

Lewis & Clark Natural Resources District
2019-2020 Biennial Review Report
of the
Voluntary Integrated Management Plan (IMP)
jointly developed with the
Nebraska Department of Natural Resources

December 16, 2021



LEWIS & CLARK
NATURAL RESOURCES DISTRICT

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INTRODUCTION

Biennially the Lewis and Clark Natural Resources District (LCNRD) and the Nebraska Department of Natural Resources (NeDNR) review and update data collected and tasks completed as part of the jointly developed Voluntary Integrated Management Plan (IMP) which was adopted in 2016. The IMP provides a coordinated monitoring and management outline for groundwater as managed by LCNRD and surface water as managed by NeDNR. The two resources are hydrologically connected in some discrete areas of the district and the IMP provides mechanisms to effectively monitor and manage both resources.

A Stakeholder Committee (IMP Chapter 7) guided development of the IMP and will be provided the biennial reports of both LCNRD and NeDNR. Stakeholders will be given the opportunity to comment on the reports and IMP activities following dissemination of the information.

The 2019 – 2020 LCNRD biennial IMP report reviews groundwater activities including water levels, irrigation well and irrigated acre expansion permits, groundwater use reports, irrigated acre certified, test holes drilled and observation wells developed. The report also includes updates on public outreach.

GROUNDWATER LEVEL MONITORING

LCNRD performs water level measurements on 31 wells across the district in the spring and fall of each year. The results of the measurements are reported to United States Geological Survey (USGS) and University of Nebraska Conservation and Survey Division (UNLCSO). Hydrographs for each of the 31 wells were developed in 2014 by NeDNR staff and has subsequently been provided to LCNRD to maintain and update with current measurements for groundwater management. An example of these hydrographs is included in Figure 1 and charts for each monitored well can be found in Appendix 1. Water levels of these wells are used as indicators of aquifer impact by water level decline. Most of the monitored wells have shown an increasing trend in spring water levels for 2019 and 2020 with most rebounding to levels observed prior to the 2012 drought which highly impacted wells across LCNRD. Water levels recorded in the fall of 2020 showed declines in the majority of wells. This trend has continued and the staff and board are paying close attention to the declining levels and are prepared to enact controls identified in rules and regulations if downward trends continue. One well located in Maskell and developed in the Dakota Formation, number 31N4E2DBAB1, caved in and can no longer be measured. The hydrograph includes measurements through 2016 when the well caved in is included in Appendix 1.

LCNRD has continued to drill test holes and develop observation wells in areas of the district to better understand the hydrogeologic framework of the district and to monitor water quality and quantity of distinct aquifers. A complete listing of district observation wells and the geologic formation they are constructed in is provided in Table 1 and a map of their locations and aquifer of development is found in Figure 2. Hydrographs from transducers installed in each observation well are being developed by LCNRD staff.



UNL-CSD Hydrogeologist, Susan Olafsen Lackey with LCNRD Office Manager, Marilyn Schumacher evaluating geologic samples collected using a geoprobe from the Missouri River Alluvium near Aten, NE.

Figure 1: Example of hydrographs representing water levels from annually measured LCNRD irrigation and domestic wells.

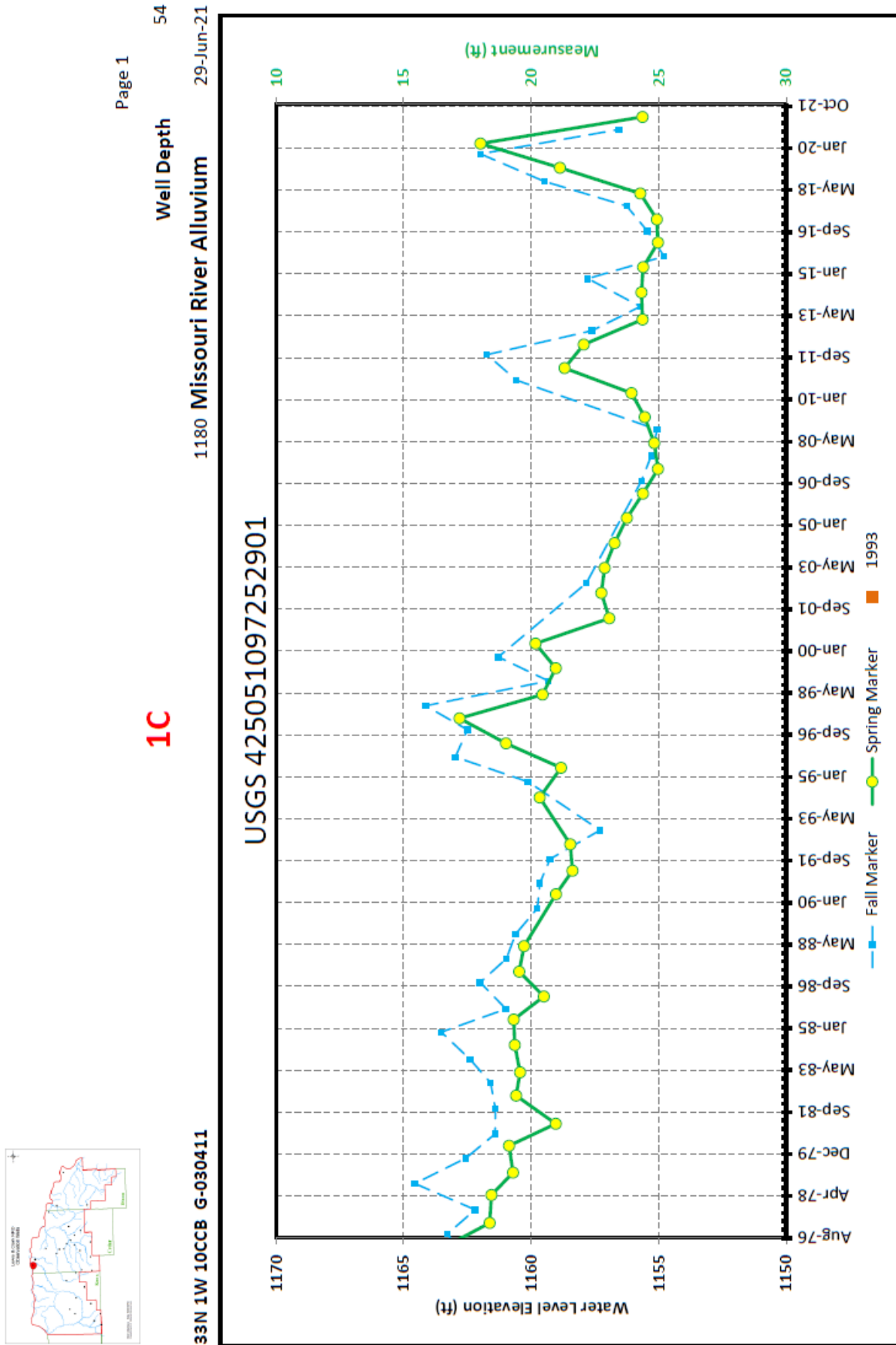


Table 1: LCNRD Test Holes and Observation Wells
and Observation Wells

LCNRD Test Holes and Observation Wells (page 1 of 2)										
Site_#	TH_#	est_lat	est_lon	Location	T	R	RgDir	Sec	Qtr	Targets
1	05-LC-14	42.787000	-97.283683	St. Helena SW	33	1	E	35	SESW	Kd (Shallow)
1(2)	05-LC-14(2)	42.786910	-97.283694	St. Helena SW	33	1	E	35	SESW	Kd (Deep)
2	03-LC-13	42.757481	-97.348515	Menominee SE	32	1	E	18	NENE	S&G in Kn area
3	02-LC-13	42.703486	-97.288859	Fordyce East	32	1	E	34	NESE	Bow Creek Alluvial
3(2)	02-LC-13	42.703486	-97.288859	Fordyce East	32	1	E	34	NESE	Bow Creek Alluvial
4	09-LC-13	42.613128	-97.314471	Hartington West	31	1	E	33	SWSE	Green Gravel
5	08-LC-13	42.554956	-97.174672	Hartington SE	30	2	E	22	SESE	P-P S&G
6	04-LC-13	42.727792	-97.162839	Wynot WHPA	32	2	E	23	SESW	Bow Creek Alluvial
7	07-LC-13	42.496211	-97.201992	Coleridge WHPA	29	2	E	16	NENW	S&G (Deep)
8	01-LC-13	42.669685	-97.171923	Hartington NE	31	2	E	15	NENE	Bow Creek Alluvial
9	05-LC-13	42.569667	-97.454742	Pleasant Valley South	30	1	W	17	SWSE	S&G (Shallow)
9(2)	05-LC-13(2)	42.569500	-97.454906	Pleasant Valley South	30	1	W	17	SWSE	S&G (Deep)
10	06-LC-13	42.598400	-97.250017	Hartington WHPA 1	30	2	E	6	SWSW	P-P S&G
11	04-LC-14	42.823333	-97.643033	Knox-Dakota	33	3	W	22	SENE	Kd (Shallow)
12	01-LC-14	42.554667	-97.269517	Hartington SW-Kn	30	1	E	25	NWNW	Kn
12(2)	01-LC-14(2)	42.554647	-97.269111	Hartington SW-Kd	30	1	E	25	NWNW	Kd (Shallow)
13	02-LC-14	42.582450	-97.7964	Central - Knox Co	30	4	W	16	NWNW	P-P S&G
14	03-LC-14	42.583156	-97.231978	Hartington WHPA2	30	2	E	18	NENE	P-P S&G
15	Sp-LC-15	42.670239	-97.170763	Hartington NE	31	2	E	14	NWNW	Bow Creek Alluvial
15(2)	Sp-LC-15(2)	42.670236	-97.170453	Hartington NE-Kn	31	2	E	14	NWNW	Kn
16	Sp-LC-15	42.705116	-97.289792	Fordyce East	32	1	E	34	NESE	Bow Creek Alluvial
16(2)	Sp-LC-15(2)	42.705147	-97.289566	Fordyce East-Kn	32	1	E	34	NESE	Kn
17	Sp-LC-15	42.601908	-97.34622	Hartington West	30	1	E	5	SWSW	Green Gravel
18	Sp-LC-15	42.612068	-97.173967	Hartington East	30	2	E	3	NENE	P-P S&G
18(2)	Sp-LC-15(2)	42.612065	-97.173842	Hartington East	30	2	E	3	NENE	P-P S&G
19	Sp-LC-15	42.655566	-97.544137	Dolphin-Bloom NE	31	2	W	22	NWNW	P-P S&G
19(2)	Sp-LC-15(2)	42.655420	-97.544179	Dolphin-Bloom NE	31	2	W	22	NWNW	P-P S&G
20	Sp-LC-15	42.596898	-97.681292	Bloomfield West	30	3	W	9	NWNW	P-P S&G
21	Sp-LC-15	42.539141	-97.779173	Bloomfield SW	30	4	W	34	NWNW	P-P S&G
22	Sp-LC-15	42.741724	-97.55669	Crofton-West	32	2	W	21	NENW	P-P S&G
23	Sp-LC-15	42.713402	-97.779137	Lindy-SW	32	4	W	27	SWSW	P-P S&G
24	Sp-LC-15	42.681056	-97.661239	Bloomfield-North	31	3	W	10	NWNW	P-P S&G
25	Fa-LC-15	42.753945	-97.347738	Menominee SE	32	1	E	17	SWNW	Narrow Paleo Valley
26	Sp-LC-16	42.844789	-97.372633	Yankton South	33	1	E	12	SWSE	Missouri River Alluv
26(2)	Sp-LC-16	42.844789	-97.372633	Yankton South	33	1	E	12	SWSE	Missouri River Alluv
27	Fa-LC-15	42.641101	-97.184731	Hartington NE	31	2	E	27	NENW	Bow Creek Alluvial
27(2)	Fa-LC-15(2)	42.641091	-97.184865	Hartington NE-Kn	31	2	E	27	NENW	Kn
28	Fa-LC-15(2)	42.649353	-97.328387	Hartington NW-Kn	31	1	E	20	SENE	Kn
29	Fa-LC-15	42.750000	-97.011389	Maskell-North	32	4	E	18	SENE	Missouri River Alluv
30	Fa-LC-15	42.423354	-96.943229	Dixon-East	28	4	E	10	NENE	P-P S&G
30(2)	Fa-LC-15(2)	42.423364	-96.94339	Dixon-East	28	4	E	10	NENE	P-P S&G
31	Fa-LC-15	42.568525	-96.937559	Dixon-North	30	4	E	15	SESE	P-P S&G
31(2)	Fa-LC-15(2)	42.568522	-96.937656	Dixon-North	30	4	E	15	SESE	P-P S&G
32	Fa-LC-15	42.423901	-96.862455	Allen WHPA	28	5	E	5	SESE	P-P S&G
33	Fa-LC-15	42.658864	-96.86796	Newcastle WHPA	31	5	E	17	NWSE	P-P S&G
34	Fa-LC-15	42.470396	-96.917631	Hwy 20	29	4	E	23	NESE	P-P S&G
35	Sp-LC-16	42.583447	-97.642176	Bloomfield WHPA	30	3	W	11	SWSW	S&G (Shallow)
35(2)	Sp-LC-16(2)	42.583355	-97.642181	Bloomfield WHPA	30	3	W	11	SWSW	S&G (Deep)

LCNRD Test Holes and Observation Wells (page 2 of 2)

Site_#	TH_#	est._lat	est._lon	Location	T	R	RgDir	Sec	Qtr	Targets
36	Su-LC-17	42.509738	-96.830583	Martinsburg	29	5	E	10	NENW	Kd
x	Pre-14	42.491472	-97.759833	Cleaveland	29	4	W	15	SENE	S&G
x(2)	Pre-14	42.491472	-97.759778	Cleaveland	29	4	W	15	SENE	S&G
x	Spalding	42.444917	-97.808172	Creighton MW-1	29	4	W	32	NWSE	S&G
x(2)	Spalding	42.444917	-97.808172	Creighton MW-1	29	4	W	32	NWSE	S&G
x(3)	Spalding	42.444917	-97.808172	Creighton MW-1	29	4	W	32	NWSE	S&G
x	Pre-14	42.444911	-97.847481	Creighton MW-2	29	5	W	36	NWSE	S&G
x(2)	Pre-14	42.444911	-97.847481	Creighton MW-2	29	5	W	36	NWSE	S&G
x(3)	Pre-14	42.444911	-97.847481	Creighton MW-2	29	5	W	36	NWSE	S&G
x	Pre-14	42.444947	-97.867272	Creighton MW-3	29	5	W	35	NWSE	S&G
x(2)	Pre-14	42.444947	-97.867272	Creighton MW-3	29	5	W	35	NWSE	S&G
x(3)	Pre-14	42.444947	-97.867272	Creighton MW-3	29	5	W	35	NWSE	S&G
x	Pre-14	42.452353	-97.877167	Creighton MW-4	29	5	W	27	SESE	S&G
x(2)	Pre-14	42.452353	-97.877167	Creighton MW-4	29	5	W	27	SESE	S&G
x(3)	Pre-14	42.452353	-97.877167	Creighton MW-4	29	5	W	27	SESE	S&G
x	Pre-14	42.473931	-97.857272	Creighton MW-6	29	5	W	24	NWSW	S&G
x(2)	Pre-14	42.473931	-97.857272	Creighton MW-6	29	5	W	24	NWSW	S&G
x(3)	Pre-14	42.473931	-97.857272	Creighton MW-6	29	5	W	24	NWSW	S&G
x	Pre-14	42.481344	-97.857481	Creighton MW-7	29	5	W	14	SESE	S&G
x(2)	Pre-14	42.481344	-97.857481	Creighton MW-7	29	5	W	14	SESE	S&G
x(3)	Pre-14	42.481344	-97.857481	Creighton MW-7	29	5	W	14	SESE	S&G
39(2)	Su-LC-20	42.634355	-97.524246	Dolphin -East	31	2	W	26	NWSW	P-P S&G
39(1)	Su-LC-20	42.634351	-97.524506	Dolphin -East	31	2	W	26	NWSW	P-P S&G
38(2)	Su-LC-20	42.670528	-97.583065	Dolphin-West	31	2	W	8	SWSW	P-P S&G
38(1)	Su-LC-20	42.670497	-97.582853	Dolphin-West	31	2	W	8	SWSW	P-P S&G
37	Su-LC-19	42.843564	-97.444442	Aten-Ditch	33	1	W	16	NWNW	Mo Alluvial
43(1)	Su-LC-21	42.840705	-97.439031	Aten-East	33	1	W	16	SENE	Mo Alluvial
43(2)	Su-LC-21	42.840705	-97.439031	Aten-East	33	1	W	16	SENE	Mo Alluvial
42	Su-LC-21	42.760479	-97.741131	Lindy-second	32	4	W	11	NESE	P-P S&G
40(2)	Su-LC-20	42.655407	-97.056165	Obert-North	31	3	E	15	SWSE	P-P S&G
40(1)	Su-LC-20	42.655407	-97.056165	Obert-North	31	3	E	15	SWSE	P-P S&G
41	Su-LC-20	42.635875	-97.054573	Obert-South	31	3	E	26	SWNW	P-P S&G

Figure 2: LCNRD Test Holes and Observation Wells, aquifers of development and location

LCNRD Test Holes and Observation Wells



GROUNDWATER PERMITTING AND REGULATIONS

Permits have been required since August 2014 for all new irrigation wells and for all irrigated acres developed in the district. Each proposed well is reviewed using a scale and scoring system which includes the number of existing wells within 6,000 feet of the proposed well, the transmissivity, and the saturated thickness of sand and gravel formations to evaluate potential of each well application. Each site proposed for groundwater irrigation expansion is also evaluated primarily to evaluate beneficial use of groundwater. Fields where more than 33% of the acres are comprised of soil types that are 6e or above and 12% slope or greater are required to implement an approved conservation plan with the Natural Resources Conservation Service (NRCS).

LCNRD directors approved 19 irrigation wells and 1,522 acres for irrigation in 2019. There were 40 wells and 3,012 acres approved for irrigation 2020. There was 1 conservation plan required over the two year period for groundwater to be applied on acres identified for agricultural production. Table 2 and Figures 3-4 represent the irrigation wells and expanded irrigated acres approved during the report period. One irrigation expansion permit application in S1/2NW1/4, N1/2SE1/4 Section 4, T31N, R3 W was required to provide additional information via a basic pump test, prior to board approval. The test involved pumping an existing irrigation well in the vicinity of the well proposed to be used for expanding irrigation while measuring the water level change that occurred in another nearby well. Following the basic pump test the permit was approved for well development.

Flow meters have been required on all new irrigation wells developed following adoption of revised groundwater quantity rules and regulations in 2014. The data collected from the flow meter in 2019 and 2020 _____. Figure 5 represents irrigation water use and crops produced for 2019 and 2020 based on reports received. Annual reporting will continue to be required on all permitted wells in LCNRD.

Certification of irrigated acres in LCNRD was actively restarted in 2020 with a small number of acres being certified by the end of the year. The acre certification process is anticipated to be completed within three to five years. Table ___ is a summary of the total certified irrigated acres in LCNRD as of December 31, 2020. Official certification of irrigated acres is made upon board approval of the landowner provided information.

LCNRD has worked with USGS to maintain stream gages on Bazile Creek near Center and worked with USGS and NeDNR on the Bow Creek stream gage near Wynot. The first 3-year agreement for the Bow Creek gage concluded in early 2019. A second 3-year agreement has been re-negotiated for LCNRD and NeDNR to evenly split the portion of the annual cost not covered by the USGS. Stream gage hydrographs are included in the NeNRD IMP report. Additional stream gage needs will be assessed over the next two-year IMP review period.

LCNRD plans to revise the district groundwater management plan that is required by Nebraska Revised Statute 46-673.01 to bring it up to date with current understanding of water resources. The plan was originally drafted in 1984 and modified through an amendment in 2014. Modification to the Rules and regulations pertaining to groundwater quantity were board approved and implemented in 2021. The modifications were primarily made to clean up a variety of items to make the rules structure meet the intent of how they are carried out. Additional modifications will be made to the rules and regulations in 2022 with the primary purpose to accommodate creating a structure where all rules are in a single document as opposed to individual documents for each rule as they are stored currently. Additional changes may be needed following the groundwater management plan update.

Table 2: Board approved irrigation well permit and expanded irrigation permit applications for 2019 and 2020.

2019 Well Expansions				
Permit	Aquifer	New Irrigated Acres	Existing Irrigated Acres	Soils % 6e
Month				
JANUARY				
none	Niobrara	66	33	0.0%
LC-223	S&G Remaining	0	246	4.2%
LC-224	S&G Remaining	0	145	39.9%
LC-225	Niobrara	73	0	0.0%
FEBRUARY				
LC-226	S&G Remaining	130	0	6.00%
none	Dakota	43	619	57.60%
none	Niobrara with S&G Limited	51	200	0%
LC-227	Dakota	0	135	5.2%
MARCH				
none	Niobrara	54	158	19.90%
LC-228	S&G Limited	25	0	43.60%
LC-229NF	S&G Remaining	0	283	0%
LC-230NF	Niobrara	0	95	0%
LC-231NF	S&G Limited	0	145	0%
LC-232NF	Niobrara	0	61	0%
APRIL				
none	S&G Limited	40	418.5	15.78%
none	S&G Limited	32	418.5	40.35%
LC-233	Dakota	136	0	1.00%
LC-234	S&G Remaining	250	0	0.0%
MAY				
none				
JUNE				
LC-235L	Niobrara	0	120	0%
none	Gravel Pit			
none	S&G Limited	52	235	0%
LC-236NF	Gravel Pit	0	260	46.30%
LC-237	S&G Limited	0	33	0%
LC-238	S&G Remaining	133	0	23%
July				
LC-239L	Niobrara with S&G Limited	0	160	Existing
August				
none				
September				
LC-240	Niobrara	69	0	43.4%
OCTOBER				
none	S & G Limited	37	55	19.4%
NOVEMBER				
LC-241	S&G Remaining	133	0	26.1%
DECEMBER				
none	S&G Remaining	133	133	12.4%
none	Niobrara			
none	Dakota	65	170	1.0%
Well Permits	Acre Expansions	New Irrigated Acres	Existing Irrigated Acres	
19	18	1522	4123	

2020 Well Expansions				
Permit	Aquifer	New Irrigated Acres	Existing Irrigated Acres	Soils % 6e
Month				
JANUARY				
none				
FEBRUARY				
LC-243	Niobrara	45	59	1.0%
LC-244	S&G Remaining	173	0	20.0%
LC-245	S&G Remaining	0	0	20.0%
LC-246	S&G Limited	219	0	26.4%
MARCH				
LC-247	S&G Remaining	0	505	27%
LC-248	S&G Remaining	0	257	0%
LC-249R	S&G Limited	0	134	0%
LC-250	S&G Remaining	0	242	51%
LC-251	Niobrara	233	0	7%
APRIL				
none	S&G Limited	40	300	1%
none	S&G Limited	33	300	0%
LC-252	S&G Limited	285	0	5%
LC-253	S&G Remaining	201	0	0.0%
MAY				
LC-254	S&G Remaining	133	0	30.2%
LC-255R	S&G Remaining	0	120	0.0%
LC-256	Niobrara	0	233	6.7%
LC-257	Niobrara	0	0	6.7%
LC-258	S&G Remaining	0	173	19.8%
JUNE				
none	Niobrara	0	233	6.7%
none	S&G Remaining	0	120	0.0%
LC-259R	S&G Remaining	0	275	0.0%
July				
none				
August				
none				
September				
LC-260R	w/ Niobrara	0	160	4.4%
LC-261	Niobrara	115	0	8.0%
LC-262	Niobrara	0	0	8.0%
none	Niobrara	66.5	0	14.2%
none	Niobrara	66.5	0	11.3%
OCTOBER				
LC-263LR	S&G Limited	0	130	6.2%
LC-264	S&G Remaining	133	0	27.5%
LC-265	Niobrara	0	266	5.8%
LC-266	Niobrara	0	115	8.0%
LC-267	S&G Limited	133	0	19.6%
LC-268	S&G Limited	68	0	42.7%
LC-269	S&G Limited	70	0	0.8%
LC-270	S&G Remaining	95	0	7.9%
NOVEMBER				
LC-271	S&G Remaining	133	0	3.2%
none	S&G Remaining	105	266	0.0%
none	Niobrara	17	116	0.0%
none	Niobrara	108	0	8.0%
LC-272	Dakota	136	0	1.0%
LC-273R	S&G Limited	0	253	18.6%
LC-274	Niobrara	0	266	6.0%
LC-275	Niobrara	0	0	6.0%
LC-276	S&G Remaining	133	0	0.0%
DECEMBER				
LC-277	S&G Remaining	0	106	0.0%
LC-278R	S&G Remaining	0	505	27.3%
LC-279	S&G Remaining	120	170	0.0%
LC-280	S&G Remaining	85	66	1.3%
LC-281	S&G Remaining	0	246	4.2%
LC-282	S&G Limited	0	66	0.0%
none	S&G Limited	66	133	5.8%
Well Permits	Acre Expansions	New Irrigated Acres	Existing Irrigated Acres	
40	26	3012	5815	

Figure 3: 2019 Expanded irrigated acres in LCNRD

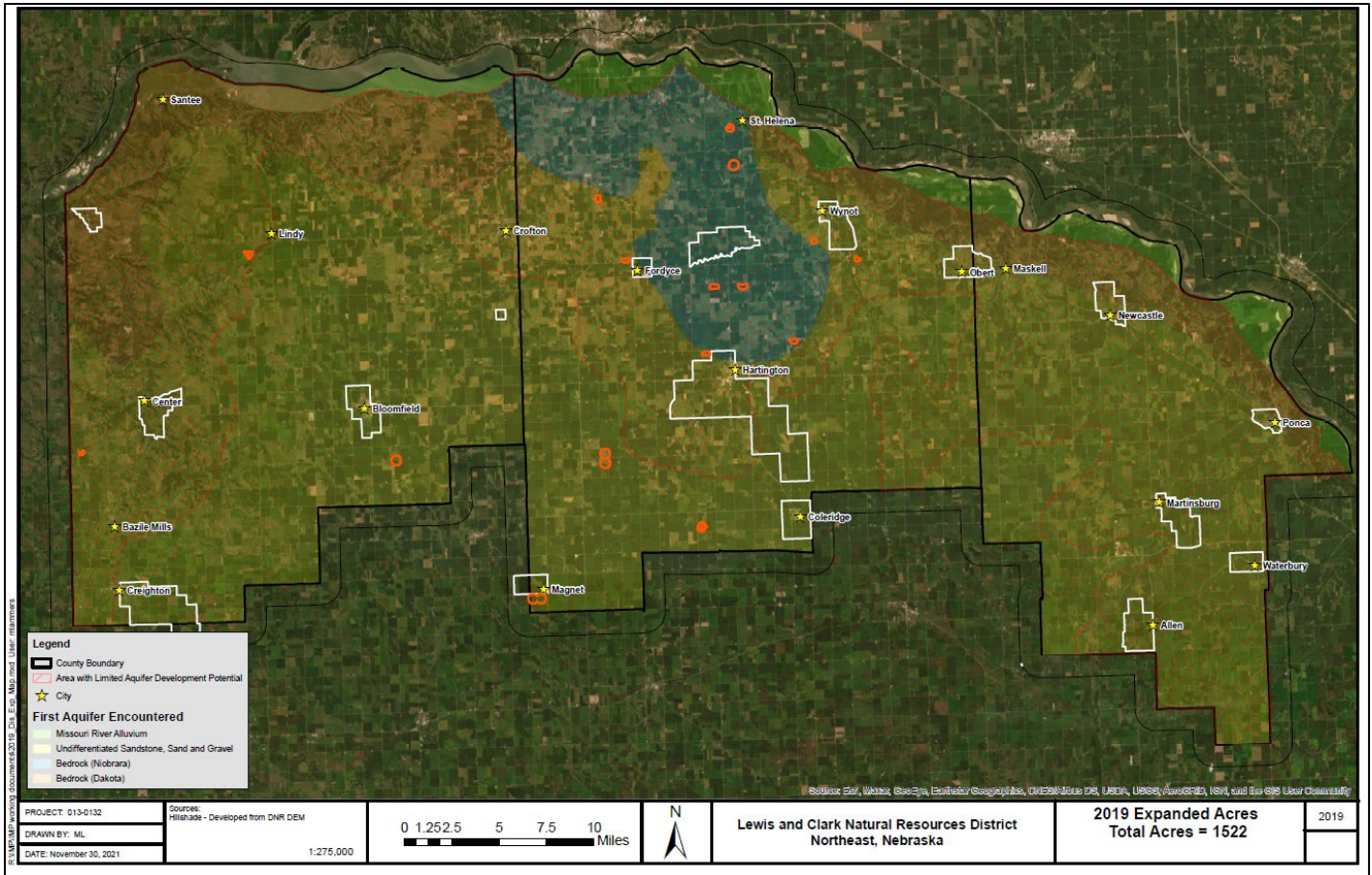


Figure 4: 2020 Expanded irrigated acres in LCNRD

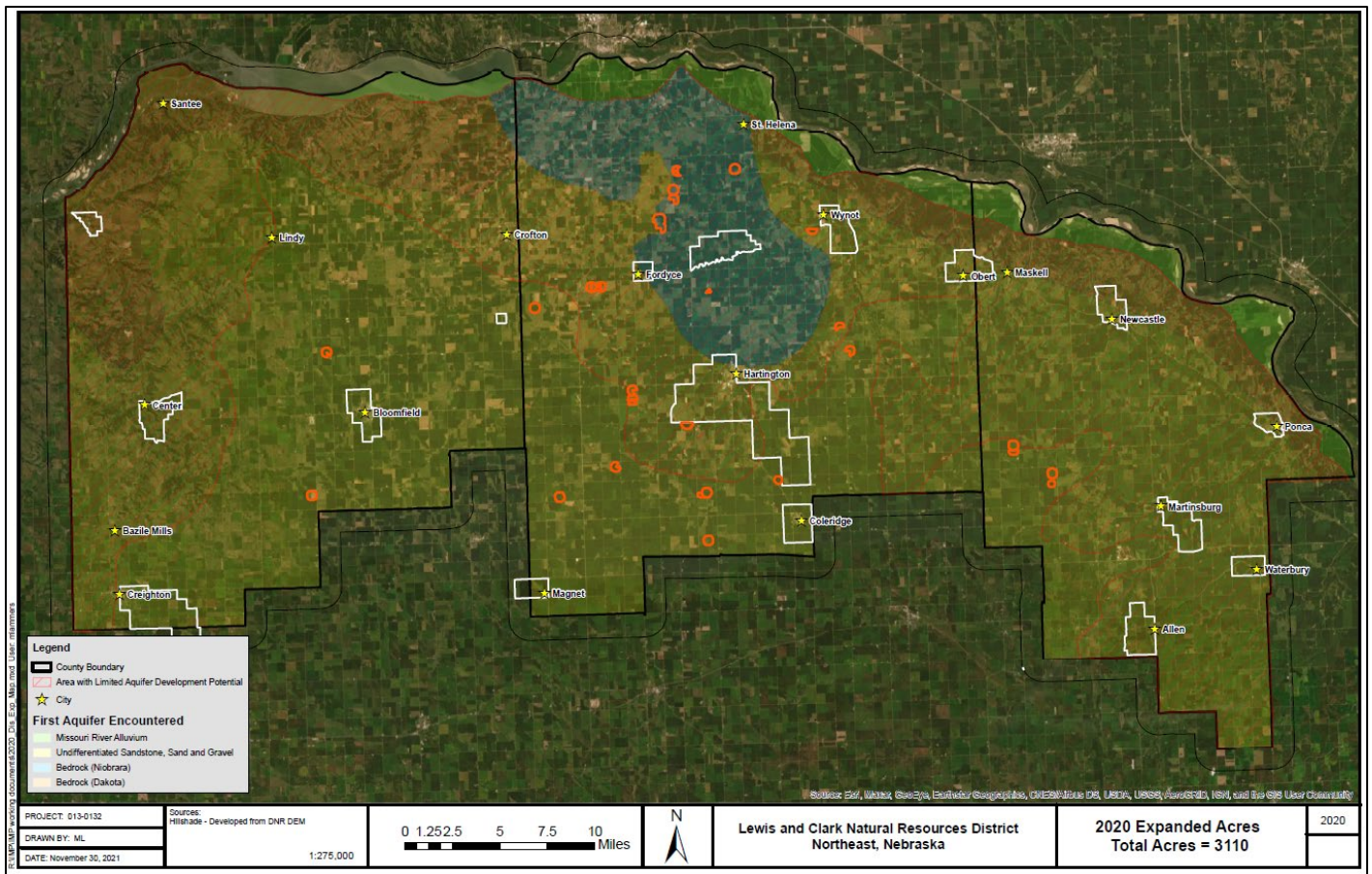
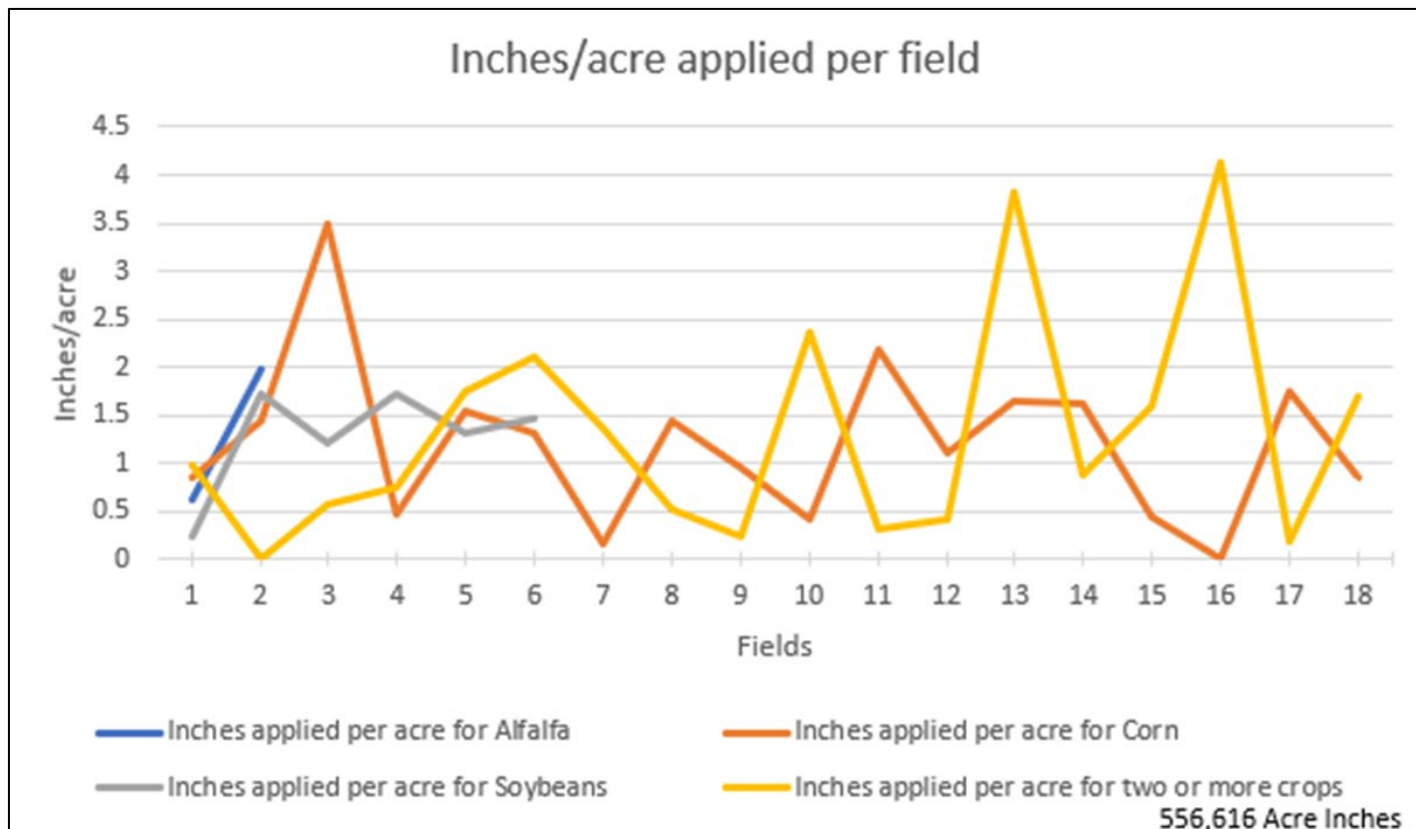


Figure 5: 2019 and 2020 Flow Meter data representing groundwater applied from irrigation wells (only new and replacement wells constructed since 2014).



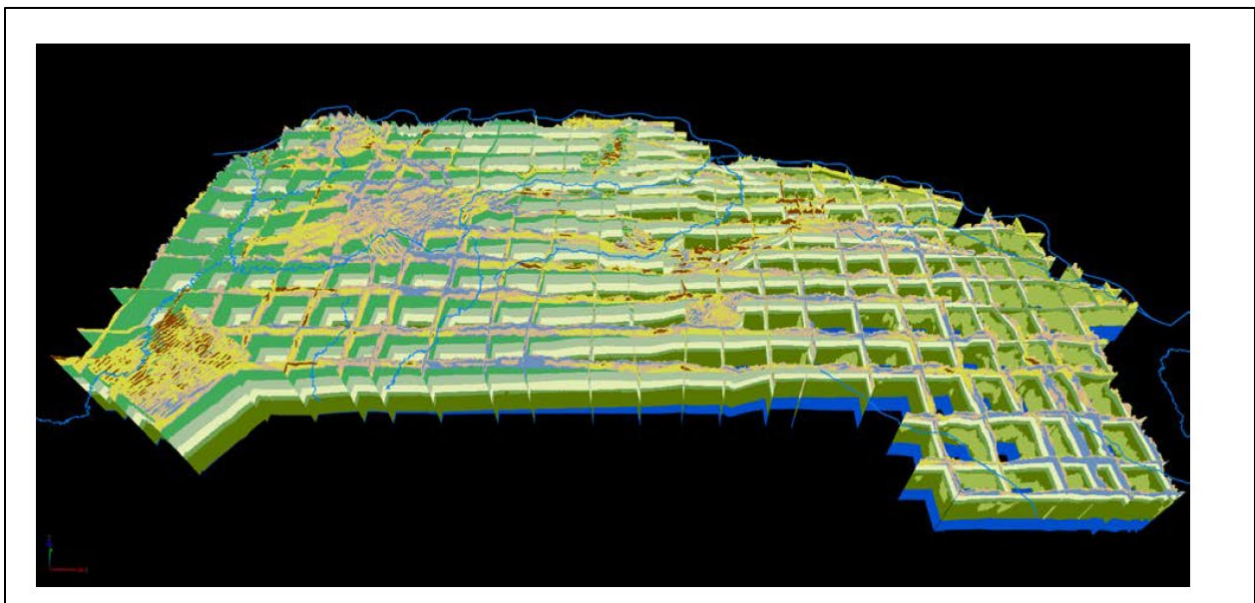
COLLABORATION WITH OTHER ENTITIES

LCNRD became an active member of the Missouri Sedimentation Action Coalition (MSAC) in 2018. The group is working to garner support and funding to draft a plan to minimize the impacts of sediment in Lewis and Clark Lake and other reservoirs on the Missouri River. It is hoped that a Section 22 plan will be approved for funding to draft a plan and that subsequently the identified activities to reduce/mitigate sedimentation in Lewis and Clark Lake will be funded. LCNRD and CKRWP have continued with a plan to locate an alternative source for the water system despite the anticipated development of a plan. The likelihood sedimentation would be mitigated in time to maintain the CKRWP intake is extremely minimal. Identification of a groundwater site to replace the intake in Lewis and Clark Lake is slated for late 2021.

LCNRD collaborates with the University of Nebraska Conservation and Survey Division (UNL-CSD) to conduct groundwater investigation and facilitate projects to further development of the LCNRD specific hydrogeologic framework. UNL-CSD worked with the NRD over the time period of the report to drill test holes, construct observation wells, develop grant applications and provide overall expertise relating to groundwater resources and geology of the district. A listing of the test holes and observation completed with UNL-CSD and other cooperating entities is provided in Table 1 and Figure 1. The work of UNL-CSD to define areas of investigation for further study and for AEM surveys has been critical to defining future work in the district.

LCNRD continues to be an active member of the Eastern Nebraska Water Resources Assessment (ENWRA) which is working through a cooperative agreement with 6 NRDs to develop a geologic framework and water budget for the previously glaciated portion of eastern Nebraska. In 2018 LCNRD worked with ENWRA and UNLCSD to conduct a three-mile grid AEM survey to investigate geologic formations of the district. See Figure 6 for a representation of the area surveyed. Additional AEM survey blocks were also completed in areas of interest for locating a potential groundwater source for the Cedar Knox Rural Water Project (CKRWP) and to increase knowledge of its aquifers. Identification of an alternative source to serve customers of CKRWP is essential to long term sustainability of CKRWP. Sediment entering Lewis and Clark Lake above Gavins Point Dam is encroaching on the intake that provides the current source water for the system and will render it unusable, likely in less than 20 years. The AEM survey report was delivered to LCNRD on September 30, 2019. The data from the survey will be available, at a later date, on the Eastern Nebraska Water Resources Assessment (ENWRA) website www.enwra.org.

Figure 6: Airborne Electromagnetic Mapping and Hydrogeologic Framework of Selected Regions of the Eastern Nebraska Water Resources Assessment Area – Chapter on the Lewis and Clark Natural Resources District



TECHNICAL STUDIES, RESEARCH AND PROJECTS

NeDNR has been working to develop the Lower Platte Missouri Tributaries Model for the last several years and LCNRD has provided information as requested for model development. LCNRD sees the need to review how data is interpreted in the model to ensure it is an accurate representation of the aquifer utilization in LCNRD. It was observed in the 2014 portion of the report provided for model production that wells were designated as bedrock wells in the southern portion of the district where very few, if any, wells are constructed in bedrock formations. This is a concern that must be addressed with NeDNR prior to use of the model to determine Fully Appropriated Basin (FAB) status. The district plans to work with NeDNR and others to review and produce a workable, representative model for LCNRD.

In the future AEM survey data could be utilized to identify areas of potential hydrogeologic connectivity and to identify where aquifer recharge occurs. LCNRD sees benefit to incorporating AEM survey data in the Lower Platte Missouri Tributaries Model prior to finalization. At this time there is no defined plan to utilize the data to improve recharge models and calculations however the data is available to do so. The information from AEM surveys have been used to evaluate aquifer systems of the district and to provide landowners geologic information when considering well development.

EDUCATION AND OUTREACH

LCNRD continues to work towards increasing public awareness of natural resources including ground and surface water conditions by providing educational materials and presentations. News articles published in 2019 and 2020 pertaining to ground or surface water include spring and fall updates on groundwater levels in the measured wells across the district, articles detailing educational events held to benefit the residents of the district, articles about the importance of sealing abandoned wells and articles that address the importance of conservation and soil health for the protection of ground and surface water resources. Directors and staff also take part in several conferences and educational opportunities throughout the year and share that information with fellow residents of the district.

In the 2019-2020 reporting period, LCNRD participated in the following public outreach events to engage stakeholders and/or to disseminate information:

- Cedar and Knox County Fairs
- Ponca State Park Outdoor Expo
- AquaFest for 5th graders
- Wonderful World of Water for high school students
- Bazile Groundwater Management Area – Field Days and Winter Meetings

LCNRD and NeDNR staff are jointly creating a brochure to well and surface water permit applicants that describes hydrogeologic connection and the purpose of integrated management. When completed, the document will be provided to all applicants for well permits and surface water permits. The district will work with NeDNR to develop and disseminate additional information and/or participate in public outreach events about integrated water management as deemed necessary or beneficial.

PROGRESS TOWARDS GOALS AND OBJECTIVES OF THE IMP

The following sections identify action items that were worked on by LCNRD during the reporting period. There are three goals identified in the IMP supported by objectives and tasks to be carried out by NeDNR and/or LCNRD. These actions help LCNRD and NeDNR make progress towards achieving the goals and objectives of the IMP.

Goal 1: Develop and maintain a district-wide water inventory.

Objective 1.1: Create and maintain a comprehensive database of ground and surface water information.

1.1.3 Inventory impact analyses and/or aquifer testing on new, large groundwater uses and surface water appropriations.

1.1.4 Continue certification of acres District-wide.

1.1.5 Update hydrographs for groundwater wells monitored.

Objective 1.2: Address data gaps in the surface and groundwater monitoring network.

1.2.2 Evaluate the need for new stream or well level gages, and the best locations for these.

1.2.3 Expand knowledge of groundwater inventory by filling in the hydrogeologic framework with additional test holes and observation wells for monitoring in areas where deemed appropriate by CSD.

1.2.4 Increase the number of monitoring wells in the Dakota and Niobrara Aquifer systems.

1.2.5 Develop additional observation wells in areas that lack adequate data to follow the trends of groundwater levels.

Goal 2: Protect existing water uses while allowing for future water development.

Objective 2.1: Collaborate with local, state, and federal entities to better manage hydrologically connected ground and surface water.

2.1.2 As hydrologically connected areas are refined, coordinate management efforts with affected local entities as needed.

2.1.3 Collaborate with UNL, NRCS, others to identify areas in the District where the potential for groundwater recharge has changed and why.

Objective 2.3: Improve water resource sustainability through innovative management strategies.

2.3.1 Consider establishing different requirements for groundwater wells drilled before the designation of a management area and those drilled afterward.

2.3.3 Explore methods to minimize water use conflicts (surface or groundwater).

Goal 3: Increase public awareness and understanding of integrated water management

Objective 3.1: Expand public outreach programs for ground and surface water.

3.1.1 Increase news releases regarding groundwater conditions and activities.

3.1.2 Create new educational/informational handouts about groundwater and surface water (well/surface water permitting, trends in surface water and groundwater levels, etc.)

Objective 3.2: Expand public outreach programs related to integrated water management.

3.2.1 Disseminate information through the District website about federal activities on the Missouri River with respect to groundwater and surface water supply in the District.

3.2.2 Develop informational materials about Integrated Water Management, and as needed, other ground and/or surface water related topics affecting the District.

3.2.3 Jointly participate in public outreach events related to integrated water management.

JOILNTLY IDENTIFIED ACTION ITEMS FOR THE NEXT TWO YEARS

LCNRD and NeDNR jointly identified actions that LCNRD will work on during the next two years and report on at the next biennial review. These actions are listed below.

GROUNDWATER LEVEL MONITORING

- Continue monitoring water levels in irrigation wells and observation wells.
- Continue updating hydrographs of water levels in irrigation wells.
- Track and report groundwater well permit and expanded irrigated acre applications and permits.
- Track and report flow meter data from irrigation wells constructed since 2014.

COLLABORATION WITH OTHERS

- Continue working with MSAC on options to address sedimentation in Lewis and Clark Lake and other Missouri River Tributaries.
- Continue working with ENWRA and to define the hydrogeologic framework in eastern Nebraska.
- Continue working with UNL-CSD to investigate groundwater resources and hydrogeologic connection in the district.

TECHNICAL PROJECTS AND STUDIES

- Continue to work with NeDNR on the Lower Platte Missouri Tributaries Model for FAB review and determination.
- Continue to utilize AEM surveys to evaluate the geology and geologic framework of the district to benefit knowledge and management of ground and surface water resources of the district.
- Identify with directors, staff, and/or stakeholders the need for additional projects and/or studies.

EDUCATION AND OUTREACH

- Continue distributing press releases to local newspapers to inform the public about water resource activities, conservation, and opportunities in LCNRD.
- Continue participation in educational events that promote water resource conservation and understanding.
- Complete the education component of the IMP with NeDNR and distribute with all well permit and irrigate acre expansion permits.

In addition to the 3 goals of the IMP the Stakeholder Committee identified 2 long-term goals. The first long-term goal is to increase understanding of tile drainage systems in the district and their impact on water supplies. Although the district sees benefit to investigating the impact of drainage tile on ground and surface water no additional studies have been proposed or implemented. The second long-term goal is to develop programs and or guidelines to encourage water conservation for municipal agricultural and industrial applications. Development of a specific program has not been accomplished however water saving best management practices (BMPs) are encouraged across the district.