

City of Bend Integrated Water System Master Plan: Planning for the Future

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Purpose of City of Bend Integrated Water System Master Plan



Continued reliability of the system to provide an adequate supply of high-quality water to its customer



Improve energy and staff efficiency and use of supply and storage



Prioritized capital plan for existing and future customers 20 years and beyond



Integrated Approach to Planning

Involvement and input from:

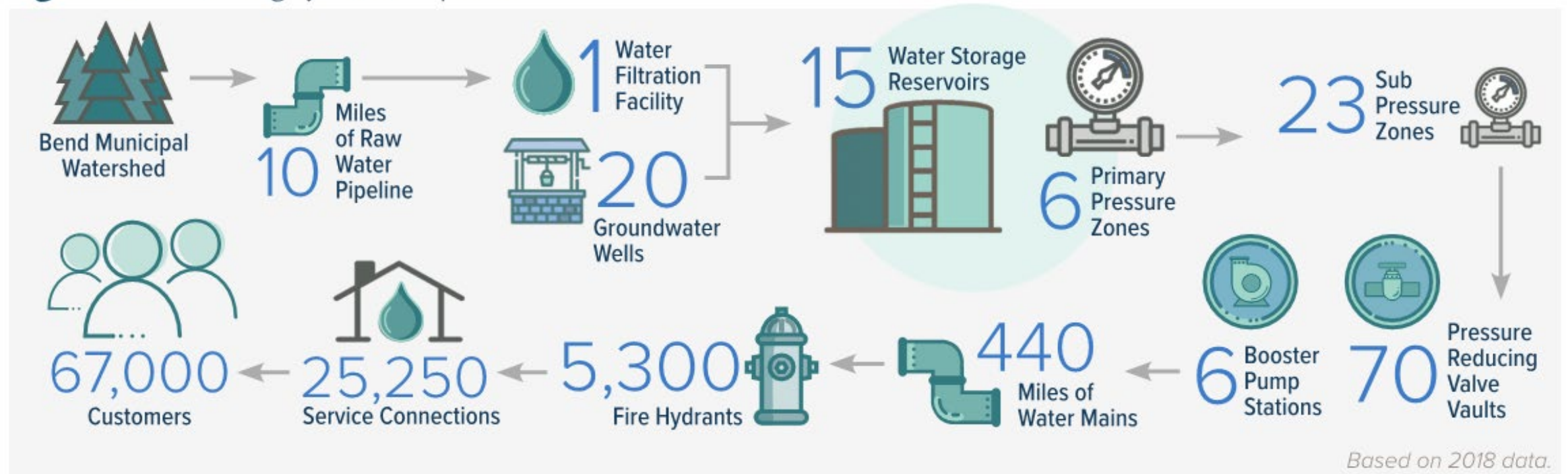
- All City Department including Operations, Finance, Streets, Water, Sewer, & Stormwater
- State regulatory agencies
- Subconsultants focused on the financial plan, development of the Water Management and Conservation Plan, 3rd party cost estimating review, level of service workshop & overall public involvement, and optimization support

CIP and Operations & Maintenance Program Developed based on many facets including:

- Condition, capacity, criticality, and operations analysis

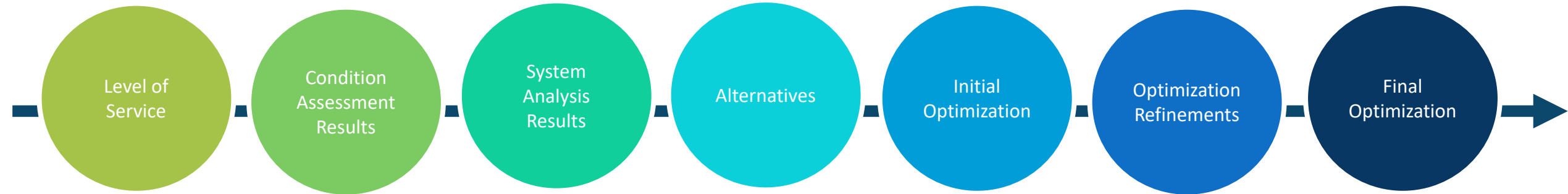
City of Bend System

Figure ES-1. Existing System Components

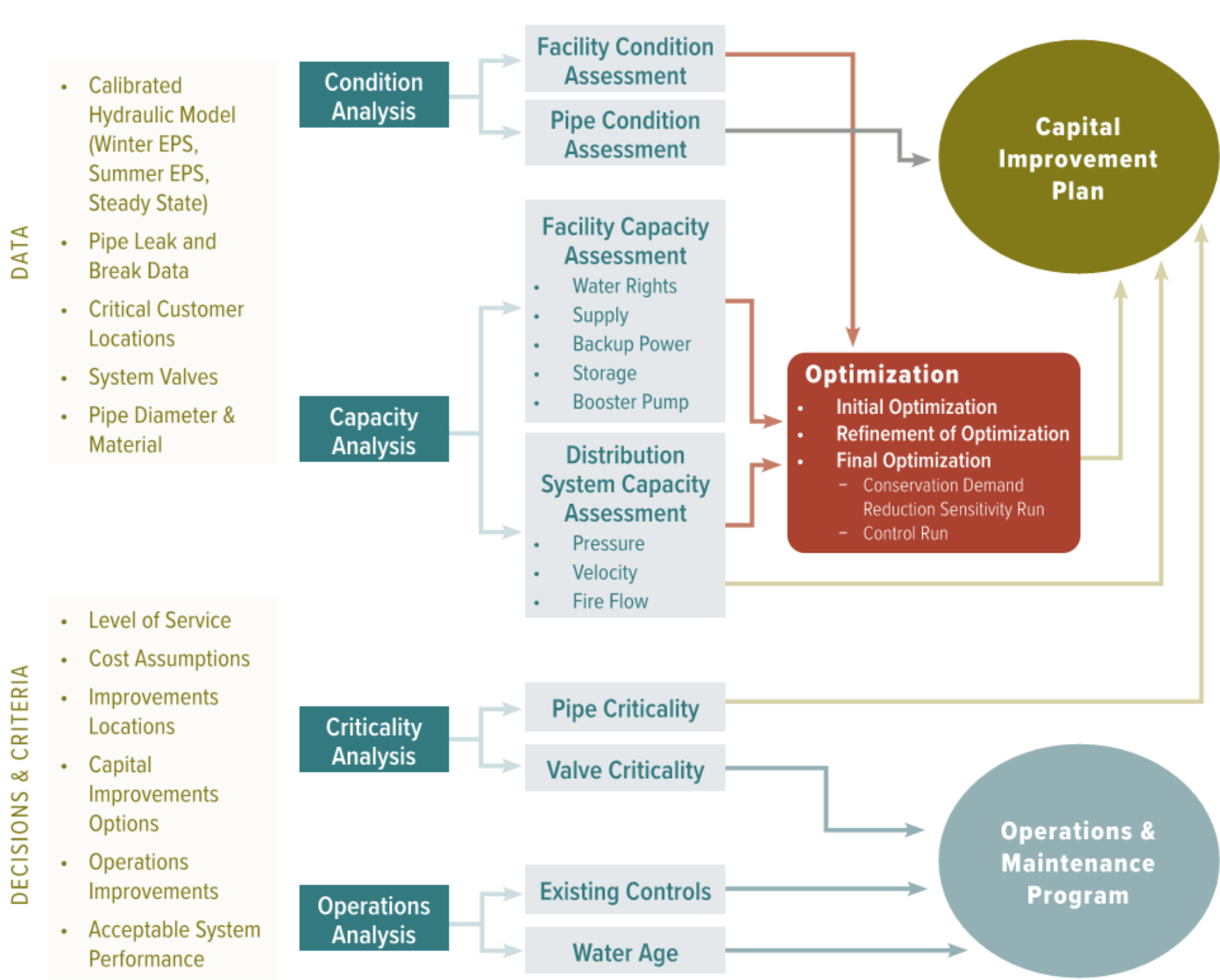




Analysis Components Used to Determine CIP

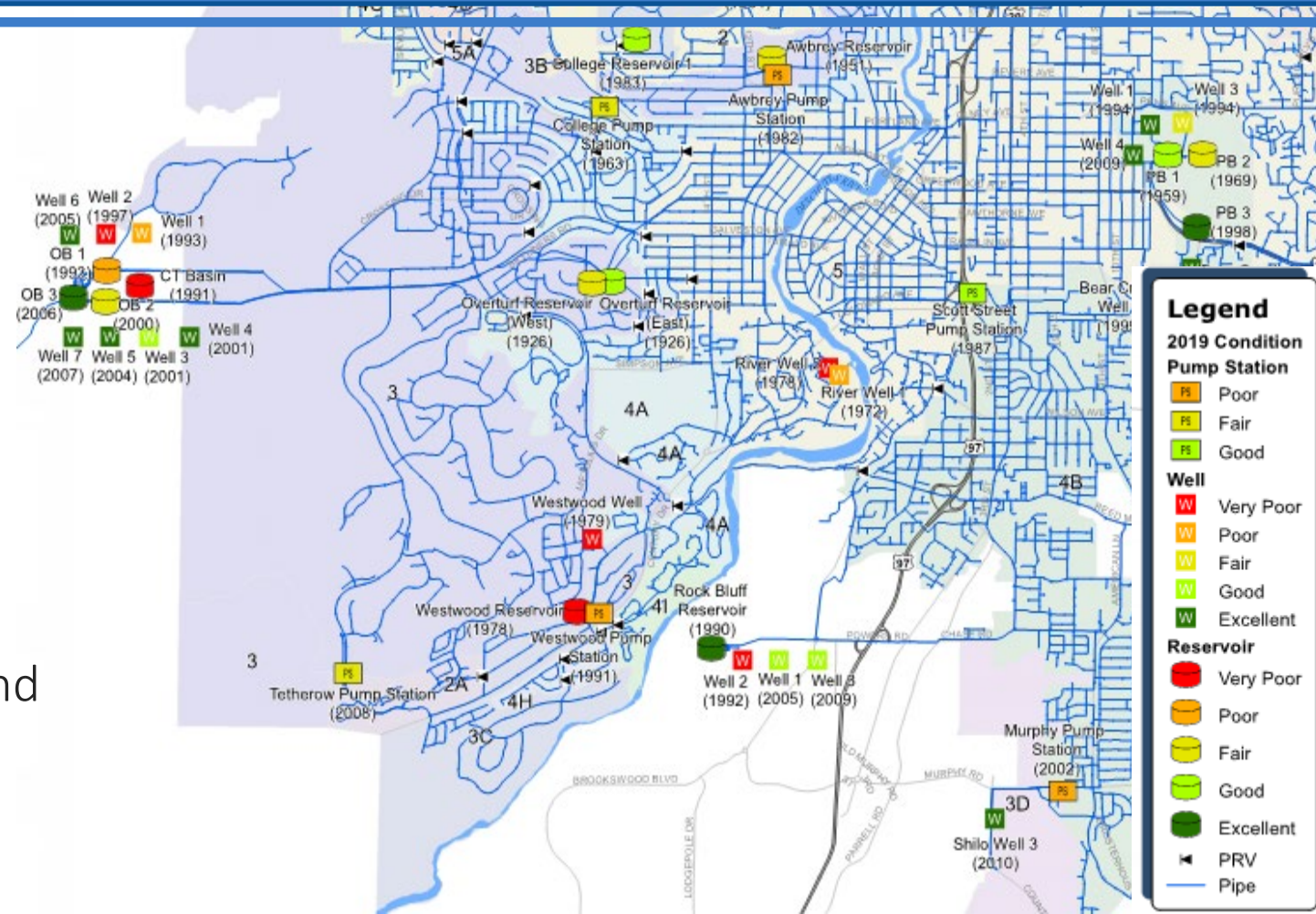


Comprehensive System Analysis Components



Condition Assessment

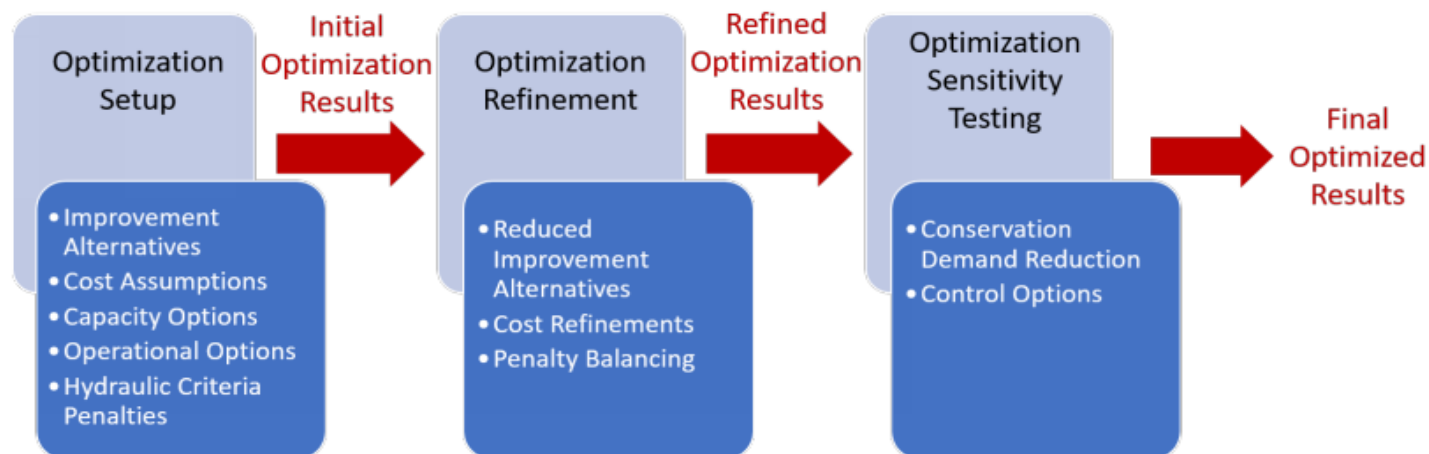
- Condition assessment of the City's active wells, storage facilities, and booster pump stations was performed
 - Review of operational narratives, power consumption records, construction drawings, property ownership, parcel size and zoning
 - Onsite examination of buildings, tanks, valves, pumps, motors, electrical equipment, safety elements, site access and security
- Ranked each facility and identified needed improvements

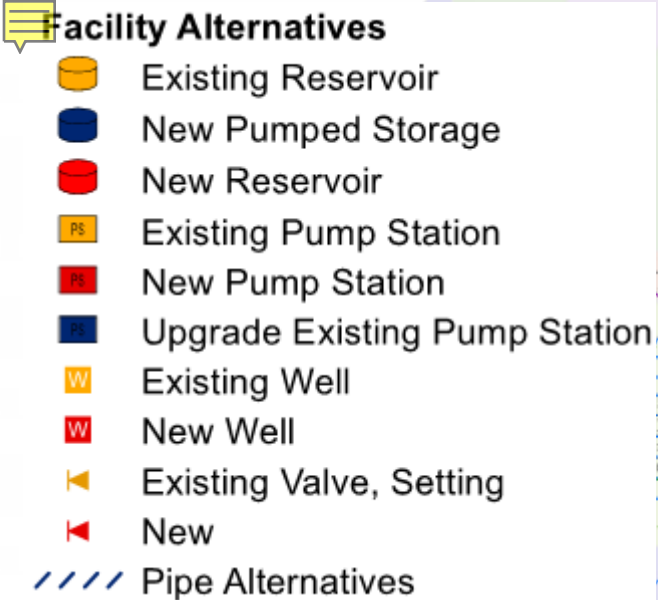


Optimization Process

- Goals
 - Determine optimal capital improvement and operations
 - Effectively meet future demands while minimizing hydraulic deficiencies
 - Fully utilize surface water supply
- Software
 - Utilizes a genetic algorithm to identify best hydraulic performance at lowest overall life cycle and capital cost
 - Evaluate hundreds of thousands of asset combinations

- Process

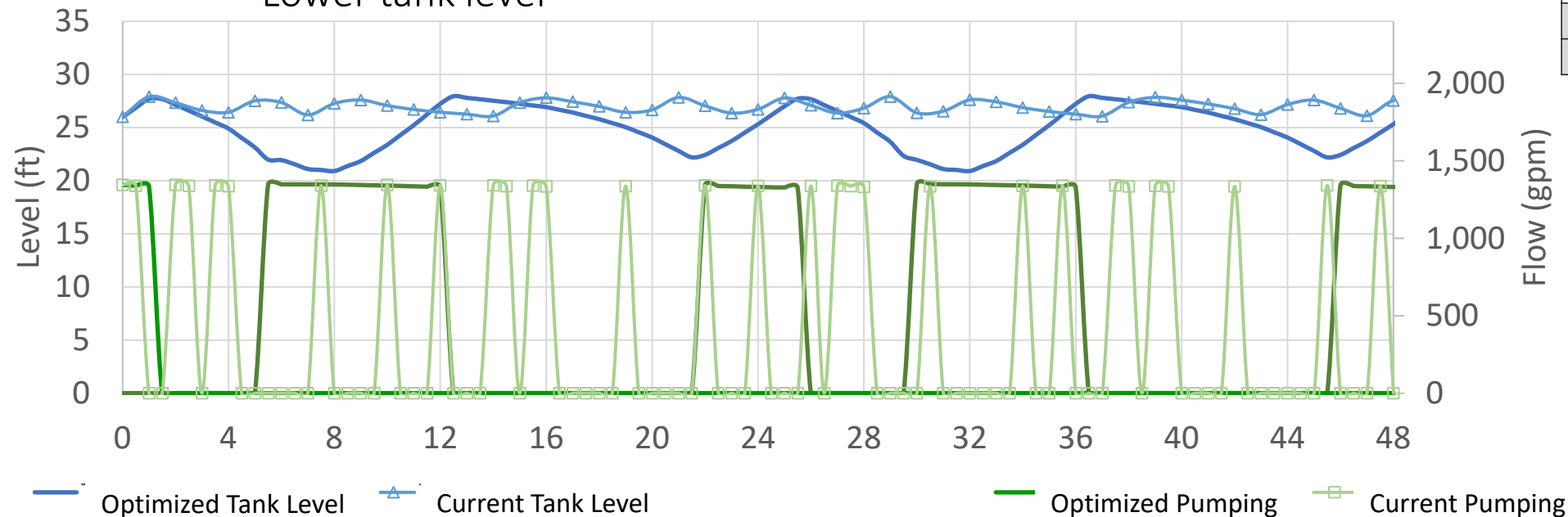




Infrastructure Type	Status	Options	Number of Facilities
Well	Existing	<ul style="list-style-type: none"> Selected/Not Selected Range of On/Off Level Control Settings 	20
	New	<ul style="list-style-type: none"> Selected/Not Selected Range of capacities representing between 1 - 3 wells per location Range of On/Off Level Control Settings 	25
Gravity Reservoir	Existing	<ul style="list-style-type: none"> Selected/Not Selected Range of volumes (HGL fixed) 	15
	New	<ul style="list-style-type: none"> Selected/Not Selected Range of volumes (HGL fixed) 	7
Pumped Reservoir	New	<ul style="list-style-type: none"> Selected/Not Selected Range of volumes Range of pump station discharge pressure settings 	7 (3 with Associated and Dependent Well Option)
Pump Station	Existing	<ul style="list-style-type: none"> Selected/Not Selected Range of On/Off Level or Discharge Pressure Control Settings 1 Option to Increase Capacity 	6
	New	<ul style="list-style-type: none"> Selected/Not Selected Range in capacity Range of On/Off Level or Discharge Pressure Control Settings 	4
PRV and FCV	Existing	<ul style="list-style-type: none"> Selected/Not Selected Range of flow or pressure settings 	4 Key System Valves (Outback Surface Water FCV, Outback Groundwater PRV, Awbrey FCV, Overturf FCV) and numerous PRV settings
	New	<ul style="list-style-type: none"> Selected/Not Selected Range of pressure settings 	9
Pipe	Existing	<ul style="list-style-type: none"> Range of Diameters 	11.5 Miles
	New	<ul style="list-style-type: none"> Selected/Not Selected Range of Diameters 	29.3 Miles

Optimization of Controls

- Optimize control of current system
- Example of optimized controls:
 - Less pump cycling
 - Lower tank level



Control	Current	Optimized
ON	24'	18'
OFF	26'	28'
ON	26'	22'
OFF	28'	28'
ON	Manual	Manual
OFF	Manual	Manual



Poll Question #1

Would your utility or the utilities you work with be more interested in optimizing capital improvement projects or optimizing operational controls?

Pipe Replacement

- Currently City is replacing approximately 1 mile per year
 - Approximately 400-year life cycle
- Goal is to increase the funding to approximately 2 miles per year
 - Approximately 200-year life cycle
- GIS data was used to assign each pipe a replacement rating based on material, diameter, valve frequency, and break history.
- Prioritize replacement based on overall rating

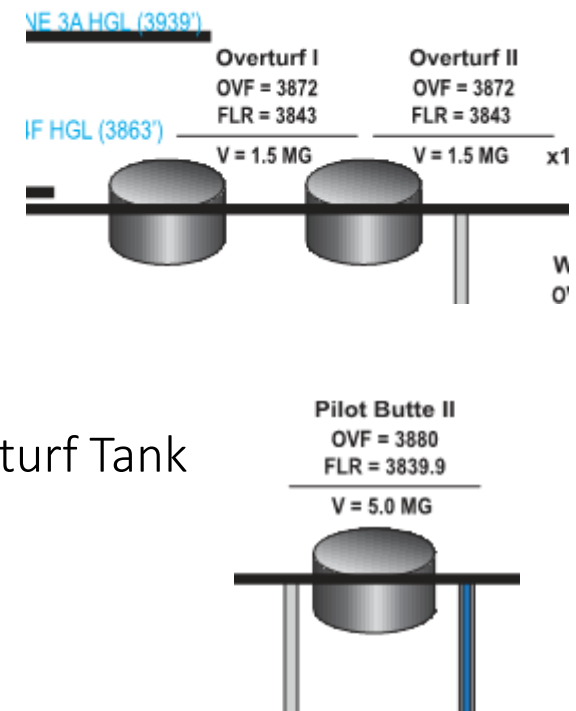
Material	Pipe Diameter (Inches)		
	1"-6"	8"-14"	16"-36"
Cast Iron	3	2	2.5
Galvanized Iron	2.5	1.5	2
PVC	2	1	1.5
Steel	3.5	1	1.5
Other	0.5	0	0

Criteria	Count	Rating
Break/Leak History	1+	2
Number of Valves Closed to Isolate Pipe	1 - 4	0
	5 - 6	3
	6 - 7	4

Rating	Pipe Diameter (inches)			Total Miles	Cumulative Total Miles
	1" - 6"	8"-14"	16"-36"		
7.5	0.00	0.00	0.03	0.03	0.03
7	0.07	0.00	0.00	0.07	0.1
6.5	0.30	0.00	0.13	0.43	0.53
6	0.22	0.33	0.00	0.55	1.08
5.5	0.33	0.00	0.56	0.89	1.97
5	0.34	1.40	0.00	1.74	3.71
4.5	0.29	0.00	0.23	0.52	4.23
4	0.00	0.81	0.29	1.10	5.33
3.5	1.29	0.00	0.00	1.29	6.62
3	21.93	2.40	0.96	25.29	31.91
2.5	1.58	0.00	0.76	2.34	34.25
2	0.40	18.90	0.01	19.31	53.56
1.5	0.00	0.00	8.61	8.61	62.17
1	0.00	1.20	0.00	1.20	63.37
0.5	29.64	0.00	0.00	29.64	93.01
0	0.01	296.05	45.65	341.70	434.72
Total¹	56.38	321.10	57.24	434.72	

Existing vs. New Facilities

- “Do nothing cost” to maintain current facilities based on facility assessment
- Included as Equivalent Uniform Annual Cost (EUAC)
- Example:
- Existing Overturf Tanks
 - Condition cost of approximately \$3.1 million (2020 \$)
 - HGL is slightly lower than other Zone 4 tanks creating need for a separate zone
- Optimizer selected decommissioning of existing tanks and construction of a new Overturf Tank
 - Decommissioning existing reservoirs approximately \$1.1 million (2020 \$)
 - New reservoir approximately \$11.2 million (2020 \$)
 - New tank at HGL of other Zone 4 tanks allowing it to operate as one zone
- Though the cost for the new facility is significantly higher, the delta between maintaining existing facility and constructing new represents the significant improvement to hydraulic performance





Poll Question #2

Does your utility or the utilities you work for have a formal pipe replacement program?

Developing a Prioritized CIP



Facilities

- Condition Rating
- Criticality
 - Only facility serving area
 - Magnitude of impact if offline



Pipe Replacement Program

- Overall rating and proximity to other projects



Timeframe of Deficiency



Impacted by Demand Reduction?



Magnitude of Deficiency



Criticality or Magnitude of Flow Impacted

Condition Prioritization Criteria

Capacity Prioritization Criteria



Summary



**Integrated approach
including all City
departments and many
consultants focused on
financial plan, conservation,
and public involvement**



**Comprehensive system
analysis including condition,
capacity, criticality &
operations used to
determine capital
improvements**



**Prioritized CIP for next
20 years**



Questions?