

A nighttime photograph of a city skyline, likely New York City, with numerous skyscrapers illuminated and their lights reflecting on the water in the foreground. The sky is dark, and the overall scene is lit with warm, golden-yellow and white lights from the buildings.

Bellevue's AC Water Main Replacement Program

AWWA PNWS Annual Conference and Exposition
April 26, 2018

Andrew Lee, City of Bellevue

Presentation Overview

- Background
 - City of Bellevue Service Area
 - Water Main Inventory
- Service Levels
- Condition Assessment Strategy
- Replacement Strategy
- Financial Strategy
- Next Steps

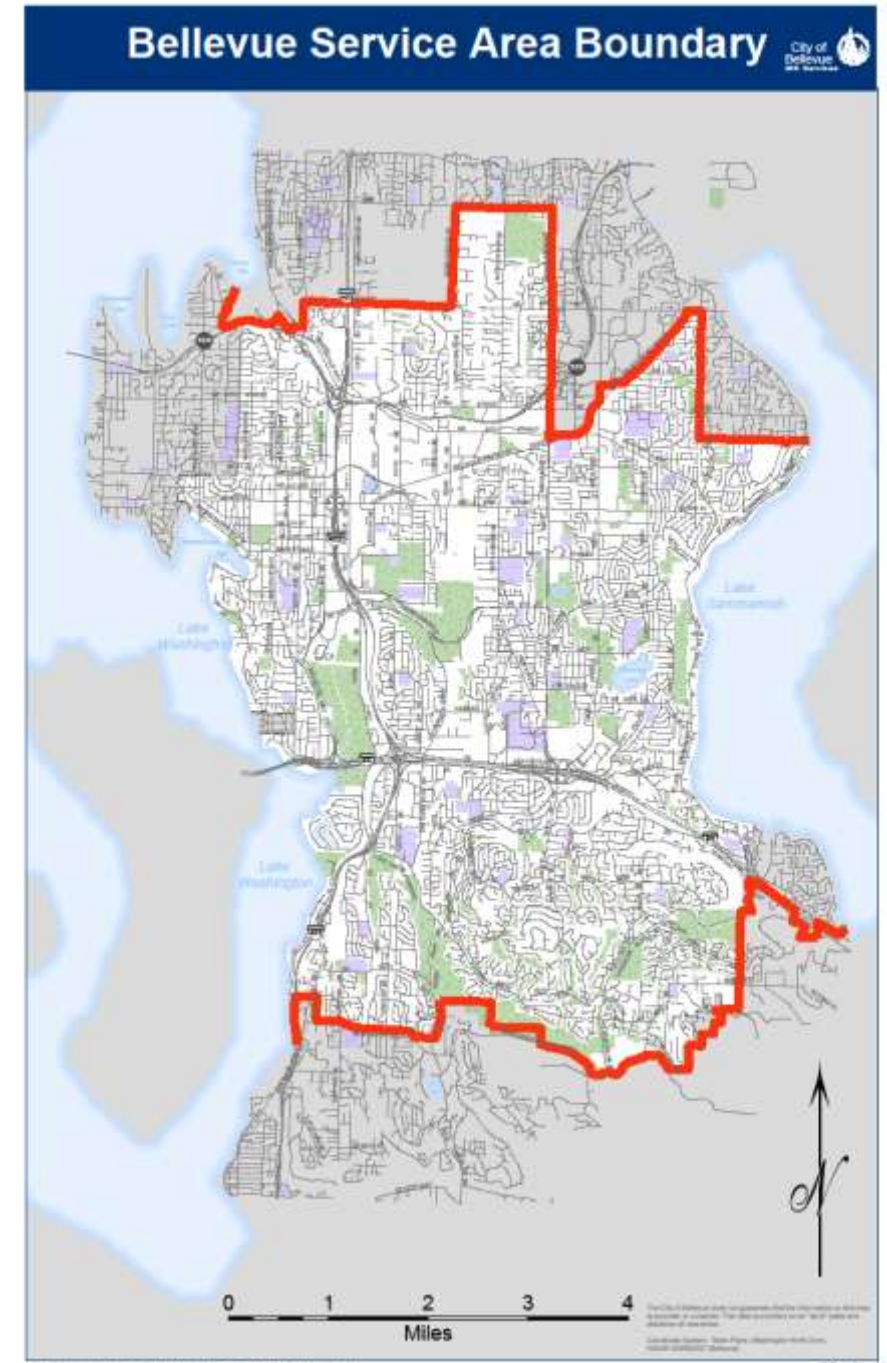
Background

- Service Area
- Inventory



Bellevue's Service Area

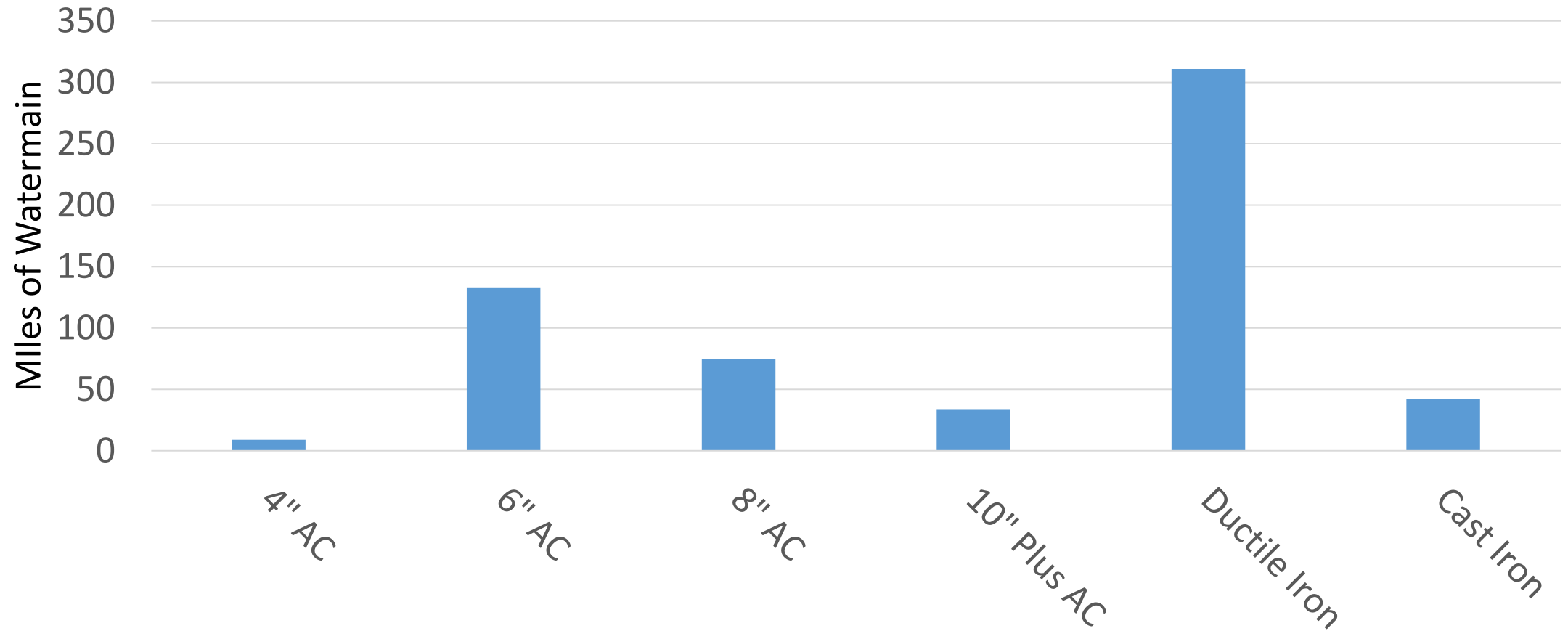
- City of Bellevue
- Beaux Arts, Clyde Hill, Hunts Point, Medina, Yarrow Point
- 140,000 residents
- Three Utilities
 - Water
 - Wastewater
 - Stormwater



Water Utility Inventory

- 619 miles of watermain
- 30,000+ saddles and services
- 25 reservoirs
- 22 pump stations
- 145 PRV's and 13 Inlets
- Approximately 300 commercial meters
- 41,000 Meter Connections

Distribution of Water Main Materials & Sizes



Service Levels

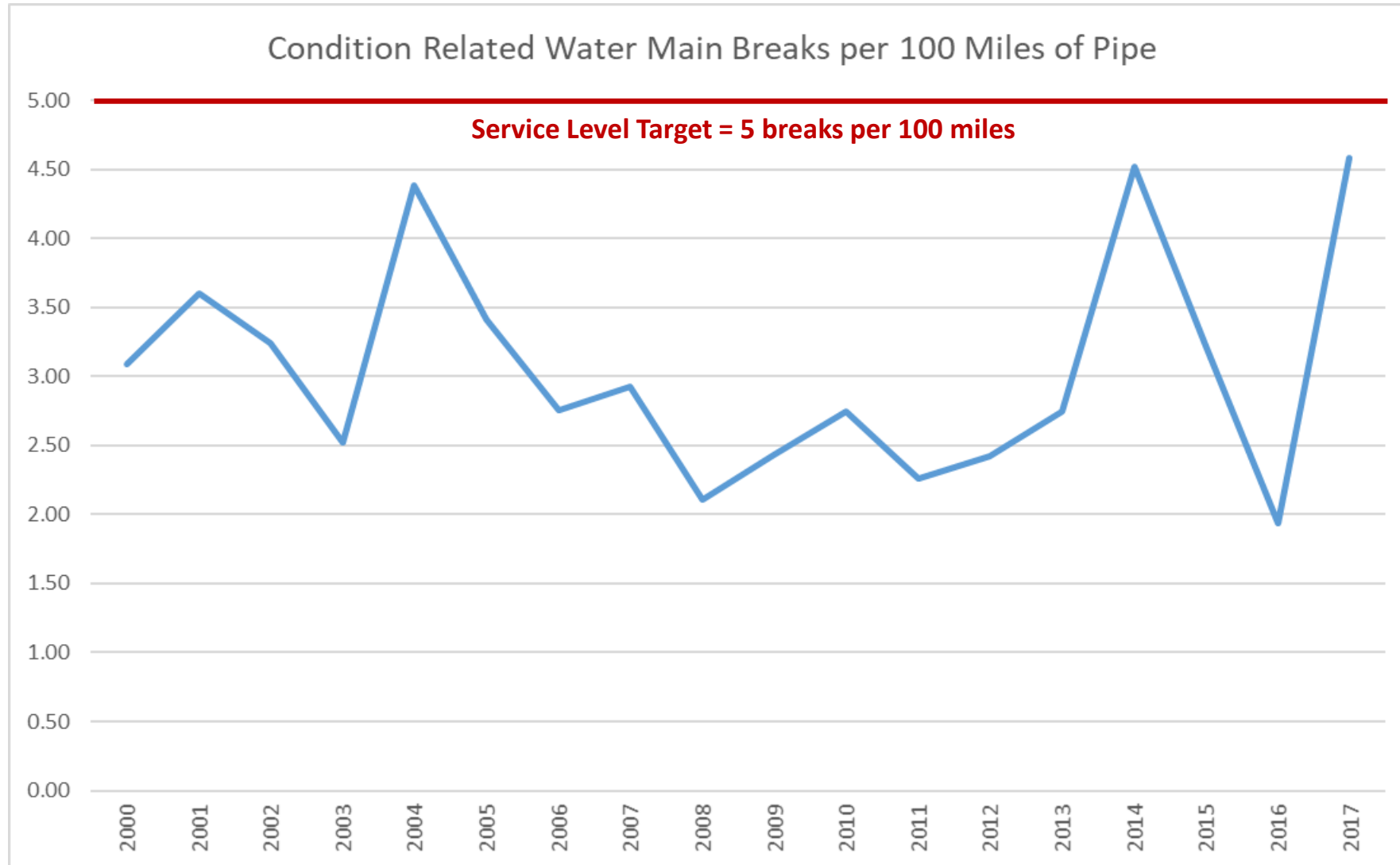
- Asset Management Goal
- Drinking Water Service Level
- Historical Data



Bellevue's Asset Management Goal

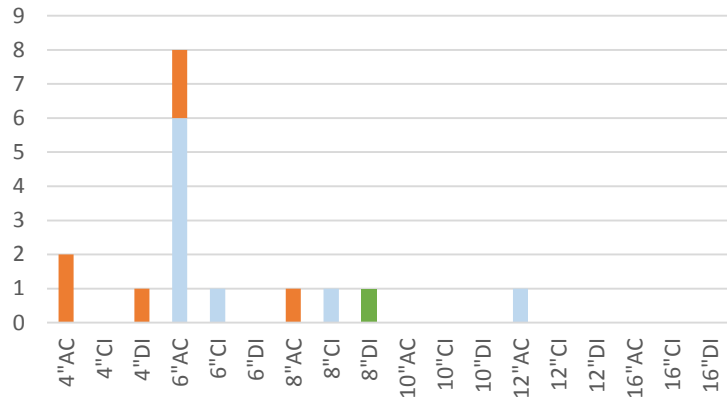
*The goal of the Asset Management Program is to maintain a **targeted level of service** for delivery of drinking water, wastewater, and storm and surface water utility services through an optimal strategy which combines operations and maintenance, renewal/rehabilitation, and replacement in a way that maximizes asset life at the minimal cost and risk to the rate payer.*

Water Main Level of Service History

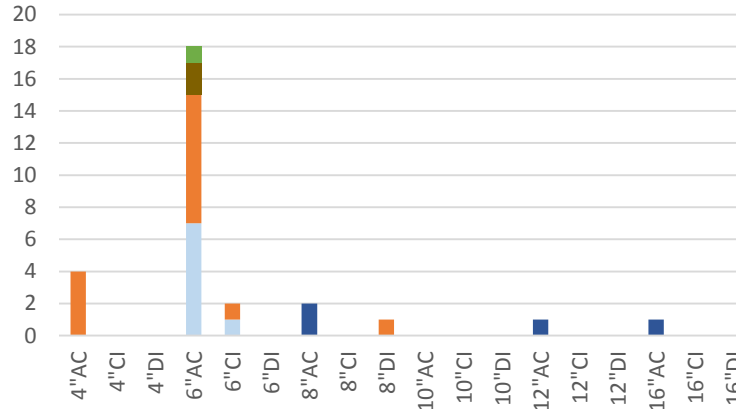


Historical Water Main Break Data

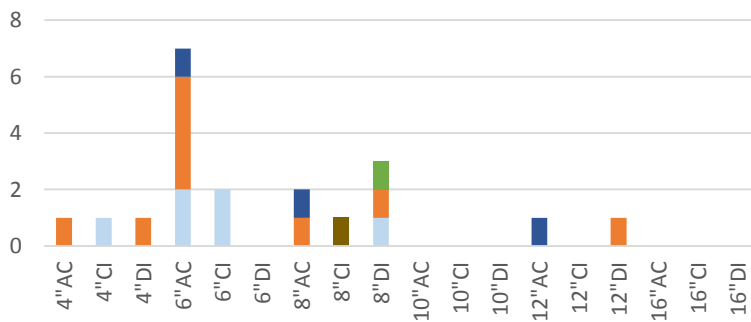
2013 Water Main Break Data



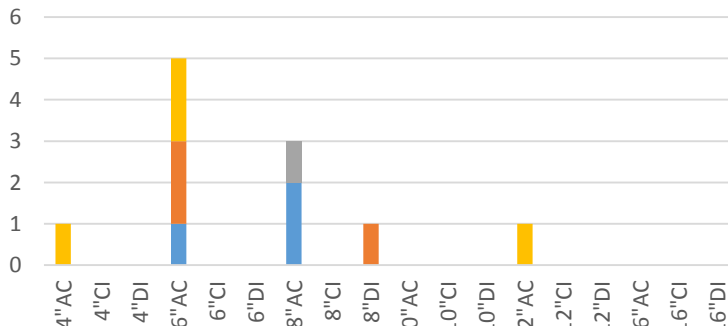
2014 Water Main Break Data



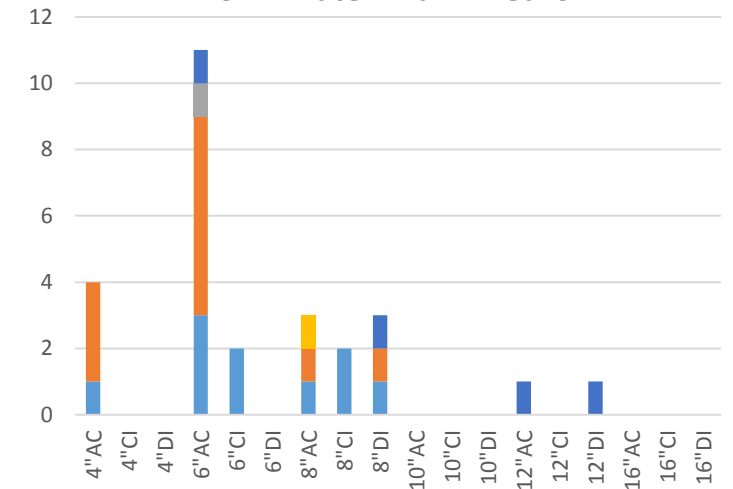
2015 Water Main Break Data



2016 Water Main Break Data



2017 Water Main Breaks



- Circumferential Crack
- Blow Out (Includes Small Holes)
- Longitudinal Crack
- Collar
- Fittings

- Circumferential Crack
- Blow Out (Includes Small Holes)
- Longitudinal Crack
- Collar
- Fittings

- Fittings
- Collar
- Longitudinal Crack
- Blow Out (Includes Small Holes)
- Circumferential Crack

Watermain Break Data

AC Break Rate

	4"	6"	8"	10"	12"
Annual average of condition related breaks 2010 to 2017	2.62	8.75	2.50	0.00	0.50
Remaining Miles of AC pipe in the system as of 2017	8.92	133.11	74.78	8.08	23.82
Average breaks per 100 miles	26.87	6.37	3.20	0.00	2.00

Pipe Condition Assessment Strategies

- Visual / External Physical observation
- Laboratory Testing
- Acoustic Testing
- Pressure Transient Testing



Pipe Condition Assessment Strategies

- Visual / External Physical observation
- Laboratory Testing
- Acoustic Testing



Condition Assessment – Staff Observations

Water Main and Service/Saddle Observation Report
(circle appropriate answer or fill in blank)

GENERAL INFORMATION

Name of Observer: Brown, JAMES Date: MAY 23, 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 Pucky 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 Feat 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: ¾-inch 1-inch 1 ½-inch 2-inch 3-inch Other _____

Service Line Material: Carbon 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
	Poor Construction	Poor Repair	Reduced Pipe Strength
	Pressure Surge	Unknown	Other _____
Repair Method:	Clamp	Replacement	Other _____

Notes: _____

AC Watermain laboratory testing

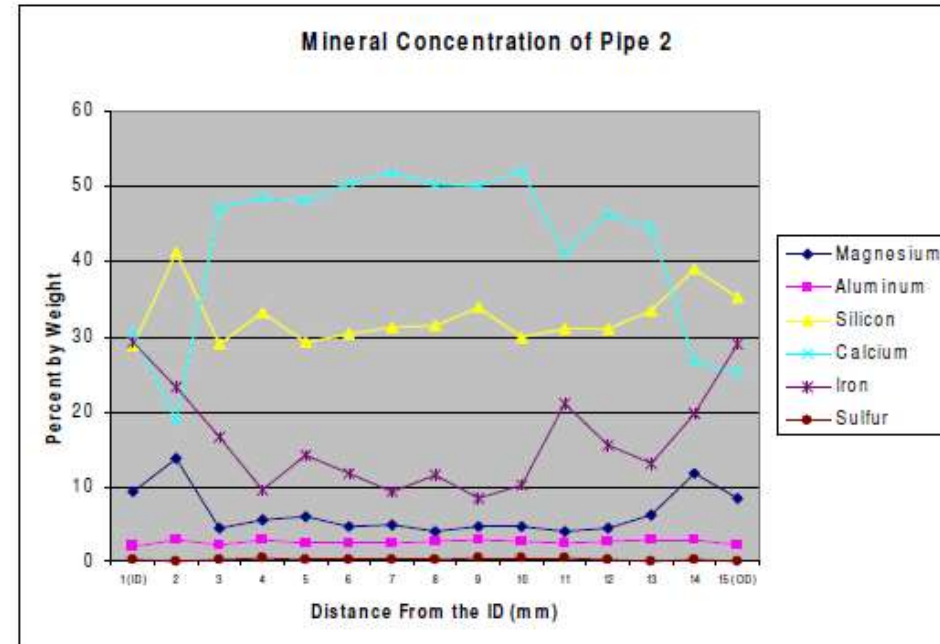
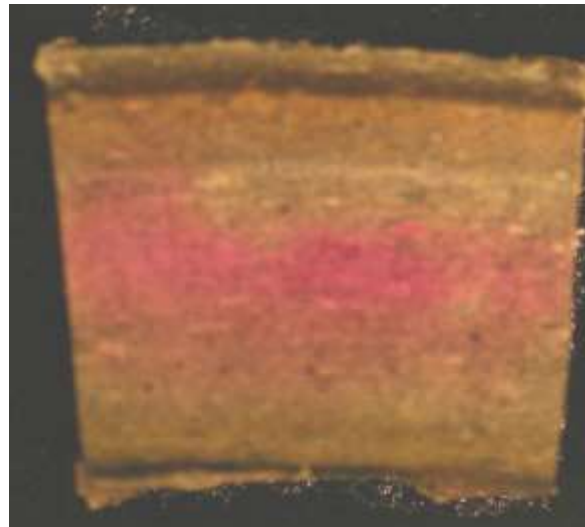
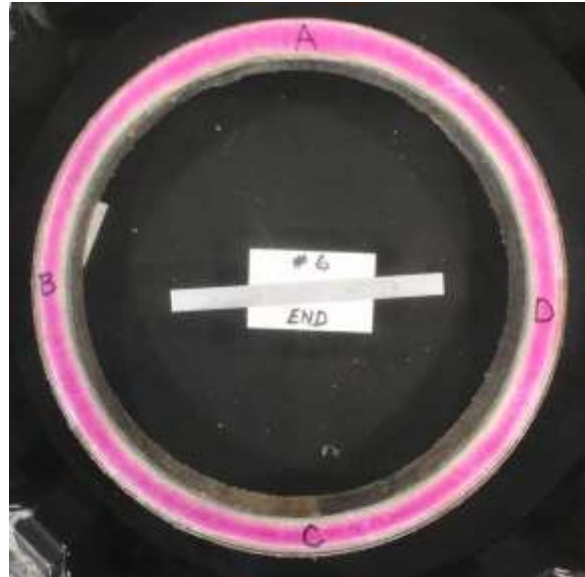


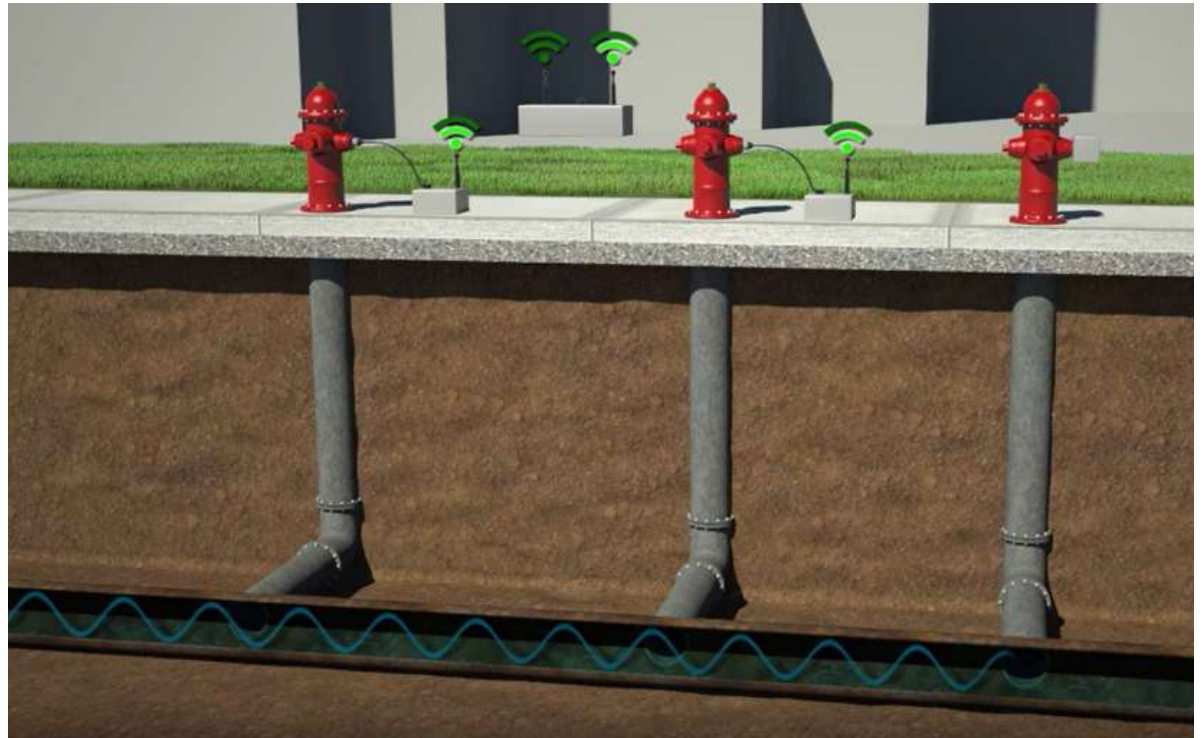
Fig. 15. Elemental Distribution through Cross Section of Pipe #2

AC Watermain Laboratory Testing (cont)



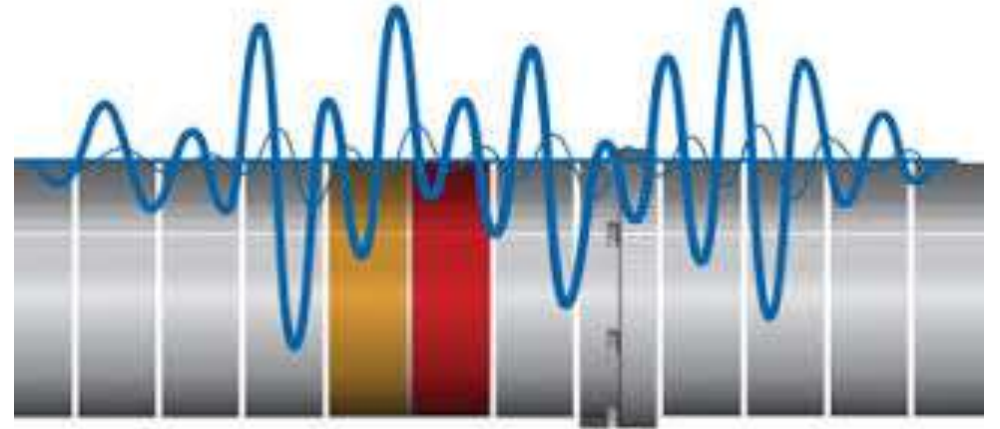
Acoustic Testing for Condition Assessment

- Acoustic Testing
 - Non-invasive
 - Uses sound waves to Measure pipe wall thickness
 - Averages the results across the length evaluated
- Confirmation of Testing Results
 - Innisglen
 - Valley Green



Pressure Transients for Condition Assessment

- P-CAT
 - Non invasive technology
 - Pressure waves injected into pipeline
 - Pinpoints problem areas (30 foot increments)
 - Limited to long straight pipe runs



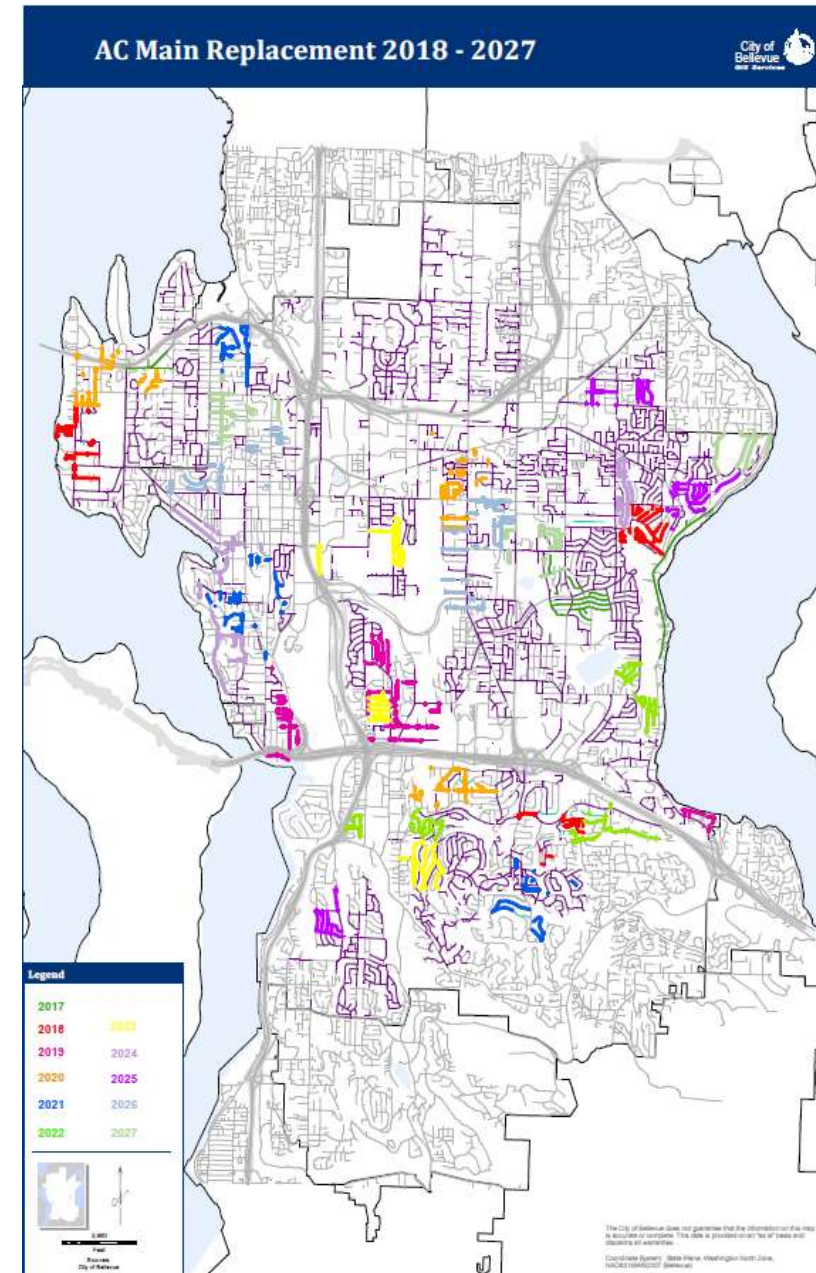
Replacement Program

- Overview
- Current Strategy
- Revised Strategy



Existing Asbestos Cement Watermain Replacement Plan

- Replacement based on risk
 - Probability of failure
 - Consequences of failure
- Focus is primarily on 4-inch and 6-inch mains
- 10 year plan renewed every year for planning purposes.
- 5 mile per year replacement plan

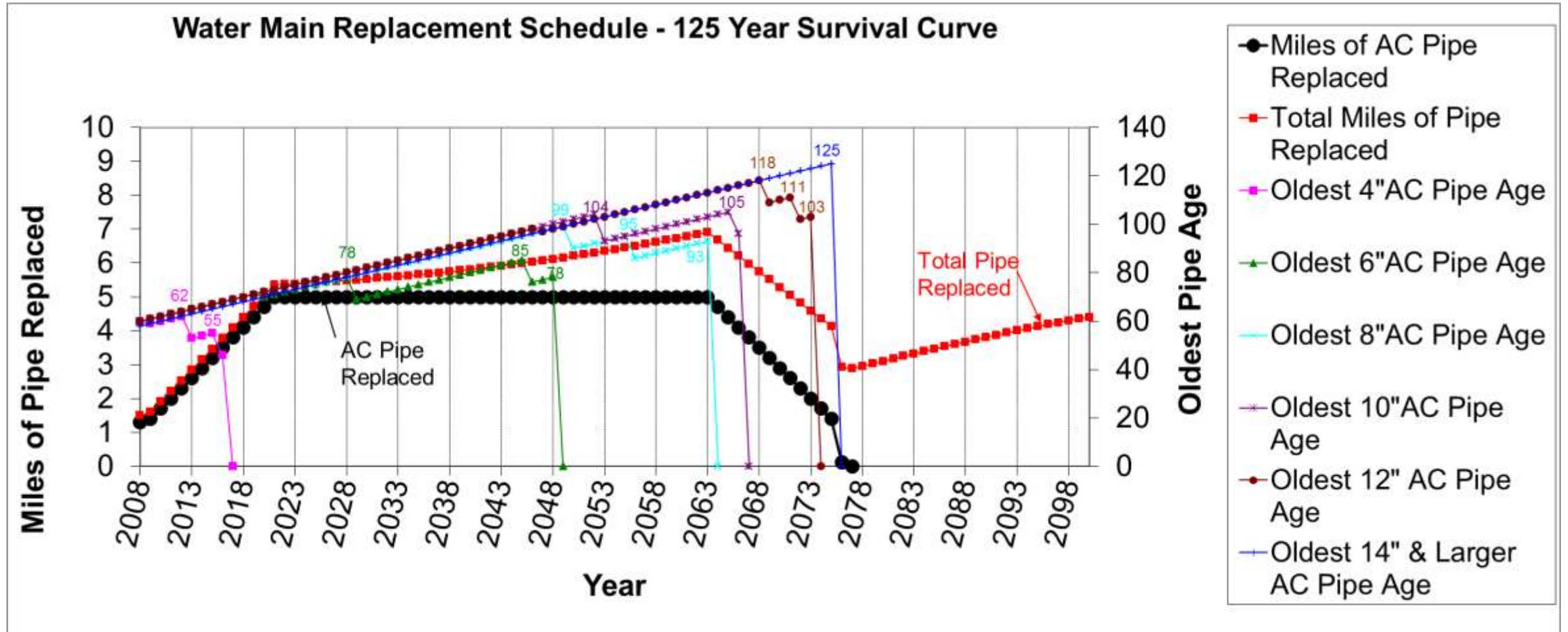


Existing Risk Model Inputs



- GIS Risk Model
- Failure and Condition Report Map
- Consequence of failure map

Long Term AC Main Replacement Plan



Gaps in the existing process

Problem

- Existing Risk model doesn't show optimal replacement schedule
- Existing risk model doesn't show probability of failure

Solution

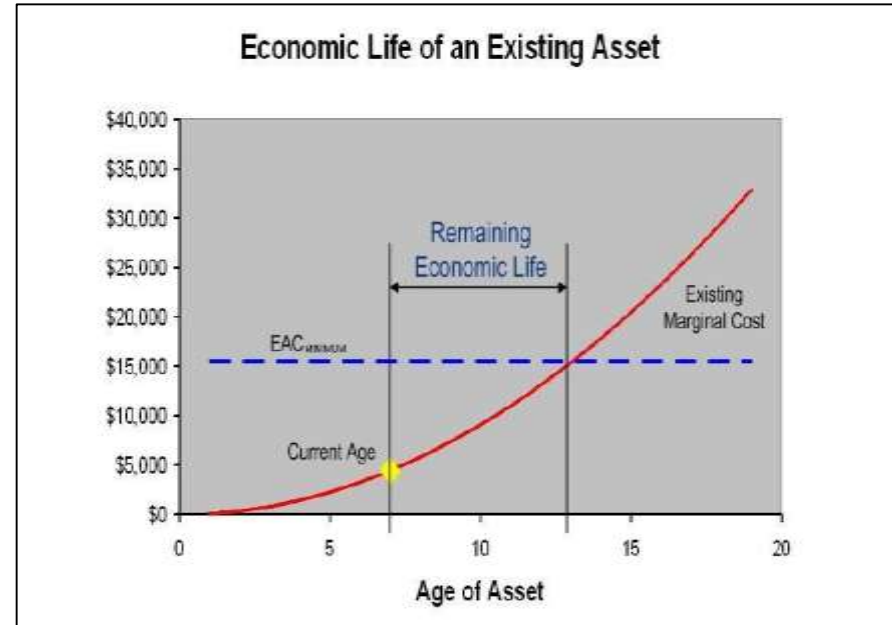
- Economic model that shows individual pipe asset replacement cost, risk cost, and failure probability
- Economic model shows optimal replacement schedule.

Economic Model

Risk based economic model that determines optimal replacement timing for water and wastewater piped assets.

Model provides a full picture of:

- Asset risk
 - Failure probability based on historical failures
 - Consequence of failure based on site-specific data
- Current and forecasted cost of ownership.



The screenshot shows a software interface with a bar chart at the top and a data table below. The bar chart compares "negative values" and "positive values" across categories 10 through 25. The data table below has columns for "Asset ID", "Age", "Cost", and "Status".

Asset ID	Age	Cost	Status
0001	10	22,700	544
0002	11	218,210	2860
0003	12	888,100	12,210
0004	13	212,900	31,210
0005	14	211,290	2,007
0006	15	99,474	12,816
0007	16	118,890	2,810
0008	17	138,444	9,810
0009	18	158,110	17,210
0010	19	177,880	24,810
0011	20	197,650	32,410
0012	21	217,420	40,010
0013	22	237,190	47,610
0014	23	256,960	55,210
0015	24	276,730	62,810
0016	25	296,500	70,410
0017	26	316,270	78,010
0018	27	336,040	85,610
0019	28	355,810	93,210
0020	29	375,580	100,810
0021	30	395,350	108,410
0022	31	415,120	116,010
0023	32	434,890	123,610
0024	33	454,660	131,210
0025	34	474,430	138,810
0026	35	494,200	146,410
0027	36	513,970	154,010
0028	37	533,740	161,610
0029	38	553,510	169,210
0030	39	573,280	176,810
0031	40	593,050	184,410
0032	41	612,820	192,010
0033	42	632,590	199,610
0034	43	652,360	207,210
0035	44	672,130	214,810
0036	45	691,900	222,410
0037	46	711,670	230,010
0038	47	731,440	237,610
0039	48	751,210	245,210
0040	49	770,980	252,810
0041	50	790,750	260,410
0042	51	810,520	268,010
0043	52	830,290	275,610
0044	53	850,060	283,210
0045	54	869,830	290,810
0046	55	889,600	298,410
0047	56	909,370	306,010
0048	57	929,140	313,610
0049	58	948,910	321,210
0050	59	968,680	328,810
0051	60	988,450	336,410
0052	61	1,008,220	344,010
0053	62	1,027,990	351,610
0054	63	1,047,760	359,210
0055	64	1,067,530	366,810
0056	65	1,087,300	374,410
0057	66	1,107,070	382,010
0058	67	1,126,840	389,610
0059	68	1,146,610	397,210
0060	69	1,166,380	404,810
0061	70	1,186,150	412,410
0062	71	1,205,920	420,010
0063	72	1,225,690	427,610
0064	73	1,245,460	435,210
0065	74	1,265,230	442,810
0066	75	1,285,000	450,410
0067	76	1,304,770	458,010
0068	77	1,324,540	465,610
0069	78	1,344,310	473,210
0070	79	1,364,080	480,810
0071	80	1,383,850	488,410
0072	81	1,403,620	496,010
0073	82	1,423,390	503,610
0074	83	1,443,160	511,210
0075	84	1,462,930	518,810
0076	85	1,482,700	526,410
0077	86	1,502,470	534,010
0078	87	1,522,240	541,610
0079	88	1,542,010	549,210
0080	89	1,561,780	556,810
0081	90	1,581,550	564,410
0082	91	1,601,320	572,010
0083	92	1,621,090	579,610
0084	93	1,640,860	587,210
0085	94	1,660,630	594,810
0086	95	1,680,400	602,410
0087	96	1,700,170	610,010
0088	97	1,719,940	617,610
0089	98	1,739,710	625,210
0090	99	1,759,480	632,810
0091	100	1,779,250	640,410

Financial Strategy

- Council Financial Policies
- 75-Year Capital Projection
- R&R Fund

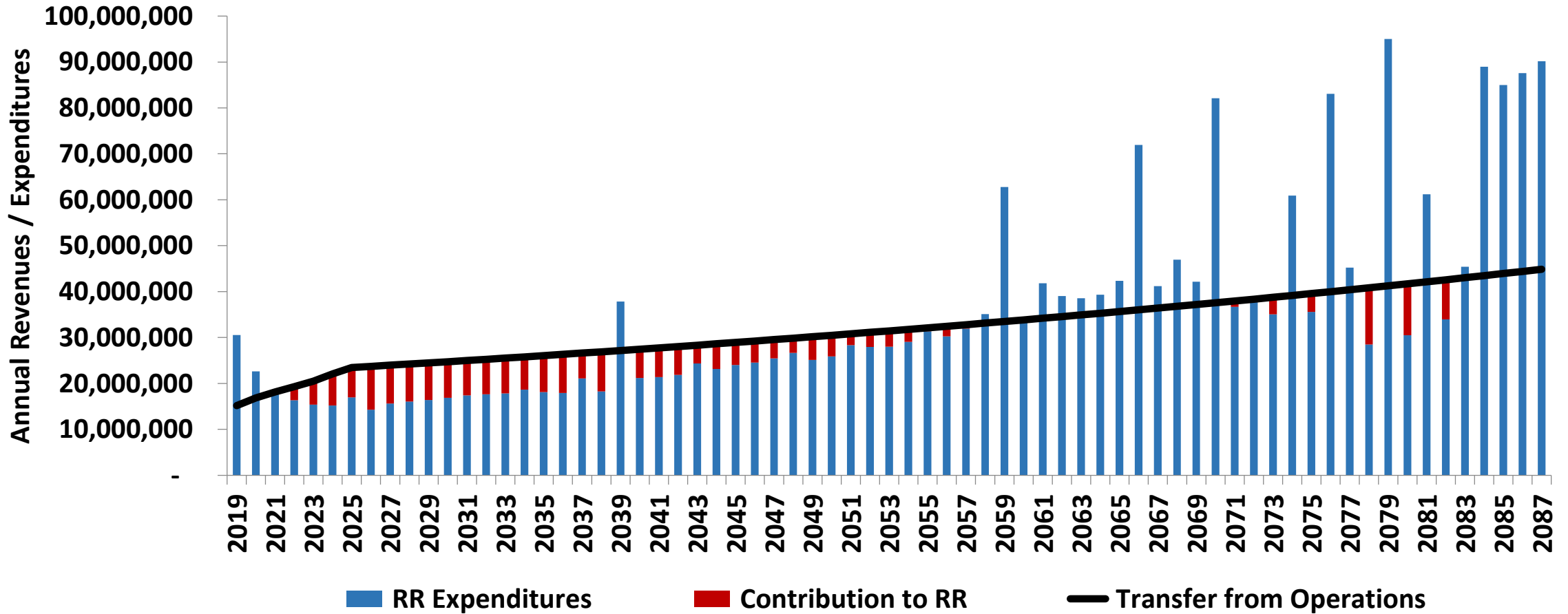


Rates Built on Strong Council-Adopted Policies

“The Tortoise, Not the Hare”

- Plan for long term investment in infrastructure
- Accumulate funds in advance of major expenses
- Maintain existing levels of service by renewing & replacing systems
- Keep rate increases gradual and uniform
- Maintain equity – each generation should pay its fair share
- Use debt sparingly and maintain financial flexibility
- Pass wholesale costs through to customers

75-Year Renewal & Replacement Projection



Next Steps

- Implement more condition assessment (e.g., acoustic testing or P-Cat) of AC water mains
- Pilot relining of existing AC water main
- Consider incorporation of new economic life model results into long-range 75-year R&R projection



Questions?

Andrew Lee

Deputy Director, Utilities

ahlee@bellevuewa.gov