



2021

LOWER PLATTE RIVER BASIN COALITION ANNUAL REPORT



March 1, 2022

TABLE OF CONTENTS

CERTIFIED IRRIGATED ACRES.....	2
MUNICIPAL AND INDUSTRIAL GROUNDWATER USE	3
NEW GROUNDWATER CONSUMPTIVE USE – WELL CONSTRUCTION PERMITS GRANTED.....	5
APPROVED WATER TRANSFERS	5
WATER BANKING.....	6
EXPEDITED VARIANCES	6
NRD MANAGEMENT: WELL AGREEMENTS	7
SURFACE WATER ALLOCATION CONVERSION TO GROUNDWATER USE	7
NRD MANAGEMENT: ACRE ROTATIONS	8
FLOWMETER DATA.....	8
GROUNDWATER ACRES ALLOCATIONS.....	9
NEW GROUNDWATER ACRES ALLOCATIONS DEPLETION IMPACT	11
DEPLETION ACCOUNTING	12
GROUNDWATER ELEVATION DATA.....	14
NEW DATA COLLECTED OR MODEL/STUDY RESULTS	14
NON-ACTION/REPORTING ITEMS	15

**2021 ANNUAL DOCUMENTATION OF WATER USE ACTIVITIES IN THE LOWER LOUP NRD
REQUIREMENT OF LOWER PLATTE RIVER BASIN COALITION (LPRBC)
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, 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, 2021, 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 2021

Year	Total Acres Certified	Acres of Groundwater	Acres of Surface Water	Acres of Co-Mingled
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 sixth 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 2/14/2022, 42 out of 43 public water supplies have sent in their water accounting information for 2021. The Village of Merna failed to report, so an estimate was included in the 2021 data chart. Each year, the NRD calculates the daily use per person. This year, due to a drier end to summer and the growing season, overall use was up to 263 gallons, per capita, per day being used compared to 253 gallons in 2020. One village also discovered a major water leak late in the summer that greatly increased their total gallons pumped in 2021.

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, 2021 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 third 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: 2021 WELL USAGE (IN GALLONS) FOR LLNRD COMMUNITIES

City Name	Annual Water Pumped	Population	Gal/per capita/per day	Connections
City of Albion	134,450,000	1699	216.8	850
City of Broken Bow	371,518,999	3506	290.3	1600
City of Burwell	68,870,000	1087	173.6	602
City of Columbus	2,274,551,301	24028	259.4	9048
City of Fullerton	82,393,400	1244	181.5	635
City of Genoa	73,500,000	894	225.3	475
City of Loup City	71,700,000	1053	186.6	560
City of Ord	429,382,000	2367	497.0	1334
City of Ravenna	130,110,000	1441	247.4	625
City of Saint Edward	70,903,235	725	267.9	340
City of Saint Paul	135,615,999	2416	153.8	1019
City of Sargent	38,057,000	500	208.5	392
Village of Anselmo	31,690,200	108	803.9	100
Village of Ansley	41,059,200	459	245.1	262
Village of Arcadia	52,589,000	283	509.1	200
Village of Arnold	88,100,000	592	407.7	388
Village of Ashton	14,338,000	198	198.4	140
Village of Bartlett	19,097,199	109	480.0	70
Village of Belgrade	17,500,000	103	465.5	82
Village of Boelus	11,395,000	181	172.5	108

2021 LLNRD Lower Platte River Basin Report

Village of Cairo	72,831,000	822	242.8	325
Village of Callaway	86,815,055	563	422.5	353
Village of Cedar Rapids	29,708,000	382	213.1	265
Village of Comstock	10,533,000	68	424.4	61
Village of Dannebrog	10,415,068	273	104.5	154
Village of Duncan	23,327,000	392	163.0	171
Village of Elba	13,199,700	192	188.4	125
Village of Ericson	19,110,900	89	588.3	32
Village of Farwell	16,624,000	138	330.0	60
Village of Greeley Center	40,295,000	402	274.6	235
Village of Litchfield	23,166,900	220	288.5	160
Village of Mason City	15,372,000	151	278.9	115
Village of Merna**	45,000,000	343	359.4	205
Village of Monroe	23,372,000	296	216.3	139
Village of North Loup*	0	0	0.0	0
Village of Palmer	15,603,000	439	97.4	239
Village of Petersburg	27,071,000	332	223.4	220
Village of Pleasanton	28,938,000	361	219.6	188
Village of Primrose	5,736,000	55	285.7	43
Village of Rockville	4,103,700	89	126.3	48
Village of Scotia	29,305,107	301	266.7	150
Village of Spalding	19,587,305	408	131.5	255
Village of Wolbach	46,953,000	224	574.3	188

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

** Merna's 2021 water usage was estimated

-Population numbers were updated by the 2020 Census

TABLE 3: AVERAGE USAGE NUMBERS CALCULATED FOR ALL LLNRD COMMUNITIES

Lower Loup Natural Resources District	
<u>Year</u>	<u>Gallons/per capita/per day</u>
2016	265.0
2017	260.1
2018	230.3
2019	211.8
2020	252.6
2021	263.5
6 Year Average	247.2

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 89 well permits in 2021 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 2021

Groundwater Well Permit Types	Number of Permits	Average Pump Capacity (gpm)
Domestic	0	0
Livestock	3	267.0
Commercial	0	0
Other	3	333.0
Irrigation (Total)	83	755.0
(Irrigation) Transfer	8	950.0
(Irrigation) Supplemental	7	920.0
(Irrigation) Well Agreement	5	725.0
(Irrigation) New Acre	21	835.0
(Irrigation) Replacement	42	833.0
Total	89	540.0

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 2021, the LLNRD approved 47 **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 2021

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	10	16	150.29	2	143.23	.65	.56
Buffalo	6	7	62.00	0	68.50	.76	.78
Custer	0	1	0	0	60.00	0	.71
Garfield	0	4	0	0	69.60	0	.92
Greeley	5	6	76.20	1	78.80	.48	.75

2021 LLNRD Lower Platte River Basin Report

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
Howard	4	0	32.00	1	0	.28	0
Nance	9	1	107.15	1	14.00	.54	.89
Platte	4	1	51.63	2	6.60	.59	.81
Rock	1	1	65.00	0	65.00	.24	.24
Sherman	6	6	180.51	1	141.42	.59	.70
Wheeler	2	4	142.00	1	236.31	.43	.72
Total	47	47	866.78		883.46	.55	.69

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 2021 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 47 transfers that took place in 2021, the LLNRD has banked a total of **1,294.7** 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	Gallons/per capita/per day
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
6 Year Total	2,778.88

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 2021, there were a total of 9 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 2021 IN THE LLNRD

County	# of Supplemental Well Agreements	Permit Approved	Agreement Approved, but waiting on a Permit
Boone	2	2	0
Custer	2	1	1
Platte	3	3	0
Valley	2	1	1
Total	9	7	2

NRD MANAGEMENT: WELL AGREEMENTS

In 2021, 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 2021

County	# of Well Agreements	SW Agreed upon to be Relinquished: full or partial	Permit Approved	SW Right Relinquishment Date
Platte	3	A-17883, A-8500 A-14623 A-8616, A-17883B, A-6684	3	NOT AS OF 2/17/22 4/28/2021 NOT AS OF 2/17/22
Valley	1	A-14765	1	12/21/2021
Total	4		4	

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.

2021 LLNRD Lower Platte River Basin Report

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
2021	A-17883B,	6/30/2000							
	A-6684,	3/10/1981	0.81	7.16	0.5967	69.5	41.47	10.08	31.39
	A-8616	6/15/1956							
2021	A-14765	03/02/1977	0.8326	10.91	0.9092	108.8	98.92	24.71	74.21
Acre-Foot Credit:									+105.6

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 2021, there was one acre rotation 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 2021

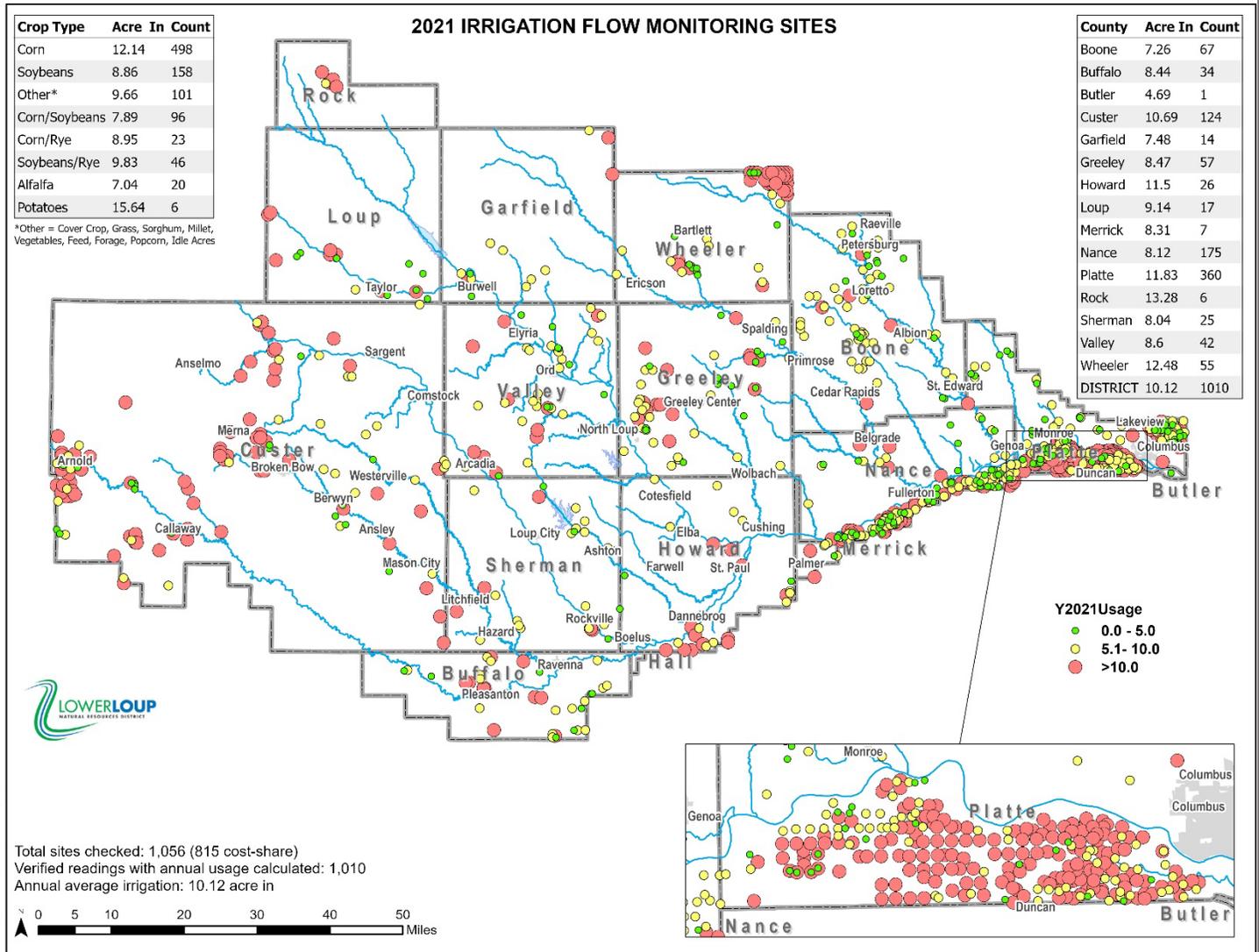
County	# of Acre Rotation Agreements Approved
Greeley	1
Total	1

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 District has designated two new groundwater quality management areas, SubAreas 29 and 30, which will require flowmeters in all irrigation wells by 2022. Groundwater quality management areas constitute 559 of all flowmeters in the District.

In 2021, LLNRD collected records of usage from 1,056 irrigation sites with 1,010 of those sites being verified as having an actual irrigation total water volume. The District average pumping withdrawals for irrigation for the 2021 season was 10.12 inches, up from 9.93 inches in 2020. The potato crop was the highest consumer of irrigation water with an average of 15.64 inches/acre pumped in 2021, with corn crop averaging 12.14 inches/acre. Except for Butler County (only 1 flowmeter), the county with the least average irrigation recorded was Boone County at 7.26 inches/acre pumped. Rock County had the highest irrigation rates at 13.28 inches/acre.

2021 LLNRD Lower Platte River Basin Report



IGIS: Projects\Water\Quality\FlowMeter: map dated 2/7/2021

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 2021, new acres applications were accepted in the North Loup, Beaver Creek, and Middle Loup sub-basins for a total of 2,951 new irrigated acres and were 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 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 include 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.

2021 LLNRD Lower Platte River Basin Report

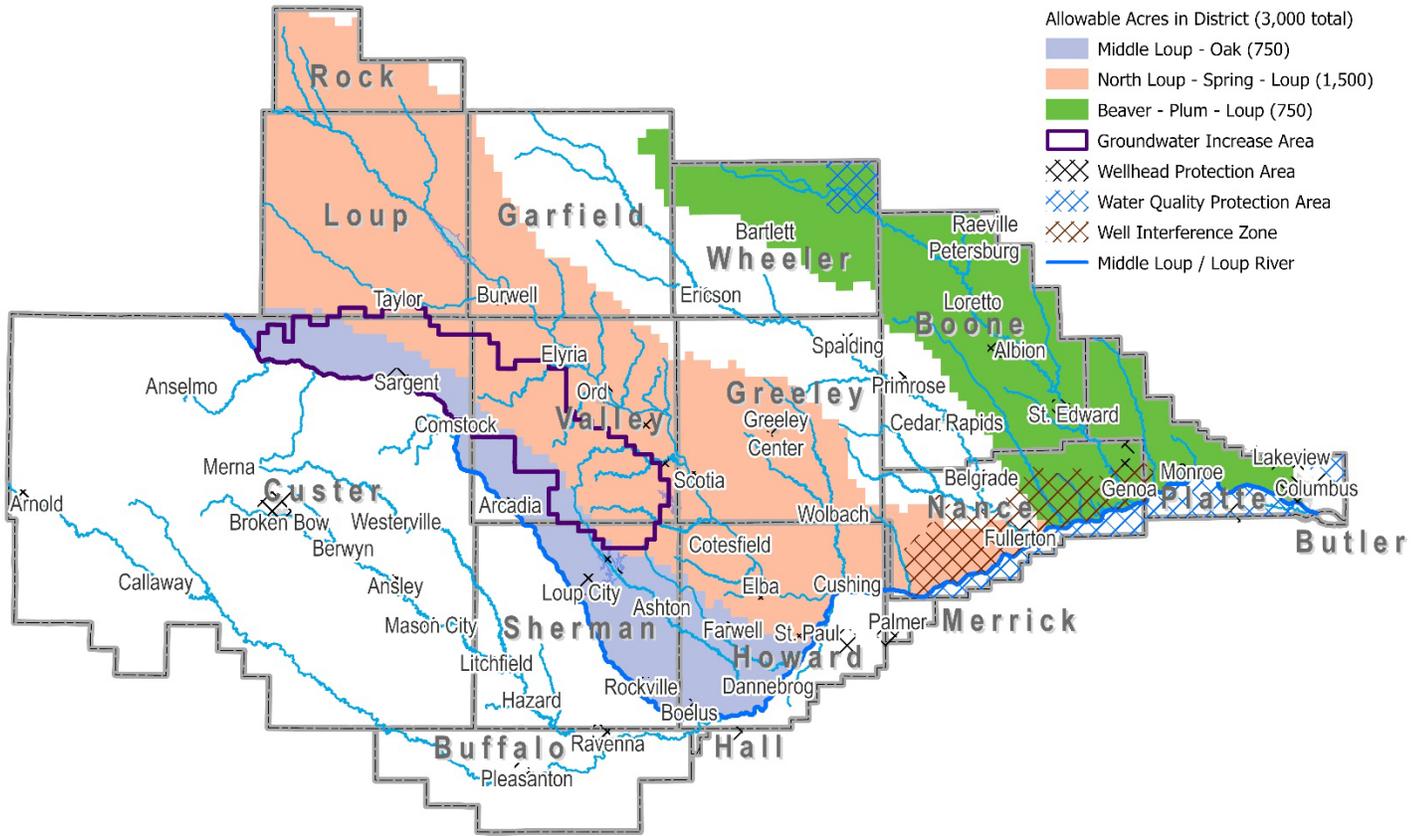


FIGURE 2: MAP OF ALLOWABLE CERTIFIED IRRIGATED ACRES IN THE LLNRD IN 2021

There were 83 applications for new irrigation: 42 in the North Loup River Basin, 16 in the Beaver Creek Basin, and 25 in the Middle Loup River Basin. The total number of acres requested in all three basins was 5,139. The average application size requested 62 acres and the average application ranking was 271 points, ranked by LLNRD processes.

At their meeting on October 28, 2021, the LLNRD Board of Directors unanimously approved 45 of the highest scoring applications across the 3 basins, as well as 3 additional applications that were submitted in non-hydrologically connected areas to streams within the District.

TABLE 11: NEW GROUNDWATER-IRRIGATED ACRES APPROVED IN THE LLNRD IN 2021

Basin	Number of Acres Approved	Pending Wells	Average SDF
North Loup	1,495.24	12	47.38
Beaver	742.33	6	50.71
Middle	713.39	1	27.21
Total	2,950.96		41.77

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 2021 allowed irrigated acres, the AF impact was 310.96 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 2021 ALLOCATION

Application	Legal	Basin	Acres	ELM3 SDF	NIR (ft)	Depletion (acre-ft)
BECCH1	20N08W13NW	Beaver - Plum - Loup	12.50	47.77	0.64	1.15
BECJA1	20N05W06NE	Beaver - Plum - Loup	24.24	36.04	0.59	1.56
BJOAN1	19N10W27SW	North - Spring - Loup	20.44	26.36	0.75	1.21
BRACA1	20N07W07SE	Beaver - Plum - Loup	90.34	49.39	0.63	8.46
DOZBE1	22N07W10SE	Beaver - Plum - Loup	63.51	47.44	0.62	5.57
DUGGE1	18N11W10NE	North - Spring - Loup	25.91	18.39	0.92	1.32
DUGRA1	18N11W23NE	North - Spring - Loup	67.63	15.46	0.73	2.29
FARDO1	16N11W33NE	North - Spring - Loup	51.87	76.30	0.71	8.40
FIGDA1	20N07W07SE	Beaver - Plum - Loup	27.31	49.39	0.63	2.56
FRATO1	17N13W04SW	North - Spring - Loup	66.95	39.69	0.76	6.03
GOOMI1	20N06W26NE	Beaver - Plum - Loup	38.59	87.44	0.59	5.99
GRAED1	18N10W18SE	North - Spring - Loup	49.33	13.29	0.92	1.81
HOLEV1	17N15W10SW	Middle - Oak	134.04	28.48	0.75	8.64
HOPCA1	18N12W19NW	North - Spring - Loup	149.45	85.40	0.88	33.53
HOPLY1	20N07W09SE	Beaver - Plum - Loup	21.67	56.21	0.62	2.26
HURBR1	21N18W20SW	North - Spring - Loup	5.26	89.49	0.83	1.18
JERJO1	15N12W33NE	Middle - Oak	129.97	18.85	0.69	5.08
JERNI1	15N11W29NE	North - Spring - Loup	191.12	34.03	0.69	13.40
JORKA2	15N12W20NE	Middle - Oak	19.98	13.17	0.69	0.55
KETPA1	21N06W12NE	Beaver - Plum - Loup	9.92	20.68	0.59	0.36
KNAJA1	18N14W23SW	North - Spring - Loup	122.23	37.49	0.78	10.67
KOVDU1	20N14W34NW	North - Spring - Loup	24.88	69.11	0.80	4.11
KURDA1	20N04W34SW	Beaver - Plum - Loup	138.35	18.54	0.61	4.72
LOERO1	20N08W11NW	Beaver - Plum - Loup	139.91	46.78	0.67	13.17
LUKKI1	14N12W15SW	Middle - Oak	107.27	32.21	0.70	7.28
MALDA1	18N06W33SE	Beaver - Plum - Loup	89.37	48.55	0.65	8.49

2021 LLNRD Lower Platte River Basin Report

MAURA1	20N17W06SW	North - Spring - Loup	127.00	79.93	0.82	25.00
MOLTH1	19N17W27NE	Middle - Oak	146.05	78.24	0.92	31.51
NEKJO1	19N11W30NE	North - Spring - Loup	8.91	28.36	0.92	0.70
OBETI1	17N11W08NW	North - Spring - Loup	82.92	26.44	0.74	4.87
OBRAM1	20N08W09SE	Beaver - Plum - Loup	12.10	47.28	0.68	1.17
PETMA1	19N14W32SW	North - Spring - Loup	154.42	52.44	0.79	19.19
PRODA1	21N06W34SW	Beaver - Plum - Loup	51.18	64.14	0.59	5.85
RANRI1	18N15W22NE	North - Spring - Loup	38.00	21.42	0.78	1.91
RANSP1	18N12W18NW	North - Spring - Loup	91.47	79.96	0.88	19.22
RASJA1	15N12W25SE	Middle - Oak	149.68	17.13	0.69	5.30
RASRO1	15N12W34NW	Middle - Oak	12.18	16.45	0.69	0.41
RICRA1	18N15W22NE	North - Spring - Loup	4.08	21.42	0.78	0.21
STEFR1	15N12W20SE	Middle - Oak	14.22	13.17	0.69	0.39
STOAL1	19N05W16NW	Beaver - Plum - Loup	23.34	90.19	0.60	3.79
THOSC1	21N15W26SE	North - Spring - Loup	16.01	58.75	0.81	2.30
TIMHA1	19N12W25SW	North - Spring - Loup	9.90	31.45	0.78	0.73
WIETH1	15N10W18SE	North - Spring - Loup	29.54	90.92	0.83	6.70
WOJTR1	16N10W25NW	North - Spring - Loup	148.05	70.60	0.68	21.45
WOOMI1	18N11W08SW	North - Spring - Loup	9.87	23.09	0.73	0.50
Total Acres			2,950.96	Total Depletions		310.96

In addition to the depletions from 45 newly approved applications as part of the standard irrigated acres scoring and application process, an additional 11 applications that scored higher than the 225-point minimum, but not high enough to make the cutoff on total acres allowed within each basin, were approved as part of the District variance process. These 11 applications were located in the District's designated "Groundwater Increase Area" (Figure 2), which is defined by an upward trend in groundwater rise of 0.5 feet per year. A total of 97.50 AF depletion was calculated from the additional 11 applications and is included in Table 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-foot 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 these transfers in acre-feet for the year 2021.

2021 LLNRD Lower Platte River Basin Report

From the 2021 transfers, the sum impact of the transferred depletions removed was 144.09 AF on 47 total transfer agreements, while the impact of the receiving acres with new development was 96.93 AF. The difference and beneficial impact was 47.15 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 264.19 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.

Some minor adjustments were made to Table 13 in this year’s report. The 2020 New Irrigated Acres depletion value was updated to 216.02 AF from 217.99 AF. This change was a result of 3 applications not being certified for all the acres that were allowed. The certification of the application occurred after the 2020 annual report was finalized, which is why it is being reported in this year’s report.

TABLE 13: SUMMARY OF ALLOWABLE DEPLETION IMPACT

Lower Loup Natural Resources District	
Project	5,883.00 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	-310.96
2021 Transfers	+47.15
2021 Variances	-97.50
2021 SW/GW Conversion	+105.6
Allowable Depletion Total	5,267.21 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

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 2021, the LLNRD staff collected groundwater level depths on 452 sites which includes both dedicated monitoring and irrigation wells. The District average decreased from 2020 readings by -0.50 feet. The District average still maintains a level well above the 1982 levels by 6.50 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

Streams in the Loup River basin are sensitive to groundwater withdrawals because of the close hydrologic connection between groundwater and surface water. The U.S. Geological Survey, in cooperation with the Upper Loup and Lower Loup Natural Resources Districts, and the Nebraska Environmental Trust, studied the age and water-quality characteristics of groundwater near the South Loup River to assess the possible effects of a multiyear drought on streamflow.

Groundwater sampled in wells screened in Quaternary-age deposits displayed a wide range of mean ages (27 to 2,100 years), fraction modern, and susceptibility index values. Groundwater with higher concentrations of chloride and higher specific conductance was indicative of younger groundwater with a narrower age distribution and is more sensitive to climatic disturbances such as short-term drought conditions, based on the calculated susceptibility index. Groundwater samples from wells and springs in Pliocene-age deposits were categorized into two groups with different geochemical and age characteristics. One sample group of springs and wells, called the Western Pliocene, had higher concentrations of chloride and nitrate with young mean ages (18 to 77 years) and narrow age distributions. Groundwater in the Western Pliocene sample group is susceptible to short-term drought.

In contrast, the other sample group from Pliocene-age deposits to the east (called Pliocene) had lower concentrations of nitrate, chloride, and mean groundwater ages ranging from 1,900 to 2,900 years old and is less likely to be affected by short-term drought conditions. Groundwater sampled from three wells screened in the Ogallala Formation was shown to have the oldest mean ages ranging from 8,700 to 23,000 years and the lowest calculated susceptibility index values observed in this study. Strong upward hydraulic gradients measured in wells indicated that groundwater from the Ogallala Formation is likely contributing to streamflow of the South Loup River.

Continuously measured gage height and specific conductance data indicated groundwater discharge from Quaternary-age deposits was highly responsive to precipitation events. In contrast, groundwater

discharge from Pliocene-age deposits (Pliocene sample group) was far less responsive, indicating groundwater discharge from Pliocene-age deposits is likely more resilient to short-term drought conditions.

The LLNRD is in the process of developing a Drought Management Plan, with finalization expected in April/May 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 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.

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.
- Groundwater Recharge Activities
 - Columbus Recharge Project is finalizing construction, although there have been setbacks with supply difficulties. The system would have been operational at the end of 2021 as both lake and groundwater wells are at or near operating levels.
- 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
 - In 2017, the LLNRD submitted a request for an instream flow application to the Nebraska Department of Natural Resources. This 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. A public hearing was held on July 27, 2017, at which time no persons voiced any opposition to proceeding with the application. As of February 2022, the request has not been approved.