PORTLAND WATER BUREAU
Corrosion Control Improvements

March 23, 2017
Meeting with OHA and EPA

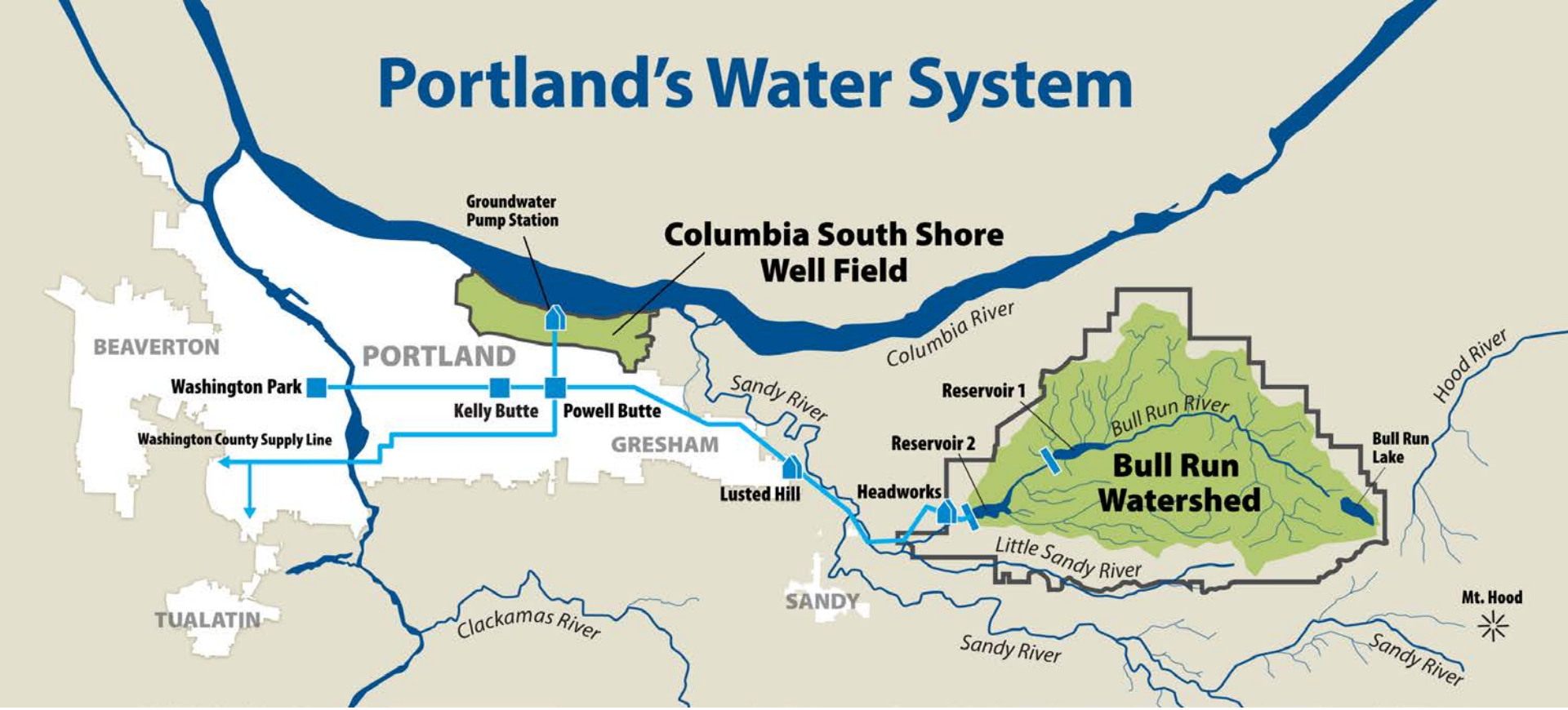
PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

Presentation Outline

- System Overview
- Portland's LCR History
- Recent & Future Project Activities
- WQ Corrosion Study
- Corrosion Control Treatment Pilot
- Schedule Considerations
- Next Steps

SYSTEM OVERVIEW

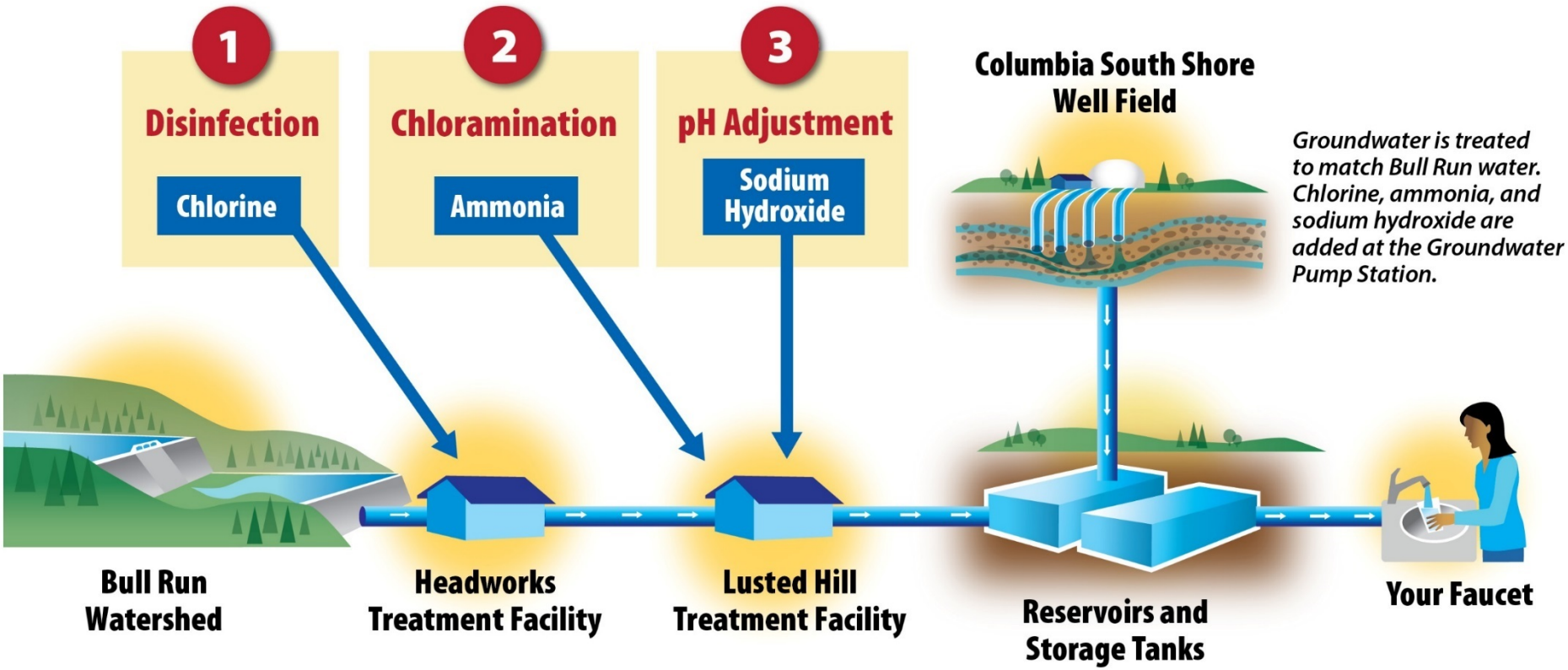
Portland's Water System



- Water Storage Facility
- Water Supply Pipes
- Water Treatment Facility
- Dam
- Portland Water System Distribution Area
- Water Source
- Protected Area

- 600,000 retail customers
- 370,400 wholesale customers
- 19 wholesale water districts
- 101 million gallons per day average (80 – 160 mgd)

Supply System Overview



Removal of Lead in the Water System

Lead-based Solder

- Worked with the State of Oregon to ban the use of lead-based solder in water systems in 1985.

Lead Pigtails

- Completed the removal of all known lead pigtails (>10,000) in the distribution system, 1998. ($10M)

Lead-component Meters

- 364 large meters serving schools, hospitals, childcare facilities, community centers, public housing complexes and large apartment building were replaced from 2001-2008.

PORTLAND’S LCR HISTORY

Lead and Copper Rule Compliance

1994

Optimized Treatment Study

- Recommends pH 9.0, alkalinity 20 mg/L as Optimized Corrosion Control Treatment
- City Council directs PWB to investigate alternatives to recommended treatment

1997

City proposes a comprehensive Lead Hazard Reduction Program (LHRP)

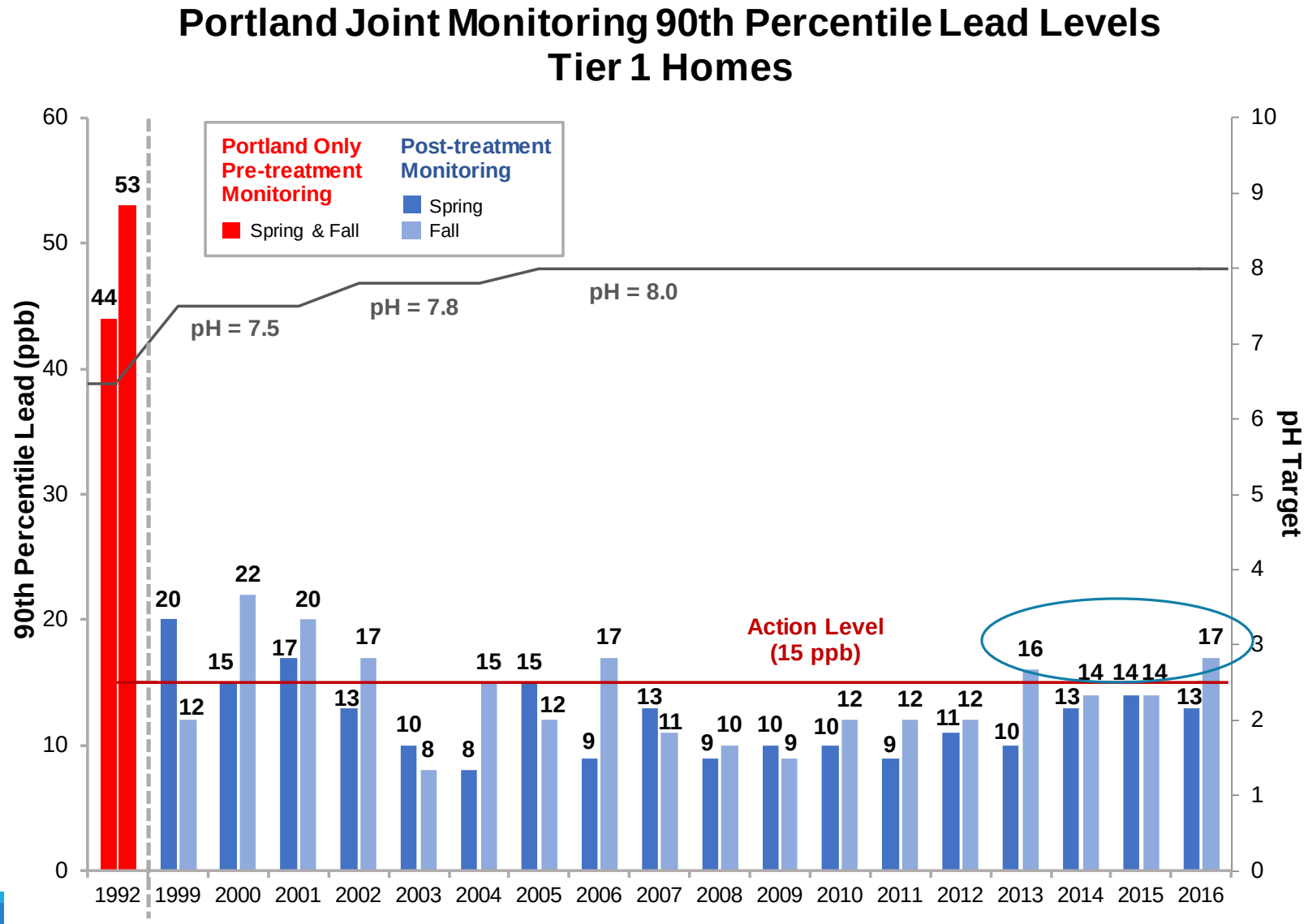
1997

State approves LHRP as Optimized Corrosion Control Treatment

1997-present

City operates under LHRP to remain in compliance with LCR

LCR Sampling History



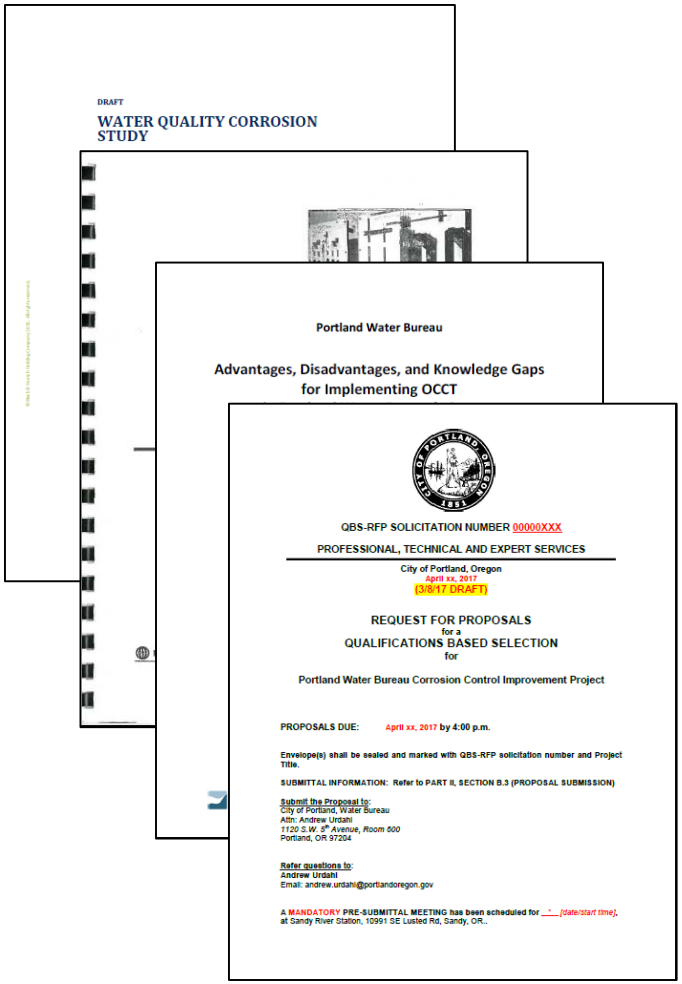
RECENT AND FUTURE PROJECT ACTIVITIES

Recent Timeline

2014	Spring	PWB begins Water Quality Corrosion Study
2016	Apr, Aug, Sept.	PWB meets with OHA and EPA
	Sept. 8	PWB proposes improved corrosion control treatment schedule to OHA
	Nov. 4	OHA approves PWB's proposed schedule and requests interim lead reduction plan
	Dec. 2	PWB submits interim lead reduction plan to OHA
2017	Jan. 24	OHA accepts PWB's interim lead reduction plan
	Feb. 7	PWB raises entry point pH from 8.0 to 8.1 Draft Water Quality Corrosion Study Report
	Mar. 8	City Council approves contract for Corrosion Control Treatment Pilot
	Mar. 9	Kick-off Workshop Corrosion Control Treatment Pilot

Progress Since First Meeting(s) with OHA and EPA

- Completed the WQ Corrosion Study
- Completed a review of all past WQ studies
- Completed an evaluation of gaps in past studies
- Reviewed WQ Corrosion Study with Council
- RFP, consultant selection, and Council approval of CCT Pilot
- Developed Bench Study Plan
- Developed outline of Pilot Study
- Began bench-scale testing
- Ready to release RFQ for design consultant



DRAFT

WATER QUALITY CORROSION STUDY

Portland Water Bureau

Advantages, Disadvantages, and Knowledge Gaps for Implementing OCCT

QBS-RFP SOLICITATION NUMBER 00000XXX

PROFESSIONAL, TECHNICAL AND EXPERT SERVICES

City of Portland, Oregon
April xx, 2017
(3/8/17 DRAFT)

REQUEST FOR PROPOSALS
for a
QUALIFICATIONS BASED SELECTION
for

Portland Water Bureau Corrosion Control Improvement Project

PROPOSALS DUE: April xx, 2017 by 4:00 p.m.

Envelope(s) shall be sealed and marked with QBS-RFP solicitation number and Project Title.

SUBMITTAL INFORMATION: Refer to PART II, SECTION B.3 (PROPOSAL SUBMISSION)

Submit the Proposal to:
City of Portland, Water Bureau
Attn: Andrew Urdahl
1120 S.W. 5th Avenue, Room 600
Portland, OR 97204

Refer questions to:
Andrew Urdahl
Email: andrew.urdahl@portlandoregon.gov

A MANDATORY PRE-SUBMITTAL MEETING has been scheduled for ___ [date/start time], at Sandy River Station, 10991 SE Lusted Rd, Sandy, OR..

WATER QUALITY CORROSION STUDY

Water Quality Corrosion Study Project Timeline

May 2014
Black and Veatch started work on the corrosion study

Oct 2014
Workshop 1 Held at PWB

June 2015
Technical Memo 1 Completed

Oct 2015
Technical Memo 2 Completed

Nov 2015 – Jan 2017
Distribution System Sampling

- April 2016: Q1 Report
- July 2016: Q2 Report
- Oct 2016: Q3 Report
- Jan 2017: Q4 Report

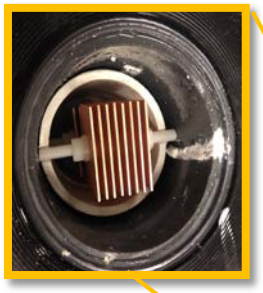
March 2017
Water Quality Summary Report Done

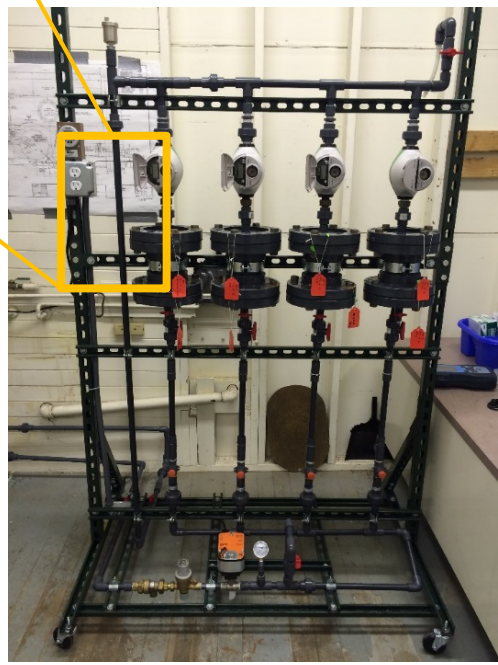
Water Quality Corrosion Study

Data Set	TCR Monitoring (Alk, Cl2, pH, Temp., Turbidity)	Nitrification Monitoring (Cl2, ORP, HPC, Free NH3, Nitrite, Nitrate, pH, Temp., Turbidity)	LCR Compliance (Total Pb, Cu, Fe, Mn, Zn)	WQP Compliance (Alk, pH)	Voluntary Lead (Total Pb, Cu, Fe, Mn, Zn)	Supplemental In-home (All parameters)	Extended WQSS and PRS Station (All parameters)
Uniform Corrosion	Alk, pH, Temp.	ORP, pH, Temp.	Total Pb	Alk, pH	Total Pb	All parameters describing uniform corrosion	All parameters describing uniform corrosion
Biostability of Water	Cl2, Temp.	Cl2, Free NH3, Nitrite, Nitrate, ORP, Temp.	Total Pb, Cu	N/A	Total Pb, Cu	All parameters describing biostability	All parameters describing biostability
Scale Transport	Turbidity	Turbidity	Total Pb, Cu, Fe, Mn, Zn	N/A	Total Pb, Cu, Fe, Mn, Zn	All parameters describing scale transport	All parameters describing scale transport

Corrosion Study: Conclusions

- Primarily dissolved lead; up to 50% particulate lead
- All three corrosion mechanisms contribute to lead release in PWB's system
- Source of lead is from premise plumbing materials
- No geographic patterns to lead release or water quality trends





Corrosion Study: Recommendations

- Conduct pilot testing
- Continue UDF
- Continue water age management

CORROSION CONTROL TREATMENT PILOT

Corrosion Control Treatment Pilot Consultant Team Leads

Melinda Friedman, PE

- Project Manager
- TAC and QA/QC on WQ Corrosion Study
- Lead author for AWWA M58 – Internal Corrosion Control in Drinking Water Distribution Systems
- Technical lead for City of Flint Distribution System Optimization Evaluation

David Cornwell, Ph.D., PE, BCEE

- Technical Advisor to the NDWAC Working Group for LCR Long-term Revisions
- Technical Lead for City of Flint Corrosion Control Evaluation
- Project manager on numerous corrosion control and OCCT studies

1994 Testing

Limitations of Bench Testing

- Surface water only (SW/GW blends tested without treatment)
- Low accuracy (Corrator-type electrochemical probes)
- All pH at/above 7.5 performed similarly well
- No scale analysis

Limitations of Pilot Testing

- Surface water only
- Did not assess new “moderate” pH/Alk 8.5/35
- Ortho dose not high enough if GW blended in
- Particulate lead not evaluated

Cu = Copper
Pb = Lead
Br = Brass

Improved LCR Compliance Understanding since 1994 Study

Old Strategies **vs.** **What We Know Now**

- Passivation (pH / Alkalinity)
- Passivation (PO_4, Silicate)
- $CaCO_3$ precipitation

- Passivation (pH / Alkalinity)
- Passivation (PO_4)
- High Cl_2 residual - Pb(IV) scale

PWB Operational Considerations

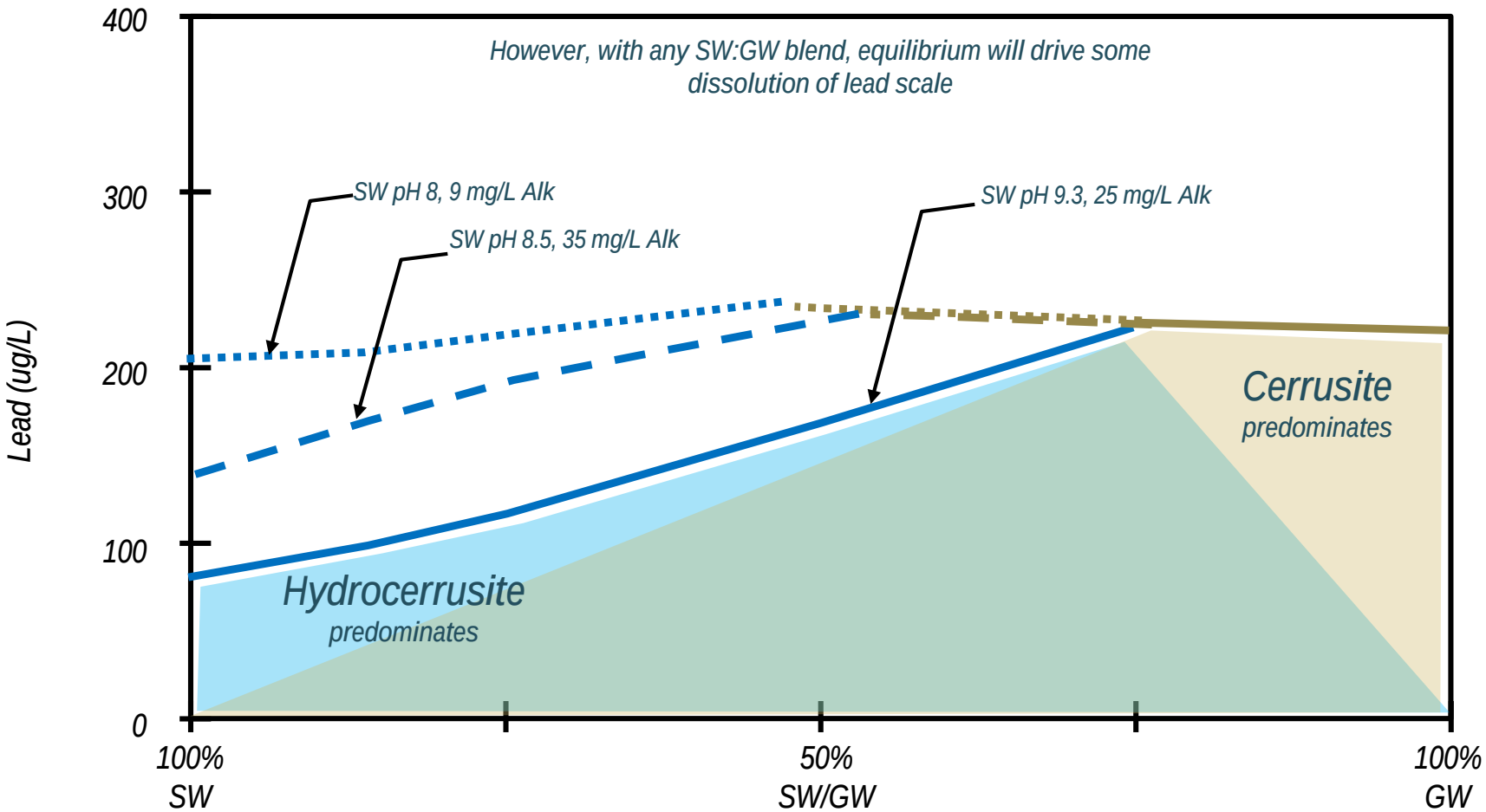
Groundwater Usage

- Increased reliance on groundwater
- Groundwater blending and/or treatment not considered in 1994 study

Wholesaler Relationships

- Increased reliance on multiple sources
- Blending and system operations

Potential Impacts of Blending SW and GW



Percent Blend of CSSWF Groundwater into Bull Run Surface Water

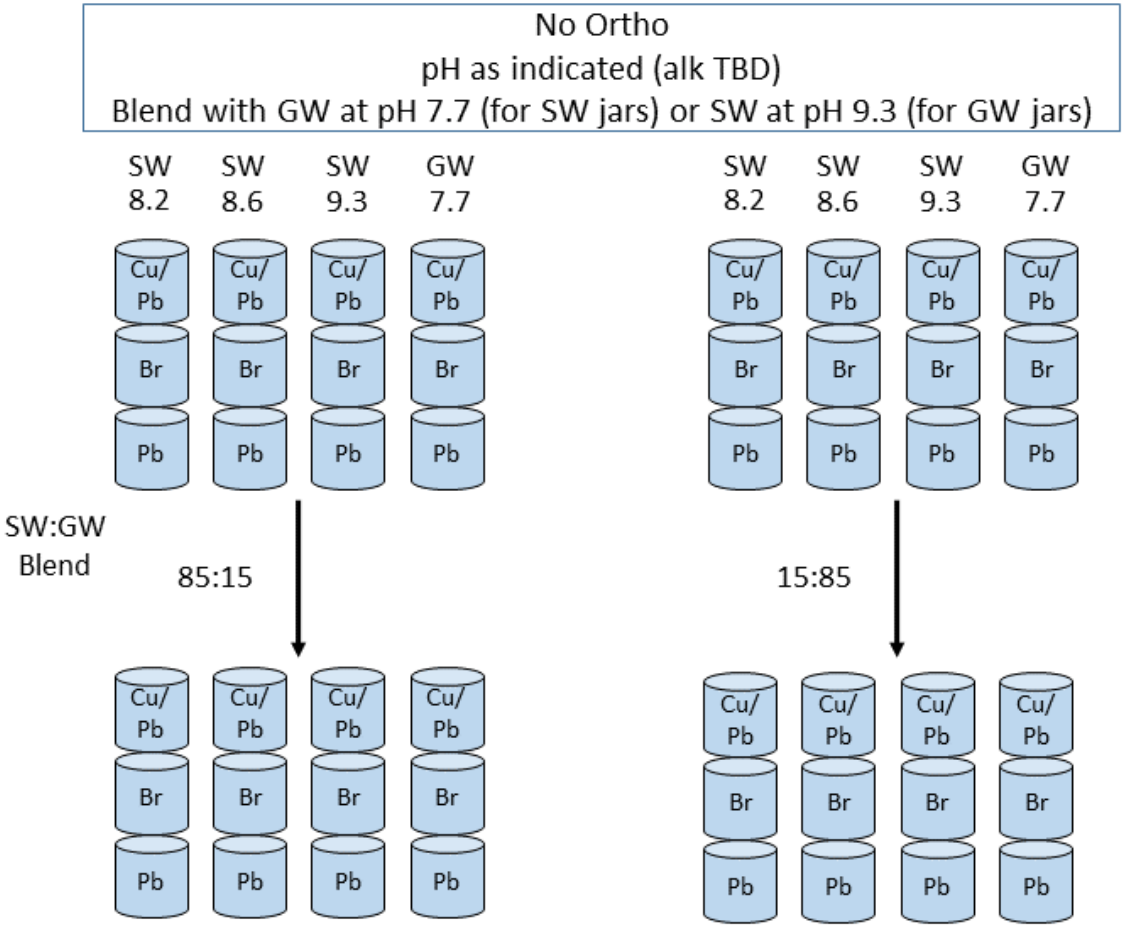
Bench-Scale Testing

- Evaluates Pb solubility for various treatment options
- One coupon per jar
- Approx. 650 mL per jar
- Water is changed twice weekly

Conditions to be Tested

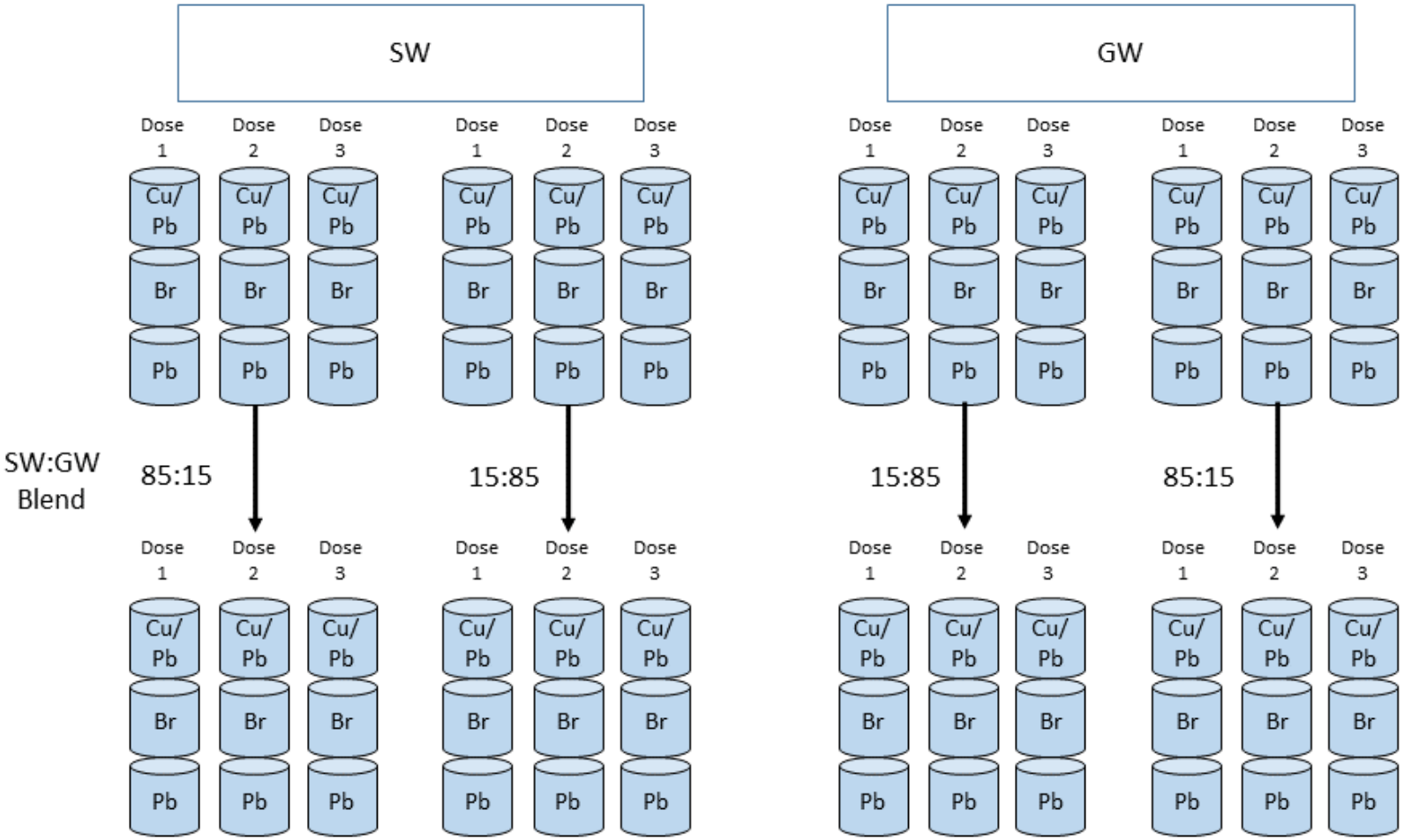
- **Two types of CCT will be evaluated**
  - pH/Alkalinity adjustment
  - PO_4 addition
- **Two phases of testing**
  - Equilibrium phase (100% surface water or ground water)
    - Goal is to get Pb scales on coupons to equilibrium
    - Assumes 5 weeks to equilibrium
  - Stability phase (blend of surface water and groundwater)
    - Goal is to evaluate stability of Pb scales under changing DIC
    - 4 weeks of evaluation

Test Plan – pH/Alk.



24 jars to be tested for 9 weeks

Test Plan – PO_4



36 jars to be tested for 9 weeks

Purpose of Pipe Loop Testing

- Expands upon bench-scale testing
- Testing under more representative water use
  - Daily alternating periods of stagnation and usage
- Further defines the time-based aspect of lead mineralogy change and release
- Includes hydrodynamic forces due to flow velocities
- Equilibrium phase – 4 to 8 weeks
- Testing Phase – 24 to 28 weeks

Tacoma Pipe Loops

EPA Pipe Loops

Major Decision Points – Pipe Loop Testing

- Conditions to test
- Length of testing
- Evaluate switching between surface water and groundwater

QUESTIONS?

SCHEDULE CONSIDERATIONS

Considerations in Schedule Development

1. Land Use & Permitting
2. Public Interactions
3. Location
4. Geotechnical Evaluations
5. Operational Considerations
6. Procurement Processes
7. Market Conditions
8. Equipment & Labor

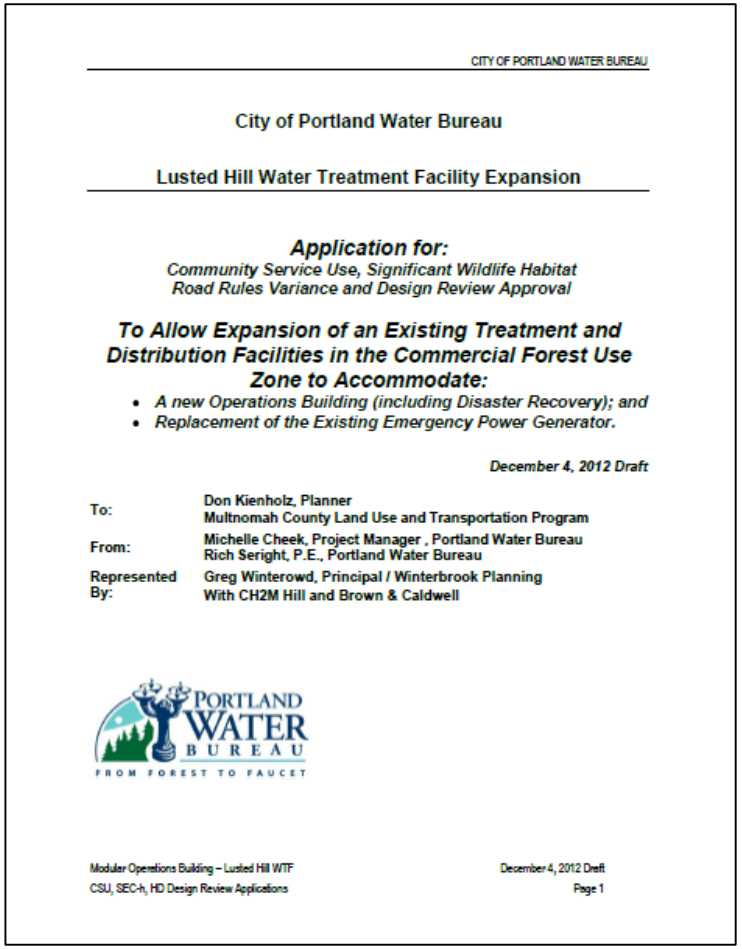
1. Land Use & Permitting

Challenges

- Zoning - Commercial Forest Use, requires conditional use
- Significant Environmental Concern Habitat, requires Wildlife Conservation Plan
- Length of time to obtain
- Appeal processes
- Building permits

Mitigation Strategies

- Start land use planning early, part of CCT Pilot contract
- Build on previous work
- Focus early design efforts on application
- Persistence



CITY OF PORTLAND WATER BUREAU

City of Portland Water Bureau

Lusted Hill Water Treatment Facility Expansion

Application for:
Community Service Use, Significant Wildlife Habitat
Road Rules Variance and Design Review Approval

To Allow Expansion of an Existing Treatment and Distribution Facilities in the Commercial Forest Use Zone to Accommodate:

- *A new Operations Building (including Disaster Recovery); and*
- *Replacement of the Existing Emergency Power Generator.*

December 4, 2012 Draft

To:	Don Kienholz, Planner Multnomah County Land Use and Transportation Program
From:	Michelle Cheek, Project Manager , Portland Water Bureau Rich Seright, P.E., Portland Water Bureau
Represented By:	Greg Winterowd, Principal / Winterbrook Planning With CH2M Hill and Brown & Caldwell

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

Modular Operations Building – Lusted Hill WTF
CSU, SEC-h, HD Design Review Applications

December 4, 2012 Draft
Page 1

2. Public Interactions

Challenges

- Perception of chemicals in the water
- Appeal processes

Mitigation Strategies

- Conversations with local organizations/sensitive users
- Education of Council members
- Started public processes

I only want water in my water

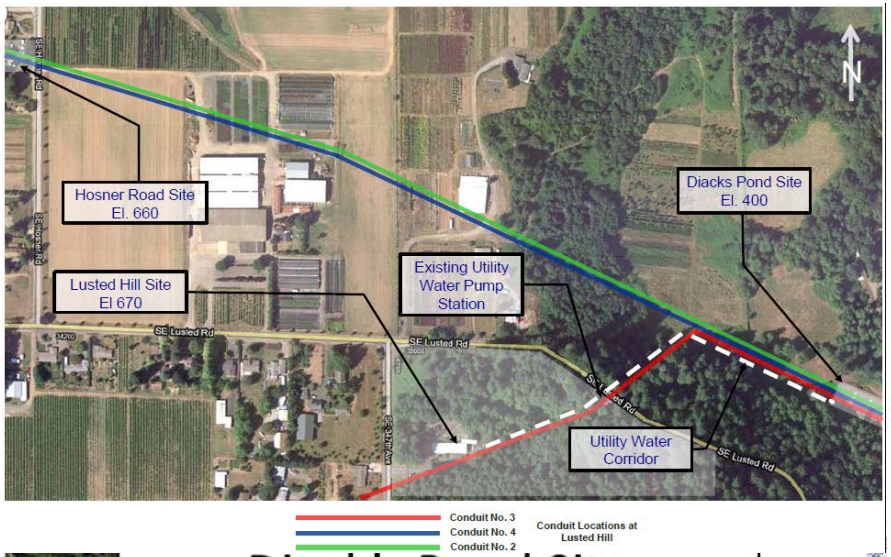
3. Location

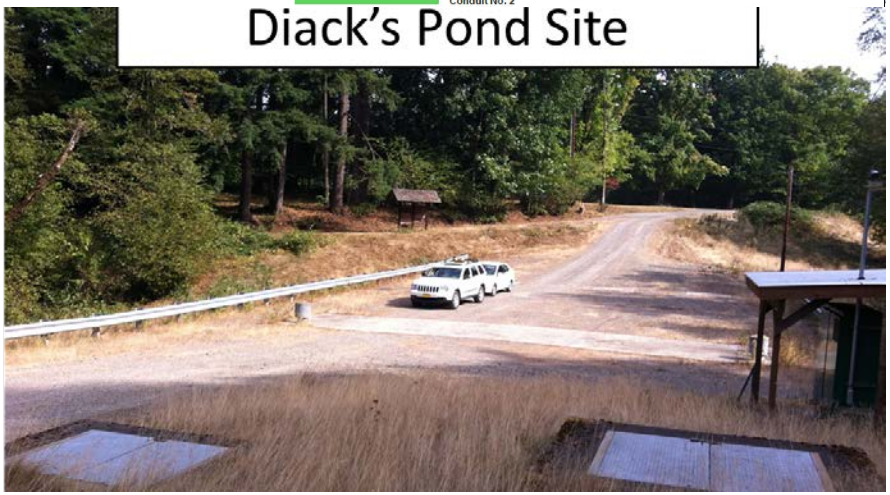
Challenges

- Distance from the city
- Rural environment
- Stringent work requirements
- Environmental mitigation
- Multiple sites
- Logistics of getting equipment to the site

Mitigation Strategies

- Market the project to contractors
- Train the contractors
- Alternative contracting
- Budget appropriately





4. Geotechnical Evaluations

Challenges

- Area of steep slopes and challenging soils
- Time to develop geotechnical baseline report
- Unforeseen conditions

Mitigation Strategies

- Preliminary design task

5. Operational Considerations

Challenges

- Build new facilities while maintaining operations
- Transitioning to new chemicals
- Coordination with other projects
- 1400 miles of unlined cast iron pipe

Mitigation Strategies

- Close planning with PWB operators
- Clear understanding of the treatment chemistry
- Flushing

6. Procurement Processes

Challenges

- Community Equity Inclusion Plan
- Multi-step processes
- Contract appeal periods
- Council approvals

Mitigation Strategies

- Start working early with Bureau of Purchases
- Start procurement process early
- Marketing to minority and women owned businesses
- Obtain Council approvals early in the process
- Alternative contracting

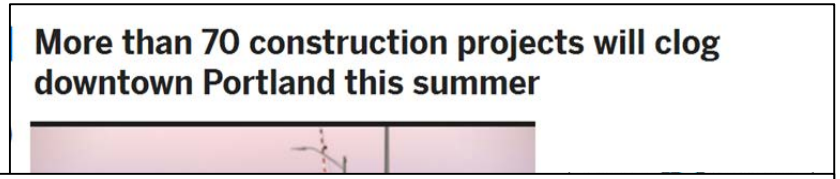
BUILDING PORTLAND BUSINESS
SOCIAL EQUITY CONTRACTING

- Prime Contractor Development Program
- Workforce Training & Hiring Program
- Community Equity Inclusion Plan
- Subcontractor Equity Program
- Fair Contracting Forum

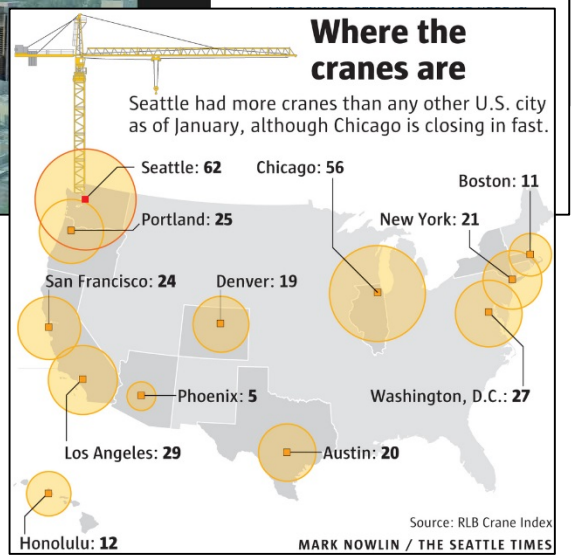
7. Market Conditions

Challenges

- Portland is booming
- Competing for resources
- TVWD, $1B


More than 70 construction projects will clog downtown Portland this summer

11 new buildings, $1.5 billion in investment planned for downtown Portland



Mitigation Strategies

- Alternative contracting, not low bid
- Ensure budgets are adequate
- Make project attractive
- Market the project to consultants & contractors

8. Equipment & Labor

Challenges

- Finding skilled labor
- Finding minority and women owned business
- Getting the labor to show up on schedule
- Getting large equipment when needed

Mitigation Strategies

- Alternative contracting
- Ensure budgets are adequate
- Make project attractive
- Market the project to consultants & contractors

Contractor abiding labor shortage at Couch 9

September 1, 2016 1:49 pm

Although the labor shortage means contractors are hiring less-skilled workers, Walsh Construction has put steps in place to keep safety a priority on the Couch 9 project in Portland's Pearl District.

Tagged with: COUCH 9 | LABOR SHORTAGE | SAFETY | WALSH | WORKFORCE DEVELOPMENT

Sky3 project team overcoming labor shortage

June 23, 2016 2:12 pm

Despite some challenges, crews are approaching completion of the mixed-use Sky3 tower in downtown Portland.

Tagged with: APARTMENTS | LABOR SHORTAGE | SKY3 | WORKFORCE DEVELOPMENT

Talent competition building in Portland

May 11, 2016 10:06 am

With work abundant, construction firms are competing to land top hires and work with the best subcontractors.

Tagged with: HOFFMAN CONSTRUCTION | JE DUNN | JLL | LABOR SHORTAGE | WESTERN PARTITIONS | WPI

A recent Example – Emergency Coordination Center

September 2009

City Council awards design contract

April 2010

30% design submittal

November 2010

60% design submittal

May 2011

90% design submittal

January 2012

Construction Started

November 2013

Construction Closeout

- $20+ million
- Addition to existing facility
- 50 months

A recent Example – Hannah Mason Pump Station

August 2010
City Council awards design contract

April 2011
30% design submittal

July 2011 – October 2012
Portland Design Commission

January 2012
60% design submittal

May – December 2012
Land Use Process

July 2013
90% design submittal

March 2015
Construction Started

March 2017
Currently in startup testing

May 2017
Construction Closeout

- $10.5 million
- Greenfield site
- 81 months

SCHEDULE UPDATE

Action	OHA Approved Compliance Schedule
Complete WQ Corrosion Study	6/1/17
Review study data and agree with OHA on treatment options; submit recommendations to city council for consideration	6/30/17
Submit WQ Corrosion Study final report to OHA	7/1/17
Submit CCT pilot study plan to OHA	9/30/17
Implement recommendations to improve the LHRP elements as identified by OHA	12/31/17
Submit CCT pilot study results and treatment	12/31/18
Begin improved CCT facility design	1/1/19
Submit improved CCT plans and specs to OHA	9/30/20
Begin CCT facility construction	1/1/21
Complete improved CCT facility	9/30/22

Action	OHA Approved Compliance Schedule	EPA's Proposed Schedule
Complete WQ Corrosion Study	6/1/17	--
Review study data and agree with OHA on treatment options; submit recommendations to city council for consideration	6/30/17	--
Submit WQ Corrosion Study final report to OHA	7/1/17	--
Submit CCT pilot study plan to OHA	9/30/17	--
Implement recommendations to improve the LHRP elements as identified by OHA	12/31/17	--
Hire design consultant		12/1/17
Submit CCT pilot study results and treatment	12/31/18	8/30/18
Begin improved CCT facility design	1/1/19	9/30/18
Submit improved CCT plans and specs to OHA	9/30/20	--
Begin CCT facility construction	1/1/21	--
Complete improved CCT facility	9/30/22	11/1/20

Action	OHA Approved Compliance Schedule	EPA's Proposed Schedule	PWB's Proposed Schedule
Complete WQ Corrosion Study	6/1/17	--	3/31/17
Review study data and agree with OHA on treatment options; submit recommendations to city council for consideration	6/30/17	--	3/17
Submit WQ Corrosion Study final report to OHA	7/1/17	--	4/5/17
Submit CCT pilot study plan to OHA	9/30/17	--	6/30/17
Implement recommendations to improve the LHRP elements as identified by OHA	12/31/17	--	12/31/17
Hire design consultant <u>and begin planning and preliminary design</u>		12/1/17	9/1/17
Submit CCT pilot study results and treatment	12/31/18	8/30/18	7/31/18
Begin improved Corrosion Control Treatment facility <u>detailed</u> design	1/1/19	9/30/18	8/1/18
Submit improved CCT plans and specs to OHA	9/30/20	--	
Begin CCT facility construction	1/1/21	--	
Complete improved CCT facility	9/30/22	11/1/20	

Action	Compliance Schedule	EPA's Proposed Schedule	PWB's Proposed Schedule
Complete WQ Corrosion Study	6/1/17	--	3/31/17
Review study data and agree with OHA on treatment options; submit recommendations to city council for consideration	6/30/17	--	3/17
Submit WQ Corrosion Study final report to OHA	7/1/17	--	4/5/17
Submit CCT pilot study plan to OHA	9/30/17	--	6/30/17
Implement recommendations to improve the LHRP elements as identified by OHA	12/31/17	--	12/31/17
Hire design consultant <u>and begin planning and preliminary design</u>		12/1/17	9/1/17
Submit CCT pilot study results and treatment	12/31/18	8/30/18	7/31/18
Begin improved Corrosion Control Treatment facility <u>detailed</u> design	1/1/19	9/30/18	8/1/18
Submit improved CCT plans and specs to OHA	9/30/20	--	4/30/20
Begin CCT facility construction	1/1/21	--	8/1/20
Complete improved CCT facility	9/30/22	11/1/20	4/30/22

Action	PWB's Proposed Schedule
Complete WQ Corrosion Study	3/31/17
Review study data and agree with OHA on treatment options; submit recommendations to city council for consideration	3/17
Submit WQ Corrosion Study final report to OHA	4/5/17
Submit CCT pilot study plan to OHA	6/30/17
Implement recommendations to improve the LHRP elements as identified by OHA	12/31/17
Hire design consultant <u>and begin planning and preliminary design</u>	9/1/17
Submit CCT pilot study results and treatment	7/31/18
Begin improved Corrosion Control Treatment facility <u>detailed</u> design	8/1/18
Submit improved CCT plans and specs to OHA	4/30/20
Begin CCT facility construction	8/1/20
Complete improved CCT facility	4/30/22

NEXT STEPS