model uses only well data for calibration at this point.
- A member of the public asked whether the groundwater flow model and calibration methods are acceptable with DWR and whether DWR has suggested specific types of model or information to use. Further, the participant asked whether DWR is looking at other GSP development processes for other examples of models being used.
    - Ms. King said that DWR will only review the model report that will be included as a section in the GSP and that the modeling software is industry standard and is universally accepted. Ms. King noted that in some cases, DWR is providing the model to use.
    - Ron Duncan, Soquel Creek Water District, emphasized that the groundwater flow model is a premier model developed by USGS and is used internationally.
    - Ben Gooding, DWR, indicated that DWR will be conducted its review upon submittal of the GSP, at that time it, could request supporting documentation and data in the course of DWR's review of the GSP.
    - Rosemary Menard, City of Santa Cruz, confirmed that those working on the models are very actively engaged with DWR throughout the GSP process, and this working relationship is the conduit through which DWR receives modeling-related information.
    - In 2016, DWR issued Best Management Practice (BMP) guidance document on the use and development of groundwater and surface water models and MGA's approach is in line with the BMPs.
- A participant asked for the frequency at which the model is updated and whether there is a percentage level for the uncertainty factor.
    - Ms. King indicated that DWR requires that the model be updated every five (5) years and that decision on the frequency of future updates lies with the MGA. With respect to the percentage level of uncertainty of the model, Ms. King explained that it is within industry standard; this is also explained in the calibration report. This draft report is currently being vetted with the technical advisory committee and will be available on the MGA website in the next couple of months.

4. Public Comment

During this segment, Mr. Poncelet invited members of the public to comment on the Committee's discussions on the role of groundwater modeling and the Mid-County groundwater model, and any other Advisory Committee work.

One participant requested that the PowerPoint slides be numbered for reference ease. Staff noted this request.

5. Groundwater Model Predictive Simulations

In this segment of the meeting, Ms. King presented on the assumptions used in groundwater model predictive simulations--including assumptions on climate change, sea level rise, groundwater demand, and projects and management actions--and the types of results from such predictive simulations--including water budget, groundwater levels, and groundwater travel time. Throughout her presentation, Ms. King described key items currently planned for analysis, including:

1. Existing conditions to model baseline conditions (current demand and climate change scenarios from Urban Water Management Plans) as a starting point for comparisons.
2. Reduction of municipal pumping to evaluate impacts on basin-wide groundwater levels.
3. Basin replenishment through injection with a 20-year project horizon (Soquel Creek Water District's Pure Water Soquel, Groundwater Replenishment and Seawater Intrusion Prevention Project) currently in the Environmental Impact Report (EIR) review phase.
4. Aquifer Storage and Recovery feasibility (City of Santa Cruz project feasibility).
5. Changes in non-municipal pumping and return flow assumptions to test for basin impacts (to understand influence of private pumping on groundwater levels and streamflow).
6. Modification of municipal pumping to understand influence on streamflow.

Following her presentation, Ms. King addressed Committee member clarifying questions and provided them with the opportunity to give input on additional questions they would like addressed by the model. Below are key additional questions that the Committee members shared during this discussion:

- Population impacts on future basin water use (demand forecasting and basin recovery).
- In-lieu recharge sensitivity analysis (location and timing of decreased pumping) for basin recovery (related to items 2, 3, 4 & 6 above).
- Injection analysis (location and timing) for basin recovery (related to items 3 & 4 above).
- Sea level rise impacts on basin recovery.

Additionally, a few Committee members requested that staff provide them with a spreadsheet containing the underlying data representing the cumulative change in groundwater in storage for the entire Basin, as well as a simplified version containing only the sums of the data.

6. Public Comment

During this last public comment session, Mr. Poncelet invited members of the public to focus comments on the Committee's recent discussions on the groundwater model or on any other Advisory Committee work.

A participant asked for more details on the City of Santa Cruz Aquifer Storage and Recovery project and whether the project considers modeling at various pumping levels. Further, the participant asked what pumping level would be needed for the Basin to replenish its own water supply.

- Ms. Menard responded that the City is currently projecting pumping at a level of 160 million gallons, and up to 210 million gallons in a drought period, and is not contemplating expanding on these numbers. Ms. Menard noted that the pilot test injection in the Beltz 12 area would provide a better sense of losses and operational needs.

7. Confirm Various Project Documents

- **June 27, 2018 Advisory Committee Meeting Summary**

  The Advisory Committee did not have any edits or comments on the draft June 27, 2018 Advisory Committee meeting summary. Mr. Poncelet confirmed it for submission to the MGA Board.

- **July 19, 2018 Advisory Committee Meeting Summary**
  The Committee members requested that the MGA Board participants be listed on this summary and noted a small edit to a presenter's name. Mr. Poncelet confirmed that this summary will be submitted to the MGA Board once these edits have been incorporated.

- **Draft Sustainable Management Criteria Proposals for Subsidence and Groundwater Quality**

  Staff distributed draft sustainable management criteria proposals for both Subsidence and Groundwater Quality and invited Committee members to review them and provide feedback to Ms. Pruitt by the September 26th Advisory Committee meeting. Staff also requested that the Committee review the Seawater Intrusion Minimum Threshold proposal (distributed at the May 23, 2018 meeting) by the end of August. Ms. Pruitt will resend the Seawater Intrusion Minimum Threshold proposal to the Committee.

Ms. King also asked the Committee to consider the role of the MGA Board related to Water Quality regulations, which are already established and implemented by the State and Regional Water Quality Control Boards. She explained that this topic is relevant now as the MGA is in the beginning stages of discussing its authority related to water quality regulations under the Sustainable Groundwater Management Act (SGMA).

8. Next Steps

In closing, Mr. Poncelet provided an overview of the GSP process timeline from September through December 2018. Executive Team members closed the meeting by thanking the attendees for their participation.

AGENDA ITEM: 2

Written Communication and Submitted Materials

WATER FOR SANTA CRUZ
COUNTY

Ms. Rosemary Menard
Santa Cruz Water Department Director
Santa Cruz, CA 95060
Via email

August 22, 2018

Re: Sustainable water supply for North Santa Cruz county

Dear Rosemary,

Water for Santa Cruz continues to work on the details of transferring water to SqCWD customers from North Coast streams that are used by Santa Cruz under pre-1914 water rights. This letter describes an average rainfall year, 2016, and investigates the water that could be harvested over a 15 year period of time, assuming in our model this average year is repeated 15 times. 2016 has been chosen because it was an average rainfall year, 30 inches, even though the N. Coast water taken during the year was only 537 Million gallons, which is less than the 671 million gallon average predicted by Santa Cruz's 2015 Urban Water Management plan update.

In this study WFSCC considered the monthly water that could have been sent to SqCWD, determining that amount by taking the least of:

1. N. Coast monthly pumping (2016)
2. SqCWD demand (2017) for that month
3. Intertie capacity (1.4 mgd x days per month).

The monthly totals were then used to total an amount of water that could have been sent to SqCWD from N. Coast sources over the entire year.

Base table, month by month analysis of water available and usable from N. Coast streams to serve customer demand in SqCWD

	Month			All Units are in millions of gallons									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr. Totals
SqCWD demand, 2017	73	61	70	73	97	107	116	110	107	103	76	74	1,067
N. Coast streams, 2016	33	61	67	59	47	60	51	50	38	22	21	28	537
1.4mgd max.	43	39	43	40	43	42	43	43	42	43	42	43	506
Lesser of SC supply vs. SCWD demand, or 1.4mgd	33	39	43	40	43	42	43	43	38	22	21	28	435
			Jan - May		198		If spend 18 million			Jan - May		198	
			70% June - Dec		166		to increase intertie			70% June - Dec		189	
			Annual total		364					Annual total		387	

5 different options of Water supply for the next 15 years were tracked and tallied. The 5 options are:

1. Water transfer pilot project ….100 million gallons per year
2. Water transfers increased to the maximum 1.4 million gallons per day Jan. – May.
3. Water transfers Jan – May, plus 70% of summer N. Coast water
4. Pure Water Soquel, 500 million gallons per year, beginning 2024
5. Year round water transfers from N. coast PLUS 500 million gallons from San Lorenzo river

The 15 year cumulative water totals for each option that could be transferred to SqCWD to allow the wells there to rest and the aquifer to recover would then be as follows:

- -Option 1. 1.6 billion gallons
- -Option 2. 3.17 billion gallons
- -Option 3. 5.49 billion gallons
- -Option 4. 5.00 billion gallons
- -Option 5. 10.6 billion gallons

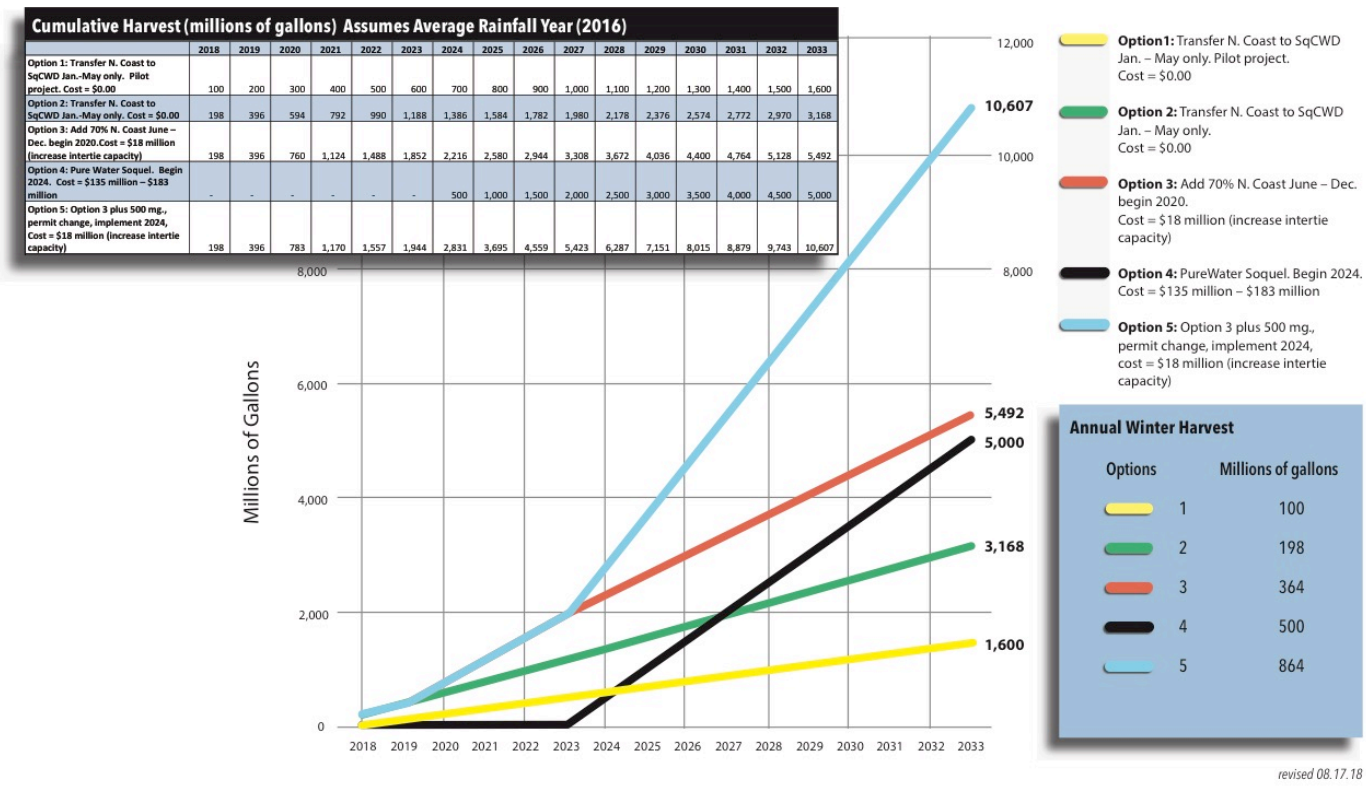
Here is the table and graphic that illustrate the 15 year cumulative effect, out to 2033 .

WATER FOR SANTA CRUZ COUNTY

Santa Cruz 15-Year Water Supply Options

Cumulative Harvest (millions of gallons) Assumes Average Rainfall Year (2016)

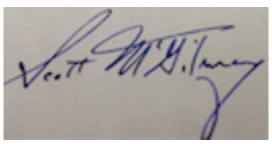
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Option 1: Transfer N. Coast to SqCWD Jan.-May only. Pilot project. Cost = $0.00	100	200	300	400	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500	1,600
Option 2: Transfer N. Coast to SqCWD Jan.-May only. Cost = $0.00	198	396	594	792	990	1,188	1,386	1,584	1,782	1,980	2,178	2,376	2,574	2,772	2,970	3,168
Option 3: Add 70% N. Coast June – Dec. begin 2020.Cost = $18 million (increase intertie capacity)	198	396	760	1,124	1,488	1,852	2,216	2,580	2,944	3,308	3,672	4,036	4,400	4,764	5,128	5,492
Option 4: Pure Water Soquel. Begin 2024. Cost = $135 million – $183 million	-	-	-	-	-	-	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000	4,500	5,000
Option 5: Option 3 plus 500 mg., permit change, implement 2024, Cost = $18 million (increase intertie capacity)	198	396	783	1,170	1,557	1,944	2,831	3,695	4,559	5,423	6,287	7,151	8,015	8,879	9,743	10,607



John Aird and I would very much appreciate the opportunity to meet with you again to review the assumptions made and results obtained in this modeling to make sure that we're not missing something crucial in this analysis and that its findings seem reasonable and legitimate based on the information used.

Please let us know when it might be possible for us to squeeze onto your schedule to go over this with you in the very near future as we think this information could be very valuable for the deliberations underway in the ongoing process of developing water supply solutions for the region.

Sincerely yours,



Scott McGilvray
For Water for Santa Cruz.

Cc: John Ricker
John Aird
Linda Wilshusen SC Water commission chair
Doug Engfer, SC Water commission vice-chair

WATER FOR SANTA CRUZ COUNTY

Santa Cruz 15-Year Water Supply Options

Cumulative Harvest (millions of gallons) Assumes Average Rainfall Year (2016)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Option 1: Option 3 plus 500 mg., permit change, implement 2024, Cost = $18 million (increase intertie capacity)	198	396	783	1,170	1,557	1,944	2,831	3,695	4,559	5,423	6,287	7,151	8,015	8,879	9,743	10,607
Option 2: Pure Water Soquel. Begin 2024. Cost = $135 million – $183 million	-	-	-	-	-	-	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000	4,500	5,000
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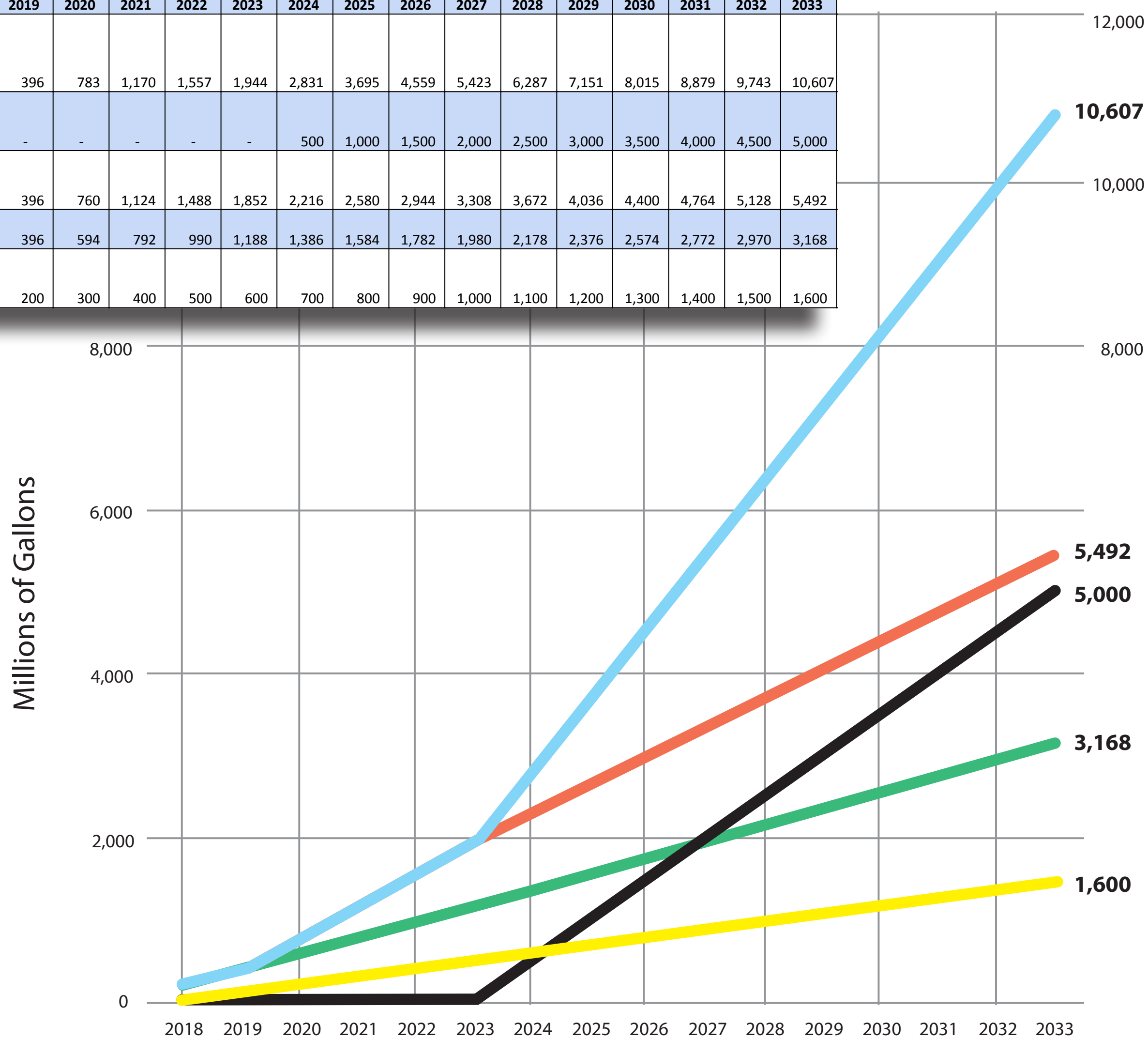
Option 4: Transfer N. Coast to SqCWD Jan.-May only. Cost = $0.00	198	396	594	792	990	1,188	1,386	1,584	1,782	1,980	2,178	2,376	2,574	2,772	2,970	3,168
Option 5: Transfer N. Coast to SqCWD Jan.-May only. Pilot project. Cost = $0.00	100	200	300	400	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500	1,600



Option 1: Option 3 plus 500 mg., permit change, implement 2024, Cost = $18 million (increase intertie capacity)

Option 2: PureWater Soquel. Begin 2024. Cost = $135 million – $183 million

Option 3: Add 70% N. Coast June – Dec. begin 2020. Cost = $18 million (increase intertie capacity)

Option 4: Transfer N. Coast to SqCWD Jan. – May only. Cost = $0.00

Option 5: Transfer N. Coast to SqCWD Jan. – May only. Pilot project. Cost = $0.00

Annual Winter Harvest

Options	Millions of gallons
1	864
2	500
3	364
4	198
5	100

revised 08.27.18a