Review of the Monolith Materials, Inc. Groundwater Flow Model

February 17, 2021

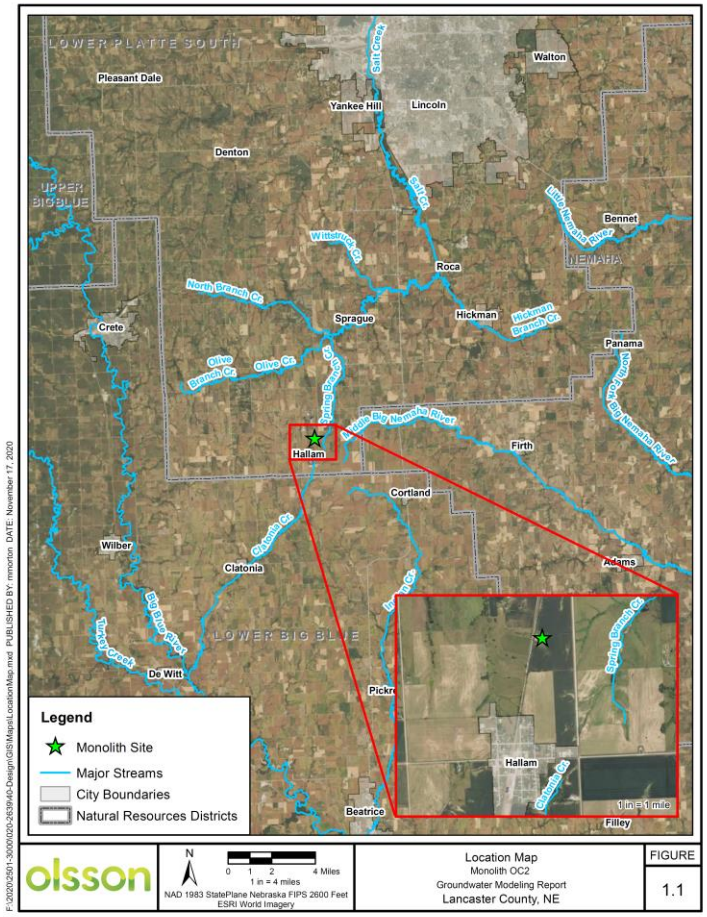
AGENDA

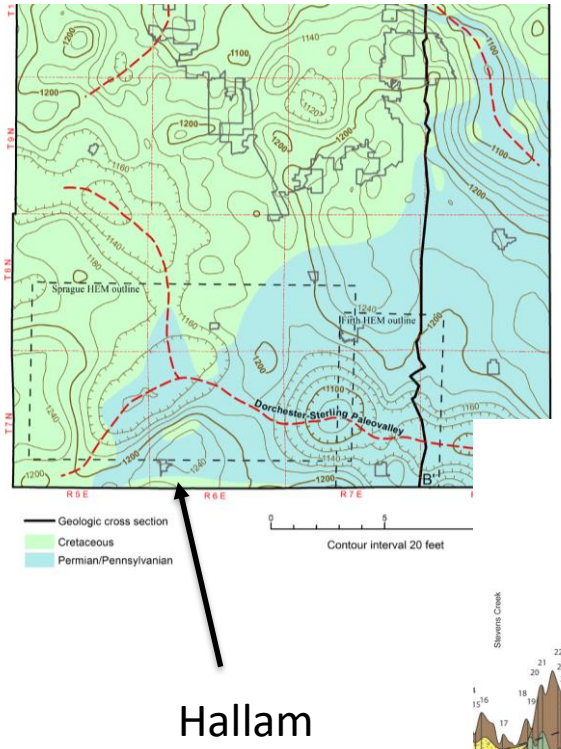
- Introductions
- Conceptual Hydrogeology
- Purpose of Model and LRE Review
- Model Review Results
- Conclusions and Recommendations

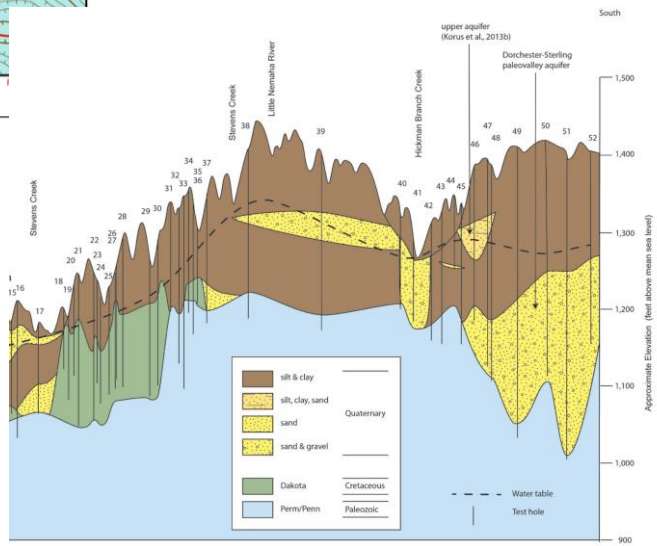
LRE WATER TEAM

- **Dave Hume**
  - Sr. Project Manager | Hydrogeologist
  - 30 years consulting hydrogeologist
  - Licensed PG (NE)
- **Jacob Bauer**
  - Hydrogeologist | Project Manager
  - 14 years consulting hydrogeologist
  - Licensed PG
- **Clinton Meyer**
  - Staff Hydrogeologist
  - 7 years consulting hydrogeologist

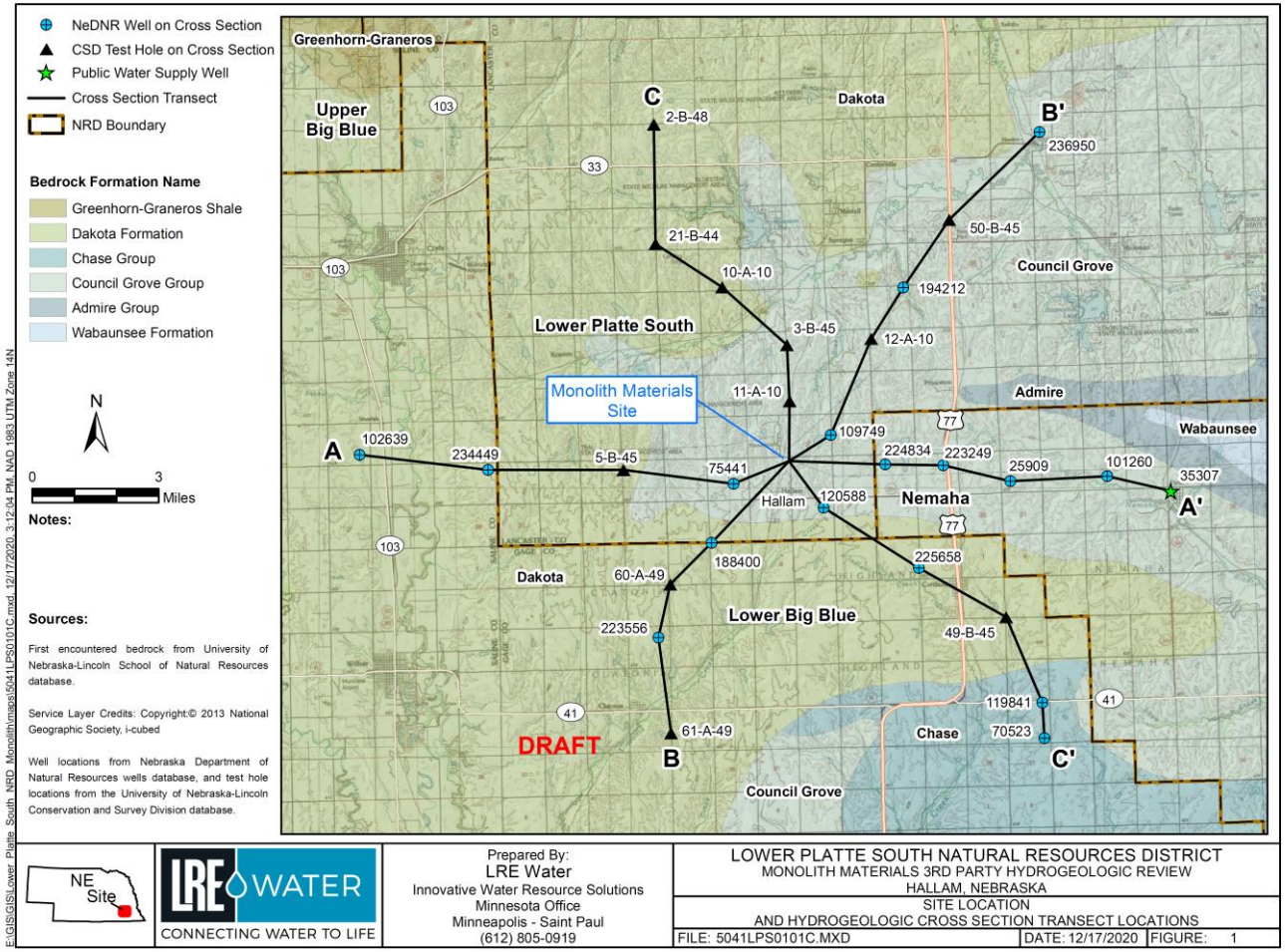
HYDROGEOLOGIC SETTING



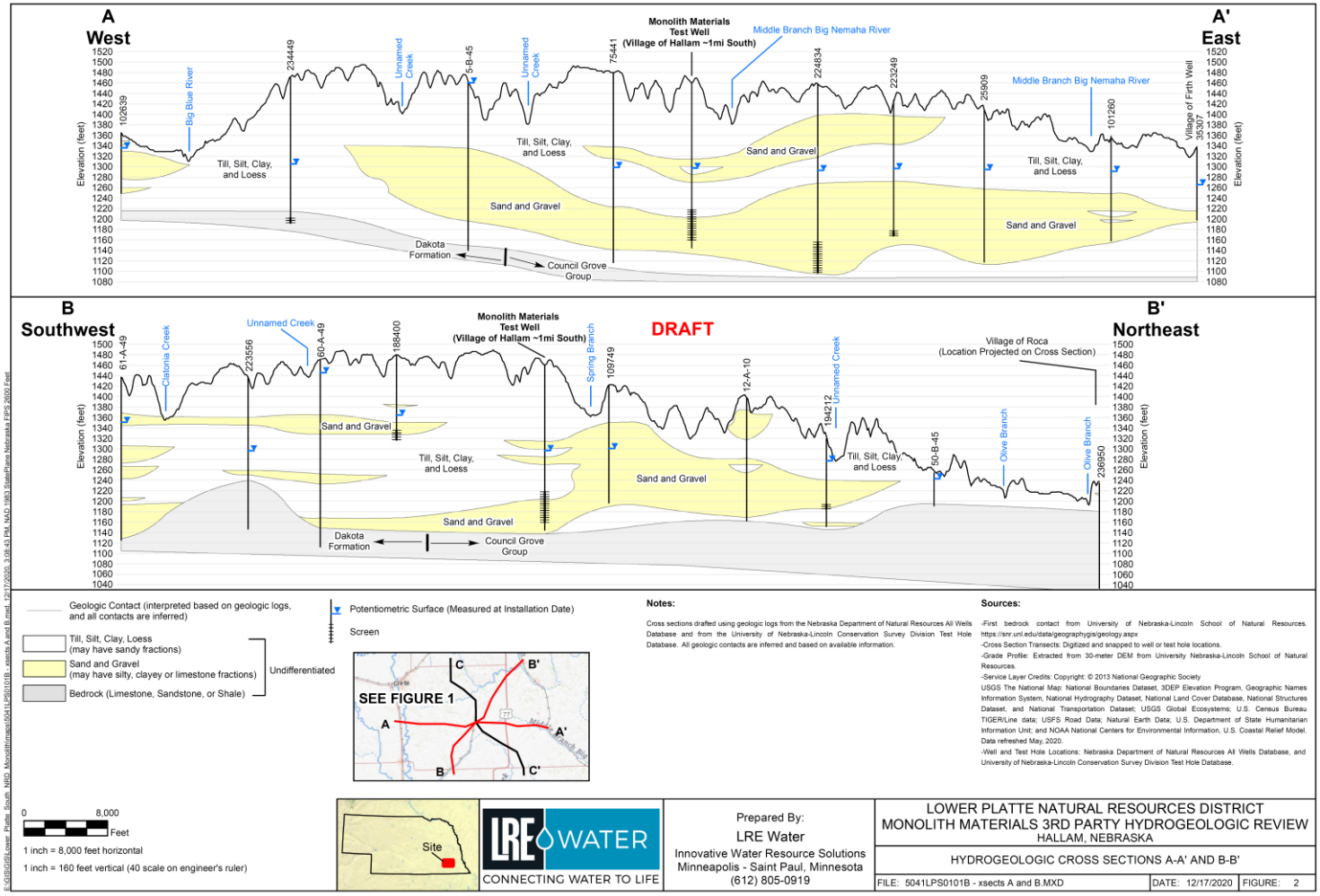




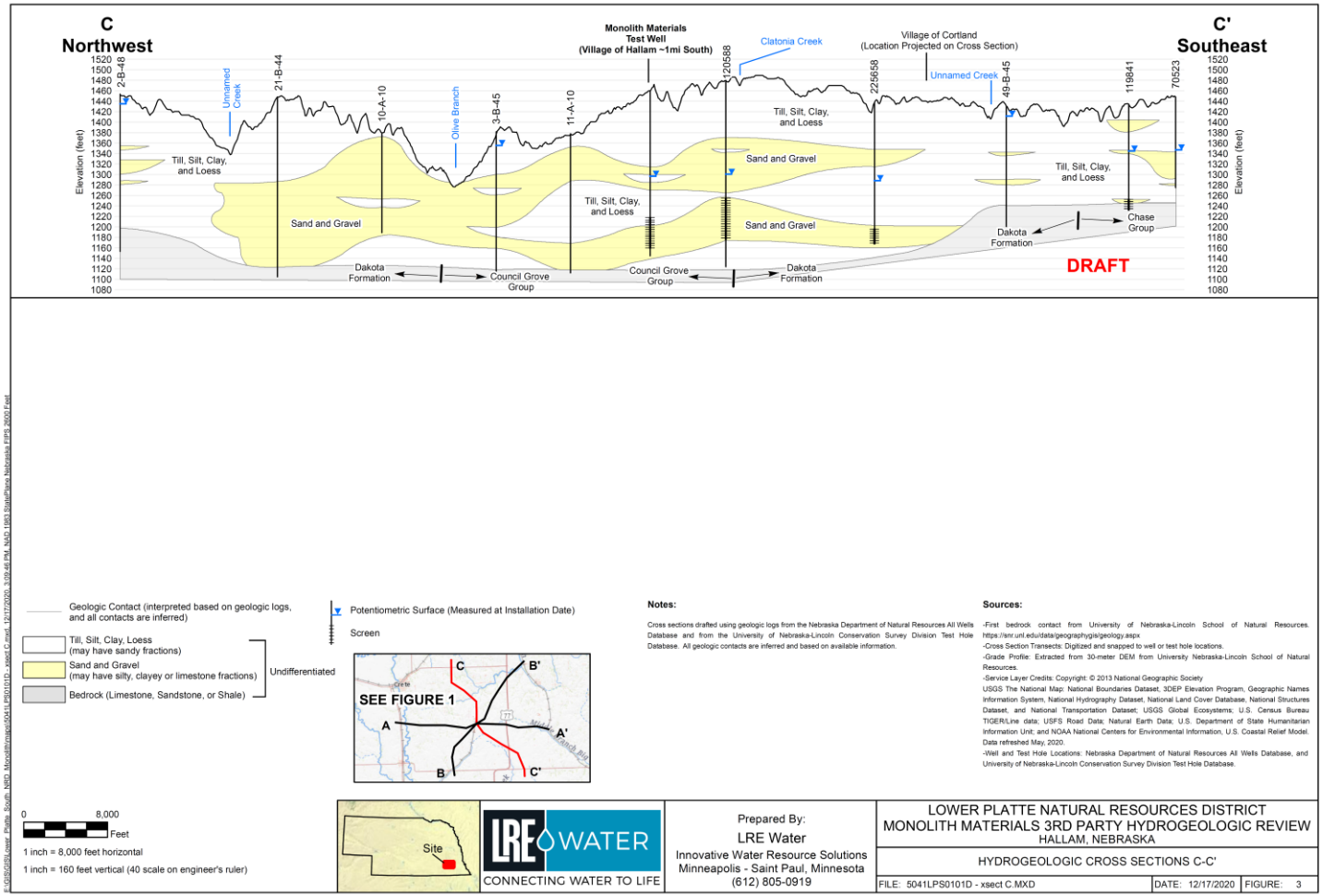
MODEL AREA HYDROGEOLOGY



HYDROGEOLOGY
CROSS SECTIONS A-A' AND B-B'



HYDROGEOLOGY CROSS SECTIONS C-C'



Notes:

Cross sections drafted using geologic logs from the Nebraska Department of Natural Resources All Wells Database and from the University of Nebraska-Lincoln Conservation Survey Division Test Hole Database. All geologic contacts are inferred and based on available information.

Sources:

-First bedrock contact from University of Nebraska-Lincoln School of Natural Resources. https://snr.unl.edu/data/geographygis/geology.aspx
-Cross Section Transects: Digitized and snapped to well or test hole locations.
-Grade Profile: Extracted from 30-meter DEM from University Nebraska-Lincoln School of Natural Resources.
-Service Layer Credits: Copyright: © 2013 National Geographic Society
USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed May, 2020.
-Well and Test Hole Locations: Nebraska Department of Natural Resources All Wells Database, and University of Nebraska-Lincoln Conservation Survey Division Test Hole Database.

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LOWER PLATTE NATURAL RESOURCES DISTRICT
MONOLITH MATERIALS 3RD PARTY HYDROGEOLOGIC REVIEW
HALLAM, NEBRASKA

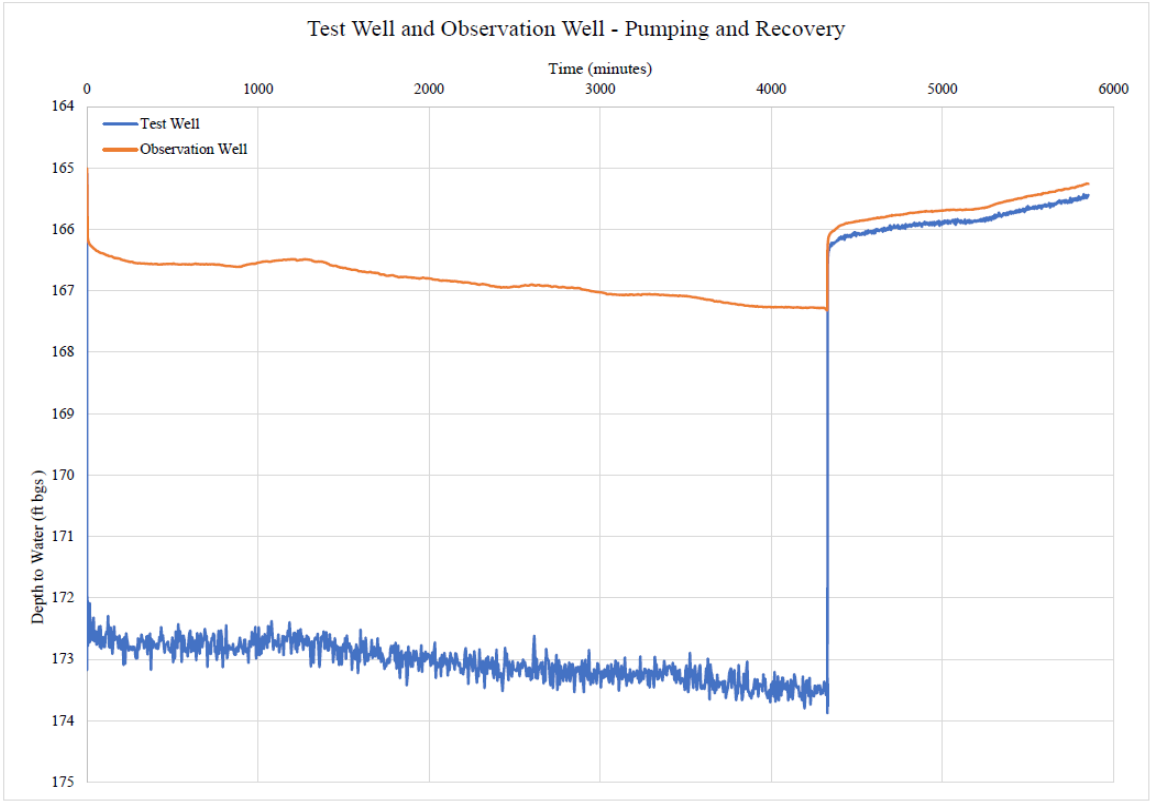
HYDROGEOLOGIC CROSS SECTIONS C-C'

FILE: 5041LPS0101D - xsect C.MXD | DATE: 12/17/2020 | FIGURE: 3

E:\GIS\5041\Lower Platte South\MXD\Monolith\mxds\5041LPS0101D - xsect C.mxd, 12/17/2020, 9:08:48 PM, NAD 1983 StatePlane Nebraska FIPS 2600 Feet

AQUIFER PUMPING TEST (AUG-SEPT 2020)

- Completed by EA Science and Technology
- Pumping Rate ~ 800 gpm for 72 hrs
- Observed 9 ft of drawdown with very good recovery
- Used in Model calibration



PURPOSE OF MODEL

- Completed by Olsson, Inc. on behalf of Monolith Model
- Evaluate potential impacts of Monolith's proposed water use on the source aquifer (Crete-Princeton-Adams aquifer) over a 50-year period
- Provided results as electronic model input and output files
- Documented in Olsson's Draft Hydrogeologic Anaysis Report (Dec. 2020)

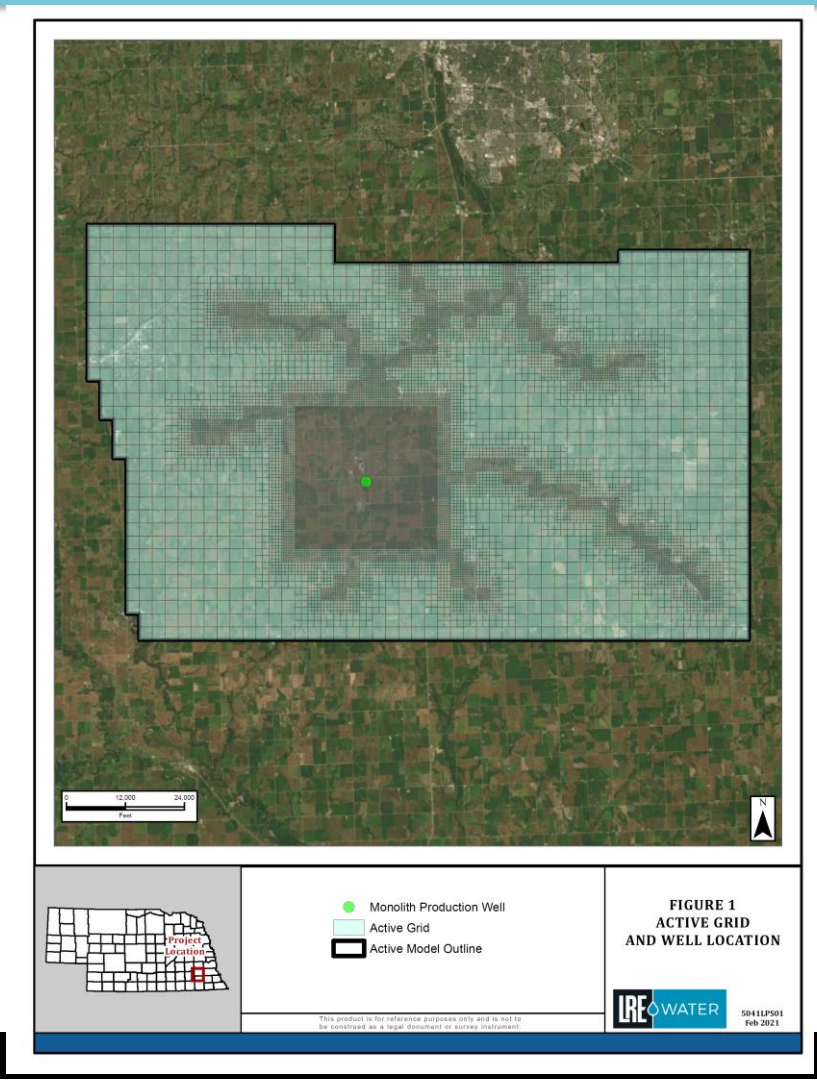
PURPOSE OF MODEL REVIEW

- Focus of LRE's review was the Model with emphasis on replicating the groundwater modeling results.
- Reviewed involved:

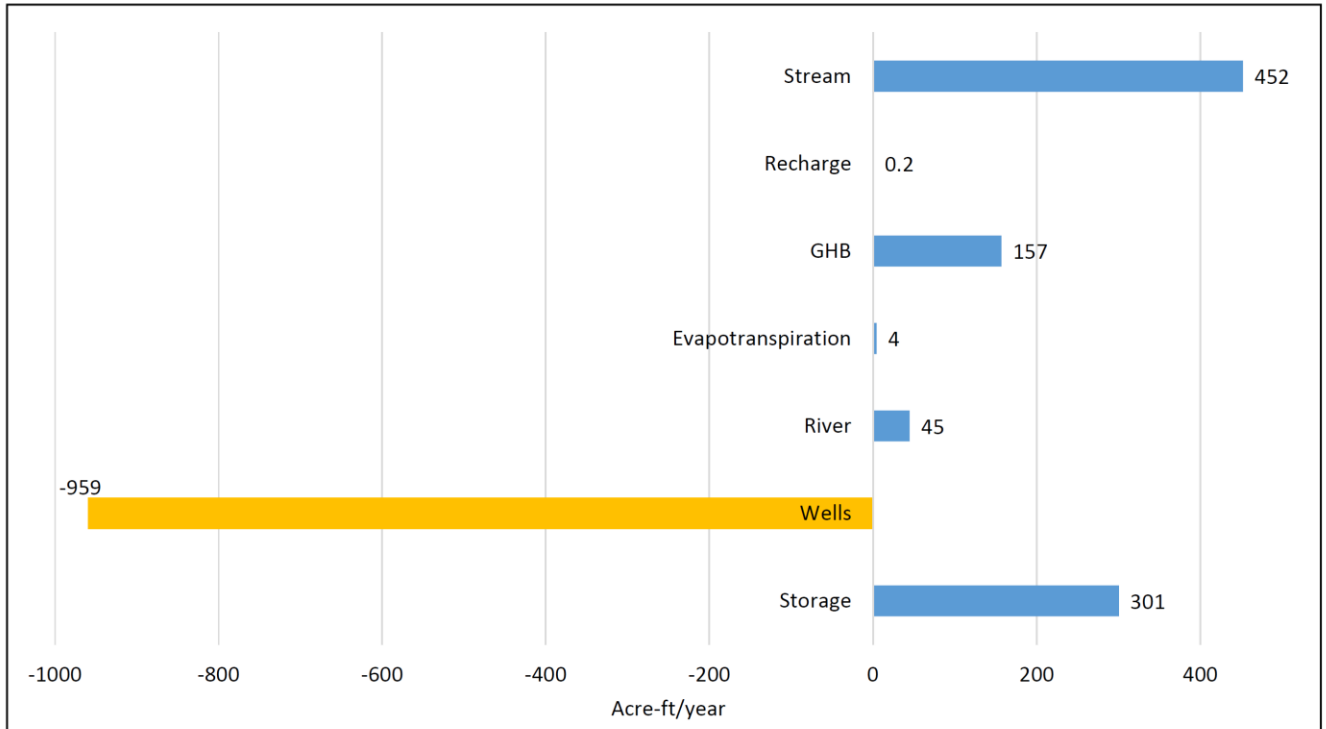
  1. Conceptual hydrogeologic model
  2. Evaluation of the Model objectives and model code
  3. Input parameters
  4. Aquifer pumping test
  5. Appropriateness of aquifer and hydraulic boundary conditions
  6. Flow simulation results for water levels and flows
  7. Applicability for simulating water level changes in response to the proposed pumping

- Re-ran Model using data files and executable codes provided by Olsson, and compared the outputs of our modeling results against those presented in Olsson's Draft Report.
- Report review results and provide recommendations

MODEL GRID AND MONOLITH WELL LOCATION



WATER BUDGET



DATE: 2/8/2021

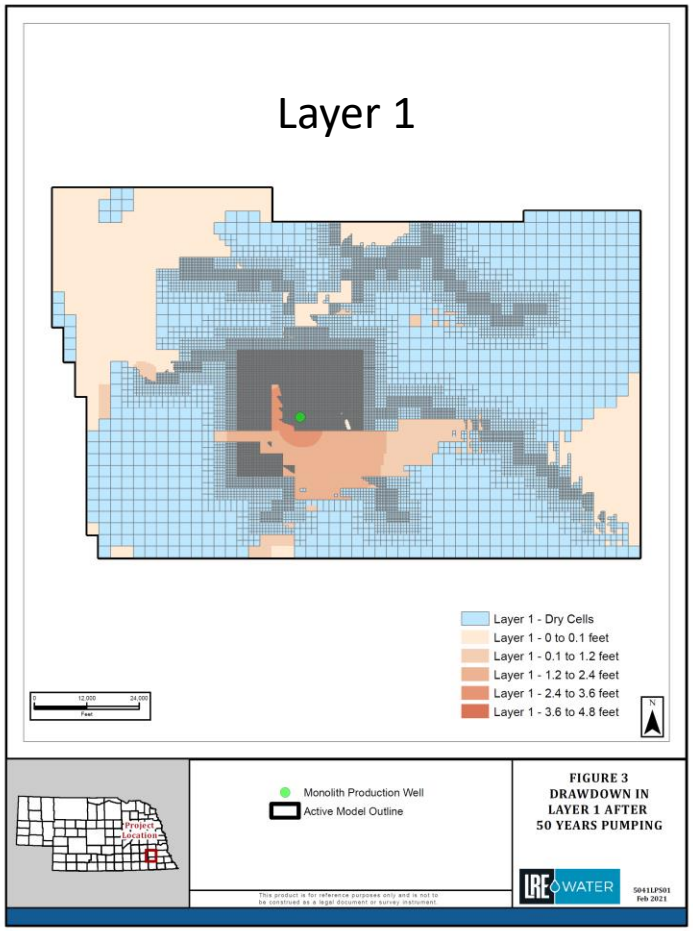
AUTHOR: CDM

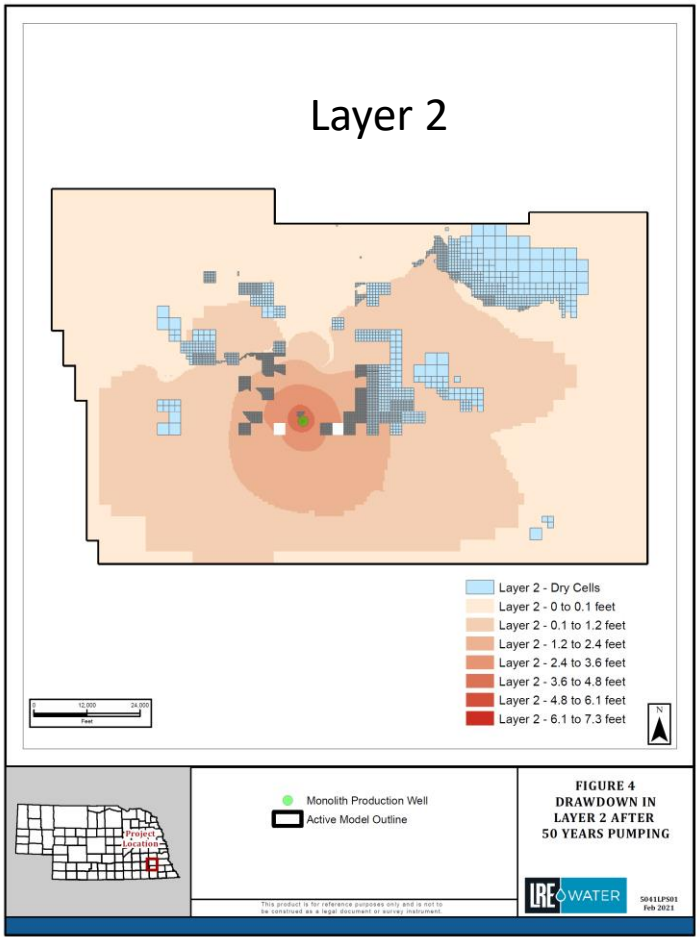
CHECKED BY: JB

Figure 2
Cumulative Water Budget Difference For Pumping and Non-Pumping Scenarios (acre-ft/year)

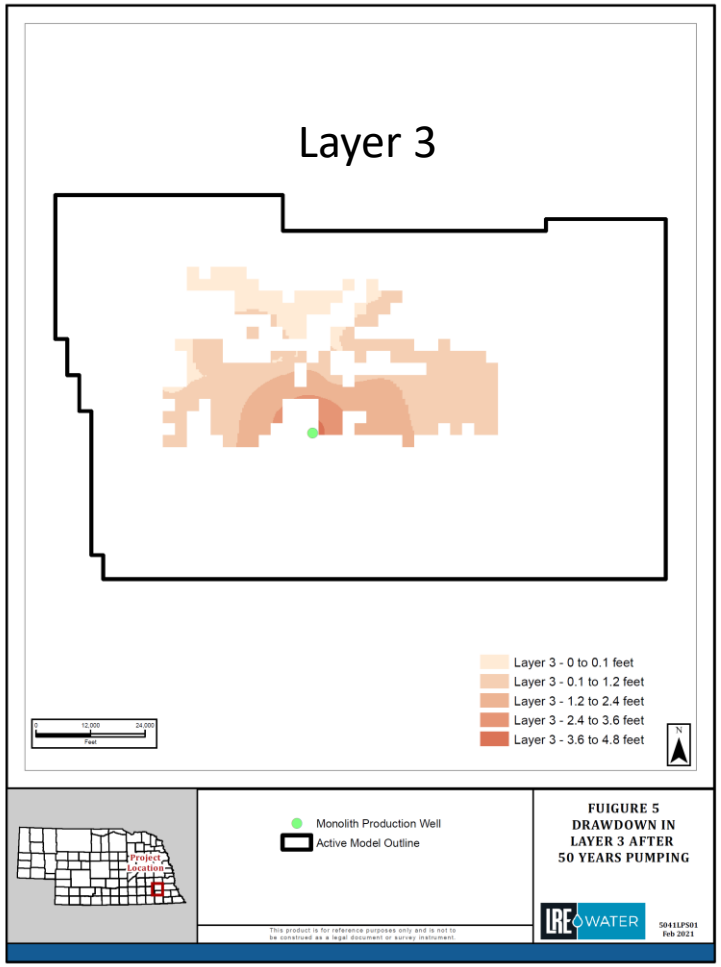
LRE WATER
CONNECTING WATER TO LIFE
1221 Auraria Parkway, Denver, CO 80204

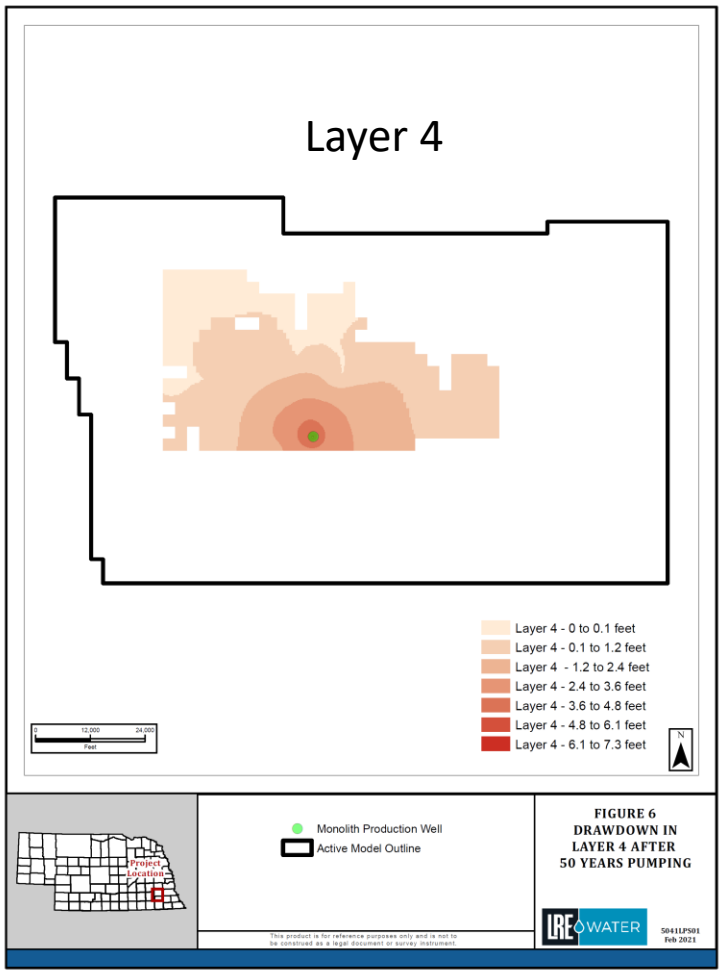
DRAWDOWN AFTER 50 YEARS (LAYERS 1 AND 2)



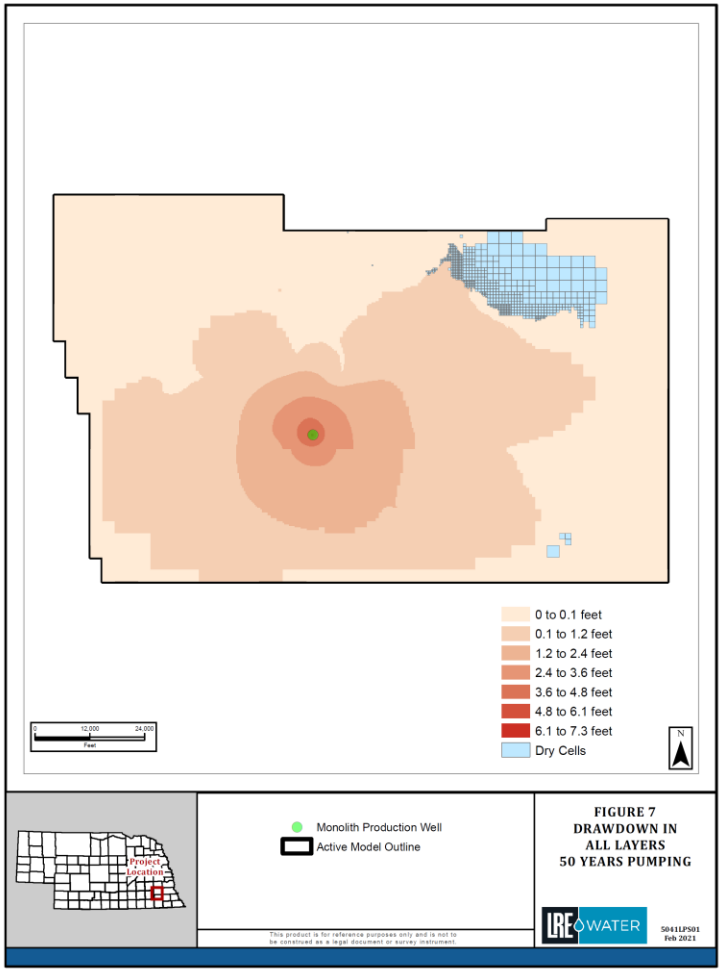


DRAWDOWN AFTER 50 YEARS (LAYERS 3 AND 4)





DRAWDOWN AFTER 50 YEARS (ALL LAYERS)



SUMMARY AND CONCLUSIONS

- Model calibration to observed groundwater level data is adequate to meet the objectives based on our modeling experience.
- Based on geologic information, including borehole logs and peer reviewed publications, it is our opinion that the structure of the aquifer in the Model represents the known geology adequately.
- Simulated groundwater level conditions in the Model are reasonable and adequately demonstrate where the sources of water come from for a Monolith Well pumping at an average rate of 595 gpm, and ranging throughout the 50 year simulation period from a minimum of 393 gpm in January to 774 in September.

SUMMARY AND CONCLUSIONS (CONT.)

- Surface water contributions account for 52% of the water pumped from the Monolith Well over 50 years. Water coming from aquifer storage accounts for 31%. The remaining significant portion (16%) comes from the General Head Boundaries from the North, South, and East. Our results are identical to the results presented by the Olsson Model.

- The model reasonably represents regional drawdown in the aquifer due to the Monolith Well pumping at an average rate of 595 gpm, and ranging throughout the 50-year simulation period from a minimum of 393 gpm in January to 774 in September.

- The assumptions included directly and indirectly into Olsson's Model are adequately conservative.

- Model extent, boundary conditions, and calibration to water level observations is appropriate for the achieving model objectives.

RECOMMENDATIONS

1. Complete a more detailed sensitivity analyses on the following:
   a. scale of hydraulic conductivity in model layers 1 and 3 (low-permeability layers); and,
   b. horizontal / vertical hydraulic conductivity ratio (kh/kv) in all layers.

2. Provide model addendum with directions for exact replication of future drawdown simulations presented by Model results. This will be useful for documenting and comparing the current model results.

3. For future reference, we recommend the current Model have less Model refinement or discretization (i.e., grid and cell size) to make it more "user friendly". We feel the same results will be achieved with a simpler model.

4. Address potential changes in water quality to the aquifer in the vicinity of Monolith's facility caused by possible leakage from the underlying bedrock, particularly the Dakota aquifer, as a result of the increased pumping.

5. Complete a desktop assessment to evaluate the potential for well interference, and provide a well interference contingency plan in the event of any issues. The recommended radial distance of the study from the Monolith facility is to be determined.

Wrap Up and Q&A


LRE
WATER