



**DEPARTMENT of AGRICULTURE
and NATURAL RESOURCES**

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**RECOMMENDATION OF ACTING CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 2044-1, H2O Clear Solutions LLC**

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. 2044-1, H2O Clear Solutions LLC, PO Box 2711316, Flower Mound TX 75027.

The Acting Chief Engineer is recommending APPROVAL of Application No. 2044-1 with a twenty-year term pursuant to SDCL 46-1-14 and 46-2A-20 because 1) although evidence is not available to justify issuing this permit without a 20 year term limitation, 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. In accordance with SDCL 46-1-14 and 46-2A-20, Permit No. 2044-1 is issued for a twenty-year term. Pursuant to SDCL 46-2A-21, the twenty-year term may be deleted at any time during the twenty-year period or following its expiration. If the twenty-year term is not deleted at the end of the term, the permit may either be cancelled or amended with a new term limitation of up to twenty years. Permit No. 2044-1 may also be cancelled for nonconstruction, forfeiture, abandonment or three permit violations pursuant to SDCL 46-1-12, 46-5-37.1 and ARSD 74:02:01:37.
2. The well will be located near domestic wells and other wells which may obtain water from the same aquifer. The well owner, under these Permits 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.
3. The well authorized by Permit No. 2044-1 must be constructed by a licensed well driller and construction of the well and installation of the pump 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.
4. The Permit holder must report to the Chief Engineer annually the amount of water withdrawn from the Madison Aquifer.
5. Water Permit No. 2044-1 appropriates up to 270 acre-feet of water annually.

See report on application for additional information.

Mark Mayer, PE
Director of Office of Water
April 23, 2025

Report to the Chief Engineer
On Water Permit Application No. 2044-1

H2O Clear Solutions

03/14/2025

Water Permit Application No. 2044-1 proposes to appropriate up to 270 acre-feet of water annually at a maximum pump rate of 0.56 cubic feet of water per second (cfs) from one well to be completed into the Madison aquifer (approximately 900 to 1500 feet deep) in the SE $\frac{1}{4}$ NW $\frac{1}{4}$ Section 14-T5N-R4E. Water is proposed to be used in a water distribution system and for commercial use. Water service is planned in portions of the N $\frac{1}{2}$ Section 14; SW $\frac{1}{4}$ NW $\frac{1}{4}$ Section 13; W $\frac{1}{2}$ Section 11; W $\frac{1}{2}$ SW $\frac{1}{4}$, SW $\frac{1}{4}$ NW $\frac{1}{4}$ Section 2; and SE $\frac{1}{4}$ NE $\frac{1}{4}$ Section 3; all in T5N-R4E. This area of interest is located in Lawrence County approximately four miles west of Spearfish, SD.

AQUIFER: Madison (MDSN)

HYDROGEOLOGY:

The Madison Group in South Dakota is a Lower Mississippian and Upper Devonian aged group of formations that in the Black Hills consists of the Englewood and Pahasapa Limestone formations (Fahrenbach et al., 2010). The Pahasapa Limestone is a "white, light-gray to tan, fine- to medium-grained limestone and dolomite containing brown to gray chert" (Martin et al., 2004). The Englewood Limestone is a "pink to lavender to light-gray, thin- to medium-bedded, fine- to medium-grained, argillaceous, dolomitic limestone" (Martin et al., 2004). The Madison aquifer consists of the permeable and porous portions of the Madison Group that are sufficiently saturated to deliver useful quantities of water. The Madison aquifer extends over more than 210,000 square miles in Montana, Wyoming, North Dakota, South Dakota, and Nebraska (Downey, 1984) although, it may not be suitable as a source of water in all those areas due to extreme depth to the aquifer and poor water quality far from the outcrops (Carter, 2002). It crops out in the Black Hills and is buried elsewhere in South Dakota (Downey, 1984). The Madison aquifer may be hydrologically connected to the underlying Deadwood aquifer. It is also hydrologically connected to the overlying Minnelusa aquifer (Long, 2002). The Minnelusa aquifer overlies the Madison unconformably (Fahrenbach et al., 2010), which means there was a period of erosion or weathering between when the Madison Group and the Minnelusa Formation were deposited. Transmissivity in the Madison aquifer mainly comes from secondary porosity features such as solution cavities, faults, and fractures (Long, 2002). Because most of the transmissivity in the Madison aquifer comes from secondary porosity features, aquifer characteristics in the Madison aquifer vary greatly from location to location (Long, 2002).

No well completion report was filed for this application, but the proposed well depth and location corresponds to the Madison aquifer. At the location of this application, land surface elevation ranges between 4,020 feet and 4,040 feet (NGVD29). Carter and Redden (1999) estimated the top of the Madison Limestone at approximately 3,575 feet mean sea level (ft msl) (NGVD29) and McKaskey (2013) potentiometric surface mapping of the Madison aquifer

estimated the water level of the Madison aquifer at approximately 3,725 ft msl (NAVD 88). Since both of these references are for use on a regional scale, the exact top of the Madison Limestone from these estimates and water levels may vary due to climatic variability. However, given the scale of the area, the difference between the vertical datums is negligible. Historically, both of these references have generally provided good insight into the Madison aquifer (Water Rights, 2025c). Based on the estimated elevations, the Madison aquifer is expected to be under confined conditions at the well site. The well completion reports on file for Madison aquifer wells within two miles support the aquifer being under confined conditions at the proposed well site (Water Rights, 2025d).

SOUTH DAKOTA CODIFIED LAW (SDCL)

Water Permit Application No. 2041-1 proposes to appropriate water from the Madison aquifer. The probability of unappropriated water being available from the aquifer can be evaluated by considering *SDCL 46-6-3.1*, *SDCL 46-2A-9* & *SDCL 46-2A-20*.

Pursuant to SDCL 46-6-3.1,

“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. An application may be approved, however, for withdrawals of groundwater from any groundwater formation older than or stratigraphically lower than the greenhorn formation in excess of the average estimated annual recharge for use by water distribution systems.”

The Madison Group is stratigraphically lower than the Greenhorn Formation (Fahrenbach et al., 2010) and the water for this application, if approved, will be used by a water distribution system. Therefore, the Water Management Board’s authority to approve this application is not restricted by whether recharge exceeds withdrawals. However, a statewide and local hydrologic budget is included in this report for the information of the Chief Engineer and the Water Management Board.

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 the Madison aquifer.

Pursuant to SDCL 46-2A-20,

“Notwithstanding §§ 46-1-14 and 46-2A-7, no water permit for construction of works to withdraw water from the Madison formation in Butte, Fall River, Custer, Lawrence, Meade and Pennington counties may be issued for a term of more than twenty years, unless the Water Management Board determines, based upon the evidence presented at a hearing that:

(1) Sufficient information is available to determine whether any significant adverse hydrologic effects on the supply of water in the Madison formation would result if the proposed withdrawal were approved; and

(2) The information, whether provided by the applicant or by other means, shows that there is a reasonable probability that issuance of the proposed permit would not have a significant adverse effect on nearby Madison formation wells and springs.”

Water Permit Application No. 2044-2 proposes to withdraw water from the Madison aquifer in one of the counties listed above. Therefore, in addition to the requirements set forth by SDCL 46-2A-9, the Water Management Board must consider the effect this application may have on nearby Madison aquifer wells and springs. This application is subject to a 20-year term limit.

HYDROLOGIC BUDGET:

Statewide Recharge

The Madison aquifer receives recharge from the infiltration of precipitation and streamflow on the outcrop area and may also receive inflow from the underlying Deadwood aquifer (Carter, et al., 2001). There are several reports available that estimate recharge to the Madison aquifer.

Woodward-Clyde Consultants (1981) estimated recharge to the outcrop of the Madison aquifer in the Black Hills to assess the potential impacts of then-proposed ETSI Coal Slurry Pipeline Project on ground and surface water resources. The upper-bound estimate of recharge in the Woodward-Clyde Consultants (1981) report is approximately 400,000 ac-ft/yr, assuming almost all of the precipitation that falls on the outcrop infiltrates into the aquifer. Woodward-Clyde Consultants (1981) produced a lower-bound recharge estimate of 140,000 ac-ft/yr based on the Rahn and Gries (1973) report. However, the Rahn and Gries report (1973) estimated recharge for all Paleozoic limestone in the Black Hills, which includes the Madison Group, the Minnelusa Formation, and the Minnekahta Formation. Rahn and Gries (1973) reported that 146.6 cfs was their minimum estimated recharge rate for the Paleozoic limestone from infiltration of precipitation, which converts to approximately 106,000 ac-ft/yr for all Paleozoic formations. The Woodward-Clyde Consultants report does not acknowledge that the Rahn and Gries (1973) report estimated minimum recharge for a larger group of formations than only the Madison aquifer and therefore the minimum recharge to the Madison aquifer as stated in the Woodward-Clyde Consultants (1981) is likely an overestimate.

Carter, et al. (2001) analyzed streamflow and precipitation data from water years 1931 to 1998 in the Black Hills area in South Dakota and Wyoming to determine the average annual recharge to

the Madison and Minnelusa aquifers. They estimated a combined average annual recharge to both aquifers to be 344 cfs, or approximately 249,000 ac-ft/yr, not including possible flow from the Deadwood aquifer (Carter, et al., 2001). Carter, et al., (2001) estimated that approximately 55% of the recharge goes to the Madison aquifer, resulting in the total estimated average recharge to the Madison aquifer from the outcrop in the Black Hills to be approximately 137,000 ac-ft/yr, not including possible inflow from adjacent aquifers or from the Madison aquifer outside of South Dakota. The Carter, et al., (2001) report uses more years of data, more recent data, and better assumptions than the Woodward-Clyde Consultants (1981) and Rahn and Gries (1973) reports. Therefore, the best estimate of recharge to the Madison aquifer is based on the Carter, et al., (2001) report.

Statewide Discharge

Discharge from the Madison aquifer in South Dakota is mainly by outflow to other aquifers when the hydraulic head in the Madison aquifer is higher than other aquifers, outflow to springs and seeps, and withdrawals by domestic and appropriative wells (Carter, et al., (2001); Water Rights, 2025d). Due to the presence of overlying aquifers and water distribution systems in many areas of the aquifer, domestic well withdrawals are a negligible portion of the hydrologic budget of the Madison aquifer. There are 178 water rights/permits currently authorized to withdraw from the Madison aquifer and 12 future use water rights/permits reserving water from the Madison aquifer (Water Rights, 2025c). Table 1 lists the future use permits.

Future Use Permit Nos. 369-1 and 439-2 are assigned to multiple aquifers, but Table 1 will only list the reserved water from the Madison aquifer. Future Use Permit No. 369-1 reserves 1,238 acre-feet annually from the Spearfish Creek alluvium, 620 acre-feet annually from the Minnelusa aquifer, and 620 acre-feet from the Madison aquifer. Future Use Permit No. 439-2 reserves 3,367 acre-feet annually from the Madison aquifer for the Meadowbrook Gallery. The remaining 2,172 acre-feet reserves water from the Minnelusa aquifer for Jackson Springs and Sioux Park Gallery.

Table 1. Future Use Permits from the Madison aquifer (Water Rights, 2025c)

Permit No.	Name/Business	County	Use	Priority Date	Amount Reserved (ac-ft/yr)
369-1	City of Belle Fourche	LA	MUN	12/10/1958	620
*439-2	City of Rapid City	PE	MUN	09/22/1956	3,367
1833-2	Weston Heights Home Owners	MD	RWS	02/18/1983	211
1872-1	City of Spearfish	LA	MUN	11/13/2006	2,704
1995-1	Black Hawk Water User District	MD	RWS	04/15/2020	1,300
2028-1	Bear Butte Valley Water, Inc	MD	RWS, WDS	03/23/2023	440
2086-2	City of Rapid City	PE	MUN	05/18/1989	4,075
2086A-2	City of Rapid City	PE	MUN	01/26/2023	**
2560-2	Fall River Water Users District	FR	RWS	05/16/2005	358
2560A-2	Fall River Water Users District	FR	RWS	05/16/2005	**
2560B-2	Fall River Water Users District	FR	RWS	05/16/2005	**
2580-2	Southern Black Hills Water System	FR	RWS	03/02/2006	1,474
				Total	14,549
FR - Fall River, LA - Lawrence, MD - Meade, PE - Pennington					
MUN - Municipal, RWS - Rural Water System, WDS - Water Distribution System					
* This permit reserves water from multiple aquifers but is assumed to withdraw solely from the Madison for estimation of the hydrologic budget; ** expands the future use area that was authorized by future use permit numbers 2086-2 and 2560-2					

Of the 178 active water rights/permits, 109 are primarily for water distribution systems (rural water system, municipal, suburban housing development, etc.), 34 primarily for irrigation, 15 for commercial use, 11 for industrial use, 4 for domestic use, 2 for geothermal use, 2 for institutional use, and one for recreation (Water Rights, 2025c). The use type determined for each water right/permit was based on the primary use categorized for each water right/permit as some permits have multiple uses (Water Rights, 2025c). Historically, average water use by non-irrigation appropriations limited by an instantaneous diversion rate have been assumed to be pumping 60% of full time at the respective permitted diversion rate. Water rights/permits limited by an annual volume are assumed to withdraw their entire respective annual volume limitation. This is a standard method used by the DANR-Water Rights Program for estimating annual withdrawals by non-irrigation appropriations from an aquifer (Water Rights, 2025c).

There are seven water rights/permits authorized to appropriate water from the Madison aquifer that are identified as being connected to a rural water system (RWS) and likely maintain their wells for standby purposes (Drinking Water Program, 2025; Water Rights, 2025c). These include Water Right/Permit Nos. 1628-2, 1709-1, 1858-2, 272-1, 568-2, 574-2, and 743-1. As a result, the average annual water use for these water rights has been estimated to be zero acre-feet per year.

Table 2. The non-irrigation water rights/permits authorized to appropriate from the Madison aquifer with estimated annual use determined by their respective diversion rate or annual volume (Drinking Water Program, 2025; Water Rights, 2025c)

Use Type	Count	Diversion Rate (cfs)	Estimated Diversion Rate Total (ac-ft/yr)	Limited by Volume (ac-ft/yr)	Total Estimated Use (ac-ft/yr)
Commercial	15	0.89	386.6	1,076	1,463.4
Domestic	4	0.22	95.6	71	166.6
Geothermal	2	1.43	621.2		621.2
Industrial	11	4.88	2,119.9	301.3	2,421.2
Institutional	2	0.2	86.9		86.9
Municipal	36	16.82	7,306.6	18,156	25,462.6
Recreational	1	1	434.4	N/A	434.4
Rural Water System	20	3.85	1,672.4	5,152	6,824.4
Suburban Housing Development	40	7.19	3,123.3	339.2	3,462.5
Water Distribution System	13			3,331.8	3,331.8
Total:	144	37.52	16,300	28,427	44,275
COM: Commercial; DOM: Domestic; GEO: Geothermal; IND: Industrial; INS: Institutional; MUN: Municipal; REC: Recreation; RWS: Rural Water System; SHD: Suburban Housing Development; WDS: Water Distribution System					

Overall, the estimated average annual withdrawal rate from the Madison aquifer by the non-irrigation water rights/permits is approximately 44,275 acre-feet per year (Table 2) (Water Rights, 2025c).

Currently, there are 34 irrigation water rights/permits authorized to appropriate water from the Madison aquifer (Water Rights, 2025c). Irrigation water rights/permits have been typically required to report their annual usage on an irrigation questionnaire since 1979. The estimated average annual withdrawal rate for the Madison aquifer irrigation water rights/permits that have reported over the period of record (1982 to 2023) is approximately 841 acre-feet per year (Water Rights, 2025a). To reflect the current development of irrigation water rights/permits more accurately, the average annual withdrawal rate for irrigation appropriations from 2014 to 2023 is approximately 828 acre-feet per year (Water Rights, 2025a).

For comparison purposes, the average annual withdrawal rate for the 34 water rights/permits authorized for irrigation use from the Madison aquifer was estimated utilizing the following method: When there are more than 10 years of data available, the average reported irrigation was used to estimate irrigation withdrawals. When there were fewer than 10 years of irrigation reports available, withdrawals are assumed to equal two acre-feet per acre, although actual usage is likely less for non-turf irrigation. In addition to the two acre-feet per acre annual estimation, permit holders with non-irrigation as a secondary use are also assumed to withdraw at their maximum instantaneous diversion rate 60% of the time. Estimated withdrawals for irrigation use are shown in Table 3. In the case of Water Right No. 1885-1, with irrigation also as a permitted use, if assumed to withdraw at their maximum instantaneous diversion rate 60% of the time plus applying 2 feet of water to each authorized acre, that sum (approximately 91 acre-feet/year) would cause the total estimated withdrawal to exceed the rate they are physically capable of withdrawing, so instead their total estimated withdrawal is 100% of their maximum instantaneous diversion rate (approximately 80 acre-feet/year).

Table 3. Permits with irrigation listed as one beneficial use, or are connected to an irrigation permit (Water Rights, 2025c)

Permit No.	Name/Business	Status	Authorized Diversion Rate (cfs)	Acres Licensed/ Permitted	Average Report (ac-ft/yr)	Years of Irrigation Reports	Est. Average Irrigation (ac-ft/yr)	Est. Non-Irr. Use (ac-ft/yr)	Total Est. Withdrawal (ac-ft/yr)
2773-2	ARROWHEAD COUNTRY CLUB	PE	1.11	100	0	6	200	0	200
1635-1	BLACK HILLS NATIONAL CEMETERY	LC	0.82	54.5	94.1	28	94.1	356.4	450.5
1452-1	BLACK HILLS STATE COLLEGE	LC	3.33	25.4	24.23	35	24.23	1,447.35	1,471.6
1670-1	BUDDY L. PEGGY A. KAMI S IRELAND	LC	3.61	253	45.64	26	*	*	*
1096A-1	BUTTE MEADE SANITARY DIST	PE	1.33	0	N/A	0	*	*	963.5
2458-2	CITY OF RAPID CITY	LC	0.8	107	109.4	23	109.4	0	109.4
2002-1	CITY OF SPEARFISH	PE	1.33	40	0	3	80	0	80
2313-2	COCA-COLA BOTTLING	LC	0.33	3	7.96	29	7.96	143.4	151.4
1899-1	DAVIS RANCHES INC	LC	1.43	100	0	15	0	0	0
1650-1	DENNIS L MILLER	LC	0.89	0	85.4	1	*	*	55.9
2673-2	DIOCESE OF RAPID CITY	LC	0.12	7	8.5	11	8.5	0	8.5
1009-1	DONALD F/ANN J BRADY	LC	0.78	53.7	29	42	29		29
1185-1	DONALD F/ANN J BRADY	LC	0.38	22.5	109.9	42	109.9	***	109.9
2286-2	DONALD KONECHNE	LC	0.1	38.5	10.2	30	10.2	0	10.2
1931-1	ELKHORN RIDGE @ FRAWLEY RANCHES LLC	LC	0.17	3.3	3	11	3	73.9	76.9
1707A-1	ELKHORN RIDGE @ FRAWLEY RANCHES LLC	PE	3.705	100	0	4	0	1,610.3	1,610.3
1707E-1**	ELKHORN RIDGE @ FRAWLEY RANCHES LLC	PE	0	0	48.2	17	48.2	0	48.2
1945-1	FRAWLEY RANCHES LLC	PE	1.11	265	59.2	10	59.2	0	59.2
1858-1	GLENCOE CAMP RESORT II LLC	LC	0.86	34	0	18	0	373.8	373.8
2593-2	HART RANCH DEVELOPMENT	LC	0.49	72.5	31.72	17	31.72	213	244.7
1911-2	HART RANCH DEVELOPMENT CO	LC	0.88	124	116.7	30	116.7	382.5	499.2
1725-2	JANICE R CROWSER	LC	1.07	75.1	2.02	26	2.02	0	2.02
2037-1	JARED AND ANNA LUKENS-BLACK	PE	0.055	0.6	0	0	1.2	23.9	25.1
2012-1	JESSE HORSTMANN	PE	0.5	43.5	0	2	87	0	87
858-2	JOHN & HEIDI MCBRIDE	LC	9.36	655.8	6.4	40	6.4	0	6.4
1885-1	JOHN T & VERONICA WIDDOSS	LC	0.11	22	18.4	7	44	47.8	79.6
1960-1	ONE DIAMOND INC	LC	1.28	150	130.1	8	300	29****	329
1223-1	P & L WATER AND HAY LLP	LC	0.67	263	186.1	42	186.1	0	186.1
1923-1	ROGER & JEAN RANSCHAU	LC	0.11	3	0.87	13	0.87	47.8	48.7
2013-1	SANTA MARIA LAND & CATTLE CORP	PE	2.22	460	0	1	920	0	920
1363-1	SPEARFISH CANYON COUNTRY CLUB	LC	0.9	80.1	66.3	37	66.3	0	66.3
2106-2	STUART RICE	LC	0.08	2.8	0.74	32	0.74	34.8	35.5
1842-1	TOM C DAVIS	LC	0.44	330	0	19	0	0	0
2741-2	TUBBS LAND & CATTLE LLC	PE	3.34	567	194.6	5	1,134	0	1,134
2879-2	WEINREIS BROTHERS	PE	0.5	75	0	0	150	0	150
419-2	WIND CAVE NATIONAL PARK	LC	0.15	6	N/A	0	12	65.2	77.2
2880-2	JEREMIAH & WENDY WALLA	PE	0.39	23.5	0	0	47		47
								TOTAL:	9,746

*Discussed in text. ** gives additional time to develop 1707A-1. *** Reports all use types in irrigation report ****Non-irrigation use(s) limited by annual volume

Water Right/Permit Nos. 1096A-1, 1496-1, and 1670-1 are all authorized to withdraw from the same well and one dam. Water Right Nos. 1096A-1 and 1670-1 authorize diversion of water for irrigation use and Water Right No. 1096A-1 and Water Permit No. 1496-1 authorize diversion of water for rural water system use. Documentation in the administrative file for Water Right No. 1670-1 indicates that the well is not valved such that it can be shut off when not in use for the beneficial uses listed on the permits. A letter dated September 9, 1988, indicates that when the water for that well is not being used for the beneficial uses described in the permits, it is used for fish and wildlife propagation. The person writing the letter indicated they would prefer the Water Management Board not order the well to be shut off when not used for irrigation or rural water listed in Water Right No. 1096A-1 of 1.33 cfs, that well withdraws approximately 963 ac-ft/yr from the Madison aquifer.

Water Right No. 1650-1 does not require the water right holder to report annual withdrawals and allocates no acreage. It provides supplemental water supply from a flowing well for Water Right No. 1231-1. Water Right No. 1231-1 permits a 110 acre-ft dam to provide water for a commercial livestock operation and irrigation of 134 acres. Water Right No. 1650-1 allows for direct irrigation from a Madison aquifer well of up to 2 acre-ft per acre for the land permitted by Water Right No. 1231-1. Kilts estimated that Water Right No. 1650-1 withdraws 55.9 ac-ft/yr (Kilts, 2019). This water right was transferred to a new owner in 2021. For the 2023 irrigation season, the owner reported using 85.36 ac-ft of water for irrigation. As this is the only year this owner has reported, the value of 55.9 ac-ft/yr will be used as their average until more years of reporting can establish an average.

Using the methods described above, the estimated average annual withdrawal rate for the Madison aquifer water rights/permits used for irrigation, as well as other uses, is approximately 9,746 acre-feet per year (Table 3) (Water Rights, 2025a and 2025c). This value will be used in this analysis to estimate the average annual withdrawal rate for the water rights/permits authorized for irrigation primarily and other uses from the Madison aquifer.

Water Permit Application No. 2585-2 for Southern Black Hills Water System proposes to appropriate 1,600 ac-ft/yr but is deferred for further study. Water Permit Application No. 2685-2 for Powertech, Inc is held in abeyance pending federal permitting and proposes to appropriate 889 ac-ft/yr.

There is one pending application for the Madison aquifer. Water Permit Application No. 2886-2 for Angostura Resort LLC, if approved, plans to appropriate up to 149 ac-ft/yr at a maximum pump rate of 0.67 cfs from one existing well and up to two additional wells for commercial use in Fall River County.

There are domestic wells completed into the Madison aquifer that do not require a water right/permit, so the withdrawal amount from those wells is unknown (Water Rights, 2025d). Due to their relatively low diversion rates, withdrawals from domestic wells are generally not considered to be a significant portion of the hydrologic budget. Additionally, with the development of water distribution systems in some areas where the Madison aquifer is present; it is likely some domestic users may have transitioned to water distribution systems. Therefore, the quantity of water withdrawn by domestic wells is estimated to be negligible to the hydrologic budget for the Madison aquifer.

Statewide Hydrologic Budget Summary

The estimated average annual recharge rate to the Madison aquifer is approximately 137,000 acre-feet per year. The estimated average annual withdrawal rate from the Madison aquifer is approximately 71,478 acre-feet per year (listed on Table 4). This application proposes to withdraw up to 270 ac-ft/yr, if approved, assuming the applicant withdraws their full volume appropriation. Therefore, based on the statewide hydrologic budget, there is reasonable probability unappropriated water is available for this application.

Table 4. Statewide Approximated Appropriative withdrawals from Madison aquifer

Use Type	Estimated Use (acre-feet/year)
Future Use Reservations	14,549
Non-Irrigation	44,275
Irrigation	9,746
Deferred and pending applications	2,638
Water Permit App. No. 2044-1, <i>if approved</i> , assuming full volume	270
Total	71,478

Local Hydrologic Budget

While the statewide hydrologic budget is used as the basis for determination of availability of water, other studies exist which have focused on smaller areas of the Black Hills. This section will address estimated withdrawals within those areas for the information of the Chief Engineer and the Water Management Board.

Carter, et al. (2001)

Carter, et al. (2001) used streamflow, precipitation, spring flow, estimated ground water flow, and well withdrawal data from 1987 to 1996 for hydrologic budgets for subareas of the Minnelusa and Madison aquifers. This application is in Subarea 2 of their report. The boundaries of the Carter, et al. (2001) subareas were designed to minimize flow across subarea boundaries. Carter, et al. (2001) estimated the total recharge to the Madison and Minnelusa aquifers in Subarea 21 was 37.9 cfs. Assuming 55% of the recharge goes to the Madison aquifer, the estimated recharge to the Madison aquifer in Subarea 2 is 20.8 cfs, or approximately 15,101 ac-ft/yr (Carter et. al, 2001). Carter, et al. (2001) do not provide values for the recharge area of the Madison and Minnelusa formations for each subarea in their report, so it is possible the proportion of recharge area to those two aquifers is different within each subarea. There are 41 water rights/permits authorized to withdraw from Subarea 2 and two future use permits reserving water from Subarea 2 Domestic well withdrawals are negligible on the scale of this hydrologic budget. Using the same methods as described in the Statewide Discharge section, the total estimated withdrawal from Subarea 2 is 11,901 ac-ft/yr as compared to the estimated recharge of 15,101 ac-ft/yr. This application proposes to withdraw up to 270 acre-feet/yr, if approved. Therefore, based on the local budget in combination with other information available, there is reasonable probability unappropriated water is available for this application.

OBSERVATION WELL DATA:

Administrative Rule of South Dakota (ARSD) 74:02:05:07 requires the Water Management Board to rely upon 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 average annual recharge of the aquifer.

Observation wells provide data on how the aquifer reacts to regional climatic conditions and local pumping. The DANR-Water Rights Program monitors 25 observation wells completed into the Madison aquifer (Water Rights, 2025b). The three closest observation wells in order of proximity to the proposed diversion point are LA-96D (approximately 1.1 miles southwest) (Figure 1), LA-90A (approximately 2.5 miles north) (Figure 2), and MD-86A (approximately 4 miles east) (Figure 3) (Water Rights, 2025b). The hydrographs for these observation wells are displayed in Figures 1 through 3 (Water Rights, 2025b). The data points utilized to construct the hydrographs are measurements of the static water level in the observation wells from the top of the well casing which were then converted to elevation in feet from the NGVD29 datum.

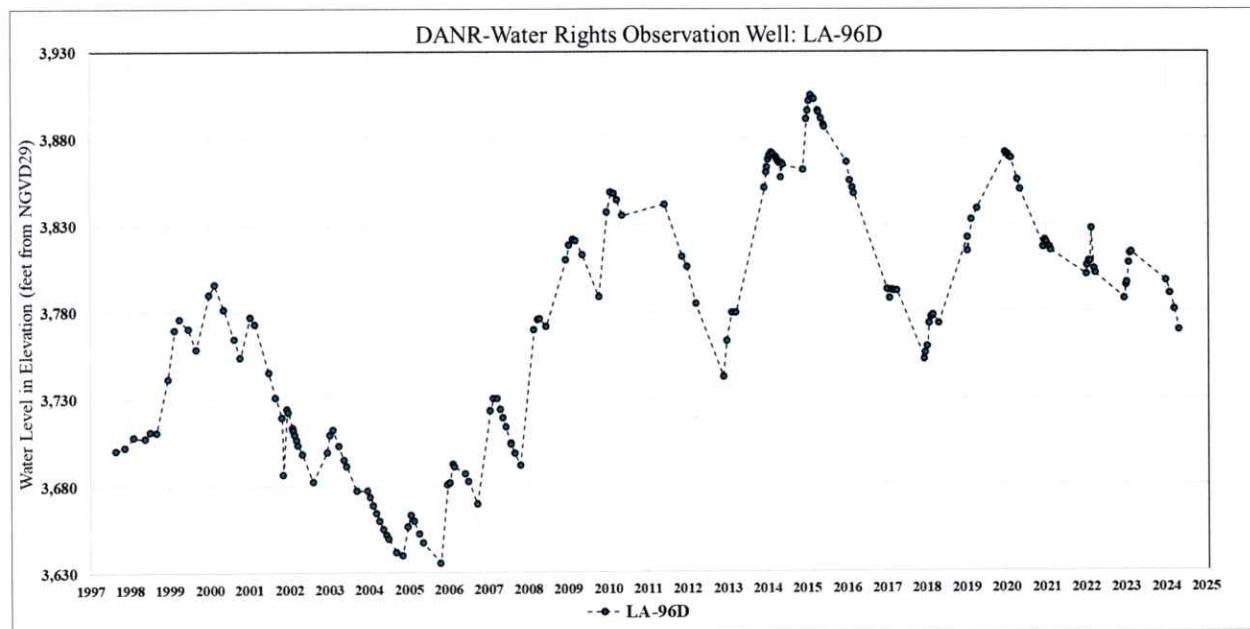


Figure 1. A graph showing the water level in elevation for observation well: LA-96D (Water Rights, 2025b)

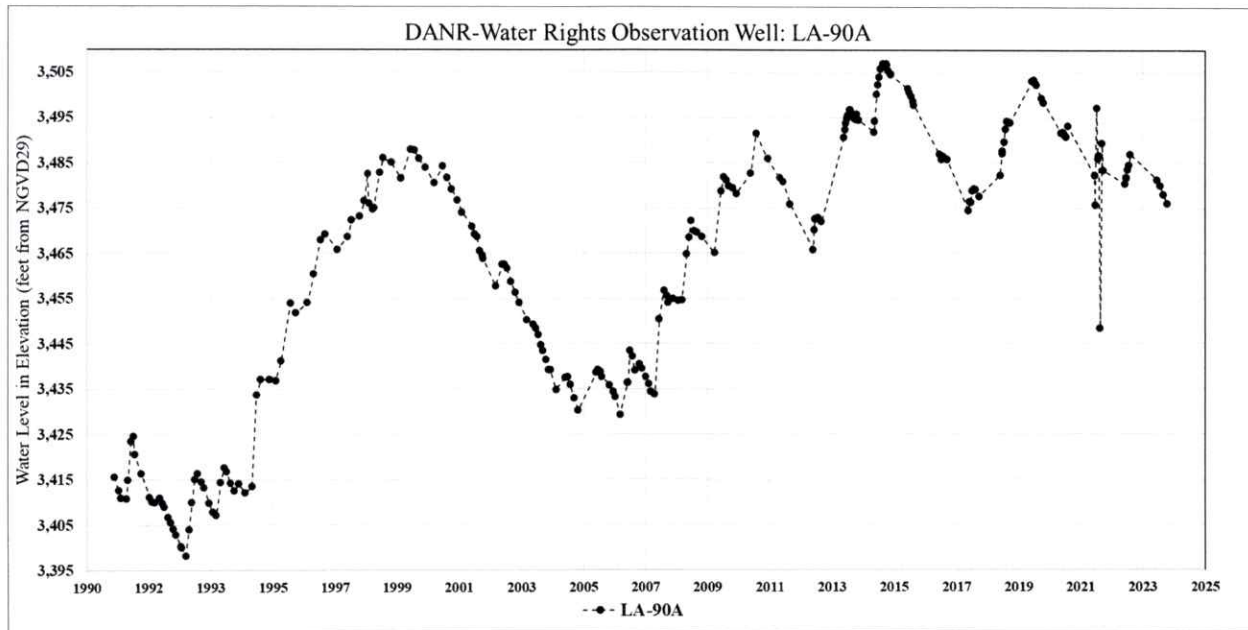


Figure 2. A graph showing the water level in elevation for observation well: LA-90A (Water Rights, 2025b)

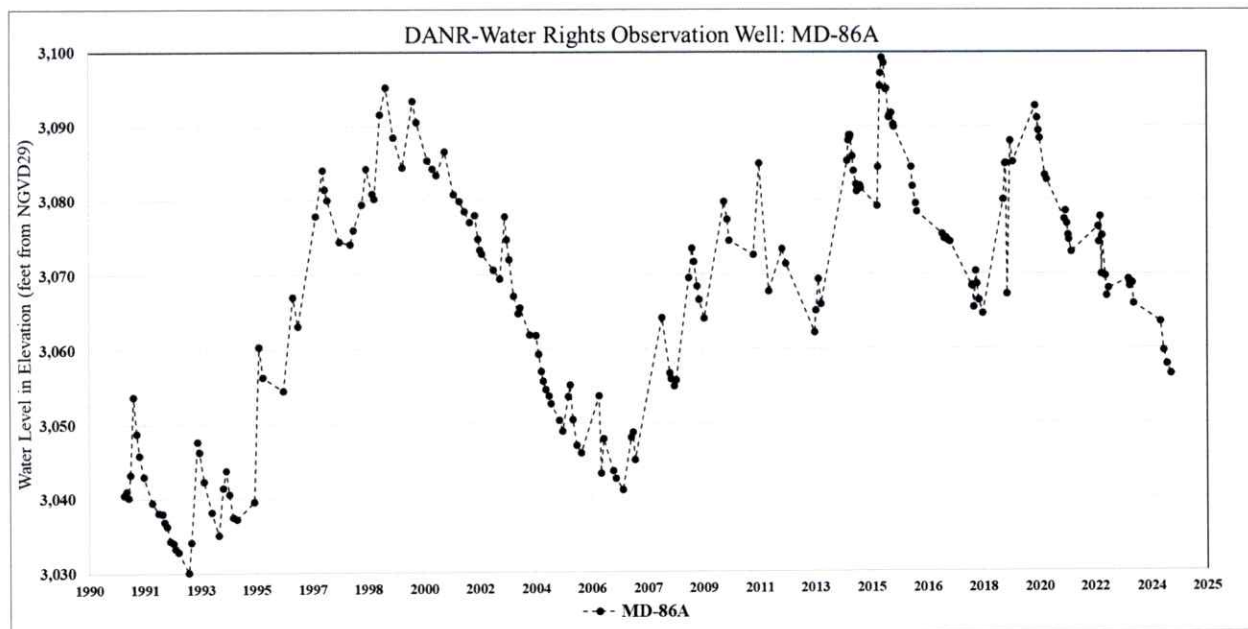


Figure 3. A graph showing the water level in elevation for observation well: MD-86A (Water Rights, 2025b)

The hydrographs for these observation wells were compared to hydrographs for other observations wells completed into the Madison aquifer and all displayed a generally similar trend as shown on the hydrographs displayed in Figures 1 through 3 (Water Rights, 2025b). The hydrographs for the observation wells display stable to increasing water levels over their respective periods of record. The hydrographs for the Madison aquifer indicate that the aquifer responds well to climatic conditions because water levels are rising during wetter periods and declining to a stable water level during drier periods. Additionally, the water levels in the

observation wells display that the amount of recharge to and natural discharge from the aquifer exceeds pumping with the aquifer responding to recharge events during the primary recharge season of late winter through spring. Aquifer recovery indicates that climatic conditions and therefore, the effects of recharge to and natural discharges from the aquifer govern the long-term fluctuations of waters levels in the aquifer rather than the impacts of pumping from the Madison aquifer. By recognizing that both recharge to and natural discharge from an aquifer can be captured for pumping, the observation well hydrographs demonstrate unappropriated water is available for the proposed appropriation

POTENTIAL FOR UNLAWFUL IMPAIRMENT OF EXISTING WATER RIGHTS:

The closest water right/permit to the proposed diversion point is Water Right No. 1680-1, which is held by Boulder Park Water User's Association. The diversion point for Water Right No. 1680-1 is located approximately 0.4 miles northwest of the proposed diversion point for this application (Water Rights, 2025c).

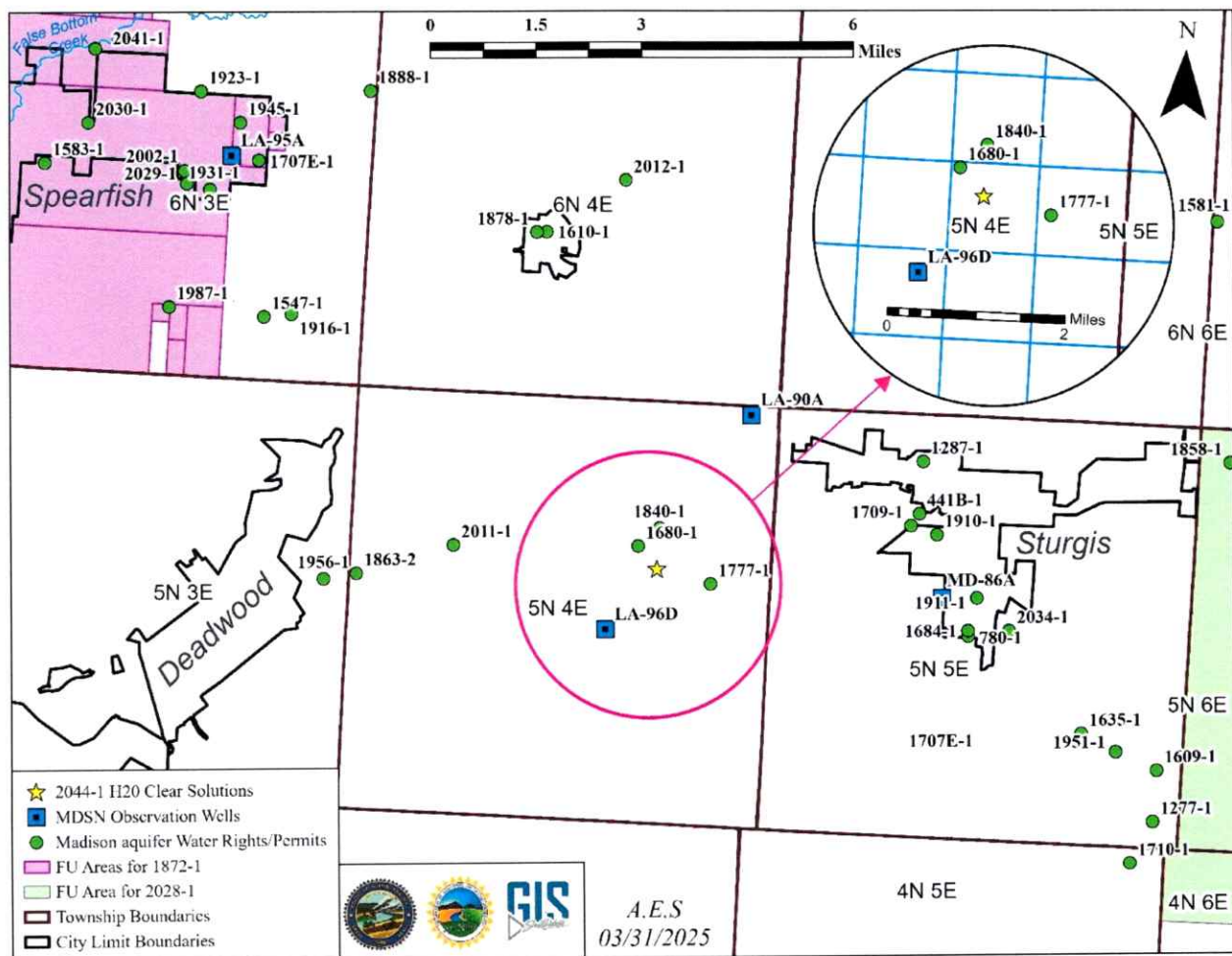


Figure 4. Approximate location of the proposed diversion for Application No. 2044-1, and the nearby Madison aquifer observation wells and water rights/permits (Water Rights, 2025b and 2025c)

There are domestic wells on file with the DANR-Water Rights Program that are completed into the Madison aquifer, with the closest domestic well on file (not held by the applicant) located approximately 0.2 miles southeast of the proposed diversion point (Water Rights, 2025d). There could potentially be other domestic wells completed into the Madison aquifer near the well the applicant proposes to use that are not on file with the DANR-Water Rights Program. The location of the domestic wells in the well completion report database maintained by the Water Rights Program is based on the location listed by the driller on the well completion report.

Table 5. Water rights/permits authorized to withdraw or reserve water from the Madison aquifer within 6 miles of Water Permit Application No. 2044-1 as shown in Figure 2 (Water Rights, 2025c)

Permit No.	Name	Status	Use Type	Authorized Diversion Rate (cfs)	Permitted Volume (ac-ft/yr)	Authorized Acres
441B-1	CITY OF STURGIS WATER DEPT	LC	MUN	0.51		
780-1	CITY OF STURGIS WATER DEPT	LC	MUN	0.66		
1287-1	CITY OF STURGIS WATER DEPT	LC	MUN	0.89		
1547-1	SIMON CONTRACTORS	LC	IND	0.09		
1610-1	CITY OF WHITEWOOD	LC	MUN	1.11		
1680-1	BOULDER PARK WATER USER'S ASSOCIATION	LC	COM	0.2		
1684-1	MIKE RINGER	LC	COM, DOM	0.022		
1709-1	MURRAY WATER COMPANY	LC	SHD, COM	0.333		
1777-1	VALHALLA ADDITION	LC	SHD	0.089		
1840-1	H2O CLEAR SOLUTIONS LLC	LC	SHD, COM	0.33		
1863-2	SEVENTY-SIX RANCH ESTATE	LC	SHD	0.07		
1878-1	CITY OF WHITEWOOD	LC	MUN	0.78	50	
1910-1	STURGIS WATER DEPARTMENT	LC	COM	2.44	1004	
1911-1	STURGIS WATER DEPARTMENT	LC	MUN	1.67	773	
1916-1	SIMON CONTRACTORS	LC	IND	0.22		
1956-1	SHIRT TAIL GULCH HOMEOWNERS ASSN	LC	SHD	0.056	15	
2011-1	MEADOW CREST SANITARY DISTRICT	PE	WDS	0.089	5.83	
2012-1	JESSE HORSTMANN	PE	IRR	0.5		43.5
2034-1	CITY OF STURGIS	PE	MUN, WDS	1.0	500	

LC: License; PE: Permit; FU: Future Use; COM: Commercial; DOM: Domestic; IND: Industrial; IRR: Irrigation; MUN: Municipal; SHD: Suburban Housing Development; WDS: Water Distribution System

No well completion report was filed for this application, but the Madison is expected to be under confined conditions at the proposed well site. Based on information from Carter and Redden (1999) as well as well completion reports in this area (Water Rights, 2025d), there is expected to be at least 200 feet of saturated aquifer thickness at the proposed well location. This would allow for enough thickness for a pump to be placed 20 feet below the top of the aquifer, which is required for the well to be considered adequate under ARSD 74:02:04:20(6). Any drawdown as a result of the diversion for this application is not expected to unlawfully impair nearby adequate wells. In Lawrence County, there are no substantiated complaints on file with the DANR-Water Rights Program regarding well interference for adequate wells completed into the Madison aquifer (Water Rights, 2025e).

The Water Management Board recognizes that putting water to beneficial use requires a certain amount of drawdown to occur. The Water Management Board has developed rules to allow water to be placed to maximum beneficial use without the necessity of maintaining artesian head pressure for domestic use. The Water Management Board defined an “adversely impacted domestic well” in ARSD 74:02:04:20(7) 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.”

The Water Management Board considered the delivery of water by artesian head pressure versus maximum beneficial use during the issuance of Water Right No. 2313-2 for Coca-Cola Bottling Company of the Black Hills. The Water Management Board adopted the Findings of Facts and Conclusions of Law that noted the reservation of artesian head pressure for delivery of water would be inconsistent with SDCL 46-1-4 which states, “general welfare requires that the water resources of the state be put to beneficial use to the fullest extent of which they are capable...” (Water Rights, 1995). Furthermore, the Water Management Board found if increased cost or decreased production as a result of impacts on artesian head pressure by legitimate users is to be considered as an unlawful impairment, it would also conflict with SDCL 46-1-4 (Water Rights, 1995). With that in mind, some existing well owners may need to install or lower pumps depending on the specific characteristics of the Madison aquifer at their location. However, when considering the statutes (SDCL 46-1-4 and 46-6-6.1), rules (ARSD 74:02:04:20(6) and (7)), and stable to increasing observation well water levels, any drawdown created from the proposed diversion is not expected to cause an unlawful impairment to existing water right/permit holders or domestic users with adequate wells. Therefore, there is a reasonable probability that any interference from the proposed appropriation will not impose unlawful impairments to existing users with adequate wells.

Impact to Springs

There are no major springs sourced from the Madison aquifer within 2 miles of this application (C. A. Naus et. al, 2011). Upon considering the deferral of Water Permit Application No. 2585-2 for Southern Black Hills Water System, the Board adopted a conclusion of law stating in part, “...The only protection South Dakota law provides when considering an application for an underground water permit for flow from an artesian spring is under the public interest criteria” (South Dakota Water Board, 1997). Given the distance between the proposed well site and the nearest springs there is reasonable probability this application can be developed without noticeably impacting flow from the spring.

CONCLUSIONS:

1. Water Permit Application No. 2044-1 proposes to appropriate up to 270 acre-feet of water annually at a maximum pump rate of 0.56 cfs from one well to be completed into the Madison aquifer (approximately 900 to 1500 feet deep) in the SE $\frac{1}{4}$ NW $\frac{1}{4}$ Section 14-T5N-R4E. Water is to be used for a water distribution system, and commercial use purposes. Water service is planned in portions of the N $\frac{1}{2}$ Section 14; SW $\frac{1}{4}$ NW $\frac{1}{4}$ Section 13; W $\frac{1}{2}$ Section 11; W $\frac{1}{2}$ Section SW $\frac{1}{4}$, SW $\frac{1}{4}$ NW $\frac{1}{4}$ Section 2; and SE $\frac{1}{4}$ NE $\frac{1}{4}$ Section 3; all in T5N-R4E. This well site is located approximately four miles west of Spearfish, SD.
2. Based on the statewide hydrologic budget and observation well data, there is a reasonable probability that unappropriated water is available from the Madison aquifer to supply the proposed appropriation.
3. There is reasonable probability that the proposed diversion by Water Permit Application No. 2044-1 will not unlawfully impair adequate wells for existing water rights/permits and domestic users.



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