

# 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

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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:

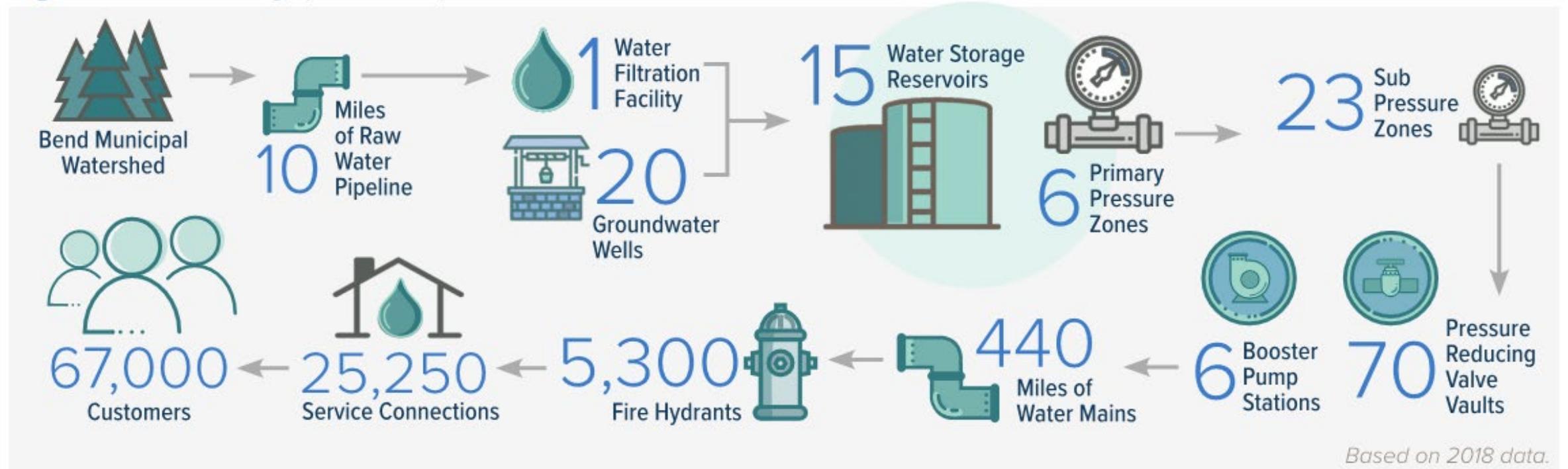
- All City Department including Operations, Finance, Streets, Water, Sewer, & Stormwater
- State regulatory agencies
- Subconsultants focused on the financial plan, development of the Water Management and Conservation Plan, 3<sup>rd</sup> party cost estimating review, level of service workshop & overall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

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

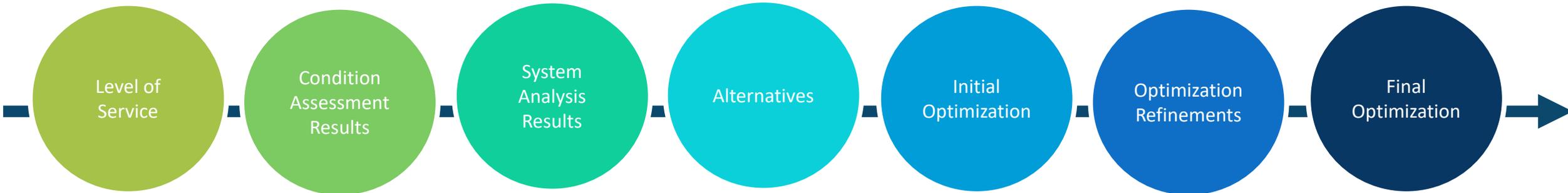
- Condition, capacity, criticality, and operations analysis

# City of Bend System

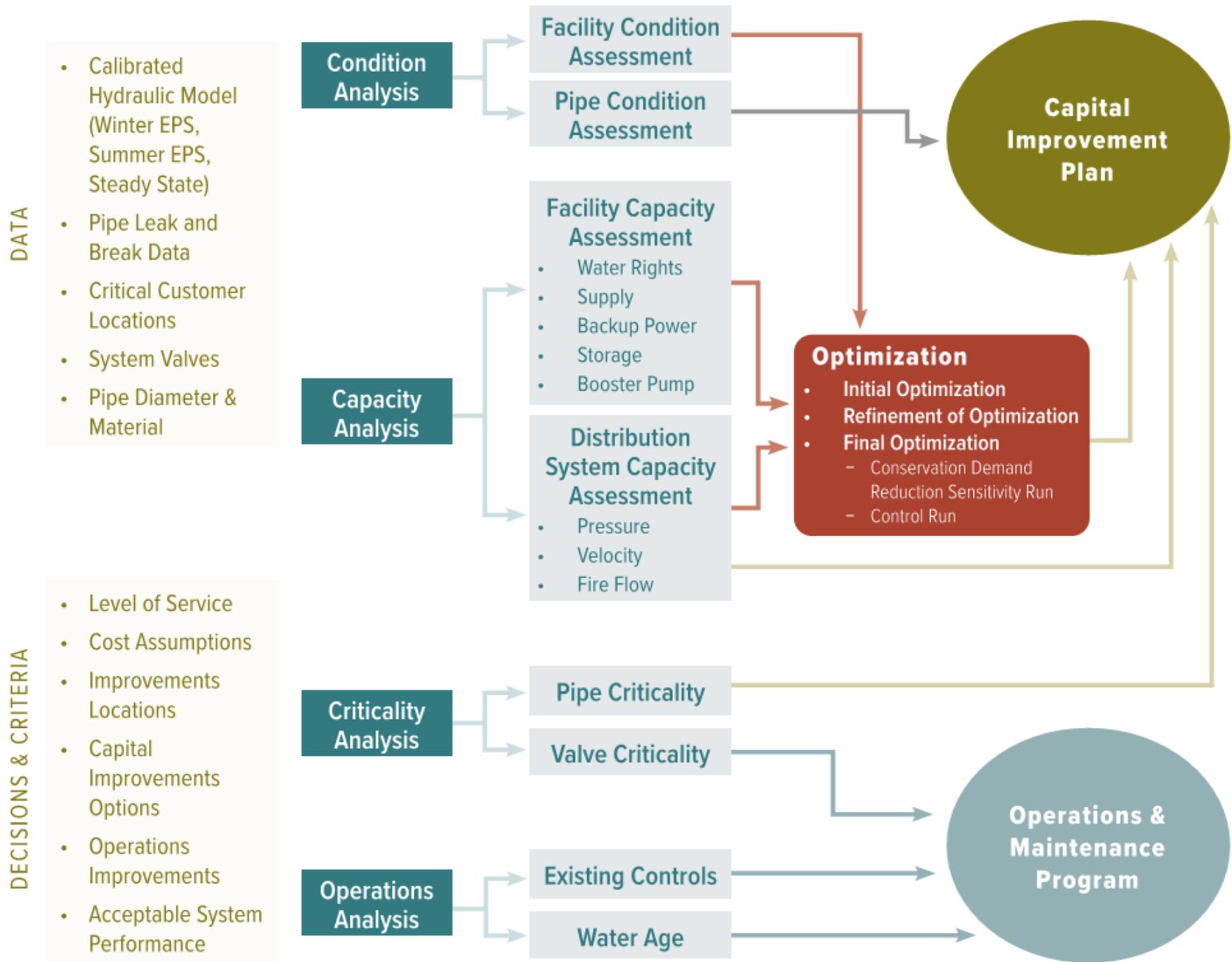
**Figure ES-1.** Existing System Components



# Analysis Components Used to Determine CIP

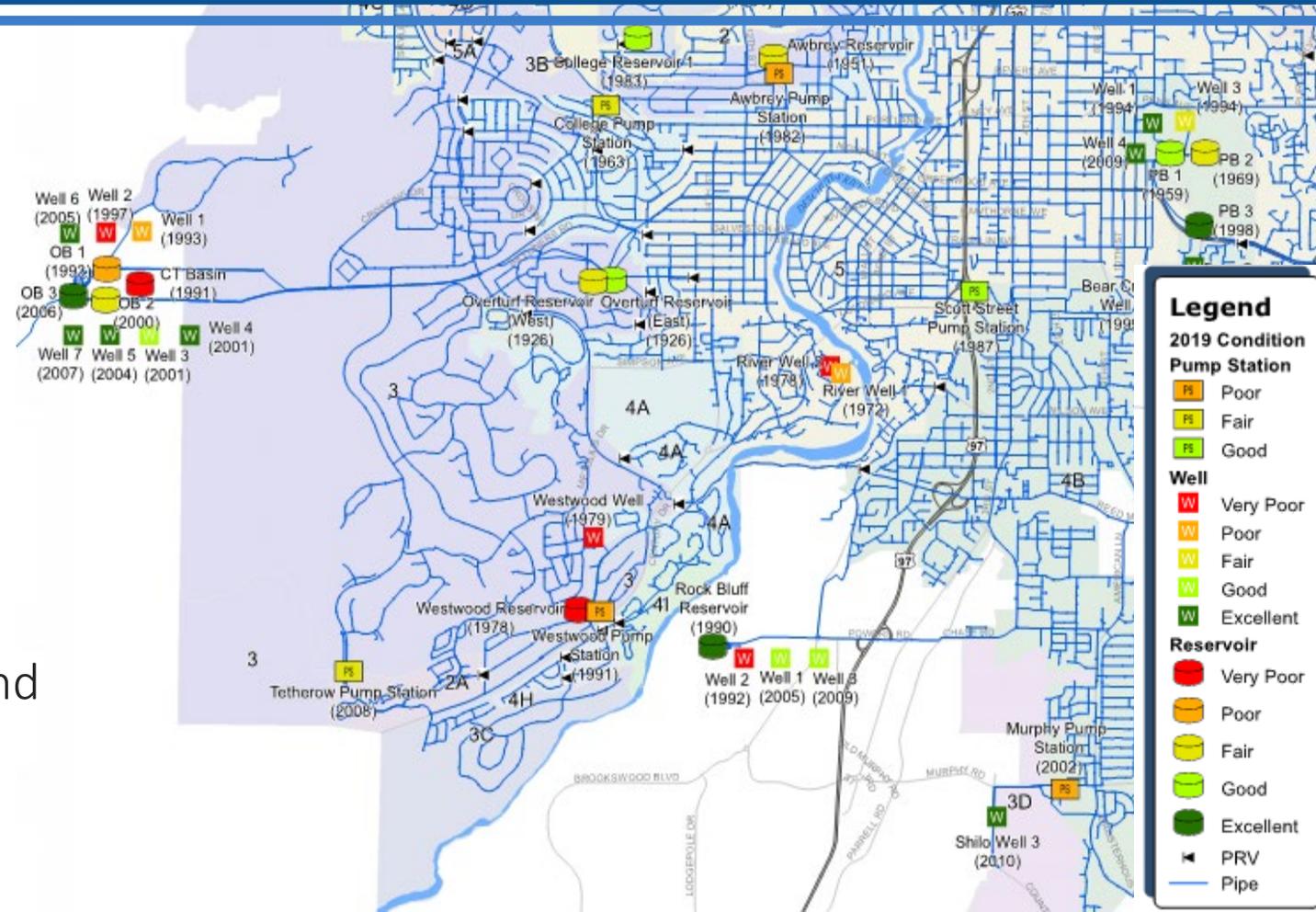


# Comprehensive System Analysis Components



# Condition Assessment

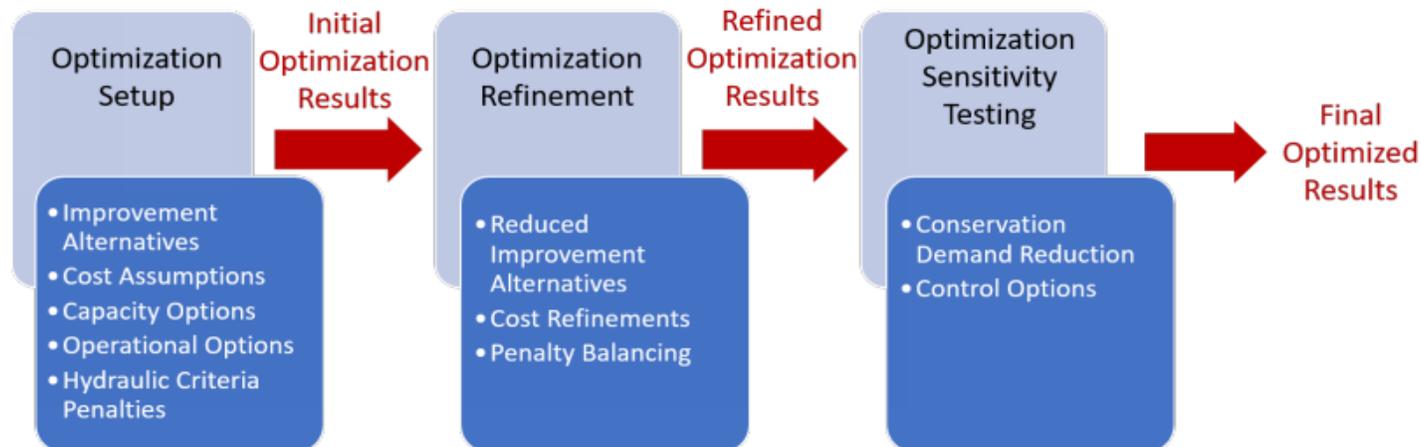
- Condition assessment of the City's active wells, storage facilities, and booster pump stations was performed
  - Review of operational narratives, power consumption records, construction drawings, property ownership, parcel size and zoning
  - Onsite examination of buildings, tanks, valves, pumps,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



# Optimization Process

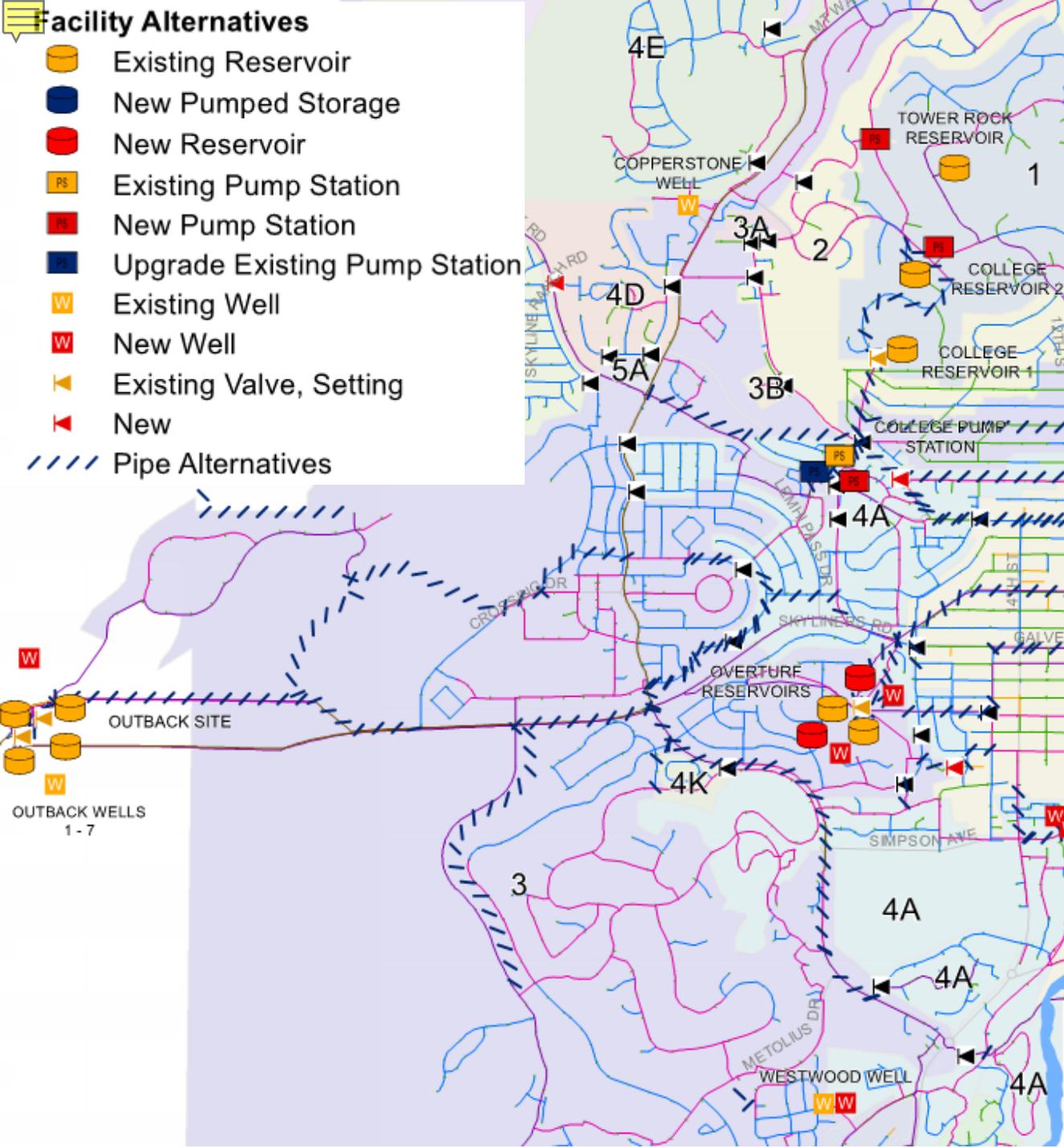
- Goals
  - Determine optimal capital improvement and operations
  - Effectively meet future demands while minimizing hydraulic deficiencies
  - Fully utilize surface water supply
- Software
  - Utilizes a genetic algorithm to identify best hydraulic performance at lowest overall life cycle and capital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

- Process



## Facility Alternatives

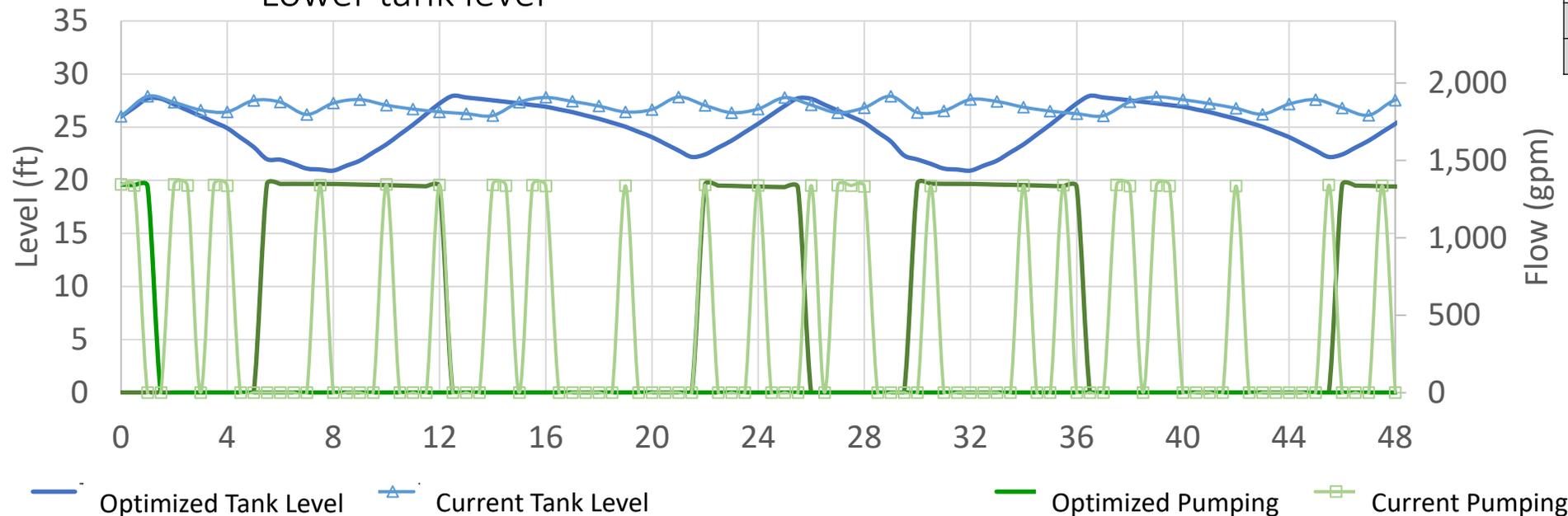
-  Existing Reservoir
-  New Pumped Storage
-  New Reservoir
-  Existing Pump Station
-  New Pump Station
-  Upgrade Existing Pump Station
-  Existing Well
-  New Well
-  Existing Valve, Setting
-  New
-  Pipe Alternatives



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

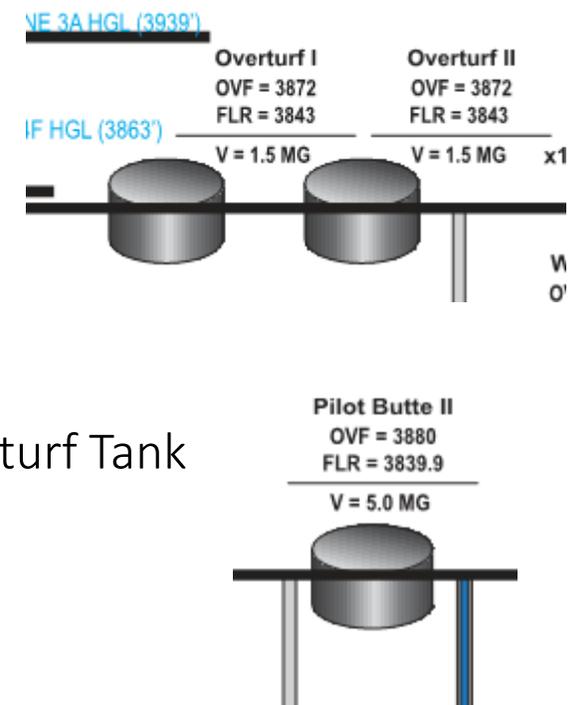
Material	Pipe Diameter (Inches)		
	1"-6"	8"-14"	16"-36"
Cast Iron	3	2	2.5
Galvanized Iron	2.5	1.5	2
PVC	2	1	1.5
Steel	3.5	1	1.5
Other	0.5	0	0

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
<b>Total<sup>1</sup></b>	<b>56.38</b>	<b>321.10</b>	<b>57.24</b>	<b>434.72</b>	

# 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

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**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?**