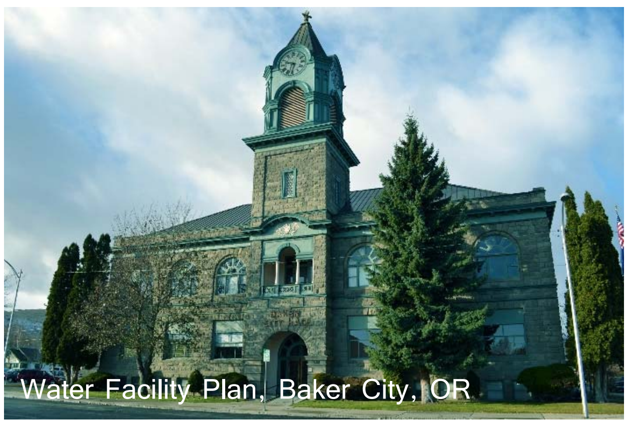

Water Master Plan, Meridian, ID


Water Facility Plan, Baker City, OR

Municipal Water Supply Planning: Inland NW Case Studies

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Water System Master Plan, Bend, OR

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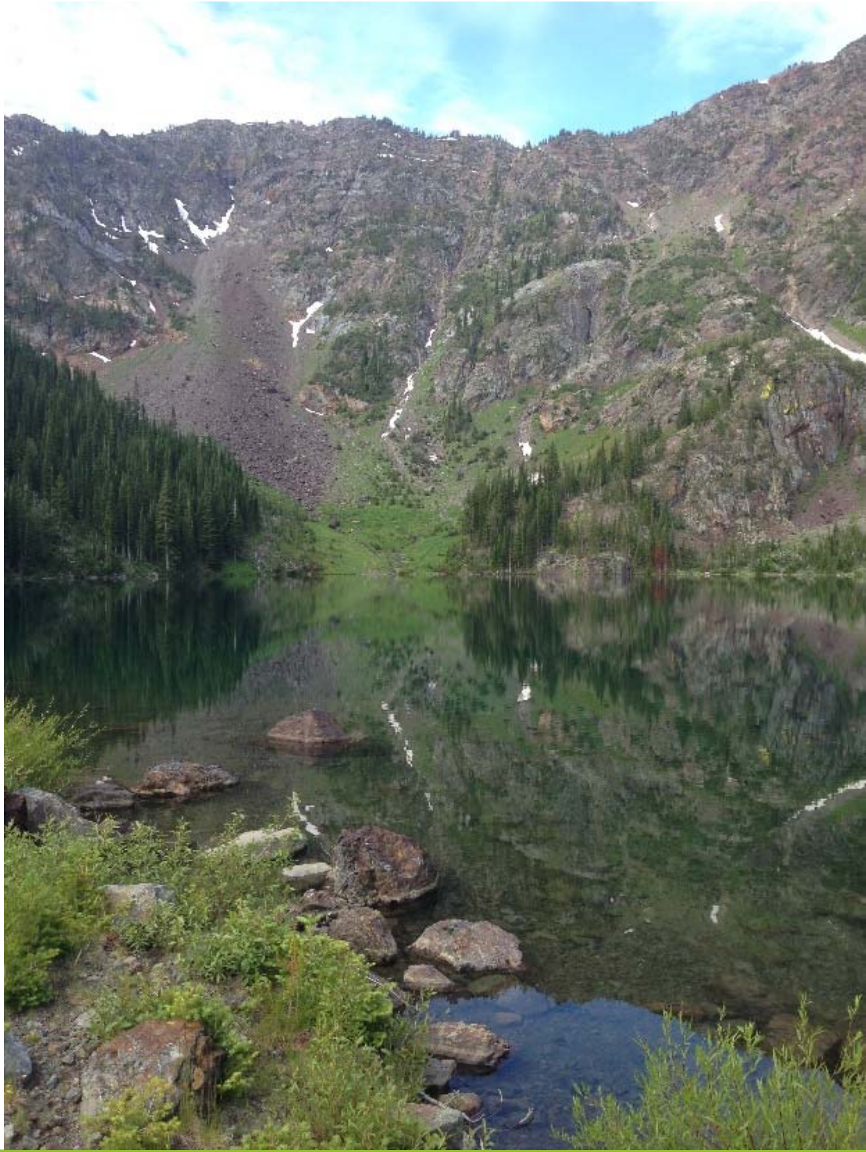
Outline

- Resiliency in water system planning
  - Storage
  - Piping
  - Supply
- Case studies
  - Baker City, OR
  - Bend, OR
  - Meridian, ID
  - Pendleton, OR
- Takeaways
- Questions

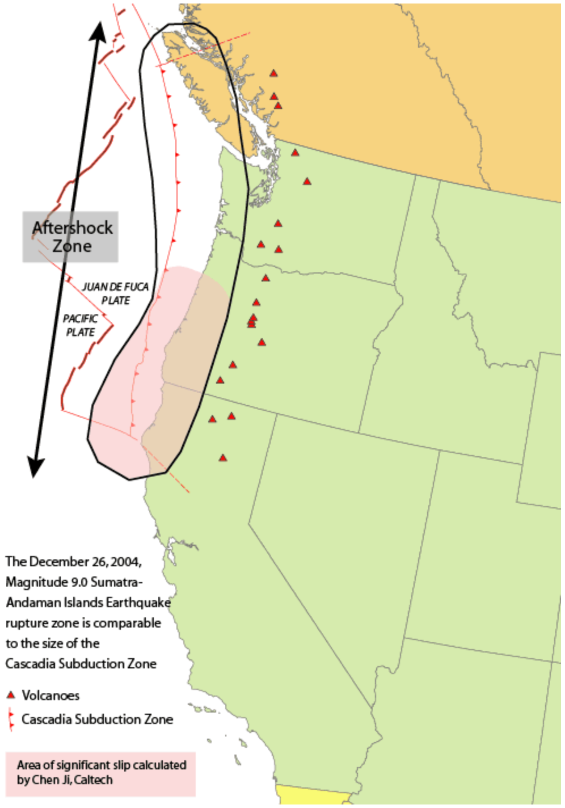


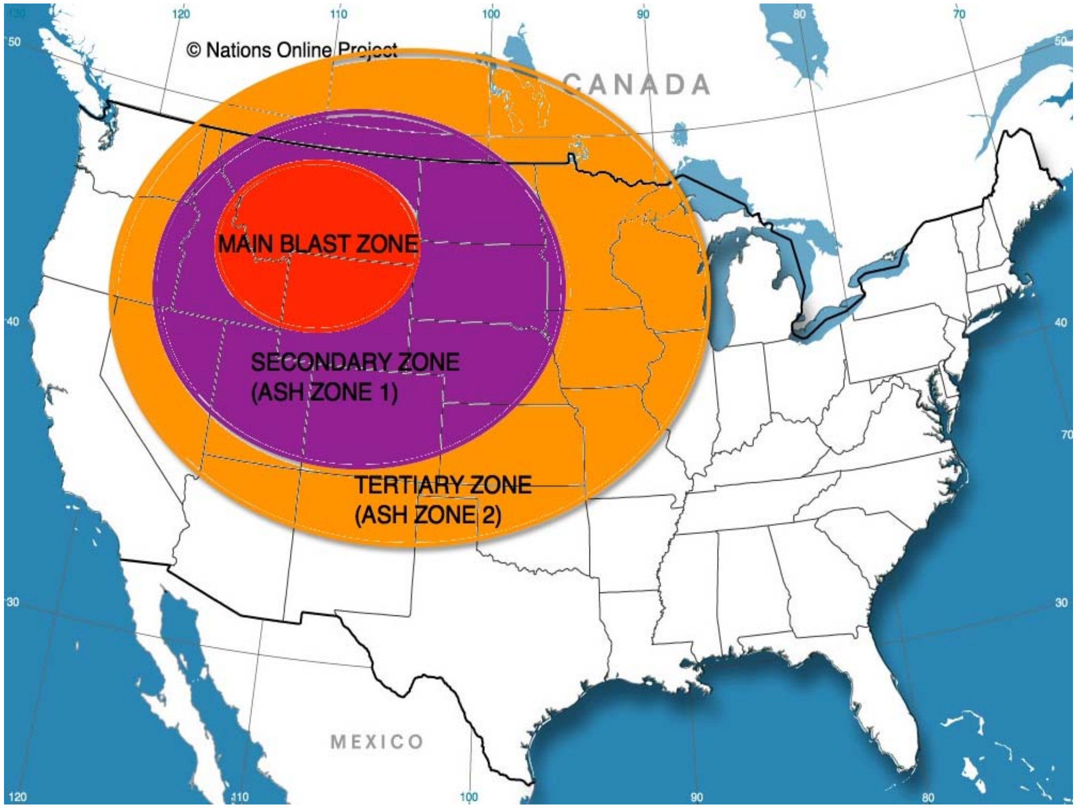
Water System Resiliency

"Infrastructure resilience is the ability to reduce the magnitude and/or duration of disruptive events. The effectiveness of a resilient infrastructure or enterprise depends upon its ability to anticipate, absorb, adapt to, and/or rapidly recover from a potentially disruptive event."

–Dr. Heather Smith, Global Water Forum, 2012

The Cascadia Event & Yellowstone Super Volcano – Could happen any day!





Resiliency | Seismic Analysis of Tanks

- Seismic implications for water tanks/assessing existing infrastructure (welded steel tank)
  - Investigate geotechnical conditions
  - Assess reservoir footing relative to overturning resistance and bearing
  - Evaluate anchors, or lack of anchors, relative to overturning and sliding
  - Determine steel plate thickness relative to the ability to resist seismic forces
  - Assess slosh height and determine if there is freeboard to avoid damage to roof
  - Investigate reservoir pipe connection to determine if they are restrained outside the footing
  - Provide flexible expansion joints on reservoir piping
  - Evaluate vent capacity following a catastrophic line break
  - Provide valves near the tank to isolate the reservoir if the piping system is damaged

Resiliency | Pipe Replacement

Replacement Considerations:

- Condition
- Age
- Material
- Contractor
- Cost (rehab techniques)
- Distribution deficiencies (fire flow, pressure, velocity, headloss, etc.)
- Other water system projects
- Other utility projects (i.e. road repaving or replacement)

How long will modern pipe materials last?

Resiliency | Seismic Analysis of Supply

- Vulnerability of water wells depends on the type and location of the earthquake, and the well construction and formation in which well is completed
- Most physical damage to wells is caused by differential movement of the soil or rock (e.g., liquefaction, slides or faulting)
- Service interruptions commonly due to damage to above-ground facilities, not well itself
- Turbidity and sand generation in wells completed in unconsolidated aquifers is common – generally can be re-developed
- In some cases, aquifer yield has been impacted
- The performance of wells in earthquakes is generally good when properly designed and located in areas less vulnerable to differential ground movement:
  - Deep, fully-penetrating cement seals, particularly in unconsolidated formations
  - Continuous wrap screens designed to retain the surrounding formation to prevent sanding
  - Located in areas away from faults, slide-prone areas, and liquefiable soils

Resiliency | Water Supply

- Common challenges in the Pacific Northwest
  - Competing uses
  - Water quality (algal bloom, turbidity, spills, and non-point source contaminants)
  - Aquifer depletion
  - Surface flows (see competing interests)
  - Climate change (diminished snowpack, type of precipitation, timing of runoff, extreme events, and water quality)
  - Watershed vulnerabilities (e.g., fire, crypto)
  - Population/water demand growth
  - Sea level rise
  - Natural disaster (earthquake, tsunami, volcanic eruption)
  - Terrorism

Case Studies


Water Master Plan, Meridian, ID

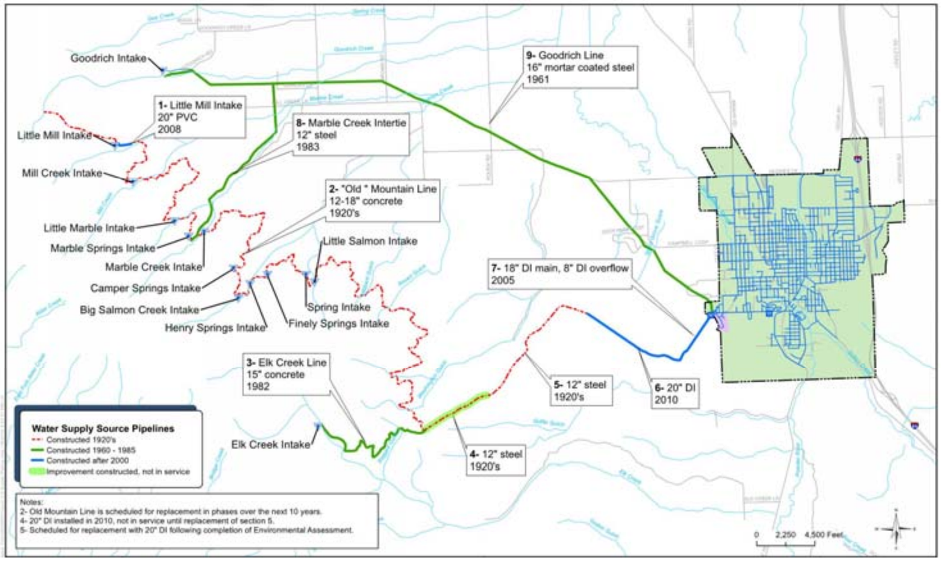

Master Planning Services, Pendleton, OR


Water Facility Plan, Baker City, OR


Water System Master Plan, Bend, OR

Baker City | System

- Serves approximately 9,890 people through 4,579 connections
- Surface water supply from 10,000 acre watershed 10 miles west of City
- 40 miles of supply piping (5 to 95 years old)
- 180 KW of Hydropower generation on supply piping
- 1 active groundwater well with ASR
- Ultraviolet treatment facility (2014)
- 77 miles of distribution piping
- 4.5 million gallon (MG) chlorine contact tank
- 2 pressure zones



Baker City | Growth

- Very little growth in City and water system
- Portland State Population Research Center population estimate of 0.3% growth per year, equates to an additional 600 people over 20 years

Year	Population Estimate	ADD (mgd)	MDD (mgd)	PHD (mgd)
2015	9,890	2.4	9.4	14.1
2020	10,039	2.5	9.8	14.7
2035	10,501	2.6	10.1	15.2

Baker City | Perspective

- Recently added UV Treatment
  - Addresses cryptosporidium risks
  - Addresses Long Term Treatment (LT2) Requirements
- Watershed vulnerability to fire
  - Invest in additional Groundwater Wells in lieu of filtering
- Replacement of aging supply piping
- Implementation of ASR for water quality mitigation
  - Native groundwater quality has aesthetic issues (Fe, Mn, TDS)

Baker City | Planning and Solutions

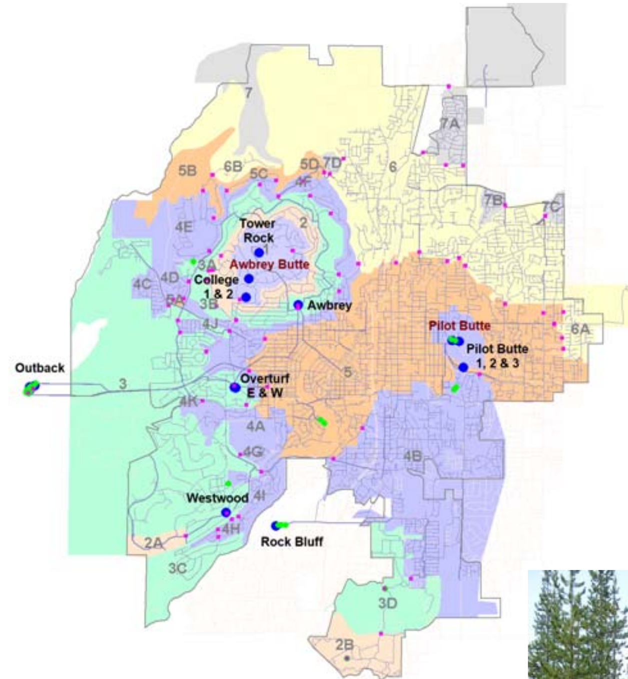
- Recent system planning document
  - Included additional groundwater supply evaluation
- Vulnerable surface water source
  - Historic cryptosporidium hits addressed with new UV Plant
  - Potential for wild fires or other disruptions. Filtering is costly and could be inadequate.
  - Construct 1-2 new well(s) to provide redundant average supply should surface water become compromised (wildfire, mechanical failure, water quality contaminant, etc.)
- Groundwater availability
  - Need to reclassify so water rights are more versatile and can be pumped from any well
  - Add ASR in new wells to mitigate native quality in groundwater and improve aquifer sustainability
- Continue replacing supply piping and begin distribution replacement program
- Maximize hydropower generation when possible

Baker City | Summary

- Minimal growth projected
- Resiliency planning driven by vulnerability of supply
  - Develop new groundwater sources to supplement surface water
- Improve water quality while addressing redundancy
  - ASR
  - Improve water rights versatility
- **Outcome:** City will have supply redundancy!

Bend | System

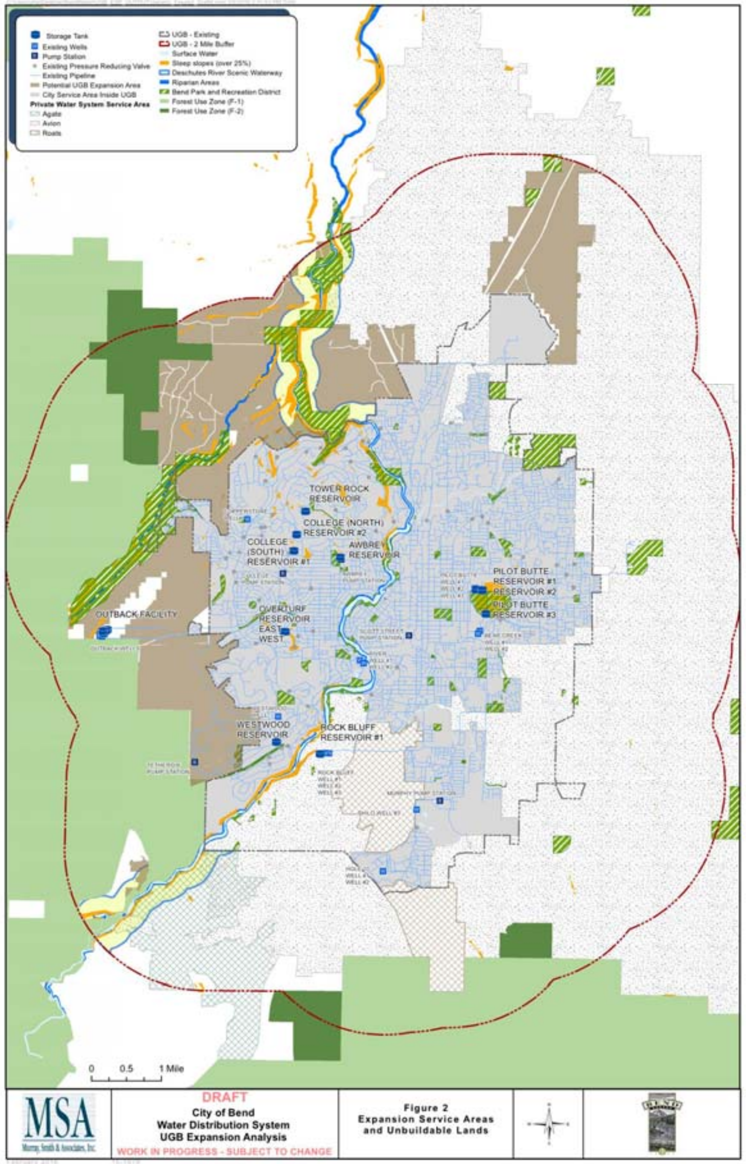
- Serves approximately 61,000 people through 24,600 connections
- Remaining City residents served by private water systems
- Surface water supply from Bridge Creek 13 miles west of the City
- 21 groundwater wells
- 470 miles of pipe
- 15 storage reservoirs
- 9 primary pressure zones



Bend | Growth

- Huge variation in growth rates since 1990s
- Currently in boom cycle
- Generally declining per capita water use has kept peak usage consistent
- City system expansion limited primarily to west

Year	ADD (mgd)	MDD (mgd)	PHD (mgd)
2015	13	27	48
2018	22	49	88
Build-out	37	84	150



Bend | Perspectives

- Innovative planning tools
  - Recent water planning efforts
    - o Evaluated pipe redundancy and critical customer service
    - o Utilized formal optimization techniques to identify best capital & life cycle cost solutions
- City goal to maximize use of surface water
  - Flows by gravity
    - o Opportunities to implement hydropower on supply line
  - Groundwater
    - o Concern over future contamination from stormwater UICs or other contamination
    - o Groundwater pumped from 800 feet below surface
  - Challenges
    - o Required **politically contentious** investment in supply piping and treatment facility
    - o How to mitigate future surface water use
- Public infrastructure projects require extraordinary public involvement efforts

Bend | Planning and Solutions

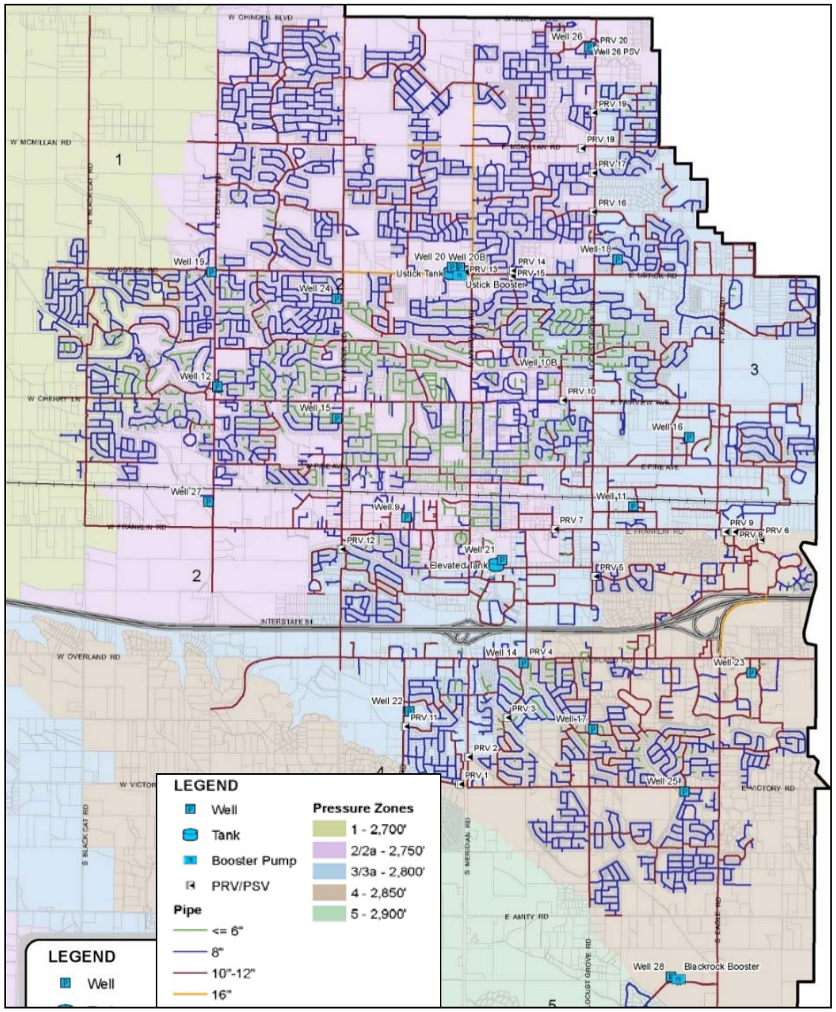
- Innovative planning approaches address resiliency and long term solutions
- Update planning documents every 5+/- years
- Involve the public in the process!

Bend | Summary

- Rapidly growing however water use has remained consistent
- Resiliency planning driven by
  - Ensuring long-term dependable water supply
  - Water system component redundancy
- **Outcome:** Surface water supply improvements, great water quality, and reducing pumping costs!

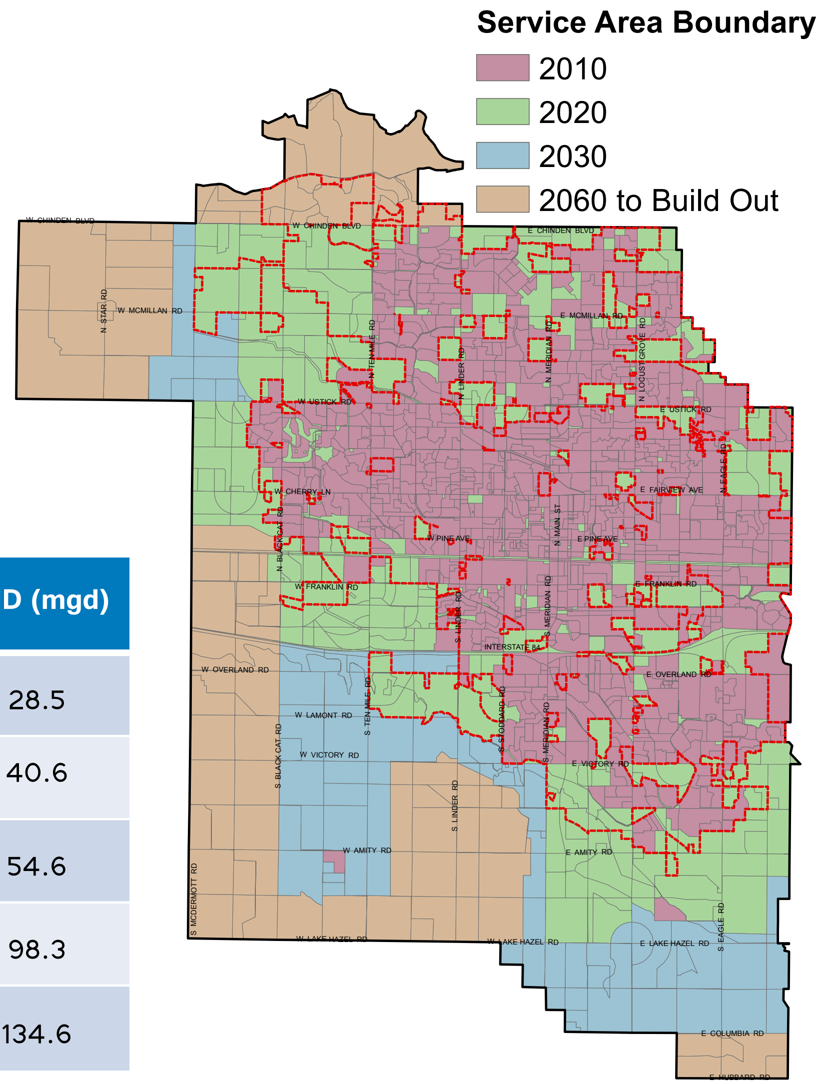
Meridian | System

- Serves approximately 91,000 people through 31,000 connections
- Relatively new system
- 516 miles of pipe
- Groundwater supply through 23 wells
- 5 pressure zones
- 1 elevated tank & 2 ground level tanks



Meridian | Growth

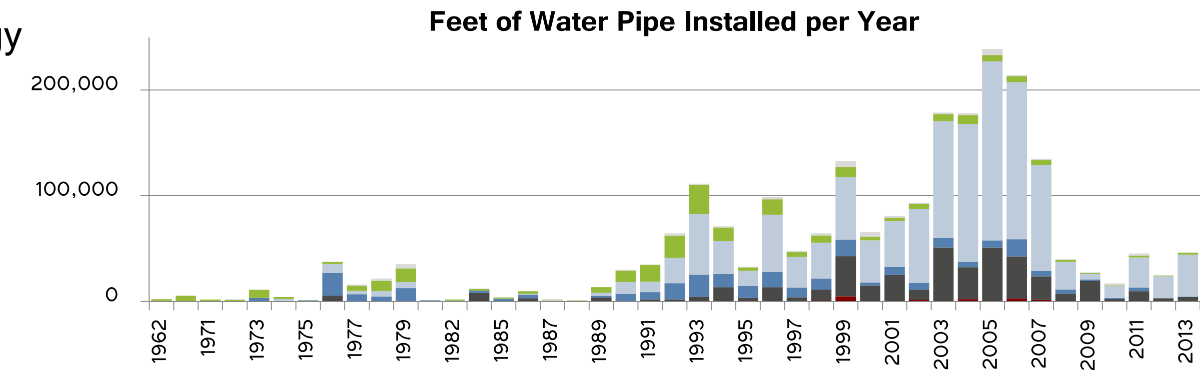
- Variable historic growth rates, with rapid growth projected to the City and water system
- Non-potable irrigation used by 80% of customers
  - New customers all have non-potable irrigation
  - Reduces overall average and peak per capita demand



Year	Population	ADD (mgd)	MDD (mgd)	PHD (mgd)
2015	91,000	9.5	19.0	28.5
2020	104,000	13.5	27.0	40.6
2030	140,000	18.2	36.4	54.6
2060	252,000	32.8	65.5	98.3
Build Out	345,000	44.9	89.7	134.6

Meridian | Perspectives

- Rapid growth requiring new wells to be drilled
- Groundwater quality
  - Challenges
  - Mitigation
- Concern over senior water right "call" that could require City to curtail their pumping
  - Agricultural to urban transition
  - Coordination with irrigation districts
- Define pipe replacement strategy
  - 80% of system installed in less than 20 years



Meridian | Planning and Solutions

- Regular System Planning
  - Update every 5 +/- years
  - Proactive Supply Planning
- Introduce issues to various stakeholders
- Perfect existing water rights permits as possible
- Collect data on groundwater trends
- Evaluate water quality options
  - ASR
  - Aquifer conditioning
  - Treatment
- Develop pipe replacement strategy

Meridian | Summary

- Rapid growth
- Resiliency planning driven by
  - Expansion of system
  - Potential water rights adjudication
  - Future pipe replacement spike
- **Outcome:** Contingency for various supply conditions and increased budgeting for pipe replacement!

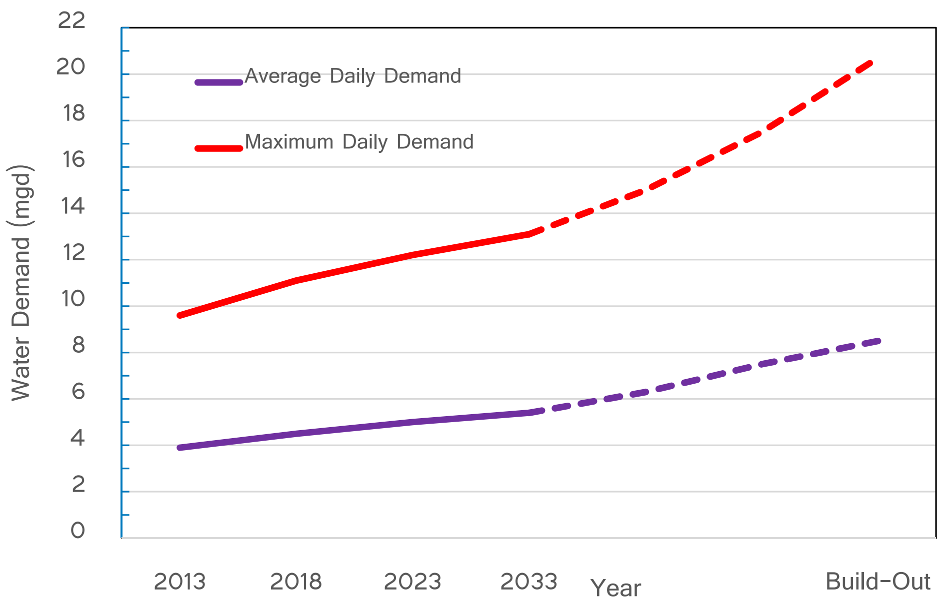
Pendleton | System

- Serves approximately 17,600 people through 5,800 connections
- Source water
  - Surface water from the Umatilla River
    - Membrane WFP: 4 MGD
  - Groundwater/ASR wells
    - 8 production wells (5 are ASR)
    - 160 kW hydropower from ASR
- 13 pressure zones
- 107 miles of pipe
- 13 booster pump stations
- 8 storage reservoirs

Pendleton | Growth

- Moderate growth projected
  - Infill and expansion in next 20 years
  - Urban Growth Boundary build-out doubles population to 33,000

Demand (gpm)	Existing	5-Year	10-Year	20-Year	Build-out
ADD	3.9	4.5	5.0	5.4	8.5
MDD	9.6	11.1	12.2	13.1	20.7

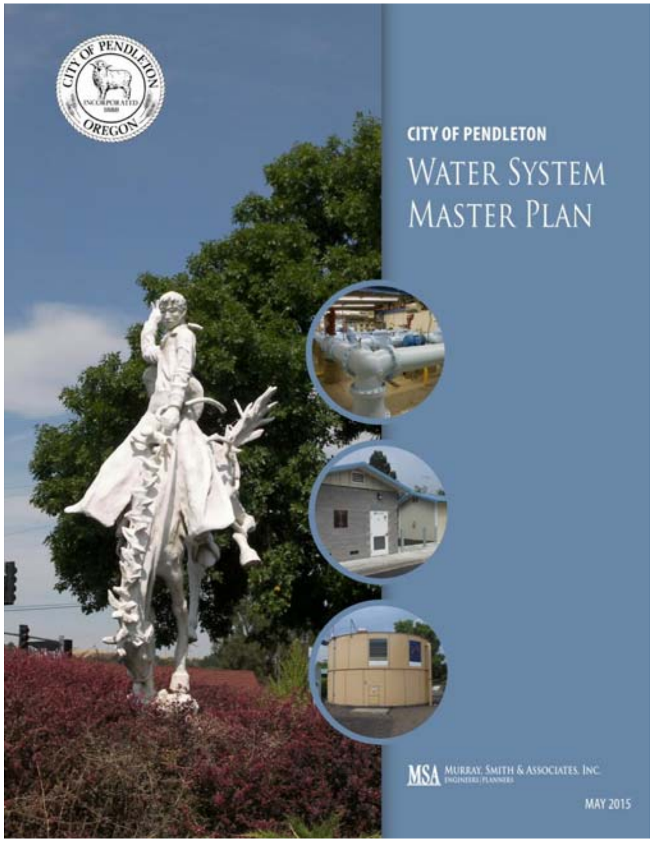


Pendleton | Perspectives

- Replacement of aging distribution system is the top priority
- Add redundancy and additional storage within system
- Continued development of information and planning tools
  - GIS and hydraulic models
  - Mobile work order and scheduling software
  - Public works best practices accreditation
- Creation of drought resistant water system
  - Surface water available in winter/spring months
    - Aquifer Storage and Recover (ASR) program implemented in 2003
    - Improving historically declining aquifer water levels
    - Banking native groundwater and stored surface water for future use
- Innovation
  - ASR hydropower program
  - Membrane retirement program
  - 100 kW of solar at Water Facility Plan

Pendleton | Planning and Solutions

- Recent system planning document (first in 20+ years)
  - 5 year update planned for 2020
- ASR has optimized surface water use and improved groundwater stability
- Innovative approaches
- Stepped rate increases to help fund pipe replacement
  - City planning to self-perform most replacement



Pendleton | Summary

- Resiliency planning driven by
  - Creation of drought resistant supply
    - Groundwater levels declining
  - Aging infrastructure
- **Outcome:**
  - Implementation of ASR to maximize surface water availability
  - Stepped rate increases provide
    - Budget for pipe replacement
    - Staffing for O&M
    - Ability to address other capital projects

Takeaways

- Every utility has a unique combination of circumstances and challenges
- Each highlighted utility continues to invest in the quality of system information (GIS, Models, SCADA, etc.)
- The common thread for addressing resiliency - adequate, up-front planning!
  - Regulatory requirements
  - Political climate
  - System demands
  - Optimizing use of sources
  - Source stability (groundwater levels, surface water access, etc.)
- Gain public and Council support relative to required investments
- Resiliency planning:
  - Takes time
  - Is implemented incrementally
  - Must look to the future

Questions