9/xx/20xx

Water & Soil Analysis

Prepared for <Bank Name>

APNS:

0xx-1xx-1xx & 0xx-0xx-0xx

Madera County, California

Prepared By:
Risk Mitigators & Advisors LLC
2525 Alluvial Ave, Ste 151, Clovis, CA 93611
(O) 559-549-2850 (E) Admin@RiskMitigators.net

WATER & SOIL ANALYSIS

Prepared for <Bank Name> on <Date>

Overview

Risk Mitigators & Advisors LLC is pleased to submit this report to support <Bank Name> in achieving its goals for better understanding the water situation on two parcels in Madera County, California for <Customer Name> and the effect the Sustainable Groundwater Management Act (SGMA) may have on their property. This report covers six (6) different areas: Water needs for the property, Water District, Groundwater Sustainability Agency (GSA), Soil Agricultural Groundwater Banking Index (SAGBI), Storie Index, and Soil Information. The report should be read in conjunction with the attached data report for all parcels. See the data report for further specific details.

Executive Summary

<Bank Name> has requested a water and soil analysis for <Customer Name> on two parcels in Madera County, California (APN# 0xx-1xx-1xx and 0xx-0xx-0xx). The two parcels are currently developed to established almonds and are in Chowchilla, California. Parcel 1 (0xx-1xx-1xx) is unserved by a water district, and Parcel 2 (0xx-0xx-0xx) is served by the Chowchilla Water District (CWD). The table below shows the estimated Summary Water Surplus/Deficit for next year as well as the estimated based on the SGMA sustainable yield based on surface water and groundwater pumping.

Water Summary			
Water District / APNs	**Avg Total AF Needed**	**Surplus/(Deficit) for 2022***	**Surplus/(Deficit) for SY***
Chowchilla Water Distritct: 0xx-0xx-0xx	3.69	(2.61)	(0.89)
Unserved: 0xx-1xx-1xx	3.69	(3.69)	(3.69)
Available with Well Pumping	6.01	3.40	1.84

* This is an estimated calculation based on 5yr avg delivery and sustainable yield.

Based on the current cropping pattern for <Customer Name>, it appears that the parcels will have sufficient irrigation water for the current cropping pattern based upon the SGMA sustainable yield needed for the Water Districts and unserved areas. Based on the estimated 2022 surface water allocations, there will be a significant reliance on a secondary source of water for all parcels. Well water is available for the parcels and is currently sufficient for irrigation needs.

Water Needs for <Customer Name>

The USDA information is taken from the NASS, Research and Development Division, Geospatial Information Branch, Spatial Analysis Research Section. The Cropland Data Layer (CDL) uses satellite imagery to determine crop cover. This information is then shared with the State Agricultural Statistics Board to track agricultural production.

Below is a table showing the water needs per the cropping pattern provided by <Bank Name> for <Customer Name> as well as the 2019 USDA Report. * Cropping pattern per client may vary from the 2019 USDA report.

Parcel 1: 0xx-1xx-1xx			
Cropping Pattern Per Client	**Water Needs Per UC Davis Study**	**Cropping Pattern Per USDA 2019**	**Water Needs Per UC Davis Study**
Almonds	424.35	Almonds	393.35
		Development/Open Space	-
		Grapes	3.00
TOTAL (Total Acres *AF Need)	**424.35**	**TOTAL** (Total Acres *AF Need)	**396.35**
Average Total AF needed	**3.69**	**Average Total AF needed**	**3.57**

Parcel 2: 0xx-0xx-0xx			
Cropping Pattern Per Client	**Water Needs Per UC Davis Study**	**Cropping Pattern Per USDA 2019**	**Water Needs Per UC Davis Study**
Almonds	439.11	Almonds	406.64
		Grapes	10.75
TOTAL (Total Acres *AF Need)	**439.11**	**TOTAL** (Total Acres *AF Need)	**417.39**
Average Total AF needed	**3.69**	**Average Total AF needed**	**3.65**

Water Districts

Chowchilla Water District

Water allocation is a percentage of water set aside on a yearly basis to fulfill contractual obligations to various water contractors. The percentage of allocated water is determined by climate, precipitation, and reservoir levels among other metrics. Due to these conditions being variable, it is common for the initial percentage set at the beginning of the year to change over the course of the year.

Parcel 2 is located within the Chowchilla Water District. District water is received from four Federal Central Valley Project contracts. Water is conveyed to the Madera Canal, Buchanan Dam, and LeGrand-Athelon. The Chowchilla irrigation district covers 85,675 acres, 73,000 being irrigated acres. Within the district, water is delivered through 159.60 miles of unlined canal, 0.80 miles of lined canal, and 45.80 miles of piped canal. The system includes 14 regulating reservoirs with a total capacity of 2,740 acre-foot.

The sustainable yield for the Chowchilla Water District per their GSP is 2.8 acre-feet per acre and is projected to be at 249,700 acre-feet per year after all projects and management actions have been implemented. Historically, water supply in the District is extremely variable. The table below shows the water availability for the past five years. As can be seen, the sustainable yield is above the current allocation. For this report, we have used the five-year average delivery to determine the surplus/deficit situation for 2022.

Total Water Supply - Chowchilla Water District	
Year	**AF/Acre (est)**
2021	0.15
2020	0.78
2019	1.30
2018	1.40
2017	1.76
5 Yr Avg	*1.08*

Unserved

Per the Chowchilla Subbasin GSP (Groundwater Sustainability Plan) submitted and currently in review, Madera County (East) will develop additional recharge basins, encourage Flood-MAR, or deliver water for in-lieu recharge in the Madera East area. The project would purchase additional water supplies that would be delivered to the Madera County East area. Madera County is currently working with partners to identify sources of supply, costs, and maximize net recharge benefits in the Subbasin. The water purchase projects include two related projects and a demand management program.

1. Import water supplies from partners into Madera County East and deliver that water for in-lieu recharge
2. Import CVP 215 water into Madera County East using Madera Canal and deliver that water to recharge ponds, dry wells, or as Flood-MAR on cropland.
3. Madera County is currently evaluating a range of demand management program options. Even so, Madera County plans to gradually phase in demand management between now and 2040. Continuing through 2025, average annual groundwater pumping will be reduced by 2% (of the total demand reduction amount) per year.

Both purchase projects are similar and follow the following general approach: The County GSA would directly acquire or facilitate the acquisition of approximately 5,000 acre-feet of new surface water supplies that would be available for diversion from Millerton during an irrigation season. The water would be acquired from a water supplier with rights/contracts for water from Millerton, or from another water supplier whose supply can be exchanged with water from Millerton. The water would be conveyed to Madera County East parcels that are within ½ mile of an existing major water delivery system (e.g., Madera Canal, CWD delivery system, natural stream course). Water would be conveyed to the various locations under a conveyance agreement entered into with CWD and others, as may be appropriate. Diversion and conveyance facilities would be constructed to serve the lands not currently within the delivery system of a district. The 5,000 acre-feet would be expected to serve the irrigation needs of approximately 3,000 to 5,000 acres of currently irrigated lands – depending on the irrigation needs of the properties.

If this is implemented, an average of 1.0 acre-foot/acre could be available for this portion of the property after 2024.

Groundwater Sustainability Agency (GSA)

This government agency must ensure the groundwater basin within their jurisdiction reaches “sustainable yield” which may include restriction on groundwater pumping and new fees for groundwater extraction. The GSAs develop a Groundwater Sustainability Plan (GSP) to set out the plan for getting the groundwater basin to “sustainable yield.”

A sustainable yield is an objective of SGMA to heal the groundwater basins while developing practices that allow groundwater extraction at a safe rate. This action is defined as the maximum quantity of water that can be withdrawn annually from a groundwater supply without causing an undesirable result. There are 6 undesirable results that GSAs must avoid in their GSAs:

1. Chronic lowering of groundwater levels.
2. Significant and unreasonable reductions in groundwater storage.
3. Significant and unreasonable seawater intrusion.
4. Significant and unreasonable degradation of water quality.
5. Significant and unreasonable land subsidence.
6. Surface water depletions that have significant and unreasonable adverse impacts on beneficial uses.

Soil Agricultural Groundwater Banking Index (SAGBI)

SAGBI is a suitability index for groundwater recharge on agricultural land. The SAGBI is based on five major factors that are critical to successful agricultural groundwater banking:

1. Deep percolation
2. Root zone residence time
3. Topography
4. Chemical limitations
5. Soil surface condition.

Based on the SAGBI for <Customer Name>, the parcels range from Very Poor (56.70%), Good (22.60%), Moderately Good (0.80%), and Excellent (19.80%). A little over half of the ranch would be a poor candidate for groundwater banking while the remainder would be a good candidate. By parcel, Parcel #1 would be a very poor candidate while Parcel #2 would be a good candidate for groundwater recharge.

It is expected that properties that have an excellent rating will have a higher marketability in the future. Overall, the <Customer Name> would be negatively affected by the SAGBI rating. Because of the large differences in each parcel, Parcel #1 would be negatively affected from a marketing perspective by the SAGBI rating, while Parcel #2 would not be negatively affected.

SAGBI is then divided into six categories ranging from Excellent to Nonagricultural as seen below in the Storie index.

Storie Index

Storie Index Grades consider 4 factors:

- Factor A: Degree of soil profile development
- Factor B: Texture of the surface layer
- Factor C: Slope
- Factor X: Manageable features, including drainage, microrelief, fertility, acidity, erosion, and salt content.

The soil is given a score ranging 0-100 percent for each category, then each score is multiplied together to get an index rating (Grade 1:100-80; Grade 2:79-60; Grade 3:59-40; Grade 4:39-20; Grade 5:19-10; Grade 6:<10).

Storie Index Grades:

- Grade 1: Excellent
- Grade 2: Good
- Grade 3: Fair
- Grade 4: Poor
- Grade 5: Very Poor
- Grade 6: Nonagricultural

Based on the Storie Index for <Customer Name>, the parcels are spit between Fair (4.10%), Poor (52.70%), Good (27.20%), and Excellent (16.10%). By parcel, Parcel #1 has a majority of Grade 4 soils while Parcel #2 has a majority of Grade 1 and 2 soils.

It is expected that properties that have an excellent rating will have a higher marketability in the future. Overall, the <Customer Name> would be negatively affected by the Storie Index rating. Because of the large differences in each parcel, Parcel #1 would be negatively affected from a marketing perspective by the Storie Index rating, while Parcel #2 would not be negatively affected.

Soil Information

The soil information is being provided to allow for further analysis and research of potential crops that may be grown on the parcels. <Customer Name> has the following seven different soil types on their property:

- **Atwater Loamy Sand 50.80 ac- 21.91%**
  - Use & Vegetation: Used mainly for production of truck crops, grapes, tree fruits, nuts, grain, and alfalfa. Vegetation consists of annual grasses, weeds, and low-growing shrubs.
  - Geographic Information:
    - Setting: On gently undulating to rolling dunes formed from granitic alluvium
    - Elevation: < 500 feet
    - Climate: semiarid, mesothermal with hot, dry summers and cool, moist winters
    - Average Annual Precipitation: 9-20 inches
    - Average Annual Temperature: 61°F
    - Average January Temperature: 44 °F
    - Average July Temperature: 78 °F
    - Frost-Free Period: 250-280 days
    - Average Annual Soil Temperature: 59 °F

- **Greenfield Sandy Loam 13.90 ac- 5.99% & Greenfield Fine Sandy Loam 32.80 ac- 14.14%**
  - Use & Vegetation: Used to produce a wide variety of irrigated field, forage, and fruit crops and for growing dryland grain and pasture. Vegetation on uncultivated areas consists of annual grass, forbs, some shrubs and scattered oak trees. Mostly irrigated field and row crops. Some areas are used as pasture. Under natural conditions the vegetation is sedges, tules, Saltgrass and willows.
  - Geographic Information:
    - Setting: On fans and terraces at elevations of 100 to 3,500 feet
    - Slope: 0-30%
    - Formed in moderately coarse and coarse textured alluvium or some wind deposited material derived from granitic and mixed sources
    - Climate: Dry subhumid mesothermal with hot, dry summers and cool, moist winters
    - Elevation: 100- 3,500 feet
    - Average Annual Precipitation: 9-20 inches
    - Average Annual Temperature:60-64 °F
    - Average January Temperature: 42-46 °F
    - Average July Temperature: 76-80 °F
    - Frost-Free Period: 200-325 days
    - Average Annual Soil Temperature: 59-65 °F and is not below 47 °F at any time for more than a few days.

- **Madera Fine Sandy Loam 122.20ac- 52.70%**
  - Use & Vegetation: Used mainly for irrigated cropland such as alfalfa, almonds, grapes, oranges, rice, and tomatoes. They are also used as irrigated pasture, dry farmed grain, and annual range. Vegetation is annual grasses and forbs.
  - Geographic Information:
    - Setting: On hummocky, gently sloping to undulating terraces at
    - Elevation: 10-250 feet.
    - Slope: 0-9%
    - Climate: Subhumid with dry hot summers and cool moist winters
    - Average Annual Precipitation: 9-18 inches
    - Average Annual Temperature: 60-63 °F
    - Average January Temperature: 45 °F
    - Average July Temperature: 80 °F
    - Frost-Free Season: over 250 days

- **Pachappa Fine Sandy Loam 2.40 ac-1.03%**
  - Use & Vegetation: Mostly under irrigation for alfalfa, small grains, and row crops as well as dry farm small grains. Yields are normally good. Annual grasses, herbs, and shrubs.
  - Geographic Information:
    - Setting: Nearly level to very gently undulating; the coarser textured types where exposed to wind are slightly hummocky and windblown Slope: 0-9%
    - Elevation: Under 1,000 Feet
    - Climate: semiarid to dry subhumid mesothermal
    - Average Annual Precipitation: 10-18 inches
    - Average Annual Temperature: 57-69 °F
    - Average January Temperature: 45 °F
    - Average July Temperature: 80 °F
    - Frost-Free Period: over 250 days

- **Ramona Sandy Loam 1.90 ac- 0.82%**
  - Use & Vegetation: Used mostly for production of grain, grain-hay, pasture, irrigated citrus, olives, truck crops, and deciduous fruits. Uncultivated areas have a cover of annual grasses, forbs, chamise or chaparral.
  - Geographic Information:
    - Setting: The Ramona soils are nearly level to moderately steep on terraces and fans
    - Elevation: 250-3,500 Feet
    - Climate: dry subhumid mesothermal with warm dry summers and cool moist winters
    - Average Annual Precipitation: 10-20 inches
    - Average Annual Temperature: 60-66 °F
    - Average January Temperature: 50 °F
    - Average July Temperature: 70 °F
    - Frost-Free Period: 230-320 days
    - Average Annual Soil Temperature: 62-67 °F

- **Tujunga Loamy Sand 7.9 ac- 3.41%**
  - Use & Vegetation: This soil is used for grazing, citrus, grapes, other fruits, and urban residential or commercial development. Uncultivated areas have a cover of shrubs, annual grasses, and forbs. In urban areas ornamentals and turf-grass are common.
  - Geographic Information:
    - Slope: 0-9%
    - Formed by alluvium weathered from granitic sources or similar. In urban areas there is usually a thin layer of human-transported materials spread over the surface
    - Elevation: 6.5-1,968 Feet
    - Climate: Dry subhumid mesothermal with hot, dry summers and cool, moist winters
    - Average Annual Precipitation: 10-25 inches
    - Average Annual Temperature: 59-64.4 °F
    - Average January Temperature: about 45 °F
    - Average July Temperature: about 81 °F
    - Frost-Free Period: 225 days inland and 365 days approaching coastal areas
    - Average Annual Soil Temperature: 60.8-68 °F

Hydrologic Soil Groups

- Hydro Group A: Sand, loamy sand, or sandy loam types of soils with low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission**.**
- Hydro Group B: Silt loam or loam. It has a moderate infiltration rate when thoroughly wetted and consists chiefly of or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.
- Hydro Group C: Sandy clay loam. They have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure.
- Hydro Group D: Clay loam, silty clay loam, sandy clay, silty clay, or clay with the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high-water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.

Irrigated Capability Classes

- Class 1: Slight limitations that restrict their use.
- Class 2: Moderate limitations that reduce the choice of plants or require moderate conservation practices.
- Class 3: Severe limitations reducing the choice of plants or require special conservation practices, or both.
- Class 4: Very severe limitations restricting the choice of plants or require very careful management, or both.
- Class 5: Little or no hazard of erosion but have other limitations, impractical to remove, that limit their use mainly to pasture, range, forestland, or wildlife food and cover.
- Class 6: Severe limitations that make them generally unsuited to cultivation and that limit their use mainly to pasture, range, forestland, or wildlife food and cover.
- Class 7: Very severe limitations that make them unsuited to cultivation and that restrict their use mainly to grazing, forestland, or wildlife.
- Class 8: Soils and miscellaneous areas have limitations that preclude their use for commercial plant production and limit their use to recreation, wildlife, or water supply or for esthetic purposes.

Irrigated Capability Subclasses:

- Subclass “e”: Soils susceptible to erosion.
- Subclass “w”: Soils where excess water is the dominant issue. This includes poor soil drainage, wetness, high water table, and overflow.
- Subclass “s”: Soil with rooting zone limitations. This includes shallowness of the rooting zone, stones, low moisture holding capacity, low fertility that is difficult to correct, and salinity.
- Subclass “c”: Soils that the climate, temperature, or lack of moisture, is the limiting factor.

Based on the irrigated capability classes for <Customer Name>, the parcels are mainly comprised of Class 4s soils (52.70%). The remainder of the ranch is comprised of Class 1 (17.20%), Class 2e/2s (26.70%), and Class 3e (3.4%) soils. By parcel, Parcel #1 has a majority of Class 4 soils while Parcel #2 has a majority of Class 1 and 2 soils.

It is expected that properties that have Class 1 and 2 soils will have a higher marketability in the future. With the majority of the soil being Class 4 and the remainder being Classes 1-3, the property would have average marketability in the future. Because of the large differences in each parcel, Parcel #1 would be negatively affected from a marketing perspective, while Parcel #2 would not be negatively affected.

Aquaoso Analysis

County of Madera GSA – Chowchilla & Chowchilla Water District GSA	
Red Flag (Risks)	**Blue Flag (Opportunities)**
Water budget deficit/overdraft Groundwater dependence Pumping limits Access fees	Recharge projects Increased supply Good water quality

Estimated Water Demand Per Parcel – Aquaoso

Water demand surplus or deficits are estimated for a parcel by calculating water supply on an aggregated per-acre basis from the associated water district minus the average crop demand, based on USDA crop data and DWR ET data for the county where the parcel is located.

This is an estimate and does not include available groundwater resources at this time (Aquaoso).
For 2021, the parcel surplus/(deficit) based on surface water deliveries only is shown below. Since the actual cropping pattern needs are about 0.08 AF/acre more than the USDA crop data needs, the numbers shown below are slightly less than the projections for the current operation. The projected needs for the current operation are highlighted in the Executive Summary table.

Parcel 1: 0xx-1xx-1xx		
	Acre-Foot per Acre	**Total Acre-Foot**
Parcel Demand Range	0.00 to 4.03	0 to 466
Parcel Demand Average	3.19	369
Parcel Surface Water Deficit Average (Unserved)	Insuficient Data	

Parcel 2: 0xx-0xx-0xx		
	Acre-Foot per Acre	**Total Acre-Foot**
Parcel Demand Range	0.00 to 4.12	0 to 493
Parcel Demand Average	3.26	391
Parcel Surface Water Deficit Average (Chowchilla WD)	Insuficient Data	Eligible

Estimated Well Water Availability

The Bank provided current pump tests for two (200hp each) deep well pumps prepared by <Pump Testing Company> as of <Month>, 2021. Per the pump location descriptions for the two tests, the “North Pump” does not appear to be located on either of the two parcels identified in this report. Upon investigation by the Bank, photos were provided for both pumps, and the Bank indicated that the North Pump is on the subject property. The measured flow rate for this pump is 941 gallons per minute. Since this parcel does not receive district water, it relies 100% on pumped groundwater. Based on the 2021 pump test, it appears that the parcel will have sufficient water availability for 2022. Based on a 2% reduction for all of Madera County per year until 2040 to reach a sustainable yield, this would result in a 40% reduction in groundwater pumping. Based upon the potential reduction for sustainable yield, it appears that the parcel will have sufficient well water available when combined with Parcel #2.

The “South Pump” is in Parcel #2 and has a measured flow rate of 899 gallons per minute. Since this parcel also receives district water, it appears that Parcel #2 will have sufficient water availability for 2022. Based on a sustainable yield of 2.8AF for Chowchilla Water District and a 2% reduction per year until 2040 for Madera County, it appears that the parcel will have sufficient well water available when combined with Parcel #1.

Conclusion

Based on the current cropping pattern and the sustainable yield for the Water Districts, <Customer Name>' water needs are sufficient to meet the sustainable yield. Based on the current surface water allocation estimate, all parcels will have sufficient water to meet their needs for 2022; however, a secondary water source will be required this year and in the future. See the charts below for the projected surplus/(deficit) by water source based upon the projected/estimated sustainable yield.

Summary for 2022		
	Current Cropping Pattern per Client	**Cropping Pattern Per USDA 2019**
Average Total AF needed	3.69	3.61
Available via Surface Water	1.08	1.08
Available via Groundwater	6.01	6.01
Surplus/(Deficit)	3.40	3.48

Summary for SGMA SY		
	Current Cropping Pattern per Client	**Cropping Pattern Per USDA 2019**
Average Total AF needed	3.69	3.65
Available via Surface Water	1.91	1.91
Available via Groundwater	3.61	3.61
Surplus/(Deficit)	1.84	1.87

If you have questions on this report, feel free to contact us at your convenience by email at Admin@RiskMitigators.net or by phone at 559-549-2850. The actual report from Aquaoso is provided as a supplement to this report and follows this section.