MONTGOMERY
& ASSOCIATES
Water Resource Consultants

Groundwater experts since 1984

DRAFT TECHNICAL MEMORANDUM

DATE: March 9, 2021 **PROJECT #:** 9090.0901

TO: Ad Hoc Sustainable Groundwater Planning Advisory Committee (GSU22 Committee)

CC: Brian Lockwood, P.G., C.Hg. and Casey Meusel
Pajaro Valley Water Management Agency

FROM: Cameron Tana, P.E., Luis Mendez, and Georgina King P.G., C.Hg.

PROJECT: Basin Management Plan: Groundwater Sustainability Update 2022 (GSU22)

SUBJECT: Proposed Sustainable Management Criteria for Seawater Intrusion

BACKGROUND

The Pajaro Valley Water Management Agency (PV Water) submitted a Groundwater Sustainability Plan (GSP) Alternative for the Pajaro Valley Subbasin (Basin) on December 31, 2016, per the Sustainable Groundwater Management Act (SGMA). The California Department of Water Resources (DWR) assessed the Alternative and approved PV Water's GSP-Alternative. DWR's assessment staff report (2019) recommended PV Water develop sustainable management criteria for seawater intrusion as follows:

- Recommended Action 6: [DWR] Staff recommend that the Agency should define a specific location of an isoconcentration contour or some other equivalent method that can be used on an ongoing basis to assess progress toward eliminating undesirable results associated with seawater intrusion to assess the goal of eliminating seawater intrusion through implementation of projects and management actions as described in the Plan.
- Recommended Action 7: [DWR] Staff recommend that the Alternative should be updated to set objective criteria consistent with achieving the stated goal that a 100 percent reduction in annual seawater intrusion rate is the operational goal for the Basin or to ~~provide~~ quantify [sic] the extent to which additional seawater intrusion would not be significant and unreasonable *(correction to assumed typo added)*.

In response to DWR's recommendations, this technical memorandum proposes specific seawater intrusion sustainable management criteria (SMC) for inclusion in the Basin Management Plan: Groundwater Sustainability Update 2022 (GSU22). The GSU22 will be submitted as the five-year update for the GSP-Alternative to DWR by January 1, 2022. The GSU22 submittal will then be considered an amendment to PV Water's Basin Management Plan Update (2014).

In order to address DWR's recommendations, the GSU22 Committee has provided feedback on the following questions to inform development of statements of significant and unreasonable conditions for beneficial uses sensitive to seawater intrusion and provide the basis of the GSU22's seawater intrusion SMCs:

- **Question 1: How should we define whether seawater intrusion is occurring in the Basin?**
- **Question 2: How far inland is seawater intrusion acceptable and why?**

SUMMARY OF SEAWATER INTRUSION SMC DEVELOPMENT TO DATE

The first Technical Memorandum for development of seawater intrusion SMC was titled *Seawater Intrusion Sustainable Management Criteria Chloride Isocontour Value* and dated December 11, 2020. We presented this technical memorandum (memo) to the GSU22 Committee at its December 15, 2020 meeting. The general question asked of the Committee at that meeting was **"How should we define whether significant and unreasonable seawater intrusion is occurring in the Basin?"** The aim of posing this question was to receive feedback on what chloride concentration would result in significant and unreasonable conditions for beneficial uses.

Although the GSU22 Committee provided feedback that the drinking water standard of 250 mg/L chloride concentration is too high for crops and therefore not the preference for agricultural uses, the GSU22 Committee generally indicated that it needed more information to provide input on defining a specific chloride concentration for the seawater intrusion SMC.

The second Technical Memorandum for development of seawater intrusion SMC was titled *Proposed Statement of Significant and Unreasonable Conditions for Seawater Intrusion and Approach to Developing Sustainable Management Criteria* and dated February 5, 2021. This memo proposed a qualitative description to answer the following question: "**How far inland is seawater intrusion acceptable and why?"** The memo also described an approach to mapping a chloride isocontour consistent with the answer to the above question.

DRAFT

The general feedback on the proposed statement of significant and unreasonable conditions at the February 11, 2021 GSU22 meeting included the following:

- The proposed statement is awkward and hard to follow.
- The statement should be based on extent of seawater intrusion, not PV Water's delivered water zone.
- It was suggested to connect the statement to the schedule for implementing projects in the Basin Management Plan Update, which was developed to reduce seawater intrusion by 90% over time.

The direction proposed to the GSU22 Committee was to return with updated mapping of chloride concentrations in the Basin and proposed chloride isocontours of seawater intrusion sustainable management criteria in order to inform development of the statement of significant and unreasonable conditions. This third technical memorandum provides additional information and a proposal.

PROPOSED STATEMENT OF SIGNIFICANT AND UNREASONABLE CONDITIONS CONNECTED TO BASIN MANAGEMENT PLAN UPDATE GOALS

As introduced at the second meeting of the GSU22 Committee in November 2020, the first step in developing SMC for any sustainability indicator is to qualitatively describe significant and unreasonable conditions for the indicator. DWR Recommended Action 7 describes the need for PV Water to describe significant and unreasonable conditions for seawater intrusion. Based on the feedback from the GSU22 Committee, the proposed statement of significant and unreasonable conditions is revised as follows:

The 2014 Basin Management Plan Update sets a goal of reducing seawater intrusion by 90% to be achieved with the successful implementation of the Phase I projects by 2025. Therefore, it would be significant and unreasonable for seawater to intrude into the Aromas aquifer beyond the inland extent of intrusion as will be observed in 2025.

The 2014 Basin Management Plan Update is the primary component of PV Water's GSP-Alternative approved by DWR. The approved GSP-Alternative provides a timeline for project implementation to achieve reduction of seawater intrusion. Therefore, it is appropriate to define significant and unreasonable conditions based on that timeline.

Phase I projects in the 2014 Basin Management Plan Update include the following:

DRAFT

- A conservation program, currently funded at $400,000 per year;
- Increased recycled water production, storage, and delivery at and from existing facilities;
- The College Lake Project, a Board approved project that has a certified Final EIR (FEIR, ESA, 2019), which is in final design; and
- The Watsonville Slough System Managed Aquifer Recharge and Recovery (MARR) Projects, which are approved and supported by a certified FEIR (ESA, 2021).

The proposed statement of significant and unreasonable conditions provides the basis for the proposed sustainable management criteria described below (Table 1). In addition to describing the reasoning for the proposed criteria, the GSU22 Committee may also use the information provided to revise the criteria to represent local interests.

Table 1. Summary of Proposed Sustainable Management Criteria for Seawater Intrusion

Sustainable Management Criteria	Proposal
Minimum Threshold Chloride Isocontour	1,000 feet inland of Estimated Isocontour for 100-250 mg/L based on observations including shallow intrusion along Elkhorn Slough
Minimum Threshold Chloride Concentration	250 mg/L
Undesirable Results	Minimum Threshold Exceedances (Seawater Intrusion Inland of Minimum Threshold Chloride Isocontour) in 3 of 5 Years
Measurable Objective Chloride Isocontour	Same as Minimum Threshold Chloride Isocontour
Measurable Objective Chloride Concentration	100 mg/L

CURRENT AND HISTORICAL CONDITIONS TO INFORM IDENTIFICATION OF CHLORIDE ISOCONTOUR SUSTAINABLE MANAGEMENT CRITERIA

Although the proposed statement of significant and unreasonable conditions is based on future conditions in 2025, the GSU22 can include sustainable management criteria such as minimum thresholds that estimate those future conditions. The sustainable management criteria will be chloride concentration isocontours consistent with DWR's Recommended Action 6 and DWR's regulations for GSPs:

> GSP Regulations § 354.28 (c)(3): "The minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results."

To inform the minimum threshold isocontours, Figure 1 and Figure 2 show maps of chloride concentrations observed in the Aromas aquifer, the principal aquifer for the Basin over different

DRAFT

time periods. Figure 1 shows historical maximums of chloride concentrations and Figure 2 shows chloride concentration maximums for 2018-2020. These data can be compared to the seawater intruded area defined by PV Water based on chloride concentrations greater than 100 mg/L through 2017.

Chloride concentrations on Figure 1 and Figure 2 are displayed based on the types of wells as follows.

- Only concentrations from wells screened in the Aromas aquifer, the principal aquifer of the Basin, are displayed.
- The identity and location of private wells sampled for chloride concentrations are confidential. To honor confidentiality, the maps show generalized areas of private wells in the Aromas aquifer as the range of maximum concentrations historically (Figure 1) and for 2018-2020 (Figure 2).
- For public agency monitoring well sites with multiple depth well completions (Figure 3), the shallowest Aromas completion with a maximum concentration above 100 mg/L is identified and that concentration is labeled on the map. This identifies the completion closest to the seawater intrusion interface as a typical seawater intrusion interface has deeper saltwater underlying shallower freshwater (Figure 4). If no completion has concentrations above 100 mg/L, the concentration in the deepest completion is labeled.

DRAFT

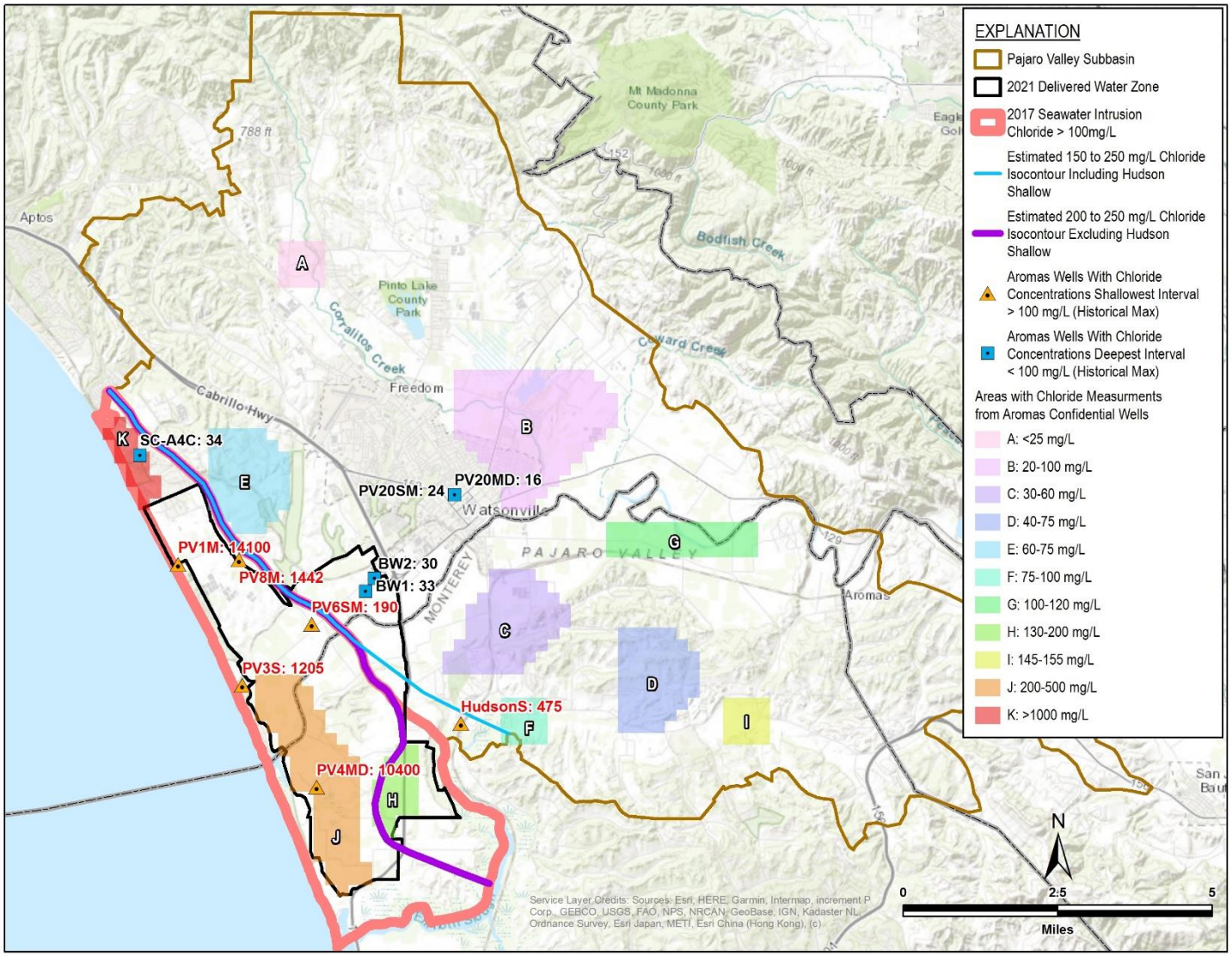

Figure 1. Historical Maximum Chloride Concentrations in Aromas Aquifer

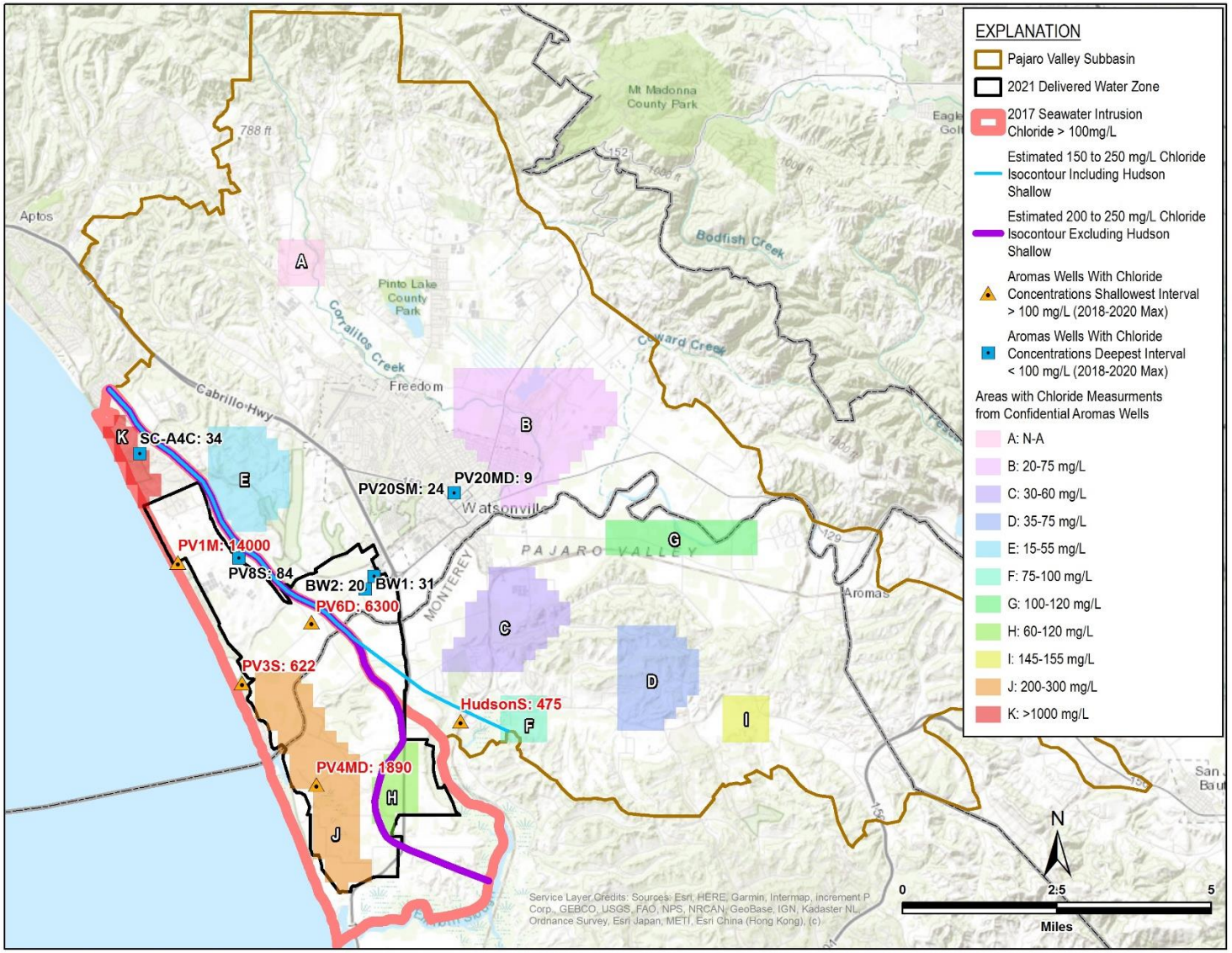

Figure 2. Maximum 2018-2020 Chloride Concentrations in Aromas Aquifer

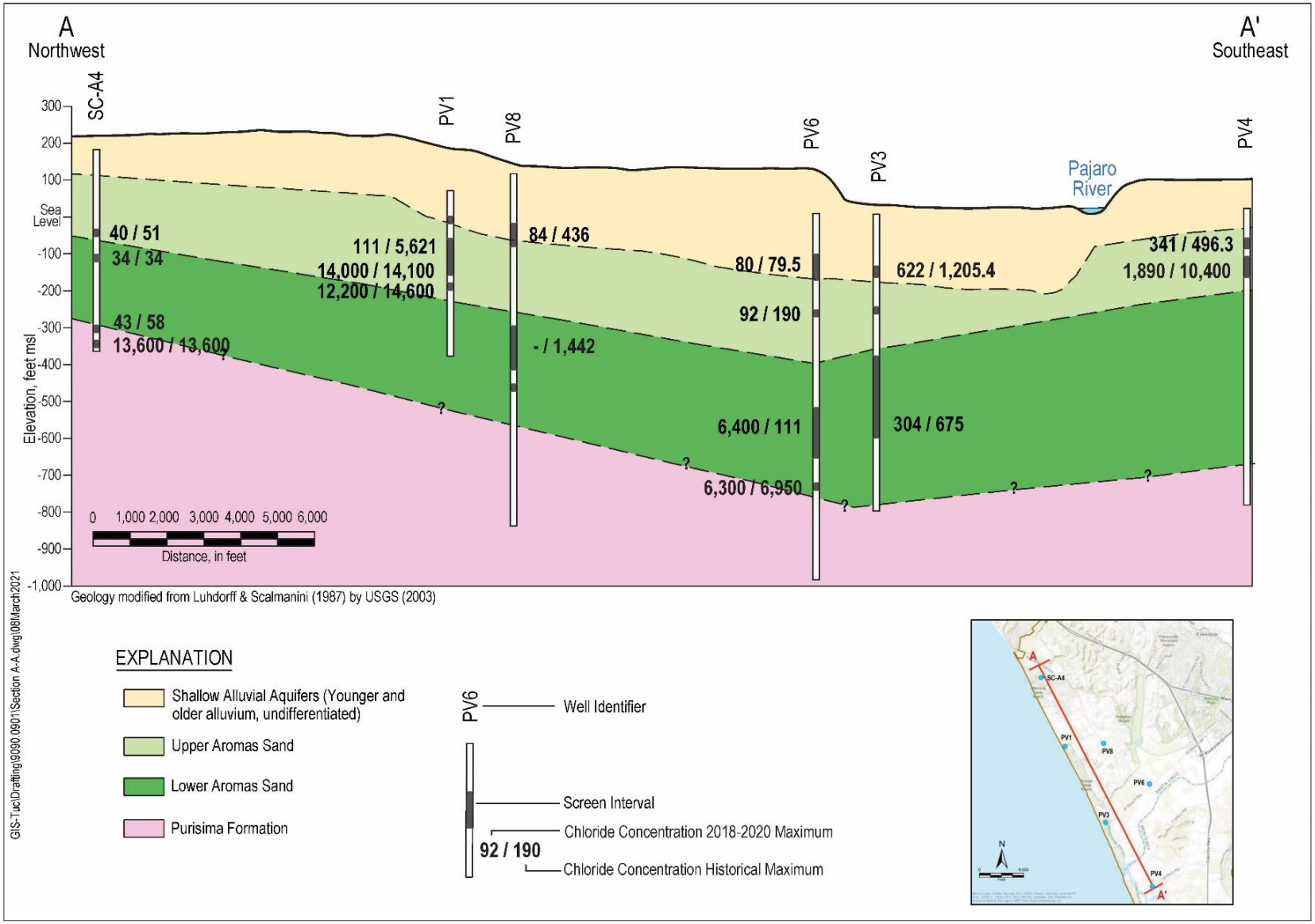

Figure 3. Cross-Section along Coast with Monitoring Well Sites of Multiple Depth Completions (modified from USGS, 2003)

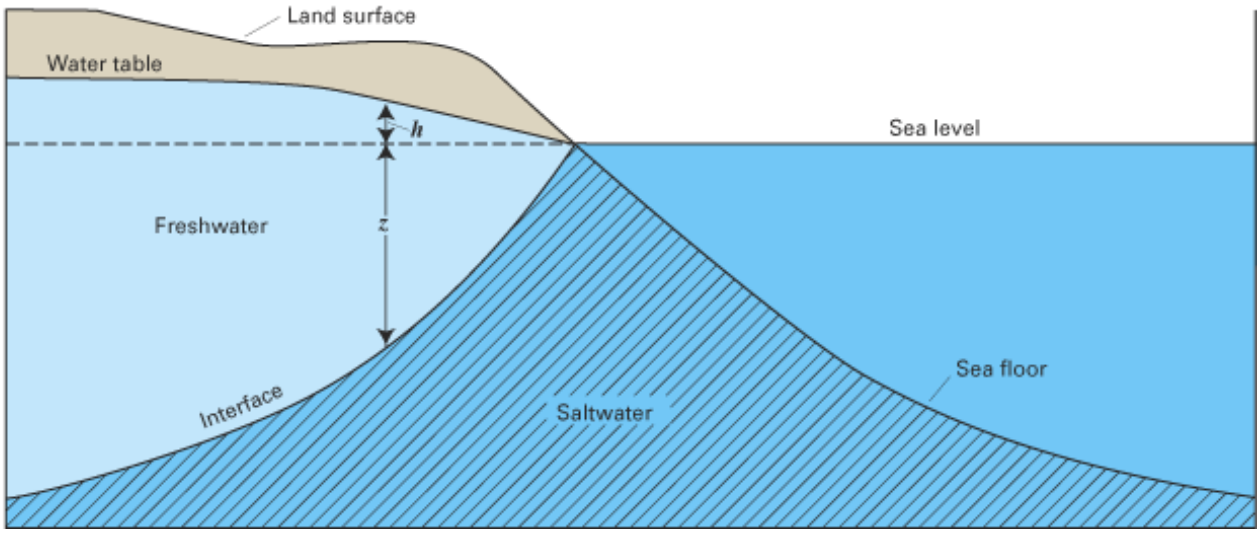

Figure 4. Schematic Showing Typical Saltwater Interface for Seawater Intrusion (Barlow *et al.*, 2003)

Appendix A includes chemographs showing chloride concentrations over time from clusters of private wells as shown on Figure 1 and Figure 2, together with concentrations from wells with multiple depth completions.

There are some primary findings from the maps of chloride concentrations and placement of isocontours based on the data.

1. The distribution of available data and range of observations do not support distinguishing multiple isocontours at different values. For example, showing completely different isocontours for 100 mg/L, 150 mg/L, 200 mg/L, and 250 mg/L is not supported by the distribution of available data. The data are not able to define the gradation of concentration with large changes across a short distance. Moreover, installing monitoring wells to better define this gradient is unnecessary.
2. An isocontour based on available data represents a dividing line between concentrations above and below the isocontour value as opposed to an estimate of where the precise concentration is located. For example, a 100 mg/L isocontour identifies the areas where concentrations are above (coastal side) and below (inland side) 100 mg/L.
3. The isocontour drawn by PV Water based on 100 mg/L chloride concentrations also can be assigned a value up to 250 mg/L chloride concentration and for the most part, accurately divide areas of lower and higher concentrations.
4. The area where an isocontour for 250 mg/L may differ from an isocontour for 100 mg/L is in the southern part of the delivered water zone (Area H on Figure 1 and Figure 2).

5. When evaluating conditions through 2017, PV Water did not have data from the Hudson Shallow and Deep wells sampled by Monterey County Water Resources Agency. The Hudson Shallow well shows chloride concentrations rising to 475 mg/L by 2018, while the Hudson Deep well has concentrations below 50 mg/L. The shallow intrusion into the upper Aromas aquifer is potentially from nearby Elkhorn Slough. This is still considered seawater intrusion even though it is via a surface water conduit that transports salt inland. However, the GSU22 could define shallow intrusion via sloughs as a natural condition driven by tidal action in the Slough and therefore not a significant and unreasonable condition. In this case, results from the Hudson Shallow well and wells similarly situated would not factor into the analysis. However, increasing concentrations at the Hudson Shallow well (Appendix A) does indicate the possibility that groundwater pumping is drawing brackish water from the slough.
6. 2018-2020 data from wells used to define the 2017 isocontour do not indicate movement of the isocontour inland since 2017.
7. There are areas (G and I on Figure 1 and Figure 2) with concentrations above 100 mg/L inland of any isocontour defining seawater intrusion. Areas G and I are not connected to seawater intrusion as there are areas (C and D on Figure 1 and Figure 2) with concentrations lower than 100 mg/L between areas G and I and any seawater intrusion isocontour. Chloride concentrations higher than 100 mg/L can occur due to reasons unrelated to seawater intrusion. For example, Area G is in the Murphy Crossing area and is impacted by high streambed infiltration rates from the Pajaro River in this area. Especially during the summer, the Pajaro River transports high concentrations of salts from upstream, out of Basin, sources. This is documented in PV Water's Salt and Nutrient Management Plan (SNMP, 2016). The SNMP identifies inland subarea Zone 1 that encompasses both Area G and I as outside the area of potential seawater intrusion. In its approval of PV Water's GSP Alternative, DWR (2019) describes the SNMP's use of assimilative capacity thresholds for water quality undesirable results unrelated to seawater intrusion as "reasonable quantifications and standards".

Based on these findings, isocontours representing observed seawater intrusion in the Aromas aquifer have been added to Figure 1 and Figure 2. One isocontour incorporates shallow intrusion at the Hudson Shallow well and can be assigned any value from 100-250 mg/L. The other isocontour does not include Hudson Shallow well and can be assigned any value from 150-250 mg/L. As seawater intrusion is expected to continue as Basin Management Plan Update projects are implemented, a minimum threshold isocontour estimating 2025 conditions can be defined some distance inland of either of these isocontours.

DRAFT

PROPOSED ISOCONTOURS FOR SUSTAINABLE MANAGEMENT CRITERIA

The proposed statement of significant and unreasonable conditions specifies seawater intrusion extent as of 2025 to be consistent with Basin Management Plan Update project implementation. Minimum thresholds are the quantitative sustainable management criteria that indicate significant and unreasonable conditions. As described above, DWR Recommendation #6 and the GSP regulations specify that chloride concentration isocontours be specified as minimum thresholds. Therefore, minimum threshold exceedances for seawater intrusion occur when seawater intrusion advances inland of the specified minimum threshold isocontour. Undesirable results based on minimum threshold exceedances after 2040 could lead to state intervention in Basin management

Isocontours for minimum thresholds will be reevaluated at the next 5-Year Update due in 2027 to better represent the seawater intrusion extent as of 2025. However, we recommend that GSU22 includes a minimum threshold isocontour as an estimate of the 2025 extent. As the minimum threshold isocontour will be reevaluated after 2025, an extensive evaluation of potential movement of the isocontour is unnecessary for GSU22. We propose defining the minimum threshold isocontour to be 1,000 feet inland of the estimated isocontour based on observed concentrations including shallow intrusion represented by high concentrations at the Hudson Shallow well shown on Figure 1 and Figure 2. Shallow intrusion via an inland surface water body like Elkhorn Slough into the Aromas aquifer could result in significant and unreasonable conditions for beneficial uses. The SNMP (PV Water, 2016) estimated historical intrusion of 176 feet per year (1 mile over 30 years) so 1,000 feet is likely farther than seawater intrusion will advance over five years. However, given the uncertainty of the estimated isocontour location, a greater distance is appropriate.

Figure 5 and Figure 6 depict the beneficial uses potentially affected by the proposed minimum threshold isocontours. Figure 5 shows agricultural land use, crop types, and agricultural well locations. Figure 6 shows water systems and domestic well locations. These figures both illustrate moving the proposed isocontour 1,000 feet inland of estimated isocontour based on observed concentrations affects only a limited number of wells.

DRAFT

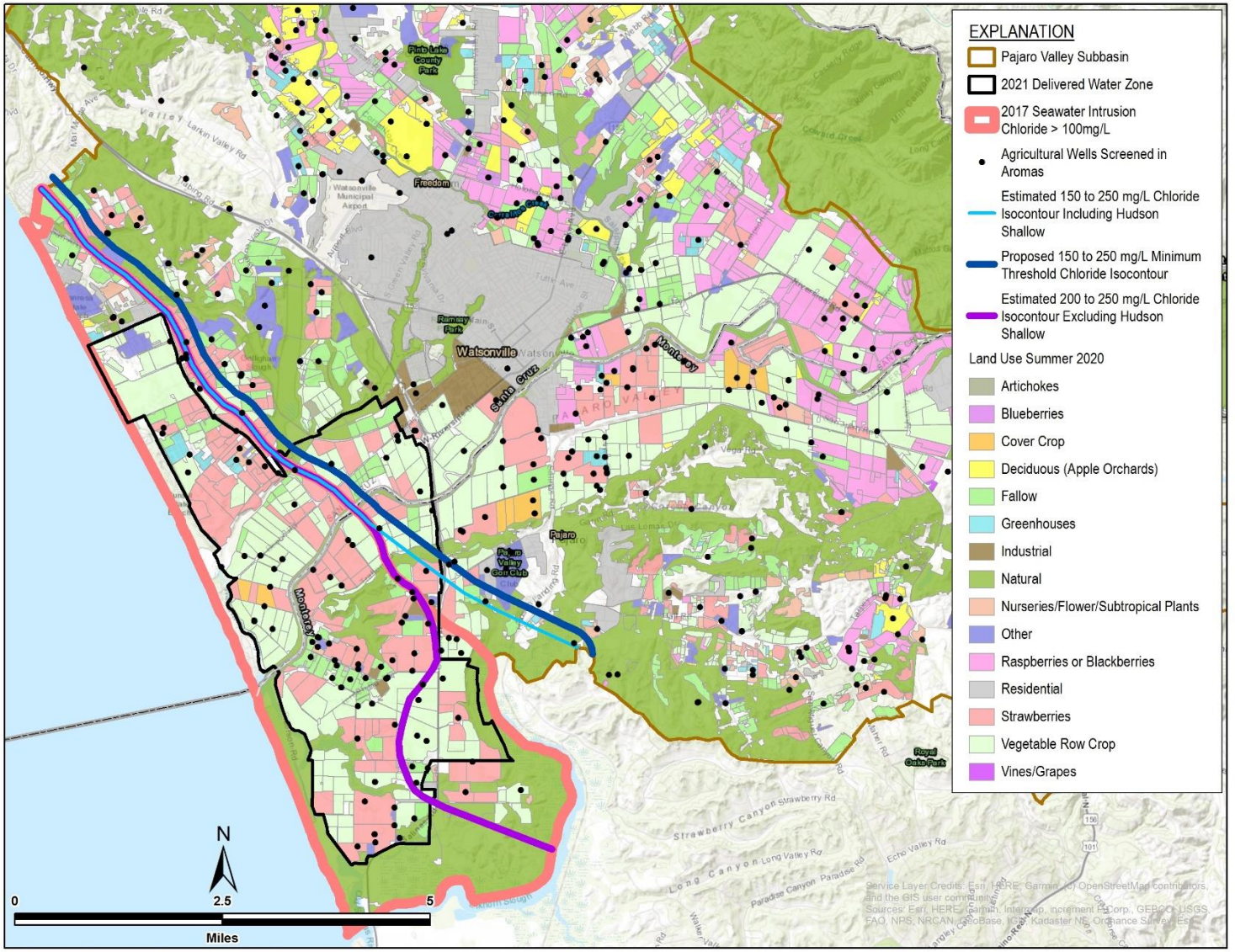

Figure 5. Proposed Minimum Threshold Isocontours, Agricultural Land Use, and Agricultural Well Locations

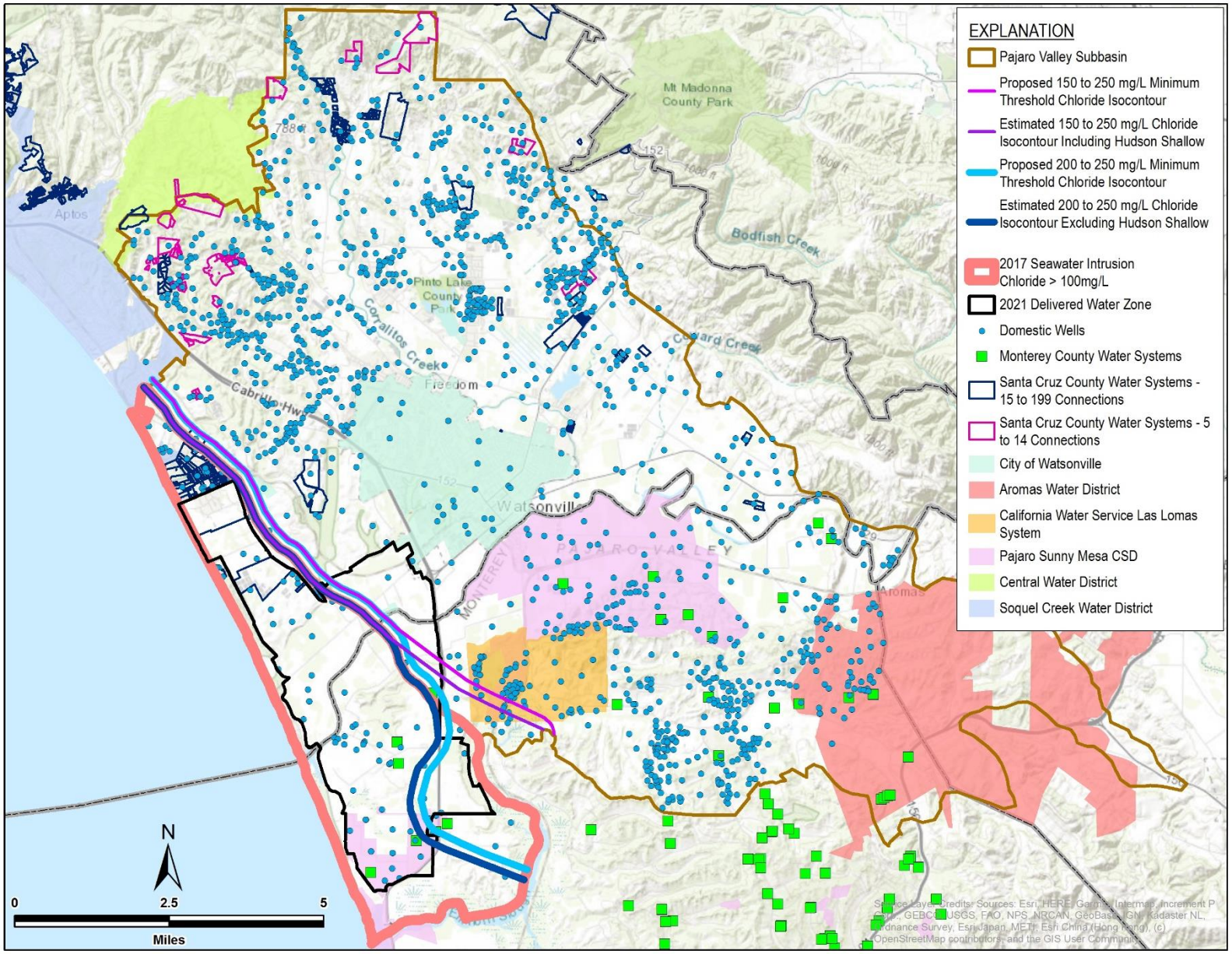

Figure 6. Proposed Minimum Threshold Isocontours, Water Systems, and Domestic Well Locations

CHLORIDE CONCENTRATION MINIMUM THRESHOLD

A specific chloride concentration still needs to be assigned to the designated isocontour line to serve as a minimum threshold to meet DWR Recommended Action 6 and the GSP regulations. A minimum threshold under SGMA indicates significant and unreasonable conditions and undesirable results are defined based on exceedances of the minimum threshold. If undesirable results occur after 2040, the State Water Resources Control Board (SWRCB) can intervene in management of the Basin.

Setting a minimum threshold chloride concentration will answer the question: **How should we define whether seawater intrusion is occurring in the Basin?** The Technical Memo titled *Seawater Intrusion Sustainable Management Criteria Chloride Isocontour Value* and dated December 11, 2020 introduced considerations for this question. The Technical Memo described groundwater quality objectives, minimum thresholds used in adjacent basins, drinking water standards, delivered water quality objectives, and crop sensitivity to chloride concentrations.

In prior meetings, the GSU22 Committee did appear to narrow the discussion for a chloride concentration minimum threshold to a range of 150-250 mg/L based on crop sensitivity that would also meet the recommended drinking water standard. Further information related to water quality objectives for water delivered to agricultural use and crop sensitivity to chloride concentrations is provided below, and Table 2 summarizes groundwater quality objectives, minimum thresholds used in adjacent basins, and drinking water standards previously presented as a reference.

Table 2. Groundwater Quality Objectives, Minimum Thresholds, and Drinking Water Standards for Chloride

Category	Location	Chloride Concentration (mg/L)	Source
Basin Plan Groundwater Quality Objective	Hollister Sub-Area	150	RWQCB, 2019
	Tres Pinos Sub-Area	150	
	Salinas Valley 180 Ft Aquifer	250	
	Salinas Valley 400 Ft Aquifer	50	
Groundwater Sustainability Plan Minimum Threshold for Seawater Intrusion	Santa Cruz Mid-County Basin	250	MGA, 2019
	Salinas Valley 180-400' Aquifer Subbasin	500	SVBGSA, 2020
Secondary Maximum Contaminant Limit for Drinking Water	Statewide (Recommended)	250	DDW, 2018
	Statewide (Upper)	500	

DRAFT

Different crops have varying salt tolerances. Table 3 shows estimates of salt tolerances for different crops grown in Pajaro Valley. An ASCE Manual and Reports on Engineering Practices (Grieve *et al.*, 2012) provides salt tolerances as soil salinity values of electrical conductivity in decisiemens per meter (dS/m). As these tolerances are provided for soils where chloride is the dominant anion, Grieve *et al.*, 2012 states that electrical conductivity in dS/m can be multiplied by a factor of 10 to estimate chloride concentrations in soil water as milliequivalents per liter (meq/L). Grieve *et al.*, 2012 also provides chloride tolerances for specific crop varietals. Strawberries and raspberries are the most chloride sensitive crop at 10 meq/L in soil. A study by Platts and Grismer (2014) in the Salinas Valley found that irrigation water with chloride concentrations up to 240 mg/L resulted in soil water concentrations of less than 10 meq/L.

Table 3. Summary of Salt Tolerances for Various Crops (Grieve *et al.*, 2012)

Crop	Salt Tolerance Rating	Electrical Conductivity Threshold in Soil (dS/m)	Equivalent Chloride Threshold in Soil Water (meq/L)
Apples	Sensitive	N/A	N/A
Artichokes	Moderately Tolerant	6.1	61
Brussels Sprouts	Moderately Sensitive	N/A	N/A
Blackberries	Sensitive	1.5	15
Blackberries (Ollaille)	N/A	N/A	20
Grape	Moderately Sensitive	1.5	15
Lettuce	Moderately Sensitive	1.3	13
Strawberries	Sensitive	1.0	10
Strawberries (Lassen)	N/A	N/A	15
Strawberries (Shasta)	N/A	N/A	10
Raspberries (Indian Summer)	N/A	N/A	10

The most chloride sensitive crop with significant acreage in the coastal portion of the Basin is strawberries. PV Water's water quality objective for chloride is 150 mg/L for water delivered to its Coastal Distribution System where strawberries as well as other crops are grown (Figure 5). However, as pointed out in the February GSU22 Committee meeting, a water quality objective for treated water that is sold to customers has a different purpose than a minimum threshold for sustainable groundwater management. As described above, minimum threshold exceedances are the basis for undesirable results that could lead to SWRCB intervention in Basin management

DRAFT

after 2040. Therefore, the minimum threshold chloride concentration should be set recognizing that potential outcome.

The December 11, 2020 memo referenced the delivered water quality goal for the Castroville Seawater Intrusion Project (CSIP) for an area where strawberries are also grown. The delivered water quality goal for CSIP is 250 mg/L (Platts, 2020), but it is often not achieved in months when surface water supply is not available to blend with recycled water (Figure 7). The December 11, 2020 memo posited that CSIP's water quality goal indicates chloride concentrations up to 250 mg/L in irrigation water may not represent significant and unreasonable conditions for agriculture in the Basin.

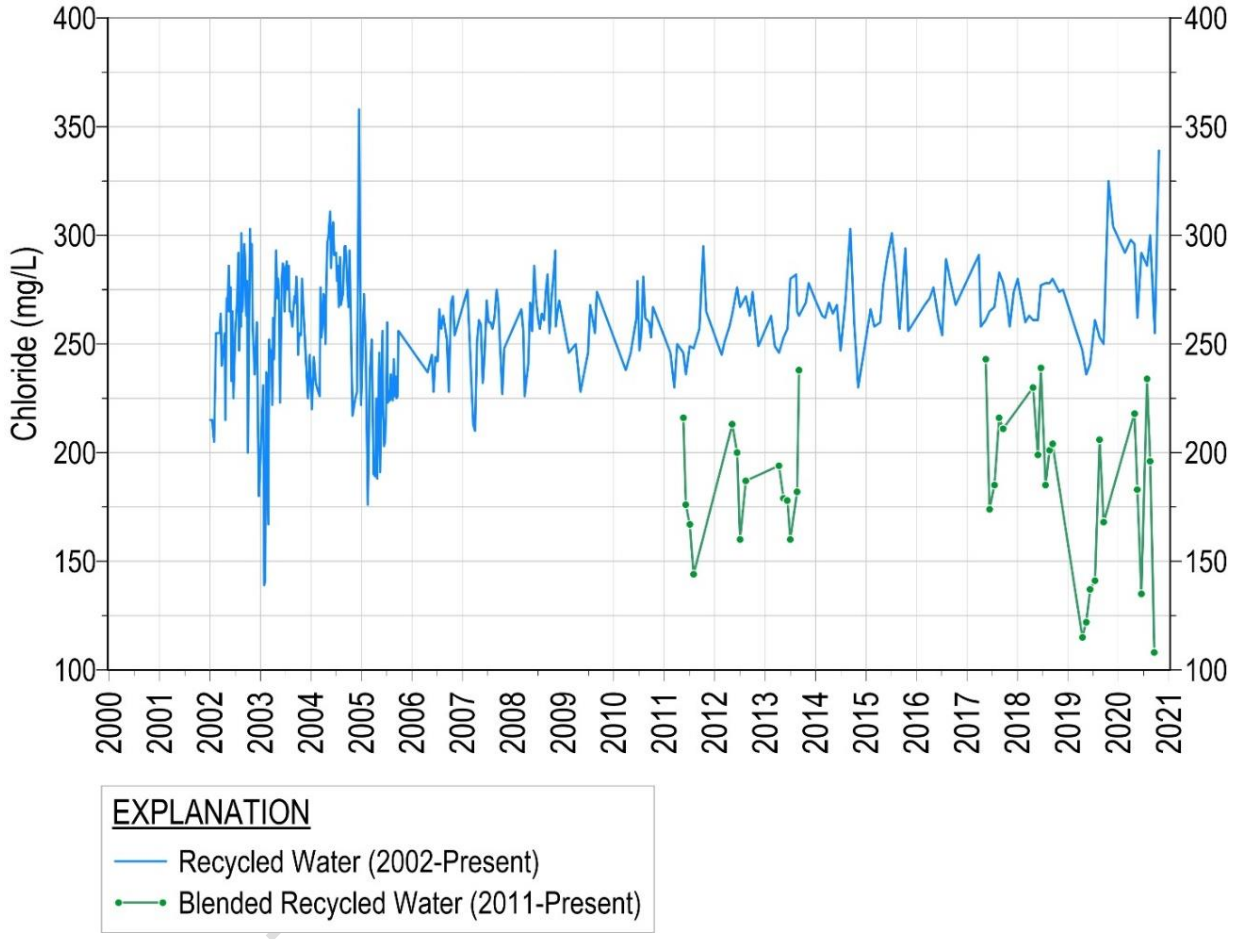

Figure 7. Chloride Concentrations in mg/L for Castroville Seawater Intrusion Project (Monterey One Water, 2021)

A GSU22 Committee member provided information on recent research of the effects of irrigation water quality on strawberry varietals conducted by irrigation and water resources advisors at University of California Extension (Biscaro and Cahn, 2019). This study evaluates effects of irrigation water constituents including chloride on two strawberry varietals: Fronteras,

primarily grown in Oxnard, and Monterey, primarily grown in Pajaro Valley. Although there was a statistically significant yield loss of 13% for the Fronteras varietal when irrigated with water containing chloride concentrations at approximately 270 mg/L, there was no yield loss for the Monterey varietal when irrigated with the same quality water (Table 4).

Table 4. Summary of Irrigation Chloride Concentration Effects on Yield Losses (Biscaro and Cahn, 2019)

Chloride Concentration (mg/L)[1]	Representative Water Quality	Yield Loss Compared to Control	
		Yield Loss for Fronteras (Oxnard)	Yield Loss for Monterey (Pajaro)
43	Control	--	--
64	Oxnard Avg	N/A	N/A
149	Pajaro Valley Avg	6%	3%
273	Pajaro Valley Avg + 1.25 Standard Deviations	13%[2]	0%
415	Pajaro Valley Avg + 2.7 Standard Deviations	17%[2]	5%

[1] Reported as milliequivalents/liter by Biscaro and Cahn; multiplied by molar weight of 35.5 for chloride
[2] Statistically significant at $p<0.05$

The study also noted that the Monterey varietal that did not show yield losses may be related to significantly greater chloride concentrations found in irrigation water of the Pajaro Valley compared to Oxnard. The study reports that average chloride concentrations in irrigation water of Pajaro Valley was approximately 150 mg/L with a standard deviation of approximately 100 mg/L. Therefore, 250 mg/L is approximately at a standard deviation from the mean for water irrigating strawberries in the Pajaro Valley.

There may be strawberry varietals grown in the Basin that are more salt sensitive than the Monterey varietal, but the information for this popular varietal grown in the Basin does not appear to support a minimum threshold lower than 250 mg/L. Given the increased risk of SWRCB intervention related to lower minimum thresholds, we recommend a minimum threshold chloride concentration of 250 mg/L to protect both agricultural and domestic beneficial uses.

UNDESIRABLE RESULTS

Groundwater sustainability is defined by the absence of undesirable results for sustainability indicators such as seawater intrusion. Observed seawater intrusion inland of the minimum threshold isocontour is considered a minimum threshold exceedance. However, a single minimum threshold exceedance need not qualify as an undesirable result that could lead to SWRCB intervention if it occurs after 2040. It is appropriate to ensure that minimum threshold

DRAFT

exceedances represent multi-year trend of inland intrusion to consider them undesirable results. To ensure this, we recommend that minimum threshold exceedances in at least three of the five preceding years be considered an undesirable result.

MEASURABLE OBJECTIVE

Measurable objectives do set higher standards for basin management than minimum thresholds, but they are not enforceable and failure to achieve or maintain them will not lead to SWRCB intervention. Measurable objectives are meant to provide aspirational targets for basin management planning as well as operational flexibility so minimum thresholds are not exceeded, and undesirable results do not occur. As the minimum threshold is a chloride concentration isocontour, the measurable objective for seawater intrusion should also be a chloride concentration isocontour in order to be consistent with regulatory requirements for GSPs:

- GSP Regulations § 354.30 (c)(b): "measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds."

For the measurable objective, we recommend using the same isocontour location as the minimum threshold, but for a chloride concentration of 100 mg/L. Using this value will allow PV Water to track seawater intrusion consistent with historical evaluations. It will also set a goal for its Basin Management Plan Update projects to prevent seawater intrusion from having any adverse effects on beneficial uses after 2025. The combination of a measurable objective of 100 mg/L and minimum threshold of 250 mg/L will allow PV Water to manage to the more protective goal, while reducing the risk of SWRCB intervention for effects that are less than significant and unreasonable.

DRAFT

MONTGOMERY & ASSOCIATES

REFERENCES

Barlow, P. M., 2003, Ground Water in freshwater-saltwater environments of the Atlantic coast, U.S. Geological Survey Circular 1262.

Biscaro, A. and M. Cahn, 2019, Assessing the Impact of Irrigation Water Quality on Strawberry Cultivars, *Progressive Crop Consultant*, http://progressivecrop.com/2019/10/assessing-the-impact-of-irrigation-water-quality-on-strawberry-cultivars/, October 3.

California Department of Water Resources (DWR), 2017, Best Management Practices for the Sustainable Management of Groundwater: Sustainable Management Criteria BMP, Draft.

California Division of Drinking Water (DDW), 2018, Secondary Drinking Water Standards, revised October 1.

California Department of Water Resources (DWR), 2019, Alternative Assessment Staff Report: Corralitos – Pajaro Valley (Basin No. 3-002.01), July 17.

Environmental Science Associates (ESA), 2019, *Consolidated Final Environmental Impact Report for the College Lake Integrated Resources Management* Project, prepared for Pajaro Valley Water Management Agency, https://www.pvwater.org/images/Resources/CollegeLake_Consolidated_Final_EIR-web.pdf, December.

Environmental Science Associates (ESA), 2021, *Watsonville Slough System Managed Aquifer Recharge and Recovery Projects Final Environmental Impact* Report, prepared for Pajaro Valley Water Management Agency, https://pvwater.org/images/projects/Sloughs/WSS_MARR_Final_EIR_1.6.2021.pdf, December.

Fox Canyon Groundwater Management Agency (FCGMA), 2019, *Groundwater Sustainability Plan for the Oxnard Subbasin*, December.

Grieve, C.M., S.R. Grattan, and E.V. Maas, 2012, Plant Salt Tolerance, *ASCE Manual and Reports on Engineering Practice No. 71 Agricultural Salinity Assessment and Management (2nd Edition)*, Wallendar, W.W. and K.K. Tenji (eds), American Society of Civil Engineers, Reston, VA, Chapter 19 pp:405-459.

Monterey One Water, 2021, CSIP Growers Page, https://www.montereyonewater.org/313/CSIP-Growers, accessed January 5.

DRAFT

Montgomery & Associates, 2020, *Seawater Intrusion Sustainable Management Criteria Chloride Isocontour Value*, technical memorandum to GSU22 Committee, December 11.

Montgomery & Associates, 2021, *Proposed Statement of Significant and Unreasonable Conditions for Seawater Intrusion and Approach to Developing Sustainable Management Criteria*, technical memorandum to GSU22 Committee, February 5.

Pajaro Valley Water Management Agency (PV Water), 2014, *Basin Management Update*, prepared by Carollo Engineers, February.

Pajaro Valley Water Management Agency (PV Water), 2016, *Salt and Nutrient Management Plan*, prepared by 2NDNATURE, October.

Platts, B., 2014, *Chloride levels increase after 13 years of recycled water use in the Salinas Valley*, California Agriculture, vol. 63 no. 3.

Platts, B. 2020, personal communication, December 10.

Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA), 2020, Salinas Valley Groundwater Basin 180/400-Foot Aquifer Subbasin Groundwater Sustainability Plan, prepared by Montgomery & Associates, January 3.

Santa Cruz Mid-County Groundwater Agency (MGA), 2019, Santa Cruz Mid-County Groundwater Sustainability Plan, November.

United States Geological Survey (USGS) and Pajaro Valley Water Management Agency (PV Water), 2003, Geohydrology of Recharge and Seawater Intrusion in the Pajaro Valley, Santa Cruz and Monterey Counties, California, USGS Fact Sheet 044-03, August.

DRAFT