An Aquifer Storage and Recovery System in Hastings, NE

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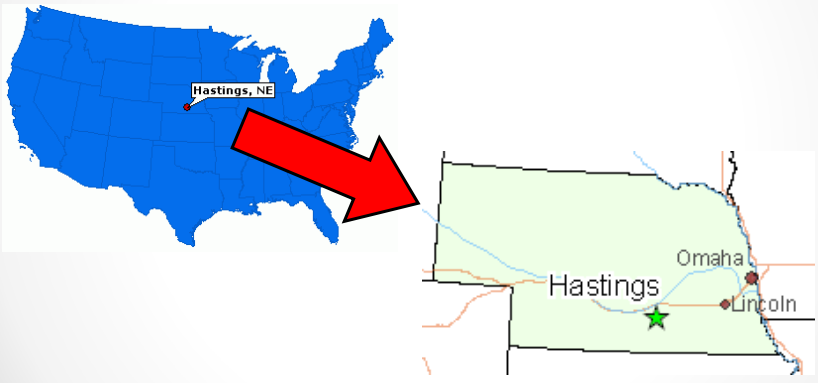
Background

Hastings, NE



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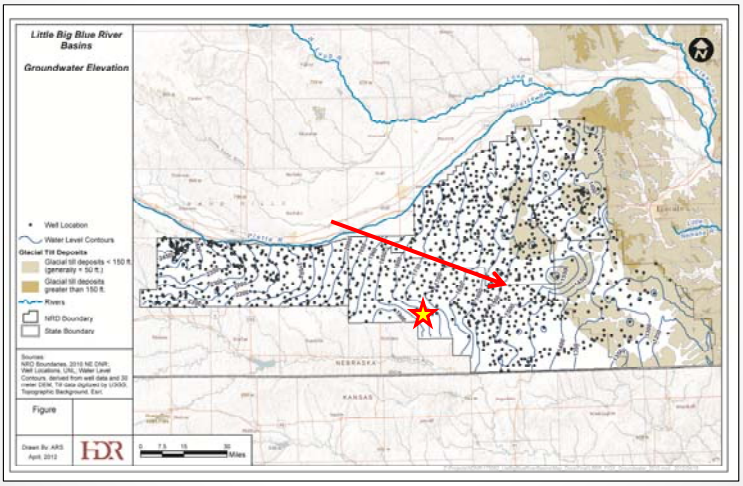
Regional Ground Water Movement



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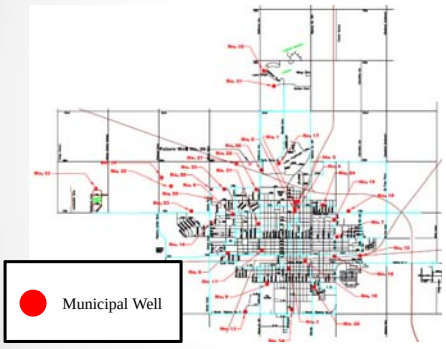
Hastings Water System



- Supplies water to the City of Hastings, NE and some smaller surrounding communities
- Established mid 1880's
  - Oldest operational well was constructed in 1915
- No water treatment in place
- 17/33 municipal wells are currently operational and in use
  - 9 lost due to nitrate contamination
  - 7 lost due to VOC contamination
- **Non-centralized system** (all wells service separate zones)

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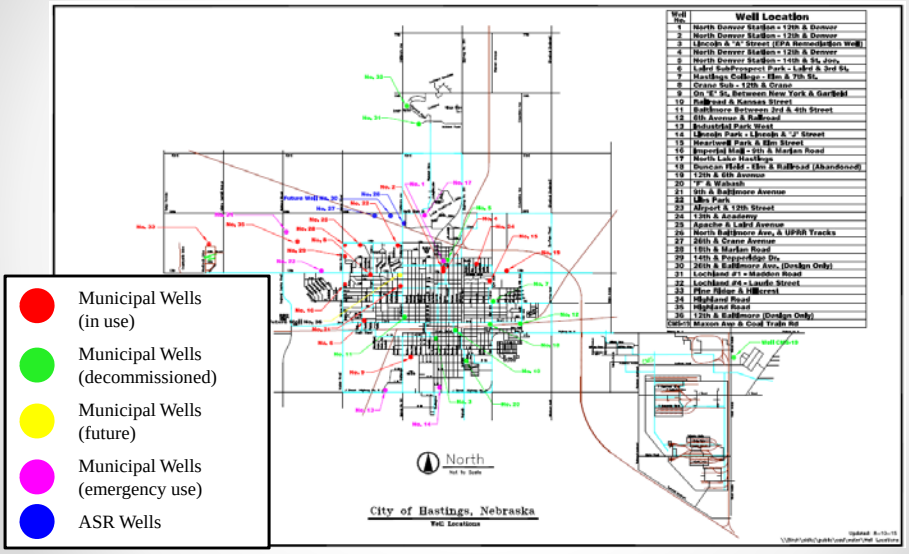
Hastings Water System



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Ground Water Quality Issues

Major Issues

- Nitrate
- Uranium
- Gross Alpha
- Selenium
- pH
- Hardness

Minor Issues

- Atrazine detected at low levels
- Increasing inorganic levels

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Solutions

- Defining the issues
- Continued monitoring and modeling
- Nitrate Management Plan
- Hastings ASR Project
  - Dual pumping technology(DPT)
  - Focused water treatment
  - Blending
  - Storage
  - Irrigation reuse and management in addition to the nitrate management plan

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Timeline

- 1997: Initial ground water and contaminant modeling by Layne Geoscience
- 2009: Updated modeling by HDR Engineering
- 2010: 1st UNL vadose zone study
- 2010-2011: City of Hastings water sampling
- 2012: Nitrate Management Plan adopted
- 2015: 2nd UNL vadose zone study
- 2015-2016: City of Hastings water sampling
- 2018: Hastings ASR Permit Issued, injection well construction
- 2021: 3rd UNL vadose zone study planned

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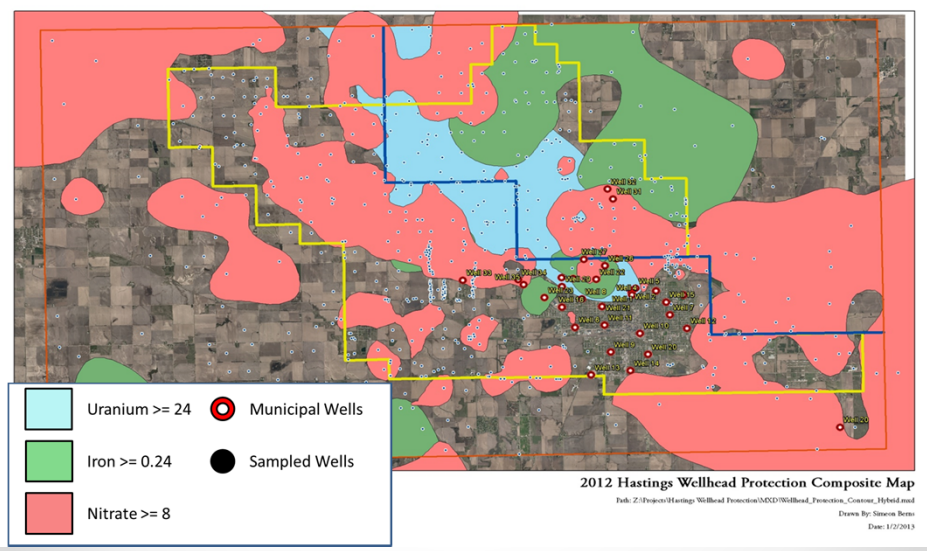
Defining the Issues



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Nitrate Management Plan

- Adopted by Hastings in 2012
- 106 square miles included, roughly the same area as the Hastings WHPA
- Includes:
  - Training
  - Soil sampling and reporting
  - Rate and timing of fertilizer application
  - Promotes water conservation (limit movement of N)

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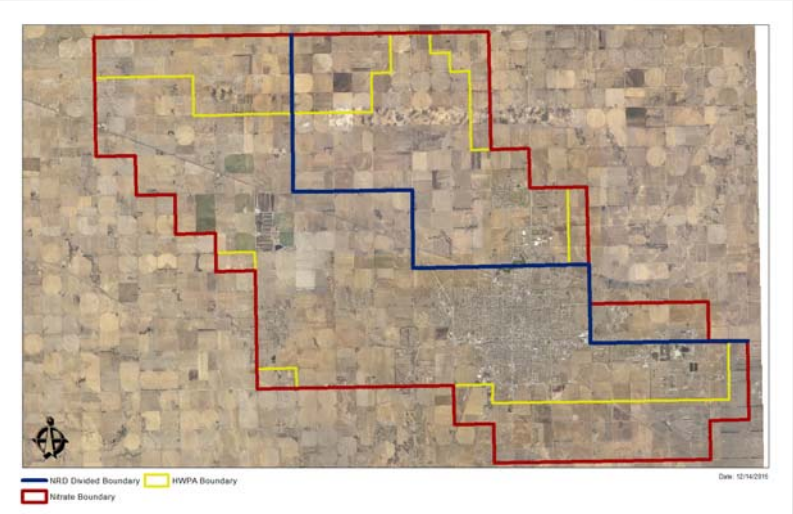
Nitrate Management Plan



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Hastings ASR Project

- Funding
- Modeling Study
- Pilot Study: ASR5
- Five permitted ASR wells
- Inject into the Quaternary Aquifer (100-200 ft bgs)
- Multiple components
  - Dual pumping technology(DPT)
  - Focused water treatment
  - Blending
  - Storage
  - Irrigation reuse and management in addition to the nitrate management plan

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What are the Costs?

Conventional Treatment Options

- Would require centralizing the system!
- Conventional RO only treatment for existing water system, construction costs: $72 million
- Conventional IX only treatment for existing water system, construction costs: $57 million
- Projected 20-year O&M costs + capital for conventional methods: $100 million

Hastings ASR Option

- Estimated Hastings ASR project, construction costs: $46 million
- Operation and maintenance cost: $1.3 million/year
- Projected 20-year O&M costs + capital for ASR methods: $72 million

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Total Est. Construction: $46 million
Total Operating and Maintenance: $1.3 million/year

Funding

- Clean Water State Revolving Loan Fund (CWSRF): $4.42 million, water sustainability funding
- $100,000/year from LBNRD
- $50,000 one-time from UBBNRD
- $150,000 from NET
- Updated water utility rates for Hastings residential customers effective Oct. 1, 2016

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2015 Pilot Study

- Groundwater modeling: HDR
- Determine ToT from ASR wells to municipal supply wells
- Multiple municipal supply wells would receive ASR water within 9-13 years

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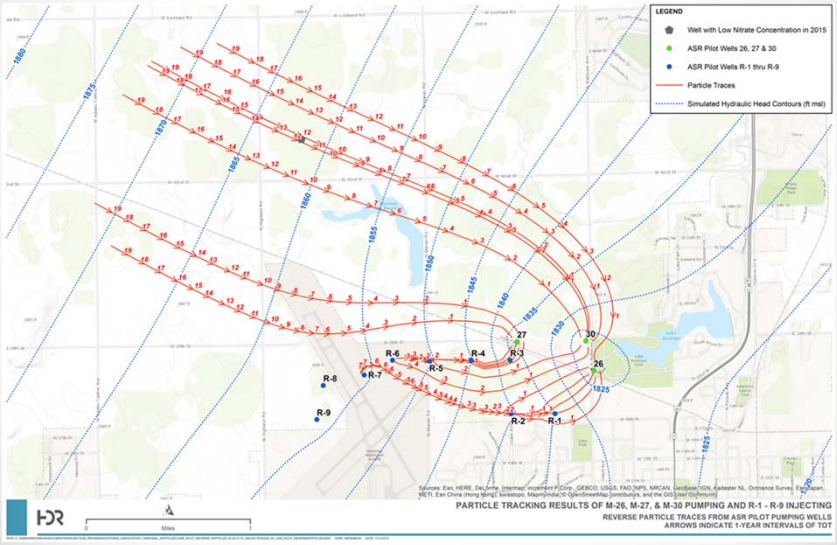
2015 Pilot Study



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Dual Pumping Technology

- Dual Pumping Technology uses two pumps located in the same casing to withdraw water from the top and bottom of the aquifer
- Higher nitrate concentrations are near the top of the aquifer
- Hastings claims DPT will allow for the extended useful life of existing wells and delay/minimize water treatment needed
- Municipal Well 16 has undergone a successful dual pumping test period
- Pump wells used for the ASR project will use DPT (converted or built)

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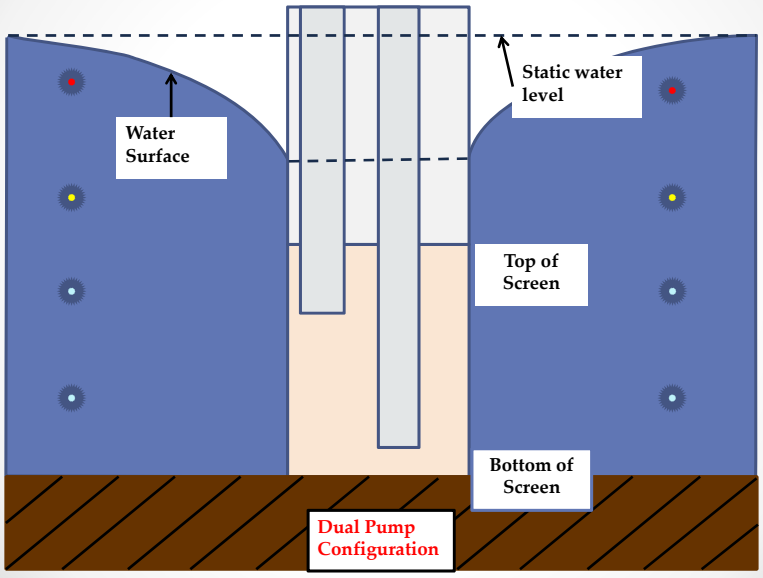
Dual Pumping Technology



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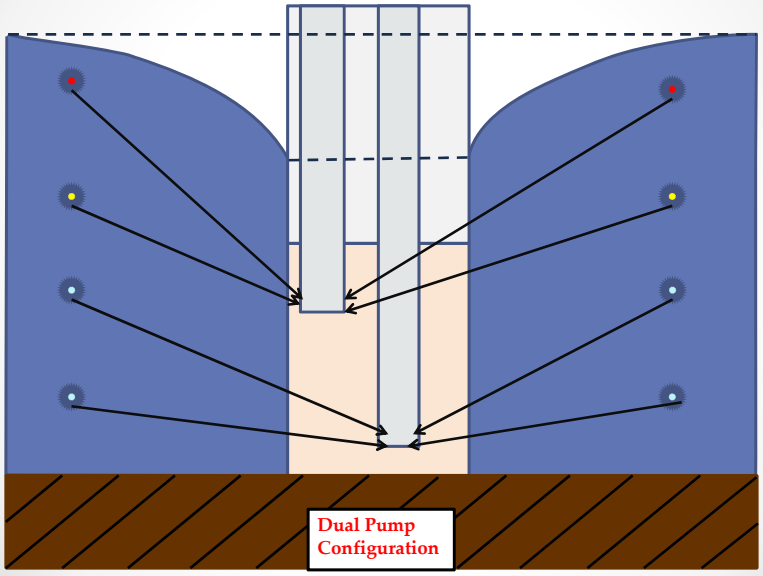
Dual Pumping Technology



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Focused Water Treatment & Blending

- Reverse Osmosis (RO) treatment to remove nitrates
- Absorbent media used to remove uranium as needed
- If lower aquifer water meets certain contaminant criteria it may bypass treatment
- Blending of waters from high and low nitrate wells if needed

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Storage

- A lined water storage pit near the treatment facility has been constructed for ASR water
- Total water storage: 130 acre-feet
- Stored water can be used for irrigation: enough to water from 1 center pivot at 12 inches/year

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Irrigation Reuse and Management

- Higher nitrate ASR water is sent to the storage pit following treatment
- Adjoining cropland is partnered with Hastings to use the water for irrigation
- Because the water has higher nitrate levels:
  - Replaces use of normally-pumped, non-treated ground water
  - Replaces the use of fertilizer
  - Crops should benefit from higher nitrate concentrations

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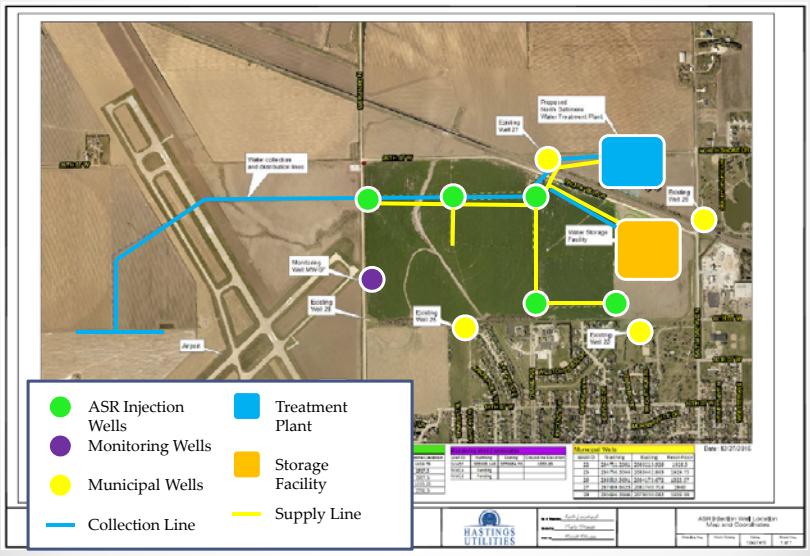
Hastings ASR Project



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Operating Data (Proposed/Permitted)

- Volume of injectate:
  - Average: 2000 gpm
  - Maximum: 2600 gpm
- Permit Limitations
  - Injection Pressure: 100.0 psig
  - Max Daily Injection Volume: Report
  - Max Daily Injection Rate: Report
  - Average Daily Injection Rate: Report
  - Nitrate (as N): 10.0 mg/L
  - Uranium: 0.03 mg/L
  - Arsenic: 0.01 mg/L
  - Drinking water quality limitations parameter suite

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Hastings ASR Conclusions

- Hastings hopes their ASR project will overall improve the quality of drinking water while keeping long-term costs lower than they would be for conventional treatment
- Permit issued by the NDEQ: January 10, 2018
- Injection well construction late January
- Estimated system start-up date of late winter-early spring 2018

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Questions?

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