The Value of Water Modeling and Master Planning

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Outline

01 Why develop Master Plans?

02 Oregon, Washington and Idaho Regulations

03 What is typically included in Master Plans

04 What else could/should be included

05 Case Studies

06 Summary/Q&A

Why Develop Master Plans?

- Master Planning vs Facility Planning
  - Generally synonymous
  - Treatment Facility Plans may be broken out separately from Distribution
- Regulator Requirements
  - Review current and anticipate future requirements
- Update System Information
- Answer Questions about your system
- Plan for upcoming issues, known or unknown
  - Such as regulatory changes or emergency conditions

Why Develop Master Plans? (Cont.)

- Assess operations and maintenance effectiveness
- Develop Capital Improvement Plans
- Support Financial Systems
  - Rate and Fee structures
  - Support Requests for Grant and Loan Funding
- Create a 5- to 20-year (or longer) roadmap for the utility
- Valuable tool for getting new staff and Council members up to speed on system
- Opportunity to create a unified vision for utility priorities and investments

Is there a Nation-wide Standard for Master Planning?

Short Answer… No.

What is available?

- Some guidance from AWWA
- Ten State Standards
- Other state specific guidelines

Washington State sets the bar nationally for Water Master Planning

- Kudos Washington!

How do WA, OR and ID Compare

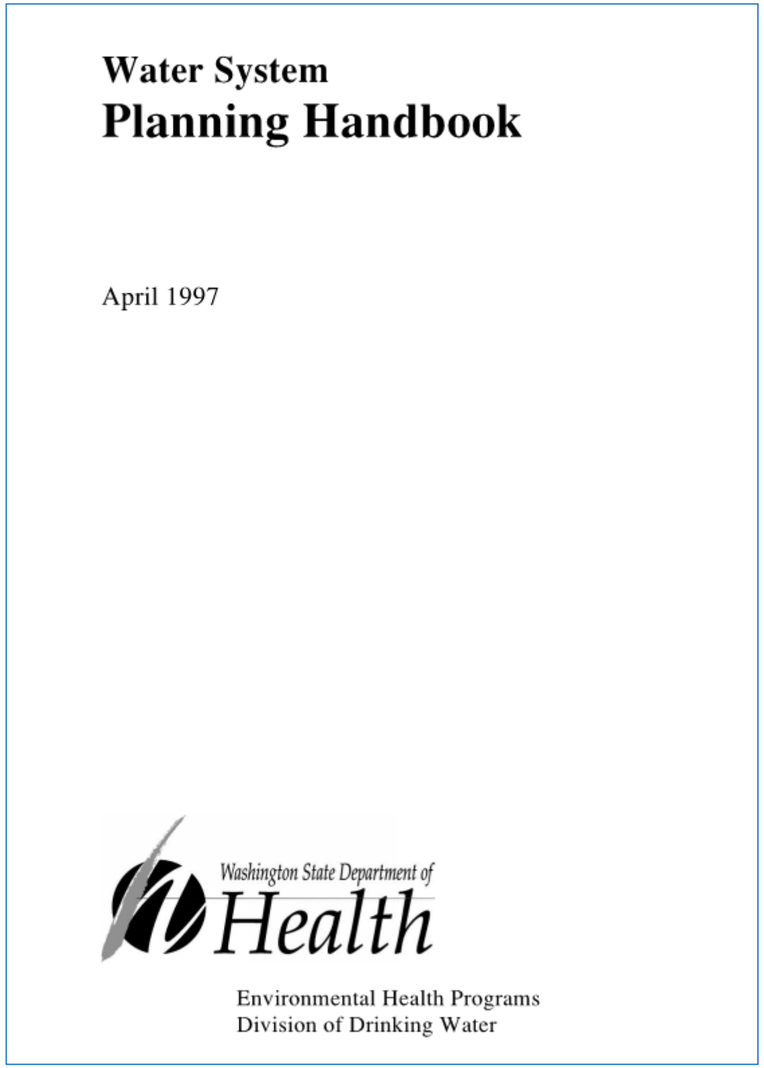
Significant differences between each state's planning requirements

- Defined Schedule for Completion of Plans
  - WA has hard requirement for how often Plans get completed (6 or 10 years)
  - OR generally every 20 years
  - ID when a "material modification or expansion" will be made in the system
- Each emphasize and require different things
  - WA again the most comprehensive covering everything from pressure criteria to conservation planning
  - OR emphasis on Water Management & Conservation Plan (WMCP) and now Seismic Resiliency
  - ID covers core planning elements
- Conservation Planning
  - WA – Yes
  - OR – Yes, as part of WMCP
  - ID - No

Washington Master Planning Requirements

National “Gold Standard” for Water Planning Requirements

- Department of Health (DOH) Office of Drinking Water Administers
- Specific criteria, format and prescriptive methods for how Plans should be completed and what they should contain
- Historically required every 6 years, now allows some utilities to update every 10 years
- Requires rigorous financial evaluation linking improvements to rates
- Significant LOE to compile Plans due to comprehensive list of items to include



Oregon Master Planning Requirements

Generally lacking in detailed guidance for the preparation of Master Plans

- Administered by the Oregon Health Authority (OHA) Drinking Water Services (DWS)
- Generally 20 years between updates, which is too long for a WMP to stay valid
- Water Quality Focused
- OR requires submission of Water Management & Conservation Plans (WMCP) – focused on source and water use

Oregon Health Authority

Document Revision Date: 3/1/2018

Oregon Health Authority, Drinking Water Services

Plan Review requirements for Master Plans at existing or new public water systems.

The requirements apply to master plans for existing and new Community water systems with 300 or more connections. Other water systems (Community with less than 300 connections), Non-Transient Non-Community, Transient Non-Community, and Non-EPA (aka State Regulated) water systems, which are defined on page 5, may also prepare a master plan and submit the document for review. Two sets of information are provided below, 'short' and 'long' instructions. The short instructions are abbreviated. If you are unfamiliar with the plan review process, it is strongly recommended you read the long instructions.

For assistance, call (971) 673-0405, fax (971) 673-0694, or email dws.planreview@state.or.us.

SHORT INSTRUCTIONS:

The following shall be submitted to OHA-DWS for review and approval:

1. One copy of a final master plan prepared by an Oregon Professional Engineer. The document must be stamped by the engineer.
2. The appropriate plan review fee. For a current fee schedule, check http://healthoregon.org/pwsplanreview.

   The fee check should be made payable to: 'OHA Drinking Water'.

Specific Requirements

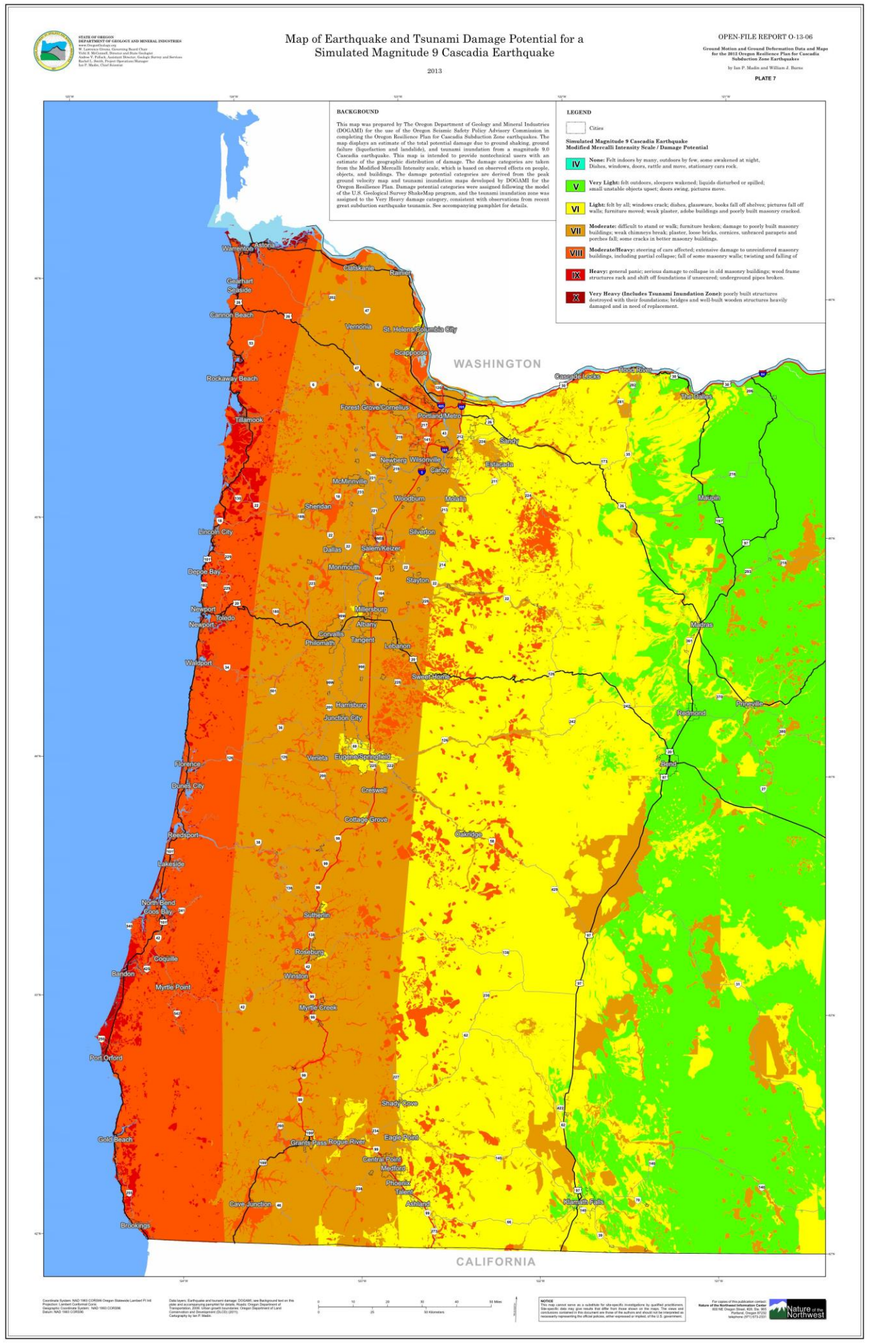
1. The master plan shall evaluate the needs to the water system for at least a 20-year period and shall include at a minimum all of the required elements outlined in Oregon Administrative Rule (OAR) 333-061-0060 (5).

2. Based on the submitted information, OHA-DWS may send a letter to the water system indicating that OHA-DWS concurs with the master plan. If the master plan is missing required elements outlined above, then OHA-DWS will notify the water system, or engineer, as appropriate. The water system, or engineer, will need to submit a revised document with the required missing elements in order for OHA-DWS to be able to concur with the master plan.

Oregon Master Planning

Seismic Resiliency Evaluation

- Requires submission of Seismic Risk Assessment and Mitigation Plan if utility is in seismic zones of 7 to 10 (mainly west of Cascades)



Idaho Master Planning Requirements

Provides adequate guidance for preparation of Plans

- Idaho Department of Environmental Quality (DEQ) Administers
- Includes section requirements and generally provides criteria for assessing system capacity and water quality

502. FACILITY AND DESIGN STANDARDS: FACILITY PLANS.
See the definition of Facility Plan in Section 003. (3-30-07)

01. Facility Plans Required. All new public drinking water systems, and existing public drinking water systems undergoing material modification or expansion, are required to have a current facility plan that shall address all applicable issues specifically required in Sections 500 through 552 of these rules including, but not limited to, hydraulic capacity, treatment capacity, standby power, redundancy, fire flows, project financing, and operation and maintenance considerations sufficiently to determine the effects of the project on the overall infrastructure. Facility plans must address the entire potential service area of the project. Facility plans may not be required for simple water main extension projects as detailed in Subsections 502.01.a. and 502.01.b. (5-8-09)

a. Department-reviewed simple water main extension projects. A facility plan is not required if the Department is provided documentation supporting the ability of the purveyor to provide service for the simple water main extension without adding system components designed to control quantity or pressure to the system and while continuing to provide the pressure and quantity requirements of Subsection 552.01. Documentation may be in the form of: (5-8-09)

i. Hydraulic modeling; (5-8-09)

ii. Usage data and flow calculations; (5-8-09)

iii. Declining balance reports that demonstrate the system has the capacity to supply the service area of the system served by the extension; or (5-8-09)

iv. Other documentation acceptable to the Department. (5-8-09)

Recommendations for Regulatory Agencies

Washington

- Ensure consistency between Plan reviews
- For utilities with significant growth/changes maintain 6-year planning cycle
- Incorporate Asset Management requirements, particularly pipe replacement

Oregon

- Adopt a defined schedule for completion of Plans of no more than 10 years
- Provide specific design criteria to ensure consistent level of service for all water systems
- Incorporate Asset Management requirements, particularly pipe replacement
- Add traditional WMP components to WMCP for more comprehensive overall document

Idaho

- Adopt a defined schedule for completion of Plans of no more than 10 years
- Incorporate conservation planning requirements
- Incorporate Asset Management requirements, particularly pipe replacement
- Tie rate/fee update to capital plan

What goes into a Master Plan?

A Master Plan (minimum) includes:

Executive Summary

System Description

Projections of Population and Water Demands

System Analysis

- Hydraulic Model
- Water Rights and Supply
- Pumping, Storage, Transmission, and Distribution
- Water Quality Requirements
- Alternatives Analysis

Typical Planning Sections (Cont.)

Operations and Maintenance

- Certifications
- Required programs and associated documentation

Capital Improvement Plan

- 5- and 20-year plan

Financial

- Show that utility has adequate funding to support O&M, Capital, and Debt Service

Appendices containing supporting documentation

Why do we Model?

To answer complex hydraulic questions surrounding:

- Complex networks of piping and facilities
- “Transient” hydraulic conditions
- Water age and/or quality

Reduces subjectivity when determining the best capital or operational solution

Provides ongoing resource for utility to analyze system changes

- Development review for fire flow availability
- Operational “what-if” analysis

Because the tools are cool ☺

- Remember… output only as good as the quality of the input data

What could also be included?

What isn’t required that could/should be?

Geographic Information Systems (GIS)

- Develop/update as part of planning
- Develop plan for updating hydraulic models
- Discuss future uses of GIS data such as work orders or asset management systems

Water conservation planning

Planning beyond 20 years

- Water supply planning
- Transmission and facility sizing

Financial Analysis

- Many states don’t require a financial plan that is coordinated with the Master Plan

What isn’t required that could/should be? (cont.)

Asset Management

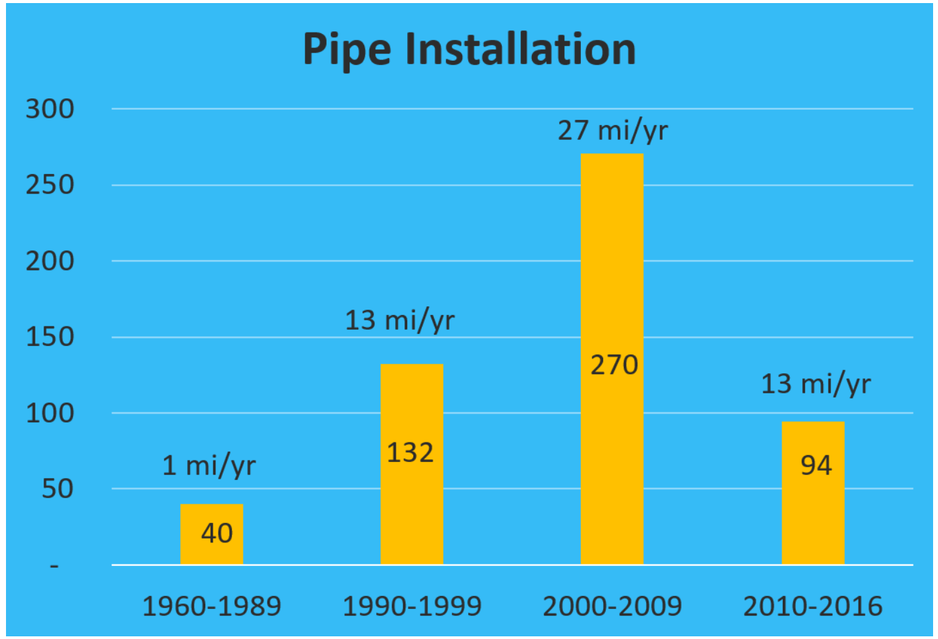
- Facility Condition Assessments
- Ongoing Pipe Replacement Programs

O&M Benchmarking

- Context for staffing levels, O&M budgets, currently implemented programs

Model Sensitivity Testing

- Water conservation impacts to infrastructure sizing
- Increasing land use density in urban cores or planned communities
- Changes in fire flow requirements



What isn’t required that could/should be? (cont.)

Resiliency Analysis – Seismic Event, Drought, Wildfire, Climate Change, etc.

- Water supply – source resiliency
- Facility structural integrity – treatment plants, pump stations, reservoirs
- Backup power – treatment plants and pumping
- Piping – material, joints, valves, thrust restraint
- Facilities and piping – geologic siting considerations

American Water Infrastructure Act of 2018

Updates Bioterrorism Act of 2002 – expanding beyond malevolent acts

- Currently an unfunded mandate
- Adds Source Water Evaluations
- Adds Financial Systems specifically cybersecurity
- Requires updated resiliency assessments
- Provide certification to EPA the assessments have been completed by specified dates
- Requires update of the Utility's Emergency Response Plan
- Failure to comply could result in $25,000/day fine

Size of System (Population)	Risk & Resilience Assessment	Emergency Response Plan
>100,000	3/31/2020	9/30/2020
50,000-100,000	12/31/2020	6/30/2021
3,300-49,999	6/30/2021	12/30/2021

What isn’t required that could/should be? (cont.)

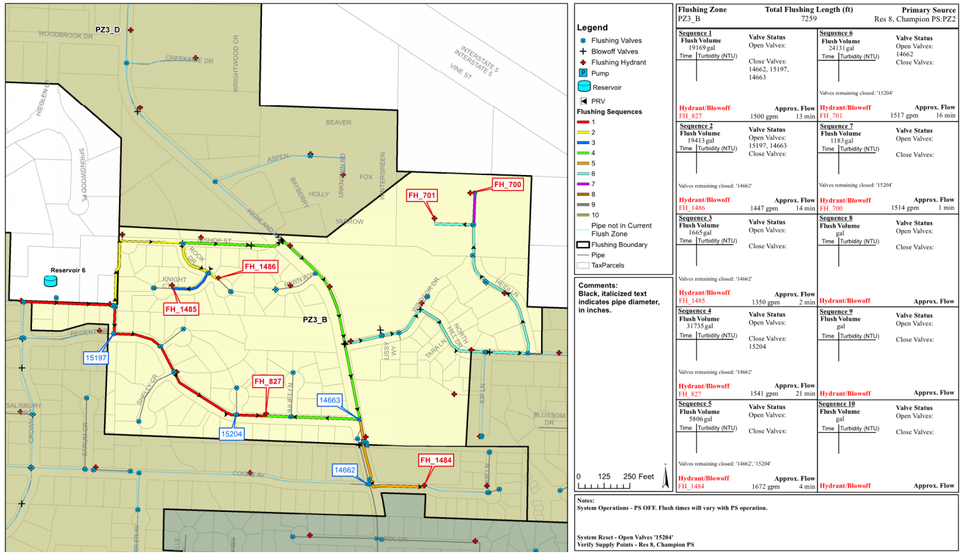
Public Involvement/Education

- Typically more prevalent for facilities – treatment and reservoirs
- Valuable for education and developing public support for:
  - Replacement of aging infrastructure
  - Required rate increases or bond levies

What isn’t required that could/should be? (cont.)

Advanced Modeling

- Steady state analysis is typically conducted for Master Plans (eg snapshot in time)
- Extended Period Simulation (EPS) or Dynamic models can answer questions about what happens “over time”
  - Water Age or Quality
- Criticality Assessments
  - Pipe and/or valve failures
- Develop Unidirectional Flushing Programs



UDF Flushing Map

How often should Master Plans be developed?

Utility dependent, typically determined by:

- System Growth
  - Demand
  - Expansion of Service Area
- New Regulations
- Staff Turnover
- Significant anticipated investments in infrastructure
- Justification for rate and/or fee increases
- Many utilities on a 10+/- year cycle

Case Studies

Cities of Bend, Pocatello, Idaho Falls, & Pendleton

Bend Optimized Water Planning 2010

Mountain resort city of approximately 80,000

- 20,000 in 1990

Late 2000's Necessary Major Investments

- Water Supply
- Water Storage
- Transmission
- Pumping

Surface and Groundwater supply options

City (Tom Hickmann) employed an innovative and unbiased process

- Identified improvements based on lowest overall life cycle costs

Bend’s Master Planning

	Traditional Master Plan	Bend’s Master Plan
Focal Point	engineering solutions	Focus on community values, then engineering solutions
Assumptions	taken at face-value	Every assumption scrutinized
Solution Set	limited	expanded
Approvers	City Staff	community members / City Staff / City Council
Modeling Type	Traditional tools	Optimization

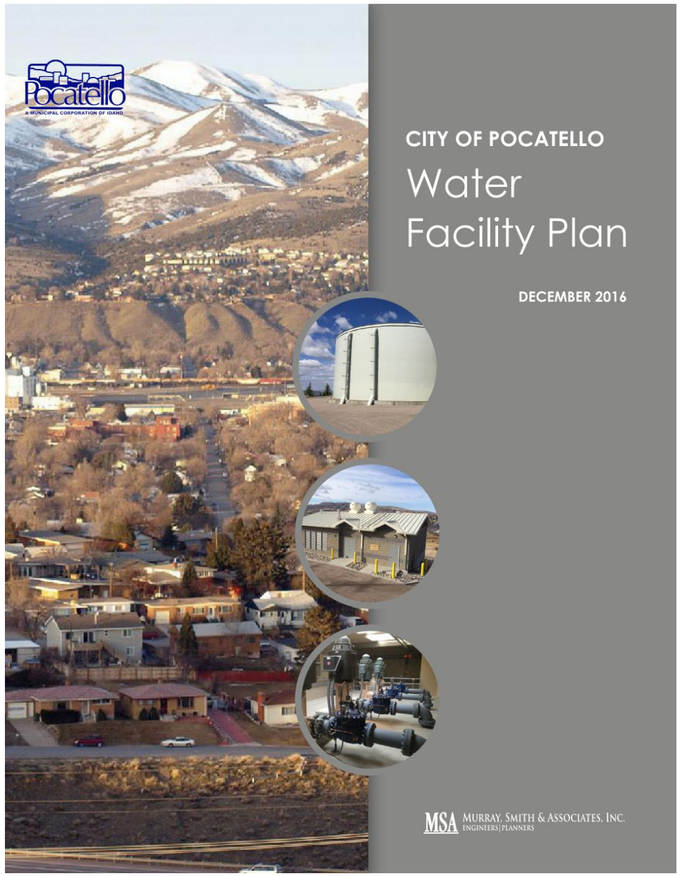
Optimization Benefits

- Evaluate thousands of possible improvement and operational options
  - Transparent
  - Identifies lowest life cycle cost solutions
- Simultaneous comparison of hydraulic and cost factors
- Unbiased
- Excellent for situations where:
  - Proposed improvements are controversial, due to cost, environment, etc
  - The systems are complex with many alternatives
  - There is need for extensive public involvement

Bend Integrated WMP 2020

- To begin with a Level of Service Workshop with City stakeholders:
  - Focus on identifying City values and risk tolerance and how they translate into engineering criteria
  - Will also define which emergency scenarios should be evaluated to address system resiliency
- Will again utilize formal optimization to assess hydraulic performance against overall life cycle costs
- Includes detailed resiliency evaluations of the distribution system
- Assess water age/quality using extended period modeling
- Will recommend an ongoing program for pipe replacement
- Incorporates the development of the WMCP and PFP into the overall effort

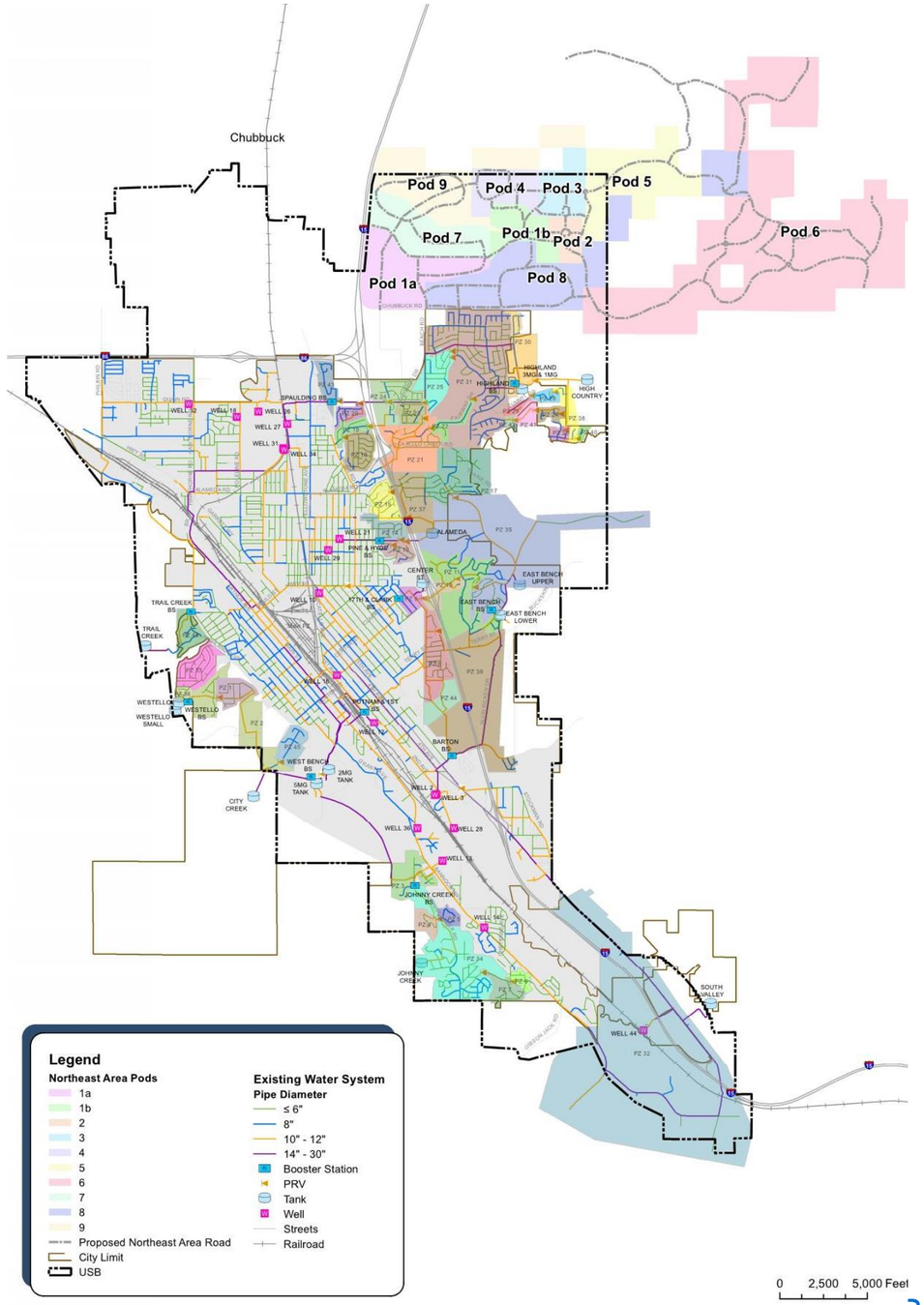
Pocatello Water and Sewer Planning



- Completed Water and Sewer Master Plan in early 2016 for community of approximately 50,000
- Included updating hydraulic models
- City actively used water model
- Overall growth in Pocatello has been <0.5%/year
- Large development planned Northeast of City in conjunction with a new freeway interchange by end of 2019

Pocatello Planning Area

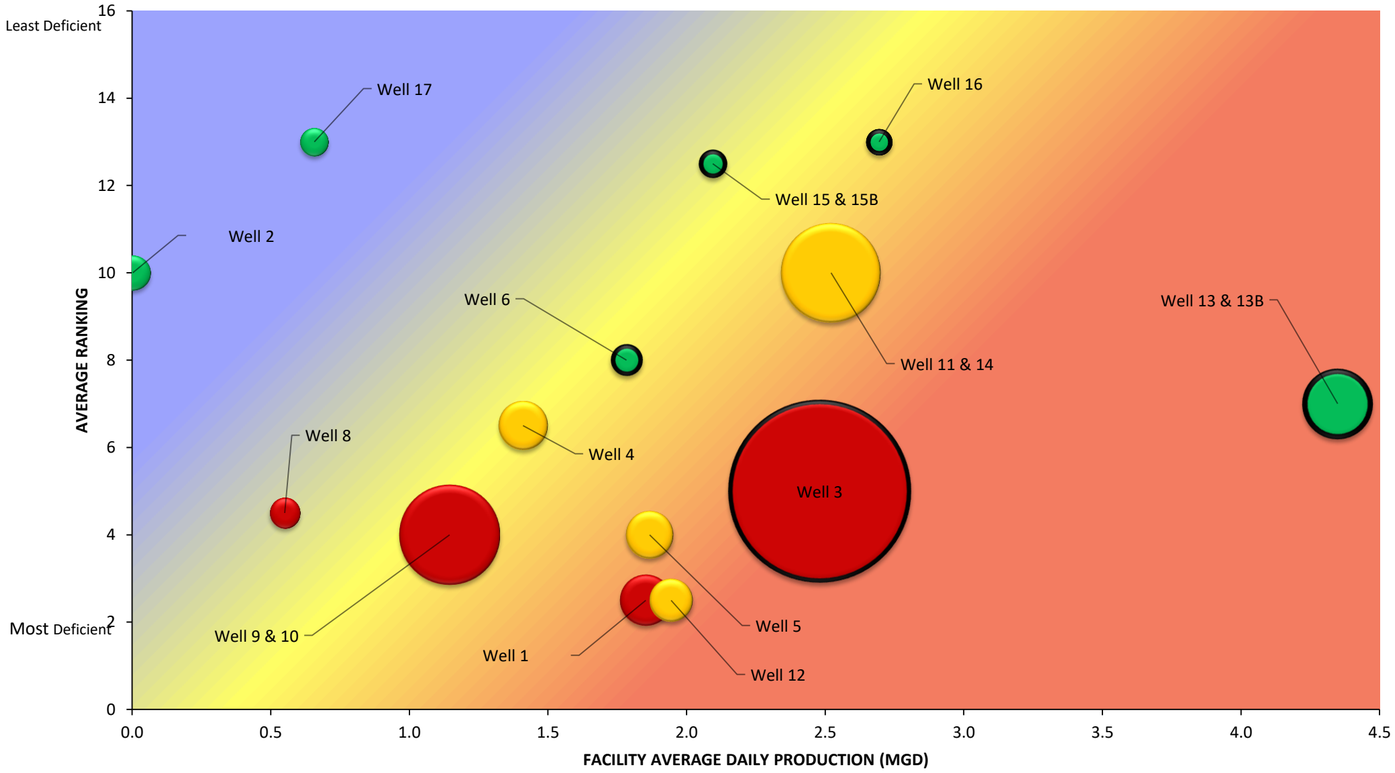
- Current Max Day Demand (MDD): 33 mgd, Proposed 20 year MDD for Development: 15 mgd
- Development will require ~ $130M in water and sewer investment (not including sewer treatment) by 2035
- Master Plan/models allowed City to identify improvements under tight timeline



Idaho Falls System Condition & Code Evaluation

14 Facility (well, booster, and tank) evaluations and resulting improvements focused on the following areas:

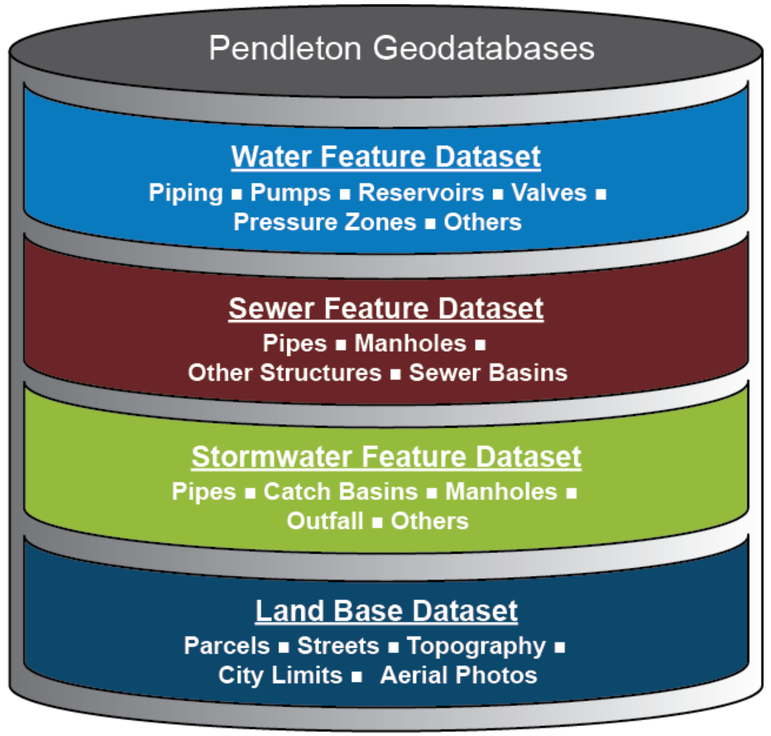
- HVAC
- Electrical
- Site/facility security
- Site/facility safety
- Piping modifications
- General condition
- Additional items



Color and size indicate relative cost and risk at each facility

Pendleton Master Planning Project

- Create GIS Databases for water, sewer and stormwater to support master planning and other public works functions
- Used Master Plans to benchmark staffing levels and justify additional hiring
- Set baseline pipe replacement targets



Reasons to Develop GIS as Part of WMP

- Primary data source for Master Planning Efforts
- Transition master data repository from CAD to GIS
  - Consolidate information sources
  - Compile base data (e.g. parcels, roads, aerials, etc)
  - Develop consistent mapping tools and products
- Use GIS as data source for hydraulic models
- Prepare for transition to new full time GIS coordinator
- Ultimately use GIS in field and for Public Access
- Staff succession Planning

Overall Summary

Summary

- Identify your needs and questions when scoping project
  - Look beyond what is strictly required by regulatory agencies
  - Leverage the investment made in developing the Master Plan
- Investment in GIS has changed the way most utilities approach planning
- Consider public involvement
  - If changes in rates or potentially controversial facilities/investments are likely to be recommended
  - Use as a tool for education for topics such as pipe replacement
- Engage engineering, O&M, and Council in the overall project
  - Range of perspectives
  - Reduces surprises during adoption and subsequent implementation
  - Increases likelihood the planning document will be used on a regular basis

Acknowledgements

- LaDonne Harris PE
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- City of Pendleton – Bob Patterson PE

Q&A

Thank you!