

County of Madera GSA Groundwater Allocation Market: Market Rules and Structure for Pilot Program

This document describes the proposed structure and rules that County of Madera Groundwater Sustainability Agencies for the Madera, Chowchilla, and Delta-Mendota Subbasins (hereinafter referred to singularly as the “County GSA”) will adopt for the purposes of the County GSA) Groundwater Allocation Market (market) pilot program. Specifically, the following sections provide detail on the objectives of the market, the overall market structure, analysis of potential market impacts, and proposed rules for avoiding or minimizing any potential adverse effects and or unintended consequences. A separate Workshop handout describes the logistics and process for participating in the market pilot program.

The market structure and rules described within this document are for the purposes of the pilot only. A key objective of the pilot (which will be a virtual exercise, as described below) is to test the potential structure, rules, and administrative processes associated with the market, should such a market be established as part of the County GSA’s actions to achieve groundwater sustainability objectives.

Background and Objectives

The County GSA is currently evaluating the potential for a market that would allow agricultural growers within the County GSA to buy and sell groundwater allocations, subject to County GSA participation, and market rules and limitations. The overall goal of the market is to decrease negative economic impacts associated with water use reductions that will be necessary to achieve groundwater sustainability within the County GSA portions of Madera and Chowchilla subbasins, as required under California’s Sustainable Groundwater Management Act (SGMA).

To test the effectiveness of the market and to ensure that it is meeting its intended objectives, the County GSA plans to initiate a year-long pilot market program in January of 2021. The pilot program will be a virtual exercise, meaning that no physical trades will take place. A primary reason for this format is that it allows us to simulate more than one-year of trading so that we can better understand potential market impacts over time and under different conditions (e.g., extended drought, wet years). It also allows us to test the effect of different market rules and to obtain feedback from participants on multiple trading simulations.

The County GSA received a grant from the U.S. Bureau of Reclamation to assess potential impacts associated with a market and to develop the pilot market program. This grant was written to include all of the GSAs within Madera County. However, groundwater allocations are a prerequisite for a functioning market (i.e., participants must have a set amount that they can sell). Currently, the County GSA is the only GSA within Madera County that has proposed allocations as a method for meeting sustainable yield under SGMA. In the future, other GSAs may become eligible to participate in the market; however, interested GSAs would need to establish tradeable groundwater allocations. As described in more detail below, individuals located outside of the County GSA may participate in the pilot market program.

General Market Structure

What is bought and sold? (market unit): Sustainable Yield (SY) allocations, bought and sold on a volume basis (acre-feet, AF).

The pilot market is predicated on the SY allocation and farm unit approach that was presented to the County GSA Advisory Committee on September 3, 2020 and October 14, 2020. Specifically, the pilot market program assumes the “opt-in” process for all landowners/farm units, and it also assumes that individuals who “opt-in” declare their intent to pump groundwater and/or sell their SY allocation (if they are historical irrigators, as described in more detail below).

Any portion “transitional” water allocation a landowner within the County GSA receives cannot be sold on the market.

Details on SY allocations, farm units, and transitional water can be found at:

<https://www.maderacountywater.com/county-gsa-advisory-committees/>.

Who can participate? Agricultural growers and farmers (hereinafter referred to as market participants) who receive an SY allocation may participate in the market.

- **Buyers:** Market participants who have “opted-in” to SY allocation and have indicated they will pump groundwater over the next year/growing season for the purposes of crop irrigation.
- **Sellers:** Market participants who have “opted-in” to SY allocation and who can demonstrate that they have irrigated crops on their land in three of the five years prior to 2020. This approach prevents landowners who have not previously used groundwater for irrigation purposes from “opting-in” simply to market their SY allocation. However, growers are allowed to retire and/or idle land and sell the associated SY allocations.

Sellers may include landowners who participate in the County GSA’s land retirement incentive program, depending on how this program is structured. For example, the incentive program could purchase easements or pay growers to retire their land while allowing them to sell associated credits. This would allow the County GSA to offer a lower incentive amount, extending available funds across more landowners.

- **Non-eligible participants.** Only landowners who meet the above requirements for buyers and sellers (i.e., related to irrigated acreage/crops) can participate in the market. Landowners who have opted out of SY Allocation, and residential, commercial, and similar landowners, cannot participate in the market.
- **Geographic location:** The County GSA is allowing all growers within the County GSA to participate in the pilot program. However, as noted above, groundwater allocations are a prerequisite for a functioning groundwater market. Currently, the County GSA is the only GSA within Madera County that has proposed allocations as a method for meeting SY under SGMA. In the future, other GSAs may opt to participate in the market; however, interested GSAs would need to establish tradeable allocations that are consistent with the sustainable yield identified in relevant Groundwater Sustainability Plans (GSPs). If a grower or farmer located outside of the County GSA

wishes to participate in the pilot, they will be assigned a SY allocation for the purposes of trading simulations.

How is water bought and sold? Buyers of SY allocations will pump more water where they are located, while sellers will forego pumping the volume of SY allocations sold. There is no physical transfer of groundwater allocations.

Based on feedback received during previous workshops, market participants will buy and sell groundwater allocations by submitting “bids” to a market administrator. Participants interested in purchasing groundwater allocations will submit a bid that includes how much they are willing to pay (\$/AF) and the amount they would like to purchase. Conversely, sellers will submit an offer that includes how much they are willing to sell their allocations for, and how much they have available to sell. Bids will be submitted electronically. For the pilot program, the County GSA will serve as the market administrator. The County GSA will match buyers and sellers based on specific criteria (described in more detail below).

The County GSA will publish information on total groundwater allocation sales and average price paid (\$/AF) each month (and potentially more frequently). Sales will be tracked by farm unit zone and potentially by crop type; however, names/parties associated with individual sales will not be published.

How often can trades be made?

In an actual market, trades will be made regularly (e.g., weekly) throughout the growing season and individual growers may buy or sell allocations multiple times throughout the year, subject to the market rules discussed in more detail below. For the purposes of the pilot, participants will have the opportunity to make virtual trades once per month based on simulated information provided by the County GSA.

SY allocations can only be traded for use within a growing season or year (or within carryover limits, as discussed below). The market platform/administrator does not facilitate multi-year trades; however, the potential for this will be evaluated during the pilot program.

[Analysis of Potential Market Impacts](#)

The Joint GSPs developed for the Madera and Chowchilla subbasins established a level of sustainable yield that represents the quantity of groundwater “...that can be withdrawn annually from a groundwater supply without causing an undesirable result” (Wat. Code, § 10721, subd. (w)). Sustainable yield is equal to the sum of the average annual recharge that occurs naturally within each basin, as well as the net infiltration associated with recharge or other projects identified in the GSP.

The SY allocations assigned to landowners will be based on the sustainable yield associated with the natural average annual recharge identified for the portions of the County GSA that fall within the Madera, Chowchilla, and Delta-Mendota subbasins. Market participants will only be allowed to trade their SY allocation; thus, the market itself will not result in pumping that exceeds sustainable yield.

However, market trades result in a change in the location of where groundwater pumping occurs. When a trade is made, sellers forego pumping the portion of their SY allocation they have sold, while buyers pump the additional groundwater allowed by the SY allocation they have purchased. The County GSA is carefully developing the market with rules in place to avoid or minimize any unintended consequences and adverse effects associated with changes in groundwater pumping from one location to another.

As a first step to establishing appropriate market rules, the County GSA worked with consultants to identify the potential for concentrated pumping to occur in any given area (i.e., due to a concentration of groundwater market purchases). To conduct this analysis, the project team used existing data and analyses conducted for the relevant GSPs. This section describes the analysis of potential market impacts.

Distribution of market supply and demand across farm unit zones

The project team examined the distribution of irrigated acreage by crop type within the Madera and Chowchilla subbasin portions of the County GSA, and within distinct zones of each subbasin. This helps to provide an indication of where potential sources of supply and demand are located and potential changes in the location of groundwater pumping. The zones analyzed are shown in Figure 1; they follow the farm unit zones that the County GSA has proposed for the establishment of farm units.

In the initial years of the market, the types of crops that are “more likely to sell” groundwater allocations include annual crops that have a lower return to water (e.g., corn, grains, hay, pasture and alfalfa). Crops that fall into the “more likely to buy” category include perennial, high value crops (e.g., citrus, nuts). While in many cases, the crops identified as “more likely to sell” will serve as an initial source of supply for the market; this is not to say that all growers of these crops will elect to sell their groundwater allocations. For example, some of these crops are tied to dairy nutrient management plans, while others serve as an important local feed source and/or cannot easily be fallowed without affecting overall farm operations. Our analysis is intended to provide an initial assessment of potential sources of supply, as well as to indicate where groundwater allocations are more likely to be used on the lands they are associated with.

For the Madera subbasin portion of the County GSA, our analysis indicates:

- Crops that fall within the “likely to buy” category are distributed across the three zones relatively proportional to how overall irrigated acreage is distributed. This makes it more likely that water purchases will be somewhat evenly distributed across the GSA (relative to existing distribution of irrigated acreage), rather than concentrated in any one area/zone.
- Crops that fall within the “more likely to sell” category are more concentrated in the West zone.
- The demand for groundwater allocations from higher value and perennial crops (i.e., more likely to buy) will be greater than the supply available from annual crops and crops that have a lower return to water (i.e., more likely to sell). Specifically, the ratio of irrigated acreage that falls within the category of “more likely to buy” versus “more likely to sell” is close to 3. Further, as noted above, not all growers of crops that are in the “more likely to sell” category will sell their groundwater allocations. Thus, some growers of higher value crops will likely begin to sell their allocations when it becomes in their best economic interest to do so. It is impossible to predict where these growers will be located, as this decision depends on individual circumstances.

For the Chowchilla subbasin portion of the County GSA:

- Overall, the ratio of irrigated acreage that falls within the category of “more likely to buy” versus “more likely to sell” is less than 1, meaning it is likely that there will be an adequate supply of groundwater allocations for the market.

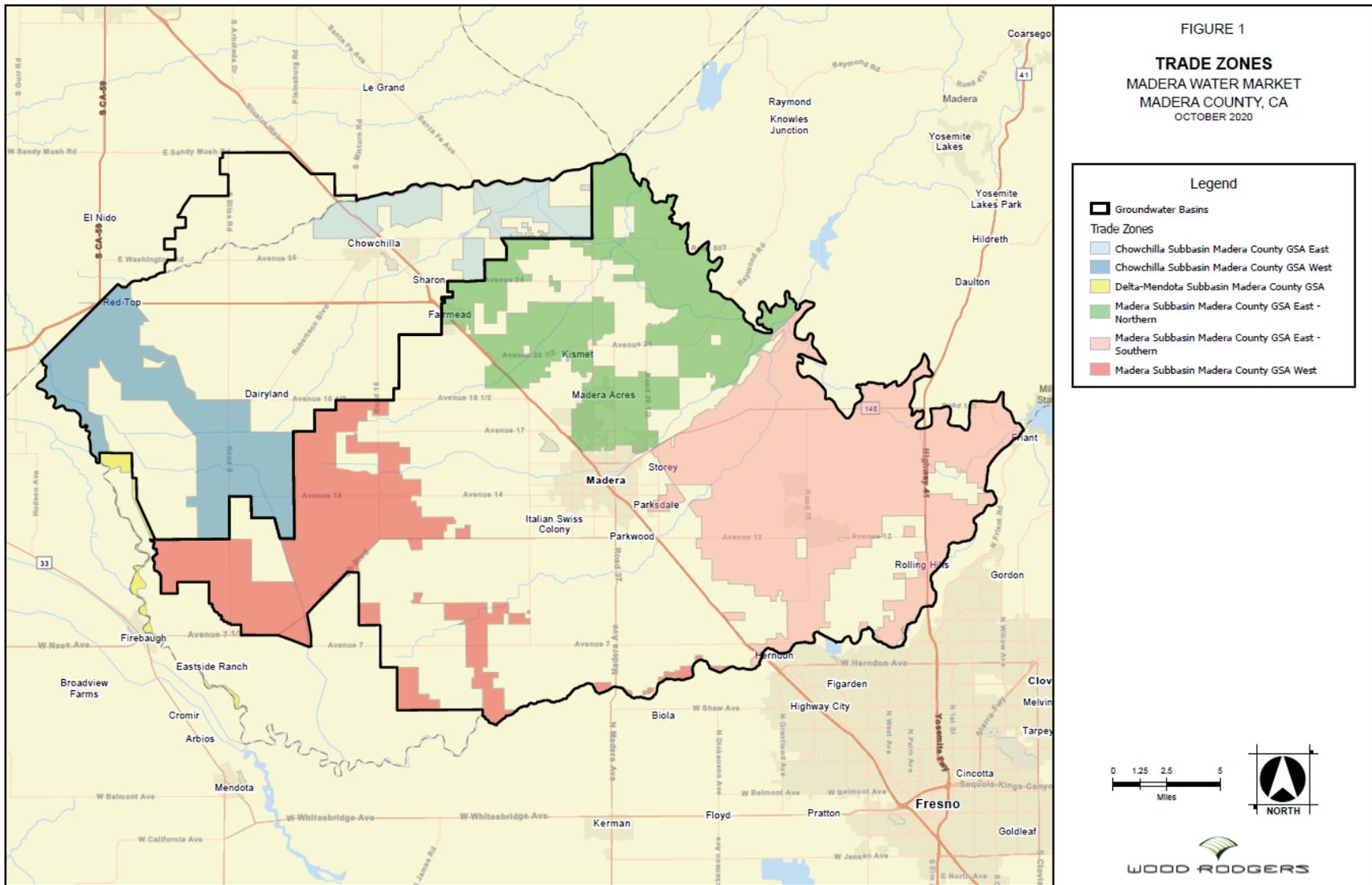


Figure 1. Farm unit zones identified for Madera County GSA portions of Madera, Chowchilla, and Delta-Mendota subbasins

- This varies by zone. The West Chowchilla zone contains 80% of the irrigated acreage that falls within the “more likely to sell” category, and 59% of the irrigated acreage classified as “more likely to buy.” This results in a ratio of 0.7 for irrigated acreage that falls within the “likely to buy” vs. “likely to sell” categories. The East zone has a buy to sell ratio of 1.8, indicating a higher level of demand relative to initial supply. Thus, more sales would likely come from the West zone.

In the Delta-Mendota subbasin portion of the County GSA, there is a relatively even split between crops that are more likely to sell vs. buy. However, there is a relatively small number of irrigated acres overall.

Analysis of potential buffer areas

In addition to overall distribution of supply and demand, the team conducted an analysis to evaluate whether there are areas of the County GSA where concentrated pumping has the potential to affect:

- Domestic, municipal, and other water supply wells
- Local surface waters and associated habitat¹
- Areas with high potential for increased land subsidence

Figure 2 shows areas located within the Madera, Chowchilla, and Delta-Mendota subbasins where this potential may exist. Each area includes a one-mile buffer area around it. It is important to note that the map identifies potential areas of concern where concentrated pumping may result in adverse effects; it does not mean that the market will lead to these effects.

The project team examined irrigated acreage within each buffer area by crop type. This allows us to evaluate the extent to which growers in these areas are more likely to buy or sell SY allocations and the resulting (potential) effects on groundwater levels. It also allows us to examine the potential impact on the market of limiting purchases in some way within these areas. Key findings of this analysis include:

- In the Madera subbasin portion of the County GSA, a relatively small portion of crops that are “more likely to buy” fall within the areas identified as having a higher potential for surface water interaction or subsidence. Further, these areas contain a higher percentage of potential sources of supply, when compared to the overall basin. Again, when a parcel or farm unit is a source of supply, less groundwater is pumped from that parcel or farm unit.
- Conversely, approximately 31% of the more likely to buy crops fall within the identified buffer areas for domestic wells and municipal wells; while 17% of supply crops fall within these areas. The buy to sell ratio is more than 5, compared to approximately 3 for the overall basin.
- In the Chowchilla subbasin portion of the County GSA, more irrigated acreage classified as “more likely to sell” falls within the potential for surface water interaction and subsidence buffer areas compared to irrigated acreage classified as “more likely to buy.”

¹ Modeling conducted for the GSPs indicate there is no hydraulic connection between regional groundwater and streams in the Madera and Chowchilla subbasins. The team analyzed the areas around the San Joaquin river to better understand the SY allocations that might be sold from within this area, which would potentially augment groundwater levels.

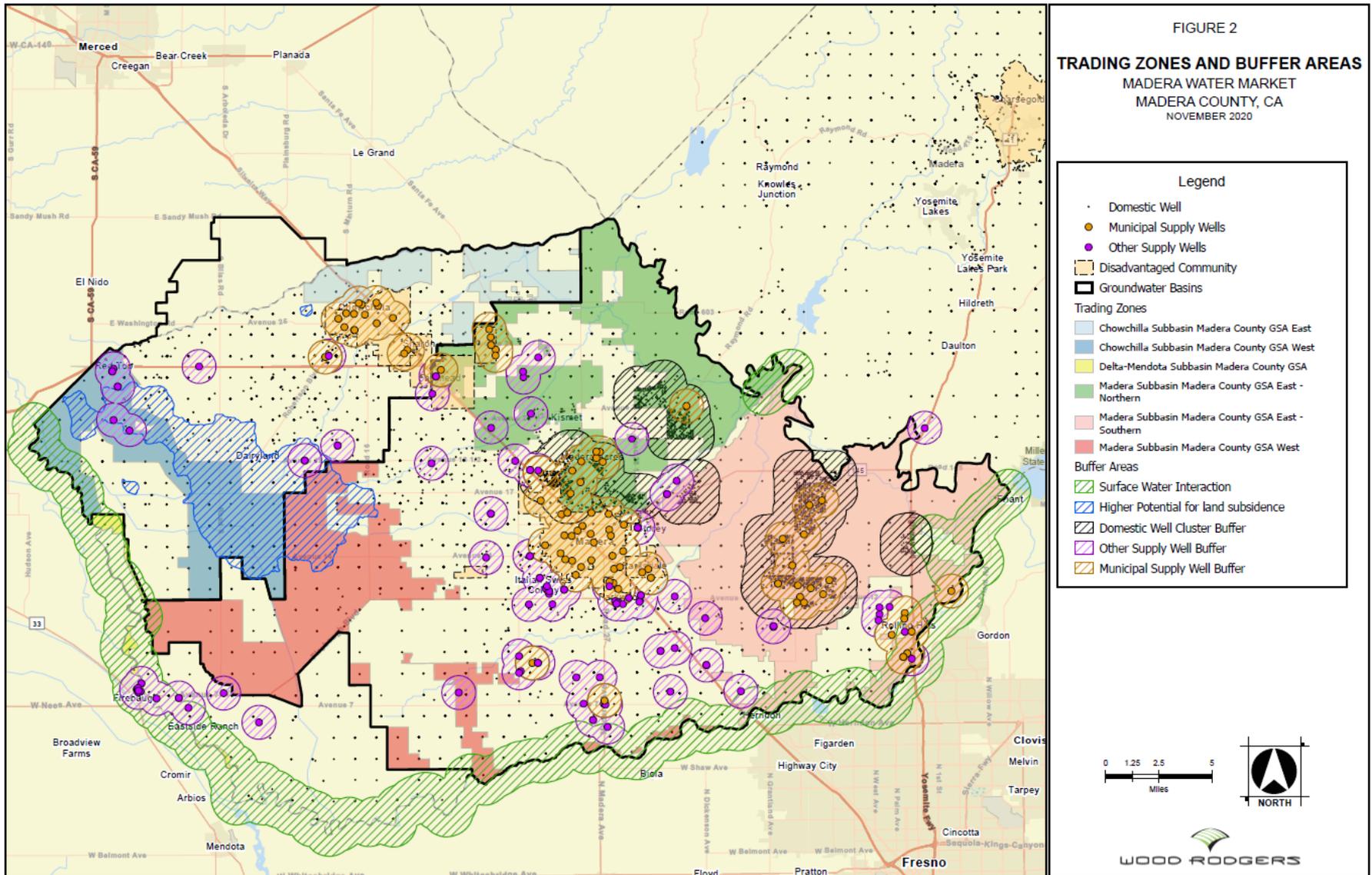


Figure 2. Buffer areas identified for Madera, Chowchilla, and Delta-Mendota subbasins

- Slightly more irrigated acreage within the municipal well buffer areas falls within the “more likely to buy” category in the Chowchilla portion of the County GSA. However, irrigated acreage within these areas account for a relatively low percentage of total irrigated acreage within the subbasin (13% and 10% of likely to buy and sell, respectively).
- Most of the irrigated acreage within the Delta-Mendota subbasin portion of the County GSA fall within area that has the potential for surface water interaction.

Summary of potential impacts

Based on the distribution of crops, it is likely that purchases will be distributed relatively evenly, relative to the existing distribution of irrigated acreage, rather than concentrated in a specific area(s). In both the Madera and Chowchilla subbasin portions of the County GSA, likely sources of supply are more concentrated in specific areas of the subbasin.

In the Madera subbasin, a much higher proportion of irrigated acres fall within the likely to buy category compared to the likely to sell. In the future, higher value crops will likely begin to sell SY allocations as overall use within the County GSA decrease and less transitional water is available. It is difficult to predict where these sellers (and their buyers) will be located.

In the Madera subbasin, the buffer areas around municipal and domestic wells contain a relatively high percentage of crop types that fall within the “more likely to buy category.”

In the other buffer areas identified (in both subbasins), there is a higher percentage of crops that are more likely to sell SY allocations compared to the overall subbasin. This indicates that there may be enough supply and demand to support trading among buyers and sellers located within these buffer areas.

It is important to note that many factors will affect a grower’s decision to buy or sell groundwater allocations (and how much to buy or sell). While analysis of the distribution of different types of crops helps to provide an indication of where potential sources of supply and demand are located, it does not provide an exact prediction of where or how many trades will occur. This will require continued monitoring over time and adaptive management by the County GSA to ensure against adverse effects.

Rules for Market Trading

As noted above, a key objective of the pilot program is to test the effectiveness and implications of rules put in place to minimize any potential adverse effects associated with a market. Thus, the County GSA will be testing rules throughout the pilot to better understand the effect on grower’s decisions to participate (or not to participate), as well as the potential effect on groundwater levels and associated undesirable results identified in the relevant basin GSPs. As such, the County GSA will elicit feedback and test alternative rules throughout the pilot related to the following:

- Trading zones (i.e., specific zones within a subbasin within which growers must trade)
- Buffer areas (i.e., special rules that apply to buyers and sellers located within identified buffer areas for domestic and municipal wells, and areas of known subsidence)
- Carryover of SY allocations for buyers and sellers
- Process and criteria for matching buyers and sellers

The following outlines the initial rules that will be put in place for the purposes of the pilot market program.

Trading zones: Trades can only occur within a subbasin. Trading is not allowed across subbasins or outside of the County GSA.

At the outset of the market, trading will not be limited to specific trading zones within the County GSA (aside from the individual subbasins). However, as discussed below, trading rules will apply to specific buffer areas.

The County GSA will monitor the location of groundwater allocation purchases over time. If purchases become concentrated in a farm unit zone relative to sales within that zone, and monitoring of groundwater levels/storage indicates that such purchases may result in adverse effects (based on sustainability thresholds outlined in the GSP), the County GSA may limit trading to within a zone or apply other rules that reduce the demand/supply imbalance. The County GSA may also establish a total purchase amount for each zone that reflects the total amount of SY allocations that can be purchased from outside the zone.

Buffer areas: As detailed above, the County GSA has identified areas where a concentration of groundwater allocation purchases has the potential to adversely affect domestic and/or municipal wells or known areas of subsidence, or to interact with surface water. There are several options for implementing special rules for buyers and sellers located within these areas to ensure against potential adverse effects. For example:

- Designating these areas as “sell only zones,” meaning individuals located within these areas would be able to sell their SY allocations (thereby foregoing pumping in their location) but could not purchase them (which would increase groundwater pumping in their location).
- Allowing buyers within these areas to only purchase groundwater allocations from sellers located within the same area (this and the previous rule are referred to as a directional restriction).
- Capping aggregate or individual purchases by market participants within these areas based on identified thresholds consistent with the GSP or relative to an identified baseline.
- Applying fees, trading ratios, exchange rates, or surcharges on transactions that result in the purchase of allocations from sellers located outside the area by buyers within the area. These rules can serve as a disincentive to buyers (and/or as an incentive to sellers) located in these areas and/or provide a source of revenue that a GSA could use to develop recharge projects or otherwise offset adverse impacts associated with groundwater pumping.

Iterations (and combinations) of these rules exist; however, they also come with real world complexities. For example, there is not necessarily a bright line or boundary where groundwater pumping may or may not have the potential to result in adverse effects. Placing restrictions on pumpers located 10 feet within a buffer area versus 10 feet outside of it may create inequities that do not necessarily benefit the groundwater basin. Further, established rules may not be necessary every year but only in dry years; however, changing rules each year may introduce uncertainties, thereby discouraging market participation. Potential impacts may also vary based on the well depth of the pumper (e.g., in areas of

subsidence); this indicates that some wells (above a certain depth) could be exempt from some restrictions on purchases that may apply to others within the same buffer area.

The pilot program offers the County GSA an opportunity to test the effect of different rules and to better understand potential market impacts. As a starting point for the pilot program, the County GSA will not place restrictions or rules on trading in any specific geographic area. However, the County GSA will closely monitor sales and purchases by crop type to better understand potential impacts on municipal and domestic wells, subsidence areas, and areas where the potential for surface water interaction exists. The County GSA may adopt rules for these areas if pumping increases beyond sustainable levels or comes within range of the minimum thresholds established in the GSPs. Throughout the pilot, the County GSA will also test and/or elicit feedback on potential rules to better understand implications for the market (e.g., the impact on participant decisions) and the groundwater basins. Based on outcomes of the pilot exercise, the County GSA will adaptively manage the program over time.

Further, the County GSA will coordinate its planned incentive program to further incentive growers located in buffer areas to sell their allocations. As part of the pilot, the County GSA will test potential incentives to better understand how it influences a grower's decision to sell.

Carryover: For the purposes of the pilot, buyers and sellers will be allowed to carryover 1-years' worth of their SY allocation into the next year. This means that a seller can sell up to two years' worth of the SY allocation in any given year. Buyers can carry over 1-years' worth of total SY allocations (including their own unused allocations and any additional allocations purchased, with the total not to exceed two years' worth of allocations).

Resale of SY allocations: Once a buyer purchases SY allocations, the allocations cannot be resold on the market.

Cap on purchases: For the purposes of the pilot, there is no limit on the amount of allocations per irrigated acre that a buyer can purchase. However, as noted above, buyers can only carry over one years' worth of SY allocation and buyers will need to use the purchased water within their farming unit in the year purchased or the subsequent year.

Matching buyers and sellers: The County GSA will match buyers and sellers using an electronic algorithm. With this approach, willing sellers submit their floor price, or their willingness to accept, in dollars per AF; buyers submit their ceiling price, or their willingness to pay, also in dollars per AF. Participants can enter a range or an exact quantity of NG allocations they wish to transfer (buy or sell).

This "smart market" approach offers several advantages. First, it provides a centralized hub for trading activity, eliminating the time and effort exerted in finding others interested in trade. Smart markets also enable simultaneous matching of many buyers to many sellers rather than matching a single buyer to a single seller, which may be impracticable and is generally economically inefficient. This results in additional gains of trade, as a single buyer and seller often don't have the exact same requirements for groundwater transfers.

This approach also provides for anonymity and confidentiality of participants. In markets that have adopted the same approach, participants have shared that anonymous trades can remove the emotion out of water deals, enabling more transactions. Small and rural communities often have long histories of interpersonal relationships, which can make or break deals. The anonymity removes the bias in both directions so that all parties are neutral to one another. It also provides equitable access to the market across all participants.

In developing criteria for matching buyers and sellers, the County GSA will explore the following as part of the pilot:

- Prioritizing trades within farm unit zones when possible
- Facilitating multi-year trades, by allowing upfront commitment to buy or sell for a set number of years as part of the initial bid submitted. A multi-year sale does not mean that a buyer could use all purchased allocations in one year. He or she would still be subject to carryover limits.

Throughout the pilot, the County GSA will also evaluate any unintended consequences that the pilot market design may impose on small, economically disadvantaged farmers within the GSA.

[Pilot Process Structure and Outcomes](#)

The pilot program will be a virtual exercise. Each month of the pilot program will be representative of one year/irrigation season in which participants simulate trades based on information provided by the County GSA. Participants will be asked to provide basic information and to simulate market participation each month. A separate handout describes the pilot process and logistics in more detail.

The County GSA will use the information collected through the pilot to develop a set of principles and guidelines (P&G) for an actual market. The P&G will clearly lay out market rules and administrative processes. The County GSA expects that once a market is established, it will continue to change as it is adaptively managed over time. This is key to overall program success and to meeting sustainable yield objective within the County GSA.