

CLEAN WATER SERVICES

TECHNIQUES FOR EVALUATING FORCE MAIN CORROSION PROBLEMS

PNCWA 2012 Annual Conference & Exhibition

October 21-24 Boise, ID

Presented by:

Mike Kebbe, P.E., Clean Water Services

Acknowledgements:

Nate Cullen, Clean Water Services

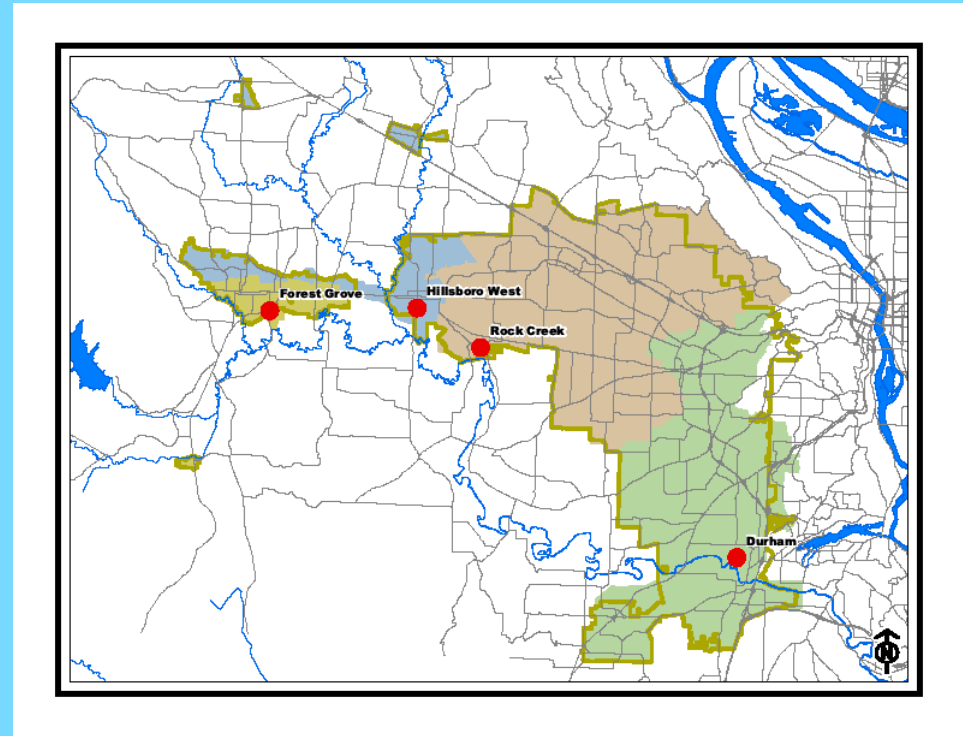
Steve Kebbe, Clean Water Services

CJ Baxter, Clean Water Services

Scott Woodbury, Clean Water Services

Jim Helton, Murray, Smith & Associates, Inc.

Susan Gierga, Murray, Smith & Associates, Inc.

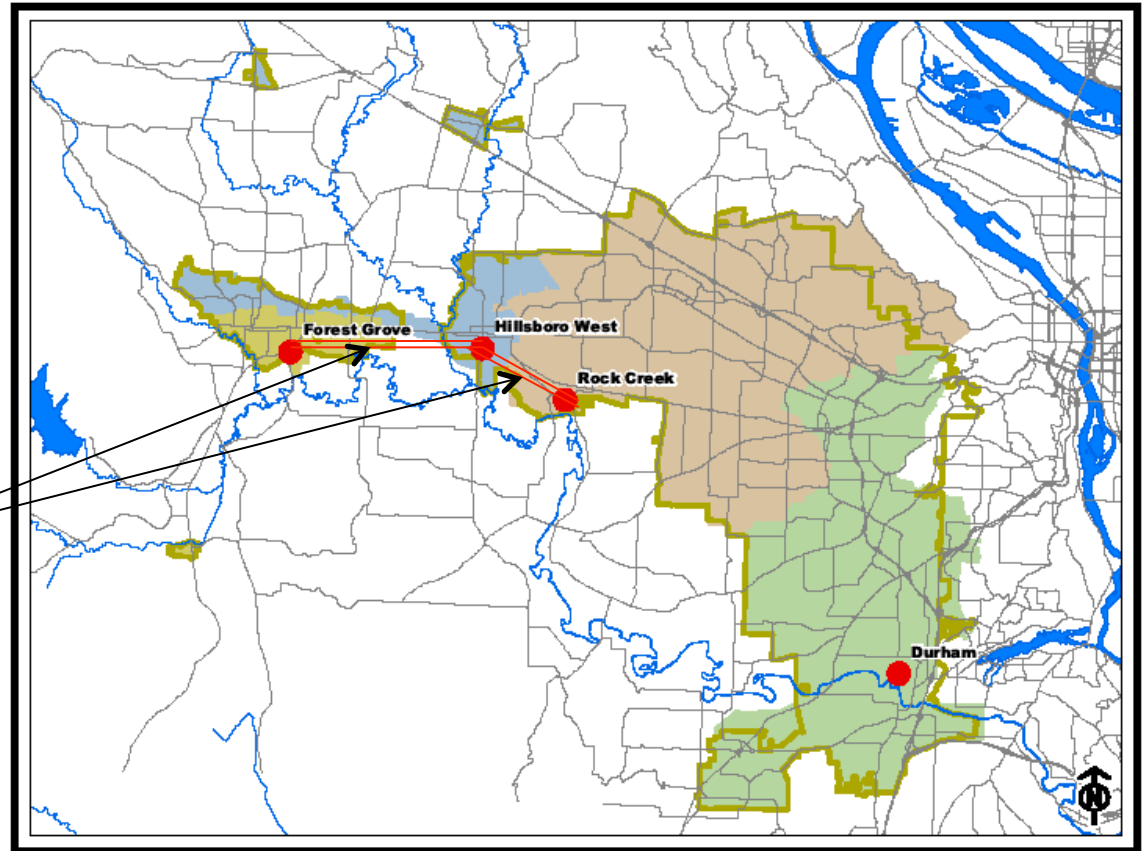


Wherever there's water, there's Clean Water.


Presentation Overview

- Background
- Project Development
- Outcome
- Questions

Twin 24-Inch Pipelines



Project Background

- Routine Maintenance found this 
- Prevention
- Develop Priority List



Force Main Maintenance / Replacement Priority List **Categories**

Categories:

- Risk
- Impact
- Cost

Force Main Maintenance / Replacement Priority List Category **Factors**

- **Risk Factors:**
 - Age
 - Stress Magnitude (PVC)
 - Soil Corrosivity
 - Failure History

Force Main Maintenance / Replacement Priority List Category **Factors**

- **Impact Factors:**

- Pipe Size
- Pipe Length
- Accessibility
- Redundancy

Force Main Maintenance / Replacement Priority List Category **Factors**

- **Cost Factors:**
 - Replacement

Force Main Maintenance / Replacement Priority List

- Risk Factors:
 - Age
 - Stress Magnitude (PVC)
 - Soil Corrosivity
 - Failure History
- Impact Factors:
 - Pipe Size
 - Pipe Length
 - Accessibility
 - Redundancy
- Cost Factors:
 - Replacement

Scoring Criteria

Force Main Maintenance / Replacement Priority List Risk Scoring

Identifier	Risk Factors	Weight of Risk Factor	Potential Score	Scoring Criteria	
A	Age	1	1	0-30 yrs	
			4	30-50 yrs	
			9	>50 yrs	
				Force Main	Reuse Line
B1	Stress Magnitude (PVC)	2	1	<25%	<50%
			4	25% - 50%	50-75%
			9	>50%	>75%
				mildly corrosive	
B2	Soil Corrosivity (DI)	2	1	mildly corrosive	
			4	moderately corrosive	
			9	highly corrosive	
C	Failure History	3	1	0 failures	
			4	1 failure	
			9	>1 failure	

Force Main Maintenance / Replacement Priority List **Impact Scoring**

Identifier	Impact Factors	Weight of Impact Factor	Potential Score	Scoring Criteria
D	Pipe Size	2	1	< 8"
			4	8" - 16"
			9	> 16"
E	Pipe Length	1	1	<1,000'
			4	1,000' to 10,000'
			9	> 10,000'
F	Access	1	1	No issues
			4	Moderate difficulty may have bores or vegetated land to consider.
			9	Seasonally in-accessible, deep bores, wetlands etc.
G	Redundancy	2	1	Reuse pipe
			4	Two pipes
			9	One pipe

Force Main Maintenance / Replacement Priority List **Cost Calculating**

- **Cost Factors:**
 - Replacement - \$/LF based on pipe diameter

Force Main Maintenance / Replacement Priority List

Scoring Criteria

- **Impact Factors:**
 - Pipe Size
 - Pipe Length
 - Accessibility
 - Redundancy
- **Risk Factors:**
 - Age
 - Stress Magnitude (PVC)
 - Soil Corrosivity
 - Failure History
- **Cost Factors:**
 - Replacement

Force Main Maintenance / Replacement Priority List **Based on Risk**

No.	Force Main/Reuse Line	Risk Factor				Risk Score	Risk Ranking
		Weight					
		A (Age)	B1 (Stress*)	B2 (Corrosivity*)	C (Failure History)		
		1	2	2	3		
21	Gaston (Reach No. 1 - Station 0+00 to 20+00)	1	9	0	9	46	1
5	King City Reuse (85th Ave to Alderbrook)	4	1	0	9	33	2
6	Summerfield Reuse (85th to Alderbrook)	4	1	0	9	33	2
7	King City Reuse (Alderbrook to King City)	4	1	0	9	33	2
15	Cipole	1	0	9	1	22	5
1	Beaverton	4	0	4	1	15	6
2	Cornelius	4	0	4	1	15	6
4	Rock Creek Ranch (Highlands)	4	0	4	1	15	6
8	Childs	4	0	4	1	15	6
9	Saum Creek	4	0	4	1	15	6
11	Sherwood	4	0	4	1	15	6
16	Pine Lodge	1	0	4	1	12	12
17	South Bull Mountain	1	0	4	1	12	12
22	Borland	1	4	0	1	12	12
22	Gaston (Reach No. 2 - Station 20+00 to 140+00)	1	4	0	1	12	12
25	Aloha #3 - #1	1	4	0	1	12	12
27	Banks	1	4	0	1	12	12
33	Jackson Bottom Pipeline	1	4	0	1	12	12

Force Main Maintenance / Replacement Priority List **Based on Impact**

No.	Force Main/Reuse Line	Impact Factor				Impact Score	Impact Ranking
		Weight					
		D (Pipe Size)	E (Pipe Length)	F (Accessibility)	G (Redundancy)		
		2	1	1	2		
54	North Plains	9	9	4	9	49	1
25	Aloha #3 - #1	9	9	9	4	44	2
29	Twin 24s #1	9	9	9	4	44	2
11	Sherwood	9	4	1	9	41	4
46	River Road 18"	9	4	1	9	41	4
22	Gaston (Reach No. 2 - Station 20+00 to 140+00)	4	9	4	9	39	6
23	Gaston (Reach No. 3 - Station 140+00 to 350+00)	4	9	4	9	39	6
53	Dawson Creek	9	9	4	4	39	6
15	Cipole	4	4	4	9	34	9
21	Orchard Hill	4	4	4	9	34	9
21	Gaston (Reach No. 1 - Station 0+00 to 20+00)	4	4	4	9	34	9
32	WQL	1	4	9	9	33	12
24	Pleasant View	4	4	1	9	31	13
37	West Union	4	4	1	9	31	13
42	Cross Creek	4	4	1	9	31	13
45	River Road 10"	4	4	1	9	31	13
50	Lower Tualatin #1	9	1	4	4	31	13
51	Lower Tualatin #2	9	1	4	4	31	13

Force Main Maintenance / Replacement Priority List **Based on Risk x Impact x Cost**

No.	Force Main/Reuse Line	Risk Score	Risk Ranking	Impact Score	Impact Ranking	Risk x Impact	Risk x Impact Ranking	Cost of Replacement, \$1,000,000s	Risk x Impact x Cost	Risk x Impact x Cost Ranking
29	Twin 24s #1	6	29	44	2	264	22	\$15.81	4173	1
25	Aloha #3 - #1	12	12	44	2	528	5	\$6.16	3253	2
54	North Plains	12	12	49	1	588	4	\$3.82	2248	3
27	Banks	12	12	26	23	312	18	\$4.28	1336	4
22	Gaston (Reach No. 2 - Station 20+00 to 140+00)	12	12	39	6	468	7	\$1.49	696	5
53	Dawson Creek	6	29	39	6	234	26	\$2.67	625	6
23	Gaston (Reach No. 3 - Station 140+00 to 350+00)	6	29	39	6	234	26	\$2.60	609	7
38	Oak Village	6	29	26	23	156	39	\$3.73	581	8
7	King City Reuse (Alderbrook to King City)	33	2	12	53	396	9	\$1.11	438	9
21	Gaston (Reach No. 1 - Station 0+00 to 20+00)	46	1	34	9	1564	1	\$0.25	388	10
11	Sherwood	15	6	41	4	615	3	\$0.41	250	11
15	Cipole	22	5	34	9	748	2	\$0.30	223	12
5	King City Reuse (85th Ave to Alderbrook)	33	2	15	51	495	6	\$0.35	175	13
2	Cornelius	15	6	21	48	315	17	\$0.46	145	14

Force Main Maintenance / Replacement Priority List

Questions, comments & suggestions?