



Pipe Dream: A Closer Look Saves City \$10 Million for Force Main Replacement

- Left to right:**
1. A 50-year-old sewer force main lies under Honolulu Harbor. Engineers must ask, "what condition is it in?"
 2. A crane lifts a slide gate into place to prevent flows.
 3. Down the hatch! A diver enters the sewer line to inspect the sub-merged pipe.



by Leighton Lum, Ph.D., P.E. & Douglas Yamamoto, P.E.

Like people and cars, sewer pipes have limited life expectancies, but sometimes they surprise you. RMTc environmental engineers helped the City and County of Honolulu determine that a critical sewer facility, expected to be at the end of its useful life, was indeed good for another 20 years. This avoided a cost of \$10 million to replace Ala Moana Force Main No. 1.

The Ala Moana Pump Station and Force Main system, Hawaii's largest, conveys wastewater from an area extending from East Honolulu to Downtown Honolulu to the 82 mgd (million gallons per day) Sand Island Wastewater Treatment Plant (WWTP). Two separate but parallel force main systems travel under the entrance to Honolulu Harbor: one is nearly 50 years old, and the other is less than 20 years old.

The Ala Moana system is capable of conveying 163 mgd of wastewater flow, but needs to accommodate projected peak flows in the year 2020 of 189 mgd and handle higher pressure requirements. Initially, system requirements pointed to the replacement, or at a minimum, rehabilitation of the smaller and older

force main to increase its capacity. In search of an alternative, the City reduced the design flows and RMTc engineers lowered the elevation of the Sand Island WWTP headworks.

RMTc then turned attention to the structural integrity of the pipe and its host of technical concerns: the age of the line; the relatively low calculated "C" value (indicating possible internal deterioration); the unlined reinforced concrete construction that would be subject to corrosion; exposure to seawater; and the underwater harbor crossing.

Verifying the integrity of Force Main No. 1 would result in significant cost savings for the project. RMTc's Chief Environmental Engineer, Leighton Lum, PhD, recalls the dilemma: "We were at a point where we could recommend that the City and County expend several hundred thousand dollars to inspect the line and possibly waste the funds, or proceed with the design and construction of a new force main that would cost well in excess of \$10 million." RMTc proposed an incremental "look before you leap" inspection process to reduce the potential cost.

Significant challenges are involved in inspecting a large-diameter force main, much of which lies beneath the state's busiest harbor:

- Could the force main be shut down, adequately sealed and emptied to allow inspection?
- Could the manholes be located and opened for inspection without damaging the force main?
- How could crews inspect the underwater section?

The first step would involve simply opening one sewer manhole and inspecting in and around it. If the results were positive, RMTc would then proceed to inspect the entire line, including both land and underwater portions.

RMTc engaged MGD Technologies, Inc., to per-

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What's IN MOTION?

IN MOTION is RMTc's bi-monthly newsletter coming your way with project profiles, industry trends, lessons learned, and everything from nostalgia from the firm's archives to our latest innovations. Our aim is to send you something worth reading. See you again in the next issue to be published in March.

Trivia Corner

RMTC designed 308 curb ramps for the City and County of Honolulu and 161 for the County of Maui in 2002.

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form the initial inspection. Under the shutdown plan, a multi-ton slide gate was installed at the discharge end of the pipeline at the Sand Island WWTP, and Ala Moana Wastewater Pump Station No. 1 was shut down. A crane then lifted the slide gate into place (*center photo, front page*).

The next step, inspecting one manhole, started a series of pleasant surprises. A land surveying crew located the buried manhole. MGD workers exposed the manhole and performed the inspection. The cover and bolts were in good condition, making it easy for the inspection crew to open the manhole. Surprisingly, only a few inches of water filled the bottom.

"The favorable conditions in the initial manhole gave us confidence to move on to inspecting the entire line," says RMTC's Dr. Lum. Along the entire land portion of the force main, MGD followed an inspection process of manned entry, video recording, internal hardness chipping and external core sampling.

Inspecting the underwater portion of the line was another matter altogether. An initial approach—pulling a sonic device into and out of the submerged portion of the force main—would not work because of bends in the line. RMTC and MGD collaborated on a second approach using manned diving teams, which was successful. A team of two divers and a 12-man support crew from American Marine Corp. inspected the submerged portion of the force main, videotaping conditions and performing hardness chipping (*right photo, front page*).

The original expectations of the condition of the force main and the actual findings were far apart.

- Severe corrosion was expected. Very little was found.
- Joint separation and deterioration were expected. Very little was observed.

- Significant grit accumulation was expected. Minimal grit was found.
- Scouring damage to the force main bottom was expected. None was found.

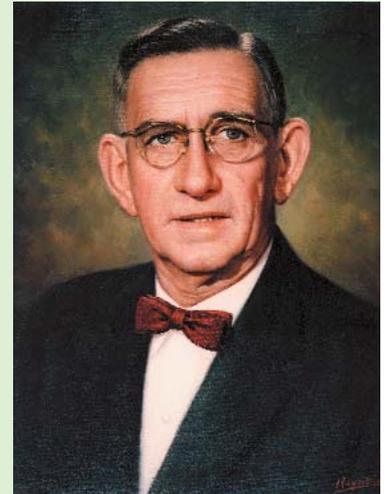
Pipe dreams can come true: a second look allowed the City and its taxpayers to extend the useful life of Honolulu's major sewer force main for up to 20 years—and save \$10 million in the process.

RMTC: Milestones 2002

Roswell M. Towill, who founded our firm in 1930, was posthumously named a Legacy Laureate in the Hawaii Business Hall of Fame by Junior Achievement of Hawaii. His business legacy in Hawaii was also recognized by both houses of the legislature and Hawaii's Congressional delegation.

In 2002, RMTC was once again named:

- Hawaii's #1 consulting engineering firm by *Pacific Business News*.
- One of the nation's top 500 design firms by *Engineering News Record*.



This painting of Roswell M. Towill is displayed in the reception area of the corporate office.

NPDES: Countdown to March 10

Don't be caught without the right permit! On March 10, 2003, the project acreage threshold for NPDES (National Pollutant Discharge Elimination System) permits will be reduced from five acres to ONE acre. For more information about our NPDES permitting services call Brian Takeda, Project Planner, at 842-1133.



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Kaupuni Neighborhood Park Master Plan, Waianae, Oahu. Recently completed by RM Towill Corporation.



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