



State of Utah

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Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF WATER QUALITY
Erica Brown Gaddis, PhD
Director

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DWQ-2018-011042 BLJ

January 22, 2019

Mayor David Hair
Millville City
PO Box 308
Millville, Utah 84326

Dear Mayor Hair:

Subject: Notice of Intent to Deny Underground Injection Control (UIC) Class V Aquifer Storage & Recovery (ASR) Permit to Millville City

The Utah Division of Water Quality (DWQ) has reviewed Millville City's permit application for a UIC Class V ASR permit and the accompanying technical report entitled *Aquifer Storage and Recovery in Millville, Cache County, Utah; Report of Investigation 275, 2016* (hereafter referred to as 'the technical report') prepared by Paul Inkenbrandt of the Utah Geological Survey. Based on our review, DWQ is providing you with notice that we intend to deny this permit in 30 days following a public comment period. The reasons for our intended denial are discussed in detail below.

STATEMENT OF BASIS FOR PERMIT DENIAL

DWQ intends to deny the issuance of the ASR permit for the following reasons:

1. Millville has failed to show that the proposed injection will not have a detrimental effect on the aquifer such as demonstrated by an increase in nitrate concentrations in the Alder-West well;
2. The pilot ASR project did not demonstrate that long term operation of the proposed ASR project would produce the intended results and sustainably lower the nitrate concentrations in the Glenridge well; and
3. The nitrate in the Glenridge well is at least partially sourced from septic system effluent located in Millville City.

Millville should first eliminate any additional contribution to the nitrate contamination in the Cache Valley principle aquifer by connecting to a sanitary sewer for new development and connect existing systems to sewer to the maximum extent practical.

EVIDENCE SUPPORTING PERMIT DENIAL

The evidence supporting the permit denial is presented in detail below.

EVIDENCE THAT ASR PILOT TESTS INFLUENCED NITRATE CONCENTRATION IN ALDER WELL

Groundwater from the Alder-West well in Providence City was monitored during the two injection tests in the Glenridge well. The figure entitled *Detail of Nitrate Trends for the Glenridge and Alder-West Well During Injection Pilot Test*, included at the end of the letter, indicates that there was some influence, with a temporal offset, on the nitrate concentrations in the Alder-West well from the injection activities in the Glenridge well. Before the Glenridge injection tests, the Alder-West nitrate concentrations were at or below 4.5 mg/L. During the pilot tests the Alder-West nitrate trend seemed to increase and decrease in response to injection and pumping at the Glenridge well. Twenty two months after the end of the injection experiment the Alder-West nitrate value had dropped to 5.9 mg/L.

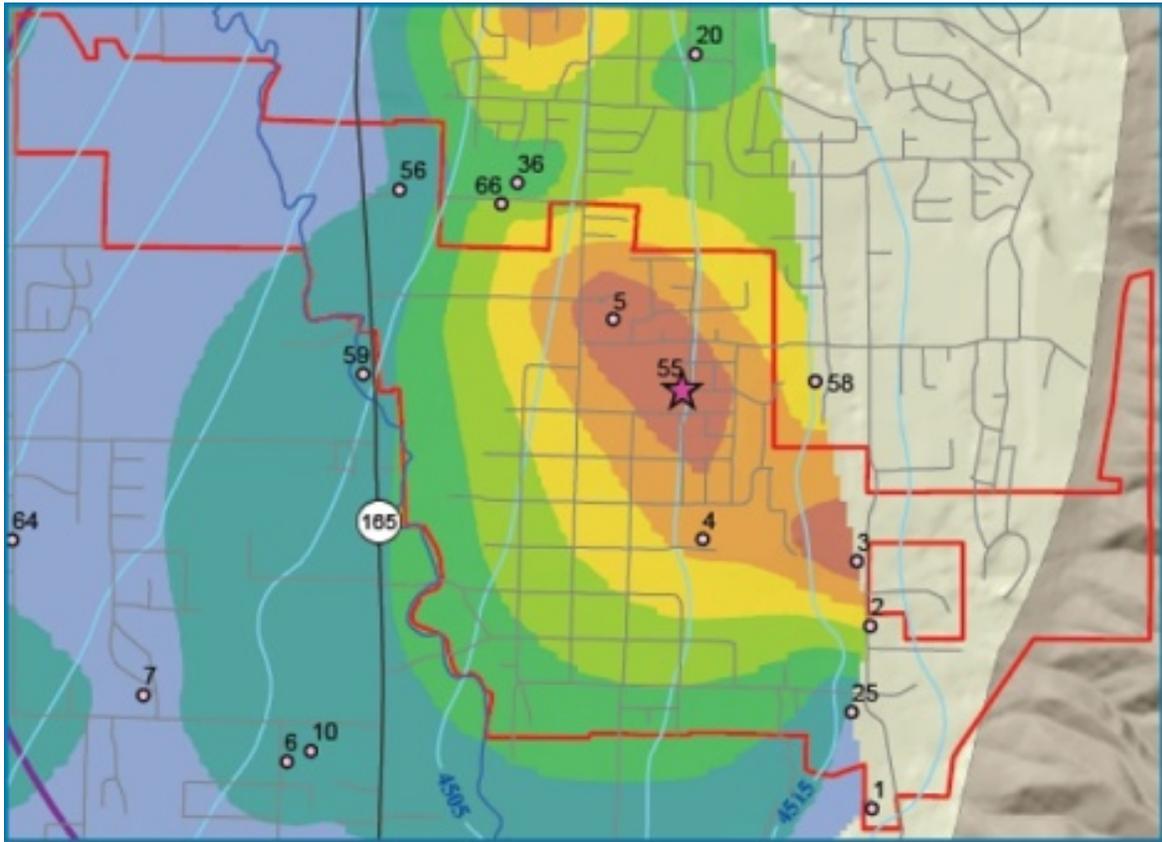
EVIDENCE THAT ASR PILOT TESTS DID NOT REMEDIATE NITRATE

Details of the nitrate concentration in water taken from the Glenridge well before, during and after the two pilot projects are presented in the figure entitled *Detail of Nitrate Trends for the Glenridge Well during Injection Pilot Tests* included at the end of the letter. Nitrate concentration before the first injection test was 7.65 mg/L in March 2014 and returned to the same value at the end of the pumping period which ended 7 months later at the end of September 2014. Nitrate concentration before the second injection test, which began at the beginning of November 2014, was 7.19 mg/L and after the end of the pumping period 11 months later, at the end of September 2015, was at 7.29 mg/L. The trend for both of these injection tests indicates that injection of Garr Springs does not provide long-lasting remediation of the high nitrate values in the Glenridge well.

SOURCE OF NITRATE IN GLENRIDGE WELL

Identifying the source of the nitrate in the Glenridge well was addressed in the technical report. Several techniques were employed to assess the four potential sources of nitrate previously identified in the Millville area: (1) septic tank effluent from on-site wastewater treatment (septic) systems, (2) fertilizer, (3) livestock excrement, and (4) geologic sources. The following map is a detail of Figure 18 of the technical report which is included in its entirety at the end of this letter¹.

¹ The detail maps in the body of this letter are clips of the full figures from the technical report. The detail maps were scaled to facilitate easier comparison between the maps. The figures, including their explanation, are included in their entirety at the end of the letter.

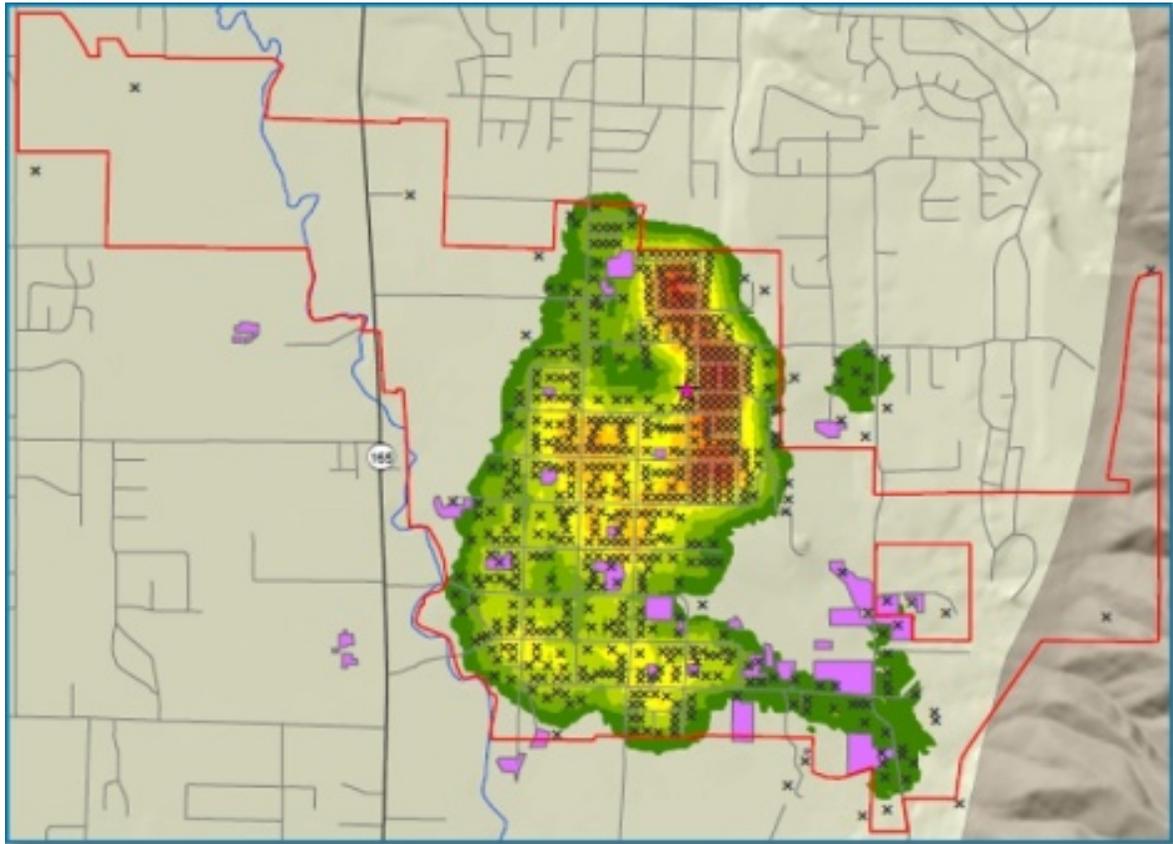


Detail of Figure 18 of the Technical Report - Nitrate Concentrations

This Figure 18 detail shows the location of several areas of high nitrate concentrations within and adjacent to Millville.

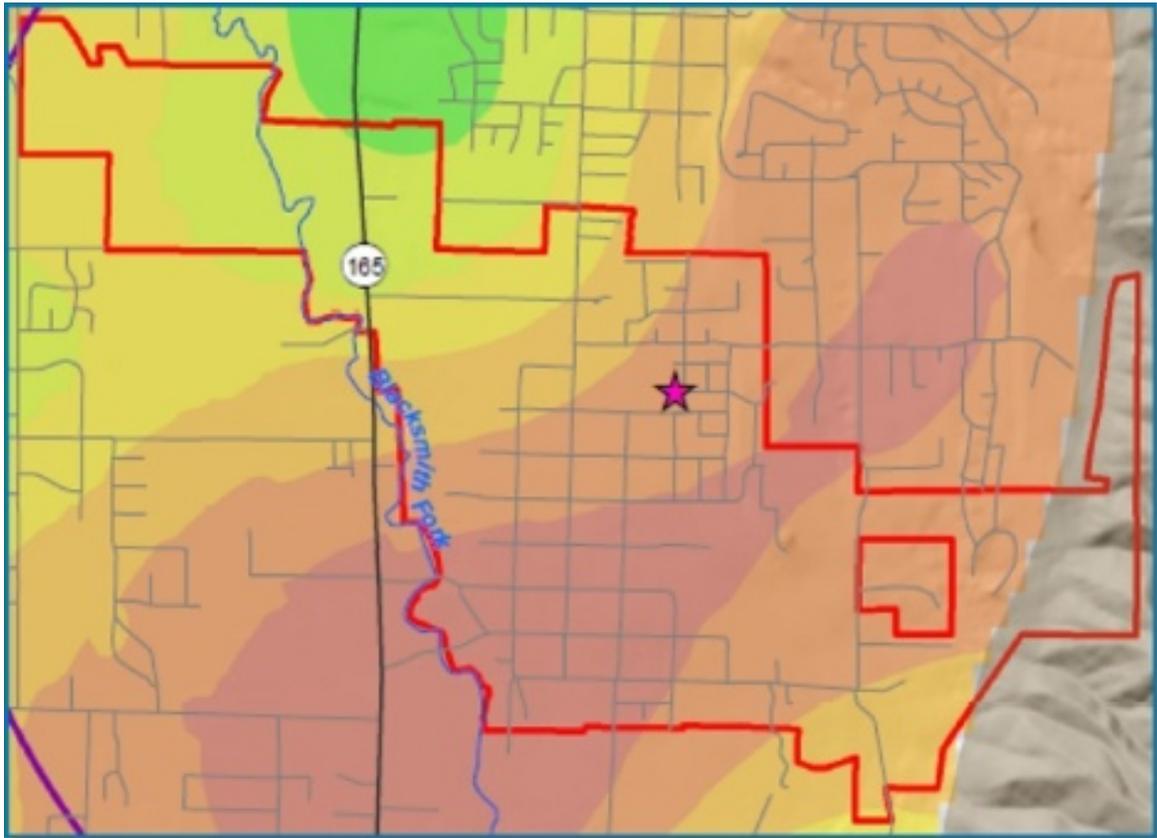
Figure 14 of the technical report shows a septic density map for the Millville area which also includes locations for animal concentrations. The red area in the following detail represents a septic density of 2 to 2.5 septic systems per acre. Previous studies conducted by Lowe and others at the UGS recommended a maximum septic density of one system per 3 acres. The current density in the red zone is more than 6 times this recommendation. Also noteworthy on this map is the number of animal concentration sites southeast of the Glenridge well.

By comparing the detail maps of Figures 18 and 14, it is evident that the large central area of high nitrate concentration is located immediately down-gradient of the highest septic system density in Millville. Another area of high nitrate concentration is located southeast of the Glenridge well where there are several animal concentration sites.



Detail of Figure 14 of the Technical Report - Septic Density & Animal Concentration Sites

Millville is located on the eastern edge of Cache Valley at the foot of the Bear River Range. As is typical of alluvial aprons along range fronts, transmissivity is high closest to the range and decreases with increasing distance from the range. The following detail of Figure 26 illustrates this point.

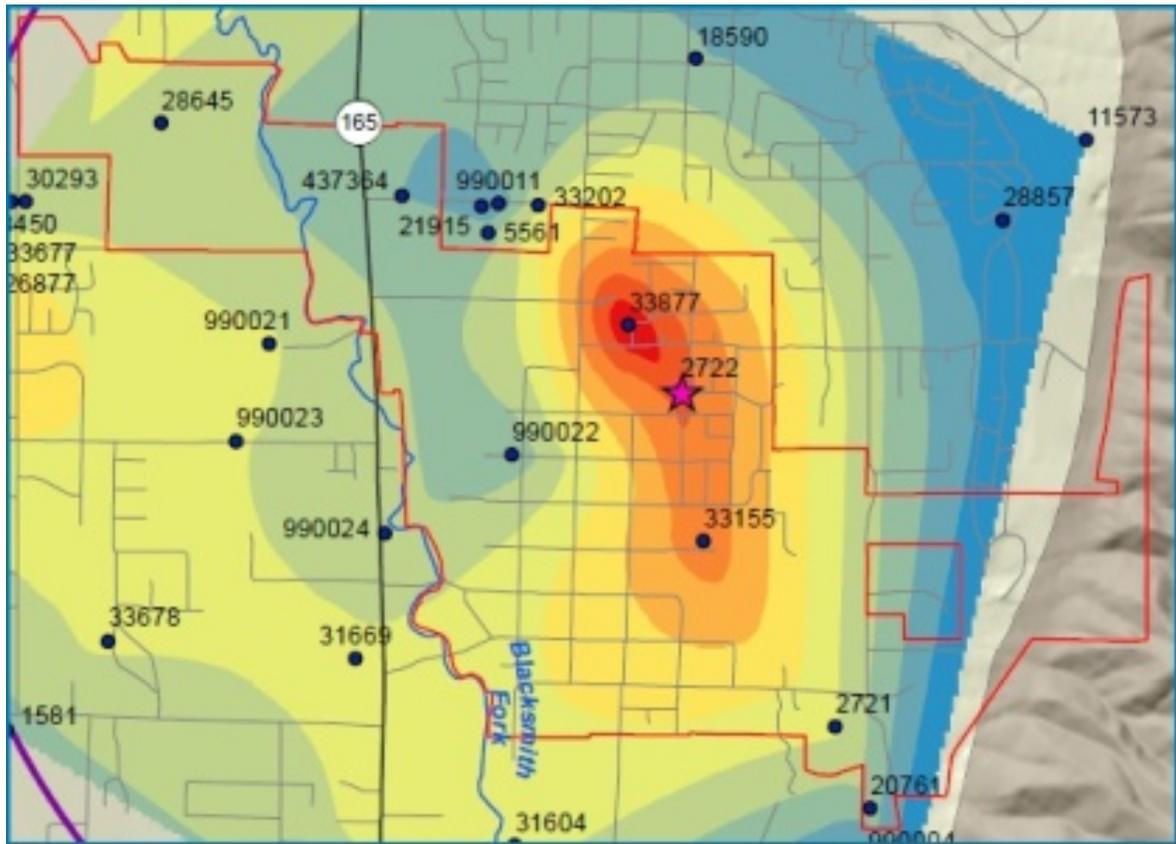


Detail of Figure 26 of the Technical Report - Transmissivity in Principle Aquifer

The upper confining units, B1 and B2, for the principle aquifers, A1 and A2, in Cache Valley are very thin to nonexistent east of the Glenridge well. This is typical of primary recharge areas for valley fill aquifers adjacent to range fronts. This is illustrated in the following detail of Figure 24, but more clearly represented in the SW to NE C-C' cross-section from the technical report which is reproduced at the end of this letter.

Coupling these hydrogeological conditions in the Millville area with sources of nitrate from the high septic system density and numerous animal concentrations creates a scenario ripe for aquifer contamination. This high contamination potential is described in the 1994 U.S. Geological Survey report titled “*Hydrogeology of recharge areas and water quality of the principal aquifers along the Wasatch Front and adjacent areas, Utah*” Water-Resources Investigations Report 93-4221:

“Primary recharge areas have the greatest potential for transmitting contamination to the principal aquifer because of the predominance of coarse-grained sediments and the absence of confining layers. These coarse-grained sediments typically have high hydraulic-conductivity values, and ground water commonly moves rapidly from the surface down to the principal aquifer.”



Detail of Figure 24 of the Technical Report - Upper Confining Unit

In an effort to identify the source of nitrate in the Glenridge well, several methods were employed. Stable isotopes of both nitrogen and oxygen from the nitrate from the Glenridge well were analyzed to determine possible sources for the nitrate. However, the results of this analysis, +5.75 for nitrogen and -5.78 for oxygen, are ambiguous as they fall within the delineated area on the following diagram for nitrate derived from nitrified NH_4 fertilizer, soil NO_3 , and nitrified manure and septic effluent.

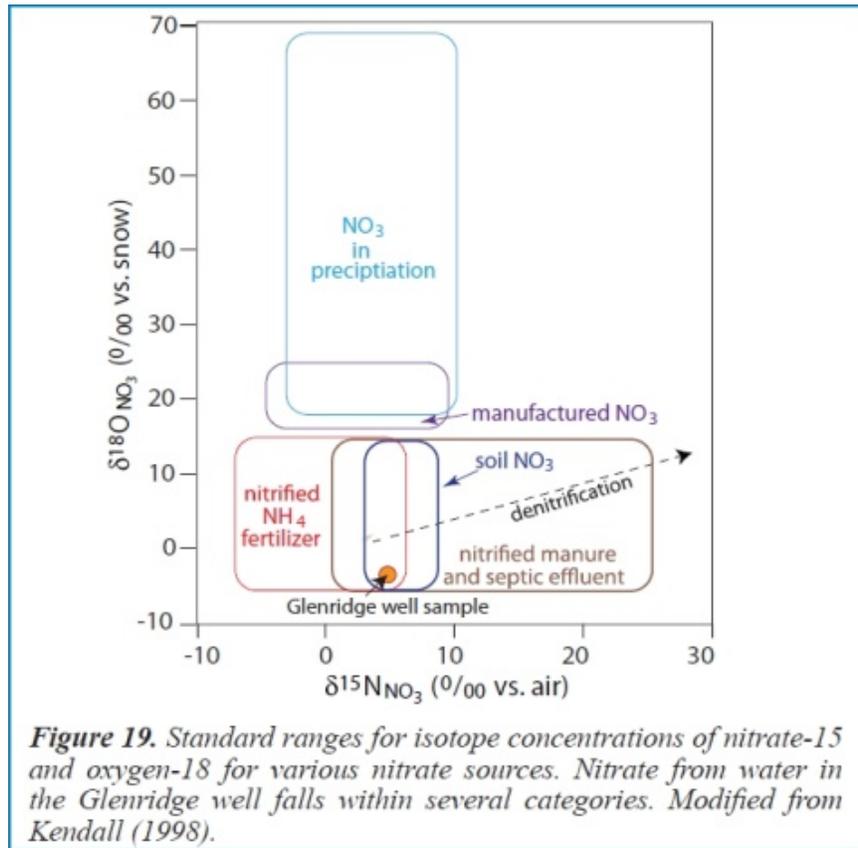


Figure 19 of the Technical Report

While the isotope study did not definitively identify septic systems as a source of nitrate, several other lines of evidence strongly support that conclusion. Figure 3 from the technical report, reproduced at the end of this letter, shows that since 2002 nitrate concentrations in the Glenridge well have increased with the steady population growth in Millville. Analysis for anthropogenic chemicals commonly associated with septic effluent can also aid in the identification of septic systems as a nitrate source. The Glenridge and Arnold wells and Knowles spring (see Figure 2 of the technical report at the end of this letter) were tested for the presence of caffeine (a stimulant), sulfamethoxazole (an antibiotic), carbamazepine (a mood stabilizer), and diethyltoluamide (DEET). Caffeine and sulfamethoxazole were detected in minute but verifiable concentrations in the Glenridge and Knowles spring, approximately 2,500 feet southeast of the Glenridge well.

There is also evidence that some nitrate contamination could be from areas upgradient and east of the Millville municipal boundary within the southeastern portion of Providence. Nitrate concentrations of between 4 and 6 mg/L were found in the Knowles and Skinner springs and the Arnold and O.Hancy wells (see Figure 2 of the technical report for locations relative to the Glenridge well).

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Mayor David Hair
Millville City

If you have any questions regarding this matter, please contact Candace Cady at ccady@utah.gov
or 801-536-4352.

Sincerely,

A handwritten signature in blue ink, appearing to read "Erica B. Gaddis".

Erica Brown Gaddis, PhD
Director

KS/DJH/CCC/blj

cc: Mr. John Mackey, Division of Water Quality, via email
Mr. Corey Twedt, City of Millville Recorder, via email
Ms. Marie Owens, Division of Drinking Water, via email

DWQ-2018-011042

Figures from Technical Report

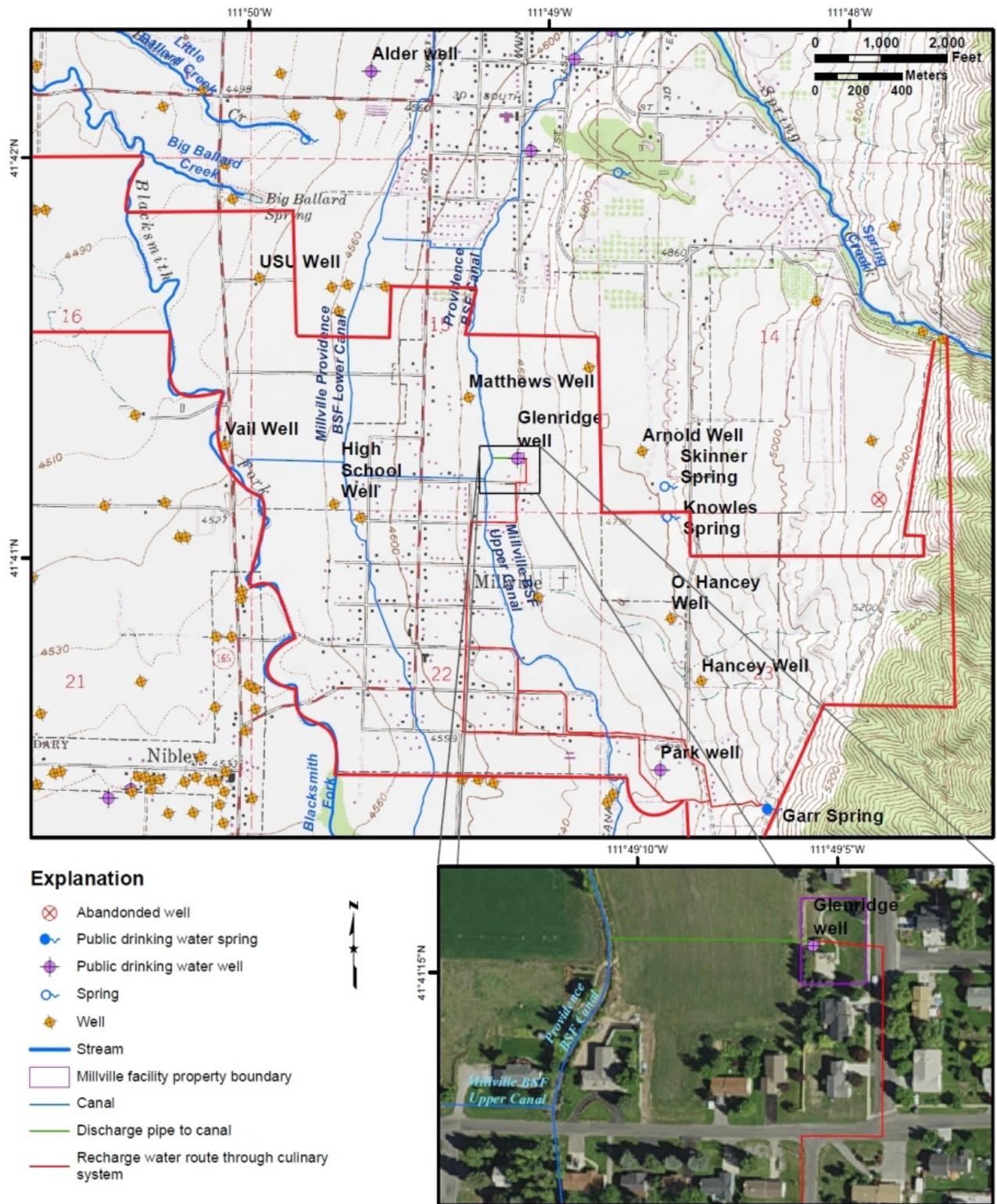


Figure 2. Location of Millville aquifer storage and recovery facility and well.

Figures from Technical Report

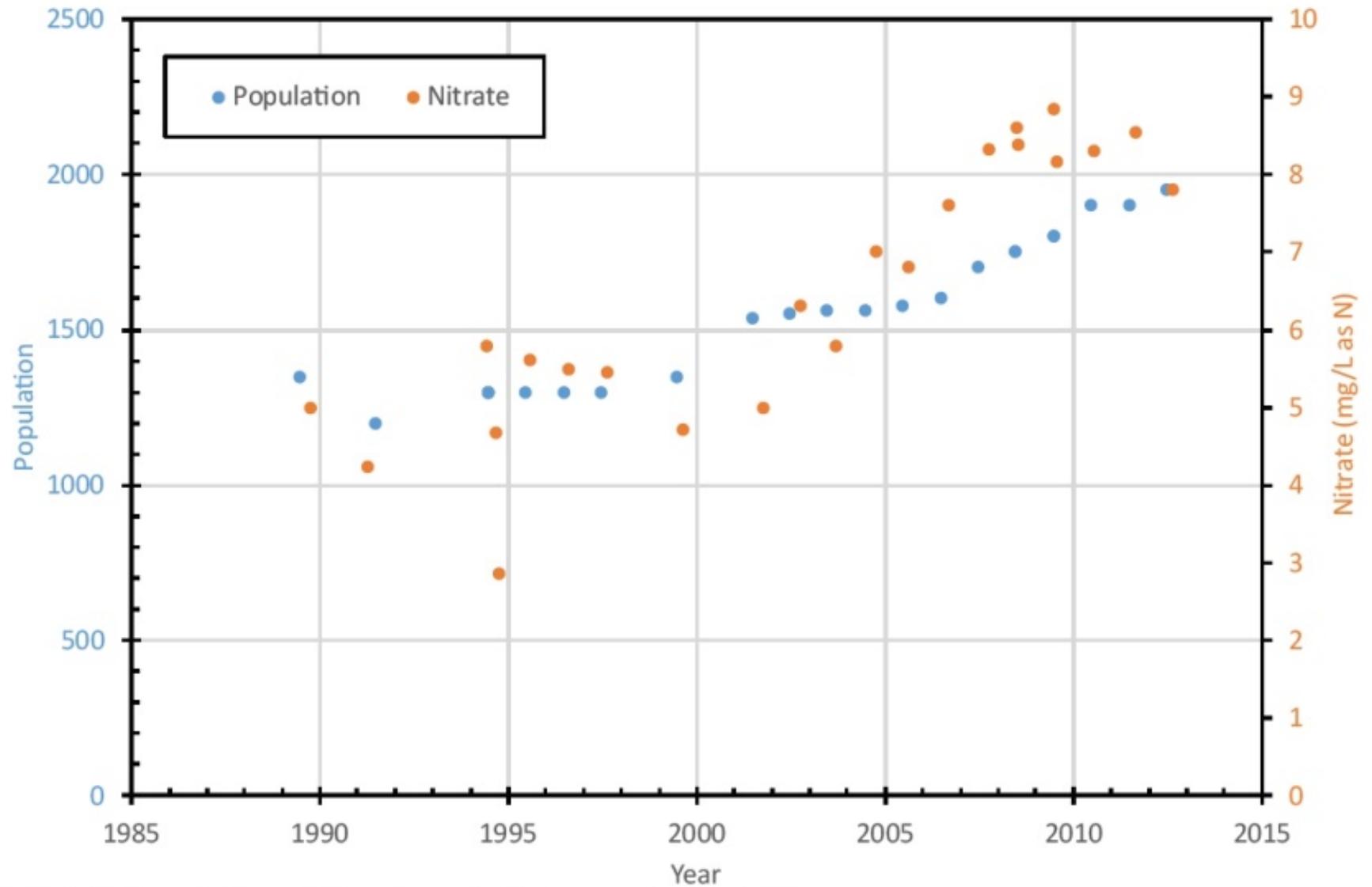


Figure 3. Millville's population and Glenridge well nitrate concentrations both increase over time.

Figures from Technical Report

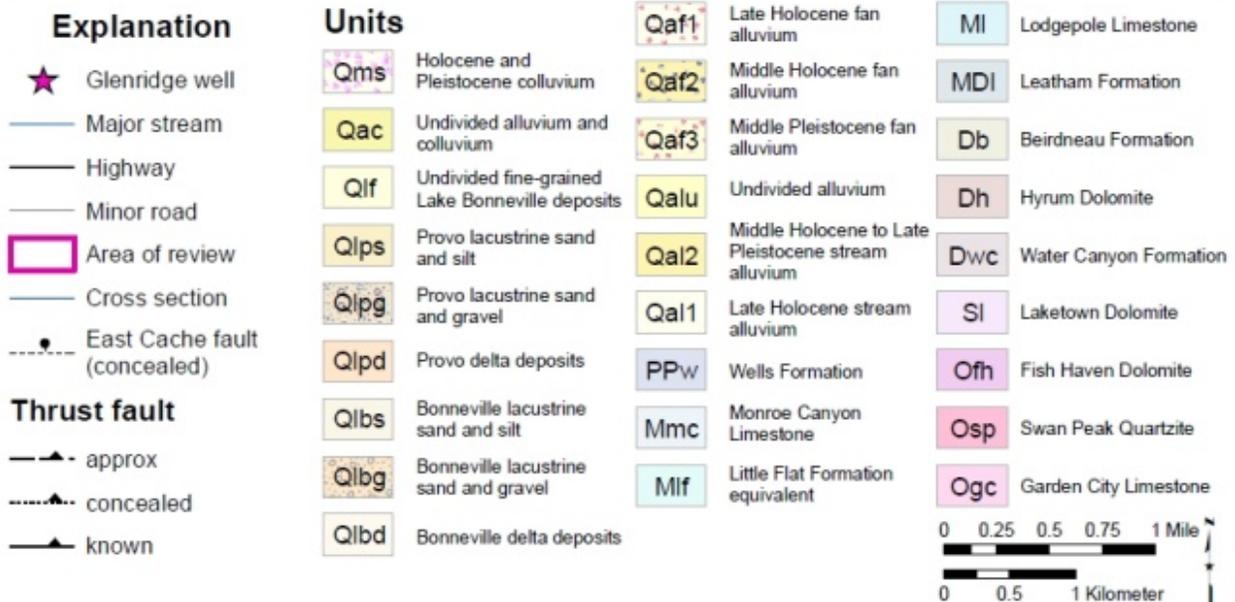
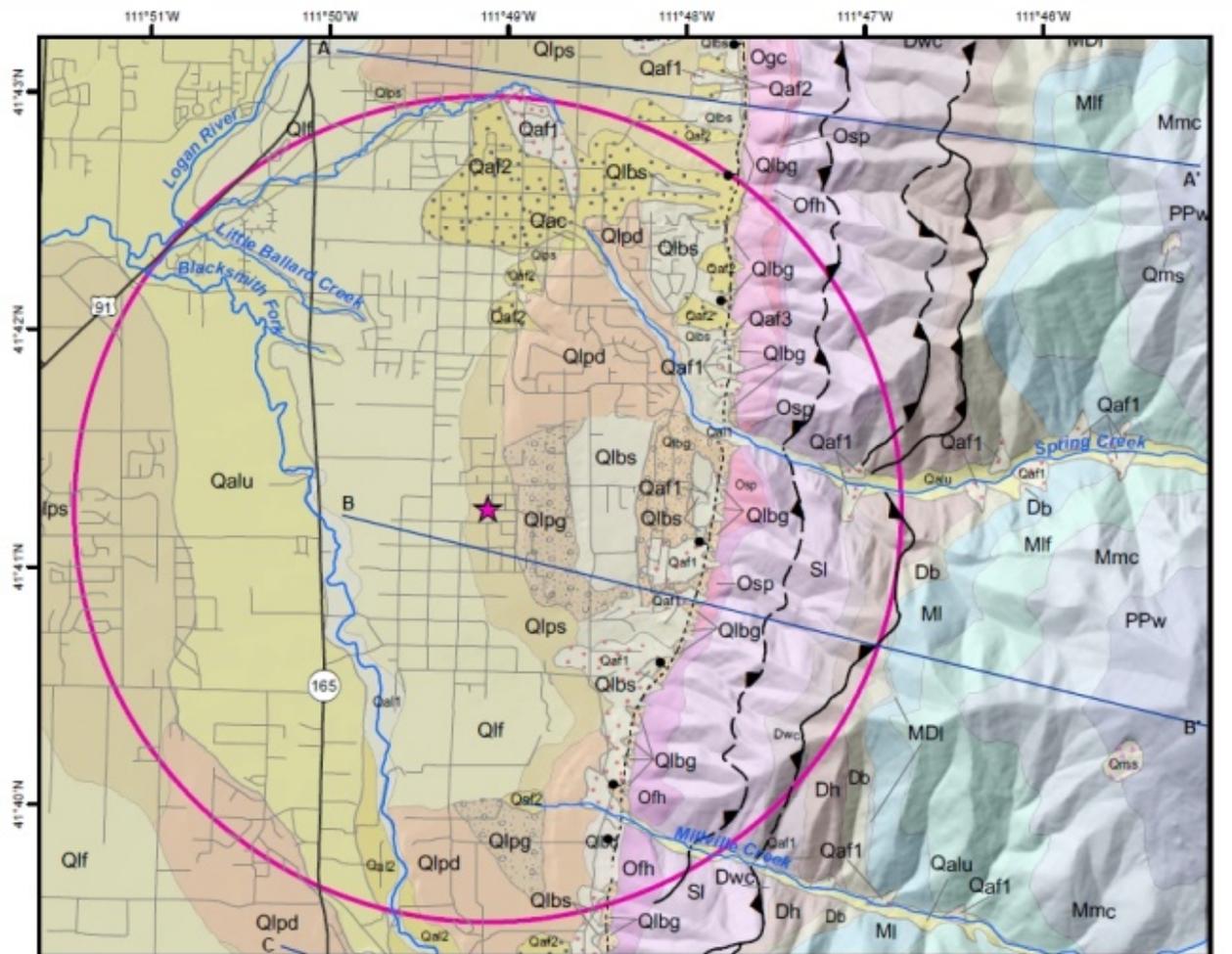
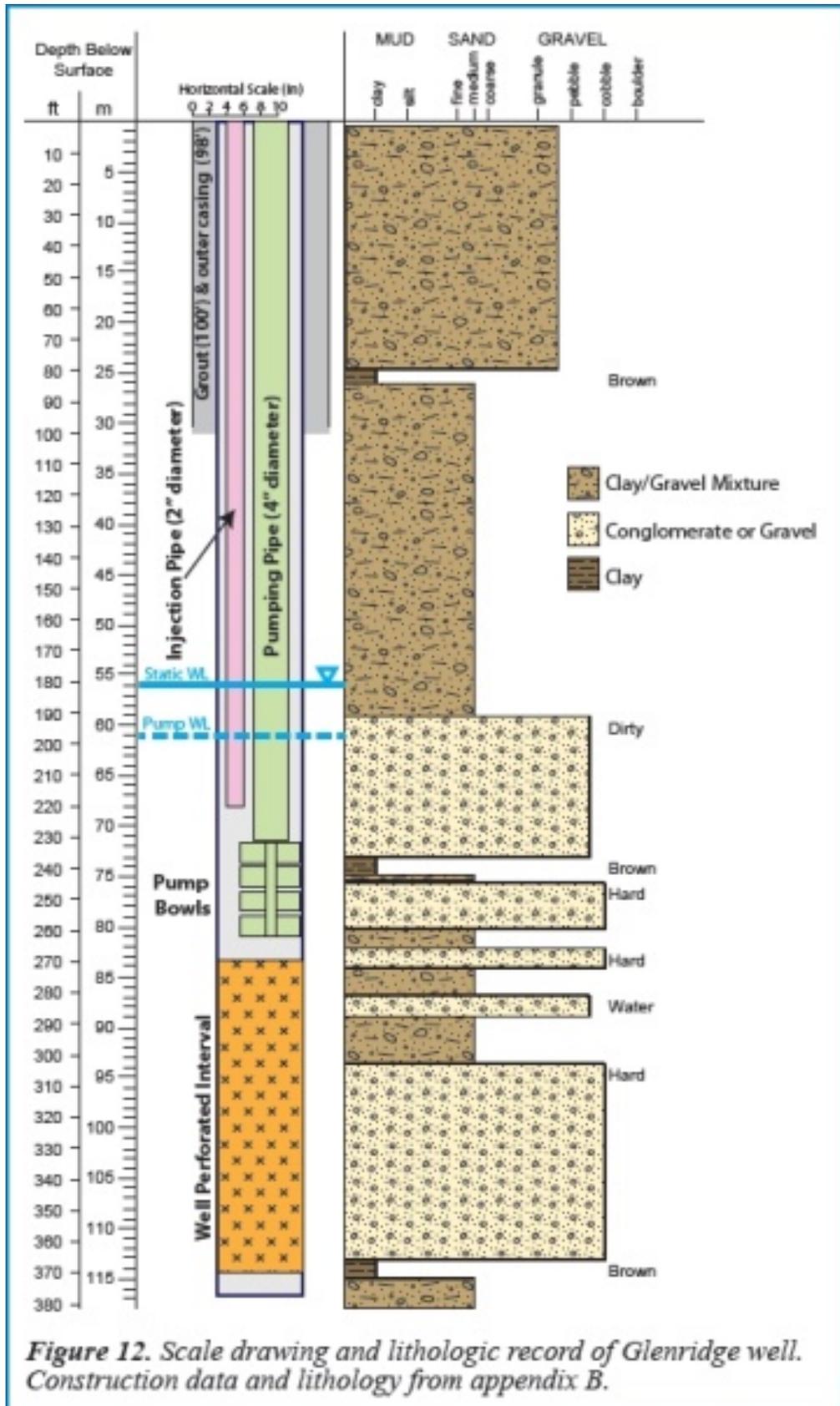
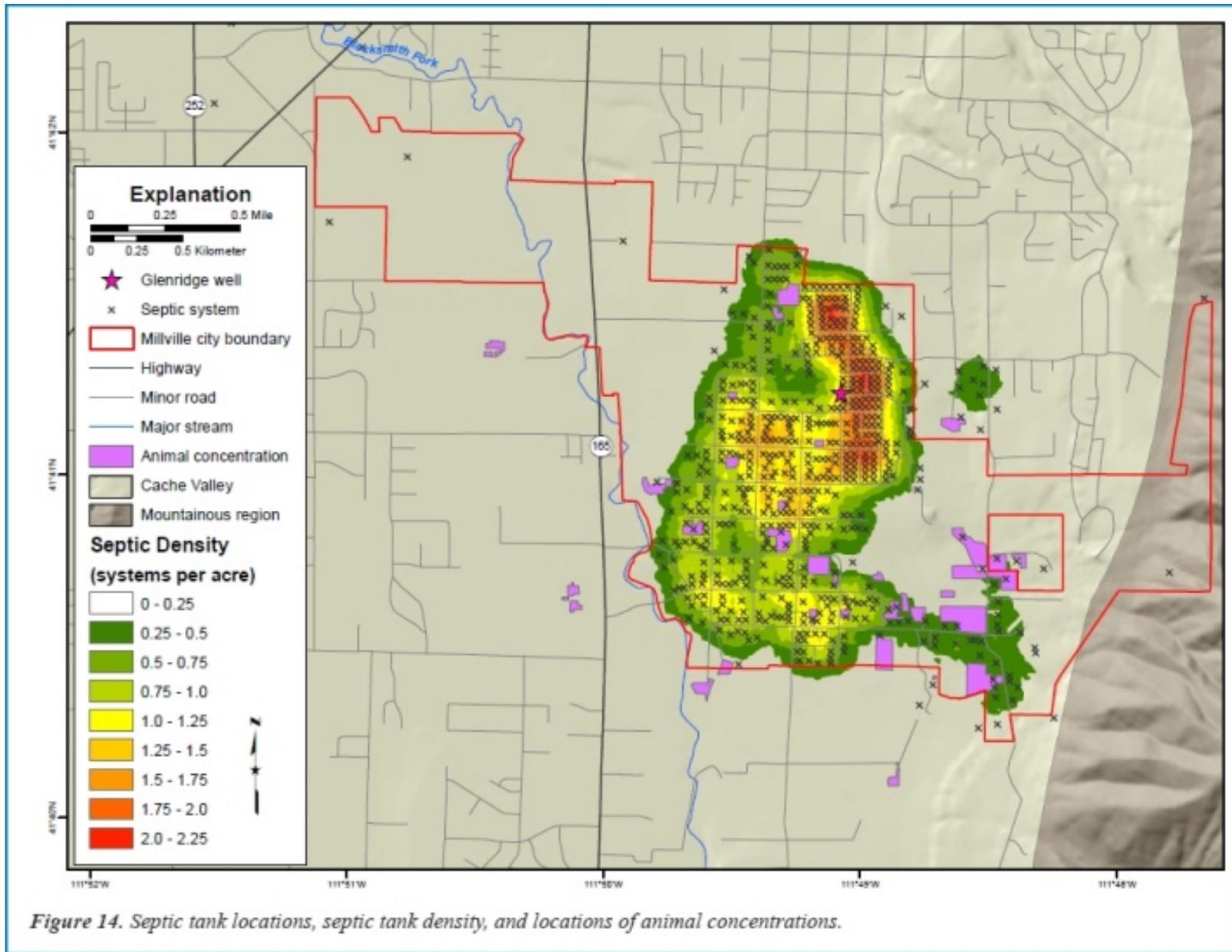


Figure 10. Geologic map of study area (modified from Evans and others, 1996).

Figures from Technical Report



Figures from Technical Report



Figures from Technical Report

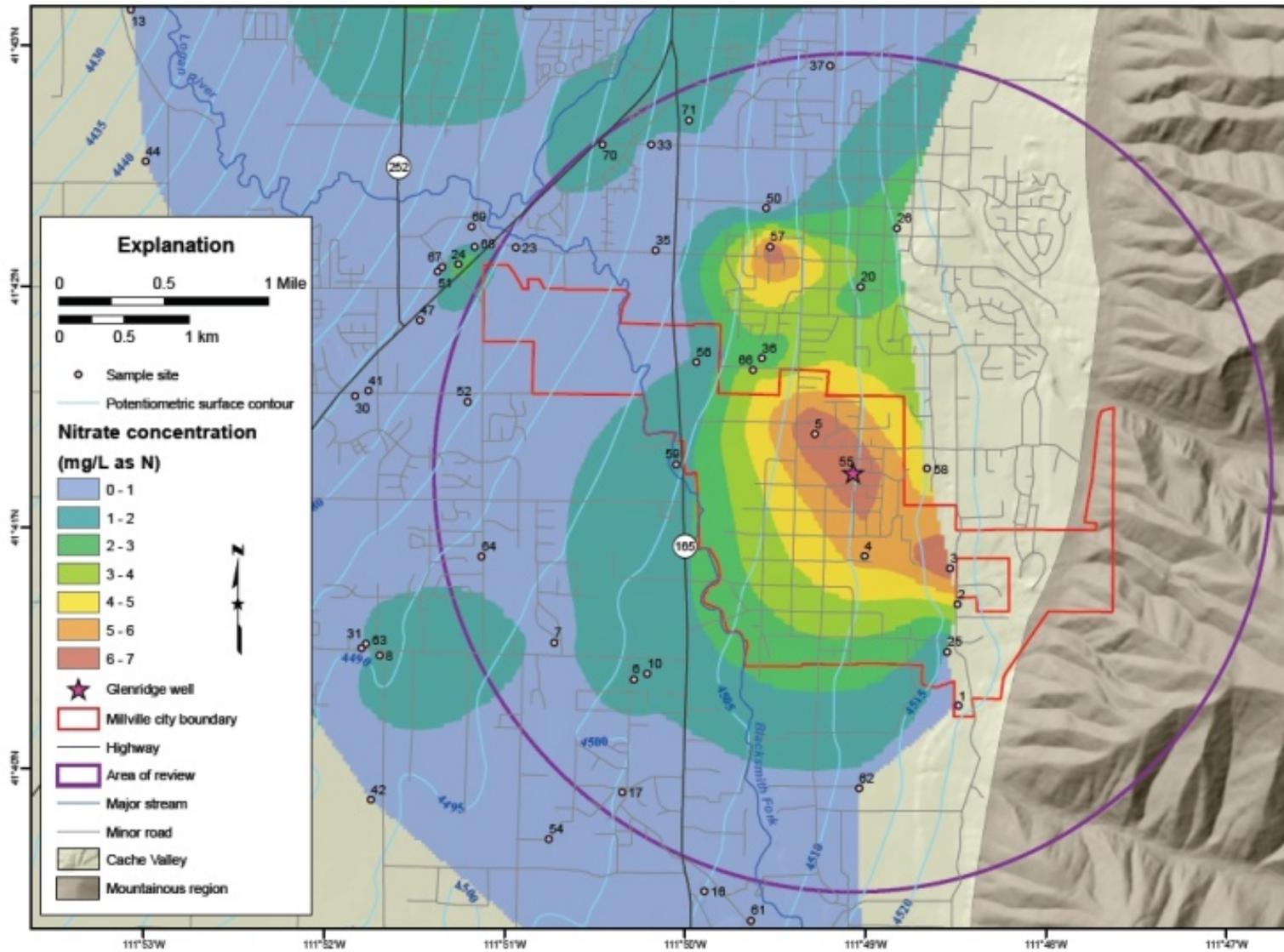
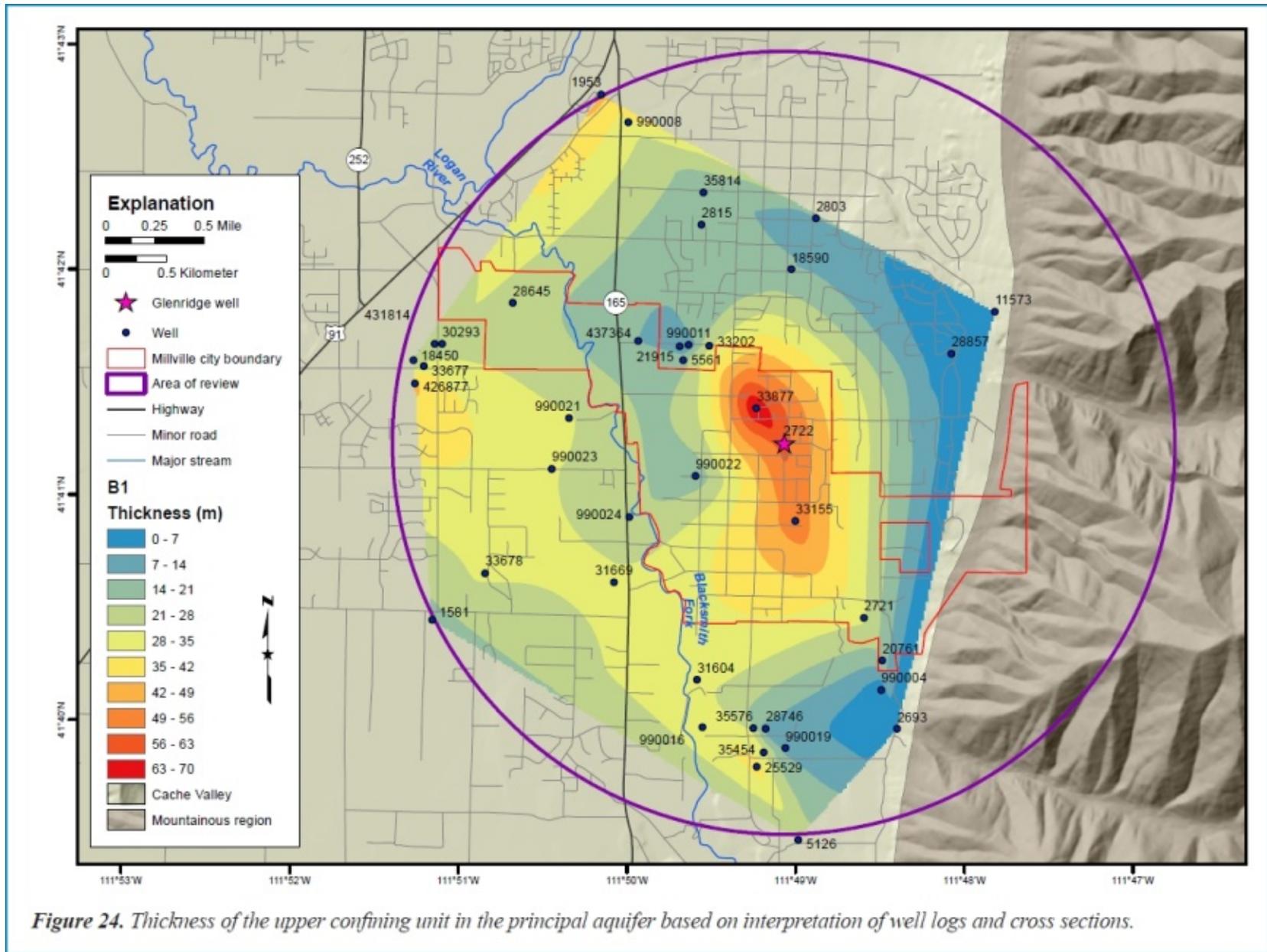


Figure 18. Nitrate concentrations in the Millville area. Numbers adjacent to sample sites are the nitrate sample numbers listed in table 10.

Figures from Technical Report



Figures from Technical Report

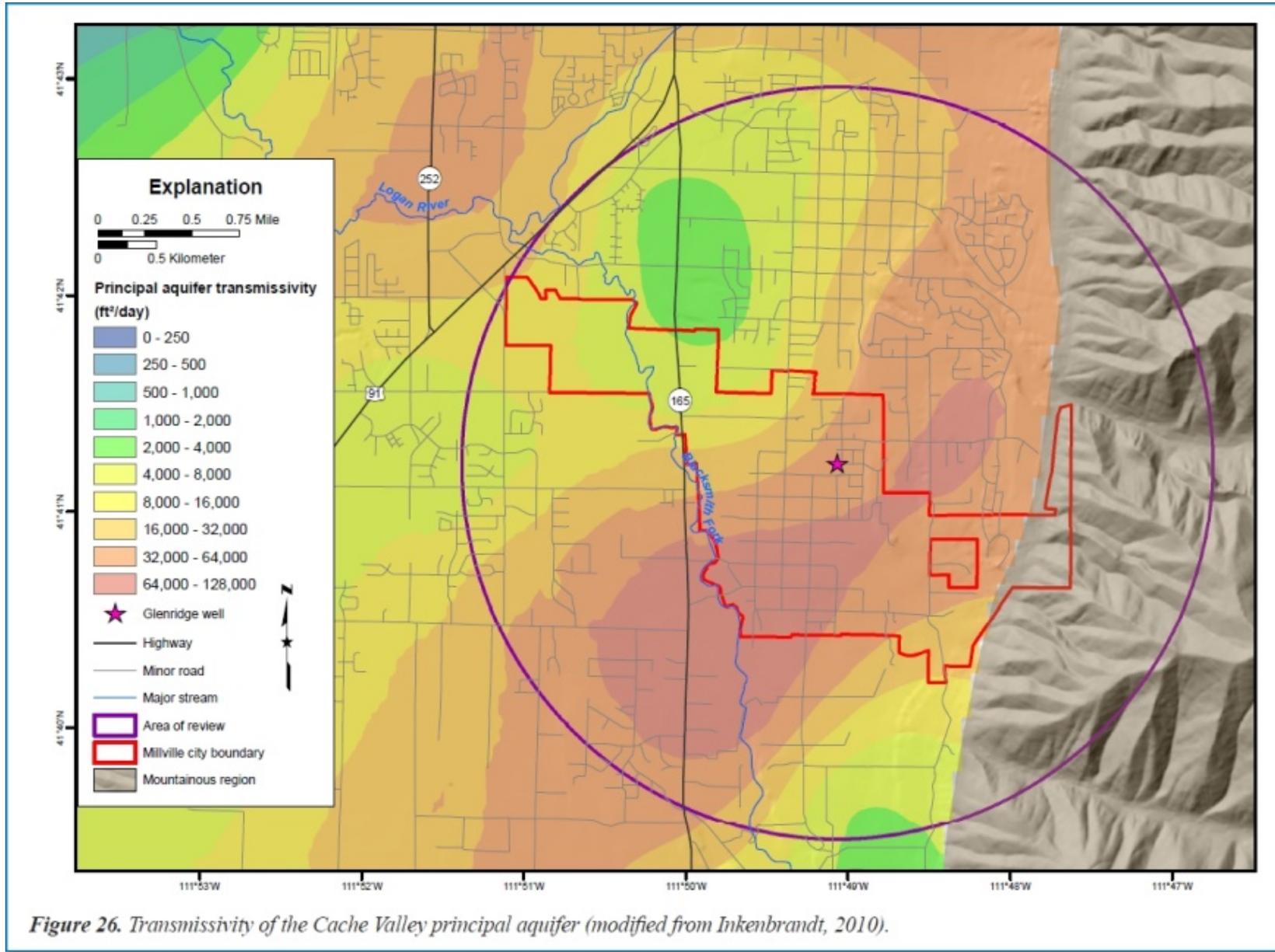
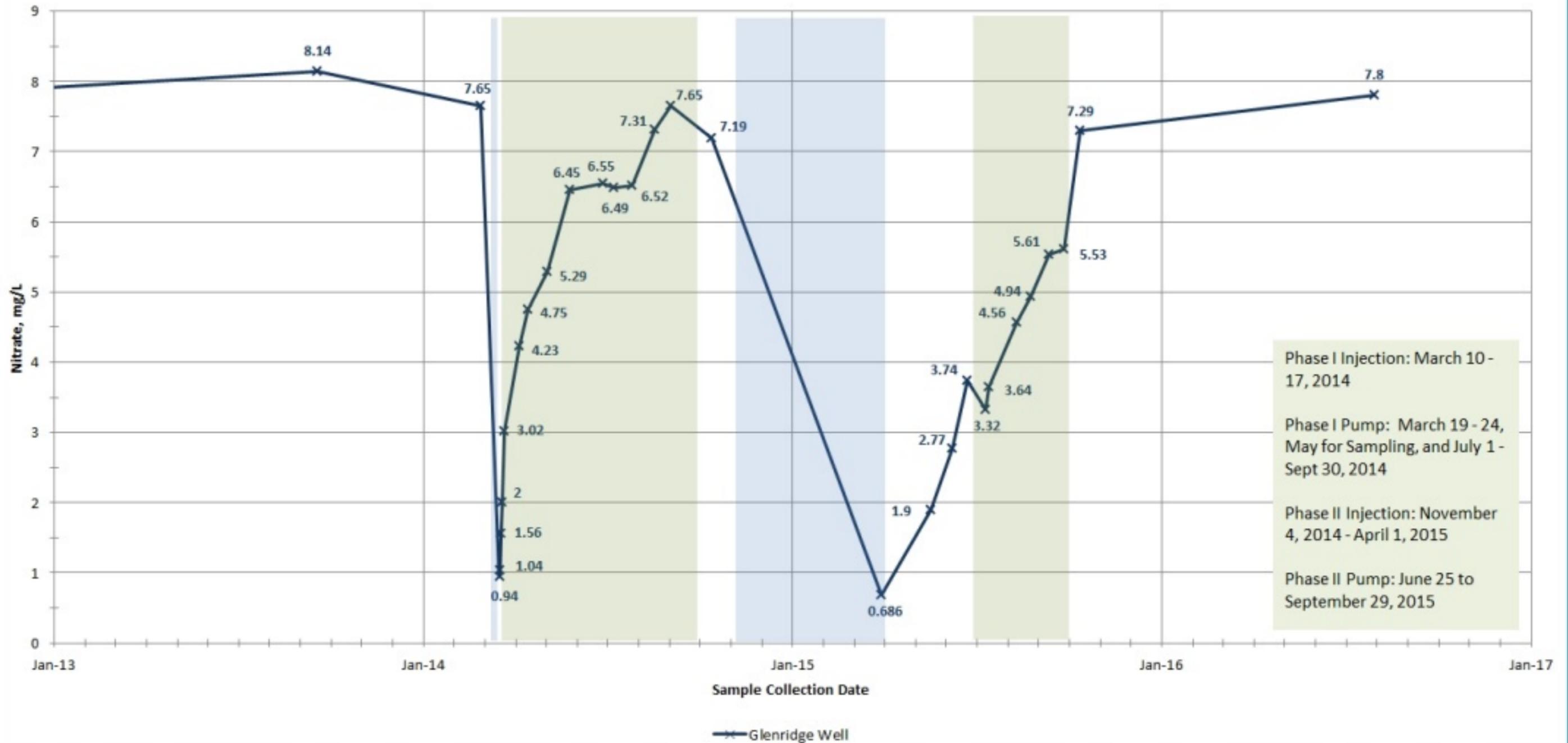


Figure 26. Transmissivity of the Cache Valley principal aquifer (modified from Inkenbrandt, 2010).

Detail of Nitrate Trends for the Glenridge Well during Injection Pilot Tests



Detail of Nitrate Trends for the Glenridge Well and Alder-West Well during Injection Pilot Test

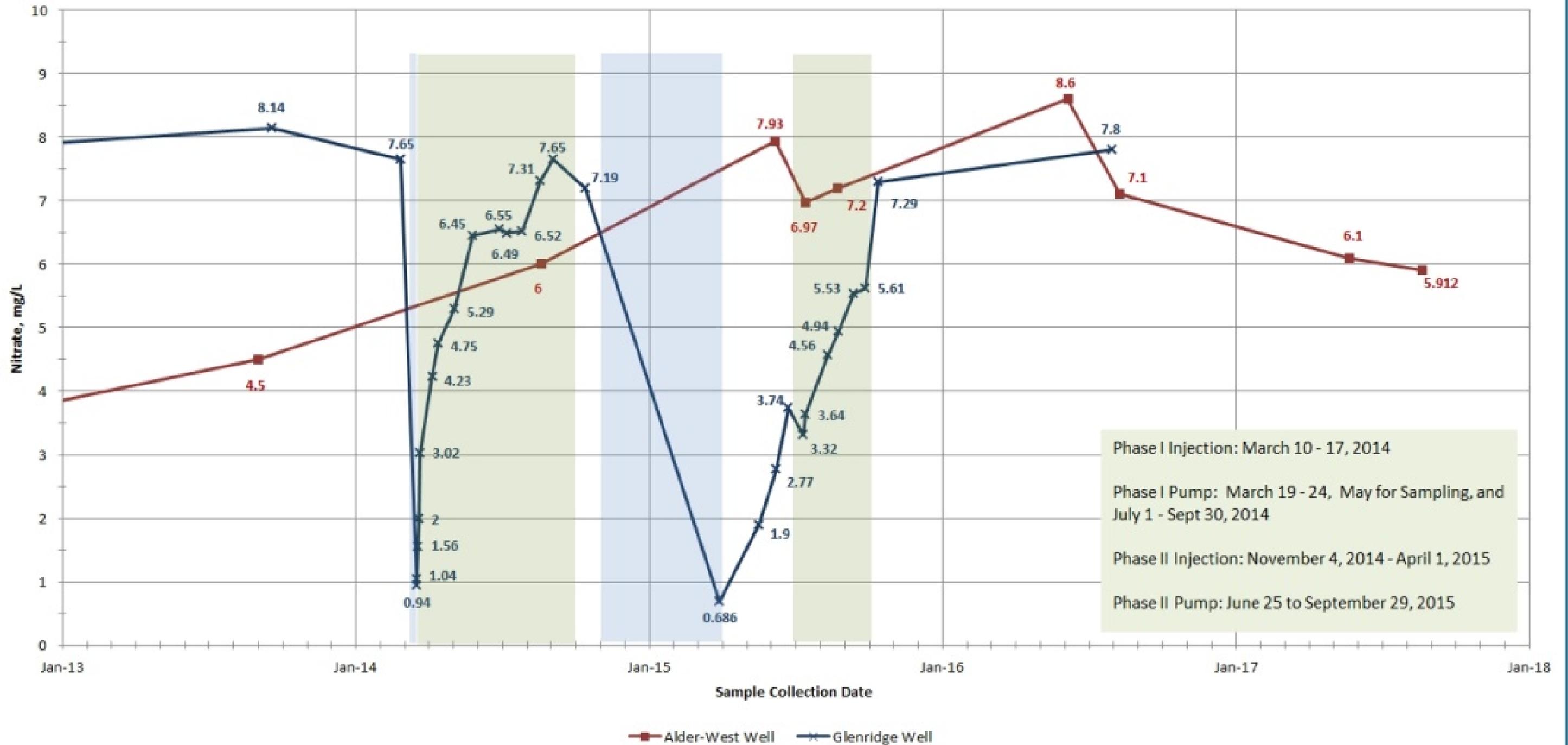
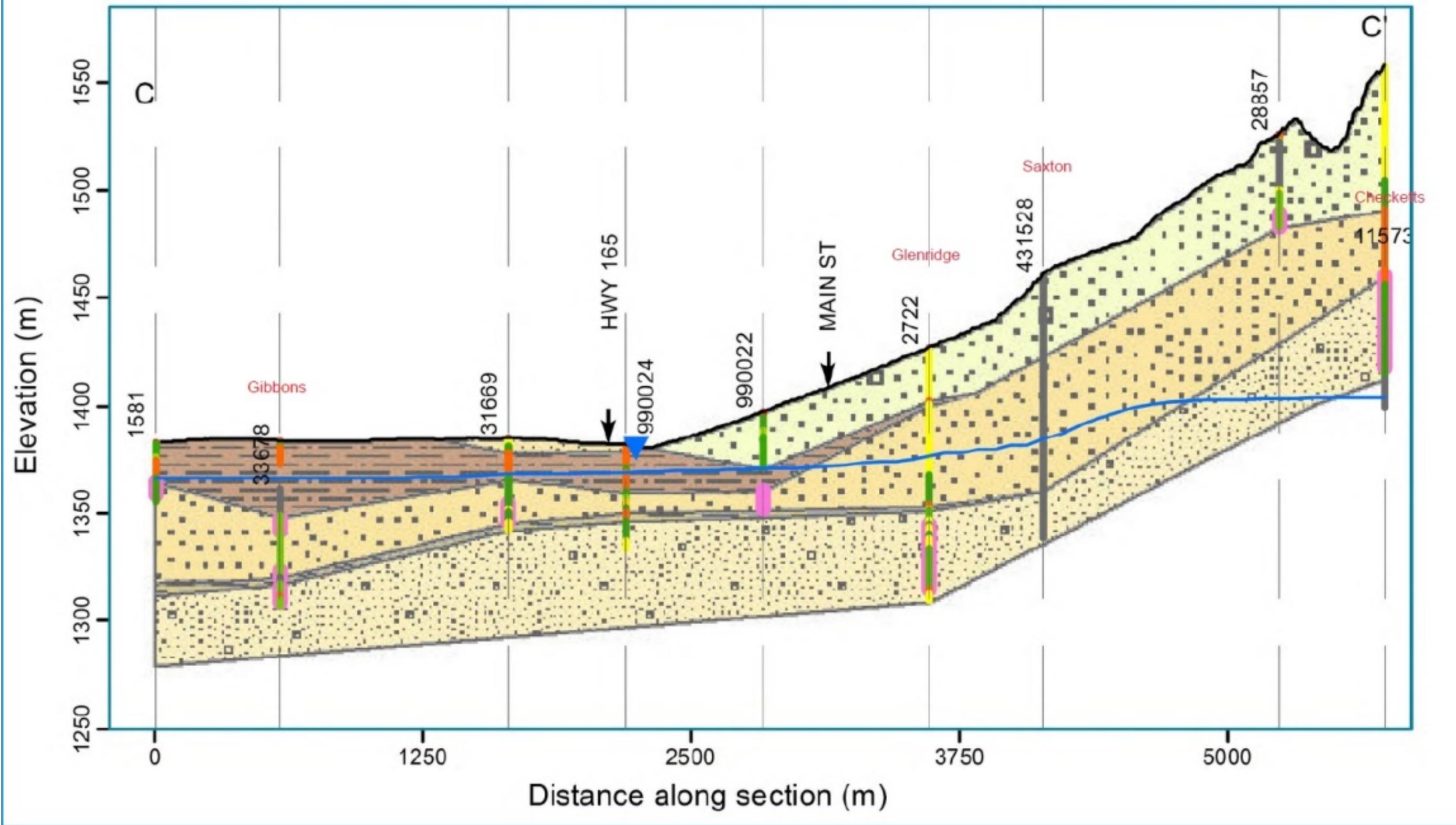


Figure B-6 Millville area cross section C





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January 24, 2019

Public Notice Announcement
Division of Water Quality
Utah Department of Environmental Quality

Purpose of Public Notice

The Utah Department of Environmental Quality is soliciting comments on its proposal to deny an Underground Injection Control (UIC) Class V Aquifer Storage and Recovery (ASR) permit under the authority of the Utah Water Quality Act, Section 19-5-104(1)(I) Utah Code Annotated 1953 as amended, and the Utah Administrative Code R317-7.

Permit Applicant Information

Applicant Name: Millville City

Applicant Mailing Address: PO Box 308
Millville, UT 84326

Applicant Facility Location: Glenridge Well, 350 North 200 East, Millville, Utah

The objectives of the ASR project were to (1) provide Millville with a method to store Garr spring water during the winter months, when Millville's water rights for the spring are active and when demand is low, (2) assist in artificially decreasing relatively high measured nitrate concentrations in the Glenridge well, and (3) further utilize existing water rights. However, the applicant has not demonstrated that the ASR project would not have detrimental effects on the aquifer as was suggested by an increase in the nitrate concentration of a nearby public water system well during the pilot tests. Additionally, initial pilot tests of the ASR project did not demonstrate that long term operation of the proposed ASR project would meet the second objective of sustainably lowering the nitrate concentrations in the Glenridge well.

Public Comments

Public comments are invited any time prior to 5:00 pm **February 25, 2019**. Written comments may be directed to the Division of Water Quality, P.O. Box 144870, Salt Lake City, Utah 84114-4870. All comments received prior to **February 25, 2019**, will be considered in the formulation of final determinations to be imposed on the permit. A public hearing may be held if written requests are received within the first 15 days of this public comment period, that demonstrate significant public interest and substantive issues exist to warrant holding a hearing.

Further Information

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536-4352, or ccady@utah.gov . Permit application documents are available for review during normal business hours at the Division of Water Quality, 195 North 1950 West Salt Lake City, Utah.

In compliance with the American with Disabilities Act, individuals with special needs (including auxiliary communicative aids and services) should contact **Kimberly Diamond-Smith**, Office of Human Resources at (801) 536-4285 (TDD 536-4414).

DWQ-2019-000619



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Erica Brown Gaddis, PhD
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January 24, 2019

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Division of Water Quality
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Salt Lake City, UT 84114-4870

If there are any questions, please contact Brenda Johnson of our office at 801-536-4329. Thank you for your assistance.

Sincerely,

Kim Shelley
Acting Director

KS/CCC/DH/blj

Enclosures (1): 1. Public Notice (DWQ-2019-000619)

DWQ-2019-000842

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Published January 24, 2019

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**Public Notice Announcement
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Utah Department of Environmental Quality**

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