PREDICTING THE REMAINING SERVICE LIFE OF WATER SYSTEM PIPES

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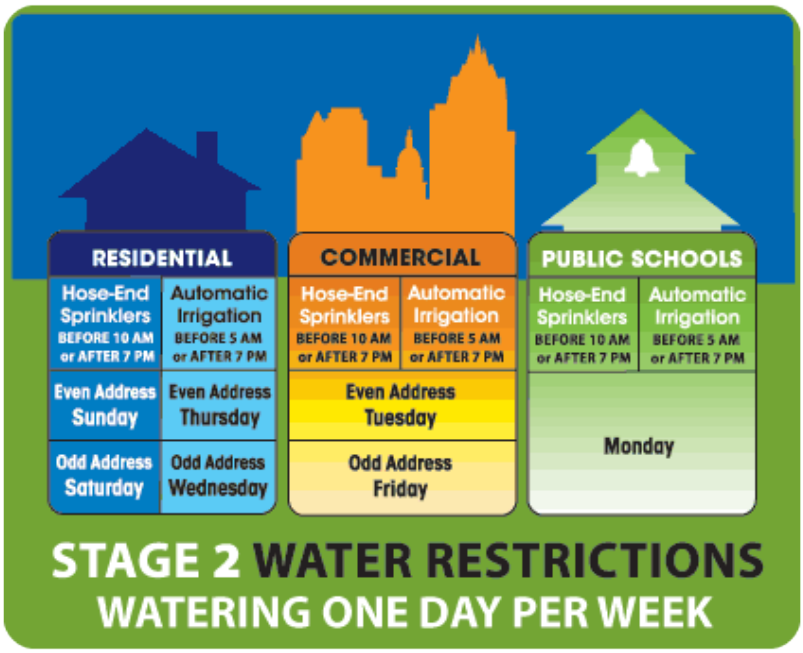
1. Drought and Water Demand

Austin residents may become victims of their own success at conserving water as city officials now are considering raising water rates to ensure the system remains in the black.

With the outstanding conservation plans including providing various rebates to the citizens, advertisements and educating the public as how to save water, the residents aren't buying enough water.

The utility sustained a $10 million loss in water sales in the first few months of this fiscal year. It recorded a $27 million loss in sales last fiscal year.

Largely because of conservation efforts, Austin homes and businesses have used less water each year since 2006, despite population growth and the lingering drought. A primary reason for the reduction is a rule that watering can be done only once a week.


RESIDENTIAL
Hose-End Sprinklers BEFORE 10 AM or AFTER 7 PM
Automatic Irrigation BEFORE 5 AM or AFTER 7 PM
Even Address Sunday
Even Address Thursday
Odd Address Saturday
Odd Address Wednesday
COMMERCIAL
Hose-End Sprinklers BEFORE 10 AM or AFTER 7 PM
Automatic Irrigation BEFORE 5 AM or AFTER 7 PM
Even Address Tuesday
Odd Address Friday
PUBLIC SCHOOLS
Hose-End Sprinklers BEFORE 10 AM or AFTER 7 PM
Automatic Irrigation BEFORE 5 AM or AFTER 7 PM
Monday
STAGE 2 WATER RESTRICTIONS
WATERING ONE DAY PER WEEK

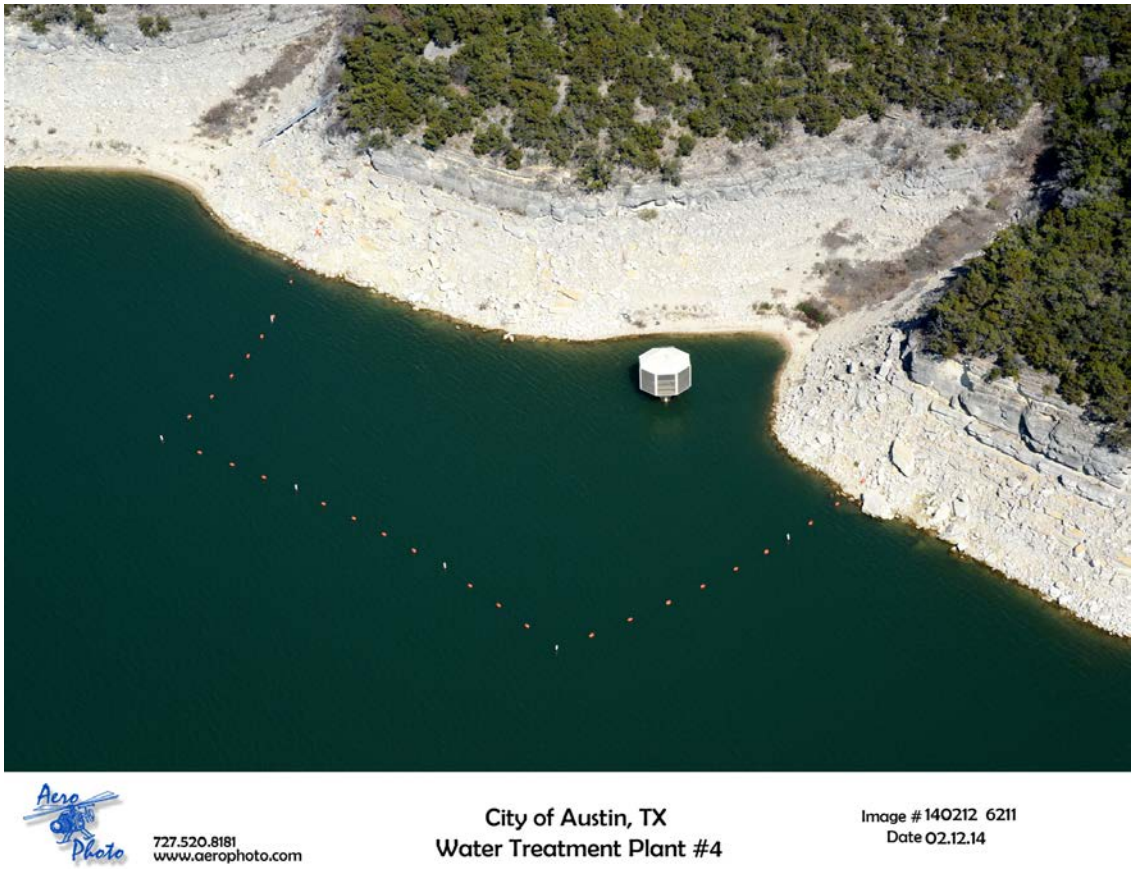
Lake Travis

Lakes Travis and Buchanan, the region's major reservoirs, now hold about 762,000 acre-feet, or 38 percent of capacity.

	2014	2014 (Projections)		Historical Low*
	Feb. 1*	May 1**	Aug. 1**	
Lake Travis (feet above mean sea level (feet msl))	628.08 (40.95 feet below monthly average)	624-622	608-599	614.18 (8/14/1951)
Lake Buchanan (feet msl)	989.26 (22.41 feet below monthly average)	984-983	970-967	983.70 (9/9/1952)
Combined Storage of lakes Buchanan and Travis (million acre-feet) / % of capacity	0.76 38%	0.67-0.63 33%-31%	0.42-0.32 21%-16%	0.62 31% (9/9/1952)

*Based on daily 8 a.m. lake levels.

**Based on persistent dry conditions and following the 2010 WMP.



Water Treatment Plant # 4 under construction

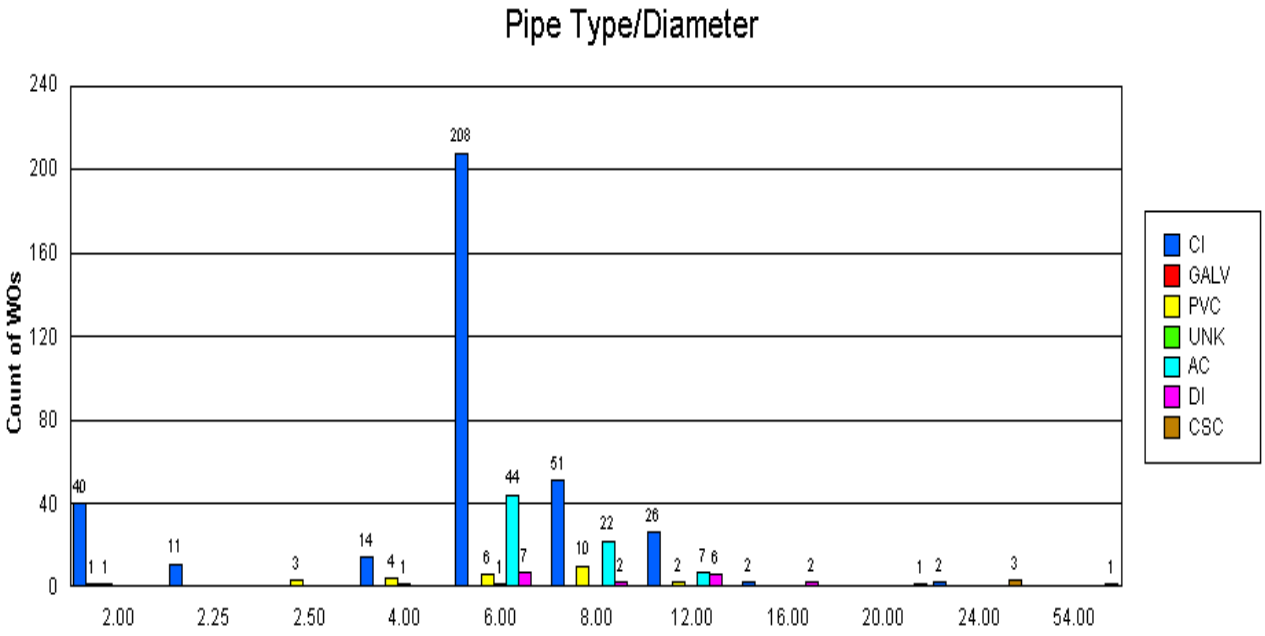
The $524 million Water Treatment Plant No. 4 (WTP4) will treat 50 million gallons of water per day that will serve the north and northwest pressure zones of Austin. The design of the plant allows for future expansion to 300 million gallons of water per day. The first phase of the project, which started in November 2010, has a three-level lake intake pump, which will occupy 4.5 acres in Lake Travis.

2. Drought, Leak Detection and Rehabilitation of Water Mains

The Small Distribution and Large Diameter Transmission Systems Leak Detection along with the Renew Austin Program are being undertaken in the Austin Water Utility (AWU). . Like all other major water utilities, AWU has been experiencing water loss. It is believed that the largest source of water loss is the result of reported and unreported breaks and leaks. Based on the most recent AWU draft Water Loss Calculation, the Utility experienced 10.98% water loss or 5,029 billion gallons of water in FY 2013. Of that 8.57% was attributed to "real loss" due to leaks and beaks and 2.14% to apparent losses.

3. Common Criteria use for replacement

- Break History
- Number of Breaks
- Pipe Material
- Historical Maintenance data
- Age



4. Non-Invasive Condition Assessment & Remaining Useful Life of a 20" Main

The condition assessment was conducted in an area generally located between downtown Austin and university of Texas campus along Nuecess street. Due to the location of the project being in the high traffic area, the assessment had to be conducted at night. The testing was performed by a vendor using Echologics technology over two nights. Acoustic monitoring sensors were placed on two valves, and the presence of leaks on the water main between the two valves was evaluated. The above ground distance between the two monitors was measured and used to assume the length of the water main segment to be evaluated. Once the leak detection assessment was performed between the segment of water main between the two valves, a noise was introduced on the water main outside of the segment being connected to the water main. This noise simulated a large leak noise, which traveled up the water main to the closest acoustic monitor and then propagated up the water main to the next acoustic monitor. The speed at which the noise traveled was used in combination with the known aspects of the water main's material characteristics to evaluate the average structural wall thickness in the segment being evaluated. The pipe's diameter, material, and structural mechanics are all critical in this evaluation.

The process provides an assessment of the Average Structural Wall Thickness (ASWT) remaining on each water main segment that is evaluated. The Echo logics' process measures the hoop stiffness of each evaluated segment and uses this information in combination with the pipe's characteristics to determine the ASWT of the pipe.

Background

Existing 1930S cast iron 20-inch water main

Former transmission main for decommissioned Green Water Treatment Plant

Condition assessment consists of:

Leak detection and providing average wall thickness and remaining useful life

5. Estimated of Remaining Useful Life of the Pipe Segments:

Austin Water provided a coupon taken from nearby 20-inch CI pipe that believe to be installed in approximately the same time frame as the Nueces water main. Testing of the coupon confirmed some material characteristics that impact both the ASWT thickness analysis and the estimate of the Remaining Useful Life (RUL) of the evaluated pipe segments. ASTM E1876091 (Dynamic Young's Modulus testing) was performed. The RUL for each segment was estimated using following:

- Design Pressure
- Critical Pressure in the absence of an external load

- Pipe internal diameter
- Critical failure load in the absence of internal pressure

The critical pressure and critical load are described in terms of the residual wall thickness where the critical variables are (Hoop stress, Rupture Stress, critical pressure, critical load, internal diameter, critical thickness, and soil bedding factor).

The critical thickness was estimated based on the evaluation of the hoop and rupture stresses using the variables described above. The rate of degradation in the pipe was estimated based on the installation date and ASWT that was measured using the Echologics process. The rate of degradation and ASWT were compared to the calculated critical thickness in order to develop the Remaining Useful Life (RUL) of each pipe segment. The estimated RUL for each segment on Nueces is more than 75 years except one line segment with RUL estimate of 60 years.

6. Lessons Learned:

With growing water demand, drought condition, and reduction in revenue the traditional criteria being used to replace water mains needs to be evaluated and other options being considered.