Executive Summary Report
ASTERRA Satellite Leak Detection
2023-2025 Review

North Kingstown, RI
October 2025

Executive Summary Report

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SUMMARY

This executive summary paper analyzes the ASTERRA satellite leak detection services performed from August 2023 to October 2025 for the North Kingstown, RI, representing year 1 and 2 of a 3 year satellite leak detection service. Performance will be compared to benchmark results achieved in other ASTERRA projects around the world and North American traditional boots-on-the-ground (BOTG) leak detection projects.

- A total of **50 leaks** were confirmed pursuant to the satellite directed field inspection in (40 days of field investigation); 44 leaks were on the utility side, 6 leaks were on the customer side of the meter.

- The estimated water loss value identified (based on a water cost of production of $3.28 per 1,000 gallons) is $204,807 per year of water loss savings.

- The total real water loss volume found by this program was 0.17 MGD or 62.4 MGY.

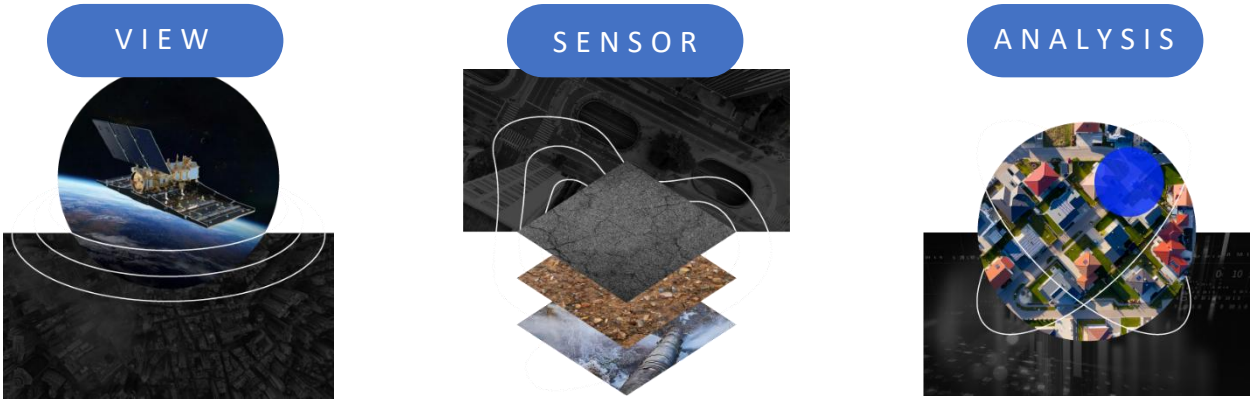
- Each crew field day identified 1.6 MGY of water loss volume. A total of 40 field crew days identified 62.4 MGY of potential water supply recovered.

- The total 3-year service cost, including the ASTERRA satellite surveys (3 satellite flyovers – 1 per year) plus BOTG (60 days of field leak inspection – 20 days per year), mobilization and report preparation was $177,000.

The simple payback period is 10.4 months.

ASTERRA

ASTERRA Technology



ASTERRA utilizes specialized radar signals taken from a satellite to scan the area of interest and collect the resulting reflected signals. These signals are analyzed and processed to identify specific indicators of wet soil saturated with potable water, screening out the signal noise and other interferences. The result is a map showing points of interest. The ASTERRA analysis typically highlights 5-10% of the entire system length, and only these locations, where there is expected to be a leak, are inspected by BOTG leak detection teams. Thus, the time and resource cost of leak detection is much lower than traditional leak detection approaches (e.g., full-system, random, systematic, or block map).

The steps taken during the North Kingstown service begin at the satellite data acquisition phase and then move into the leak detection field investigation phase whereby the leak detectors investigate points of interest generated from the satellite imagery, and confirm the leaks in the field into actionable data. The steps taken over the course of the satellite service to the field investigation are outlined as follows:

1. **Data Acquisition:** Obtain L-band satellite imagery of North Kingstown area of interest (potable water lines).
Year 1: Data provided in August, 2023
Year 2: Data provided in December, 2024

2. **Analysis:** Apply patented algorithm based on soil saturation (highlighting points of interest within North Kingstown system showing elevated levels of potable water saturation).

3. **Data Integration:** Integrate points of interest data into online platform for the end-user to utilize and investigate via acoustic leak detection (platform is called EO Discover).

4. **Visualization:** Present points of interest visually within the EO Discover platform, which also includes North Kingstown water lines mapped out for reference when investigating points of interest in the field.

5. **Quality Control:** Perform QA/QC on data prior to releasing data to end-user.

6. **Delivery:** Provided North Kingstown with delivery email containing a link to the online EO Discover platform containing points of interest and hosted a tutorial on the platform.

7. **Acoustic Field Investigation:** Subcontracted acoustic leak detection team then investigated the highlighted points of interest within North Kingstown system.
Year 1: 20 days of field investigation performed in October 2023
Year 2: 20 days of field investigation performed in January 2025

8. **Final summary/report:** North Kingstown received leak cards from the investigation for the repair crews to fix the leaks. The utility is also able to review the results from the survey via the online EO Discover platform. The cycle then repeats upon further satellite scans and analysis.

There is 1 satellite flyover remaining, estimated to be taken in March 2026 with the final 20 days of field investigation to be completed subsequently.

NORTH KINGSTOWN, RI PROJECT AREA RESULTS

The satellite image for the North Kingstown, RI service was collected in August 2023 and December 2024 covered the entirety of its service area. Table 1 shows the results from the work performed. A grand total of 50 leaks were confirmed during this effort; 26 of the leaks were identified by work orders. Of the 50 leaks found by ASTERRA direction, 44 were on the utility side of the meter, and thus are non-revenue water leaks, while 6 were on the customer side of the meter. The 50 leaks were found in 40 crew inspection days. A total of 24 miles of pipeline were physically inspected by the BOTG crews. This resulted in a performance metric of

2.1 leaks found per mile inspected. The system is comprised of mostly Asbestos Cement and PVC pipe. It is much more difficult to acoustically identify a leak on plastic pipe or AC than on metal pipe as the sound travels less and has a lower pitch and intensity.

The field inspection work was conducted in October 2023 and January of 2025. The breakdown of the 44 utility side leaks found by subtype is listed below in Table 1, which lists the AWWA M36 leak flow size by subtype.

Table 1

Real Water Losses Identified

REAL WATER LOSS IDENTIFIED BY LEAK TYPE - GPM			
Leak Type	**Number**	**Flow Rate (GPM)**	**Total Flow (GPM)**
Service Pipe	11	6.9	75.9
Hydrant	5	3.5	17.5
Curb Stop	2	0.7	1.4
Work Orders	26	1	26
Total	**44**		**120.8**

Of the 44 leaks contributing to real water loss, 39 have been repaired:

Repaired Leaks as of October 7th 2025			
Leak Type	**Number**	**Flow Rate (GPM)**	**Total Flow (GPM)**
Service Pipe	8	6.9	55.2
Hydrant	3	3.5	10.5
Curb Stop	2	0.7	1.4
Work Orders	26	1	26
Total	**39**		**93.1**

DISCUSSION

The following analysis will focus on the real water loss value identified by the ASTERRA directed field leak inspection work. Real water loss value found by this program is 0.17 million gallons per day, or 62.4 million gallons per year, and the data is listed in table 2. This is calculated by multiplying the number of each type of leak (e.g., main, service) confirmed by its estimated leak flow rate as defined in the AWWA M36 Water Audits and Loss Control Programs Manual. For leaks associated with work orders, without any additional leak information, a rate of 1 GPM was used for savings quantification purposes. This resulted in an average leak flow rate of 2.7 GPM. This factor was applied to the 44 utility side leaks found via the ASTERRA directed program.

Table 2

Water Loss Recovered

ASTERRA DIRECTED LEAKS - WATER LOSS				
	Number of Utility Leaks	**Average Leak Flow Rate**	**Daily Water Loss Rate**	**Yearly Water Loss Reduction**
Total	**44**	**2.7 GPM**	**171,072 GPD**	**62.4 MGY**

A total of 40 crew days were spent inspecting the points of interest (POIs) for leaks that contribute to the lost water. A total of 62.4 MGY of potential water loss was identified based on the leak estimates. Thus, each day a crew spent searching for leaks generated 2.5 MGY of potential water loss reduction, or effectively new supply. This lost water could be used to meet additional demand in the system without the need for additional aquifer withdrawals, or new capital improvements. These results show that crews spending days in the field searching for leaks, pursuant to the ASTERRA satellite program, generate valuable results.

Approximately 94% of the leaks found by field inspections (47 of 50) resulting in real water loss are due to leaks that have not yet surfaced. These leaks potentially can last for many months or even years before they are discovered without the ASTERRA survey program. Locating these leaks earlier adds to the value proposition of the satellite program.

VALUE PROPOSITION

To calculate the value proposition of the ASTERRA satellite leak detection services, the cost of the work must be compared to the value of the water loss reduction. The value of the water is considered to be the cost of production; comprised of the cost of procurement, pumping, treatment, and distribution. The cost of service is comprised of the satellite imagery collection and analysis cost plus the leak crew cost. The value of water loss reduction is calculated by estimating the volume of water lost, the duration of the leak and the cost of water procurement, treatment, and delivery.

Nominal Cost of Production (Procurement, Pumping, Treating, Distributing)

Vs

Cost of Service (ASTERRA Data Analysis + Leak Detection Crew days)

To calculate the amount of water lost per leak, the estimates in AWWA Manual M36, Water Audits and Loss Control Programs are used in this analysis to be consistent with other project reports. Customer side leaks and work order leaks will not be used to calculate non-revenue water loss reduction. The daily leak loss rate will be normalized to a yearly value for the purposes of calculating the value benefit to North Kingstown, RI.

The cost of water production is estimated to be $3.28 per 1000 gallons. These factors generate the dataset used to create the individual figures and thus calculate the financial savings to North Kingstown, RI. Overall total cost of service was $177,000,
and the total value accrued was $204,807. This generates a simple payback period of 10.4 months. Further value will be realized with an additional incoming satellite scan analysis and 20 days of additional field investigation in spring, 2026 to complete the service.

75% of the available POIs have been physically inspected by the BOTG (144 of 191). There would be more real water loss identified and thus a greater value to Customer if more, or all, of the POIs were investigated.