LOWER LOUP
NATURAL RESOURCES DISTRICT

2019

LOWER PLATTE RIVER BASIN COALITION ANNUAL REPORT

DATE:

February 26, 2019

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2019 ANNUAL DOCUMENTATION IN THE LOWER LOUP NRD

REQUIREMENT OF LOWER PLATTE BASIN COALITION (LPBC)
BASINWIDE WATER MANAGEMENT PLAN

CERTIFIED IRRIGATED ACRES

The Lower Loup Natural Resources District (LLNRD or District) began the process of irrigated acres certification in 2006 and it was completed January 1, 2008. The District required that both Groundwater and surface water irrigated acres be certified through its process. The acres to be certified must be capable of receiving groundwater or surface water through irrigation works, mechanisms or facilities at the time. The certification must include a completed District certification form, an assessor document with a raised seal, and FSA aerial photo with irrigated fields delineated. A District GIS shapefile of the field boundary was created using ArcGIS to allow accounting and compliance reviews.

Subsequent to January 1, 2008, to certify a property as being irrigated, a landowner must show proof of irrigation at least 2 out of the 10 years for the period from 1997 – January 1, 2008. Documentation considered for the process of certification includes, but is not limited to: FSA historical photos and 578 forms depicting certified irrigated boundaries, county assessed records, and conservation easement agreements with programs such as CRP. Certification is constantly tracked through GIS, and field boundary adjustments take place as needed. Additionally, the entire District is flown for active chlorophyll measurements recorded through infrared photography and field boundaries, and irrigation totals are measured and policed to prevent deviation from the original certification by NRD staff. This 4-band imagery is collected in late August into early September to ensure crop maturity and further differentiate between those areas impacted by irrigation and those without.

Detailed data regarding amount and water source of certified irrigated acres in the period between January 1, 2018, and December 31, 2018, can be found in **TABLE 1. Certified Acres** below. The LLNRD Geographic Information System (GIS) has been synched with its data management system to allow for more accurate drawings and better database access through the District program. This process assists with identification of duplicates and erroneously drawn fields and allows staff to “clean” the database.

Table 1. Certified Acres 2018

Year	Total Acres Certified	Acres of Groundwater	Acres of Surface Water	Acres of Co-Mingled
2018	1,220,592.42	1,018,792.98	153,789.92	48,009.51

MUNICIPAL AND INDUSTRIAL GROUNDWATER USE

The LLNRD is in the third year of collecting municipal water use data. Developing and maintaining a comprehensive inventory of the location and source of the District's current and future water supplies, water uses, and outflows was Objective 1.1 of the Integrated Management Plan developed by the NRD and the Nebraska Department of Natural Resources. To collect this data, a Municipal Accounting Form was developed and sent to the water operators of each community.

As of 2/22/19, 42 out of 43 public water supplies have sent in their water accounting information for 2018. Each year, the NRD calculates the daily use/per person. This year due to the increased rainfall, overall use was down slightly to 225 gallons, per person per day, being used, compared to 259 gallons in 2017.

The LLNRD is continuing its work from 2018 on updating our Groundwater Management Area Rules and Regulations to include industrial and municipal use and accounting. Collecting this data has been voluntary up to this point. Currently, the LLNRD is not fully appropriated, so rules will not necessarily follow current statutes found in LB 962.

TABLE 2: **MUNICIPAL WATER USE IN THE LLNRD IN 2018.**

City Name	2018 Water Pumped	Population	Gal/per capita/per day	Connections	Metered
Albion, City of	106,070,000	1,650	176.1	896	Yes
Anselmo, Village of	23,659,300	159	407.7	100	Yes
Ansley, Village of	41,406,470	441	257.2	260	Yes
Arcadia, Village of	30,068,800	311	264.9	200	No
Arnold, Village of	52,600,000	597	241.4	395	Yes
Ashton, Village of	11,367,000	194	160.5	140	Yes
Bartlett, Village of	15,348,000	124	339.1	70	No
Belgrade, Village of	16,903,500	150	308.7	77	No
Boelus, Village of	11,284,000	189	163.6	96	Yes
Broken Bow, City of	342,924,000	3,600	261.0	1,700	Yes
Burwell, City of	54,498,000	1,210	123.4	615	Yes
Cairo, Village of	59,665,000	790	206.9	335	Yes
Callaway, Village of	60,733,251	537	309.9	350	Yes
Cedar Rapids, Village of	28,171,000	382	202.0	265	Yes
Columbus, City of	1,868,192,443	22,797	224.5	8,943	Yes
Comstock, Village of			#DIV/0!		
Dannebrog, Village of	16,552,000	325	139.5	142	Yes
Duncan, Village of	20,489,000	359	156.4	171	Yes
Elba, Village of	10,423,700	215	132.8	125	Yes

TABLE 2: **MUNICIPAL WATER USE IN THE LLNRD IN 2018.**

City Name	2018 Water Pumped	Population	Gal/per capita/per day	Connections	Metered
Ericson, Village of	18,154,200	89	558.8	32	No
Farwell, Village of	13,825,000	120	315.6	60	Yes
Fullerton, City of	76,689,000	1,307	160.8	635	Yes
Genoa, City of	55,836,000	981	155.9	486	Yes
Greeley, Village of	35,821,000	431	227.7	235	Yes
Litchfield, Village of	18,549,300	262	194.0	150	Yes
Loup City, City of	52,410,000	1,029	139.5	560	Yes
Mason City, Village of	11,540,300	178	177.6	115	Yes
Merna, Village of	24,000,000	363	181.1	204	Yes
Monroe, Village of	17,109,500	284	165.1	146	Yes
North Loup, Village of *					
Ord, City of	374,252,000	2,409	425.6	1,334	Yes
Palmer, Village of	20,285,000	474	117.2	230	Yes
Petersburg, Village of	20,160,000	333	165.9	228	Yes
Pleasanton, Village of	20,634,000	341	165.8	186	Yes
Primrose, Village of	3,994,000	61	179.4	35	Yes
Ravenna, City of	122,888,000	1,300	259.0	625	Yes
Rockville, Village of	17,462,700	110	434.9	48	Yes
Sargent, City of	41,973,000	535	214.9	370	Yes
Scotia, Village of	18,131,974	320	155.2	150	Yes
Spalding, Village of	25,236,000	497	139.1	255	Yes
St. Edward, Village of	55,431,500	705	215.4	340	No
St. Paul, City of	120,567,900	2,300	143.6	1,022	Yes
Wolbach, Village of	64,260,000	287	613.4	188	No
Total	3,999,565,838	48,746	225	22,514	

*Water provided through City of Ord

-Population numbers were supplied by the municipality.

NEW GROUNDWATER CONSUMPTIVE USE – WELL CONSTRUCTION PERMITS GRANTED

The LLNRD established a well moratorium in 2007. Before this date, all high-capacity wells (greater than 50 gallons per minute) were required to be permitted via a certified well permit issued by the LLNRD as dictated by the Groundwater Management Plan. New well permits are still required for all high-capacity wells and may still

be issued for supplemental and replacement wells that are for non-irrigation uses. Any new high-capacity irrigation well must be previously approved through the variance process (see "Variance" portion of this report). LLNRD approved 66 well permits in 2018 for varied uses as reported in the table below.

***TABLE 3:* APPROVED GROUNDWATER WELL PERMITS IN THE LLNRD IN 2018.**

Groundwater Well Permit Types	Number of Permits	Average Pump Capacity (gpm)
Aquaculture	**1**	800.00
Dewatering	**6**	700.00
Irrigation (Total)	**54**	**818.50**
(Irrigation) Transfer	*10*	900.00
(Irrigation) Supplemental	*8*	806.25
(Irrigation) Variance	*2*	800.00
(Irrigation) New Acres	*9*	627.80
(Irrigation) Replacement	*25*	860.00
Livestock	**5**	100.00
TOTAL	**66**	**712.51**

APPROVED WATER TRANSFERS

The LLNRD Rules and Regulations allows any person to transfer groundwater irrigation rights from one location to another if the acres are certified by the District. Transfers can only occur downstream or to the adjacent section and cannot have a net increase impact on any stream based on the most recent stream depletion factor from the best groundwater model available. Acre transfers are only allowed to occur once per year. The deadline for application for transfer is March 1 of each year. In 2018, the LLNRD approved 48 ***Agreements to Transfer Certified Irrigated Acres & Right to Use Groundwater***. There were no denials to any transfer requests. See the summary in Table 4 below. Transfer agreements are classified both by landowners who are moving their irrigated acre rights (off) and those that are receiving the rights in another location (in).

***TABLE 4:* APPROVED CERTIFIED IRRIGATED ACRES TRANSFERS IN THE LLNRD IN 2018.**

County	# of Agreements Receiving Land owners	# of Agreements Transferring Land owners	Acres Transferred in	# New wells resulting from Transfer	Acres Transferred off	Avg Transferred In SDF	Avg Transferred Off SDF
Boone	17	15	649.45	5	478.55	.58	.65
Buffalo	2	2	23.80	0	25.20	.67	.64
Custer	4	4	74.24	1	81.54	.50	.52
Garfield	2	5	54.90	2	177.41	.44	.37
Greeley	8	4	154.96	3	47.80	.29	.34
Hall	0	1	N/A	0	10.00	N/A	.39
Howard	3	2	28.70	0	22.20	.45	.35
Nance	5	1	223.60	2	95.00	.70	.85
Platte	3	0	127.00	1	N/A	.45	N/A
Sherman	2	1	51.50	0	18.0	.46	.69
Valley	0	1	N/A	0	35.0	N/A	.44
Wheeler	2	12	42.50	0	456.61	.43	.68
Total	**48**	**48**	**1,430.65**	**14**	**1447.31**	**.51**	**.57**

WATER BANKING

The LLNRD requires that all transfers result in no new net increase in depletions to any stream utilizing the most current stream depletion number extracted from each section. The section number is averaged from the best available groundwater/surface water model for use by LLNRD. The 2018 section-assigned stream depletion factor (SDF) was utilized using the USGS Elkhorn-Loup Model (ELM) in its Phase 3 capacity. Any transferring of irrigated acre rights from a low to a higher SDF requires an acre offset. Acres transferred from a higher SDF to a lower SDF are only allowed at a 1:1 ratio, with the LLNRD banking the remaining difference. As a result of the 2018 transfers, the LLNRD has banked a total of **346.35** groundwater-irrigated acres. Additional information regarding the ELM project can be found here:

https://pubs.er.usgs.gov/publication/sir20185106

EXPEDITED VARIANCES

The LLNRD Board of Directors has designated a set of conditions under which specific requests for a variance may be approved by methods other than the Variance Committee process. An expedited variance is a variance that meets LLNRD Board pre-approved conditions and, as such, does not need to be reviewed by the NRD Variance Committee. These expedited variances all have a Supplemental Well Agreement. There were no denials to any expedited variance requests. In 2018, there were a total of 7 expedited variances (Table 5) that were approved through NRD process.

***TABLE 5:* APPROVED EXPEDITED VARIANCES IN 2018 IN THE LLNRD.**

County	# of Supplemental Well Agreements	Permit Approved	Agreement Approved, but waiting on a Permit
Buffalo	1	1	0
Custer	2	2	0
Greeley	2	2	0
Howard	1	1	0
Valley	1	0	1
Total	**7**	**6**	**1**

NRD MANAGEMENT: WELL AGREEMENTS

In 2018, there was 1 well agreement that was approved. This well agreement was granted based on the stipulation that the landowner relinquish all or part of the existing surface water right(s) held through the Department of Natural Resources process. There were no denials to any variances with a well agreement request.

***TABLE 6:* APPROVED WELL AGREEMENTS IN THE LLNRD IN 2018.**

County	# of Well Agreements	SW Agreed upon to be Relinquished	Permit Approved	SW Right Relinquishment Date
Greeley	1	A-10641R, A-10641 REDUCED TO 36AC	0	10/2/2018
Total	**1**	**2**	**1**	

NRD MANAGEMENT: ACRE ROTATIONS

Acre rotations are agreements set forth by a participating landowner and the LLNRD, which allows a landowner options to choose how they distribute certified acres over a tract of land. In 2018, there were two separate acre

rotations that were approved by the LLNRD. These 2 Acre Rotation Agreements have 2 or 3 options the landowner can choose in one calendar year. After an option is selected, the landowner notifies the LLNRD in writing prior to May 1st of that calendar year, before any irrigation is authorized. There were no denials to any acre rotation requests. Enforcement is conducted by the LLNRD through annual infrared imagery and field personnel visitation.

***TABLE 7:* APPROVED ACRE ROTATIONS IN THE LLNRD IN 2018.**

County	# of Acre Rotation Agreements Approved
Buffalo	2
Total	**2**

FLOWMETER DATA

The LLNRD has collected ground and surface water use information for irrigation on an annual basis since 2010. Flowmeters have been cost-shared across the District on a voluntary basis since 2009. However, the LLNRD required that all high-capacity irrigation wells in Groundwater Management Area 28 (see Figure 1, inset) be outfitted with a flowmeter to track irrigation total withdrawals starting in 2016.

In 2018, LLNRD technicians recorded flowmeter data at 911 sites with 871 verified readings on irrigation systems with an average irrigation total of 4.91 inches, down from 9.3 inches in 2017. This was largely due to widespread and timely rains across the District. The potato crop followed by a cereal rye cover was the highest consumer of irrigation water with an average of 11.19 inches/acre pumped in 2018. Valley County recorded the least average irrigation at 1.42 inches/acre pumped, and Rock County had the highest irrigation rates at 7.06 inches/acre applied mostly to corn and soybean crops.

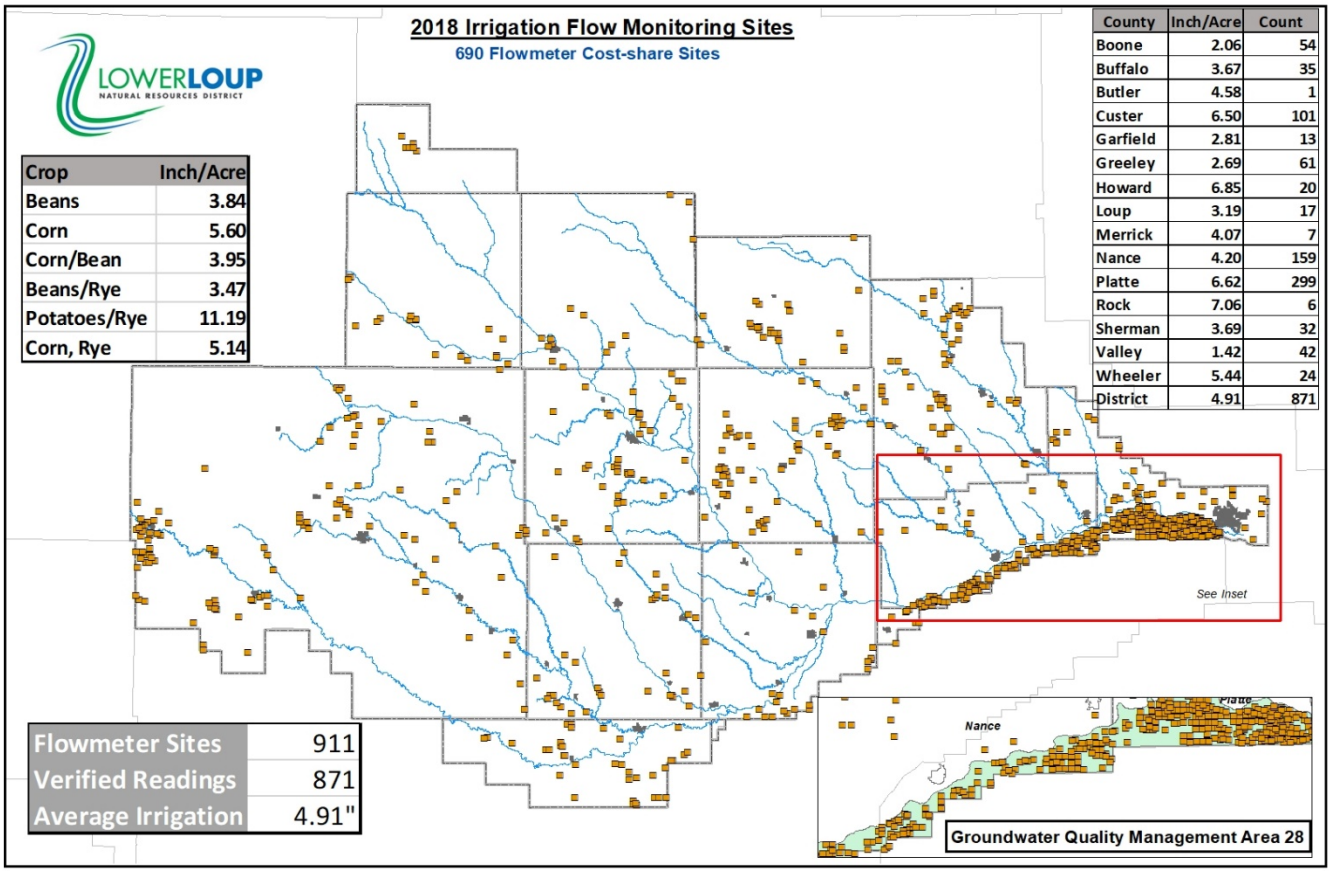

FIGURE 1: IRRIGATION MEASURING AND REPORTING SITES IN THE LLNRD IN 2018

GROUNDWATER ACRES ALLOCATIONS

The LLNRD has the option to issue additional groundwater acres allocations each year based on the conditions of water resources in the District. New acres applications are accepted from September 1-20 when the Board authorizes additional development. Applications for new irrigation are ranked using District approved criteria. The criteria include Stream Depletion Factor, the status of nearby groundwater and surface water resources, the size of applications being applied for, and soil classification.

In 2018, new acres applications were accepted in the North Loup River, Beaver Creek, and Middle Loup Sub-Basins for a total of 2,626.42 new irrigated acres and have been approved by the LLNRD Board of Directors. The North Loup and Beaver Creek basins continued to show upward or stable trends in both surface and groundwater resources (static water levels and stream gages). The Middle Loup River Basin, while showing upward trends in the stream gages, has had downward static water levels measured south of the river. A map representing the three basin areas for allowable certified irrigated acres in 2018 is included in Figure 2.

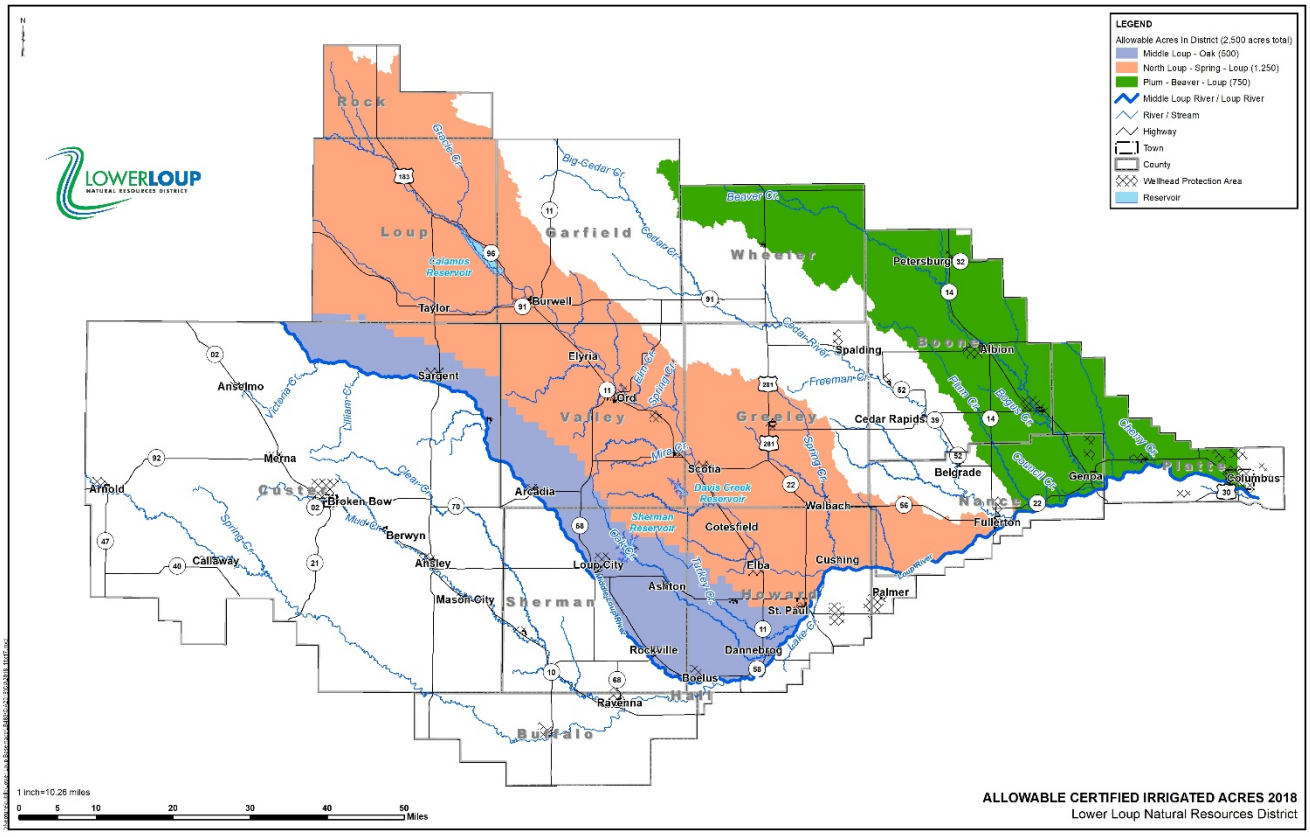

FIGURE 2: MAP OF ALLOWABLE CERTIFIED IRRIGATED ACRES IN THE LLNRD IN 2018.

There were 67 applications for new irrigation: 23 in the North Loup River Basin, 25 in the Beaver Creek Basin, and 19 in the Middle Loup River Basin. The total number of acres requested in all three basins was 4,102.19. The average application size requested was 61.67 acres and the average application ranking was 272 points, ranked by the LLNRD process.

At their meeting on October 25, 2018, the LLNRD Board of Directors unanimously approved all applications that ranked 225 points or greater. This meant approval of 23 new irrigated acres applications in the North Loup River Basin, 11 applications in the Beaver Creek Basin, and 9 applications in the Middle Loup River Basin. There were 1,317.92 new acres approved in the North Loup, 767.80 in Beaver Creek, and 540.70 in the Middle Loup River Basin.

***TABLE 8:* NEW GROUNDWATER-IRRIGATED ACRES APPROVED IN THE LLNRD IN 2018.**

Basin	Number of Acres Approved	Pending Wells	Average SDF
Beaver	767.80	7	57%
North Loup	1,317.92	7	38%
Middle Loup	540.70	18	53%
Total	2,626.42	**32**	**49%**

NEW GROUNDWATER ACRES ALLOCATIONS DEPLETION IMPACT

As part of the agreement to the Coalition planning effort, the associated Districts developed new depletion limits for the basin to evaluate basin water supplies moving forward. The Lower Platte Basin Coalition approved a methodology for determining the impact of individual allocations, as well as accounting for the total amount of acre-feet (AF) impact moving forward. For agricultural uses, allowable number of irrigated acres in the hydrologically connected area can be determined by multiplying the number of acres, times the net irrigation requirement in feet, times the SDF as a decimal, times 30% depletions occurring during peak season. The Lower Loup NRD, being primarily encompassed by the Loup Basin, has agreed to 5,883 AF of allowable development over a five-year period.

After applying the agreed-upon methodology to the 2018 allowed irrigated acres, the AF impact was 277.54 AF of agriculture depletions. Table 9 represents a breakdown of the numbers associated with the 43 applications.

***TABLE 9:* NEW GROUNDWATER IRRIGATED ACRES DEPLETIONS CALCULATED FROM THE 2018 ALLOCATION**

Application	Legal	Basin	Acres	ELM3 SDF	NIR (ft)	Depletion (Acre-Ft)
ANDBR1	NW 10 19N 05W	Plum - Beaver - Loup	70.04	83.11	0.60	10.55
ANDPA1	NE 09 16N 08W	North - Spring - Loup	95.66	24.23	0.72	5.00
BAKCO1	NW 11 15N 13W	Middle - Oak	103.04	16.29	0.70	3.53
BERTY1	SW 18 19N 10W	North - Spring - Loup	67.92	31.33	0.78	4.96
BODJI1	SW 28 21N 14W	North - Spring - Loup	22.63	42.97	0.79	2.32
BONRI1	NW 11 18N 15W	North - Spring - Loup	3.05	25.44	0.79	0.18
BRORE1	SW 24 20N 17W	North - Spring - Loup	118.07	60.76	0.82	17.68
BRURO1	NE 17 19N 16W	North - Spring - Loup	13.63	47.89	0.83	1.62
ELMCD1	NE 18 17N 03W	Plum - Beaver - Loup	116.20	93.61	0.80	26.05
FARED1	SW 28 15N 10W	North - Spring - Loup	89.45	72.62	0.82	15.93
GORMA1	SE 34 17N 13W	North - Spring - Loup	104.67	18.65	0.73	4.25
HANCL1	NE 35 20N 19W	Middle - Oak	68.51	76.82	0.84	13.20

HANCO1	SE 11 19N 12W	North - Spring - Loup	95.08	36.17	0.92	9.47
HOSRI1	SE 24 18N 16W	Middle - Oak	24.91	34.07	0.77	1.97
JEFLI1	SW 15 21N 15W	North - Spring - Loup	36.72	54.42	0.84	5.02
KETPA1	NE 12 21N 06W	Plum - Beaver - Loup	13.53	20.68	0.59	0.50
KNAJA1	NW 35 21N 18W	North - Spring - Loup	88.60	84.49	0.83	18.71
KOZMI1	SE 35 20N 18W	Middle - Oak	17.00	71.28	0.83	3.02
KUSJA1	NE 16 14N 13W	Middle - Oak	24.90	48.91	0.70	2.55
LANRO1	NE 06 17N 14W	North - Spring - Loup	10.24	18.33	0.77	0.43
LASKE1	NW 33 18N 06W	Plum - Beaver - Loup	87.45	43.55	0.65	7.45
LINJO1	SW 20 21N 06W	Plum - Beaver - Loup	62.97	52.52	0.60	5.94
MAGRI1	NE 12 17N 11W	North - Spring - Loup	135.00	12.31	0.72	3.61
MRKTR1	SW 11 14N 12W	Middle - Oak	61.35	26.76	0.69	3.39
NITTO1	SE 01 13N 13W	Middle - Oak	122.00	59.02	0.69	14.85
NOBDA1	SE 28 21N 08W	Plum - Beaver - Loup	128.80	46.35	0.69	12.27
PENRI1	NE 13 17N 05W	Plum - Beaver - Loup	7.61	72.85	0.65	1.07
SCOMA1	SE 36 19N 07W	Plum - Beaver - Loup	13.42	43.17	0.62	1.08
SHEDE1	NW 23 18N 11W	North - Spring - Loup	68.97	15.46	0.73	2.34
SMYDA1	SE 09 14N 12W	Middle - Oak	99.51	28.74	0.70	6.04
SPRDA1	NW 03 17N 03W	Plum - Beaver - Loup	158.30	82.54	0.76	29.89
STARO1	NE 23 19N 12W	North - Spring - Loup	61.53	35.20	0.78	5.06
STJHS1	SW 36 18N 11W	North - Spring - Loup	15.17	11.99	0.75	0.41
STOMA2	NE 23 19N 04W	Plum - Beaver - Loup	33.03	25.81	0.62	1.60
STORA1	SE 19 18N 05W	Plum - Beaver - Loup	76.50	44.42	0.63	6.41
TIMJE1	SW 25 19N 12W	North - Spring - Loup	20.52	35.27	0.77	1.68
TIMJE2	SE 26 19N 12W	North - Spring - Loup	5.99	35.27	0.77	0.49
WEBJA1	SW 07 21N 16W	North - Spring - Loup	48.01	88.56	0.88	11.16
WIEKA1	NW 16 17N 13W	North - Spring - Loup	33.01	29.01	0.75	2.17
WIEKA2	NE 17 17N 13W	North - Spring - Loup	36.01	23.79	0.75	1.94
WOIKE1	NW 31 14N 12W	Middle - Oak	24.90	47.95	0.69	2.46
WOORI1	NW 07 19N 10W	North - Spring - Loup	41.58	36.33	0.77	3.49
WROIR1	NW 27 16N 12W	North - Spring - Loup	106.63	25.88	0.70	5.80
		Total Acres	**2,632.16**		**Total Depletions**	**277.54**

DEPLETION ACCOUNTING

As mentioned in “Approved Water Transfers”, LLNRD Rules and Regulations allow any person to transfer irrigation rights from one location to another if they meet the criteria set forth by the District. Because of the established criteria of not allowing any new net increase in depletions to any stream, the net amount of acre-feet impact should be either relatively similar by a transfer or actually decreased due to any transferring of irrigated acre rights from a low to a higher SDF, requiring an offset in acres. Transferred from a higher SDF to a lower SDF are only allowed at a 1:1 ratio. The same agricultural methodologies used to apply towards

groundwater acre application was applied to transfers. Both the transferring location, where the acres were removed, and the newly developed acres where the right was transferred to, were assessed. Table 10 represents the net effect of these transfers in acre-inches for the year 2018.

From the 2018 transfers, the sum impact of the transferred depletions removed was 207.99 AF, while the impact of the receiving acres with new development was 146.52 AF. The difference and beneficial impact was 61.47 AF back to the basin as a positive gain.

Due to LLNRD rules and regulations on transferring irrigated acres, an overall beneficial gain to the Loup Basin in three years of transfers totals 177.52 AF, according to LPBC methodology. This is sufficient proof that LLNRD has taken the correct course for allowing transfers, and the water banking process is working. The LLNRD will continue to reassess the banking process to find ways to improve the efficiency and streamline reporting through both the IMP and Coalition requirements.

***TABLE 10:* SUMMARY OF ALLOWABLE DEPLETION IMPACT**

Lower Loup Natural Resources District	
Project	**5,883 AF**
2016 New Irrigated Acres	204.52
2016 Transfers	-54.22
2017 New Irrigated Acres	164.65
2017 Transfers	-61.83
2018 New Irrigated Acres	277.54
2018 Transfers	-61.47
2019 New Allowable Depletion	**5,413.81 AF**

GROUNDWATER ELEVATION DATA

One of the LLNRD's primary responsibilities since its inception in 1972 has been collecting groundwater elevation data. Each year, District personnel measure groundwater elevations in both the spring and fall to compare against historical levels. Spring levels are used to report on the status of groundwater, whether increasing or decreasing, and to determine if potential changes are needed in the District. Changes can include recommendations against issuing additional irrigated acres or for developing a flowmeter requirement with a potential allocation system. Recommendations also include either allowing or denying transfers into a particular area. Fall levels are used as an indicator of stress that has been placed on the aquifer during the irrigation season. The District has also employed the use of pressure transducers to get continual monitoring at various locations through the NRD. To date, the LLNRD has 61 active transducers across the District recording water levels every 8 hours. Additionally, the District implemented a real-time transducer network in the Columbus vicinity as part of the recharge project. Dedicated monitoring wells contain telemetry equipment that collects an hourly reading on 3 monitoring well sites, as well as an artificial lake in the area that will be used as part of the recharge basin.

In 2018, the LLNRD staff collected groundwater level depths on 427 sites which includes both dedicated monitoring and irrigation wells. The District average increased from 2017 readings by 0.50 feet. The

District average still maintains a level well above the 1982 levels by 3.28 feet. The 1982 level is used by the Lower Loup NRD's Groundwater Management Plan as the keystone level to implement additional management action.

NEW DATA COLLECTED OR MODEL/STUDY RESULTS

The LLNRD implemented a plan in the Columbus, Nebraska, vicinity to assess available water, develop a localized water budget, identify recharge projects, examine hydrogeology, and develop a groundwater model. This project, named Columbus Area Water Resources Assessment (CAWRA) was completed in late 2016 with a recommendation to utilize flows out of the Loup Public Power Canal to offset groundwater depletions occurring due to municipal and industrial pumping. The model was 2 townships in size located around Columbus, consisted of a 100-meter by 100-meter grid, and had a calibration period of January, 1999, through December, 2013.

The LLNRD partnered with the USGS and Upper Loup NRD to assess groundwater and surface water interactions along portions of the Loup River System through the use of thermal imagery. Approximately 320 river miles were flown and recorded using thermal imaging to determine the presence or absence of groundwater inflows. This imagery identified temperature anomalies and were compared against ground-truth sites using ground-based methods including streamflow, water temperature and potentiomanometer measurements.

Ravenna State Lake was identified in the Quantity portion of the South Loup Watershed Management Plan as a potential structure that could be utilized for retiming water back into the South Loup River. The LLNRD setup a 2-part study analyzing water quality in Ravenna State Lake, as well as assessing area groundwater declines and using the lake to offset and retime water to address those declines. A localized water budget was developed for a 110 square mile area around Ravenna State Lake, and a hydrogeologic assessment was conducted to determine the viability of using such a retiming methodology. The end conclusion was that the direct contact of the lake to surface water flows and the limited recharge capacity would not allow for sufficient benefit to implement the recharge work. Quality analysis is ongoing for the 2019 sampling season.

In an effort to track not only municipal use, but also commercial and industrial, the LLNRD applied for a Nebraska Environmental Trust Grant to fund the installation of approved flowmeters. The NRD plans to administer a cost-share program for meters that would then be used to collect data to further refine the water budget within the District. On February 20th, the Environmental Trust notified the NRD of a successful grant application. The NRD will now have funds available for the next three years to cost-share on meters for municipal, commercial, industrial, as well as irrigation systems.

NON-ACTION/REPORTING ITEMS

The Coalition members are responsible for reporting on a number of items that are currently not included as part of the LLNRD day-to-day operations. These Items include:

- Retirement of Groundwater Consumptive Uses
    - Some retirement of groundwater irrigation takes place due to the transfer process. See the section "Transfers" above.

  - The LLNRD does not have a need for wide scale retirement of groundwater consumptive use.
- Stream Flow Accretion activities
  - Transfers allowed by the NRD do not have a negative net impact on the stream and theoretically result in neutral or positive effects on streamflow, see “TRANSFERS” above.
  - Under “NRD MANAGEMENT: WELL AGREEMENTS” the LLNRD is taking proactive measures to reduce surface water allocations, switching those primary sources to groundwater which would result in an immediate reduction to streamflow impacts and likely cause accretion to flows in the impacted stream.
- Stream gage measurements on NRD maintained gages
  - LLNRD has no stream gages under its operational jurisdiction at this time; however, the LLNRD is a partner with both the NeDNR and USGS in the operations of various streams across the Loup Basin.