DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

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RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT APPLICATION NO. 8232-3, Barry & Robin Vculek

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. 8232-3, Barry & Robin Vculek, 1109 S 7th Street, Oakes ND 58474..

The Chief Engineer is recommending APPROVAL of Application No. 8232-3 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing rights, 3) the proposed use is a beneficial use and 4) it is in the public interest with the following qualifications:

1. The wells approved under this Water Right No. 3656-3 and Water Permit No. 8232-3 will be located near domestic wells and other wells which may obtain water from the same aquifer. The well owner under these water rights shall control his withdrawals so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.

2. Pursuant to SDCL 46-5-6 which allows a greater diversion rate if the method of irrigation, time constraints, or type of soils so requires, Water Right No. 3656-3 and Water Permit No. 8232-3, combined, authorize a maximum diversion rate of 5.79 cfs for the irrigation of 380 acres with an annual volume not to exceed 2 acre feet of water per acre per year.

3. This Permit is approved subject to the irrigation water use questionnaire being submitted each year.

See report on application for additional information.

Jeanne Goodman

Jeanne Goodman, Chief Engineer
August 16, 2016

REPORT TO THE CHIEF ENGINEER
ON
WATER PERMIT APPLICATION NO. 8232-3
BARRY & ROBIN VCULEK
AUGUST 8, 2016

Water Permit Application No 8232-2 proposes to increase the diversion rate authority, add a diversion point, change the location of the acreage authorized for irrigation and clarify the location of the diversion points for an existing irrigation project. Water Right No. 3656-3 authorizes the irrigation of 380 acres, using three wells completed into the McPherson management unit of the Spring Creek aquifer, at a maximum diversion rate of 3.00 cubic feet of water per second (cfs). An inspection of Water Right No. 3656-3, conducted pursuant to SDCL 46-5-3, identified four discrepancies between what the water right authorized and what was developed. The inspection identified: (a) the system was capable of diverting water at a rate of 5.79 cfs, (2.79 cfs greater than the authorized rate); (b) the system was capable of diverting water from four wells (one additional well than was authorized); (c) the wells are in the SE¼NW¼, N½NW¼, SW¼ NE¼ and the center of the SW¼ Section 22, T127N-R71W; (d) the irrigated acreage is located in the W½, NE¼, NW¼SE¼ Section 22,T127N-R71W. This application, if approved and Water Right No. 3656-3 will authorize a total diversion rate of 5.79 cfs for irrigation of 380 acres. The applicant is requesting a diversion rate greater than the statutory limit of 1 cfs per 70 acres.

AQUIFER: SPRING CREEK: MCPHERSON (SC:M)

GEOLOGY AND AQUIFER CHARACTERISTICS:
The McPherson management unit of the Spring Creek aquifer consists of sand and gravel deposited as glacial outwash probably "during the last episodes of melting of the continental ice sheet" (Hamilton, 1974). The deposition of the outwash was limited to channels between large blocks of ice and till (Hamilton, 1974). The McPherson management unit of the Spring Creek aquifer underlies approximately 101,200 acres of McPherson County and contains an estimated 307,000 acre-feet of recoverable water in storage in the County (Hedges and others, 1982). The maximum thickness of the Spring Creek aquifer is estimated to be 85 feet. However, the average thickness is about 30 feet (Hamilton, 1982). Completion reports on file for three of the irrigation wells associated with this project identify the top of the aquifer ranging from 28 to 42 feet below grade and 66 feet, 54 feet and 29 feet of saturated thickness, respectively (Water Rights, 2016b and Water Rights 2016c). The aquifer is under confined conditions in the project area with a potentiometric surface less than 20 feet below grade. The transmissivity of the Spring Creek: McPherson was estimated to range from 49,110 to 119,835 gal/day/ft based on the specific capacities of seven irrigation wells completed into the aquifer (Buhler, 2012).

This application does not propose an increase to the acreage authorized for irrigation by Water Right No. 3656-3, therefore the appropriation from the Spring Creek: McPherson aquifer will not increase with approval of this application. Water Permit No. 8232-2, if approved, will authorize the current, as built, irrigation project. A May 7, 2016, inspection of Water Right No. 3656-3 identified an irrigation project consisting of four wells, capable of diverting 5.79 cfs, delivering water through four center pivot irrigations systems (M. Rath, personal communication, August

10, 2016). A July 1, 1980, inspection of Water Right No. 3656-3 identified a project consisting of three wells, capable of diverting 3.00 cfs, delivering water through two towable center pivot irrigation systems (Water Rights, 1980). Although the number of irrigated acres has remained the same (380 acres), the project, as constructed is capable of using more water than could be used in 1980 since all of the acreage can now be irrigated simultaneously.

Water use reported under Water Right No. 3656-3 is shown in Table 1. Based on the reported diversion rate (gpm), annual rate (Ac-ft/yr), and application rate (in/yr), it appears that the diversion rates and application rate increased for the irrigation project between 2001 and 2002. The average annual water use reported under this appropriation was 107.6 ac-ft/yr for 1980-2001, while the average annual water use was 390.5 ac-ft/yr for 2002-2015 (Water Rights, 1980-2016a).

Table 1. Water use reported under Water Right No. 3656-3 (Water Rights, 1980-2016b)

Year	Acres	gpm	days	hours	Ac-ft/yr	in/yr
2015	380	2800	36	24	445.46	14.067
2014	380	2500	21	24	232.01	7.326565
2013	380	2500	41	24	452.97	14.30425
2012 $Crop_1$	280	1600	47	24	332.32	14.24244
2012 $Crop_2$	100	1200	28	24	148.49	17.81821
2011	380	2600	33	24	379.17	11.9737
2010	380	2400	36	24	381.82	12.05743
2009 $Crop_1$	100	600	25	24	66.29	7.954556
2009 $Crop_2$	260	1600	15	24	106.06	4.895111
2008 $Crop_1$	200	1200	56	24	296.97	17.81821
2008 $Crop_2$	115	700	34	24	105.18	10.97498
2008 $Crop_3$	65	400	27	24	47.73	8.8112
2007 $Crop_1$	264	1600	49	24	346.47	15.74841
2007 $Crop_2$	116	600	44	24	116.67	12.06898
2006	NA	NA	NA	NA	NA	NA
2005	330	2250	33	24	328.13	11.93183
2004	342	2200	35	24	340.28	11.93959
2003	342	2200	43	24	418.06	14.66864
2002	337	2000	47	24	415.40	14.79185
2001	326	1350	35	24	208.81	7.686151
2000 $Crop_1$	50	450	25	10	20.71	4.971597
2000 $Crop_2$	260	800	30	15	66.29	3.059445
1999 $Crop_1$	130	600	10	10	11.05	1.019815
1999 $Crop_2$	130	600	15	12	19.89	1.835667
1999 $Crop_3$	130	600	10	20	22.10	2.03963
1999 $Crop_4$	40	450	10	20	16.57	4.971597
1998 $Crop_1$	135	750	22	24	72.92	6.48149
1998 $Crop_2$	30	450	12	24	23.86	9.545467
1997 $Crop_1$	135	700	20	10	25.78	2.291436
1997 $Crop_2$	135	700	15	15	29.00	2.577865
1997 $Crop_3$	60	450	20	15	24.86	4.971597

SDCL 46-2A-9

Pursuant to SDCL 46-2A-9, a permit to appropriate water may be issued only if there is reasonable probability that there is unappropriated water available for the applicant's proposed use, that the proposed diversion can be developed without unlawful impairment of existing rights and that the

proposed use is a beneficial use and in the public interest. This report will address water availability and existing rights issues only.

WATER AVAILABILITY:

Approval of Water Permit Application No. 8232-3 will authorize an additional withdrawal from the Spring Creek: McPherson aquifer. The average amount of water reportedly pumped annually by this irrigation project increased by approximately 283 ac-ft/yr since 2001, when it appears the system changes that are to be authorized by this permit were put in place. The probability of 283 acre-feet of unappropriated water available for appropriation can be evaluated by considering SDCL 46-6-3.1 which requires that:

> "No application to appropriate groundwater may be approved if, according to the best information reasonably available, it is probable that the quantity of water withdrawn annually from a groundwater source will exceed the quantity of the average estimated annual recharge of water to the groundwater source."

If the source of the water is older or lower than the Greenhorn formation and a water distribution system has applied for a permit, the Board need not consider the recharge/withdrawal issue. In the case of Application No. 8232-3, the Spring Creek: McPherson aquifer is not older or lower than the Greenhorn formation, and a water distribution system is not involved, therefore recharge versus withdrawals must be considered.

Recharge versus Withdrawals:

Recharge:

Recharge to the Spring Creek: McPherson aquifer which occurs through infiltration of precipitation falling on the aquifer surface has not been quantified. However, the Spring Creek: McPherson aquifer is considered a "non-buried aquifer" in the "surface system" by Hedges and others (1985). Other non-buried aquifers in the surface system in this area include the Bowdle aquifer and the Selby aquifer. Recharge rates determined for these aquifers using observation well analysis is estimated to be 2 inches/year for the Selby aquifer and between 2 and 2.7 in/yr in the Bowdle aquifer (Hedges and others, 1985). Based on recharge rates for these similar aquifers, a recharge rate of 2 inches/year is assumed for the McPherson management unit of the Spring Creek aquifer. The average annual recharge for the Spring Creek: McPherson would be approximately 16,850 acre-feet/yr.

Withdrawals:

There are eight existing water rights/permits appropriating water from the Spring Creek: McPherson, they are shown on Figure 1 and in Table 1 (Water Rights, 2016b).

Table 1. Water Rights/Permits appropriating water from the McPherson management unit of the Spring Creek aquifer (Water Rights, 2016b).

PERMIT NO	NAME	PRIORITY DATE	STATUS	USE	CFS	ACRES
3012-3	MARVIN & MARK MORLOCK	09/13/1976	LC	IRR	2	211
3656-3	BARRY & ROBIN VCULEK	03/08/1976	LC	IRR	3	380
3925A-3	JEFF NEUHARTH	04/27/1977	LC	IRR	2.28	160
5706-3	BORDER CLUB	08/31/1992	LC	COM	0.01	0
6258-3	BARRY & ROBIN VCULEK	04/12/2001	PE	IRR	12	940
7304-3	MICHAEL C NEUHARTH	01/03/2012	LC	IRR	1.78	136
7323-3	BARRY & ROBIN VCULEK	02/15/2012	PE	IRR	3.56	264
7455-3	DAN METTLER	09/26/2012	PE	IRR	1.78	160
8052-3	DENNIS WOLFF	09/24/2014	PE	IRR	2.2	157

Water use from the Spring Creek: McPherson is principally for irrigation. A summary of the reported pumping from the aquifer for irrigation is shown in Table 2.

Table 2. Water use reported for irrigation from the Spring Creek: McPherson aquifer (Water Rights, 1980-2016)

YEAR	NO. PMTS	APPROPRIATION (Acre-feet)	PUMPED (Acre-feet)
2015	8	5567	1357.74
2014	7	5253	811.36
2013	7	5253	1768.36
2012	6	4981	1388.51
2011	4	4133	890.36
2010	4	4133	1004.81
2009	4	4133	606.04
2008	4	4133	1351.83
2007	4	4133	1545.84
2006	5	4739	2770.28
2005	5	4739	1415.5
2004	5	4739	1224.48
2003	5	4739	1904.35
2002	5	4739	2095.91
2001	4	2859	611.4
2000	4	2859	560.3
1999	4	2859	340.49
1998	4	2859	442.37
1997	4	2859	285
1996	4	2859	317
1995	4	2619	120.64
1994	4	2619	317.19
1993	4	2859	21
1992	4	2859	374.8
1991	4	2859	456.1
1990	4	2859	715
1989	4	2859	838
1988	4	2859	1075.2
1987	3	2379	350
1986	3	2379	198
1985	4	2699	410
1984	5	2819	388
1983	3	2379	256.15
1982	3	2379	211.58
1981	6	3779	308
1980	5	3456	566
Minimum	*3*	*2379*	*21*
Maximum	*8*	*5567*	*2770.28*
Average	*4.47*	*3534.14*	*813.82*

Withdrawals from the Spring Creek: McPherson aquifer are expected to be considerably less than the average annual recharge to the aquifer, and there is a reasonable probability that unappropriated water is available from the aquifer for this proposed appropriation.

Observation Well Data:
Administrative Rule of South Dakota Section 74:02:05:07 requires that the Water Management Board shall 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."

The DENR-Water Rights Program monitors five observation wells completed into the Spring Creek: McPherson aquifer. Hydrographs for the observation wells are shown in Figures 1-6.

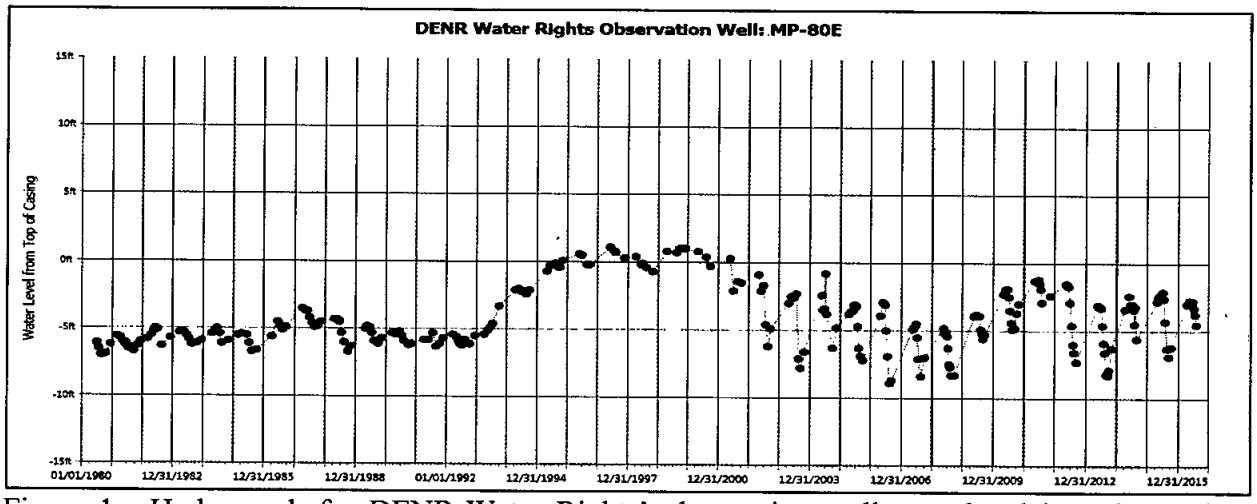

Figure 1. Hydrograph for DENR-Water Rights' observation well completed into the Spring Creek McPherson aquifer within one-half mile (east) of the wells that are to supply this water permit.

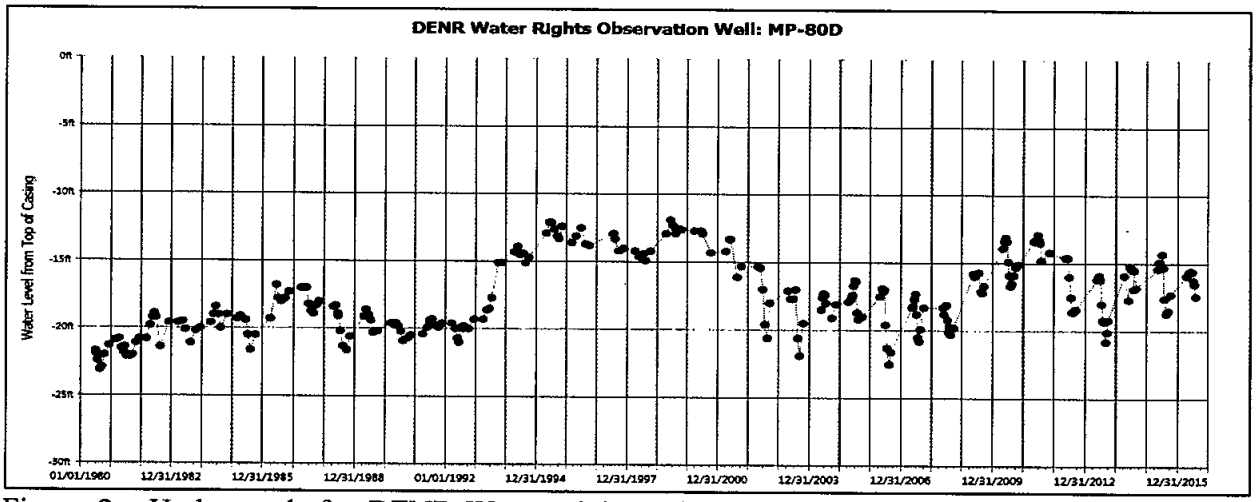

Figure 2. Hydrograph for DENR-Water Rights' observation well completed into the Spring Creek McPherson aquifer approximately one mile west of the wells that are to supply this water permit.

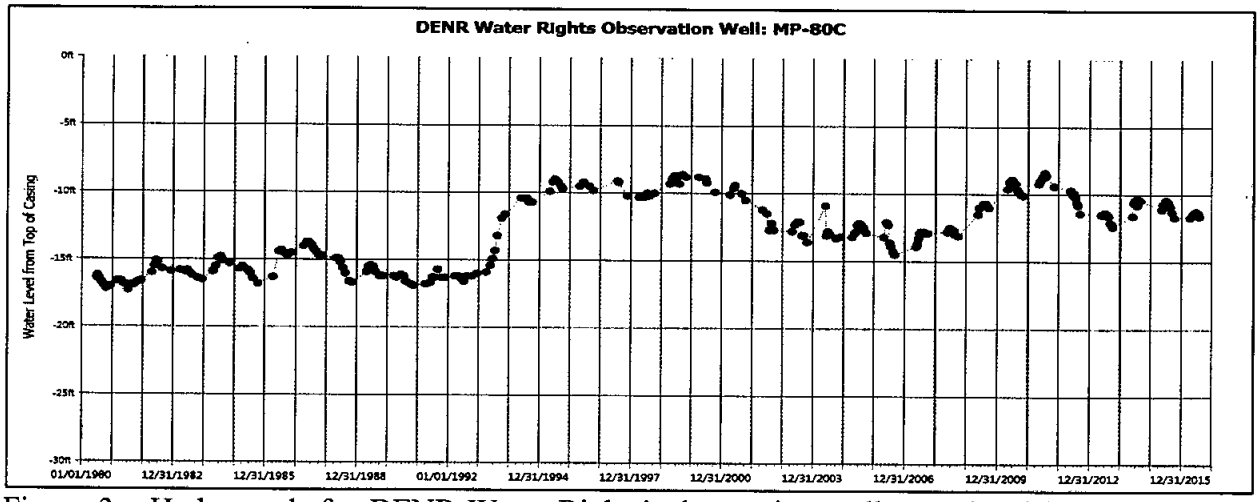

Figure 3. Hydrograph for DENR-Water Rights' observation well completed into the Spring Creek McPherson aquifer approximately three and one-half miles west of the wells that are to supply this water permit.

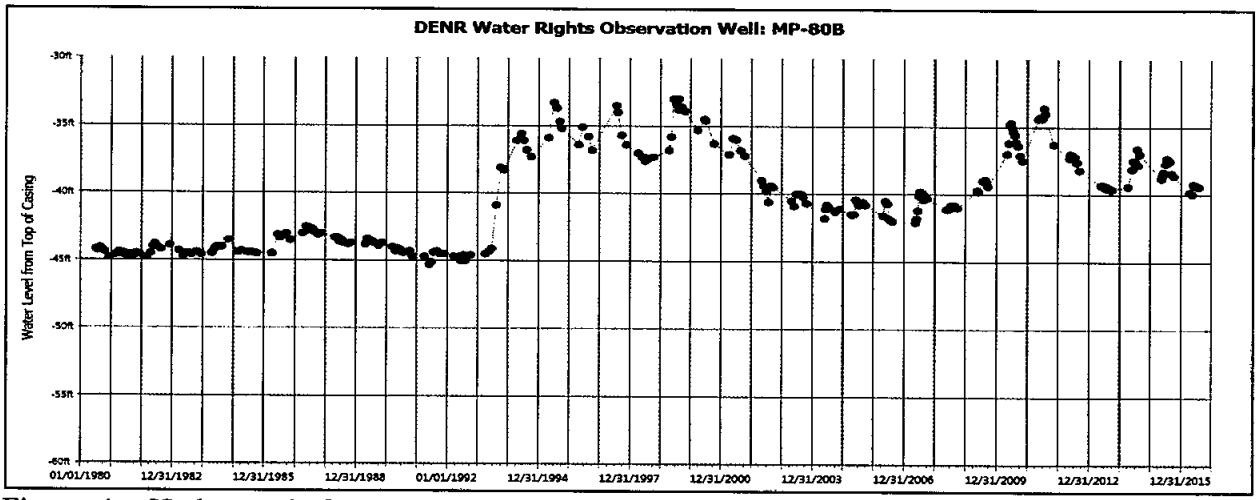

Figure 4. Hydrograph for DENR-Water Rights' observation well completed into the Spring Creek McPherson aquifer approximately six and one-half miles west-northwest of the wells that are to supply this water permit.

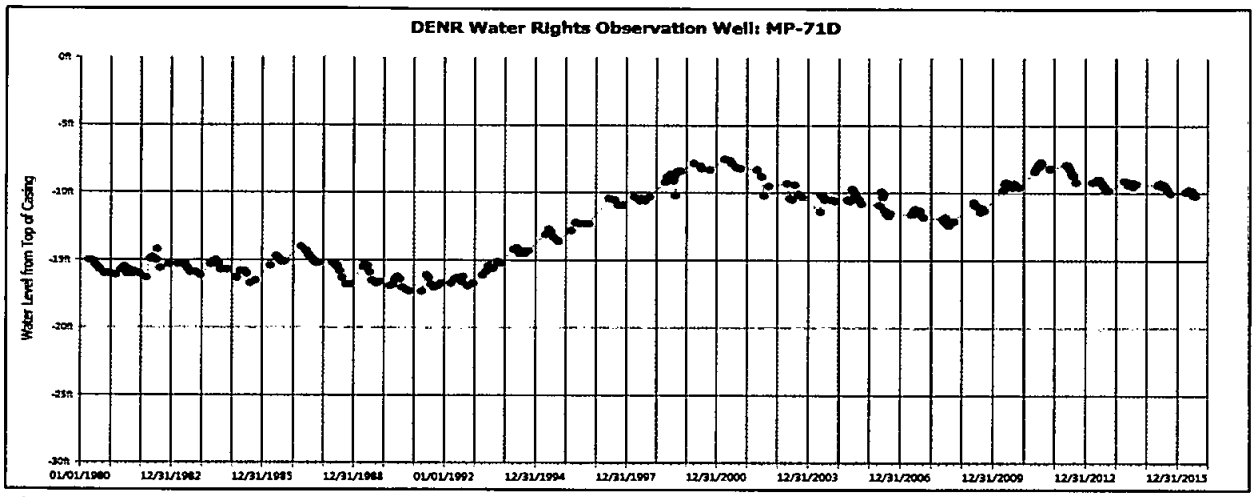

Figure 5. Hydrograph for DENR-Water Rights' observation well completed into the Spring Creek McPherson aquifer approximately 10 and one-half miles northeast of the wells that are to supply this water permit.

In general, the hydrographs show upward trending water levels over the period of record. The hydrographs document that the aquifer responds well to climatic conditions with rising water levels during wet years and declining water levels during dry years. The data documents that at the current level of development temporal well withdrawal is masked by climatic conditions. Therefore, recharge to and natural discharge from the aquifer greatly exceeds well withdrawal, so water is available for capture before natural discharge. Therefore, unappropriated water is available from the Spring Creek: McPherson aquifer to support the proposed appropriation.

EXISTING WATER RIGHTS:

As stated earlier, this application proposes a permit to authorize an existing irrigation project. Evidence suggests that the project has actually been operating under what would be the constraints of Water Permit No. 8232-3, if it is approved. Observation well data in the immediate vicinity of this irrigation project (see Figure 1.) has recorded seasonal fluctuations of 4-6 feet since 2001 as compared to seasonal fluctuations of one foot or less before 2001(Water Rights, 2016a). It appears that the artesian pressure in the area has experienced an additional 3-5 feet of drawdown in this area as a result of the alterations to this irrigation project that this application proposes to authorize. Considering the greater than 70 feet of artesian head pressure in this area, 3-5 feet of additional fluctuation should not be considered significant.

Considering that SDCL 46-6-6.1 does not protect artesian head pressure as a means of delivery and the Water Management Board has consistently recognized that to place water to maximum beneficial use a certain amount of drawdown may occur, a nearby adequate well defined by ARSD 74:02:20(7), which states that the pump intake must be set 20 feet below the top of the aquifer or, if the aquifer is less than 20 feet thick, as near to the bottom of the aquifer as is practical, is not expected to be adversely or unlawfully impaired. Therefore, there is a reasonable probability that any well interference from the proposed appropriation will not cause a significant impact and will also not adversely or unlawfully impair existing users.

SDCL 46-5-6

Pursuant to SDCL 46-5-6, the diversion rate for an irrigation appropriation cannot be in excess of one cfs for every 70 acres, or "the equivalent thereof." The statute does provide that the Water Management Board may allow a greater diversion rate if the method of irrigation so requires. Water Permit Application No. 8232-3 indicates "This application also requests authorization of the total diversion rate of more than 1 cfs per 70 acres due to the need to efficiently operate the four center pivot irrigation systems."

CONCLUSIONS:

1. Water Permit Application No. 8232-3 proposes a water permit that will allow an existing irrigation project to maintain status quo.
2. Water Permit Application No 8232-2 proposes to increase the diversion rate authority, add a diversion point, change the location of the acreage authorized for irrigation and clarify the location of the diversion points for an existing irrigation project.
3. Approval of Water Permit No. 8232-3 will not increase the annual appropriation from the Spring Creek: McPherson aquifer.
4. The diversion proposed by this application will not adversely impair existing wells.

Ken Buhler
SD DENR-Water Rights Program

REFERENCES:

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Water Rights, 1980-2016b, Irrigation Questionnaire for Water Right No. 3656-3 for the years 1979-2015: SD DENR-Water Rights Program, Joe Foss Building, Pierre, SD

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Water Rights, 2016b, Water Right/Permit Files, SD DENR-Water Rights Program, Joe Foss Bldg, Pierre, SD.

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