



NATIONAL GROUNDWATER MONITORING NETWORK FINAL REPORT

For Objective 1 by the Mojave Water Agency

Award Number: G22AC00117-00

Agency Name: Mojave Water Agency

Title: Configure Web Services to Become a New Data Provider

Author(s) and Affiliation(s) with address and zip code:

Tony Winkel, Director of Water Resources, Mojave Water Agency

13846 Conference Center Drive

Apple Valley California 92307-4377

Telephone: 760-946-7000

Email: twinkel@mojavewateragency.com

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B. Main Body of the Report

Overview of Work Planned and Accomplished During the Project:

The Mojave Water Agency (MWA) initiated a project to become a new data provider for the National Groundwater Monitoring Network (NGWMN) under Objective 1. The project focused on connecting MWA's Water Information System by Kisters Data Management System (WISKI DMS) to the NGWMN using the Kisters Web Interoperability Solution (KiWIS) web services module. This report includes the accomplishments, challenges and anticipated future adjustments to the program as it relates to the agreement established and overall progress in response to the performance metrics.

To accomplish Objective 1: To Become a New Data Provider with the NGWMN, The MWA performed the following task elements:

- Purchase and develop KiWIS web-services module to connect MWAs WISKI DMS to the NGWMN.
- Populate a subset of fourteen (14) wells to populate the program which includes reviewing, assessing, and entering well completion, location and geologic data for the trend or surveillance sites from MWA's existing monitoring program. The goal was to ensure that these sites can provide long-term trends and capture seasonal highs and lows to monitor regional aquifer conditions. The timeline to establish the subset of wells for the program was delayed due to staff attrition. This task was completed after onboarding a newly hired MWA Hydrogeologist.
- Monitoring Categories and Subnetworks were defined as outlined in the NGWMN Framework document.
- All data was collected, organized, and went through QAQC of metadata. MWA staff, the Kisters development team and staff from NGWMN coordinated and held meetings to ensure the data were furnished in an appropriate format for the NGWMN. MWA experienced multiple challenges with the project management aspect from the Kisters development team. Despite proactive communication efforts on the MWA side, there were consistent delays in deadlines by the Kisters consultant. Additionally, timely delivery and accuracy were not consistently maintained by Kisters, resulting in multiple delays on MWA's project timeline. MWA is committed to working collaboratively to find effective solutions and ensure that future collaborations are more aligned with shared goals.

- Gaps in the data were assessed and MWA staff tried to fill as many gaps as possible, to ensure NGWMN data requirements. This included Lithology, observation method, casing details and after further discussions with the NGWMN measurement method and accuracy as MWA participates in the USGS Hydrologic Instrument Facility (HIF) program for water level equipment (electric tapes and steel tapes).
- MWA staff worked to populate the NGWMN Monitoring Location Registry with the site and network information.
- Data collection and data management protocols were reviewed and are pending updates on the protocols established in linking MWA's DMS to NGWMN.

For New Data Providers:

Description of Existing Water-Level and/or Water-Quality Networks:

The MWA's existing in-house monitoring network comprises eight (8) stream gauges approximately four hundred thirty (430) actively monitored key wells, a data management system (DMS) with a comprehensive data record dating back to the early 1900s. The database contains data from over twenty thousand (20,000) wells, accompanied by detailed information on lithology, well construction, and other groundwater parameters. Additionally, MWA maintains approximately two hundred six (206) wells equipped with pressure transducer data loggers, sixteen (16) of which are connected to real-time telemetry systems providing hourly readings and ten (10) scientific weather stations to better model hydrologic understanding.

To ensure data accuracy and adherence to USGS standards, discrete water level measurements for MWA's monitoring well network are taken monthly, quarterly, and semi-annually. The majority of the monitoring wells are visited quarterly for manual QA/QC measurements, with field data thoroughly reviewed by MWA hydrogeologists before submission for further review and approval. In addition, because of MWA's longstanding collaboration with the USGS, MWA participates in the Hydrologic Instrument Facility (HIF) calibration of all tapes used to collect water levels and participates in annual training lead by the USGS

The primary goal of MWA's groundwater monitoring program is to capture long-term trends and seasonal fluctuations in aquifers across its service area. This data serves as a critical basis for managing basin health in the Mojave River Basin area and reporting efforts under an Adjudication, overseen by the court. Furthermore, the data supports MWA in implementing recharge basins to replenish declining aquifers.

In addition to groundwater level monitoring, MWA conducts annual water quality sampling campaigns as part of its basin management and monitoring objectives. These sampling events occur once a year in one (1) of the seven (7) management subareas, carried out through a longstanding cooperative agreement between MWA and USGS. MWA's water quality program aims to define and assess ambient water quality conditions throughout its service area, ensuring the protection and sustainable management of water resources. The water quality program is variable year to year due to the number of monitoring wells, the size of each basin, the amount of samples, and staff time required to complete sampling campaigns.

Description of Site Selection Criteria and Process:

The MWA strategically selected wells from the MWA's existing monitoring program based on the following:

- The ability to represent aquifer conditions as outlined the goals for the NGWMN. This included understanding long-term trends, seasonal variations and the anthropogenic effects on the groundwater levels.
- MWA Hydrogeologist reviewed the NGWMN guidelines, and took inventory of wells with the most complete data quality field data set.
- Looked at the spatial distribution to ensure a balance and considered the density.
- The Ability for MWA to continue monitoring and accessing the wells was also taken into consideration, as the intention was to maintain these wells as =long-term water level trend sites. All of the wells selected are dedicated monitoring wells.

Description of Process Used to Assign Subnetworks and Monitoring Categories:

MWA's service area includes many chronically over-drafted groundwater basins that have suffered from decades of human impacts through agricultural, municipal, and industrial processes. In addition, MWA manages the ground-water resources with artificial recharge at some locations. Because of this, the wells are considered heavily impacted by human use and are assigned to the "Documented Changes" Subnetwork. Each of the wells is monitored at a minimum of a bi-annual basis, with most being measured quarterly, and is assigned to the "Trend Well" Monitoring Category.

Field Techniques for Water-Level Measurement and Water-Quality Sample Collection:

The MWA's Field Sampling Plan includes the methods and field techniques for Water-Level and Water Quality Sample Collection. The below has been summarized for the purpose of this report.

Water-Level Measurement

Static water levels will be measured during well runs on a monthly, quarterly, and semi-annual basis. Water levels will be recorded on Subarea specific "Water Level Data Sheets" and entered into MWA's Kisters field visit tool. Field Preparations include planning routes in advance, and ensuring vehicles safety kits and necessary tools are in the vehicle. The water level measurements are read to the nearest hundredth of a foot (± 0.01) from a permanently marked measuring point (MP) on the well (e.g., top of casing or reference elevation). Measuring instruments are calibrated according to United States Geological Survey (USGS) protocol which includes the use of HIF tape calibrations.

Electronic water level measurements will be recording according to the USGS procedure in the "GWPD 4 Measuring water levels by use of an Electric tape":

1. The Water level meter probe will be decontaminated prior to use at each well with a dilute solutions of (0.01-2%) Liquinox soap solution followed by a deionized (DI) water rinse.
2. The decontaminated probe or electrode are lowered into the well until the instrument indicates that the water column has been reached with sound and light notifications.
3. The probe or electrode is slowly raised and lowered in and out of the water column until the Specialist is satisfied that the instrument is providing a reliable water level reading. If necessary, the instrument's sensitivity will be adjusted according to the manufacturer's instructions.
4. The measurement on the cable or tape will be read to the nearest ± 0.01 foot against the established measuring point (MP). This measurement will be recorded as "depth to water" at the measuring point (below MP or BMP).
5. Check measurements are recorded and require documented observations if the measurement does not agree within ± 0.02 of the original measurement.

Water-Quality Sample Collection:

Under objective 1, the MWA proposed to include water levels. It is the intention of MWA to grow coordination with the USGS NGWMN to eventually include water quality at a future time.

Description of Data Management Procedures:

All procedures for data acquisition and reporting follow USGS standard procedures as outlined in TM1-a1 – Groundwater Technical Procedure of the U.S. Geological Survey. MWA’s field staff are trained annually by USGS field staff in an onsite visit. All data collected will be entered into a DMS called WISKI .Wiski facilitates all necessary data processing from field collection, import, processing, quality control, review, and preservation.

Data imported into the MWA DMS are preserved within the system, with redundancy in time series data storage and the ability to revert data to its original state. The entire 2014 SQL based virtual system server is backed up monthly, with offsite and cloud-based industry standard backups. In addition, all original files downloaded or produced during field data collection are stored and backed up monthly outside of the DMS.

Data quality and integrity are primarily managed by standardized reviews that include hydrographs. The process begins with field staff importing data into the DMS. MWA hydrogeologists and Water Resources Manager then review and approve data. The review rating process enables published data to move through the database and enable final, reviewed data to be shared with the NGWMN.

[List of Minimum Data Elements and How They are Provided to the Data Portal:](#)

The current KIWis web portal provides access to groundwater levels (depth to water), water quality, well construction information, and lithology logs. The fourteen (14) wells made available to the NGWMN network only include groundwater levels, these wells include:

USGS_ID	station name	Common Name	Measurement Frequency
340804116205901	01N06E34D03	Joshua Tree Cemetery	Quarterly
342738116553905	04N01W01R08	Rancho Lucerne A	Quarterly
342324116374901	04N03E35J01	Swanee North	semi-annually
342514117134801	04N03W19G02	Rock Springs 1	Quarterly
342318117141101	04N03W31L06	Deep Creek 1	Quarterly
342814117150501	04N04W01C02	Jess Ranch 1	Quarterly
342519117240701	04N05W21H01	MOGW	Quarterly
343004117153801	05N04W23R03	FG North Narrow Park	Quarterly
342923117370601	05N07W28L01	MSCW	Quarterly
343548117203501	06N04W19E06	TZ 2	Quarterly
344524117193401	08N04W29E03	Helendale 3	Quarterly
345416116451601	09N02E03G06	Calico East	Quarterly
345350117074001	09N02W06L11	Lenwood 1	Quarterly
345136117101201	09N03W23D02	Hodge Outlet FCF	Quarterly

Well construction, and lithology logs. More wells will eventually be made available to the NGWMN network as time permits.

Notes on Sites with Missing Required Data Elements:

Only one (1) well location (04N03E35J01), of the fourteen (14) wells submitted, does not meet the recommended monitoring frequency shown in table 4.5.1.1. This well location is monitored on a semi-annual basis instead of quarterly as recommended by the NGWMN table 4.5.1.1. The thirteen (13) that do meet the recommendations are measured quarterly and have pressure transducers installed for continuous monitoring.

The fourteen (14) wells submitted do not meet the recommendations for annual water quality trend monitoring. Water quality sampling currently occurs in these wells every seven (7) years.

Recognizing the role that comprehensive data plays in water resource management MWA's future endeavors include a proactive initiative to drill new monitoring wells to fill gaps in the monitoring network. As we progress with this project it is MWA's intent to continue our commitment to the NGWMN and share this reliable data for informed decision-making.

Description of Web Services Used or Installed for this Project:

To accommodate the requirements for the NGWMN, MWA used KIWIS. KIWIS provides an API option via HTTP to be used by client applications and scripts. The data can be queried using HTTP GET or POST. Two (2) additional output formats which were not part of the standard KIWIS were added, namely the WaterML2.0 timeseries value format and the GroundwaterML2.0 format. MWA and the USGS NGWMN Staff coordinated with Kisters staff to map the data in the web services to the NGWMN portal. At the time of this report, this work is still in progress as MWA and NGWMN staff work to resolve some complications of data formatting issues. It is the intent of MWA to continue these efforts.

Analyte List Used for Water-Quality Sampling Networks:

MWA is not currently providing water quality data to the NGWMN under objective 1. The standard analyte list for Mojave includes:

Alkalinity- Bicarbonate (as CaCO ₃)	Barium- Dissolved	Chromium VI
Alkalinity- Carbonate (as CaCO ₃)	Beryllium- Dissolved	Color
Alkalinity- Hydroxide (as CaCO ₃)	Boron- Dissolved	Conductivity
Aluminum- Dissolved	Cadmium- Dissolved	Copper- Dissolved
Antimony- Dissolved	Calcium	Fluoride
Arsenic- Dissolved	Calcium- Dissolved	Hardness
	Cation/Anion Balance	Iron
	Chloride	Iron- Dissolved
	Chromium- Dissolved	Iron- Ferric

Iron-Fe +2	Nitrite-NO2	Sulfate
Langlier Index	NO3+NO2 as N	TDS
Lead- Dissolved	pH	Temperature
Magnesium	Phosphate-Ortho	Thallium- Dissolved
Magnesium- Dissolved	Potassium- Dissolved	Turbidity
Manganese- Dissolved	Potassium	Uranium- Dissolved
Mercury- Dissolved	Redox Potential (Eh)	(pCi/L)
Nickel- Dissolved	Selenium- Dissolved	Vanadium- Dissolved
Nitrate-N	Silica- Dissolved	Zinc- Dissolved
Nitrate-NO3	Sodium- Dissolved	
Nitrite-N	Sodium	

List of Laboratories and their Accreditation:

MWA uses Eurofins laboratories for analysis of water quality sampling. Eurofins participates in the Environmental laboratory Accreditation Program (ELAP). In 2023 Eurofins participated in the USGS Standard Reference Sample (SRS) project in efforts to support MWA in submitting water quality to NWIS. At this time however, no work was performed to put Water Quality data onto the NGWMN.

Work Done under Objectives 2 or 3 as Part of the Initial Project:

No work was performed under Objectives 2 or 3 in the initial project.

Conclusion

Throughout the project, the MWA aimed to enhance the cooperation and relationship with the USGS and the NGWMN. MWA faced multiple challenges, including staff attrition and project management with the Kisters development team. Despite these, MWA consistently worked to address and maintain partnerships, ensuring the commitment and accountability of the project. MWA remains focused on providing data that is representative of aquifer conditions, and beneficial to the NGWMN.

Attachments:

Invoices

Federal Financial Report

MWA and USGS Meeting Summary- "...MWA is striving to produce high-quality data and should be commended for their efforts."