AQUALLIANCE
DEFENDING NORTHERN CALIFORNIA WATERS

April 30, 2022

California Department of Water Resources
1416 9th Street
Sacramento, CA 95814

Re: Vina Subbasin Groundwater Sustainability Plan

To whom it may concern:

AquAlliance, the California Sportfishing Protection Alliance, and the California Water Impact Network (hereinafter AquAlliance) submit the following comments and questions on the Vina Subbasin Groundwater Sustainability Plan ("Vina GSP" or "Plan"). There are serious flaws in the Plan that require significant changes to the document, without which the public and policymakers are truly left in the dark and dangerous consequences are obfuscated.

Introduction

The goal of the Sustainable Groundwater Management Act (SGMA) is to sustainably manage groundwater resources for long-term reliability and multiple economic, social, and environmental benefits for current and future beneficial uses based on the best available science (Water Code 113). The people of California have a primary interest in the protection, management, and reasonable beneficial use of the water resources of the state, both surface and underground, and in the integrated management of the state's water resources to meet the state's water management goals. Proper management of groundwater resources will help protect communities, farms, and the environment against prolonged dry periods and climate change, while preserving water supplies for existing and potential beneficial use. Failure to manage groundwater to prevent long-term overdraft infringes on overlying and other proprietary rights to groundwater.

California's Water Code specifically established as state policy that *every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes* (WC 106.3(a)). State agencies, including the California Department of Water Resources (CDWR), the State Water Resources Control Board (SWRCB), and the State Department of Public Health, are required to *consider this state policy when revising, adopting, or establishing policies, regulations, and grant criteria when those policies, regulations, and criteria are pertinent to the uses of* water (WC 106.3(b)). The Water Code also creates a state policy *that the use of water for domestic purposes is the highest use of water and that the next highest use is for irrigation* (WC 106). The Groundwater Sustainability Agencies (GSAs) were created by SGMA and are delegated by the state the authority to create and implement a Groundwater Sustainability Plan (GSP), which makes the GSA(s) a political subdivision of the state. Therefore, approval of any SGMA GSP created by a GSA(s) or county agency, that is then approved by the CDWR and the SWRCB, must be consistent with the state policies that protect and prioritize the public's right to safe and available supply of groundwater for all beneficial uses.

Implementation of the SGMA requires the creation of a GSP that provides for the development and reporting of those data necessary to support sustainable groundwater management, including those data that help describe the basin's geology; the short- and long-term trends of the basin's water balance, and other measures of sustainability; and those data necessary to resolve disputes regarding sustainable yield, beneficial uses, and water rights. A presumption inherent in SGMA is that sustainable management of a groundwater basin won't repeat or perpetuate the management errors of the past. That the design of the Vina Subbasin GSP sustainability monitoring program requires years of declining groundwater levels before an undesirable result can occur suggests that the past mismanagement practices will persist. The November 2021 Vina Subbasin[1] Final GSP (Vina GSP) fails to meet the SGMA goal of water resource sustainability and protection of the water rights of all beneficial users and uses.

These comments on the December 15, 2021 Vina Subbasin Final GSP are being provided to support our recommendation that the California Department of Water Resources and the State Water Resources Control Board find that the GSP is incomplete because of multiple deficiencies and the overall failure of the document to comply with the statutory and regulatory requirements of the SGMA and the Water Code. These comments are supplemental to previous October 17, 2021 comments provided on the Draft Vina Subbasin GSP, which are attached in Vina Final GSP in Appendix 1-F (appendices pdf pp. 107 to 125) and November 11, 2021 comments that were submitted to the GSP and additionally to DWR through the SGMA portal.

The proposed sustainable management criteria presented in the Vina GSP fail to demonstrate as required by SGMA that the goal of groundwater sustainability is achievable and will occur within 20 years of GSP adoption for: (1) chronic lowering of groundwater levels, (2) reduction of groundwater storage, (3) degraded water quality, (4) depletions of interconnected surface waters, and (5) inelastic land subsidence. The Final Vina GSP fails to protect the beneficial uses for all users of groundwater in the subbasin in these ways:

- The final plan calculates sustainable yield by assuming that the Vina Subbasin Groundwater Sustainability Agencies' (GSAs) management actions and projects will have no effect on the change in groundwater storage before the year 2030, and that after

[1] California Groundwater Basin number 5-021.51, part of the Sacramento Valley Groundwater Basin.

that the annual average loss in storage will be -10,000 acre-feet per year (afy), half the historic rate of -20,000 afy.

- The final plan assumes that sustainable yield can be calculated by subtracting only the loss in groundwater storage from the Historical baseline average annual groundwater pumping, therefore the impacts to subbasin sustainability from the other sustainability indicators are not being considered.
- The final plan sets the Management Objectives (MOs) for groundwater level by assuming that stabilization of the subbasin's groundwater levels won't occur before 2030 and then extends a downward groundwater trend line based on short-term climatic cycles during the dry periods since 2000 to calculate a groundwater level in the year 2030. The MOs are all set deeper than the lowest historical elevation regardless of the historical trend.
- The final plan doesn't have any planned sustainability projects that result in a benefit to the subbasin storage by 2030, but relies on potential or conceptual projects that will likely require extensive permitting to provide the substantive relief necessary to stabilize groundwater levels.
- If the final plan's potential and conceptual projects aren't in place and don't achieve the zero change in groundwater storage by 2030, groundwater levels will likely continue to decline in proportion to groundwater pumping, even at the sustainable yield rate of 233,500 afy.
- The final plan management actions and projects to achieve sustainability are apparently based on the idea that it is …*impractical…* to manage a groundwater basin… *in a manner that fully protects the shallowest wells.*
- The final plan sets the Minimum Thresholds (MTs) for unreasonable results in the management of groundwater levels at depths that can result in an unspecified number of the domestic wells going dry for sustained periods, if not permanently.
- The Draft Vina GSP stated that for the Chico Management Area …*the MT for all RMS wells was based on the 15 percentile of total well depth for wells completed after 1980.* This language wasn't included in the final plan, but the MTs are the same as in the draft plan.
- The final plan in setting the MTs reasons that …*the lowering of groundwater levels during two or more consecutive dry and/or critically dry year types is not considered significant and unreasonable and therefore not considered an undesirable result, as long as the groundwater levels rebound to levels greater than the MT following those consecutive dry and/or critically dry years.*
- The final plan sets the MT groundwater elevations only for wells that are *sustainably constructed*, which the plan defines as: 1) they were installed following the relevant County Well standards within permeable aquifer material, 2) have been appropriately maintained (e.g., well problems are not due to clogging of well screens or silting of well), and 3) were installed after 1980. Apparently, any wells not meeting these standards are not considered sustainable.
- The final plan adds a condition to the meaning of "*undesirable result*" that states that [*e*]*xceeding the MT may lead to significant and unreasonable effects during drought years and impacts to domestic wells and other groundwater uses may occur and would*

not constitute an Undesirable Result. Local and state drought responses play a role in addressing dry year impacts. However, once a drought period ends, it is anticipated that groundwater conditions should return to the MO levels. Apparently, the plan intends to leave management during the drought years to the local and state governments.

- The final plan sets the sustainability criteria, so that the total basin-wide average change in groundwater storage volume when groundwater levels decline from the MOs to the MTs is approximately -637,784 acre-feet (af) with an average change in storage during droughts of -78,800 afy from the 2070 Climate change simulation.
- **The loss in storage volume of 637,784 af between the MO and MT elevations will allow groundwater levels to decline for 8 continuous years of drought before the MTs are reached**. An unreasonable result from the decline in groundwater levels won't be declared for another two years because of the definition of an MT, assuming those years aren't dry and/or critically dry water years.
- When combined with the Historical baseline loss in groundwater storage since the year 2000 of 372,400 af, the Vina GSP will apparently allow a loss of groundwater storage, and the associated **decline in groundwater levels of over 1-million acre-feet** before a significant and unreasonable reduction of groundwater storage triggers the need to declare an undesirable result.
- The Vina GSP water budgets assume that groundwater pumping will decrease with the 2070 scenario by 5,500 afy from the Historical baseline, and the net stream gains (stream gains from groundwater (accretion) minus stream seepage to groundwater) will decrease 6,300 from the Historical baseline. **This is an approximate 36.8% reduction in stream flow from the Historical baseline with the 2070 scenario.**
- The 2070 scenario also results in a loss in net stream flow that's greater than the reduction in groundwater pumping. The ratio of the change in net stream gains to change in groundwater pumping is 114%. The loss in net stream gains with the 2070 scenario isn't considered in the calculation of sustainable yield.
- The final plan acknowledges the lack of data to make informed decisions on the sustainability management criteria for interconnected surface waters and groundwater dependent ecosystems, but still establishes groundwater level MOs and MTs that are lower than historical levels and allow for a decade of drought before triggering an undesirable result due to declining groundwater levels.
- The final plan's groundwater quality monitoring program appears to be designed to actively monitor only the deepest aquifer zone for one potential contaminant, salinity, even though there are at least nine known cleanup sites in the subbasin that have discharged solvents from dry cleaners and metal manufacturing, as well as fuels from underground fuel storage and other potential contaminants from landfills.
- The Vina GSP fails to clearly state that GSAs have a role in protecting water quality for all beneficial uses and users; in particular, the protection of domestic water supply must be the primary concern for managing the subbasin (WC 106.3(a)).
- Monitoring shallower aquifer zones where most domestic wells are screened is apparently assumed to be the responsibility of other government agencies, RWQCB, DTSC, USEPA, or state and local health departments.

- The final plan's groundwater quality management program has failed to meet the monitoring objectives of SGMA that require that a GSP have a network to monitor …*the impacts to the beneficial uses or users of groundwater* and *[c]ollect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues* [CCR T23, Sections 354.34(b)(2) and 354.34(c)(4)].
- The final plan places the responsibility for the monitoring and protection of domestic wells on other government agencies without demonstrating that programs actually exist to collect sufficient spatial and temporal data to determine groundwater quality trends across the entire subbasin.
- The final plan's GRAs management actions and projects don't specifically address measures that might be taken should it be necessary to remediate contaminated wells or mitigate the spread of contaminants of concern (COCs).
- The final plan states that there are no records of land subsidence caused by groundwater pumping in the Vina Subbasin, but doesn't set any MO or MT numerical values for inelastic land subsidence.
- The final plan uses the MOs and MTs for groundwater level as the proxies for the land subsidence sustainability threshold, which appears to set multiple subsidence standards across the subbasin like those for groundwater.
- The final plan's use of MTs for groundwater level elevations that are set far below the lowest historic levels and too low to be protective of all beneficial uses may cause inelastic land subsidence not seen before in the subbasin.
- The final plan's failure to set numeric standards for the MOs and the MT land subsidence sustainability and the threshold for an unreasonable result may lead to damage to the subbasin's infrastructure.
- The final plan's land subsidence sustainability standard is inconsistent with the sustainability goals of SGMA because it apparently doesn't require management actions during drought years and requires that the GRAs wait until the area of the problem is extensive and the magnitude large before declaring an undesirable result.
- The Vina GSP doesn't set or determine the frequency of land subsidence monitoring or reporting.
- The Vina GSP assumes that the DWR and NASA's Jet Propulsion Lab will determine the monitoring frequency for data collection at the land subsidence GPS monuments and with InSAR.

The Final Vina GSP Fails to Comply with SGMA and the Water Code.

The following sections provide expanded discussions of the deficiencies listed above regarding how the Vina GSP fails to protect the beneficial uses for all users of groundwater in the subbasin.

1. The Vina GSP calculates a sustainable yield for the subbasin in Section 2.3.6 by assuming that, if no management actions are taken between years 2030 and 2042, the groundwater

level will on an average decline 21 feet below the MOs, a decline of 1.75 feet per year, presumably because pumping will continue at the Historical baseline rate of 243,500 afy (Section 2.3.6, pp. 138 and 139, pdf 178 and 179). The plan assumes that the GSAs' management actions and projects after 2030 will result in reducing the historical change in groundwater storage from approximately -20,000 afy to -10,000 afy. The sustainable yield is then calculated by subtracting only the -10,000 afy of storage loss from the historical pumping rate of 243,500 afy, which then results in a pumping rate of 233,500 afy and a zero balance to the change in groundwater storage. This calculation has several assumptions that raise issues about its validity. While the following discussion addresses some of those issues, and for now puts aside the fact that sustainable yield isn't just about creating zero balance in the change in groundwater storage, the other sustainability indicators also need to be considered.

For the calculation of sustainable yield, the GSP apparently accepts that groundwater levels will continue to decline until 2030 at the same rate caused by the Historical baseline conditions that produced an annual change in groundwater storage of -20,000 afy (-19,600 afy in Table 2-8). With that assumption, the GSP sets the MOs by projecting …*the groundwater level based on the groundwater trend line of the RMS well for the dry periods (since 2000) of observed short-term climatic cycles extended to* 2030 (Figure 3-4 and Table 3-1, pp. 148 and 150, pdf 188 and 190).

The GSP assumes that by 2030 …*the GSAs could implement projects and management actions to address the long-term groundwater level decline*… (p. 148, pdf 188). In other words, the GSP expects that no management actions or projects will be implemented before 2030 that result in stabilization of the subbasin's groundwater levels or achieve any subbasin groundwater level sustainability. To be *practical,*[2] the GSAs expect and plan for continuation of the historical loss in groundwater storage and a decline in groundwater levels that apparently require the MOs' elevations be set to accept this future decline. See Comment Nos. 3, 4, 5, 7 and 8 for additional discussions on the MOs.

The estimate of sustainable yield appears to be based on the logic that the historical groundwater storage change of -20,000 afy will be reduced by 10,000 afy by reducing the rate of groundwater pumping starting on or before 2030. This still leaves the need to eliminate an additional 10,000 afy in storage loss to achieve a storage balance of zero, with which the GSP calculates a sustainable yield of 233,500 afy. The GSP appears to assume that after 2030 the management actions and projects listed in Table 5-1 (pp. 191 and 192, pdf 231 and 232) will result in an additional 10,000 afy in direct recharge to the subbasin that would then cancel out the remaining storage loss, producing a change in storage balance of zero. Table 5-1 also has several in-lieu recharge projects, but those should probably be credited towards the 10,000 afy reduction in groundwater pumping because that's what happens. Surface water is used instead of pumping groundwater …*in order to leave*

[2] See Master Response – Measurable Objectives and Minimum Thresholds (MO/MT): …*protect all domestic wells because it is impractical to manage a groundwater basin in a manner that fully protects the shallowest wells; Appendix 1-F, pdf pp. 136 through 138.*

groundwater in the basin (WC 10721(m)). In either case, if direct or in-lieu recharge projects are ever implemented along with reductions in groundwater pumping and allocation (Section 5.3.7, p. 210, pdf 250), they need to amount to 20,000 afy in order to eliminate the historical loss of groundwater storage, achieve a change in storage balance of zero, and possibly produce a temporary surplus. All recharge to the subbasin that's being used in the calculation of sustainable yield should be for the good of the whole subbasin, not to an individual as a storage right. Any recharge that isn't for the good of the whole subbasin shouldn't be considered as an improvement in stored groundwater for the purposes of the sustainable yield calculation, because it can be pumped out at any time regardless of the condition of the subbasin. If groundwater is ever stored by an individual under a specific water right, the individual right holder should have to demonstrate that the extraction won't cause harm to the beneficial uses or users in the subbasin or management area and won't contribute to any undesirable result.

The Sustainable Management Criteria (SMC) in the Vina GSP for groundwater levels and groundwater storage are based on an assumption of continued unsustainability to at least the year 2030. Achieving groundwater resource sustainability in the Vina Subbasin is dependent on the GSAs' ability to successfully implement the Table 5-1 recharge projects and/or reduce groundwater pumping by 2030 and beyond. Until these projects are implemented, the subbasin will continue to be unsustainable. Note that additional reductions in pumping and/or increases in recharge may be needed to prevent undesirable results to the other sustainability indicators (see Comment No. 7).

2. A review of Vina GSP projects in Table 5-1 finds that only five of the sustainable projects are for direct recharge — 5.2.3.3, 5.2.4.3, 5.2.4.5, 5.2.4.8, and 5.2.5.2 (pp. 191 and 192, pdf 231 and 232). Of these, only the 5.2.3.3 - Flood Managed Aquifer Recharge (Flood/MAR) project is a planned project with a timetable of 2022 to 2032. The project is described as [i]ndividual recharge projects that *will eventually occur, but this particular project will focus on the initial scoping and identify specific recharge opportunities in the Vina Subbasin* (p. 195, pdf 235). The project description indicates that no estimated groundwater offset and/or recharge is applicable to this planned project. The other direct recharge type projects that are considered potential or conceptual include: 5.2.4.3 – stream flow augmentation at 1,000 to 5,000 afy; 5.2.4.5 – recycled wastewater at 5,000 afy; 5.2.4.8 – surface water supply and recharge at 1,000 afy per project; and 5.2.5.2 – recharge from the Miocene Canal at 2,000 afy. All of these potential projects will require a SWRCB water rights permit, as well as other permits, and compliance with CEQA (see Required Permitting and Regulatory Process sections for each project).

   If these potential and conceptual projects aren't in place by 2030, then the underlying assumption of sustainable yield achieving a zero change in groundwater storage and stable groundwater levels after 2030 is invalid. If zero change in storage by 2030 isn't achieved, groundwater levels will likely continue to decline in proportion to groundwater pumping even at the **purported** sustainable yield rate of 233,500 afy. The decline in groundwater levels will likely be proportional to the historical decline of 1.75 feet per year from a storage loss of approximately 20,000 afy, a loss of 11,200 afy per foot of decline (afy/f). This may be part of the reasoning for setting the MO groundwater elevations below historic lows and MT elevations far below what appears to be needed for periods of drought (see Comment No. 5).

3. The Vina GSP sets the MO elevations at …*a point above the MT allowing for a range of active management to prevent undesirable results and reflect the desired state for groundwater levels at the year 2042. To establish the MO, the water-level hydrograph of observed groundwater levels at each RMS was evaluated. The historical record at these locations shows cyclical fluctuations of groundwater levels over a four- to seven-year cycle consistent with variations in water year type according to the Sacramento Valley Water Year Hydrologic Classification.* …[*T]he MO was therefore based on the trend line of observed historical data extended to the year 2030. …[T]he projection of groundwater levels for each RMS was based on a simple non-statistical linear projection of the observed data (Figure 3-3). Generally, the lowest groundwater levels of a given cycle were used for the projection, unless they appeared to be outliers relative to the general long-term trend of the non-dry years in the cycle. …[T]he MO are therefore intended to address the long-term trend of the "peaks and valleys" of the short-term cycles and stop the long-term decline in groundwater levels during dry years (*Section 3.3.3, pp. 147 through 149, pdf 187 through 189).

AquAlliance Exhibits 1-1 to 1-3 are compilations of the Appendix 3-C hydrographs for the representative monitoring sites (RMS) groundwater level wells for each of the three Vina Subbasin management areas. These compilations were made to facilitate visual comparisons of the MOs and MTs and historical groundwater levels. A visual analysis of these hydrographs finds that most of the RMS groundwater level wells don't exhibit the downward trend in groundwater levels in recent years that the GSP uses to justify the …*simple non-statistical linear projection to year 2030*. The MO elevations are clearly set at or below the average groundwater levels in recent years, and many are set far below the lowest historical level. The MOs appear to be set at a depth that ranges from 5 to 15 feet below the recent average groundwater levels. This raises a question of validity of the GSP's justification for the MO elevations.

These RMS groundwater level well hydrographs appear to contradict the assumption that groundwater levels are in continual decline. In fact, the Executive Summary in the GSP states that *[g]roundwater storage in the subbasin is relatively stable and changes in groundwater storage reflect groundwater level trends. The Sacramento River and streams that cross the Vina Subbasin stabilize storage volumes by providing recharge to the Vina Subbasin*. Between 2000 and 2018, groundwater storage in the Vina Subbasin decreased annually approximately 0.07% from a total of 16 million acre-feet, which calculates to a total of approximately 212,800 af over 19 years. The Executive Summary then states that *…it is highly unlikely that the Vina Subbasin will experience conditions under which the volume of stored groundwater poses a concern. However, the depth to access that groundwater across the Vina Subbasin does pose a concern* (p. ES-8, pdf 27).

Note that the change in storage calculated in Table 2-8 (p. 123, pdf 163) for the Historical baseline groundwater budget for the years 2000 to 2018 is -19,600 afy, which produces a total of approximately 372,400 af loss in groundwater storage as shown in Figure 2-17 (p. 85, pdf 125).

The MO elevations set at or below the lowest historical groundwater level appear to be based on the assumption that groundwater storage in the Vina Subbasin must be allowed to decline at the Historical baseline rate until 2030. The historical annual rate of groundwater decline is part of the sustainable yield calculation that assumed that 21 feet of decline will occur between 2030 and 2042, or 1.75 feet per year for 12 years, without implementation of the GSP projects in Table 5-1. The Historical baseline change in annual groundwater storage is -19,600 afy (Table 2-8, p. 123, pdf 163), which yields an average of -11,200 afy/f.

The reasoning for setting the MO elevations below the historical groundwater levels even for RMS wells that have a slight downward project misrepresents the baseline condition of the subbasin groundwater levels as evidenced in the RMS well hydrographs (AquAlliance Exhibits 1-1 to 1-3). **The Vina Subbasin MOs should be raised to a level that is consistent with the current groundwater conditions in the subbasin, not the conditions that would occur without any sustainability management.**

4. The Final Vina GSP sets the MTs for unreasonable results in the management of groundwater levels at depths that can result in an unspecified number of the domestic wells going dry for sustained periods, if not permanently (Section 3.3.2, pp. 145 through 147, pdf 185 through 187). In the Final GSP's response to comments that expressed concern …*that the MT and MO are set too low to protect against undesirable results to domestic well owners, groundwater dependent ecosystems, and stream flows*, the Master Response in Appendix 1-F (Appendices pdf 136 through 138) stated that it was …*impractical…*to manage a groundwater basin…*in a manner that fully protects the shallowest wells.* The Vina GSP in setting the MTs reasons that …*the lowering of groundwater levels during two or more consecutive dry and/or critically dry year types is not considered significant and unreasonable and therefore not considered an undesirable result, as long as the groundwater levels rebound to levels greater than the MT following those consecutive dry and/or critically dry years* (Section 3.3.2, p. 146, pdf 186).

   The Vina GSP doesn't provide any statistics on the number of shallow wells that will be affected by the MOs and MTs. Appendix 3-B (appendices pdf 293 through 310) does provide graphs showing the well depths associated with each RMS monitoring well, along with the ground surface, MO, and MT elevations, but leaves it to the reader to determine the number of wells that might go dry. In the Draft Vina GSP, a statement was made that for the Chico Management Area …*the MT for all RMS wells was based on the 15 percentile of total well depth for wells completed after 1980* (Draft GSP p. ES-8). For the Final Vina GSP, this language on the reasoning for the MTs in the Chico Management Area was removed (p. ES-13, pdf 32), but the final MO elevations in Table 3-1 remain the same as the in the Draft GSP

(p. 150, pdf 190). This suggests that Final Vina GSP MOs levels for the Chico Management Area are still going to make the 15th percentile of the domestic wells susceptible to going dry. The Final GSP does state that the graphs in Appendix 3-B … *were used to identify the MT that would be protective of the majority of the domestic wells in the RMS zone while recognizing the RMS well is not fully representative of wells within the zone due to changes in ground surface and water surface elevation throughout the area* (p. 147, pdf 187). **So, apparently some type of statistical analysis of well depths was done in setting the MT elevations, but that analysis isn't be made available for public review.**

The number of domestic wells that will go dry under the MTs for the other two management areas is unstated but not apparently unknown (Section 3.3.2, p. 15 through 147, pdf 185 through 187, and Appendix 3-B graphs). Appendix 3-A provides figures that show the average depth of domestic, irrigation and public water supply wells for each section in the Vina Subbasin using different colors. Unfortunately, the domestic well figure in Appendix 3-A (Appendices pdf 290) uses barely discernable changes in tints of yellow to identify wells in the uppermost 200 feet, which is the depth range where the MTs will likely affect the most domestic well owners, and the figure doesn't associate these averages to the RMS groundwater wells or well polygons (see Appendix 3-B for maps of polygons around each RMS well). Again, the Vina GSP leaves it to the public to determine how many domestic wells will be impacted by the proposed management plan.

5. The Vina GSP states *[t]he Sustainable Management Criteria (SMC) for Chronic Lowering of Groundwater Levels is based on groundwater levels throughout the Vina Subbasin that would support sustainably constructed domestic wells.* The GSP defines in Section 3.3.2 (pp. 145 through 147, pdf 185 through 187) the meaning of "*sustainably constructed*" to include:
    - Wells that have been installed following the relevant County Well standards within permeable aquifer material,
    - Wells have been appropriately maintained (e.g., well problems are not due to clogging of well screens or silting of well), and
    - Wells installed after 1980.

    The Vina GSP also adds a condition to the meaning of "*undesirable result*" that states [*e]xceeding the MT may lead to significant and unreasonable effects during drought years and impacts to domestic wells and other groundwater uses may occur and would not constitute an Undesirable Result. Local and state drought response play a role in addressing dry year impacts. However, once a drought period ends, it is anticipated that groundwater conditions should return to the MO levels* (p. 146, pdf 186). Apparently, the final plan intends to leave management during the drought years to the local and state governments.

6. The Vina GSP states that *[f]rom a policy perspective, sustainably constructed domestic wells going dry during non-dry year conditions would be a "significant and unreasonable" undesirable result of groundwater management* (p. 145, pdf 185). By this reasoning, wells going dry during *dry years* is not considered *significant and unreasonable*.

The Vina GSP defines the MT for Undesirable Result for the Chronic Lowering of Groundwater Levels as occurring when:

> *Two RMS wells within a management area reach their MT for two consecutive years of non-dry year-types.*

This exclusion of dry and critically dry water years from the MT definition, along with the requirement that two RMS wells exceed their MTs for two consecutive years, raises several questions:

- Why is the loss of domestic wells, or agricultural wells, from lowered groundwater levels or changes in water quality during dry and critically dry water years considered a beneficially sustainable management practice, instead of a significant and unreasonable negative impact to the well owners?
- Why are the MTs for groundwater levels not being set to prevent impacts to domestic wells during periods of drought, i.e., dry and critically dry water years?
- Does the non-dry water year standard for groundwater levels mean that the Vina Subbasin GSAs won't sustainability manage the subbasin during droughts? Is that the responsibility of local and state governments?
- Don't Water Codes 106, 106.3(a) and 106(b) require that the Vina Subbasin GRAs establish GSP policies that prioritize and protect domestic water supply for all types of water years? If not, why not?
- Why do the Vina Subbasin GSAs assume that the groundwater levels "should" rise above the MT elevations and readily return to the MOs with a non-dry water year?
- From the historical data and simulation of future conditions, how many years does it take for groundwater to rise from the lowest levels near the MTs back up to the MO elevations (see Figures 2-17 and 2-43, pp. 85 and 137, pdf 125 and 177)? Does this duration validate the exclusion of dry years from the definition of an undesirable result for the chronic lowering of groundwater levels?
- During the years it takes for groundwater levels to rise from the MT to the MO elevations, how may domestic wells will remain dry?
- During the rise from the MTs' elevations, why can't groundwater levels fall back below the MTs with intermittent dry years that last less than two years still be considered an undesirable result? In other word, if groundwater levels oscillate above and below the MTs for years, why isn't that an undesirable result?
- Why is the dewatering of a domestic and/or small agricultural well for less than 2 consecutive years considered a beneficially sustainable practice that's in compliance with Water Code Sections 106 and 106.3(a)?
- Why is dewatering of domestic and/or small agricultural wells that might occur cyclically each summer considered a beneficially sustainable practice and who is benefitting? Certainly not the small landowner.
- Why does the SMC require that two RMS wells exceed their MTs for two consecutive non-dry years? If domestic and/or small agricultural wells in only one RMS polygon

go dry repeatedly for two years or dry every other year, why is that considered a beneficially sustainable management practice?

- Do the two RMS wells in a group have to be adjacent or can they be discontinuous or spread across the subbasin?
- Can more than two RMS wells be part of a group?
- Can there be more than one group of two RMS wells in a management area?
- What is the start date of the 2-consecutive-year clock? Does it start on the earliest day that one of the two, or more, wells exceeds its MT, on the day the last of the wells in the group exceeds its MT, or some other intermediate date?
- What happens to the start date of the 2-consecutive-year clock if additional RMS wells exceed their MTs after the day of the minimum of two wells needed for a group? In other words, does the start date begin anew when a well is added to an existing group?
- Are additional wells made part of the existing group or does a new group have to be formed once there are enough additional wells to make another two-well MT exceedance group?
- If there are multiple two-well MT exceedance groups, how is the determination of an undesirable result made if the exceedance in any one group is less than 2 years, but the combined duration of the exceedance for all groups is greater than 2 years?
- Do the wells assigned to a group stay in the same group forever, or do the wells in a group change when there are fewer than two wells exceeding their MTs, or the 2-year clock stops?
- What happens to the start date when the first two-well group is spread across the subbasin, and additional MT exceedance wells are next to each other around a local pumping depression but within the first group's larger area?

7. The Vina Subbasin MT elevations for the 17 RMS groundwater level wells were established based on: [*p*]*otential impacts and the extent to which they are considered "significant and unreasonable" were determined by the GSAs Boards of Directors with input from the SHAC and members of the public* (Section 3.3.3, p. 144, pdf 184). The GSP doesn't provide specifics on the reasoning for the MT elevation at each RMS groundwater well, except for possibly the Chico Management area, where the Draft GSP stated the MT elevation of 85 feet was set for all wells in the management area based on the depth of …*15 percentile of total well depth for wells completed after 1980* (Draft GSP p. ES-8).

   The MO elevations were set above the MT to allow …*for a range of active management to achieve the sustainability goal and prevent undesirable* results. This range of active management between the MT and the MO is referred to as the *margin of operational flexibility* (MOF) (Section 3.3.3, p. 144, pdf 184). Using the basin-wide change in storage, -11,200 afy for each 1-foot decline in groundwater level[3], and the proportion of each

[3] Basin-wide change in storage per foot of groundwater decline estimated from historical change in storage of -19,600 afy (Table 2-8, p. 123, pdf 163), and average historical decline of 21 feet for 12 years, or 1.75 feet per year (Section 2.3.6, pp. 138 and 139, pdf 178 and 179). (-19,600 afy / 1.75 ft/yr = -11,200 afy/f)

management area to the total subbasin area, an estimate can be made of the average volume of groundwater stored in the MOF for each management area. AquAlliance Exhibit 2 is a modification of Table 3-1 (p. 150, pdf 190), which shows the MO and MT elevations and depths, and the averages for each management area. The MO minus MT (MO – MT) storage volume, the MOF, is calculated based on the proportion of each management area to the subbasin whole area. For example, the North Management Area is 112 square miles (sq. mi.) out of a total of 289 sq. mi. for the Vina Subarea, or approximately 38.9% of the subbasin area, with an average decline from the MO to the MT of -67 feet causing a change in groundwater storage volume of -290,453 af.

The total basin-wide change in volume when groundwater levels decline from the MOs to the MTs is approximately -637,784 af. AquAlliance Exhibit 3 is a modification of Figure 2-43 (p. 137, pdf 177), which shows the simulated changes in groundwater storage for the Current and future 2030 and 2070 scenarios. Overlain on this graph are lines that give an estimate of the average slope of the annual change in storage during 2070 scenario drought years. The 2070 scenario drought years' changes in storage range from -41,000 afy to -107,000 afy with an average of -78,800 afy.

Using the average change in storage for 2070 scenario drought years of -78,800 afy and the total MOF storage volume of 637,784 af, the Vina GSP will allow groundwater levels to decline for 8 continuous years before the MTs are reached (AquAlliance Exhibit 2). An unreasonable result from the decline in groundwater levels won't be declared for another two years or more because of the definition of an MT (p. 145, pdf 185). When combined with the Historical baseline loss in groundwater storage since the year 2000 of 372,400 af, the Vina GSP will apparently **allow a loss of groundwater storage, and the associated decline in groundwater levels, of over 1-million acre feet before a significant and unreasonable reduction of groundwater storage triggers the need to declare an undesirable result** (372,000 afy + 637,784 afy = 1,009,784 af).

The MO and MT elevations for the Vina Subbasin are apparently established to allow for a period of drought lasting 10 years before management of the subbasin is considered unreasonable. A GSP that's designed to allow for impacts from a decade of continuous drought before needing to take management actions and/or implement corrective sustainability projects is likely not consistent with the SGMA meaning of sustainable management that protects all the beneficial uses and users in the Vina Subbasin.

8. An alternative to setting the MT depths to accommodate a decade of drought would be to assume that sustainable management of the Vina Subbasin would plan for the decline in groundwater levels and storage from 3 years of continuous drought years, dry and critically dry water years, with the assumption that a temporary surplus from non-dry water years would be available to buffer the impacts from longer periods of drought. Using the average loss in storage for a drought year of -78,800 afy, and the ratio of MO – MT storage in each Management Area to the total basin MOF storage, an estimate can be made of the volume of storage lost during 3 years of drought (see bottom table of AquAlliance Exhibit 2). Using

the estimated basin-wide change in storage volume of -11,200 afy/f, the average decline in groundwater elevation from 3 years of drought can be calculated for each management area. The 3-year-drought groundwater elevation declines range from approximately 25 to 7 feet, which are approximately 1/3 of the current MO – MT distance.

The conclusion we reach about the Vina GSP MO and MT elevations is that they should be set higher. For example, the MO elevations should be set at the average of the RMS water levels during the most recent decade, which would raise the elevations approximately 5 to 15 feet. The MT elevations could then be set to accommodate 3 years of drought at elevations averaging 7 to 25 feet below the new MO elevations depending on the management area. The MT should also be changed to trigger an undesirable result when groundwater level declines below the MT elevation for one year in only one RMS well. This would reduce the number of domestic and small agricultural wells that will go dry during droughts and create the need for sustainable management actions and projects to create a sustainable groundwater resource for all users and all beneficial uses. Note that the MTs may need to be higher than the 7 to 25 feet we suggest because of the impacts on interconnected surface waters, groundwater dependent ecosystems (GDEs), and possibly water quality and inelastic land subsidence.

9. The change in groundwater storage with the 2070 scenario isn't the only sustainability indicator that's important to the management of the Vina Subbasin. AquAlliance Exhibits 4 and 5 are modifications of the Groundwater Budget in Table 2-8 and the Land and Surface Water Budget in Table 2-7, with columns added that calculate the difference between the Historical and Current water budgets and the future scenarios. Row numbers and column letters have been added to facilitate discussions.

   Although the Vina GSP water budgets assume that groundwater pumping will decrease with the 2070 scenario by 5,500 afy from the Historical baseline (AquAlliance Exhibit 4, row 19, column I), the net stream gains (stream gains from groundwater (accretion) minus stream seepage to groundwater) will decrease 6,300 afy from the Historical baseline (row 27, column I). This is an approximate **36.8% reduction in stream** flow from the Historical baseline with the 2070 scenario (row 27, column J), and a ratio of the change in net stream gains to change in groundwater pumping of 114% (row 28, column I). Why does a decrease in pumping result in an increase in losses to interconnected streams?

   The stream seepage to groundwater increases approximately 17%, 3,600 afy, with the 2070 scenario (row 11, columns I and J), while the stream gains from groundwater decreases 73%, -2,700 afy, (row 23, columns I and J). Both reduce stream flows. By itself, the loss of stream flow when pumping is reduced seems contradictory. So, what changes in other water budget components are causing this stream flow loss? The only one that is obvious is an increase in the western boundary outflow of groundwater by 9,500 afy, or 17% (row 24, column I and J). The Vina GSP describes the western boundary net outflows as representing the …*Sacramento River gains from groundwater and subsurface outflows to the Corning*

Subbasin. The split between these outflows is uncertain at this time and identified as a data gap (p. 125, pdf 165).

As noted in Comment No. 1, the sustainable yield should be calculated to prevent undesirable results for all the sustainability indicators. The decrease in groundwater pumping with the 2070 scenario causes a significant decline in the interconnected surface water flows, and therefore the sustainable yield as calculated using only change in storage is invalid. Logic suggests that the rate of pumping for an actual sustainable yield would have to be below the current estimate of 233,500 afy to prevent future losses of interconnected stream flows. How much reduction would depend on the complexity of the Vina Subbasin groundwater system and the interactions with the neighboring subbasins. Multiple groundwater model runs would likely be needed to find a future pumping rate under the 2070 Climate Change conditions that doesn't create additional losses to interconnected streams and other surface water features.

10. An issue raised in the comments on the Draft GSP is the fact that declining groundwater levels as proposed by the MOs and MTs will cause significant impacts to interconnected surface waters and Groundwater Dependent Ecosystems GDEs, but the monitoring network in the Vina GSP can't adequately measure the impacts to these resources. The Master Responses to Comments on Interconnected Surface Waters (ICWs) and Groundwater Dependent Ecosystems acknowledges the need for additional data and for monitoring stations to characterize the relationship between shallow groundwater conditions, groundwater pumping, surface water depletions, and GDEs to evaluate impacts to environmental users, such as listed aquatic species, plants, river flows and timing, or water temperatures (Appendix 1-F, pp. 4 through 7, pdf 138 through 141)]. Yet this acknowledgement of a lack of data to make informed decisions on the sustainability management criteria for ICWs and GDEs didn't prevent the Vina GSAs establishing groundwater level MOs and MTs that are lower than historical levels and allow for a decade of drought before triggering an undesirable result due to declining groundwater levels.

    This doesn't seem to be consistent with the intent of SGMA. That is, the requirement to use the best available information and best available science in support of developing the GSP sustainability criteria doesn't mean that the sustainability criteria can be set at unreasonable levels when there is a lack of information or science about the resource being managed (WC 113, T23 Section 355.4(b)(1)). An assumption with development of any functioning and effective management plan and monitoring program is that minimal information is needed to make reasoned decisions**. If information is lacking to make informed decisions, then an interim management plan should be designed to prevent negative impacts to the resource(s) until the monitoring network and basic data collection are adequate to make scientifically based decisions.**

    The Vina GSP is setting sustainability criteria for the high priority SGMA ranked Vina Subbasin with MOs and MTs that allow groundwater levels to decline below historic conditions, which would logically cause negative impacts to domestic and small agricultural wells, tribal areas, disadvantaged communities, interconnected surface waters, GDEs, and possibly water quality and subsidence. This is being done without a reasonable level of scientific knowledge of the conditions in the subbasin or what potential impacts might occur from these uniformed sustainability criteria, and without monitoring to measure the impacts. A normal approach to writing a management plan for a resource that is being negatively impacted, where there are insufficient data to make informed decisions, is to not expect that continuing the status quo will result in improved conditions. The message from the Vina Subbasin GSAs seems to be that obtaining adequate knowledge about the impacts to these resources and communities isn't that important and shouldn't change how the subbasin in being managed.

11. The Vina GSP estimated the interactions between groundwater systems and surface water features within the Vina Subbasin at a basin scale, with the Butte Basin Groundwater Model (Section 2.2.6.3, pp. 100 through 103, pdf 140 through 143). The GSP classified the hydraulic connection between streams and rivers as either *gaining, losing, or disconnected* (p. 94, pdf 134), depending on the elevation of groundwater relative to the stream. When the water table elevation adjacent to the stream is above the elevation of water in the stream, groundwater can flow into the stream, i.e., *gaining* reach, or accretion. When the water table elevation is below the elevation of the stream, the stream can lose water to groundwater system, resulting in a *losing* reach. The third term, *disconnected*, denotes the opposite of a connected stream which SGMA defines as …*surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted* (CCR T23, Section 351(o)). While SGMA's definition of a connected stream is partially correct, it misrepresents the facts on how streams and groundwater interconnect and the fact that interconnection can still occur when there is an unsaturated zone beneath the stream.[4]

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[4] See these articles about how the disconnection of streams and groundwater results in maximum stream flow losses that spread as the groundwater depression enlarges.

- Brunner P., Cook P. G., and Simmons C. T., 2009, Hydrogeologic controls on disconnection between surface water and groundwater, Water Resources Research, v. 45, W01422, pgs 1-13. https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2008WR006953
- Brunner P., Cook P.G. and Simmons C.T., 2011, Disconnected Surface Water and Groundwater: From Theory to Practice, Ground Water, v. 49, no. 4, pgs 460-467. https://libra.unine.ch/Publications/Philip_Brunner/25762
- Cook P.G., Brunner P., Simmons C.T., Lamontagne S., 2010, What is a Disconnected Stream?, Groundwater 2010, Canberra, October 31, 2010 – November 4, 2010, pg 4. https://www.researchgate.net/profile/Philip-Brunner/publication/266251504_What_is_a_Disconnected_Stream/links/54dfa2c80cf29666378b9e57/What-is-a-Disconnected-Stream.pdf

- Fox G.A. and Durnford D.S., 2003, Unsaturated hyporheic zone flow in stream/aquifer conjunctive systems, Advances in Water Resources, v. 26, pgs. 989-1000. http://www.geol.lsu.edu/blanford/NATORBF/5%20Modeling%20Papers%20of%20Groundwater%20Flow%20of%20Stream&Aquifer%20Systems/Fox%20et%20al_Water%20Resources_2003.PDF

Cook and others, 2010, provide a brief paper that discusses …*the most common misconceptions associated with the term disconnected*. They include the following statements found in scientific literature as being …*incorrect as general definitions of disconnected rivers:*

- *in a disconnected system, there is no flow between the river and the aquifer,*
- *pumping under a disconnected stream will not affect streamflow,*
- *a river is disconnected if an unsaturated zone separates the river from the aquifer,*
- *a river is disconnected if the water table is below the streambed*

Cook and others, 2010, note that as …*the groundwater table is lowered sufficiently, an unsaturated zone begins to develop.* As the groundwater level continues to decline, the infiltration rate from the stream is no longer linearly related to the rate of decline in the water table, and the infiltration rate out of the stream transitions from connected to disconnected. With continued decline in the water table, the unsaturated capillary zone beneath the stream no longer intersects the base of the stream, so that further decline in water table no longer affects the infiltration rate, and the pressure head beneath the base of the stream reaches a constant value. At this point the stream is now considered to be disconnected at that location. *The infiltration rate at disconnected will depend on the thickness and hydraulic conductivity of the clogging layer, and the surface water depth.* However, even *[a]t a site that was believed to be disconnected, the streamflow was generally declining*. That is, the stream is losing water at a constant rate until it becomes dry. A better description of a disconnected stream would be a *losing-disconnected stream*.

It is important to point out that the assertion in SGMA that a disconnected stream is no longer an interconnected surface water feature and groundwater pumping can't affect stream flow is scientifically invalid. Cook and others, 2010, point out that:

> *Even though lowering the groundwater table at a specific point under a disconnected system will not increase the infiltration rate directly, it is not correct to assume that additional pumping will not affect a disconnected river on a larger scale. Increased groundwater pumping will result in a widening of the cone of depression, and this can extend the length over which the river is disconnected (Fox and Durnford, 2003).*

A scientifically correct description of groundwater and surface water interactions is critical to understanding the implications for managing the groundwater and surface water resources of the Vina Subbasin, SGMA regulations notwithstanding. The Vina GSP states that [*a] disconnected system is also present when the stream is dry and therefore cannot interact with the underlying water table*, and …*that an overlying surface water that is "completely depleted" does not represent an interconnection with the underlying* *groundwater* (Section 2.2.6, p. 94, pdf 134). This assumption is incorrect if any portion of the stream still has surface water flow, and managing a subbasin under this assumption can result in significant harm to the stream environment, its wildlife, and its habitats.

Even though a stream is dry at one location it doesn't mean that it is disconnected from the shallow aquifer system. As groundwater levels decline, the point in the stream where it begins to dry out migrates further downstream. For example, the Vina Subbasin has gaining, losing, and mixed reaches (see Figure 2-27, p. 102, pdf 142). As groundwater levels decline to the MT depths, averaging more than 60 feet below the MOs in the North and South Management areas, the point in the stream where gaining flow starts will move further westward and downstream, producing greater lengths of losing stream and more loss of flow. Small changes in groundwater elevation can result in long sections of stream transitioning from gaining to losing. For example, for land surface that has a slope of 1 foot of elevation rise to 500 feet of horizontal distance, a typical slope of the land in Vina Subbasin west of Highway 99 (Figure 2-2, p. 47, pdf 87), every one foot of groundwater decline can cause 500 feet of downstream migration of the losing-to-gaining transition point. The transition from gaining to losing causes the loss in stream flow to increase to a maximum before the stream goes dry. The downstream migration of the losing-to-gaining transition point will decrease the flow of the stream and potentially cause significant harm to surface water, wildlife, habitats, and water rights. The reduction in net stream flow gain with the 2070 scenario (AquAlliance Exhibit 4, row 27, columns I and J), is clear evidence that the decline in groundwater levels proposed by Vina GSP will likely cause significant harm to the beneficial uses and users of interconnected surface waters.

This is a significant impact to the streams in the Vina Subbasin that increases as the groundwater levels decline from the MO elevations, which increases the length of stream channel that becomes disconnected**. The Vina GSP is incorrect in assuming that when a stream becomes disconnected, actions to management groundwater levels are no longer needed**. Declines in groundwater levels can still cause a significant impact on the stream flows. The GRAs' management actions now proposed in the Vina GSP are insufficient to sustainably protect interconnected stream flows, and the associated wildlife, habitat, and vegetation.

12. The Vina GSP identified only salinity as a Contaminant of Concern (COC) for the subbasin (Section 3.5, pp. 151 through 154, pdf 191 through 194). The plan does identify the locations of historical and current contaminant cleanup sites and lists contaminants at nine active cleanups (Section 2.2.4.2 and Figure 2-18, pp. 86 through 89, pdf 126 through 129). The sources of the contaminants are mostly solvents from dry cleaners and metal manufacturing, with some underground fuel storage and landfills. The GSP fails to discuss the long-term nitrate problems in and around the City of Chico. The Vina GSP water quality RMS well network is made of 8 wells (Tables 4-7 and 4-8, and Figure 4-6, pp. 185 and 187, pdf 225 and 227). AquAlliance Exhibit 6 is a composite of the contaminant map Figure 2-18 overlain with the Vina RMS water quality well locations in Figure 4-6.

AquAlliance Exhibit 6 shows that except for the one RMS water quality well in the Chico Management Area, the Vina Subbasin RMS water quality wells are distant from the known contaminant sites and don't appear to be aligned with the down-gradient flow paths from those sites. For groundwater elevation contours, (see Figures 2-10 through 2-13, pp. 75 through 78, pdf 115 through 118). The screened intervals for the RMS water quality wells range from 484 feet below ground surface (ft-bgs) to 1,030 ft-bgs (Table 4-7). It is apparent from the design of the Vina Subbasin RMS water quality well network that it isn't intended to monitor shallow aquifer contaminants that might impact domestic wells, either natural or from the known cleanup sites.

The Vina GSP assumes that …*point-source contaminants are managed and regulated through a variety of programs by the Regional Water Quality Control Board (RWQCB, DTSC, and the USEPA). Through coordination with existing agencies, the Vina Subbasin GSAs will know if existing regulations are being met or groundwater pumping activities in the Vina Subbasin are contributing to significant and unreasonable undesirable effects related to degraded water quality from these constituents* (p. 152, pdf 192). The GSP identifies in Table 5-1 two planned projects that will purportedly benefit water quality — 5.2.3.4 - Community Water Education Initiative, and 5.2.3.5 - Fuel Management for Watershed Health (pp. 196 and 197, pdf 236 and 237).

The Community Water Education Initiative would …*expand on community outreach and education associated with water-related topics and issues of the region* and …*focus on topics such as regional groundwater issues, connectivity of surface and groundwater, decision-making during drought years, basic aquifer knowledge, and more, and target agricultural well users, domestic well users, and municipal customers. The scope would also include technical seminars and field trips, as well as creating educational materials such as fact sheets, printed materials, and website content.* The connection between groundwater quality and the Fuel Management for Watershed Health project is unspecified in the GSP.

The Vina GSP groundwater quality monitoring program appears to be designed to actively monitor only the deepest aquifer zone for one COC, salinity. Monitoring shallower aquifer zones where most domestic wells are screened is apparently assumed to be the responsibility of other government agencies, RWQCB, DTSC, USEPA, or state and local health departments. The GSP seems to assume that monitoring the domestic well water quality will somehow occur without actually identifying who will conduct the monitoring, where it will be done, or how it will be reported. The GSP states that the GRAs will coordinate with the other government agencies to …*know if existing regulations are being met or groundwater pumping activities in the Vina Subbasin are contributing to significant and unreasonable undesirable effects related to degraded water quality from these constituents.* However, the GSP doesn't discuss what management actions will be taken if groundwater pumping in the Vina Subbasin is causing significant and unreasonable degradation of water quality. The GSP doesn't state what the MOs or MTs are for the subbasin's natural and contaminant cleanup site COCs, except for salinity. The GSP doesn't state what management actions might be taken to remediate contaminated wells or mitigate the spread of COCs. The GSP doesn't mention that there are existing groundwater quality standards for the subbasin in the Sacramento River Basin Water Quality Control Plan[5] or the full primary and secondary drinking water standards of Title 22.[6]

The Vina GSP fails to clearly state the role of the GSAs in protecting water quality for all beneficial uses and users. In particular, the protection of domestic water supply must be the primary concern for managing the subbasin (WC 106.3(a)). SGMA empowers the GSAs with the authority to control pumping rates and locations throughout the subbasin to protect all beneficial uses and users of groundwater, an authority over groundwater resources that other regulatory agencies don't possess. This is likely the reasoning behind the recent Governor's Executive Order N-7-22.

This Governor's Executive Order N-7-22 requires that written approval be obtained from the GSAs of any medium- or high-priority subbasin before a permit for any new well or alteration of an existing well can be issued. The GSAs must verify that the groundwater extraction by the proposed well would not be inconsistent with any sustainable groundwater management program established in any applicable GSP adopted by that GSA and would not decrease the likelihood of achieving a sustainability goal for the basin covered by a GSP. In addition, the GSAs must verify that the new well or alteration of an existing well is not likely to interfere with the production and functioning of existing nearby wells, and not likely to cause subsidence that would adversely impact or damage nearby infrastructure.

The Vina GSP groundwater quality management program has failed to meet the monitoring objectives of SGMA that require that a GSP have a network to monitor … *the impacts to the beneficial uses or users of groundwater* and … *collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues* (CCR T23, Sections 354.34(b)(2) and 354.34(c)(4)). Instead, the Vina GSP limits the water quality monitoring to one constituent, salinity, and uses only wells screened in the deepest aquifer zone, at locations that aren't down gradient from known site of contamination. The GSP places the responsibility for the monitoring and protection of domestic wells on other government agencies without demonstrating that programs actually exist to collect sufficient spatial and temporal data to determine groundwater quality trends across the entire subbasin. Finally, the GSAs' management actions and projects don't specifically address measures that might be taken to remedy or mitigate the spread of COCs.

13. The Vina GSP monitoring program for land subsidence will use a network of 19 GPS land survey monuments in the Vina Subbasin managed by DWR (Section 1.6, p. 37, pdf 77). Although Butte County has three extensometers, **none of the extensometers are in the Vina Subbasin**. Figure 2-19 (p. 92, pdf 132) shows the locations of the Vina Subbasin

[5] https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/sacsjr_201805.pdf
[6] https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chemicalcontaminants.html

subsidence GPS monuments. Table 2-4 (p. 91, pdf 131) gives a summary of the cumulative and average annual subsidence from 2008 to 2017 measured at the GPS stations and measured by Interferometric Synthetic Aperture Radar (InSAR) between 2015 and 2019. InSAR data presented in Figure 2-20 (p. 93, pdf 133) show a …*distinction between changes in elevations observed on the northern and eastern flanks of the Vina Subbasin versus changes observed in the center* (p. 91, pdf 131). AquAlliance Exhibit 7 is a composite map of the InSAR subsidence data in Figure 2-20 overlain with the subsidence GPS monument locations and measurements in Figure 2-19. This exhibit shows that the amount of land subsidence to date aligns with the areas identified by InSAR.

The Vina GSP states that there are no records of land subsidence caused by groundwater pumping in the Vina Subbasin (p. ES-8, pdf 27). Elsewhere, the GSP states that a 2019 review of the subsidence data found changes in ground surface elevations were slight and remained at or above baseline levels, concluding that the non-observance of inelastic land subsidence …*is likely due to historically relatively stable groundwater levels and subsurface materials that are not conducive to compaction. For this reason, inelastic land subsidence due to groundwater pumping is unlikely to produce an undesirable result in the Vina Subbasin* (p. 155, pdf 195).

The Vina GSP doesn't set any numerical values for inelastic land subsidence MO or MT, apparently because of the assumption that subsidence will not occur in the Vina Subbasin. Instead, the Vina GSP will use the groundwater level SMCs as a proxy for land subsidence. The use of the groundwater level MOs and MTs for land subsidence appears to set multiple subsidence standards across the subbasin like those for groundwater (see Table 3-1 and AquAlliance Exhibit 2). The land subsidence MO is the same as the MOs for groundwater levels:

> *The groundwater level based on the groundwater trend line of the RMS well for the dry periods (since 2000) of observed short-term climatic cycles extended to 2030.*

For the land subsidence MTs and the quantitative undesirable result threshold for land subsidence, the MT is the same as for groundwater levels:

> *Two RMS wells within a management area reach their MT for two consecutive years of non-dry year-types.*

Concerns have been expressed above in Comment Nos. 3 through 6 that the groundwater level elevations of the Vina Subbasin MOs and MTs are set too low to be protective of all beneficial uses and users, and therefore will not result in a sustainably managed groundwater subbasin as defined and required by SGMA. Setting the MT elevations far below the historical lowest levels may cause inelastic land subsidence not seen in the subbasin.

If the GSAs believe that land subsidence won't occur in the Vina Subbasin, then the MO for land subsidence should be set at the numerical value of zero. The MT value should be a numerical value that is less than the vertical displacement that would result in damage or harm to infrastructure in the subbasin including bridges, canals, pipelines, rail lines, highways, levees, building, homes, etc. The GSAs should conduct engineering inspections and provide analyses of the subbasin infrastructure to determine how much settlement has occurred to date and how much more can tolerated before structural damage occurs.

The Vina Subbasin land subsidence MT should be set at a value that incorporates a factor-of-safety that would allow time for management actions to stop any subsidence before the structures are damaged and in need of repair or replacement. In addition, the MOs and MTs for land subsidence should be measured and evaluated for all water year types, not just non-dry years. The use of the groundwater level MT will apparently require that the MT for subsidence be exceeded at two or more monitoring stations for two consecutive, non-dry years before an undesirable result can be declared. This will delay the recognition of land subsidence and will likely cause more permanent subsidence and structural damage, not less.

The decline of groundwater levels in Vina Subbasin during drought years could be a major cause of land subsidence. A land subsidence sustainability standard that doesn't require management actions during drought years, but does require the GSAs to wait until the area of the problem is extensive and the magnitude large before an undesirable result is declared, isn't consistent with the sustainability goals of SGMA.

The Vina GSP assumes that the DWR and NASA's Jet Propulsion Lab will determine the monitoring frequency for data collection at the land subsidence GPS monuments and from InSAR. *Data collected from both sources requires post processing and analysis, therefore the frequency of reporting is dependent on the work performed by DWR and by NASA's JPL. There are no extensometers in the Vina Subbasin* (Section 4.5.2, p. 173, pdf 213). The Vina GSP apparently doesn't set or determine the frequency of land subsidence monitoring or reporting. The frequency of subsidence monitoring should be based on the needs of the subbasin and not a decision left to DWR or NASA.

In addition, the Vina GSP should address how the InSAR data will be used, in particular, how small areas of subsidence identified by InSAR will be evaluated. Small areas of subsidence can cause large and costly structural problems. A sinkhole adjacent to and/or beneath a bridge abutment or a section of levee isn't something that the GSAs should allow to enlarge before taking management actions. The ability of InSAR to measure small areas of subsidence should be seen as an important tool for identifying and preventing large, costly, and possibly irreparable damage to the Vina Subbasin.

Conclusion

Sustainability is not found in the Vina GSP, let alone ***equitable*** sustainability for all residents, farms, businesses, and the environment, which is documented in our October 17, 2021 comments, November 11, 2021 comments (AquAlliance Exhibit 8), and above. There are GSAs in the region that are dominated by large residential and non-residential landowners, many of whom have sought to play in the lucrative water market already to the detriment of their neighbors, streams, rivers, habitat, and species. Sadly, SGMA opened this door further: "Non-residential landowners and future banking partners may find it in their common interest to interpret the legislative intent (74) [7] and lax definitions of safe yield and overdraft provided in the Act (75) [8] based on the opinion in *Los Angeles v. San Fernando*, which encourages drawing down basins to create additional storage space and prevent water 'wasting.'(76) [9] Thus, in addition to potential exports from the Vina subbasin, it is foreseeable that a future GSA will encourage drawdown of the aquifer to satisfy massive crop thirst, which will with intention create extra storage space for imported waters to 'recharge' the subbasin. As a result of future water exchanges and banking, local residents will bear the additional cost of digging deeper wells just to maintain their straws in the aquifer, and will increasingly compete with each other over a diminishing percolated supply while banked supplies increase."[10]

By its own admission, the Vina GSP is bent on pursuing long-held plans by some local water districts, DWR, and the U.S. Bureau of Reclamation to expand conjunctive use through groundwater manipulation, artificial recharge, and potential dam reoperation that will harm the people and environment of the GSA and surrounding region. The draft Plan will not lead to sustainability as required by SGMA, but will allow major groundwater fluctuations, significant well losses, and cost burdens on harmed groundwater dependent farms, homes, and businesses. This was predicted in 2016: "This potential conflict will become acute in the likely scenario where artificial recharge inhibits natural recharge so that it is difficult, if not impossible, to determine the relative quantity of each. Given explicit provisions in the Act and statewide policy favoring storing surface water underground it is not difficult to envision a privately-controlled GSA systematically drawing down percolated groundwater to create

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[7] Keats, Adam et al., 2016. *Not All Water Stored Underground is Groundwater: Aquifer Privatization and California's 2014 Groundwater Sustainable Management Act*. Footnote: *2014 Act, § 10720.1(g) (It is the intent of the Legislature "[t]o increase groundwater storage and remove impediments to recharge.").* p. 106.

[8] *Id. Footnote: 2014 ACT, § 10721(v) ("Sustainable yield" is defined as "the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result."); 2014 ACT, § 10735(a) ("Condition of long-term overdraft" means the condition of a groundwater basin where the average annual amount of water extracted for a long-term period, generally 10 years or more, exceeds the long term average annual supply of water to the basin, plus any temporary surplus. Overdraft during a period of drought is not sufficient to establish a condition of long-term overdraft if extractions and recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.").*

[9] *Id. Los Angeles v. San Fernando 14 Cal. 3d 199, 280 (1975) ("We agree with plaintiff that if a ground basin's lack of storage space will cause a limitation of extractions to safe yield to result in a probable waste of water, the amount of water which if withdrawn would create the storage space necessary to avoid the waste and not adversely affect the basin's safe yield is a temporary surplus available for appropriation to beneficial use. Accordingly, overdraft occurs only if extractions from the basin exceed its safe yield plus any such temporary surplus.").*

[10] *Id.* pp. 106-107.

storage space in the basin, and then replenishing the basin with imported water, with little consideration of the ability for overlying users to access the basin or the long-term health of the surrounding ecosystem.” [11]

For all the reasons discussed in our multiple comments on the Vina Subbasin draft and here on the final GSP, the Plan fails to meet SGMA’s goal of water resource sustainability and protection of the water rights of all beneficial users and uses. In accordance with legal requirements to protect the Public Trust, the Plan also fails. It also appears that the GSP will foist the responsibility to demonstrate damage from undesirable results on the unsuspecting public, creating an impossible burden for all but the large water districts with deep pockets. Therefore, the Plan must be rejected by DWR and the SWRCB.

Respectfully submitted,

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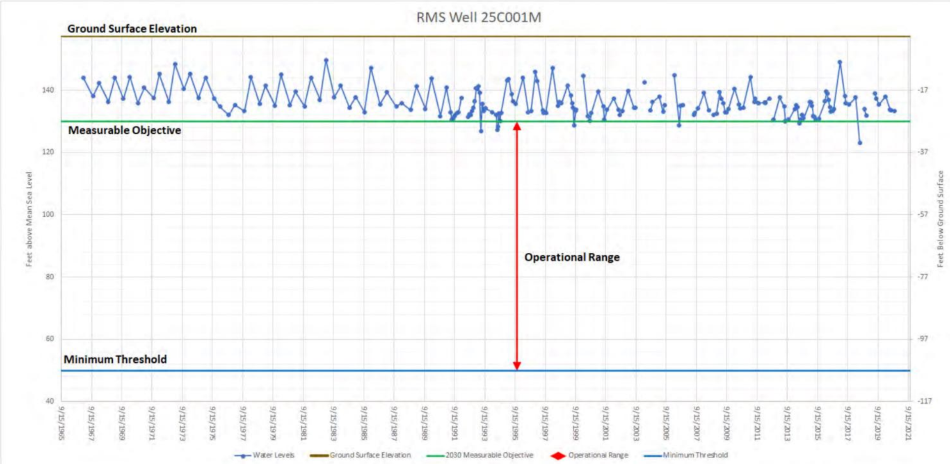
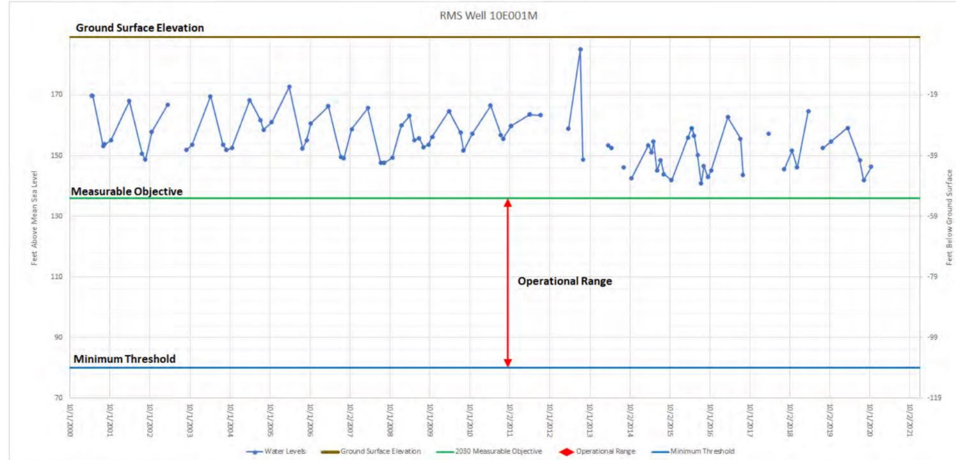
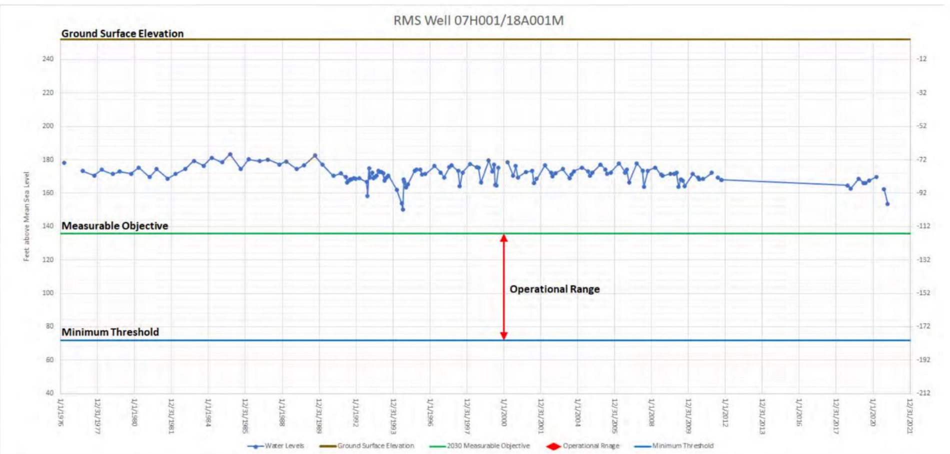
[11] *Id.* pp. 98-99.

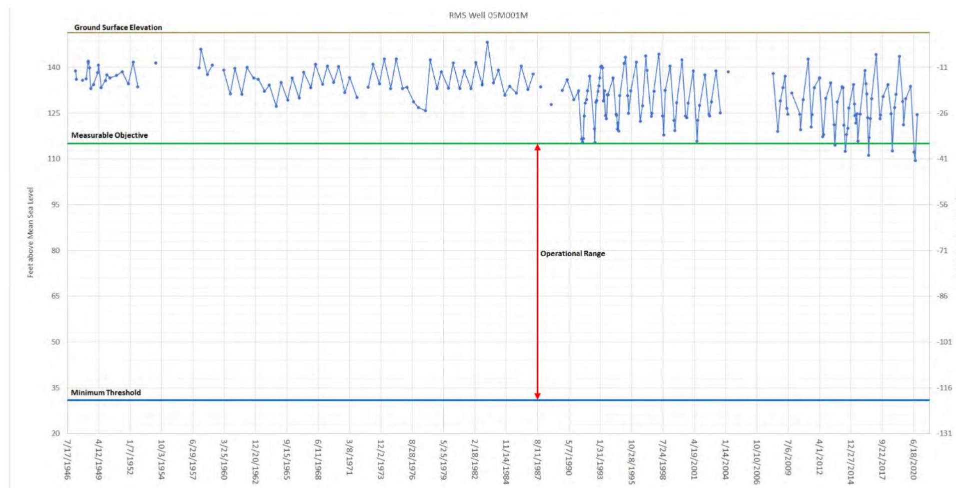
Vina Subbasin North Management Area RMS Wells - Appendix 3C

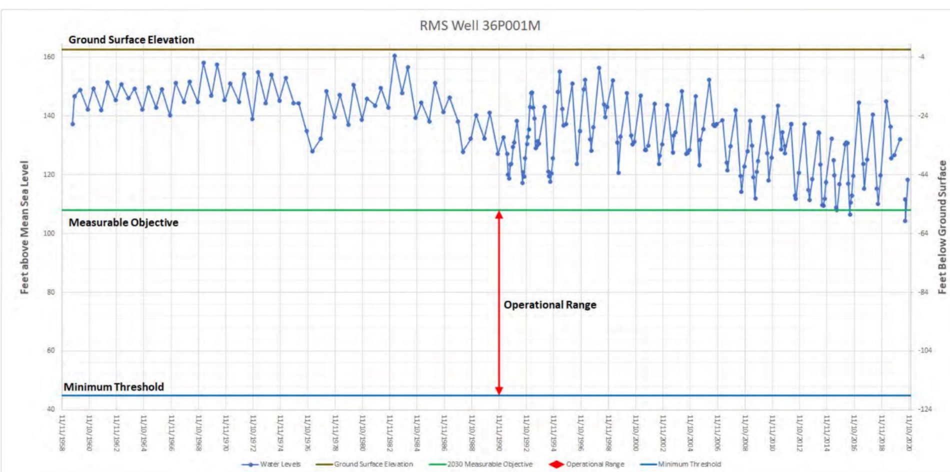
AquAlliance Exhibit 1-1

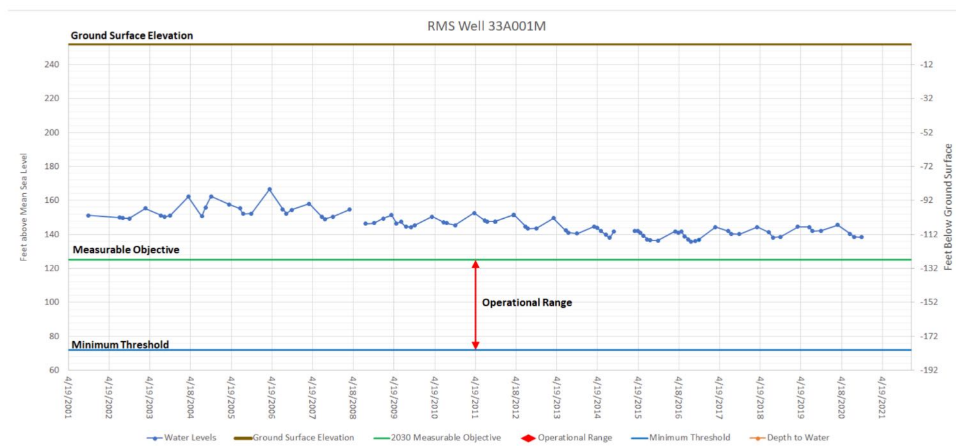






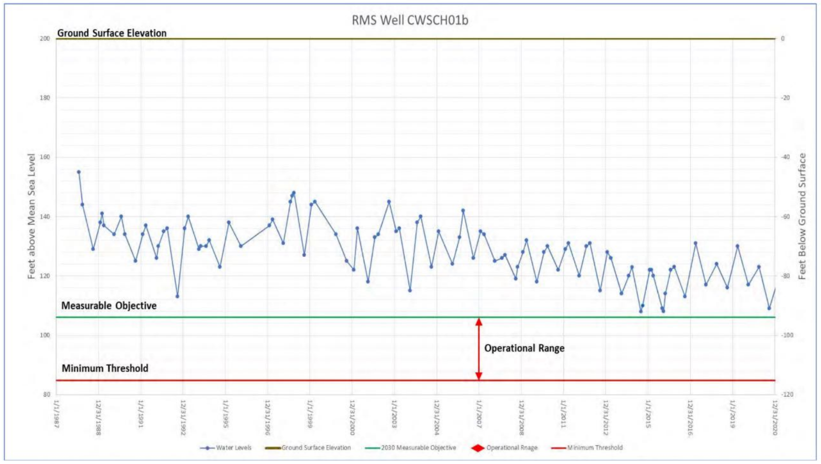


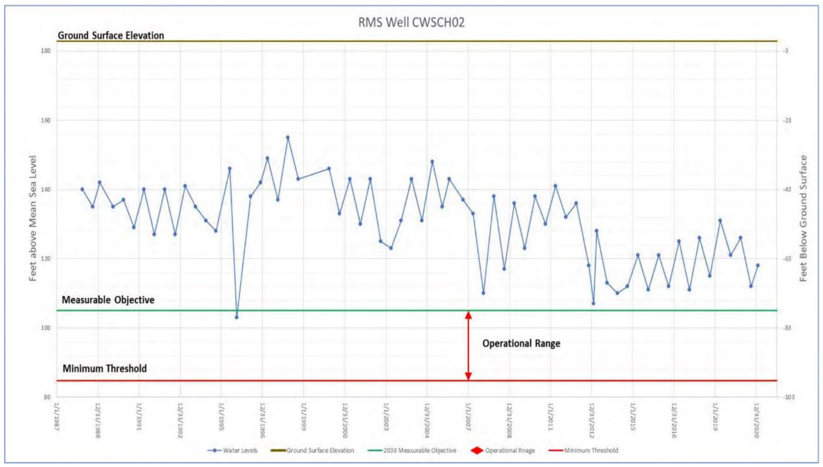


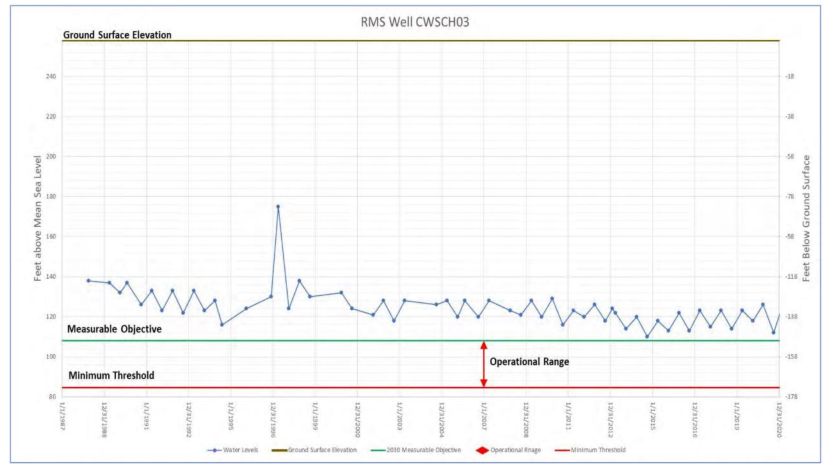


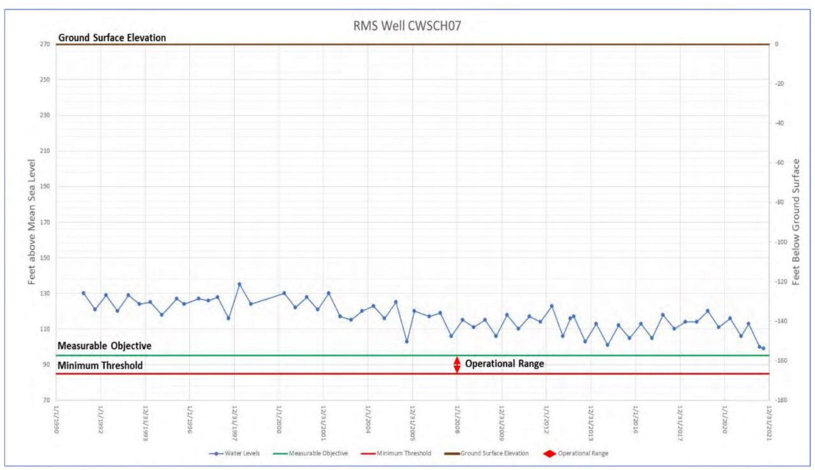
AquAlliance Exhibit 1-2

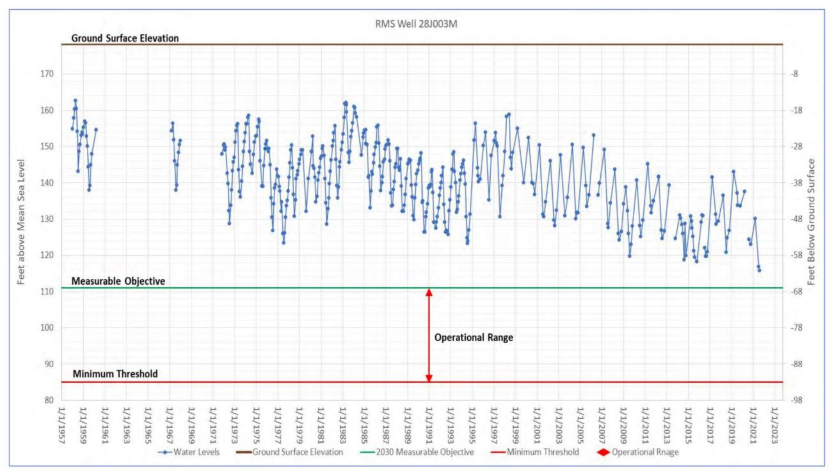
Vina Subbasin Chico Management Area RMS Wells
Appendix 3C





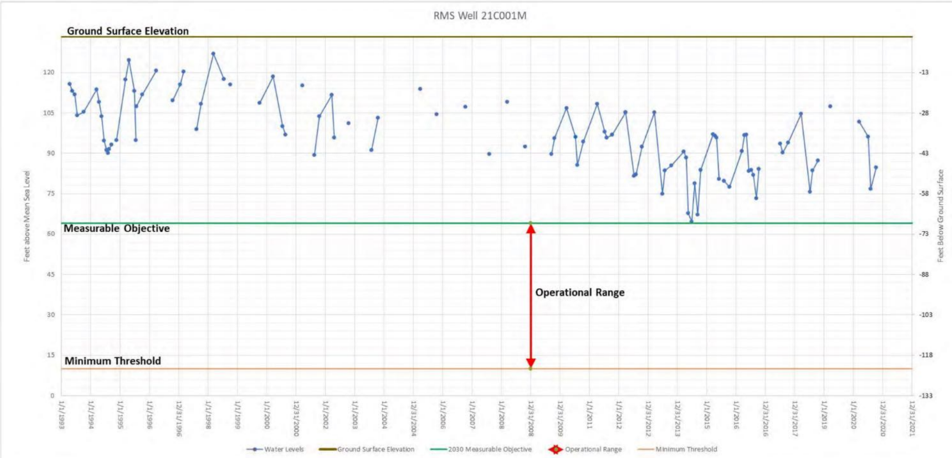


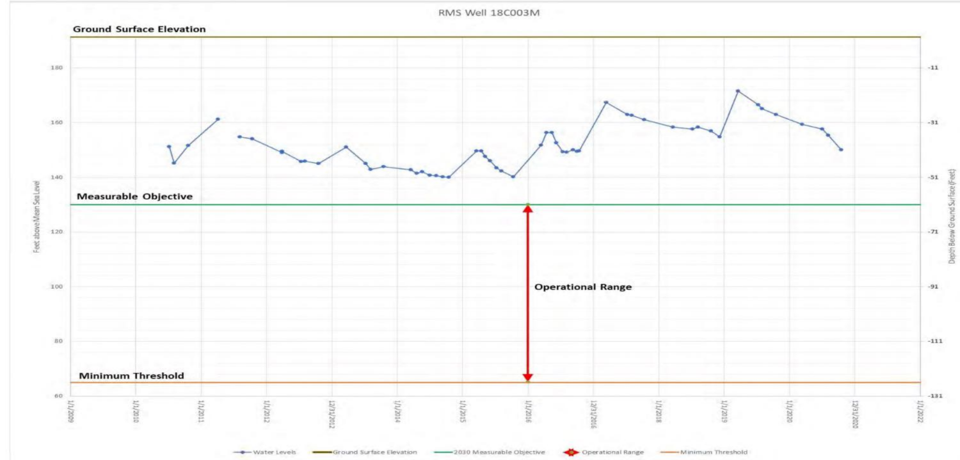


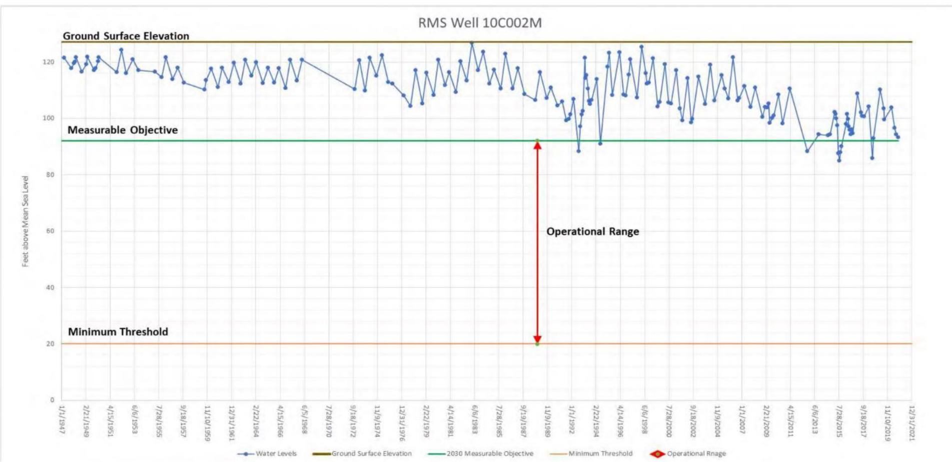


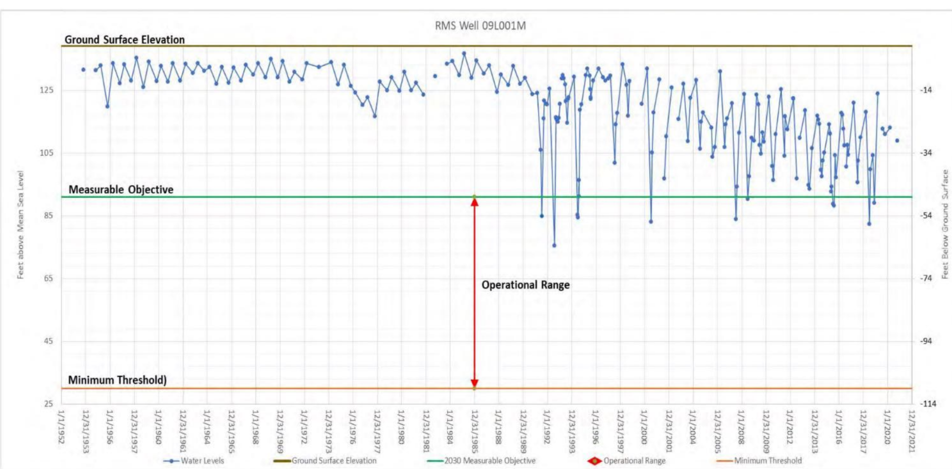
Vina Subbasin South Management Area RMS Wells - Appendix 3C

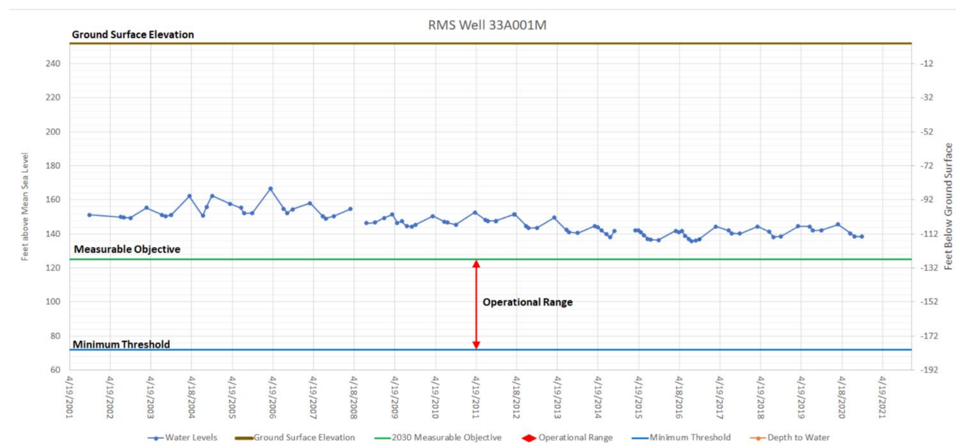
AquAlliance Exhibit 1-3











AquAlliance Exhibit 2

Modifed Vina Final Table 3-1
Groundwater Levels SMC by RMS in Feet Above Mean Sea Level

RMS Well ID	CASGEM Well ID	Ground Surface Elevation, feet amsl	MT Elevation, feet amsl	MT Depth, feet bgs	MO Elevation, feet amsl	MO Depth, feet bgs	MO - MT, feet	IM		
								2027	2032	2037
Vina Subbasin – North Management Area - 112 sq.mi. - 38.9%										
25C001M	22058	157.40	50	107	130	27	-80	130	130	130
10E001M	36972	189.38	80	109	136	53	-56	137	136	136
07H001M[1]	52536	282.00	72	210	136	146	-64	140	136	136
05M001M	34472	151.48	31	120	115	36	-84	116	115	115
36P001M	22056	162.75	45	118	108	55	-63	110	108	108
33A001M	23713	252.34	72	180	125	127	-53	128	125	125
		Average	**58**	**141**	**125**	**74**	**-67**	127	118	123
				MO- MT Storage Volume, AF[2]			**-290,453**			
Vina Subbasin – Chico Management Area - 46 sq.mi. - 16%										
CWSCH01b	58017	200	85	115	106	94	-21	107	106	106
CWSCH02	58043	183		98	105	78	-20	108	105	105
CWSCH03	58044	260		175	108	152	-23	109	108	108
CWSCH07	58045	266		181	95	171	-10	97	95	95
28J003M	19346	178.89		94	111	68	-26	113	111	111
		Average	**85**	**133**	**105**	**113**	**-20**	107	105	111
				MO- MT Storage Volume, AF[2]			**-35,840**			
Vina Subbasin – South Management Area - 130 sq.mi. - 45.1%										
21C001M	35539	133.34	10	123	64	69	-54	67	64	64
18C003M	24440	189.07	65	124	130	59	-65	132	130	130
10C002M	16127	127.35	20	107	92	35	-72	93	92	92
24C001M	35608	157.75	18	140	77	81	-59	81	77	77
09L001M	33461	139.33	30	109	91	48	-61	93	91	91
26E005M	24493	182.26	36	146	95	87	-59	97	95	95
		Average	**30**	**125**	**92**	**63**	**-62**	94	92	92
				MO- MT Storage Volume, AF[2]			**-311,491**			
				Subbasin MO- MT Storage Volume, AF			**-637,784**			
				Average Drought Storage Change, AFY[3]			**-78,800**			
				MO- MT Years of Drought Storage			**8**			

Estimated MO - MT Change for 3 Year of Drought at -78,400 AFY	% of Subbasin MOF Storage Volume	3 Years MOF Storage Volume, AF	GW Storage, AF/Ft[4]	3 Years GW Decline, Feet[4]	MO-MT / 3 Yrs - Decline
North Management Area	**45.5%**	**-107,659**	**4,357**	**-24.7**	**2.7**
Chico Management Area	**5.6%**	**-13,284**	**1,792**	**-7.4**	**2.7**
South Management Area	**48.8%**	**-115,457**	**5,051**	**-22.9**	**2.7**
Total Storage Volume 3 Yrs Drought	**100.0%**	**-236,400**	**11,200**		

1. MO is associated with GSP Well ID 18A001M - CASGEM # 21556

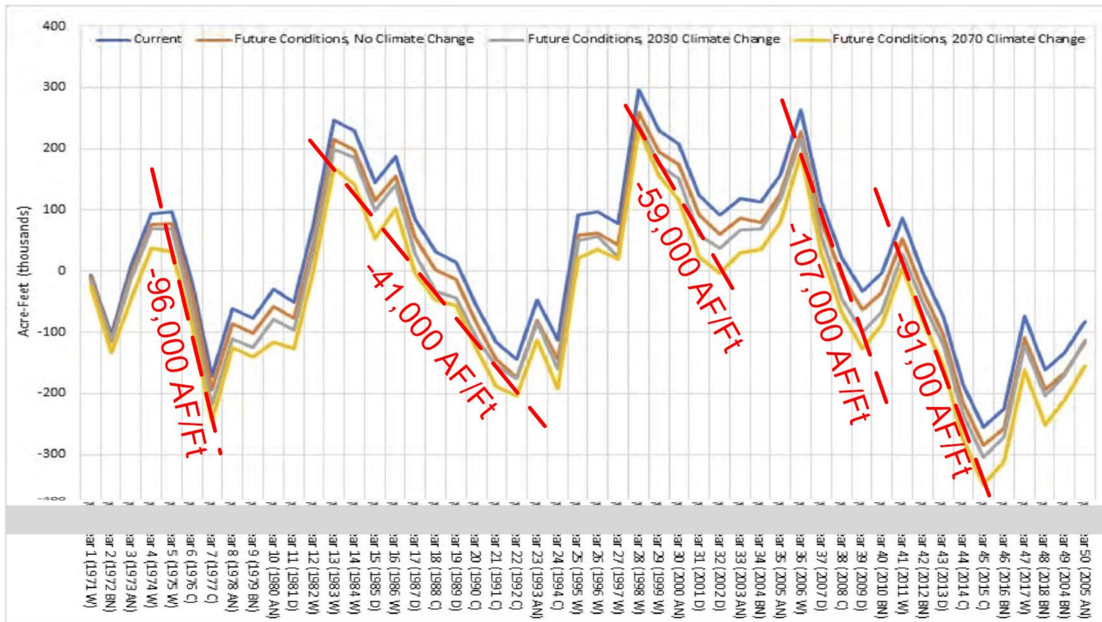
2. Storage Volume based on(Management Area x Specific Storage x Average MO-MT Thickness); Specific Storage of 11,200 afy/ft from Tables 2-

3. Average of Multiyear Droughts from Figure 2-43.

4. Based on management area % of Specific Storage of 11,200 afy/ft from Tables 2-8 & 2-10.

AquAlliance Exhibit 3

Vina Subbasin
Average Change in Groundwater Storage During Drought Years



Average Annual Drought Storage Change = -78,800 AF/Ft

Cumulative Change in Groundwater Storage for Current and Future Conditions Baseline Scenarios Vina Groundwater Subbasin GSP		Project No.: SAC282	December 2021	Figure **2-43**

AquAlliance Exhibit 4

Modified Vina Final GSP Table 2-8: Water Budget Differences Summary: Groundwater System

	A	B	C	D	E	F	G	H	I	J	K	L
	Component	**Historical, 2000 - 2018 (AFY)**	**Current, (AFY)**	**Change Climate No Future, (AFY)**	**Change Climate 2030 Future, (AFY)**	**Change Climate 2070 Future, (AFY)**	**Historical vs 2030 Climate Change (AFY)**	**Historical vs 2030 Climate Change (%)**	**Historical vs 2070 Climate Change (AFY)**	**Historical vs 2070 Climate Change (%)**	**Current vs 2070 Climate Change (AFY)**	**Current vs 2070 Climate Change (%)**
	Inflows											
1	**Subsurface Inflows**	**137,400**	**143,200**	**142,800**	**144,600**	**145,500**	**7,200**	**5.2%**	**8,100**	**5.9%**	**2,300**	**1.6%**
2	Foothill Area	45,700	50,100	49,700	50,600	50,600	**4,900**	**10.7%**	4,900	10.7%	500	1.0%
3	Los Molinos Subbasin	63,000	67,000	67,300	67,900	68,100	**4,900**	**7.8%**	5,100	8.1%	1,100	1.6%
4	Butte Subbasin	28,600	25,900	25,500	25,800	26,600	**-2,800**	**-9.8%**	-2,000	-7.0%	700	2.7%
5	Wyandotte Creek Subbasin	200	300	200	300	300	**100**	**50.0%**	100	50.0%	0	0.0%
6	**Deep Percolation**	**192,700**	**191,800**	189,300	194,500	**196,800**	**1,800**	**0.9%**	**4,100**	**2.1%**	**5,000**	**2.6%**
7	Precipitation	120,200	125,400	120,400	123,500	123,600	**3,300**	**2.7%**	3,400	2.8%	-1,800	-1.5%
8	Applied Surface Water	4,800	5,600	5,600	4,900	4,500	**100**	**2.1%**	-300	-6.3%	-1,100	-19.6%
9	Applied Groundwater	67,600	60,900	63,300	66,100	68,700	**-1,500**	**-2.2%**	1,100	1.6%	7,800	12.3%
10	**Seepage**	**24,000**	**27,700**	27,800	27,800	**27,400**	**3,800**	**15.8%**	**3,400**	**14.2%**	**-300**	**-1.1%**
11	Streams	20,800	24,100	24,200	24,600	24,400	**3,800**	**18.3%**	3,600	17.3%	300	1.2%
12	Canals and Drains	3,200	3,600	3,600	3,200	3,000	**0**	**0.0%**	-200	-6.3%	-600	-16.7%
13	**Total Inflow**	**354,100**	**362,700**	**359,900**	**366,900**	**369,700**	**12,800**	**3.6%**	**15,600**	**4.4%**	**7,000**	**1.9%**
	Outflows											
14	**Subsurface Outflows**	**70,400**	**76,200**	**72,000**	**70,700**	**67,800**	**300**	**0.4%**	**-2,600**	**-3.7%**	**-8,400**	**-11.7%**
15	Foothill Area	300	200	200	200	200	**-100**	**-33.3%**	-100	-33.3%	0	0.0%
16	Los Molinos Subbasin	4,700	900	900	900	900	**-3,800**	**-80.9%**	-3,800	-80.9%	0	0.0%
17	Butte Subbasin	65,400	75,100	70,800	69,500	66,600	**4,100**	**6.3%**	1,200	1.8%	-8,500	-12.0%
18	Wyandotte Creek Subbasin	0	0	0	0	0	**0**	**0.0%**	0	0.0%	0	0.0%
19	**Groundwater Pumping**	**243,500**	**209,200**	**215,800**	**225,900**	**238,000**	**-17,600**	**-7.2%**	**-5,500**	**-2.3%**	**28,800**	**13.3%**
20	Agricultural	209,100	185,500	184,800	194,700	206,800	**-14,400**	**-6.9%**	-2,300	-1.1%	21,300	11.5%
21	Urban and Industrial	26,500	20,100	27,500	27,500	27,500	**1,000**	**3.8%**	1,000	3.8%	7,400	26.9%
22	Managed Wetlands	8,000	3,500	3,500	3,600	3,700	**-4,400**	**-55.0%**	-4,300	-53.8%	200	5.7%
23	**Stream Gains from Groundwater**	**3,700**	**1,100**	1,000	1,000	**1,000**	**-2,700**	**-73.0%**	**-2,700**	**-73.0%**	**-100**	**-10.0%**
24	**Western Boundary Net Outflows**	**56,100**	**77,400**	73,000	71,000	**65,600**	**14,900**	**26.6%**	**9,500**	**16.9%**	**-11,800**	**-16.2%**
25	**Total Outflow**	**373,700**	**363,900**	**361,800**	**368,600**	**372,400**	**-5,100**	**-1.4%**	**-1,300**	**-0.3%**	**8,500**	**2.3%**
26	**Change in GW Storage (Inflow - Outflow)**	**-19,600**	**-1,200**	**-1,900**	**-1,700**	**-2,700**	**17,900**	**-91.3%**	**16,900**	**86.2%**	**-1,500**	**-78.9%**
27	**Net Stream Gains (Accretion - Stream Seepage)[1]**	**-17,100**	**-23,000**	**-23,200**	**-23,600**	**-23,400**	**-6,500**	**-38.0%**	**-6,300**	**-36.8%**	**-400**	**-1.7%**
28	**Net Stream Gains / GW Pumping**	**-7.0%**	**-11.0%**	**-10.8%**	**-10.4%**	**-9.8%**	**36.9%**	**--**	**114.5%**	**--**	**-1.4%**	**--**

1. Line 23 – Line 11

AquAlliance Exhibit 5

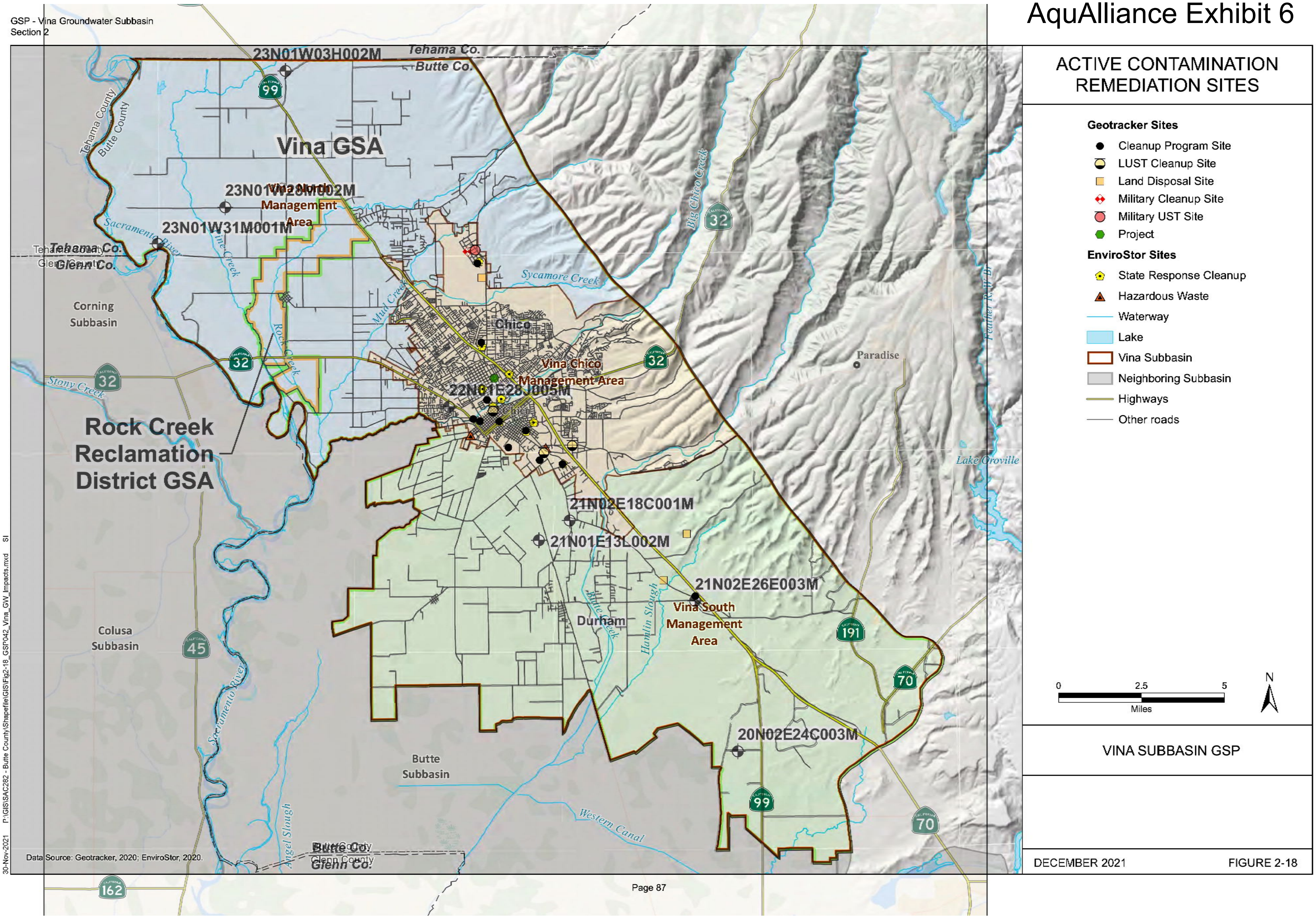
Modified Vina Final GSP Table 2-7: Water Budget Differences Summary: Land and Surface Water System

	A	B	C	D	E	F	G	H	I	J	K	L
	Component	Historical, (AFY)	Current, (AFY)	Change Climate No Future, (AFY)	Change Climate 2030 Future, (AFY)	Change Climate 2070 Future, (AFY)	Historical vs 2030 Climate Change (AFY)	Historical vs 2030 Climate Change (%)	Historical vs 2070 Climate Change (AFY)	Historical vs 2070 Climate Change (%)	Current vs 2070 Climate Change (AFY)	Current vs 2070 Climate Change (%)
1	**Inflows**											
2	**Surface Water Inflows**	554,800	602,300	601,900	630,600	652,200	75,800	13.7%	97,400	17.6%	49,900	8.3%
3	Outside Diversions	400	400	400	400	400	0	0.0%	0	0.0%	0	0.0%
4	Butte Creek	298,100	324,900	324,900	339,200	348,700	41,100	13.8%	50,600	17.0%	23,800	7.3%
5	Big Chico Creek	111,200	114,500	113,700	118,000	120,500	6,800	6.1%	9,300	8.4%	6,000	5.3%
6	Pine Creek	13,400	14,200	14,200	14,800	15,000	1,400	10.4%	1,600	11.9%	800	5.6%
7	Dry Creek	14,000	14,500	14,500	15,000	15,300	1,000	7.1%	1,300	9.3%	800	5.5%
8	Rock Creek	16,600	17,200	17,200	17,700	17,700	1,100	6.6%	1,100	6.6%	500	2.9%
9	Little Chico Creek	17,800	20,700	20,400	21,000	21,100	3,200	18.0%	3,300	18.5%	400	2.0%
10	Mud Creek	14,400	17,400	17,300	17,800	17,900	3,400	23.6%	3,500	24.3%	500	2.9%
11	Singer Creek	1,500	1,700	1,700	1,700	1,800	200	13.3%	300	20.0%	100	5.9%
12	Little Dry Creek	3,200	5,800	5,800	6,000	5,900	2,800	87.5%	2,700	84.4%	100	1.7%
13	Precipitation Runoff from Upslope Lands	61,600	69,000	69,900	77,500	86,300	15,900	25.8%	24,700	40.1%	17,300	24.7%
14	Applied Water Return Flows from Upslope Lands	2,600	1,900	1,900	1,700	1,600	-900	-34.6%	-1,000	-38.5%	-300	-15.8%
15	**Precipitation**	410,900	421,700	421,700	438,200	453,100	27,300	6.6%	42,200	10.3%	31,400	7.4%
16	**Groundwater Pumping**	243,500	209,200	215,800	225,900	238,000	-17,600	-7.2%	-5,500	-2.3%	28,800	13.3%
17	Agricultural	209,100	185,500	184,800	194,700	206,800	-14,400	-6.9%	-2,300	-1.1%	21,300	11.5%
18	Urban and Industrial	26,500	20,100	27,500	27,500	27,500	1,000	3.8%	1,000	3.8%	7,400	26.9%
19	Managed Wetlands	8,000	3,500	3,500	3,600	3,700	-4,400	-55.0%	-4,300	-53.8%	200	5.7%
20	**Stream Gains from Groundwater**	3,700	1,100	1,000	1,000	1,000	-2,700	-73.0%	-2,700	-73.0%	-100	-10.0%
21	**Total Inflow**	1,212,900	1,234,300	1,240,400	1,295,700	1,344,300	82,800	6.8%	131,400	10.8%	110,000	8.9%
	Outflows											
22	**Evapotranspiration**	362,900	348,300	347,300	358,200	371,400	-4,700	-1.3%	8,500	2.3%	23,100	6.7%
23	Agricultural	253,500	243,000	242,000	250,700	262,300	-2,800	-1.1%	8,800	3.5%	19,300	8.0%
24	Urban and Industrial	21,800	20,900	27,400	27,900	28,400	6,100	28.0%	6,600	30.3%	7,500	27.4%
25	Managed Wetlands	6,000	3,000	3,000	3,100	3,100	-2,900	-48.3%	-2,900	-48.3%	100	3.3%
26	Native Vegetation	81,200	80,900	74,400	76,100	77,200	-5,100	-6.3%	-4,000	-4.9%	-3,700	-5.0%
27	Canal Evaporation	400	500	500	400	400	0	0.0%	0	0.0%	-100	-20.0%
28	**Deep Percolation**	192,700	191,800	189,300	194,500	196,800	1,800	0.9%	4,100	2.1%	5,000	2.6%
29	Precipitation	120,200	125,400	120,400	123,500	123,600	3,300	2.7%	3,400	2.8%	-1,800	-1.5%
30	Applied Surface Water	4,800	5,600	5,600	4,900	4,500	100	2.1%	-300	-6.3%	-1,100	-19.6%
31	Applied Groundwater	67,600	60,900	63,300	66,100	68,700	-1,500	-2.2%	1,100	1.6%	7,800	12.3%
32	**Seepage**	24,000	27,700	27,800	27,800	27,400	3,800	15.8%	3,400	14.2%	-300	-1.1%
33	Streams	20,800	24,100	24,200	24,600	24,400	3,800	18.3%	3,600	17.3%	300	1.2%
34	Canals and Drains	3,200	3,600	3,600	3,200	3,000	0	0.0%	-200	-6.3%	-600	-16.7%
35	**Surface Water Outflows**	633,300	666,300	675,900	715,100	748,700	81,800	12.9%	115,400	18.2%	82,400	12.2%
36	Precipitation Runoff	57,900	58,300	62,100	66,700	72,800	8,800	15.2%	14,900	25.7%	14,500	23.3%
37	Applied Surface Water Return Flows	2,200	2,800	2,800	2,200	1,800	0	0.0%	-400	-18.2%	-1,000	-35.7%
38	Applied Groundwater Return Flows	20,200	14,000	16,000	16,000	16,000	-4,200	-20.8%	-4,200	-20.8%	2,000	12.5%
39	Streams	525,500	563,800	567,600	605,200	633,600	79,700	15.2%	108,100	20.6%	69,800	12.3%
40	Butte Creek Diversions to Butte Subbasin	27,500	27,400	27,400	25,100	24,400	-2,400	-8.7%	-3,100	-11.3%	-3,000	-10.9%
41	**Total Outflow**	1,213,000	1,234,200	1,240,300	1,295,600	1,344,300	82,600	6.8%	131,300	10.8%	110,100	8.9%
42	**Change in SW Storage (Inflow - Outflow)[1]**	-100	100	100	100	0	200	-200.0%	100	-100.0%	-100	-100.0%
43	**Net Stream Gains (Accretion - Stream Seepage)[2]**	-17,100	-23,000	-23,200	-23,600	-23,400	-6,500	38.0%	-6,300	-36.8%	-400	-1.7%
44	**Surface Waters (Inflow - Outflow)[3]**	-78,500	-64,000	-74,000	-84,500	-96,500	-6,000	7.6%	-18,000	-22.9%	-32,500	-43.9%
45	**Streams (Inflow - Outflow)[4]**	-35,300	-32,900	-37,900	-54,000	-69,700	-18,700	53.0%	-34,400	-97.5%	-36,800	-97.1%
46	**Net Stream Gains / GW Pumping[5]**	-7.0%	-11.0%	-10.8%	-10.4%	-9.8%	36.9%		114.5%		-1.4%	
47	**Net Stream Gains / Stream (Inflow - Outflow)[6]**	48.4%	69.9%	61.2%	43.7%	33.6%	34.8%		18.3%		1.1%	

1. Line 21 – Line 41 *2. Line 20 – Line 33* *3. Line 2 – Line 35*

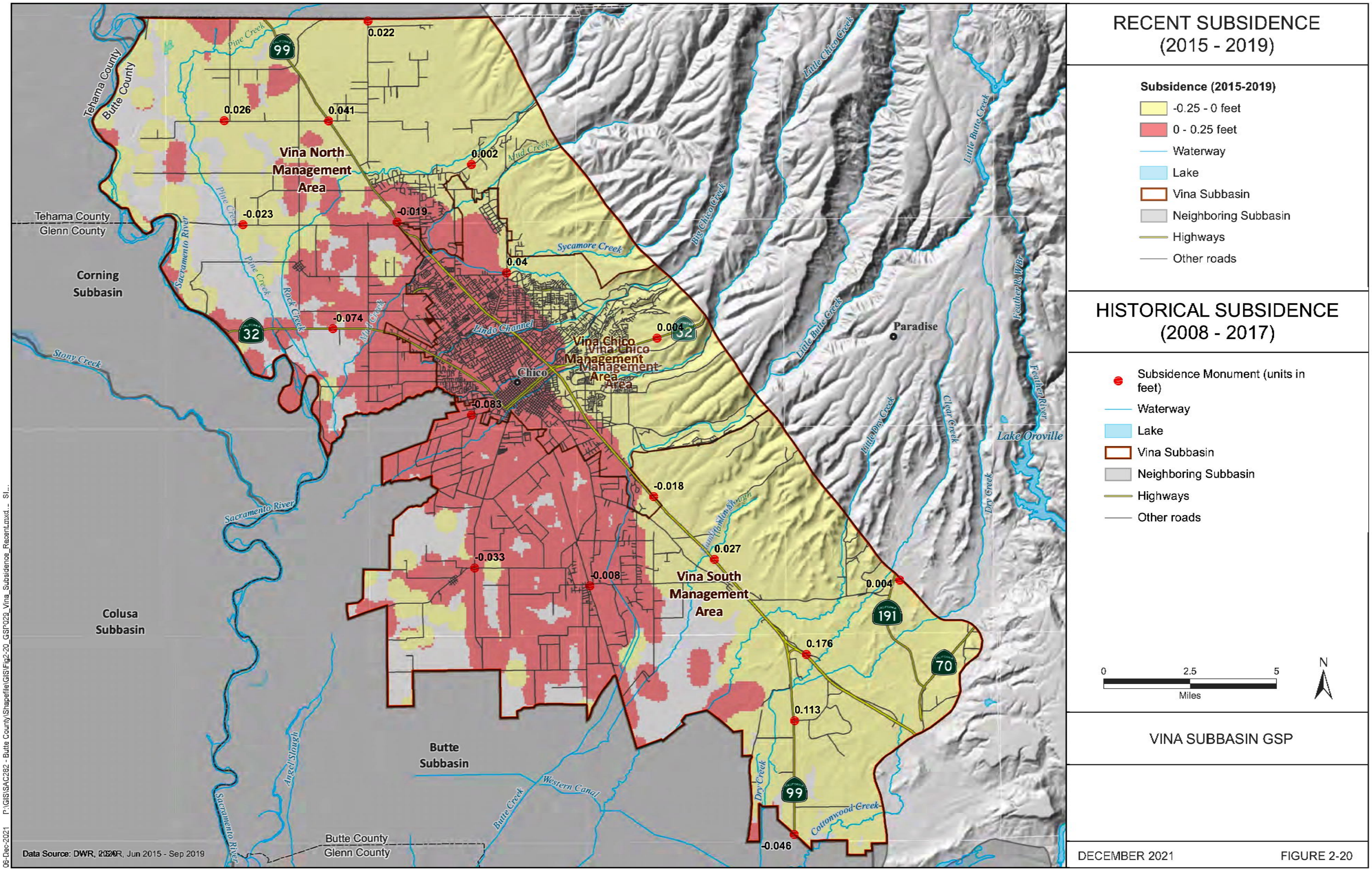
4. Sum (Line 4 to Line 12) – Line 39 *5. Line 43 / Line 16* *6. Line 43 / Line 45*

AquAlliance Exhibit 6



Modified after Vina Final GSP Figures 2-18 and 4-6

AquAlliance Exhibit 7



Modified after Vina Final GSP Figures 2-19 and 2-20