

TECHNICAL MEMORANDUM

DATE: June 30, 2025

Project No. 23-1-099

**SUBJECT: Antelope Subbasin – Well Monitoring Equipment Summary Technical Memorandum
Component 0, Category (d), Task 5 Deliverable**

PURPOSE

The Antelope Subbasin Groundwater Sustainability Agency (GSA) is planning a community domestic well monitoring program whereby volunteers' domestic wells will be equipped with telemetered groundwater level monitoring equipment to enhance the understanding of groundwater levels related to domestic well beneficial users. Through the Sustainable Groundwater Management (SGM) Program, the GSA received funding from the California Department of Water Resources (DWR) to purchase equipment and implement the volunteer-based domestic monitoring program. The GSA received enough funding with the intention to equip up to 25 domestic wells with monitoring equipment. The purpose of this technical memorandum is to outline the selection process for the monitoring equipment to be purchased and installed.

EVALUATED EQUIPMENT

Three systems were evaluated for the purposes of the monitoring program. The systems were compared using the following criteria

1. **Hardware Cost** – The hardware cost is the total purchase price of the monitoring equipment including any cellular or web hosting data services.
2. **Web Hosting/Telemetry Capabilities** – It is important for the program to collect and transmit data remotely. This criteria focuses on the ability of the device to transmit data remotely and where the data is stored. The cost of any web services, cellular data costs, or recurring payments are taken into account here.
3. **Data Management** – Once the data is sent to the centralized location it needs to be easily viewed and visualized by the public. This criteria evaluates how well the collected data can be integrated into any data management systems and visualization programs already have in place.
4. **Community/Volunteer Friendly** – The program emphasizes community outreach and engagement and how well the equipment is to use by the public is taken into account under this criterion. This includes how intrusive the equipment is and if it will interfere with current well operations and how informative the collected data will be to the individual volunteers.
5. **Technical Setup** – The complexity and difficulty of setup and installation of the equipment is evaluated under this criteria with a preference of more user friendly “plug and play” options.

WellIntel ST System

The WellIntel system is an acoustic based module that is installed in a pre-existing port on the users well head. The module has a microphone that hangs 3-5 inches below the well head that receives the rebounded acoustic signal that is sent from the main system that sits approximately 12 inches above the top of the well head. The hardware can be run on a battery or solar panel. There is also a current transducer that is clipped to the power supply for the well pump that is used to tag water level readings as pumping, recovery, or static. The depth to water readings are transmitted via radio signal to a transmitter connected to the well owners Wi-Fi router. The data is then transmitted to the cloud for storage and reporting.

Hardware Cost

The hardware costs received from WellIntel include all necessary hardware for the module on the well head, the Wi-Fi radio transceiver, and 5 years of potential battery and sensor replacements that may be needed. The hardware cost for a single system is \$2,250 and \$56,250 for a network of 25. The cost for one year of data hosting is \$6,000 for the network of 25 systems totaling \$30,000 for the five-year initial timeline covered by the grant. The total cost for 25 pieces of equipment and 5 years of web hosting/data management is \$86,250.

Web Hosting/Telemetry Capabilities

The WellIntel system is ready to be used in a telemetry network. The hardware functions to transmit water levels to a central cloud-based location at intervals selected by the program manager. Data hosting and services are handled by WellIntel on a subscription basis.

Data Management

The WellIntel data management system has the capabilities to be easily tailored to the needs of the GSA. WellIntel is set up with separate user and public facing dashboards designed to give well owners a deeper look into their well systems on a personal dashboard and a way to look at basin wide data while keeping owner information private. The data hosted on the WellIntel websites can then be easily integrated into any of the GSA's web-based data visualization tools via API. WellIntel data service subscription costs include work and integrations necessary. This means that the public can view all GSA data related to other projects in addition to the domestic well data at no additional cost or work by the GSA.

Community/Volunteer Friendly

WellIntel's hardware is non-intrusive acoustic measurements designed not to interfere with owner operations. This means that nothing is installed down-well that could potentially cause pumps or other in-well equipment to be inoperable. The data management system also offers the well owners insight into their well health in real time. Water level measurements are available to the owner and, due to the addition of the current transducer, can be compared to pump operations. This means owners can gain insight into pump efficiency, recovery times, drawdown during pumping, and seasonal changes within their well.

In addition to the hardware benefits for the volunteer, WellIntel also supplied a trial piece of equipment at no charge to a stakeholder volunteer member to see how the operations work. During that time the owner has been able to reach out to WellIntel with questions regarding the system and the data and WellIntel has been extremely helpful and responsive. The WellIntel team has also been involved with similar community monitoring projects and is able to take on a large role in public outreach and program development.

Technical Setup

Installation and setup of the WellIntel system can be handled in a number of ways. WellIntel has trained staff that are able to handle all the installation procedures including calibration, sensor install, and Wi-Fi transmitter install. Additionally, the system comes fully assembled with robust installation instructions that GSA or subconsultants can follow. The GSA's consulting team installed the trial equipment with no prior experience with the equipment. The WellIntel technical team was available by phone during the installation to help troubleshoot and was extremely helpful and communicative to both the consultant and well-owner. The WellIntel team also provides professional system installation by their team with in-person training for GSA staff to provide experience for future installations.

Eno Scientific – Well Watch 670

The Eno Scientific Well Watch 670 is an acoustic based data logger designed to fit on the wellhead in an available sounding port. The system is self-contained and includes a screen for visualizing real time water levels and trends. The system is powered through a hardwired connection that can be connected to a solar panel in remote locations where power is not readily available. Utilizing an external transmitter and cellular service, the system can be adapted to telemetered data transmission.

Hardware Cost

The hardware costs received from Eno Scientific were based on a 10 sensor 3-year cellular service connection quote. The quote included the Well Watch 670 module, a solar panel for power, and the hardware and cellular service for 3 years. The cost for a single system with 3-year cellular data service is \$3,080 totaling \$77,000 for 25 systems across the network.

Web Hosting/Telemetry Capabilities

Telemetry capabilities of the system are not built in and requires 3rd party external hardware to be installed. The hardware needed utilizes cellular data network to transmit collected measurements and requires a service plan. The web hosting would then need to be built and maintained by the GSA or consultant in order to store and view the data.

Data Management

Data management and visualization is not handled by Eno Scientific and would need to be handled by the GSA. In order to view the network data, technical experts would need to create software to communicate with the sensors, as well as a visualization tool. The GSA could utilize preexisting web-viewer tools that were created for other SGMA data visualizations and write code to bring collected data from the telemetry systems to their DMS and then into to the web-viewer.

Community/Volunteer Friendly

The Well Watch 670 is an acoustic based sounder that sits on the top of the well cap and is unobtrusive to well operations. No down-well equipment needs to be installed, minimizing risk to the operation of the well. Real time water level data can be viewed by the well owner on the device itself and potentially through the GSA's web-viewer depending on how that system was built. The power needed to supply the device is potentially obtrusive to the volunteer in that it would require either making electrical changes in order to utilize existing well power, installing battery packs that would require GSA staff to visit the volunteer property to maintain, or installation of a solar panel.

Technical Setup

Technical knowledge of telemetry on both the software and hardware side is required to make the system function to the needs of the GSA. The Well Watch system itself is simple and user-friendly to install but would require additional 3rd party equipment to utilize the data in telemetry applications. A software system would also need to be built in order to utilize the data for telemetry applications.

In Situ Rugged Troll System

The In-Situ Rugged Troll Vu-Link system is a ready built pressure transducer that is lowered into the well and communicates with the Hydro-Vu system via cellular network to create a telemetry network across all wells it is installed. The system consists of a pressure transducer, direct read cable, data logger/telemetry device, cellular network antenna, and a subscription to the Hydro-Vu data management system.

Hardware Cost

The hardware costs received from In-Situ included everything needed to monitor a single well and a 5-year subscription to the data management system. The cost for equipment on a single well is \$2,790.70 equating to 69,767.50 for the anticipated 25 systems.

Web Hosting/Telemetry Capabilities

The In-Situ system has telemetry capabilities built into the equipment so it is ready for telemetered transmission out of the box. The telemetry operates utilizing the cellular data network available in the location and transmits data to the In-Situ branded Hydro-Vu web platform. Web hosting is included in the quote for the equipment and does not require additional work by the GSA.

Data Management

The Hydro-Vu online platform is what is used to store and manage data collected from the In-Situ equipment. The platform allows users to view and filter data and export collected readings to a Microsoft Excel document for management and integration into other data viewer services. There is potential for the data to be integrated into the GSA's current web viewer applications via API but is not included in the subscription costs. The GSA or consultant would need to build a system for importing data from one platform to another.

Community/Volunteer Friendly

The hardware itself and online system are straightforward to install and to understand for most technically savvy users. The sensor does offer water level readings via the dashboard however; the well owner is limited to viewing data in the timeframe the sensors are set to by the program manager. The equipment is also a down-well based water level sensor that could potentially interfere with pumping operations.

Technical Setup

The hardware installation requires the well-head to be opened and then the equipment is lowered into the well. The hardware itself is readymade but the installation requires some technical knowledge and carries some liability concerns for the GSA.

CONCLUSIONS

To evaluate and compare the separate equipment options, each system was compared using each criterion and given a comparative score of 1 through 3. The system that best met the goals of the criteria received a 1 and the system least in line with the criteria received a 3. Ratings across all categories were totaled and the system with the lowest score was chosen as the best fit for the program. Scores for each rating criteria and total rating scores are presented in **Table 1**.

Table 1 – Equipment Comparison Ratings						
Equipment	Hardware Cost	Web Hosting/ Telemetry	Data Management	Community/ Volunteer Friendly	Technical Setup	Total Rating
WellIntel	2	1	1	1	1	6
Eno Scientific	3	3	3	2	2	13
In-Situ	1	2	2	3	3	11

Hardware Cost

The different hardware costs were compared and are presented in **Table 2**. The In-Situ system received the highest rating for costs. Although the dollar amount of the Eno Scientific device was less than the WellIntel system, it received a lower score under this category because the cellular data service was for 3 years and would require software development. Factoring these additional costs in would likely cause it to increase over the WellIntel quote.

Table 2 – Equipment Cost Comparisons			
Equipment	Hardware Cost (per well)	Web Hosting/ Telemetry services	Total 5-Year cost (25 Wells)
WellIntel	\$2,250	\$6,000	\$86,250

Eno Scientific	\$3,080 ¹	N/A ²	\$77,000 ³
In-Situ	\$2,213	\$14,445	\$69,770

1 – Hardware cost includes cellular data subscription

2 – No Web Hosting Services Included

3 – Quote is for 3 years not 5

Web Hosting/Telemetry Capabilities

The WellIntel equipment received the highest rating for this category because the system operates on the well owners Wi-Fi network and because the web hosting services is included and does not require addition work by the GSA. Cellular data signals in rural areas can be unreliable but the In-Situ equipment includes web hosting services which is why it was scored higher than the Eno Scientific equipment.

Data Management

Both the WellIntel and In-Situ equipment include online cloud-based data management systems and viewers available for users. WellIntel scored higher than In-Situ because they have a web development team willing to tie the data to the GSA's data viewing tools at no extra cost. Eno Scientific does not have data management included in their systems and so it received the lowest scores.

Community/Volunteer Friendly

The WellIntel equipment scored the highest in this category for a number of reasons. The equipment itself is unobtrusive and has a small footprint meaning it will not interfere with well owner operations. Another reason WellIntel equipment is favorable in this category is it offers each individual well owner insight into the operations and health of their system by use of the private well dashboard. The GSA is focused on increasing community outreach and engagement which can be bolstered by providing this info to well owners. The In-Situ equipment received the lowest score because of its down-well nature which can potentially interfere with well operations.

Technical Setup

WellIntel equipment received the highest score because of the ease of installation which has been directly observed by the GSA through the installation of a trial module. WellIntel staff can install the equipment, train GSA staff for installation, or remotely guide installation with technical assistance over the phone. In-Situ requires the well head to be opened in order for the equipment to be deployed so it received the lowest score in this category.

Recommendations

The WellIntel Equipment received the best score when compared to the other equipment evaluated. It is recommended that WellIntel be selected to provide the Community Domestic Well Monitoring Program with the equipment to monitor water levels with telemetry. Based on the evaluation the WellIntel system offers the most comprehensive benefits for the stakeholders in the Subbasin for the price.