



**DEPARTMENT of AGRICULTURE
and NATURAL RESOURCES**

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**RECOMMENDATION OF ACTING CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 9025-3, City of Lake Norden**

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Acting Chief Engineer, Water Rights Program, Department of Agriculture and Natural Resources concerning Water Permit Application No. 9025-3, City of Lake Norden, PO Box 213, Lake Norden SD 57108.

The Acting Chief Engineer is recommending APPROVAL of Application No. 9025-3 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing domestic water uses and water rights, 3) the proposed use is a beneficial use and 4) it is in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board with the following qualifications:

1. The wells approved under this Permit and Water Right No. 8433-3 are located near domestic wells and other wells which may obtain water from the same aquifer. The well owner under this Permit must control withdrawals so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.
2. Any future replacement wells must be constructed by a licensed well driller and construction of the wells and installation of the pumps must comply with Water Management Board Well Construction Rules, Chapter 74:02:04 with the well casing pressure grouted (bottom to top) pursuant to Section 74:02:04:28.
3. The permit holder must report to the Chief Engineer annually the amount of water withdrawn from the Prairie Coteau Aquifer.
4. This Permit and Water Right No. 8433-3 authorize a combined total annual diversion of up to 1,277 acre-feet of water.

See report on application for additional information.

Adam Mathiowetz, PE
Acting Chief Engineer
April 21, 2026

Report to the Acting Chief Engineer on
Water Permit Application No. 9025-3
City of Lake Norden
April 17, 2026

Water Permit Application No. 9025-3 by the City of Lake Norden seeks to appropriate an additional 310 acre-feet of water annually and add 0.77 cubic feet per second (cfs) to the maximum rate of diversion from three existing wells currently authorized by Water Right No. 8433-3. Water Right No. 8433-3 appropriates up to 967 acre-feet of water annually, at a maximum combined rate of 1.34 cfs from three wells completed into the Prairie Coteau aquifer (97, 101, and 103 feet deep) located in the S $\frac{1}{2}$ SW $\frac{1}{4}$ (Lots 1, 2, and 3) Section 15-T113N-R53W for municipal use. This application, if approved, and Water Right No. 8433-3 will authorize the appropriation of up to 1,277 acre-feet of water annually at a combined pump rate of 2.11 cfs. This site is in Hamlin County, approximately one mile northeast of Lake Norden, SD.

Aquifer: Prairie Coteau (PCO)

Hydrogeologic Information and Aquifer Characteristics

The Prairie Coteau aquifer is the catchall name used by the SD DANR Water Rights Program and accepted by the Water Management Board for discontinuous intermediate aquifers located on the Coteau des Prairies in northeastern South Dakota that are not a part of another named aquifer (Water Rights, 2026a, 2026b, and 2026c). Intermediate aquifer is a term used to describe bodies of glacial outwash (sands and gravels) that do not typically include surficial (at or very near land surface) or basal (in contact with or very near bedrock) aquifers, such as the Big Sioux and Altamont aquifers, respectively (Hedges et al., 1982). These discontinuous outwash deposits can be in sand and gravel lenses separated by clay layers in the glacial drift (vertical separation) as well as being geographically separated (horizontal separation) (SDGS, 2026; Water Rights, 2026b). Mathiowetz (2020 & 2021) contains more detail on aquifer characteristics for this portion of the Prairie Coteau aquifer as determined by two aquifer performance tests.

The density and depth of drill holes available to delineate the most likely extent of this portion of the Prairie Coteau aquifer remain limited beyond approximately one mile of the well sites for this application and the presence of several lakes, sloughs, and wetlands in the area further limit potential drill sites (SDGS, 2026; Water Rights, 2026a & 2026b). Due to this, Mathiowetz (2021) relied upon information from two aquifer performance tests to evaluate water availability and unlawful impairment potential for Water Permit No. 8433-3, which authorizes the existing wells for this application. A review of well completion reports and other drilling data for the vicinity indicates there has been little to no new drilling since Mathiowetz (2021), so additional data for this aquifer is limited to the several additional years of Water Rights observation well readings and pumping by the city (SDGS, 2026; Water Rights, 2026a & 2026b).

Therefore, an attempt to delineate this portion of the Prairie Coteau aquifer for this application was not made and the report will rely on Mathiowetz (2020 & 2021), associated aquifer performance tests, and the response of the aquifer to the city's pumping since the issuance of Water Permit No. 8433-3.

The existing wells for this application are completed into glacial outwash ranging from 83 to 103 feet below grade or elevation 1,560 to 1,587 ft (vertical datum not specified but assumed to be NAVD88 due to year of the report) (LRE, 2021). Aquifer thickness at the well sites for this application ranges from 14 to 18 feet thick (LRE, 2021). When the wells were initially drilled in 2018, the water level was approximately 80 feet above the top of the aquifer (Water Rights, 2026a). The available information for this aquifer indicates it is typically under confined conditions; as are all three existing wells for this application (Water Rights, 2026a & 2026b).

South Dakota Codified Law (SDCL)

SDCL 46-2A-9

Pursuant to SDCL 46-2A-9, "A permit to appropriate water may be issued only if there is a reasonable probability that there is unappropriated water available for the applicant's proposed use, that the diversion point can be developed without unlawful impairment of existing domestic water uses and water rights, and that the proposed use is a beneficial use and in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board as defined by SDCL 46-2-9 and 46-2-11." This report will address the availability of unappropriated water and the potential for unlawful impairment of existing domestic water uses and water rights within this portion of the Prairie Coteau aquifer in South Dakota.

Water Availability

Water Permit Application No. 9025-3 proposes to appropriate water from the Prairie Coteau aquifer for municipal use. The probability of unappropriated water being available from an aquifer can be evaluated by considering SDCL 46-6-3.1 which requires, "No application to appropriate groundwater may be approved if, according to the best information reasonably available, it is probable that the quantity of water withdrawn annually from a groundwater source will exceed the quantity of the average estimated annual recharge of water to the groundwater source." If the source of the water is older or lower than the Greenhorn Formation and the application is for a water distribution system defined in SDCL 46-1-6 (17), the Board need not consider the recharge/withdrawal issue. Although this application is for a water distribution system, as defined in SDCL 46-1-6 (17); the Prairie Coteau aquifer is not older or stratigraphically lower than the Greenhorn Formation. Therefore, the withdrawal/recharge issue must be considered.

Observation Wells

In determining the availability of unappropriated water for a permit application Administrative Rule 74:02:05:07 requires the Water Management Board to rely on the record of observation well measurements, in addition to other data, to determine that the quantity of water withdrawn annually from the aquifer does not exceed the estimated annual recharge.

The Water Rights Program currently monitors 63 observation wells completed into the various outwash bodies grouped under the name Prairie Coteau aquifer. Of those, only three wells are currently identified as being completed into the same outwash body (or portion of the aquifer) as the existing wells for this application. These observation wells are all located within one mile (5,280 feet) of the wells for this application shown in Figure 1. The hydrographs for these observation wells (HN-2021A, HN-2021B, and HN-2021C) are shown in Figure 2.



Figure 1: Map of observation wells and existing water rights currently known to be in this portion of the Prairie Coteau aquifer

Report on Water Permit Application No. 9025-3

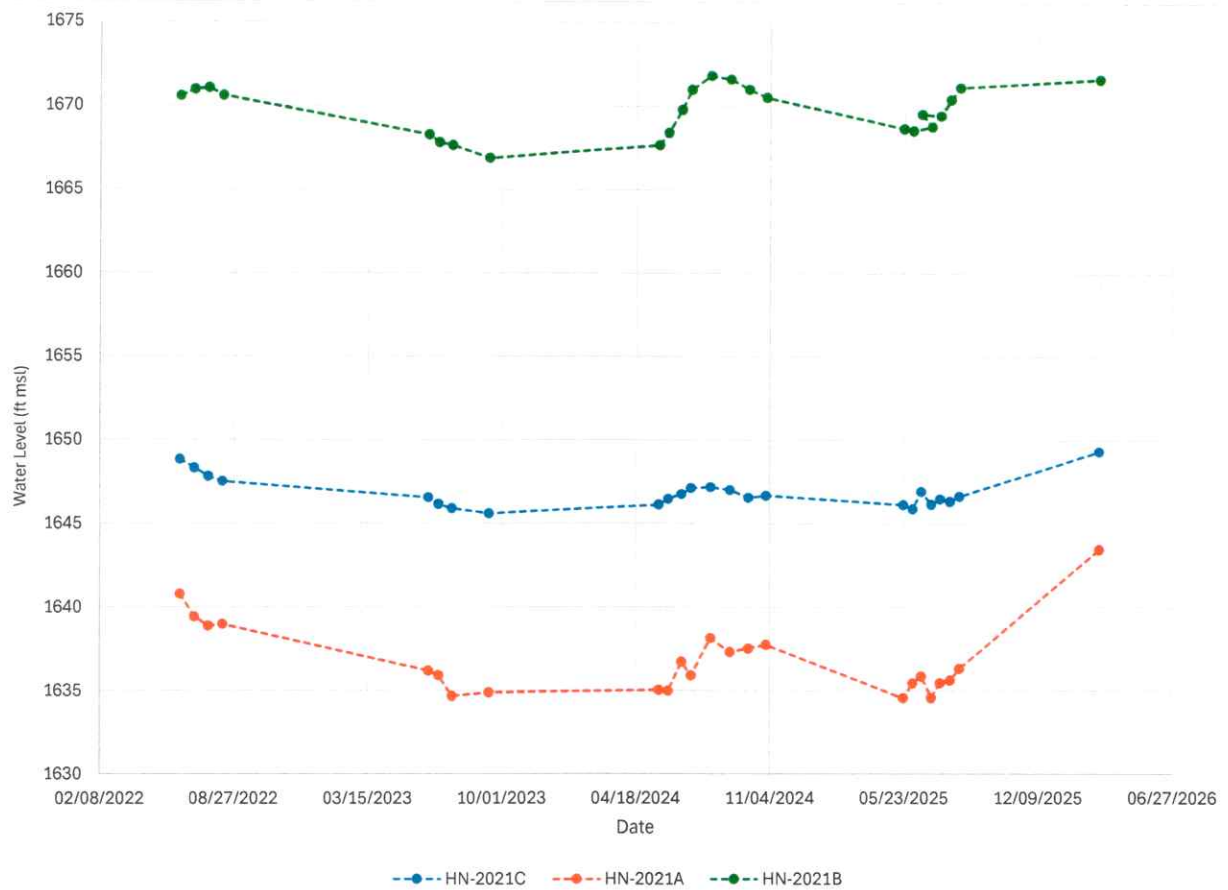


Figure 2: Hydrographs for the observation wells in this portion of the PCO (Water Rights, 2026c). Top of casing from LRE (2021), datum not specified but assumed to likely to be NAVD88.

The period of record for these observation wells is limited but it does offer some additional insight into water availability beyond the original aquifer performance tests when paired with the City’s water use from the aquifer during this period. The City’s pumping from the aquifer is shown in Table 1. The City’s annual usage from the aquifer has been slightly increasing every year, since Permit No. 8433-3 was issued.

Table 1: Lake Nordan's Reported Water Use from the PCO aquifer (Layman, 2026)	
Year	Water Use (acre-feet)
2021	588
2022	730
2023	741
2024	740
2025	762
Average	712

Despite the City’s ongoing pumpage from the aquifer, measured water levels have remained relatively stable at the observation wells, with rises in measured water levels during wet periods and gradually declining measured water levels during dry periods. This demonstrates that the aquifer responds well to climatic conditions. Ultimately, the observation wells in the aquifer indicate that natural conditions dominate the aquifer, and that recharge to and natural discharge from the aquifer exceeds pumping. Since recharge to and natural discharge from an aquifer can be captured for pumping, there is a reasonable probability that unappropriated water is available for this application.

These observation wells are all under confined conditions, so measured water levels are above the top of the aquifer which represents the upward pressure of the water in the aquifer on the overlaying confining layer (also known as artesian head pressure). Artesian head pressure is generally reactive to nearby pumping. This can be seen in the water level measurements from the wells during the aquifer performance testing work shown in Figure 3. In Figure 3, wells L1, L2, and L3 are the wells this application proposes to utilize which are all within 0.1 miles of each other. Well NNMW in Figure 3 corresponds to observation well HN-2021A, NEMW to HN-2021B, and SWMW-D to HN-2021C.

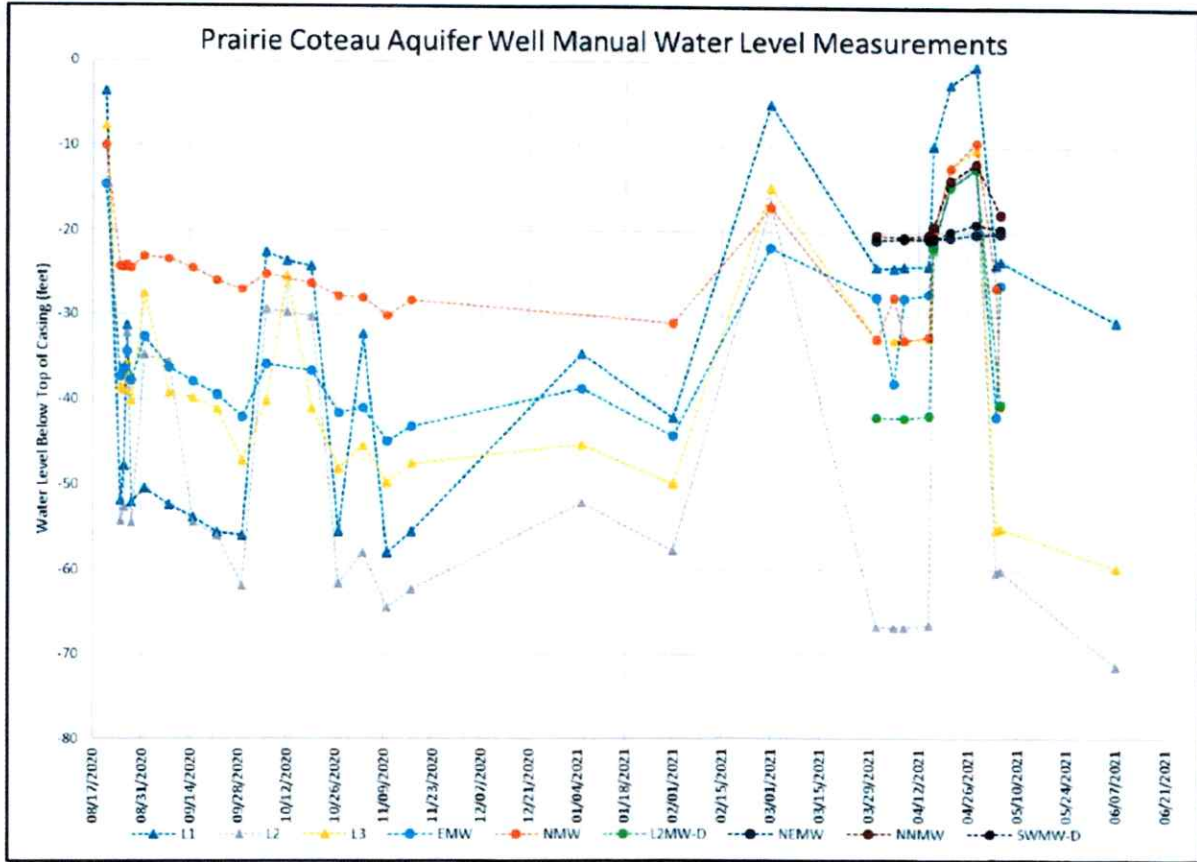


Figure 3: Well measurements from the period of aquifer performance testing (Mathiowetz, 2021). Note y-axis in in different units from Figure 2.

Hydrologic Budget

Withdrawals

Discharge from this portion of the Prairie Coteau aquifer occurs through well withdrawals and leakage to adjacent aquifers or surface water bodies with lower hydraulic head. (Leap, 1972; Water Rights, 2026b). Only two non-irrigation water rights/permits are currently considered to be completed into this portion of the Prairie Coteau. These are Water Permit No. 8433-3 for municipal use and Water Right No. 7193-3 for domestic use. Those permits are summarized in Table 2.

Permit No.	Name		Use	Rate (cfs)	Annual Volume (acre-feet)	Estimate Annual Use (acre-feet)
7163-3	Travis or Kimberly Hymans	09/29/2009	domestic	0.078	n/a	34
8433-3	City of Lake Norden	06/30/2020	municipal	1.34	967	967
Total				1.418	967	1,001

The Water Rights Program estimates average water use by non-irrigation appropriations limited by instantaneous diversion rate to be less than 60% of full time pumping at the permitted diversion rate. For water rights/permits limited to an annual volume, full use of that volume is

assumed for estimating average annual withdrawal (unless information is available to indicate that average water use has stabilized at a lower number), and it is assumed that future use permits will be fully developed. Estimated water use associated with Water Right No. 7163-3 is 34 acre-feet per year, based on diversion rate. Given the city's reported water usage under Water Permit No. 8433-3 has grown since the permit was issued and the city is asking for more volume with this application, the full annual volume for the permit will be used to estimate average use. Therefore, the total estimated average annual appropriate withdrawals for water rights/permits believed to be completed into this portion of the Prairie Coteau aquifer is 1,001 acre-feet per year, and this application, if approved, would raise that to 1,311 acre-feet per year.

Mathiowetz (2021) reviewed the usage of this portion of the Prairie Coteau aquifer by domestic wells and determined that domestic usage of this aquifer was very likely insignificant compared to the estimated recharge and the annual use proposed by the City of Lake Norden.

Recharge

The outwashes of the Prairie Coteau aquifer typically receive recharge from infiltration of precipitation where the aquifer is at or near land surface or overlain by permeable to semi-permeable layers, seepage from connected surface water bodies with higher hydraulic head than the aquifer, and leakage from adjacent (both vertically and horizontally) aquifers with higher hydraulic head (potentiometric surface) (Leap, 1972). It is unclear what the specific sources of recharge to this portion of the Prairie Coteau aquifer are. The most likely sources of recharge are infiltration of precipitation and a connection to the Big Sioux: Brookings aquifer and/or nearby lakes (Mathiowetz, 2021), since a recharge response to a precipitation event during the 30-day aquifer performance test was observed (LRE, 2021). Additionally, assessment of the aquifer performance test data indicated that positive boundary conditions (recharge source) were encountered during the performance test.

Mathiowetz (2021) compiled and reviewed numerous recharge estimates for this aquifer but ultimately concluded that the most reasonable recharge rate to use for this this aquifer was 900 to 6,004 acre-feet per year. This range was obtained using the most conservative radius of influence from the aquifer performance test (15,804 feet or 18,013 acres) and applying the upper end of the range from Hedges et al. (1985) for buried confined aquifers (0.15 to 0.6 inches per year) and the upper boundary by using the recharge rate for the Big Sioux: Brookings aquifer from observation well analysis by Hedges et al. (1985) (4.0 inches per year). The use of the upper end of the confined range is justified given the rapid response of the aquifer to the precipitation event observed during the aquifer performance test, and the water quality in the aquifer indicating the aquifer has a source of recent recharge. The case for an upper end of 4.0 inches per year is much more questionable given the available information for the aquifer does indicate it is primarily under confined conditions and confining layers typically reduce recharge rates to a confined aquifer when compared to an unconfined aquifer (like the Big Sioux: Brookings) at similar climatic conditions. However, based on the evidence of a likely hydrologic connection to surficial aquifers and/or

surface water bodies, it is likely that the actual recharge rate to the aquifer exceeds the 0.6 in/yr from Hedges et al. (1985).

For the 30-day aquifer performance test, LRE (2021) estimated four different radii of influence of a similar magnitude ranging from 15,804 to 23,099 feet (18,013 to 38,481 acres). The smaller of the two radii calculated included the portion of the test data that was influenced by the recharge events that happened during the aquifer test. The two larger radii used only the portion of the test data not influenced by the recharge event, so only used the first 21 days of the test prior to the precipitation event. Typically, the longer the period of pumping the higher the radius of influence, so the shorter period having a higher radii illustrates the precipitation event likely created a false low in the radii calculated including that data. Additionally, the performance test was done in the spring so the background trend in the aquifer during the performance test showed slightly increasing water levels which would slightly lower the calculated radius of influence for the test, so the largest of the calculated radii was obtained by both excluding the recharge event and correcting the test data to account for background conditions in the aquifer. Applying the upper end of the range from Hedges et al (1985) for buried confined aquifers of 0.6 inches per year across the four radii results in a recharge range of 900 to 1,924 acre-feet per year with the mid-point of the range at 1,412 acre-feet per year. Given this and the stable trend in the measured water levels at the observation wells, despite several years of pumping by the City of Lake Norden, it is reasonable to use the historic Water Rights Program method of utilizing the middle of the estimated recharge range when evaluating recharge versus withdrawals in an estimated hydrologic budget.

Balance

The total estimated average annual withdrawals for water rights/permits believed to be completed into this portion of the Prairie Coteau aquifer is 1,001 acre-feet per year, and this application, if approved, would raise that to 1,311 acre-feet per year. Information to estimate the average annual recharge to the aquifer is limited; however, based on the aquifer performance tests and the response of water levels in the aquifer, the currently best available information supports that recharge to this portion of the Prairie Coteau aquifer is at least 900 to 1,924 acre-feet per year, with the mid-point of the range at 1,412 acre-feet per year. Therefore, based on the hydrologic budget when combined with the additional years of observation well data for the aquifer, there is a reasonable probability that unappropriated water is available for this application.

Potential for Unlawful Impairment of Existing Water Rights

Water rights/permits currently considered as appropriating water from this portion of the Prairie Coteau aquifer in the area of the well sites for this application are shown in Figure 1 and summarized in Table 2. The nearest water right/permit to the well sites for this application is Water Right No. 8433-3 held by the City of Lake Norden; which utilizes the same well sites as this application proposes to use. The nearest water right/permit to the proposed well location for Application No. 9025-3, not held by the applicant, is Water Right No. 7163-3 located approximately 0.8 miles to the north of the well sites for this application. The nearest domestic

well on file likely completed into this portion of the Prairie Coteau aquifer to the proposed well sites for this application is located approximately 240 feet away from the nearest of the wells for this application (Mathiowetz, 2021). The wells for this application have been in operation for several years with no complaints of unlawful impairment (Water Rights, 2026d). Additionally, the city has protections in place to ensure they do not pump their own well dry (Mathiowetz, 2021). Drawdown from a pumping well is greatest at the pumping well, so these protections also limit the impact the City's well can have on nearby users.

The aquifer is under confined conditions at the well sites for this application. In the past, the Water Management Board has recognized that to place water to maximum beneficial use a certain amount of drawdown may occur. The Water Management Board has promulgated rules that allow water to be placed to maximum beneficial use without the necessity of maintaining artesian head pressure for domestic use. The Board has defined an adversely impacted domestic well as "a well in which the pump intake was set at least 20 feet below the top of the aquifer at the time of construction or, if the aquifer is less than 20 feet thick, is as near to the bottom of the aquifer as is practical and the water level of the aquifer has declined to a level that the pump will no longer deliver sufficient water for the well owner's needs." In the case of Water Permit Application No. 2313-2 for the Coca-Cola Bottling Company of the Black Hills, the Water Management Board adopted findings that noted that if the increased costs or decreased production as a result of the impacts of legitimate users of artesian head pressure could be considered an adverse impact, it would conflict with SDCL 46-1-4 (Water Rights, 1995). SDCL 46-1-4 requires the water resources of the state be put to beneficial use to the maximum extent of which they are capable. While some domestic well owners may need to lower their pumps to account for fluctuations in artesian head pressure due to pumping from this application, given the lack of complaints, the city's protections on their own wells, and artesian pressure at the well sites, there is reasonable probability that this application, if approved, will not unlawfully impair existing water rights/permits or domestic users with adequate wells.

Conclusions

1. Water Permit Application No. 9025-3 seeks to appropriate an additional 310 acre-feet of water and add an additional 0.77 cfs to maximum rate of diversion from three existing wells currently authorized by Water Right No. 8433-3. Water Right No. 8433-3 appropriates up to 967 acre-feet of water annually, at a maximum combined rate of 1.34 cfs from three wells completed into the Prairie Coteau aquifer (97, 101, and 103 feet deep) located in the S $\frac{1}{2}$ SW $\frac{1}{4}$ (Lots 1, 2, and 3) Section 15-T113N-R53W for municipal use.
2. This application, if approved, and Water Right No. 8433-3 will authorize the appropriation of up to 1,277 acre-feet of water annually at a combined pump rate of 2.11 cfs.

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3. When considering the best currently available observation well and hydrologic budget data for the aquifer, there is a reasonable probability that unappropriated water is available for this application.
4. There is a reasonable probability that this application, if approved, will not unlawfully impair existing water rights/permit holders or domestic users with adequate wells.



Whitney Kilts

Natural Resources Engineer III
SDDANR-Water Rights Program

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