Water Quality Challenges and Solutions for ASR Systems

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May 1, 2024

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Water Quality Regulations for ASR

- Don’t diminish the quality or quantity of water available for beneficial use.
- Protect the environment (including us) from exposure to harmful chemicals.
- Provide the highest drinking water quality to consumers.

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Challenges / Considerations in this Presentation

- Geochemical compatibility between source water and the aquifer
- Disinfection by-products in stored water
- pH of recovered water
- Juggling all the monitoring

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Geochemical Compatibility

Chlorinated source water + aquifer materials + native groundwater + time = Recovered water quality

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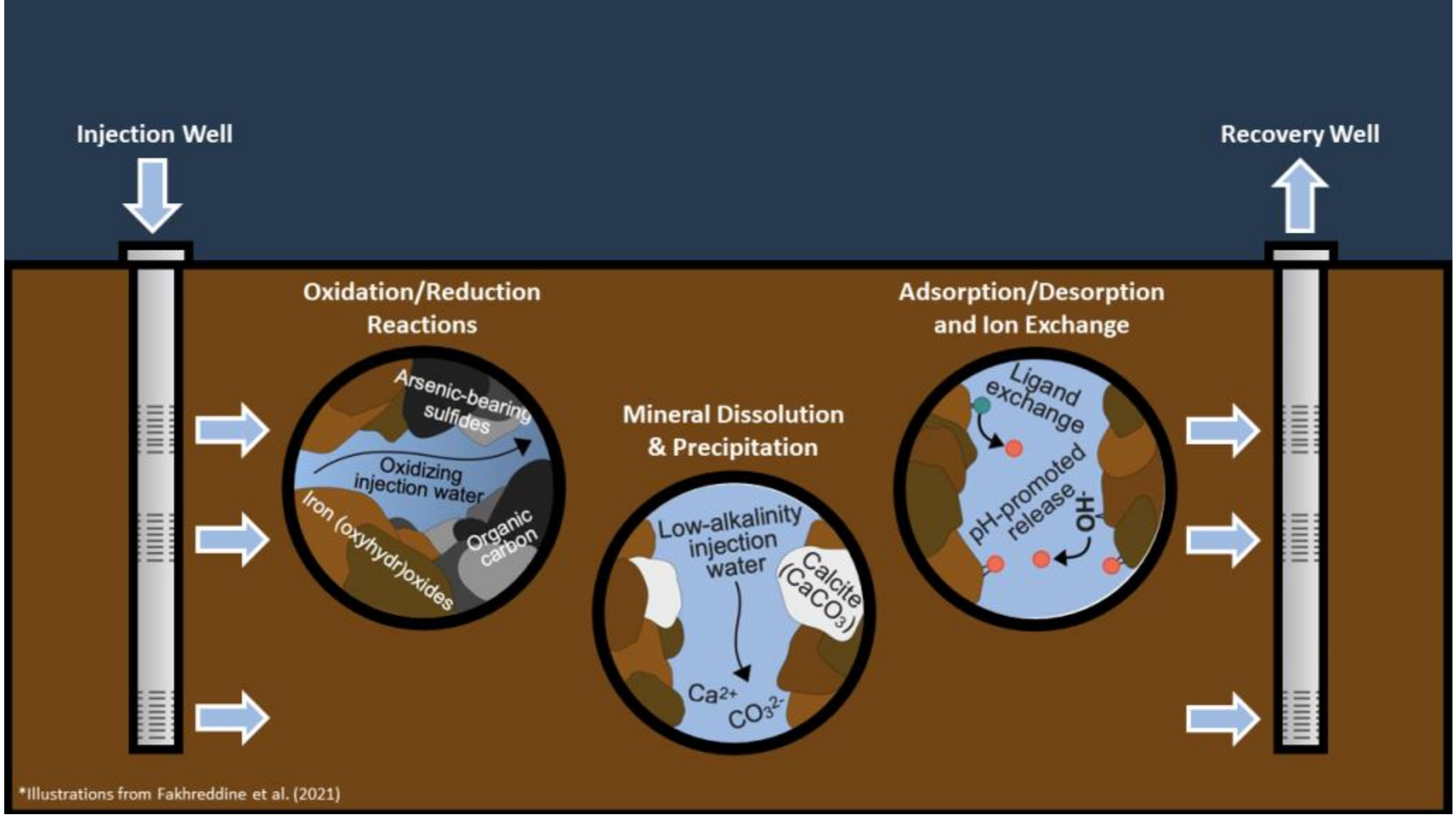

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Geochemical Compatibility Assessments

Why?

Avoid undesirable outcomes:

- Precipitation leading to mineral clogging of the well screen and aquifer around the well
- Promotion of well and aquifer-clogging bacteria populations
- Mineral dissolution / ion exchange leading to poor recovered water quality – potential need for costly treatment

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Geochemical Compatibility Assessments

When?

- Planning – use an approximation of water quality to identify fatal flaws
- Feasibility stage / application / new well – get good site-specific data
- UPDATE when there is a change (new source, change in treatment, new well)

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Disinfection By-Products in Stored Water

Focus on trihalomethanes (chloroform) formation during storage

Depends on:

1. Residual chlorine in recharge water
2. Redox environment of the aquifer
3. Presence of organic carbon
4. **Contact time**

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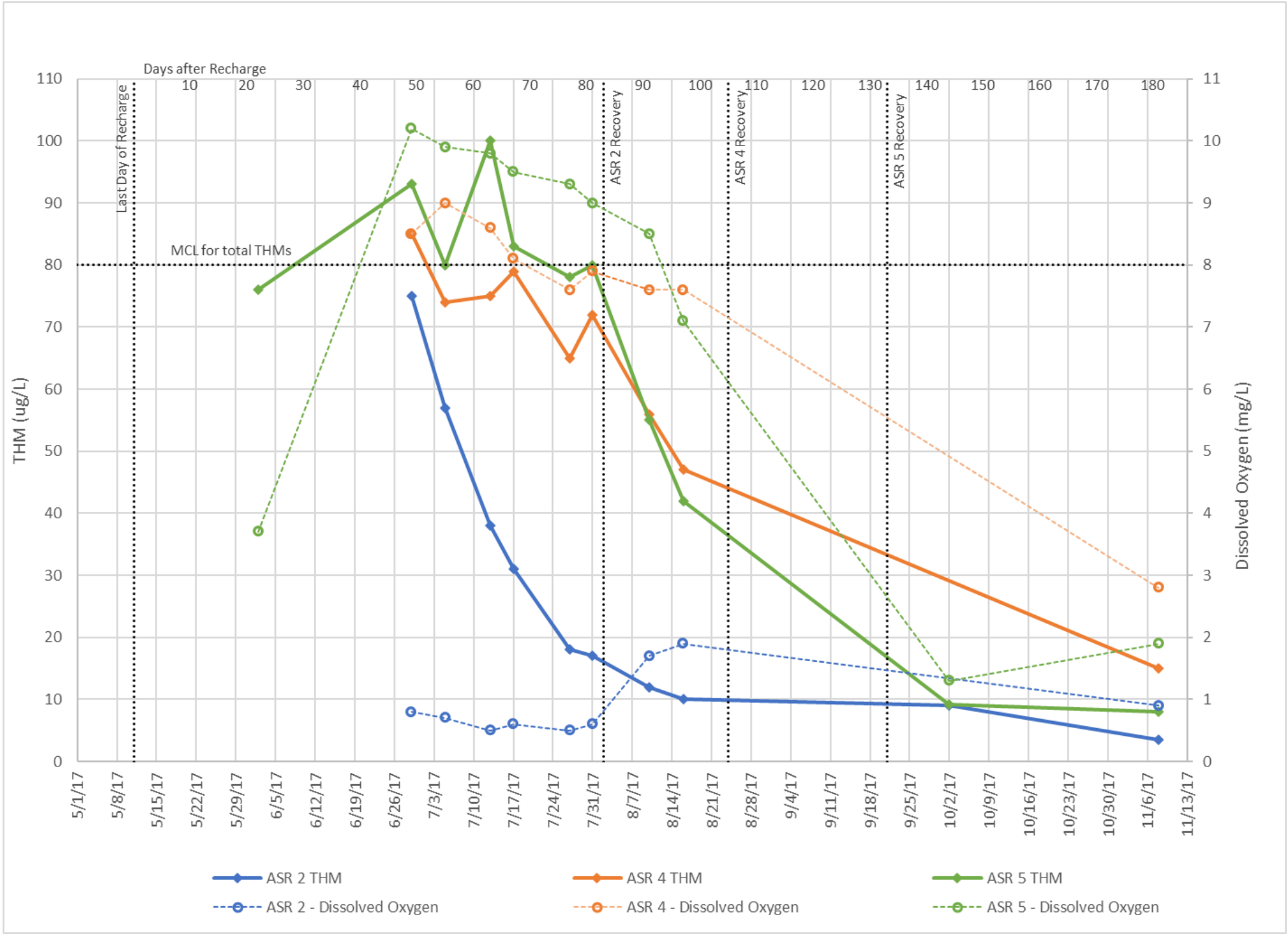
Variability During Storage



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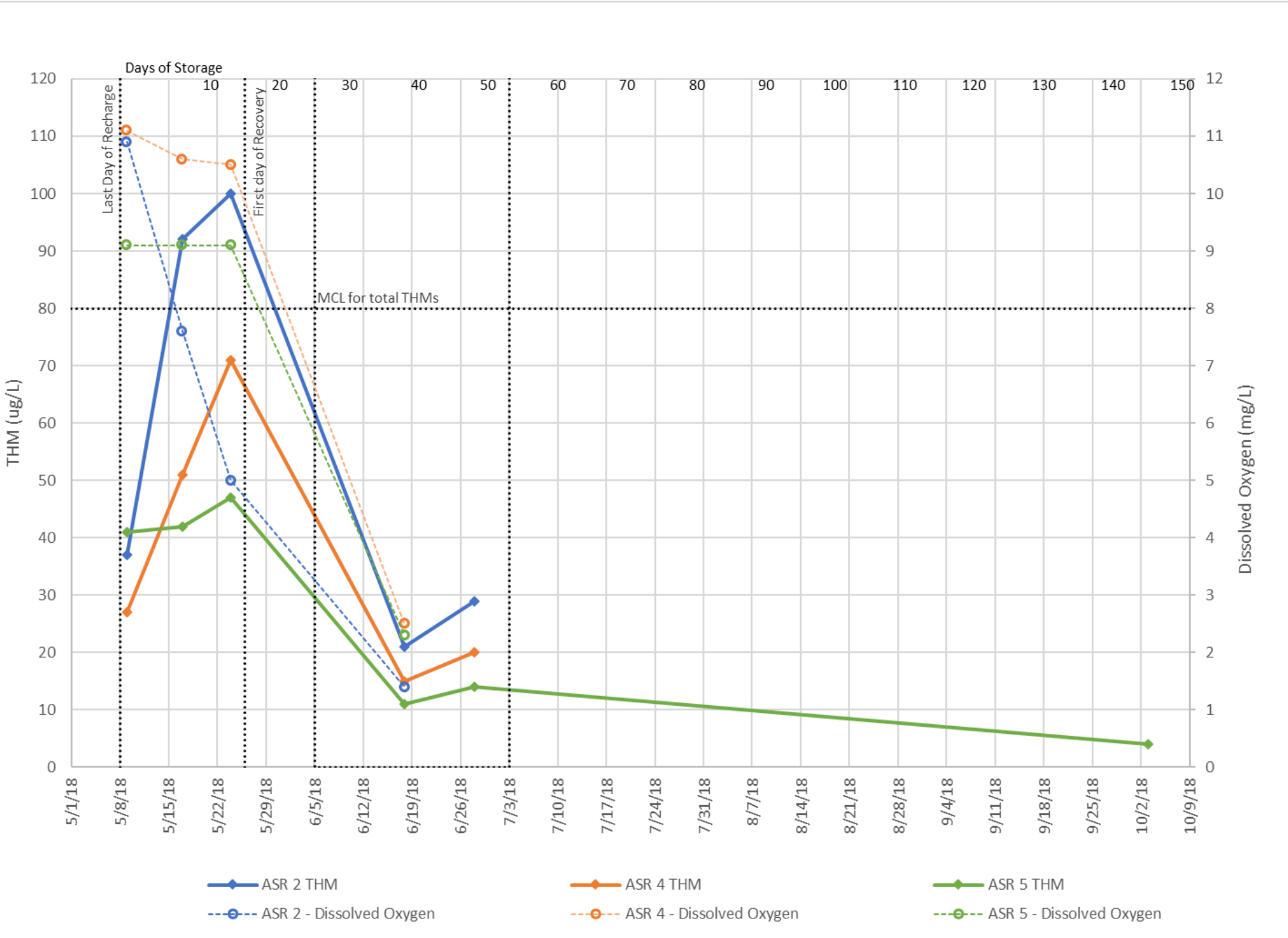
Variability During Storage



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Sample Timing Matters

- Observed correlation with storage volume → avoid carryover storage
- Observed concentration declines during recovery → pump to waste
- Reasonable conclusions biased by the monitoring plan → unnecessary operational changes

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What now?!

- Test THMs frequently during storage in early pilot testing.
- Reduce frequency after formation and degradation rates are understood.
  - Rates will probably change, but change is manageable if we start with good data
- If concentrations are persistently high, consider investing in an analyzer.
- Fed up – reduce Cl residual in recharge water.

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pH of Recovered Water

- May differ from distribution targets
- May change throughout the recovery season
- May change long-term

- Implications for corrosion control

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pH of Recovered Water

- Continuous monitoring is best (don't rely on 1 or 2 samples)
- Let the trends guide the solution
  - Build more storage volume
  - Blending
  - Treatment

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Juggling the Monitoring

- ASR seasonal requirements
  - Source water and receiving groundwater before recharge
  - Source water during recharge
  - Stored water before recovery
  - Recovered water
- Drinking water program requirements
  - Weekly, monthly, quarterly, yearly, 3/6/9-year

Juggling the Monitoring

- Focus on getting good data early
- Reduce monitoring once trends are clear
- Look for overlap and opportunities to streamline

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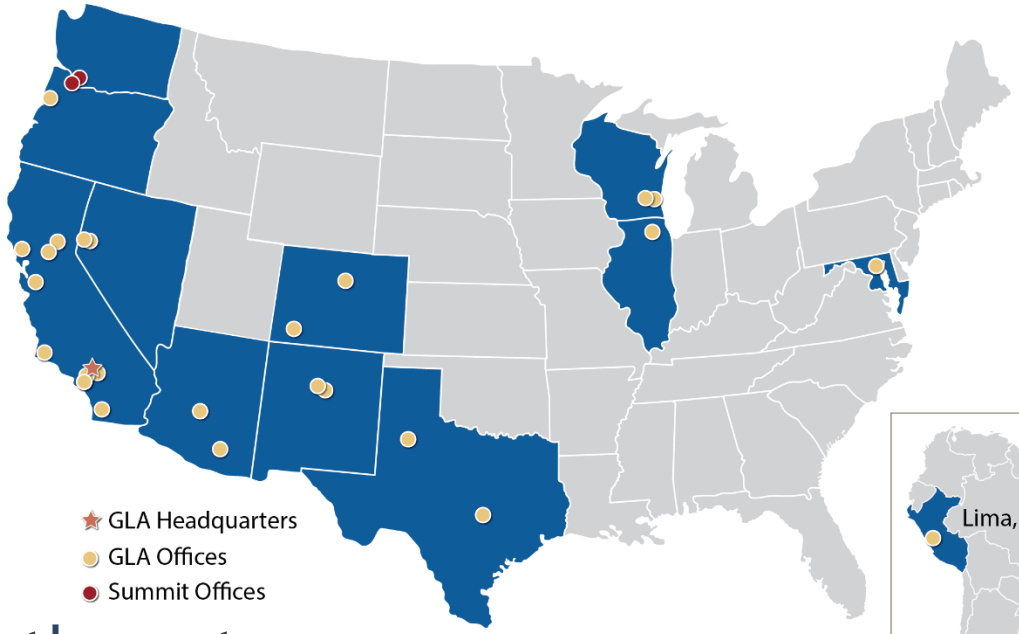

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- Established 2022
- Offices in Portland, OR and Camas, WA
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