

Lewis & Clark Natural Resources District  
**2017-2018 Biennial Review Report**  
of the  
**Voluntary Integrated Management Plan (IMP)**  
jointly developed with the  
**Nebraska Department of Natural Resources**  
October 17, 2019



**LEWIS & CLARK**  
NATURAL RESOURCES DISTRICT

## **Table of Contents**

Introduction.....	1
Groundwater Level Monitoring.....	1
Groundwater Permitting and Regulations.....	5
Collaboration With Other Entities.....	8
Technical Studies, Research, and Projects.....	9
Education and Outreach .....	10
Progress Towards Goals and Objectives of the IMP .....	10
Jointly Identified Action Items For The Next Two Years .....	11

## **Listing of Figures**

Figure 1. Example of LCNRD Hydrographs .....	2
Figure 2. LCNRD Map of Test Holes and Observation Wells .....	4
Figure 3. Map of 2017 Expanded Irrigated Acres in LCNRD .....	7
Figure 4. Map of 2018 Expanded Irrigated Acres in LCNRD .....	7
Figure 5. 2018 Flow Meter Data representing groundwater use since 2014 .....	8
Figure 6. Airborne Electromagnetic Mapping and Hydrogeologic Framework of LCNRD.....	9

## **Listing of Tables**

Table 1. LCNRD Test Holes and Observation Wells.....	3
Table 2. Board approved well and expanded irrigated acre permits .....	6

## **Listing of Appendices**

Appendix 1. Lewis & Clark NRD Hydrographs of Water Levels .....	13
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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 2017 – 2018 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 (UNLCSD). Hydrographs for each of 29 of the 30 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 aquifers impacted by water level decline. Most of the monitored wells have shown an increasing trend in spring water levels for 2017 and 2018 and many have rebounded to levels observed prior to the 2012 drought which highly impacted wells across LCNRD. One well located in Maskell and developed in the Dakota Formation, number 31N4E2DBAB1, caved in and can no longer be measured. The hydrograph through 2016 when the well cave 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.



LCNRD Water Resources Coordinator recording water level and quality data from a dedicated observation well.

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

1C

Well Depth

1180 Missouri River Alluvium

16-Oct-19

33N 1W 10CCB

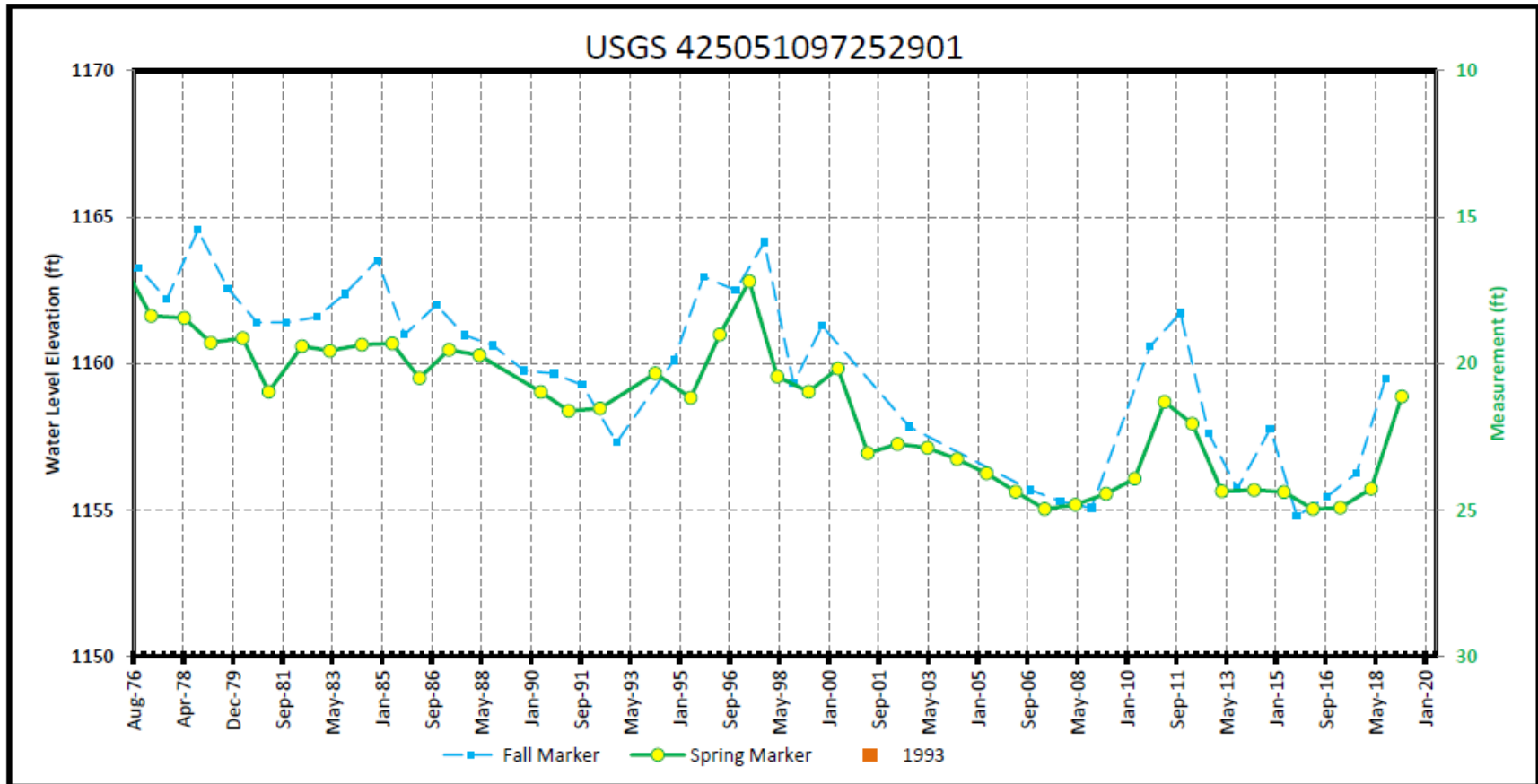




Table 1: LCNRD Test Holes and Observation Wells

LCNRD Test Holes and Observation Wells											
Site Number	Test Hole Number	Location	T	R	Range Dir	Sec	Qtr	Targets	Well Number	Reason for Investigation	
1	05-LC-14	St. Helena SW	33	1	E	35	SESW	Kd (Shallow)	06M	Dakota	
1(2)	05-LC-14(2)	St. Helena SW	33	1	E	35	SESW	Kd (Deep)	06D	Dakota	
2	03-LC-13	Menominee SE	32	1	E	18	NENE	S&G in Kn area	Test Hole	Well Inter	
3	02-LC-13	Fordyce East	32	1	E	34	NESE	Bow Creek Alluvial	Test Hole	Well Inter	
3(2)	02-LC-13	Fordyce East	32	1	E	34	NESE	Bow Creek Alluvial	Test Hole	Well Inter	
4	09-LC-13	Hartington West	31	1	E	33	SWSE	Green Gravel	Test Hole	Well Inter	
5	08-LC-13	Hartington SE	30	2	E	22	SESE	P-P S&G	08M	No Data	
6	04-LC-13	Wynot WHPA	32	2	E	23	SESW	Bow Creek Alluvial	10M	WHPA	
7	07-LC-13	Coleridge WHPA	29	2	E	16	NENW	S&G (Deep)	11M	WHPA	
8	01-LC-13	Hartington NE	31	2	E	15	NENE	Bow Creek Alluvial	Test Hole	No Data	
9	05-LC-13	Pleasant Valley South	30	1	W	17	SWSE	S&G (Shallow)	09M	No Data	
9(2)	05-LC-13(2)	Pleasant Valley South	30	1	W	17	SWSE	S&G (Deep)	09D	No Data	
10	06-LC-13	Hartington WHPA 1	30	2	E	6	SWSW	P-P S&G	03M	WHPA	
11	04-LC-14	Knox-Dakota	33	3	W	22	SENE	Kd (Shallow)	05M	Dakota	
12	01-LC-14	Hartington SW-Kn	30	1	E	25	NWNW	Kn	04S	Niobrara	
12(2)	01-LC-14(2)	Hartington SW-Kd	30	1	E	25	NWNW	Kd (Shallow)	04M	Dakota	
13	02-LC-14	Central - Knox Co	30	4	W	16	NWNW	P-P S&G	12M	WQ	
14	03-LC-14	Hartington WHPA2	30	2	E	18	NENE	P-P S&G	07M	WHPA	
15	Sp-LC-15	Hartington NE	31	2	E	14	NWNW	Bow Creek Alluvial	Test Hole	No Data	
15(2)	Sp-LC-15(2)	Hartington NE-Kn	31	2	E	14	NWNW	Kn	x	Niobrara	
16	Sp-LC-15	Fordyce East	32	1	E	34	NESE	Bow Creek Alluvial	19S	Well Inter	
16(2)	Sp-LC-15(2)	Fordyce East-Kn	32	1	E	34	NESE	Kn	19D	Niobrara	
17	Sp-LC-15	Hartington West	30	1	E	5	SWSW	Green Gravel	30M	Well Inter	
18	Sp-LC-15	Hartington East	30	2	E	3	NENE	P-P S&G	18S	WQ	
18(2)	Sp-LC-15(2)	Hartington East	30	2	E	3	NENE	P-P S&G	18M	WQ	
19	Sp-LC-15	Dolphin-Bloom NE	31	2	W	22	NWNW	P-P S&G	22S	WQ	
19(2)	Sp-LC-15(2)	Dolphin-Bloom NE	31	2	W	22	NWNW	P-P S&G	22M	WQ	
20	Sp-LC-15	Bloomfield West	30	3	W	9	NWNW	P-P S&G	Test Hole	WQ	
21	Sp-LC-15	Bloomfield SW	30	4	W	34	NWNW	P-P S&G	27M	WQ	
22	Sp-LC-15	Crofton-West	32	2	W	21	NENW	P-P S&G	21M	Bkgrd	
23	Sp-LC-15	Lindy-SW	32	4	W	27	SWSW	P-P S&G	23M	No Data	
24	Sp-LC-15	Bloomfield-North	31	3	W	10	NWNW	P-P S&G	26M	No Data	
25	Fa-LC-15	Menominee SE	32	1	E	17	SWNW	Narrow Paleo Valley	20M	No Data	
26	Sp-LC-16	Yankton South	33	1	E	12	SWSE	Missouri River Alluv	25S	No Data	
26(2)	Sp-LC-16	Yankton South	33	1	E	12	SWSE	Missouri River Alluv	25M	No Data	
27	Fa-LC-15	Hartington NE	31	2	E	27	NENW	Bow Creek Alluvial	17S	WQ	
27(2)	Fa-LC-15(2)	Hartington NE-Kn	31	2	E	27	NENW	Kn	17D	Niobrara	
28	Fa-LC-15(2)	Hartington NW-Kn	31	1	E	20	SENE	Kn	24D	Niobrara	
29	Fa-LC-15	Maskell-North	32	4	E	18	SENE	Missouri River Alluv	16S	No Data	
30	Fa-LC-15	Dixon-East	28	4	E	10	NENE	P-P S&G	Test Hole	WQ, No Data	
30(2)	Fa-LC-15(2)	Dixon-East	28	4	E	10	NENE	P-P S&G	x	WQ, No Data	
31	Fa-LC-15	Dixon-North	30	4	E	15	SESE	P-P S&G	13S	WQ, No Data	
31(2)	Fa-LC-15(2)	Dixon-North	30	4	E	15	SESE	P-P S&G	13M	WQ, No Data	
32	Fa-LC-15	Allen WHPA	28	5	E	5	SESE	P-P S&G	14M	WHPA	
33	Fa-LC-15	Newcastle WHPA	31	5	E	17	NWSE	P-P S&G	15M	WHPA	
34	Fa-LC-15	Hwy 20	29	4	E	23	NESE	P-P S&G	Test Hole	WQ, No Data	
35	Sp-LC-16	Bloomfield WHPA	30	3	W	11	SWSW	S&G (Shallow)	28S	WHPA	
35(2)	Sp-LC-16(2)	Bloomfield WHPA	30	3	W	11	SWSW	S&G (Deep)	28M	WHPA	
36	Su-LC-17	Martinsburg	29	5	E	10	NENW	Kd	29M	WQ	
x	Pre-14	Cleaveland	29	4	W	15	SENE	S&G	2S	WQ	
x(2)	Pre-14	Cleaveland	29	4	W	15	SENE	S&G	2M	WQ	
x	Spalding	Creighton MW-1	29	4	W	32	NWSE	S&G	ML-1S	WQ	
x(2)	Spalding	Creighton MW-1	29	4	W	32	NWSE	S&G	ML-1M	WQ	
x(3)	Spalding	Creighton MW-1	29	4	W	32	NWSE	S&G	ML-1D	WQ	
x	Pre-14	Creighton MW-2	29	5	W	36	NWSE	S&G	ML-2S	WQ	
x(2)	Pre-14	Creighton MW-2	29	5	W	36	NWSE	S&G	ML-2M	WQ	
x(3)	Pre-14	Creighton MW-2	29	5	W	36	NWSE	S&G	ML-2D	WQ	
x	Pre-14	Creighton MW-3	29	5	W	35	NWSE	S&G	ML-3S	WQ	
x(2)	Pre-14	Creighton MW-3	29	5	W	35	NWSE	S&G	ML-3M	WQ	
x(3)	Pre-14	Creighton MW-3	29	5	W	35	NWSE	S&G	ML-3D	WQ	
x	Pre-14	Creighton MW-4	29	5	W	27	SESE	S&G	ML-4S	WQ	
x(2)	Pre-14	Creighton MW-4	29	5	W	27	SESE	S&G	ML-4M	WQ	
x(3)	Pre-14	Creighton MW-4	29	5	W	27	SESE	S&G	ML-4D	WQ	
x	Pre-14	Creighton MW-6	29	5	W	24	NWSW	S&G	ML-6S	WQ	
x(2)	Pre-14	Creighton MW-6	29	5	W	24	NWSW	S&G	ML-6M	WQ	
x(3)	Pre-14	Creighton MW-6	29	5	W	24	NWSW	S&G	ML-6D	WQ	
x	Pre-14	Creighton MW-7	29	5	W	14	SESE	S&G	ML-7S	WQ	
x(2)	Pre-14	Creighton MW-7	29	5	W	14	SESE	S&G	ML-7M	WQ	
x(3)	Pre-14	Creighton MW-7	29	5	W	14	SESE	S&G	ML-7D	WQ	

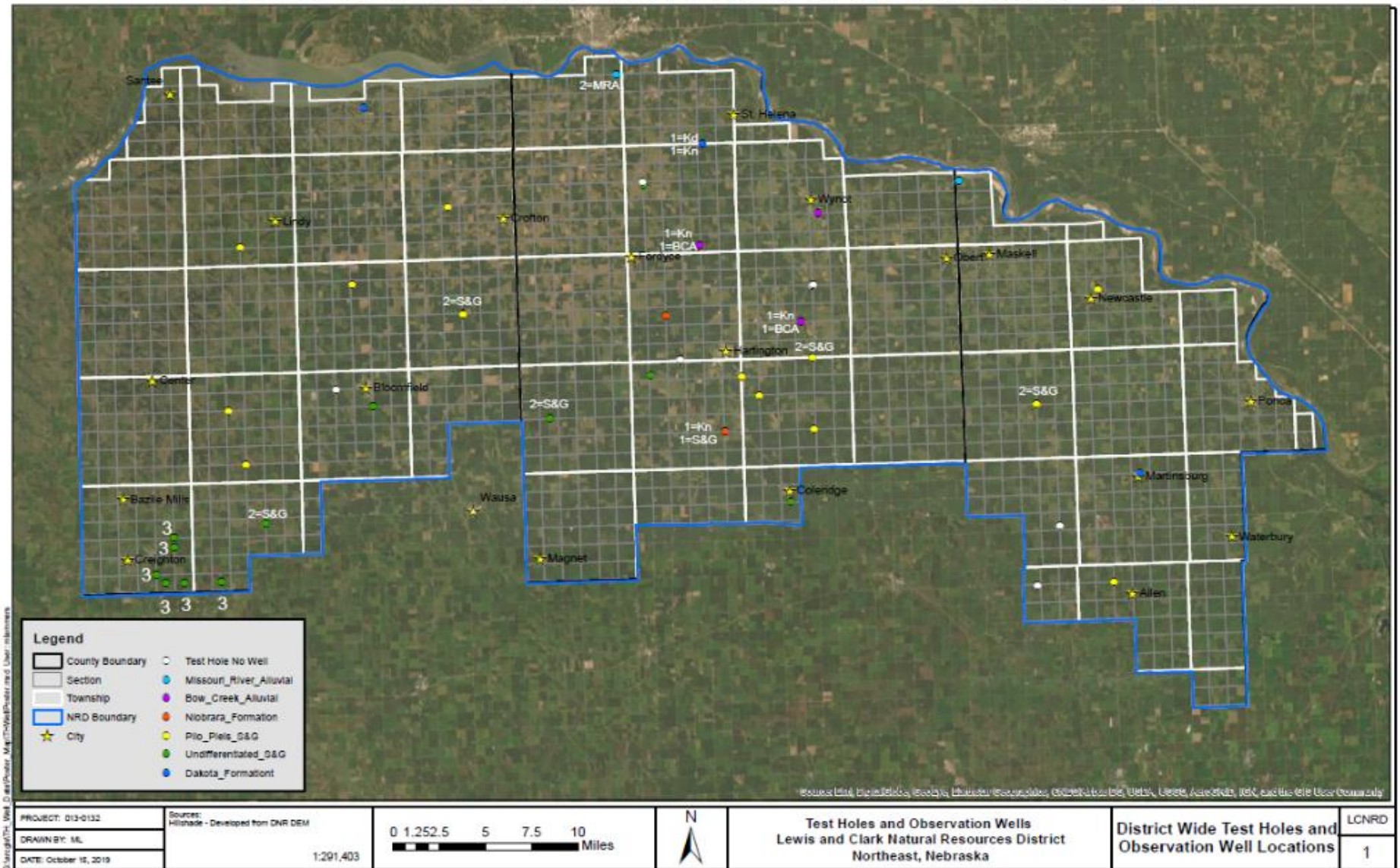
Light blue rows indicate sites were test holes were drilled but no observation wells were installed

WQ = Water Quality

Well Inter = Well Interference

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

# Lewis & Clark NRD Test Holes & 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 27 irrigation wells and 1307 acres for irrigation in 2017. 18 wells and 1689 acres for irrigation were approved in 2018. There was a total of 3 conservation plans required in 2017 and 2018 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. Only a handful of flow meter reports were received in 2017 and 70 flow meter reports were received in 2018, 44 of which utilized groundwater during 2018. Figure 5 represents irrigation water use and crops produced for 2018 based on reports received. Annual reporting will continue to be required on all permitted wells in LCNRD.

Certification of irrigated acres in LCNRD has been delayed numerous times due to staff changes, IT issues and software malfunctions. Staff are nearing the end of a several month process with the software development company to return the data base and software to a functional status. Official certification of irrigated acres with review by the board of directors will begin once integrity of the database and software is confirmed. Staff have initiated preliminary certifications and to date approximate certifications include 13,000 acres by about 70 producers in Cedar County, 8,200 acres by 35 producers Knox County and 630 acres by 5 producers in Dixon County. Certifications will be provided in the next biennial IMP report.

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. Rules and regulations pertaining to groundwater quantity are also planned for revision in order to bring them up to date and incorporate activities occurring in the district.



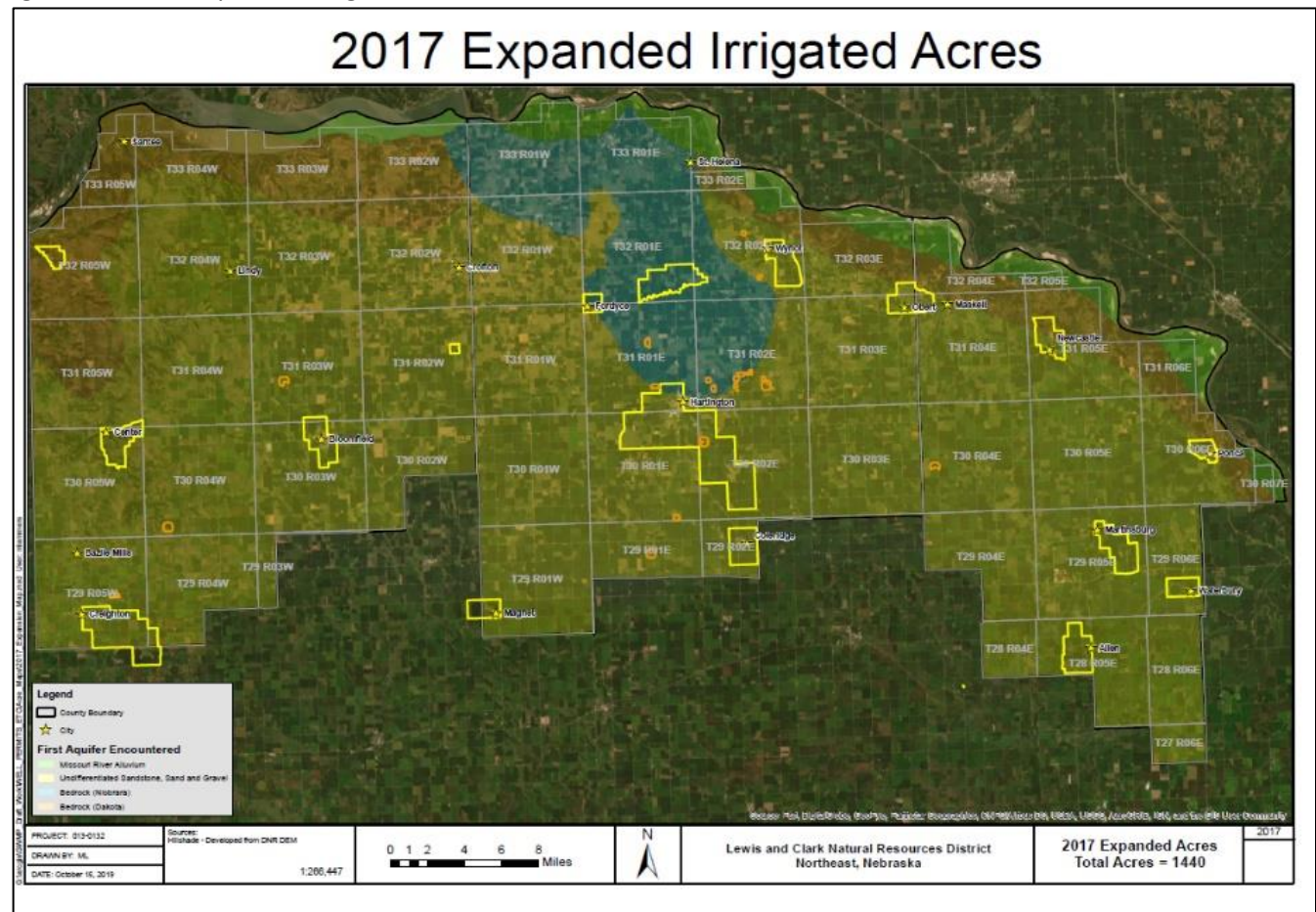
2017 Well Expansions				
Permit	Aquifer	New Irrigated Acres	Existing Irrigated Acres	Soils % 6e
Month				
LC-178	Niobrara	133	0	0.0%
<b>January</b>		<b>133</b>	<b>0</b>	
None	Dakota	30	649	76.9%
<b>February</b>		<b>30</b>	<b>649</b>	
none	Niobrara with S&G Limited	51	200	
LC179	S&G Limited S&G			
LC180	Limited	0	200	4.40%
<b>March</b>		<b>51</b>	<b>600</b>	
none	Niobrara with S&G Limited	30	133	0.0%
none	S&G Limited	76	200	29.4%
none	S&G Limited	35	85	0.0%
LC-181	Niobrara with S&G Limited	108	0	0.0%
LC-182	S&G Remaining	0	253	18.6% Existing
LC-183	S&G Limited	0	139	47% Existing
none	Kn	32	133	2.0%
LC-184	S&G Remaining	0	133	.5% Existing
<b>April</b>		<b>281</b>	<b>1076</b>	
LC-185	S&G Limited with Niobrara	12	148	17.6% Existing
LC-186L	Niobrara with S&G Limited	0	108	0% Existing
<b>May</b>		<b>12</b>	<b>256</b>	
LC-187	S&G Remaining	140	0	34.25%
LC-188 LC-189	Niobrara Niobrara	0 0	65 65	0% Existing
LC-190 LC-191	S&G Remaining S&G Remaining	0 0	133 133	0% Existing
<b>June</b>		<b>140</b>	<b>396</b>	
LC-192	S&G Remaining	88	199	3.8% Existing
LC-193R	S&G Limited	0	120	Existing
LC-194R	Niobrara with S&G Limited	0	160	Existing
<b>July</b>		<b>88</b>	<b>479</b>	
LC-195R	S&G Remaining	0	665	Existing
LC-196	S&G Remaining	110	0	0%
LC-197	S&R Remaining	67	0	0%
none	S&G Remaining	0	217	Existing
<b>August</b>		<b>177</b>	<b>882</b>	
LC-198	S&G Remaining	133	0	26.1%
LC-199R	S&G Remaining	0	0	0.0%
LC-200	Niobrara	116	0	2.10%
<b>September</b>		<b>249</b>	<b>0</b>	
none	Niobrara Niobrara	25	413	24.5%
<b>0</b>		<b>25</b>	<b>413</b>	
none	S&G Remaining	0	0	18.9%
LC201	Dakota	66	0	3.3%
<b>November</b>		<b>66</b>	<b>0</b>	
none	S&G Limited	55	80	31.1%
LC202	S&G Remaining	0	133	0.4%
LC203	S&G Limited	0	158	24.9%
LC204	S&G Remaining	0	124	0.0%
<b>December</b>		<b>55</b>	<b>495</b>	
Well Permits	Acre Expansion	New Irr Acres	Existing Irr Acres	
27	19	1307	5246	

2018 Well Expansions				
Permit	Aquifer	New Irrigated Acres	Existing Irrigated Acres	Soils % 6e
Month				
none	S & G Remaining	17	133	0.0%
none	S&G Remaining	160	0	18.9%
<b>January</b>		<b>177</b>	<b>133</b>	
LC205	S & G Remaining	155	0	12.20%
none	S & G Limited	30	266	0.0%
<b>February</b>		<b>185</b>	<b>266</b>	
LC206	S & G Remaining	34	133	0%
LC207	Niobrara	115	0	0.80%
none	S & G Remaining	22	133	12%
LC208	S & G Limited	133	0	5%
<b>March</b>		<b>304</b>	<b>266</b>	
none	Kd	108	205	0%
LC209	Kd			
LC210	Kd	418.47	0	34.23%
LC211	S & G Limited			
LC212	S & G Limited	135	0	5.20%
none	S & G Limited	42	60	0.0%
<b>April</b>		<b>703.47</b>	<b>265</b>	
LC213NF	S & G Remaining	66	0	7.70%
none	S & G Limited	32	110	10.50%
LC214NF	Niobrara	0	115	0.8%
<b>May</b>		<b>98</b>	<b>225</b>	
LC215	S & G Limited	0	135	5.20%
LC216	S & G Limited			
LC217	S & G Limited	55	0	14.80%
<b>June</b>		<b>55</b>	<b>135</b>	
none	S & G Limited	100	134	41.2%
LC218NF	S & G Limited with Niobrara	0	67	0.0%
LC219NF	S & G Limited with Niobrara	0	170	0.0%
LC220	S & G Limited	0	55	14.8%
LC221	S & G Limited	0	418.5	34.2%
<b>July</b>		<b>100</b>	<b>844.5</b>	
<b>August</b>		<b>0</b>	<b>0</b>	
LC222	S & G Limited	0	418.5	34.2%
<b>September</b>		<b>0</b>	<b>418.5</b>	
<b>October</b>		<b>0</b>	<b>0</b>	
<b>November</b>		<b>0</b>	<b>0</b>	
none	Niobrara	66	33	0.0%
<b>December</b>		<b>66</b>	<b>33</b>	
Well Permits	Acre Expansion	New Irr Acres	Existing Irr Acres	
18	22	1689	2586	

Table 2: Board approved irrigation well permit and expanded irrigation permit applications for 2017 and 2018.



Figures 3: 2017 Expanded irrigated acres in LCNRD



Figures 4: 2018 Expanded irrigated acres in LCNRD

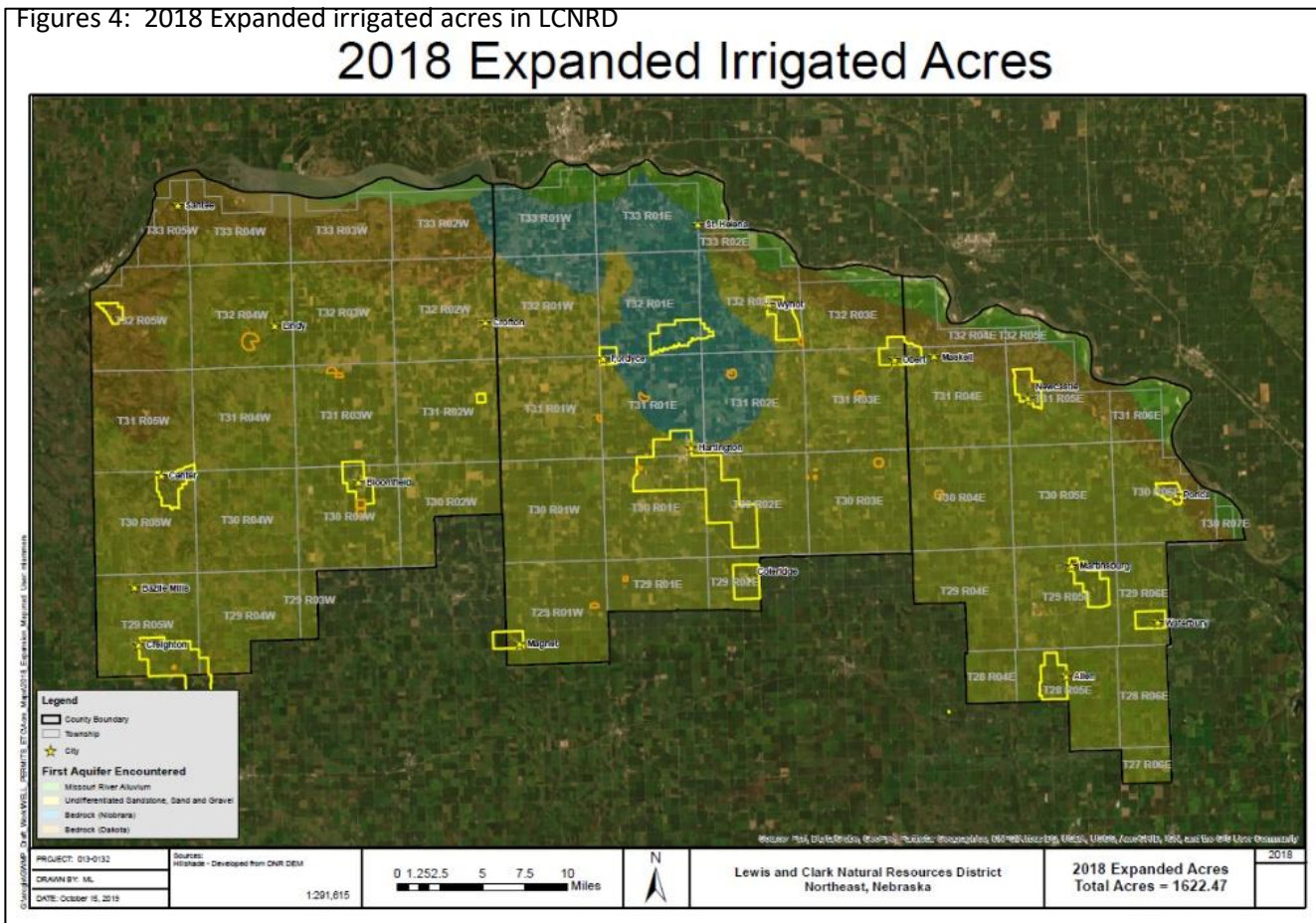
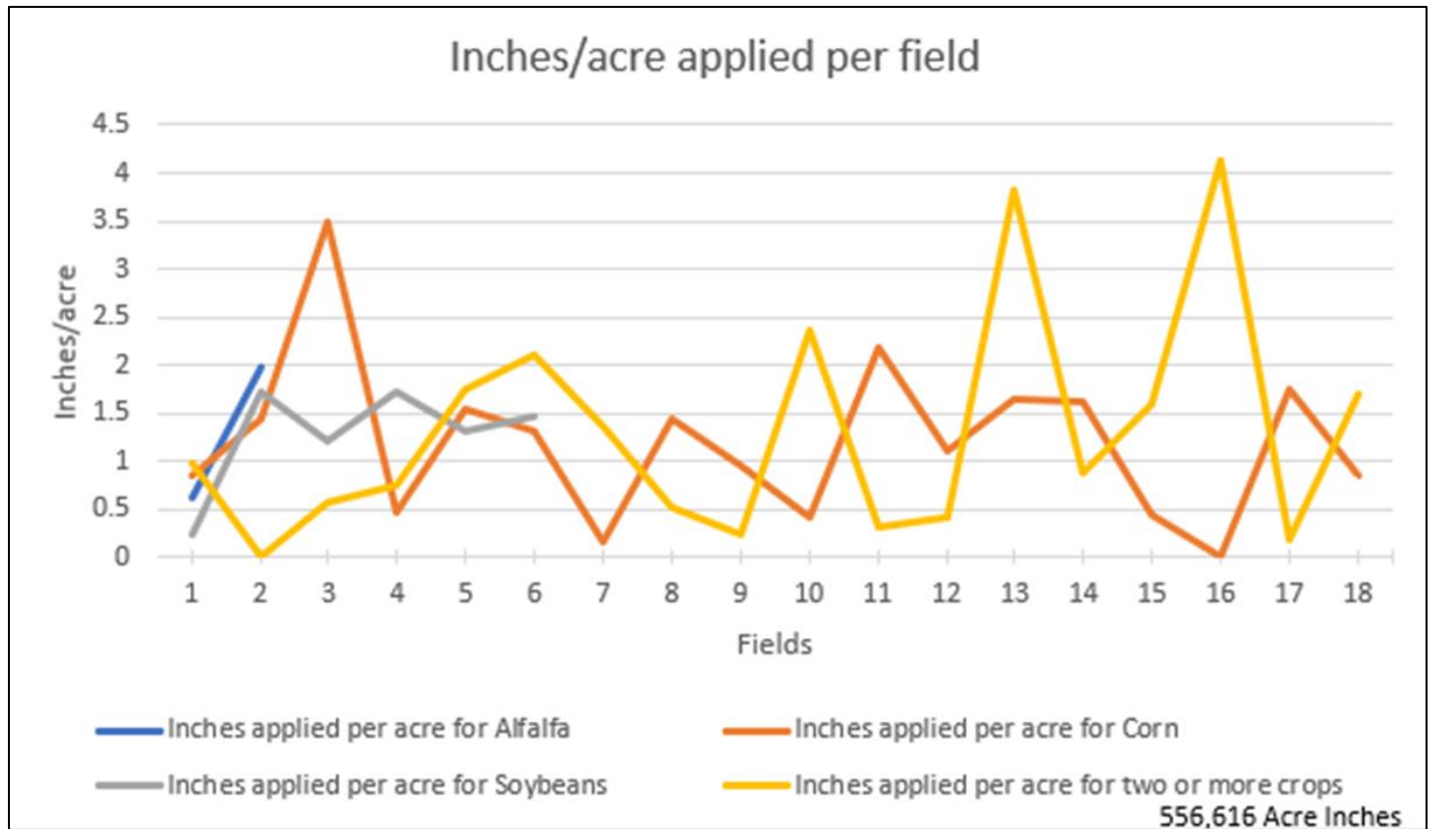


Figure 5: 2018 Flow Meter data representing groundwater applied from irrigation wells developed since 2014



## 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 are continuing 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.

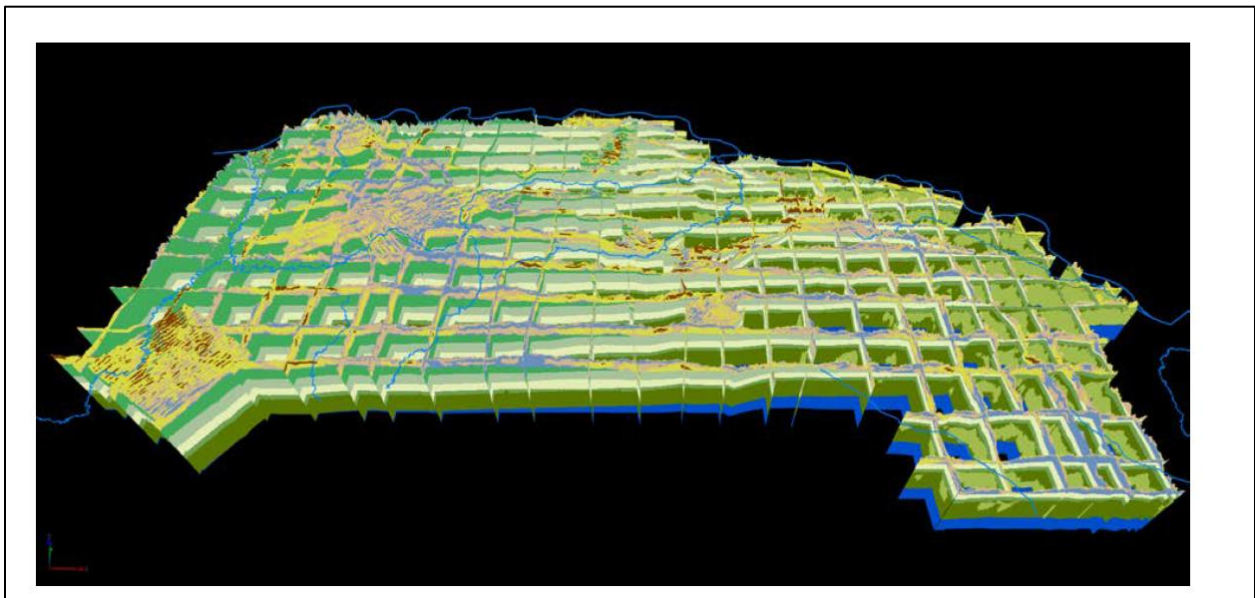
LCNRD collaborates with the University of Nebraska Conservation and Survey Division (UNLCSD) to conduct groundwater investigation and facilitate projects to further development of the LCNRD specific hydrogeologic framework. UNLCSD worked with the NRD over the time period of the report to drill test holes, construct observation wells, plan Airborne Electromagnetic (AEM) surveys, 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 UNLCSD and other cooperating entities is provided in Table 1 and Figure 1. The work of UNLCSD 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](http://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 2017 and 2018 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, and 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 2017-2018 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 5<sup>th</sup> graders
- Wonderful World of Water for high school students

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.



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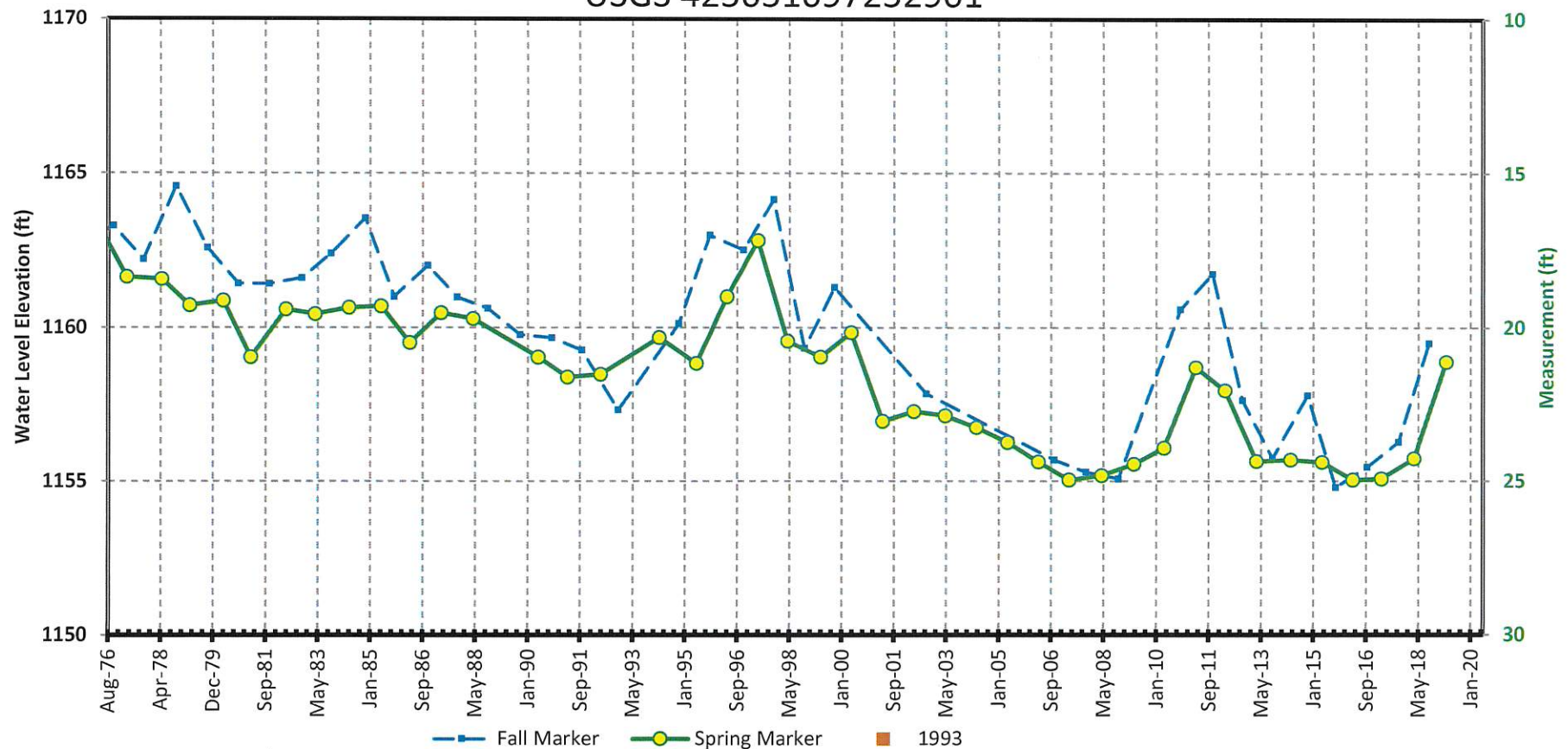
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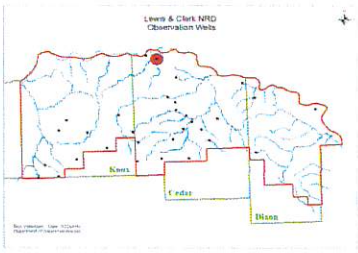
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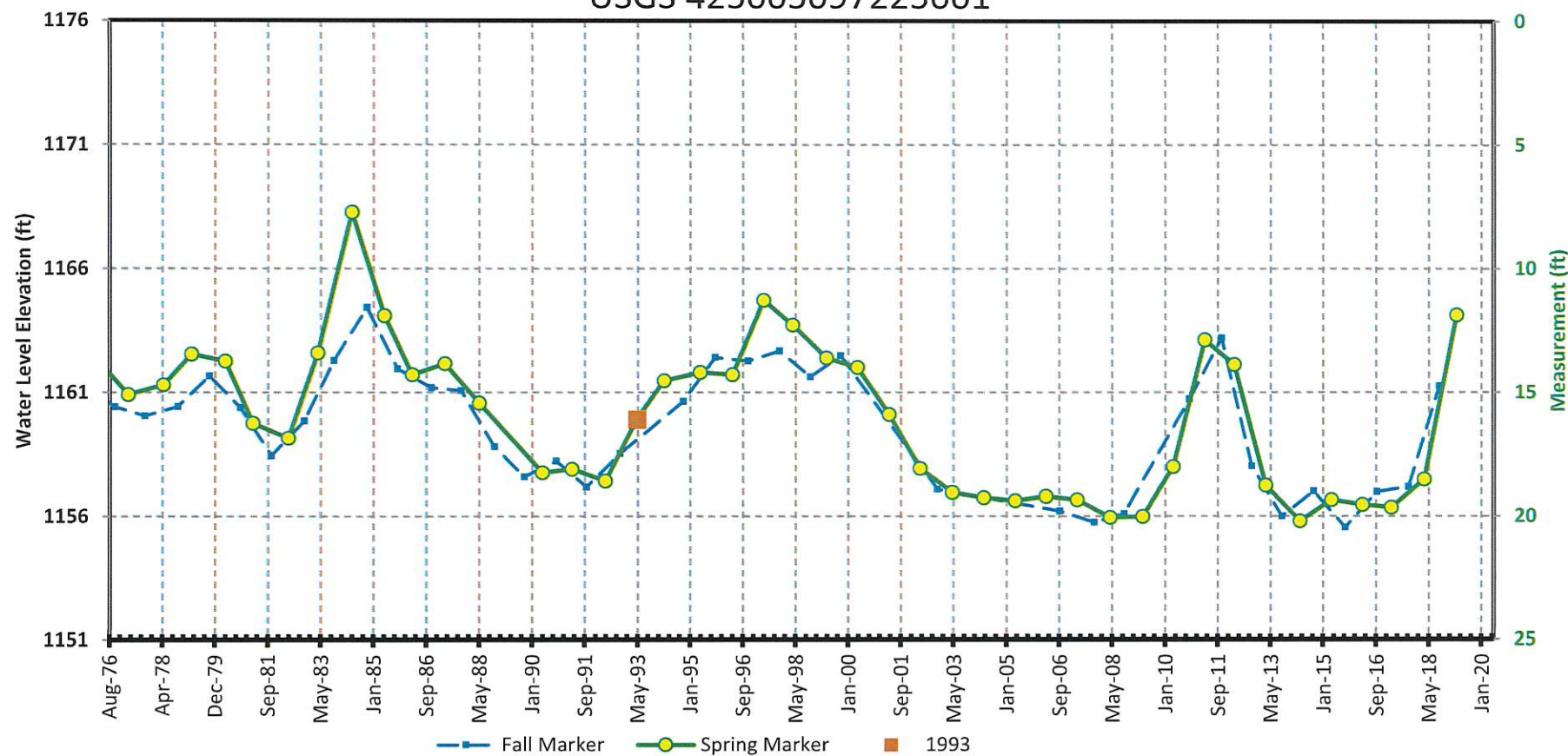
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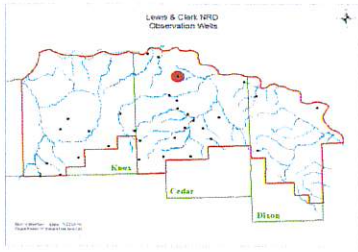
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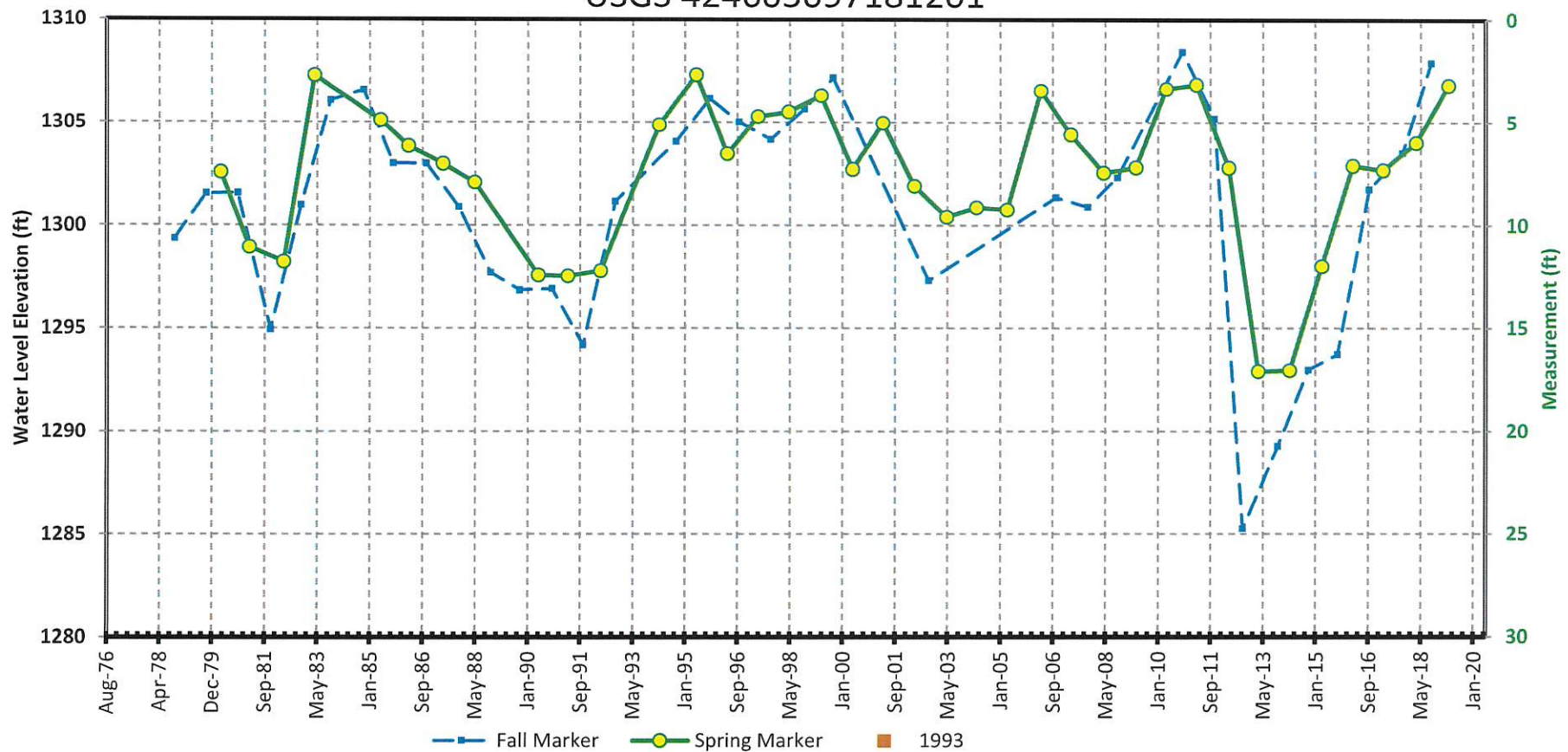
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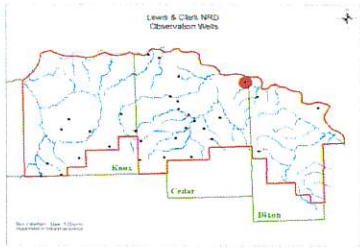
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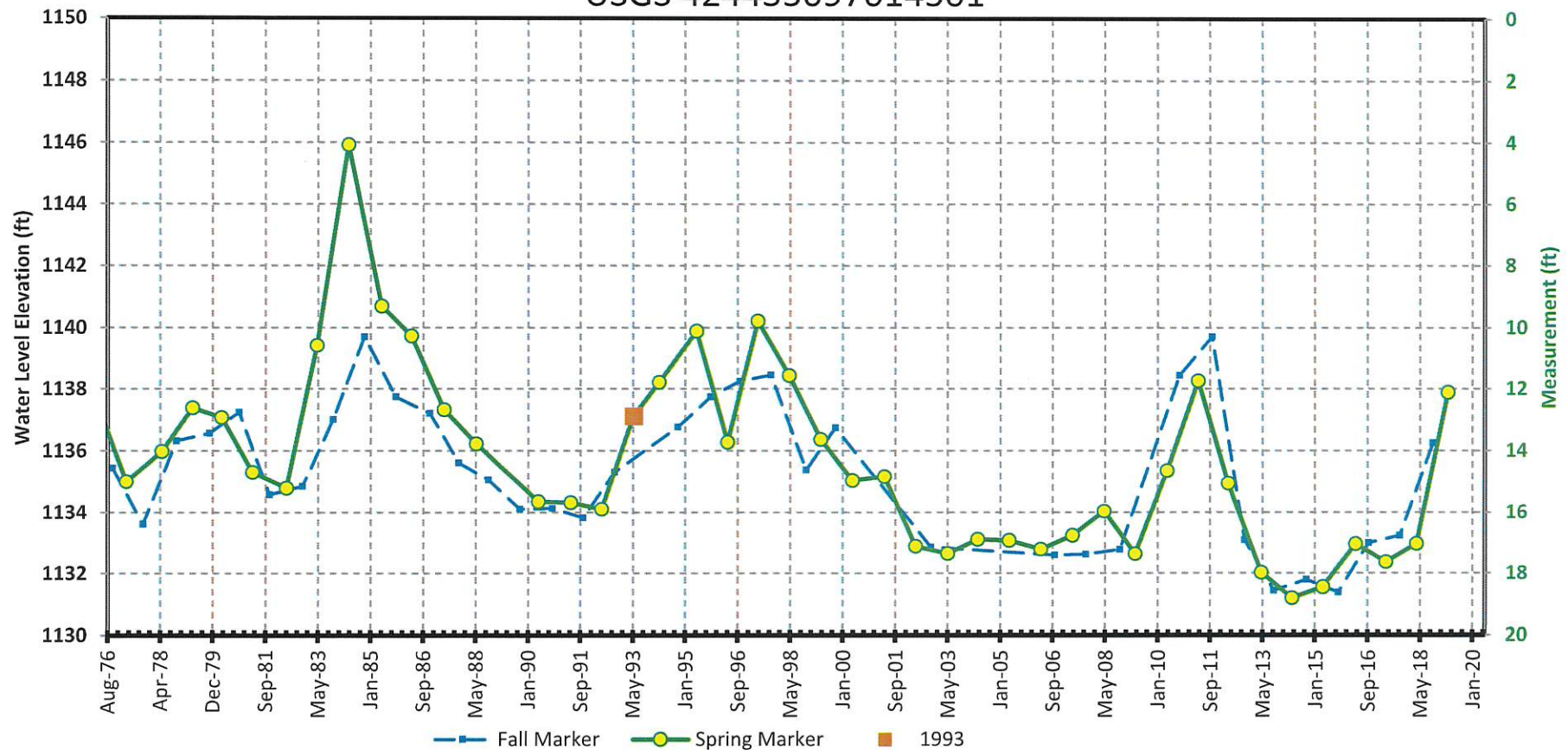
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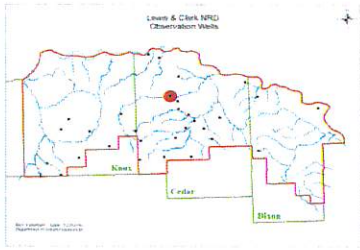
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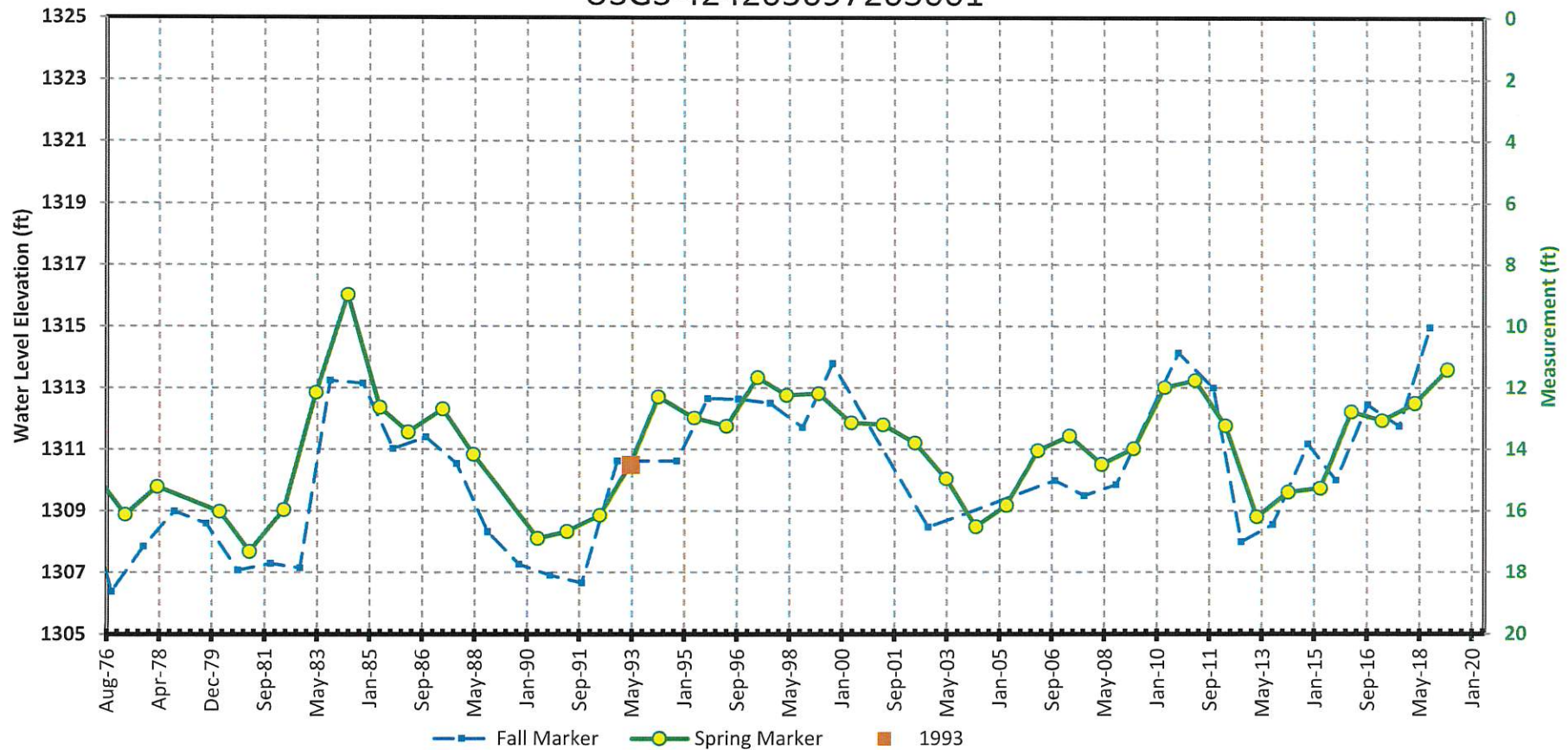
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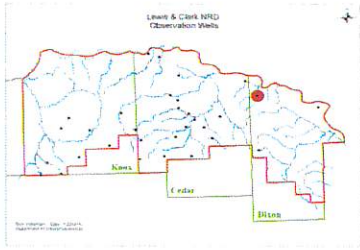
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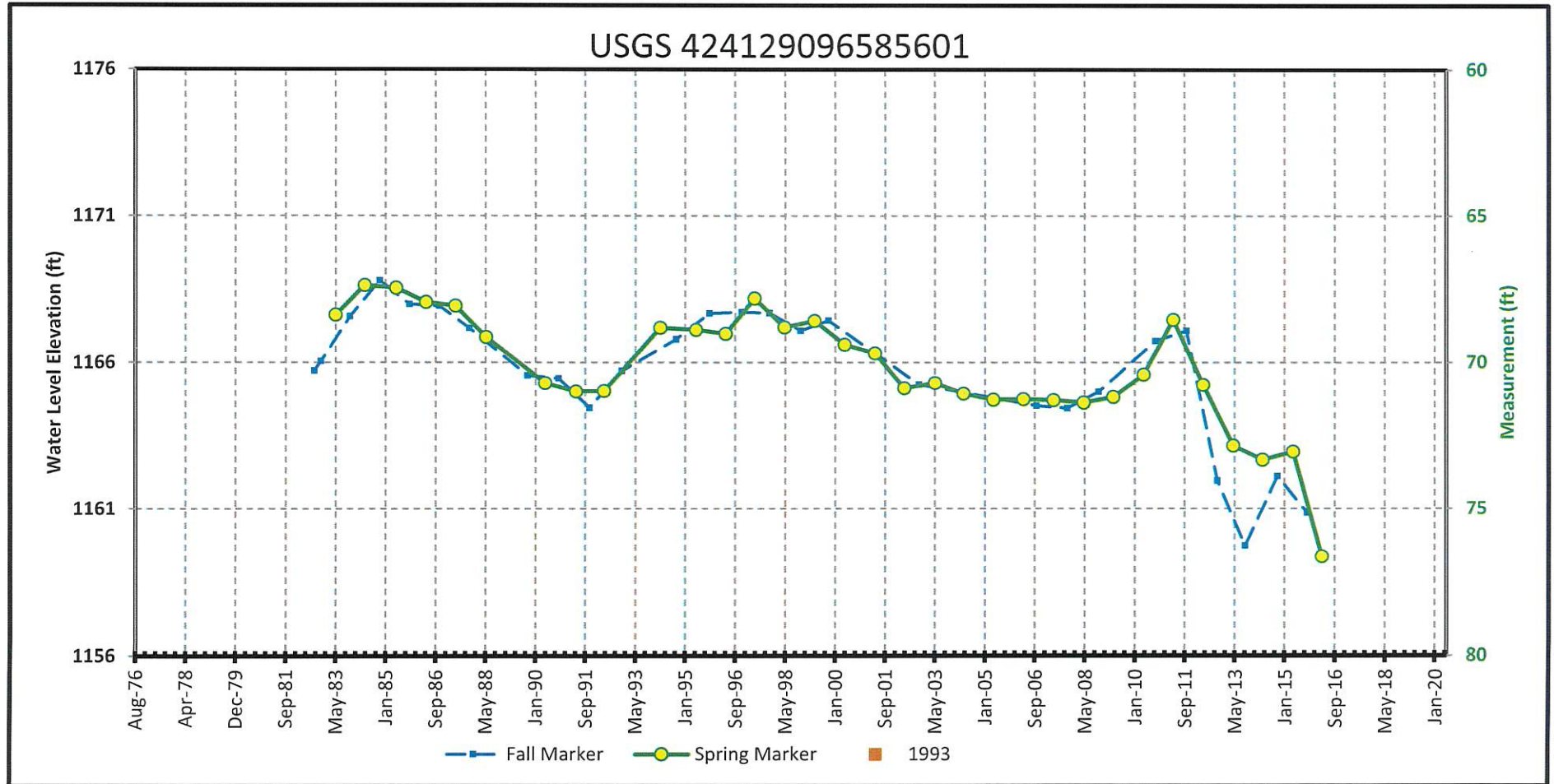
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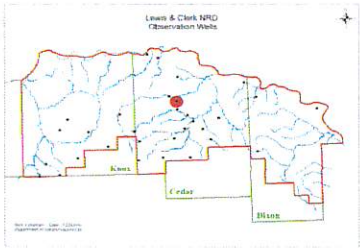
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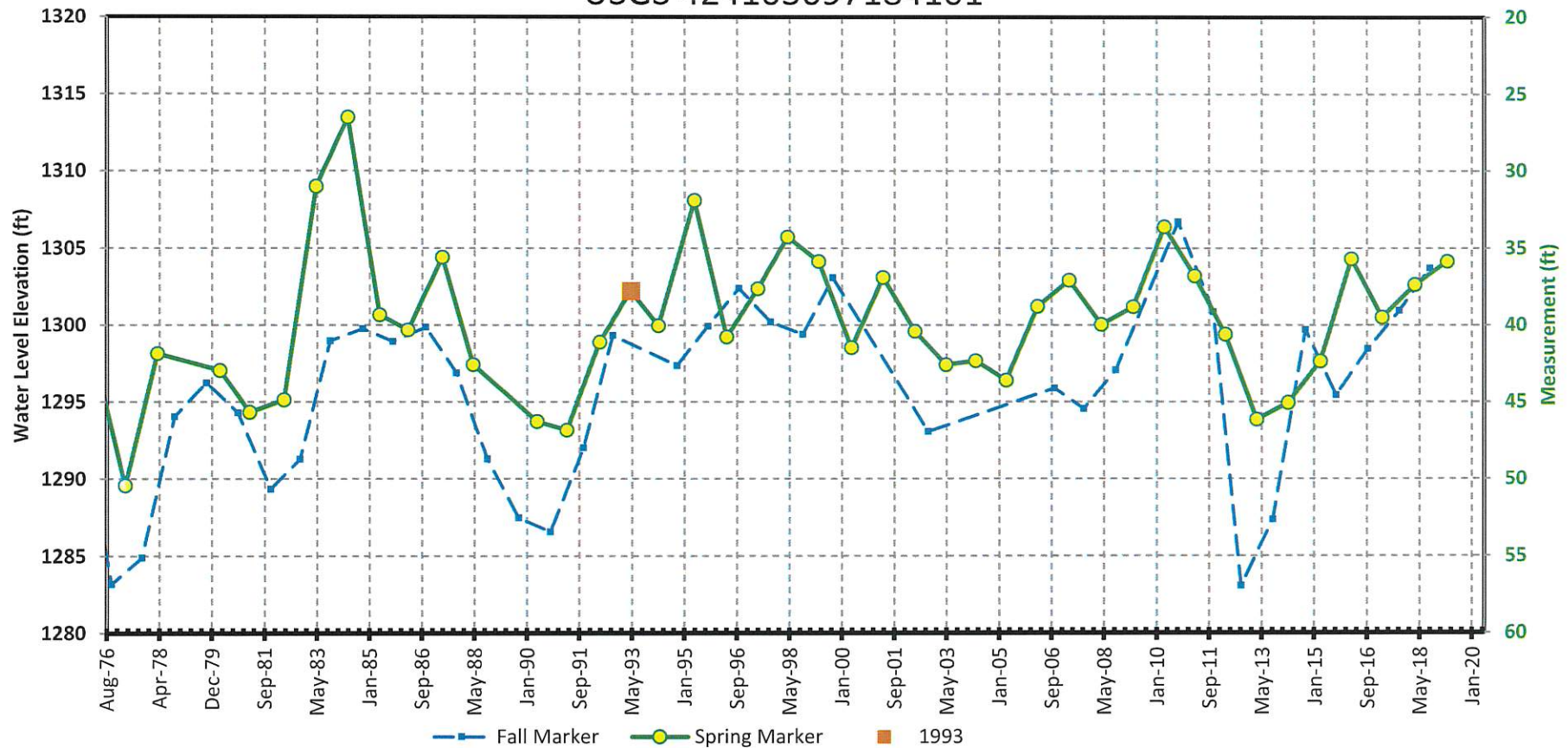
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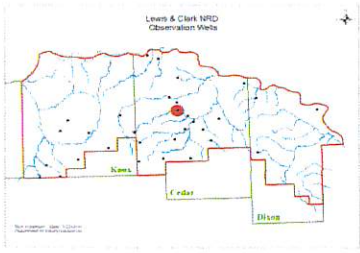
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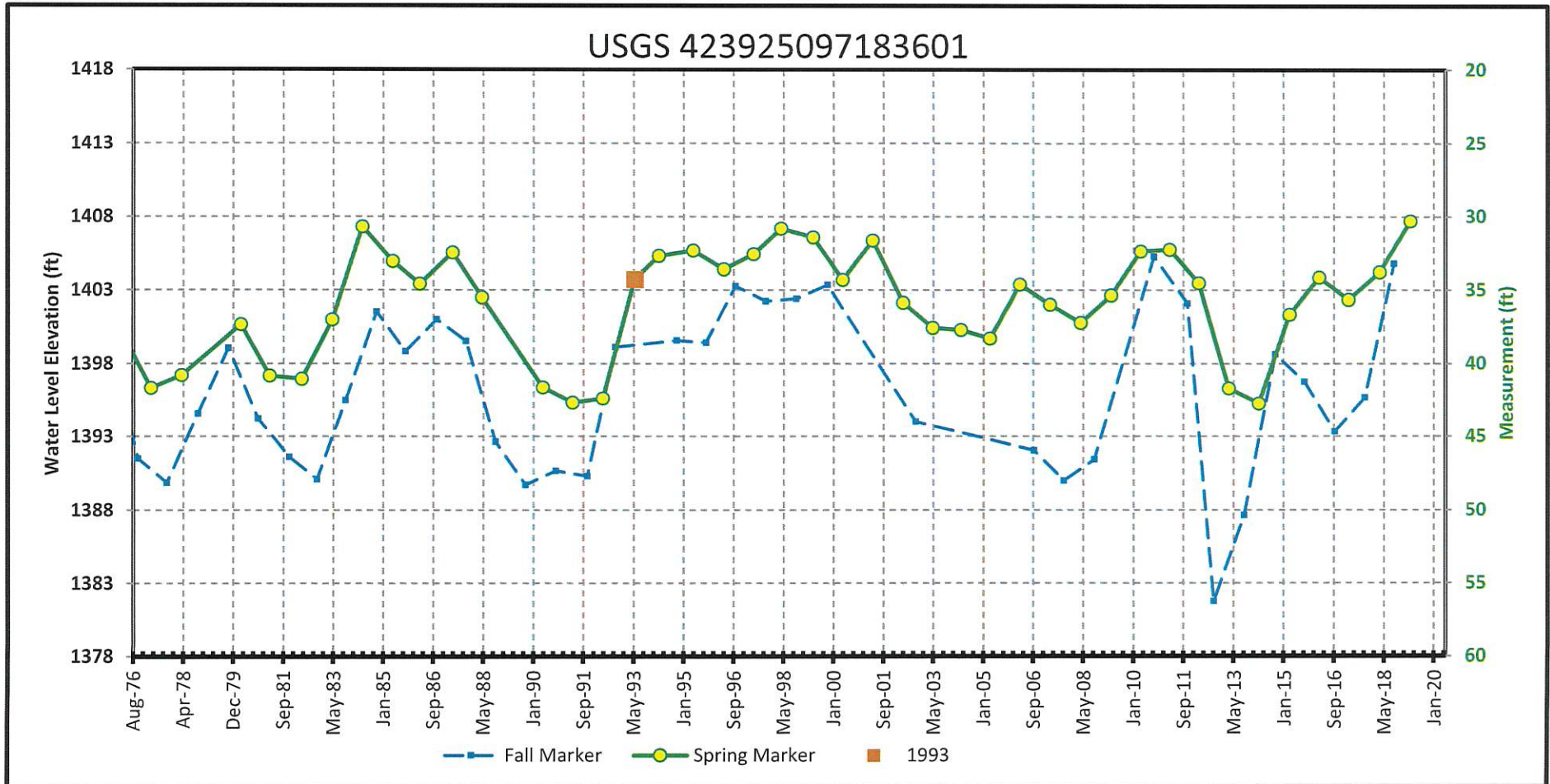
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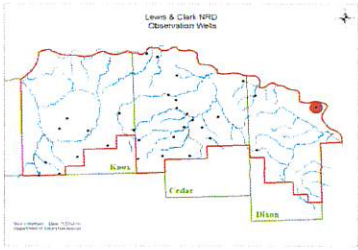
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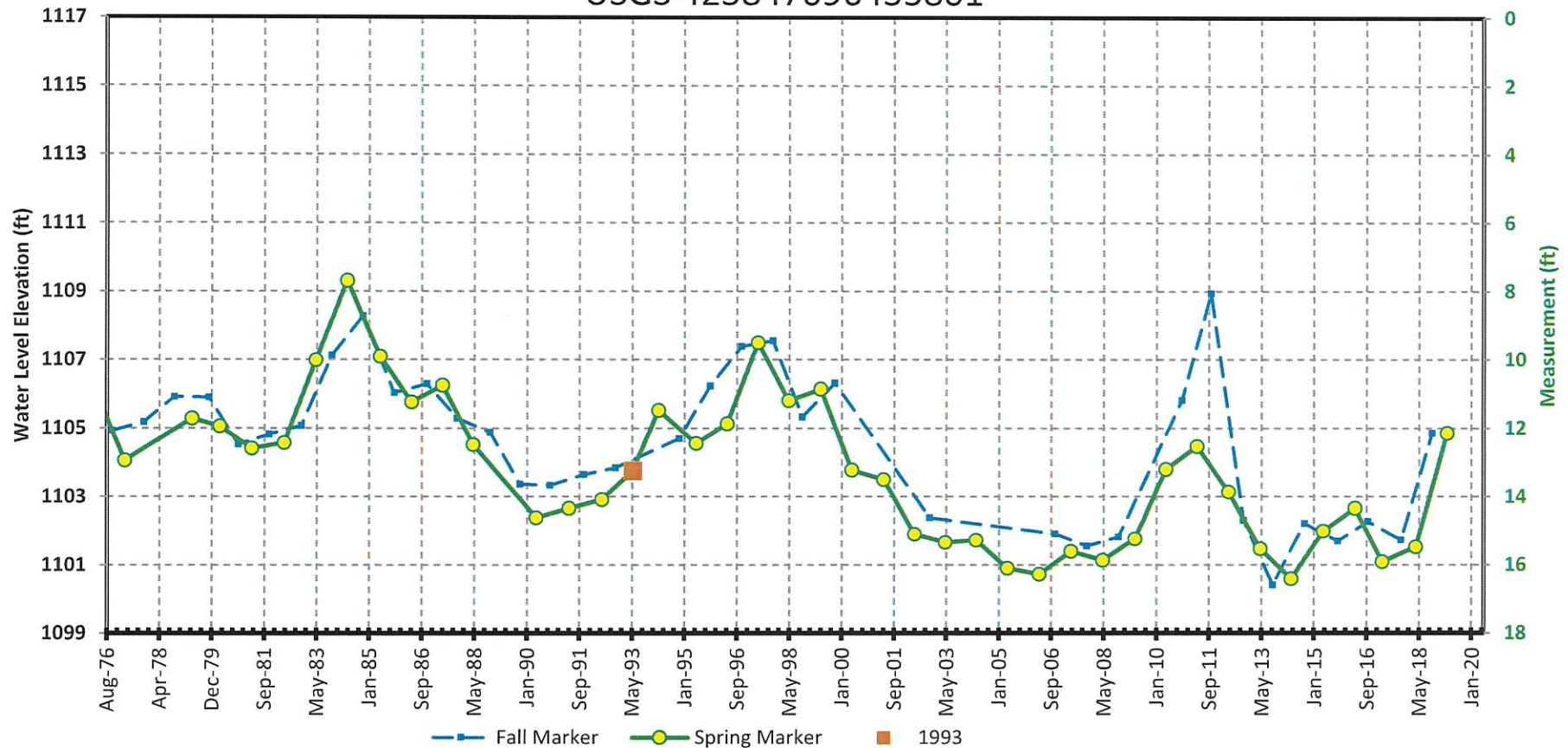
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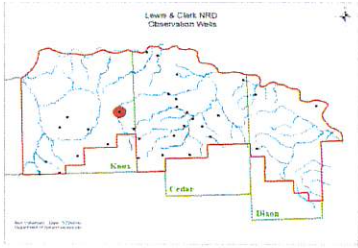
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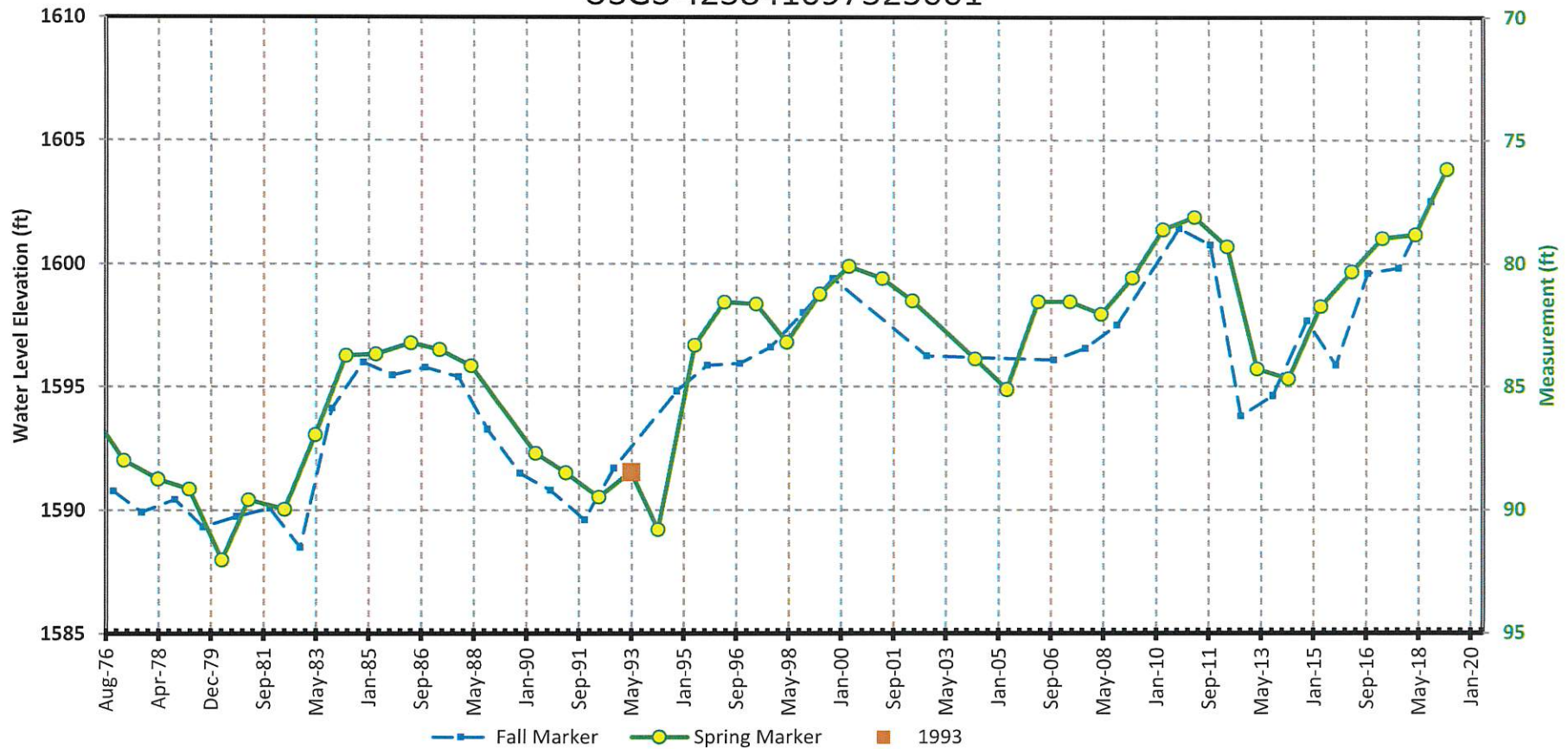
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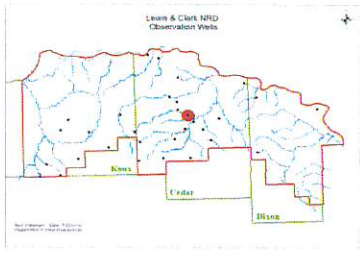
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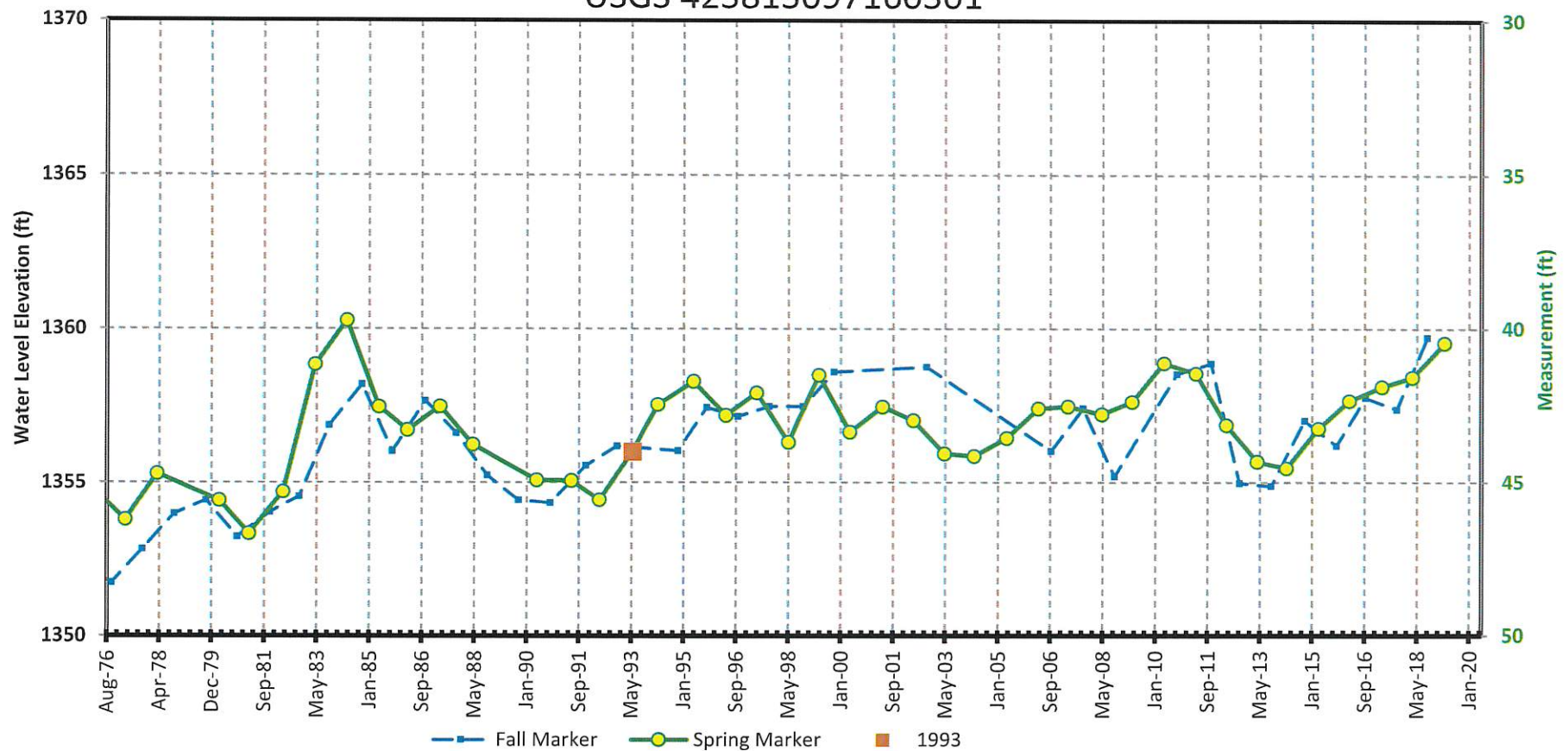
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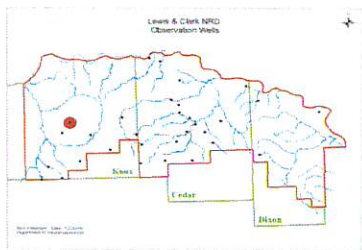
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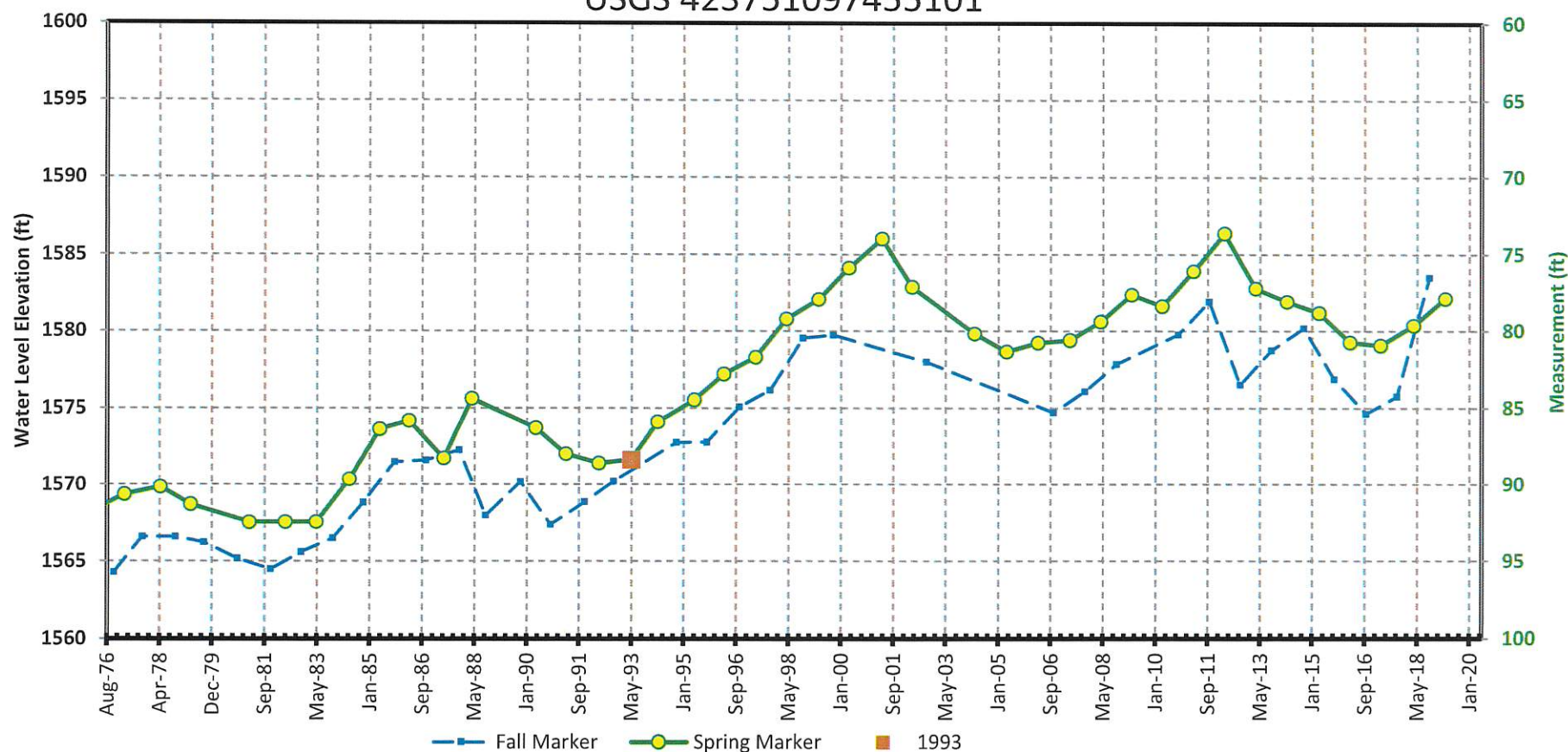
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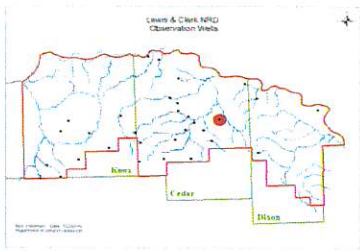
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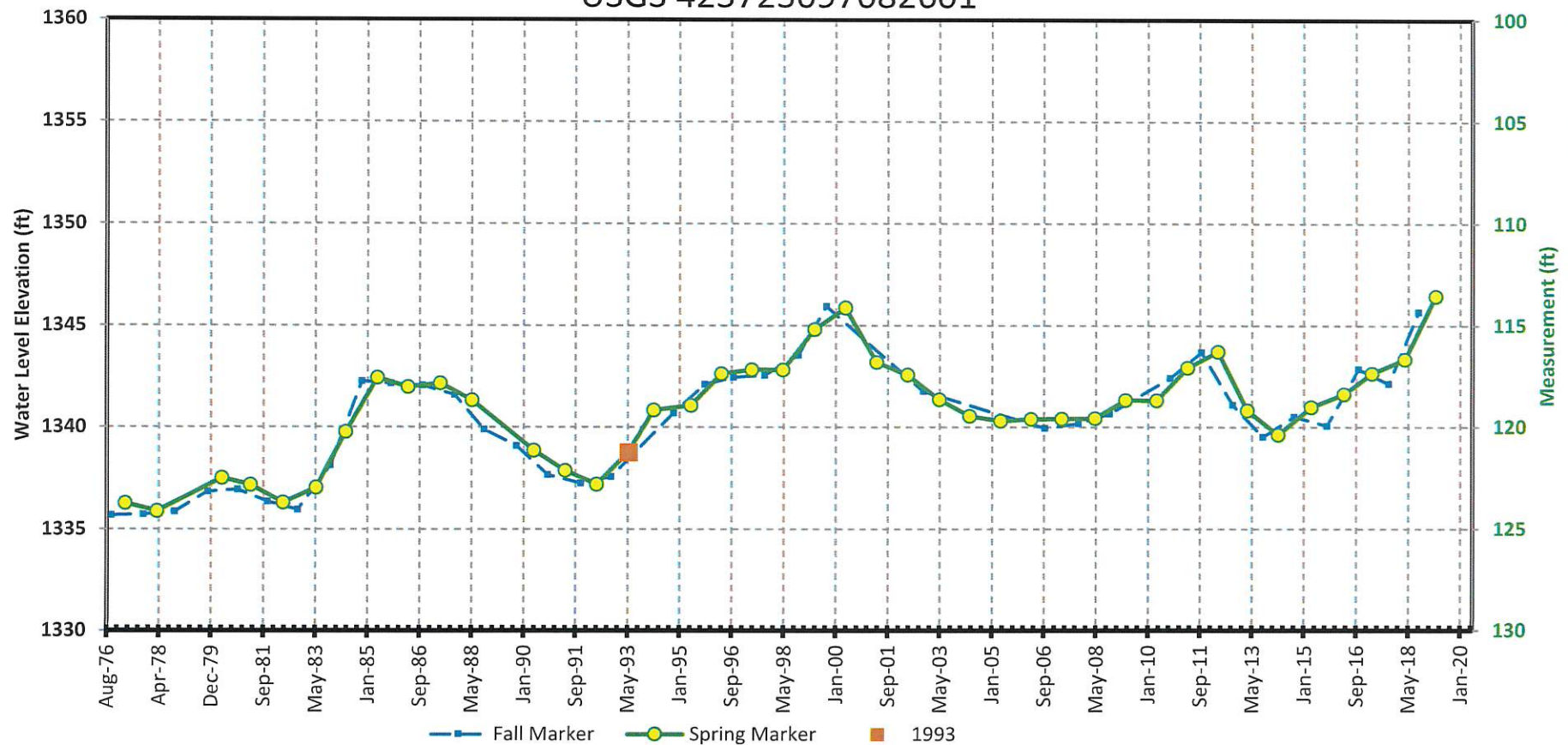
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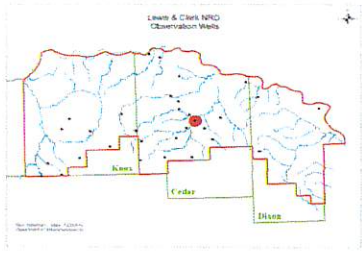
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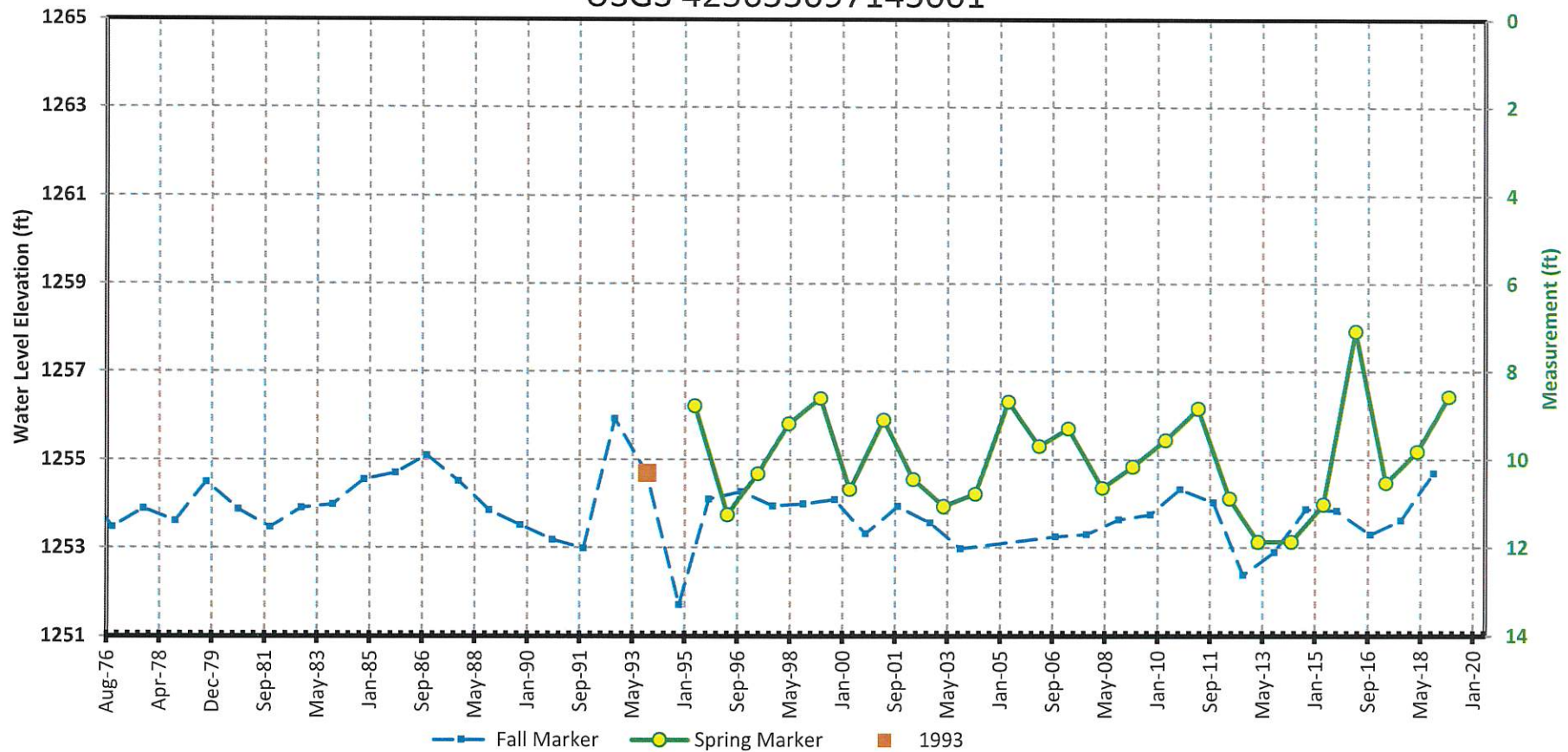
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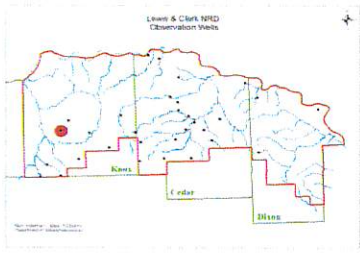
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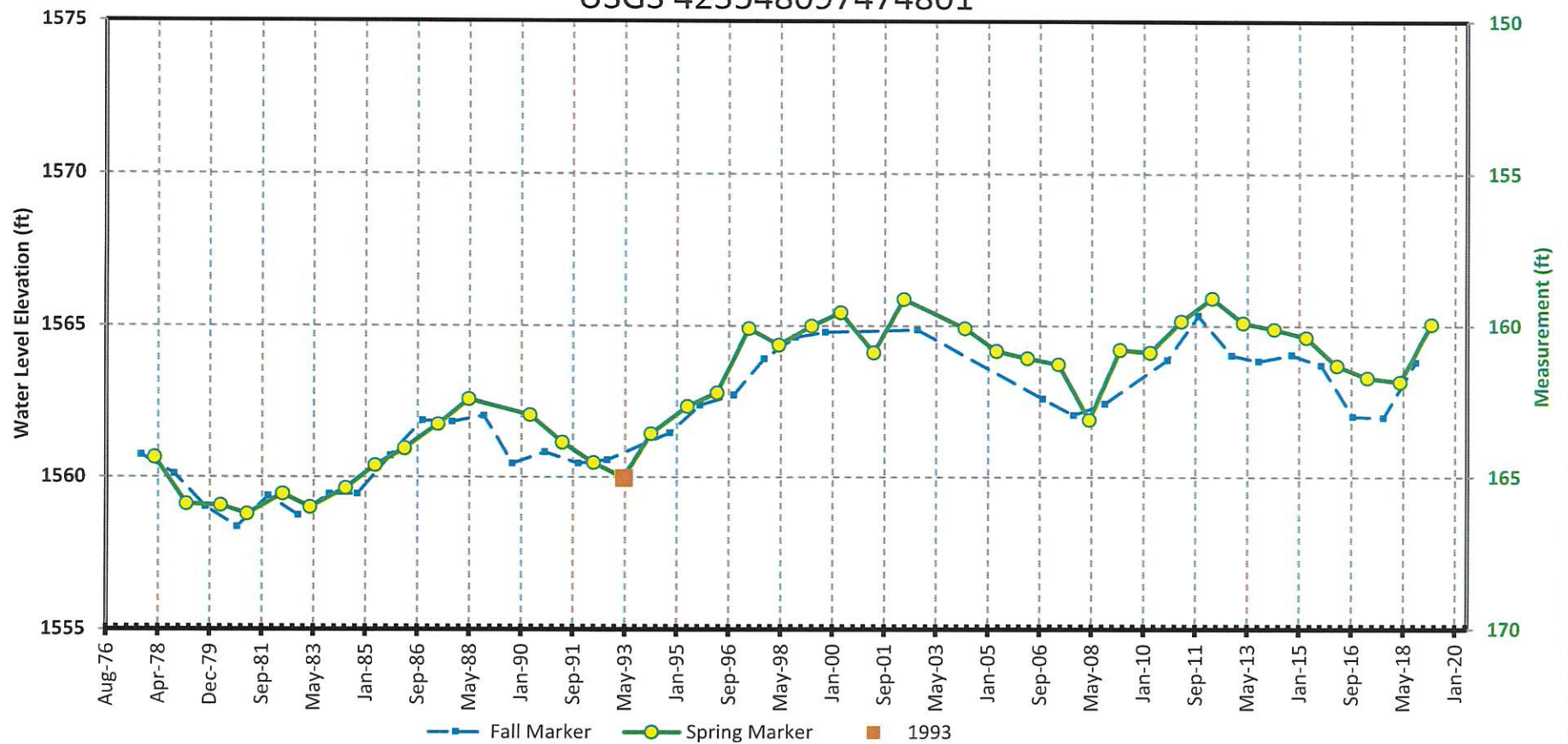
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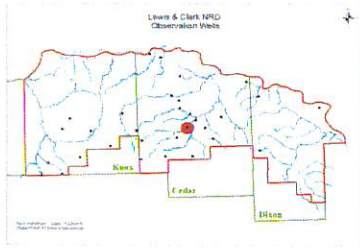
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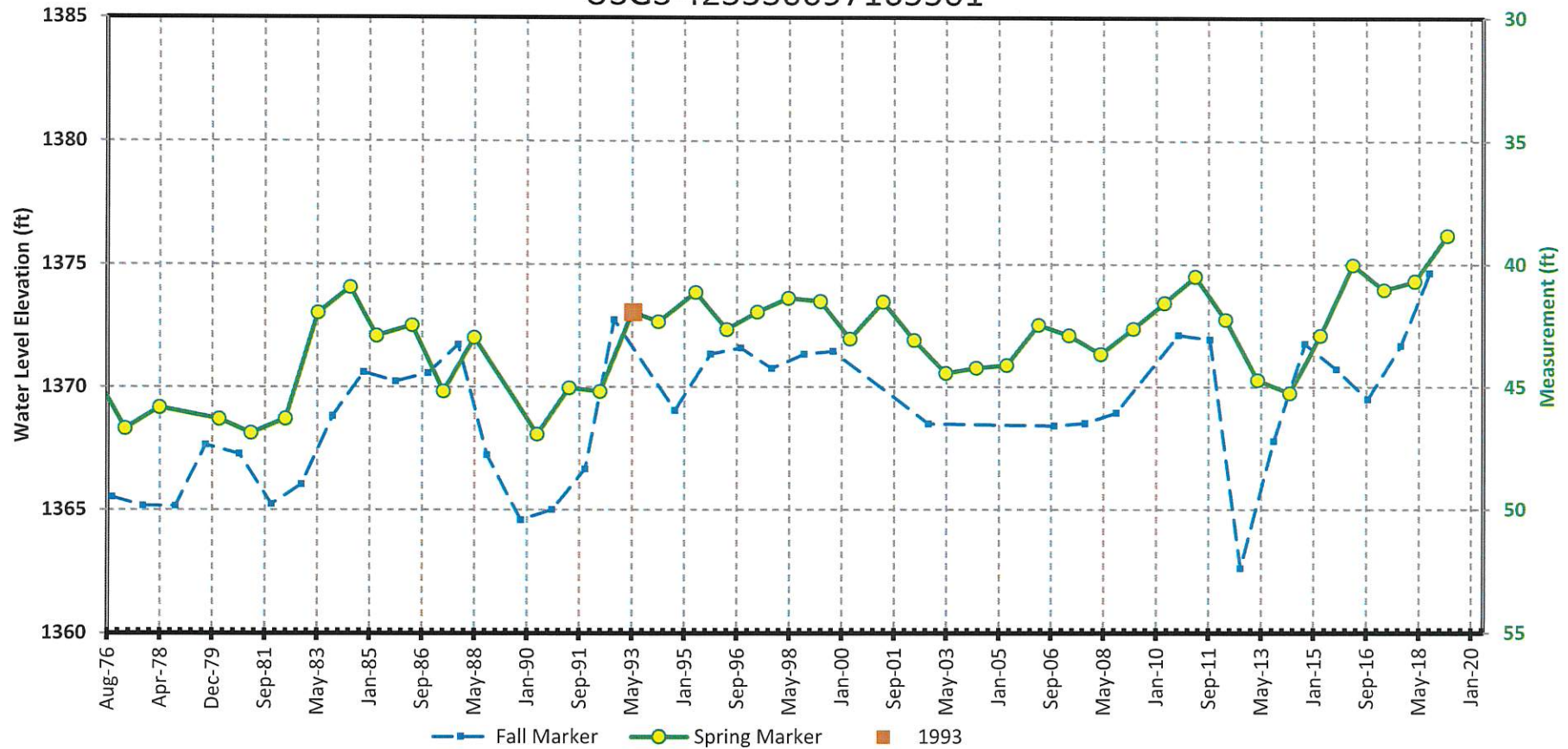
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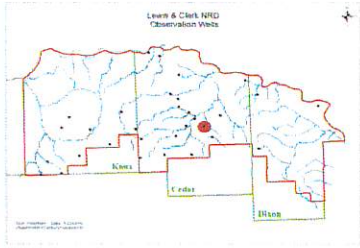
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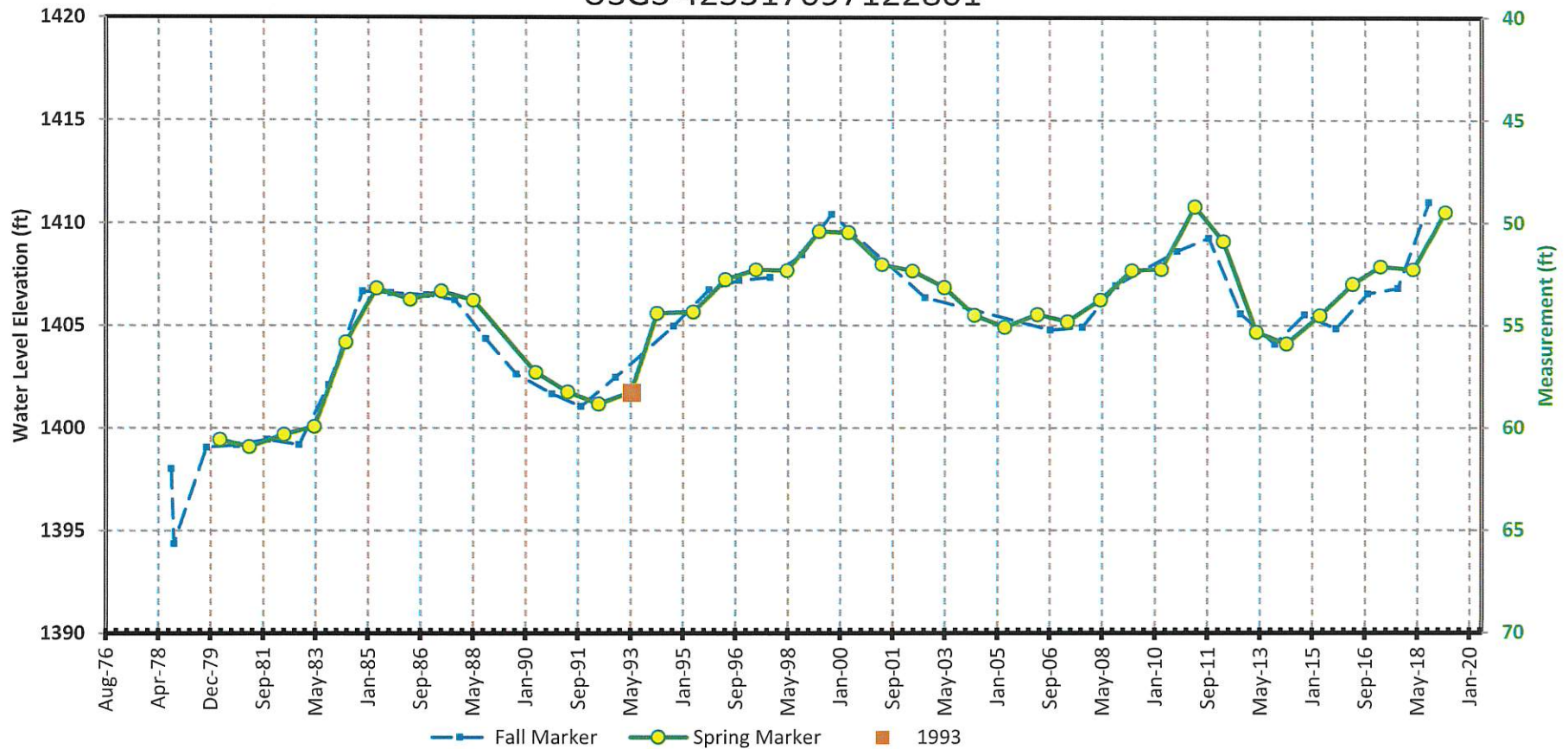
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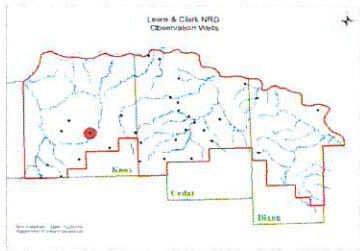
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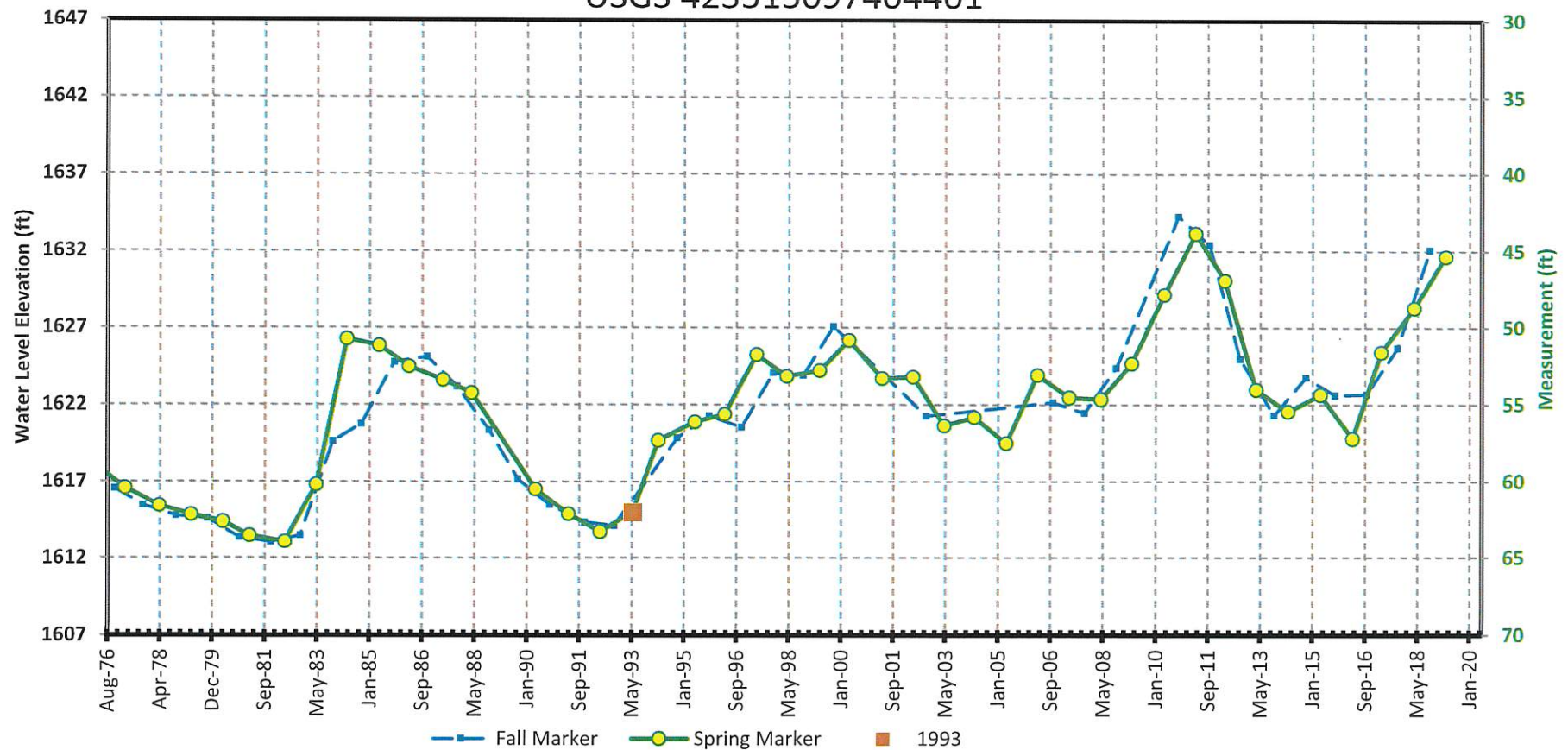
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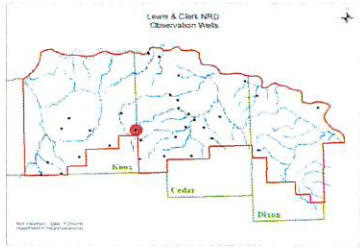
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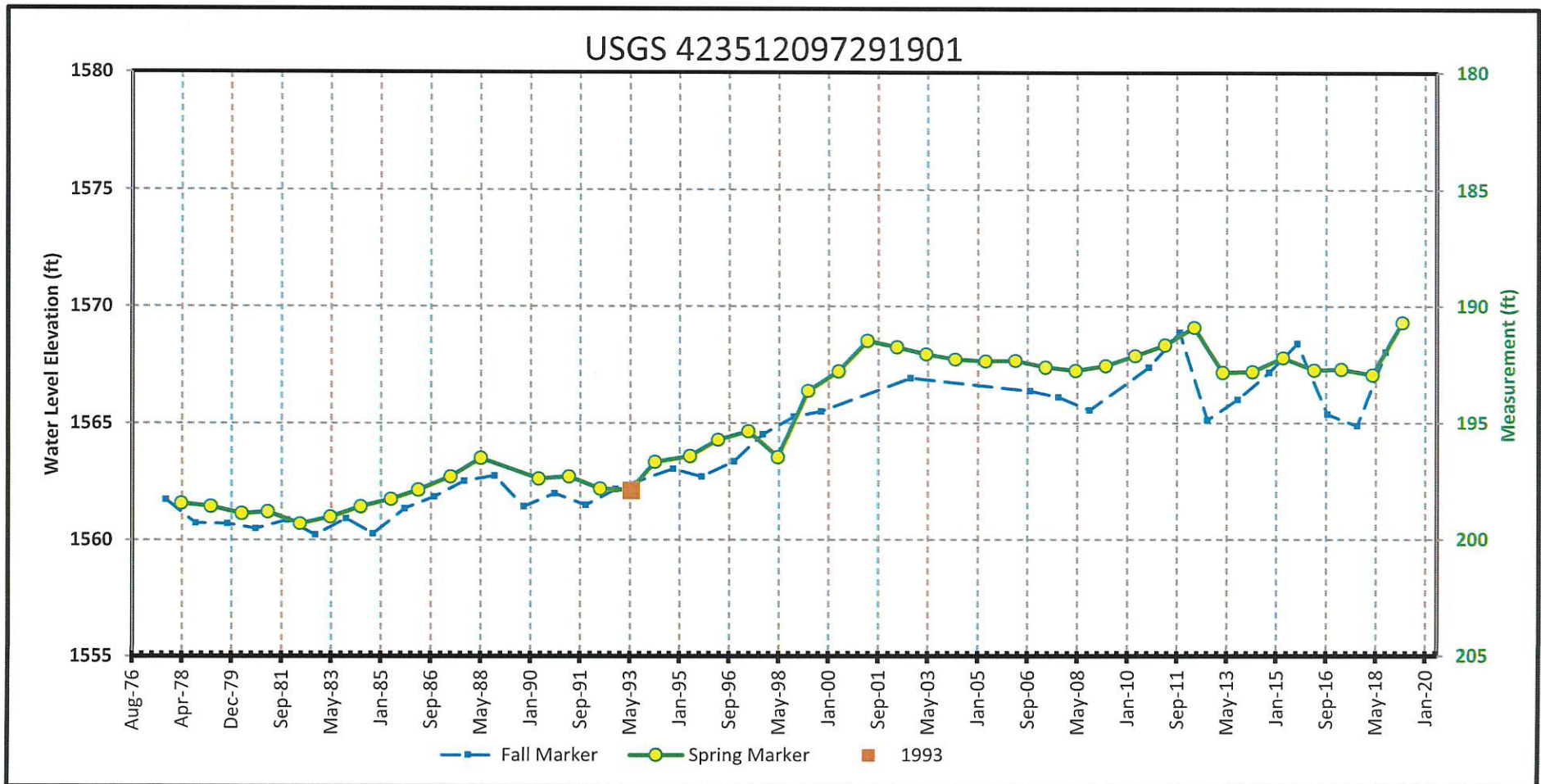


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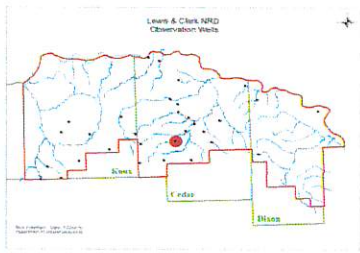
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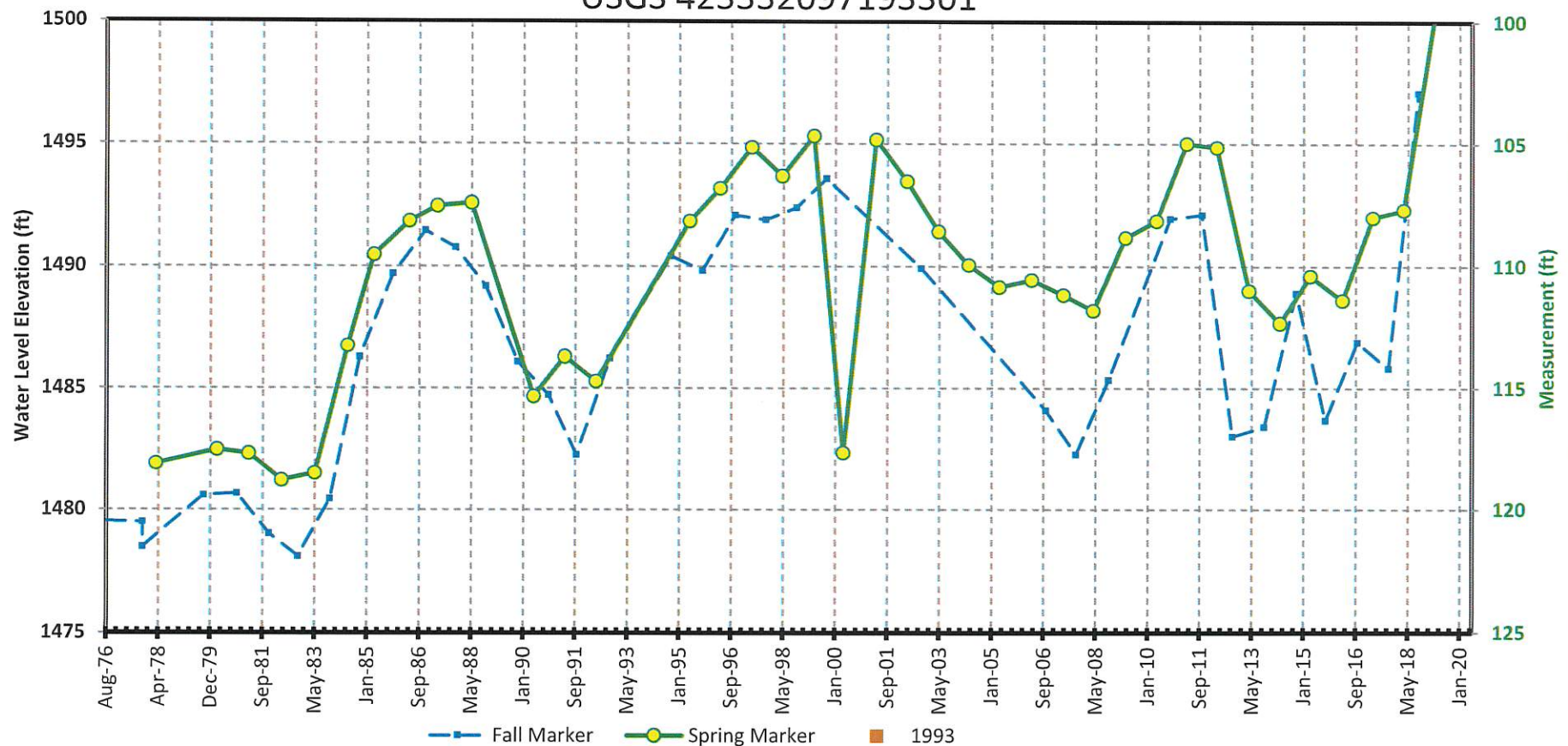
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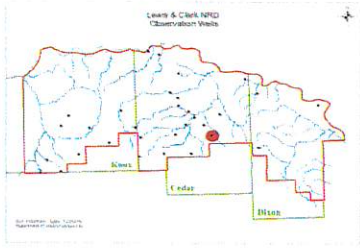
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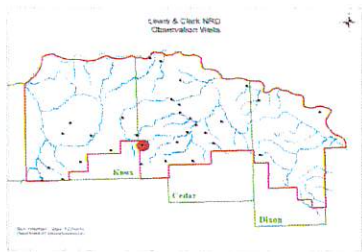
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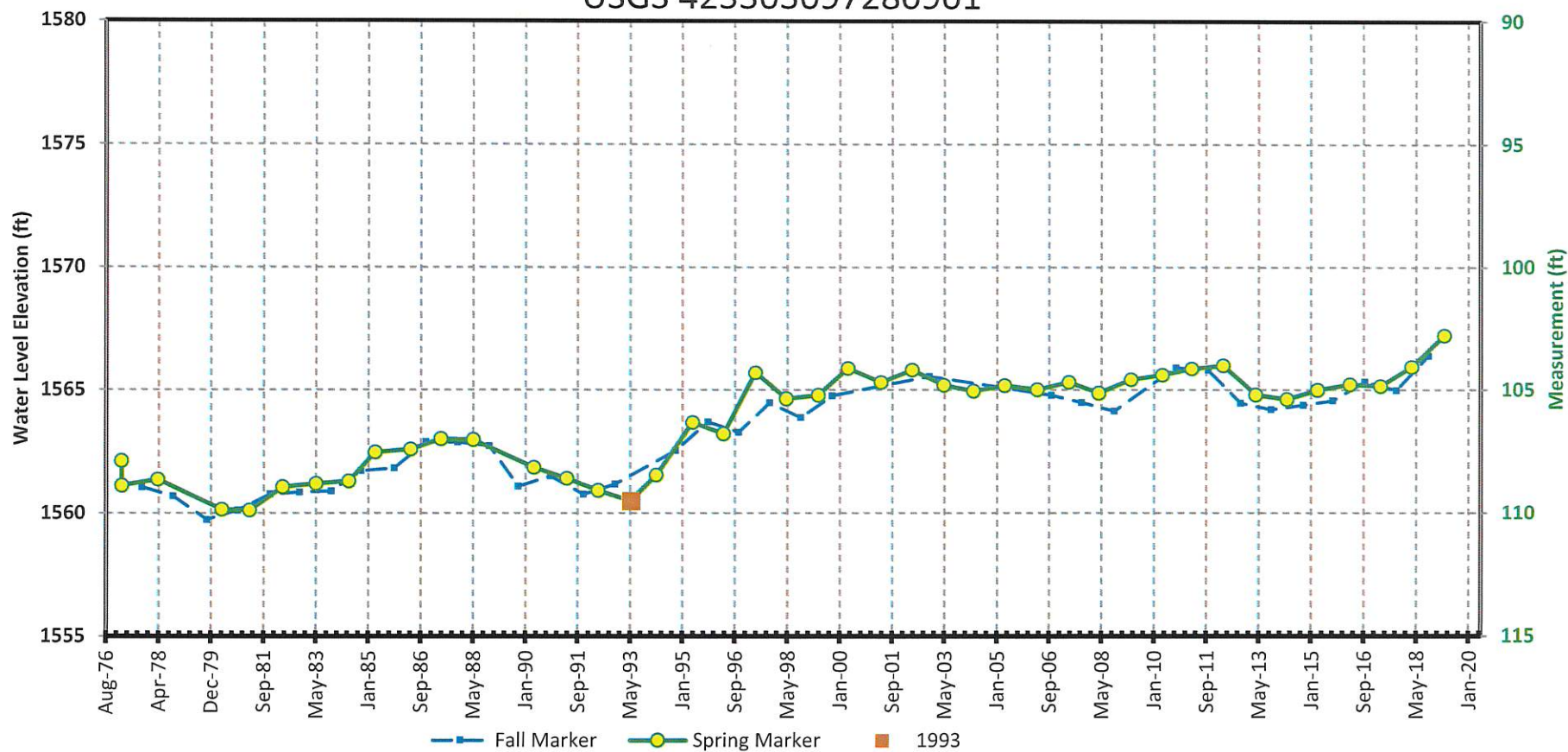
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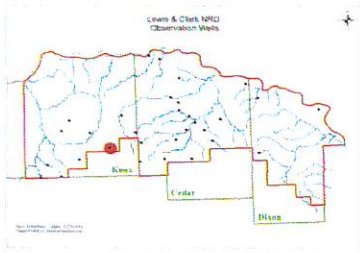
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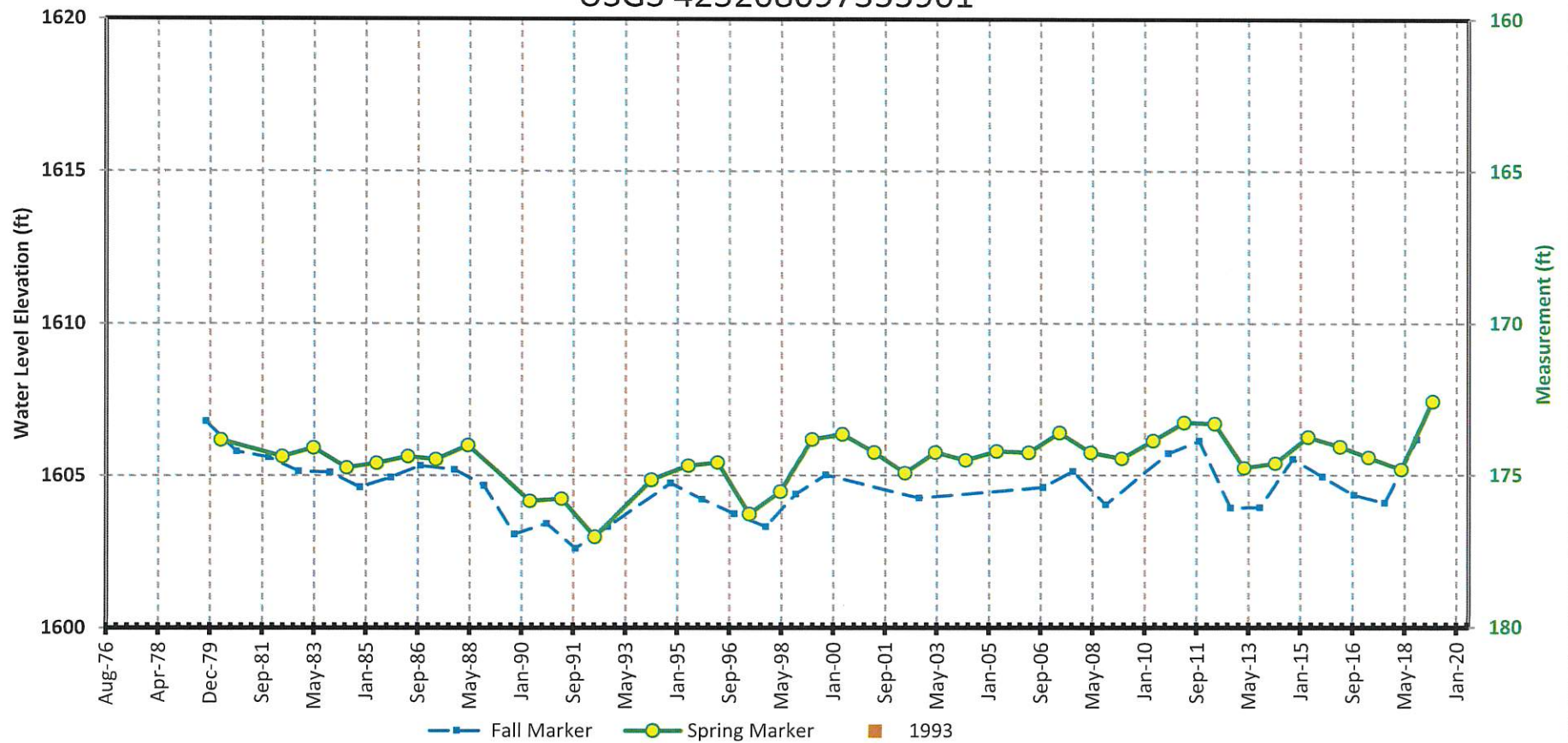
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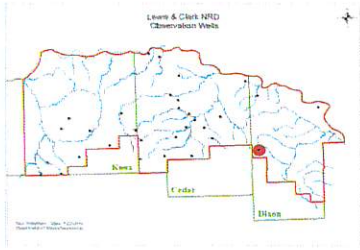
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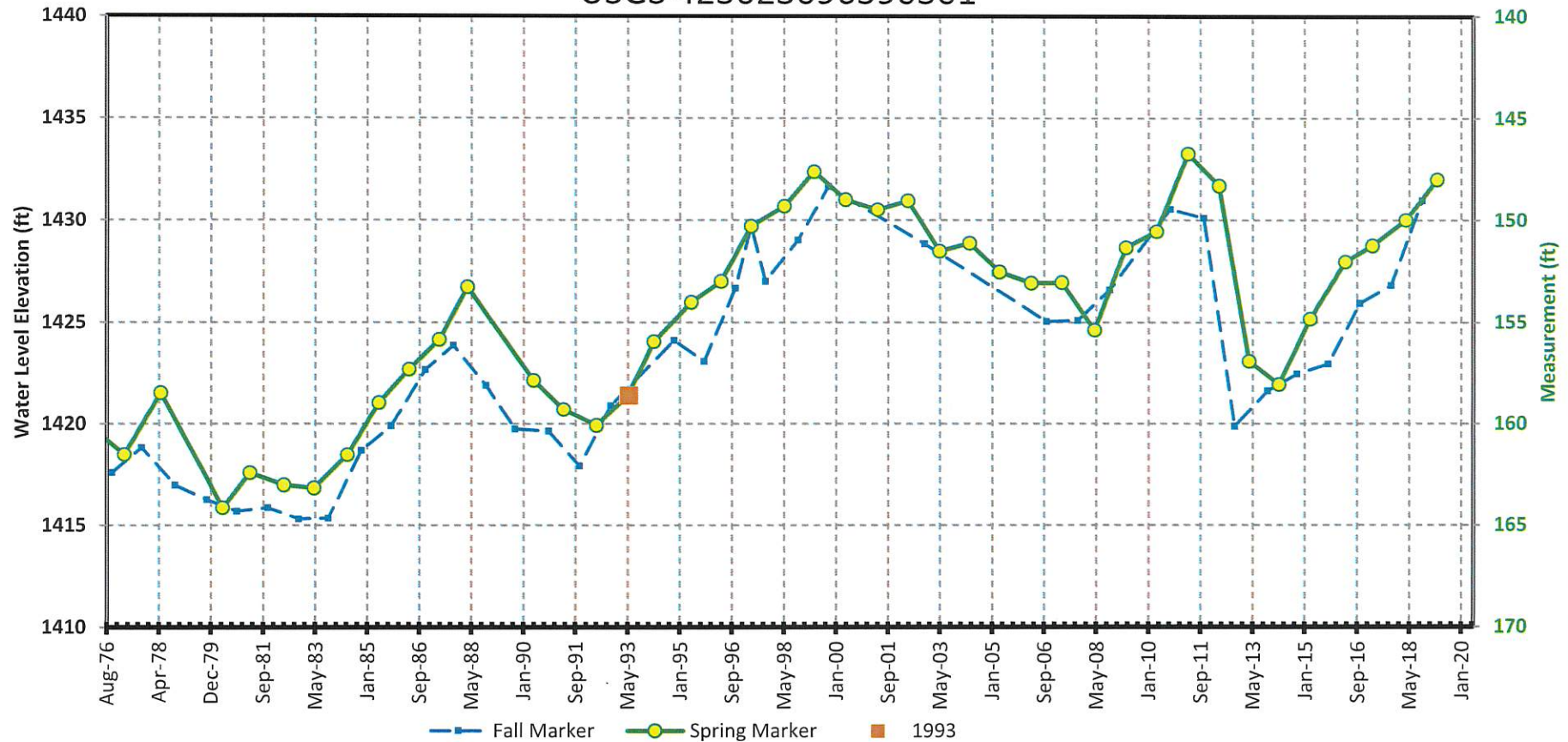
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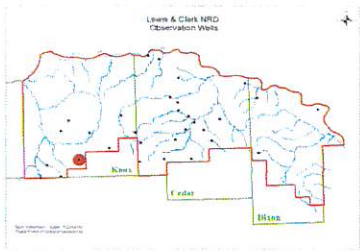
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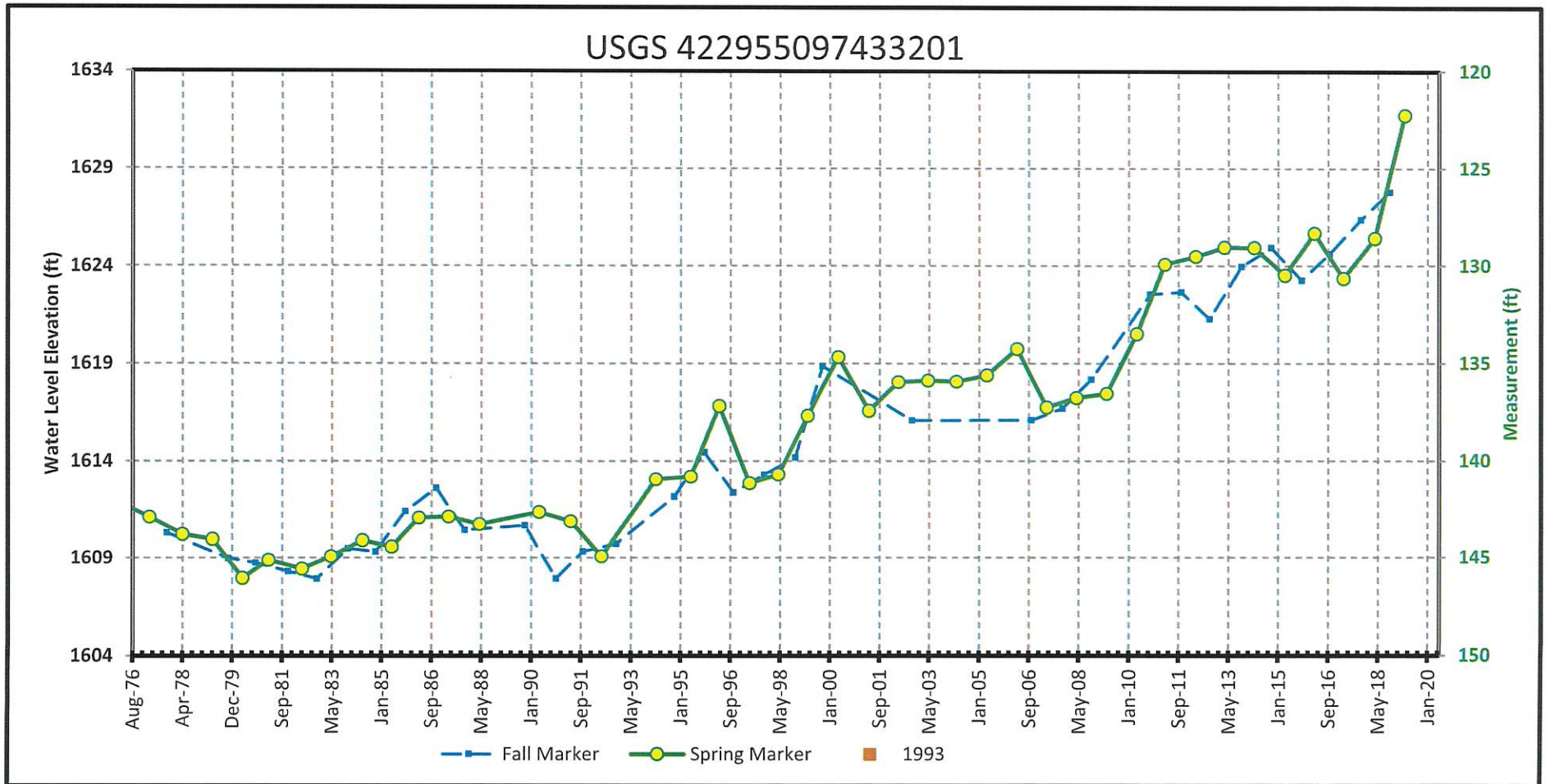
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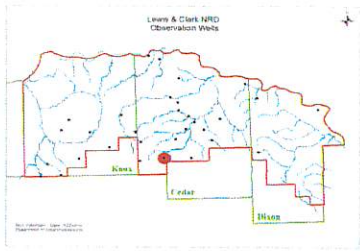
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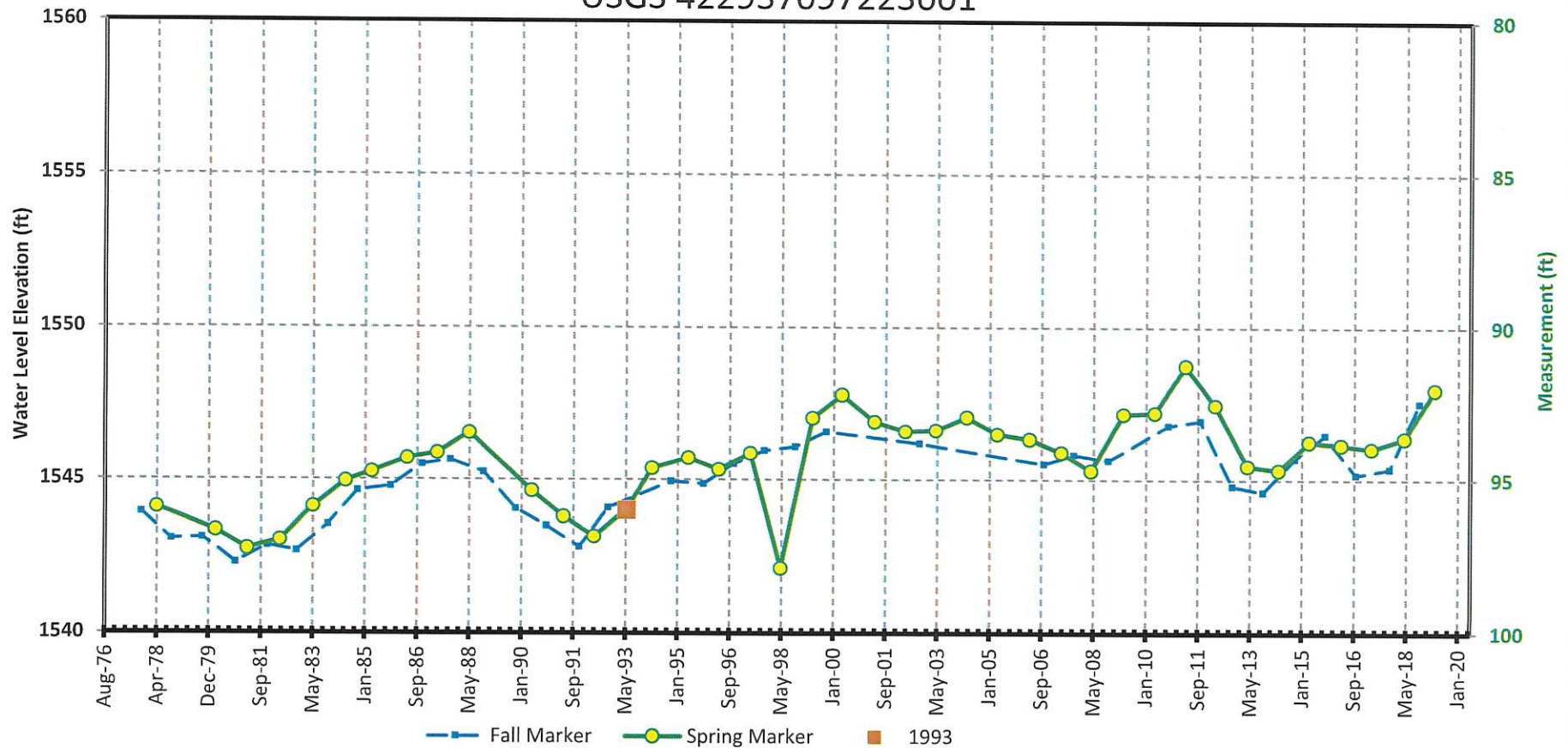
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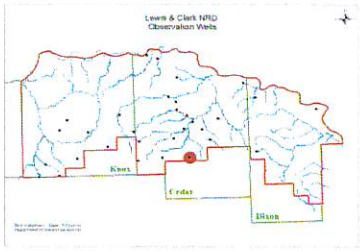
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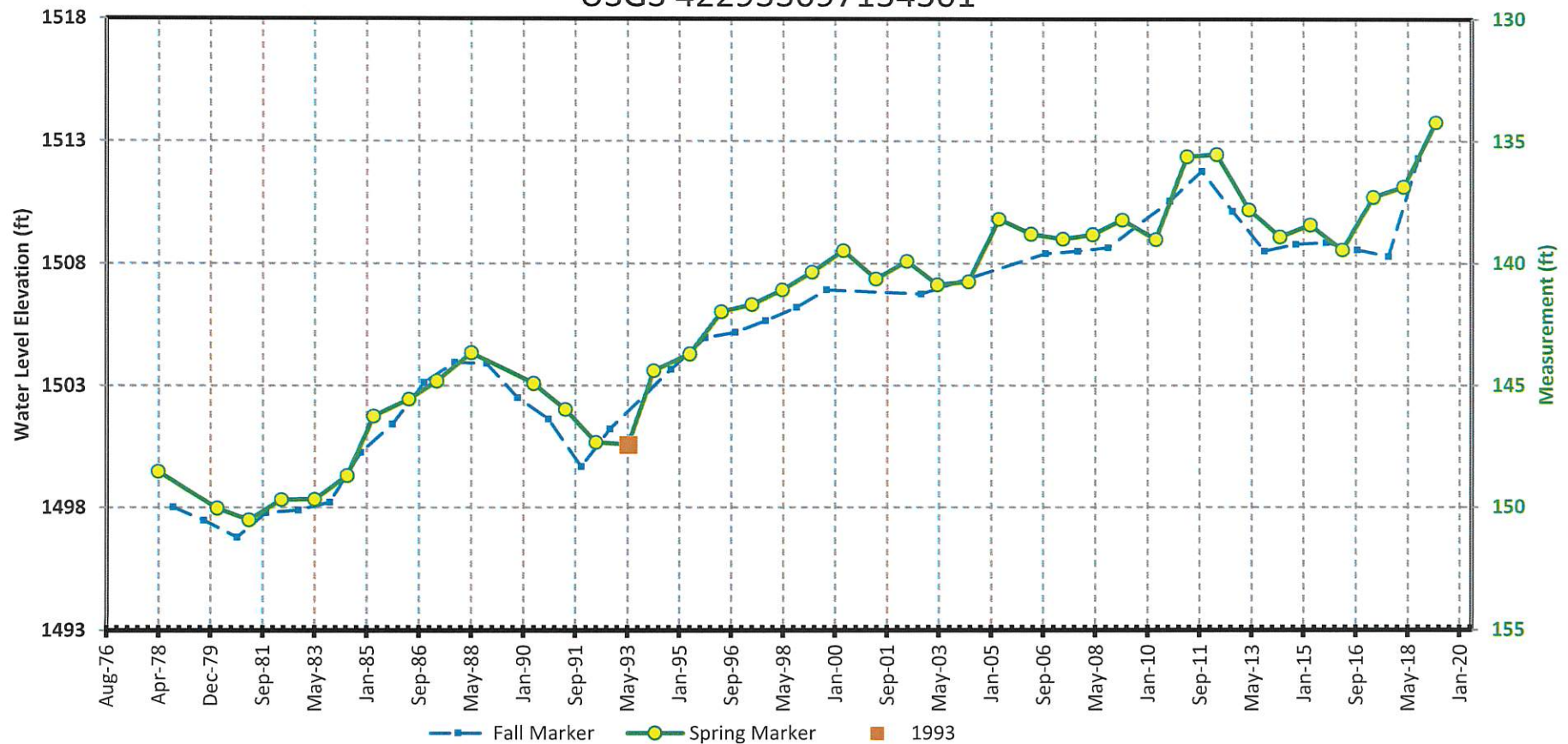
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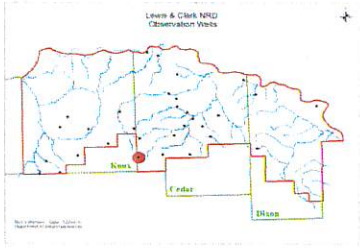
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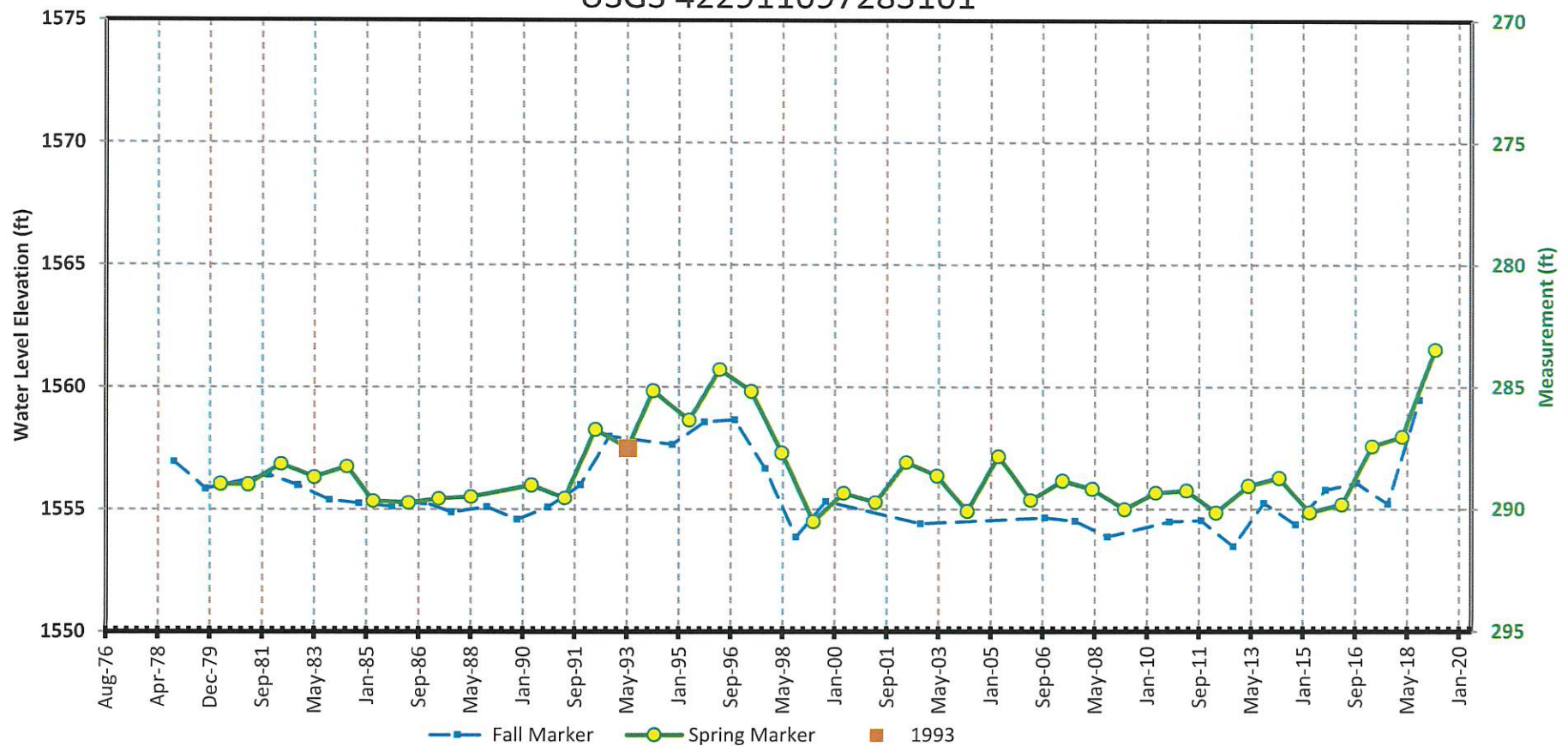
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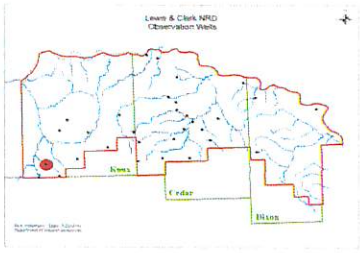
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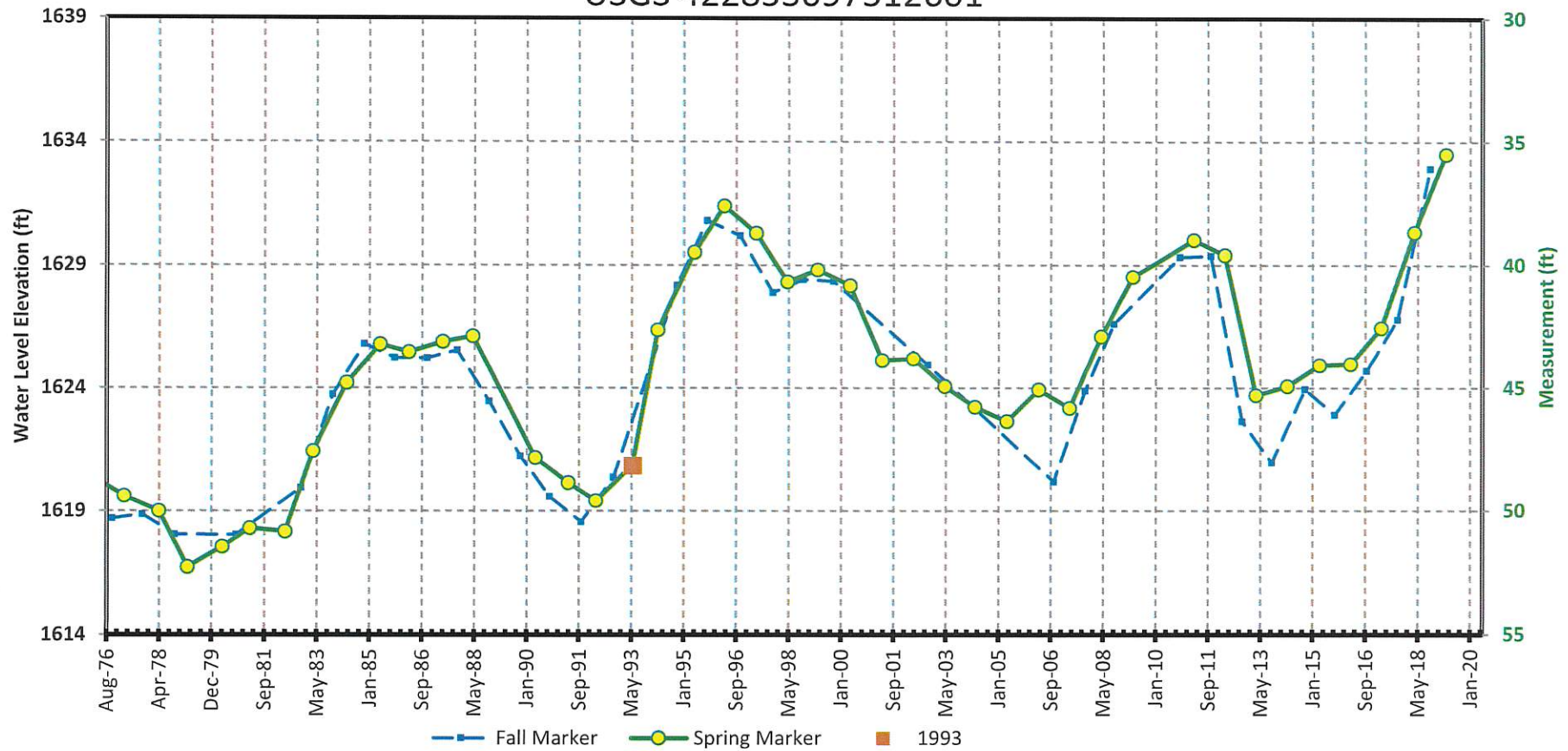
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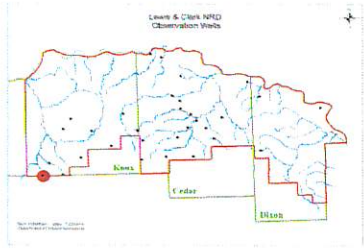
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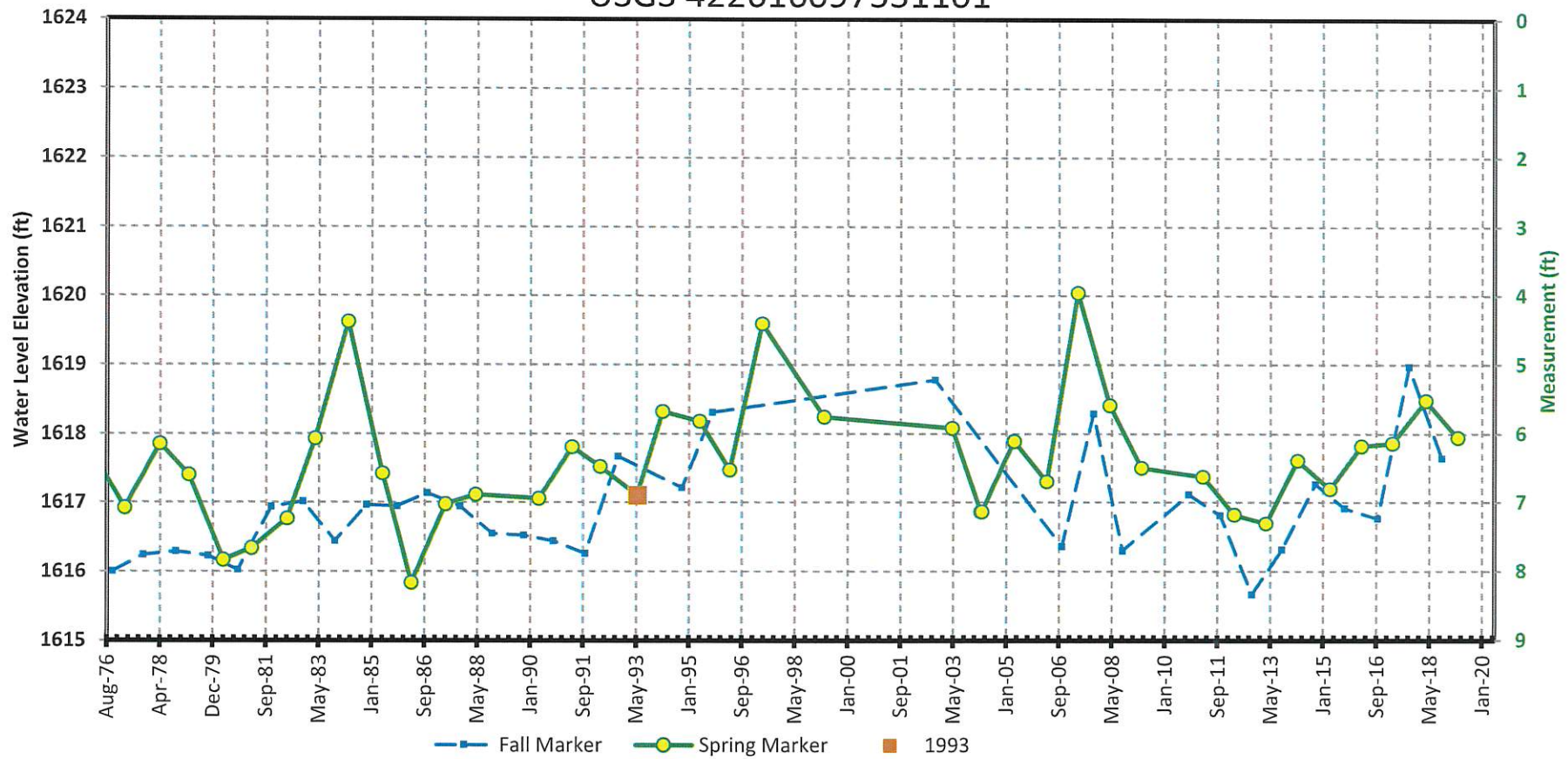
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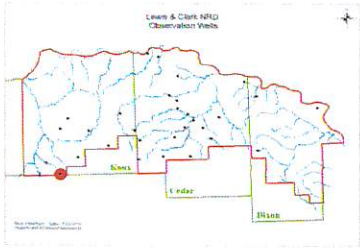
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