

WATER PERMIT NO. 2763-2

Name of Applicant: City of Box Elder

Address: 420 Villa Dr, Box Elder SD 57719 Phone: 605 390-6114

Amount of Water Claimed: 0.24 cfs Total Acres: NA

Source of Water Supply: groundwater (1 existing well)

Water to be used for: municipal County: Pennington

Type of Waste Disposal System:

Location:

PRIORITY Date Received: 6-1-17 Application/License Fee: \$ 950 (refund \$200 license fee)

Corrected Application Received: Period of Annual Use: Jan 1 – Dec 31

Remarks: Based on inspection by S Quissell

Diversion Point: NW 1/4 NE 1/4 Sec 34-T2N-R8E

Land to be Irrigated: NA

Depth of Well: 4,370 feet deep

Well Driller: Water System Drilling

Remarks:

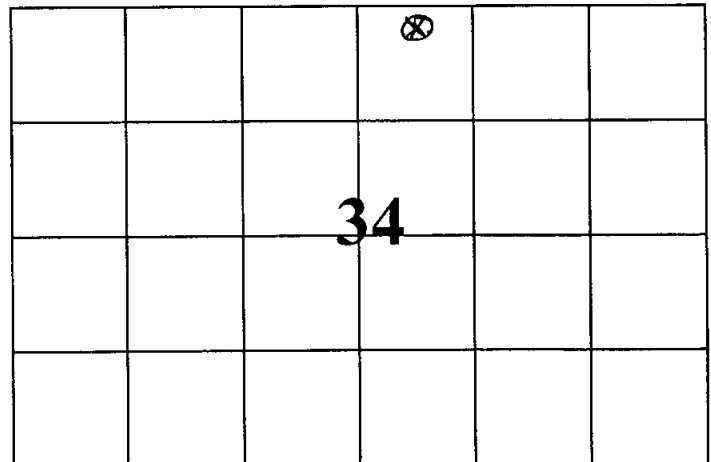
Type of Map: aerial

Prepared by: S Quissell

Reviewed and the Number Assigned on: 6-1-17

By: **Karen Schlaak**

Notice of Hearing - date to intervene: _____



RECEIVED
JUN - 1 2017
WATER RIGHTS
PROGRAM

Check use(s) of water:

Type of Application: (check one) ☒ **New** ☐ **Vested Right** (Use predates Mar 2, 1955) ☐ **Future Use Reservation**
☐ **Place to Beneficial Use Water Reserved by Future Use Permit No.** _____
☐ **Amendment/Correction to Permit No.** _____

Description of amendment/correction: (i.e. change diversion point(s), add diversion point(s), change use, etc.)

1. Name to Appear on Water Permit **City of Box Elder**

Mailing Address 420 Villa Drive Box Elder SD 57719
(Address) (City) (State) (Zip Code)

Phone 605.390.6114 Mobile _____ Email _____

2. Amount of water claimed 0.24 *CFS or 104 **GPM and 104 ***AF or _____ Gallons
Flow rate and volume are both required. (*Cubic Feet per Second) (**Gallons per Minute) (***Acre Feet - storage capacity of dam/dugout or annual use)

3. Source of water supply **Madison Augifer**

4. Location of point of diversion One well in NW1/4 NE1/4 Section 34-T2N-R8E County **Pennington**

(example - 3 wells in SW1/4 NE1/4 section 12-T104N-R53W)

If not a public water supply (e.g. municipal), will water be used outside of the area described above? ☐ Yes ☐ No

If "Yes," where will water be used?

(example - NW1/4 section 12-T104N-R53W)

5. County or counties where water will be used **Pennington**

6. Annual period during which water is to be used January 1 thru December 31

7. Give a description of the project. When available include any preliminary engineering report or other reports or information that will help explain the project. (Attach sheet if more space is needed)

For an additional 0.24 cfs to Water Permit No. 2577A-3.2

I, Bob Kaufman Public Works Director, the applicant, certify under
Name of Person Title (if applicable)

penalty of perjury that I have read this application, examined the attached map, and that the matters stated are true. I further certify, if acting on behalf of an entity or individual other than myself, that I am authorized to submit this application.

Attachments: Attach Form 2A if diversion is from a well or dugout, or if storage of water is proposed. Also, attach map and any other technical information. (see instructions)

**SOUTH DAKOTA
WATER PERMIT NO. 2763-2**

Date of first receipt of application June 1, 2017.

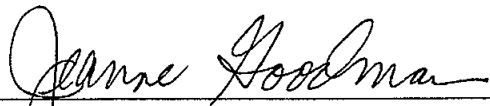
The Chief Engineer, on behalf of the Water Management Board, issues Water Permit No. 2763-2 to City of Box Elder, c/o Bob Kaufman, Public Works Director, 420 Villa Drive, Box Elder SD 57719 authorizing the construction of the water use system and the placing of water to beneficial use subject to the following limitations, conditions and qualifications:

1. Water Permit No. 2763-2 appropriates 104 acre-feet of water annually at a maximum diversion rate of 0.24 cubic feet of water per second (cfs). This appropriation is in addition to what is currently authorized by Water Permit No. 2577A-2. Water Permit No. 2577A-2 authorizes 0.67 cfs (290 acre-feet annually) from one well completed into the Madison Aquifer (4,370 feet deep) located in the NW 1/4 NE 1/4 Section 34-T2N-R8E. An investigation of the permit found the system capable of diverting an additional 0.24 cfs from the existing well. This permit and Water Permit No. 2577A-2 will authorize an annual volume of 394 acre-feet of water annually at a maximum diversion rate of 0.91 cfs.
2. The water appropriated shall be used for the purpose of municipal use and may not exceed the amount of water needed for beneficial use.
3. The water is to be used during the following described annual period: January 1 – December 31.
4. The date of approval of Permit No. 2763-2 is August 21, 2017.
5. The date from which applicant may claim right is June 1, 2017 (104 acre-feet annually).
6. Water rights obtained in compliance with the laws of the State of South Dakota may not be unlawfully impaired by this appropriation.

QUALIFICATIONS

1. In accordance with SDCL 46-1-14 and 46-2A-20, Permit No. 2763-2 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. 2763-2 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 shall 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 Permit holder shall report to the Chief Engineer annually the amount of water withdrawn from the Madison aquifer.
4. Water Permit Nos. 2577A-2 and 2763-2, combined, appropriate up to 394 acre feet of water annually.

WATER MANAGEMENT BOARD

By: 
Jeanne Goodman, Chief Engineer
Water Rights Program
Department of Environment and Natural Resources

SEP 26 2017
date



Supplemental Information

(type or print)

1. Well Information

(check one or both as applicable) ☐ Drilling new well(s) ☒ Using existing well(s)

a) If new wells, how many ____ Have test holes been drilled ☐ Yes ☐ No Drilled by ____
(if yes, please provide copies of logs)

b) If existing wells, how many 1 Provide copy of log(s), if available. Drilled by Water System Drilling

For either Existing or Proposed Wells:

c) Well Depth (required) 4,370 Depth to Top of Water Bearing Material 3,935 Depth to Water from Surface 638

d) Distance to nearest domestic well on applicant's property _____ Property owned by others _____

2. Wastewater Disposal System Information

a) Type of System (i.e. septic tank, drain field) _____

b) System Capacity (gallons) _____ Year Constructed _____

c) Connected to the City of _____ Sanitary System

3. Dugout Information

a) Surface Dimensions _____ Depth _____

b) Depth to water (ground surface to water level) _____

4. Water Storage Dams

If the proposed water use system contains one or more storage dams, please furnish the information requested below for each dam. The locations of the dams need to be shown on the map submitted with the application.

a) If a private engineering firm or government agency was involved in the design of this dam, please give their name and address:

b) Freeboard _____

c) Crest Width _____

Crest Length _____

d) Height _____

e) Primary Outlet Capacity _____

If pipe, diameter _____

f) Secondary Spillway Capacity _____

Spillway Width _____

g) X & Y Slope (e.g. 3 to 1 is a typical slope)

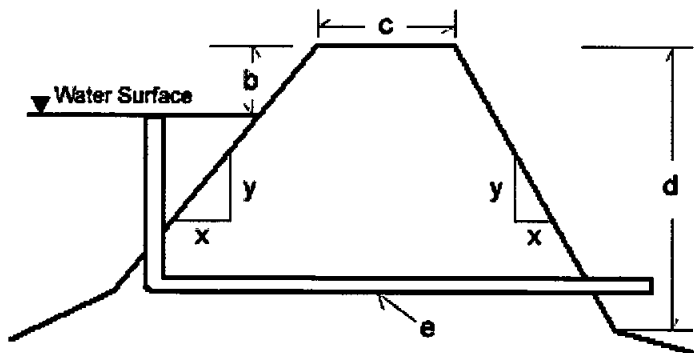
Upstream _____

Downstream _____

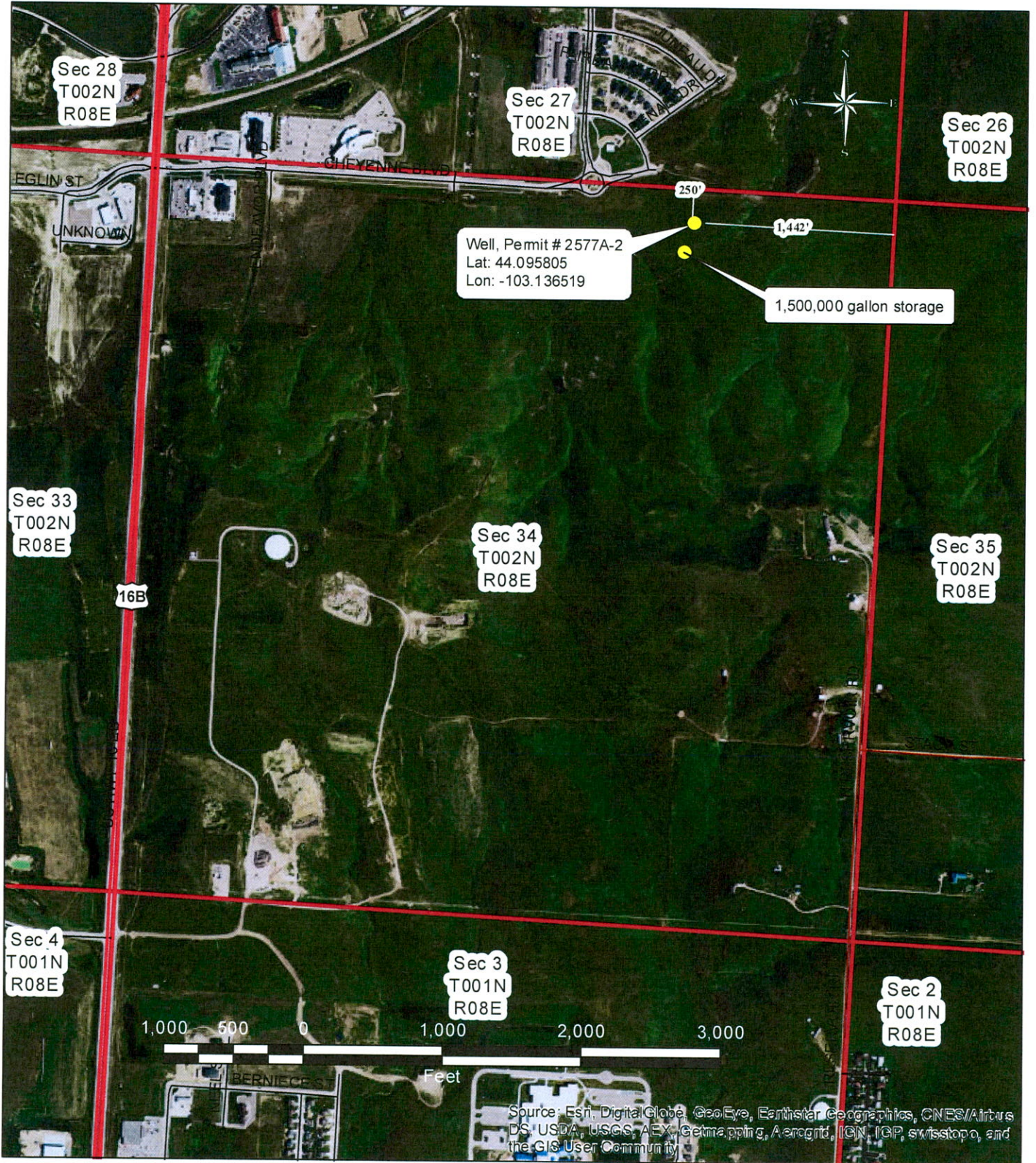
h) Surface Area of Impoundment _____

i) Storage _____ Acre Feet

j) Drainage Area Above Dam _____ Acres



Water Right #2577A-2
City of Box Elder
5/4/2017



Steven Quissell

Steven Quissell
Water Rights Inspector
DENR Water Rights Program



RECEIPT

WATER RIGHTS PROGRAM

South Dakota Department of Environment and Natural Resources

Date 6/1, 20 17

RECEIVED OF City of Box Elder 420 Villa Drive Box Elder SD 57719

The following amount in fees for services rendered as provided for by law:

Fee for Application for Permit No. <u>2763-2</u> to Appropriate Water, to construct and to put water to beneficial use	750	00
Fee for Application for Permit No. _____ to Appropriate Water for Future use		
Fee to retain Future Use Permit No. _____ after period of seven years.		
Fee for Inspecting Constructed Works, confirming beneficial use and issuing Water License No. <u>2763-2</u>	200	00
Fee for Filing Transfer Form _____		
Fee for _____		
Fee for Issuing New Well Driller's License No. _____ for C.Y. _____		
Fee for Renewal of Well Driller's License No. _____ for C.Y. _____		
Fee for Issuing Well Pump Installer's License No. _____ for C.Y. _____		
Fee for Renewal of Well Pump Installer's License No. _____ for C.Y. _____		
(Any Other Work Provided by Law)	TOTAL	950 00

No. 0-2-4

By Jenna Goodman
Chief Engineer

September 26, 2017

PAYMENT REQUEST FORM

PAYEE: City of Box Elder
% Bob Kaufman, Public Works Director
420 Villa Drive
Box Elder, SD 57719

FROM: DENR Water Rights Program
523 E. Capitol Ave
Pierre, SD 57501-3181

DESCRIPTION OF SERVICE, PRODUCE OR TRANSFER

Refund License Fee submitted with Water Permit Application #2763-2

AMOUNT: \$200.00

FUNDING SOURCE:

GENERAL: X

FEDERAL:

OTHER:

COMMENTS:

AUTHORIZATION:



I declare and affirm under the penalties of perjury that this claim is in all things, true and correct.
I further agree to comply with the provisions of the Civil Rights Act of 1964 and regulations issued thereunder relating to nondiscrimination in federal assisted programs.

Water Rights Program - DENR
Conversation File Documentation

NAME OF PERSON OR FILE: Application No. 2764-2, Box Elder

ADDRESS: COUNTY: Pennington County

DATE: June 1, 2017 TELEPHONE: 605 390-6114

RE: annual volume

I contacted Mr. Bob Kaufman, Public Works Director for the city of Box Elder. DENR received their application for an additional 0.24 cfs from the well authorized by Water Permit No. 2577A-2. This was based on Steve Quissell's inspection.

I indicated that in addition to the 0.24 cfs we also limit permits by an annual volume in acre feet. Permit No. 2577A-2 authorized 0.67 cfs at an annual volume of 290 acre feet. This volume equates to approximately 60 percent pumping. Sixty percent pumping of 0.24 cfs is 104 acre feet of water annually. Mr. Kaufman asked that their application be amended to reflect an annual volume of 104 acre feet of water.

NAME: Eric Hunkeler



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3182
<http://denr.sd.gov>

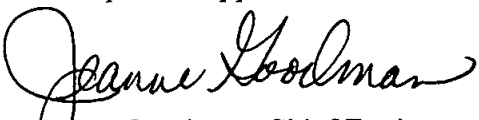
**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 2763-2, City of Box Elder**

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Environment and Natural Resources concerning Water Permit Application No. 2763-2, City of Box Elder, c/o Bob Kaufman, Public Works Director, 420 Villa Drive, Box Elder SD 57719.

The Chief Engineer is recommending APPROVAL of Application No. 2763-2 with a 20 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 rights, 3) the proposed use is a beneficial use and, 4) it is in the public interest with the following qualifications:

1. In accordance with SDCL 46-1-14 and 46-2A-20, Permit No. 2763-2 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. 2763-2 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 shall 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 Permit holder shall report to the Chief Engineer annually the amount of water withdrawn from the Madison aquifer.
4. Water Permit Nos. 2577A-2 and 2763-2, combined, appropriate up to 394 acre feet of water annually.

See report on application for additional information.


Jeanne Goodman, Chief Engineer
August 1, 2017

Report to the Chief Engineer
Water Permit No. 2763-2
City of Box Elder
July 17, 2017

Water Permit No. 2763-2 proposes to appropriate 104 acre-feet of water annually at a maximum diversion rate of 0.24 cubic feet per second (cfs) from one existing well completed into the Madison aquifer. The existing well for this application is currently authorized under Water Permit No. 2577A-2. Water Permit No. 2577A-2 authorizes an annual appropriation of 290 acre-feet at a maximum diversion rate of 0.67 cfs from one well completed into the Madison aquifer located in the NW ¼ NE ¼ Section 34-T2N-R8E for municipal use. During the licensing inspection the constructed system was found to be capable of diverting an additional 0.24 cfs from the existing well. Together this application, if approved, and Water Permit No. 2577A-2 will authorize an annual appropriation of 394 acre-feet per year at a maximum diversion rate of 0.91 cfs for municipal use for the City of Box Elder.

Aquifer: Madison (MSDN)

Hydrogeology and Aquifer Characteristics

The Madison aquifer is a regional aquifer that underlies portions of Montana, Nebraska, North Dakota, South Dakota, Wyoming, and Canada (Peterson, 1984). This aquifer occurs within the Mississippian aged Madison Limestone. The Madison Limestone is locally referred to as the Pahasapa Limestone in the Black Hills. The Madison aquifer typically occurs within the upper portion of the Madison Limestone where solution features and fractures have increased the permeability of the Madison Limestone (Greene, 1993).

The Madison limestone is a generally massive gray to buff limestone that is locally dolomitic (Strobel et al., 1999). The upper portion is karstic in nature, containing solution features that result in widespread secondary permeability (Kyllonen and Peter, 1987). The primary porosity of the aquifer is low, with average porosity estimated at 11% and effective porosity estimated at 5% (Rahn, 1979). However, aquifer characteristics are variable due to the local heterogeneity of the aquifer as a result of joints, fractures, solution features and regional variation in the aquifer (Greene et al., 1999). The lower portion of the Minnelusa Formation acts as a confining layer between the Madison and Minnelusa aquifers but may have increased permeability in the area of the outcrop as a result of brecciation and fractures from folding (Kyllonen and Peter, 1987). Putnam and Long (2007) postulate that “the hydraulic connection between the Madison Limestone and the Minnelusa Formation is spatially variable and probably results from faults, fractures, and breccia pipes.” However, aquifer tests in the Minnelusa aquifer conducted in the Spearfish area reported on in Greene et al. (1999) did not observe drawdown in area Madison observation wells. Madison aquifer tests in the western Rapid City area reported on in Greene (1993) showed drawdown only in the Madison aquifer at the study’s Canyon Lake

site; however, at the study's City Quarry site drawdown in both the Madison and the Minnelusa was observed. Furthermore the Canyon Lake wells have a notable difference in head (approximately 60 feet) (Water Rights, 2017a). The generally significant differences in potentiometric head between the aquifers, indicates a hydrologic separation between the two aquifers (Water Rights, 2017a; Strobel et al., 2000a; Strobel et al., 2000b; and Williamson et al., 2000).

The amount of recoverable water in storage for the Madison aquifer in western South Dakota was estimated at 644,827,200 acre-feet of which an estimated 29,798,400 acre-feet is in Pennington County (Allen et al., 1985). However, due to the large amount of heterogeneity in the characteristics of the Madison aquifer, water availability at any one location is subject to variability. Putnam and Long (2007) observe this in the wide ranges of well yields present in the aquifer with the majority of yields ranging from 10 to 200 gallons per minute and some well yields ranging from 400 to 1,750 gallons per minute. In regard to water quality, Driscoll et al. (2002) notes that water quality declines in the aquifer further from the Madison outcrop areas.

The well completion report for this well indicates that the well was drilled to a total depth of 4,370 feet below grade. The report indicated the top of the Madison Formation at 3,935 feet below grade. At the time of well completion (April 2016) a static water level of 638 feet below grade was reported. This reported depth to the top of the Madison and water level results in a reported artesian head pressure of 3,297 feet at the well site.

South Dakota Codified Law (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 there is unappropriated water available for the applicant's proposed use, the proposed diversion can be developed without unlawful impairment of existing rights, and the proposed use is a beneficial use and in the public interest. This report will address the availability of unappropriated water and potential effects on existing rights from the aquifer that are pertinent to this application.

Water Availability

The probability of unappropriated being water available from the Madison 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. 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." Additionally, pursuant to SDCL 46-1-6 (17) a water distribution system is defined as "a system of piping, valves, storage tanks, pumps, and appurtenances by which water is conveyed for domestic or municipal use by a common distribution system, including a municipality as defined in § 9-1-1, a nonprofit

rural water supply company as defined in § 10-36A-1, a water user district as defined in § 46A-9-2, a sanitary district as defined in chapter 34A-5, or homes, including mobile homes as defined in § 32-3-1, and manufactured homes as defined in § 34-34A-1.1 supplied by a common distribution system.” Here, the Madison aquifer is older than the Greenhorn Formation and a water distribution system is involved, however, water availability in the aquifer will still be examined.

Hydraulic Budget

General Hydraulic Budget

Recharge

In the Black Hills, the Madison aquifer is recharged by streamflow losses and infiltration of precipitation where it outcrops (Carter et al. 2001a). Woodward Clyde Consultants (1981) estimated recharge in South Dakota to the Madison aquifer to range from 140,000 to 400,000 acre-feet per year; however when Woodward Clyde Consultants (1981) referred to the Madison aquifer they included everything between the Cretaceous shales and the Precambrian. Carter et al. (2001a) as part of the Black Hills Hydrology study estimated combined average annual recharge from precipitation and streamflow to the Madison and Minnelusa aquifers in the Black Hills area for water years 1931-1998 at 344 cfs (249,211 acre-ft). When considering the distribution of this recharge between aquifers, Carter et al. (2001a) notes that both aquifers receive a similar volume of recharge from precipitation. However, recharge due to streamflow is thought to be slightly higher in the Madison aquifer due to the upgradient location of its outcrops (Carter et al. 2001a). Based on this, Carter et al. (2001a) estimated that the Madison aquifer receives about 55% (137,066 acre-ft) and the Minnelusa aquifer receives about 45% (112,145 acre-ft) of the combined average annual recharge, although it is noted that this is subject to localized temporal and spatial variability based on outcrop patterns in the Black Hills area.

Withdrawals

Withdrawals from the Madison aquifer are pumping from wells, headwater springs, and artesian springs (Carter et al. 2001a). Well withdrawals can be divided into irrigation and non-irrigation uses. There are currently 150 water rights/permits, eight future use permits, one application on hold by the applicant, and one deferred application from the Madison aquifer (Water Rights, 2017b). Water rights/permits from the Madison aquifer in South Dakota are primarily located in or around the outskirts of the Black Hills, likely due to the decline in water quality as distance from the outcrop area increases. Of the 150 water rights/permits ten are outside of the Black Hills region, eight in Haakon County, one in Ziebach County and one in Dewey County.

The majority of water rights for the Madison aquifer are for non-irrigation use. Historically, average water use by non-irrigation appropriations limited by instantaneous diversion rate has been less than 60% of full time pumping at the permitted diversion rate. Average annual use of Madison water rights/permits limited by diversion rate only is estimated at less than 21,459 acre-feet per year. For water rights/permits limited to an annual volume, full

use of that volume is assumed for estimation of average annual withdrawal. Water rights/permits that are limited by an average volume have an estimated appropriation of 22,996 acre-feet per year. Future use permits are assumed to be fully developable. The eight future use permits reserve a total of 12,085 acre-feet from the Madison aquifer. However, Future Use Permit No. 439-2 reserves 3,367 acre-feet from groundwater, infiltration galleries, and Minnelusa and Madison Formation wells located along Rapid Creek for municipal use by Rapid City but does not attribute specific amounts to any of the listed water sources. Since there is no specific water source attributed to Future Use Permit No. 439-2, the potential for the entire amount being developed into from the Madison aquifer is accounted for in the hydraulic budget. The deferred and on hold applications (Water Permit Application No. 2585-2 and Water Permit Application No. 2685-2) are for a total annual volume of 2,488.8 acre-feet. City of Dupree, City of Eagle Butte, Town of Midland, and City of Philip obtain their drinking water from a rural water system (Drinking Water Program, 2017), however these water rights were still included in the estimation of average annual non-irrigation use since at least one of these water rights (City of Philip) is likely utilized for geothermal use to some extent (Water Rights, 2017b). Carter et al. (2001b) estimates average domestic and livestock watering use of the Madison aquifer during water years 1987 to 1996 at about 2.25% of well withdrawals from the Madison aquifer for the study period. This indicates that the Madison aquifer is typically utilized for uses or diversion rates that require a water right and that domestic and livestock watering are not a significant portion of the hydraulic budget for the aquifer. In the case of the Madison aquifer this is likely due to the high costs of drilling Madison wells except near the outcrop, which would cause domestic users to be preferential to overlying aquifers (such as the Minnelusa) as a water source. This results in an estimate average annual non-irrigation use of less than 59,028 acre-feet per year.

There are 30 water rights/permits appropriating water from the Madison aquifer that include irrigation as a permitted use. The estimate of average annual irrigation usage from the Madison aquifer in South Dakota is challenging due to the natural variation in average annual precipitation across the Black Hill area. Additionally, both landscape irrigation (lawns, golf courses, etc.) and agricultural irrigation (hay, crops, etc.) occur under these permits further making the calculation of any one application rate to apply across the acres authorized for irrigation from the aquifer challenging. Therefore in the case of the irrigation water permits/rights, examination of the historical reported irrigation pumpage of each water right/permit for irrigation with the assumption there would be no major changes in the system or its management would yield a reasonable estimation of average annual irrigation water use. Estimated average annual water use based on annual reported pumpage for 28 of the 30 water rights/permit that contain irrigation as a permitted use is summarized in Table 1.

Water use was not examined for Water Right No. 1752-1 and Water Permit 1707E-1. In examining the file for Water Right No. 1752-1 the groundwater component of this water right is discharge from a geothermal system using water from the Madison aquifer under another permit (Water Right No. 1633-2 included in the non-irrigation portion of the hydraulic budget) that is discharged to the Bad River upstream of the diversion point for this water right (Water Rights,

2017b). Additionally, in reviewing the irrigation questionnaires for Water Right No. 1752-1 irrigation under this permit appears to depend primarily on water availability in the Bad River (Water Rights, 1983-2016). Therefore, average annual usage of Water Right No. 1752-1 from the Madison aquifer is estimated at zero acre-feet per year. Water Permit No. 1707E-1 authorizes a total annual appropriation across all permitted uses (including irrigation) of 502.5 acre-feet; therefore water use under this permit was estimated as part of the non-irrigation portion of the budget as an annual appropriation.

Table 1: Estimated Average Annual Water Use By Irrigation Water Rights/Permits in the Madison Aquifer (Water Rights, 2017b and 1983-2016)

Permit No.	Estimate Average Annual Use (acre-feet/year)	Permitted or Licensed Acres
1009-1	34.8	53.73
1185-1	105.5	22.52
1223-1	220.7	263
858-2	16.2	655.75
1096-1	65.7	216
1363-1	54.6	80.1
1452-1	20.3	25.44
1635-1	116.8	54.5
2106-2	1.0	2.8
1911-2	142.2	124
2286-2	12.2	38.5
2313-2	8.6	3
1670-1	59.1	106
2458-2	121.7	107
Subtotal	979.4	1752.34
water rights/permits with less than ten years constructed system data		
1842-1	0.0	330
1858-1	0.0	34
2593-2	16.1	72.5
1899-1	0.0	100
2673-2	9.8	7
1725-2	7.4	75.1
1923-1	1.1	21.25
1931-1	5.4	85.22
1945-1	16.4	265
1885-1	no data	22
419-2	no data	6
1960-1	new permit	150
1096A-1	reported under 1096-1 and 1670-1, no additional acres	
1504-1	reported under 1096-1 and 1670-1, no additional acres	
Subtotal	56.3	1168.07
Total	1035.7	2920.41

Table 1 splits water rights/permits into two groups, those with at least ten years of reported water use data after system construction and those with less than ten years of data. Ten years of data was chosen in an attempt to have a sufficient number of reporting years to reflect water use under the multi-year drier and wetter climatic periods that occur in the Black Hill area. Average annual irrigation use for water rights/permits with more than ten years of data is estimated at 980 acre-feet per year based on historical reported pumpage (Water Rights, 1983-2016). For Water Right No. 858-2, historical water use is relatively low in comparison to the number of permitted acres; this is likely due to this water right also including the Cheyenne River as a water source (Water Rights, 2017b).

For newer water rights/permit with less than ten years of irrigation use reporting, average annual water use is estimated to be less than statutory annual volume limit of two acre-feet per acre per year (pursuant to South Dakota Codified Law 46-5-6), with the exception of Water Right No. 419-2, which was issued at three acre-feet per acre per year. Therefore, irrigation under these water rights/permits is estimated to be less than 2,342 acre-feet per year based on the statutory annual volume limits for these water rights/permits. Water Right Nos. 1842-1, 1858-1, and 1899-1 have all reported multiple years of sufficient moisture and Water Right No. 1858-1 appears to be a secondary water source for irrigation, therefore average annual use under these water rights is expected to be much less the statutory limit of two acre feet per acre per year (Water Rights, 1983-2016).

Average annual recharge to the Madison aquifer in the Black Hills area was estimated at 137,066 acre-ft per year. Average annual appropriative withdrawals are estimated to be less than 62,350 acre-feet per year. In considering these estimates of average annual use and recharge in relation to the amount of storage available in the aquifer, both are small percentages of the amount of water stored in this aquifer. Taking this into consideration the Madison aquifer could experience several years of drought condition with only minimal impacts to wells or springs. However, not all of the recharge to or storage in the Madison aquifer could possibly be accessed at any one location, therefore this general hydraulic budget is simple intended to demonstrate the nature of the Madison aquifer as a large water resource.

Localized Hydraulic Budget

On a more localized scale, Carter et al. (2001b) analyzed the hydraulic budgets for the Madison and Minnelusa aquifers in the Black Hills region for water years 1987 to 1996. Carter et al. (2001b) utilized nine subareas as part of their analysis, with subareas constructed based on hydraulic flow paths to minimize flow across boundaries. Long and Putnam (2002) conducted a water budget analysis for the Madison and Minnelusa aquifers in Rapid City and the surrounding area for water years 1988 through 1997 as part of a conceptual model for these aquifers in the area. The conceptual model of Long and Putnam (2002) served as the basis for the later numerical model by Long and Putnam (2009) of the same area. In considering these studies, the work of Long and Putnam (2009) offer greater detail regarding the individual hydraulic budgets of the two aquifers. Therefore, Long and Putnam (2009) will be utilized as the basis for the

localized hydraulic budget analysis for this report. The study area for Long and Putnam (2009) is shown in Figure 1, and the hydraulic budget components for the Madison aquifer in the model area are summarized in Table 2.

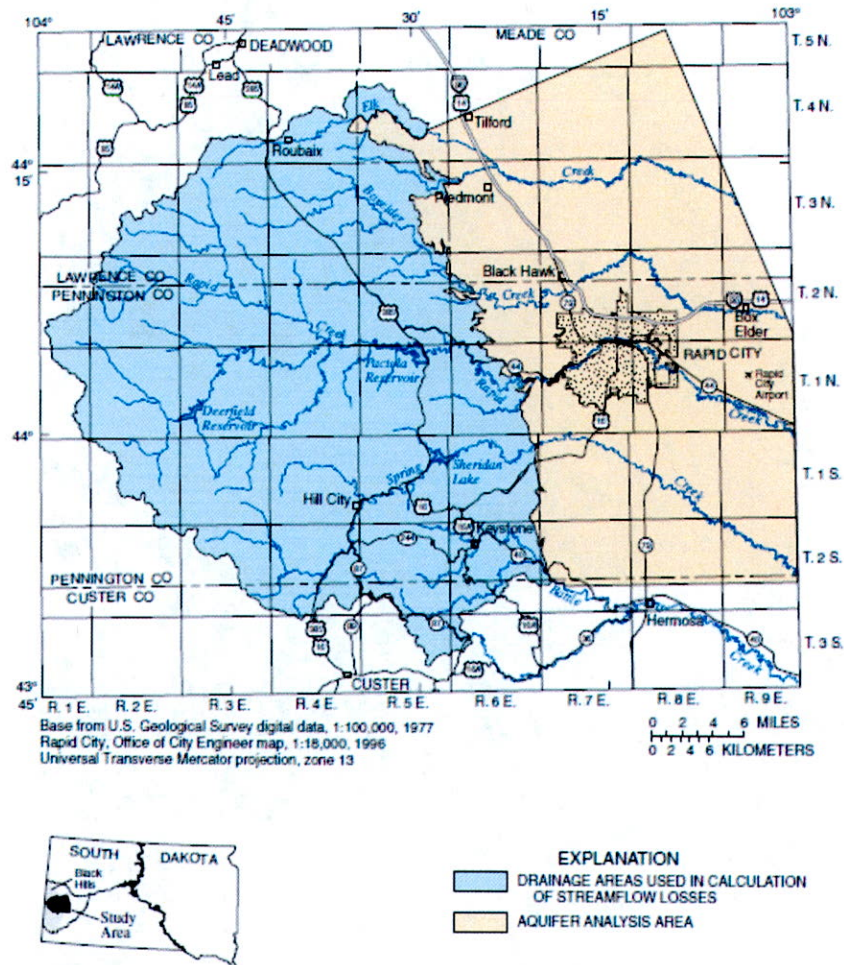


Figure 1: Rapid City conceptual model area for the Madison and Minnelusa aquifers (modified from Long and Putnam, 2002)

Table 2: Estimated water-budget components for the steady-state simulation by Long and Putnam (2009) for the Madison aquifer

Water Budget			
	Component	Rate (cfs)	Rate (acre-feet/yr)
Inflow	Streamflow recharge	36.2	26,209
	Areal recharge	15.1	10,932
	Upward leakage from the Deadwood	6.3	4,561
	Total Inflow	57.6	41,702
Outflow	Combined Springflow	32.8	23,747
	Water Use	6.7	4,851
	Regional Outflow	12.2	8,833
	Total Outflow	51.7	37,431

In addition to the budget components identified in Table 2, there may also be leakage from the Madison aquifer to the Minnelusa aquifer. Long and Putnam (2002) estimated leakage to the Minnelusa aquifer to be about eight cubic feet per second in the study area.

There are 52 water rights/permits currently authorized to appropriate water from the Madison aquifer and 3 future use permits in the study area for Long and Putnam (2002 and 2009). Utilizing the same methodology as the generalized hydraulic budget to estimate water use in the area modeled by Long and Putnam (2009) average annual non-irrigation use is estimated at less than 18,261 acre-feet/per year, 7,653 acre-feet per year are reserved under future use, and average annual irrigation use is estimated at less than 444.7 acre-feet per year. This is a total estimated average annual appropriative use of less than 26,358.7 acre-feet/year. Considering that recharge to and natural discharge from the aquifer (regional outflow, springflow, leakage) are available for capture, there is a reasonable probability the water is available for that additional annual appropriation of 104 acre-feet per year requested by this application.

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 monitors 25 observation wells completed into the Madison aquifer (Water Rights, 2017a). In general, the observation wells for the Madison aquifer document that water levels in the aquifer are dominated by climatic conditions. There are eight observation wells located in the study area for Long and Putnam (2009). The hydrographs for these observation wells are shown in Figure 2 through Figure 9.

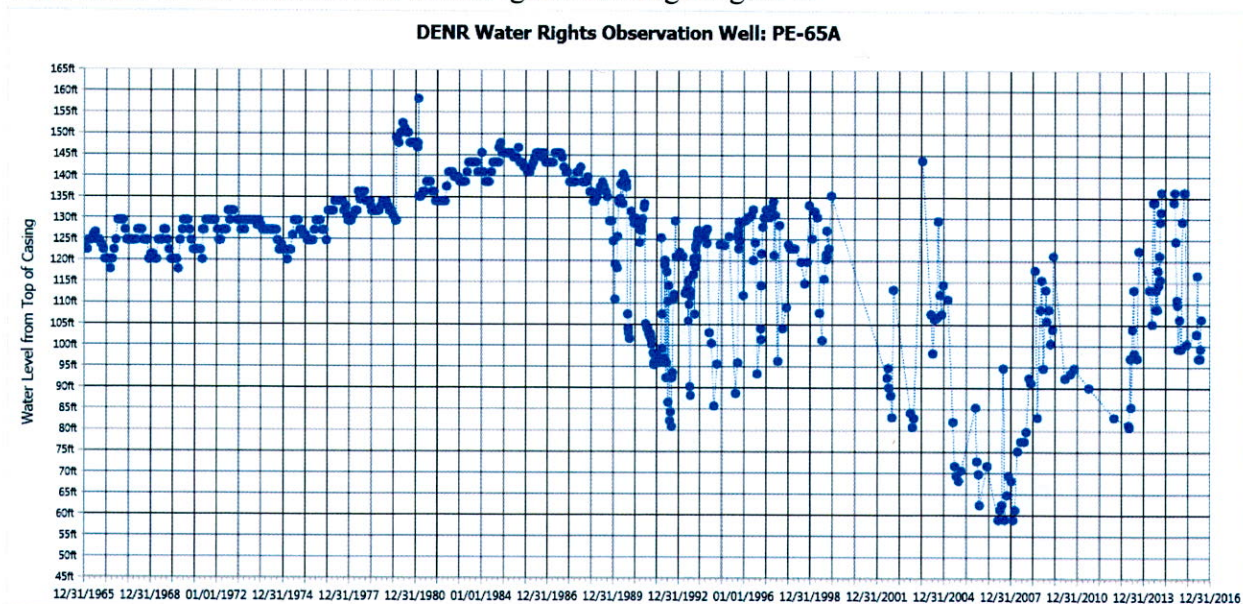


Figure 2: Hydrograph of observation well PE-65A located 6.5 miles to the west southwest (Water Rights, 2017a)

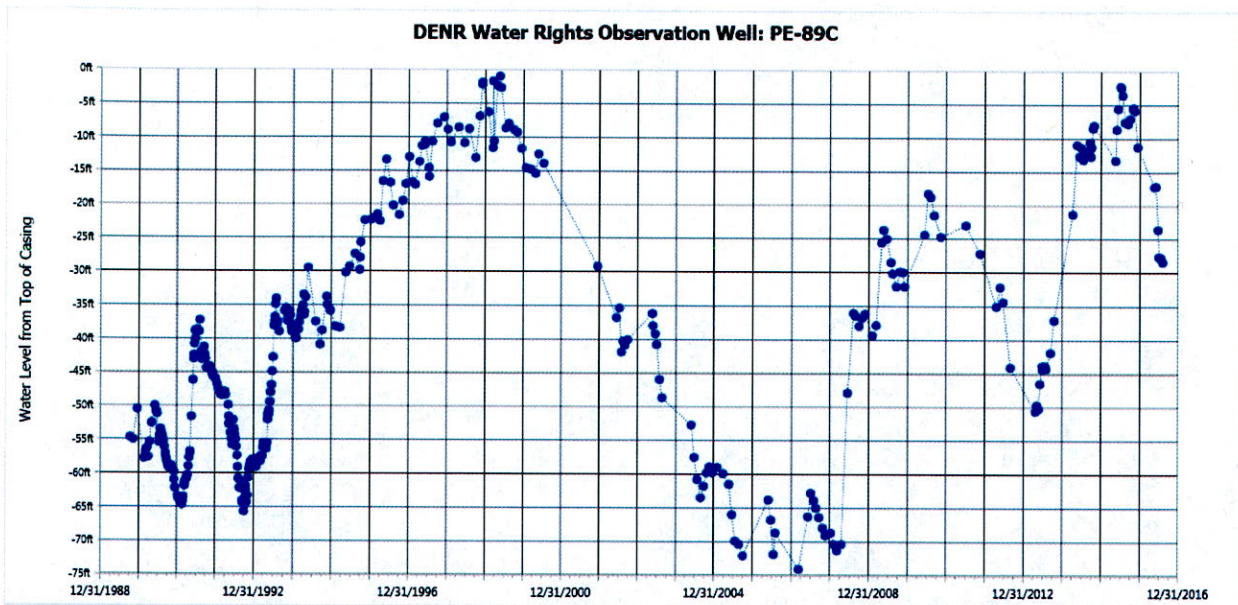


Figure 3: Hydrograph of observation well PE-89C located 8.0 miles to the west (Water Rights, 2017a)

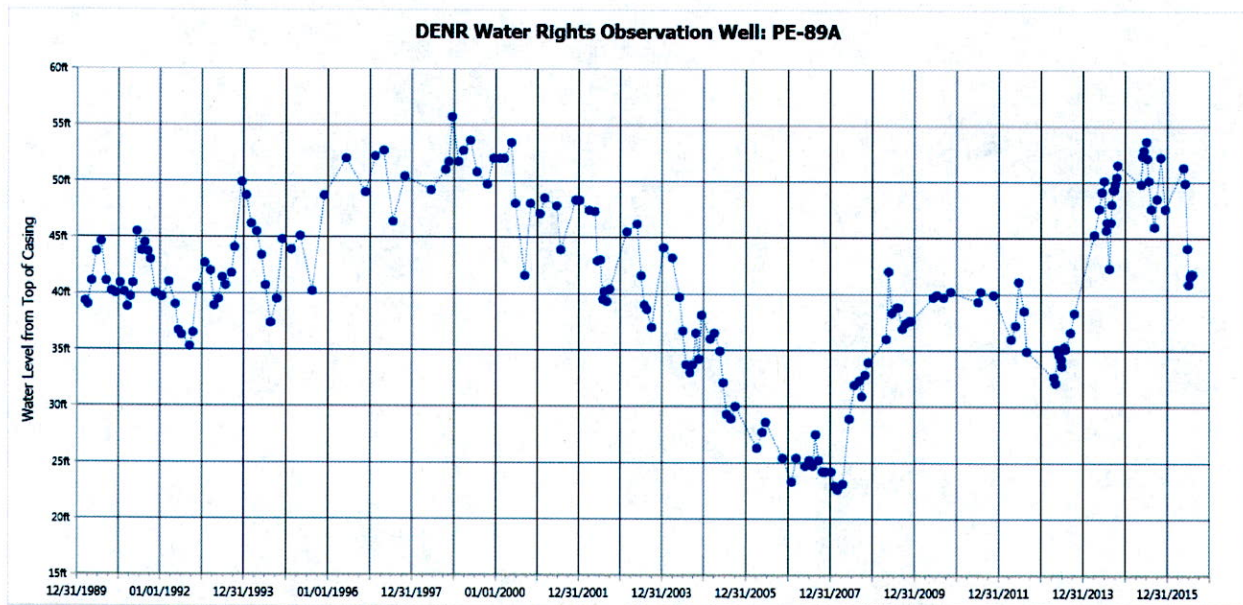


Figure 4: Hydrograph of observation well PE-89A located 8.2 miles to the west southwest (Water Rights, 2017a)

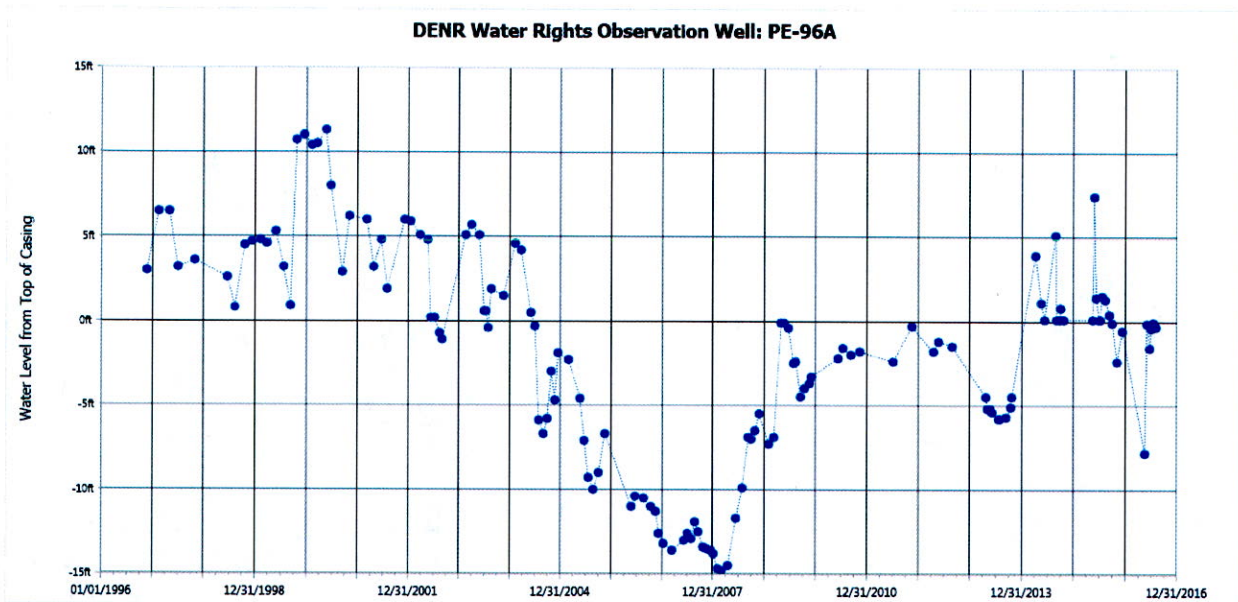


Figure 5: Hydrograph of observation well PE-96A located 9.1 miles to the west southwest (Water Rights, 2017a)

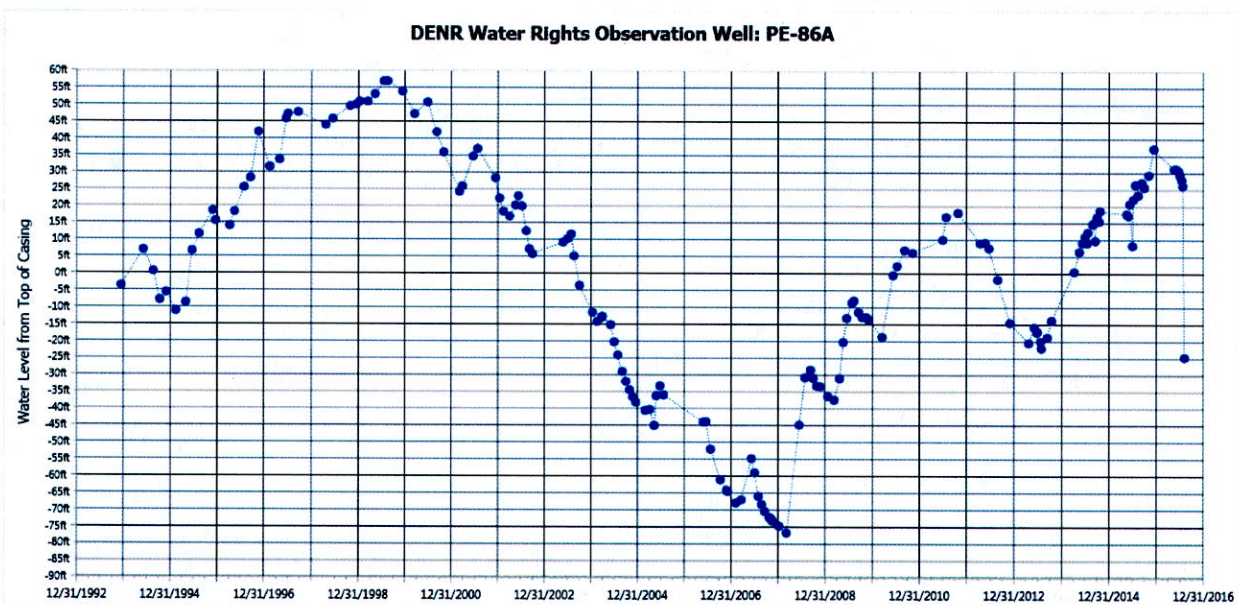


Figure 6: Hydrograph of observation well PE-86A located 9.9 miles to the southwest (Water Rights, 2017a)

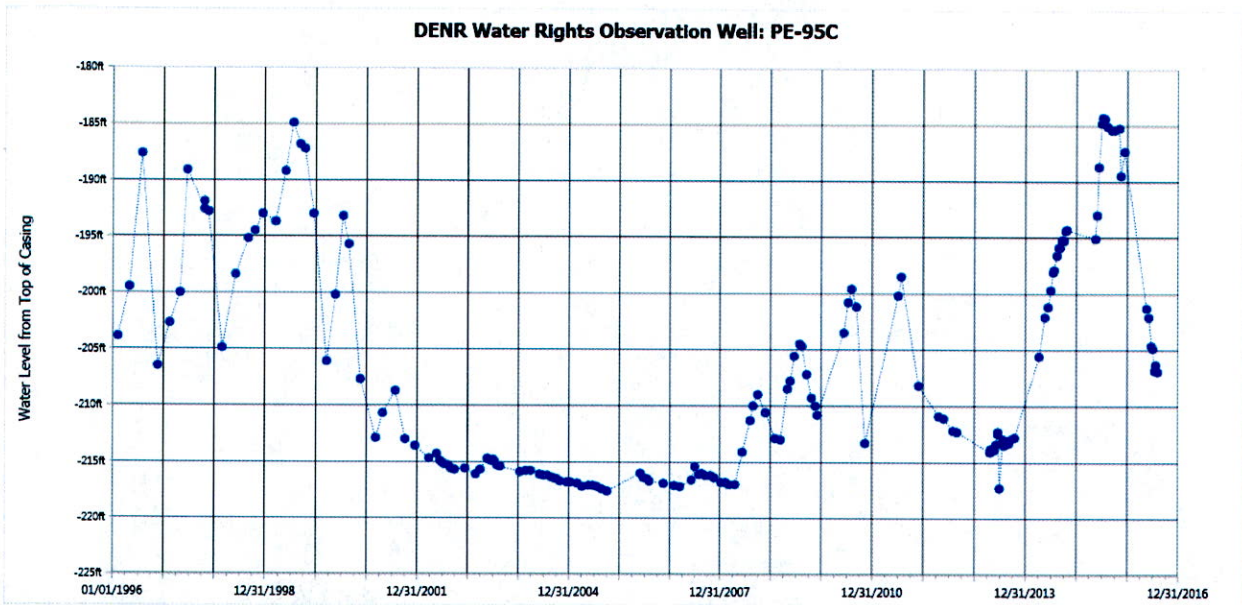


Figure 7: Hydrograph of observation well PE-95C located 11.9 miles to the west northwest (Water Rights, 2017a)

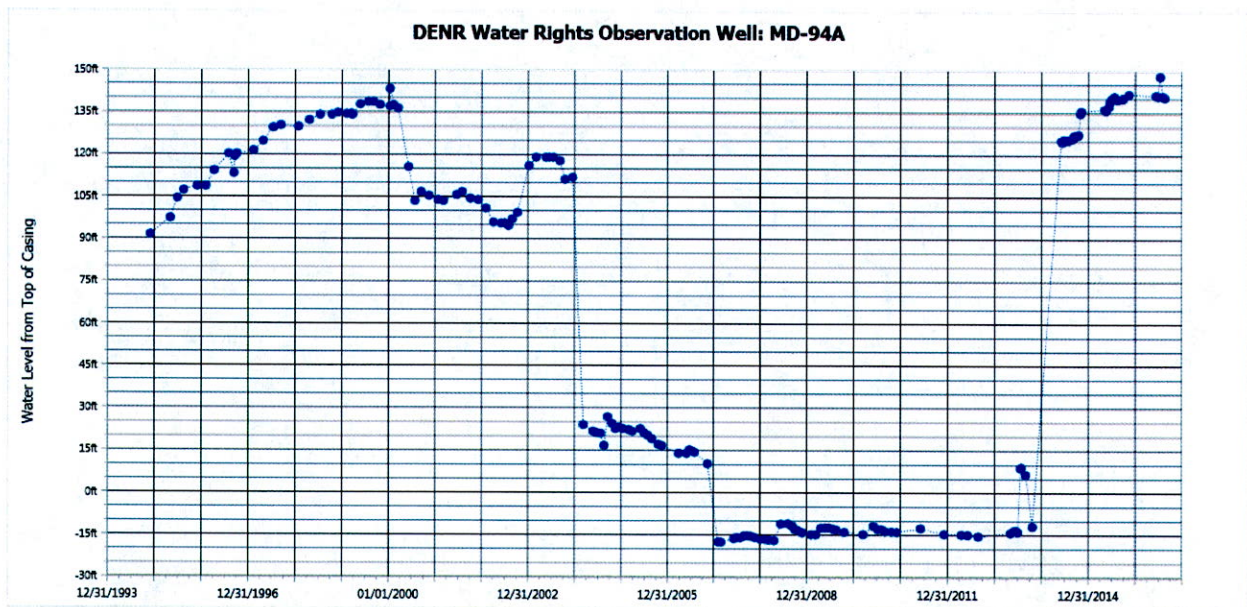


Figure 8: Hydrograph of observation well MD-94A located 15 miles to the northwest (Water Rights, 2017a)

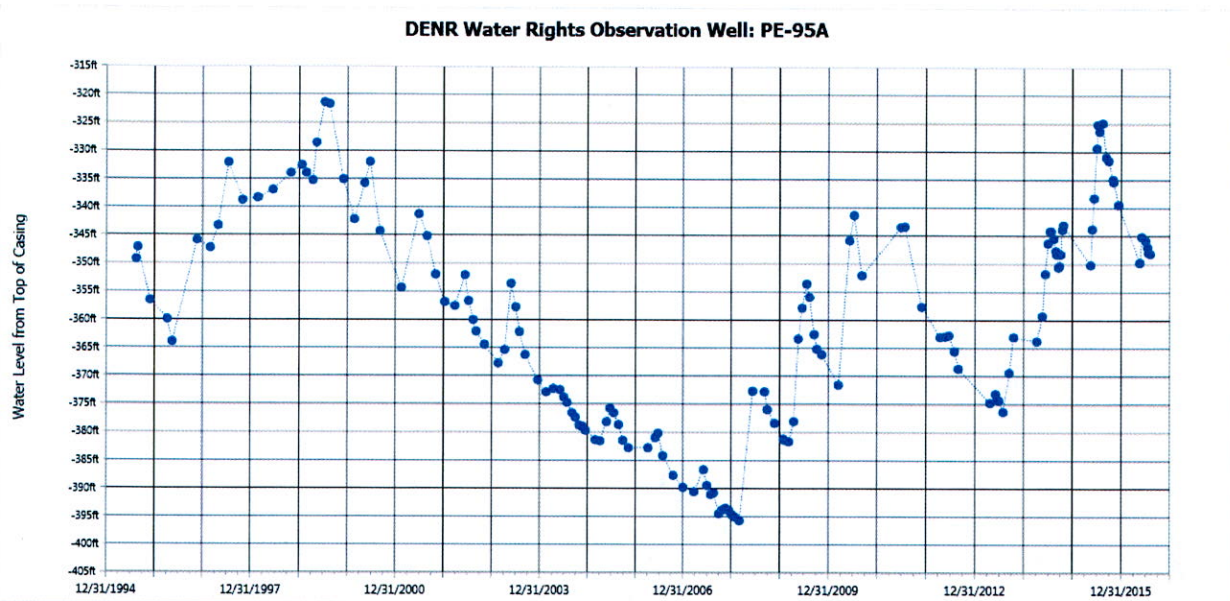


Figure 9: Hydrograph of observation well PE-95A located 17.8 miles to the southwest (Water Rights, 2017a)

Over the period of record, these observation wells show cyclic conditions of water levels, recharging during wetter periods and gradually declining during drier periods. The response of the aquifer to the wetter period and drier period cycles that occur in the Black Hills region can be noted in the hydrographs for these wells. Observation well PE-65A (see Figure 2) is in close proximity (about 0.2 mile) to three high capacity wells for Rapid City. In examining the hydrograph for PE-65A the localized effects of drawdown as a result of pumping can be observed beginning around 1990. However, the water levels still demonstrate a response to climatic conditions. Additionally, water levels can be observed to recover to similar to pre-pumping levels. Observation wells that show a long term continual decline of the aquifer's water level or artesian pressure could indicate that withdrawals from the aquifer were exceeding recharge over the long term, however this is not observed in these observation wells, including an observation well under the localized influence of high capacity pumping (see Figure 2). This indicates that recharge to and natural discharge from the aquifer exceeds well withdrawals. Since recharge to and natural discharge from the aquifer can be captured for pumping, unappropriated water is available in the aquifer.

Existing Users

Area Madison aquifer water rights/permits are shown in Figure 10 and summarized in Table 3. The nearest Madison aquifer water right/permit diversion point not held by the applicant is Water Right No. 2124-2 held by Rapid City located approximately 5.0 miles to the west. The well site for this application is also located within about 0.76 miles of the future use area for Future Use Permit No. 2086-2 for the City of Rapid City from the Madison aquifer.

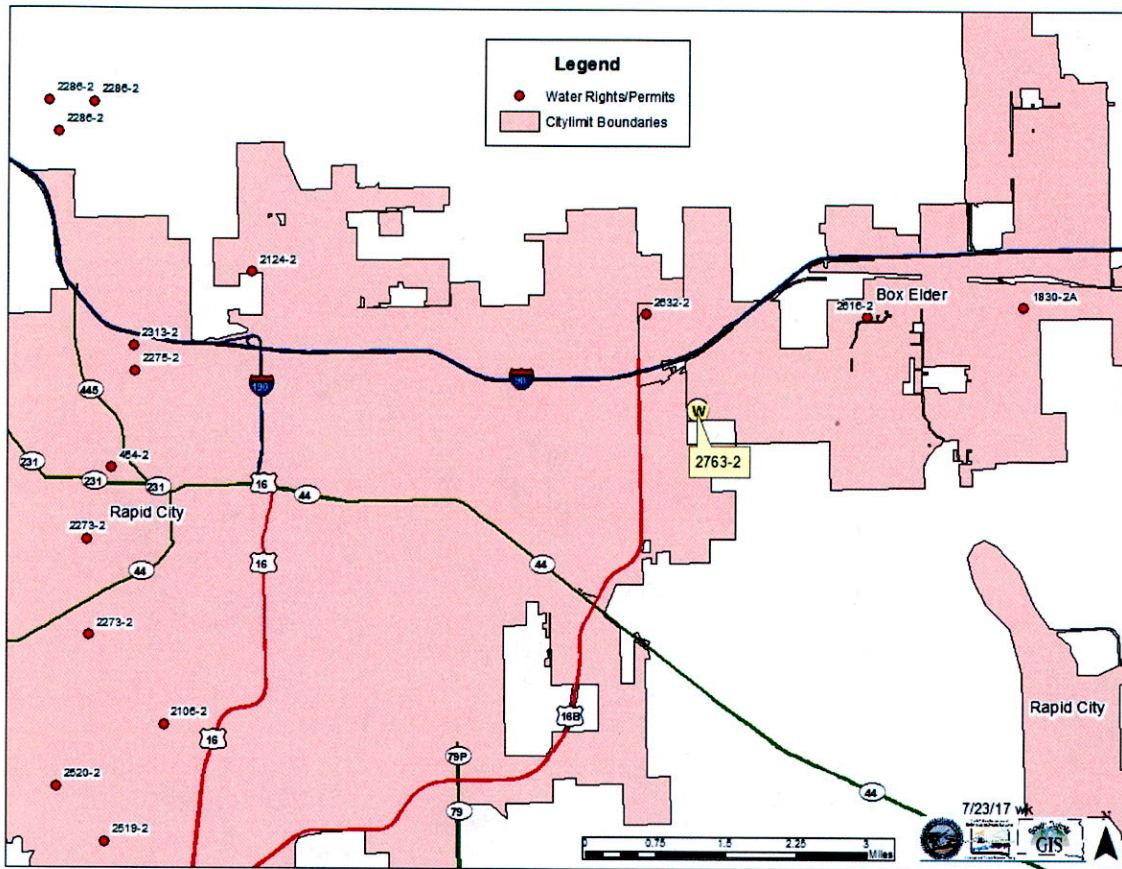


Figure 10: Water rights/permits in the area of this application currently authorized to appropriate water from the Madison aquifer (Water Rights, 2017b)

Table 3: Summary of Water Rights/Permits in Figure 10 (Water Rights, 2017b)

Permit No.	Name	Status	Use	Rate (cfs)
454-2	CITY OF BOX ELDER	LC	MUN	1.11
1830-2A	STUART RICE	LC	IRR/DOM	0.089
2106-2	CITY OF RAPID CITY	LC	MUN	1.79
2124-2	CITY OF RAPID CITY	LC	MUN	11.06
2273-2	CITY OF RAPID CITY	LC	MUN	3.8
2275-2	DONALD KONECHNE	LC	IRR	0.1
2286-2	COCA-COLA BOTTLING	LC	IRR/COM	0.33
2313-2	CITY OF RAPID CITY	LC	MUN	4.12
2519-2	CITY OF RAPID CITY	LC	MUN	1.78
2520-2	CITY OF BOX ELDER	PE	MUN	0.67
2577A-2	CITY OF BOX ELDER	LC	MUN	1
2616-2	CITY OF BOX ELDER	PE	MUN	1
2632-2	BLACK HILLS CORPORATION	LC	IND	1

LC- water right, PE- water permit, Mun- municipal, irr-irrigation, dom-domestic, com-commercial, ind- industrial

Domestic well completion reports on file with the SDDENR-Water Rights Program indicate that domestic wells in the area are predominantly completed into aquifers of a lesser

depth then the Madison aquifer (Water Rights, 2017c). Since this aquifer is expected to be under confined conditions at the well location for this application, drawdown as a result of pumping will occur. 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. An adversely impacted domestic well has been defined by the Administrative Rules of South Dakota 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.” 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 of fact that noted that if the increased costs or decreased production as a result of the impacts of legitimate users on 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. Considering the 3,297 feet of artesian head pressure reported in the well completion report, there is a reasonable probability that existing water rights/permits and adequate domestic wells as defined by the Administrative Rules of South Dakota 74:02:04:20 (6) will not be adversely impacted by pumping under this application. Additionally, since the lower portion of the Minnelusa Formation and the lower portion of the Madison Formation generally serve as upper and lower confining units for the Madison aquifer, this application, if approved, is not expected to impact water rights/permits or domestic wells completed into other aquifers.

Term Limitation on Madison Water Permits

In considering water rights/permit appropriating water from the Madison aquifer that involve the construction of new wells, pursuant to SDCL 46-2A-20, “...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.”

Additionally pursuant to SDCL 46-2A-21, “At the end of the twenty-year limitation, the board may cancel a permit or amend the permit with a new term limitation of up to twenty years,

if the board is unable to make a finding after notice and hearing that sufficient information is available to delete the term limitation.”

Evidence is not available to justify issuing this permit without the 20 year Madison aquifer term limit.

Public Interest

There are several springs located in the Long and Putnam (2002) study area. The conceptual model of Long and Putnam (2002) noted that geochemical analysis on the largest spring complex in the study area (Jackson-Cleghorn) indicates a Madison aquifer origin, however in the numerical model a very small portion of the Jackson-Cleghorn spring complex was modeled as Minnelusa in origin (Long and Putnam, 2009). Naus et al. (2001) notes that City Springs in the study area is of Madison origin. Additionally, Long and Putnam (2002) attributed springflow primarily to the Madison aquifer in the study area based on the hydraulic information for the Madison and Minnelusa aquifers in the study area. However, in the numerical model of Long and Putnam (2009) the flow of Boxelder Springs was attributed to the Minnelusa aquifer. Anderson et al. (1999) indicates that a small portion of water in the Meadowbrook Gallery along Rapid Creek is likely from a bedrock source, but could not determine if the Madison or Minnelusa aquifer was the source. Anderson et al. (1999) also notes a probable contribution from a bedrock source to the Girl Scout Gallery. Since this application is the result of a licensing inspection to authorize the additional diversion above the currently permitted amount of the system already in place, this application would not be expected to have any impact on area springs.

Conclusions

1. Water Permit No. 2763-2 proposes to appropriate 104 acre-feet of water annually at a maximum diversion rate of 0.24 cfs from one existing well completed into the Madison aquifer currently authorized under Water Permit No. 2577A-2. Water Permit No. 2577A-2 authorizes an annual appropriation of 290 acre-feet at a maximum diversion rate of 0.67 cfs from one well completed into the Madison aquifer located in the NW ¼ NE ¼ Section 34-T2N-R8E for municipal use.
2. This application, if approved, and Water Permit No. 2577A-2 would authorize an annual appropriation of 394 acre-feet per year at a maximum diversion rate of 0.91 cfs for municipal use for the City of Box Elder.
3. There is a reasonable probability that water is available from the Madison aquifer for the annual appropriation requested by this application.
4. There is a reasonable probability this the application, if approved, will not adversely impact existing water rights/permits or adequate domestic well in the area.

5. Evidence is not available to justify issuing this permit without the Madison aquifer 20 year term limit.


Whitney Kilts
SDDENR Water Rights Program

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DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182

denr.sd.gov

**NOTE: TO BE SURE OF PUBLICATION ON
THE CORRECT DATES, CONTACT
THE NEWSPAPER RIGHT AWAY.**

August 2, 2017

City of Box Elder
c/o Bob Kaufman, Public Works Director
420 Villa Dr
Box Elder SD 57719

Dear Mr. Kaufman:

Water Permit Application No. 2763-2 for municipal use has been examined and found to comply with the South Dakota Water Laws and applicable rules. A notice has been sent to the Rapid City Journal printed at Rapid City SD (Ph # 605-394-8300). You will need to contact the newspaper and authorize publication of this notice. For your information, a copy of the notice, the recommendation of the Chief Engineer and report on the application are enclosed. Please review the notice prior to publication and notify this office, if you have any corrections or questions.

Be sure to contact the above newspaper to authorize publication of your Notice and to arrange for payment. Early contact with the paper can eliminate delays. Upon receiving authorization from you, the publisher has been instructed to publish your notice. The newspaper has also been instructed to send us the Proof of Publication. We must receive Proof of Publication before action can be taken on the application.

Sincerely,


Eric Gronlund
Natural Resources Engineer
(605) 773-3352

enclosures

NOTE: If you plan to contest any part of the Chief Engineer's recommendation, you must file a petition pursuant to the procedures outlined in the attached notice of hearing. The Water Management Board will then consider your concerns during a hearing on the application.

Instruction to Newspaper - Publish the Notice on August 9, 2017. The applicant is responsible for payment.

NOTICE OF APPLICATION NO. 2763-2 to Appropriate Water

Notice is given that the City of Box Elder, c/o Bob Kaufman, Public Works Director, 420 Villa Drive, Box Elder SD 57719 has filed an application for a water permit to appropriate 104 acre-feet of water annually at a maximum diversion rate of 0.24 cubic feet of water per second (cfs). This appropriation is in addition to what is currently authorized by Water Permit No. 2577A-2. Water Permit No. 2577A-2 authorizes 0.67 cfs (290 acre-feet annually) from one well completed into the Madison Aquifer (4,370 feet deep) located in the NW 1/4 NE 1/4 Section 34-T2N-R8E. An investigation of the permit found the system capable of diverting an additional 0.24 cfs from the existing well. This application, if approved, and Water Permit No. 2577A-2 will authorize an annual volume of 394 acre-feet of water annually at a maximum diversion rate of 0.91 cfs for municipal use.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 2763-2 with a 20 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 rights, 3) the proposed use is a beneficial use and, 4) it is in the public interest. The Chief Engineer's recommendation with qualifications, the application, and staff report are available at <http://denr.sd.gov/public> or contact Eric Gronlund for this information, or other information, at the Water Rights Program address provided below.

Any person interested in opposing or supporting this application or recommendation must file a written petition with BOTH the applicant and Chief Engineer. The applicant must file a petition if contesting the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Program, Foss Building, 523 E Capitol, Pierre SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by August 21, 2017.

The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reasons for opposing or supporting the application, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained.

If the applicant does not contest the recommendation of the Chief Engineer and no petition to oppose the application is received, the Chief Engineer shall act on the application pursuant to the recommendation with no hearing held before the Water Management Board. If a petition opposing the application or contesting the recommendation is filed, then a hearing will be scheduled and the Water Management Board will consider this application. Notice of the hearing will be given to the applicant and any person filing a petition.

Steven M. Pirner, Secretary, Department of Environment and Natural Resources. Published once at the total approximate cost of _____.

Schlaak, Karen

From: Schlaak, Karen
Sent: Wednesday, August 02, 2017 9:42 AM
To: RCY Legals (legals@rapidcityjournal.com)
Subject: 2763-2, City of Box Elder
Attachments: 2763-2public.short.docx; FORM8.FRM.doc

Attached is a notice to be published on August 9, 2017.

City of Box Elder, c/o Bob Kaufman, Public Works Director, 420 Villa Drive, Box Elder SD 57719 (605 390-6114) has been notified to contact you to authorize publication and arrange for payment.

Please send the affidavit or return the attached Proof of Publication form ASAP to the Water Rights Program, 523 E Capitol, Pierre SD 57501.

Let me know if you have questions. Please acknowledge receipt of this email.

Karen Schlaak

SD DENR, Water Rights Program
(605) 773-3352



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/s/ Steven M. Pirner, Secretary
Department of Environment and Natural Resources

(Published once of the total approximate cost of \$73.11)

Affidavit of Publication

STATE OF SOUTH DAKOTA

County of Pennington

SS:

Tracey Kennedy being first duly sworn, upon his/her oath says: That he/she is now and was at all time hereinafter mentioned, an employee of the RAPID CITY JOURNAL, a corporation of Rapid City, South Dakota, the owner and publisher of the RAPID CITY JOURNAL, a legal and daily newspaper printed and published in Rapid City, in said County of Pennington, and has full and personal knowledge of all the facts herein stated as follows: that said newspaper is and at all of the times herein mentioned has been a legal and daily newspaper with a bonafide paid circulation of at least Two Hundred copies daily, and has been printed and published in the English language, at and within an office maintained by the owner and publisher thereof, at Rapid City, in said Pennington County, and has been admitted to the United States mail under the second class mailing privilege for at least one year prior to the publication herein mentioned; that the advertisement, a printed copy of which, taken from said Rapid City Journal, the paper in which the same was published, is attached to this sheet and made a part of this affidavit, was published in said paper once each day for one successive day, the first publication there of being on the 9th day of August that the fees charged for the publication there of are 13 dollars and 11 cents.

Tracey Kennedy

Subscribed and sworn to before me this 9th day of August, 2017.

Dustin Rice

Notary public

DUSTIN RICE



NOTARY PUBLIC
SOUTH DAKOTA



7/1/20
My commission expires

Report of Examination of Works and/or Application of Water to Beneficial Use For Permit No. 2577A-2

I have this day, May 4, 2017 made a thorough examination of the water use system constructed by **City of Box Elder, 420 Villa Drive, Box Elder, SD 57719** of Permit No. **2577A-2**, bearing the priority of **10/15/2012** authorizing the diversion of **0.67** cu. ft. per second of the water from one well for municipal purposes, in Pennington County.

Inspection contact & relationship to permit holder, if applicable: **Bob Kaufman, Public Works Director**
605-390-6114

A. Works used to divert the water:

Well Information:

- 1) Well Drilling Firm: Water System Drilling (4/2016)
- 2) No. of Wells 1
- 3) Depth(s) 4,370 feet
- 4) Well log is available Yes

Casing:

- 1) Diameter 16" - 0 to 40', 10.75" - 0 to 1,500', 7" - 1,376 to 4,000'
- 2) Length 4,000 feet
- 3) Type Steel

Screen:

- 1) Type open hole
- 2) Length 370 feet
- 3) Static water level 638 feet

Pump:

- 1) Make Global Product Solutions/Flotek Industries
- 2) Model 55 stage 538-11000 (set @ approx. 1,600 ft.)
- 3) Size 5.4"
- 4) Capacity 410 gpm (metered rate)
- 5) Horsepower rating 192 hp/2537v/49amp (variable speed drive)

Note: Water level after 26 hrs pumping at 440 gpm was 851 ft. at time of well completion.

B. Works used to transport water to place of use:

- 1) Type PVC
- 2) Size 12" main connecting storage reservoirs
- 3) Length -- feet

C. Works used to apply water to beneficial use:

The well authorized by Permit No. 2577A-2 is one of three wells currently used by the City for municipal supply. Four storage reservoirs ranging in size from 800,000 to 1,500,000 gallon are incorporated into the system. Box Elder also supplies water to the "east base water line" which serves homes northeast of the City.

D. Compliance with Permit Requirements:

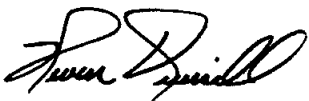
- 1) Permit qualifications being abided by: Yes (see comment below requiring increased diversion rate)
- 2) Exceptions to compliance are: none

E. Condition and Location:

1. The system is in good condition with the point of diversion located as follows:
250' S and 1,442' W of the NE corner Section 34 T2N R8E (44.095805, -103.136519)
2. The works are capable of diverting and conveying to the place of use **0.91** cu. ft. per second (410 gpm) of water which is to be used for **municipal** use. A new permit is required for the additional 0.24 cfs. If the new permit is approved, 2577A-2 and the new permit should be incorporated and the license should be issued for 0.91 cfs.
3. All structures, wells and lands on map: **No, well only**

F. Comments or other permit(s) associated with the project:

The City of Box Elder also has Licensed Water Right Nos. 1488-1, 1689-2, 1830-2, 591-2, 870-2, 934-2, 2616-2, and Water Permit No. 2631-2. An increase in diversion rate for permit 2577A-2 of 0.24 cfs will be required to increase total authorized diversion to 0.91 cfs.

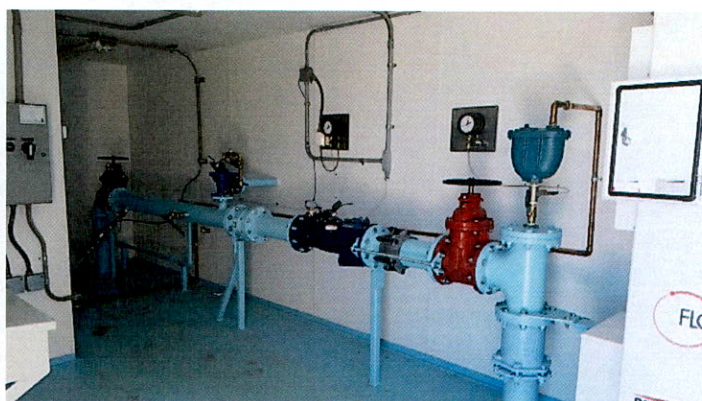


Steven Quissell
Water Rights Inspector
DENR, Water Rights Program

Date report completed: 5/15/2017



Well site



Pump house valves and plumbing



Controls



BOX ELDER ESP EQUIPMENT
SELECTION DATA

PRODUCTION TECHNOLOGIES

Provided Well Information:

Well Information	Data
Production Casing Size [IN]	7
Production Casing Weight [LB/FT]	23
Production Capacity [GPM]	400
Total Dynamic Head [FT]	1,590
Production Tubing Size [IN]	6
Production Tubing Weight [LB/FT]	16
Production Tubing Thread Type	8 RND EUE
Bottom-Hole Temperature [F]	100

Selected Equipment:

Equipment Selection	Type	Quantity
Discharge	5.5" 8 RND EUE	1
Pump	55 STG 538-11000	1
Intake	540 STANDARD	1
Adapter	400 SEAL / 540 INTAKE	1
Seal	400 B8L	2
Motor	456 192HP/2537V/49A	1
Motor Base	ADAPTER	1
Sensor (Optional)	DOWN-HOLE UNIT	1
Sensor (Optional)	CHOKE PANEL	1
Sensor (Optional)	DECODER	1
Variable Speed Drive	249 KVA VSD 6P	1
Step-Up Transformer	260 KVA TRANSFORMER	1
Cable	#4 LEAD EPDM 5KV FLAT GALV	1600
Motor Lead Extension	55 FT 456 #6 LEAD EPDM 5KV	1

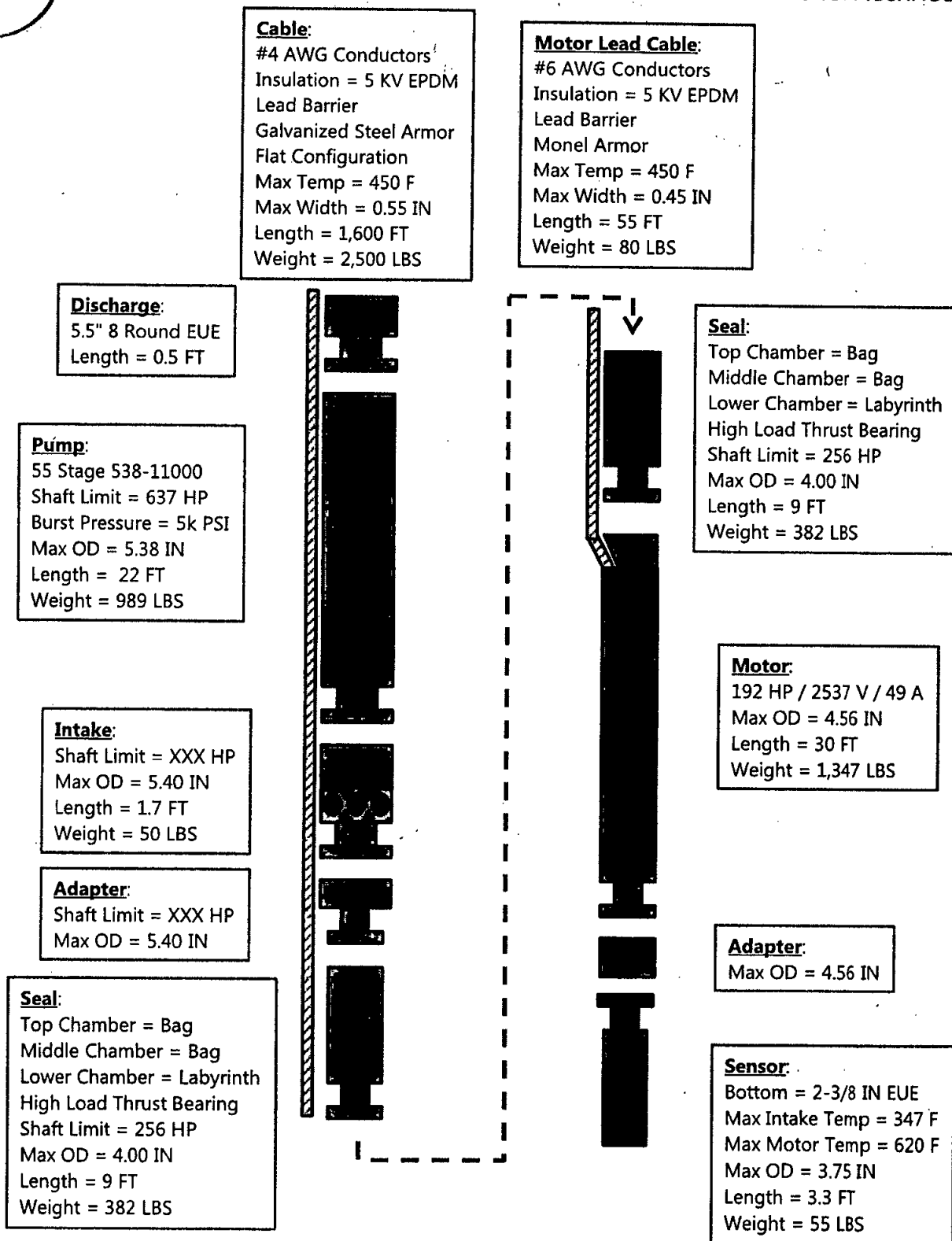
Predicted Operating Parameters:

Sizing Information @ 60 Hz	Data
Pump TDH [FT]	1,811
Pump HP Requirement [HP]	216
Additional HP Requirement [HP]	2
Motor Voltage [V]	2,614
Motor Amperage [A]	54
Motor Load [%]	114
Fluid Speed by Motor [FT/SEC]	8
Cable Size [AWG]	4
Cable Length [FT]	1,600
Total Cable Voltage Loss [V]	39
Voltage Loss to Motor Voltage [%]	1
Required Surface Voltage [V]	2,653
Surface KVA [KVA]	248



Box Elder Down-Hole ESP Schematic

PRODUCTION TECHNOLOGIES

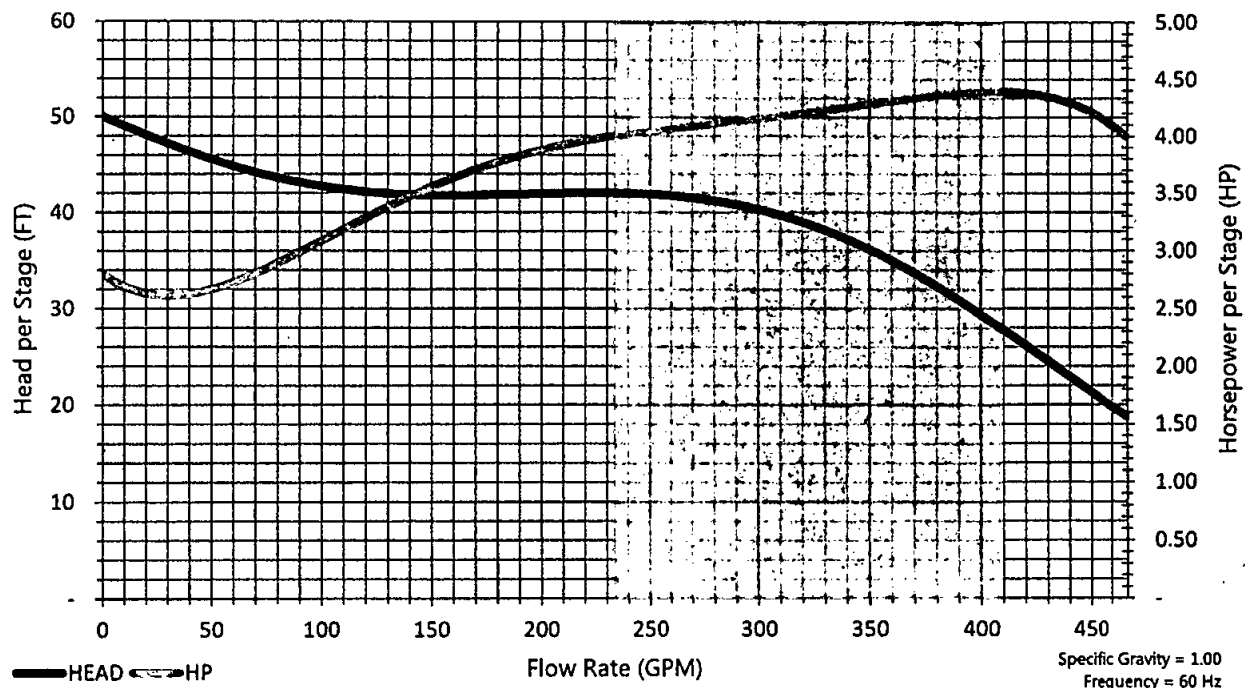




BOX ELDER ESP EQUIPMENT SELECTION DATA

PRODUCTION TECHNOLOGIES

Supplemental Pump Information:



Supplemental Sensor Information:

Standard Measured Parameters	
Intake Pressure	
Intake Temperature	
Motor Temperature	
Vibration (X, Y, Z)	
Inclination Angle (X, Y, Z)	
Current Leakage	

Sensor Data	
Temperature Resolution	± 1 %
Pressure Rating	8,700 PSI
Pressure Accuracy	± 0.1 %
Pressure Resolution	0.015 PSI
Vibration Rating	6 G
Vibration Resolution	0.001 G
Current Leakage Rating	20 mA
Current Leakage Accuracy	5 %



BOX ELDER ESP EQUIPMENT SELECTION DATA



Variable Speed Drive Information:

Standard Specifications	
Nominal Voltage	480 V
Interface	7" Touchscreen
Input	6 Pulse or Active Front End
Output	Filtered PWM
Data Logging Capacity	6 Months
Digital Inputs	12
Digital Outputs	2
Analog Inputs	2
Analog Outputs	1
Enclosure Type	NEMA 3R
Communication Types	RS-232, RS-485, Modbus RTU
Operating Ambient Temperature	-22 F to 104 F
Storage Temperature	-40 F to 140 F
Max Altitude Without De-rate	3,300 FT
Power Factor	0.98
Line Voltage Variation	-15% to +10%
Line Frequency Variation	45 to 66 HZ

Standard Features
Wireless Access Point
External USB Port
High Intensity LED Status Indicators
SCADA Ready
Backspin Detection
Stuck Pump Start Routine
Gas Lock Mitigation
Lost Phase Operation
Active Pump-Off Control
Enclosure Heater
Current Limit Mode

Optional Features
Input Power Meter
Data Retention Ride Through Module
SCADA Monitoring
Expandable Input / Output
UL Certification

STATE OF SOUTH DAKOTA

WATER LICENSE NO. 2763-2

(1) The City of Box Elder, c/o Bob Kaufman, Public Works Director, 420 Villa Drive, Box Elder SD 57719 made Application No. 2763-2, June 1, 2017 for a water permit to divert an additional 0.24 cubic feet of water per second (cfs) (104 acre-feet annually) from Madison Aquifer, Pennington County, South Dakota for municipal use purposes. Permit No. 2763-2, with a priority date of June 1, 2017 was approved August 21, 2017 and issued to the applicant for diversion of water with construction of the described water supply system and the application to beneficial use of water completed.

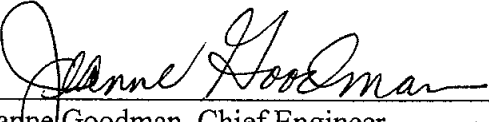
Water Permit No. 2577A-2, with a priority date of October 15, 2012, authorized diversion of 0.67 cfs (290 acre-feet annually) from one well. The applicable portions of No. 2577A-2 are incorporated into this Water License No. 2763-2.

(2) The water supply system has been completed and water applied to beneficial use in accordance with South Dakota State Law. Pursuant to South Dakota Codified Law 46-5-30.1, the holder and/or owner of Incorporated Water Right No. 2763-2 is issued a license, bearing priority dates of October 15, 2012 (0.67 cfs - 290 acre-feet annually) and June 1, 2017 (0.24 cfs - 104 acre-feet annually) to appropriate a total of 0.91 cubic feet of water per second (394 acre-feet annually) from one well - Madison Aquifer for municipal use.

The diversion point is located: 250 feet south and 1,442 feet west of the NE corner of Section 34-T2N-R8E (NW 1/4 NE 1/4).

(3) This license is subject to South Dakota Water Law, any limitations or conditions listed in Water Permit No. 2763-2 including the following qualifications:

- In accordance with SDCL 46-1-14 and 46-2A-20, Permit No. 2763-2 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. 2763-2 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.
- 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 shall control withdrawals so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.
- The Permit holder shall report to the Chief Engineer annually the amount of water withdrawn from the Madison aquifer. *Water use reports are submitted annually and on file with the Water Rights Program.*
- Water Permit Nos. 2577A-2 and 2763-2, combined, appropriate up to 394 acre feet of water annually.


Jeanne Goodman, Chief Engineer
Water Rights Program
Department of Environment and Natural Resources

SEP 26 2017
date





DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182

denr.sd.gov

2763-2
2577A-2

SEP 26 2017

City of Box Elder
c/o Bob Kaufman, Public Works Director
420 Villa Drive
Box Elder SD 57719

Dear Mr. Kaufman:

Enclosed are Water Permit and Water License No. 2763-2. The applicable portions of No. 2577A-2 are incorporated into Water License No. 2763-2. This is the final water right document completing the city's process of obtaining a Water Right. Also, included with the license is a map prepared by the staff engineer who conducted the investigation.

A fee of \$950 was submitted with the permit application. The license fee originally submitted with the Permit No. 2577A-2 will be applied towards No. 2763-2 since the two permits are being incorporated. Therefore, \$200 will be refunded to the city within two weeks.

For your information SDCL 46-6-27 requires that if in the future the owner drills a replacement well and has no plan to use the old existing well, the old well is considered abandoned and must be plugged. Also, any well that is being used or is not considered abandoned must be valved and controlled, if flowing, or sealed and capped so that no leaking occurs either underground or at the surface.

As long as you use the water beneficially, as stated in the Water License, the State Water Laws provide that you have a continuing right to use the water. If you have any questions, please contact our office.

Sincerely,

Jeanne Goodman, Chief Engineer
Water Rights Program
(605) 773-3352

enclosures