

Large System Planning - Hydraulic Model and Water Master Plan Development for United Water Idaho

May 1, 2015



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**PNWS AWWA Conference
Bellevue, WA**

- United Water Idaho is an investor-owned utility serving the City of Boise, regulated by the Idaho Public Utilities Commission
- The company was established in June 1890
- For 104 years, groundwater supplied the system
- Surface Water, from 2 plants, now supplies 25 to 30% of the total production

Why Develop a Master Plan

- Three basic reasons for the Master Plan
 1. Distributed well supplies led to inadequate transmission capacities
 2. Regulatory changes over time
 3. System complexity due to varied topography

System Description

- Number of People Served: 240,000
- Number of Pressure Zones: 90
- Number of Wells: 80
- Number of WTPs: 2
- Number of Booster Pumps: 43
- Number of Reservoirs: 35
- Number of Pressure Control Stations: 106
- Miles of Pipe: 1,200

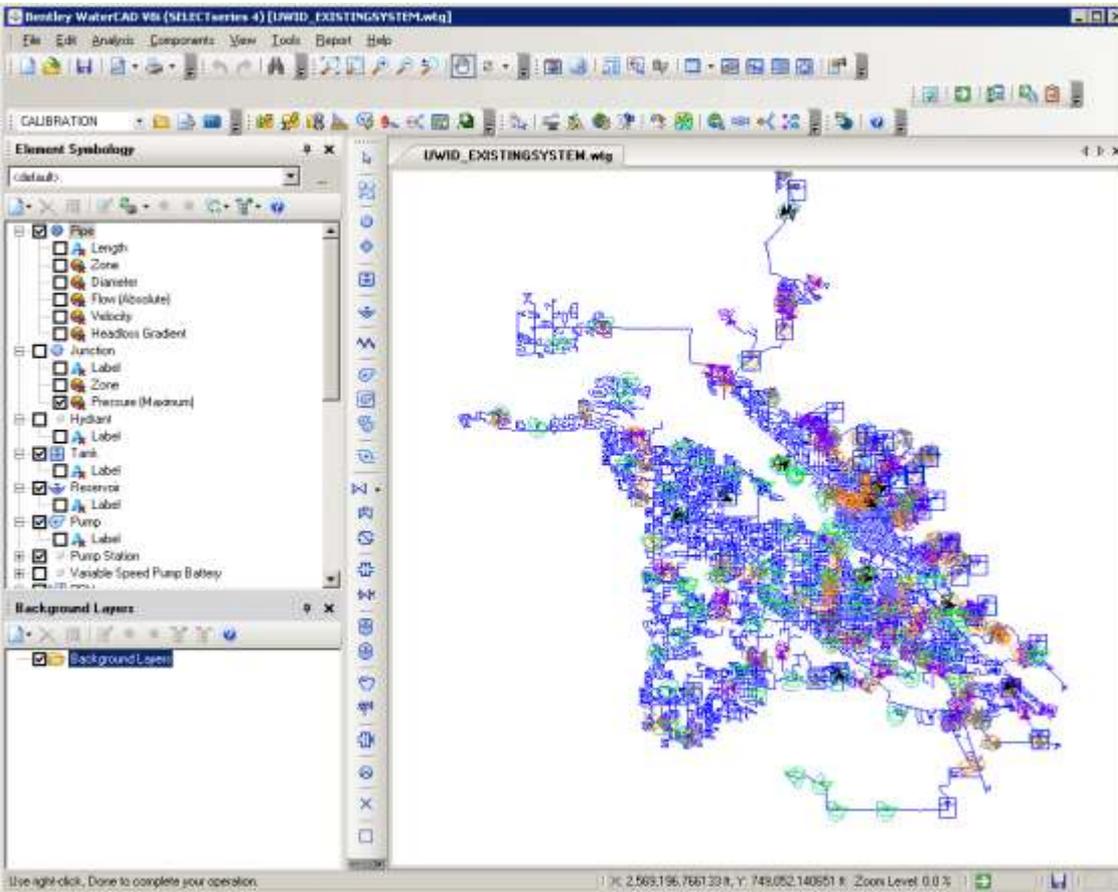
Based on 2013 inventory

Model Development

- The model updating process was based on the following sources of information
 - GIS database inventory
 - Pump curves
 - As-built drawings
 - Control/operation rules
 - Well production and flow test records

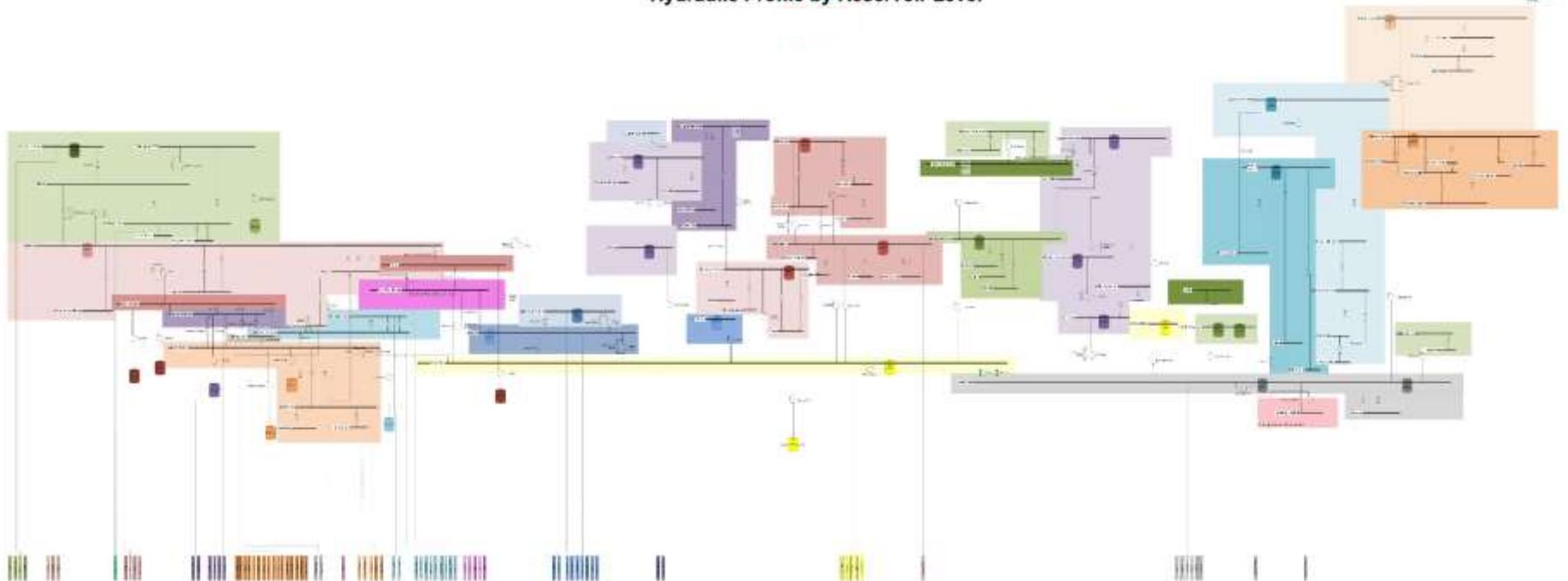
Summary:

- WaterCAD v8i
- Validation process using available SCADA data



Hydraulic Profile

Water Distribution System
Hydraulic Profile by Reservoir Level

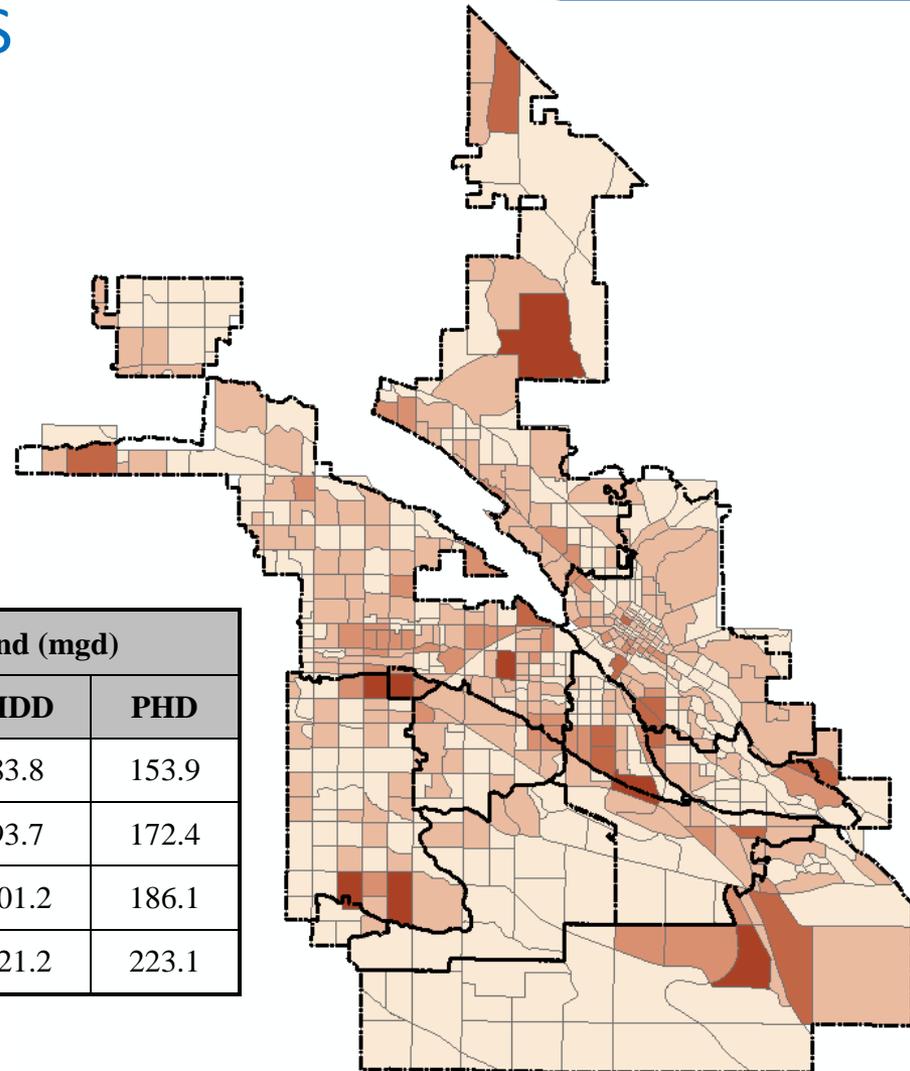
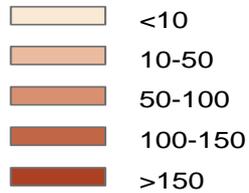


Water Demands

EXPECTED GROWTH - COMPASS

Expected Growth

Demand gpm



Planning Horizon	Demand (gpm)			Demand (mgd)		
	ADD	MDD	PHD	ADD	MDD	PHD
2013	28,600	58,200	106,800	41.2	83.8	153.9
2020	31,872	65,019	119,635	45.9	93.7	172.4
2025	34,416	70,209	129,184	49.6	101.2	186.1
2035	41,248	84,146	154,829	59.4	121.2	223.1

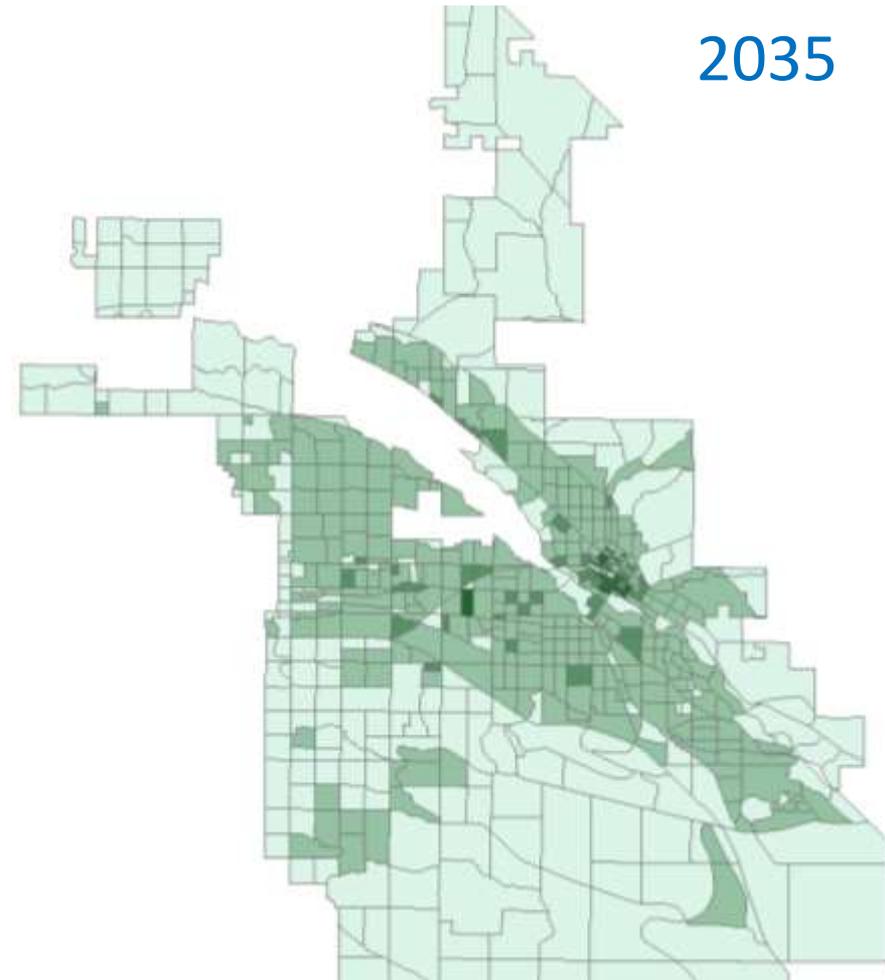
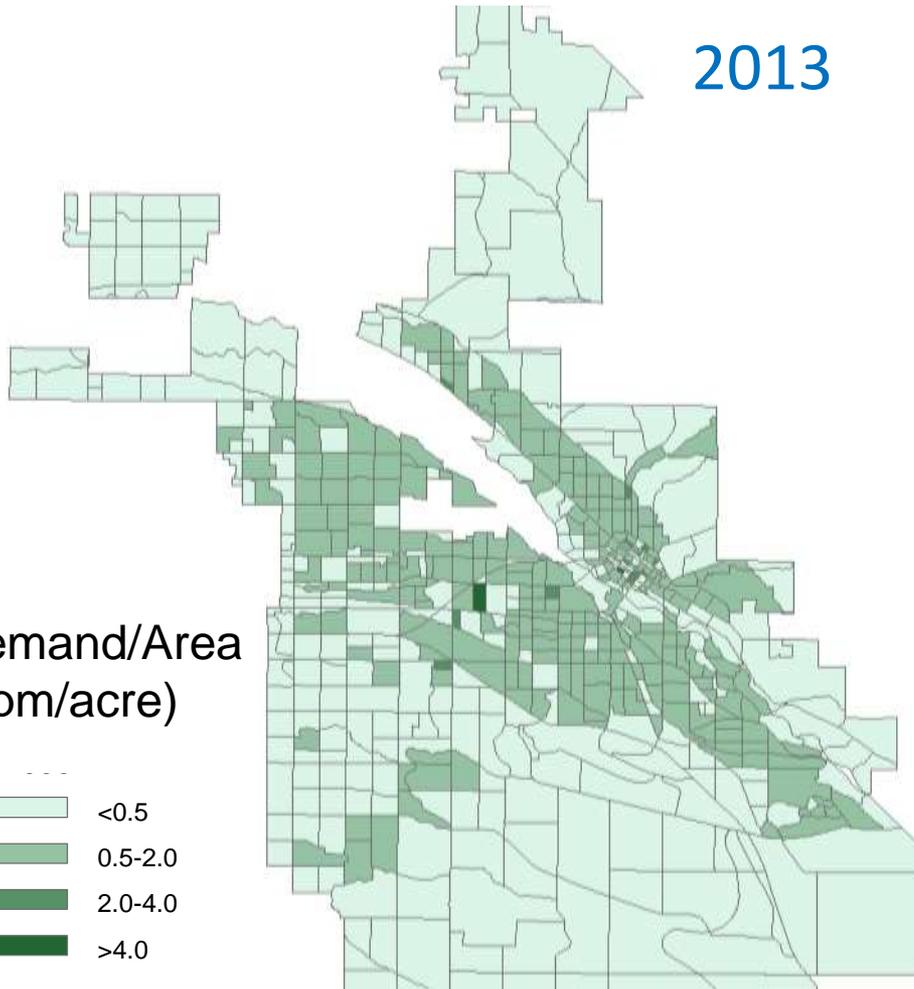
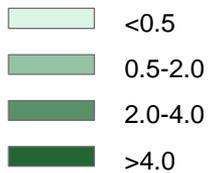
Demand Allocation

DEMAND ALLOCATION (Normalized by Area)

2013

2035

Demand/Area
(gpm/acre)



Due to the

- Number of pressure zones (90+)
- Number of facilities (160+)
- Interconnected nature of the system

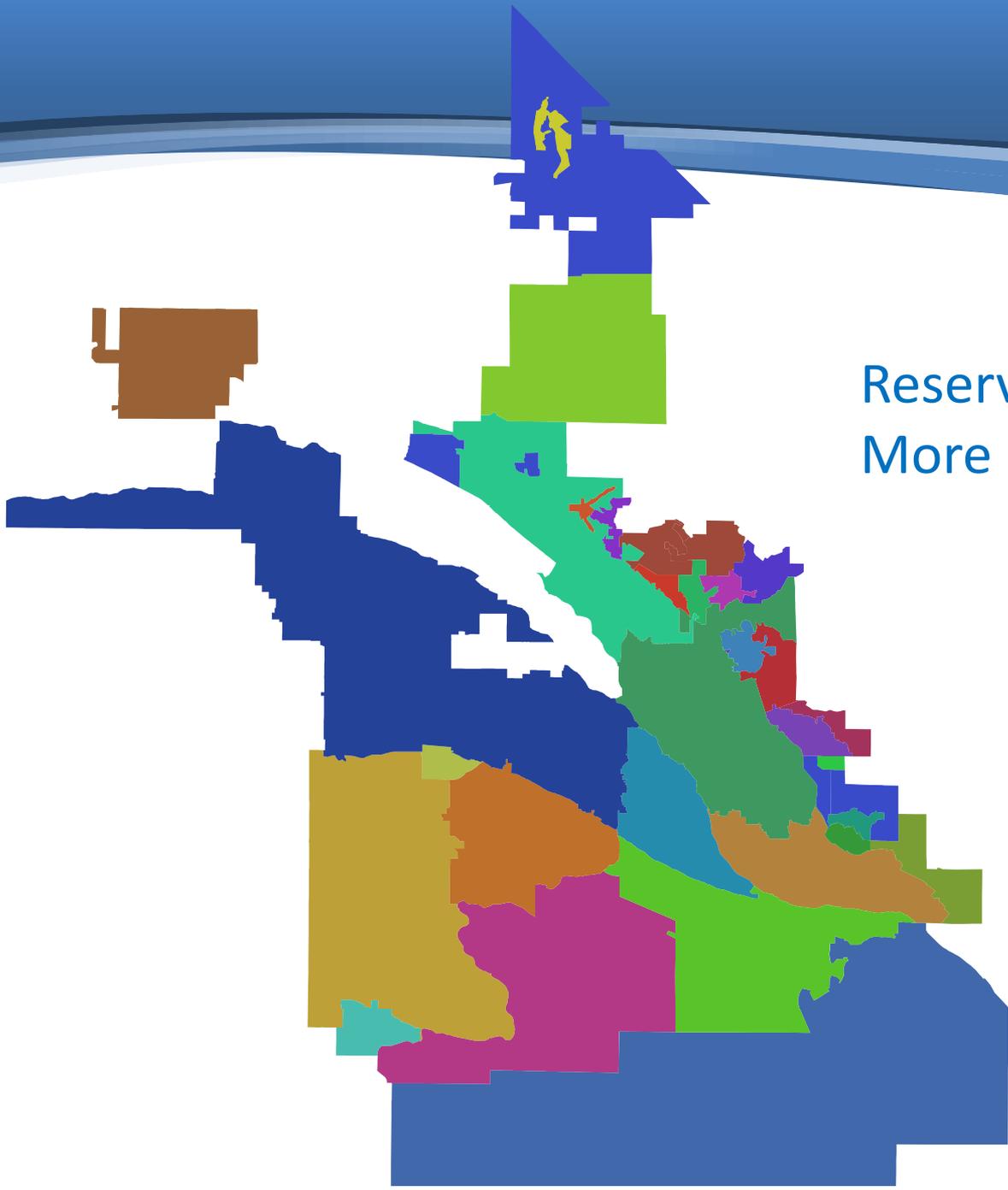
a rigorous and structured analysis approach was required

Analysis Units



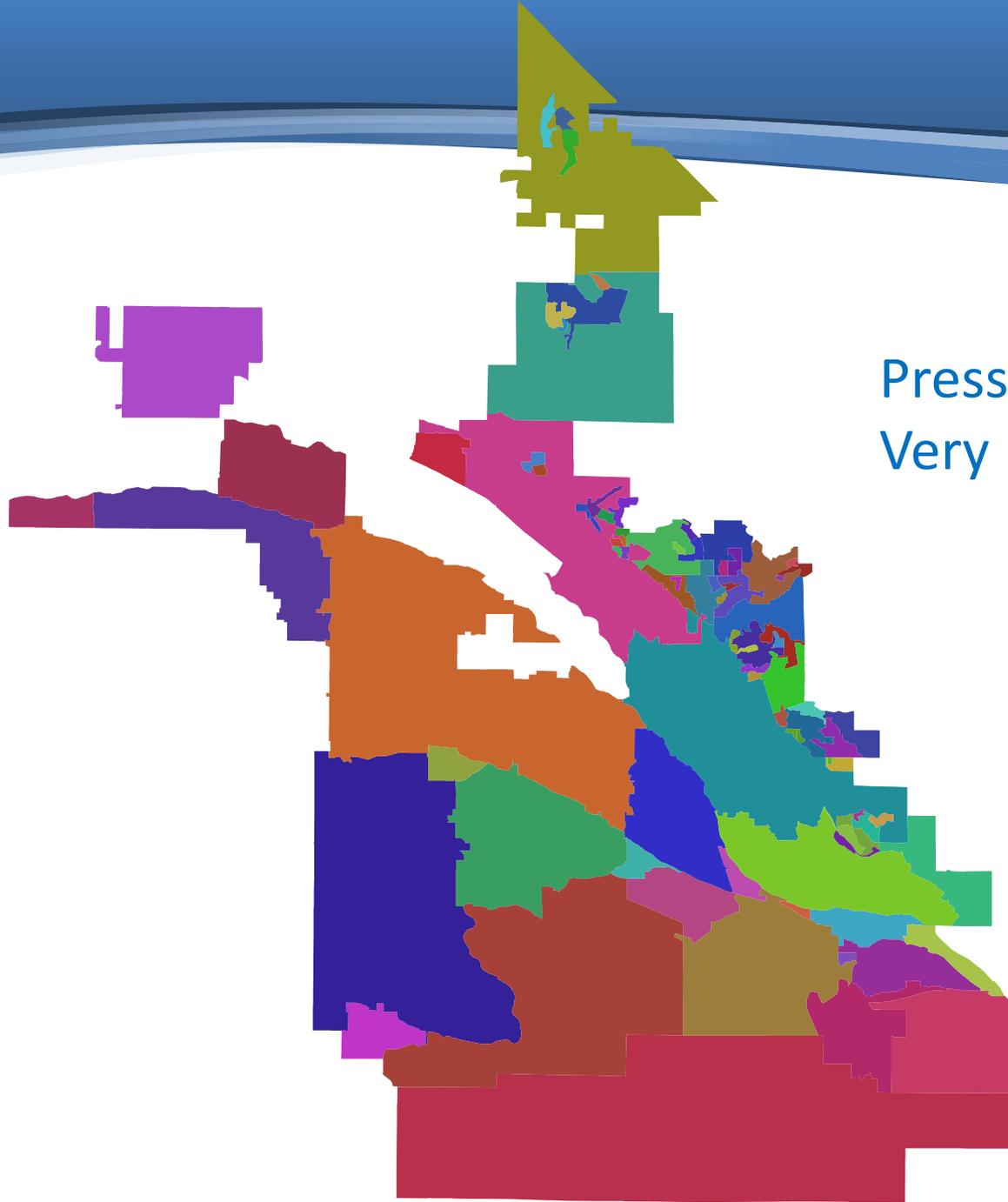
Service/Supply Levels
Big Picture

Analysis Units



Reservoir Levels
More Detailed

Analysis Units



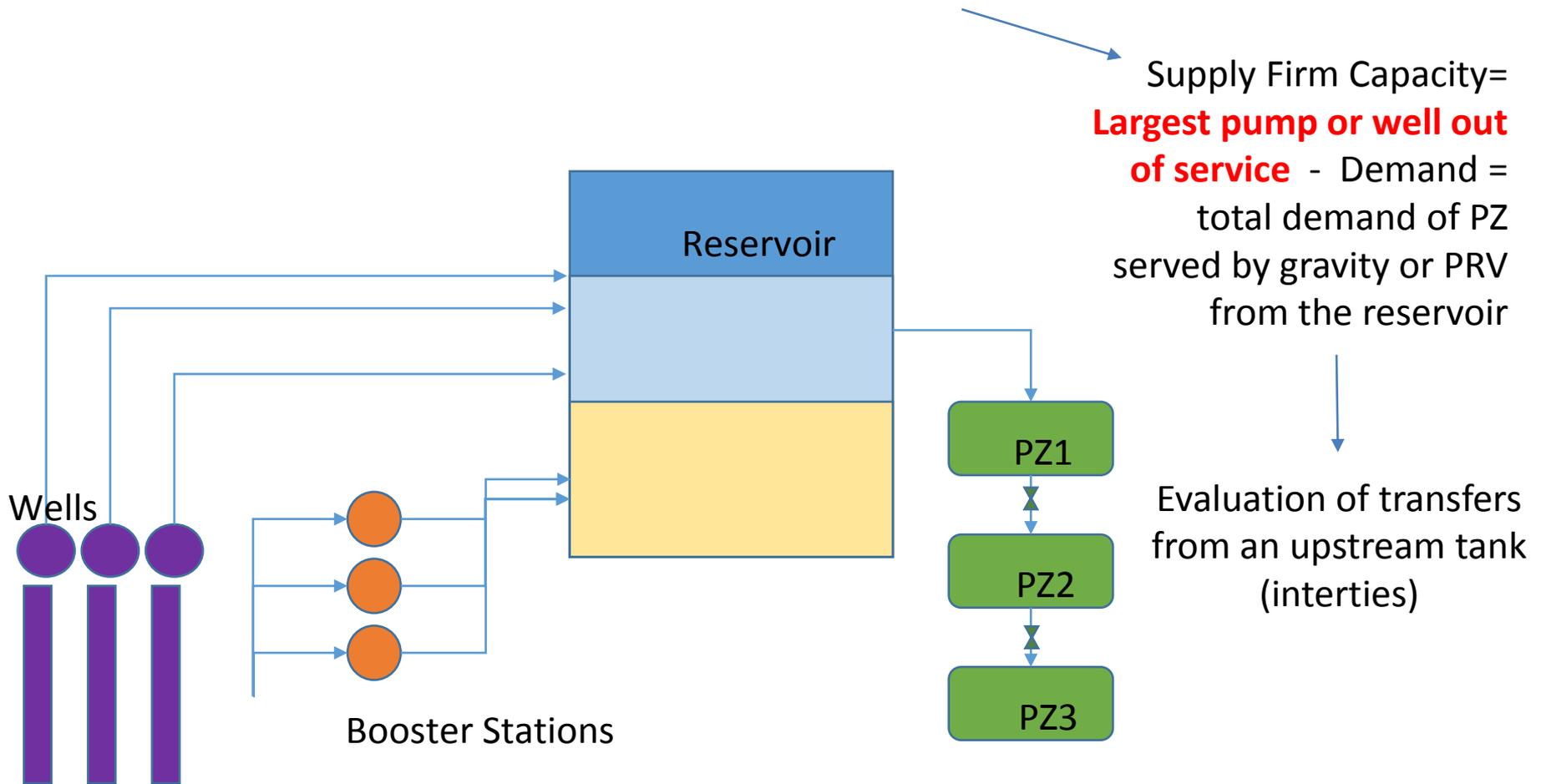
Pressure Zones
Very Detailed

System Analysis

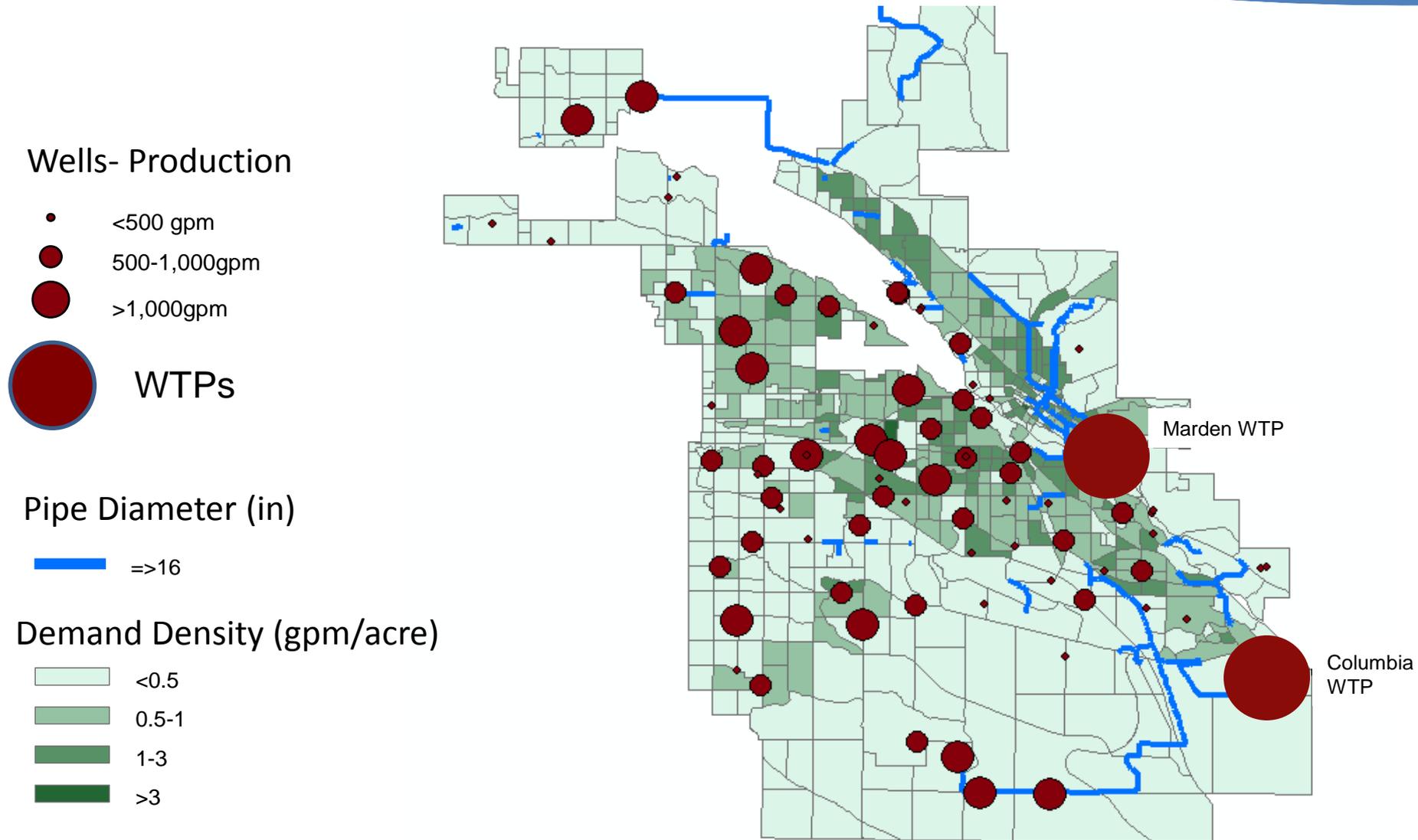
Section	Evaluation	Evaluation Area	Methodology	Planning Horizons
1	Supply	Supply Levels (10)	Excel table/Inventory vs. required	Existing, 2020,2025,2035
2	Storage	Reservoir Levels (34)	Excel table/Inventory vs. required	Existing, 2020,2025,2035
3	Pumping Capacity	Pumped Levels (21)	Excel table/Inventory vs. required	Existing, 2020,2025,2035
4	Pipe Capacity	Pressure Zone (90)	Hydraulic model simulations	Existing, 2035

Supply Capacity Evaluation

Supply Firm Capacity vs. Demand



Supply Evaluation | Existing Supply Location

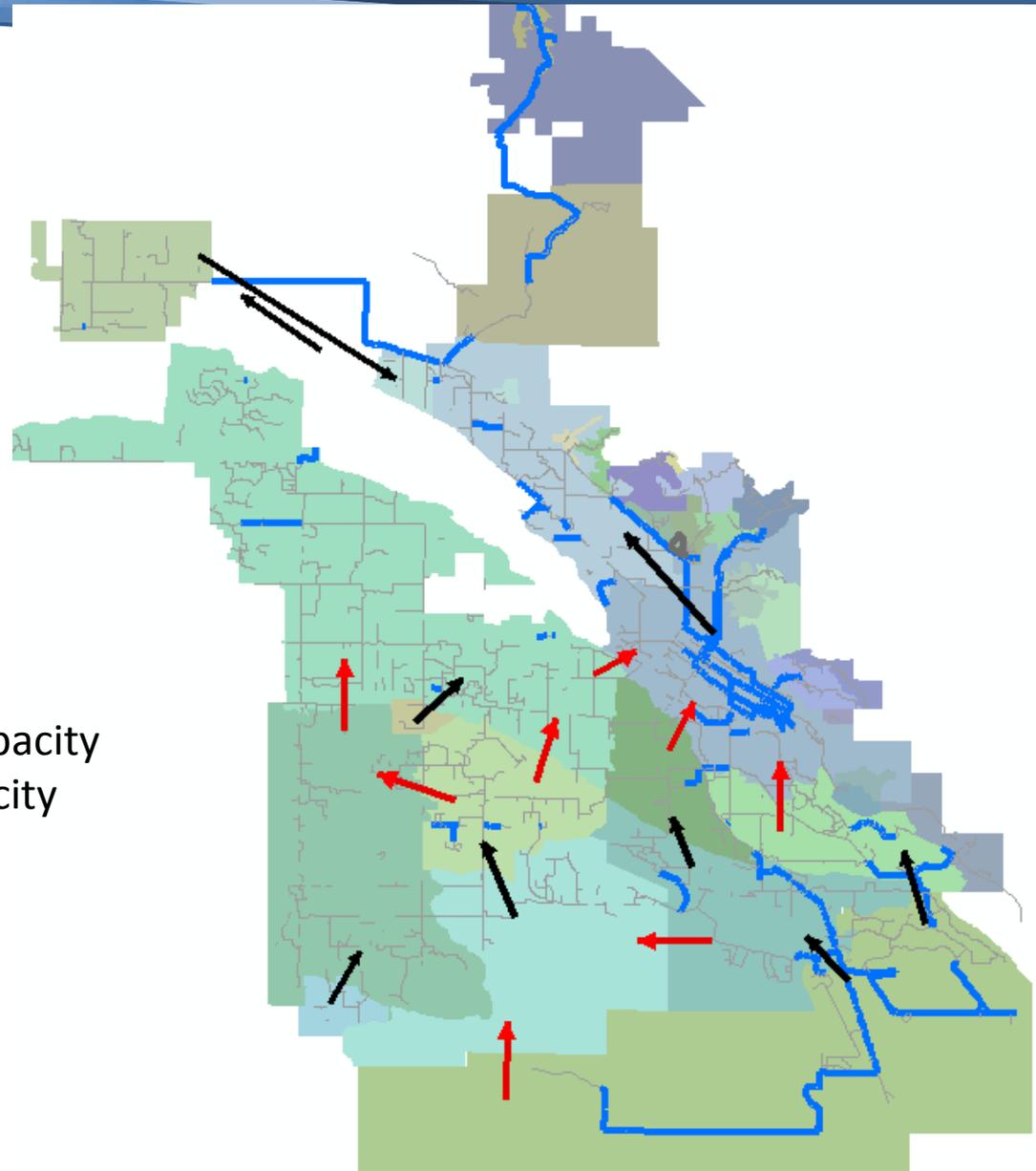


Supply Evaluation

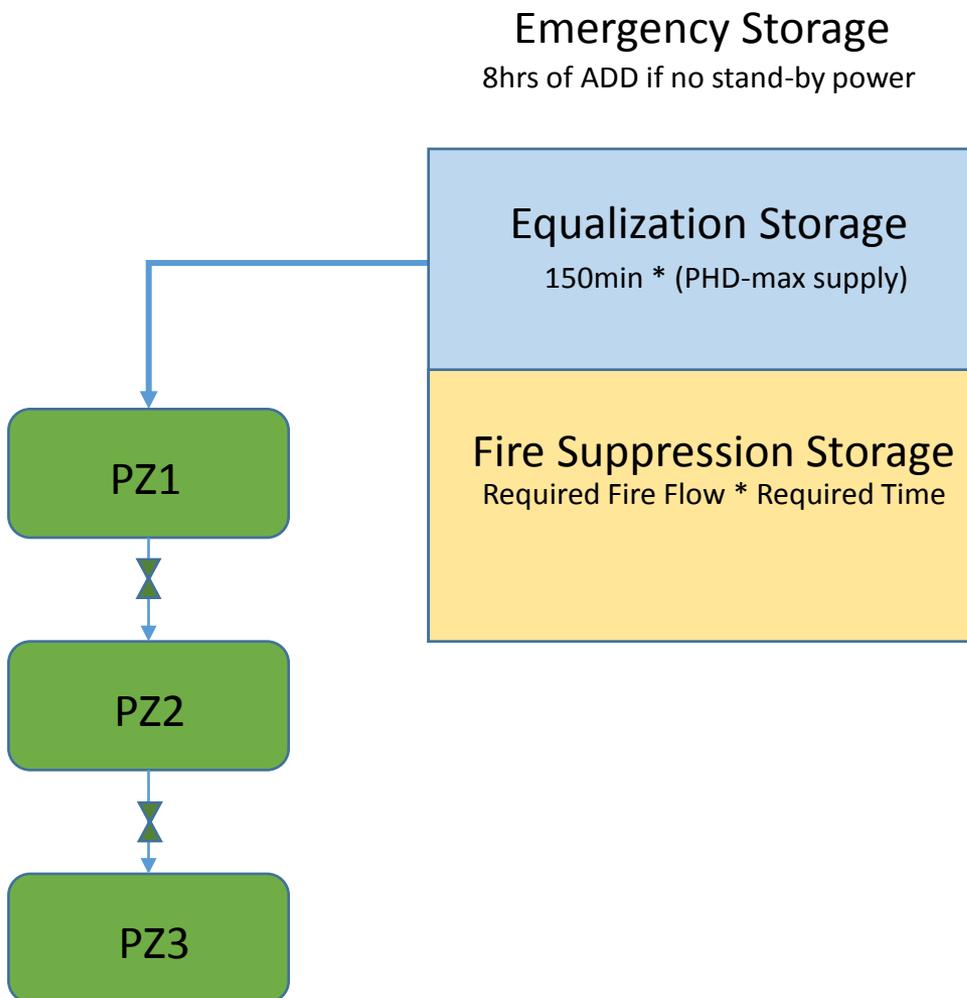
Available supply/ storage from higher supply levels: based on conveyance

- Adequate conveyance capacity
- Limited conveyance capacity

Foothills Systems are part of the Hulls Gulch or GoodStreet/Hidden Hollow supply levels



Storage Capacity Evaluation



Required vs. Existing Usable Storage
(Existing Usable Storage: available volume above a level that will provide the pressures above the minimum during peak demand conditions)

↓
Deficiency

↓
Evaluation of alternatives for fire flow (fire pump on a supply pump station)

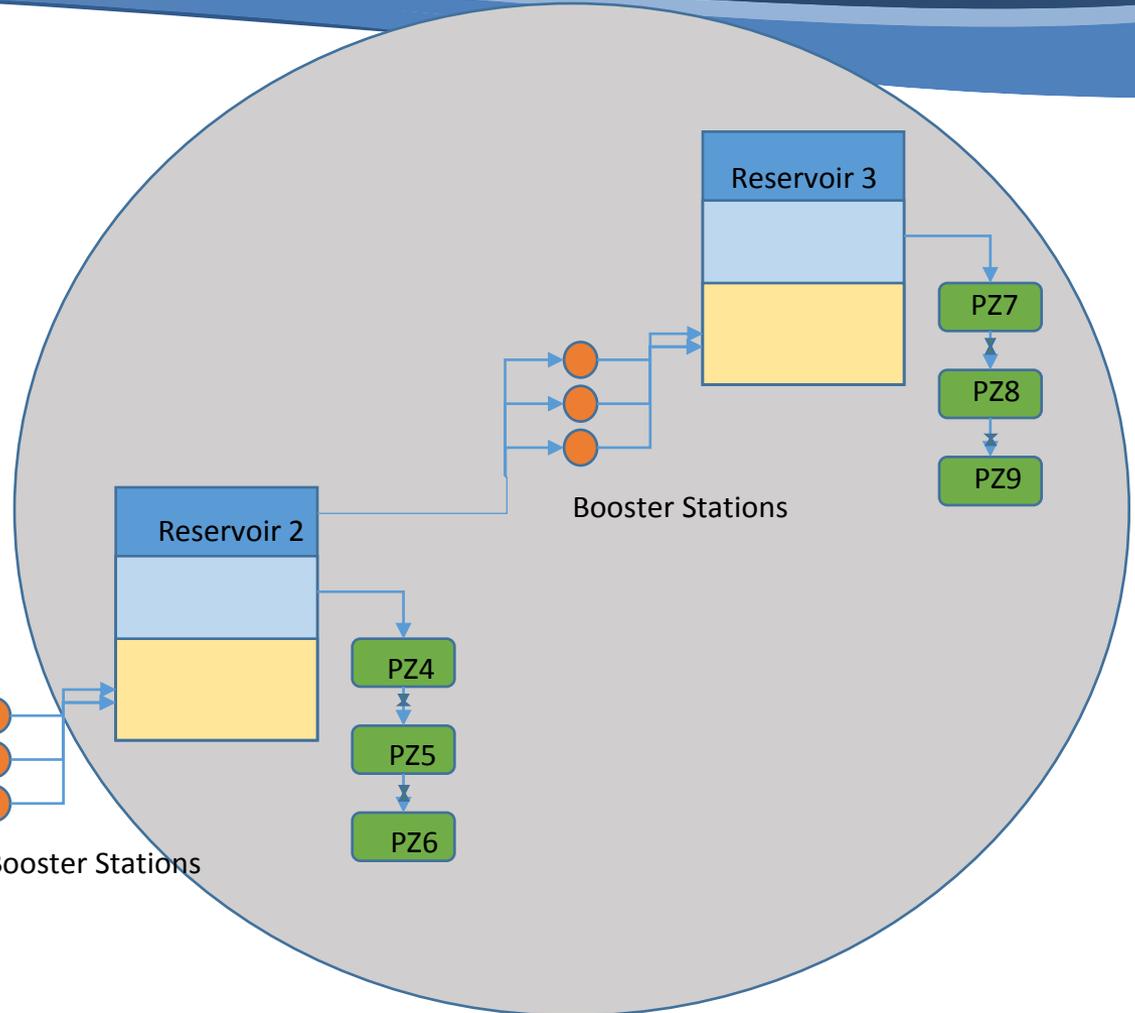
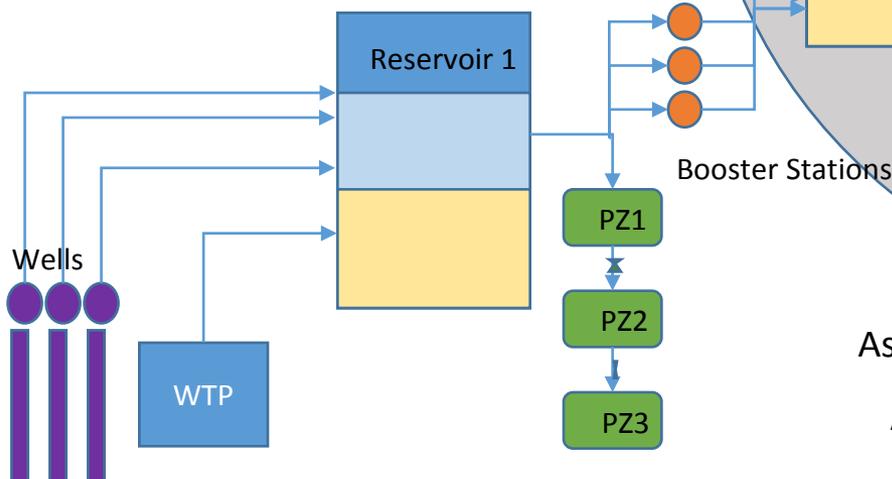
↓
Evaluation of transfers from a higher tank

Storage: Existing – 2035 Deficiencies

- 4 Locations - Addressed by Supplementing Storage from a Higher Reservoir Level
- 13 Locations - Addressed by Pumping Improvements or Additional Storage
- 2 Locations - Requiring Additional Storage

Pumping Analysis

Pumping Capacity Evaluation - Foothills Systems



Associated Demand for Reservoir 1 Supply = PZ1+...+PZ9

Associated Demand for Booster Station 2 = PZ4+...+PZ9

Associated Demand for Booster Station 3 = PZ7+...+PZ9

Summary of Supply/Storage/Pump Station Deficiencies

DEFICIENCIES	EXISTING	2020-2035
Additional Supply (location)	3	4
Additional Storage	1	1
New Pump Station	3	0
Pump Station Capacity Upgrade	5	2
Pump Station Upgrade as Alternative to Storage	7	0

**** Recommendations based on existing conveyance restrictions ****

Pipe Capacity Evaluation

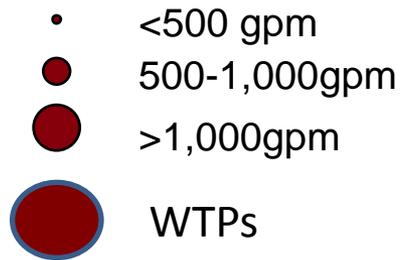
- Existing and 2035 deficiencies for
 - Overall Transmission Grid
 - MDD & PHD
 - Fire flow
 - Reservoir Refill

Based on hydraulic model simulations

Transmission Evaluation

Supply Location vs. Transmission Network

Wells- Production

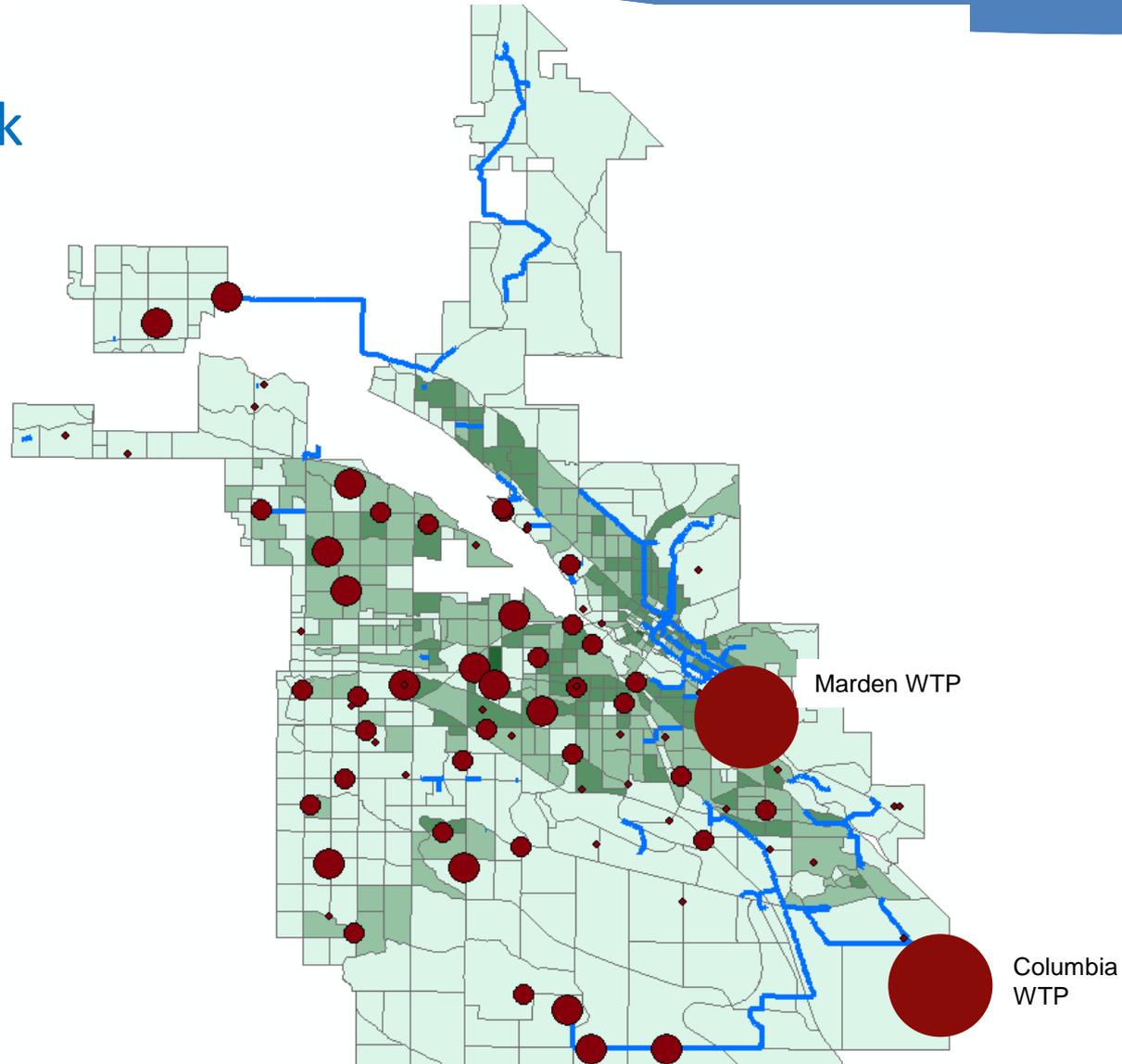
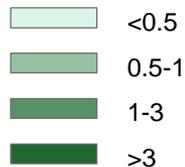


Pipe Diameter (in)



Demand Allocation

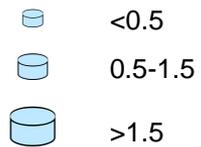
Density (gpm/acre)



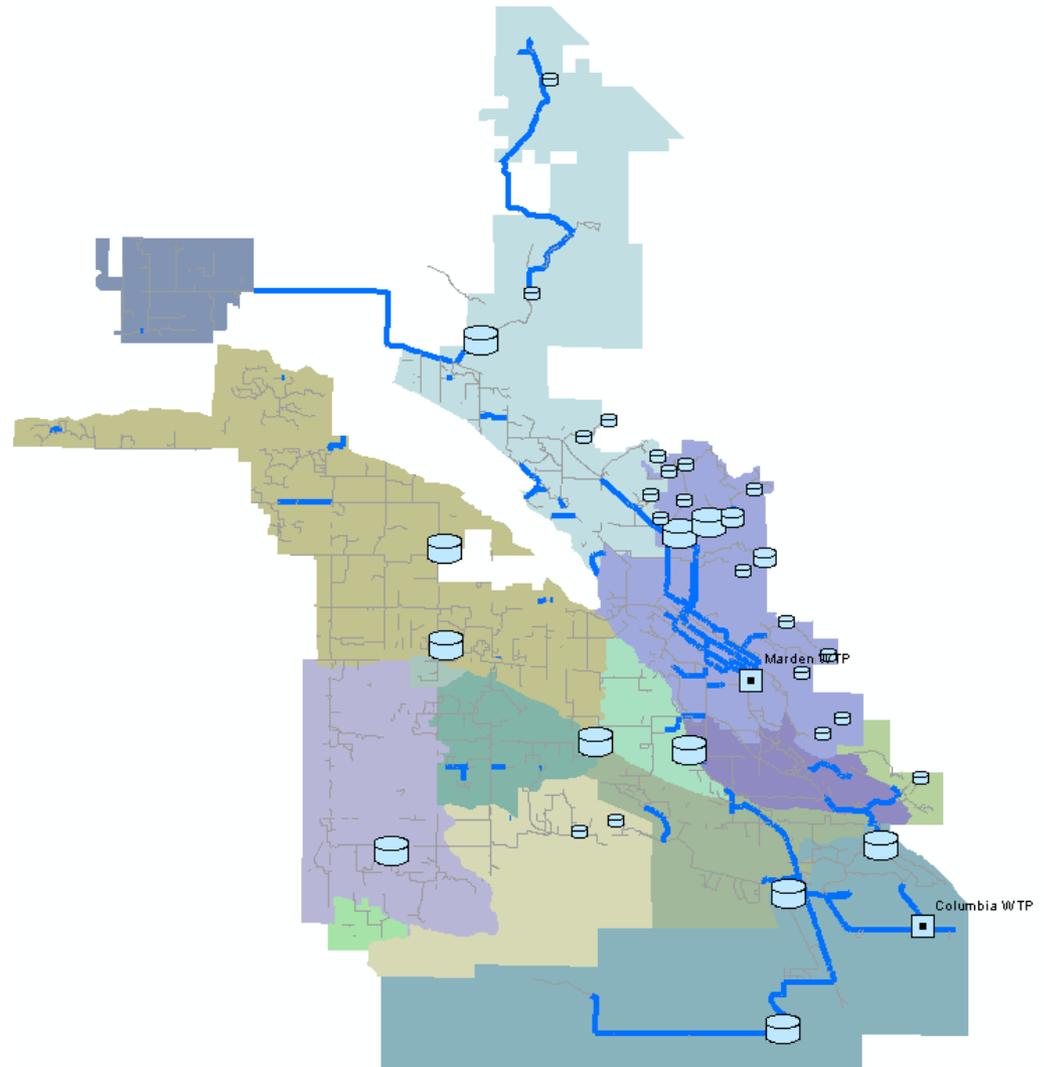
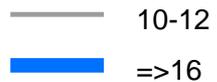
Transmission Evaluation

Storage location vs. transmission network

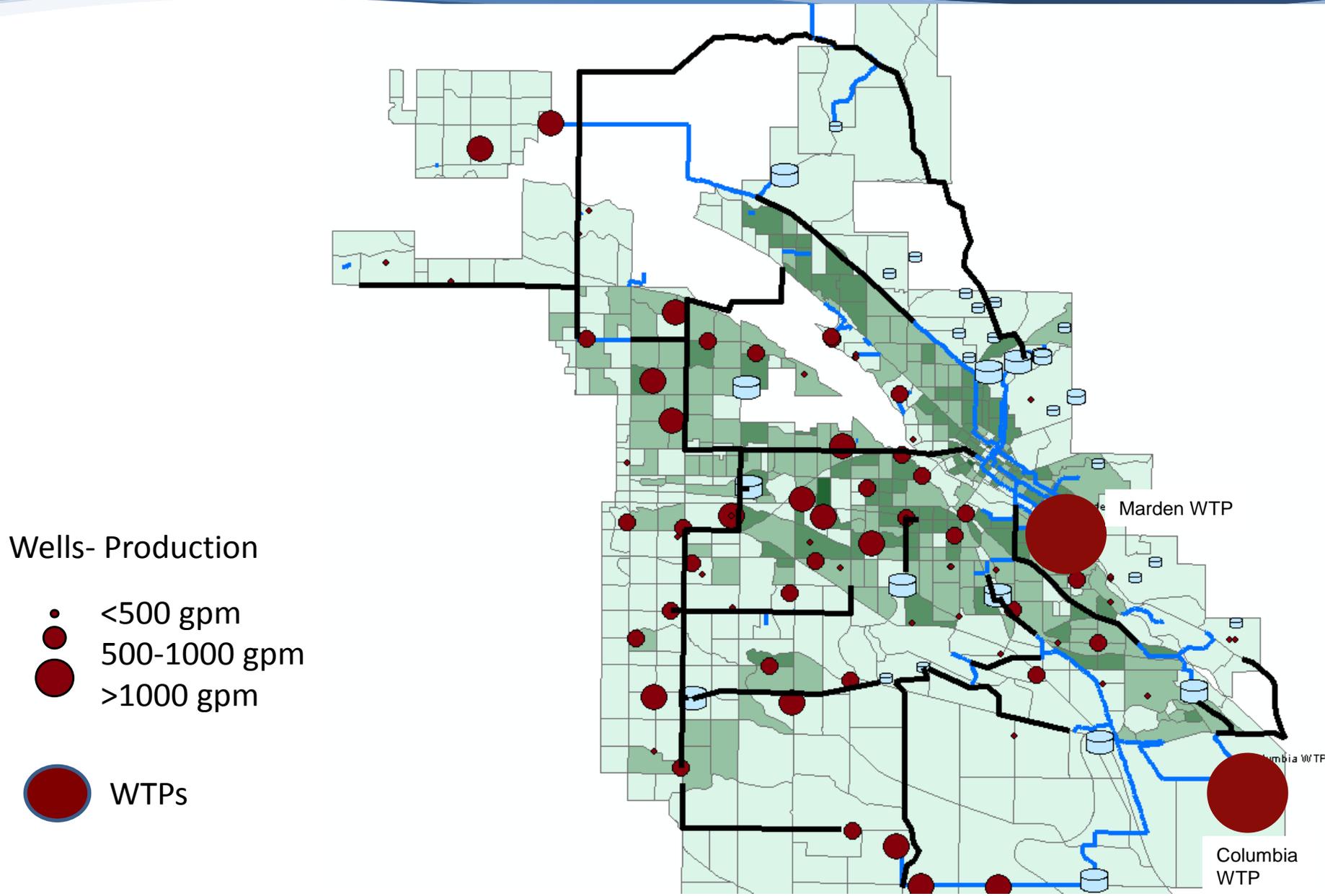
Tank Volume (MG)



Pipe Diameter (in)



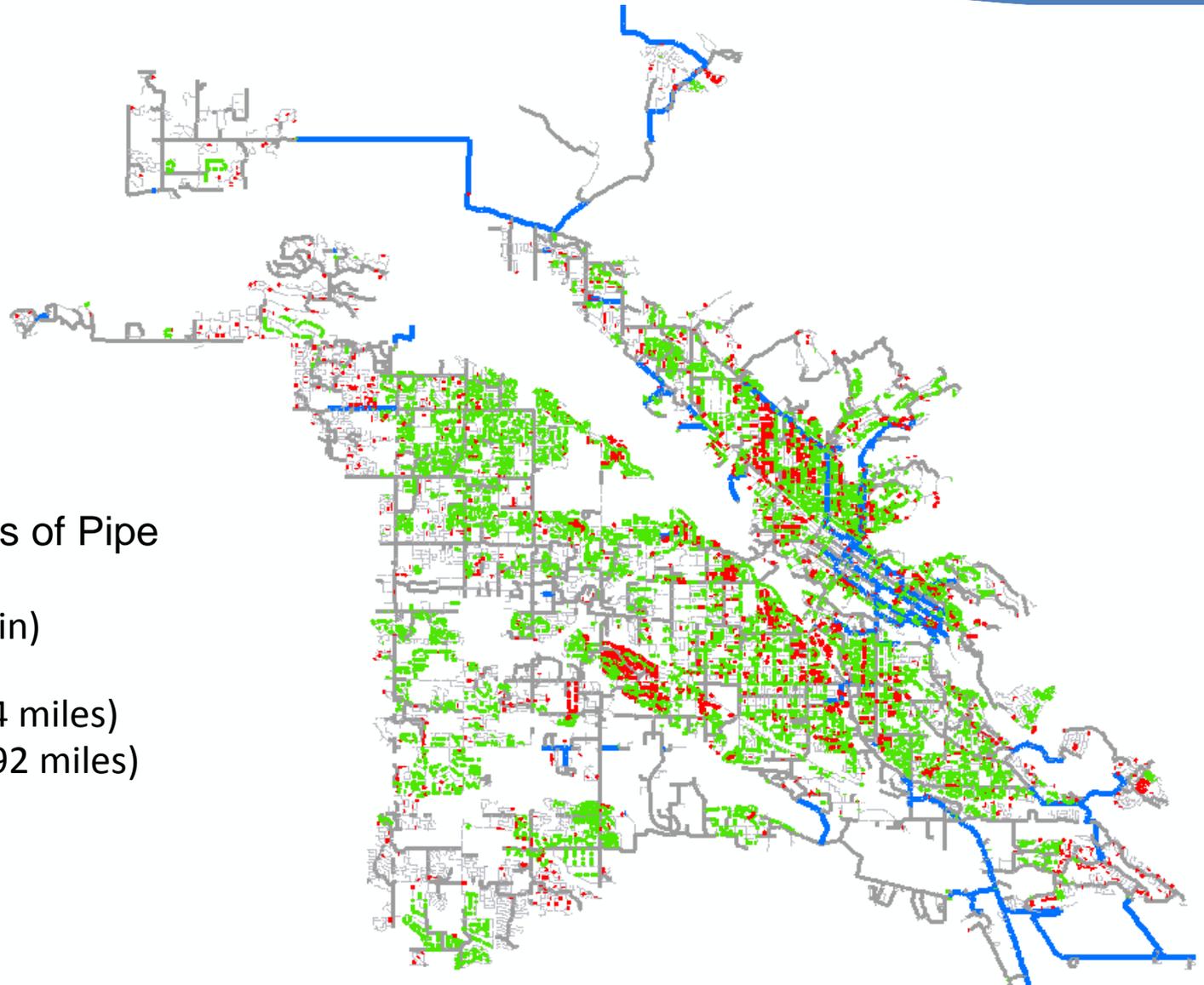
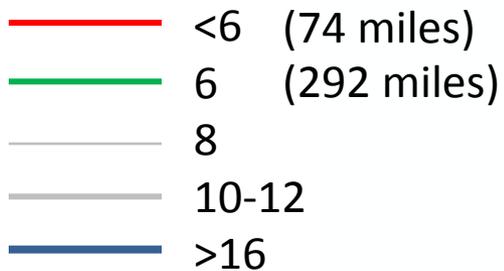
Transmission Evaluation – Conceptual Network



Small Pipes

1,200 Total Miles of Pipe

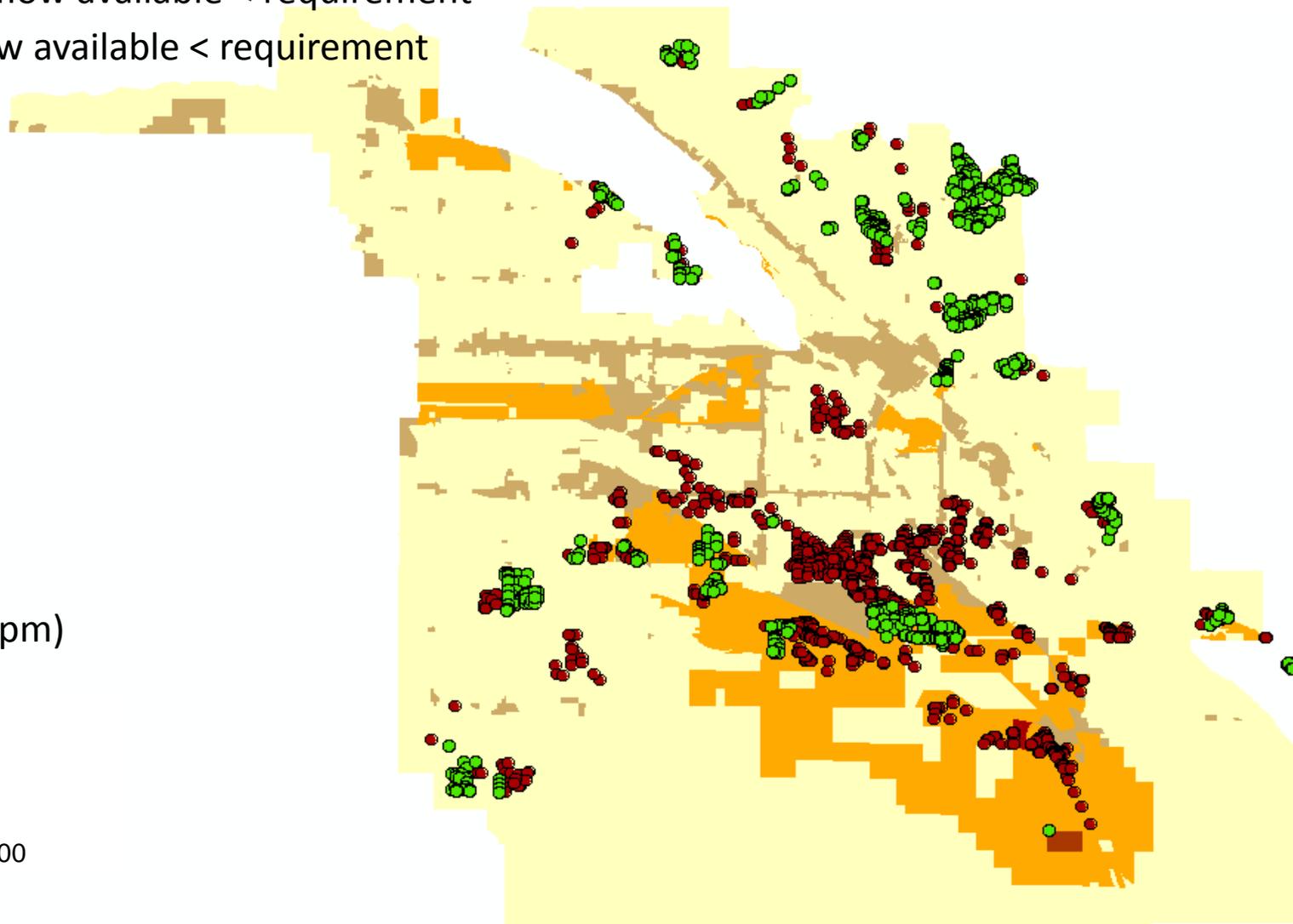
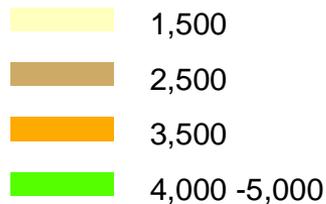
Pipe Diameter (in)



Fire Flow Deficiency Locations

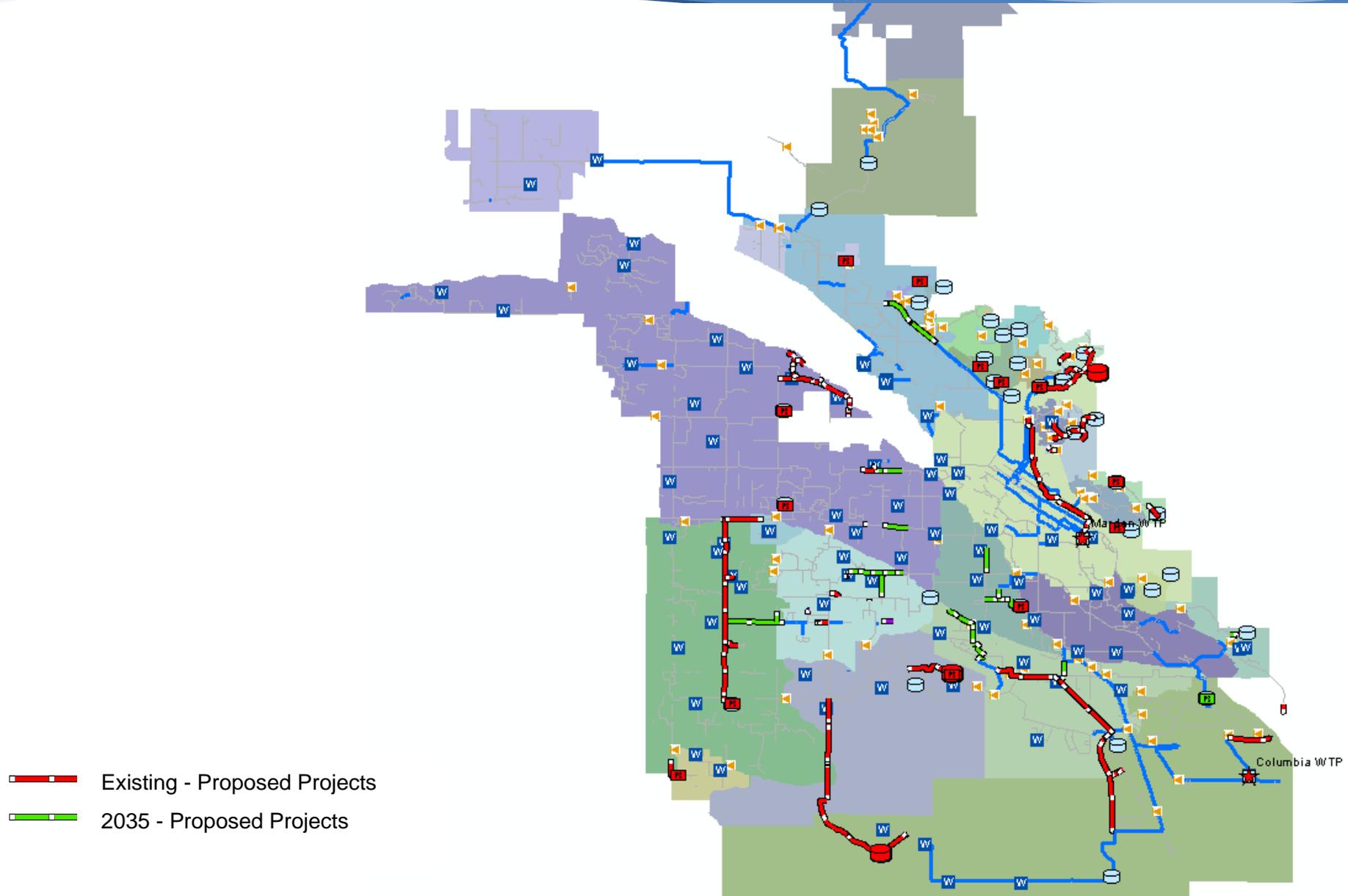
- Existing Fire flow available < requirement
- 2035 Fire flow available < requirement

Fire Flow Requirement (gpm)



- Improvements sized to serve 2035 demands
- Pipe improvements sized using standard pipeline diameters: 8, 12, 16, 24, 30, and 36 inches.
- No pipe improvements smaller than 8-inch
- Costs for water treatment plant improvements were provided by UWI

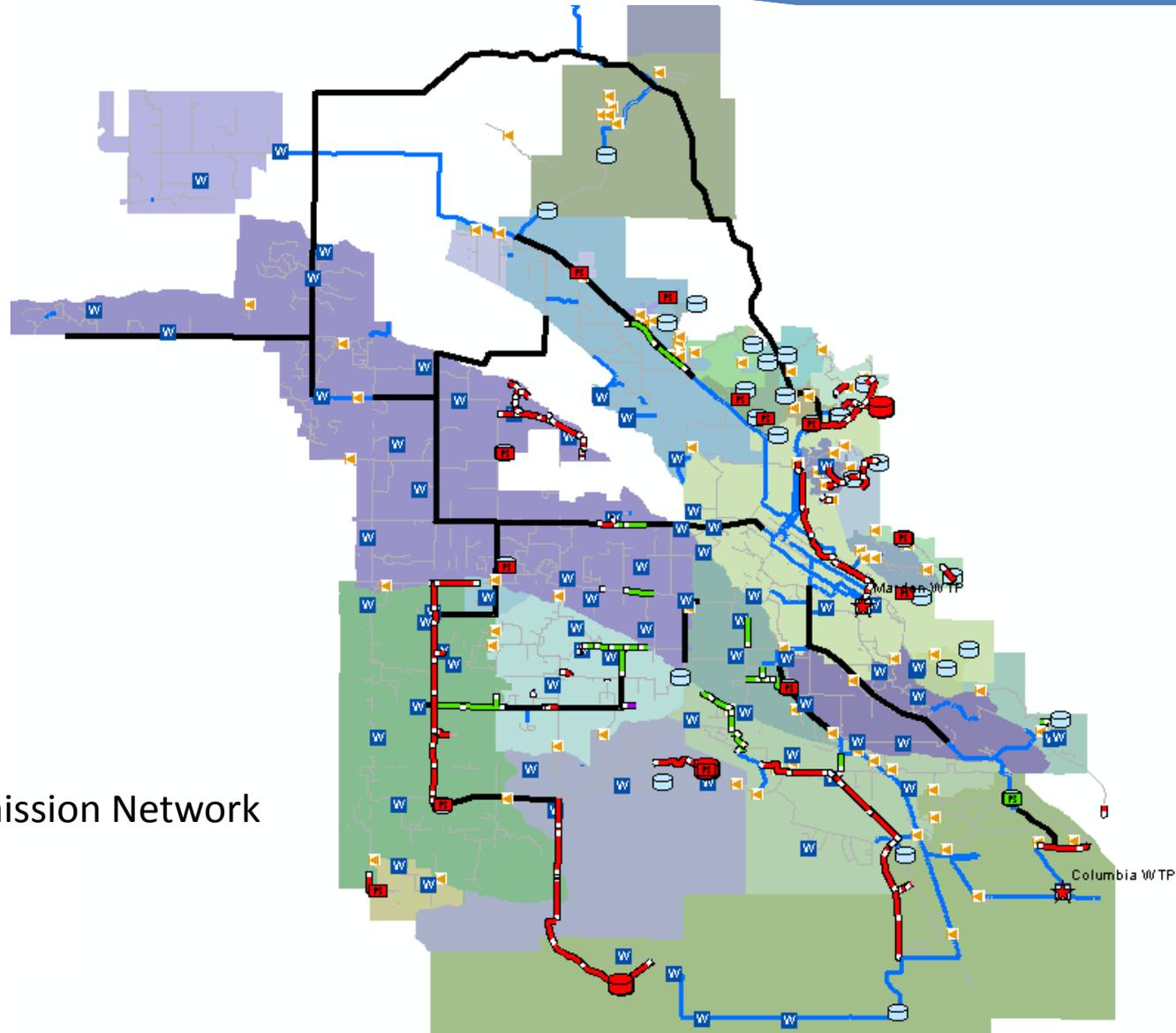
Proposed Solutions | Existing , 2035



Future Options

Additional transmission improvements could reduce future supply needs

- Conceptual Transmission Network
- Existing - Proposed Projects
- 2035 - Proposed Projects



- Proposed 5 year CIP includes:
 - Expansion of both Marden and Columbia WTPs
 - 3 new storage reservoirs
 - 13 pump projects (upgrade, replacement or new facilities)
 - 31 pipe projects (transmission and distribution, approx. 23miles)

- Proposed 20 year CIP includes:
 - Expansion of both Marden and Columbia WTPs
 - 3 new wells
 - 5 pump projects (upgrade, replacement or new facilities)
 - 29 pipe projects (transmission and distribution, approx. 17miles)

Unique Challenges

- Number of zones and facilities
- First comprehensive modeling effort
 - First combined system model
- What level of supply redundancy should be used
 - e.g. How many facilities out of service at once
- Fire flow requirements
 - Generally higher than what the system was designed for
- Overall lack in transmission between
 - Pressure Zones
 - Sources of supply (wells, WTPs, boosters)
 - Storage facilities

Unique Challenges

- New source recommendations were based on the ability to supply several reservoir levels from a single location
- Interconnected nature of the system is a plus; however, makes analysis challenging
- CIP recommendations were based several factors:
 - Localized issues
 - Larger scale concepts
 - Solving more than one deficiency

- Execute Improvement Projects
- UWI to bring operation of model in-house
- Continue to improve accuracy of the information
- Use for planning and design support

- Questions

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