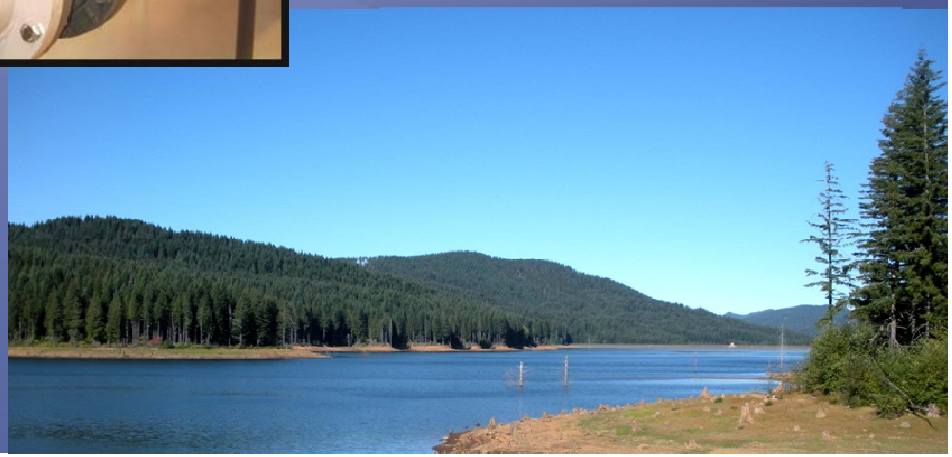
ASR System Operations and Maintenance Requirements

PNWS-AWWA 2010 Annual Conference
Tacoma, Washington
May 12, 2010

www.beavertonoregon.gov



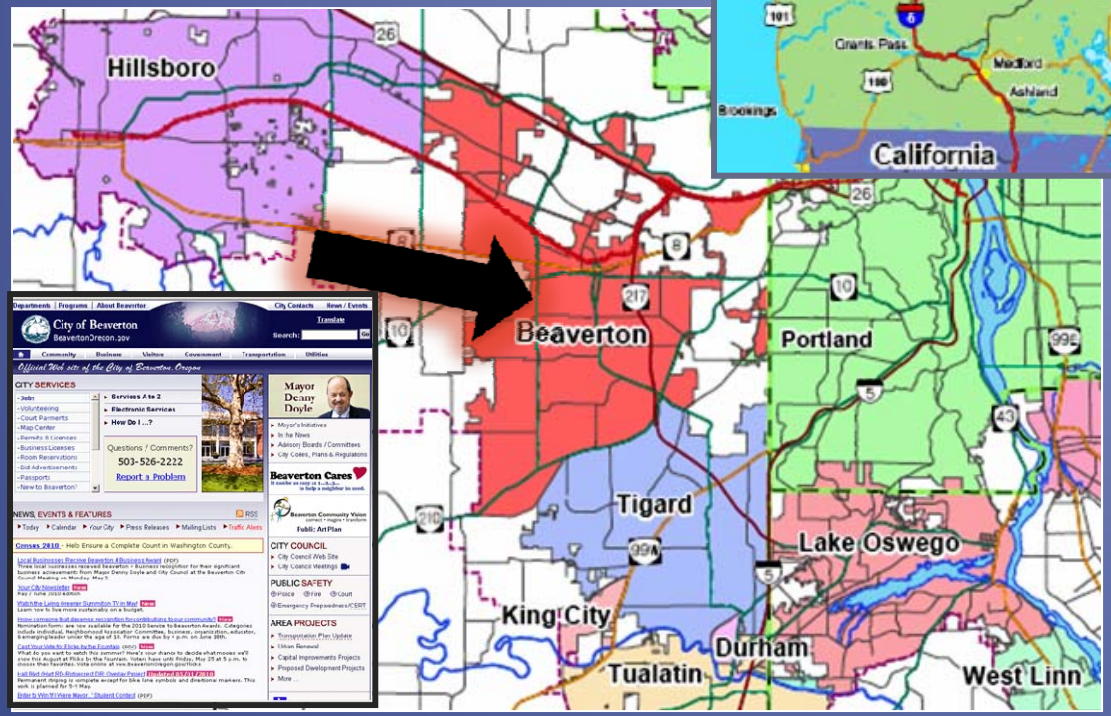
Presentation Outline

- Overview of City's Water System
- ASR Infrastructure
- Operations and Maintenance
- Lessons Learned
- Q & A

Acknowledgements

- Beaverton Water Operations Staff
- GSI Water Solutions – Hydrogeology

City of Beaverton



City of Beaverton

Potable Water Mains

Entire System

Total Length: 263 miles

Total Customer Meters: 16,986

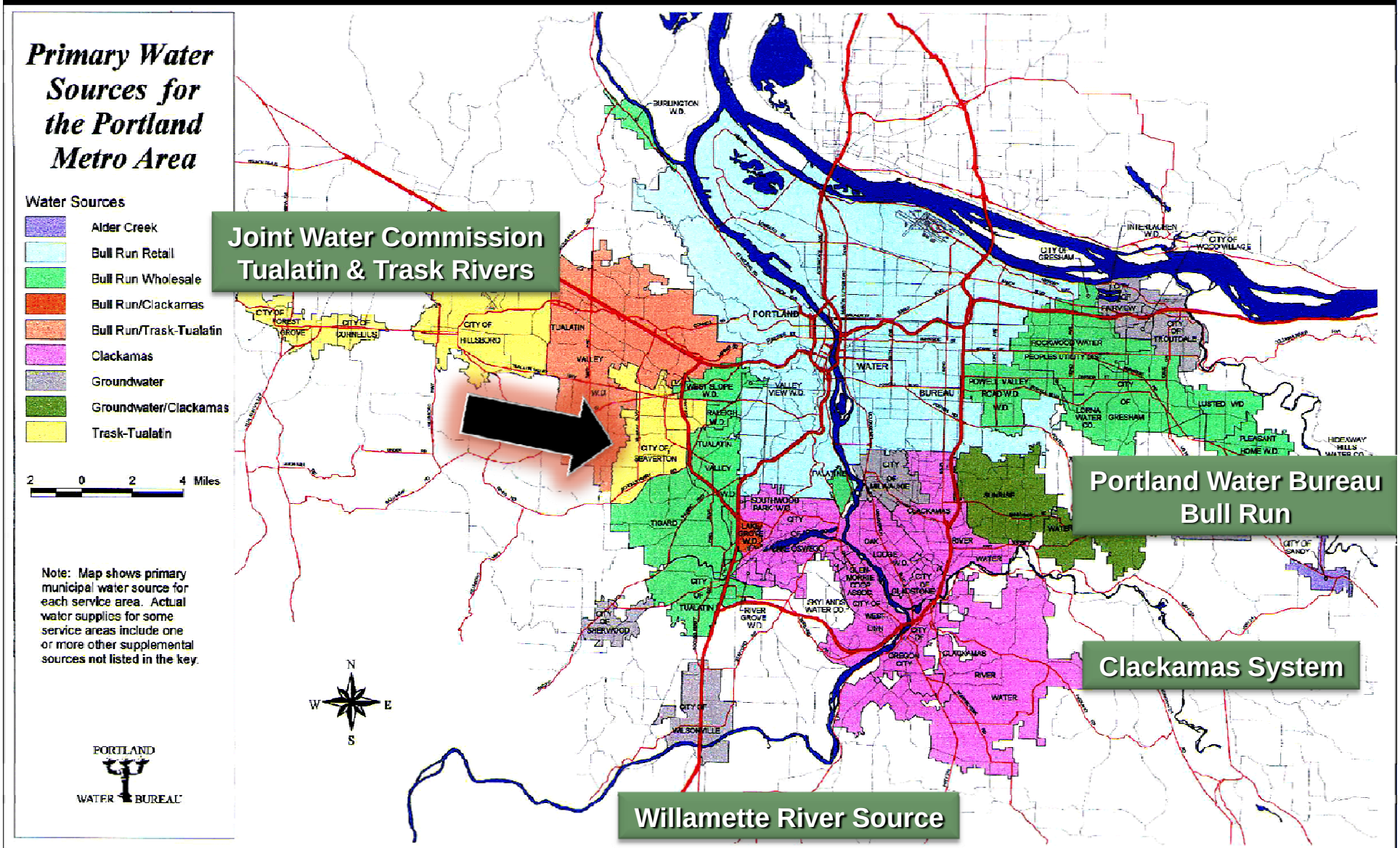
Population Served: 67,000

City of Beaverton Water Supply

Beaverton used groundwater supply from the inception of its water system in the 1920s until the early 1980s.

From 1960 to 1979, Beaverton was supplied with drinking water primarily by the City of Portland, and by groundwater from the Hanson Road well (1966-1983).

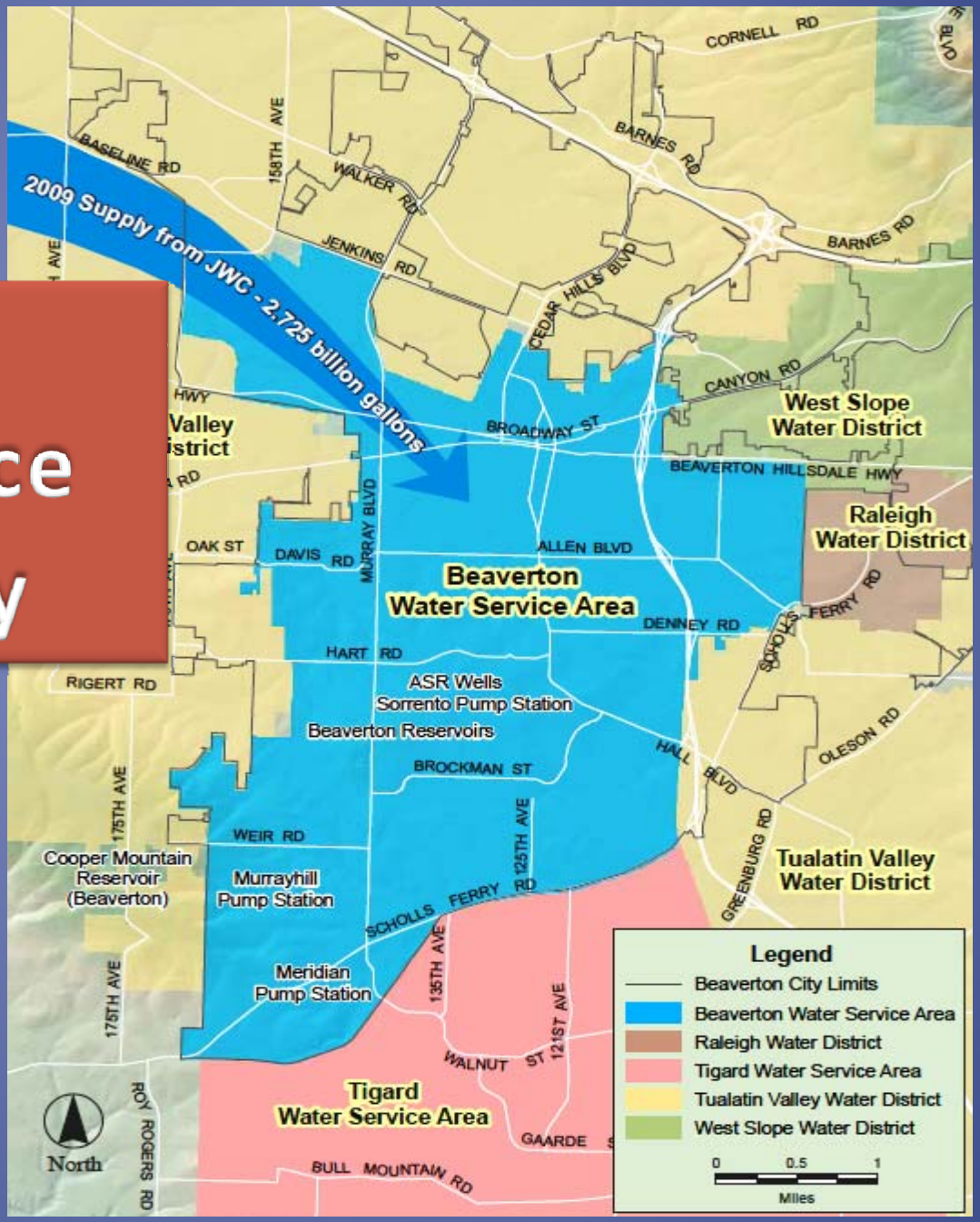
Regional Water Supply Sources

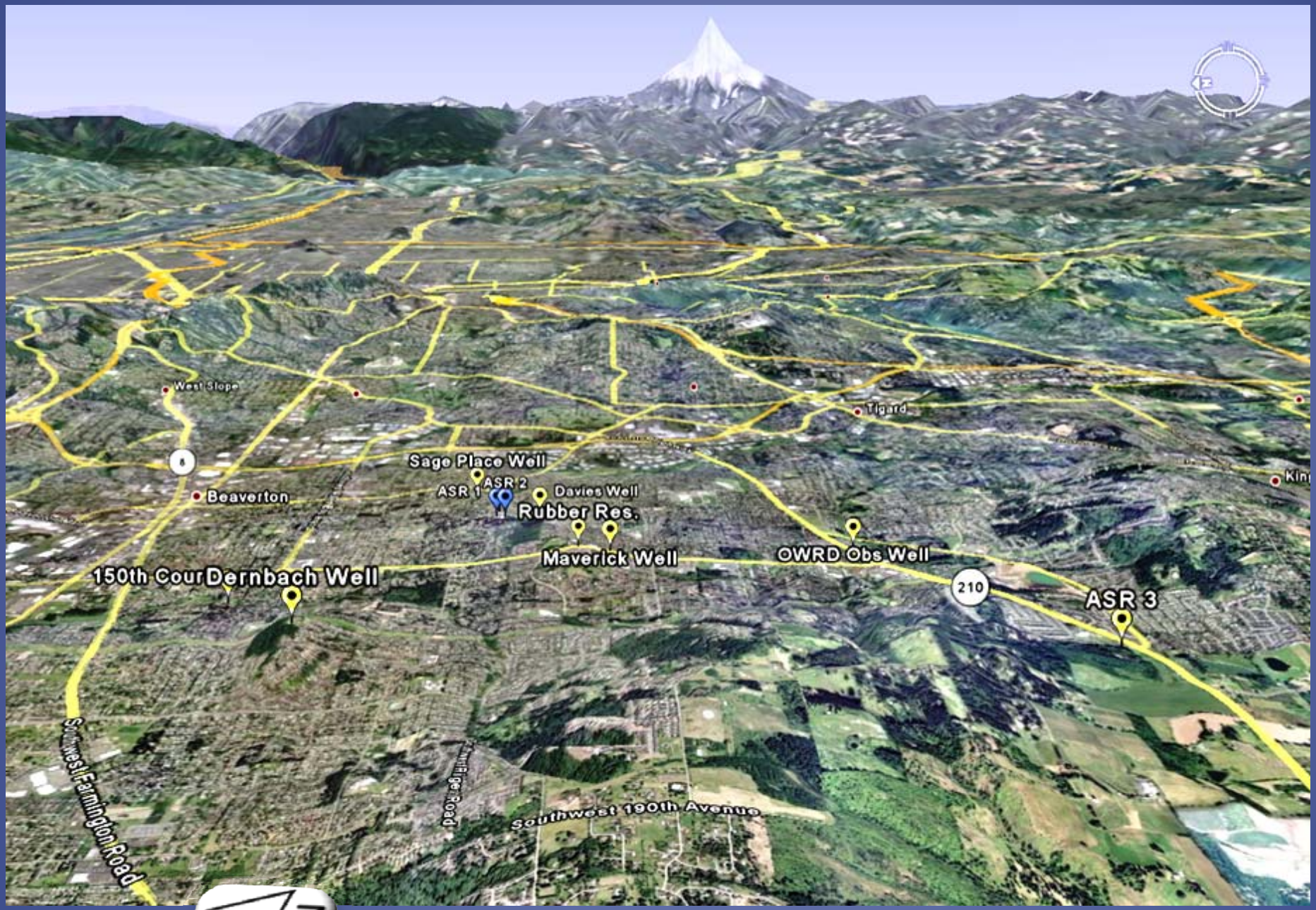


Beaverton's Treated Surface Water Supply

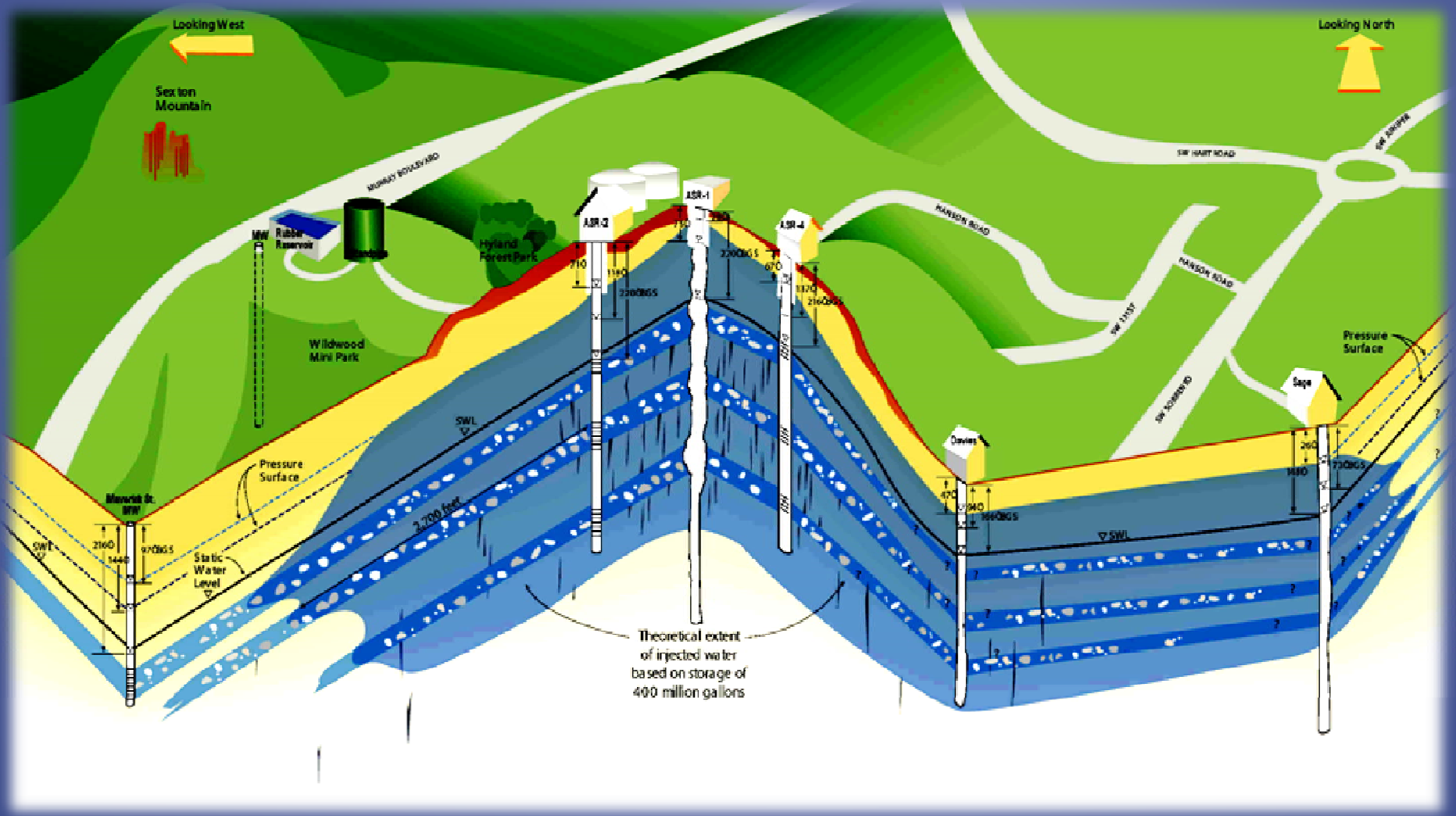
Average Daily Demand = 8 – 9 mgd
Peak Day Demand = 17 mgd

** 14 mgd capacity in JWC South Transmission Line

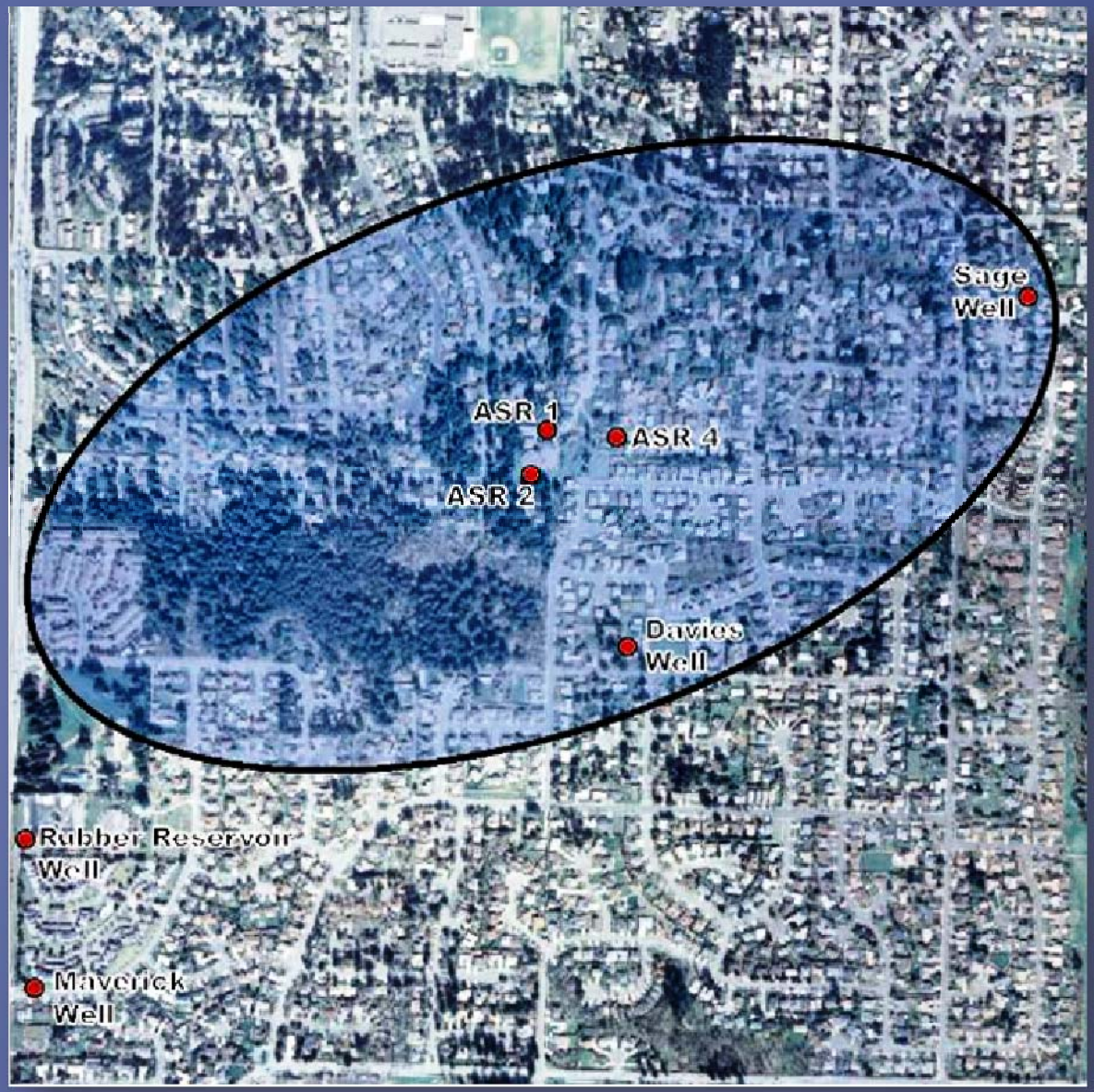



West Slope
Tigard
Sage Place Well
ASR 1
ASR 2
Davies Well
Beaverton
Rubber Res.
Maverick Well
OWRD Obs Well
150th Cour
Dernbach Well
210
ASR 3
Southwest Farmington Road
Southwest 190th Avenue

Sorrento Wellfield
ASR Well #'s 1, 2, and 4
Hydrogeology – Columbia River Basalt

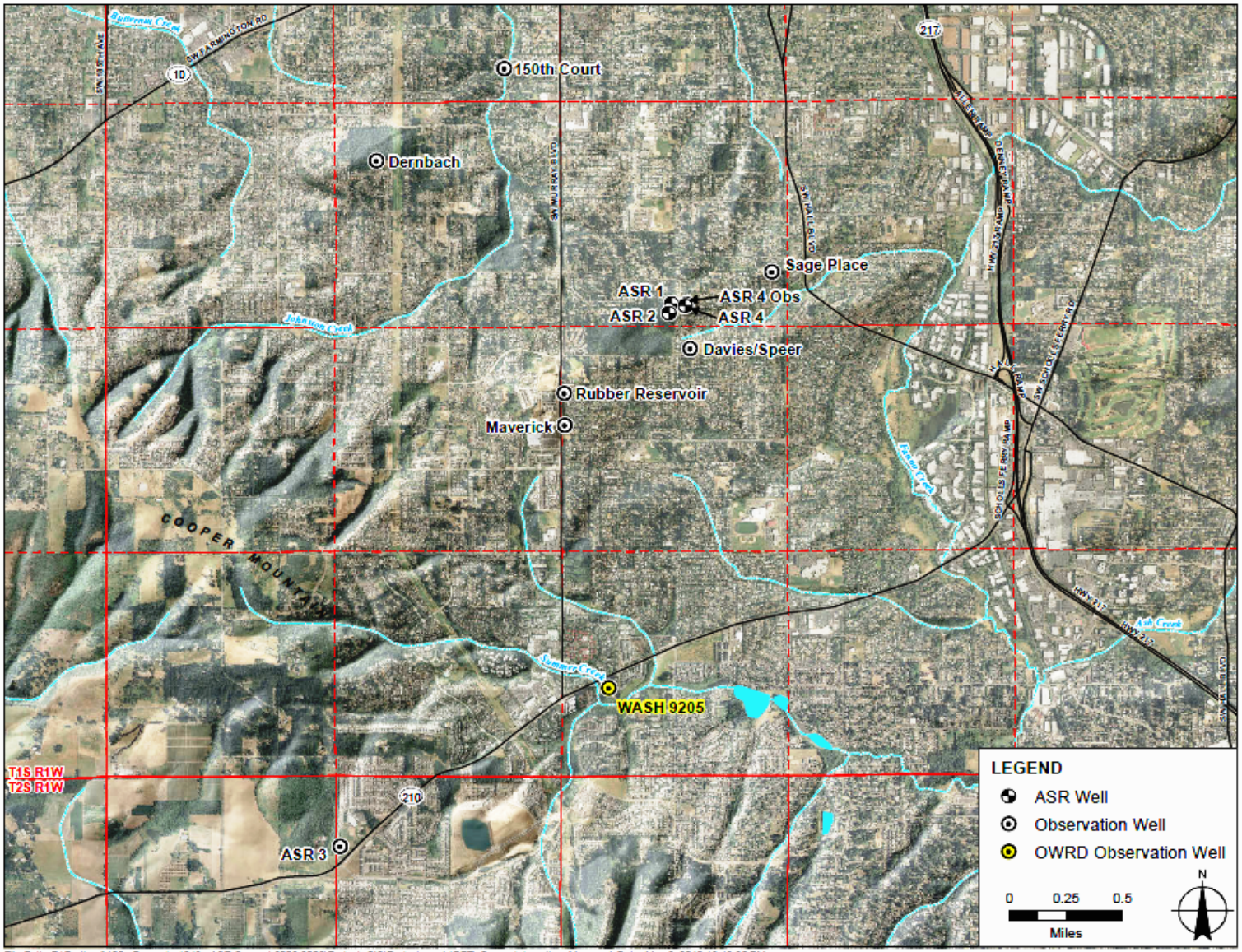


ASR Footprint



** Aerial extent of injected water based on annual storage target of 400 million gallons. Storage area radius is approximately 2,700 feet.

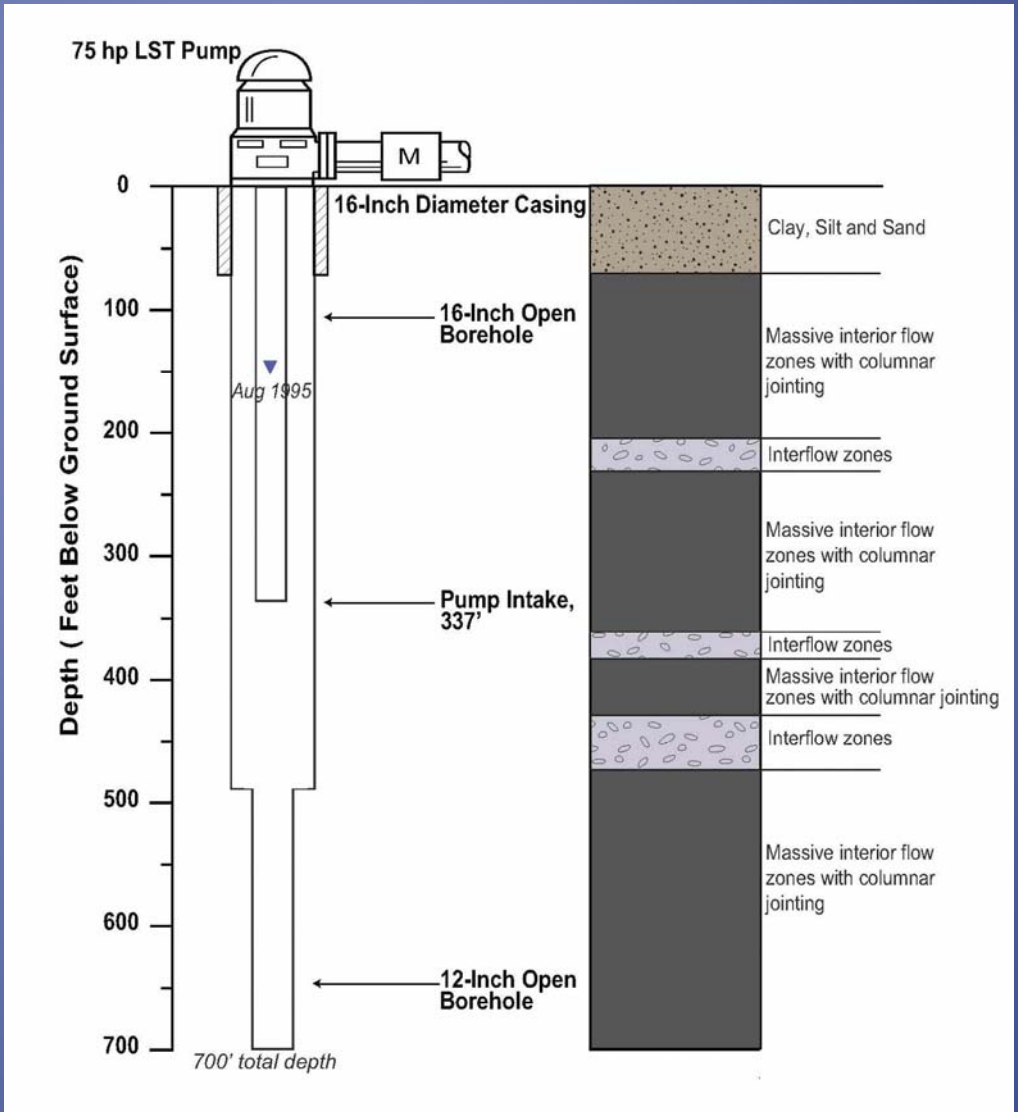
Local Observation Wells



File Path: P:\Portland\100 - Beaverton\049 - ASR Support 2008-2009\Project_GIS\Project_mxds\PPT_General_Location_Map.mxd, Date: May 6, 2010 12:49:25 PM

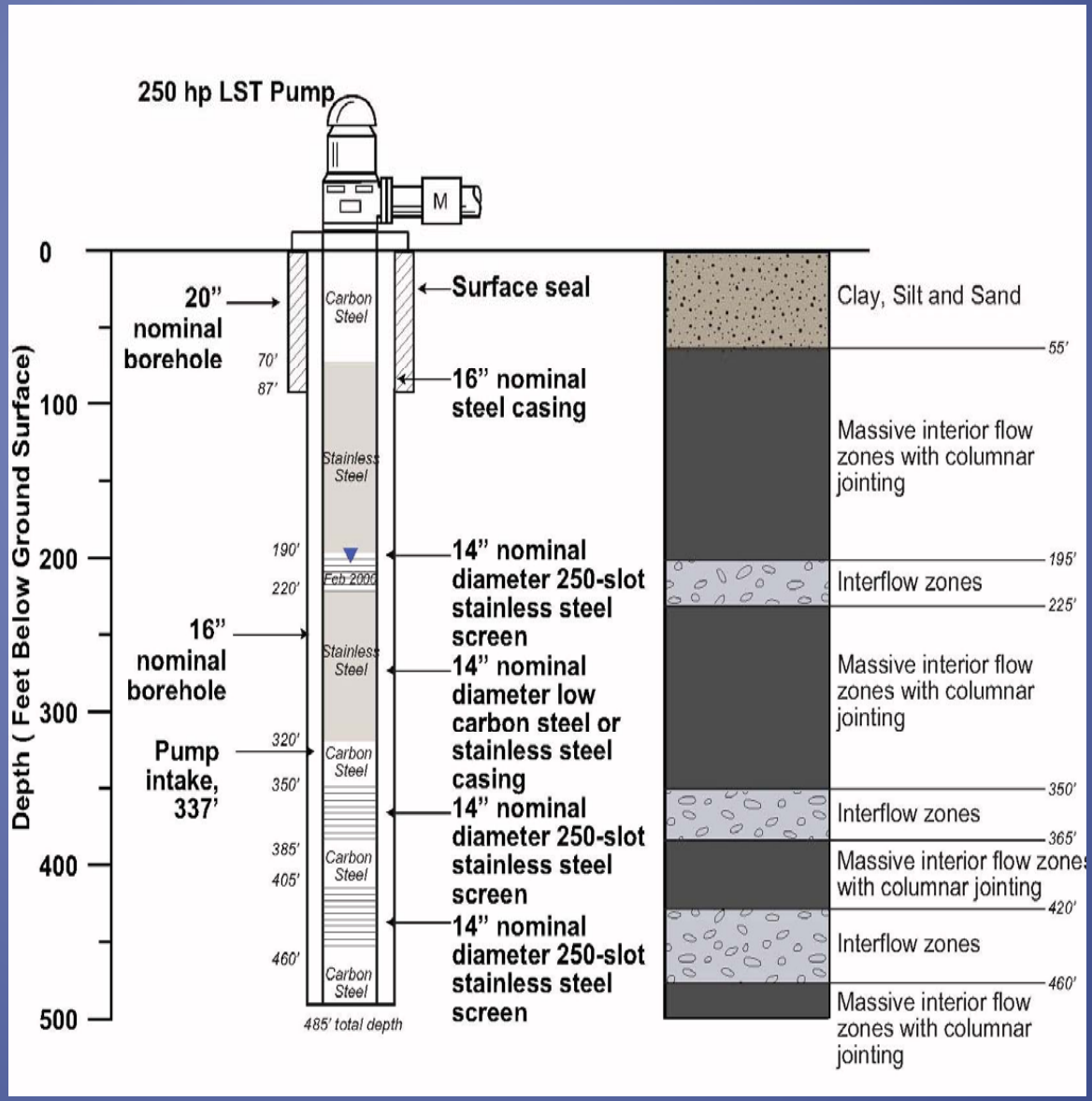
Beaverton ASR Wells

ASR #1 (1 mgd)



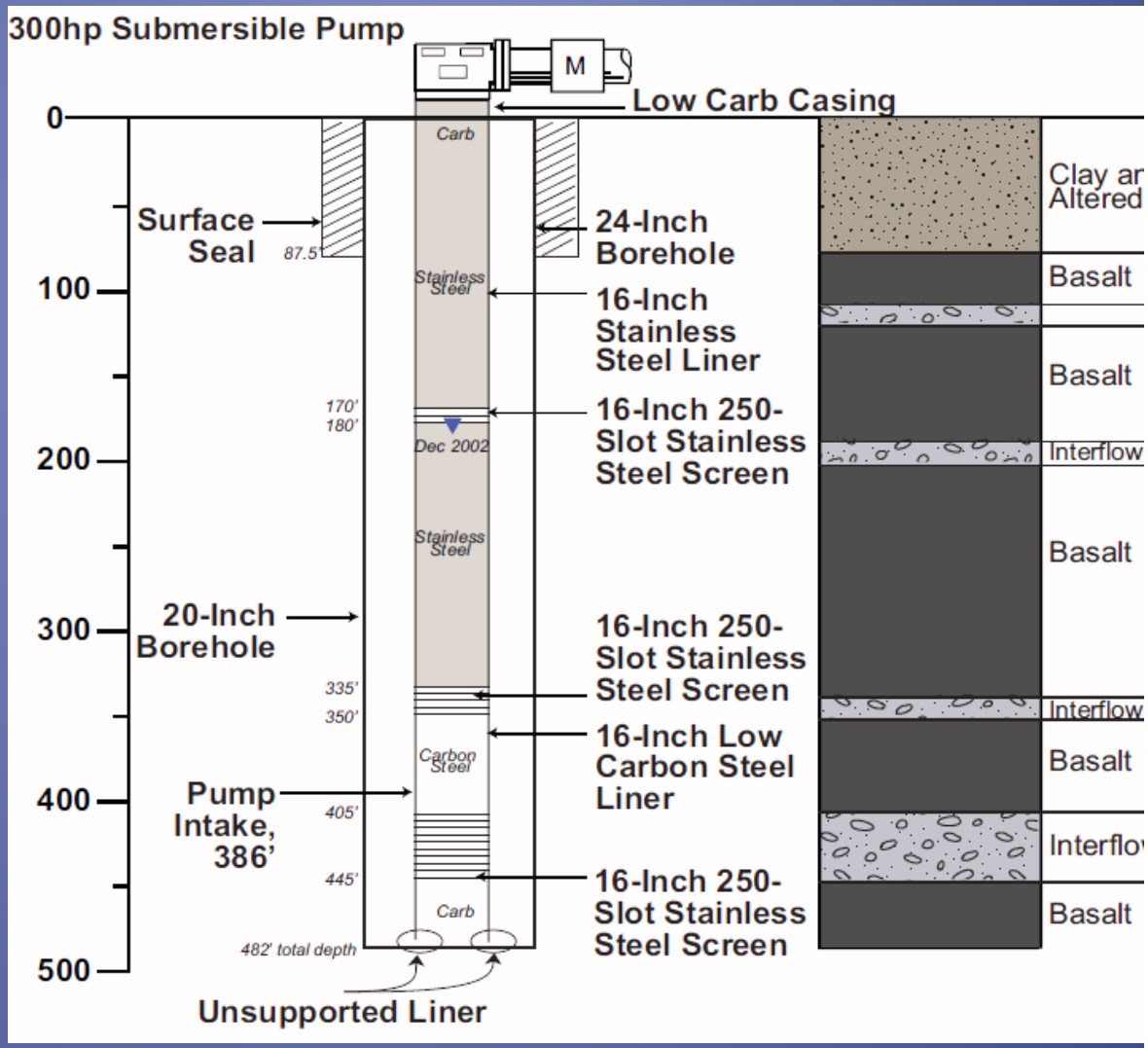
Beaverton ASR Wells

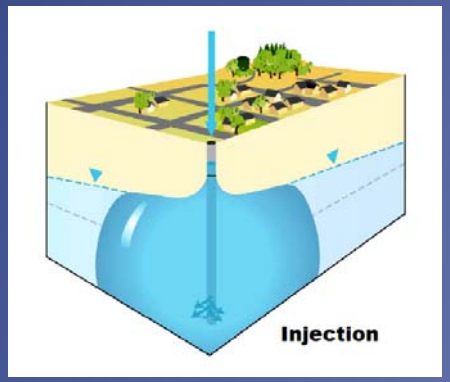
ASR #2 (2 mgd)



Beaverton ASR Wells

ASR #4 (4 mgd)





Typical ASR Injection Cycle

- Notification to Water Master
- Backflush and sample distribution system
  - Process and routing
- Well conditioning/cleaning column
  - Flow rate, “white bucket” test

GSI Water Solutions, Inc.

December 21, 2009

SENT VIA EMAIL

Mr. Daniel C. Heller, District 18 Watermaster
Field and Technical Services Division
Watermaster District 18
1400 SW Madison Street #240
Hillsboro, OR 97123

RE: Notice of Injection and Recovery for Cycle 13 at the Hansen Road Well (ASR No.3), Cycle 10 at ASR No. 2 and Cycle 8 at ASR No. 1, City of Beaverton Sunset Water Works site Aquifer Storage and Recovery Pilot Study Project (Limited License No. 882)

Dear Daniel:

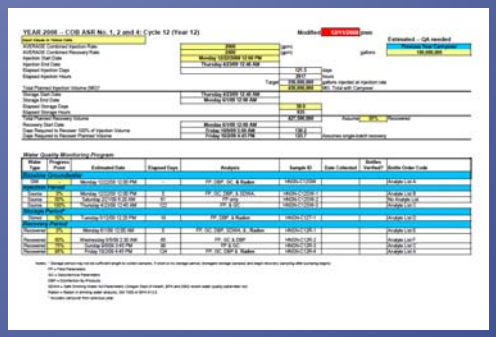
On behalf of the City of Beaverton (City), this letter serves as notice to the Tualatin Basin Water Master that the City plans to begin injection and subsequently recovery cycles at ASR 1, ASR 2, and ASR 3 between January 2010 and October 2010, as part of the aquifer storage and recovery (ASR) project. ASR 1, ASR 2, and ASR 3 are located at the City's Sunset Water Works Facility in Beaverton, Oregon.

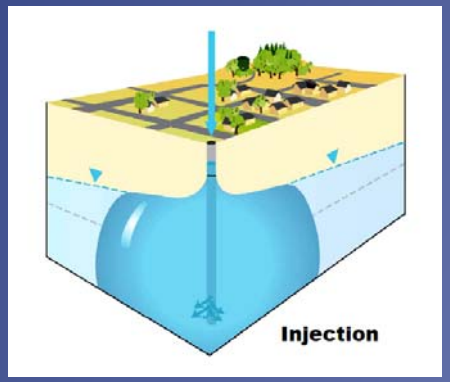
We plan to submit the Year 2008-2009 ASR operations report to the Oregon Water Resources Department (OWRD) by mid-February 2010. Our proposed monitoring plan (water level and water quality) for the upcoming ASR cycle will be included in this report.

The following provides notification information for testing per Limited License 882. In addition, please be aware that the start of injection and the volume of injected water may change depending on turbidity or the injection cease water and potential down time during injection. Likewise, the start of recovery will be contingent on the volume of water that was injected, pending water needs for the City, and the timing of OWRD's notice on when the City can no longer withdraw water from the Tualatin River. We will however strive to keep OWRD informed of the City's ASR activities.

Injection:

- ASR Limited License Number: 882
- Location of the injection source water diversion: City of Beaverton's municipal water supply source from the North and Tualatin Rivers.
- Amount of water to be diverted (injected):
  - ASR No. 1 Cycle 12 – 60 million gallons (MG)
  - ASR No. 2 Cycle 9 – 60 MG

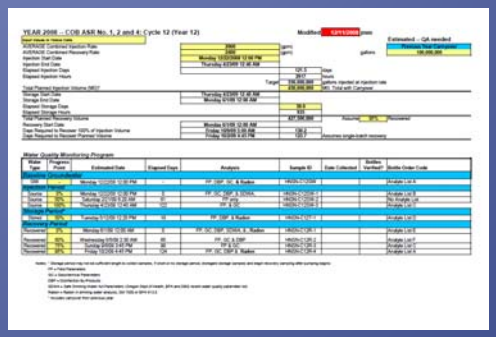




Typical ASR Injection Cycle (cont.)

- Wellhead sample at start of injection
- Seasonal considerations
  - Reservoir turnover/water quality

SENT VIA EMAIL



Water Quality Testing

Table 6

YEAR 2009 – COB ASR No. 1, 2 and 4: Cycle 12 (Year 12)

Input Values in Yellow Cells					Estimated
AVERAGE Combined Injection Rate:	2000	(gpm)			Previous Year Carryover
AVERAGE Combined Recovery Rate:	2400	(gpm)		gallons	100,000,000
Injection Start Date	Monday 12/22/2008				
Injection End Date	Thursday 4/23/09				
Elapsed Injection Days		121.5	days		
Elapsed Injection Hours		2917	hours		
	Target	350,000,000	gallons injected at injection rate		
Total Planned Injection Volume (MG)*		450,000,000	MG Total with Carryover		
Storage Start Date	Thursday 4/23/09				
Storage End Date	Monday 6/1/09				
Elapsed Storage Days		39.0			
Elapsed Storage Hours		935			
Total Planned Recovery Volume		427,500,000	Assume	95%	Recovered
Recovery Start Date	Monday 6/1/09				
Days Required to Recover 100% of Injection Volume	Friday 10/9/09	130.2			
Days Required to Recover Planned Volume	Friday 10/2/09	123.7	Assumes single-batch recovery		

Water Quality Monitoring Program

Water Type	Progress Point	Estimated Date	Elapsed Days	Analysis	Sample ID	Date Collected	Bottles Verified?	Bottle Order Code
Baseline Groundwater								
GW	-	Monday 12/22/08	-	FP, DBP, GC, **& Radon**	HNSN-C12GW			Analyte List A
Injection Period								
Source	0%	Monday 12/22/08	0	FP, GC, DBP, & SDWA,	HNSN-C12SW-1			Analyte List B
Source	50%	Saturday 2/21/09	61	FP only	HNSN-C12SW-2			No Analyte List
Source	100%	Thursday 4/23/09	122	FP, & GC	HNSN-C12SW-3			Analyte List C
Storage Period*								
Stored	50%	Tuesday 5/12/09	19	FP, DBP, **& Radon**	HNSN-C12T-1			Analyte List D
Recovery Period								
Recovered	0%	Monday 6/1/09	0	FP, GC, DBP, SDWA, **& , Radon**	HNSN-C12R-1			Analyte List E
Recovered	50%	Wednesday 8/5/09	65	FP, GC & DBP	HNSN-C12R-2			Analyte List F
Recovered	75%	Sunday 9/6/09	98	FP & GC	HNSN-C12R-3			Analyte List C
Recovered	95%	Friday 10/2/09	124	FP, GC, DBP & **Radon**	HNSN-C12R-4			Analyte List A

Notes: * Storage period may not be sufficient length to collect samples, if short or no storage period, disregard storage samples and begin recovery sampling after pumping begins

FP = Field Parameters

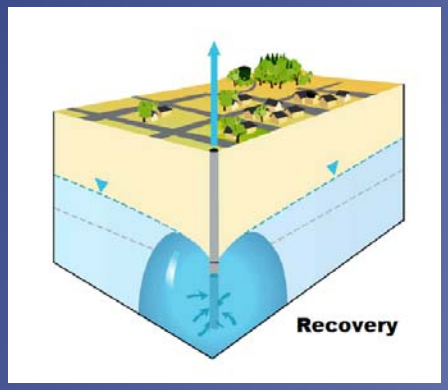
GC = Geochemical Parameters

DBP = Disinfection By-Products

SDWA = Safe Drinking Water Act Parameters (Oregon Dept of Health, EPA and DEQ recent water quality parameter list)

Radon = Radon in drinking water analysis, SM 7500 or EPA 913.0

* Includes carryover from previous year



Typical ASR Recovery Cycle

- Notification to Water Master
  - Approx. start 2-3 days after regulated off river
- Backflush & sample at wellhead
  - Weekly Bac-T testing (not required)
- Final water sampling
- Annual ASR Report

GSI Water Solutions, Inc.

December 21, 2009

SENT VIA EMAIL

Mr. Darrell C. Hadley, District 13 Watermaster
Field and Technical Services Division
Watermaster District 13
1400 SW 5th Street #200
Hillsboro, OR 97123

RE: Notice of Injection and Recovery for Cycle 12 at the Hansen Road Well (ASR No.1); Cycle 10 at ASR No. 2; and Cycle 4 at ASR No. 4, City of Beaverton Sunset Water Works site. Aquifer Storage and Recovery Pilot Study Project (Limited License No. 001)

Dear Darrell:

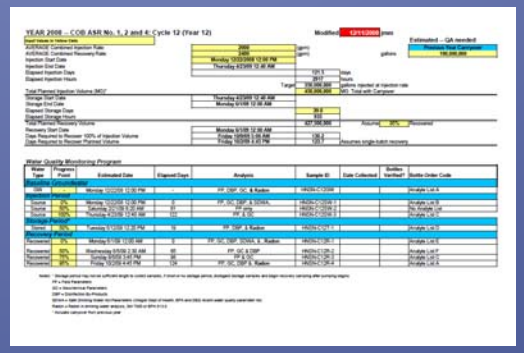
On behalf of the City of Beaverton (City), this letter serves as notice to the Tualatin Basin Water Master that the City plans to begin injection and subsequently recover water at ASR 1, ASR 2, and ASR 4 between January 2010 and October 2010, as part of the aquifer storage and recovery (ASR) project. ASR 1, ASR 2, and ASR 4 are located at the City's Sunset Water Works Facility in Beaverton, Oregon.

We plan to submit the Year 2008-2009 ASR operations report to the Oregon Water Resources Department (OWRD) by mid-February 2010. Our proposed monitoring plan for site level and water quality for the upcoming ASR cycle will be included in this report.

The following provides notification information for testing per Limited License 0001. In addition, please be aware that the start of injection and the volume of injected water may change depending on turbidity of the injection source water and potential down time during injection. Likewise, the start of recovery will be contingent on the volume of water that was injected, pending requirements for the City, and the timing of OWRD's notice of when the City can no longer withdraw water from the Tualatin River. We will however strive to keep OWRD informed of the City's ASR activities.

Injection:

- ASR Limited License Number: 001
- Location of the injection source water: Beaverton, City of Beaverton's municipal water supply source from the Bonny and Tualatin Rivers.
- Amount of water to be Stored (injected):
  - ASR No. 1: Cycle 12 = 40 million gallons (MG)
  - ASR No. 2: Cycle 10 = 40 MG



YEAR 2008 – COB ASR No. 1, 2 and 4: Cycle 12 (Year 12)

Modified: 12/11/2008 Jean

Estimated – QA needed

Total Volume to Yellow Date			
AVERAGE Combined Injection Rate	2000	(gpm)	
AVERAGE Combined Recovery Rate	1400	(gpm)	
Injection Start Date	Monday 12/22/2008 12:00 PM		
Injection End Date	Thursday 4/23/09 12:45 AM		
Elapsed Injection Days		121.5	Days
Elapsed Injection Hours		2917	hours
	Target	350,000,000	gallons injected at injection rate
Total Planned Injection Volume (MG)*		350,000,000	MG Total with Carryover
Storage Start Date	Thursday 4/23/09 12:45 AM		
Storage End Date	Monday 6/1/09 12:00 AM		
Elapsed Storage Days		38.5	
Elapsed Storage Hours		922	
Total Planned Recovery Volume		437,500,000	Assume 20% Recovered
Recovery Start Date	Monday 6/1/09 12:30 AM		
Days Required to Recover 100% of Injection Volume	Friday 12/25/09 3:30 AM	126.2	
Days Required to Recover Planned Volume	Friday 10/23/09 4:30 PM	157.7	Assumes single-batch recovery

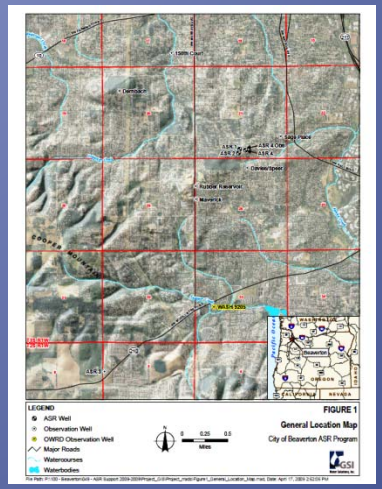
Water Quality Monitoring Program

Water Type	Frequency Point	Estimated Date	Elapsed Days	Analysis	Sample ID	Date Collected	Bottles Verified?	Bottle Order Code
Storage								
Source	100%	Monday 12/22/08 12:00 PM		FP, DBP, GC, & Radon	HRDN-C12008			Analyte List A
Storage								
Source	50%	Monday 12/22/08 12:00 PM	0	FP, GC, DBP, & SOWA	HRDN-C12008-1			Analyte List B
Source	50%	Saturday 2/21/09 5:30 AM	61	FP, PPB	HRDN-C12008-2			No Analyte List
Source	100%	Thursday 4/23/09 12:45 AM	121	FP, & GC	HRDN-C12008-3			Analyte List C
Storage Period								
50 Stored	50%	Tuesday 5/12/09 12:45 PM	19	FP, DBP, & Radon	HRDN-C12-1			Analyte List D
Recovery Period								
Recovered	5%	Monday 6/1/09 12:00 AM	0	FP, GC, DBP, SOWA, & Radon	HRDN-C12R-1			Analyte List E
Recovered	20%	Wednesday 6/3/09 2:30 AM	60	FP, GC, & DBP	HRDN-C12R-2			Analyte List F
Recovered	35%	Sunday 8/9/09 5:45 PM	108	FP & GC	HRDN-C12R-3			Analyte List G
Recovered	50%	Friday 10/23/09 4:45 PM	154	FP, GC, DBP, & Radon	HRDN-C12R-4			Analyte List H

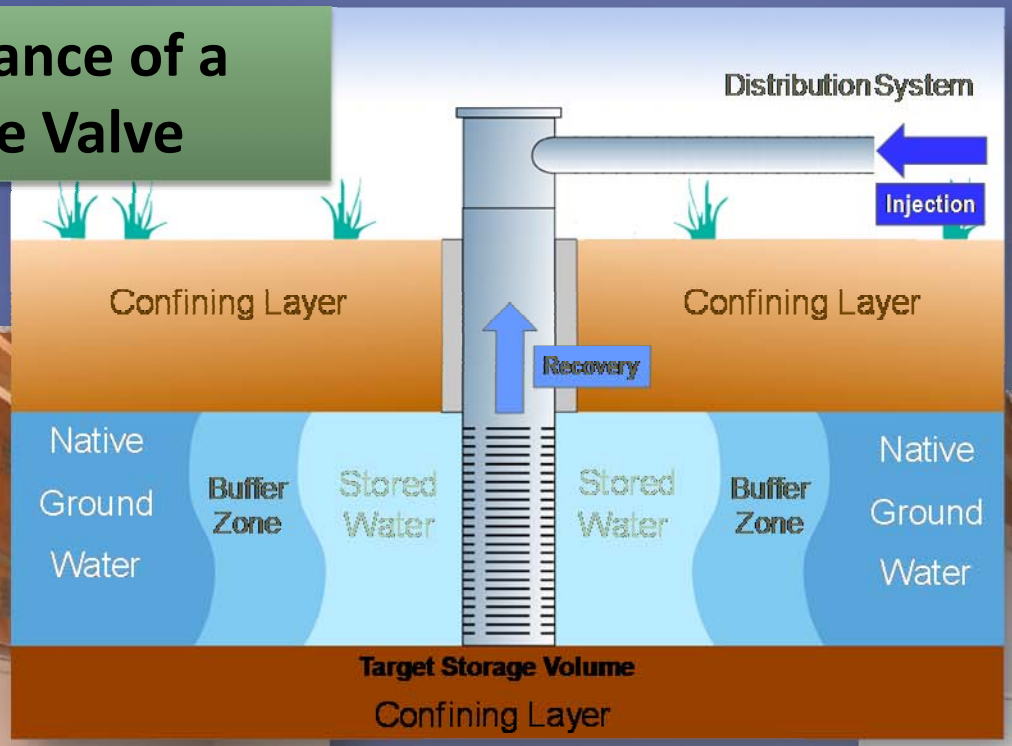
Notes: Storage period may not be sufficient length to control samples. If more or no storage period, discharged storage samples and begin recovery sampling after pumping begins.
FP = Field Parameters
GC = Geochemical Parameters
DBP = Disinfection By-Products
SOWA = Safe Drinking Water Act Parameters (Oregon Dept of Health, SPA and DEQ Month water quality operation list)
Radon = Radon in drinking water analysis, Set 1500 or EPA 913.0
* Includes carryover from previous year

Lessons Learned

- Know your system
- Collect data
- Establish system baseline
- Monitor system & water levels
- Operator training



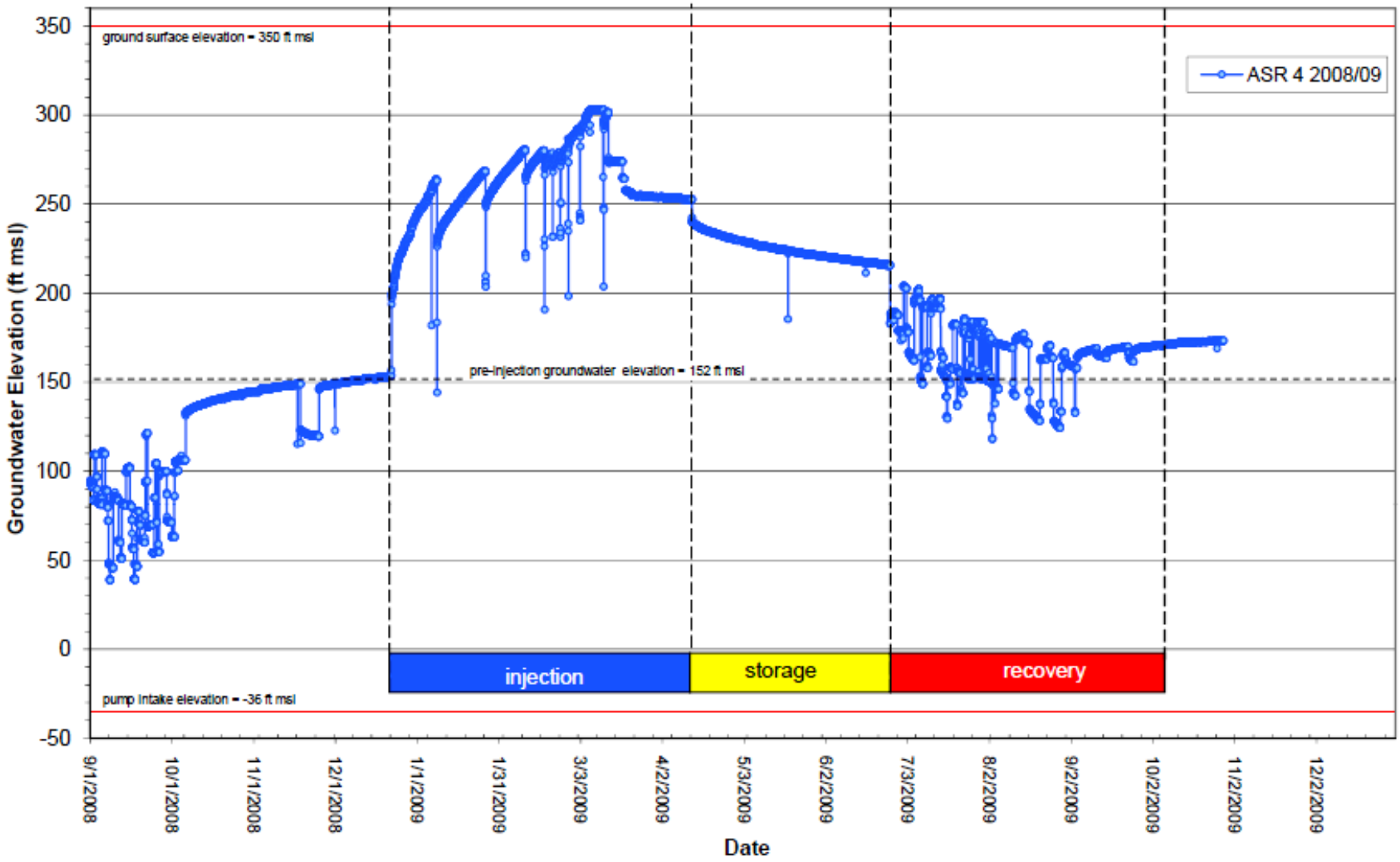
The Importance of a Downhole Valve



ASR No. 4

- Better control of injection flow rate
- Minimize risk of air plugging

Figure 8
ASR No. 4 Groundwater Elevation
City of Beaverton ASR Program



Questions?

City of Beaverton

Public Works Department

www.beavertonoregon.gov