

Ka Wai Ola - Water For Life

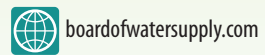
WATER IS ESSENTIAL FOR LIFE. The BWS is committed to providing the people of O'ahu with safe, dependable and affordable water now and into the future. To ensure we continue to do so efficiently and effectively, one of the BWS's key initiatives is a Water Master Plan. A Water Master Plan is a comprehensive program that looks ahead 30 years, evaluates the entire water system, identifies necessary improvements, and balances needs and costs of providing water to our residents and visitors.

O'AHU'S WATER SYSTEM IS MASSIVE. EACH AND EVERY DAY, the BWS pumps an average of 145 million gallons of water and maintains infrastructure including 2,100 miles of pipes, 90 booster pump stations, 94 water sources (wells, tunnels and shafts) and 171 water storage reservoirs.

UNDERGROUND OR OTHERWISE OUT OF SIGHT for the most part, this water infrastructure is subjected to ongoing wear from the island's volcanic soils, earth movement, ground settling, weather, natural corrosion and the flow of water through it. Water main breaks are perhaps the most prominent signs of wear, but there is much more going on that is not evident day-to-day.

THE BWS IS INVESTING IN IMPROVEMENTS to protect and maintain the water system. These investments of the people's money are helping us continue to capture, treat, store, move and sustain water for all of us on O'ahu, now and for future generations.

Contact Us:



boardofwatersupply.com

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(808) 748-5041



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contactus@HBWS.org



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About the Condition Assessment



Safe, dependable, and affordable water now and into the future



**WATER FOR LIFE
KA WAI OLA**

How the Condition Assessment Will Benefit O'ahu

The people of O'ahu have made a considerable investment in our water infrastructure. But O'ahu's water storage tanks, pumps, pipelines and other facilities are showing signs of wear and tear, passing their useful lives and sometimes failing outright. While water main breaks in the street are the most dramatic and visible symptoms of this problem, the slow deterioration of other types of water infrastructure has serious consequences.

- ▶ Condition Assessments provide hard data that help determine where to spend funds, based on criticality, condition and value. These assessments can be expensive, but are worth the protection of public investments in infrastructure. Over time, emergency repairs are far more expensive than proactive restoration or replacement.
- ▶ The Condition Assessment is an important source of information for the Honolulu Board of Water Supply's (the BWS's) Water Master Plan, which is also underway. In the Water Master Plan, condition information will be applied, helping to identify significant infrastructure risks to O'ahu's water system and make them a priority to repair, rehabilitate or replace.



While different parts of a water system may be assessed with different techniques and technologies, the general approach is the same. A specific structure or component is identified for attention. Its condition is examined and the resulting data are recorded. The data will be used in a separate initiative, the Water Master Plan, to identify and prioritize corrective actions for repair, rehabilitation or replacement. The analysis also can help identify improvements to design, operations and maintenance standards, so that existing and new infrastructure can be more efficient and last even longer.

Portions of the system are chosen for assessment based on an initial review of their current condition, value, significance for reliability and quality, and past performance. This makes it possible to focus attention where it will make the greatest impact, rather than evaluating every component of the system, which would be impractical, time consuming and extremely expensive.

When to Perform a Condition Assessment

The American Water Works Association (AWWA) recommends Condition Assessments as a best practice for water utilities to determine what infrastructure needs attention and where to best spend limited public funds. AWWA is the world's largest nonprofit scientific and educational association dedicated to managing and treating water.

Industry guidelines for conducting Condition Assessments indicate that they should be performed when:

- ▶ a sizeable infrastructure investment has been made
- ▶ the probability of failure of a piece of infrastructure seems considerable
- ▶ the consequences of failure of a piece of infrastructure are unacceptably high

As stewards of O'ahu's precious water supply and the money paid by our customers, the BWS is applying state-of-the-art methods that will enable us to make decisions in a more systematic way, with greater accuracy and efficiency. This will allow us to allocate resources more effectively, supporting the BWS's commitment to continue providing safe, dependable and affordable water to all of its customers, now and in the future.

The Purpose of a Condition Assessment

A Condition Assessment is a comprehensive evaluation of the current state of a water system. Similar to a personal health exam by a doctor, both physical conditions and activities are looked at. The resulting information is used to identify concerns to address in both the short and long terms. In the case of a water system, the condition of the infrastructure, operations and maintenance activities are assessed.

Historically, it has been common practice for water utilities to assess the need for infrastructure replacement or extensive rehabilitation based on past failures, age, material, use and soil conditions. Today, by applying new approaches, utilities can be much more comprehensive and proactive in their Condition Assessments and more accurately identify where attention is most needed.

While the BWS has done smaller and less detailed assessments in the past, this is the most comprehensive Condition Assessment ever conducted for O'ahu's water system.

Components of the Condition Assessment

Evaluation methods vary greatly depending upon the type of facility, accessibility, potential problems and information desired. They range from physical evaluation to analyzing data gathered using state-of-the-art technology. Briefly, here's how the BWS is assessing the condition of each major type of infrastructure.

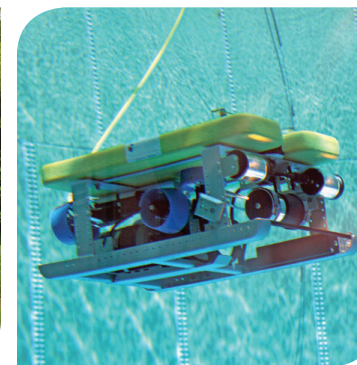
Reservoirs

Large drinking water storage tanks (or reservoirs) are located all around the island, some holding as much as 6 million gallons. (6 million gallons is a year's supply for about 40 typical homes on O'ahu.) These reservoirs, critical for reliable water supplies, are subject to weather, wear and corrosion. The BWS is evaluating each of these reservoirs, with experts looking at and recording the condition of surfaces, connections, walls and roofs, strength of underlying concrete and other attributes specific to individual tanks. Based on this initial assessment, 16 of these reservoirs will undergo an intensive examination to determine their structural strength in adverse conditions, such as hurricanes or earthquakes.

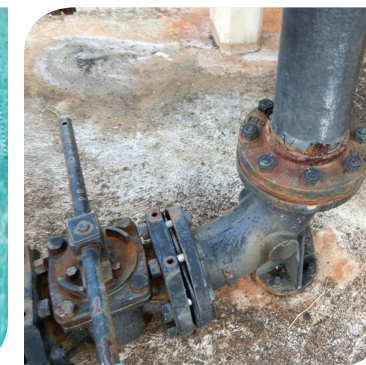
For 30 reservoirs that are more than 40 years old, remote-operated vehicles will act as underwater eyes to inspect the interior condition. These small diving machines measure just 25 inches by 15 inches by 11 inches. Each unit has multiple high-resolution cameras, underwater and above-water lighting, and electronic gauges that record the precise location of each picture they take.



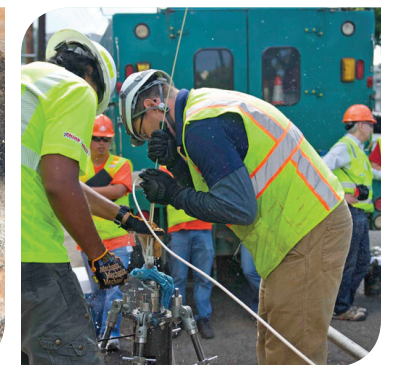
Inspector conducting an assessment of a BWS reservoir



Remote-operated vehicles will assist in inspecting the BWS's reservoirs



Rusting pipes and valves at a BWS water treatment facility



Inserting a pipeline inspection tool to assess a water main

These inspections provide the BWS with a detailed and accurate understanding of cracks, leaks and general physical condition of each reservoir.

The BWS uses remote-operated vehicles instead of divers for safety and because the vehicles can inspect reservoirs while the reservoirs remain in service.

Pump Stations and Wells

Pumps are used to draw water from underground, to move water uphill and to keep water moving to customers. The BWS's system includes 184 pump stations, most with multiple pumps, some of which are able to move as much as 45 million gallons per day.

The Condition Assessment is evaluating all of these pump stations, starting with an examination of structures, roads, site conditions and security measures (such as fencing). Individual pumps are inspected for cracks, corrosion, insulation, wiring and other conditions. Each pump is then run to test if it meets requirements for flow and pressure.

Water Treatment Facilities

O'ahu is blessed with a natural water supply of very high quality, so treatment is minimal. Automated chlorine treatment is used, with granular activated carbon treatment where necessary due to prior agricultural activity. The Condition Assessment includes evaluation of all treatment facilities. Mechanical components are being examined for signs of corrosion. Valves are being checked to determine whether they open and close fully and

correctly. Controls are being tested to verify they are operational and accurate.

Pipelines

The pipes that carry water throughout O'ahu were installed at different times. They are made of varied materials and are of varied sizes, some as large as 42 inches in diameter. Like all built objects, the pipes wear out over time. Water running through pipes causes wear and tear. Volcanic soil, like that found on O'ahu, can lead to corrosion which breaks down the pipe material. Even the smallest crack or hole, if unnoticed and unattended, can eventually become a main break.

As part of the Condition Assessment, the BWS's staff have been inspecting pipes inside and out, conducting forensic analyses of pipes that have failed, collecting data on breaks and leaks and gathering information on operations and maintenance. Computer analysis is being applied to relate these thousands of data points to one another, making it possible to identify which stretches of pipeline are most critical for service dependability and which are most vulnerable to failure. The results will help in deciding where to invest first in repair, corrosion protection, rehabilitation and replacement projects.

Analysis already has identified that the primary contributors to main breaks on O'ahu are corrosion, ground settlement, water pressure surges, pipe materials and traffic vibration. These findings are helping the BWS to target areas where main breaks can be prevented or reduced.