

A ROCK IN THE RIVER:

Navigating obstacles in the quest for energy efficiency at Hannah Mason Pump Station

Presented by:

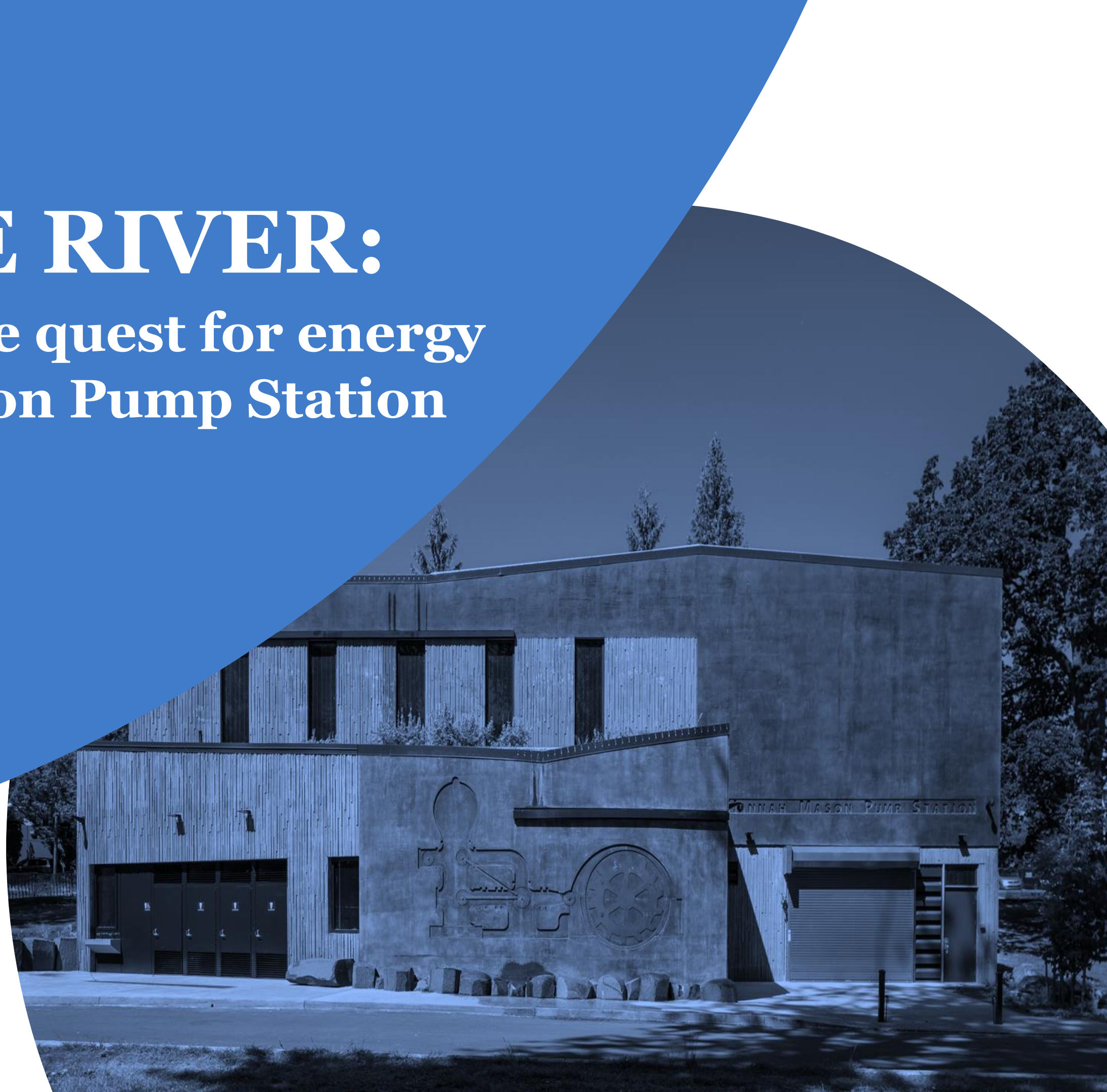
Keith Walker, Portland Water Bureau

Kate Conrad, Murraysmith

Eddie Kreipe, Murraysmith



murraysmith



Agenda



- 01 Background, Service Area, & Energy Efficient Opportunities
- 02 Design Requirements and Public Involvement
- 03 Building & Site Design Challenges
- 04 Creative Solutions
- 05 Energy Efficient Pump Station and Pump/Drive Selection
- 06 Pump Control Valves and Other Design Discussions
- 07 Conclusions and Q&A



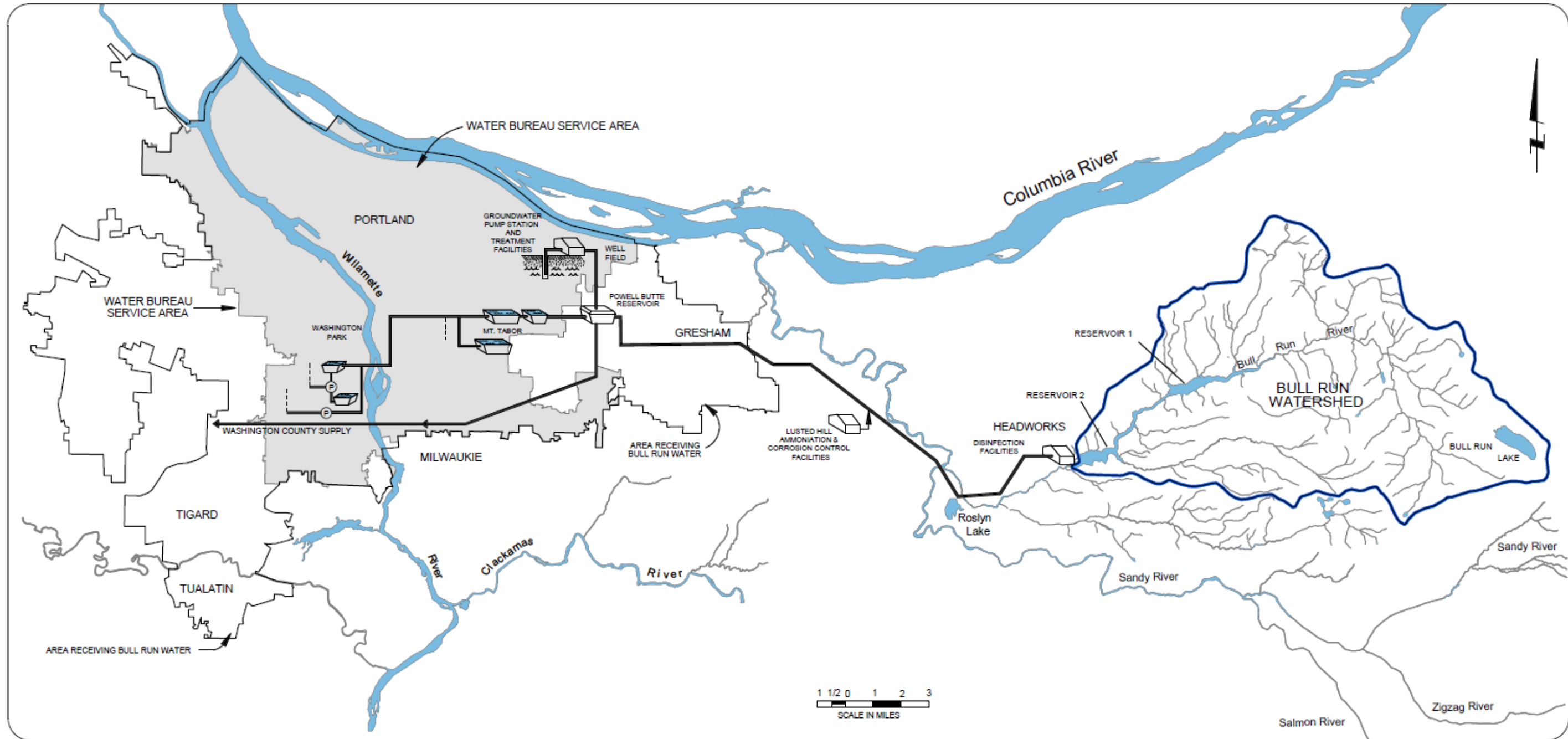
History & Design Compact

- Replace the 100-year-old Fulton Pump Station
- Primary supply for SW Portland, over 15,000 services
- Distribution System Master Plan listed as “highest priority”
- Seismically Inadequate
- Tax lot cannot be enlarged





System Overview





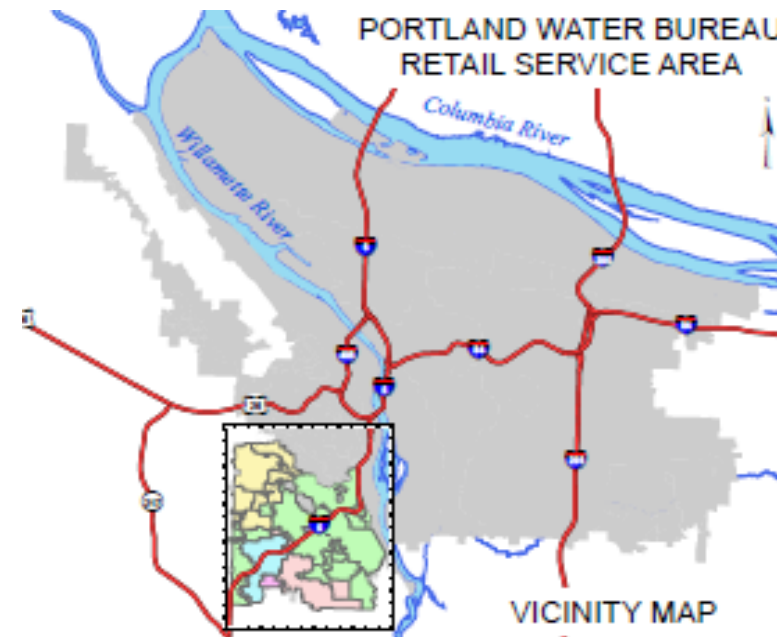
15,800 Water Services

Neighborhoods

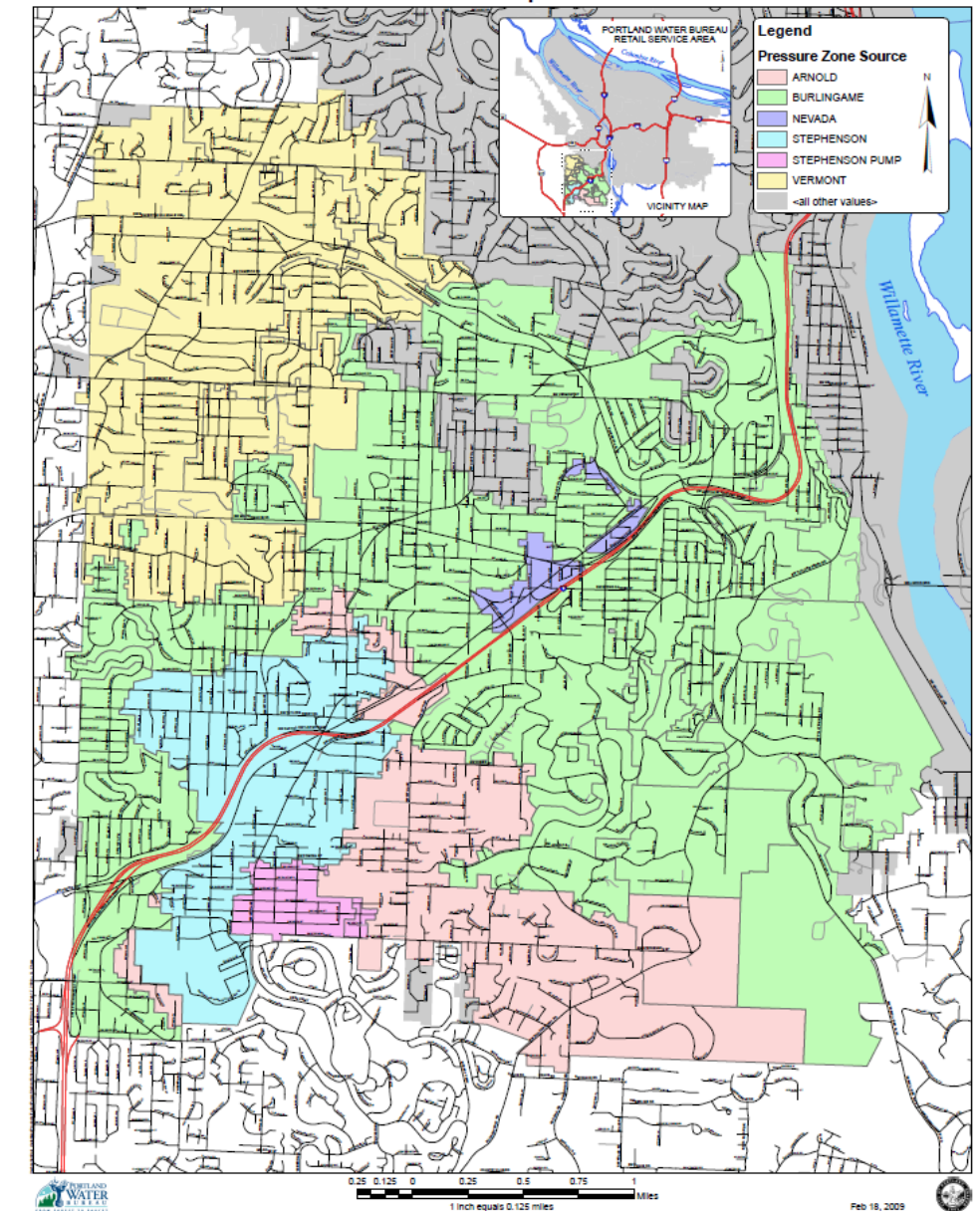
- Arnold Creek
- Ashcreek
- Bridlemile
- Collinsview
- Crestwood
- Far Southwest
- Garden Home/Raleigh Hills
- Hayhurst
- Hillsdale
- Maplewood
- Markham
- Marshall Park
- Multnomah
- South Burlingame
- West Portland Park

Wholesale Customers:

- TVWD
- Valley View WD
- Lake Grove WD
- City of Tigard and Lake Oswego

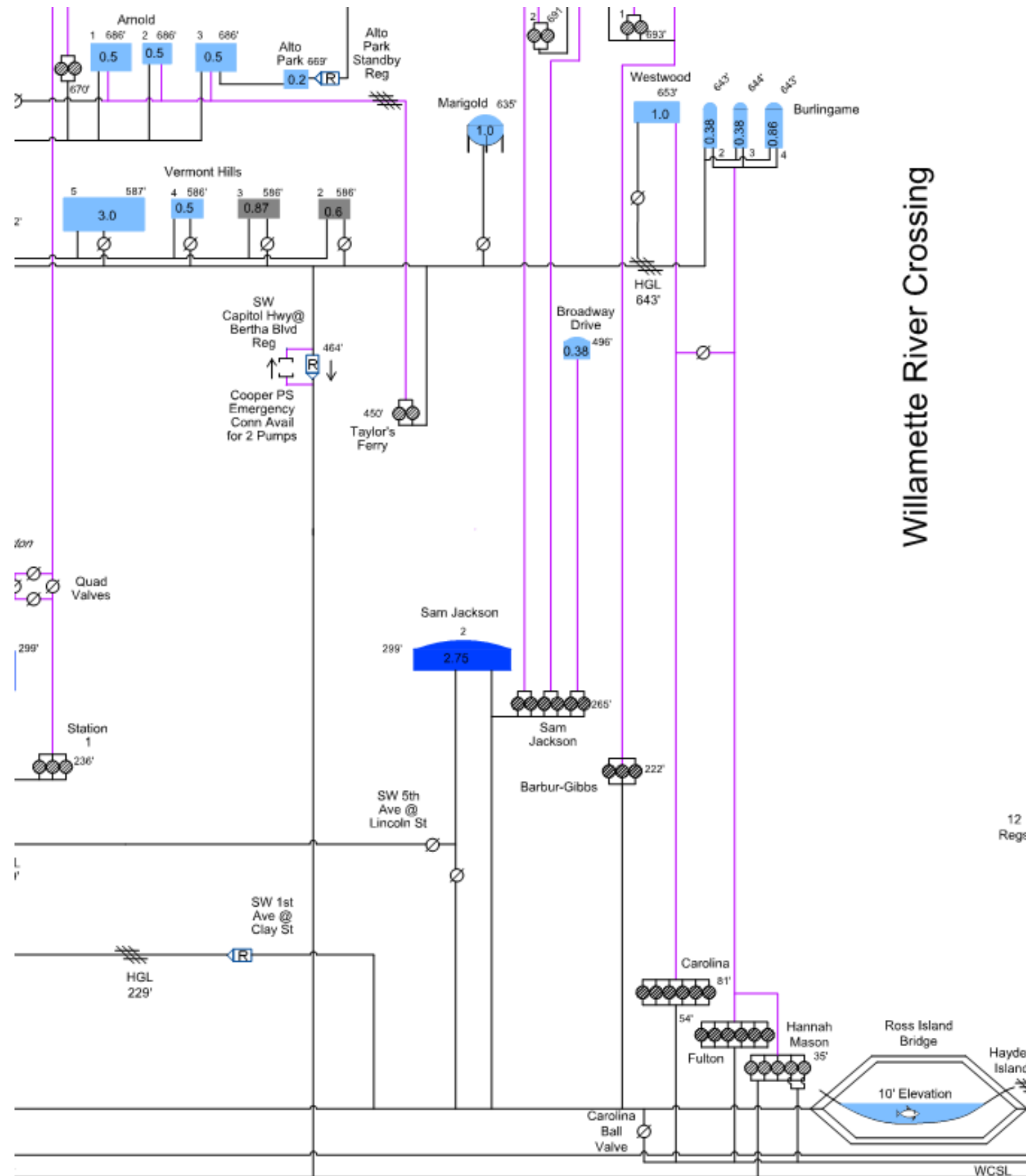


Pressure Zones Fed by
Fulton Pump Station





Burlingame Cascade: Distributed Storage



- Burlingame (3 tanks @ 1.5mg)
- Westwood (1mg)
- Marigold (1mg)
- Vermont Hills (4 tanks @ 5mg)
- Stephenson (2 tanks @ 1.1mg)
- Arnold (3 tanks @ 1.5mg)



Solution Requirements

- Acceptance (Public Involvement)
- Sense of Place (Zoning)
- Permanence (Architectural)
- Performance (Design)
- Continuing Savings (ETO)
- Functional Design Criteria
 - Pumping BEP Range
 - Leverage NPSH
 - Structure & Floodplain

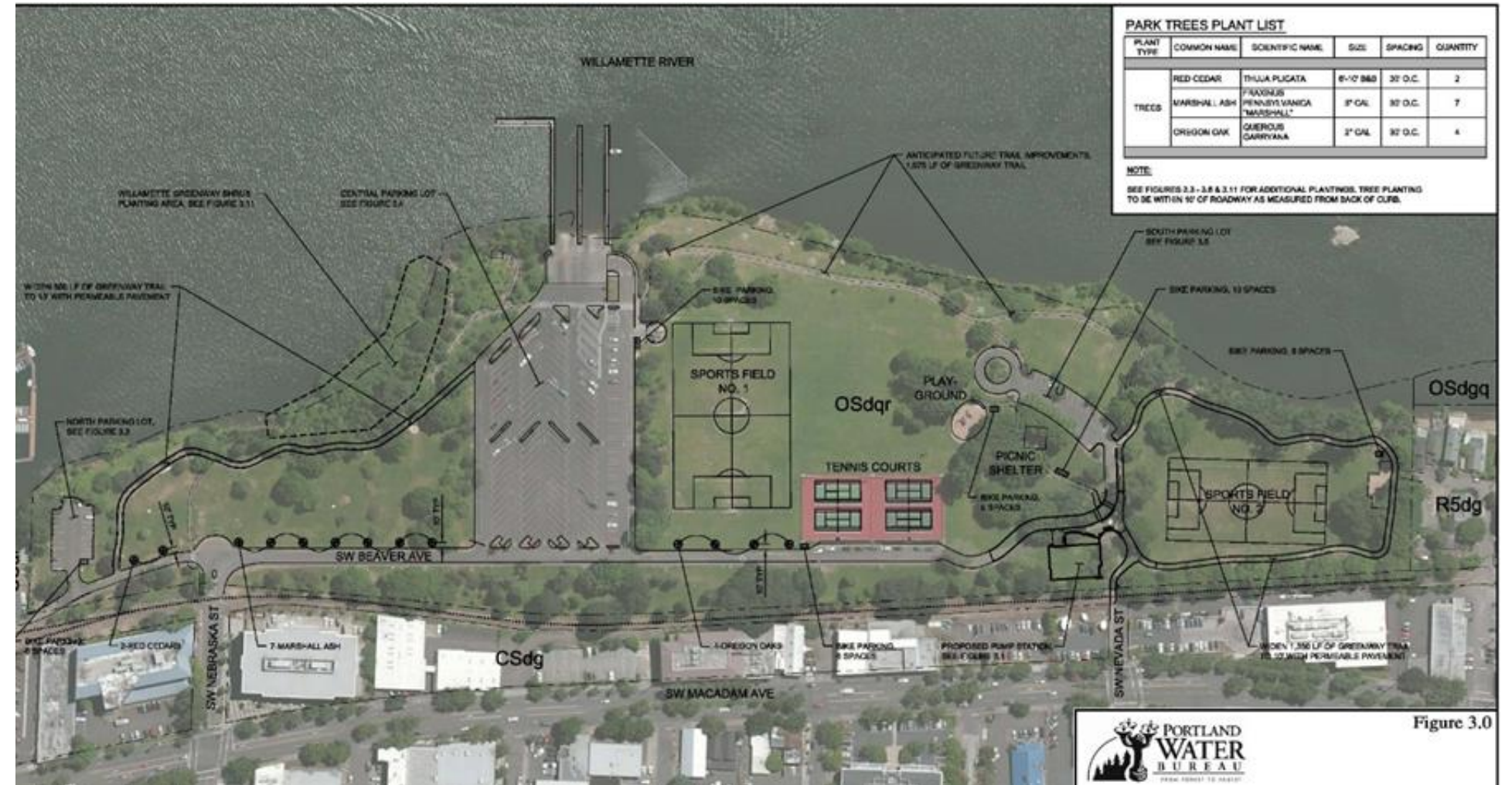




Willamette Park Site Selection

Improvements

- Four restrooms and a Park Bureau storage facility
- Park facilities and trails upgraded to ADA requirements
- ~3,200 linear feet of trail and walkway improvements
- Stormwater improvements (stormwater facilities and tree plantings)
- Extensive landscaping improvements throughout the Park
- Increased bicycle parking





Zoning & Permitting

Zoning:

- Type III CU (Open Space)
- Zone Map Amendment (River Recreational to River General)
- Greenway Review
- Non-Conforming:
 - Landscaping (Interior Planting Standards)
 - Minimum Setback (4 of 5 standards met)
- Chapter 24.50 Flood Hazard Variance

Permits:

- PP&R NPUP
- 1200c Permit
- Trimet rail crossing easement
- ODOT rail crossing
- Urban Forestry Permits (\$100k)

Design Commission:

- Pre application conference
- Final



Public Involvement

- 2008 Public Outreach Plan
- 2011 Public Open House, design unveiled
- 9-member Public Advisory Committee (PAC)
- Sponsored Concerts in the Park
- Participated in other community events



From Adversaries to Advocates!



Hannah Mason Pump Station Open House

Come learn more about the construction of the new Hannah Mason Pump Station

We invite you to comment on the current construction, view the construction schedule and view renderings of the new pump station. Portland Parks & Recreation will also be in attendance to provide information about upcoming Willamette Park improvements.

WHAT: Hannah Mason Pump Station Open House

WHEN: Thursday, May 7th, 2015

WHERE: Umpqua Bank - South Waterfront - 3606 SW Bond Ave

TIME: Drop in anytime from 5:30PM – 7PM

**Willamette Park Projects Presentation at 6:00 pm*

For more information about this project:

Email: Sam Beresky at sam@ja.us.com - Call: 503-235-5881

Visit us online: <https://www.portlandoregon.gov/water/hannahmason>

Thank you for your patience and cooperation as the Portland Water Bureau works to improve the City's century old water system.





Design a Pump Station that...

Houses:

- 5 large vert turbine pumps w/VFDs
- 2 supply suction sources
- Large electrical room & Parks storage room
- 4 public restrooms

Located:

- 60ft x 100 ft parcel
- 10ft below floodplain
- Within public park & Greenway corridor

...that is “whisper” quiet and invisible

...and meets the Bureau’s goals of max energy efficiency and improved reliability/redundancy





5 Land Use Reviews

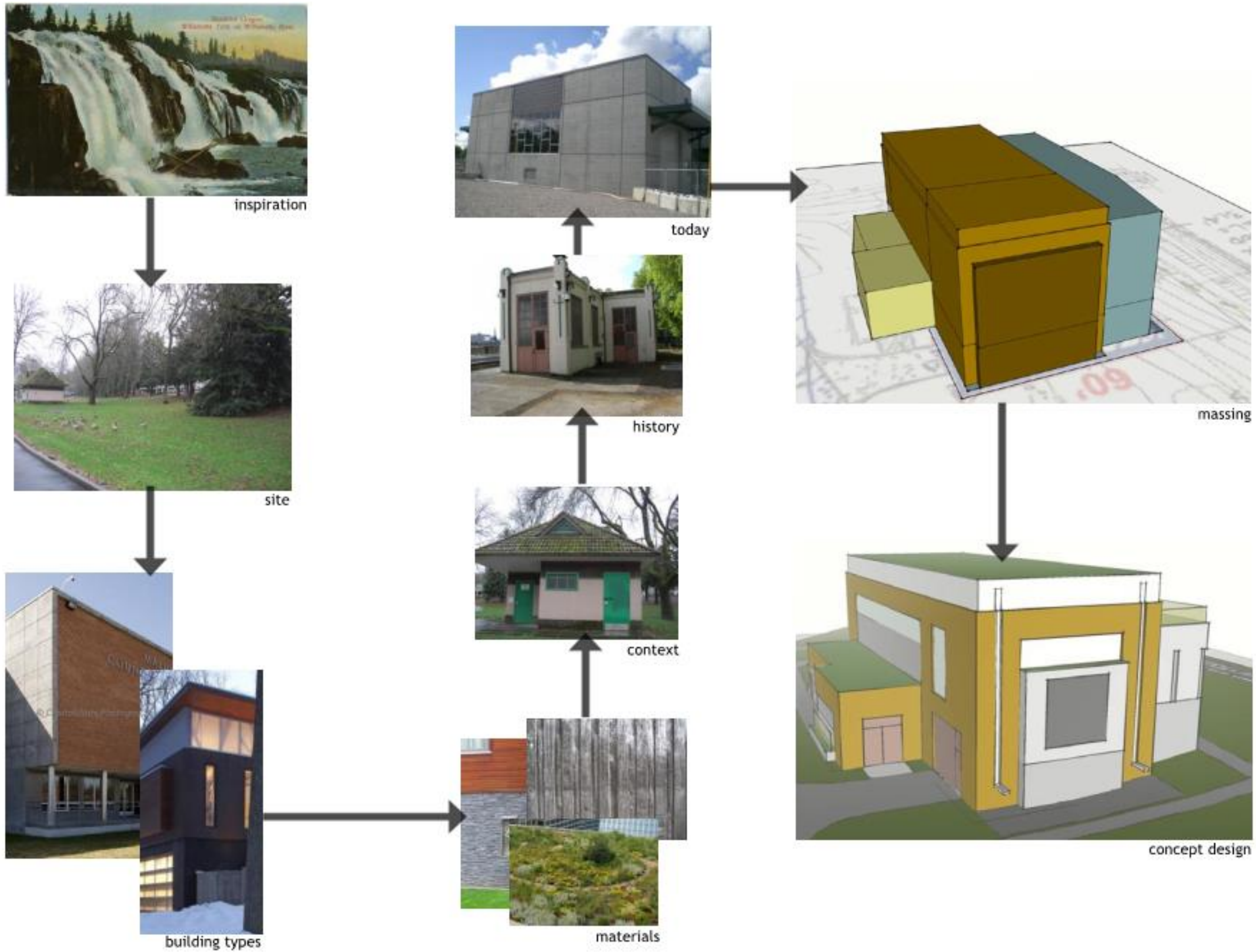
- Greenway
- Zone Change
- Design Review
- Conditional Use
- Adjustment Review

Public Approval

- Multiple Citizen Advisory Groups
- Early PI Process
- Interwoven with LU Reviews



Concept Development



Willamette Park Pump Station - Public Design Process Review





Initial Concepts



“Quiet” Concept



“Blend In” Concept



“Whisper” Concept



Designed to “Whisper”

- Angled Roof
- Curved Lines
- Dark Stone Color
- Columnar Basalt Look
- Eco Roof





Flood-able Design

- Flood Louvers allows water to flood in/out of ground level floor
- Structural design prevents float/shift/collapse
- Requires all equipment to be on 2nd floor (pumps/electrical/HVAC/controls/etc.)

Indoor Bridge Crane

- To hoist pumps/equipment through hatch to ground floor
- Eliminated the need to bring crane to site (Non-Park Use Permit required & no tree impacts)





Transmission Main Installations

Challenges/Goals:

- Extend large mains 800LF from existing pump station
- Congested utility corridor
- Minimize impacts to neighborhood
- Avoid disruption to Highway
- Avoid OPB buried fiber bank (statewide emergency broadcast system)

Collaborative Solutions:

- Obtain easement from OPB
- Trenchless install from Park to across Highway; 225LF at average 15ft depth
- Actively monitor vibrations during construction





Environmental Sensitivities

- Tree Preservation
- New Tree Plantings
- Bird-Friendly Glass



First design to adopt the National Audubon Society's new bird-friendly building design guidelines



Park Enhancements

- Improved ADA Restrooms
- Plaza with new bike parking
- Improved multi-use trails
- Landscaping & drainage improvements for 3 parking lots
- Integrated Art / Educational Element



Pelton Wheel Pump

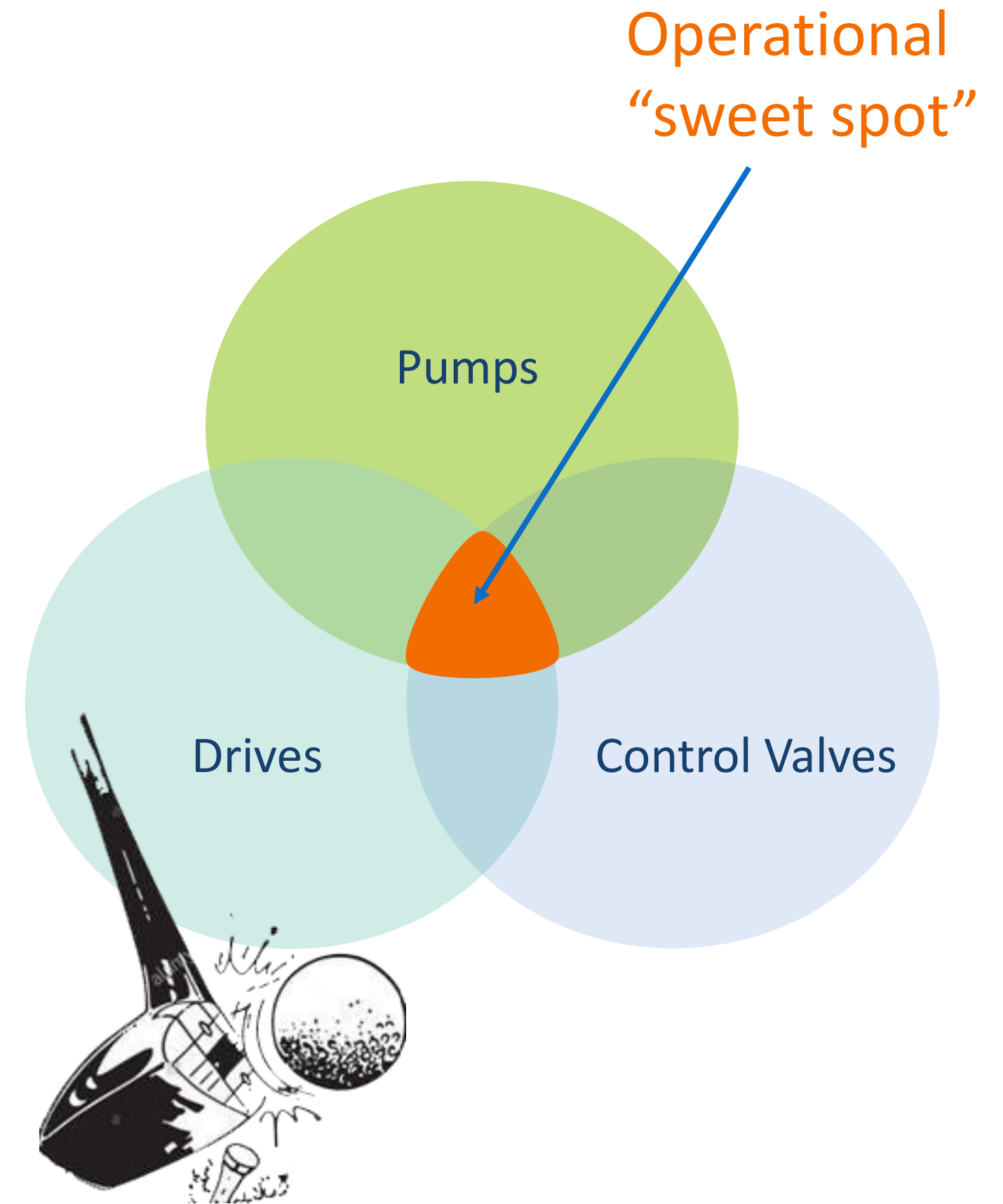


Energy Efficiency Goals

- Use high pressure WCSL as primary source
- Develop pump/drive/control valve system and strategy that provides operational “sweet spot”
- Pump efficiency >80% at BEP
- High efficiency HVAC system

Pump Selection Criteria

- 12MGD from both sources using variable speed drives
- Preferred Operating Region (HI 9.6.3): 70% to 120% BEP
- 5 pumps total
- Replace 150hp pump with future 600hp pump





Pump/Drive System Selection

VFD's

- VFD's are 95% efficient-5% heat loss
- Operational flexibility

Early Design:

- Three 300hp & two 600hp pumps-all VFD pumps
- All pumps operate on both supply sources

Energy Efficient Final Design

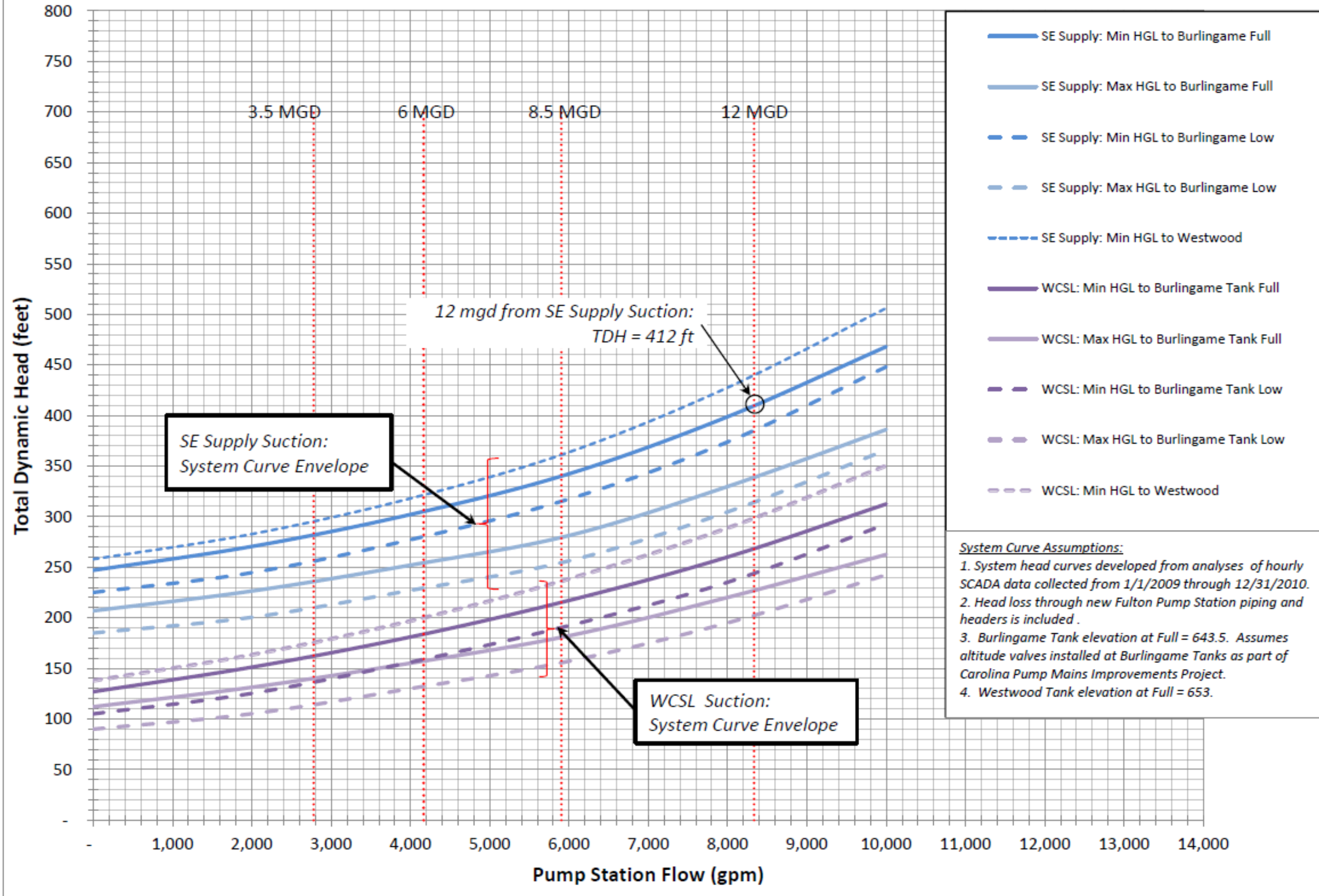
- Three 150hp pumps from WCSL only
 - Two constant speed, one VFD
 - Workhorse pumps >95%
 - VFD-low flow demand & flexibility
- Two 600hp pumps from both sources
 - Provide 12MGD both sources
 - Redundancy and reliability



System Curve Development

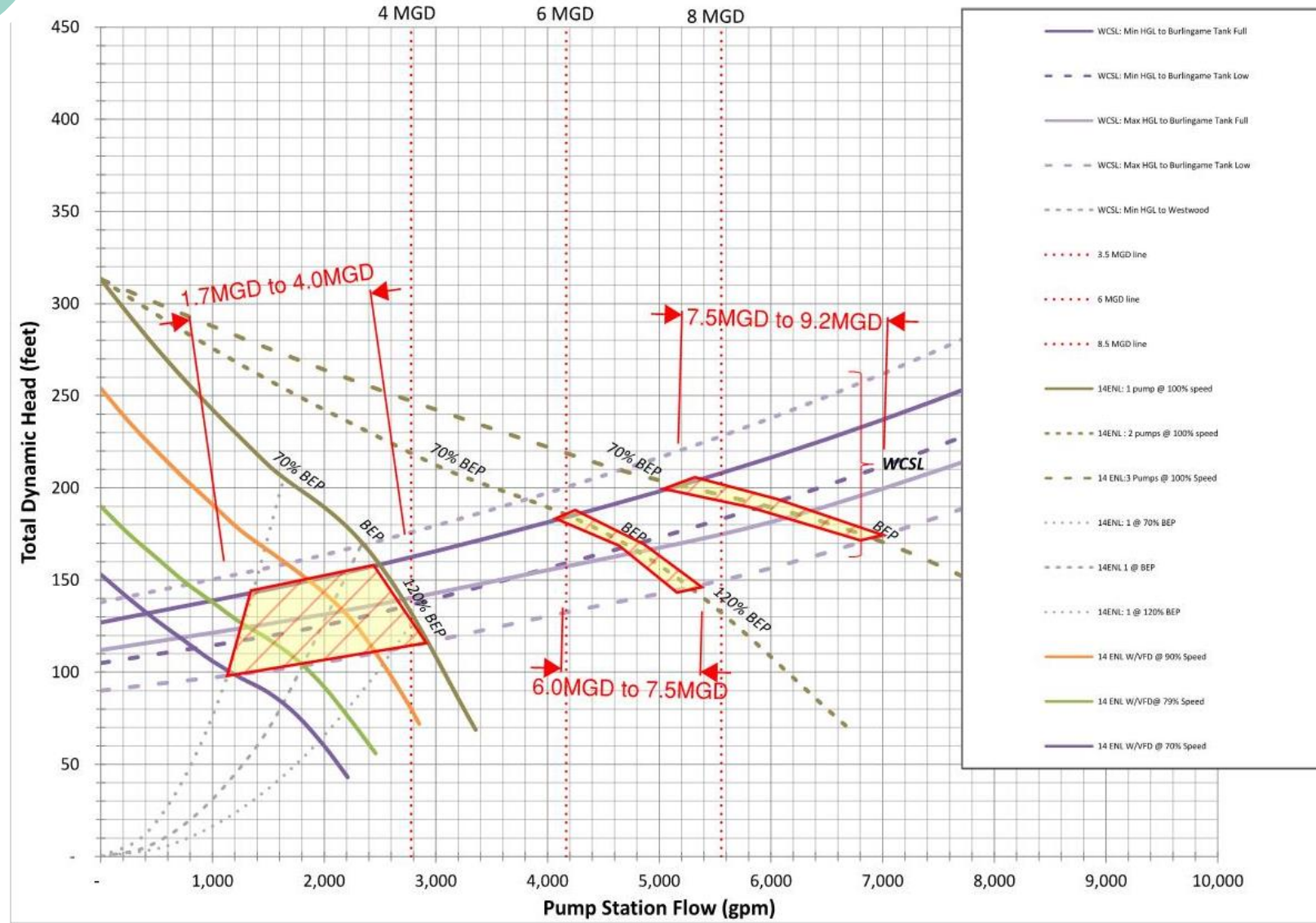


Figure 1. System Head Curves, Based on 2009-2010 Hourly SCADA Data
Fulton Pump Station Replacement - Design Memorandum, 100% Submittal



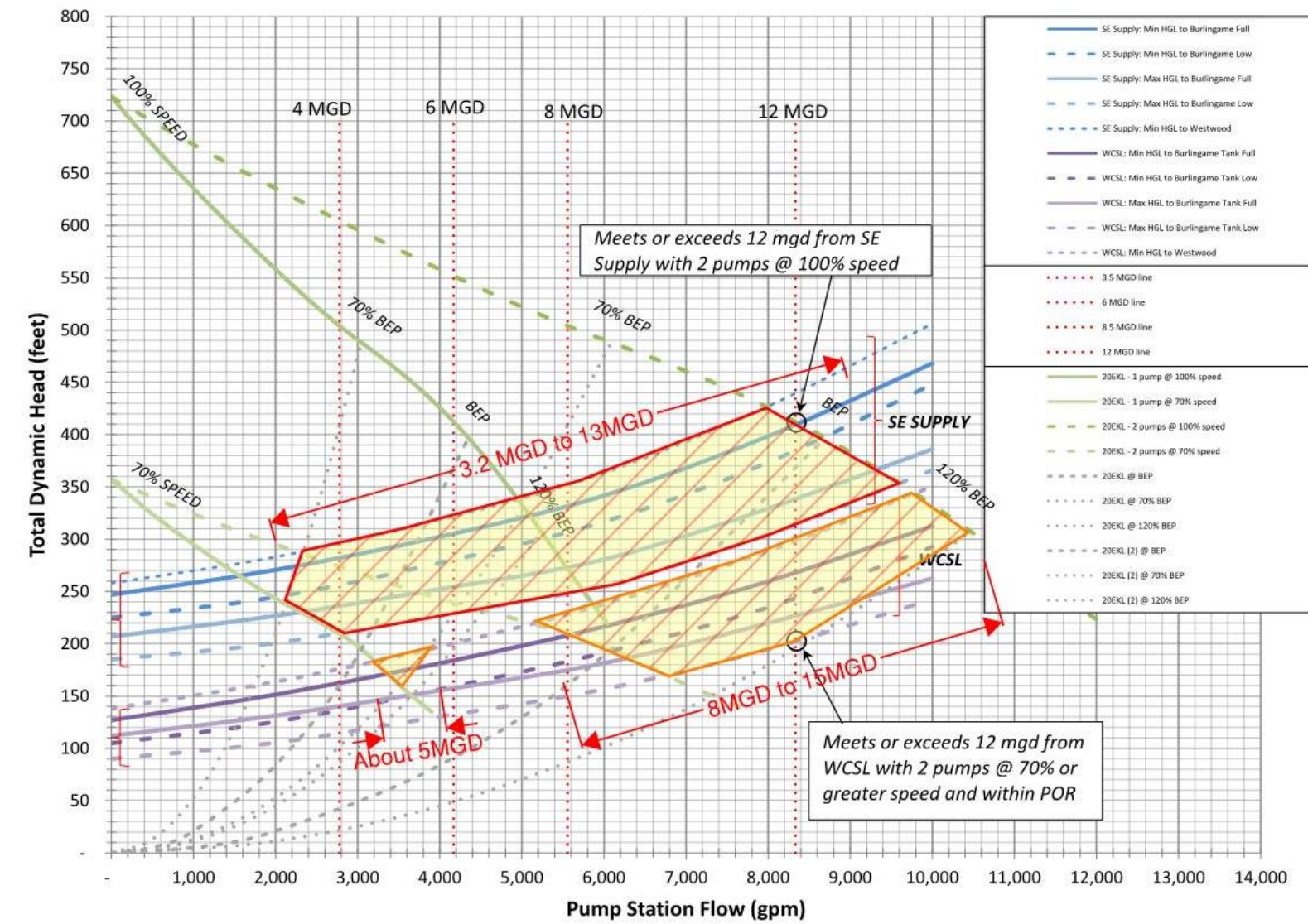


150 HP Pump



- 1 VFD pump-flexibility at low flow demands
- 2 constant speed pumps provide 6.0 – 7.5 MGD
- All 3 pumps can provide 7.5 – 9.2 MGD

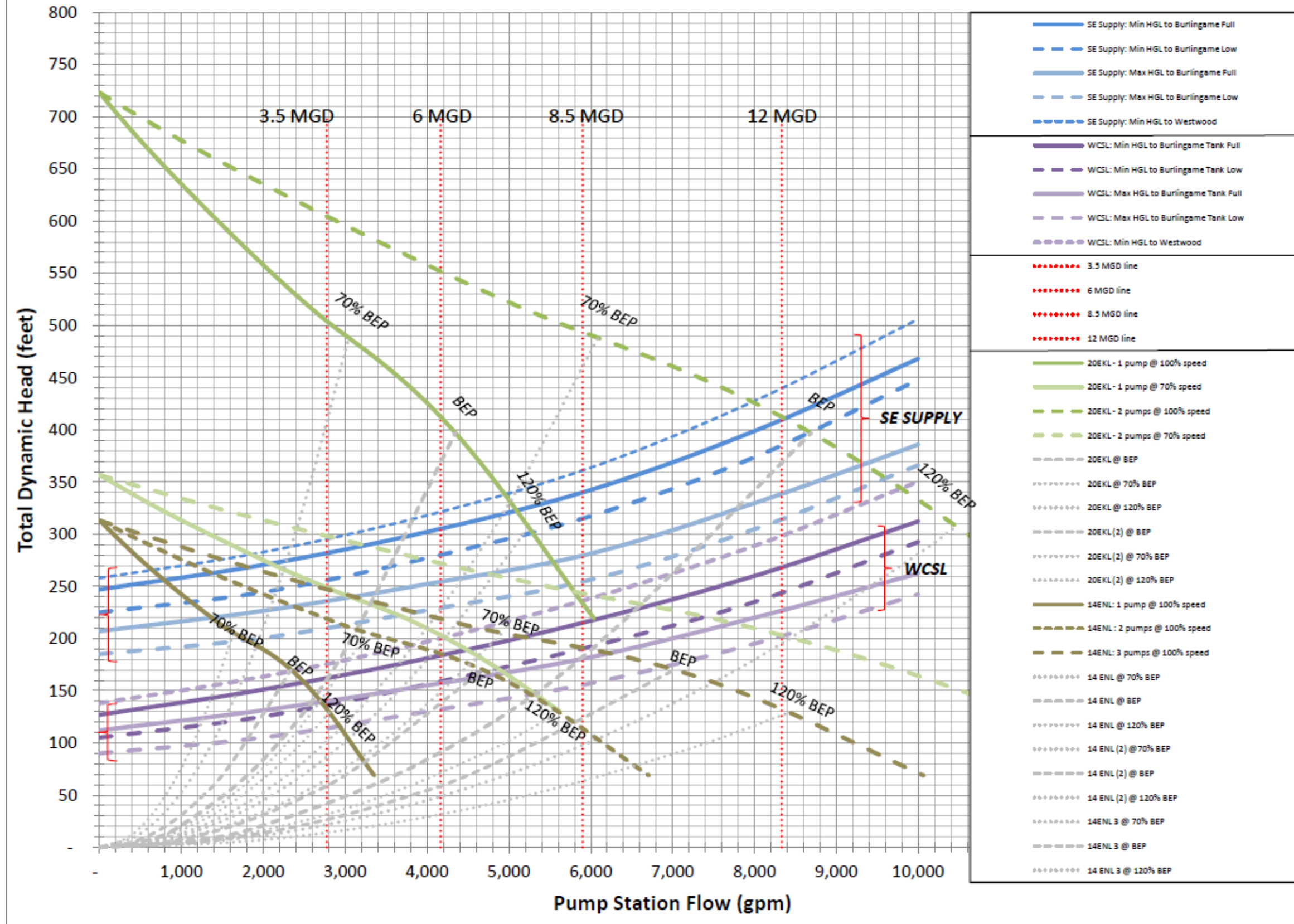
600 HP Pump



- 2 VFD pumps connected to 2 separate sources-12 MGD from either source-redundancy & reliability
- Range of 3.2 – 13 MGD from low pressure SE Supply
- Range of 8 – 15 MGD from high pressure WCSL



Figure 4. Pump Curves: Flowserve (2) 20EKL-VFD, (2) 14ENL Pumps-CS, (1) 14-ENL-VFD
Fulton Pump Station Replacement - Design Memorandum, 100% Submittal





Energy Efficient Control Valves

Globe Style Diaphragm Pump Control Valve (Clay-Val)

- PWB standard valve
- High head loss (3-6 psi)-energy inefficient
- PWB desired energy efficient PCV system

Pump Control Valves Evaluated

- Hydraulic/Electronic actuated PCV
 - Butterfly and Ball Valve
 - Low head loss, requires separate check valve
- Check Valves
 - Swing and Slanting Disc
 - Slanting disc has low head loss and slow closure

Pump Control Valve Evaluation Criteria

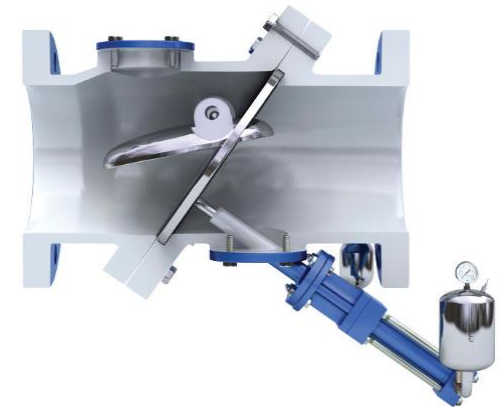
- Controlled open/close speeds-surge control
- Meet 320psi+ pressure w/ 500psi at pump shutoff
- Energy efficient system and compact footprint



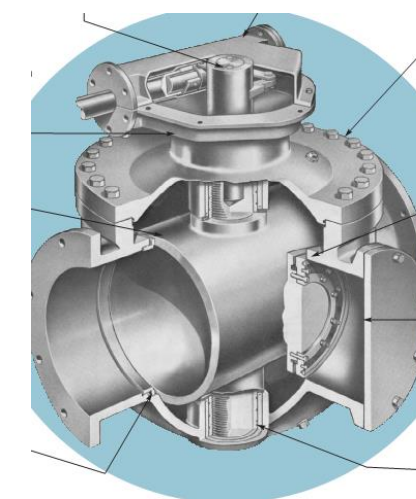
VS



+



OR



+





Energy Efficient Control Valves

Final Pump Control System

- Hydraulically actuated high-performance butterfly valve and slanting disc check valve
- Over \$280,000 in energy savings over 40 years compared to globe style PCV**

Pump Discharge Valve Cost Analysis
One 600-hp pump running 12 hours/day at 6 mgd flow rate

Valve Type	Cv value	Energy Cost for 40 years	Valve Cost	Total Cost for 40 Years
16" Ball Valve	34400	\$30,650	\$39,000	\$69,650
18" Ball valve	47900	\$20,071	\$41,500	\$61,571
20" Ball valve	59900	\$12,446	\$49,300	\$61,746
16" BFV	8460	\$52,313	\$19,000	\$71,313
18" BFV	11100	\$32,768	\$20,200	\$52,968
20" BFV	13500	\$21,010	\$22,900	\$43,910
16" Diaphragm Valve	2110	\$387,756	\$31,000	\$418,756
20" Diaphragm Valve	3400	\$150,053	\$51,500	\$201,553
24" Diaphragm Valve	4020	\$102,753	\$54,500	\$157,253
16" Tilting Disc	10030	\$42,490	\$24,000	\$66,490
18" Tilting Disc	13200	\$37,443	\$27,600	\$65,043
20" Tilting Disc	16800	\$16,927	\$29,600	\$46,527

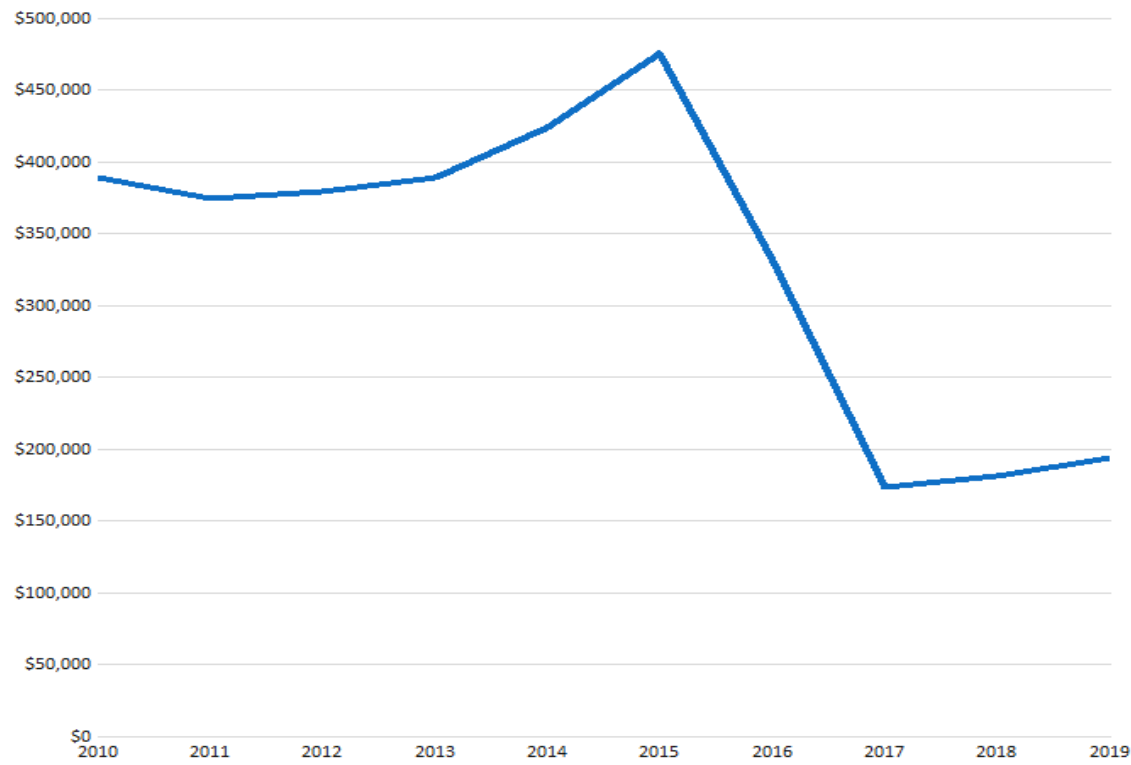


Total = **\$137,803** VS **\$418,756**



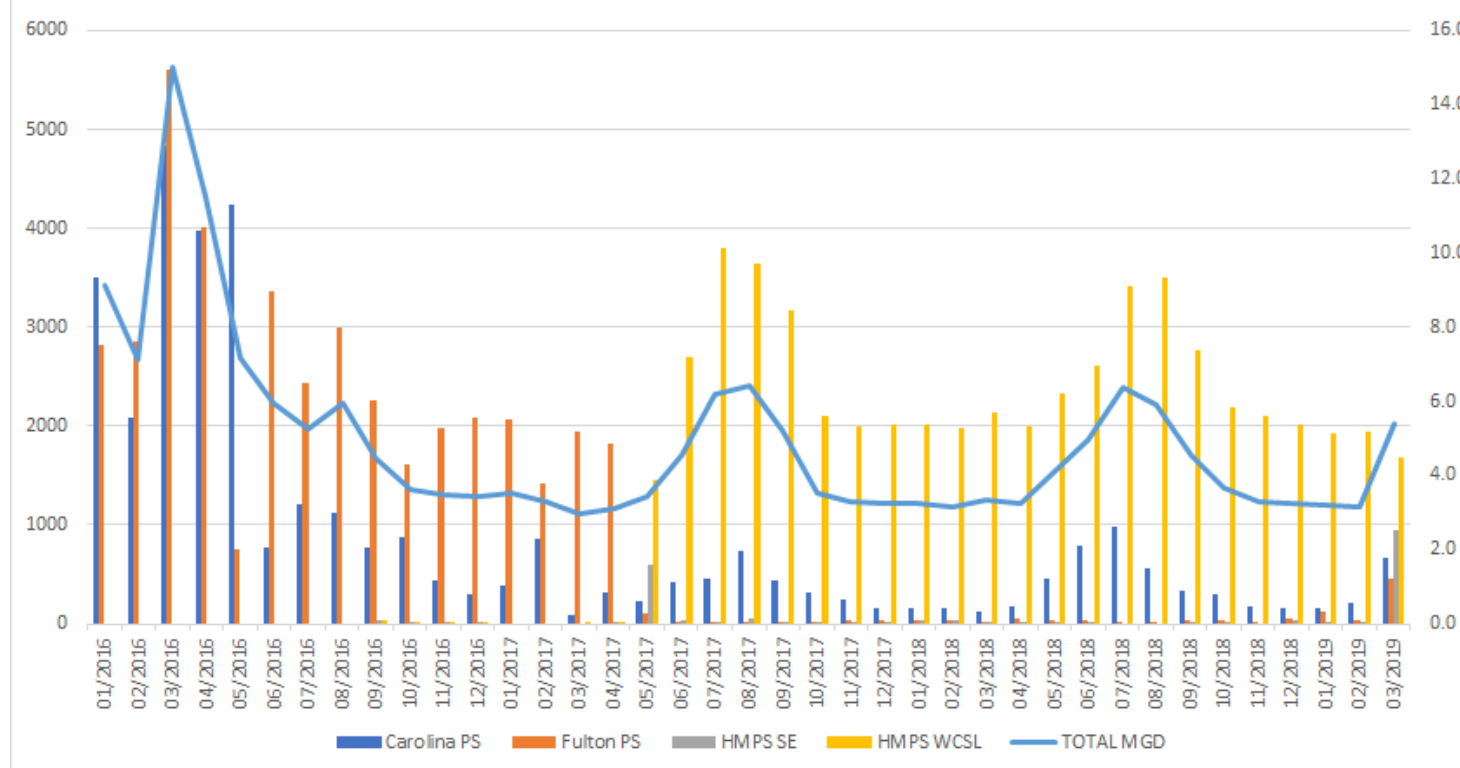
Energy Savings

Total Burlingame Service Area Annual Energy Cost



- Energy Trust Incentive: **\$500k**
- Pumping Cost Reduction
 - Carolina – 430 gal/kWh
 - Fulton – 762 gal/kWh
 - HMPS – 1380 gal/kWh
- Total System Energy Cost

Burlingame Service Area Demands 2016-19





Keys to Success

- Early public involvement
- Partnering with stakeholders
- Holistic & creative design solutions
- Flexibility





Q&A



murraysmith



Thank you!



Project Teams

Design

- Dave Evonuk
- Mike Ross
- David Mackinnon
- Deb Smith
- Chris Chambers
- Carol Lane

Zoning

- Tom Carter

Construction

- Tom Leavitt
- Walt Lewandowski
- Ryan Spackman

Survey/ROW

- Ben Gossett
- Paul Ejgird, Tim Alcover, et.al.

Murraysmith Team

- Mike Carr
- Eddie Kreipe
- Kate Conrad
- Justin Luce
- Justin Ford
- MWA Architects
- PSE Structural
- JLA Public Involvement
- Hart Crowser Geotech
- MWH