LOWER LOUP
NATURAL RESOURCES DISTRICT

2022

LOWER PLATTE RIVER BASIN COALITION ANNUAL REPORT

March 1, 2023

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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, surface and comingled water irrigated acres be certified through its processes. The acres to be certified must be capable of receiving groundwater and/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 Geographic Information System (GIS) dataset of the field boundary was created using GIS software 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. Certification is constantly tracked through GIS, and field boundary adjustments take place as needed. Additionally, the entire District is flown and imaged for active chlorophyll measurements recorded through infrared photography. Irrigation totals are measured and policed to prevent deviation from the original certification by NRD staff. The 4-band imagery is collected in August into early September to ensure crop maturity and further differentiate those areas impacted by irrigation.

Detailed data regarding amount and water source of certified irrigated acres in the period between January 1, 2018, and December 31, 2022, can be found in **TABLE 1. Certified Acres** below. The LLNRD 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 regularly "clean" the database.

***TABLE 1.* CERTIFIED ACRES 2018 THROUGH 2022**

Year	Total Acres Certified	Acres of Groundwater	Acres of Surface Water	Acres of Co-Mingled
2022	**1,230,788.6**	**1,032,302.9**	**155,013.9**	**43,471.8**
2021	1,226,619.1	1,028,003.6	154,568.29	44,047.21
2020	1,225,343.3	1,025,409.78	154,023.50	45,910.02
2019	1,222,623.19	1,021,728.46	153,680.81	47,213.92
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 seventh 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 2/22/2023, 39 out of 43 public water supplies have sent in their water accounting information for 2022. Each year, the NRD calculates the daily use per person. This year, due to less rain and drought conditions throughout much of the District, overall use was 260 gallons, per capita, per day.

To comply with the implementation of *Rule 15, Commercial or Industrial Use and Accounting* that was adopted into the LLNRD's Groundwater Management Area Rules & Regulations, 2022 usage information was sought from owners/operators that had registered commercial/industrial wells. This includes high-capacity livestock wells (pump 50 gallons per minute or more). The LLNRD is in its fourth year collecting this type of well use information. Commercial/industrial water use was collected but due to proprietary nature of this information it is not included in this report.

***TABLE 2:* 2022 WELL USAGE (IN GALLONS) FOR LLNRD COMMUNITIES**

City Name	Annual Water Pumped	Population	Gal/per capita/per day	Connections
City of Albion	148,421,567	1699	239.3	850
City of Broken Bow	158,781,925	3506	124.1	1600
City of Burwell	73,460,000	1087	185.2	602
City of Columbus	2,258,891,264	24028	257.6	9048
City of Fullerton	87,200,000	1244	192.1	635
City of Loup City	72,770,000	1053	189.3	560
City of Ord *	433,440,000	2113	562.0	1334
City of Ravenna	125,441,000	1441	238.5	625
City of Saint Edward	74,896,982	725	283.0	340
City of Saint Paul	141,726,000	2416	160.7	1019
City of Sargent	37,115,000	500	203.4	392
Village of Ansley	46,791,000	459	279.3	262
Village of Arcadia	32,784,700	283	317.4	200
Village of Arnold	115,009,000	592	532.3	388
Village of Ashton	28,152,000	198	389.5	140
Village of Bartlett	25,792,000	109	648.3	70
Village of Belgrade	13,931,100	103	370.6	82
Village of Boelus	10,933,000	181	165.5	108
Village of Cairo	91,353,995	822	304.5	325
Village of Callaway	110,102,682	563	535.8	353
Village of Cedar Rapids	38,570,000	382	276.6	265
Village of Comstock	18,550,000	68	747.4	61
Village of Dannebrog	11,374,273	273	114.2	154
Village of Duncan	21,897,000	392	153.0	171

Village of Elba	12,211,199	192	174.3	125
Village of Ericson	24,408,597	89	751.4	32
Village of Farwell	18,752,000	138	372.3	60
Village of Greeley Center	45,053,995	402	307.1	235
Village of Litchfield	19,442,900	220	242.1	160
Village of Mason City	19,134,300	151	347.2	115
Village of Monroe	24,688,000	296	228.5	139
Village of North Loup *	0	254	0.0	0
Village of Palmer	33,096,000	439	206.6	239
Village of Petersburg	32,976,000	332	272.1	220
Village of Pleasanton	31,600,000	361	239.8	188
Village of Primrose	6,737,000	55	335.6	43
Village of Rockville	4,150,400	89	127.8	48
Village of Scotia	34,695,300	301	315.8	150
Village of Wolbach	55,917,000	224	683.9	188

*City of Ord provides water for the Village of North Loup and Green America Biofuels Ethanol Plant

* Villages of Anselmo, Merna, Spalding and Genoa will be added to the report when information is available

-Population numbers were updated by the 2020 Census

***TABLE 3:* AVERAGE USAGE NUMBERS CALCULATED FOR ALL LLNRD COMMUNITIES**

Lower Loup Natural Resources District	
Year	**Gallons/per capita/per day**
2016	265.0
2017	260.1
2018	230.3
2019	211.8
2020	252.6
2021	263.5
2022	260.3
7 Year Average	**249.1**

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. Any new high-capacity irrigation well must be previously

approved through the variance process (see "Variance" portion of this report). LLNRD has approved 83 well permits in 2022 for varied uses as reported in the table below.

LLNRD affirms that any new water well or replacement well that is constructed after May 09, 2016, may be subject to additional restrictions as the Board of Directors deems reasonable and necessary in light of hydrologic conditions within the District.

***TABLE 4:* APPROVED GROUNDWATER WELL PERMITS IN THE LLNRD IN 2022**

Groundwater Well Permit Types	Number of Permits	Average Pump Capacity (gpm)
Domestic	1	0
Livestock	4	267.0
Commercial	2	0
Industrial	1	333.0
Other	2	
Irrigation (Total)	**73**	**824.04**
(Irrigation) Transfer	12	906.25
(Irrigation) Supplemental	8	807.15
(Irrigation) Well Agreement	3	725.00
(Irrigation) New Acre	19	850.00
(Irrigation) Replacement	31	831.82
Total	**83**	**601.15**

APPROVED WATER TRANSFERS

The LLNRD Rules and Regulations allow 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 2022, the LLNRD approved 75 ***Agreements to Transfer Certified Irrigated Acres & Right to Use Groundwater***. There were no denials to any transfer requests. See the summary in Table 5 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). Wells resulting from an approved transfer may not be reflected in the "Well Permit Granted" table under the current year.

***TABLE 5:* APPROVED CERTIFIED IRRIGATED ACRES TRANSFERS IN THE LLNRD IN 2022**

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	19	7	698.40	9	182.40	.57	.55
Buffalo	3	3	26.5	0	26.5	.39	.74
Custer	5	6	47.8	1	59.1	.15	.28
Garfield	9	13	127.92	0	172.92	.39	.61
Greeley	12	11	168.92	3	220.5	.36	.65
Howard	2	2	116.3	0	116.3	.71	.46
Merrick	2	2	47.2	0	47.2	.53	.54
Nance	2	0	21.0	0	0	.58	0
Platte	10	10	194.43	0	224.45	.69	.66

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
Valley	6	5	117.1	1	106.1	.28	.43
Wheeler	5	16	260.3	4	715.76	.45	.69
Total	**75**	**75**	**1,825.87**		**1,871.23**	**.47**	**.60**

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 2022 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 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 75 transfers that took place in 2022, the LLNRD has banked a total of **723.39** groundwater-irrigated acres. Additional information regarding the ELM project can be found here:

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

TABLE 6: **LLNRD TOTAL BANKED ACRES REPORTED DURING FIRST INCREMENT**

Lower Loup Natural Resources District	
Year	**Irrigated Acres**
2016 (34)	638.06
2017 (34)	223.92
2018 (48)	346.35
2019 (31)	133.97
2020 (22)	141.88
2021 (47)	1,294.7
2022 (75)	723.39
7 Year Total	**3,502.27**

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 2022, there were a total of 10 expedited variances (Table 7) that were approved through NRD processes. Supplemental wells have a requirement of historical use prior to 2006.

***TABLE 7:* APPROVED EXPEDITED VARIANCES IN 2022 IN THE LLNRD**

County	# of Supplemental Well Agreements	Permit Approved	Agreement Approved, but waiting on a Permit
Buffalo	1	1	0
Custer	2	1	1
Greeley	1	0	1
Merrick	1	1	0
Nance	3	1	2
Platte	2	2	0
Total	10	6	4

NRD MANAGEMENT: WELL AGREEMENTS

In 2022, there was 1 well agreement approved. This well agreement was granted based on the stipulation that the landowner relinquish all or part of the existing surface water right held through the Department of Natural Resources processes. There were no denials to any variances with a well agreement request.

***TABLE 8:* APPROVED WELL AGREEMENTS IN THE LLNRD IN 2022**

County	# of Well Agreements	SW Agreed upon to be Relinquished: full or partial	Permit Approved	SW Right Relinquishment Date
Loup	1	A-2635B, A-2263BR (Full)	1	5/12/22
Total	1		1	

SURFACE WATER ALLOCATION CONVERSION TO GROUNDWATER USE

As surface water rights are either converted to groundwater acres or completely retired, the LLNRD has initiated a tracking mechanism that incorporates the basin-wide depletion accounting and its effect on the available acre-feet of depletions. According to the LLNRD and consultants who developed the tracking mechanism for depletions, an overall credit can be claimed to the affected basin for the unused depletions and applied to the existing allowable acre-foot depletion balance if proper procedures are met. These procedures are enacted when surface water rights are fully relinquished and converted to groundwater acres, if those surface water rights are located along stream reaches impacted by baseflow and are not associated with irrigation district water rights. Credit is being claimed by the LLNRD for these surface water retirements. Appropriate credit is determined by subtracting the difference of the full depletion amount of the surface water right from the groundwater impacts using stream depletion, net irrigation requirement in feet and number of acres associated with the conversion. The LLNRD can provide historical evidence of irrigation through infrared photography collected since 2006. The NeDNR is expected to provide field inspection reports and adhere to the adjudication process defined by Nebraska Revised Statutes.

The following table reports all credits from surface water conversion to groundwater use:

***TABLE 9:* SUMMARY OF SURFACE WATER ALLOCATIONS CONVERTED TO GROUNDWATER**

YEAR	RightIDs	Date	SDF	NIR	NIR/12	ACRES	SW_DEP	GW_DEP	GW_SW Diff
2022	A-2635B*	9/8/1936	0.8924	11.47	0.96	100.74	96.29	25.78	70.51
2022	A-2263BR*	3/18/1932	0.8924	11.47	0.96	100.74	96.29	25.78	70.51
								Acre-Foot Credit:	**+70.51**

*Same field

NRD MANAGEMENT: ACRE ROTATIONS

Acre rotations are agreements set forth by a participating landowner and the LLNRD, which allows the landowner an option to choose how they distribute certified acres over a tract of land. In 2022, there were eight acre rotations approved by the LLNRD. Acre Rotation Agreements have 2 or 3 options the landowner can choose in one calendar year. Acres remain in this rotation pattern until the landowner notifies the LLNRD otherwise. Enforcement is conducted by the LLNRD through annual infrared imagery and field personnel visitation.

***TABLE 10:* APPROVED ACRE ROTATIONS IN THE LLNRD IN 2022**

County	# of Acre Rotation Agreements Approved
Buffalo	1
Custer	2
Greeley	1
Sherman	2
Platte	2
Total	**8**

FLOWMETER DATA

The LLNRD has collected groundwater 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 be outfitted with a flowmeter to track irrigation total withdrawals starting in 2016. The two new groundwater quality management areas, SubAreas 29 and 30, now also require flowmeters. Groundwater quality management areas constitute 580 of all flowmeters in the District.

In 2022, LLNRD collected records of usage from 1,116 irrigation sites with 1,029 of those sites being verified as having an actual irrigation total water volume. The District average pumping withdrawals for irrigation for the 2022 season was 12.66 inches, up from 10.12 inches in 2021. The potato crop was the highest consumer of irrigation water with an average of 20.3 inches/acre pumped in 2022, with corn crop averaging 15.07 inches/acre. Except for Butler County (only 1 flowmeter), the county with the least average irrigation recorded was Garfield County at 7.26 inches/acre pumped. Wheeler County had the highest average irrigation rates at 17.48 inches/acre.

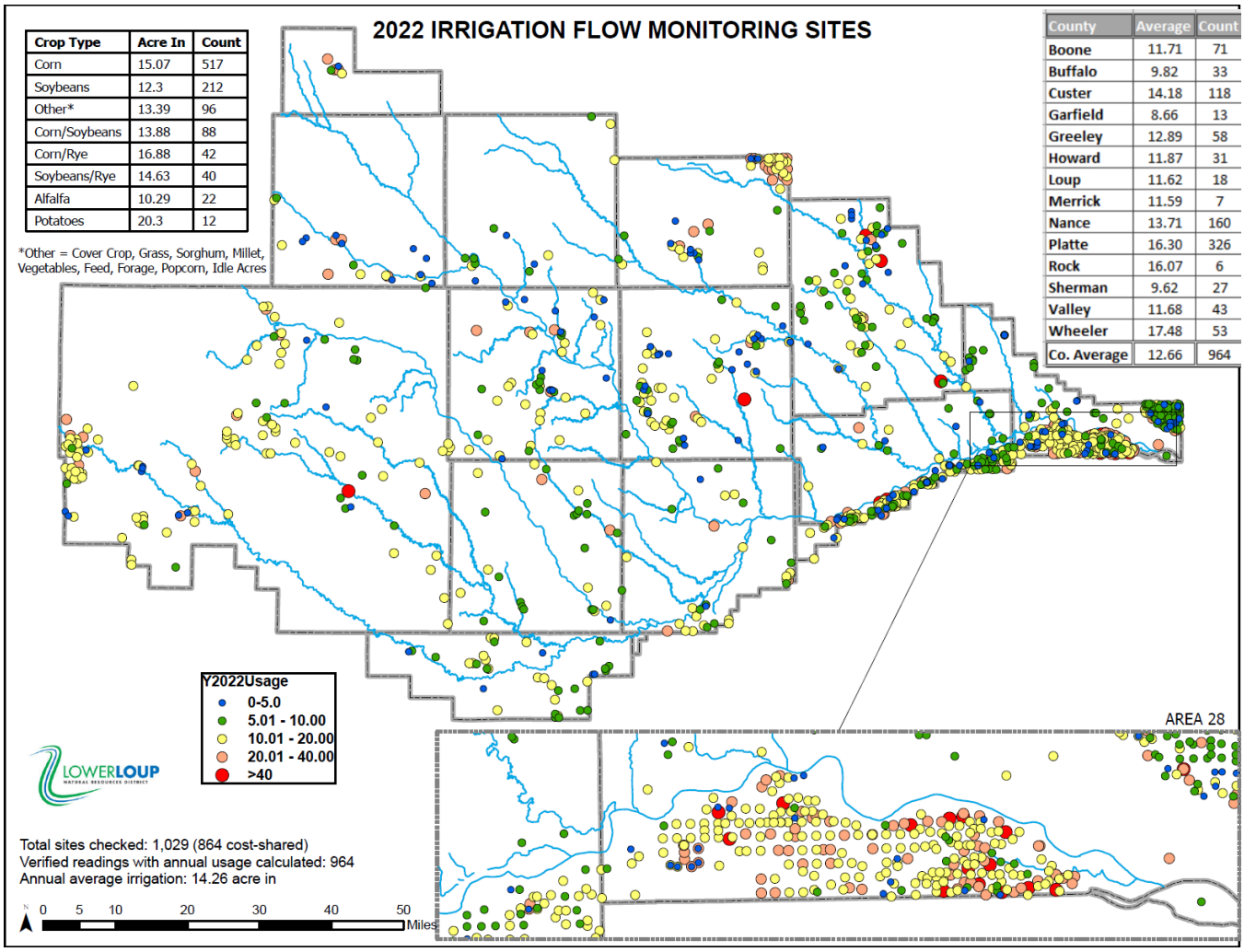

FIGURE 1: **IRRIGATION MEASURING AND REPORTING SITES IN THE LLNRD IN 2022**

GROUNDWATER ACRES ALLOCATIONS

The LLNRD has the option to issue additional groundwater acre 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. In 2022, new acres applications were accepted between the North Loup and Middle Loup sub-basins for a total of 1,124.93 new irrigated acres and were approved by the LLNRD Board of Directors. The North Loup basin continued to show upward or stable trends in both surface and groundwater resources (static water levels and stream gages), especially on the west side of the river. The Middle Loup Basin, while showing upward trends in the stream gages, has had downward static water levels measured in the vicinity, especially south of the river. The criteria includes Stream Depletion Factors, the status of nearby groundwater and surface water resources, the size of applications being applied for, and the soil classification. In 2019, additional points were awarded to applications located in the designated groundwater increase area.

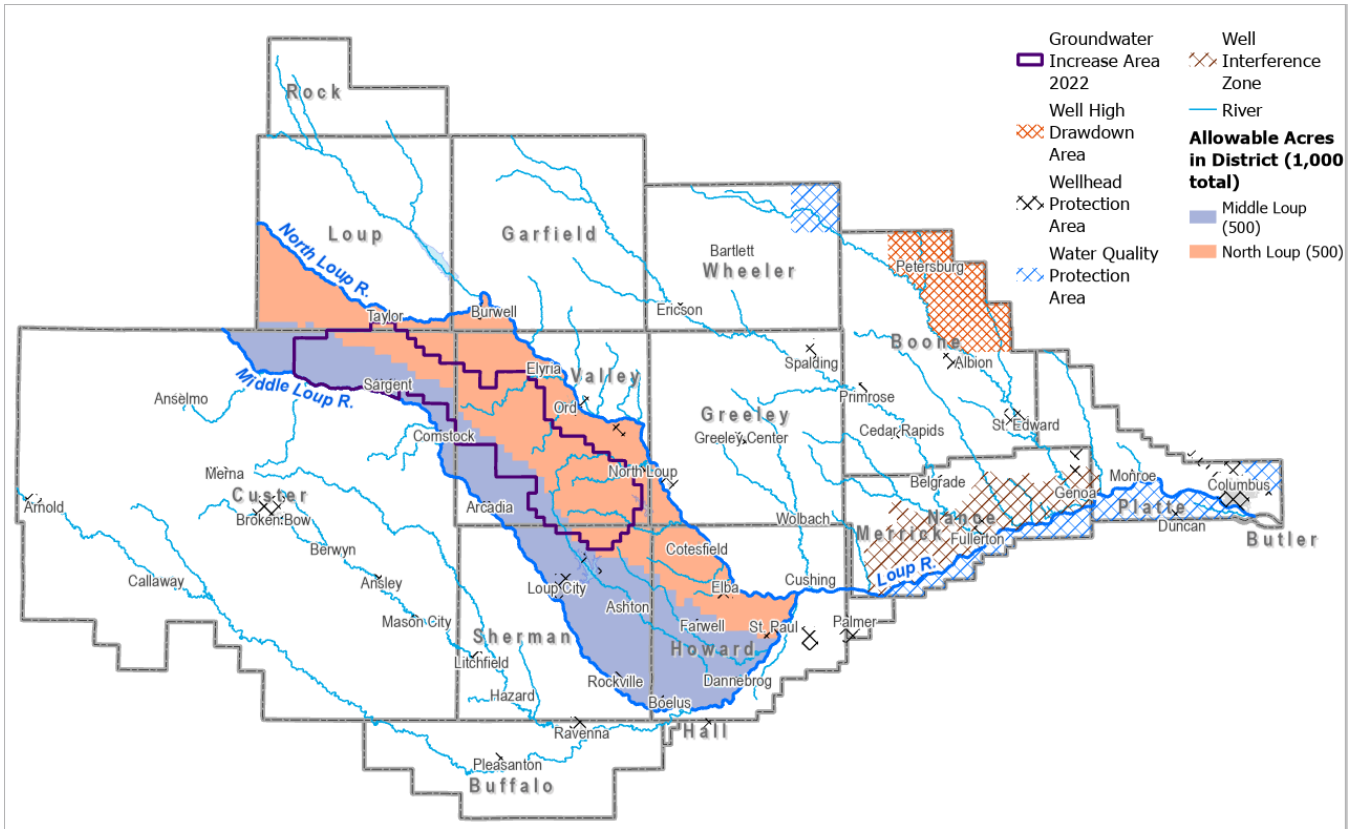

FIGURE 2: **MAP OF ALLOWABLE CERTIFIED IRRIGATED ACRES IN THE LLNRD IN 2022**

There were 43 applications for new irrigation: 17 in the North Loup River Basin and 26 in the Middle Loup River Basin. The total number of acres requested in all three basins was 2,098.31. The average application size requested 48 acres and the average application ranking was 249 points, ranked by LLNRD processes.

At their meeting on October 27, 2022, the LLNRD Board of Directors unanimously approved 28 of the highest scoring applications across the 2 basins.

TABLE 11: **NEW GROUNDWATER-IRRIGATED ACRES APPROVED IN THE LLNRD IN 2022**

Basin	Number of Acres Approved	Pending Wells	Average SDF
North Loup	588.43	7	43.79
Middle	536.50	6	37.02
Total	**1,124.93**	**13**	**40.40**

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 River 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. This annual report reports date from the final year of the five-year period.

After applying the agreed-upon methodology to the 2022 allowed irrigated acres, the AF impact was -90.13 AF of agriculture depletions. The table below has a breakdown of the numbers associated with the 45 approved applications.

TABLE 12: **NEW GROUNDWATER-IRRIGATED ACRES DEPLETIONS CALCULATED FROM THE 2022 ALLOCATION**

Application	Legal	Basin	Acres	ELM3 SDF	NIR (ft)	Depletion (acre-ft)
STEJO1	14N12W23NE	Middle Loup N	22.76	0.31	0.70	1.47
SKIDA1	15N14W14NE	Middle Loup N	23.61	0.45	0.71	2.26
GOUDA1	18N16W33SW	Middle Loup N	6.65	0.62	0.94	1.16
MOOEV1	15N13W25SW	Middle Loup N	97.28	0.26	0.71	5.49
RILJA2	15N14W36NE	Middle Loup N	9.95	0.53	0.70	1.10
LEWDO1	15N13W04NE	Middle Loup N	32.27	0.21	0.70	1.44
LEWDO2	15N13W04NE	Middle Loup N	10.41	0.21	0.70	0.46
STEJA1	13N12W14NW	Middle Loup N	18.85	0.61	0.69	2.37
KASTH1	15N12W30SW	Middle Loup N	147.07	0.22	0.70	6.79
STOJO1	15N12W31SE	Middle Loup N	24.90	0.27	0.70	1.42
BRENO1	17N15W36SW	Middle Loup N	24.94	0.32	0.75	1.79
CYBDA1	13N13W01NE	Middle Loup N	9.90	0.59	0.69	1.21
MRKMA1	14N12W12SE	Middle Loup N	107.91	0.21	0.69	4.57
HURCL1	21N18W20SW	North Loup S	10.00	0.89	0.83	2.24
KUSJU1	16N13W20SE	North Loup S	24.87	0.11	0.71	0.59
FAREA1	18N15W20SW	North Loup S	64.54	0.25	0.77	3.79
HRUDE1	19N16W09SW	North Loup S	142.45	0.44	0.83	15.59
EDWJI1	17N14W15SW	North Loup S	92.09	0.15	0.77	3.09
KNAJA2	19N14W36NE	North Loup S	7.14	0.77	0.90	2.05
KOELA1	18N14W19SW	North Loup S	18.85	0.24	0.78	1.05
KNAJA1	19N14W36NW	North Loup S	21.08	0.77	0.76	3.69
JACAD1	18N15W17NE	North Loup S	9.92	0.24	0.79	0.57
RADDE2	19N16W08SW	North Loup S	9.38	0.48	0.82	1.10
POSMI1	15N12W11SE	North Loup S	24.82	0.27	0.69	1.41
RADDE1	19N16W08SW	North Loup S	9.96	0.48	0.83	1.18
JORKA1	15N12W05NW	North Loup S	9.90	0.09	0.70	0.18

TRURI1	15N10W19NW	North Loup S	46.50	0.78	0.70	7.60
MEIKE1	20N17W34SW	North Loup S	96.93	0.61	0.82	14.47
		Total Acres	**1,124.93**		**Total Depletions**	**90.13**

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 decreased due to any transferring of irrigated acre rights to a higher SDF, which would require an offset in acres. Transfers 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 13 represents the net effect of all transfers in acre-feet through year 2022.

From the 2022 transfers, the sum impact of the transferred depletions removed was 346.28 AF on 75 total transfer agreements, while the impact of the receiving acres with new development was 224.7 AF. The difference and beneficial impacts were 121.58 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 six years of transfers totals 385.77 AF according to LPRBC 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 13:* SUMMARY OF ALLOWABLE DEPLETION IMPACT**

Lower Loup Natural Resources District	
Project	**11,908.00 AF**
2016 New Irrigated Acres	-204.52
2016 Transfers	+69.66 [a]
2017 New Irrigated Acres	-164.65
2017 Transfers	+40.88 [a]
2018 New Irrigated Acres	-275.30 [b]
2018 Transfers	+66.67 [a]
2019 New Irrigated Acres	-245.48 [c]
2019 Transfers	+19.85
2020 New Irrigated Acres	-216.02 [d]
2020 Transfers	+19.98
2020 Variances	-29.30
2016-2020 SW/GW Conversion	+558.15
2021 New Irrigated Acres	-310.38 [e]

2021 Transfers	+47.15
2021 Variances	-85.95 [e]
2021 SW/GW Conversion	+105.6
2022 New Irrigated Acres	**-90.13**
2022 Variances	**-21.18**
2022 Transfers	**+121.58**
2022 SW/GW Conversion	**+70.51**
Allowable Depletion Total	**11,385.12 AF**

[a] revised February 2020; corrections made to some transfers for 2016, 2017, and 2018

[b] revised June 2019; not all approved acres were certified by applicants in 2018

[c] revised August 2020; not all approved acres were certified by applicants in 2019

[d] revised August 2021; not all approved acres were certified by applicants in 2020

[e] revised August 2022; not all approved acres were certified by applicants in 2021

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 the status of groundwater, whether increasing or decreasing, and to determine if potential changes are needed in the District. Fall levels are used as an indicator of stress that has been placed on the aquifer during the irrigation season. The District has employed the use of pressure transducers to get continual monitoring. To date, the LLNRD has 77 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 5 monitoring well sites, as well as an artificial lake in the area that will be used as part of the recharge basin.

In spring 2022, the LLNRD staff collected groundwater level depths on 454 sites which includes both dedicated monitoring and irrigation wells. The District average decreased from 2021 readings by -1.35 feet. The District average still maintains a level well above the 1982 levels by 5.66 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 completed a Drought Management Plan which was accepted by the Board of Directors on November 17, 2022. Input for the plan was derived in large part from stakeholder meetings attended by a cross-section of District residents and natural resources professionals (including NeDNR) in 2021 and early 2022. The stakeholder meetings produced a framework for establishing drought definitions, drought area assignments, drought monitoring protocols, and management actions to implement during the stages of a drought within the District.

Aerial Electromagnetic data (AEM) across large areas of Nance County were conducted with assistance from the Water Sustainability Fund on August 19th - 21st 2022. Approximately 24 miles of flight lines were collected east-west and 12 miles collected north-south direction, which included 31 miles along the Loup River. Hydrogeologic framework was developed in the final report to determine aquifer materials, thickness, estimate transmissivity, and assist with the development of potential groundwater management regions. Water quality concerns and

recharge areas were also developed from the AEM flight lines. This work stems from groundwater conflicts occurring during times of drought throughout this area. A final report is expected in spring 2023.

COLUMBUS AREA GROUNDWATER RECHARGE PROJECT

The Columbus Area Recharge Project began development because of significant groundwater depletions in an area on the southeast edge of Columbus, NE. The LLNRD initiated the project and gathered partners including Archers Daniel Midland, City of Columbus, Platte County, and the Christopher's Cove Homeowners Association that worked collectively to develop and complete the project. The final project fundamentals involve providing the area with additional groundwater recharge by conveying supplemental surface water to areas of high potential recharge. The project pipes water from the nearby Loup Tailrace Canal and discharges it into the Lost Creek channel near the city. The water impounds into the mostly dry creek and seeps into the ground, recharging the area's groundwater. The project also discharges water from an auxiliary well, into Christopher Cove which is a nearby water body used by the project for groundwater recharge. The recharged water provided by the project offers more stable groundwater levels for public use, especially in dry years.

The completed project began operations in June 2022. The initial season of operations was very much a project development and testing phase during which the system was closely monitored and operated under direct observation to ensure performance and prevent possible undesirable site impacts. The surface water intake at the Loup Tailrace Canal and the auxiliary well were operated at varying durations and performance levels throughout the pumping season. The operations allowed the project team to verify design expectations and develop an Operations and Maintenance Plan based on actual project function.

The pumping values were at times difficult to collect because of testing and troubleshooting involved with newly installed site equipment and inconsistent data. The surface intake site operated for 86 days for a total of approximately 878 ac/ft of water. The auxiliary well site operated for 73 days for a total of approximately 181 ac/ft of water. A very conservative groundwater recharge estimate for the 2022 season is approximately 466 ac/ft of water. The estimated groundwater recharge amounts are based on design expectations and data collected throughout the operating season. The calculations consider volume of water pumped, recharge area, potential recharge rates, evapotranspiration rates, and additional factors that may affect groundwater recharge. The LLNRD will further refine future operations to enhance and maximize potential groundwater recharge.

NON-ACTION/REPORTING ITEMS

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

- Retirement of Groundwater Consumptive Uses
    - The LLNRD does not currently have a need for large 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 "APPROVED WATER 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.
- Instream Flow Requests
    - The LLNRD submitted a request for an instream flow application to the Nebraska Department of Natural Resources. An order of approval was received by the NRD on May 31, 2022. The application is in consideration of the value of benefits to fish, wildlife, recreation, out-of-stream uses and economic impacts. The flow reach begins at the confluence of the North and Middle Loup Rivers near St. Paul and extends to the Loup Public Power Canal near Genoa. The application included supporting scientific, economic, biological, and hydrological data and information.