

ASTERRA MasterPlan in Action

Hitachi Omiya City Water Department

 Hitachi Omiya City, Japan | Case Study



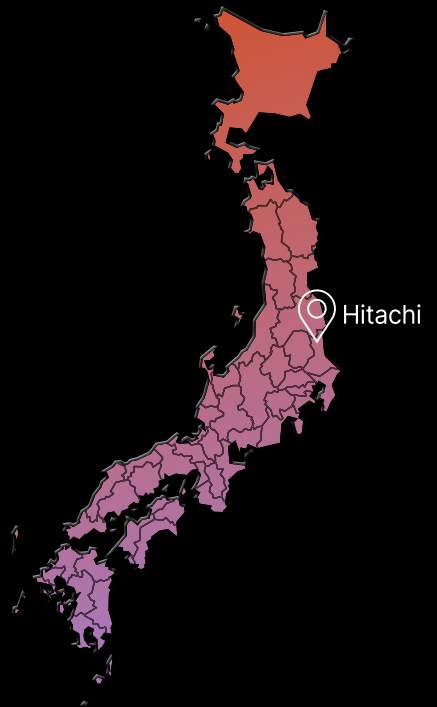
BACKGROUND

Hitachi-Omiya City is located in the eastern part of Ibaraki Prefecture, Japan, with a population of 38,118 people and a total area of 348.45 square kilometers. Approximately 59% of the area is classified as forests or mountains. The water distribution network in the city spans a total of 1,326 kilometers, with major distribution pipes accounting for 810 kilometers and supply pipes for 516 kilometers. The city provides services to a total of 15,655 households. Like similar challenges occurring worldwide, Hitachi-Omiya City has faced significant issues with aging water pipelines and the resulting decrease in water supply efficiency over the years. To address this challenge with a fresh approach, the city decided to adopt ASTERRA's satellite-based risk screening service for the entire municipality. ASTERRA utilizes L-band Synthetic Aperture Radar (SAR) satellite imagery analysis to detect potable water adjacent to water pipelines and visualize it in two ways. The data from ASTERRA Recover is mapped to identify areas where leak detection teams should prioritize their efforts. The other product, ASTERRA MasterPlan, provides reference data for identifying pipeline sections

with a high risk of leakage and requiring replacement. As Hitachi-Omiya City was in the process of preparing for the adoption of Recover, the March 2022 major earthquake caused anticipated damage to the pipelines. In collaboration with J21 Co., Ltd., the Japanese distributor, and Yokohama Water Co., Ltd., additional analysis of MasterPlan was conducted to utilize and validate ASTERRA data before and after the disaster.

MasterPlan is a pipe deficiency asset management tool that uses two overlapping satellite images to detect high levels of drinking water proximate to pipelines, providing the utility with actual ground intelligence that can be integrated into their pipe replacement modelling program. MasterPlan can be used to optimize pipe replacement plans and help prevent resource misallocation. MasterPlan data is presented as a GIS layer that can be integrated into an asset management program showing pipe deficiencies at 5 levels, from low to high.

Two sets of satellite images were taken, one pair on December 24th 2021 and January 21st 2022 and another pair on April



15th 2022 and May 13th 2022. Two sets of MasterPlan analyses were created.

The comparative analysis of the two MasterPlan analyses have shown a significant increase in the percentage of high level pipes deficiency, with the total percentage of levels 3 to 5 increasing from 9.93% to 23%.

Main Pipes Deficiency Level comparison (%)

Deficiency Level	January 2022	May 2022
1	61.87%	49.19%
2	28.2%	27.79%
3	4.5%	12.36%
4	2.84%	9.01%
5	2.59%	1.64%

FULL SYSTEM DISPLAY

Full system display of the two MasterPlan analyses provides a clear visual demonstration of Hitachiomiya water distribution system deficiencies situation and how it has changed over the six month

time period. The map on the left is from January and the one on the right is from May 2022. The darker the pipe segment is the higher the rated deficiency, and a review of the two maps shows evidence

of notable changes in the location and intensity of pipeline deficiency in various locations, especially in the North-East and South-East areas of the Hitachi Omiya water distribution system.

The images show the pipe segments that have the highest deficiency ratings and thus are the areas that should be given the most attention relative to asset management and condition assessment planning. The two maps can be overlain to focus on the most problematic areas of the system. The MasterPlan analyses can be ground truthed in a number of ways. The areas can be inspected by field leak inspectors to determine the number, size and location of non-surfacing leaks that exist. Virtual or real DMA's (District Management Areas)

can be setup and analyzed to determine the flows in and out of specific sections of the pipe system. Alternatively, a pressure management study can be performed to determine losses in the system section of interest.

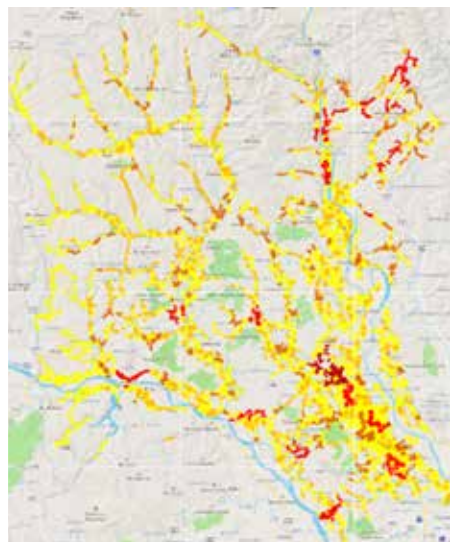
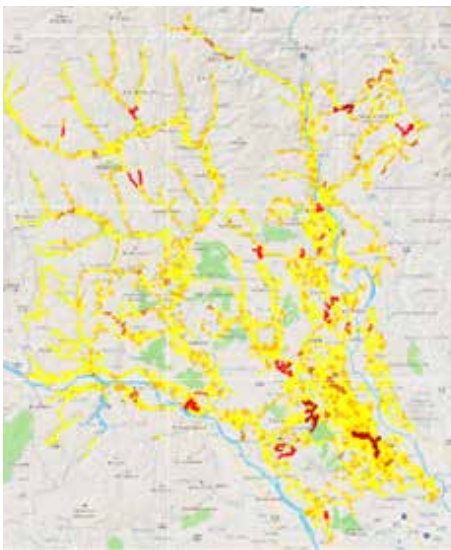
Another way to use the MasterPlan results is as a data layer that can be incorporated into the utilities asset management condition assessment analysis program. This data layer can be added to other pertinent information, such as pipe age,

pipe type, break history and soil type, to increase the accuracy of the analysis to determine which pipe sections should be replaced.

The comparative MasterPlan analyses over the six month study period suggests that ASTERRA satellite imagery can assist municipalities and water utilities to identify the impact of time on their potable water distribution systems, and can be a useful tool for utilities to efficiently deploy field teams to inspect the most vulnerable pipe segments.

There is a clear connection between deficiency levels and leaks locations in the Hitachiomiya water distribution system. This provides a strong indication to the effectiveness of the MasterPlan analysis as a supportive asset management tool.

As the Hitachi Omiya City ground survey continues, the city can also confirm the results by adding pipe segments deficiency levels into its pipe replacement planning, as well as inspecting pipe sections identified and replaced to determine the level of deficiency and leaks that existed on them.



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