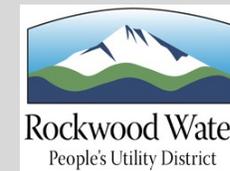




- **Asset Management, Replacement and Renewal Funding**

Bret Bienerth (Lake Oswego-Tigard WTP)

Kari Duncan (Rockwood Water Peoples Utility District)



- *October 2021*

Agenda

- Background
- Development of the Computer Maintenance Management System
- Development of a Renewal and Replacement Fund

Overview: Lake Oswego Tigard Water Project

- \$254 Million Water Supply Project
- Plan, Design, Construct, Commission:
 - River Intake Pump Station, Water Treatment Plant, Pipeline(s), Reservoir, Tigard Pump Station
- Project Duration: 2009 - 2017
- Major Systems Online by July 2016 & Supply to Tigard
- Asset Management and “Replacement and Renewal Funding” is an element of the IGA between Tigard and Lake Oswego

Lake Oswego Tigard Water Supply System



Elected Officials Support

- Partners commit to the ongoing funding of asset Renewal and Replacement
- Managing Agency commits to maintenance of system and must be able to report on activities and condition

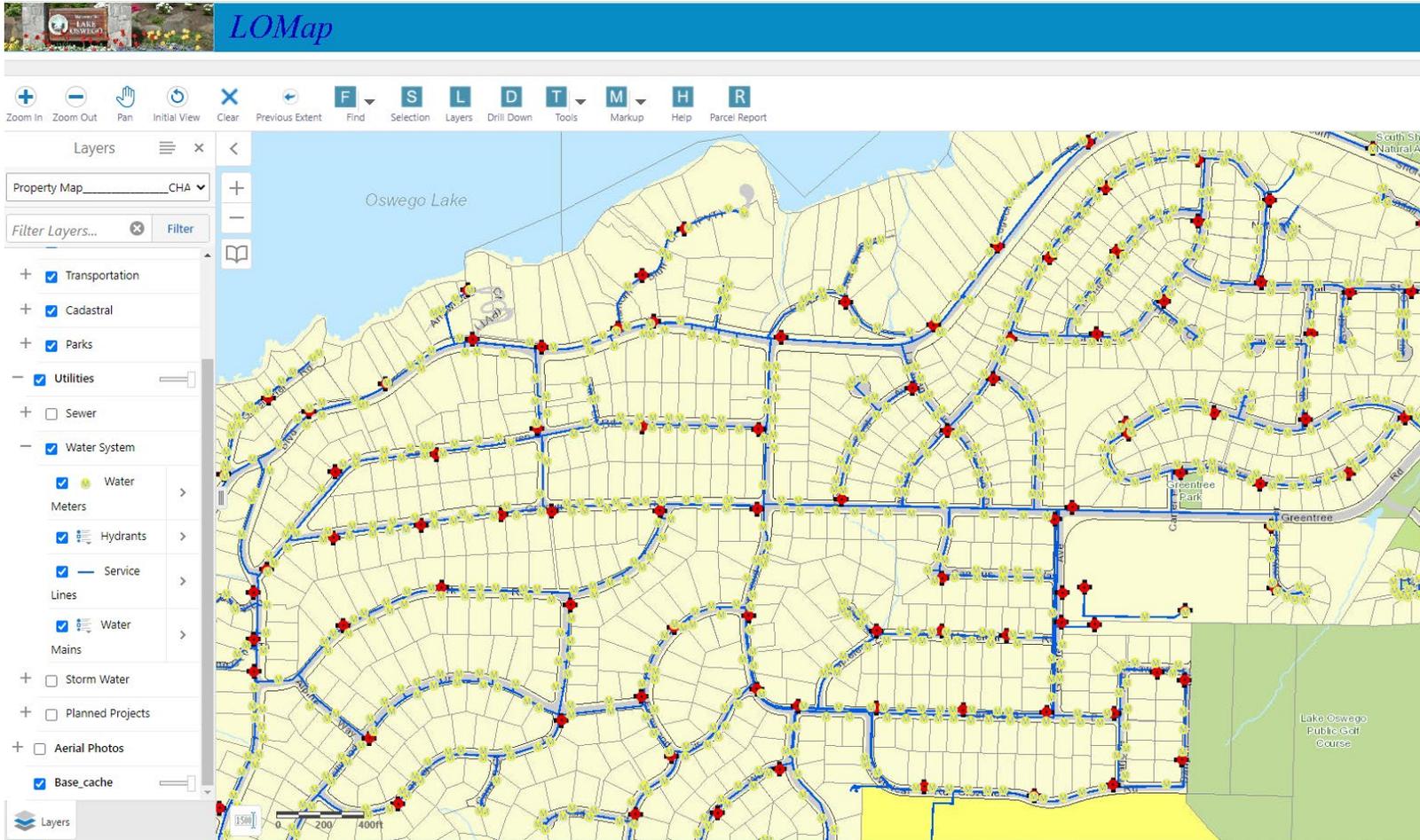




Vertical Assets

- 1800 assets on a 9 acre site
- Ranging from a \$75 mister to a \$1.1M ozone generator





Horizontal Assets

Assets distributed across a large geographic area, such as a Water distribution system or City street system.



Asset Loader Basics

- Contractor was responsible for gathering required information from vendors / manufacturers
 - Horsepower, model #, serial #, cost, etc.
- Contractor provided a reviewable spreadsheet and Equipment Record Forms
- Asset Loader used to populate CMMS with assets and their information – not maintenance schedules

Asset Loader Spreadsheet

2017-05-15_AMID-WTP-BCtoSlayden.xlsx - Excel

Ricardo Campos

File Home Insert Page Layout Formulas Data Review View BLUEBEAM Tell me what you want to do

Clipboard Font Alignment Number Styles Cells Editing Bluebeam

K31

Rotating/Mechanical Equipment												
	Asset ID	Asset Name	Installation Cost	Purchase Cost	Purchase date	Expected Life (years)	Mean Time Between Failure - Hours	Average Monthly Use - Hours	Total Usage - Hours	WARRANTY INFORMATION Shipping date	WARRANTY INFORMATION Startup date	WARRANTY INFORMATION Effectiveness
Input Responsibility (Contractor, Owner, Future)	Contractor	Contractor	Future	Contractor	Contractor	Contractor	Future	Future	Future	Contractor	Contractor	Contractor
Desired Asset Information (examples/units)	XXXXXX.XXXXXX	Air Compressor #1	The dollar cost of installation.	The invoiced dollar cost, including shipping and taxes.	The date the invoice was paid.	Expected asset life as by design.	As experienced by LOT.	As monitored by PLC, hour meters, etc.	As monitored by PLC, hour meters, etc.	When the asset ships from the factory.	The date all submittals are signed off.	When the asset becomes effective.
Input Type (e.g., text, number, etc., or chosen from a dropdown)	text	text	number	number	XXXXXX	number	number	number	number	XXXXXX	XXXXXX	XXXXXX
Where to find information.	SPECs / Drawings	SPECs	Contractor	Accounting / Invoice	Accounting / Invoice	Designer / Vender	Future	Future	Future	Submittal	Contractor	Determined by from Warranty
	TKS 17 PDP 03	Thickened Solids Pump No.3		\$ 9,824.00	10/24/13					8/11/14	4/17/15	5/4/15
	TKS 17 CTP 01	TKS Mixing Pump		\$ 44,762.00	10/24/13					6/17/14	4/17/15	5/4/15
	MDP 18 PTP 01	Polymer Feed Pump No.1		\$ 10,384.00	10/24/13					9/23/14	4/17/15	5/4/15
	MDP 18 PTP 02	Polymer Feed Pump No.2		\$ 10,384.00	10/24/13					9/23/14	4/17/15	5/4/15
	SHC 20 PTP 01	Sodium Hypochlorite Feed Pump No.1		\$ 10,384.00	10/24/13					9/23/14	4/17/15	5/4/15
	SHC 20 PTP 02	Sodium Hypochlorite Feed Pump No.2		\$ 10,384.00	10/24/13					9/23/14	4/17/15	5/4/15
	SHC 20 PTP 03	Sodium Hypochlorite Feed Pump No.3		\$ 10,384.00	10/24/13					9/23/14	4/17/15	5/4/15
	CSC 20 PTP 01	Caustic Soda Feed Pump No.1		\$ 10,384.00	10/24/13					9/23/14	4/17/15	5/4/15

Asset Type list Color Codes Landsc.-Site Civil Buildings Basins Tanks and Structures Large Driven Large Driver Rotating-Mechanical Eq. "Special" Pipe-Main Instrumentation Valve-Slide Gate ...

Ready 70%

EQUIPMENT RECORD FORM

- Basic information on an asset
 - Price
 - Installation date
 - Manufacturer and vendor info
 - Maintenance requirements

EQUIPMENT RECORD FORM							
1. GENERAL INFORMATION							
EQUIP DESCRIP	Chopper Pump Mixing Systems			EQUIP LOC	Thickened Solids Pump Station		
ASSET ID	TKS 17 CTP 01	SHOP DWG NO.	17M-2/17I-2	DATE INST	10-Feb-15	COST	\$44,762.00
MFGR	Vaughan Company, Inc.			MFGR CONTACT	Glenn R. Dorsch		
MFGR ADDRESS	364 Monte-Elma Rd. Montesano, WA 98563					PHONE	(360) 249-4042
VENDOR	Pumpteck of Oregon		VENDOR CONTACT	Gary Carter		PHONE	(503) 659-8718
VENDOR ADDRESS	321 South Sequoia Parkway Canby, OR 97013					PHONE	(503) 659-8718
2. MAINTENANCE REQUIREMENTS							Hours
Motor Greasing. Do not mix greases unless grease compatability has been checked and verified. (Refer to Baldor T-Frame Motor Lubrication)	D	W	M	Q	S	A	1 Hour
Add oil to pump bearing housing. Repair Immediately. (Refer to Vaughan Horizontal Chopper Pump Lubrication)							As needed
Check Seal oil in the Vaughan Seal. Repair-only if new oil is quickly contaminated. (Refer to Vaughan Seal Lubriation)					X		.5-1 Hour
Check the clearances between the impeller and cutting surfaces						X	.5-1 Hour
Check amperage draw to the pump motor and compare to amperage measured at startup			X				0.25 Hours
Check for seal or packing leakage at the stuffing box area.			X				0.25 Hours
Inspect electric motor				X			0.25 Hours
List all additional maintenance requirements on p. 2 of this form.							
LUBRICANTS:	RECOMMENDED: Baldor T-Frame Motor: #2 Brg Grease (Shell-Dolium BRB, Texaco-Premium RB, Chevron-SRI No. 2, Unocal-Turbine 100)						
	ALTERNATIVE:						
MISC. NOTES:	For Vaughan Horizontal Chopper Pump: ISO 100 Turbine Oil (Shell-Turbo T-100, Texaco-Regal-100, Chevron-Rando HD-100, Unocal-Turbine 100) For Vaughan Seal: ISO 46 Turbine Oil (Shell-Turbo T-46, Texaco-Regal-46, Chevron-Rando HD-46, Unocal-Turbine 46)						

Asset LOADER to Asset Maintenance

- CMMS had assets populated by contractor
- Able to focus on building maintenance schedules using the ERFs
- Consistent naming convention –
 - TKS 17 CTP 01
 - TKS = Thickened Solids
 - 17 = Building 17
 - CTP = Centrifugal Pump
 - 01 = Pump #1 of this type



One Asset Many Schedules

- Multiple schedules
- Some schedules expired based on lessons learned



Unit Maintenance Schedules (5 records)								
	Maintenance Schedule	Activity ▲	Next	Maintena...	Inter...	UM	Last	Expire
<input type="checkbox"/>	1043	Lubricate	11/12/2021		6	Months	5/17/2021	
<input type="checkbox"/>	1082	Lubricate	4/2/2019		3	Months		3/18/2019
<input type="checkbox"/>	1044	Measure	10/2/2022		12	Months	1/22/2021	
<input type="checkbox"/>	1041	Service	3/12/2019		1	Months	10/31/2018	6/6/2019
<input type="checkbox"/>	1042	Service	11/10/2021		3	Months	8/10/2021	

Group Maintenance Schedules (2 records)								
	Maintenance Schedule	Asset Group ▲	Activity	Next	Maintena...	Inter...	UM	Expire
<input type="checkbox"/>	1188	1166	Service	6/1/2022	Predictive	12	Months	
<input type="checkbox"/>	1190	1166	Inspect	3/1/2022	Predictive	6	Months	

Work Order #	26729		
Activity Code	Measure	Measure	
Asset	RotatingMechEquip_WTP	1302	
	Thickened Solids Mixing Pump TKS 17 CTP 01		

Location			
Location	[Address: 4250 S. Kenthorp Way West Linn, Oregon 97068]		
Room	Pump Room	Directions	South
Area	17	WTP Solids Thickening and Storage	
Subarea	17-13	Thickened Solids Pump Room	

Work Order Information					
Initiated	10/1/2021	Group Project	Maint Type	Preventive	
Assigned To	NLujan	Problem	Responsibility	Mechanical	
Initiated By		Priority	Medium	Due By	11/12/2021
Schedule Start	10/2/2021 12:25 PM	Reg Type			
Estimated Labor	1.0	Actual Labor			

Comments	
<u>WTP-</u> Chopper Pump Mixing Systems - W - Annual	
Check the clearances between the impeller and cutting surfaces Change gear oil.	

Work Order

- Is generated by the CMMS
- Identifies the asset
- Establishes the priority of the work
- Gives instructions on the work to be done

CMMS Organized by Asset Type

Pros

- Like assets are grouped together
 - Specialized info gathered for different buckets

Cons

- Difficult to search across buckets
- One system could end up in multiple buckets
 - Finished Water Pump, Motor, VFD all in different buckets

Electrical_WTP

HVAC_WTP

Instrumentation_WTP

LandscapeSiteCivil_WTP

LargeDriven_WTP

LargeDriver_WTP

Pipe-Main_WTP

PLC - Control Systems_WTP

RotatingMechEquip_WTP

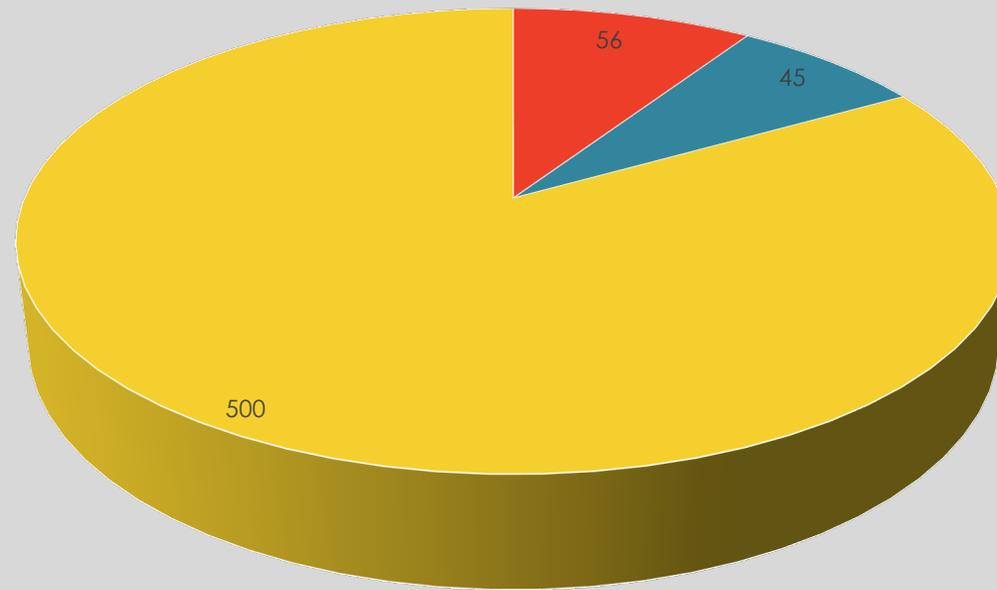
Lake Oswego Quarterly Statistics

	Labor Report	Closed WO By Maint Type								Schedule Compliance Report							Total Work orders and Hours by Responsibility							
Quarter	Total	Corrective		Predictive		Preventive		Total	Hours	Completed WOs						Over	Operations		Mechanical		I & C		Electrical	
	Hours	#	%	#	%	#	%		Per	On-Time/ Early		After Due Date		Closed/Not Done		Due WOs	#	Hours	#	Hours	#	Hours	#	Hours
										#	%	#	%	#	%	#								
2021 / Q3	434.96	34	5.41	42	6.68	553	87.92	629	0.69	566	89.98	63	10.02	0	0.00	44	96	70	140	169	392	197	1	10
2021 / Q2	608.79	43	5.97	45	6.25	632	87.78	720	0.85	639	88.75	81	11.25	0	0.00	76	157	66	173	244	385	251	5	48
2021 / Q1	586.20	49	7.29	42	6.25	581	86.46	672	0.87	600	89.29	72	10.71	0	0.00	2	76	53	144	121	440	254	12	158
2020 / Q4	658.47	47	6.06	3	0.39	726	93.56	776	0.85	596	76.80	179	23.07	1	0.13	0	162	53	262	223	350	283	2	100
2020 / Q3	376.05	56	8.95	43	6.87	527	84.19	626	0.60	564	90.10	62	9.90	0	0.00	0	80	61	163	148	374	119	4	44
2020 / Q2	492.37	38	4.87	30	3.85	712	91.28	780	0.63	703	90.13	77	9.87	0	0.00	0	158	66	223	181	381	159	18	87
2020 / Q1	422.89	66	8.82	3	0.40	679	90.78	748	0.57	664	88.77	83	11.10	1	0.13	0	163	133	222	180	361	101	2	8

- Track Corrective vs Predictive and Preventive work
- Identify what type of work is being done – Operations, Mechanical, I & C, Electrical
- Are W/O's done on time?

Work management and Reporting

3rd Quarter 2020 Work Orders



■ Corrective ■ Predictive ■ Preventive

Computer Maintenance Management System (My favorite features)

- Organizes and tracks all physical assets
 - Over 1800 assets at the Lake Oswego Tigard WTP
- Keeps records of all work done on each asset
- Never forgets to generate a work order
- Work Orders come with instructions and lessons learned from earlier work

Lessons Learned

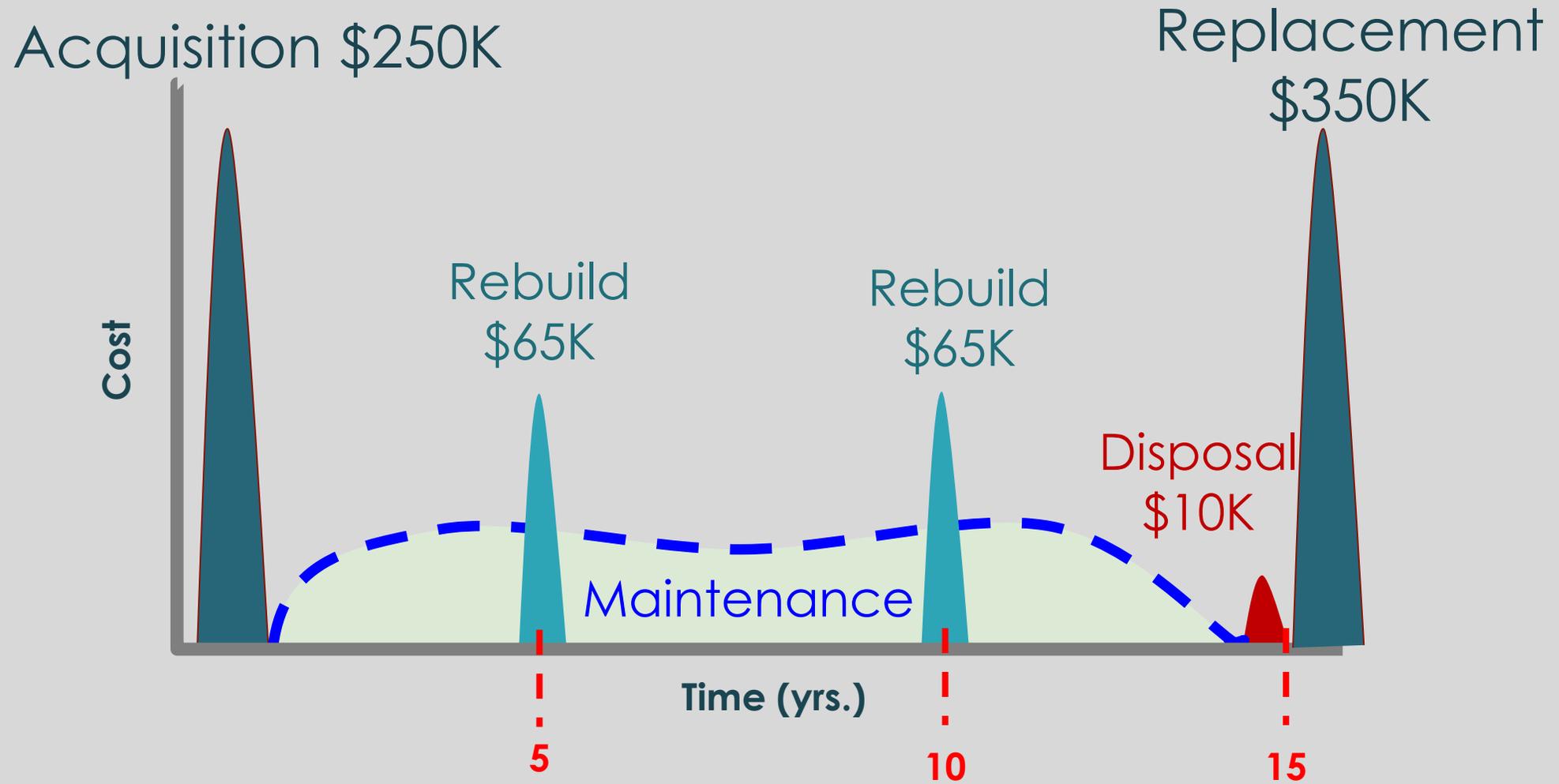
- Understand what comes standard in your CMMS
 - Are you recreating features that already exist?
- Using an asset loader to populate your CMMS is much faster than creating each asset individually
 - Over 1800 assets
 - CMMS must be populated so maintenance schedules can be created before assets are accepted
- Maintenance information from contractor
 - Starting point for setting up maintenance schedules
 - Can be changed later based on field experience

Renewal and Replacement Funding

LOT Water Supply Agreement states that:

- An inventory shall be taken of all assets associated with the supply facilities
- The inventory includes
 - Current value
 - Repair and replacement costs
 - Schedule for repairs and replacements based on useful life
- Each party shall budget and pay for renewal, repair and replacement costs proportional to their ownership interest

Pump Replacement & Rebuild



Refurbishment/Replacement Rate

Year 2017 Dollars, \$Millions

	Replacement Cost (\$M)	1%	2%	3%	4%	5%
River Intake Pump Station	<i>\$11.0</i>	\$0.1	\$0.2	\$0.3	\$0.4	\$0.5
Water Treatment Plant	<i>\$69.3</i>	\$0.7	\$1.4	\$2.1	\$2.8	\$3.5
Water Pipelines	<i>\$69.6</i>	\$0.7	\$1.4	\$2.1	\$2.8	\$3.5
Bonita Pump station	<i>\$6.1</i>	\$0.1	\$0.1	\$0.2	\$0.2	\$0.3
Waluga Reservoirs	<i>\$11.3</i>	\$0.1	\$0.2	\$0.3	\$0.5	\$0.6
TOTAL	<i>\$167.3</i>	<i>\$1.7</i>	<i>\$3.3</i>	<i>\$5.0</i>	<i>\$6.7</i>	<i>\$8.4</i>

**Bottom
Quartile**

Median

Original R&R Plan Included All Assets

ID	Name	ParentID	InstallDat	AssetTypeID	ReplacementCost
FNW-51-VBM-02	BPS PZ410 Surge/Bypass Valve Pilot Isolation Valve	Bonita PS - Valves/Slide Gates	11/1/2015	BAV	\$ 9,249.08
FNW-51-VBM-71	BPS PZ470 Surge/Bypass Valve Pilot Isolation Valve	Bonita PS - Valves/Slide Gates	11/1/2015	BAV	\$ 9,249.08
FNW-51-VBM-72	BPS PZ470 Surge/Bypass Valve Pilot Isolation Valve	Bonita PS - Valves/Slide Gates	11/1/2015	BAV	\$ 9,249.08
02 PCV 711	Bearing Lube Pressure Contol Valve #1	RIPS	2/25/2014	PCV	\$ 109.40
02 PCV 721	Bearing Lube Pressure Control Valve #2	RIPS	2/25/2014	PCV	\$ 109.40
02 TNK 731	Bearing Lube Hydropneumatic Tank	RIPS	2/25/2014	TNK	\$ 8,161.75
NEW-RIPS1	Site	RIPS	1/1/2015	NOREPLACE-200	\$ 386,442.55
NEW-RIPS2	Portable Gantry Cranes	RIPS	1/1/2015	MEQ	\$ 16,909.06
NEW-RIPS3	Yard Piping	RIPS	1/1/2015	NOREPLACE-200	\$ 559,318.76
RAW 01 CKV 101	Emergency Relief Gate - Upstream Wet Well	RIPS	3/14/2014	STRUCTURE	\$ 4,307.97
RAW 01 CKV 201	Emergency Relief Gate - Downstream Wet Well	RIPS	3/14/2014	STRUCTURE	\$ 4,307.97
RAW 01 GMO 001	Vehicle Gate Motor Operator	RIPS	8/24/2015	GMO	\$ 8,810.98
RAW 01 LCP 001	Fish Screen Local Control Panel	RIPS	1/1/2015	LCS	\$ 2,018.83
RAW 01 MCP 001	Fish Screen Master Control Panel	RIPS	1/1/2015	LCS	\$ 352,439.20
RAW 01 SCR 101	Fish Screen 1	RIPS	2/5/2015	FSCSCR	\$ 239,521.79
RAW 01 SCR 201	Fish Screen 2	RIPS	2/5/2015	FSCSCR	\$ 239,521.79
RAW 01 SCR 301	Fish Screen 3	RIPS	2/5/2015	FSCSCR	\$ 239,521.79
RAW 01 SLG 101	Tee Screen 1 Isolation Slide Gate	RIPS	4/15/2014	GTV	\$ 60,554.53
RAW 01 SLG 201	Tee Screen 2 Isolation Slide Gate	RIPS	4/15/2014	GTV	\$ 60,554.53
RAW 01 SLG 301	Tee Screen 3 Isolation Slide Gate	RIPS	4/15/2014	GTV	\$ 60,554.53
RAW 01 SLG 401	Wet Well Chamber Isolation Slide Gate	RIPS	4/15/2014	GTV	\$ 70,717.10
RAW 02 ARV 101	ARV - Pump 1 - Column Pipe Air Relief Valve	RIPS	5/27/2014	ARV	\$ 437.60
RAW 02 ARV 201	ARV - Pump 2 - Column Pipe Air Relief Valve	RIPS	5/27/2014	ARV	\$ 437.60
RAW 02 ARV 301	ARV - Pump 3 - Column Pipe Air Relief Valve	RIPS	5/27/2014	ARV	\$ 437.60
RAW 02 ARV 401	ARV - Pump 4 - Column Pipe Air Relief Valve	RIPS	5/27/2014	ARV	\$ 437.60

Revised Plan Includes Large Assets

- Smaller Assets (below \$5000) are budgeted for in the Operations Budget
- Some Larger repair and replacement is also funded in the annual Operating Budget, which drove the preferred R&R savings rate down
- Example: Filter Media Replacement every 5-10 years

Cost Comparison

Asset Replacement-Total \$169M

- Cost of replacing every asset in system once
- Does not include repair costs or frequency of replacement
- All assets (including assets with useful life > 50years)

Asset Repair and Replacement - Total \$244M

- Includes all repair and replacement activities through 2091

Revised Asset Repair and Replacement-Total \$180M

- Limited to 50 year timeframe
- Includes frequency of replacement
- Omits O&M costs under \$5,000

Total Cost Over 50 Year Timeframe

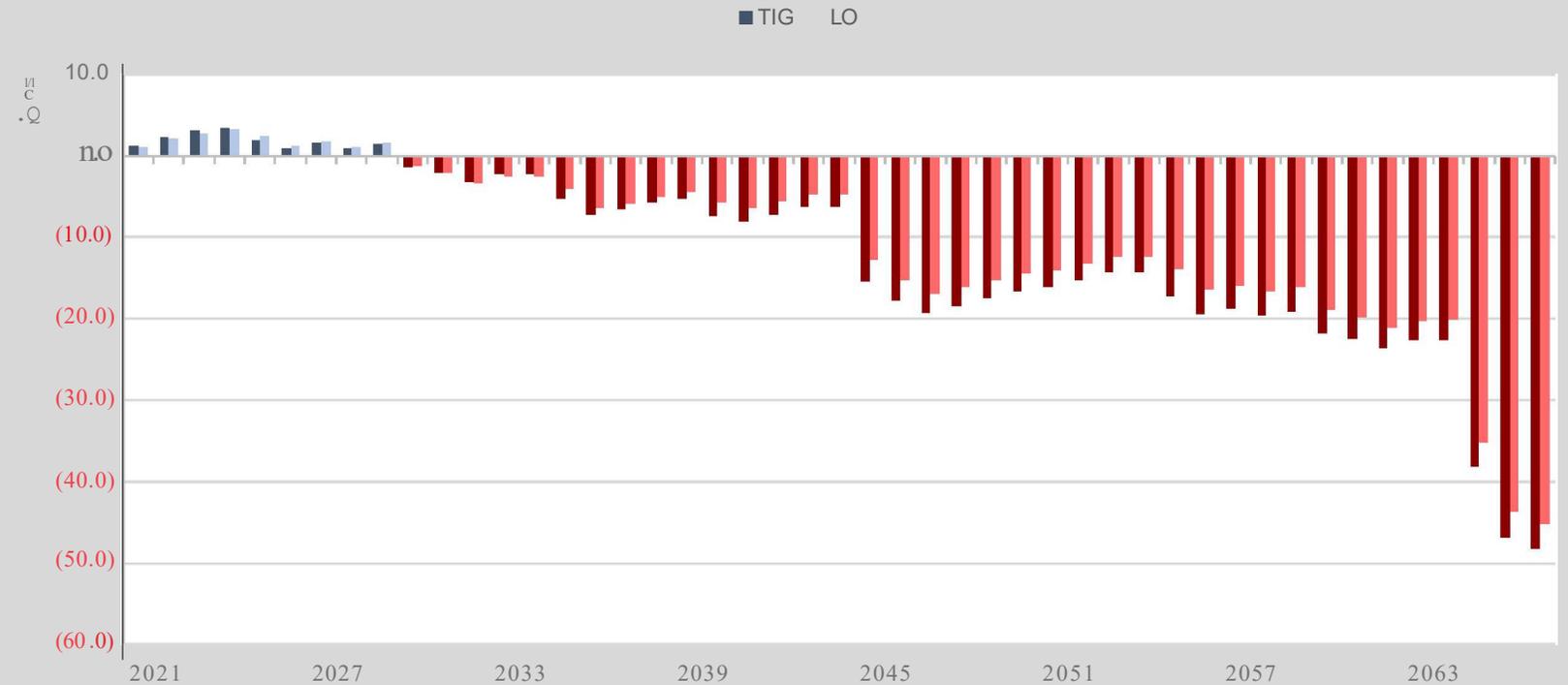
	City of Tigard	City of Lake Oswego
Total Cost	\$92.7 M	\$86.9 M
Average Annual Cost	\$1.9 M	\$1.8 M
Max Annual Cost	\$16.5 M in 2065	\$15.9 M in 2065

Reserve 1%* Annually

Combined - \$1.8M
Tigard - \$927K
LO - \$869K

Funding shortfall occurs
in 2030

*1% of the total lifecycle
repair and replacement
cost for each city.



Inclining Block Strategy Reserve Plan

Reserve %
increases in "
blocks over time

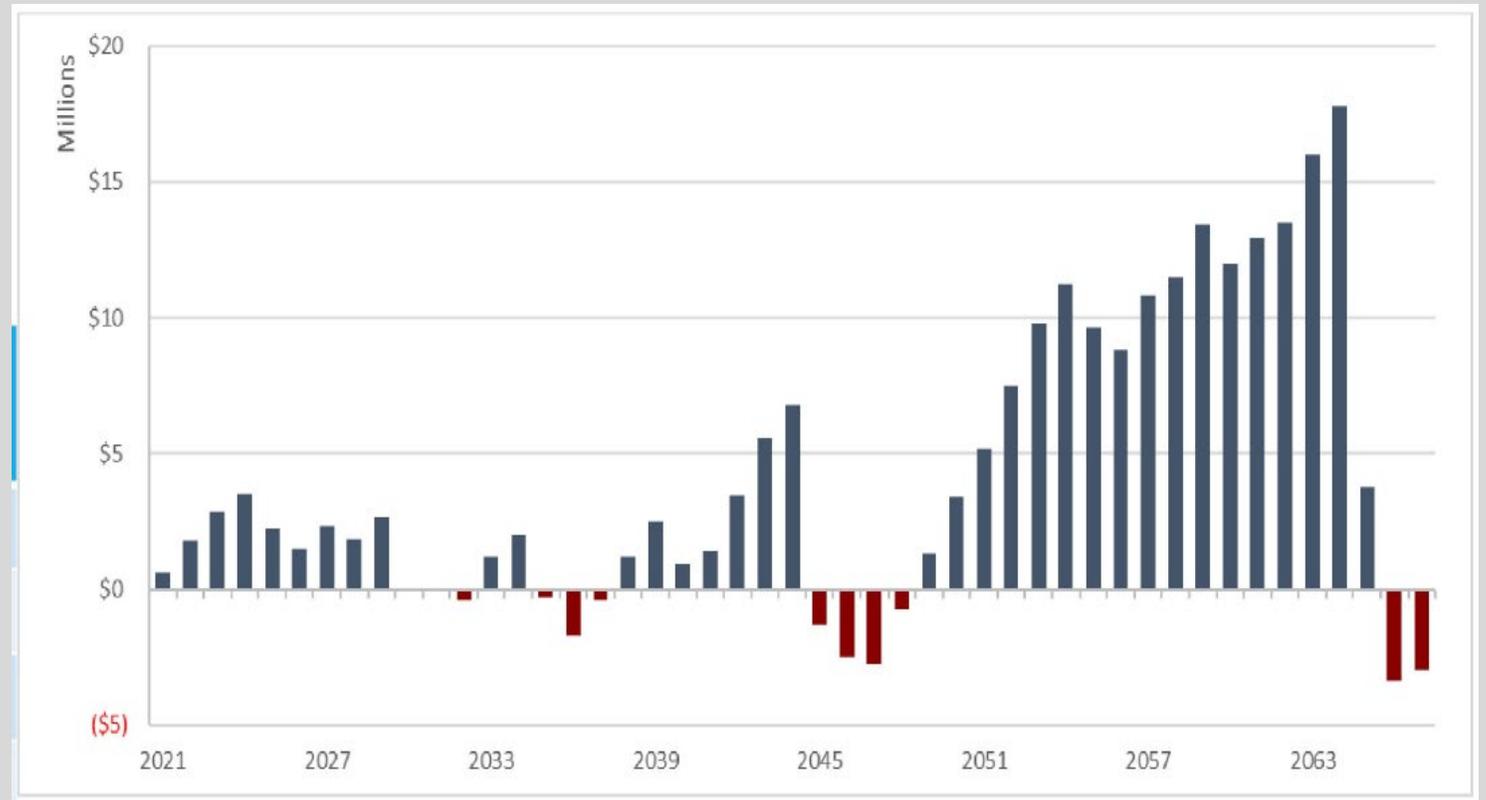
Promotes
intergenerational
equity

Customizable to fit
each individual
city's debt
schedule and
long-term forecasts

City of Tigard Proposed Plan

Reserve % increases every 10 years
Tigard debt retires in FY 2046

Fiscal Years	Reserve %	\$/year M
2021-30	1.25%	1.16
2031-40	1.75%	1.62
2041-50	2.25%	2.09
2051-60	2.50%	2.32
2061-67	2.75%	2.55

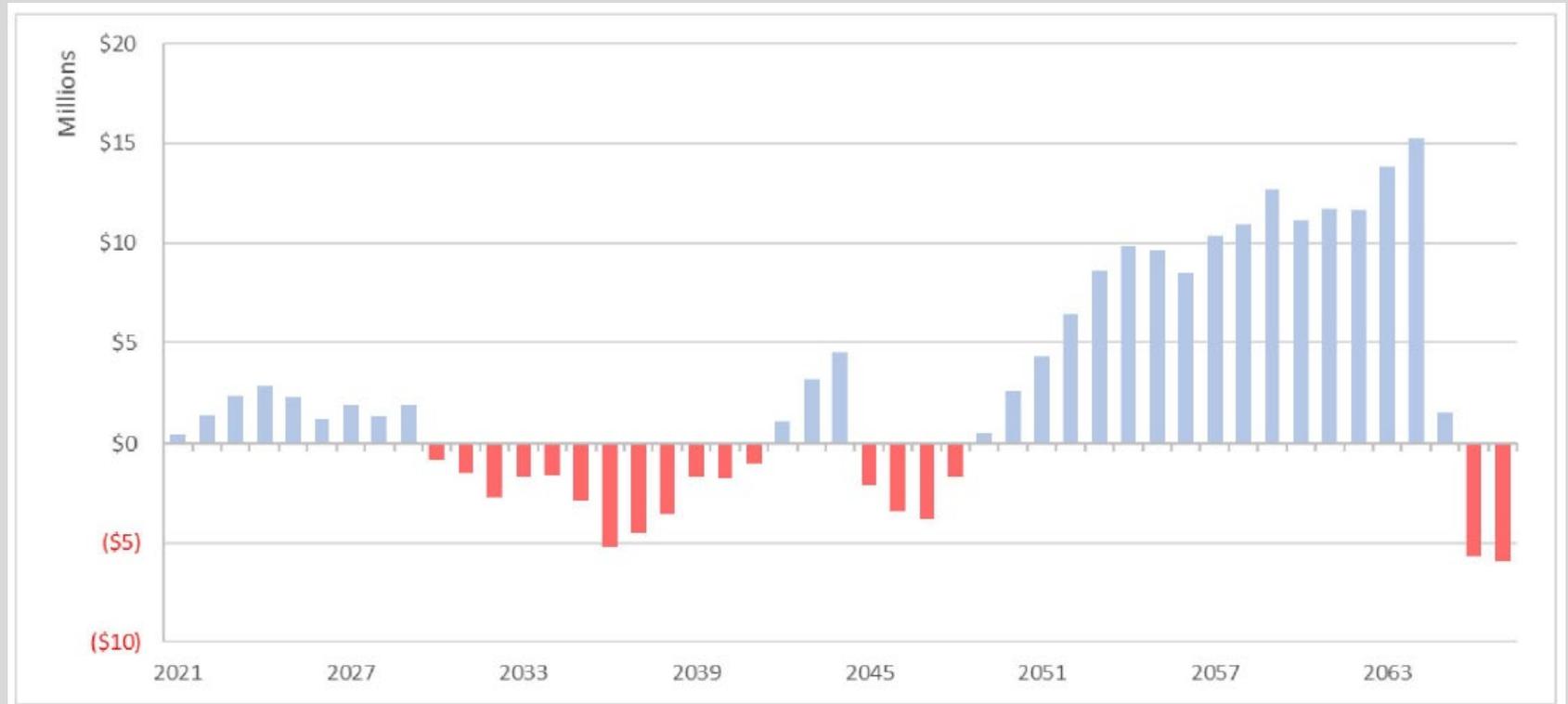


City of Lake Oswego Proposed Plan

Reserve % increases
in FY 2039

Lake Oswego's debt
retires in 2038

Fiscal Years	Reserve %	\$/Year M
2020-38	1.15%	1
2039-67	2.50%	2.17



Summary



THE DATA DRIVEN STRATEGIES FOR
WORK ORDERS AND R&R STARTED
FROM THE SAME DATABASE



PLANNING AHEAD AND
FORMATTING DATA ALLOWED
CONSISTENCY AMONG PROJECTS



STAFF TIME WAS THEN EFFICIENTLY
APPLIED USING VARIOUS DATA
TOOLS

Questions?

- Bret Bienerth, Lake Oswego- Tigard WTP Manager
- bbienerth@ci.Oswego.or.us
- 503-635-0394

- Kari Duncan, General Manager Rockwood Water Peoples Utility District
- kduncan@rwpud.org
- 503-674-4507