

Asset Management

~~An
Australian
SPU
EPA
Bellevue~~

Perspective

Pacific Northwest Section
American Water Works Association

Bill Heubach

April 29, 2015

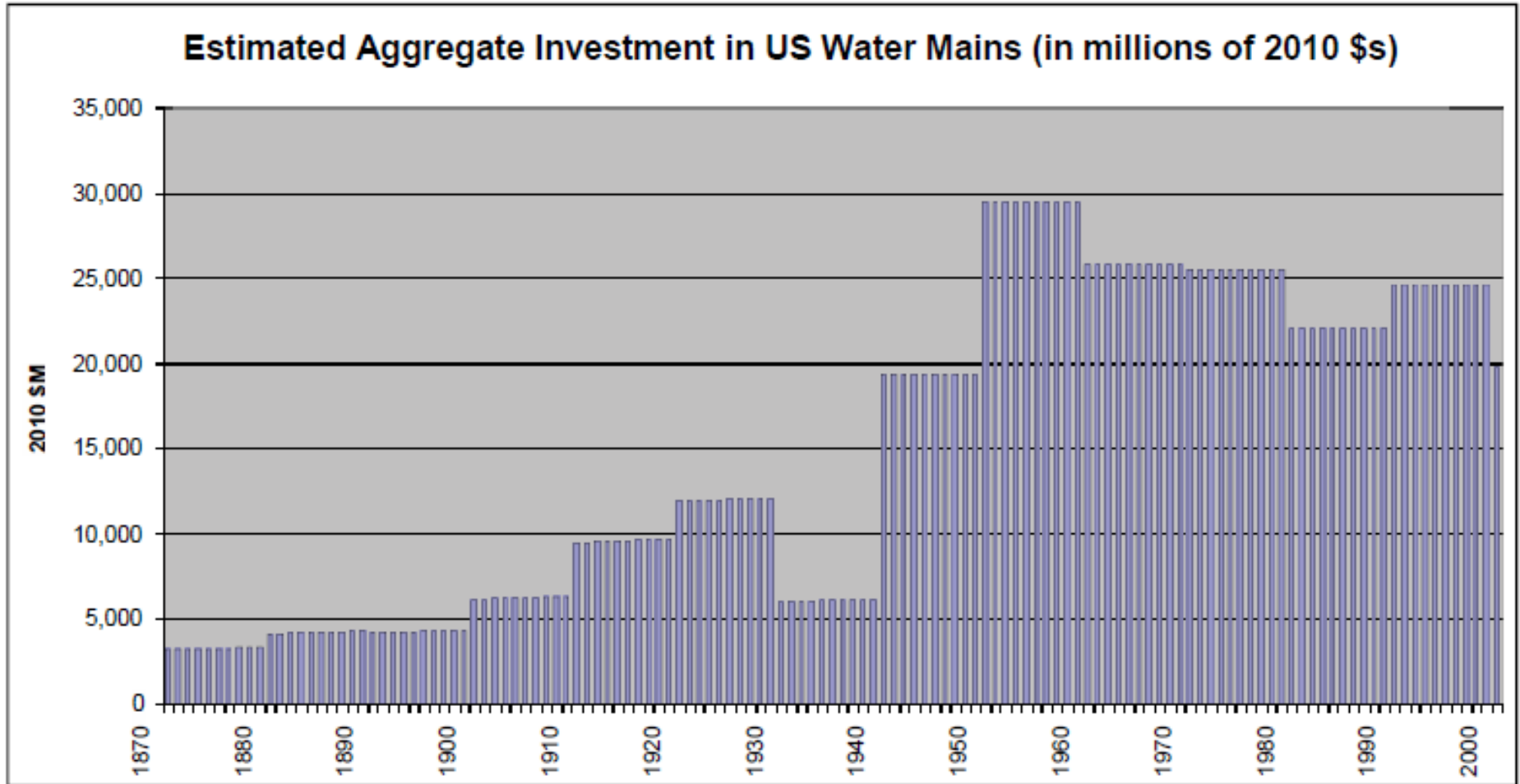
Asset Management

- Why?
- What Is It?
- The Asset Management Team
- How Asset Management Is Played

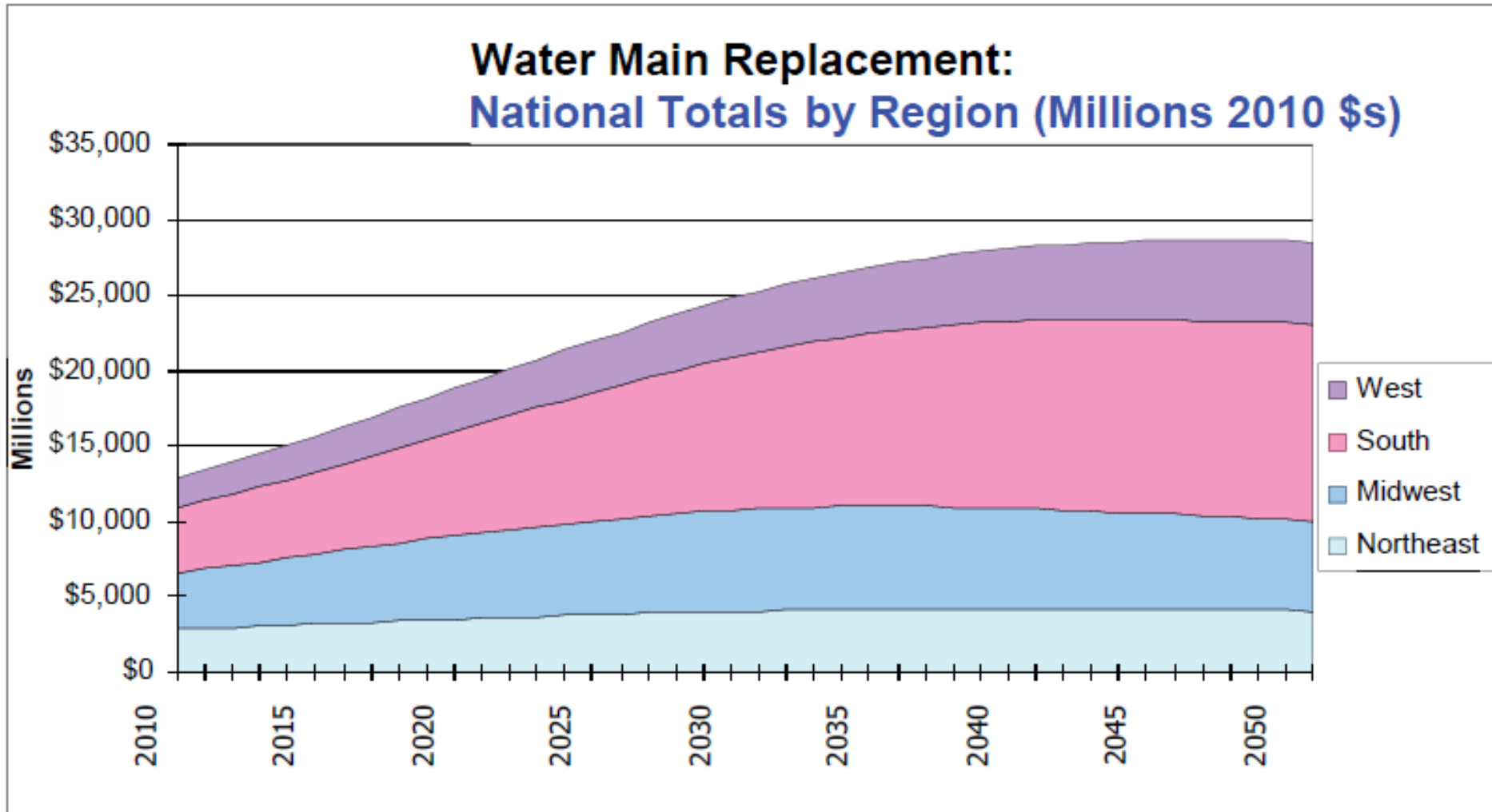
The Facts (Sort of)

- Amount of water lost in the United States every year from breaks and leaks
 - 2.1 Trillion Gallons (22 billion gallons in Chicago alone)
- Water Infrastructure Needs Through 2050
 - \$1.7 Trillion (AWWA)
- Water Infrastructure Need Over Next 20 Years
 - \$384 Billion (EPA)

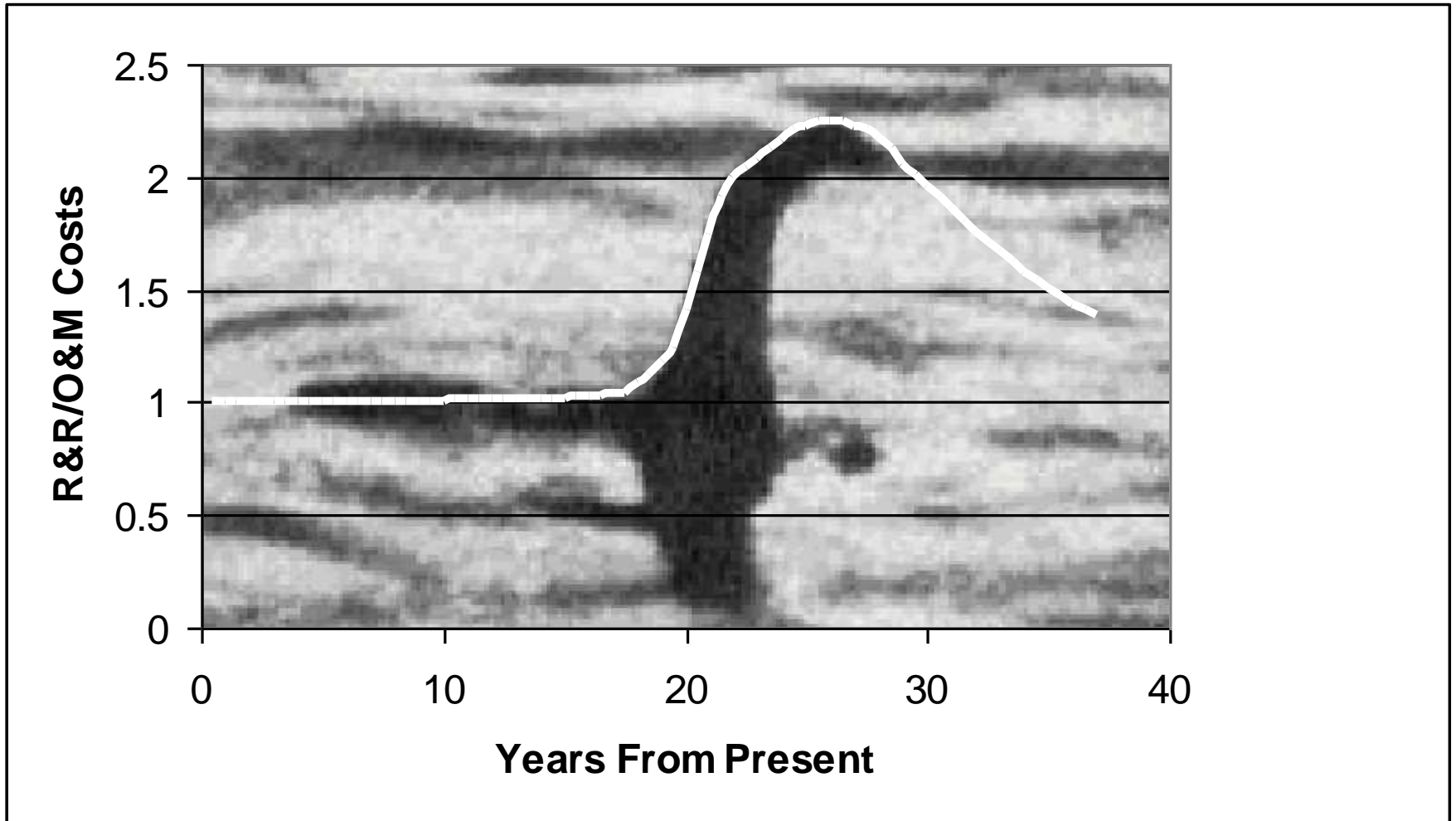
US Water Main Installation (AWWA)



US Water Main Replacement (AWWA)



The Implications ...



Washington DC/Maryland



Pittsburgh



Cincinnati



Los Angeles



Portland, Oregon



Seattle



Bellevue, Washington



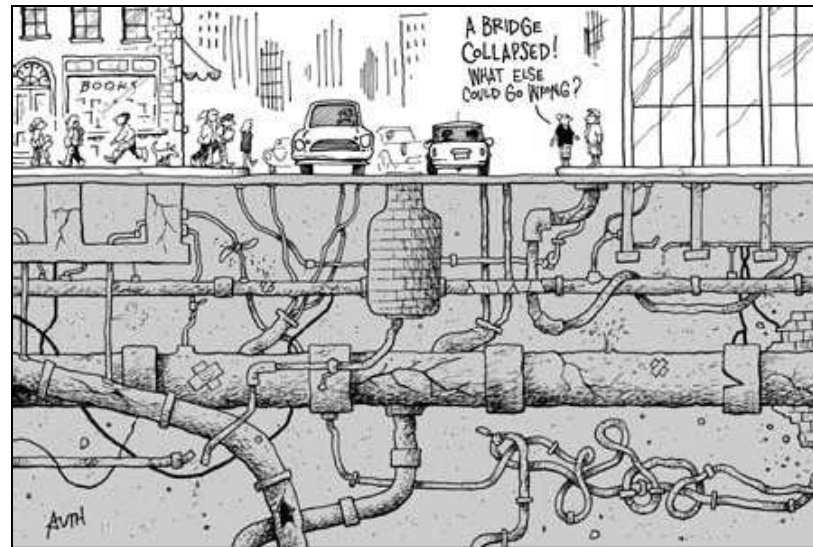
The Growing Concern

“A \$1 trillion problem courses under America's streets”

~ AP Associated Press

“Repair needs taxing San Jose. Leaders consider ways to cover costs.”

~ San Jose Mercury News



“Aged infrastructure costly to area water systems.”

~ The Grand Rapids Press

“Aging waterlines require repairs, replacement. Experts say rates will rise over time”

~ Pittsburgh Post-Gazette

“Hefty water, sewer bills likely to keep growing. San Diegans pay more than people in other big cities.”

~ The San Diego Union Tribune

“\$4.6 billion needed to fix Hetch Hetchy. Huge bond measure proposed, with rate hikes for all users.”

~ San Francisco Chronicle

Manhattan Beach water, sewer rates could rise 30 percent

~ Daily Breeze, October 21, 2009

"It was bad management... the fact that we've gotten to this place is unfortunate."

~ Councilmember Nick Tell

"This bill was passed to us, and guess what, the bill is due."

~ Councilmember Richard Montgomery

Toledo water/sewer bills on the rise

~ WTVG, November 22, 2010

Roughly five years ago the city had about \$100 million in its water, sewer and storm- water reserves. Now that totals less than \$20 million...

"As I look around I think most of you council people were here for the past few administrations. Why didn't you say something? Why didn't you raise the rates back then?"

~ Business owner Doug Beat

NPR – October 29, 2014

"Anytime somebody tells me that we have to spend more money, I'm going to look at who is telling me that and do they have an interest in it," says Steve Ellis of the Washington-based group Taxpayers for Common Sense.

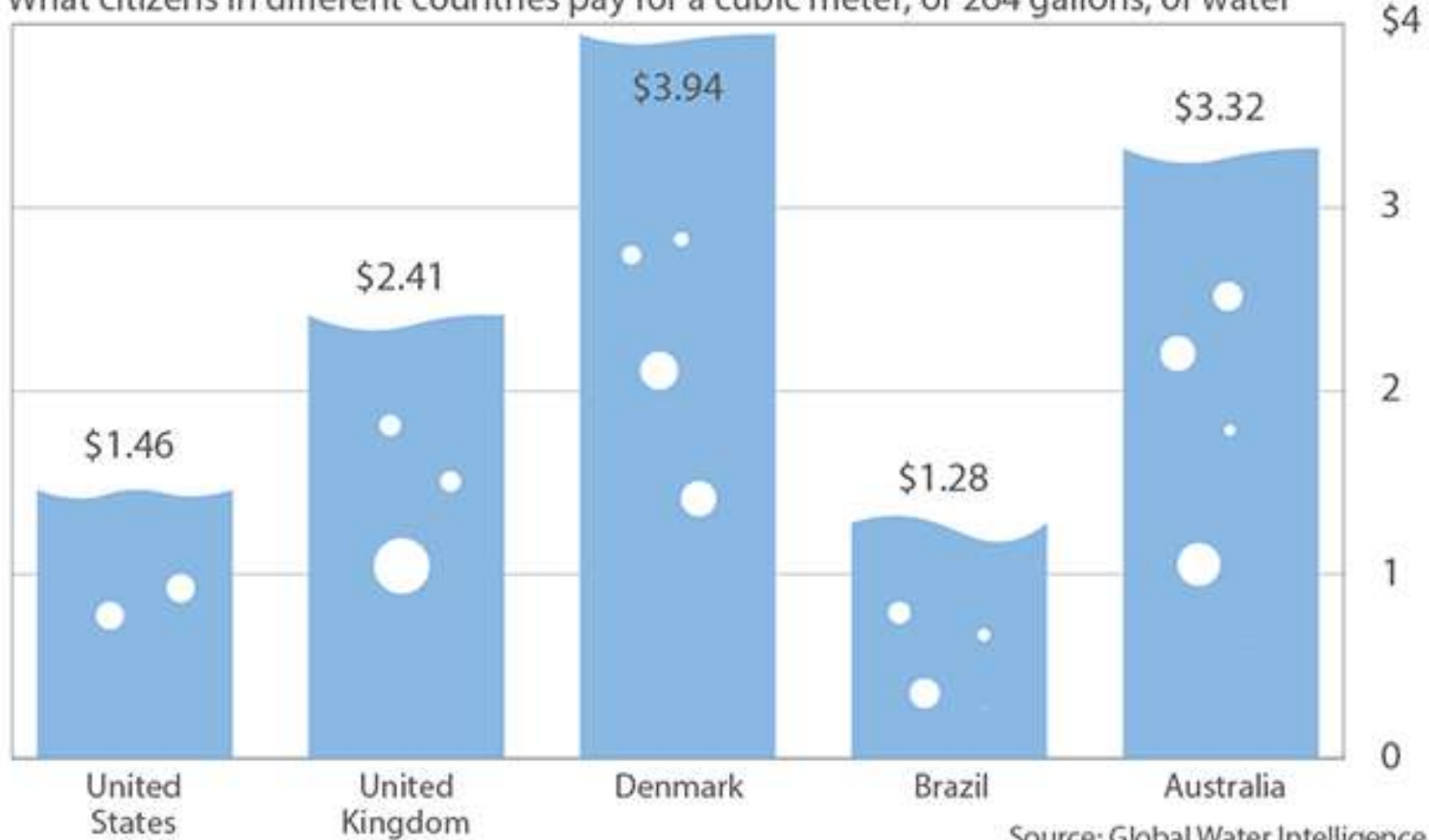
He says water utilities stand to gain from massive water infrastructure spending, as does the American Society of Civil Engineers, which gives the nation's water infrastructure a **barely passing grade of "D."**

Ellis says that doesn't mean big spending on water infrastructure isn't needed. Voters just need to make sure there's proper oversight, as well as investments in better technologies and conservation.



What the world pays for water

What citizens in different countries pay for a cubic meter, or 264 gallons, of water



Asset Management

- Optimizing of the cost of
 - acquiring,
 - operating,
 - maintaining,
 - renewing and
 - replacing infrastructure assets...
- While meeting service levels expected by the community and required by regulators...
- At an acceptable level of risk



ASSET MANAGEMENT

Meeting Agreed Customer & Environmental Service Levels While Minimizing Lifecycle Costs

Asset Management

» About Asset Management

Industry Info

Business Case Guide

Value Management Program

Strategic Asset Management Plans

Reference Library

Asset Management at SPU is the practice of making deliberate decisions in a transparent manner, fully informed by:

- Project Risks: (likelihood of failure) x (consequence of failure) = risk cost
- Triple Bottom Line Analysis (financial, environmental, and social impacts and benefits)
- Project Life-cycle Cost

3 Key Tools

- Executive review of triple bottom line business cases for capital investments equal to or greater than \$1 million or more. The review schedule and document library are [here](#).
- [Stage Gates](#) ensures specific review and oversight of risks at critical points in delivering a capital project
- [Value Management Program](#): Value Analysis (VA) and Value Engineering (VE) on all projects equal to or greater than \$5 million to ensure we identify best value.

Asset Management Program Goal – Good Stewardship of the Community’s Investment in Utility Services

- Cost Effective Allocation of Resources
- Facilitate More Informed Decision Making
- Long Range Planning

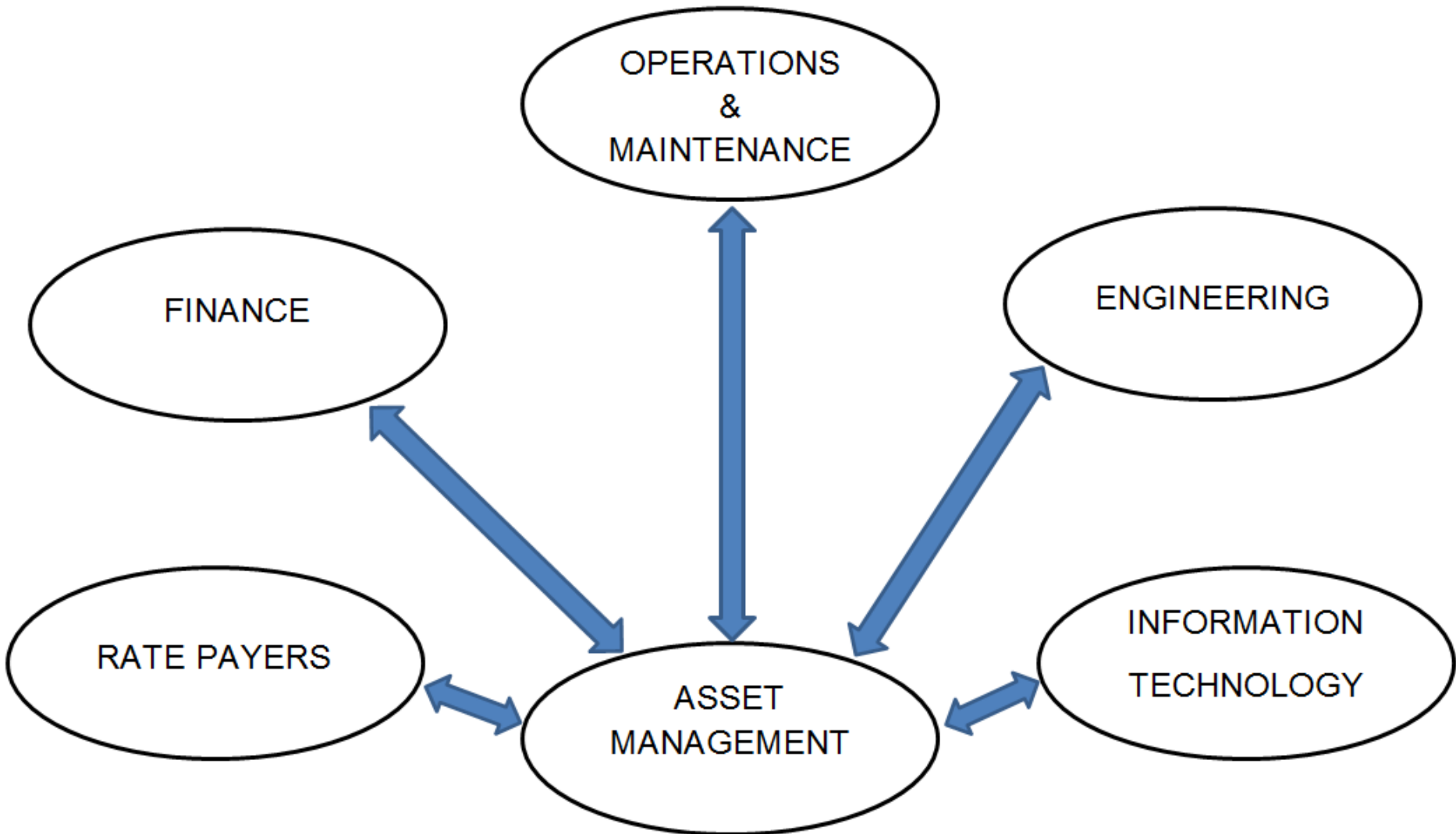
And The Best Asset Management Approach Is ...

- The Australian Approach?
- The EPA Framework?
- The Bellevue Utilities Approach?
- The SPU Approach?
- The Tacoma Approach?
- The Sammamish Plateau Approach?
- The *your utility name goes here* Approach?

Asset Management Core Functions

- Asset Inventory
- Asset Condition
- Service Levels
- Responsible Infrastructure Management Needed to Maintain Service Levels
- Funding Infrastructure Management

Asset Management Team

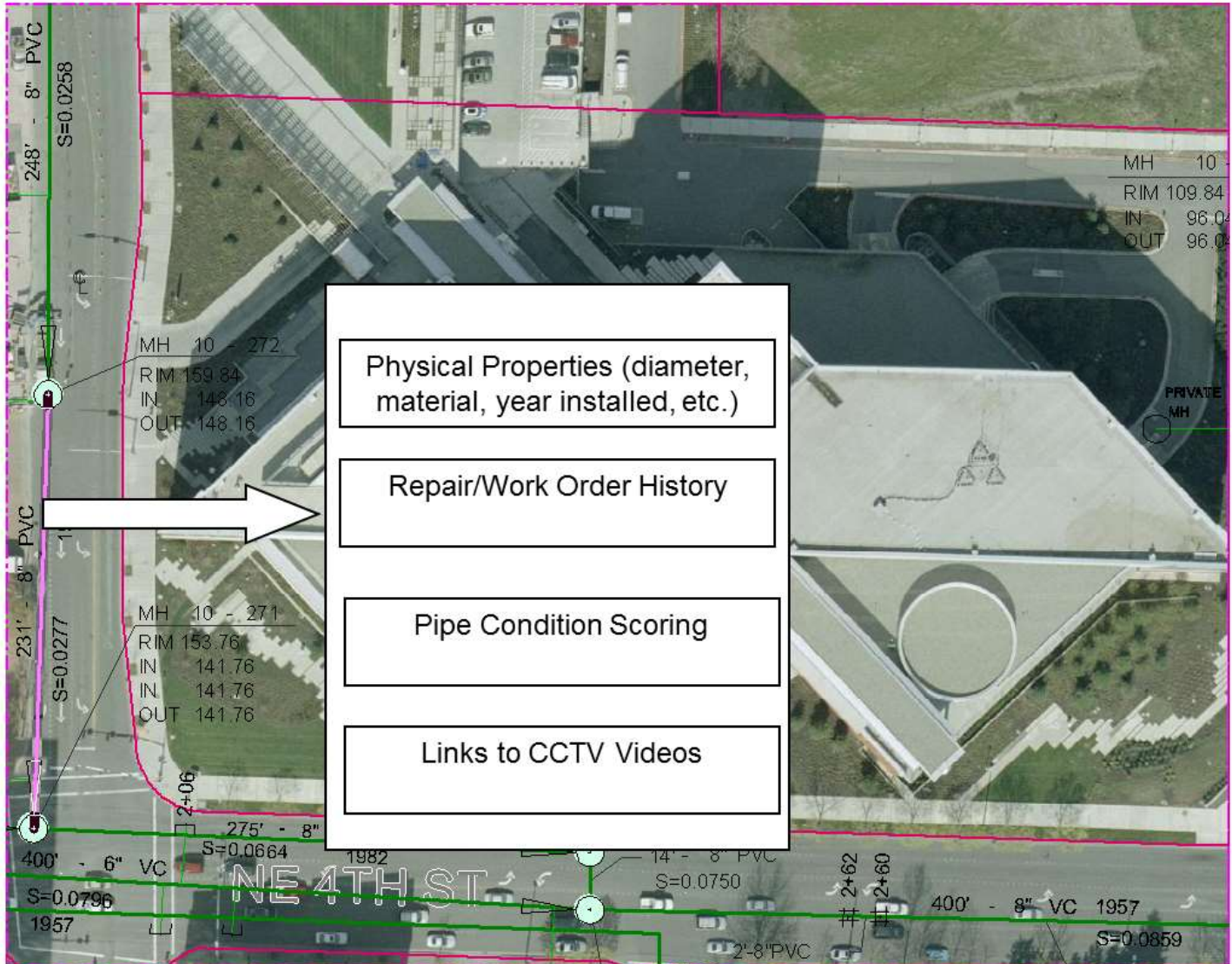


Asset Inventory Team: Information Technology – CMMS And GIS

The screenshot displays a web browser window with the URL <http://spumainm01.mains.com/Assets/lookup.aspx?assetBusinessid=1886&conf>. The page title is "Assets" and the sub-header is "EPU Production Instance - MainP". The interface includes a search bar, a "Select Action" dropdown, and a menu with options like "List", "Asset", "Spurs/Parts", "Safety", "Routing Points", "Specifications", "Features", "Vehicle Usage", and "Work". Below the menu is an "Advanced Search" section with a "Save Query" button. The main content area is a table titled "Assets" with a filter icon and a refresh button. The table has columns for "Asset", "Description", "Location", "Description", "Assigned Crew (Vehicles)", "Serial #", "OPERATED", "MILES", and "Asset". The table contains 20 rows of data, all representing water mains assets. Below the table is a "Select Records" button and a "Show MapEngine" button. The Windows taskbar at the bottom shows the system time as 11:47 AM on 1/27/2015.

Asset	Description	Location	Description	Assigned Crew (Vehicles)	Serial #	OPERATED	MILES	Asset
302749	8" WATER MAIN	21885	4000-4099 56TH AVE SW, 90196					
76946	8" WATER MAIN	1621	3600-3799 36TH AVE S, 90144					
40686	8" WATER MAIN	28738	5300-5499 S FOUNTAIN ST, 90178					
89428	8" WATER MAIN	12388	4520-4699 E LAUREL DR NE, 90195					
77487	8" WATER MAIN	29187	10400-10599 21ST AVE SW, 90148					
914628	12" WATER MAIN	332_WTR	MAP 332 - WATER MAINS & APPURTENANCES					
996538	8" WATER MAIN	628_WTR	MAP 628 - WATER MAINS & APPURTENANCES					
76256	4" WATER MAIN	38528	8600-8825 41ST AVE SW, 90136					
57385	8" WATER MAIN	22563	2000-2899 15TH AVE S, 90144					
52528	8" WATER MAIN	7992	100-299 N 75TH ST, 90163					
48950	8" WATER MAIN	27650	6700-6899 40TH AVE S, 90118					
16668	8" WATER MAIN	6832	8500-8599 27TH AVE NE, 90115					
54181	8" WATER MAIN	24928	8200-8399 17TH AVE SW, 90106					
305914	12" WATER MAIN	28549	8500-8599 14TH AVE S, 90100					
17416	8" WATER MAIN	11846	6000-6499 25TH AVE NE, 90115					
80003	8" WATER MAIN	11895	1300-1399 NE 63RD ST, 90115					
72866	4" WATER MAIN	10628	8200-8299 22ND PL NE, 90115					
80615	8" WATER MAIN	5814	11300-11499 38TH AVE NE, 90125					
21191	8" WATER MAIN	7531	2000-2899 NW 75TH ST, 90117					
12885	6" WATER MAIN	38943	13800-13899 16TH AVE SW, 90166					

Asset Inventory Team: Information Technology – Enterprise Software



Asset Inventory Team: Operations and Maintenance – Field Observation

Water Main and Service/Saddle Observation Report

(circle appropriate answer or fill in blank)

GENERAL INFORMATION

Name of Observer: Brian James Date: May 03, 2010

Address: 12204 SE 54TH Grid: G-15

Notes: _____

Pipe Depth: less than 3 ft. 3 feet more than 3 ft. _____

Observation includes an existing service line connection: Yes No (If yes, fill out reverse side)

Observation is associated with a facility failure or break: Yes No (If yes, fill out reverse side)

PIPE INFORMATION

Diameter: 4" 6" 8" 10" 12" 14" 16" 18" 24" Other _____

Material: AC (Simplex? Yes No Unknown) DI CI PVC Other _____

If pipe is DI, is exterior covered with plastic? Yes - bagged Yes - wrapped No

If pipe is metal, is the interior lined? Unknown Yes - mortar Yes - composite No

CONDITION INFORMATION

Was a Tapping Coupon saved and labeled with the address on this report: Yes No

If pipe is AC, surface condition is: Hard Punky Soft Other PIPE IN GOOD CONDITION.

If pipe is metal, any external corrosion: None Slight Moderate Extensive

If pipe is metal, any internal corrosion: Unknown None Slight Moderate Extensive

SOIL INFORMATION

Type: Sand Peat Clay Loam Hard Pan Cinder Pit Run Gravel

Other _____

Moisture: Unknown (due to pipe break) Dry Wet Saturated

If this main observation included a service line connection and/or is associated with a facility failure, Please fill out the appropriate information on the reverse side of this report.

Water Main Observation Report - Page 2

SERVICE LINE AND SADDLE INFORMATION – if observed

Service Line Diameter: ¼-inch 1-inch 1 ½-inch 2-inch 3-inch Other _____

Service Line Material: Carlon HDPE PVC galvanized copper Other _____

If service line is metal, any corrosion or pitting: None Slight Moderate Extensive

Notes: _____

Saddle Strap Material: Cor-ten Stainless Steel Other _____

Saddle Strap Corrosion: None Slight Moderate Extensive

Saddle photographed and the photo labeled with the address on this report: Yes No

Saddle replaced: Yes No

Notes: _____

FAILURE INFORMATION – if applicable

Failed Facility: Service Line Saddle Main

Failure Type: Crack – Circumferential Crack – Longitudinal Crack – Other

Hole – Small (Leak) Hole – Large (Burst)

Joint – Separation Joint – Gasket

Failure Cause: Dig-up Settlement Roots Land Slide Earthquake

Poor Construction Poor Repair Reduced Pipe Strength Corrosion

Pressure Surge Unknown Other _____

Repair Method: Clamp Replacement Other _____

Notes: _____

Asset Condition Assessment Team: Operations and Maintenance – Field Observations



Asset Condition Assessment Team: Operations and Maintenance – Field Observations

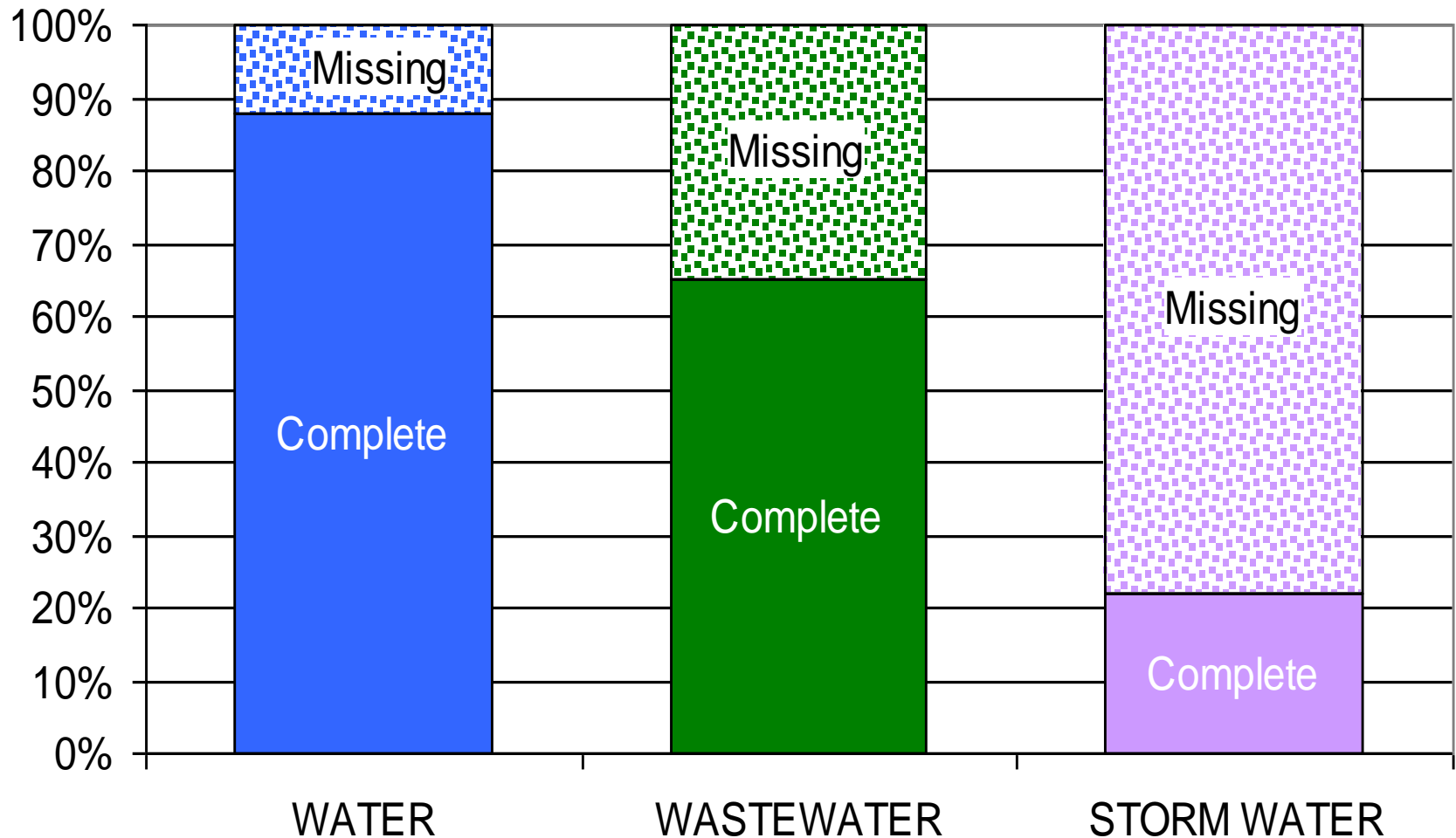


Asset Condition Assessment Team: Operations and Maintenance – Field Observations

ID	WD	Address	Dibs Date	Fail Attr	Fail Type	Fail Cause	Main Mat	Inst Date	Main Dia	Main Depth	Main Int	Ma Ext Cnd	Corros post	Serv Mat	Serv Dia	Serv Cnd	Stabils Mat	Stabils Cnd	Soil Type	Soil Moist	MidairMeth	Sytl
12601720		1343 98th A	3/12/2010				AC		6	36		PUNKY		COPPER	0.75	CORROSION	CORTEN	CORROSION	SAND	DRY		
120609-06140		856 LK Was	5/16/2009				AC		10			SOFT		COPPER	0.75	CORROSION	CORTEN	CORROSION	SAND	WET		
120709-06139		8914 NE 1st	3/16/2009				AC		10			SOFT		COPPER	0.75	CORROSION	CORTEN	CORROSION	SAND	WET		
125209-18063		2559 155th	11/1/2009	SERVICE	CCRACK	POOR_CONDIAC						SOFT		CARLON	0.75		CORTEN	CORROSION	SAND	WET		
125709-20955		15225 NE 3rd	1/8/2009	SADDLE			CORROSION AC		5			HARD		COPPER	0.75	CORROSION	CORTEN	CORROSION	HARD_PAN	UNKNOWN	REPLACEMENT	
125809-19716		11605 SE 1	11/24/2009	SADDLE			CORROSION AC		6			HARD		COPPER	0.75		CORTEN	CORROSION	HARD_PAN	UNKNOWN	REPLACEMENT	
1309		9010 Lake Washington St		SADDLE	NEEDS_REP	POOR_CONDIAC		1963	12	33		SOFT		COPPER	0.75	NEEDS_REPLACEMENT	NEEDS_REPL	GRAVEL	DRY			
1280		13800 SE 5th St		NONE	NA	NA	AC		6	40		HARD		COPPER	0.75	GOOD		RUST	HARD_PAN	DRY		
1274		2080 140th	10/15/2010	NONE			AC_UNKNOWN		6	36					0.75			NONE	LOAM	DRY		
1296		10006 NE 29th Pl		NONE	NA	NA	AC	1954	6	54		SOFT		COPPER	0.75	GOOD		REPLACED	SAND	DRY		
1302		538 Overlake Drive		NONE	NA	NA	AC	1948	6	38		SOFT		COPPER	0.75	GOOD		GOOD	SAND	GRAVDRY		
1296		4406 140th Ave SE		NONE	NA	NA								COPPER	0.75			NEEDS_REPL	SAND	HARD DRY		
1297		4414 140th Ave SE		NONE	NA	NA	AC		6	40				COPPER	0.75			NEEDS_REPL	SAND	HARD DRY		
1299		4631 133rd Ave SE		NONE	NA	NA	AC		6	44		HARD		COPPER	0.75	GOOD		NEEDS_REPL	SAND	PEAT DRY		
1311		8816 NE 16th St		NONE	NA	NA	AC		6	36		HARD		COPPER	0.75	NEEDS_REPLACEMENT	REPLACED	SAND	PIT_RDRY			
1294		267 140th Ave NE		NONE	NA	NA				40		HARD		COPPER	0.75	GOOD			SAND	PIT_RDRY		
1298		4422 140th Ave SE		NONE	NA	NA	AC		6			HARD			0.75				HARD_PAN	WET		
1295		3828 170th Ave SE		NONE	NA	POOR_CONDIAC			6	36		SOFT		POLY	0.75	BROKEN		REPLACED	PIT_RUN	WET		
128309-19061		3221 330th	11/6/2009	SERVICE			CORROSION DI		8						1		CORTEN	CORROSION	HARD_PAN	DRY		REPLACEMENT
128109-18031		1920 109th	11/1/2009				CORROSION AC		6			HARD		COPPER	1	CORROSION	STAINLESS_S	NONE	SAND	WET		REPLACEMENT
1238		2503 124th	9/9/2009				AC		6			HARD		HDPE	1	CORROSION	CORTEN	NONE	HARD_PAN	DRY		
120307-16130		14597 SE 6	2/12/2008				AC		6			HARD		HDPE	1		CORTEN	CORROSION	HARD_PAN	DRY		
1240		9036 NE 41	9/10/2009				AC		6			HARD		COPPER	1		CORTEN	NONE	HARD_PAN	DRY		
122609-10927		2620 78th A	7/29/2009				DI		8					COPPER	1	CORROSION	NONE	NONE	SAND	DRY		
108106-17967		2617 Evang	1/26/2007	NONE	NA	POOR_CONDIAC		1948	6	44		SOFT			1				SAND	LOAMWET		REPL
1239		9033 NE 376th	9/2009	SADDLE			CORROSION AC		6			HARD		COPPER	1	CORROSION	CORTEN	CORROSION	HARD_PAN	DRY		REPLACEMENT
123609-16749		4589 Somer	8/8/2009	SADDLE			CORROSION AC		6			HARD		COPPER	1	CORROSION	CORTEN	CORROSION	HARD_PAN	DRY		REPLACEMENT
201006-20202		3223 93rd P	12/18/2008	SADDLE	GASKET		CORROSION DI		4				NO	HDPE	1		CORTEN	CORROSION	CLAY	UNKNOWN		REPLACEMENT
116607-18527		4528 145th	10/9/2007				CORROSION AC		6			PUNKY		COPPER	1			CORROSION	CLAY	UNKNOWN		REPLACEMENT
120207-19540		14253 SE 1	1/30/2008	SERVICE			POOR_CONDIAC		6			HARD		CARLON	1		CORTEN	CORROSION	HARD_PAN	UNKNOWN		REPLACEMENT
122509-11609		16422 SE 8th	6/2009	SERVICE	OCRACK		POOR_CONDIAC		6			HARD		CARLON	1		CORTEN	CORROSION	SAND	UNKNOWN		REPLACEMENT
125009-18094		11755 NE 3	11/1/2009	SADDLE			CORROSION DI		8				NO	HDPE	1		CORTEN	CORROSION	SAND	WET		REPLACEMENT
117407-14654		1486 30nd	10/23/2007	SADDLE			CORROSION AC		6			PUNKY			1		CORTEN	CORROSION	SAND	WET		REPLACEMENT
20509-06079		730 95th AV3	13/2009				AC		10			HARD		COPPER	1	CORROSION	CORTEN	CORROSION	CLAY	DRY		
20609-06082		736 95th AV3	13/2009				AC		10			HARD		COPPER	1	CORROSION	CORTEN	CORROSION	CLAY	DRY		
113207-09374		1617 100th	7/13/2007				AC		6			HARD			1			CORROSION	CLAY	DRY		
126109-08203		4418 137th	3/16/2010				AC		6			HARD		COPPER	1	CORROSION	CORTEN	CORROSION	HARD_PAN	DRY		
126926273		9121 NE 196th	3/2010				AC		6			PUNKY		COPPER	1	CORROSION	CORTEN	CORROSION	HARD_PAN	DRY		
121408-13767		8036 NE 41	4/22/2009				AC		6					COPPER	1	CORROSION	STAINLESS_S	NONE	HARD_PAN	DRY		
116507-10542		1616 32nd	10/10/2007				AC		6			SOFT		COPPER	1	CORROSION	CORTEN	CORROSION	PIT_RUN	DRY		
125945174		1404 143rd	2/23/2010	MAIN	CCRACK	Unknown	AC		4	30		HARD		HDPE	1		CORTEN	CORROSION	SAND	UNKNOWN		
16506-05725		1920 180th	5/6/2006				AC		6			HARD		COPPER	1	CORROSION	STAINLESS_S	NONE	HARD_PAN	WET		
116707-18484		4532 140th	10/9/2007	SADDLE			CORROSION AC		4			SOFT		COPPER	1	CORROSION	CORTEN	CORROSION	PIT_RUN	WET		
124609-18735		16715 SE 3	10/27/2009	SADDLE	BURST		CORROSION AC		6			HARD		COPPER	1	CORROSION	CORTEN	CORROSION	GRAVEL	UNKNOWN	CLAMP	
1276296190		14021 NE 84	17/2011	SERVICE	JOINT		CORROSION AC		6			SOFT		COPPER	1	CORROSION	CORTEN			UNKNOWN	CLAMP	

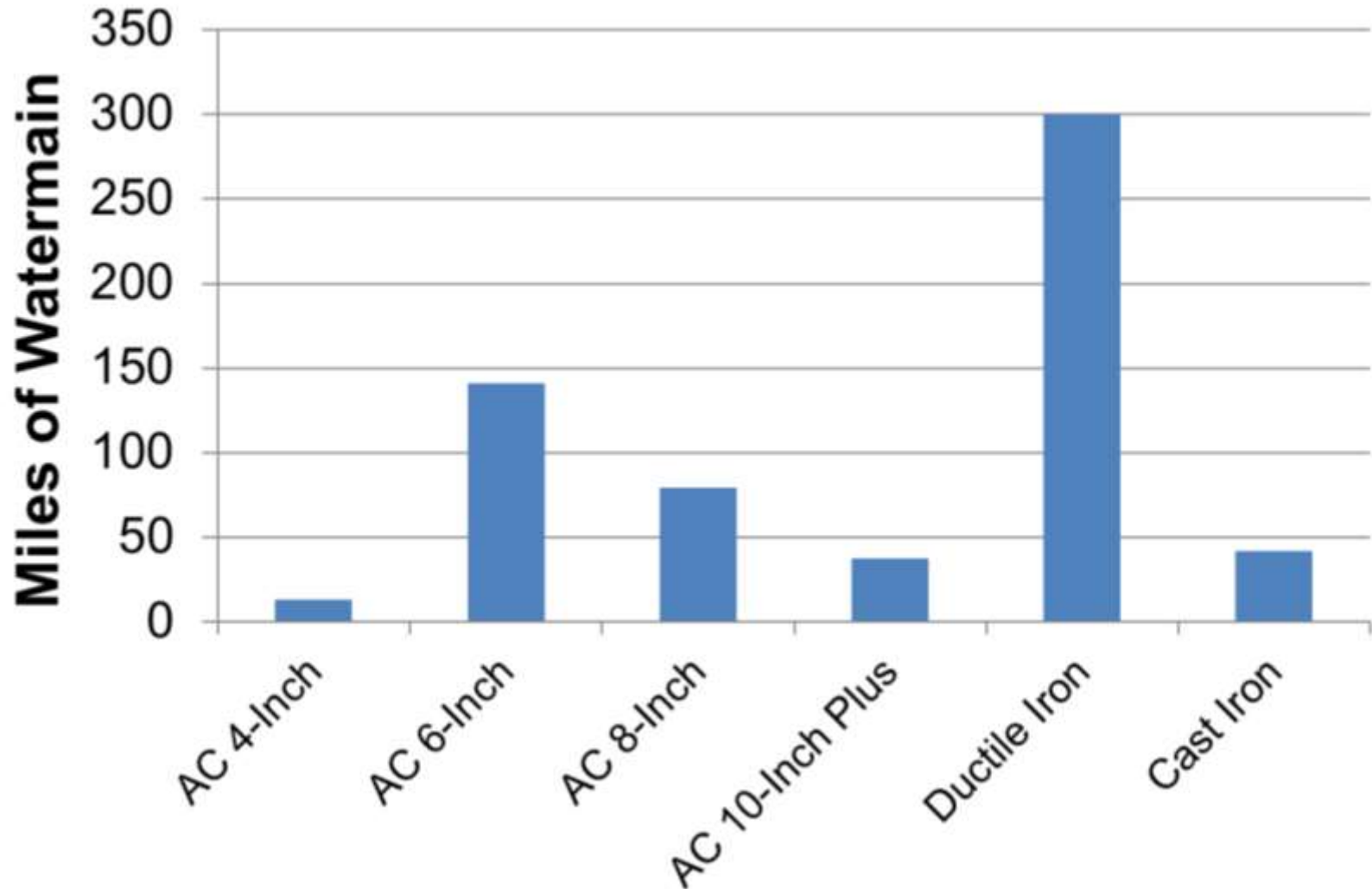
Asset Inventory Team: Engineering – Missing Data

ASSET REGISTRY DATA FOR PIPELINES



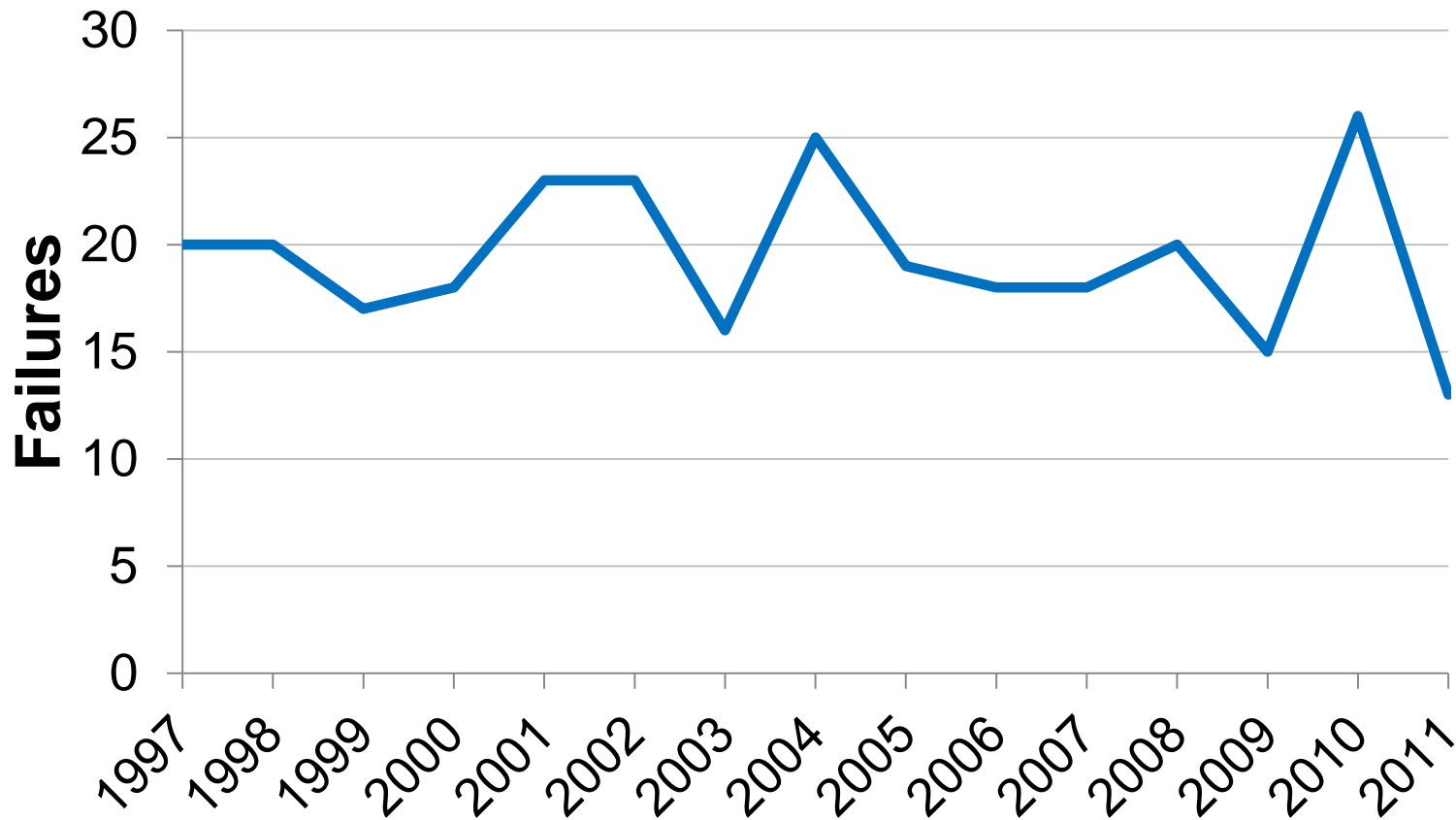
Asset Inventory Team: Engineering – Data Collection/Criticality

Watermain Inventory



Asset Condition Assessment Team: O&M, Engineering, IT – Failure Tracking

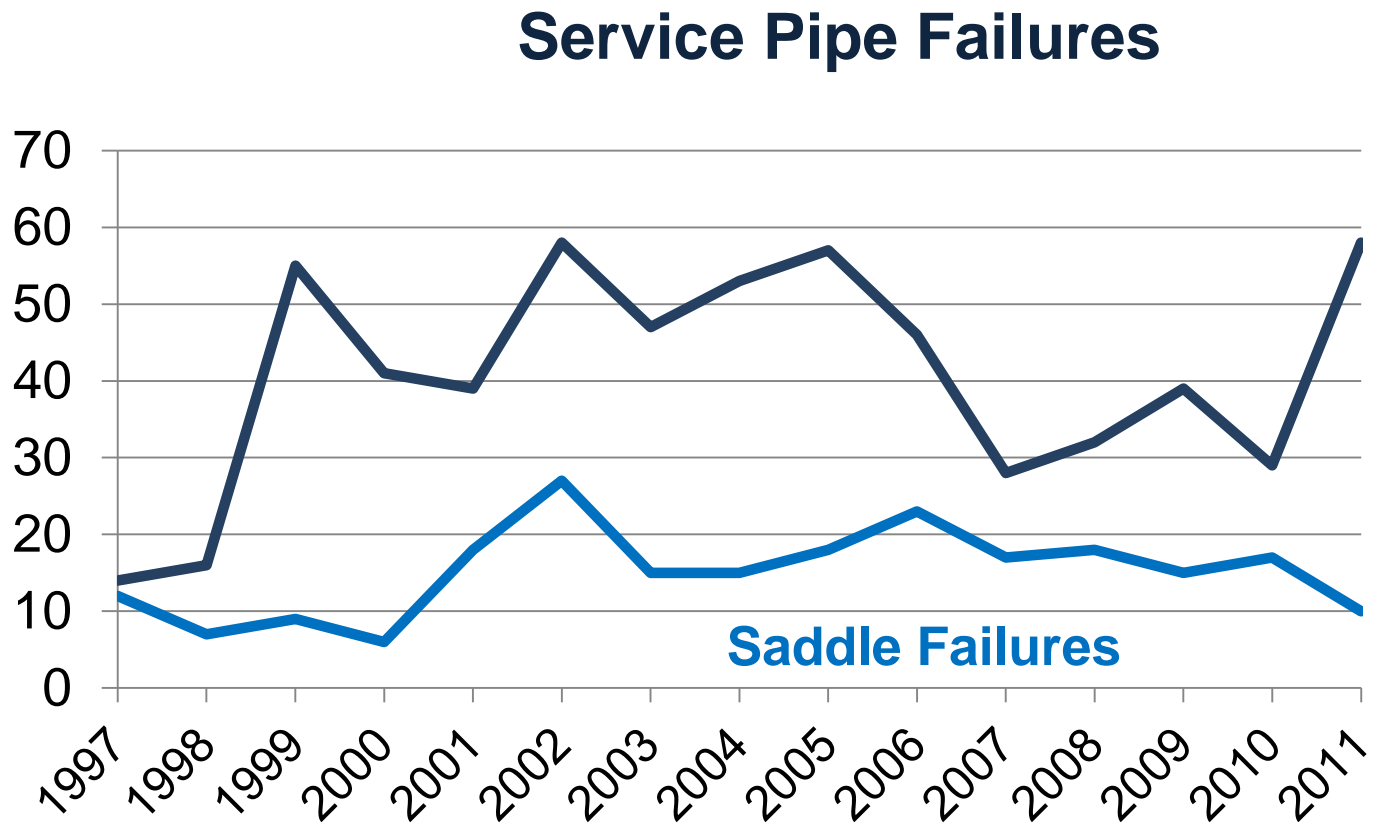
Watermain Failures



Asset Condition Assessment Team: O&M, Engineering, IT – Failure Tracking

Saddle and Service Failures

Saddle and Service Failures



Asset Condition Assessment Team: Engineering - Inspection

Volunteer Park Standpipe
Inspection Report
April 24, 2001

The exterior masonry façade, enclosed riveted steel tank and tank/façade roof were inspected on April 24, 2001. The purpose of this inspection was to identify apparent damage from the February 28, 2001 Nisqually Earthquake.

Exterior Masonry Façade

There was no apparent earthquake damage to the exterior masonry façade. There were a few minor (thin and/or short in length) cracks and chips in the bricks but these cracks were well worn and not related to the earthquake. There was some minor cracking where the roof truss members are embedded into the masonry façade. These cracks were well worn and did not appear to be related to the earthquake. No distress was observed where the stair supports that connect the steel tank to the masonry façade are embedded in the masonry.

Roof

The tank roof is a circular timber diaphragm with radial struts. The diaphragm is supported by steel trusses and topped with slate tiles.

In one or two locations, a complete tile was missing. In approximately a dozen other tiles, portions of the tile was either severely cracked or missing. Although it is possible that a few already cracked tile pieces were completely dislodged during the earthquake, the tile damage appeared to be ongoing and related to weathering. Had the deformations been large enough in the roof diaphragm to dislodge the slate tiles, there likely would have been signs of distress or damage where the roof supports are embedded in the masonry.

Riveted Steel Tank

There were no signs of earthquake damage to the riveted steel tank shell or anchor bolts. As noted previously, the east hatch seal was leaking. The rust from the leaks on the tank appeared to indicate that although the leak had started fairly recently (for example, within the last six months), there is a good possibility that the leak was preexisting at the time of the earthquake. Given that the seal is relatively inexpensive to repair, it is probably not worthwhile to seek FEMA reimbursement.

Some significant pitting corrosion was also observed in the east hatch area.

Water On Sidewalk Outside of Tank

On the sidewalk that circles the tank, on the east and northeast side of the tank, there were puddles on the sidewalk and muddy areas in the surrounding ground. This water was not related to the hatch seal leak. The water did not appear to be ponded rainwater. There was a sprinkler head in the area that may have been the water source.



Asset Condition Assessment Team: Engineering – Testing



Asset Condition Assessment Team: Engineering – Analysis

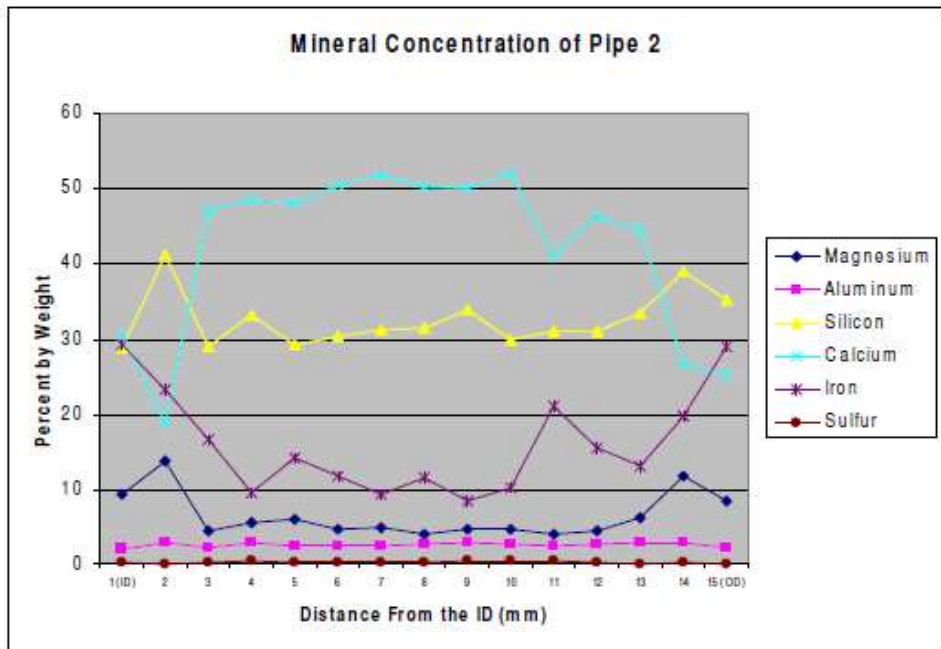
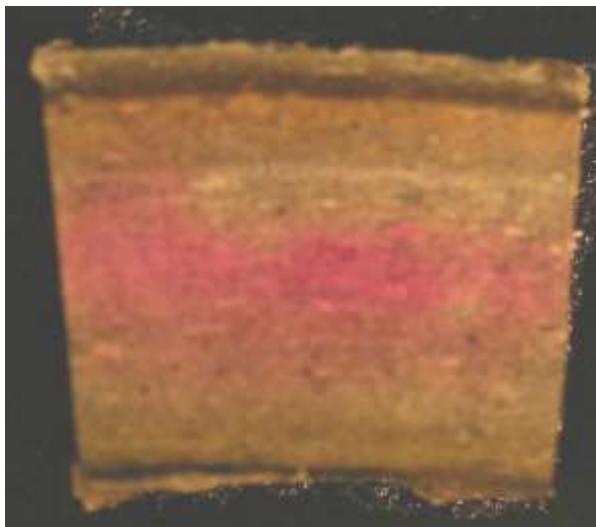
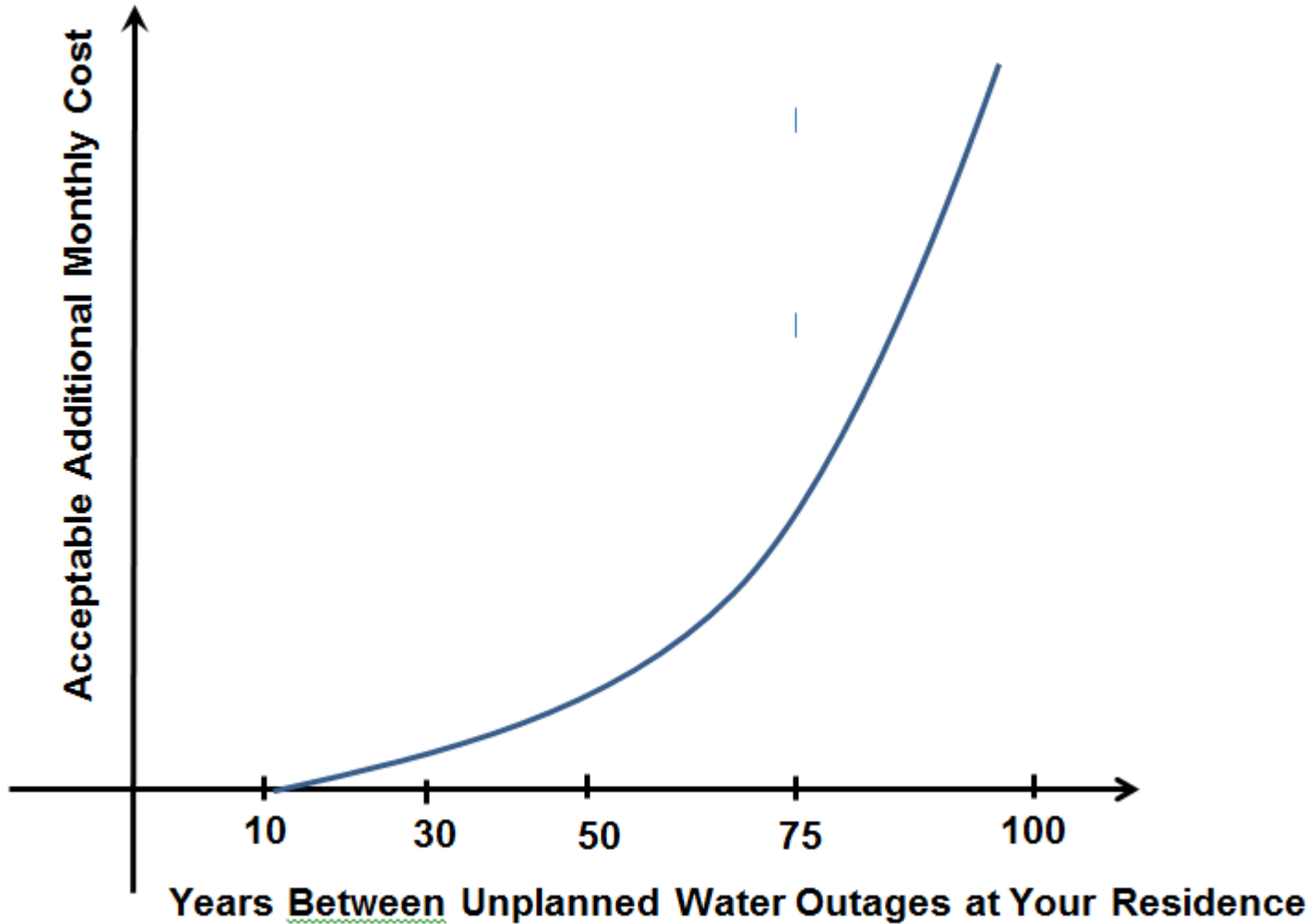


Fig. 15. Elemental Distribution through Cross Section of Pipe #2

Service Level Team: Rate Payers and Finance – Considerations

- Highest Level Performance Measure
- Stakeholder Expectations
 - Residential customers
 - Business/Industry
 - Critical needs (e.g., hospitals and fire)
 - Political Leadership
 - REGULATORY REQUIREMENTS
- Willingness to Pay

Service Level Team: Rate Payers and Finance – Willingness to Pay



Service Level Team: Rate Payers and Finance – Willingness to Pay



Assessing Customer Preferences and Willingness to Pay: A Handbook for Water Utilities



Environmental & Resource Economics (2005) 32: 509–531
DOI 10.1007/s10640-005-7686-7

© Springer 2005

Households' Willingness to Pay for Water Service Attributes

DAVID HENSHER¹, NINA SHORE² and KENNETH TRAIN^{3,*}

¹University of Sydney, Sydney, Australia; ²NERA Economic Consulting; ³Department of Economics, University of California, 549 Evans Hall 3880, Berkeley, CA, 94720-3880, USA;

*Author for correspondence (e-mail: train@econ.berkeley.edu)

Accepted 20 May 2005

Abstract. Water consumption and disposal are often taken for granted as essential services with required levels of service quality, yet little is known about how much consumers are willing to pay for specific service levels. As customers in many countries face changing levels of water availability (especially shortages linked possibly to climate change and limited catchment capacity), the need to assess the value (and hence benefit) to society of varying service levels and prices in an effort to secure the provision of and disposal of water has risen on public agendas. In an attempt to establish how much customers are willing to pay for specific levels of service, we use a series of stated choice experiments and mixed logit models to establish the willingness to pay to avoid interruptions in water service and overflows of wastewater, differentiated by the frequency, timing and duration of these events. The empirical evidence is an important input into the regulatory process for establishing service levels and tariffs, as well as useful planning information for agencies charged with finding cost effective ways of delivering services at prices that customers deem to be value for money.

Key words: mixed logit, waste water, water service

JEL classifications: C13, C25, D12, Q25

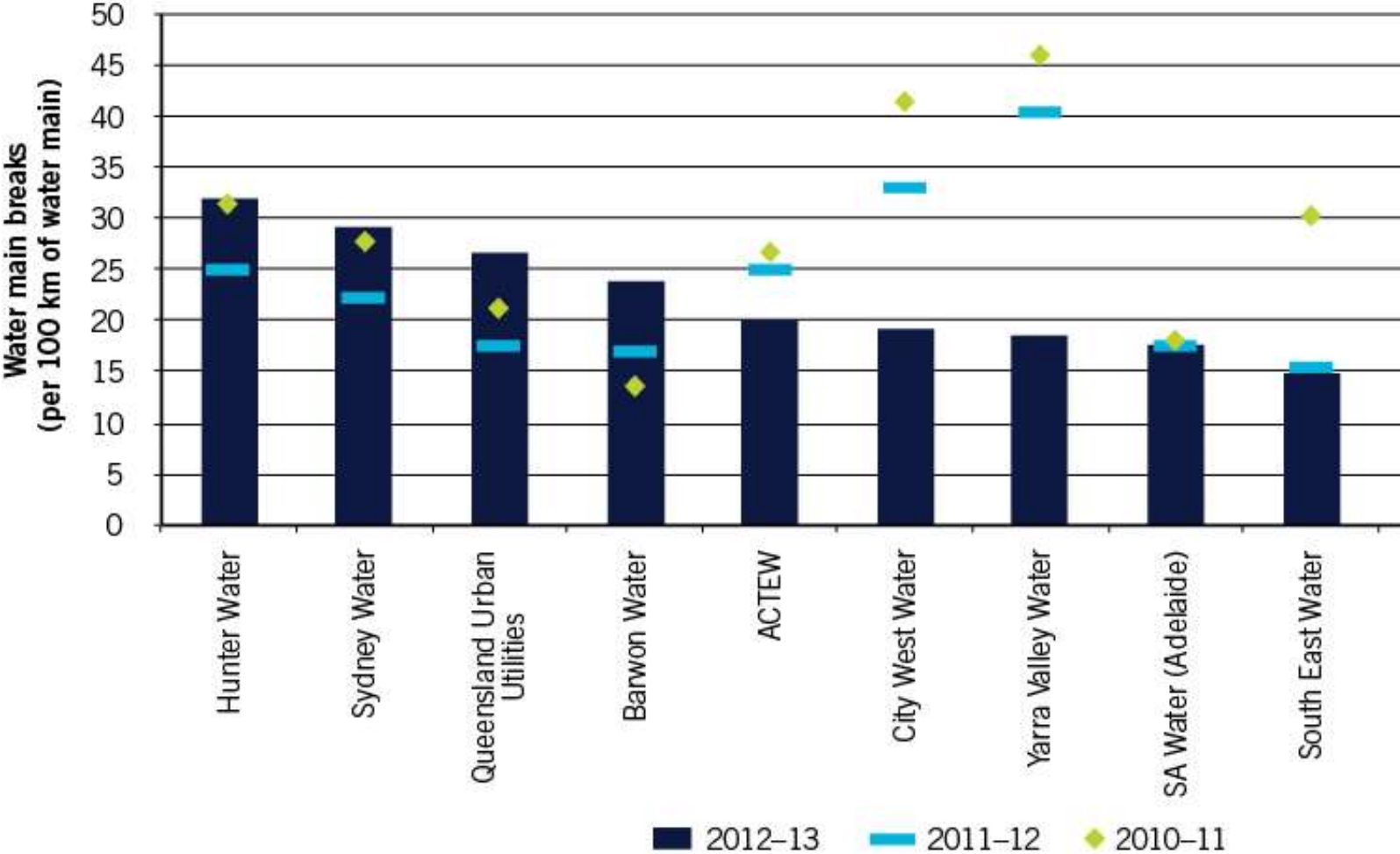
1. Introduction

Drinking water and sewage services are generally provided by either a local government agency or a regulated firm. In either case, explicit decisions must be made as to the appropriate mix of service quality and price. Water service interruptions can occur due to unexpected emergencies or system failures, as well as for planned maintenance. The expected frequency, timing, and duration of interruptions can be affected by the capital investments and operations of the supplier, with higher levels of service generally being attainable through higher costs and hence higher prices. For wastewater, the analogous issue concerns overflows: reducing the expected frequency and time to repair overflows incurs a cost, which translates into higher prices for customers. To determine the appropriate level of these service attributes relative to price, information is needed on the value that customers place on each attribute.

Service Level Team: Engineering – Benchmarking

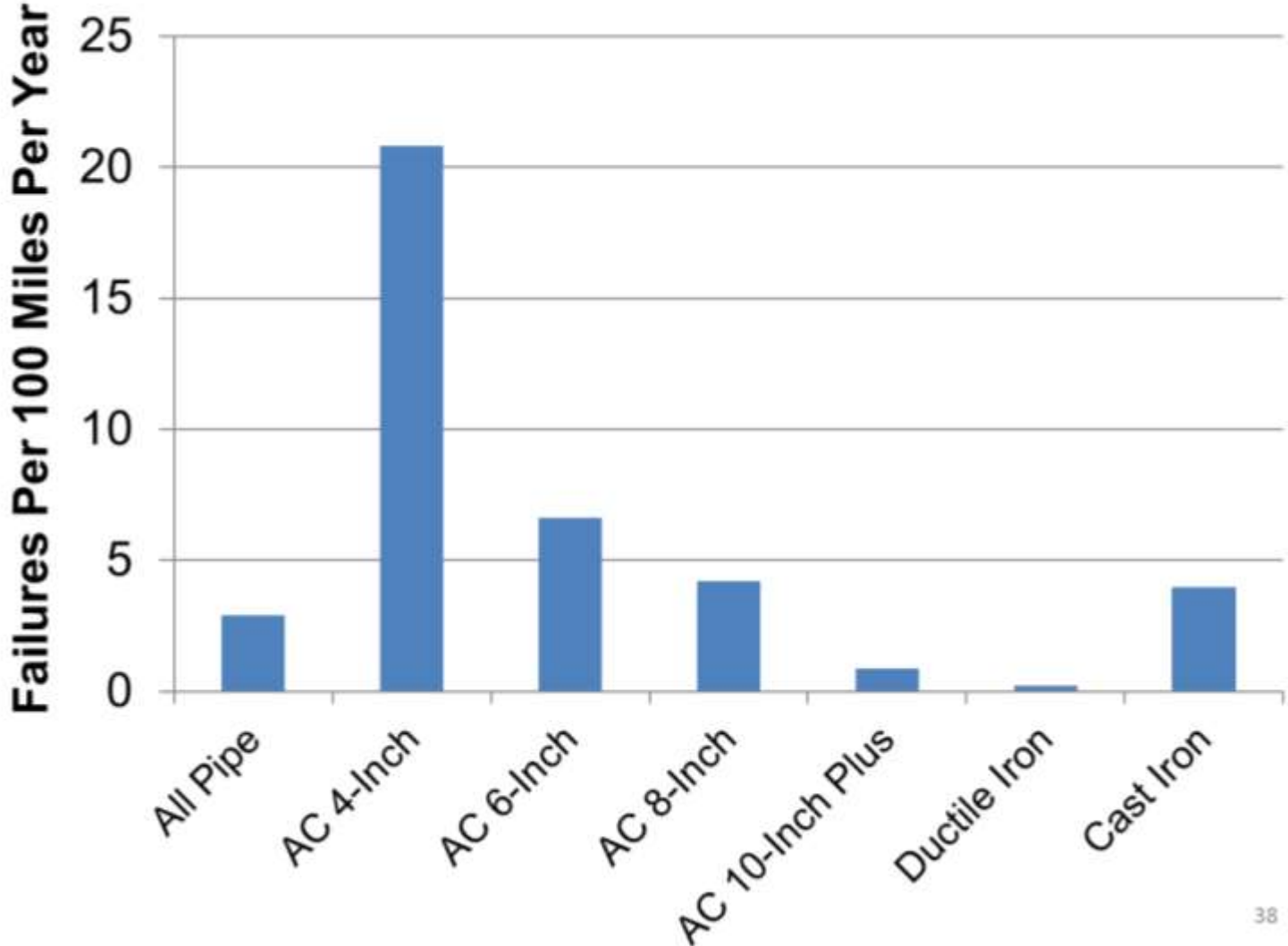
Figure 8.2: A8 Water main breaks, 2010–11 to 2012–13 (per 100 km of water main)

For utilities with 100 000+ connected properties



Service Level Team: Engineering – Benchmarking

2010 - 2012 Watermain Failure Rates



Service Level Team: Rate Payers and Finance – Example Targets

Revised March 26, 2015

Seattle Public Utilities Service Levels

Below are SPU's services and service levels that we will report on in 2015 to SPU employees to City Council:

Focus Area: Making it Easier to Get Help and Find Answers

SPU Services	Service Levels
Effective customer service	Customers rank their satisfaction with SPU services at least 5 on a scale of 1-7
	% of customer issues resolved in first phone call (target TBD)
	% of customer bills that do not require adjustment (target TBD)
	Respond to 90% of priority drinking water, drainage, and wastewater problems within one hour
	Increase households enrolled in the Utility Discount Program from 17,079 in January 2015 to 19,600 by year-end

Focus Area: Better Protecting Your Health and Our Environment

SPU Services	Service Levels
Mountain fresh drinking water	Maintain 100% compliance with Department of Health regulations
	Provide instream water for fish and meet other tribal, regional, state, and federal commitments
Safe sewage transport to King County treatment plants; drainage that reduces flooding & pollution	Limit sanitary sewer overflows to no more than 4 per 100 miles of pipe per year
	Limit combined sewer overflows to waterbodies to 1 per outfall per year
	Remove 100 tons of pollutants from roads during 2015
Planning for the future	To support the Citywide goal of 700 million gallons of runoff managed using Green Stormwater Infrastructure by 2025, SPU has a 2015 target of managing 8 million gallons of stormwater via RainWise rain gardens and cisterns
	Achieve goals for water conservation
Effective recycling and composting	Increase solid waste recycling to 60% by December 2015 and 70% by 2022
Efficient graffiti removal	Clean up graffiti on SPU property and SDOT structures within targeted times (10 business days for SDOT structures; 6 business days for SPU property)

Service Level Team: Rate Payers and Finance – Example Targets

Focus Area: Improving How We Work to Deliver Consistent, High Quality Services

SPU Services	Service Levels
Mountain fresh drinking water	Limit yearly drinking water outages of more than 4 hours to less than 4% of retail customers
	Meet obligations in wholesale customer contracts for pressure, flow, and unplanned transmission system outages
Drainage that reduces flooding & pollution	No critical services (e.g., hospitals) are inaccessible due to flooding, except during extreme storm events (events exceeding a 100-year, 24-hour design storm event)
Dependable solid waste pickup	Provide reliable solid waste pickup with only one missed pickup for each 1,000 stops
	Limit late container deliveries to a maximum of two per 100 deliveries
	Collect at least 95% of missed solid waste pickups within one business day following notification by customers
All services	Stay within the overall 4.6% rate path through 2020
	Meet the aspirational goals for WMBE usage in purchasing and consulting contracts

NOTE: The Workforce Focus Area is not specifically represented here, but it indirectly affects all services levels.

Service Level Team: Example Service Levels

Water and Waste Customer Service Standards

mission statement

To deliver quality and reliable water, wastewater and solid waste services that meet the needs of the community.

customer service standards

Cairns Regional Water & Waste is a commercialised business unit of Cairns Regional Council charged with the responsibility of providing water, wastewater and solid waste services, including recycling to the Cairns community. These services are provided to over 150,000 residential customers and tourists, in addition to over 4,000 commercial and industrial customers.

contact details

Customer Service Centres:

Council Chambers, 119-145 Spence Str., Cairns

Stockland Shopping Centre, Mulgrave Rd, Earlvile

Gordonvale Library, 88 Norman St, Gordonvale

Smithfield Library, Cheviot St, Smithfield

Mossman Offices, 64-66 Front St., Mossman

Postal Address:

General Manager
Cairns Regional Council
Water & Waste
PO Box 389
Cairns Qld 4870

Business Address:

119-145 Spence St.
Cairns Qld 4870

Phone:

Cairns: 07 4044 3044
Mossman: 07 4099 9444
Toll-free: 1800 070 444

Website:

www.cairns.qld.gov.au

Email:

council@cairns.qld.gov.au




Water Services Performance Indicators

	Performance Indicator	Performance measure	Target
Day to Day Continuity	Number of connections experiencing unplanned interruptions	Per 1000 connections / year	150
	Number of connections experiencing planned interruptions	Per 1000 connections / year	15
	Time for restoration of service	% of services restored < 5 hrs	98%
	Response/reaction time to incidents (emergency)	% of response to emergency < 30 min	98%
	Response/reaction time to incidents (all events)	% of response to incident < 24 hours	95%
	Connections receiving 1 interruption per year	% of connections	12%
	Average interruption duration – planned	Hours	1.5
	Average interruption duration - unplanned	Hours	1.5
	Relative incidence of planned and unplanned interruption water incidents (events)	Ratio	1:11
	Minimum pressure at property boundary	kpa	220
Adequacy and quality of normal supply	Maximum pressure at property boundary	kpa	500
	Drinking water quality complaints	Per 1000 connections / year	<5
	E. Coli result for class C recycled water	Less than 1000 cfu/100mL (of samples taken for a twelve month period)	95%
	Drinking water quality incidents	Number of incidents	15
	Urban / rural supplies – E. Coli	Nil per 100mL	98%
	Urban / rural supplies - turbidity	< 5NTU	95%
	Urban / rural supplies – pH	6.5 to 8.5	98%
Urban / rural supplies - colour	Up to 15.0	98%	
Continuity in the long term	Water main breaks and leaks	Per 100km / year	17



Water and Waste




This document provides details on the following:

- Obligations of Cairns Regional Council Water & Waste in delivering the water, wastewater and solid waste services;
- Levels of service to be provided to our customers based on performance indicators and goals;
- Expectations we have for our customers.

This is a condensed version of the complete Cairns Regional Water & Waste Customer Service Standards, available on our website. Including information on billing, new services, metering, complaints and resolution.

www.cairns.qld.gov.au



Sewage Wastewater Services Performance Indicators

	Performance Indicator	Performance measure	Target
Effective transport of sewage	Sewage overflows	Per 100km / year (gravity and rising main)	<15
	Sewage overflows to customer properties	Per 1000 connections / year	<2
	Odour complaints	Per 1000 connections / year	<2
	Response/reaction time to incidents (all events)*	% of response to all events < 24 hrs	98%
	Response/reaction time to incidents (emergency)	% of response to emergency < 1 hour	98%
Continuity in the long run	Priority one events when service restored within 5 hours	% restored within 5 hours	95%
	Sewer main breaks and chokes	Per 100km / year	<10

Waste & Recycling Services Performance Indicators

	Performance Indicator	Performance measure	Target
Effective Collection of Residential Waste	New bin delivery	Response time for new bin delivery	100% within 48 hours
	Missed services - kerbside waste	Number of missed services per month	Less than or equal to 1 per 1000 services
	Response time to missed services - kerbside waste	Response time for collection of missed kerbside waste services	100% within 24 hours
	Missed services - kerbside recycling	Number of missed services per month	Less than or equal to 1 per 1000 services
	Response time to missed services - kerbside recycling	Response time for collection of missed kerbside waste services	100% within 24 hours
	Response time to repair/replacement requests - kerbside waste and recycling	Response time to repair/replace requests for kerbside waste and recycling	100% within 48 hours

Customer Assistance Performance Indicators

	Performance Indicator	Performance measure	Goal
Customer Assistance Performance Goals	Install new residential water connection	Working days	15
	Number of properties that do not receive 48 hours advance notice for planned water and sewerage works	Number	0
	Average time taken by Water and Waste to respond to customer calls (rings)	Rings	4
	Customer Request Management (CRM) completed within prescribed timeframe	5 Working days	95%

Emergency Assistance: Cairns Regional Water & Waste maintains a 24-hour contact service for emergency events related to service systems, such as a burst water main or sewage overflow. Please call during and after hours on 40443044

Managing Assets: Engineering and O&M – Identifying AM Options and Strategies



Managing Assets: Engineering and O&M – Identifying AM Options and Strategies

Assumption: Pump station with a collapsing floor

- Option 1 – Do Nothing
- Option 2 – Rebuild existing floor
- Option 3 – Upgrade entire structure to current standards
- Option 4 – Replace entire pump station with new above ground pump station
- Option 5 – Replace entire pump station with prefabricated below ground pump station

Managing Assets: Engineering, O&M and Finance – Cost Analysis

- Economic
 - Capital
 - Operations and Maintenance
 - Repair
 - Loss of Business Opportunity
- Environmental
- Social



Managing Assets: Engineering, O&M and Finance – Cost Analysis

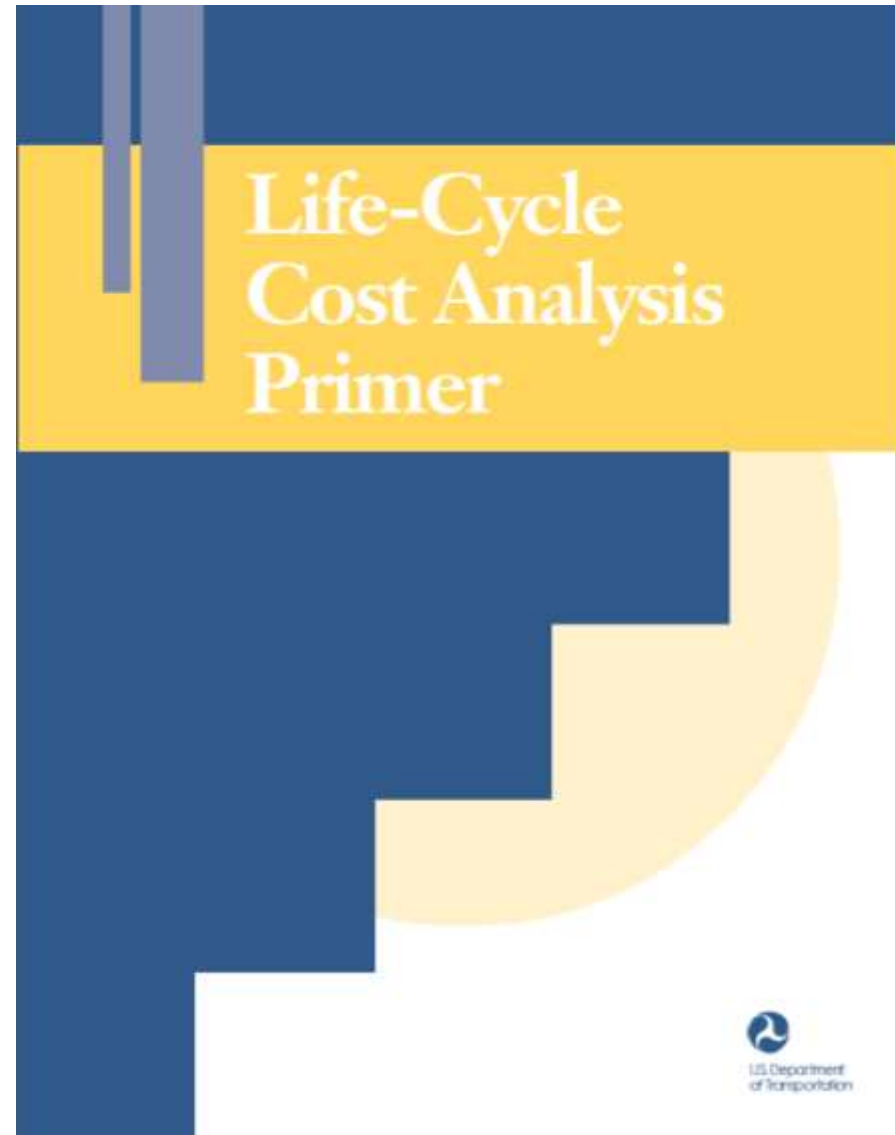
NIST Handbook 135
1995 edition

LIFE-CYCLE COSTING MANUAL for the Federal Energy Management Program

Sieglinde K. Fuller
Stephen R. Petersen



U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Institute of Standards
and Technology



U.S. Department
of Transportation

Managing Assets: Engineering, O&M and Finance – Cost Analysis



**The Value of Water:
Concepts, Estimates,
and Applications for
Water Managers**

**Triple Bottom Line Reporting
of Sustainable Water Utility
Performance**

Subject Area:
Environmental Leadership

Subject Area:
Efficient and Customer-Responsive Organization

Managing Assets: Engineering, O&M and Finance – Cost Analysis



- ABOUT
- Leadership
- OMB Organization Chart
- Open Government Plan
- RSS Feeds
- Intellectual Property
- Agency Info
- Bulletins
- Circulars
- Budget
- State and Local Governments
- Educational and Non-Profit Institutions
- Federal Procurement
- Federal Financial Management
- Federal Information Resources / Data Collection
- Memoranda
- Privacy Guidance
- Reports
- Federal Register
- FOIA
- NDA
- No FEAR
- OMB Locator

Circular A-94 Appendix C Revised December 2014

OMB Circular No. A-94

[Click here for PDF assistance](#)

DISCOUNT RATES FOR COST-EFFECTIVENESS, LEASE PURCHASE, AND RELATED ANALYSES

Effective Dates. This appendix is updated annually. This version of the appendix is valid for calendar year 2015. A copy of the updated appendix can be obtained in electronic form through the OMB home page at http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c/. The text of the main body of the Circular is found at http://whitehouse.gov/omb/circulars_a094/, and a table of past years' rates is located at <http://whitehouse.gov/sites/default/files/omb/assets/a94/dischist.pdf>. Updates of the appendix are also available upon request from OMB's Office of Economic Policy (202-395-3316).

Nominal Discount Rates. A forecast of nominal or market interest rates for calendar year 2016 based on the economic assumptions for the 2016 Budget is presented below. These nominal rates are to be used for discounting nominal flows, which are often encountered in lease-purchase analysis.

Nominal Interest Rates on Treasury Notes and Bonds
of Specified Maturities (in percent)

3-Year	5-Year	7-Year	10-Year	20-Year	30-Year
1.7	2.2	2.5	2.8	3.1	3.4

Real Discount Rates. A forecast of real interest rates from which the inflation premium has been removed and based on the economic assumptions from the 2016 Budget is presented below. These real rates are to be used for discounting constant-dollar flows, as is often required in cost-effectiveness analysis.

Real Interest Rates on Treasury Notes and Bonds
of Specified Maturities (in percent)

3-Year	5-Year	7-Year	10-Year	20-Year	30-Year
0.1	0.4	0.7	0.9	1.2	1.4

Analyses of programs with terms different from those presented above may use a linear interpolation. For example, a four-year project can be evaluated with a rate equal to the average of the three-year and five-year rates. Programs with durations longer than 30 years may use the 30-year interest rate.

Other Documents

[Text of OMB Circular No. A-94 in HTML or PDF \(22 pages, 78 kb\)](#)

[Table of Past Years Discount Rates from Appendix C of OMB Circular No. A-94 \(2 pages, 22 kb\)](#)

[Memorandum M-15-05, 2014 Discount Rates for OMB Circular No. A-94 \(2 pages, 78 kb\)](#)

Managing Assets: Engineering, O&M and Finance – Cost Analysis

Nominal Interest Rates on Treasury Notes and Bonds of Specified Maturities (in percent)

3-Year 1.7	5-Year 2.2	7-Year 2.5	10-Year 2.8	20-Year 3.1	30-Year 3.4
---------------	---------------	---------------	----------------	----------------	----------------

Real Discount Rates. A forecast of real interest rates from which the inflation premium has been removed and based on the economic assumptions from the 2016 Budget is presented below. These real rates are to be used for discounting constant-dollar flows, as is often required in cost-effectiveness analysis.

Real Interest Rates on Treasury Notes and Bonds of Specified Maturities (in percent)

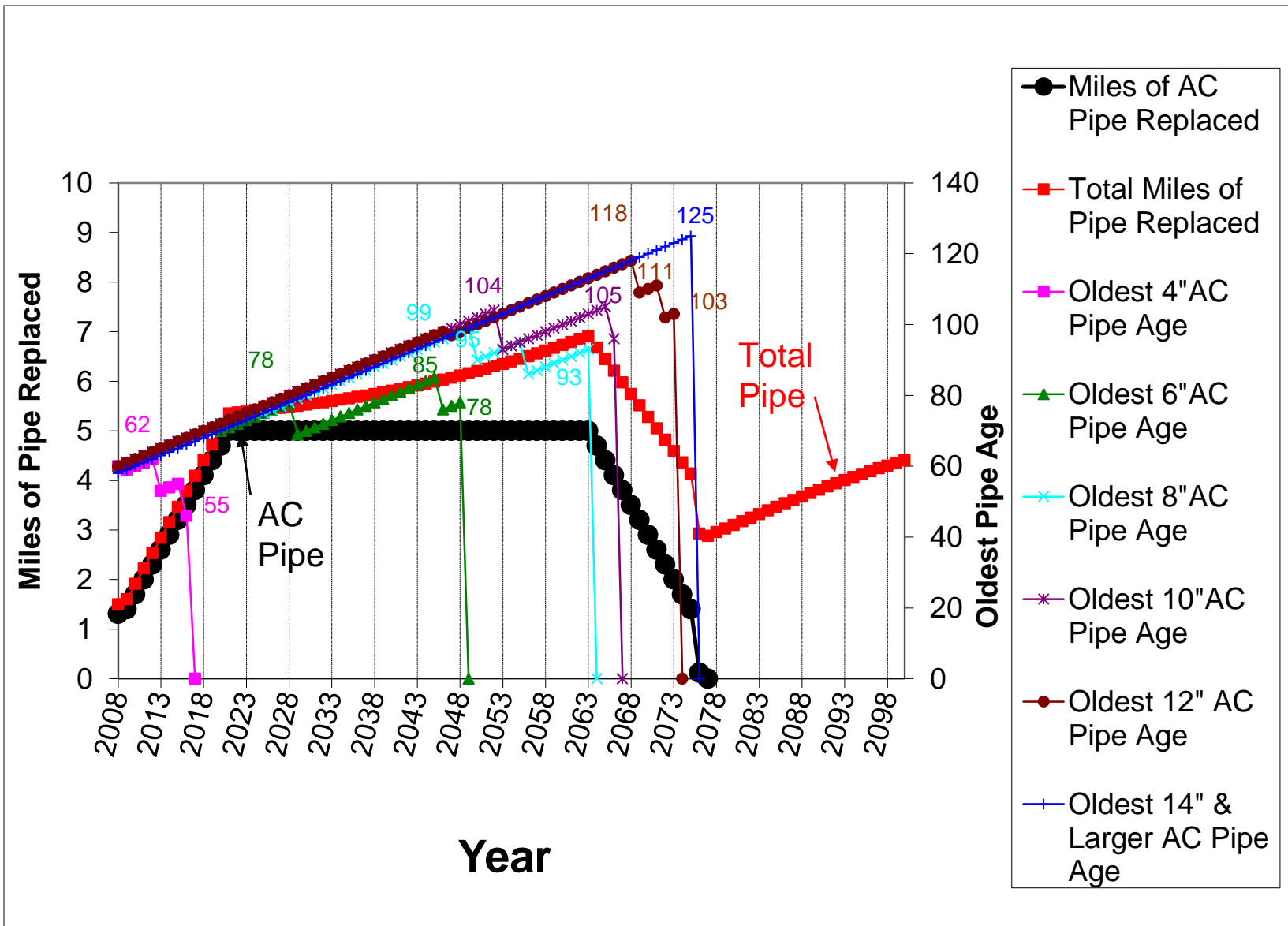
3-Year 0.1	5-Year 0.4	7-Year 0.7	10-Year 0.9	20-Year 1.2	30-Year 1.4
---------------	---------------	---------------	----------------	----------------	----------------

Analyses of programs with terms different from those presented above may use a linear interpolation. For example, a four-year project can be evaluated with a rate equal to the average of the three-year and five-year rates. Programs with durations longer than 30 years may use the 30-year interest rate.

Life Cycle Cost Analysis Example

XYZ Project						
Alternative 1 - Partial Demolition with Gravel Fill						
Date						
NET PRESENT VALUE (Net Cost)	\$451,449					
INITIAL NET COST	\$345,677					
Discount Rate =	2.70%					
Discount Rate Basis:	Real Interest Rate on 30-year Treasury Bill as of December 2009 (recommended long-term discount					
Year Zero =	2010					

Managing Assets: Engineering, O&M – Developing Strategies



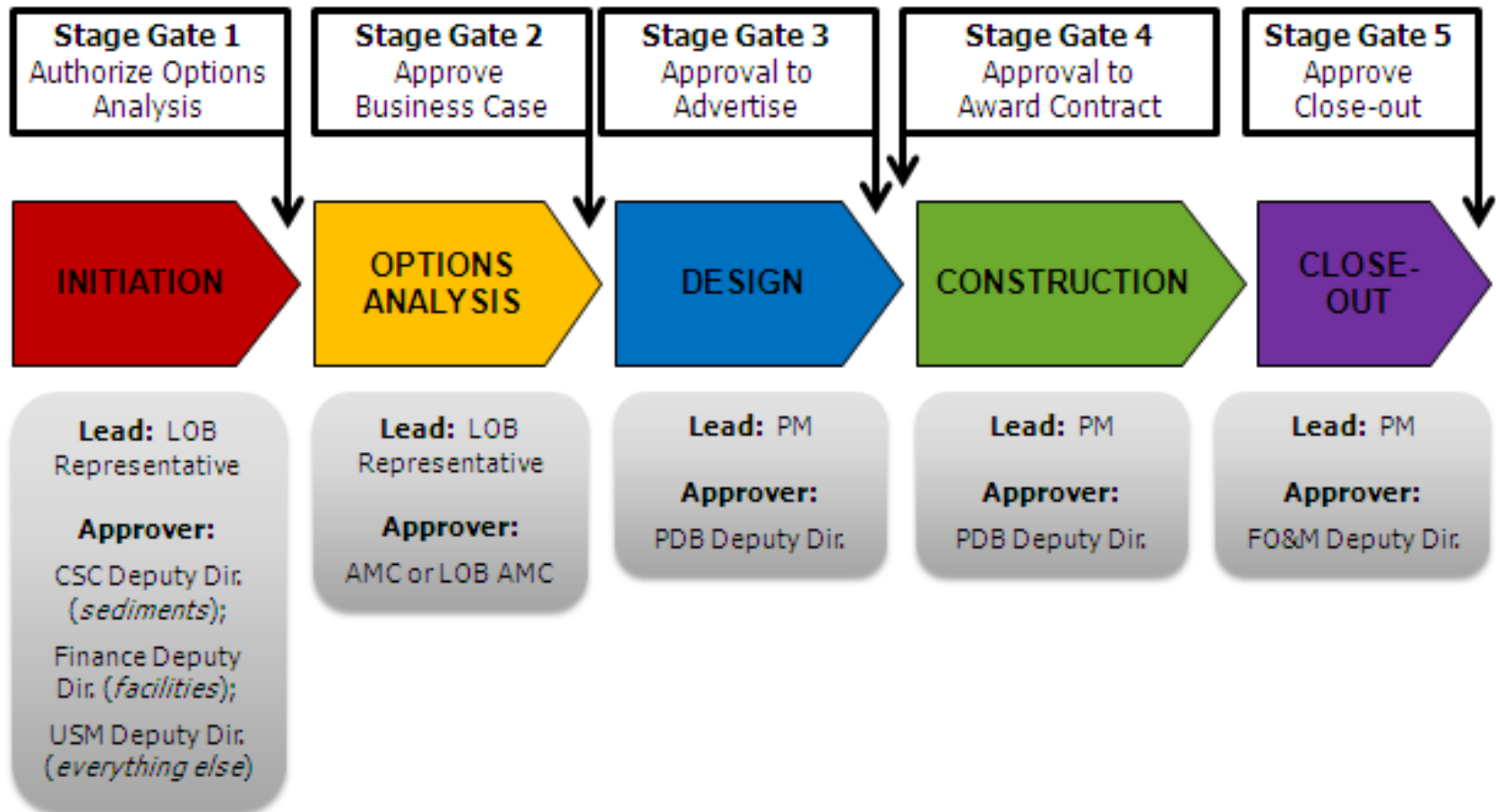
Managing Assets: (Simple) Example Process/Documentation

Wilburton Area Wastewater Capacity Improvements Summary of Life Cycle Costs

	Alt 1 – Upsize Mains	Alternative 1A – Upsize Mains, Use Existing SE 8th St Piles	Alternative 2 – New P.S. to Divert Most Flows to Metro	Alternative 4 – New P.S. to Divert All Flows to Metro
Net Present Value of Capital Costs	\$4,746,642	\$4,449,795	\$4,111,716	\$9,342,306
Net Present Value of Operations and Maintenance Labor Costs	\$0	\$0	\$883,564	\$883,564
Net Present Value of Operations and Maintenance Energy Costs	\$0	\$0	\$191,067	\$309,414
TOTAL	\$4,746,642	\$4,449,795	\$5,186,347	\$10,535,284

Managing Assets: Example Process/Documentation

Stage Gate Process Flow for CIP Infrastructure Projects



Managing Assets: Example Process/Documentation



Stage Gate 1: Authorize Options Analysis

<<Insert Project Name and Preparation Date>>

Delete all red text before finalizing document.

Purpose

The purpose of Stage Gate 1 is to document the rationale and approval for funding and initiation of the Options Analysis Phase to solve a problem or address an opportunity. Detailed information is included in the Initiation and Options Analysis Guide and the SG 1 Instructions.

1. Prospective Project Information

Provide information about the problem or opportunity.

Prospective Project Name	
Activity Number (E#)	
Fund & Business Area	
Sub-Budget Control Level	
LOB Representative	
Delivery Representative	
O&M Representative	<i>If known.</i>
Problem or Opportunity	<i>Briefly, describe the problem or opportunity that will be addressed by the potential project.</i>
Key Drivers	<p><i>A worthwhile project must offer value to the ratepayers for at least one of the following drivers. Select all that apply to this potential project.</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> Demand for a new service level (e.g. new Council adopted standard) <input type="checkbox"/> To prevent an existing service level from falling. <input type="checkbox"/> To meet an existing service level. <input type="checkbox"/> To reduce life cycle cost or risk cost of meeting an existing service level. <input type="checkbox"/> To reduce or eliminate risk exposure. (e.g. fire flow in a neighborhood. <input type="checkbox"/> To meet a regulatory requirement. Insert name: _____ <input type="checkbox"/> To meet a Gap Action Plan or Efficiency Savings from the Strategic Business Plan. <p><i>Insert the Strategic Business Plan Section, name and number:</i></p> <p>_____</p>

Historical Summary	<i>Describe the history related to the problem or opportunity. Include information about any related project(s).</i>
--------------------	--

2. Proposal

Provide a brief summary description of proposal.

Example: Approve \$30K to study four options for addressing unmet water pressure service levels in the Rainier Beach area. Completed Options Analysis anticipated in 3Q 2015.

3. Rationale

Describe the risks and consequences of no action based on the Problem or Opportunity above. Explain how this potential project will address the Key Drivers above.

If this potential project has a basis in a planning document, please identify that plan or analysis (including the date of its approval or adoption). Briefly explain how that plan or analysis identifies this problem or opportunity as a priority. Cite the plan.

--

4. Options Summary

Briefly describe the preliminary options that have been identified. Provide preliminary estimates of the costs (select the appropriate range) and benefits (may be qualitative) of each possible solution. Add rows if needed.

|

Managing Assets: Example Process/Documentation

	Option Name	Brief Description	Anticipated Benefits	Estimated Lifecycle Cost
#1	<i>E.g. No Action/Base Case</i>			Choose an item.
#2	<i>O&M Only</i>			Choose an item.
#3	<i>Capital Solution #1</i>			Choose an item.
#4	<i>Capital Solution #2</i>			Choose an item.

5. Project Prioritization

Use [SPU Prioritization ranking](#) and rating criteria to identify this project's [Priority Rank](#) and [Priority Rating](#) in the table below. Provide greater detail about the selected ratings in the table's far right column. For instance, name the regulation, legal agreement, other agency driving the project, and the relevant adopted service level.

Priority Rank	Rank/Rating	Description
Regulatory Mandates, Legal Agreements, ex: Consent Decree		
External Drivers		
Infrastructure		
Levels of Service		
Other Factors		

6. Service Equity

Use the questions below to frame the real and potential Service Equity issues for further study during Options Analysis. For assistance in completing this section, contact Michael Davis 615-1376 or Steve Hamai 733-9430, in SPU's Environmental Justice and Service Equity Division.

(Note: Application of the Equity Planning Stakeholder Analysis and Project and Program Development tools typically will be required during Options Analysis, and relevant findings presented at Stage Gate 2. These tools can be found on the SPU [Community Engagement & Equity Planning SharePoint site](#).

1. Discuss and list any racial and/or other socio-economic disparities (one group benefiting or negatively affected more than another group) in the effects of this problem or opportunity.
2. Who will be impacted by this service or project? List the categories or types of SPU customers impacted (e.g. multi-family residents), and if applicable, SPU employees.

3. Describe your plans and resource needs to ensure effective outreach and engagement of those customers and communities who historically have not responded to past outreach engagement efforts.
4. Identify the Service Equity Subject Matter Expert who will participate as a team member. Enter the name in Section 8.2 (Proposed Team Members).
5. Indicate whether the project proposes to hire any consultants during Options Analysis and if so, contact SPU's WMBE Subject Matter Expert Vicky Schiantarelli.

7. Climate Change

Climate change is projected to alter temperature and precipitation patterns as well as marine water levels (in Puget Sound and in the Duwamish River) over the next several decades.

Is the underlying problem or any solution under consideration potentially affected by climate change (e.g. a facility potentially affected by sea level rise, or stormwater infrastructure affected by precipitation intensity changes)? If so, describe below how the Options Analysis will take into account these factors.

There are resources available, including the [Climate Change website](#) and the [Sea Level Rise Map](#) to determine if this project could be affected by future sea level rise. If you have any questions, contact James Rufo-Hill 386-4138 or Paul Fleming 684-7626 in SPU's Corporate Asset Management.

8. Plan of Action for Options Analysis

8.1 Approach

Summarize the approach or methodology to be used in assessing options and preparing Stage Gate 2. State whether the approach is likely to be a Cost-Benefit or a Cost-Effectiveness Analysis. Identify probable environmental review and permitting concerns, Code Requirements or technical work such as preliminary engineering, geotechnical testing, flow monitoring, etc... Include action items from Service Equity and Climate Change findings. If the lifecycle cost of the recommended option is greater

Managing Assets: Example Process/Documentation

than \$5 million, describe how Value Planning will be incorporated into the Options Analysis.

8.2 Proposed Team Members

Identify team members to participate in Options Analysis, including their role on the project team and the functional area or special expertise they represent. Do not include the One Team Representatives that are on Page 1.

Role on Team	Functional Area/Expertise	Member Name/Branch
Economist		
Asset Management Reviewer		
Budget Analyst		
Service Equity SME		
Climate Change SME		
Business Area Manager		
Design Engineer		
<i>Additional members as needed</i>		

8.3 Options Analysis Cost

Identify the estimated cost to perform Options Analysis. Provide supporting detail as an attachment or a hyperlink if appropriate.

If during Options Analysis, the Total Cost Projection exceeds the SG 1 Approved Budget by 25% or more use the [Stage Gate Change Process](#).

Customize this table as needed.

Task	Cost
Initiation (Cost to prepare SG 1)	
Options Analysis (including PMP development and completion, as necessary)	
Prepare Stage Gate 2	
Total Requested SG 1 amount	\$

8.4 Value Management

[Value Management](#) is comprised of Value Planning (VP) and Value Engineering (VE). Value Planning (VP) is used to improve the value of the project alternative selection through high level assessment and validation of critical project cost, schedule and risk items. VP validates early cost, schedule and project risks and aids in the Business Case development. Value Engineering (VE), seeks to optimize design function while minimizing resources and is typically completed during the design phase after SG 2 approval.

Value Planning (VP) study is required after Stage Gate 1 for projects with a total lifecycle cost of \$5M or more.

- Yes = VPA is required to validate the project alternative selection.
 No = VA is not required.

8.5 Schedule

Provide a schedule for Options Analysis and tentatively for project implementation. If during Options Analysis, the Schedule exceeds the SG 1 Approved Estimated Completion date by 6 months or longer, use the [Stage Gate Change Process](#).

EPMS purposes the last day of any given quarter is used.

Product Development Lifecycle	Estimated Completion
Project Initiation	
Stage Gate 1 Approval	Month/Day/Year
Options Analysis	
Stage Gate 2 Approval	Quarter/Year
Design Phase	
Stage Gate 4 Approval	Quarter/Year
Construction Phase	
Substantial Completion	Quarter/Year
Close-out	
Stage Gate 5 Approval	Quarter/Year

9. Portfolio Review

9.1 Preliminary CIP Cost Estimate

Select one option from Section 4 above for inclusion in the 6-Year CIP and provide a preliminary estimated cash flow below. Document the current [inflation rate](#) here:

Please note the source of the cashflow information if it comes from a prepared report or plan. Cashflow is informational only.

Managing Assets: Example Process/Documentation

Here is more information regarding AACE's [Cost Estimate Classification System](#).

	LTD	20XX	20XXx	20XX	20XX	20XX	20XX	Total Cost Projection	Estimate Class (1 to 5)
Initiation & Options Analysis Completion, include PMP, if applicable.									
Preliminary Option # & Name									
Adopted Budget									

9.2 Funding Availability/Impact on Portfolio

Describe projected availability of funding (\$) – according to adopted/proposed budget, 6-year CIP, current or proposed rates, or other projections.

	Funding Availability	Impact/Comment
<input type="checkbox"/> Yes <input type="checkbox"/> N	Confirmed funding is available to complete Options Analysis including the Business Case.	Describe any impacts or issues.
<input type="checkbox"/> Yes <input type="checkbox"/> N	Funding projected to be available for project implementation.	Identify potential impacts on Fund (CIP and O&M) – be specific about projects affected.

9.3 Projected Availability of Staff Resources

Confirm availability of staff to complete work through Stage Gate 2, and projected availability of staff to implement the project in future years. Please note if you anticipate consultant support for the Options Analysis.

	Staff Availability	Impact/Comment
<input type="checkbox"/> Yes <input type="checkbox"/> N	Confirmed Staff are available to complete Options Analysis and the Business Case.	Describe any impacts or issues.
<input type="checkbox"/> Yes <input type="checkbox"/> N	Staff projected to be available to deliver project.	Identify CIP and O&M staffing needs.

10. Pre-Governance Decision Approval

The box checked below indicates that the Utility Services (US) Division Director has made a decision regarding whether the project as outlined satisfies the Asset Management methods and standards that have been established by the US Division.

<input type="checkbox"/> Approved <input type="checkbox"/> Not <input type="checkbox"/> NA	Utility Services Division Director: <insert name and signature; cut-and-paste of email authorization with date and time stamp is acceptable>	Date:
Comments:		

11. Approval

Populate the following table with the names, signatures, and approval dates for people in the roles identified to indicate approval and proceed with Options Analysis.

Initiation Approval		
	Name and Signature (attach email if approval is electronic)	Date
<input type="checkbox"/>	[Insert Name] LOB Representative	
<input type="checkbox"/>	[Insert Name] Business Area Manager	
<input type="checkbox"/>	[Insert Name] Deputy Director, [Insert Branch Name]	

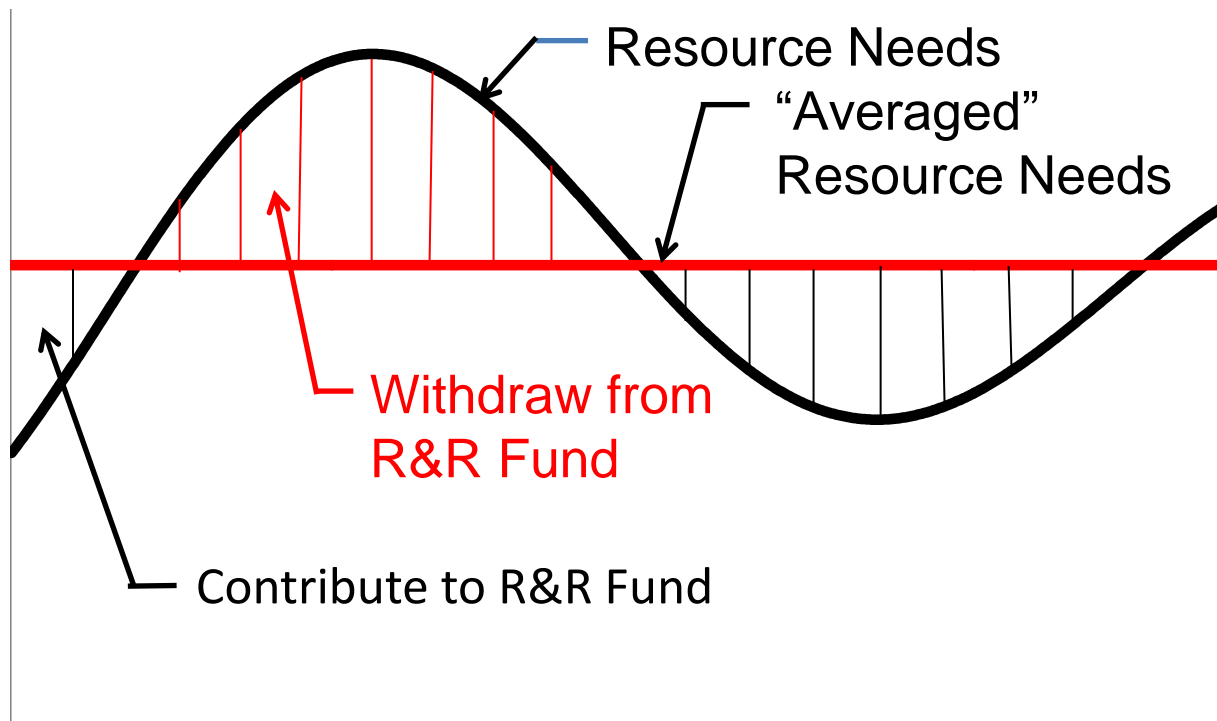
12. Appendix

Funding: Engineering, O&M - Prioritization

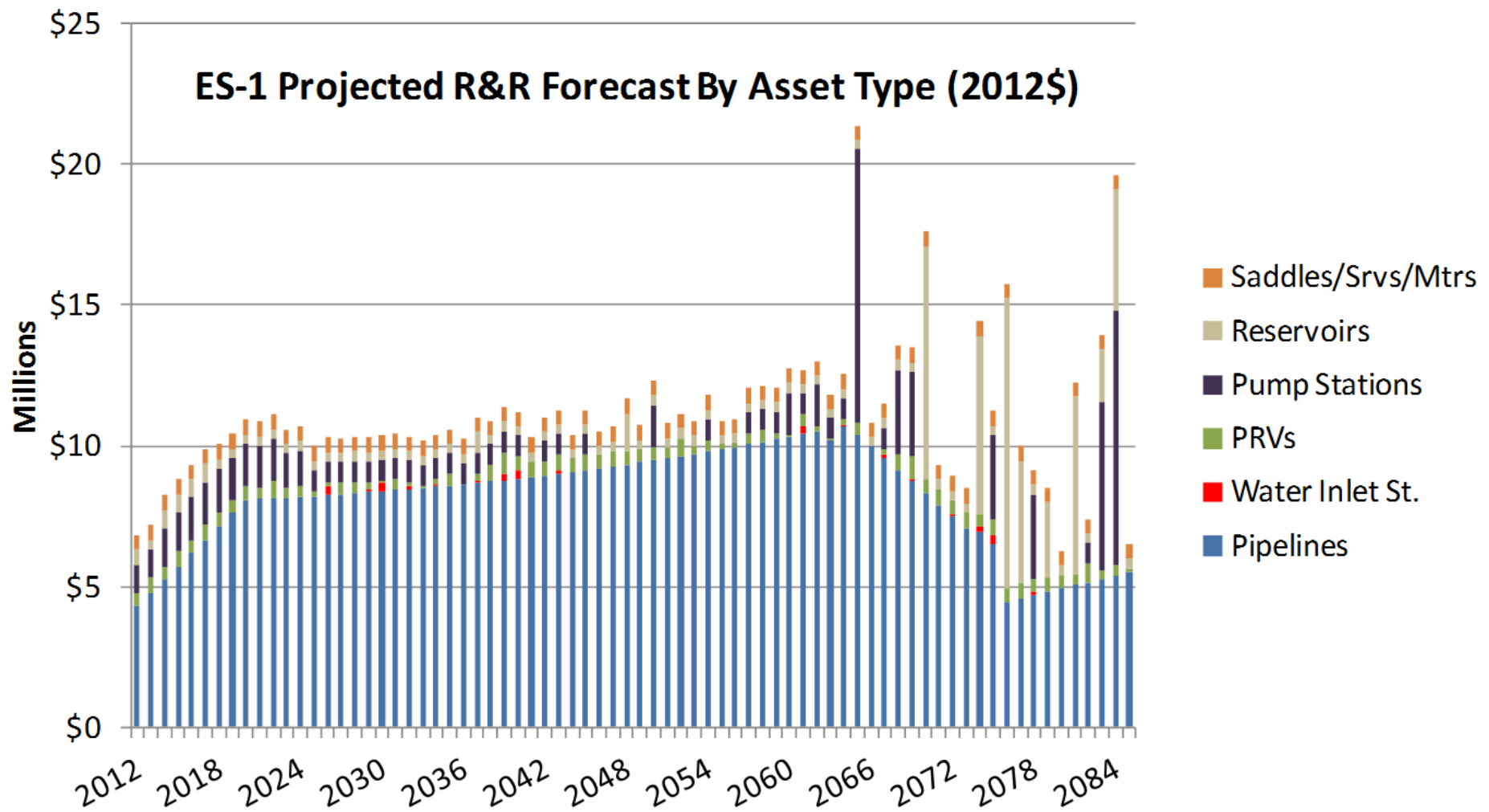
		Consequence				
		How severe could the outcomes be if the risk event occurred? →				
		1	2	3	4	5
		Insignificant	Minor	Significant	Major	Severe
Likelihood	5 Almost Certain	5 Medium	10 High	15 Very high	20 Extreme	25 Extreme
	4 Likely	4 Medium	8 Medium	12 High	16 Very high	20 Extreme
	3 Moderate	3 Low	6 Medium	9 Medium	12 High	15 Very high
	2 Unlikely	2 Very low	4 Low	6 Medium	8 Medium	10 High
	1 Rare	1 Very low	2 Very low	3 Low	4 Medium	5 Medium

Funding – Finance and Ratepayers – Strategy

- Maintain Service Levels
- Intergenerational Fairness
- Avoid Sharp Rate Hikes



Funding – Engineering and Finance – Needs Forecast



QUESTIONS?