Aquifer Injection and Lake Augmentation

Work Group Meeting, White Bear Lake Area Comprehensive Plan

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Aquifer Injection and Lake Augmentation - Purpose

Evaluate the feasibility of wastewater reuse for aquifer injection or direct lake augmentation to improve White Bear Lake surface water levels and reduce pressure on aquifer.

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Permitting Requirements

- United State Environmental Protection Agency Region 5 – Class V Injection Well Permit Required
- Minnesota Department of Health – Minnesota Rules, Chapter 4725 prohibits injection wells – variance required.
- Minnesota Pollution Control Agency – risk-based assessment
- Department of Natural Resources
- Watershed Organizations
- Army Corp of Engineers
- Pilot Testing

Water Quality Goals

- Disinfected tertiary treatment
- Match existing water quality
  - No chloride
  - No contaminants
  - No nutrients
- Membrane Bioreactor Wastewater Treatment
- Reverse Osmosis
  - Remineralization

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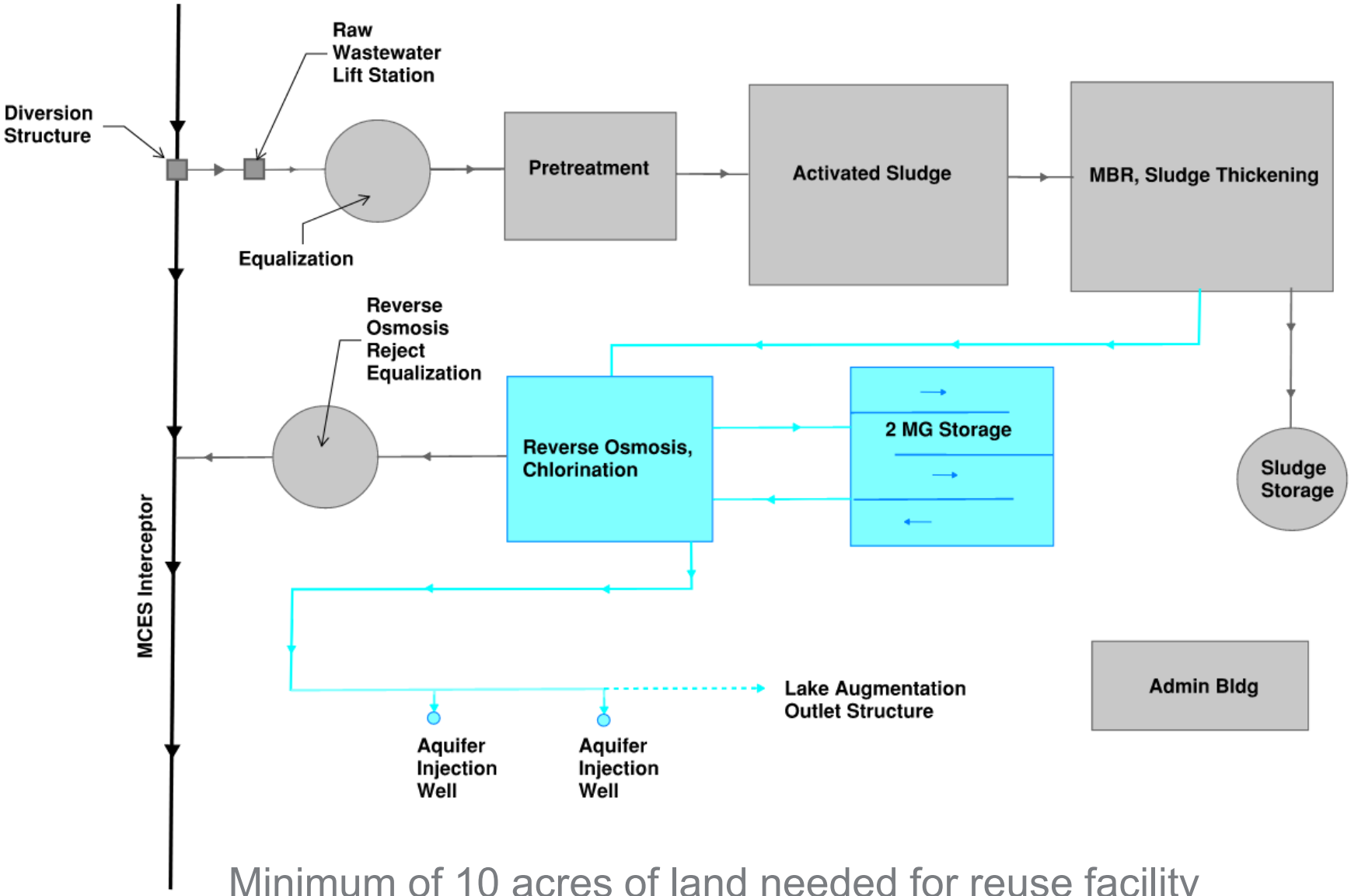
Wastewater Reuse – Aquifer Injection



Minimum of 10 acres of land needed for reuse facility

Aquifer Injection – System Layout

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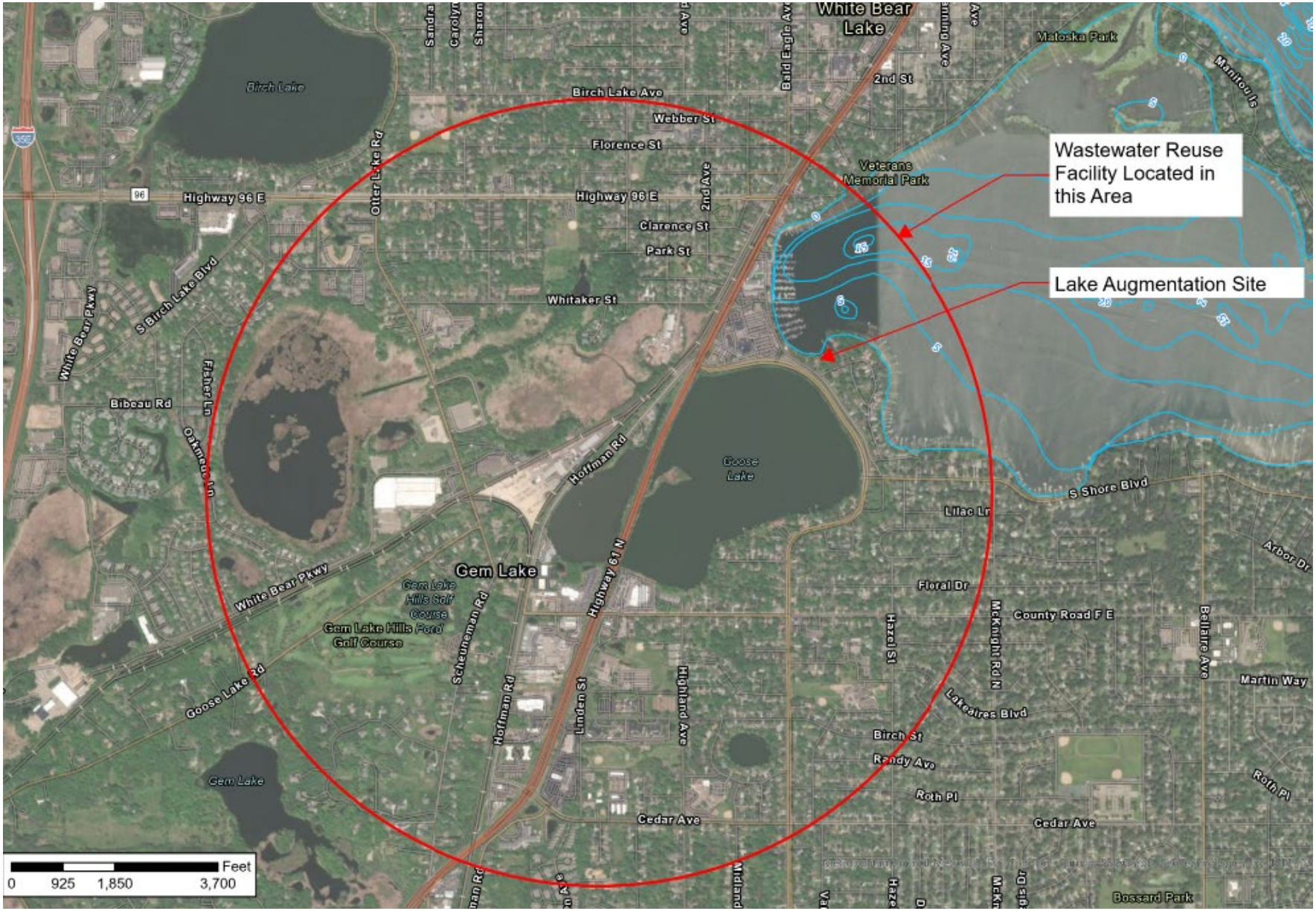
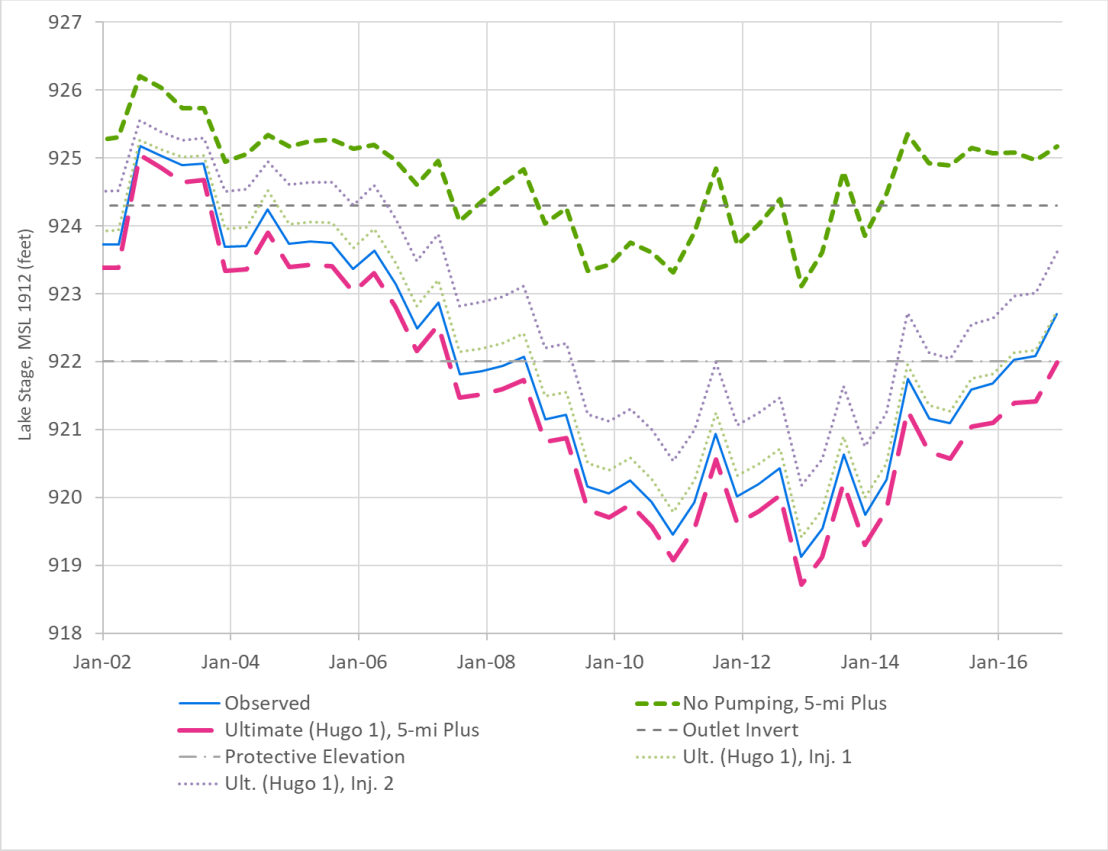
Augmentation – System Layout



Lake Level Modeling - Injection



- Ultimate (Hugo 1)
- Injection well(s) adjacent to White Bear Lake, 1 MGD or 2 MGD

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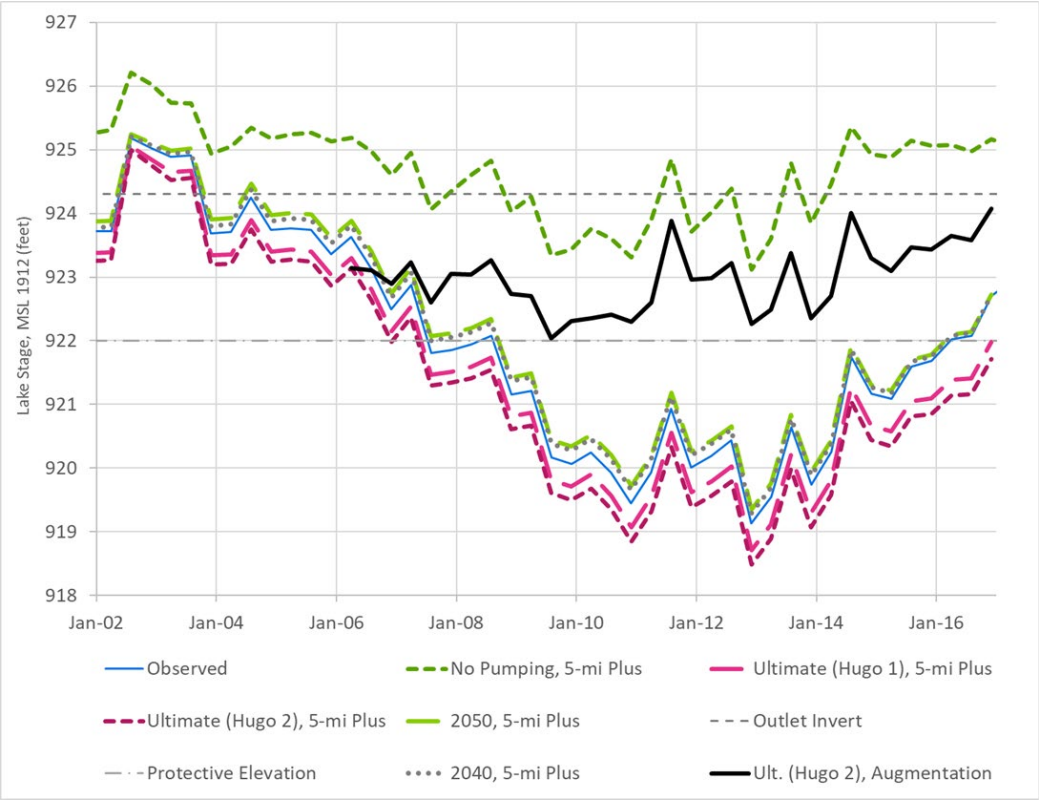
DNR Lake Level Modeling – Augmentation



- Ultimate (Hugo 2), Augmentation
- Up to 4 million gallons per day – *cannot do this much with reuse water*
- Augmenting during open water season
- Up to 780 million gallons per year – *cannot do this much with reuse water*

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Aquifer Injection – Capital Cost Opinion

Component	Unit	Est. Quantity	Unit Price	Cost
Effluent Diversion	LS	1	$910,000	$910,000
0.5 MG Equalization Tank	LS	1	$2,500,000	$2,500,000
2.5 MGD Wastewater Treatment Plant	LS	1	$75,000,000	$75,000,000
2 MGD RO Reuse Treatment Plant	LS	1	$18,000,000	$18,000,000
2 MG Storage	LS	1	$5,000,000	$5,000,000
0.5 MG Reject Water Equalization	LS	1	$2,500,000	$2,500,000
12” Aquifer Injection Watermain	LF	5,400	$500	$2,700,000
Injection Wells	EA	2	$1,000,000	$2,000,000
			Subtotal	**$108,600,000**
			40% Contingency	$43,400,000
			Construction Subtotal:	**$152,000,000**
			Easement and Land Acquisition	$2,000,000
			Pilot Testing	$3,000,000
			15% Engineering	$22,800,000
			15% Construction Admin	$22,800,000
			Total:	**$202,600,000**

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Augmentation – Capital Cost Opinion

Component	Unit	Est. Quantity	Unit Price	Cost
Effluent Diversion	LS	1	$910,000	$910,000
0.5 MG Equalization Tank	LS	1	$2,500,000	$2,500,000
2.5 MGD Wastewater Treatment Plant	LS	1	$75,000,000	$75,000,000
2 MGD RO Reuse Treatment Plant	LS	1	$18,000,000	$18,000,000
2 MG Storage	LS	1	$5,000,000	$5,000,000
0.5 MG Reject Water Equalization	LS	1	$2,500,000	$2,500,000
12” Aquifer Injection Watermain	LF	2,800	$500	$1,400,000
Augmentation Outfall	LS	1	$4,100,000	$4,100,000
			Subtotal	**$109,400,000**
			40% Contingency	$43,800,000
			Construction Subtotal:	**$153,200,000**
			Easement and Land Acquisition	$2,000,000
			15% Engineering	$23,000,000
			15% Construction Administration	$23,000,000
			Total:	**$201,200,000**

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O&M Cost Opinion

Item	Annual Cost
Labor (3 FTE)	$450,000
Membrane Replacement (5 yr for RO and 7 yr for MF)	$125,000
Chemicals	$150,000
Electricity	$225,000
Natural Gas	$100,000
Equipment Repair	$200,000
Lab Testing	$200,000
Total Annual O&M:	**$1,450,000**

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Aquifer Injection and Augmentation Conclusions

- Aquifer injection or augmentation with reuse water is expensive
- Modest lake level improvements, better with augmentation
- Significant regulatory hurdles
- No obvious capital cost offset
- Collect wastewater samples

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Questions?

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