A proposal for

Water Works and Sewer Board of the City of Prichard, AL

Proposal & Scope of Work

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5 June 2023

ASTERRA

ASTERRA uses patent-protected technology for infrastructure condition assessment, pipe replacement modeling, and leak detection in urban and rural, water or sewage networks, using L-band synthetic aperture radar (SAR) mounted on a satellite. The technology is based on a proprietary algorithm that detects soil moisture resulting from treated water or wastewater leaks, through the analysis of SAR data. This is of considerable value to industry, governments, and citizens. Because the observation point is orbiting 390 miles above the Earth, this allows for simultaneous monitoring of pipes within a large network.

ASTERRA's Martian Roots

ASTERRA's core technology is based on the search for underground water on Mars and other planets. Lauren Guy, a geophysicist, and entrepreneur who developed the approach, quickly recognized the application could be even more effective here on Earth. The water was closer, the need more immediate, and the technology had the potential to solve a number of critical problems. Mr. Guy founded Utilis (now known as ASTERRA) in 2013 to develop applications for the new technology. In 2016, leak detection in underground water systems became the first commercially used application. This solution is now called Recover.

A Revolutionary Change

From an orbiting satellite, our algorithm which is fine-tuned to detect treated drinking water and wastewater, reveals underground leaks as small as 0.2 gallons per minute. Now, managers of underground water infrastructure can see the water leaking from their systems. Even in the largest cities, it could be seen all at once, with unheard-of speed and efficiency. ASTERRA continues to refine the technology and expand its applications beyond leak detection, adding pipeline monitoring and deficiency analysis as well as property assessment to its growing capabilities.

Impact

ASTERRA actively contributes to the United Nations Sustainable Development Goals, particularly focusing on Goal numbers 6 (Clean Water and Sanitation), 9 (Industry, Innovation, and Infrastructure), and 13 (Climate Action). By leveraging our expertise in satellite-based infrastructure intelligence, we empower organizations to make data-driven decisions and build a resilient and sustainable future. We are dedicated to creating lasting positive change and supporting the achievement of the SDGs globally.

1. **Satellite Radar – Scan Acquisition**

   Raw scans of the area taken by radar over Areas of Interest (AOI) received from client

2. **Radiometric Corrections**

   ASTERRA takes the raw scan and prepares it for analysis, by filtering interferences from buildings, manmade objects, vegetation, water bodies, and more

3. **Algorithmic Analysis**

   ASTERRA's unique and patented algorithm targets the spectral signature of treated water or wastewater and its interaction with the soil

4. **Availability to Client**

   Newly detected leak locations are delivered via the EO Discover platform to the client on an ongoing basis, with frequency depending on the level of monitoring purchased.

Advantages of Ongoing Monitoring

Today, utilities typically survey their system blindly and reactively. This approach yields minimal results which leads many utilities to deprioritize proactive leak detection. Usually, utilities are forced to use limited resources for work orders to find, dig and repair leaks. In most cases, this results in falling further behind the curve and increased pipe breakages. Rather than leak detectors surveying the entire system blindly, Recover guides leak detectors to likely leak locations or points of interest which ASTERRA has highlighted through their analysis. Now, leak detectors only need to walk 5-10% of the system where water is already leaking. With a single scan, ASTERRA identifies ~30% of the active leaks in your system. Additional scans allow for ongoing monitoring which will result in more active leaks being identified in your system. Additionally, leaks are continuously arising and enlarging, thus ongoing monitoring will continue to detect more leaks even in areas previously inspected.

Client Benefits & Impact

ASTERRA provides a comprehensive, accurate, and non-invasive remote sensing solution for locating leaks and monitoring any potable water and wastewater system in the world. This works over any type of terrain – flat or hilly; sparsely populated or densely populated high-rises. This is done by extracting information from SAR scans taken high above the ground and converting them into locations of underground potable water or wastewater leaks. Reducing NRW additionally has a positive effect on the environment. By reducing non-revenue water loss, the amount of processing decreases, resulting in a reduction of power use and the associated environmental effects. Locating and fixing wastewater leaks in sewer systems also helps the environment by preventing pollution.

Main benefits of Recover:

- Non-invasive technology: Deployment of sensors or hardware on the ground is not necessary.

- ASTERRA technology is effective irrespective of soil type, pipe material, and pipe diameter.

- Covers large areas at once. Surveys an entire system in urban and rural areas, while also providing location intelligence at a fine resolution. Identifies potential leaks in areas that traditional acoustic leak detection programs may not typically survey.

- Find more leaks in a shorter period: Increases the efficiency of traditional acoustic leak detection programs by prioritizing work locations and offering quicker response times.

- Screening technology that can be used directly or indirectly for condition assessment, asset

  budget planning and work on structural changes prioritizing network riskier zones.

- Identifies background (i.e., non-surfacing) leaks that might otherwise go undetected for long periods of time.

- Can fit into either CAPEX or OPEX budgets.

- Provides a positive impact on the environment (reduces water loss, electricity used, and CO_2 produced).

ASTERRA's Solutions

ASTERRA's solutions include Recover and MasterPlan for potable water and wastewater. All are made available on ASTERRA's EO Discover platform. Recover and MasterPlan are ASTERRA's commercial services offered in this proposal. The output from the proprietary algorithm is provided through the analysis of the SAR data combined with other processing techniques owned by Utilis (dba ASTERRA).

Recover for Leak Detection

Recover, the recipient of the AWWA Innovation Award in 2021, is a satellite-based solution for monitoring and detecting leaks in drinking and wastewater systems. It enhances operational efficiency and budget optimization by providing infrastructure intelligence for proactive pipe repair and planning. With Recover, entire city-wide systems can be monitored efficiently.

This advanced technology quickly locates non-surfacing leaks, allowing leak detection crews to focus on targeted repairs instead of unnecessary digging. Compared to traditional methods, Recover identifies more leaks and increases field crew efficiency by up to 400%. It offers the water industry the lowest cost per leak found, averaging 3.5 leaks per crew day compared to 1.3 with traditional acoustic methods. By reducing non-revenue water loss, which amounts to 17 billion gallons annually worldwide, Recover brings significant benefits to companies in the industry.

Furthermore, Recover assists the wastewater sector by mitigating the risks of fines, consent decrees, legal consequences, and reputational damage.

Recover Insights

At the start of the client's subscription period, each client is provided access to the EO Discover platform where they can access the data in the form of GIS files, the U-View application, or the dashboard with individual projects and field performance metrics. Each client is also provided access to the U-Collect field investigation application. The platform can be accessed 24/7 during the subscription period to view ASTERRA's analysis and results of field investigations track success metrics. Recover's specific features include:

Recover (POI Output): A GIS layer containing the POIs, provided in SHP and KML format for import into any GIS system (client-based, ESRI, or ASTERRA-provided U-Collect and U-View) that can be overlaid on a map displaying streets, pipes, hydrants, valves, and potential leak information.

EO Discover: A link to the EO Discover password-protected platform displaying data and field results, along with monitoring the progress of the project/service progress in real-time.

Temporal and Spatial Analysis: With a single scan, Recover identifies ~30% of the leaks in a given system. With multiple scans, Recover will identify up to 25% more of the leaks in the given system. Through multiple scans we can identify leak clusters through a temporal and spatial analysis which will aid in maintenance prioritization and asset management plans.

MasterPlan for Pipe Deficiency Assessment

Providing unique insights not available from anyone but ASTERRA, MasterPlan is an actual (not predictive) measurement of non-surfacing pipe leaks. It is pipe agnostic and collected non-invasively by a satellite with wide coverage, often scanning a full system instantaneously. MasterPlan provides actionable insights into your asset management plan in one easy data layer. Trained on five years of leaks discovered using Recover, the new algorithm assesses the deficiency of an entire pipe system using multiple SAR scans over time.

ASTERRA MasterPlan provides a GIS dataset containing pipe deficiency levels derived from SAR data. This solution is based on the same proven patented algorithm that is used by Recover to detect leaks in your system but is extended to monitor your system over time using statistical analysis. The general process takes all POIs identified in two consecutive satellite scans (identical coverage and angle) over your area of interest and analyzes the POI results. It then compares the POIs from multiple scans and identifies the clusters of POIs between them.

These results are processed through a learned statistical algorithm and used to assign pipes a score from low to high, signifying the level of deficiency observed.

With ASTERRA Masterplan, we can identify critical areas where the client can focus its future pipeline rehab and replacement efforts. These high deficiency areas can be used for asset management planning purposes, e.g., capital improvement replacement planning.
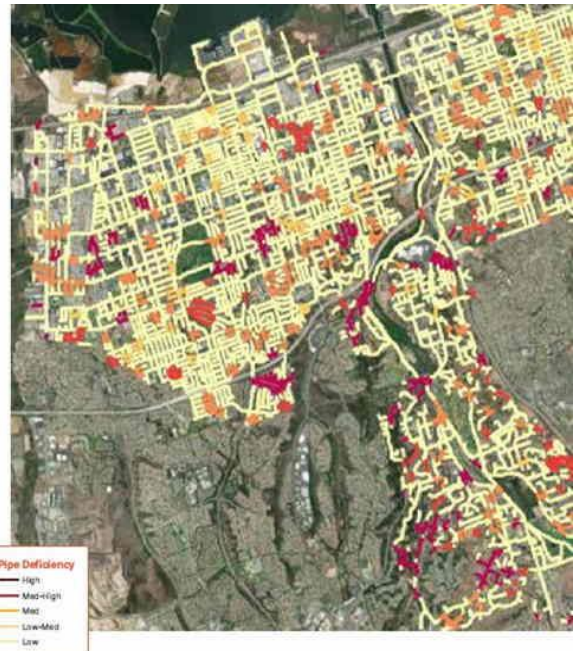
MasterPlan Insights

MasterPlan provides utilities and engineers with insights into actual pipe conditions. This GIS data layer is compatible and easily integrates into all GIS and GIS-based software. Combine this data with other information, such as pipe age, material, work orders, and consequence of failure to further enhance your replacement planning models or water system master plans.

MasterPlan (Pipe Deficiency Output): A GIS layer containing client pipe segments rated based on condition. Provided in SHP and KML format for import into a GIS or risk modeling system (Client map displaying streets, pipes, hydrants, valves, and potential leak information).

EO Discover: Login credentials to the EO Discover's password-protected platform for viewing the pipe data via GIS or U-View applications and for monitoring pipe deficiency levels.

MasterPlan Pipe Deficiency Assessment: A summary assessment detailing the condition of the client's pipes based on the GIS data output of pipe scores from low to high deficiency.

U-View Licenses: Licenses are provided for U-View (allows the client to view the data) for the duration of the EO Discover subscription period.

Typical Process and Timeline

- After confirmation of the order through the contract signature or receipt of a purchase order, ASTERRA will acquire the satellite scan(s). ASTERRA must have the order confirmation at least 21 days prior to the first date of satellite coverage to move forward with the satellite data procurement. The date of the acquisition is subject to the technical and operational constraints of the third-party satellite operation company and may change at any time.

- Before the acquisition, the client will provide ASTERRA with an Area of Interest (AOI). Unless agreed otherwise by the parties, the AOI is a designated geographical area to be surveyed using satellite within the client-provided service area.

- During the period prior to the scan acquisition, the client will provide ASTERRA with a GIS layer of all available treated water or sewage lines in the AOI to be analyzed. If available, the client will also provide a hydrant and valve layer within the AOI.

- Unless otherwise agreed upon by both the parties, ASTERRA will provide services only in the AOI overlapping with the client's provided GIS pipe system layer.

- After acquiring the scan and receiving the GIS pipe layers from the client, data will begin to populate on the EO Discover platform. This is approximately 7-14 business days after the first scheduled scan acquisition date. Scan acquisition dates may be changed by a third party (satellite operator) or due to technical constraints. Service start dates may be affected due to poor scan quality according to ASTERRA's quality assurance standards.

- Where applicable, leak field inspection work can begin after the leakage data has populated on EO Discover on an agreeable date between both parties.

PROPOSAL

Scope of Work

The scope of work contained herein details the work and services ASTERRA will provide as well as the roles and responsibilities of both ASTERRA and Water Works and Sewer Board of the City of Prichard, AL **("Client")**.

Roles, Responsibilities, and Offerings – ASTERRA

ASTERRA will provide Recover data as a service via EO Discover and it will consist of areas identified as potential leaks (i.e., areas containing soil moisture of treated water and/or wastewater underground) using a proprietary satellite imaging algorithm across the **Client's** water system. ASTERRA will provide a primary contact person for technical and administrative purposes who will interact with the **Client**.

ASTERRA's Responsibilities ("Services"):

- Acquiring and analyzing the satellite scan(s).

- Providing potential leak location data as a service through our password-protected platform, EO Discover. This data can be exported as GIS data files.

- Providing best practices for field inspection protocols to the Client.

ASTERRA's Solution for Potable Water:

- **Recover (POI Output):** GIS layer containing the POIs, provided in GIS data files formatted for import into any GIS system.

- **EO Discover:** Provides access to monitor and track the progress of the project/service in real time and calculates ROI and impact metrics for ongoing KPI tracking. The license is for the period of service purchased.

- **U-Collect and U-View Licenses**: Provided for each of the following: U-Collect (allows field technician to collect data in the field), and U-View (allows field technician to view data from anywhere). The license is active upon delivery for the period of service. Additional licenses may be purchased and/or the initial license extended at the request of the client.

- **Kick-off Meeting:** Prior to fieldwork, an ASTERRA or ASTERRA-certified team (regardless of if it the client's team or a contractor), will call a kick-off meeting to agree on the operational field plan to address the Client's specific needs and the best practices required to get the best results.

- Optional: Acoustic Leak Detection for Field Investigation (for Potable Water Pipelines Only): Based upon selecting this option, ASTERRA will provide a certified subcontracted acoustic leak detection team to investigate the points of interest, provide a list of verified leaks, and mark them for repair. The leak detection field verification team(s) is proficient and experienced in using and operating acoustic equipment. The team should be provided with all the needed tools to access the listening points.

- Optional: ASTERRA MasterPlan Pipe Deficiency Map, provided as a GIS data set, if purchased within the Recover tier available or as an additional service option.

- Optional: ESRI Arc GIS Field Maps Integration – data provided in your ESRI ArcGIS online accounts for easy use in ArcGIS Field Maps. (Additional cost may apply if it is not included in the Recover service tier already).

ASTERRA's Solution for Wastewater

- **Recover (POI Output):** GIS layer containing the POIs, provided in GIS data files formatted for import into any GIS system.

- **EO Discover:** Provides access to monitor and track the progress of the project/service in real time and calculates ROI and impact metrics for ongoing KPI tracking. The license is for the period of service purchased.

- **Kick-off Meeting**: ASTERRA or ASTERRA-certified team will call a virtual kick-off meeting to discuss the data delivered and demonstrate the usage of the platform.

Roles, Responsibilities, and Offering – Client

The Client is responsible for providing baseline system data, work order history, and in some cases, an acoustic field verification team to inspect POIs identified by ASTERRA. The client shall identify a primary contact person for technical, administrative, and field inspection coordination. ASTERRA agrees to use the information described below only for the client's specific project and to not share the information with any other third party.

Client Responsibilities

- **Pipe System Information for Potable Water Lines:** Prior to scan acquisition, the **Client** shall provide ASTERRA with a detailed and accurate GIS pipe system layer. If GIS is not available, roads will be used to guide the analysis. ASTERRA will use this layer to identify POIs. The GIS layer should include pipe material and diameter, length of pipeline to be analyzed, hydrants, valves, and any other detailed information available.

- **Pipe System Information for Wastewater Lines:** Prior to scan acquisition, the **Client** shall provide ASTERRA with a detailed and accurate GIS pipe system layer. If GIS is not available, roads will be used to guide the analysis. ASTERRA will use this layer to identify POI locations. The GIS layer should include pipe material and diameter, forced and/or gravity lines, length of pipeline to be analyzed, manholes, depth, and any other detailed information available.

- **Leak Detection History (Work Orders):** The **Client** shall provide ASTERRA with a detailed and accurate history of leak findings and repairs beginning one (1) week before the date the first satellite scan is acquired and through the project life cycle.

- **Leak Detection Performance Metrics for Potable Water Lines:** The **Client** shall provide ASTERRA with relevant and available performance metric data related to previous **Client**-utilized leak detection methodologies. This information will be used to calculate value metrics of the service and will be provided to the Client in the final report for their use.

Client Services for Potable Water

Areas of Interest (AOI)

During this service, ASTERRA will survey the Area of Interest (AOI) to be determined by the client, contained to 269 linear miles of mains and service pipes as outlined in the image below:
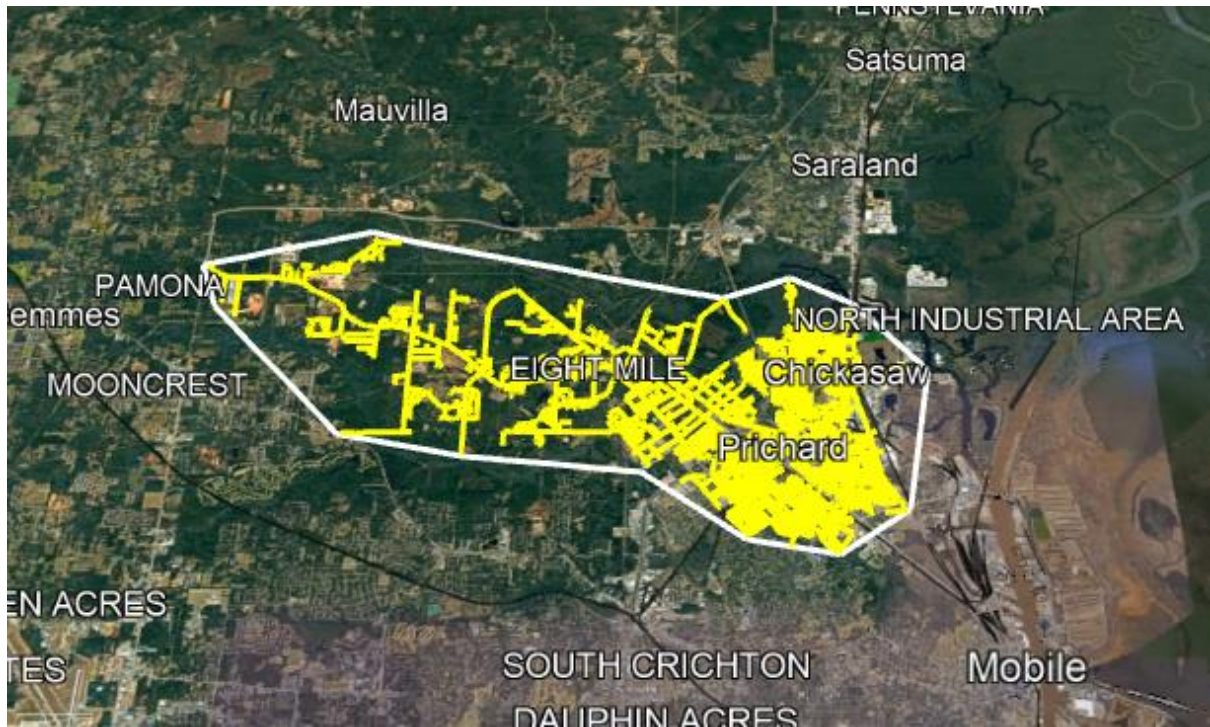
Once ASTERRA receives the full GIS pipe system information from the client, the pipe and total miles analyzed per delivery will be identified. Note: both main and service lines will be counted for total pipe length calculation.

EO Discover

Subscription-Based Service Packages

ASTERRA's Recover solution and features are provided via a subscription to EO Discover with an option to select one of three district levels of service (Detect, Prevent or Advise). Each service level contains specific features designed to meet clients' current and future needs, with additional add-on services available.

Detect	Prevent	Advise
2 licenses: EO discover	**4 licenses:** EO discover	**6 licenses:** EO discover
Base line leak analysis	Base line leak analysis	Base line leak analysis
Leak Locations	Leak Locations	Leak Locations
U-collect/U-View Apps (2 licenses)	U-collect/U-View Apps (4 licenses)	U-collect/U-View Apps (6 licenses)
	Temporal and Spatial leak Analysis	**Enhanced** Temporal and Spatial leak Analysis
	Prioritized Leak locations for field investigation	Prioritized Leak locations for field investigation
		MasterPlan Pipe Deficiency Map
		ESRI ArcGIS Field Maps Compatibility
		Personal Success Manager

Always Included: Online support, customized success plan, best practices tutorials
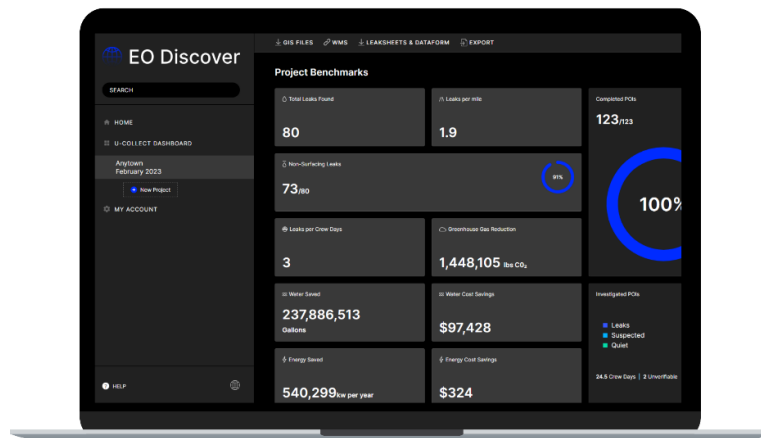
Pricing

Area of interest (AOI) for analysis:

Potable Water lines: 269 miles

	Detect		Prevent		Advise	
	QTY	Price	QTY	Price	QTY	Price
Package	12 months	$24,500	12 months	$38,000	12 months	$59,000
Total	**$24,500**		**$38,000**		**$59,000**	

Optional Additional Services

Subcontracted Acoustic Leak Detection Team - BOTG (40 hours/ 5 Days)	10 Days	$19,000	15 Days	$27,000	20 Days	$36,000

Package price discount for 24 months subscription: 5 %

Package price discount for 36 months subscription: 10 %

Proposal is valid until: September 30, 2023

Note: Once a package is selected, please contact ASTERRA sales team for terms of use and signature processing.