IrriWatch Portal
Growers’ User Guide

Madera County

September 2021

This user guide is meant to assist growers from Madera County that have signed up on the IrriWatch portal. This document helps growers to swiftly check their ETAW rates for individual fields, as well as for the whole farm. In addition, information is available regarding the crop water status (e.g. soil moisture, soil water potential, midday leaf water potential), crop nutrient status (leaf Nitrogen) and crop production.
# IrriWatch User Guide – IrriWatch Portal

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Introduction

The Madera County Groundwater Sustainability Agency (Madera County GSA) is responsible for the implementation of the groundwater sustainability plans for the Madera County GSA in the Madera, Chowchilla and Delta-Mendota Subbasins. Over the course of 20 years, the amount of groundwater extracted from the aquifer will be equal to the water that is recharged to the aquifer. Madera County GSA has formally decided to allocate water to growers based on Evapotranspiration from Applied Water (ETAW). IrriWatch is the selected portal to monitor and report ET from Applied Water and is being implemented with assistance from Davids Engineering.

ETAW is a measurement of consumptive use, or the amount of water vaporized into the atmosphere. It is not the same as Applied Water or water that is pumped and applied with an irrigation system. The main reason for this difference is that not all water applied is consumed by the crop; some water percolates below the root zone and in some cases, small volumes may run off the field. The Madera County GSA has decided to account for what plants truly consume (a volume equal to, or smaller than the volume that you pump). Fields without irrigation have negligible ETAW values.

Key Terms

Allocation
the amount of water that a given farm unit has to use over the course of a year measured in ETAW

Evapotranspiration from Applied Water (ETAW)
the amount of water vaporized into the atmosphere, or the consumptive use of the applied water.

Farm Unit
all parcels in a single Farm Unit Zone owned or managed by a single entity.

Farm Unit Zone
one of six sub-areas of the Madera County GSA in which parcels may be grouped together to reflect ownership or management practices.

Water Budget Button
provides an overview of the cumulative ETAW from all fields, allocation and the remaining ETAW in each farm unit. This “water statement” shows the current cumulative water use relative to the total annual allocation for each farm unit with a tab for each Farm Unit Zone. It is updated daily.
Madera County GSA Grower IrriWatch Enrollment Process
You can easily enroll in the Madera County GSA Grower IrriWatch Program. To enroll, send an email to Etmeasurement@maderacounty.com including the following information:

- Your Email address
- Your APNs
- Your crops, soil types and irrigation method (Optional for tracking allocation)

After enrollment, IrriWatch will send you an email as in Figure 1 with the request to create a password. You will also be asked to validate fields, crops, soils and irrigation methods, which is your opportunity to check the accuracy of crop type, soil type, and irrigation method. Note that only one email address is permitted for each company upon registration; additional members’ email addresses may be added later to the company account. Note also that your data is private. Except for Madera County GSA, no one else has access to view your fields or data. Comments and edits can be sent to support@irriwatch.com, preferably with a sketch or a map. IrriWatch data is live since the 1st of January 2021.

Dear Madera GSA grower,

Thank you for registering for the IrriWatch irrigation advisory service that is offered free of charge through the Madera County GSA. Please login to portal.irriwatch.com with your email as your username and create a password. Review your field boundaries, crop types, irrigation types and soil types. If corrections are needed, please send written or visual corrections to support@irriwatch.com. If one or more of your fields is not found, it might be located outside the Madera County GSA, in another nearby GSA.

If requested, IrriWatch will adjust your field boundaries before the January 1, 2021, IrriWatch start date. IrriWatch cannot adjust field boundaries during the growing season but will adjust field boundaries between November 1 and December 15th each year for the upcoming year. If one crop is harvested and you plant a second crop, please inform irriWatch of the plant date of the next crop and the crop type will be updated. You can view the graphs and download spreadsheets with the data, but you cannot edit the field boundaries, crop, soil, or irrigation type information. Your fields will also be visible on the irriwatch App that is freely downloadable from the PlayStore or AppStore. Also, you can add more members with their email addresses to your company account.

Thank you,

IrriWatch

Figure 1. Example of introductory Email sent by IrriWatch after signing up.

Site Login
Log in to portal.irriwatch.com using the username and password provided to you. If you forgot your password, you can request a new one. The fields you see should correspond with the APN numbers provided during the registration process. Each field should consist of a single crop, thus some parcels may consist of more than one field. Fields outside the County GSA boundaries are excluded from the data subscription.
Opening Page

Once you have logged into the portal, select Fields on the left-hand tab. The opening page you see should look like Figure 2, with your registered fields displayed. Each subtitle in this section corresponds to one of the buttons or options found on the opening page.

![Figure 2. Opening page shown when Fields is selected from left-hand panel.](image)

On the main page of the IrriWatch portal, you can see the details of each individual field (Figure 3). By hovering over each field with your mouse, the name/code of the field, the crop type, soil type and irrigation system used will be displayed in a window near the cursor. If the crop, soil or irrigation type are incorrect, inform the IrriWatch team via support@irriwatch.com. In accordance with Madera County protocols, the code of each field includes its APN number and an irrigated field number to allow for differentiation between different fields with the same APN number. For example, if your APN was “123-456-789” the code would be “123456789_FieldNumber” where “FieldNumber” is an assigned six-digit value. Personalized field names can be added to the end of the APN code for easier recognition by managers. If this is desired, please send a table with the APN-Irrigation field numbers (from IrriWatch), along with your preferred field names to support@irriwatch.com.

![Figure 3. Pixel Level Map Displaying Crop, Soil, and Irrigation Type for a Given Field](image)
Setting Units and Language
The header of the portal (orange bar across the top of the screen) provides the option to select your preferred measurement system: metric or Imperial (English) units, and your preferred language from separate drop-down screens.

Cumulative ETAW Map
The map on the opening page shows a data layer from the category “Pixel level.” Every pixel represents 33 feet x 33 feet on the ground; by zooming-in, you can inspect each field and variability within each field.

The data layer shown in Figure is “Actual Evapotranspiration Due to Applied Water Cumulative (inch).” The accumulation begins January 1st each year. The evapotranspiration of applied water is a measurement of consumptive use, or the amount of irrigation water vaporized into the atmosphere. It is not the same as Applied Water. The main reason for this difference is that not all water applied is consumed by the crop; some water percolates below the root zone and in some cases small volumes may run off the field. The Madera County GSA has decided to account for what your plants truly consume (a volume equal to, or smaller than the volume that you pump). Fields without irrigation have negligible ETAW values.

Farm Unit Zones
The Madera County GSA is divided into six Farm Unit Zones with allocations allowed to be shared within designated “farm units.” These farm units are comprised of all parcels in a single Farm Unit Zone that are owned or managed by a single entity. A single ownership entity or management entity with parcels in more than one Farm Unit Zone will have more than one farm unit (i.e., parcels that are spread across multiple Farm Unit Zones cannot be managed together as a whole, but rather the parcels within each farm unit zone can be managed together in the Farm Unit Zone where they are located).

On the top right side of the map screen, by clicking the “Madera County Zones,” you can view the different Farm Unit Zones within which irrigated lands can be grouped into a single farm unit. If you zoom out, you can see all six Farm Unit Zones that have been designated by the Madera County GSA (Figure 4). Each of your fields will be in one of these zones.

*Figure 4. Six Farm Unit Zones shown when Madera County Zones is checked.*
Water Budget Button

The green button on the opening page entitled “Water Budget” (Figure 5) provides you with an overview of the cumulative ETAW from all your fields, allocation and the remaining ETAW in the each farm unit. This “water statement” shows the current cumulative water use relative to the total annual allocation for each farm unit with a tab for each Farm Unit Zone. It is updated daily.

NOTE: It is important to note that water allocation is based on ETAW (ET from applied water) and not on ET or on Applied Water (as recorded from flow meters).

If you click on “Water Budget”, a farm unit water budget window will appear which shows the farm unit water budget report, which gives information for each of Farm Unit Zones in which you have registered parcels. The water budget report (Figure 5) includes three key volumes:

- The allocated water budget (ETAW)
- The cumulative ETAW use to date (by calendar year)
- The remaining water budget (ETAW) until the end of the season

Information is provided as a water depth (inches) or as a volume (acre-feet, AF).

If your fields are located in different Farm Unit Zones, you will be able to see the water budget of your farm unit in each zone separately by choosing the relevant zone from the tabs at the top of the screen.

The allocation is calculated and applied for each farm unit. Each Subbasin has a different allocation depending on the area of irrigated and unirrigated lands within the Subbasin and the calculated sustainable yield for that Subbasin. For example, in 2021, the Chowchilla subbasin has an allocation of 26.7 inches of ETAW/acre/year (Figure 6) while the Madera subbasin has an allocation of 28.3 inches ETAW/acre/year (Figure 6).
By toggling between different Farm Unit Zones, you can monitor your water budget for all fields in each Farm Unit zone (*Figure 7*).

**Field Budget Button**

The next green button “Field Budget” provides you with information on the ETAW of individual fields (*Figure 8*).
Each page of the table displays up to 10 fields (Figure 9). You should click on “Next” to access the next 10 fields and so on to see all the fields. The tabs at the top of the table are for navigating to other Farm Unit Zones.

The Field Budget tracks ETAW for each individual field throughout the calendar year. Fields with particularly high and low values for ETAW can be identified. At the top of each table (in blue), you will find the totals and averages for each zone. The numbers for “ET applied water cumulative (inch)” and “Total AF” match the values reported in the “Water Budget” report for each farm unit zone.
Pixel level – Maps

Upon opening IrriWatch, the default map will display the “Actual Evapotranspiration Due to Applied Water Cumulative (inch)” at the pixel level, with each pixel being approximately 33 feet x 33 feet. On the lower right-hand side of the page, you can select and change which data layer you want to display at the pixel level on the map. The displayed map is the map for the previous day (Figure 10). You can also select the “Measurement dates” you want to review. The map below shows the Cumulative Actual ET due to applied water (in inches) for each pixel of the field measured as of June 30th (2021).

Figure 9. Field Budget Overview for Chowchilla GSA East. Showing the first 10 fields of 25 fields.

Figure 10. Pixel Level Map of Cumulative Actual ET due to Applied Water

Contact Information: support@irriwatch.com
Field Level - Maps
In addition to the “Pixel Level” map, you can similarly access “Field Level” maps to display field-averaged parameters. More information is available under Other Available Information.

Field Level – Graphs and Tables
When viewing the map with either “Pixel Level” or “Field Level” data displayed you can click on a pixel in a field to open a graph showing the “ET applied water aggregated by farm unit” (Figure 11). A Farm Unit includes all irrigated fields owned or managed by one entity in a single defined Farm Unit Zone. The blue line on the graph represents EТАW of the selected field. The same graph also displays the average EТАW aggregated by farm unit (in orange) with the shaded area representing the variability among all the fields in this farm unit. For idle fields, the minimum value should be zero inches and the entire graph will be filled with the shaded area.

![Figure 11. Field Level Graph of ET of Applied Water](image)

Above the graph, there is a pull-down menu that you can use to select graphs of additional parameters for review (Figure 12). By selecting a graph and clicking on the red question mark to the left, more background information on that particular graph can be accessed.
Figure 12. Pull-Down Menu of Additional Available Field-Level Graphs

See the Other Available Information section for a description of the other available parameters.

For example, Figure 13 shows the “Virtual soil moisture probe” where:

- The blue dotted line is the Volumetric Water Content (VWC) at field capacity; in this example it is 26% or 0.26 as a fraction. Moisture exceeding field capacity will result in percolation because the soil can no longer retain this moisture;
- The red dotted line is the permanent wilting point (here it shows 6% or 0.06 as a fraction);
- The solid red line is the critical soil moisture level (which is the crop water stress line). Beyond this level of moisture, soil moisture is no longer easily available and crop water stress begins;
- The solid blue line is the soil moisture averaged across all pixels located in the field. The blue shaded area represents the variability within the field.

For optimal soil moisture conditions for crop production, the solid blue line should remain in the green zone (between critical soil moisture level and field capacity).
A different way to express soil moisture is normalization by soil type. The graph below (Figure 14) shows the moisture expressed as a “fullness” of the root zone. It is the level of soil moisture in the root zone between wilting point and field capacity. The normalization between 0 and 100% gives additional insights into how “full” the root zone really is.

The soil properties required for the construction of this graph are taken from the SSURGO soil database for Madera County prepared by USDA. Their standard soil texture values (sand, silt, and clay fractions) are converted into soil water holding capacity for each field. If you think the soil information for your field is incorrect, provide the team (support@irriwatch.com) a table with the soil type for each field. You can also share soil maps of your own farm with the IrriWatch team. Updated soil information will have no impact on ET and ETAW but does change the soil moisture time profile and may change the estimate of the next irrigation date.
Other Available Information

Select available information is discussed in the sections below. These are often the most common maps and options used. Note that these descriptions are not exhaustive and the user may choose from other options in addition to those described.

Pixel Level Maps

Actual Evapotranspiration

You can also review other data layers such as the daily actual evapotranspiration (ET) (*Figure 15*). Most of these graphs are displayed at the pixel level to show variability within fields. The default unit is inch/day. Note that the absolute value of ET is expected to be higher than ETAW because it also includes ET from precipitation.
Actual and Cumulative Crop Production

You will also be able to track Actual and Cumulative Crop Production (*Figure 16*) and several other parameters. Note that the crop production represents the total dry matter production due to photosynthesis. It is the incremental production that occurs on a given day due to carbon assimilation into the crop. These carbon-molecules are used by the plant to create stems, leaves, flowers, grains, roots and tubers among other crop organs. For most crops, there is a clear relationship between accumulated crop production and the final fresh yield (not provided by IrriWatch). This relationship is based on crop and variety dependent conversion factors. This can be used to monitor your crop production in relation to your water allocation.
Percent vegetation cover is the percentage of soil covered by green vegetation, at the pixel level, as seen in Figure.
Field Level Maps

In addition to the “Pixel Level” map, you can similarly access “Field Level” maps to display field-averaged parameters. As an example, the image below (Figure 18) shows the Minimum Advised Water, which is the calculated minimum amount of water to be applied on the current day to avoid water stress. The irrigation advice is updated daily in the morning. It is based on the satellite images from the previous day in conjunction with the weather forecasts of the current day.

![Field Level Map of Minimum Advised Water](image)

**Figure 1. Field Level Map of Minimum Advised Water**

The Minimum Advised Water is the amount required to replenish ET and percolation such that the soil moisture remains above the soil moisture stress line. The Maximum Advised Water indicates the amount of water needed to fill the soil reservoir back to field capacity. Note that both Min and Max advised water volumes are aligned with application capacity of a particular type of irrigation system. For instance, the maximum application of a drip system is much lower than a flood irrigation system.

When there is no need for irrigation on the day advice is accessed, the “Time Until Next Irrigation” will be provided for each field (Figure 19). This helps managers making their weekly schedule and allows them to check day-by-day any need for adjustments to irrigations.

NOTE: It is important to note that variability in soil properties and other local factors also impact the amount of water required to replenish ET and percolation. Each grower should consider these factors in addition to the minimum and maximum advised amounts when deciding how much water to apply. You are the expert for your fields! This is simply meant as advice.
In addition to creating maps and graphs, you can download tabular data for each field. Just click on the “Table data” tab near the top of the page (Figure 20) and the daily values for the complete history of that field will be provided (Figure 21). The data can be downloaded in either CSV or Excel format.
Alternatively, it is possible to collect data from all fields on the same day. Tabular data is generated from the green button “Tabular data for selected date”, which is visible on the opening page.

User Settings

User Profiles
In the IrriWatch Portal, there are 3 generic profiles that can be assigned to users:

- Field Irrigator
- Local Manager
- Expert

Each profile allows access to a different maximum set of parameters. While experts may want to access all data layers, maps and info, a local manager or field irrigator may be interested only in looking at soil moisture levels and irrigation advice. For convenience, the default set of parameters to view and monitor is kept small. The user can always select extra parameters, depending on the user profile. The parameters available to each profile are shown below (Figure 22):
Figure 22. Three Different User Profile Options with Selected Parameters for Field Irrigator, Local Manager, Expert
In order to change your profile (Field irrigator, Local manager, or Expert), go to Settings on the left-hand side panel of the portal, and click on Change Profile to select the one you prefer (Figure 23). You also may select which parameters are displayed at field level, at pixel level and in graphs. You can do this by clicking on Change Parameters and selecting the parameters you want. After you Save these settings, all extra data layers chosen are instantly available.

Figure 23. Change User Profile or Parameter Preferences in Settings Window