



KANSAS CORPORATION COMMISSION

2024 | OIL & GAS REMEDIATION SITE STATUS



➤ Serving the people of Kansas by regulating the State's energy infrastructure, oil and gas production and commercial trucking to ensure public safety.



About the Commission



Andrew J. French
Chairperson



Dwight D. Keen
Commissioner



Annie Kuether
Commissioner

The Commission consists of three members appointed by the Governor to overlapping four-year terms. No more than two members may be of the same political party. The authority of the Kansas Corporation Commission is derived from K.S.A. 74-601 to 74-631.

The Commission regulates investor-owned utilities operating in the state, the Kansas oil and gas industry and motor carrier safety. The KCC does not regulate most electric cooperatives, water cooperatives, municipalities, wireless telephone, long distance service, cable companies, or internet services.

To carry out its multi-faceted mission, the Commission is financed from assessments, registration fees, operating charges, federal funds, and other fee funding sources. The KCC does not receive funding from the state general fund.

FY2023

BUSINESS MEETINGS

96

EVIDENTIARY HEARINGS

14

PUBLIC HEARINGS

3

3,498 TOTAL ORDERS ISSUED
BY THE COMMISSION
IN FY2023



The Commission meets bi-weekly at 10 a.m. on Tuesday and Thursday. The meeting is broadcast live on the KCC's YouTube channel. To preview the agenda in advance, sign up for meeting notifications at:

<https://kcc.ks.gov/>



For more information, access the KCC Legislative reports at:

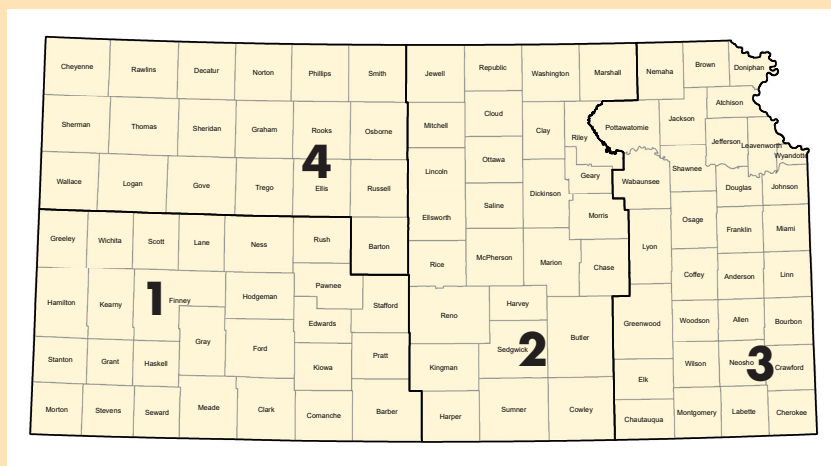
<https://kcc.ks.gov/commission-activity/reports-to-the-legislature/2024>

KCC Conservation Division

Quick Reference

Conservation Division | Central Office

266 N. Main St., Ste. 220
Wichita, KS 67202-1513
(316) 337-6200



Conservation Division District Offices:

District Office No. 1

210 E. Frontview, Suite A
Dodge City, KS 67801
Phone: (620) 682-7933

District Office No. 2

3450 N. Rock Road
Building 600, Suite 601
Wichita, KS 67226
Phone: (316) 337-7400
Fax: (316) 630-4005

District Office No. 3

137 E. 21st Street
Chanute, KS 66720
Phone: (620) 902-6450

District Office No. 4

2301 E. 13th Street
Hays, KS 67601-2651
Phone: (785) 261-6250
Fax: (785) 625-0564



A large, dark silhouette of an oil pumpjack dominates the foreground, its long arm extending across the upper half of the frame. The background is a vibrant sunset sky, transitioning from a deep orange near the horizon to a pale blue at the top. The sun is a bright, glowing orb on the right side of the horizon. In the lower part of the image, other industrial structures, including a smaller pumpjack and storage tanks, are visible in silhouette against the bright sky. The overall mood is industrial and serene.

- Regulate oil and natural gas exploration and production.
- Inspect, license and monitor drilling and production operations.
- Oversight of abandoned well plugging and site remediation.



256

with **\$656,050**
in assessed fines.*

*Fines are payable to state general fund.
The KCC receives no funding from the state general fund.



Oil & Gas

The KCC Conservation Division regulates, enforces laws, and supervises activities associated with the exploration and production of oil and natural gas. Conservation staff works to prevent degradation of land and water resources, prevent waste in the production of crude oil and natural gas resources, and protect correlative rights of mineral owners and royalty interest holders. The Conservation Division's main office is located in Wichita, with District Offices in Chanute, Dodge City, Hays and Wichita.

Federal grant to plug thousands of abandoned wells

The KCC received a \$25 million Initial Grant under the Infrastructure Investment and Jobs Act (IIJA) to plug abandoned wells. It is estimated the grant will fund the plugging of 2,295 wells. The sale of salvage from completed plugging projects brought in enough money to add another 218 wells to the plugging list for a total of 2513 wells. As of November 28, the work was nearly 75% complete with 1869 wells plugged at a cost of \$19.5 million. The map below shows the number of wells plugged in each county. The legend shows of the number of wells in each project that was put out for bid.

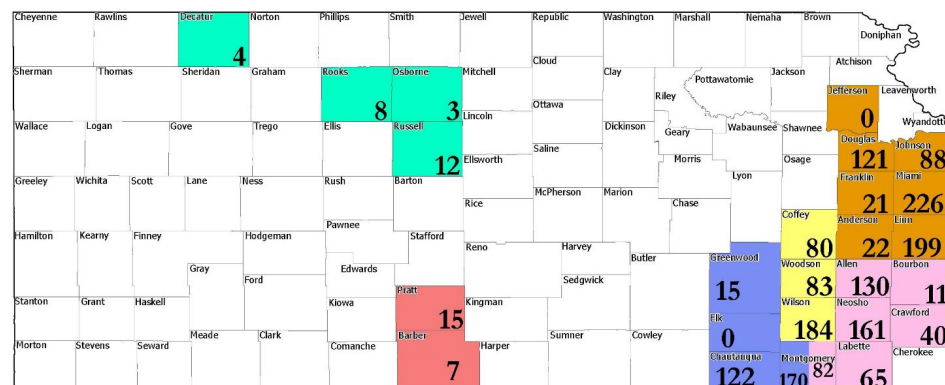


U.S. Representative Sharice Davids and U.S. Secretary of the Interior Deb Haaland visited well plugging sites in Olathe and Gardner on July 10. KCC District 3 Supervisor, Troy Russell explained the process and answered questions.

In addition to the current Initial Grant, Kansas is eligible to receive a Formula grant of up to \$33.6 million payable in two parts. KCC staff is currently working on the application for Phase 1 (\$25 million). The funds are expected to be available in early 2024.

Kansas may also qualify for Performance Grants, which are awarded based on regulatory improvements and as matching grants to cover plugging activity over the average number of wells plugged from 2011-2019. Information on the application process is not yet available.

Kansas' Federal Plugging Projects Preview



Map indicates the number of wells plugged in each county using federal funding from the initial grant. Number in legend indicates the total number of wells in each project.

State-wide total of wells plugged to-date: 1,869
Amount paid to contractors for wells invoiced: \$19,510,223.00



State plugging fund remains critical

The influx of Federal funds has greatly increased the number abandoned wells being plugged, but it doesn't eliminate the need for the state program, which is supported by the Abandoned Oil and Gas Well Fund. There are still more wells to be plugged than the Federal grants will cover. The plan is to plug as many wells as possible using both Federal and State funds.

At the close of 2023, there were 5285 wells requiring action in the Abandoned Well database. The number may increase as staff responds to complaints, new well location techniques are adopted, and companies become insolvent. A well is considered "abandoned" when it has been permanently taken out of production, is not properly plugged to prevent possible air or groundwater pollution, and the rightful legal owner cannot be determined or located to take responsibility.

Abandoned Wells in Kansas

	2023**	2024**	CHANGE
DISTRICT 1			
Priority One	4		
Priority Two	0		
Total	4		
DISTRICT 2			
Priority One	106		
Priority Two	3		
Total	109		
DISTRICT 3			
Priority One	4,683		
Priority Two	404		
Total	5,087		
DISTRICT 4			
Priority One	85		
Priority Two	0		
Total	85		

Total Wells Requiring Action* 5,290 5,285 5

Total Wells Plugged with State Funds* 11,121 11,240 119

* Since creation of the Abandoned Well Plugging funds in 1996.

** Calendar year

What does it cost?

The cost to plug an abandoned well depends on where it is located. Wells in western Kansas are typically deeper and cost more to plug. In the eastern part of the state, they tend to be shallow.

District 1 - Dodge City
\$11,755.70*

District 2 - Wichita
\$14,123.48*

District 3 - Chanute
\$5,990.39*

District 4 - Hays
\$10,817.64*

* Based on 5-year average

How to report an abandoned well

Oil and gas drilling in Kansas began in the 1860s. Record keeping by early operators was not as precise as it is today. It is not uncommon for older abandoned wells to be discovered by landowners who were unaware they existed.

The KCC is actively looking for abandoned oil and gas wells. Staff investigates these wells in order to determine if they pose a risk to public safety or the environment.

If you find an abandoned well, please report it. A [form](#) on the KCC website makes it easy.

For detailed information on oil and gas regulation, access the KCC Legislative reports at:

<https://kcc.ks.gov/commission-activity/reports-to-the-legislature/2024>

Remediation sites prioritized based on risk

The KCC Conservation Division manages an inventory of contamination sites that have varying degrees of impact to groundwater, surface water, soil or wells. These sites have no responsible parties related to oil and gas exploration and production activities. The current evaluation period, January 1, 2023, through December 31, 2023, ended with no sites resolved or added, resulting in a total of 47 active sites. The 2024 Remediation Site Status report contains a description and evaluation of each site.



IMPACTED RESOURCES	NO. OF REMEDIATION SITES
Groundwater, Surface Water, Soil & Well Problems (Cavity, Abandoned)	67
Public Water Supply	7
Domestic Supply	19
Stock Supply	13
Irrigation Supply	9

Note: Some sites have impacts to multiple resources.

IMMEDIACY LEVEL	NO. OF SITES
Low & Low to Moderate	20
Moderate	9
Moderate to High & High	14
Other (Under Remediation)	4
Total	47

Appendix

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- 12 | Site Impact, Immediacy and Target Remediation Levels by County
- 16 | Contamination Site Expenditures
- 18 | Remediation Site Report



**Abandoned Oil and Gas Well / Remediation Site Fund
Remediation Sites
Status Report**

Introduction

Enacted in 1996, K.S.A 55-192 and K.S.A. 55-193 create an Abandoned Oil and Gas Well / Remediation Fund for the Kansas Corporation Commission to plug abandoned wells and remediate contamination sites (sites and wells having no responsible parties related to oil and gas exploration and production activities). K.S.A 55-194 requires the Corporation Commission to prepare an annual Remediation Site Status Report for the office of the Governor and certain legislative committees. This report for the period January 1, 2023, through December 31, 2023, contains information for each of the sites with regard to the following: (1) A description and evaluation of the site; (2) the immediacy of the threat to public health and environment; (3) the level of remediation sought; (4) any unusual problems associated with the investigation or remediation; (5) any remedial efforts completed during the review period; (6) current contaminate level; (7) status of the site; (8) direct and indirect costs associated with remedial efforts; and (9) an estimate of the cost to achieve the recommended level of remediation or an estimate of the cost to conduct an investigation sufficient to determine the cost of remediation. The Site Remediation cash expenditures for FY2024 are projected to be approximately \$500,000.

Site Inventory

This Remediation Site Status Report consists of 47 sites. This report includes sites that were transferred to the control of the Kansas Corporation Commission (KCC) from the Kansas Department of Health and Environment (KDHE) by legislative action in 1995 and in-house sites already under KCC jurisdiction. Of the original 109 sites, four were combined with other sites. During previous evaluation periods, 81 sites have been resolved and 23 sites have been added. The current evaluation period, January 1, 2023, through December 31, 2023, ended with no sites resolved or added, resulting in a total of 47 active sites. Summary tables for site impacts and immediacy levels as well as estimated costs are found at the beginning of the report. The tables below provide an overview of distribution of sites with respect to both resources impacted and the range of immediacy levels for required remediation.

Distribution of Active Sites with Respect to Impacted Resources

Impacted Resources	Number of Sites
Groundwater, Surface Water, Soil and Well Problems (Cavity, Abandoned)	67
Public Water Supply	7
Domestic Supply	19
Stock Supply	13
Irrigation Supply	9

Note: Some sites have impacts to multiple resources.

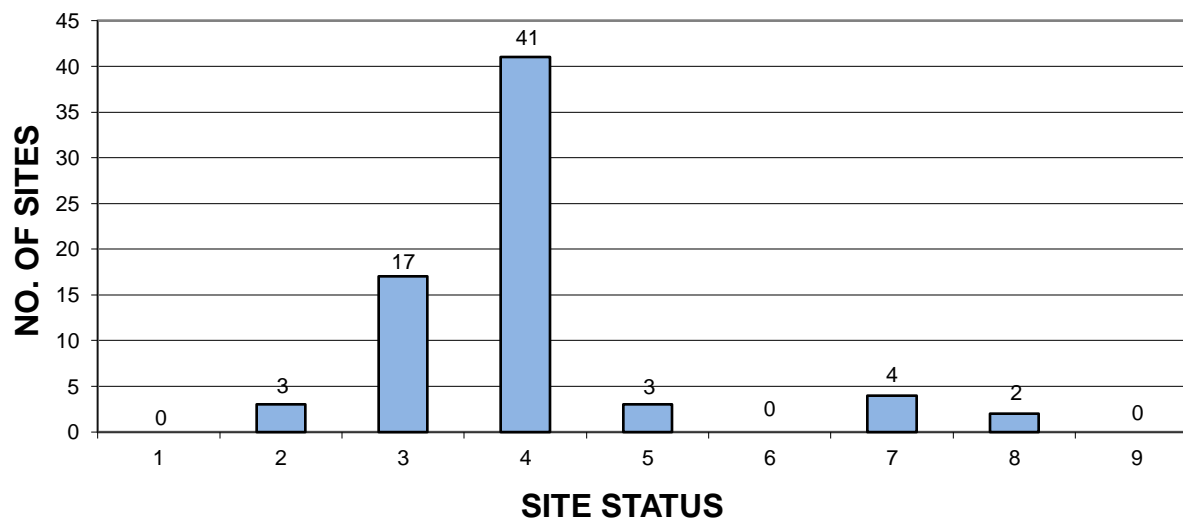
Distribution of Active Sites with Respect to Immediacy Levels

Range of Immediacy Level	No. of Sites
Low & Low to Moderate	20
Moderate	9
Moderate to High & High	14
Other (Under Remediation)	4
Total	47

Site Status

In general each contamination site has a definable life cycle. This cycle begins with, then follows a sequence of investigatory and possible remedial activities which move the site towards ultimate resolution. The first phase of the cycle is the site assessment. This phase defines general site parameters and conditions forming the basis for additional efforts at the site. Once the assessment is complete the site moves on to a new phase. This next phase may be short term or long term monitoring followed by resolution of the site. Another scenario might include an extensive investigation phase followed by the installation of a monitoring system whose sample results may indicate the necessity for certain remedial activities and additional post remediation monitoring prior to resolution of the site. The following graphs depict the current status of the 47 listed sites on a statewide and KCC District basis.

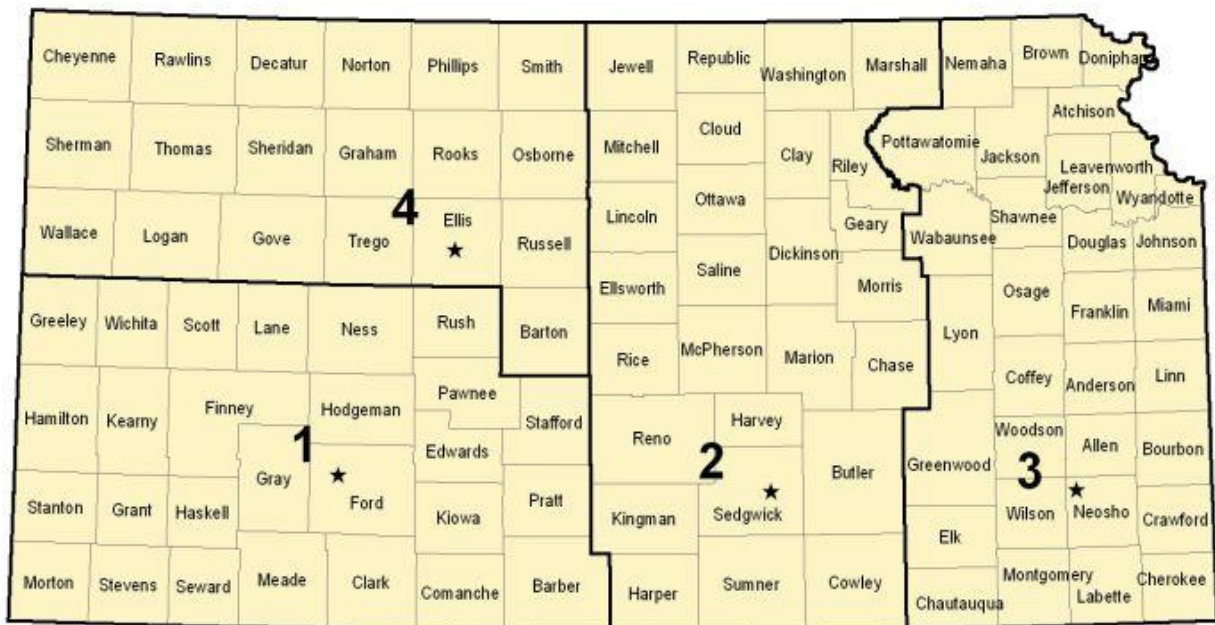
STATEWIDE DISTRIBUTION OF SITES BY STATUS



1. SITE ASSESSMENT	2. SHORT TERM MONITORING	3. INVESTIGATION
4. LONG TERM MONITORING	5. REMEDIATION PLAN	6. INSTALLATION
7. REMEDIATION	8. POST REMEDIATION MONITORING	9. RESOLVED

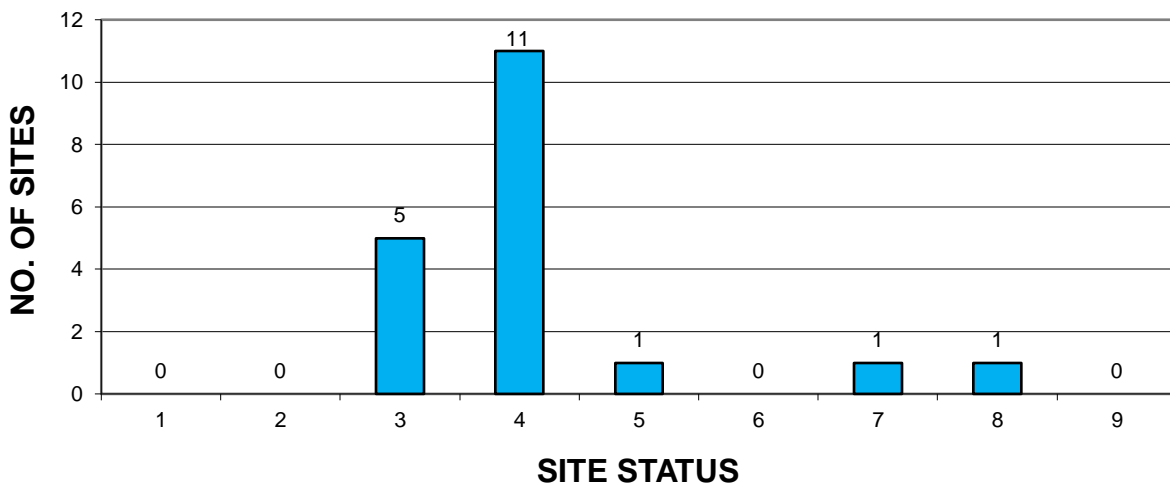
Note: Sites may have more than one status.

DISTRIBUTION OF SITES IN EACH DISTRICT BY STATUS



KCC District Map

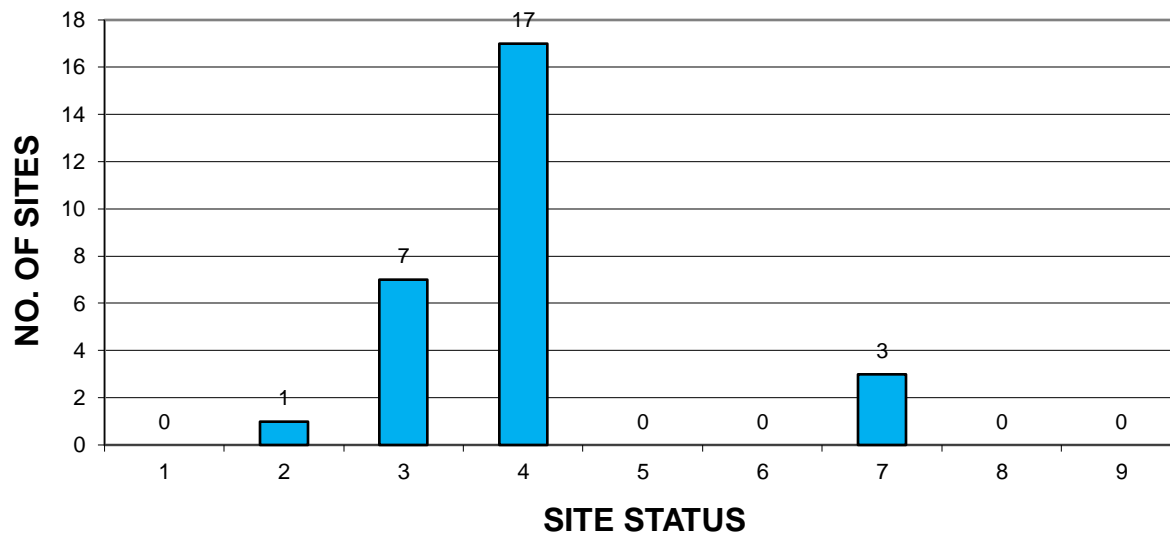
DISTRICT 1



1. SITE ASSESSMENT	2. SHORT TERM MONITORING	3. INVESTIGATION
4. LONG TERM MONITORING	5. REMEDIATION PLAN	6. INSTALLATION
7. REMEDIATION	8. POST REMEDIATION MONITORING	9. RESOLVED

Note: Sites may have more than one status.

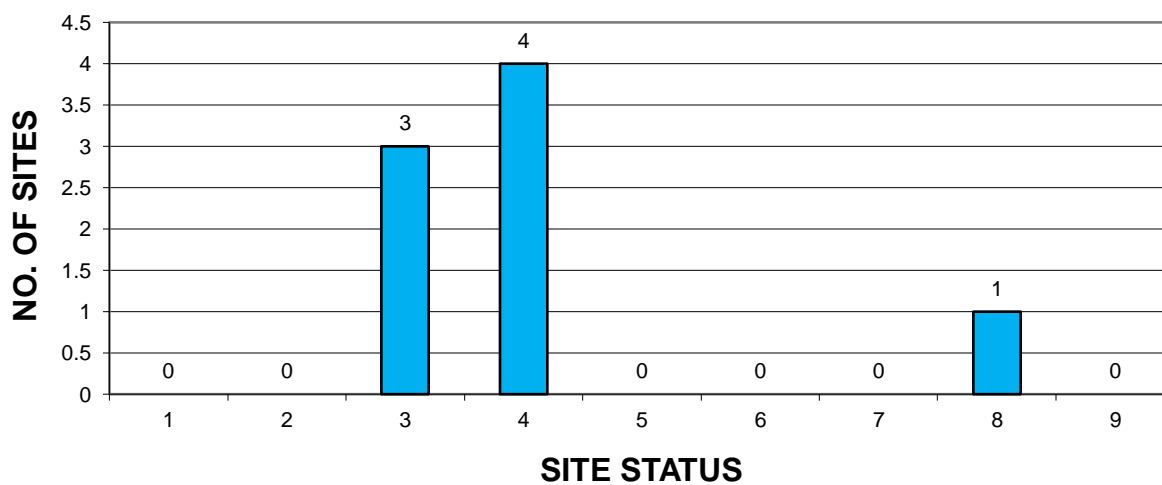
DISTRICT 2



1. SITE ASSESSMENT	2. SHORT TERM MONITORING	3. INVESTIGATION
4. LONG TERM MONITORING	5. REMEDIATION PLAN	6. INSTALLATION
7. REMEDIATION	8. POST REMEDIATION MONITORING	9. RESOLVED

Note: Sites may have more than one status.

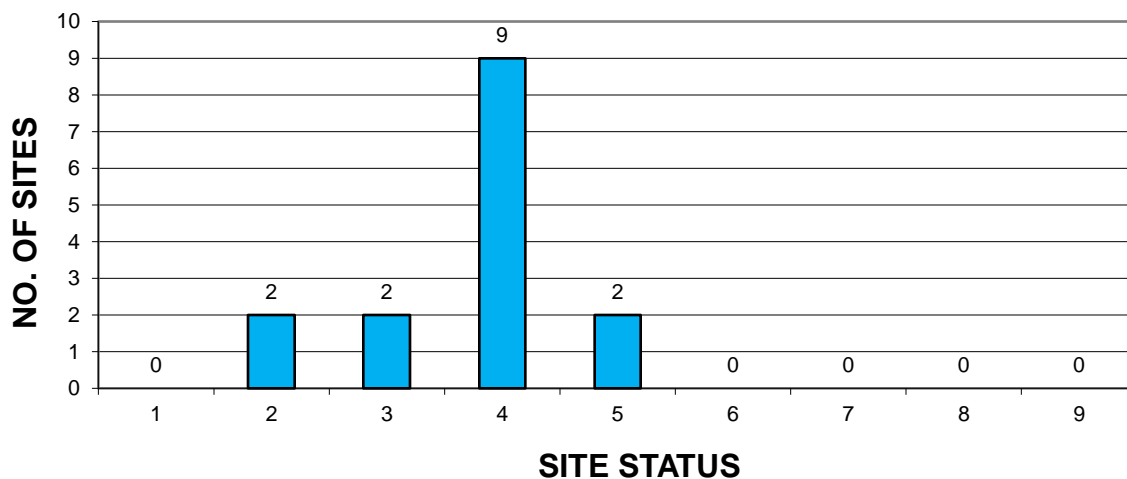
DISTRICT 3



1. SITE ASSESSMENT	2. SHORT TERM MONITORING	3. INVESTIGATION
4. LONG TERM MONITORING	5. REMEDIATION PLAN	6. INSTALLATION
7. REMEDIATION	8. POST REMEDIATION MONITORING	9. RESOLVED

Note: Sites may have more than one status.

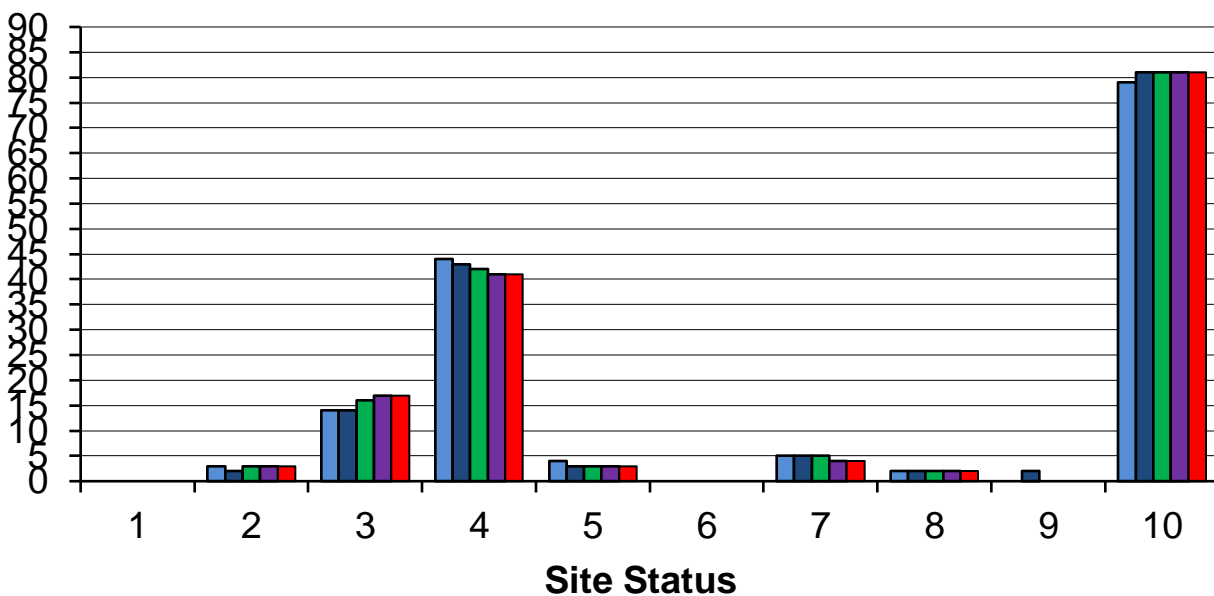
DISTRICT 4



- | | | |
|-------------------------|--------------------------------|------------------|
| 1. SITE ASSESSMENT | 2. SHORT TERM MONITORING | 3. INVESTIGATION |
| 4. LONG TERM MONITORING | 5. REMEDIATION PLAN | 6. INSTALLATION |
| 7. REMEDIATION | 8. POST REMEDIATION MONITORING | 9. RESOLVED |

Note: Sites may have more than one status.

Distribution of Sites by Status for Reporting Periods 2020 - 2024



2020 2021 2022 2023 2024

- | | | |
|---------------------------|--------------------------------|------------------|
| 1. SITE ASSESSMENT | 2. SHORT TERM MONITORING | 3. INVESTIGATION |
| 4. LONG TERM MONITORING | 5. REMEDIATION PLAN | 6. INSTALLATION |
| 7. REMEDIATION | 8. POST REMEDIATION MONITORING | 9. RESOLVED |
| 10. RESOLVED - CUMULATIVE | | |

Note: Sites may have more than one status.

Conclusions

This report provides information concerning the location, resource impact, immediacy level, and site description and status for 47 listed contamination / remediation sites related to exploration and production activities in the state. In addition, data is presented with regard to staff expenditures for site management, administration, and inspections, as well as authorization and/or expenditures against the Abandoned Well / Remediation fund for investigatory and remedial activities at the sites.

The Conservation Division of the Corporation Commission is committed to work with the oil and gas industry of the state, other state agencies and the public to provide a scientifically sound and technically based remediation program.

**Impacts, Immediacy and Target Remediation Levels for
Kansas Corporation Commission Contamination Sites**

County	Site Name	KCC District	Impact	Immediacy	Target Level Of Remediation	Unusual Problems	Estimated Total Cost
Barber	Harbaugh	1	GW / Domestic / Stock Well	High	1000 ppm	Yes	\$ 450,000*+
Barber	Hrencher	1	GW/ STK / Soil / SW	Mod-High	1000 ppm	No	\$ 150,000
Barber	Packard	1	GW / DM / STK	Moderate	1000 ppm	Yes	\$ 10,000
Barber	Wildboy's	1	GW / SW / PWSW	Mod-High	500 ppm	No	\$ **
Decatur	Jennings	4	GW / DM / PWSW / SD	Mod-High	500 ppm	No	\$ 2,000
Ellis	Dinkel	4	GW / Domestic (SS)	Low	500 ppm	No	\$ 30,000
Ellis	Ruder	4	Groundwater / SW	Moderate	500 ppm	Yes	\$ 29,000
Graham	Balthazor	4	GW / Domestic (SS)	Low	250 ppm	No	\$ 10,000
Graham	Fink, Leon	4	Groundwater / Stock Well	Low	500 ppm	Yes	\$ 2,000
Harvey	Hollow-Nikkel	2	GW / Domestic / Irrigation	Moderate	500 ppm	Yes	\$ 75,000
Harvey/Reno	Burrton	2	GW / Domestic / Irrigation	High	Variable	Yes	\$3,000,000+
Haskell	Clawson (Mesa)	1	Groundwater / Irrigation	Mod-High	500 ppm	Yes	\$ 450(yr)*

County	Site Name	KCC District	Impact	Immediacy	Target Level Of Remediation	Unusual Problems	Estimated Total Cost
Hodgeman	Schraeder	1	Groundwater / Stock Well	Low	350 ppm	No	\$ 30,000
Kingman	South Spivey	2	GW / SW / Stock Well	Low	750 ppm	Yes	\$ 5,000*
Kingman	Trostle	2	GW / Soil / Stock Well	Low	500 ppm	No	\$ 2,500*
Kingman	Yeoman	2	GW / DM /Stock Well	Moderate	NA	No	\$ 56,000+
Linn	McDonald - East	3	GW / SW	Low	500 ppm	No	\$ 1,500(yr)
McPherson	Galva City	2	GW / DM / PWSW	UR	500 ppm	Yes	\$ 500,000
McPherson	Knackstedt	2	WP (Cavity)	Moderate	NA	Yes	\$ 5,000
McPherson	McPherson Landfill	2	GW / DM / SD / INDWSW	UR	500 ppm	No	\$ 26,500*
McPherson	Nikkel-Epps	2	GW / DMSS / IR	Mod-High	500 ppm	Yes	\$ 20,000
McPherson	Running Turkey Creek	2	GW / DM / SW / SD	Mod-High	500 ppm	Yes	\$ 125,000
McPherson	Selzer	2	Groundwater / SW	Moderate	500-750 ppm	Yes	\$ 20,000
McPherson	Voshell	2	GW / SW / DM / IR / STK	High	500 ppm	Yes	\$ 20,000+
Montgomery	Fowler	3	Soil	Low	300 ppm	Yes	\$ 4,500
Montgomery	Mantooth	3	GW / SW	Moderate	500 ppm	Yes	\$ 10,000+
Morton	Smith-Finn	1	Groundwater / Domestic	UR	500 ppm	Yes	\$ 200,000*
Neosho	Brazil	3	SW / GW / PWS / Soil	Low-Mod	500 ppm	No	\$ 63,000

County	Site Name	KCC District	Impact	Immediacy	Target Level Of Remediation	Unusual Problems	Estimated Total Cost
Pawnee	Enoch-Thompson	1	Groundwater / Stock Well	Low-Mod	1000 ppm	No	\$ 500(yr)*
Pawnee	Macksville	1	Groundwater / IR / SW	Mod-High	300 ppm	Yes	\$ 20,000(yr)*
Reno	Arlington	2	GW / Soil / DM / IR	Moderate	250 ppm	Yes	\$ 7,500*
Rice	Brothers	2	Groundwater	Low	500 ppm	Yes	\$ 4,000
Rice	Little River	2	Groundwater / PWSW	High	300 ppm	Yes	\$ 46,500
Rice	Stowe-Zaid	2	Groundwater / Soil	Low	350 ppm	Yes	\$ 12,000
Rooks	Elm Creek	4	GW / Domestic / Stock Well	Mod-High	500 ppm	Yes	\$ 300,000
Rooks	Irey - Hrabe	4	Groundwater	Moderate	500 ppm	No	\$ 15,000
Rooks	Schruben-Rogers	4	Groundwater	Low	250 ppm	No	\$ 2,000
Russell	Maupin	4	Groundwater / Stock Well	Low	500 ppm	No	\$ 2,000
Russell	Russell City	4	GW / Domestic / Irrigation	Low	1000 ppm	Yes	\$ 400,000
Russell	Russell RWD #1	4	Groundwater / PWSW	Low-Mod	250 ppm	Yes	\$ 33,000
Russell	Sander	4	GW / Domestic / Stock Well	Low	1000 ppm	No	\$ 300
Sedgwick	Sample	2	Groundwater	Low	500 ppm	Yes	\$ 2,000
Sedgwick	Schulte Field	2	GW / Domestic / PWSW	UR	500 ppm	Yes	\$ 300,000
Stafford	Curtis	1	Groundwater / Irrigation	Low-Mod	500-1000 ppm	Yes	\$ 27,000

County	Site Name	KCC District	Impact	Immediacy	Target Level Of Remediation	Unusual Problems	Estimated Total Cost
Stafford	French Sink	1	WP (Cavity)	Mod-High	NA	Yes	\$ 3,000
Stafford	Leesburg Sink	1	WP (Cavity)	Mod-High	NA	Yes	\$ 62,000*
Wilson	Wingate	3	Groundwater / Soil	Low	500 ppm	Yes	\$ 15,000
Total Estimated Cost							\$6,099,250

ABDW=Abandoned Well DM=Domestic GW=Groundwater INDWSW=Industrial Water Supply Well IR=Irrigation Well
 Mod=Moderate PWSW=Public Water Supply Well SD=Surface Damage STK=Stock Well SW=Surface Water
 SS=Sole Source UR=Under Remediation WSW=Water Supply Well WP=Well Problem

*PRP – Potential Responsible Party involvement **See Harbaugh Site for costs +Actual costs have exceeded original estimate

CONTAMINATION SITE EXPENDITURES

SITE NAME	CONTROL NO.	STAFF HOURS	EXPENDITURE FOR STAFF HOURS	REMEDIATION FUND AUTHORIZATION / EXPENDITURE FY 2023/24 TOTAL	
ARLINGTON	20030016-001	36.5	\$1,128.29		
BALTHAZOR	970023-00	7	\$211.72		
BRAZIL	990040-001	17	\$529.21		\$10,791.18
BROTHERS	970029-00	8.5	\$268.07		\$4.26
BURRTON	970003-00	459.5	\$15,782.25	\$557,425.70	\$911,442.17
CLAWSON	970005-00	3	\$99.10		
CURTIS	970034-00	5	\$157.12		\$4,199.17
DINKEL	970035-00	3	\$99.10		
ELM CREEK	970043-00	9	\$283.43		\$29,212.25
ENOCH THOMPSON	970044-00	6	\$187.84		
FINK	970007-00	4	\$129.82		
FOWLER	970046-00	9	\$283.43		
FRENCH	990002-001	3	\$99.10		\$346.50
GALVA CITY AREA	980033-001	304	\$10,017.05	\$13,701.74	\$356,441.23
HARBAUGH	970049-00	11	\$327.77	\$3,128.70	\$710,253.92
HOLLOW NIKKEL	970009-00	9	\$283.43	\$2,578.10	\$57,145.29
HRENCER	970051-00	5	\$155.41		\$189.94
IREY-HRABE	970053-00	5	\$160.54		
JENNINGS	970054-00	11	\$331.19		
KNACKSTEDT	970060-00	7.5	\$237.35		\$29,759.39
LEESBURG SINK	20040003-001	3	\$99.10		\$6,266.00
LITTLE RIVER	20000057-001	14	\$437.04		\$3,112.20
MACKSVILLE	970066-00	9	\$280.01	\$1,585.00	\$93,209.98
MANTOOTH	980058-001	19	\$590.65		\$17,349.00
MAUPIN	970068-00	4	\$129.82		
MCDONALD-EAST	970070-00	9	\$283.43		

SITE NAME	CONTROL NO.	STAFF HOURS	EXPENDITURE FOR STAFF HOURS	REMEDIATION FUND AUTHORIZATION / EXPENDITURE FY 2023/24 TOTAL	
MCPHERSON LANDFILL	980034-001	11.5	\$432.08	\$533.40	\$25,154.20
NIKKLE-EPPS	20100082-001	10	\$314.15		\$8,318.75
PACKARD	970075-00	7.5	\$230.50		\$310.09
RUDER	970082-00	4	\$122.98		\$12,960.00
RUNNING TURKEY CREEK	20010033-001	22	\$742.69		\$61,603.07
RUSSELL CITY	970083-00	3	\$99.10		\$1,192.60
RUSSELL RWD #1	970084-00	4	\$122.98		
SAMPLE	970088-00	4	\$129.82		
SANDER	970089-00	3	\$99.10		
SCHRAEDER	970013-00	6	\$187.84		\$1,590.90
SCHRUBEN-ROGERS	970014-00	4	\$122.98		
SCHULTE	970015-00	62	\$2,007.50	\$363.91	\$183,424.71
SELZER	970093-00	14	\$437.04		\$12,133.50
SMITH-FINN	970095-00	3	\$99.10		
SOUTH SPIVEY	970096-00	13.5	\$421.68		
STOWE-ZAID	20000035-001	7	\$221.99		\$4,057.85
TROSTLE	980038-001	16.5	\$513.85		
VOSHELL	20030059-001	49	\$1,614.10	\$311.15	\$22,012.73
WILDBOY'S	970017-00	5.5	\$170.77		
WINGATE	970107-00	10	\$314.15		\$8,296.00
YEOMAN	20060021-001	19	\$650.53		\$102,690.76
Totals:		1,259.5	\$41,646.20	\$579,627.70	\$2,673,467.64

**REMEDIATION
SITES
REPORT
2024**

Project: *Albert Harbaugh Contamination Site, Barber County, District 1*

Site Location: Legal location is the SE/4 Section 20 & NE/4 Section 29, Township 33 South, Range 11 West, Barber County.

Impact/Immediacy: The groundwater for domestic and stock wells has been contaminated from several sources on this project. This site is rated as high immediacy and remediation of the groundwater began on November 1, 1999.

Site Description: The site is located in the alluvial valley on the flood plain of the Medicine River, in the Rhodes Pool, approximately nine miles south of Medicine Lodge. This site covers an area of approximately 1000 feet wide and 3500 feet long. This location and other sites in the area are continually increasing the chlorides in the groundwater aquifer of the Medicine River valley.

Unusual Problems: It is probable that all source areas of natural halite pollution into the aquifer have not been identified. Areas of suspected sources have not continued to contribute to the contamination since the remediation of the ground water has been implemented. These areas are suspected to have achieved a natural closure at this time. Unless all the source areas are located and plugged, the contamination will continue until there is natural closure.

Status of Project: All 13 recovery wells along with all 13 monitoring wells were sampled. According to the data the plume has settled back to the Northwest portion of the site. An unidentified flowing core hole near these wells is the probable source of these chlorides with other sources contributing additional contamination across the rest of the remediation site. Differences in chloride values of wells in close proximity to each other are attributed to different screening depths.

Level of Remediation Sought:

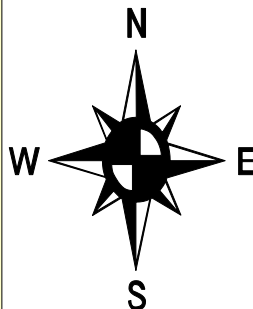
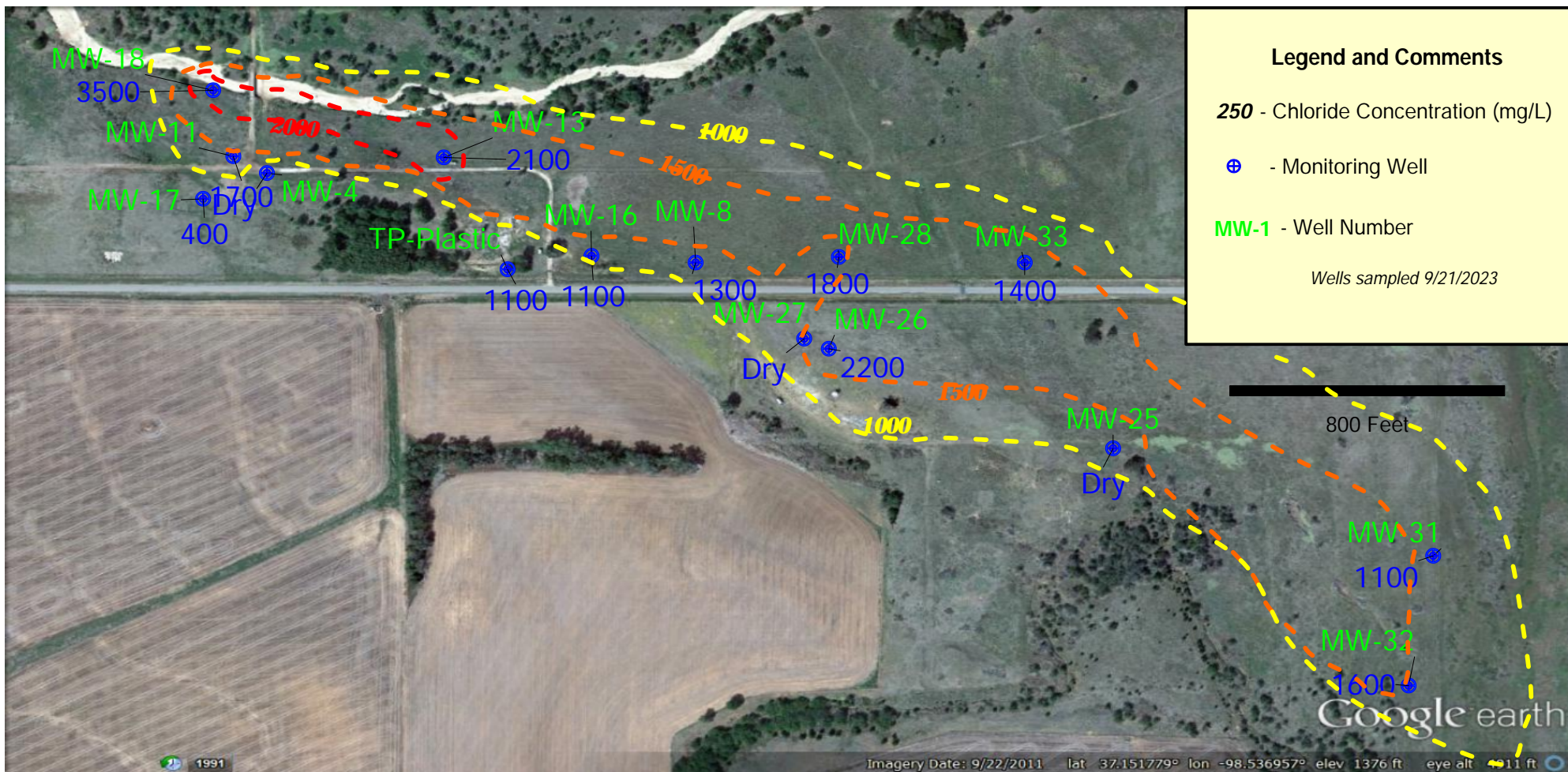
Ideal: 250 ppm Chloride

Target: 1000 ppm Chloride

Recommendation for Future Work: Make the necessary repairs to return the recovery system back to operation. Review the data to continue taking a targeted approach at remediating the site. The plugging of more monitoring wells that are outside of the plume as well as recovery wells that are unusable will look to be plugged. Repair wells MW-4, MW-25 & MW-27.

Estimated Total Cost: Total costs have exceeded the original estimate of \$450,000. There will be additional costs for a pumper and maintenance.

Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
970049-00	11 Hrs. / \$327.77	\$3,128.70	\$710,253.92
Current Contaminate Level: 100 ppm Cl- to 3,500 ppm Cl-			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	

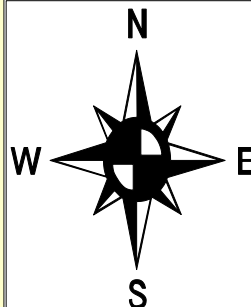
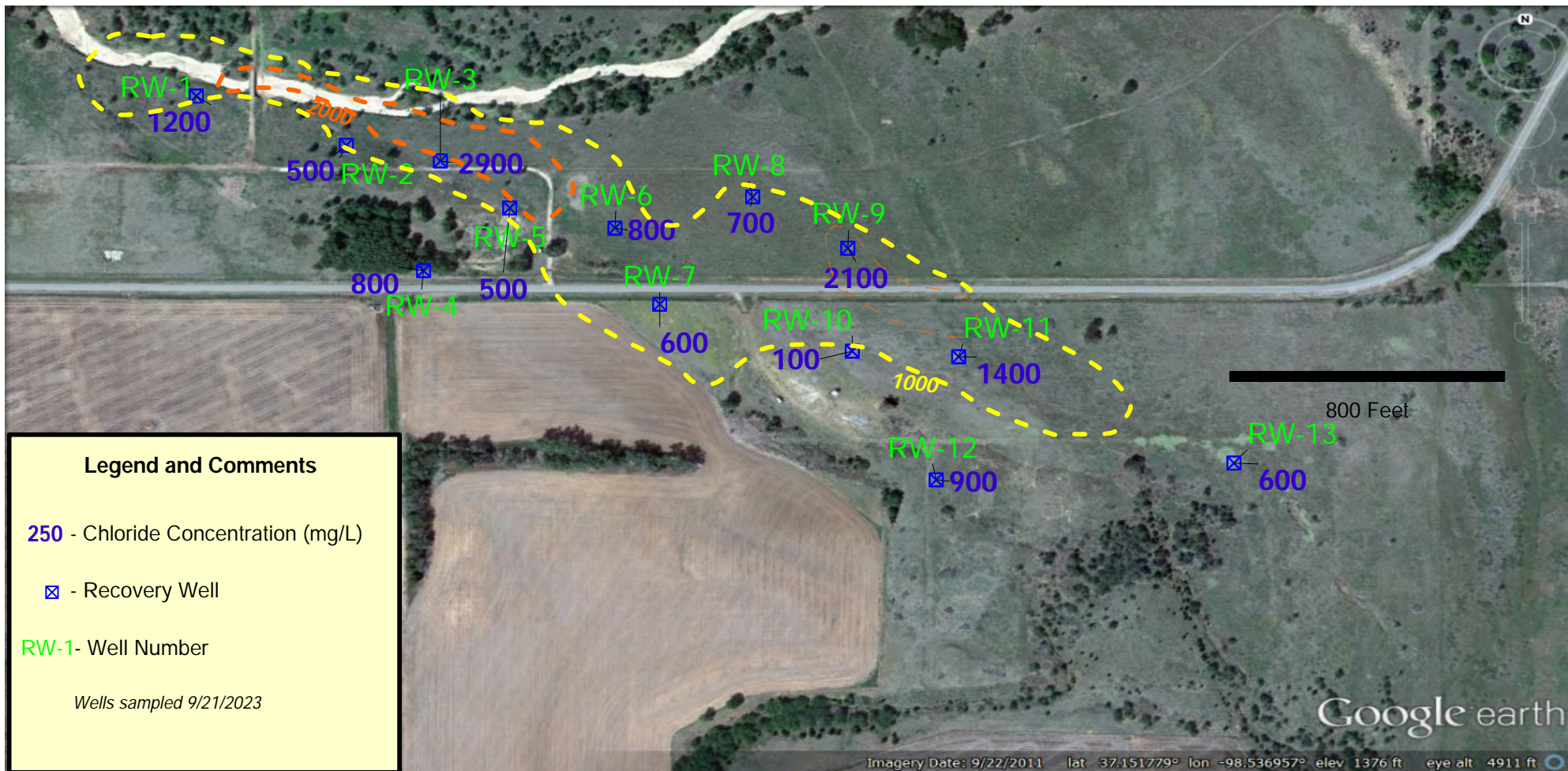


Harbaugh Site

Sections 20/29-T-33S-R11W
Barber County, Kansas

2023 Area Map with Monitoring Well Chlorides

KCC Control # 970049-00 District 1
N. Feldkamp 9/28/2023



Harbaugh Site

Sections 20/29-T-33S-R11W

Barber County, Kansas

2023 Area Recovery Well Map with Chlorides

KCC Control # 970049-00 District #1

N. Feldkamp 9/28/2023

Project: Hrencher Contamination Site, Barber County, District 1

Site Location: Legal location is W/2 Section 36, Township 32 South, Range 12 West, Barber County.

Impact/Immediacy: The salt-water intrusion in the area affected the groundwater, small pond, stock wells and there is a salt scar near the pond. This site is classified as moderate to high for remediation.

Site Description: The surface area is predominately “red beds” of lower Permian age. The area is dissected by small drainage patterns and the alluvial channels filled with local parent material shale and gypsum. The area of high chlorides (1000 ppm +) is a narrow channel 300 feet wide and approximately 8000 feet long near the present stream. This small stream flows into the Medicine Lodge River within a half-mile.

Unusual Problems: None.

Status of Project: Staff collected five groundwater samples on September 21, 2023. Chloride levels overall in the project area have remained consistent with previous years. Sometime during 2003-2011 MW-5, MW-7, and MW-11 have been destroyed. MW-5 was originally drilled to provide a profile of the chlorides in the main channel, whereas MW-7 was drilled to eliminate additional sources of contamination and has historically been fresh. MW-11 was drilled in order to evaluate the down gradient concentration of chlorides, but since it has been destroyed, the leading edge of the plume is left undefined.

Level of Remediation Sought:

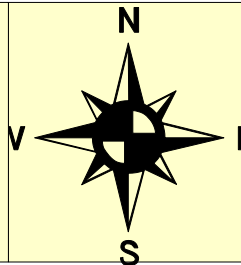
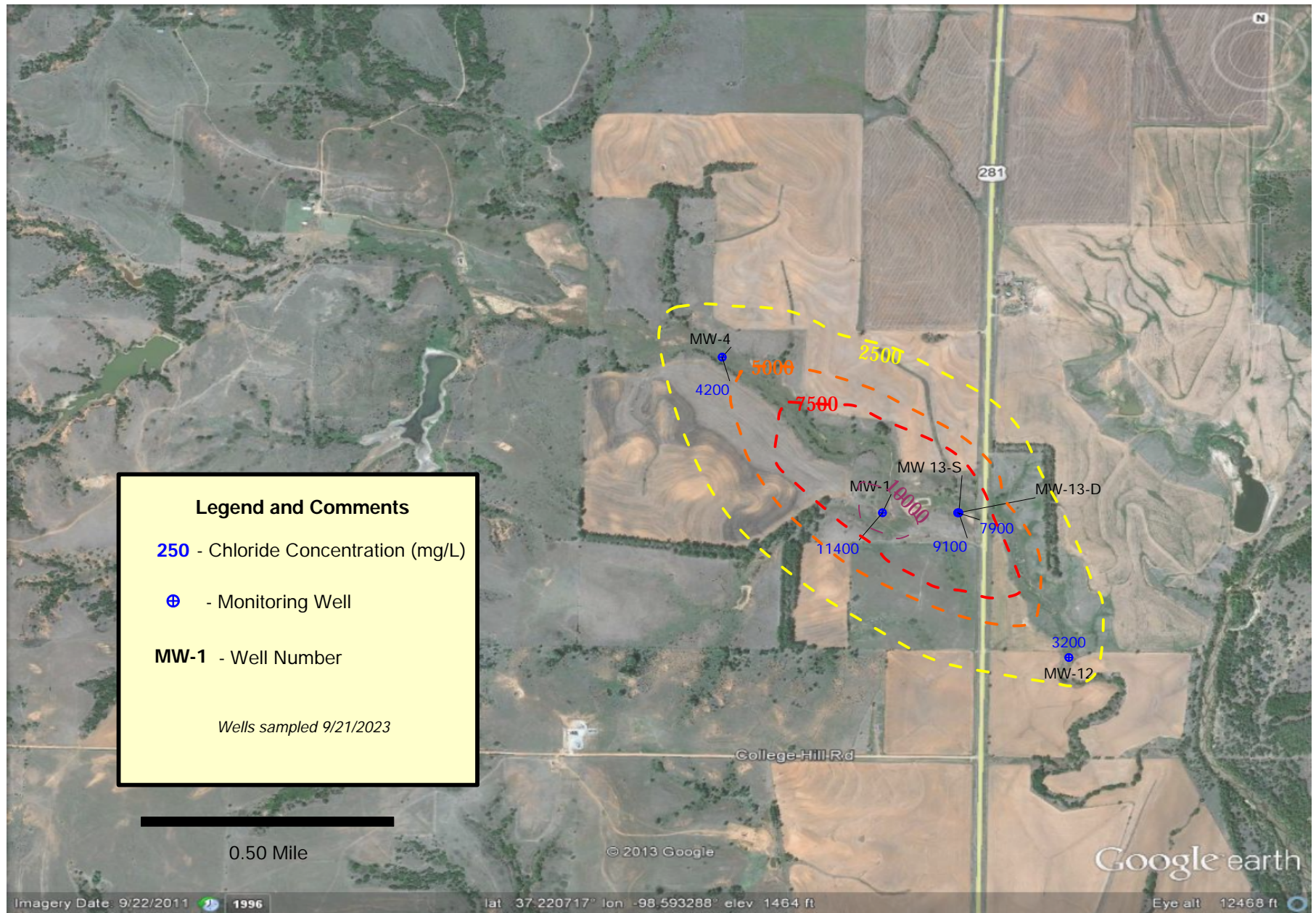
Ideal: 250 ppm Chloride

Target: 1000 ppm Chloride

Recommendation for Future Work: Continue sampling on an annual basis. As chloride levels have continued to increase down gradient, it may be necessary to design and install a remedial system for this site. Additional monitoring wells need to be drilled to define the toe of the plume. Further investigation and sampling will continue to determine if a remedial system is appropriate for this site.

Estimated Total Cost: \$150,000 if necessary to install a remediation system.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970051-00	5 Hrs. / \$155.41		\$189.94
Current Contaminate Level: 3,200 ppm Cl- to 11,400 ppm Cl-			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Hrencher Site
Sections 26/35/36-T-32S-R12W
Barber County, Kansas
2023 Area Map with Chlorides
KCC Control # 970051-00 District 1
N. Feldkamp 09/28/2023

Project: Packard Contamination Site, Barber County, District 1

Site Location: Legal location is Section 15, 22, 23 Township 31 South, Range 13 West, in Barber County. 7 miles west of Medicine Lodge on river road.

Impact/Immediacy: The ground water has been contaminated, and a very good water well has been contaminated with chlorides. Immediacy level is rated as moderate.

Site Description: The salt-water plume is moving to the south away from the Packard #1 oil well. It has contaminated the water supply well and could possibly damage the domestic well at the abandoned house, the supply well in the SE/4 of section 23, and the spring to the southwest.

Unusual Problems: The contamination could be from multiple sources.

Status of Project: A total of seven groundwater samples were collected on September 21, 2023. Four monitoring wells samples were taken in addition to a house well, stock well, and spring. Chloride data shows the plume remains confined. Chlorides historically have decreased, but over the past several years have remained consistent.

Level of Remediation Sought:

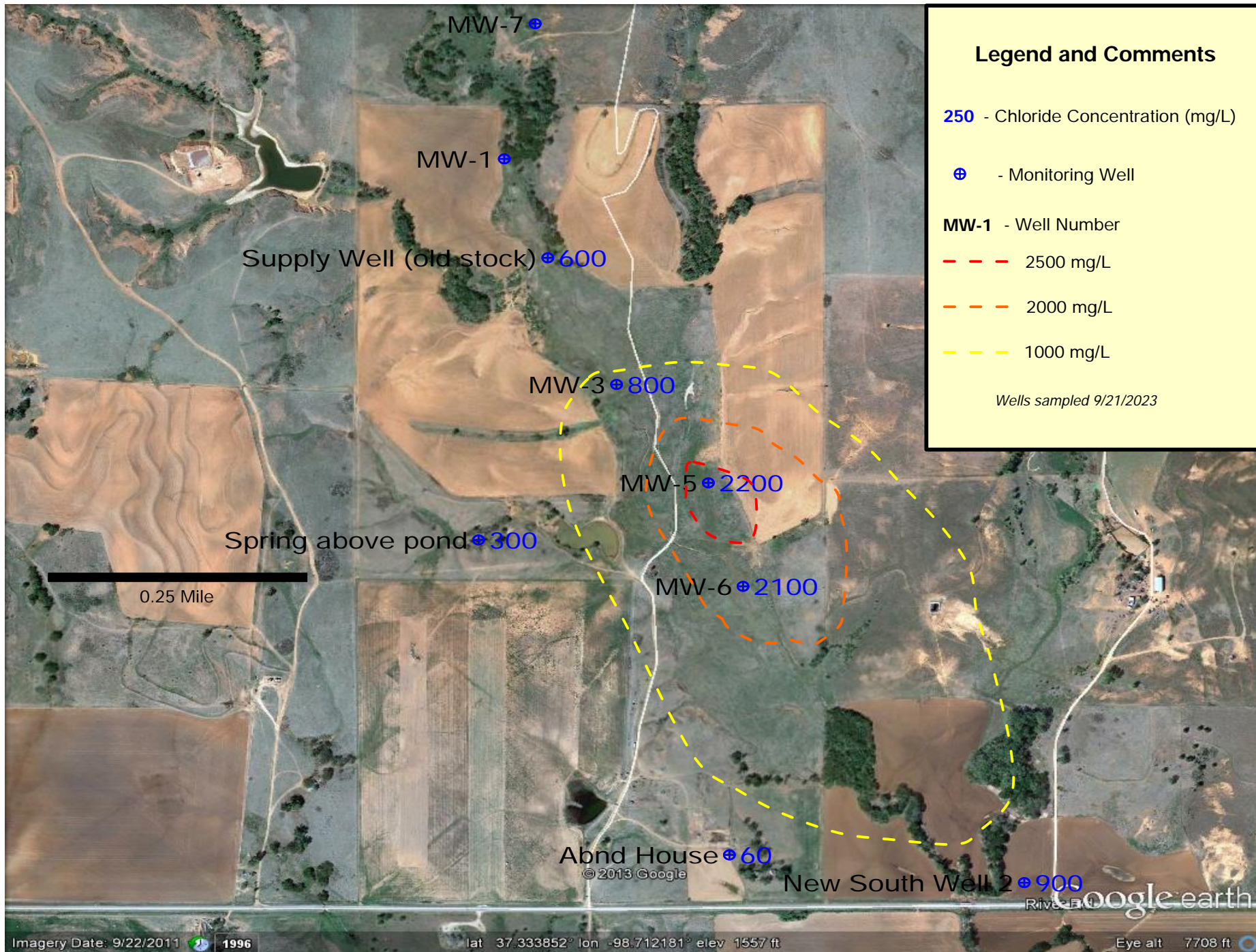
Ideal: 250 ppm Chloride

Target: 1000 ppm Chloride

Recommendation for Future Work: Monitoring will continue on an annual basis as the area continues to be remediated by natural attenuation. As the groundwater in this area is relatively shallow, several holes may be augured to gather more comprehensive data on the size and whereabouts of the chlorides. Depending on the information gathered, additional permanent monitoring wells may need to be installed. Analytical may need to be run on the new south supply well in order to determine if the chlorides are of a natural source, or from oilfield activities.

Estimated Total Costs: \$10,000

Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
970075-00	7.5 Hrs. / \$230.50		\$310.09
Current Contaminate Level: 60 ppm Cl- to 2200 ppm Cl-			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Packard Contamination Site
 Sections 15/22/23-T31S-R13W
 Barber, County Kansas
 2023 Area Map with Chlorides
 KCC Control # 970075-00 District1-N. Feldkamp 9/28/23

Project: *Wildboy's Land & Cattle Contamination Site, Barber County, District 1*

Site Location: Legal location is NE/4 of Section 28, Township 33 South, Range 11 West, Barber County, 9 miles S of Medicine Lodge on Hwy 281, 1E, 1S, 1E into farmstead.

Impact/Immediacy: The impact is to the groundwater and surface water of the area. Immediacy level is rated at moderate to high.

Site Description: The site is located within the Medicine Lodge River Valley.

Unusual Problems: None.

Status of Project: On September 21, 2023, samples were collected from three monitoring wells and a stock well. The well site monitoring well was not accessible due to the landowner locking out access. In general, the chlorides at this site have been quite variable, but has been trending downward the last five sampling events.

Level of Chloride Sought:

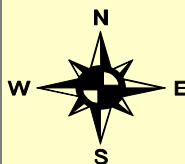
Ideal: 250 ppm Chloride

Target: 500 ppm Chloride

Recommendations for Future Work: Continue annual sampling of the site.

Estimated Total Cost: If necessary, installation of recovery system and disposal facility with long term monitoring. Costs associated with the installation of the disposal well are attached to the Harbaugh site.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970017-00	5.5 Hrs. / \$170.77		See Harbaugh
Current Contaminate Level: 150 ppm Cl- to 3,600 ppm Cl-			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Wildboys Site
2023 Area Map with Chlorides
 Sections 28/33-T-33S-R11W
 Barber County, Kansas
 KCC Control # 970017-00 District 1
 N. Feldkamp 9/25/2023

Project: Jennings Contamination Site, Decatur County, District 4

Site Location: NW/4 of Section 25, Township 4 South, Range 27 West, Decatur County.

Impact/Immediacy: Groundwater contaminated by poor oil field practices including discharges and spills. Domestic water wells to the east and northeast of the Jennings Unit, including two former public water supply wells (PWS) have been impacted. A recent spill, and observed increase in the chloride levels at the spill location and monitoring well have fundamentally changed the site. Immediacy level is rated moderate to high.

Site Description: The current city water supply well is located west and upstream of the Jennings Unit, and it is not believed to have been impacted by oil field pollution at this time. The contaminated wells within the city limits are used for purposes other than human consumption. The site is situated within the stream valley of Prairie Dog Creek.

Unusual Problems: None.

Status of Project: Sampling of the monitoring well adjacent to the brine transfer station has established an overall downward trend punctuated by rapid increases in chloride levels, which may be correlated to spills at the transfer station. Because the chloride level of the PWS well up gradient of the Jennings Unit has remained steadily at background levels, it is evident that the elevated contamination in the monitoring well is the result of operations on the lease. In August 2021, a spill was discovered on the Jennings Unit, approximately ½ mile east of the PWS well, and ¼ mile west of the monitoring well. This spill was significant, and both brine and crude oil impacts to the surface, vegetation, and groundwater have been discovered. The groundwater at the site of the spill is approximately 90,000 ppm chloride. Following the spill, the monitoring well was sampled, and the chloride found to be 13,000 ppm, up from 60 ppm in 2020. Sampling in 2022 indicated that the concentration in the well is 40,500 ppm, and it was 18,000 ppm in April of 2023.

Level of Remediation Sought:

Ideal: 250 ppm Chloride

Target: 500 ppm Chloride

Recommendations for Future Work: Bach Oil Production is the responsible party for contamination on the site. Due to the proximity of the recent spill to the PWS well, KDHE assumed the lead for the remedial efforts at this western portion of the site. Bach has entered the State Cooperative Program with KDHE, and has retained the services of geologic consultants and soil remediation companies. A geophysical survey was conducted to delineate the extent of the groundwater contamination at the spill location. This demonstrated that there is a discrete plume corresponding to the spill, and a separate source responsible for the pollution noted near the brine transfer station. Additional geophysics will be conducted, and the RP will be required to remediate the groundwater.

Estimated Total Costs: \$2,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970054-00	11 Hrs. / \$331.19		
Current Contaminate Level: 18,000 ppm Cl⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input type="checkbox"/> 4. Long Term Monitoring	<input checked="" type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Jennings Groundwater Monitoring Site

Section 25 of Township 4 South, Range 27 West, Decatur County, Kansas
2023 Groundwater Chloride Levels

District #4 - Sampled 4/14/2023 - Map Drawn on 9/28/2023 by C. Neeley



Project: Dinkel Contamination Site, Ellis County, District 4

Site Location: SE/4 of Section 32, Township 13 South, Range 17 West, Ellis County

Impact/Immediacy: Brine from oil field operations has impacted a shallow aquifer within the Big Creek drainage. The affected water was originally the sole source of domestic water for the farmstead, which is now on rural water. The immediacy level for this site is rated as low.

Site Description: This site is bounded on the north by I-70, positioned within the Younger Oil Field, and has active oil wells, enhanced recovery wells, and disposal wells in the vicinity. Possible contaminant sources include an evaporation pit (permit revoked July 1, 1958), a shallow injection well (injection authorization revoked September 3, 1969), or drilling pits associated with a nearby well.

Unusual Problems: None.

Status of Project: A total of 16 holes were drilled on the site in August and September of 2000, and three were completed as monitor wells. The household is on rural water, and the well water is now utilized for cattle. Pumping to waste may be utilized to remove contaminated water; however, the aquifer may not have the capacity to allow for appreciable gains when compared to the amount of water pumped. Because the house has a source of drinking water, and the chloride concentrations in the aquifer are not unsuitable for beef cattle, remediation is not warranted at this time. In 2019, the casing on MW 9 was broken off at ground level, which allowed the casing to become plugged. An attempt to reopen the well was unsuccessful, and the well was plugged according to KDHE regulations.

Well ID	2019 Chlorides	2020 Chlorides	2021 Chlorides	2022 Chlorides	2023 Chlorides
5	1,300 ppm	1,150 ppm	1,200 ppm	1,100 ppm	1,150 ppm
7	1,050 ppm	1,000 ppm	1,300 ppm	1,050 ppm	800 ppm
9	Plugged				

Level of Remediation Sought:

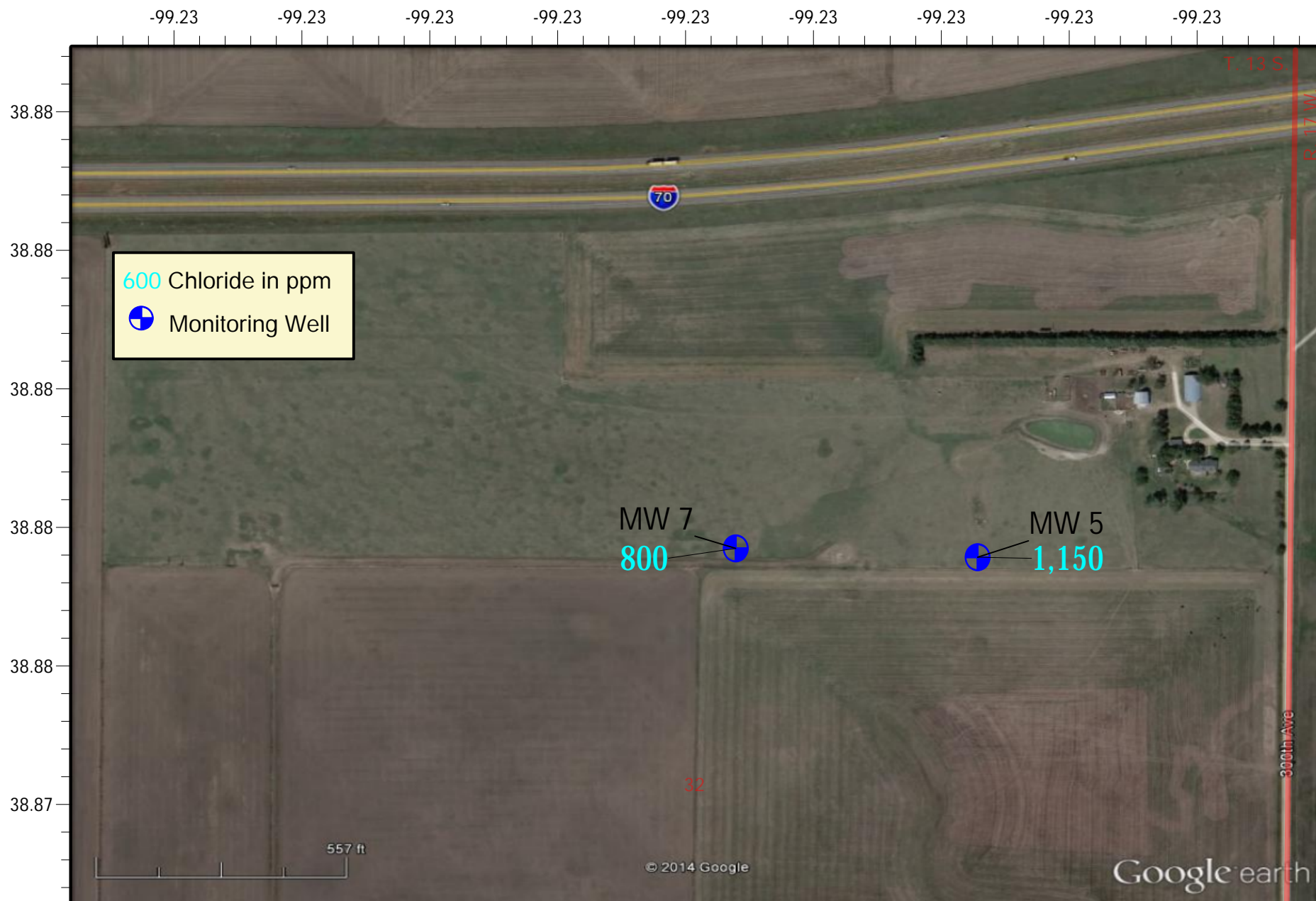
Ideal: 100 ppm Chloride

Target: 500 ppm Chloride

Recommendations for Future Work: Annual sampling will continue at this site.

Estimated Total Costs: \$28,000 to \$30,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970035-00	3 Hrs. / \$99.10		
Current Contaminate Level: 800 ppm Cl ⁻ to 1,150 ppm Cl ⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Dinkel Groundwater Monitoring Site

Section 32 of Township 13 South, Range 17 West, Ellis County, Kansas
2023 Groundwater Chloride Levels
District #4 - Sampled 9/27/23 - Map Drawn on 9/28/2023 by C. Neeley



Project: *Ruder Contamination Site, Ellis County, District 4*

Site Location: Sections 17, 20, and 28 of Township 15 South, Range 18 West, Ellis County.

Impact/Immediacy: The Ruder Creek Alluvial Aquifer has been impacted by brine intrusion due to surface ponds and artesian flow of saline water from the Cedar Hills Sandstone into shallower aquifers via old wellbores in the area. The Immediacy level for this site is rated as moderate.

Site Description: Ruder Creek runs southwest of US 183 from near Hays to the Smoky Hill River near Schoenchen. North of the site, Ruder Creek is divided into east and west branches, which come together into the main trunk in the northern section of the site. The area is almost exclusively range land with a subtle relief from the uplands to the bed of the stream. Documented oil field pollution has existed in the drainage since the 1930's, and correspondence made during 1954 states that the west branch was fresh while the east branch and the main trunk of the stream were heavily impacted by brine. Historical aerial photographs show many pits and tank battery locations directly adjacent to the stream. The sources of pollution in this area have been numerous, and geographically as well as temporally wide spread, complicating the investigation and remediation of the overall issue.

Unusual Problems: Proximity to the City of Hays' public water supply well field.

Status of Project: Presently, the chloride concentrations in the monitoring wells range from 1,250 ppm in MW1 at the northern end of the site, to 300 ppm in the southern monitoring well near the Smoky Hill River. This north-south chloride gradient has persisted for many years. Appreciable decreases in chloride contamination have not been observed throughout the duration of sampling, and it is unknown if the input of additional contaminants has been halted by the closure of surface pits, plugging of flowing wells, and general improvement of lease practices. A test hole augured in 2018 approximately 100' northeast of the northern monitoring well (MW1) produced water with a concentration of only 600 ppm. It is not yet known if this is representative of the groundwater north of this well, and further work will be conducted to determine if MW1, which was not completed in alluvium, is anomalous.

Level of Remediation Sought:

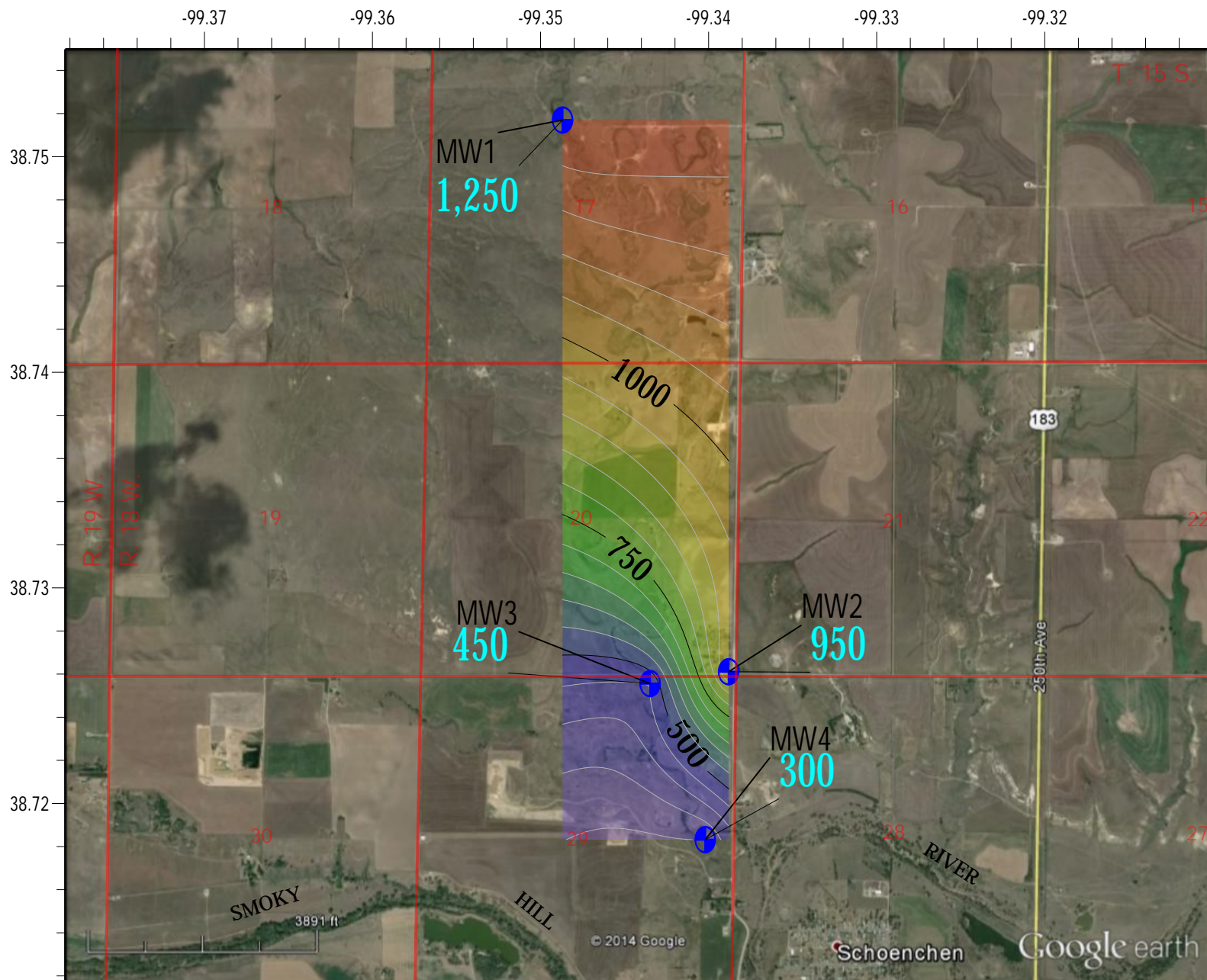
Ideal: 250 ppm Chloride

Target: 500 ppm Chloride

Recommendations for Future Work: Conspicuous potential sources of pollution have been identified on a historical aerial photograph, and a conductivity survey will be carried out and combined with additional groundwater sampling. This site will continue to be monitored on an annual basis, and resources will be compiled to identify other possible sources of pollution.

Estimated Total Costs: \$29,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970082-00	4 Hrs. / \$122.98		\$12,960.00
Current Contaminate Level: 300 ppm Cl ⁻ to 1,250 ppm Cl ⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Ruder Creek Groundwater Monitoring Site

Sections 17, 20, and 29 of Township 15 South, Range 18 West, Ellis County, Kansas
2023 Groundwater Chloride Levels

District #4 - Sampled 6/13/2023 & 7/18/2023 - Map Drawn on 9/28/2023 by C. Neeley



Project: Balthazor Contamination Site, Graham County, District 4

Site Location: Section 23 of Township 9 South, Range 21 West, Graham County.

Impact/Immediacy: Pollution from past oil field activity has impacted an aquifer which supplies domestic water to a homestead. The immediacy level is rated as low.

Site Description: At the time that the site was listed, a well in section 14 was the sole source of water for the residence. Though the chloride concentration was at 600 ppm when it was last tested in 2002, this well is no longer utilized by the landowner. The sole source of domestic water for the residence is a water well to the south in section 23. The quarter that the water well is located in has three oil wells that are dry and abandoned, four that are plugged and abandoned, and four producers. The majority of these wells were originally drilled in the 1940s.

Unusual Problems: None.

Status of Project: When the new domestic well was drilled in 2011, the chloride level was 2,300 ppm. In 2022, the concentration was 375 ppm. A line failure necessitated that the property owner switch to a third well. This well is 75 ppm. The three monitoring wells on the location have remained relatively stable with a subtle overall decrease in contamination. The contamination levels in 2021 were found to be 1,000 ppm in MW #1, 1,200 ppm in MW #2, and 10 ppm in MW #3. In 2022, the concentrations were 1,200 ppm in MW #1, 1,350 in MW #2, and 20 ppm in MW #3. In 2023, they are 1,150 ppm, 1,250 ppm, and 50 ppm, respectively.

Level of Remediation Sought:

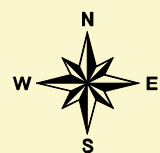
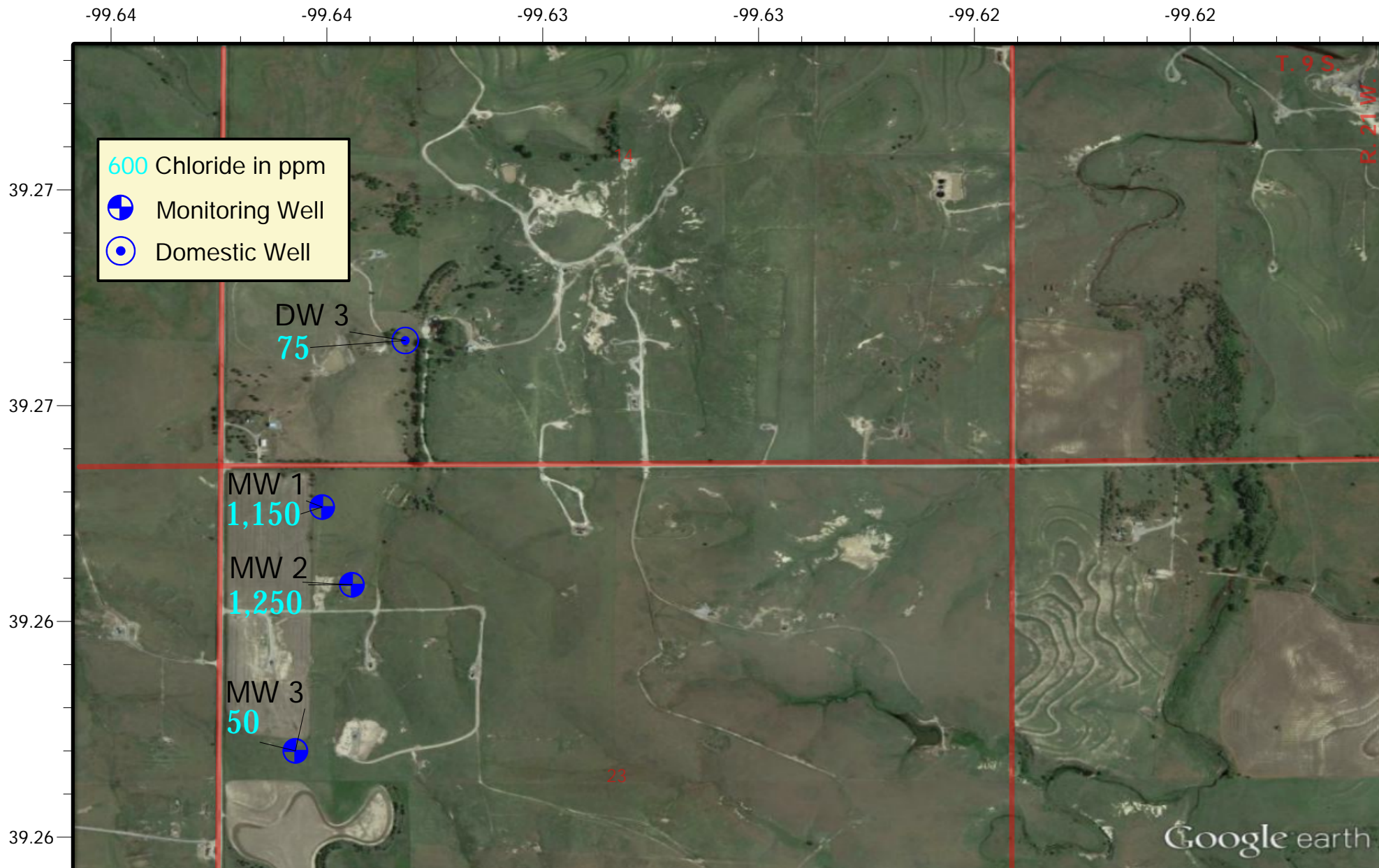
Ideal: 250 ppm Chloride

Target: 250 ppm Chloride

Recommendations for Future Work: The source of the contamination is likely an old brine pit in the NW/4 of Section 23, T.9S. R.21W., and the feasibility of decreasing the contamination level through remediation will be considered but needs to be weighed against the site parameters. The contamination level will continue to be monitored.

Estimated Total Costs: \$10,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970023-00	7 Hrs. / \$211.72		
Current Contaminate Level: 50 ppm Cl ⁻ to 1,250 ppm Cl ⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Balthazor Groundwater Monitoring Site

Section 23 of Township 9 South, Range 21 West, Graham County, Kansas
2023 Groundwater Chloride Levels

District #4 - Sampled 4/27/2023 - Map Drawn on 9/28/2023 by C. Neeley



Project: *Leon Fink Contamination Site, Graham County, District 4*

Site Location: SE/4 of Section 22, and NE/4 of Section 27, Township 8 South, Range 22 West, Graham County.

Impact/Immediacy: Stock well in the Codell Formation testing high in chlorides. Immediacy level is rated as low.

Site Description: The site encompasses a stock well and a now abandoned domestic well. Both were drilled into the Codell Sandstone, which is a marginal aquifer in Graham County. The chloride in the stock well was initially very low, but rose sharply during the 1970's. Surface sources were considered, but due to the nature of the bedrock and the depth to the Codell Aquifer, it is more likely that the pollution originated from a source below ground. The Fink #2 saltwater disposal well (SWD) was originally completed as an oil well in 1954, and converted to an enhanced oil recovery well before ultimately being converted back to a SWD. This well was long the subject of interest, but before the implementation of the Federal Underground Injection Control, there was little statutory authority to rigorously check the integrity of the well bore. For this reason, it was never proven or disproven that the well was the source. The construction of this well is highly suspect, and may or may not continue to be a conduit for saline water from brackish zones to enter the Codell, despite the fact that the well was plugged in 1984.

Unusual Problems: The depth to the contaminated zone is approximately 250 to 300 feet, making investigation and remediation difficult.

Status of Project: The domestic well has been abandoned due to a water level that is inadequate for use by the owner, and the house has been demolished. The last sample taken from this source in 2004 contained a chloride concentration of 200 ppm. Samples from the stock well continue to be tested, and the well is presently being utilized for livestock, which will contribute to a reduction in chloride concentrations if the source has been eliminated. An overall downward trend has been observed over the history of the site, and the current contamination concentration is at 750 ppm.

Level of Remediation Sought:

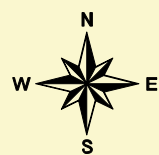
Ideal: 250 ppm Chloride

Target: 500 ppm Chloride

Recommendations for Future Work: This site should be monitored short-term to ascertain if the lowered chloride concentration will be maintained.

Estimated Total Costs: \$2,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970007-00	4 Hrs. / \$129.82		
Current Contaminate Level: 750 ppm Cl ⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input checked="" type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Leon Fink Groundwater Monitoring Site

Section 27 of Township 8 South, Range 22 West, Graham County, Kansas
 2023 Groundwater Chloride Levels
 District #4 - Sampled 8/2/2023 - Map Drawn on 9/28/2023 by C. Neeley



Project: *Hollow-Nikkel Contamination Site, Harvey County, District 2*

Site Location: The Hollow Nikkel Site in northwestern Harvey County is approximately eighteen miles northwest of Newton. The site includes sections 7, 8, 17, 18, 19, 20, 29, and 30 in Township 22 South and Range 3 West. This site is within the Equus Beds Aquifer boundaries.

Impact/Immediacy: The potential impact is on irrigation and rural residential wells. The KCC rates this site at a moderate immediacy level. Over the last few years, the city of McPherson has investigated the possibility of the area as a public water supply.

Site Description: The project area covers approximately 15 square miles. The contaminated plume is aligned in a north-to-south configuration, about 2 miles wide and 4 miles long. Plume morphology appears to be controlled by the bedrock channel. This channel has an alignment similar to that of the plume. Contamination mapped to date is primarily confined to the Equus Beds aquifer's lower zone, consisting of McPherson Formation Pleistocene unconsolidated sand and gravel deposits at a depth of 200 to 250 feet on top of the Permian-aged Wellington Formation shales. However, the location near EB-34 shows contamination throughout all three aquifer zones.

Unusual Problems: To remediate this site, the planning, land access acquisition, and development of a suitable water disposal method would be very time-consuming and financially intensive. Changes within the aquifer appear to result from brine water moving horizontally along the gradient and vertically into areas lacking a clay aquitard.

Status of the Project: The Ground Water Management District #2 performs annual water sampling with funding from the KCC to analyze the water samples. The City of McPherson, GMD#2, and the Kansas Water Office have been investigating utilizing the area for public water supply for the city of McPherson. KCC understands that plans are moving forward, with multiple Public supply wells being drilled and the infrastructure for the pipeline being built.

The A Zone monitoring Wells have had mainly one change in chlorides since 2022. The A zone chloride level increased in EB-36A by 133 mg/L. This well is in the north center of the monitoring well matrix. EB-26A had a modest drop of 26 mg/L chlorides. All other well changes were negligible and can be considered stable from 2022. The highest chlorides continue to be at EB-34A with 803 mg/L Chlorides.

B Zone monitoring wells show increases in many high chloride wells in 2023. The main wells were EB-34B, which increased by 120 mg/L, and EB36B, which increased by 69 mg/L Chlorides. EB-35B had a modest increase of 35 mg/L, about the same increase as last year. EB-27B Increased by 75mg/L in the site's far northeastern edge. All other B zone wells were stable or dropped regarding chloride levels. EB-34B, historically the highest chloride well, was tested to be 1550 mg/L Chlorides.

C Zone wells had substantial decreases as well as two modest increases. The most considerable change was at EB34C, which decreased by 870mg/L. the last three sampling events show significant decreases as well. This well had a substantial increase of 1100 mg/L four years ago. EB-35C decreased by 550 mg/L, stopping last year's increase in chlorides. EB-27C, which in the past saw increases, dropped for the third year, with -90 mg/L Chlorides. There were three modest increases of 50 or fewer mg/L chlorides in the north-central portion of the site. Overall, the C zone showed a consistent lower salinity trend this year. The possibility of chloride migration down the gradient could explain these changes.

Overall, many wells showed relatively stable salinity, except those that historically had higher chloride levels. The drop in the C zone levels is significant, especially as this appears to be a trend. It is unknown where these chlorides are moving, but it is assumed that migration is horizontal, not vertical, as the C zone lies on top of the low permeability Wellington Shale.

Level of Remediation Sought:

Ideal: 250 mg/l

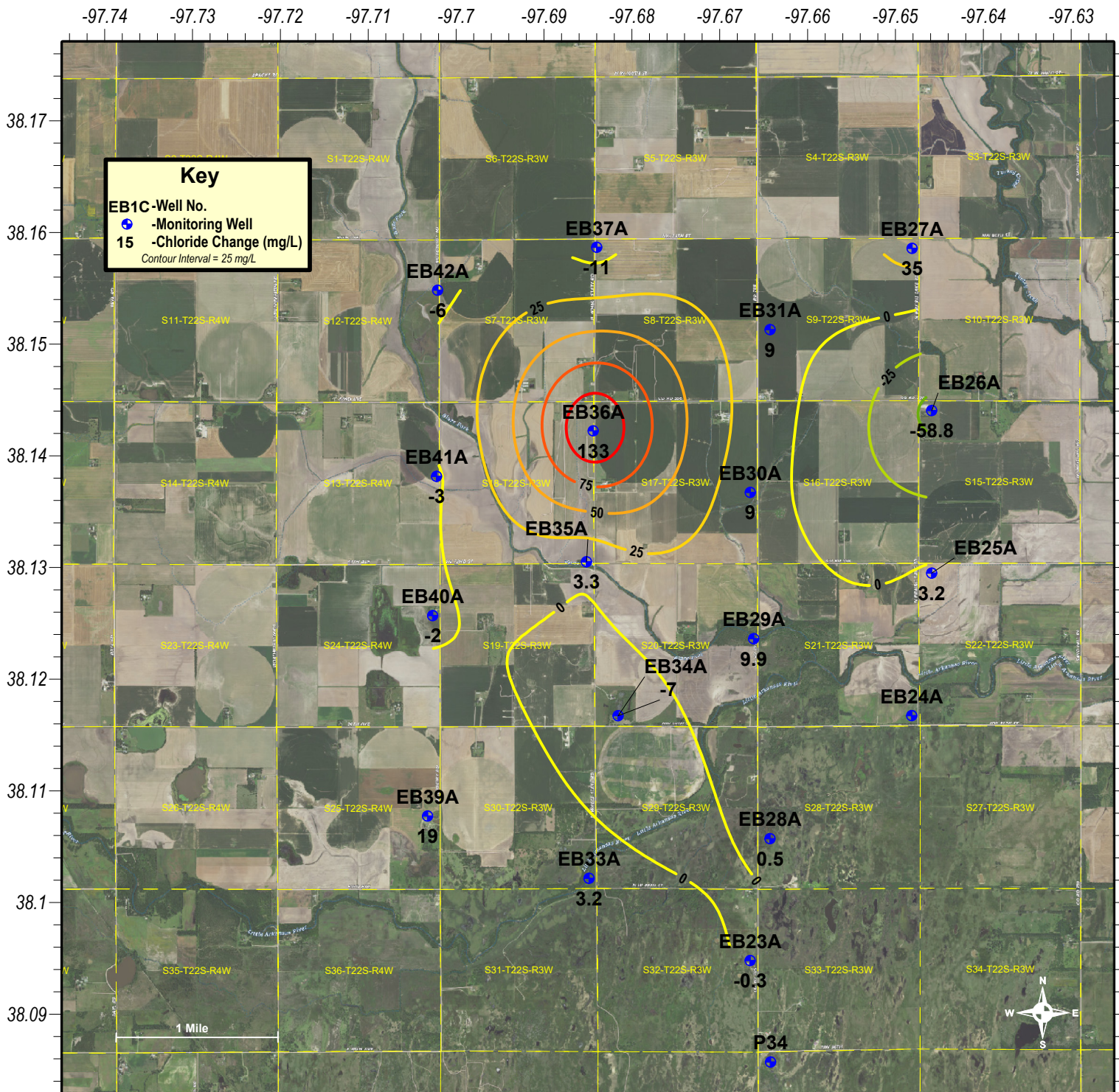
Target: 500 mg/l

Recommendations for Future Work: KCC should continue to collect data from GMD #2 annually for monitoring purposes. The highest chlorides appear centered on EB-34 in all vertical zones. This has always been the case with the Hollow-Nikkel Site. Adding new monitoring wells near EB34, the heart of the plume, could help define the highest chlorides for successful remedial action. With the city of McPherson currently planning on installing a long-term public water supply source just south of the area, additional monitoring wells to the south may be necessary to supplement the monitoring wells installed by the city. In addition, monitoring wells added north of the current site could further investigate the source of higher chlorides seen over the last five years in the

northern wells.

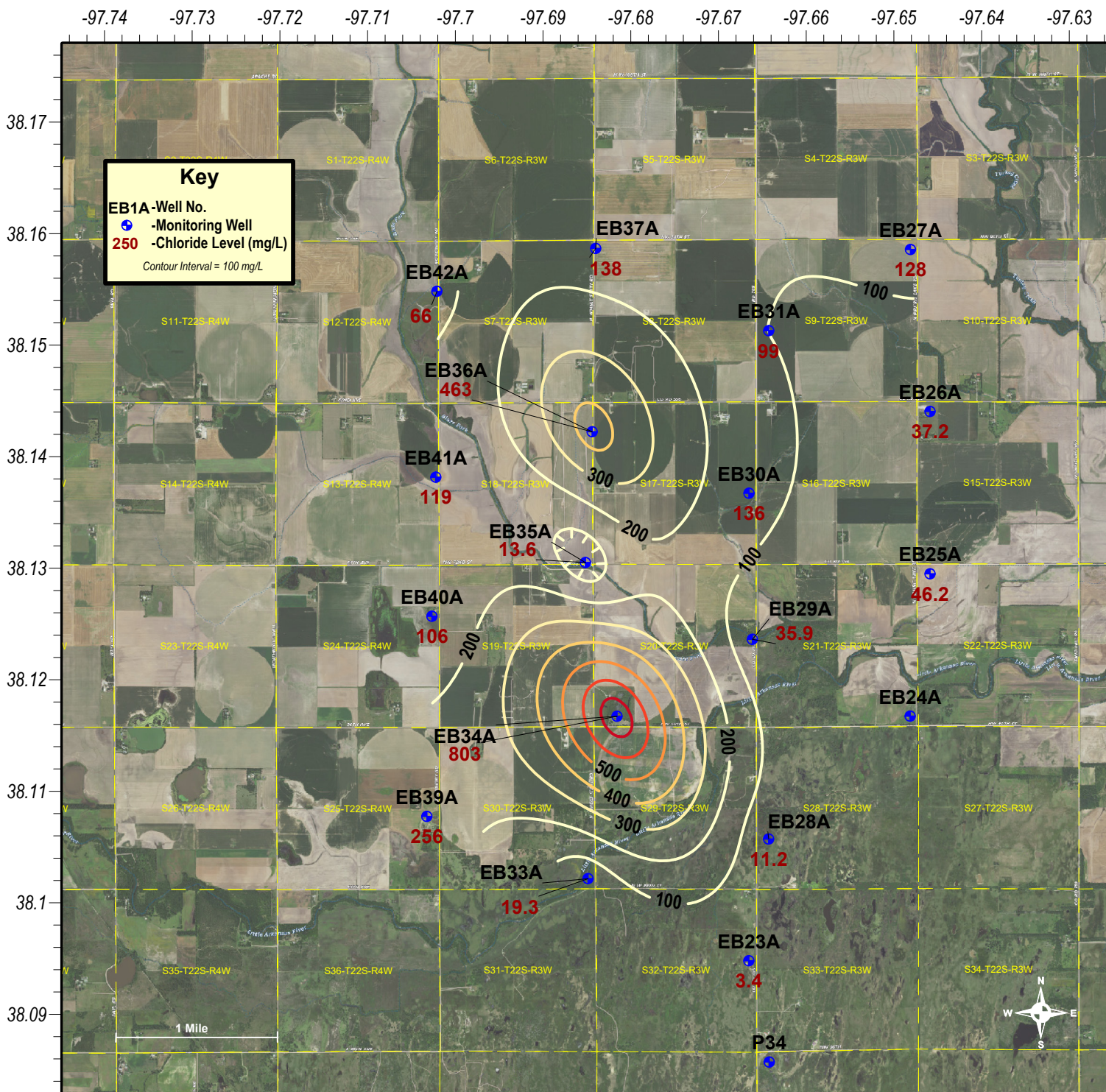
Estimated Total Costs: Costs include time spent for district personnel to gather and analyze groundwater data obtained from GMD #2, plus research possible remediation avenues and contamination sources.

Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
970009-00	9 Hrs. / \$283.43	\$2,578.10	\$57,145.29
Current Contaminate Level: Varies; There are hot spots in each zone.			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



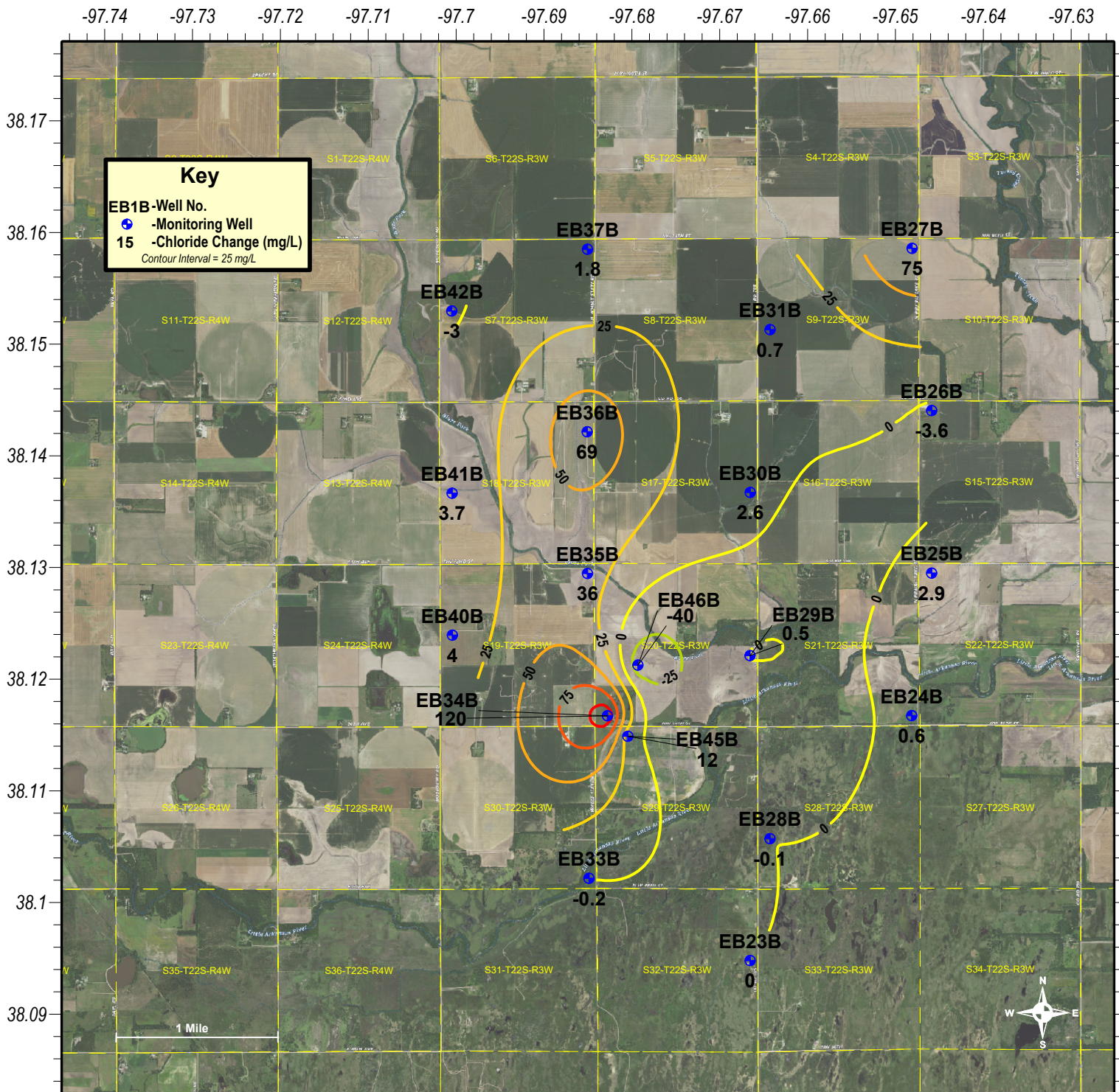
Hollow-Nikkel Brine Contamination Site KCC Control #970009-00

Multiple sections of Townships 22 South and Range 3 & 4 West, Harvey County, Kansas
A Zone Change in Chlorides from 2022 to 2023
 KCC District #2 Field Office - Wells sampled Summer of 2023 by GMD #2 - Map Drawn on 9/29/2023 by D. Bollenback



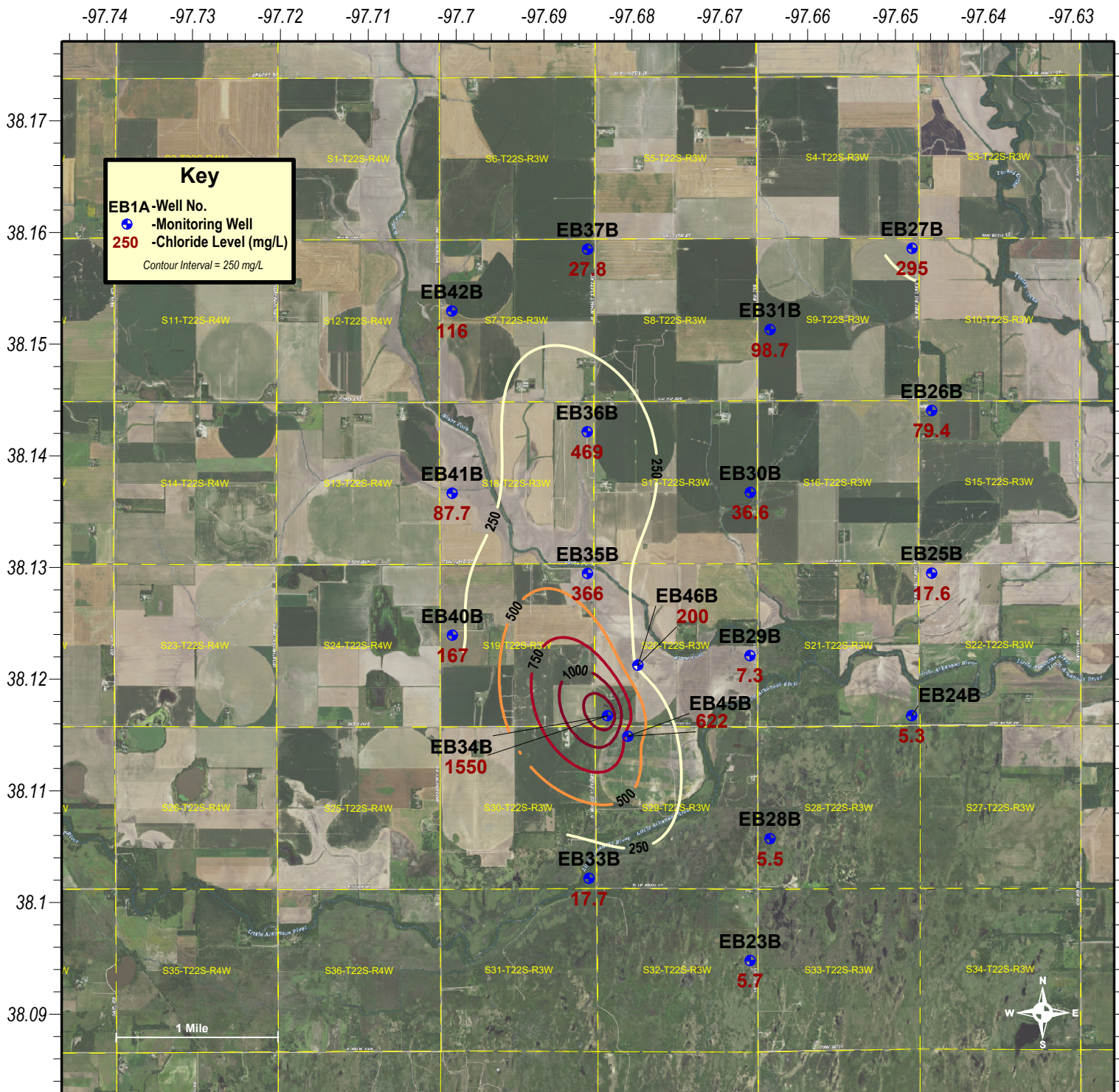
Hollow-Nikkel Brine Contamination Site KCC Control #970009-00

Multiple sections of Townships 22 South and Range 3 & 4 West, Harvey County, Kansas
2023 Chloride Levels in the Equus Beds A Zone
 KCC District #2 Field Office - Wells sampled Summer of 2023 by GMD #2 - Map Drawn on 9/29/2023 by D. Bollenback



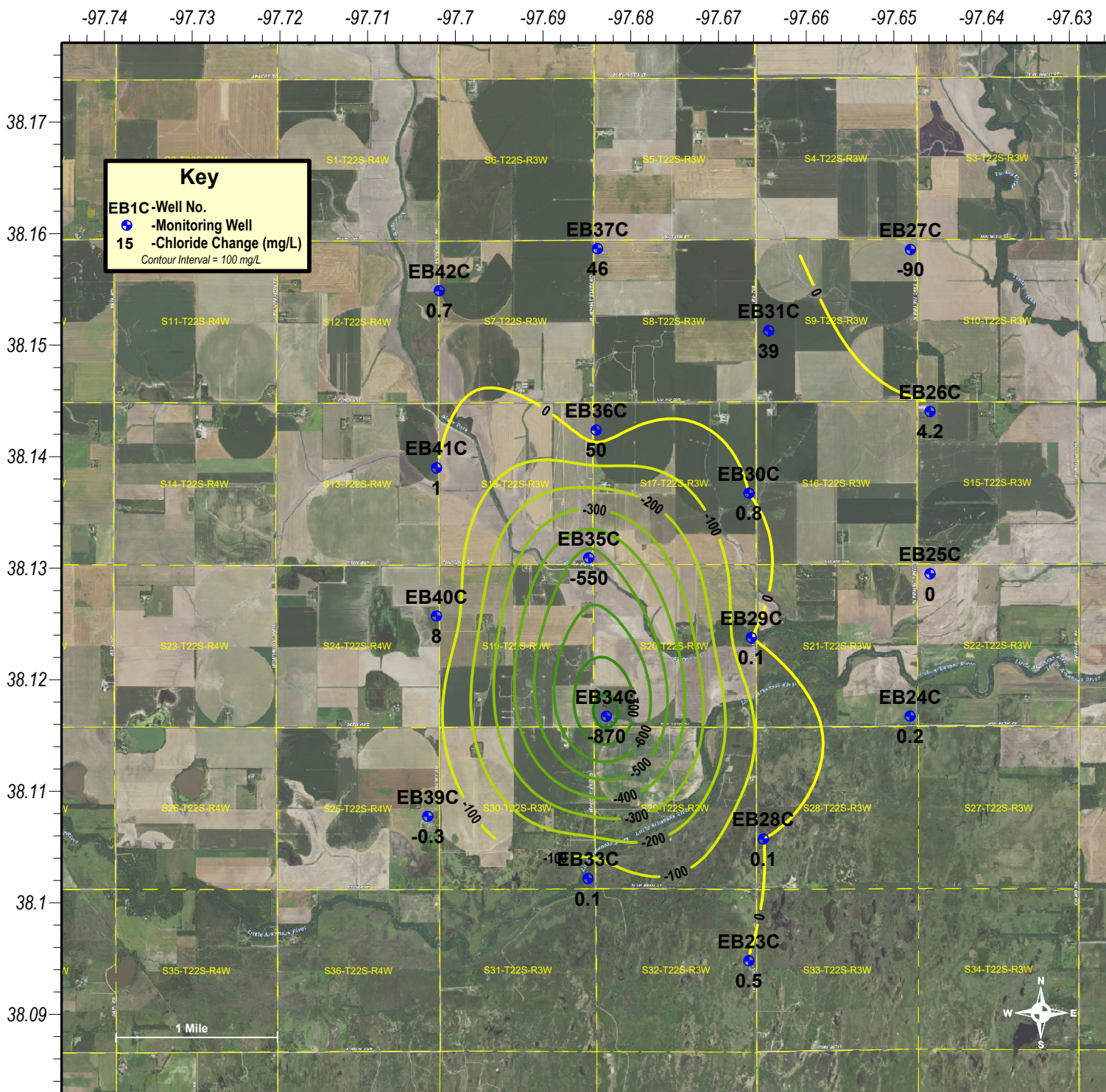
Hollow-Nikkel Brine Contamination Site KCC Control #970009-00

Multiple sections of Townships 22 South and Range 3 & 4 West, Harvey County, Kansas
B Zone Change in Chlorides from 2022 to 2023
 KCC District #2 Field Office - Wells sampled Summer of 2023 by GMD #2 - Map Drawn on 9/29/2023 by D. Bollenback



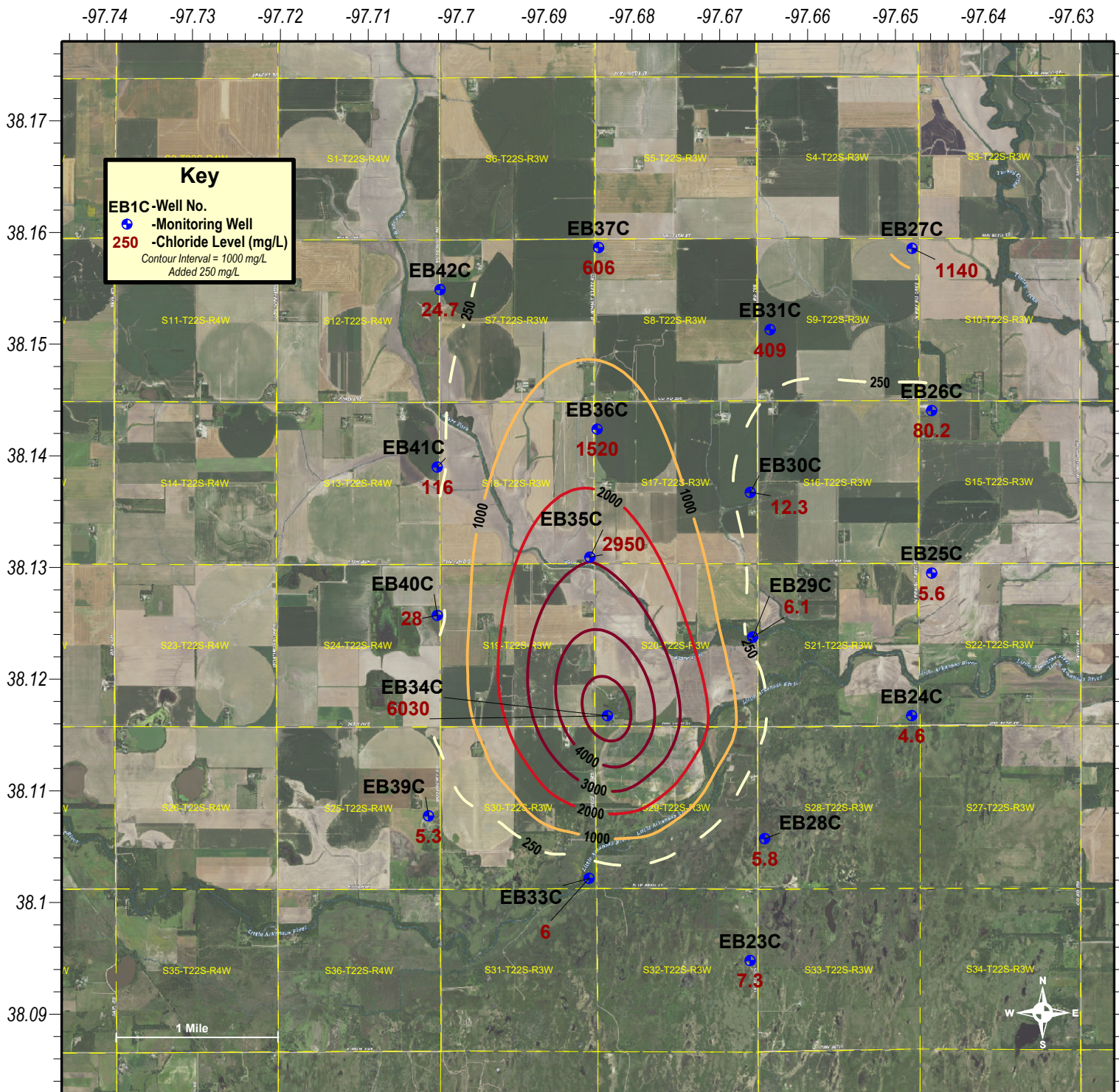
Hollow-Nikkel Brine Contamination Site KCC Control #970009-00

Multiple sections of Townships 22 South and Range 3 & 4 West, Harvey County, Kansas
2023 Chloride Levels in the Equus Beds B Zone
 KCC District #2 Field Office - Wells sampled Summer of 2023 by GMD #2 - Map Drawn on 9/29/2023 by D. Bollenback



Hollow-Nikkel Brine Contamination Site KCC Control #970009-00

Multiple sections of Townships 22 South and Range 3 & 4 West, Harvey County, Kansas
C Zone Change in Chlorides from 2022 to 2023
KCC District #2 Field Office - Wells sampled Summer of 2023 by GMD #2 - Map Drawn on 9/29/2023 by D. Bollenback



Hollow-Nikkel Brine Contamination Site KCC Control #970009-00

Multiple sections of Townships 22 South and Range 3 & 4 West, Harvey County, Kansas
2023 Chloride Levels in the Equus Beds C Zone
 KCC District #2 Field Office - Wells sampled Summer of 2023 by GMD #2 - Map Drawn on 9/29/2023 by D. Bollenback

Project: Burrton Contamination Site, Harvey & Reno Counties, District 2

Site Location: The Burrton site is in western Harvey County and eastern Reno County, approximately 18 miles west of Newton and 12 miles east of the city of Hutchinson. The site includes acreage in Townships 23 and 24 South, Ranges 3 and 4 West.

Impact/Immediacy: The contamination site affects local domestic and irrigation wells. Hydrogeological computer modeling from 2007, paid for by the KCC, shows that portions of the plume could intercept parts of the Wichita Well Field within 50 years. In addition, the Equus Beds aquifer is a significant public water supply source for much of the population of Sedgwick County. Therefore, KCC ranks the Burrton Site at a very high level of immediacy based on the resource impacted and the site's geographical size.

Site Description: The total maximum area affected by the contamination covers approximately 25 to 30 square miles. Generally, the contaminated plumes align in a northeast-to-southwest configuration parallel with the associated producing areas. The local groundwater management district's water quality sampling network indicates oil field brine contamination of all three significant zones within the Equus Beds Aquifer. Depth to groundwater ranges from 10 to 35 feet with saturated thickness in the order of 150 to 250 feet. The City of Wichita's ASR project, a multi-million dollar investment, is directly attempting to slow the Burrton brine plume. In addition, district #2 investigates private groundwater wells and water quality in the area, including a geoprobe investigation to the northwest of Burrton in 2015.

Unusual Problems: The need for suitable disposal facilities and the large area extent of the plume make the cleanup of this site very costly and inefficient. The physical day-to-day maintenance and monitoring of this size's withdrawal and disposal system would require a significant commitment of labor and resources. Also, over-pumping the aquifer as part of a remediation plan for oilfield brine could cause natural chlorides to migrate from the Arkansas River into the Equus Beds. Considering the variable conditions within the aquifer, different areas within the contaminated plume must be evaluated separately during cleanup to ensure fresh and usable water is preserved. Recovered fluids would be low in chlorides and well within the range of treatable water, so disposal of this fluid could be considered wasteful.

Status of the Project: GMD #2 sampled the monitoring wells in the summer of 2023. This site is in monitoring status with the KCC, but other entities, including the city of Wichita, are actively attempting to remediate the contamination problem. The KWO has recently paid for a summary report on the possible remedial project within the Burrton Intensive Groundwater Use Area (IGUCA). KCC installed 25 new monitoring wells throughout the Burrton IGUCA in the spring of 2023. These wells were picked to replace old 1930s vintage 1.25" wells that had deteriorated and were under scrutiny for leaks and integrity. KCC also replaced some GMD2 wells that had been damaged or had questionable screen placement.

In 2023, the A zone wells showed slight chloride increases in multiple wells in the IGUCA, probably due to the recent drought. There were more significant chloride increases in EB2A, EB10A, and EB15A. The most concerning would be EB15A, which resides along the eastern edge of the IGUCA and is pretty close to the Wichita wellfield, which increased by 130 mg/L. A zone drops were sparse and relatively insignificant, mainly in the southeastern edge of the IGUCA. The B Zone showed significant changes over the last year, both up and down. There were significant drops in chloride concentrations in the northwest and along the eastern edge. EB4B dropped by 280 mg/L in the northwest, and EB15B dropped by 69 in the east. B Zone increases in the southwestern corner and middle also occurred, with EB1B increasing by 290 mg/L. EB57B and EB8B, more central, also had increases. EB-8B data should be noted to be from the EB8B/C completed by the KCC this year and may not be a true equivalence relating to last year's sampling of EB8B. EB61C, a direct replacement well installed this spring, had the highest chloride levels in the B Zone at 1300 mg/L chlorides. The lower C zone had a modest decrease in EB13C by 51 mg/L, but most were stable with a slight change of less than ten mg/L either way. There was a minor increase of 37 mg/L in EB16C, which should be monitored in future sampling. The C Zone wells have remained relatively stable for the last few years.

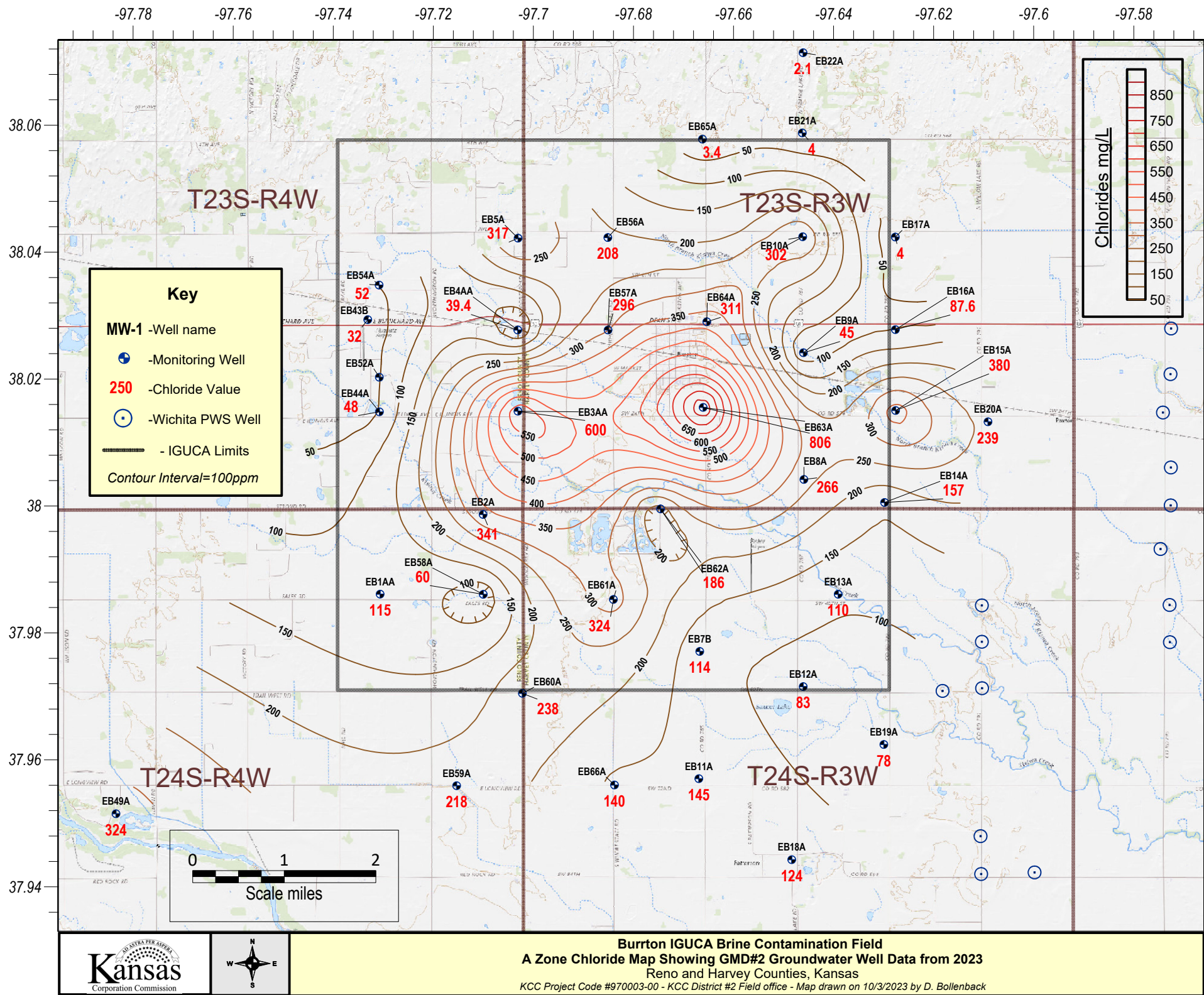
KCC's installation of new monitoring wells utilizing a drilling technique called sonic drilling successfully added many complete lithological boring logs that will help KCC, GMD2, and other entities conduct better hydrological modeling regarding tracking the Burrton Brine Plumes. These wells also allow all entities studying the IGUCA better confidence in the data obtained through sampling the monitoring network. KCC is currently adding and utilizing the new data to databases and models. KCC noted that some new southern wells have higher chlorides in the lower zones. Analytical testing of these wells to determine if they are related to the Arkansas River and not the oil field sourced would be beneficial to understanding the complex hydrological issues of the Burrton IGUCA.

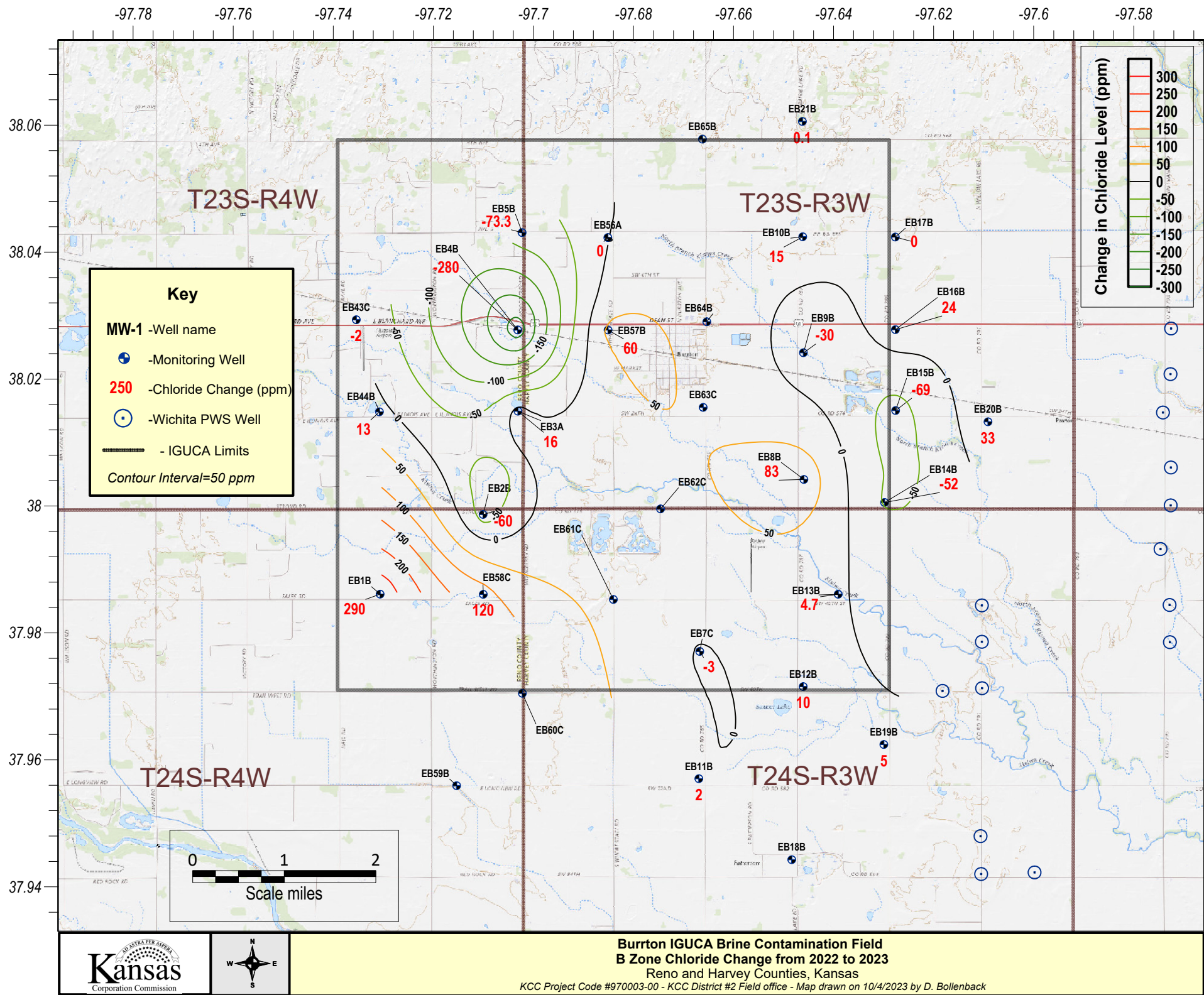
Level of Remediation Sought:**Ideal:** 250 mg/L Chloride**Target:** 300 mg/L

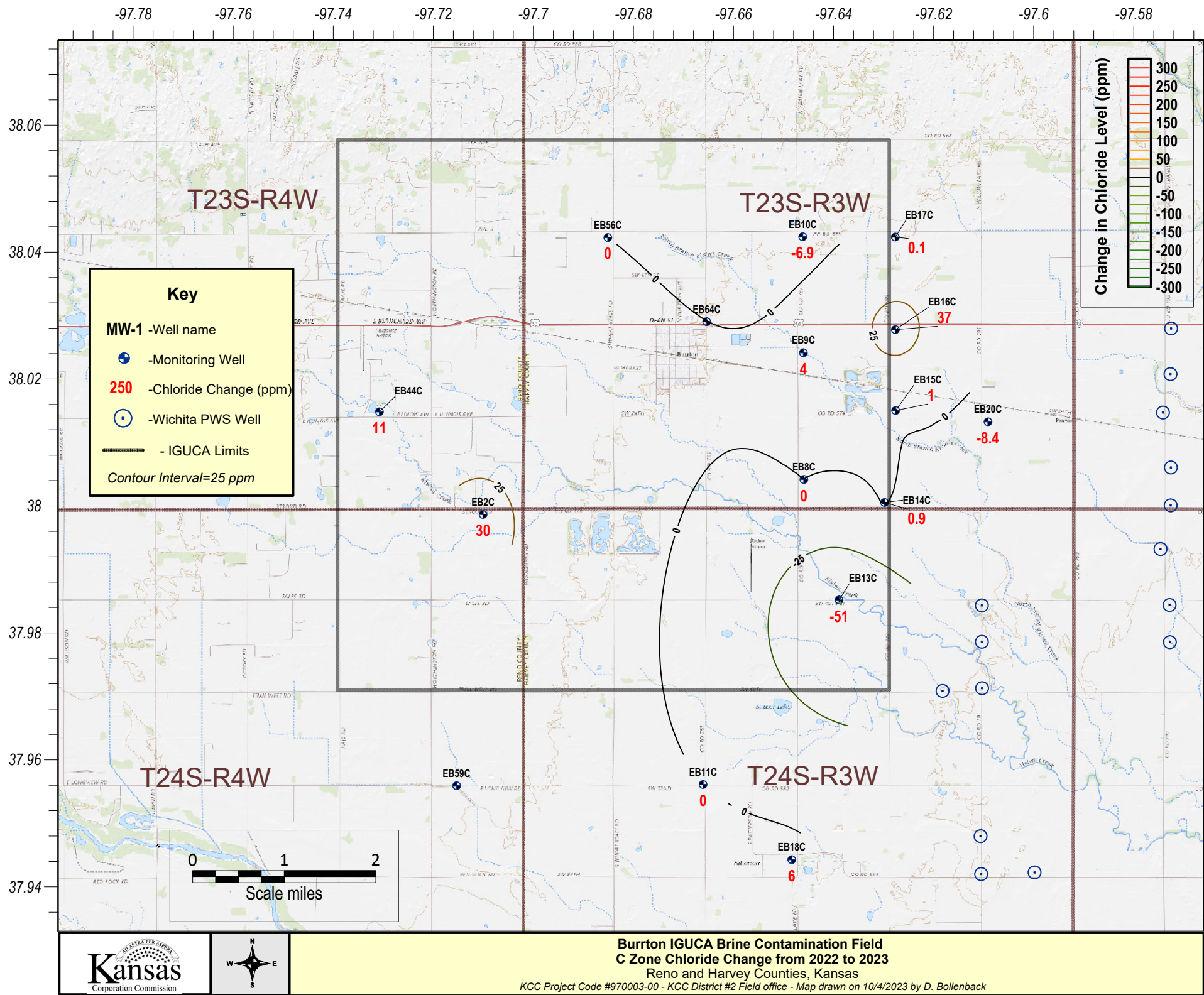
Recommendations for Future Work: Continue working with Groundwater District #2, including funding annual water well sampling and analyzing this high-priority data. KCC Staff attends many meetings and conferences regarding the work being done regarding Burrton and continues to do so. KCC is assembling a small drilling package for groundwater contamination in the northwest just outside the IGUCA due to a new complaint filed with the KCC and GMD2. KCC is working with GMD2 on investigating this area. Future monitoring well installations are also being discussed with GMD2, prioritizing eastern edge delineation and internal plume delineation in the center of the IGUCA.

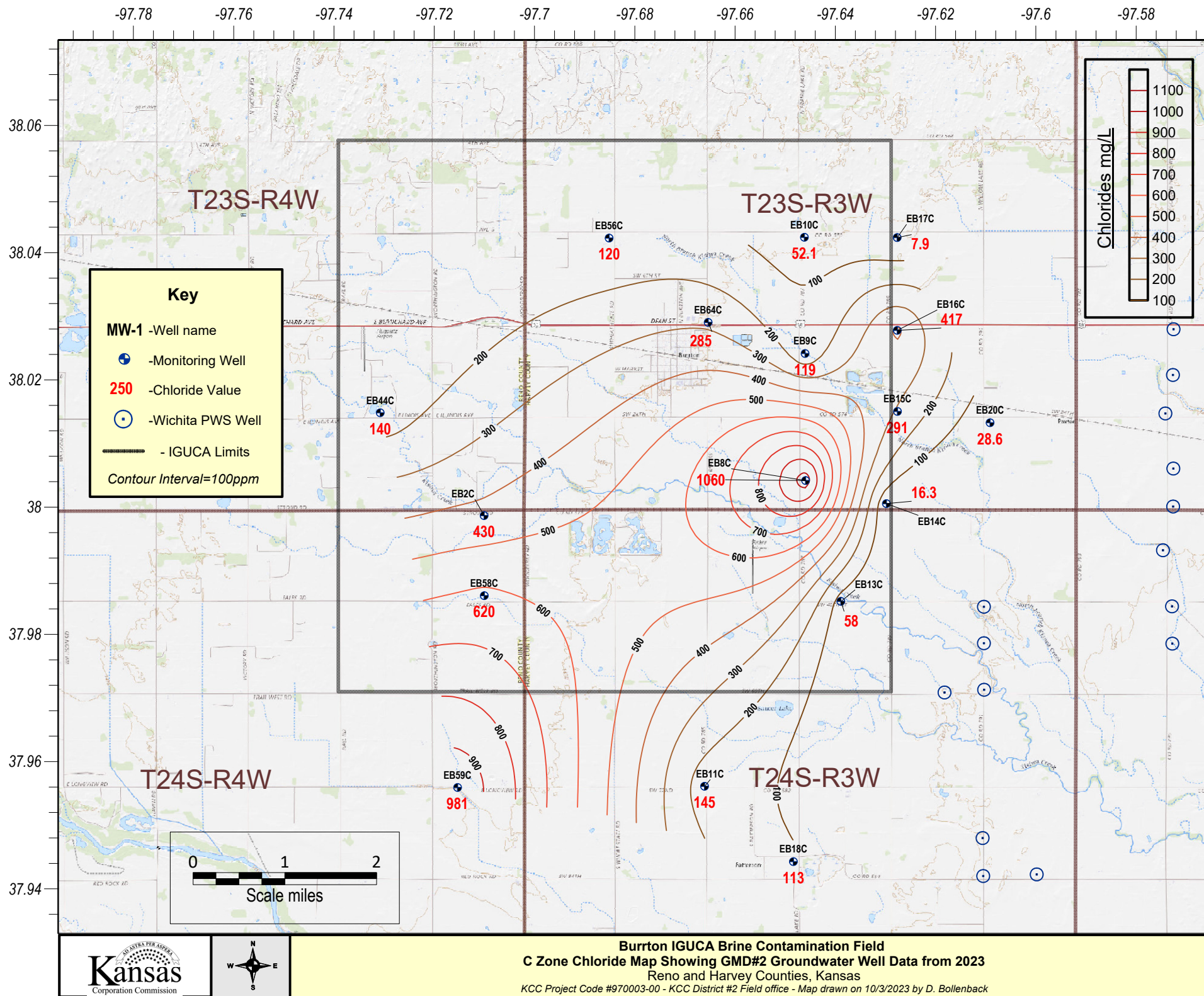
Estimated Total Cost: KCC Pays for the analytical laboratory work for the GMD2 in the IGUCA, which is estimated to cost around \$8,000 for 2023. Other expenses include staff time reviewing the information and data of the new well installation, and hydrological and geological research into the IGUCA area. Drilling new wells would have an extensive range depending on the number of wells, type of drilling technique utilized, and current prices, but a minimum of \$75,000 should be expected.

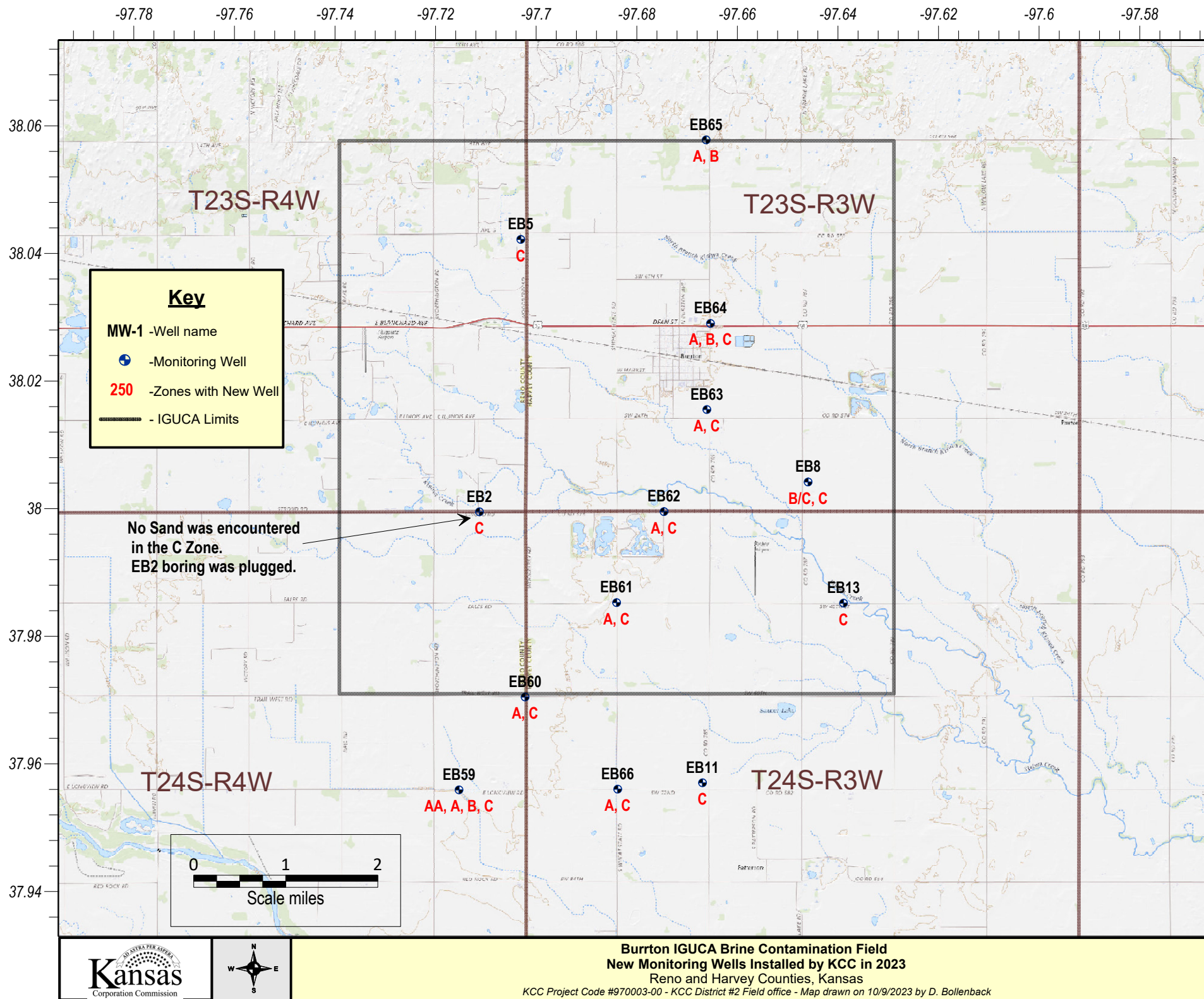
Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
970003-00	459.5 Hrs. / \$15,782.25	\$557,425.70	\$911,442.17
Current Contaminate Level: 2.1 mg/l to 1,300 mg/l Cl ⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long-Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	

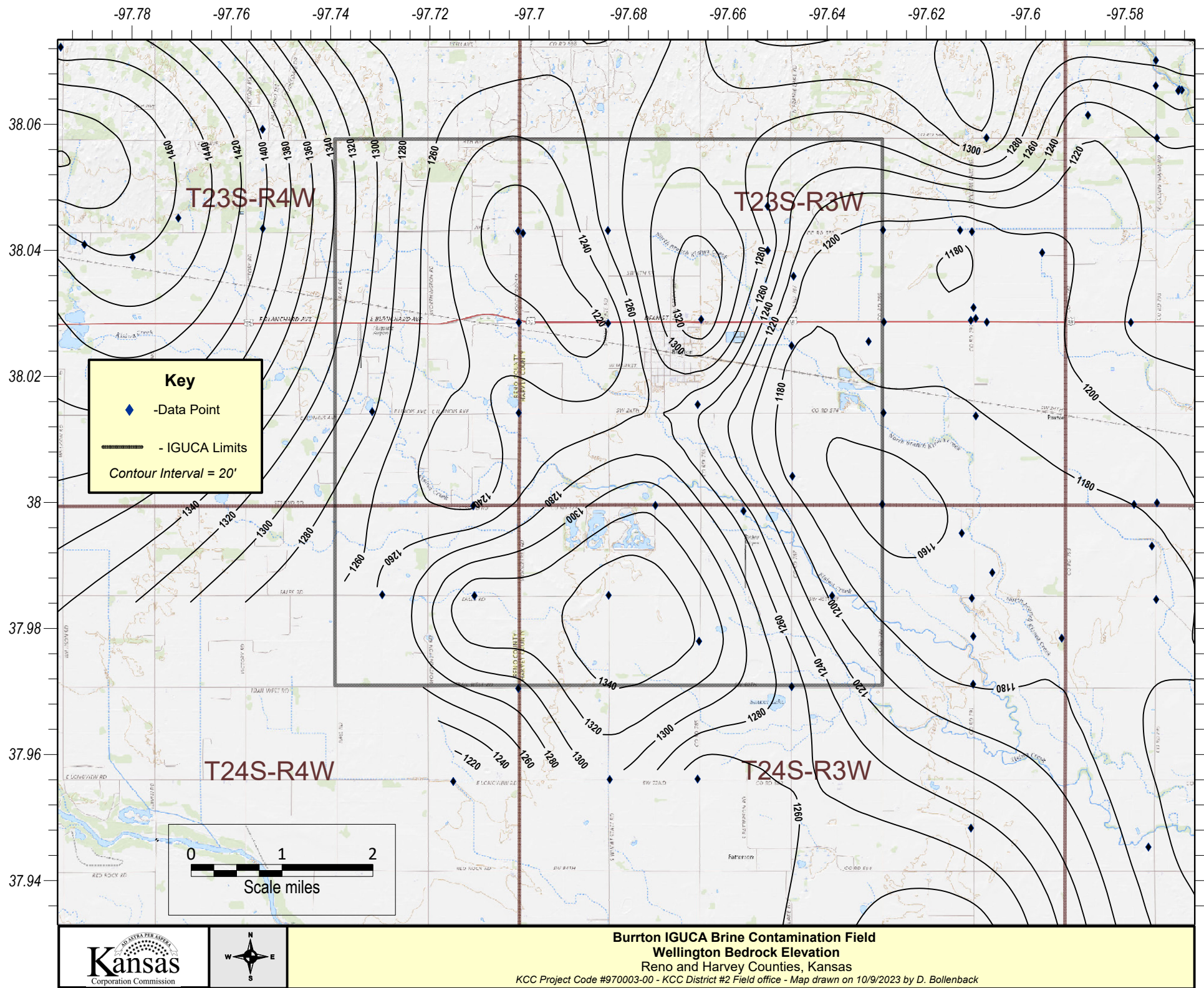












PHOTOGRAPHIC RECORD

Photo No.:1

Photographer:
D. Bollenback

Date:
4/28/2023

Direction:
East

Description:
Drilling Monitoring
wells with the EWI
Sonic Rig.

LAT/LONG:



Photo No.:2

Photographer:
D. Bollenback

Date:
6/7/2023

Direction:
Northeast

Description:
EWI drilling the new
wells at EB65.

LAT/LONG:



Annual Report Photo Log
Site/Lease Name: Burrton IGUCA
Site Location: Harvey & Reno Counties, Kansas
KCC Control #970003-00

PHOTOGRAPHIC RECORD

Photo No.:3

Photographer:
D. Bollenback

Date:
4/25/2023

Direction:
Northwest

Description:
Stacked out
lithological core
taken utilizing Sonic
drilling.

LAT/LONG:



Photo No.:4
Photographer:
D. Bollenback

Date:
4/25/2023

Direction:
N/A

Description:
Closer view of the
2.5' lithological core
samples.

LAT/LONG:



Annual Report Photo Log
Site/Lease Name: Burrton IGUCA
Site Location: Harvey & Reno Counties, Kansas
KCC Control #970003-00

PHOTOGRAPHIC RECORD

Photo No.:5

Photographer:
D. Bollenback

Date:
5/15/2023

Direction:
N/A

Description:
Photo showing a geologist logging and examining the core samples

LAT/LONG:



Photo No.:6

Photographer:
J. Klock

Date:
9/22/2023

Direction:
South

Description:
The finished completion at EB62.

LAT/LONG:



Annual Report Photo Log
Site/Lease Name: Burrton IGUCA
Site Location: Harvey & Reno Counties, Kansas
KCC Control #970003-00

Project: *Clawson Contamination Site, Haskell County, District 1*

Site Location: Legal location is East half of Section 33 and all of Section 34, Township 29 South, Range 34 West, Haskell County.

Impact/Immediacy: Irrigation well is contaminated and a pollution threat to other irrigation wells if contaminate is not contained to site. Site immediacy is rated at moderate to high and is under long term monitoring at the present time by the PRP.

Site Description: The site consists of a plume of brine-contaminated groundwater moving in an easterly direction. Area is blanketed by 500 feet of Ogallala sand and gravel. Bedrock underlying the Ogallala is the Dakota/Cheyenne formation. There is a total of 600 feet of freshwater bearing strata. Pollution occurs along a clay layer 360 feet below the surface (in the upper part of the freshwater aquifer). No domestic wells in the affected area. One irrigation well is currently polluted to the extent it cannot be used for irrigation purposes. Depth to groundwater is 300 feet. Depth to Cretaceous bedrock is 510 feet in the center of the SW/4 of Section 34. The Red Beds underlie the three aquifers at a depth of 635 feet.

Unusual Problems: High yield rates of the Ogallala formation and ongoing severe drought.

Status of Project: On October 6, 2023 the site consultants Daniel B. Stephens & Associates, Inc. sampled seven monitoring wells on the Clawson site. Samples ranged from 580mg/L chloride in 05-01 to 2020mg/L chloride in well 02-04. Overall the historic chloride levels have have dropped throughout this site, and that trend continued during this sampling event. The consultants also tested the bromide to chloride ratio in each sample that shows the results of the chloride concentrations are from oilfield brine mixing with groundwater. A new PRP took over the site on November 1, 2019.

Level of Remediation Sought:

Ideal: 250 ppm Chloride

Target: 500 ppm Chloride

Recommendations for Future Work: There have been ongoing discussions of groundwater modeling to see how starting up the irrigation well for agriculture use would affect the plume.. The 7 wells continue to be monitored until target concentrations are met. All of these expenses will be covered by the PRP and will only happen with the consent of the KCC.

Estimated Total Costs: KCC - \$450 a year. PRP – in excess of \$2 million.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24
970005-00	3 Hrs. / \$99.10	
Current Contaminate Level: 580 ppm Cl- to 2,020 ppm Cl-		
Status:		
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved

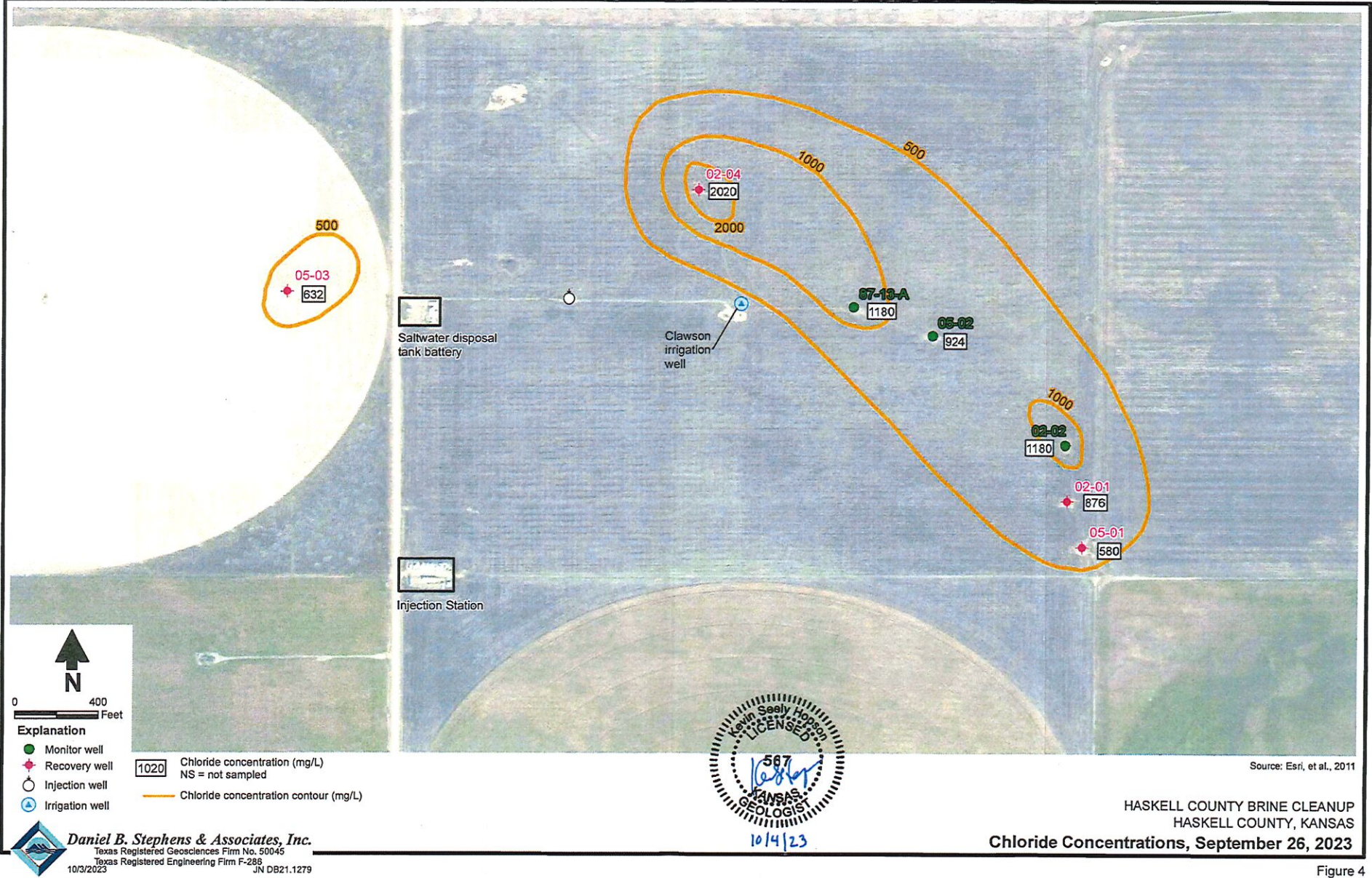


Figure 4

Project: *Schraeder Contamination Site, Hodgeman County, District 1*

Site Location: Legal location is E/2 of Section 3 and W/2 of Section 2, Township 24 South, Range 24 West, Hodgeman County.

Impact/Immediacy: Contamination to groundwater, stock wells and possibly an irrigation well in the future. Immediacy level is rated as low.

Site Description: The chloride concentration of the Ogallala formation water supplying a stock well has been high in chlorides.

Unusual Problems: None.

Status of Project: Six groundwater samples were taken in 2023. Chlorides in these samples ranged from 100 ppm chlorides at Well K, to 480 ppm chlorides in Well L. The values across the site have decreased from the previous sample years. There has been a slow decline in the chlorides at this site due to natural attenuation; this trend is expected to continue in the future. Windmill G was running but the well was dry.

Level of Remediation Sought:

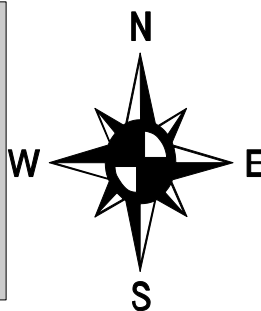
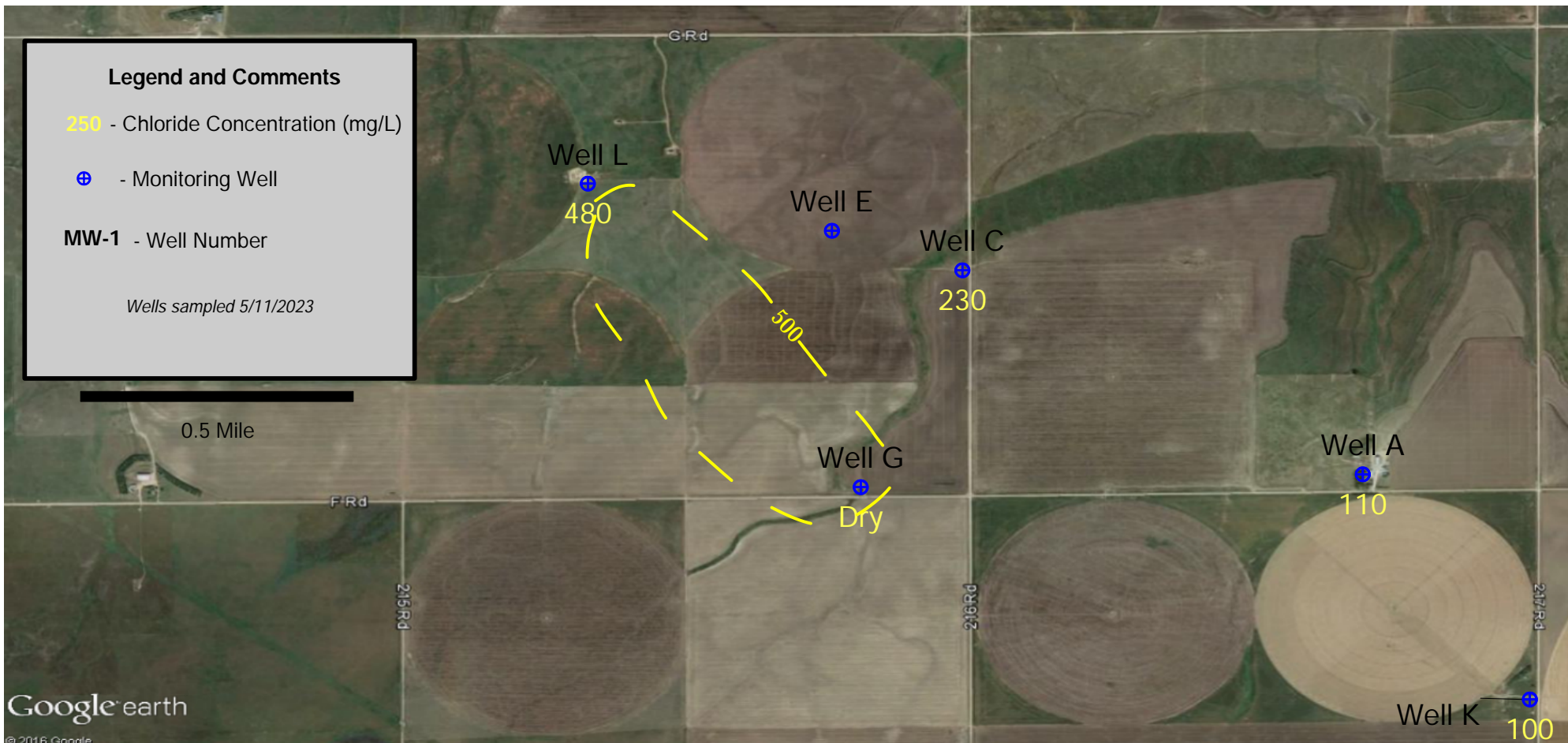
Ideal: 250 ppm Chloride

Target: 350 ppm Chloride

Recommendations for Future Work: Continue annual monitoring of the site.

Estimated Total Costs: \$30,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures
		FY 2023/24 Total
970013-00	6 Hrs. / \$187.84	\$1,590.90
Current Contaminate Level: 100 ppm Cl- to 480 ppm Cl-		
Status:		
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved



Schraeder Site
 Sections 2/3/11-T-24S-R24W
 Hodgeman County, Kansas
2023 Area Map with Chlorides
 KCC Control # 970013-00 District 1
 N. Feldkamp 9/18/2023

Project: South Spivey Contamination Site, Kingman County, District 2

Site Location: The area is 3.5 miles south of Spivey, near an unnamed tributary of the Chikaskia River. The legal location is Sections 27 and 34 of Township 30 South, Range 8 West, in Kingman County.

Impact/Immediacy: The impacts are on groundwater resources associated with local agricultural wells. KCC has rated this site as having a low immediacy level.

Site Description: The project area lies within an intermittently flowing creek bed within the large Spivey-Grabs oil and gas field. The area is remote, and the surface use is primarily cattle grazing, oil and gas production, and wind turbines. The geology in the area is unconsolidated Tertiary and Quaternary deposits overlying the Permian, Nippewalla Group Shale. This Shale is along valleys of the Chikaskia River system and its tributaries. The unconsolidated sediments usually consist of poorly sorted sands, silts, and gravel and can be up to 60 feet thick. The Permian erosional surface dips to the north towards the Chikaskia River. Most overlain locations with unconsolidated sediments show good infiltration from precipitation but can vary in horizontal permeability due to a lack of sediment sorting or less permeable silt development. Groundwater tends to follow the slope of the Permian erosional surface. A PRP remediated this site in 1993 when an oil and gas lead line broke and flowed for some time, contaminating the alluvium. The PRP removed the remedial system once chloride levels dropped. It was unknown at the time how much brine water infiltrated the local alluvium.

South Spivey Site is in an annual sampling program. Natural attenuation of the site occurs, but chloride readings have varied somewhat over the years with the annual precipitation amounts. The contaminated aquifer is so shallow that chloride levels change with yearly precipitation. The closest water well is over 1 mile down gradient from the plume. KCC noted that Oneok had two brine spills from a 4" line in 2017 and 2018. This line crossed 170th Street just west of the plume. KDHE documentation states that 253 tons of soil were removed during the clean-up, and remediation was effective. Historical Records indicate that the local ponds were utilized for saltwater disposal as early as 1957.

Unusual problems: The withdrawal rate can be low due to the low permeability of the aquifer if it lies outside the well-sorted paleochannels, especially at the south end of the site. Some monitoring wells have an excellent capacity for pumping groundwater, while others can pump dry. The permeability differences within the alluvium channels allow brine plumes to move unpredictably.

Status of Project: The southernmost B wells continued to drop in chlorides over the last year. Heavy rains in early 2019, 2020, and 2021 may have pushed these chlorides north. The area is in extreme drought conditions and has drastically lowered the local perched water table, including this year, which is even lower than in 2022. KCC sampled the wells via a submersible pump on June 23rd, 2023. Chlorides in 2023 are moving north with increased levels at MW-B3 and B-4. MW-B5 was unchanged but lies within a natural spring, which may be separate from the southern contaminated area. The Pond South of the B wells was 650 mg/L Chloride, higher than some years, but the pond level was shallow from the drought. The pond was inundated with cattle waste and green algae, which may have helped input some salt into the water.

Level of Remediation Sought:

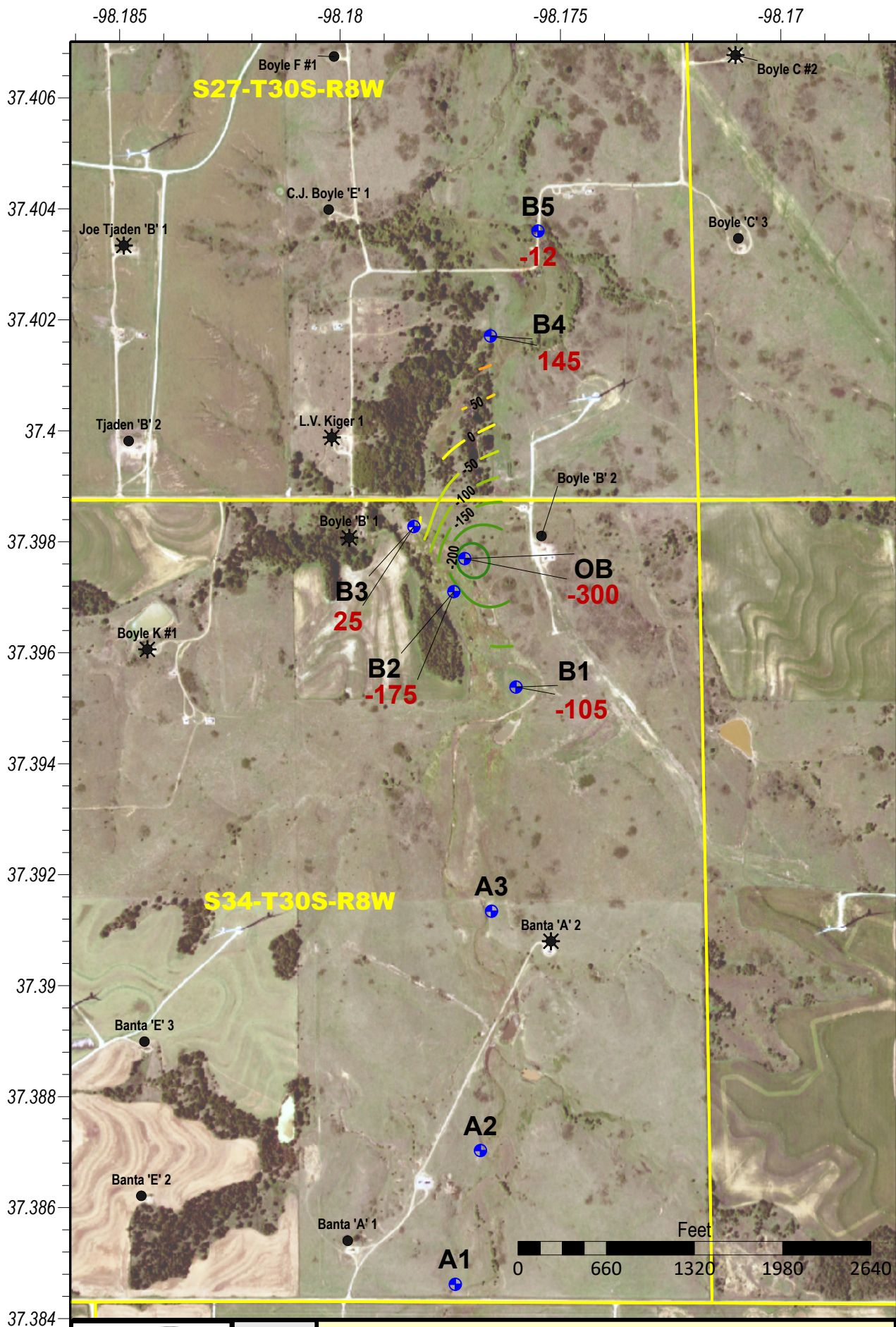
Ideal: 250 mg/l Chloride

Target: 750 mg/l Chloride

Recommendations for Future Work: KCC recommends annual continued sampling of the B monitoring wells and surface waters. One well (OB) remains over the target level of 750 mg/L of Chlorides. KCC plans to plug all southern A wells as only the A-3 is viable and below the ideal chloride target level. No other action is needed, as this site has a low immediacy rating.

Estimated Total Costs: \$700 per year for sampling, testing, and research. The cost to plug the wells would range from \$600 to \$1,500.

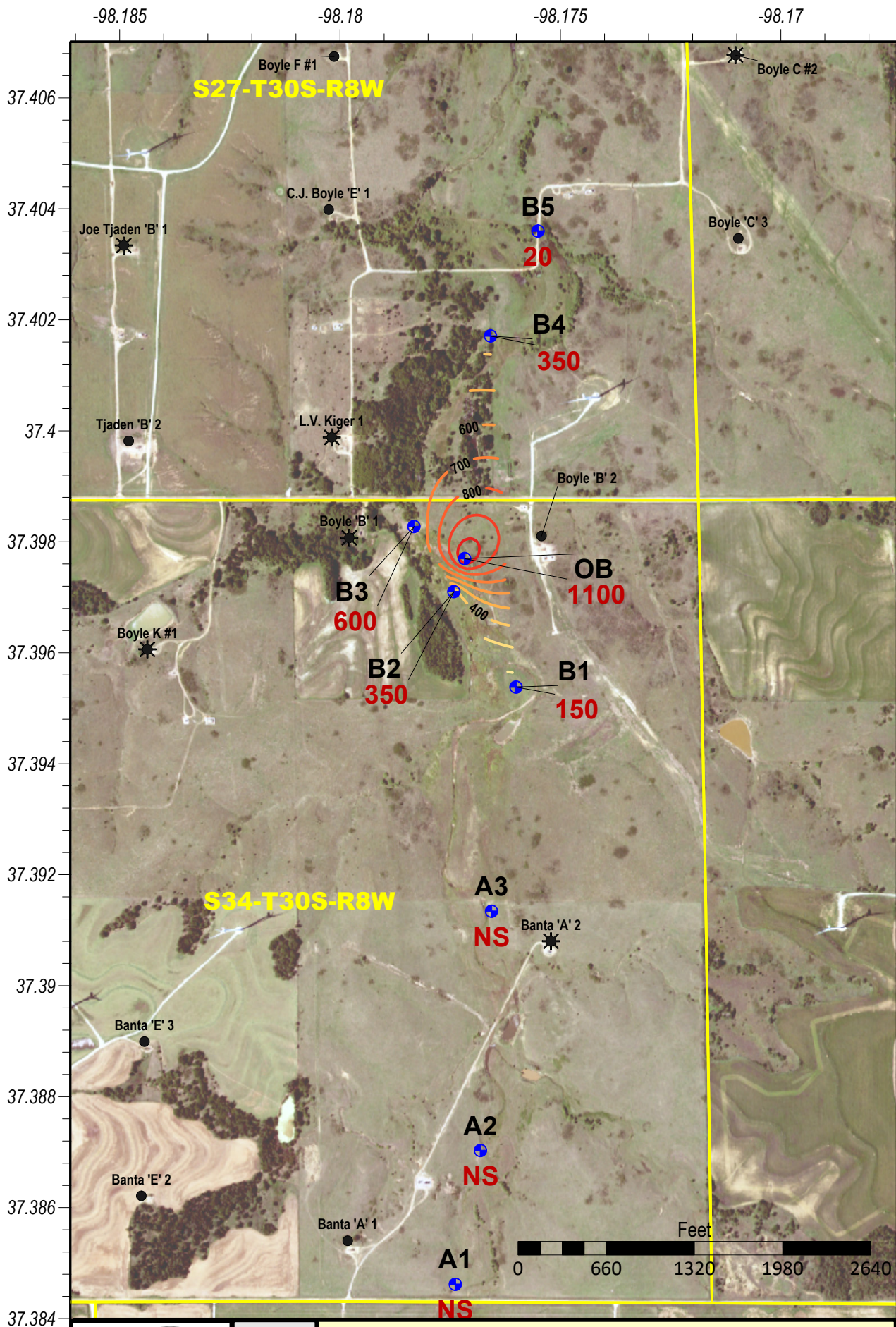
Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970096-00	13.5 Hrs. / \$421.68		
Current Contaminate Level: 20 mg/L Cl ⁻ to 1,100 mg/L Cl ⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



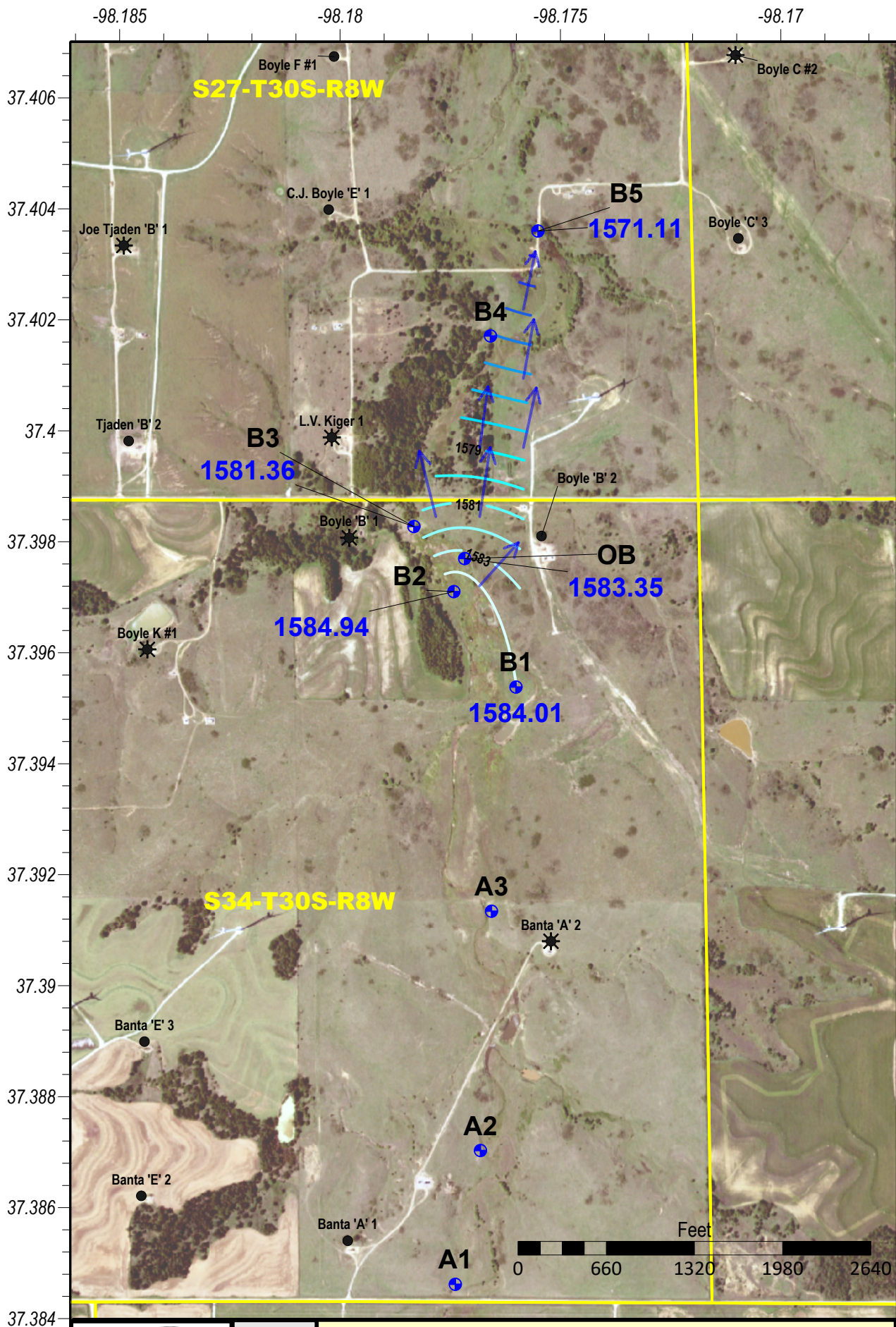
Key

- Monitoring Well
- 250-Change(mg/L)
- Oil Well
- Oil and Gas Well

South Spivey Brine Monitoring Site - #970096-00
Sections 27 & 34 of Township 30 South and Range 8 West, Kingman County, Kansas
Chloride Change from 2022 to 2023
KCC District #2 Field Office - Site wells sampled on 6/23/2023 - Map Drawn on 9/18/2023 by D.Bollenback



South Spivey Brine Monitoring Site - #970096-00
 Sections 27 & 34 of Township 30 South and Range 8 West, Kingman County, Kansas
Site Chloride Levels 2023
 KCC District #2 Field Office - Site wells sampled on 6/23/2023 - Map Drawn on 9/18/2023 by D.Bollenback



Key

- Monitoring Well
- 1532 - Elevation (ft)
- Oil Well
- Oil and Gas Well



South Spivey Brine Monitoring Site - #970096-00
 Sections 27 & 34 of Township 30 South and Range 8 West, Kingman County, Kansas
Groundwater Elevation Map
 KCC District #2 Field Office - Site wells gauged on 6/23/2023 - Map Drawn on 9/18/2023 by D.Bollenback

Project: Trostle Contamination Site, Kingman County, District 2

Site Location: This site is 2.3 miles west and 2.75 miles south of Murdock, Kansas. The legal description is the northeastern quarter of Section 33, Township 28 South, and Range 6 West of Kingman County, Kansas. The site is in the drainage systems of Sand Creek, located 1 mile north of the site. Sand Creek is a tributary of the South Fork Ninescah River.

Impact/Immediacy: The high chlorides could impact the groundwater, affecting stock wells in the immediate area and draws, usually dry but containing water after significant rainfall. The aquifer is very low-yielding. In addition, there are erosion effects on the terrain without vegetation. There are no domestic wells nearby. Therefore, KCC has classified this site as low immediacy.

Site Description: Historically, the Trostle salt-water disposal well battery is most affected. Seven monitoring wells below the Trostle salt-water disposal well also have elevated chlorides. The most likely cause was something related to the salt-water tank, such as discharges or line leaks. A PRP remediated the plume via an interceptor trench. However, the PRP abandoned the system after the holding tanks failed, and the site moved into the monitoring phase of the investigation. There has only been one reported spill at the SWDW since 2005. Local hydrology is a perched aquifer system. Precipitation that infiltrated the Pleistocene Alluvium moves downward until it contacts the impermeable red Ninescah shale. Groundwater then flows down a gradient on top of the shale. The general movement of fluids in the perched water table flows to the northwest.

Unusual Problems: None.

Status of Project: On August 27, 2023, KCC Staff sampled all eleven groundwater monitoring wells. Staff utilized a bailer to purge at least three well volumes of groundwater from each well before sampling. All monitoring wells bailed dry and were allowed to recharge before sampling due to the lack of groundwater to perform a complete purge. MW-9 has never recharged for sampling, so KCC sampled it without purging. Groundwater samples from each monitoring well were collected in one 250 ml polyurethane container for analysis at the KCC District #2 Laboratory.

Laboratory results show significantly lower chlorides around the tank battery, mainly MW-3, which dropped 2,451 mg/L from 2022. This well had a significant increase last year, but the drop from 2022 is much more significant than the increase witnessed in the previous year. There were chloride decreases in most wells except MW-8, which increased by 350 mg/L. MW-6 showed an eight mg/L increase, but level increases this low are not considered significant. Due to the limited perched hydrology, chlorides can move with changes in precipitation amounts. 2022 and 2023 were extremely dry in the region. Most wells had less than 3 feet of groundwater, and some wells had less than one foot of water. Water levels were lower than any sampling event in the last ten years.

Level of Remediation Sought:

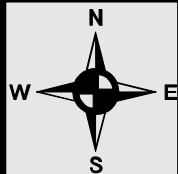
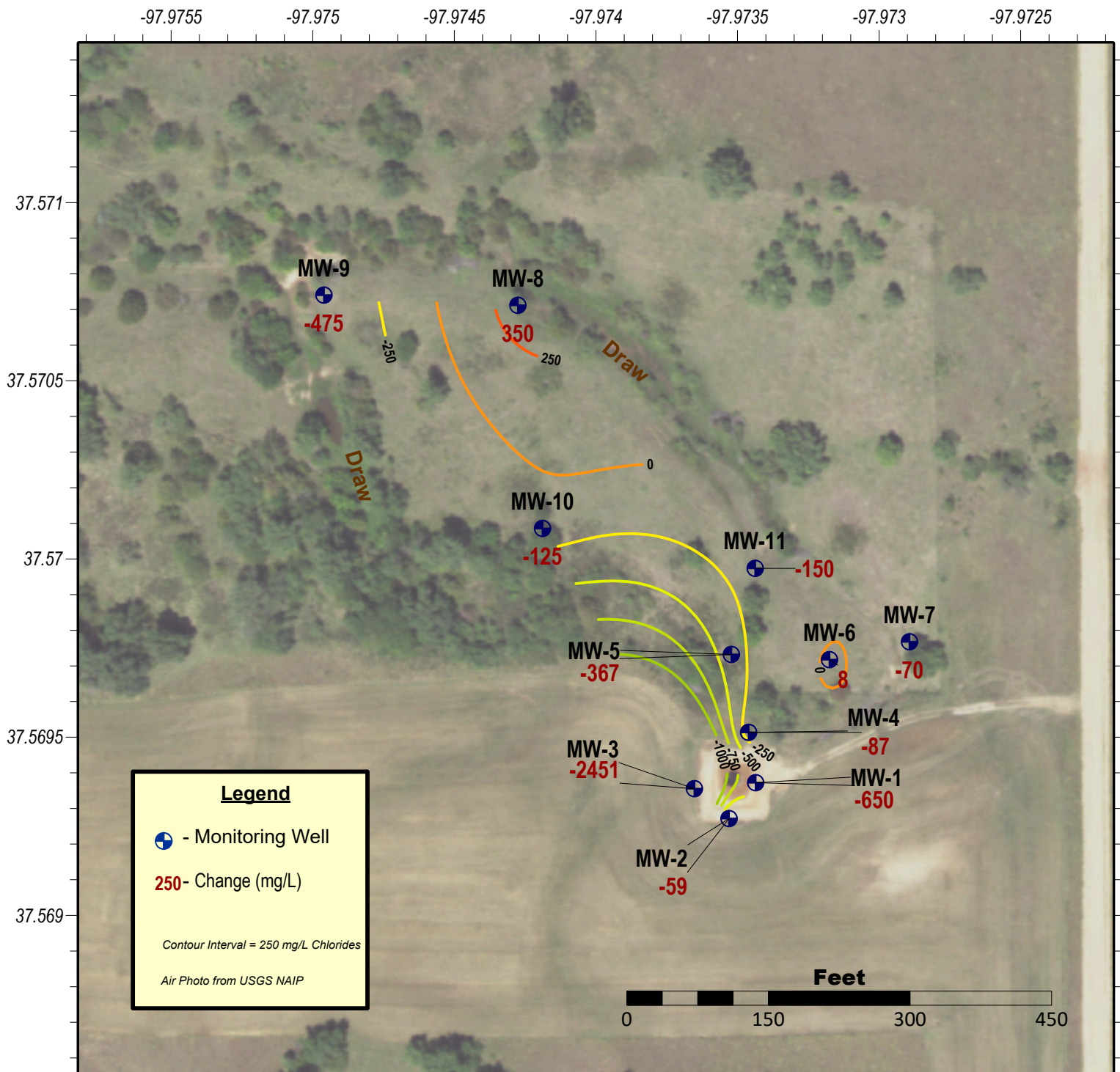
Ideal: 250 mg/l Chloride

Target: 500 mg/l Chloride

Recommendations for Future Work: Due to the limited amount of water resources affected and the recent data, KCC recommends continuing to sample the Trostle annually. KCC does not recommend expanding the monitoring well matrix currently. A small, low-volume recovery system is an option, but KCC is uncertain about how beneficial a system would be due to the aquifer's low deliverability. Higher precipitation rates may help flush out the local system, though KCC expects to see higher chlorides downgradient if that occurs.

Estimated Long-Term Cost: The estimated cost to the KCC, on average, is \$532 per year for site inspection, running an analysis of the water, and data and report preparation.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
980038-001	16.5 Hrs. / \$513.85		
Current Contaminate Level: 40 mg/L in MW-6 to 2,000 mg/L chlorides in MW-1			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	

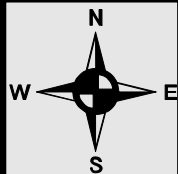
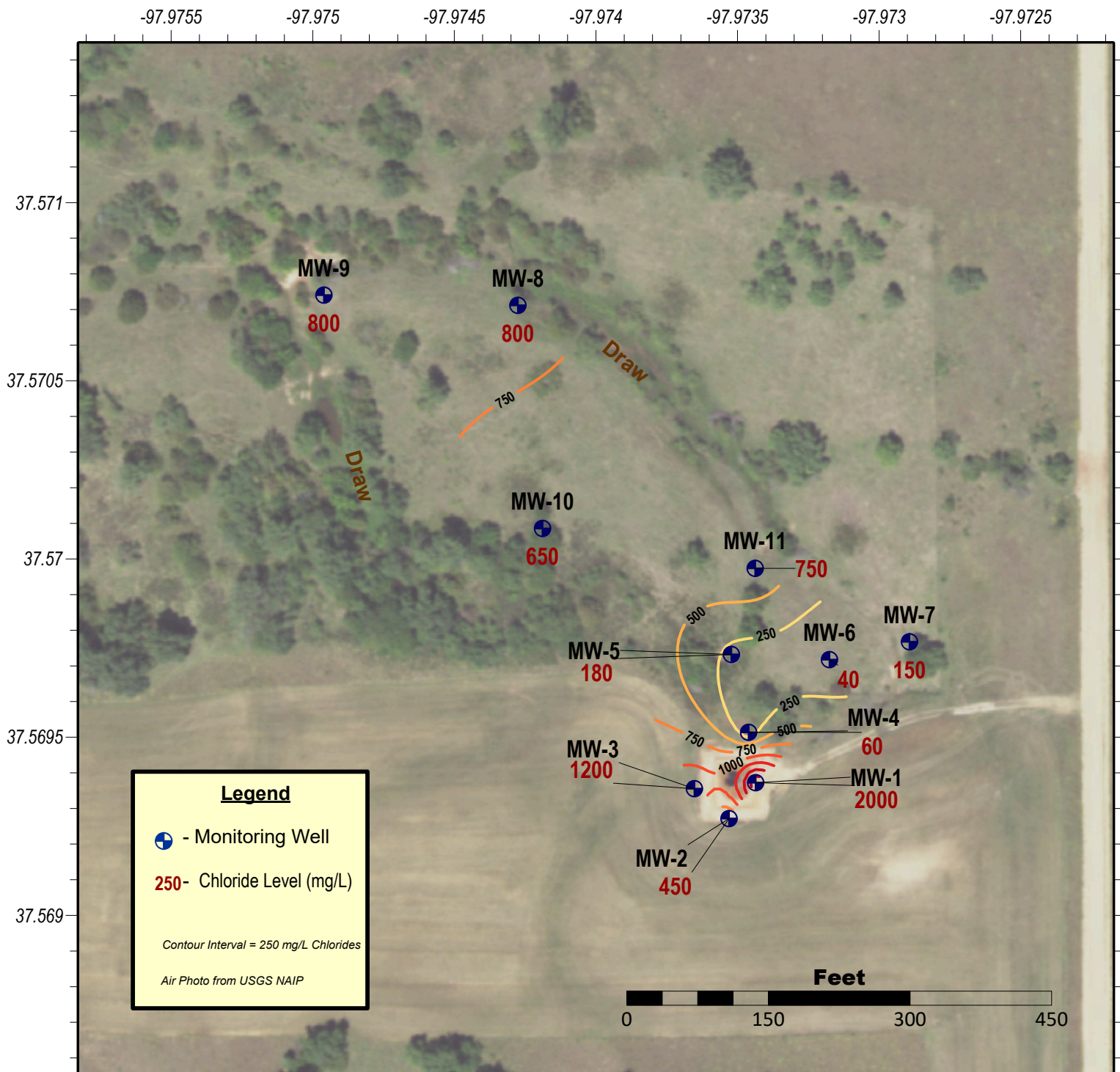


Trostle Brine Contamination Monitoring Site

Section 33 of Township 28 South and Range 6 West, Kingman County, Kansas

Change in Chlorides from 2022 to 2023

KCC District #2 Field Office - Control #980038-001 - Wells Sampled on 7/27/2023 - Map Drawn on 9/19/2023 by D Bollenback

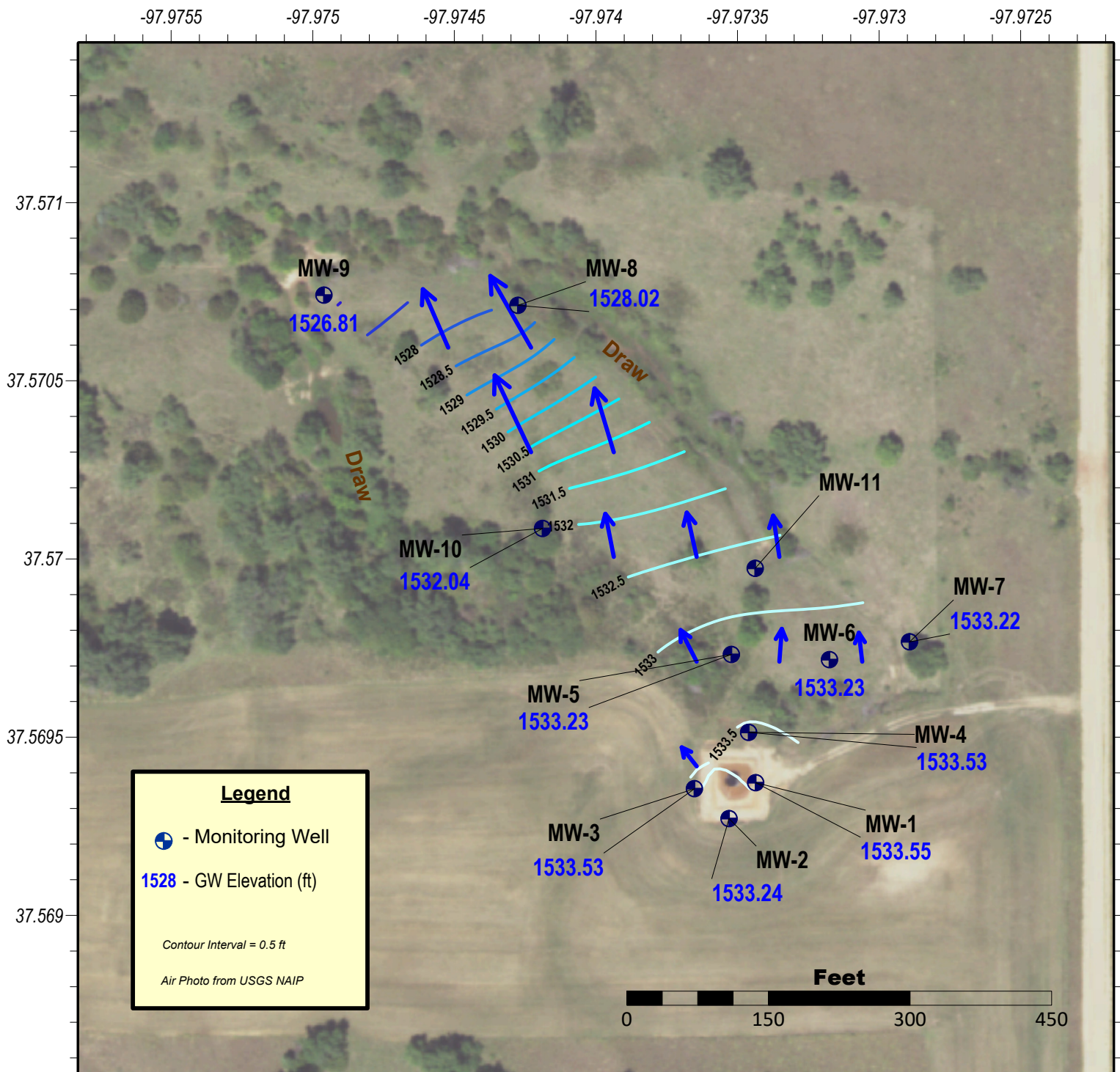


Trostle Brine Contamination Monitoring Site

Section 33 of Township 28 South and Range 6 West, Kingman County, Kansas

2023 Chloride Levels

KCC District #2 Field Office - Control #980038-001 - Wells Sampled on 7/27/2023 - Map Drawn on 9/19/2023 by D Bollenback



Kansas
Corporation Commission

N
W E
S

Trostle Brine Contamination Monitoring Site
 Section 33 of Township 28 South and Range 6 West, Kingman County, Kansas
Groundwater Elevation Map
 KCC District #2 Field Office - Control #980038-001 - Wells Gauged on 7/27/2023 - Map Drawn on 9/19/2023 by D Bollenback

Project: Yeoman Site, Kingman County, District 2

Site Location: The Yeoman site is located in the center of the southeast quarter of Section 35, Township 28 South, Range 7 West. This area is five miles south and three miles east of the city of Kingman in Kingman County.

Impact/Immediacy: The abandoned Yeoman #1 located in the center of the SE/4 may have contributed to the charged up shallow zones in the Permian Red Beds with gas, but was found as an abandoned unplugged well with gas coming to surface. The site classification is moderate due to the small amount of remaining stray gas in place.

Site Description: The Yeoman #1 is located in a pasture used for grazing cattle. The Permian Red Beds are encountered at a depth of 50' consisting of very soft, sandy weathered red shale. The unconsolidated alluvium above the Red Beds consists of a fine to medium grain sand that is the primary shallow aquifer for this area. There are five monitoring/recovery wells offsetting the abandoned Yeoman #1 that were drilled in December 2005 to a total depth of 150 feet with gas encountered as shallow as 110 feet. Each monitoring/recovery well has approximately 90 feet of 7 inch surface casing set.

In April 2010, the KCC District 2 office drilled an additional 6 monitoring wells around the perimeter of section 36 in the section east of the Yeoman site. This was done in an attempt to delineate the escaped gas and follow the upward trend of the Permian red beds to the northeast. Gas was found at all 6 locations with small initial shut-in pressures from 15 to 37 psi at the wellhead.

Unusual Problems: None at this time.

Status of the Project: Currently the 6 additional monitoring wells that were drilled in 2010 have little to no pressure. Monitoring Wells #9, #10 and #11 have no gas pressure at this time, indicating that there is no longer a source charging the shallow zones. The five monitoring/recovery wells directly offsetting the Yeoman #1 are currently in a monitoring phase only. The wells produced the stray gas into a sales line from April 2006 to June 2019 with a total cumulative amount of 260,027 Mcf. (From KGS Production data.) Currently the wells will build up pressure ranging from 12 to 29 psi, but will blow down to zero psi very quickly, demonstrating that there is not an active source of gas and that this is residual stray gas left in place.

On June 27, 2023, District Geologist David Bollenback and District Supervisor Jeff Klock flow tested the North Recovery Well, East Recovery Well, and Recovery Well #5 (RW #5). Shut-In pressures were lower at all three wells than in 2022 and gas flow rates were very small with all three wells dropping to zero psi during testing. All wells were flowed through a .25" choke. In comparison, RW #5 was flowed through a .5" choke in 2019 and was able to flow gas for over an hour when fully opened to the flow meter. (12.6 to 8.87 Mcf/day over last 45 minutes of that test) In 2023, RW #5 started at 14.1 Mcf when fully opened to the flow meter through a .25" choke and fell to 0 psi in 17 minutes. The 2023 flow tests would indicate that there is not an active source still feeding gas into the shallow Red Beds and that this is residual stray gas left in place.

Level of Remediation Sought:

Ideal: N/A

Target: N/A - Complete the plugging of the Yeoman #1 once escaped gas has been depleted from the Red Beds.

Recommendation for Future Work: District Staff will continue to flow test the Recovery Wells to ensure that flow rates and pressures continue to drop. Staff would recommend at this time the Yeoman #1 plugging be completed. In February 2005 an attempt was made to plug the entire well but due to the shallow zones being charged with gas, the surface casing that was set could not be completely cemented in place and gas was allowed to vent up the backside of the casing. At this time there is no gas venting on the backside of the Yeoman #1.

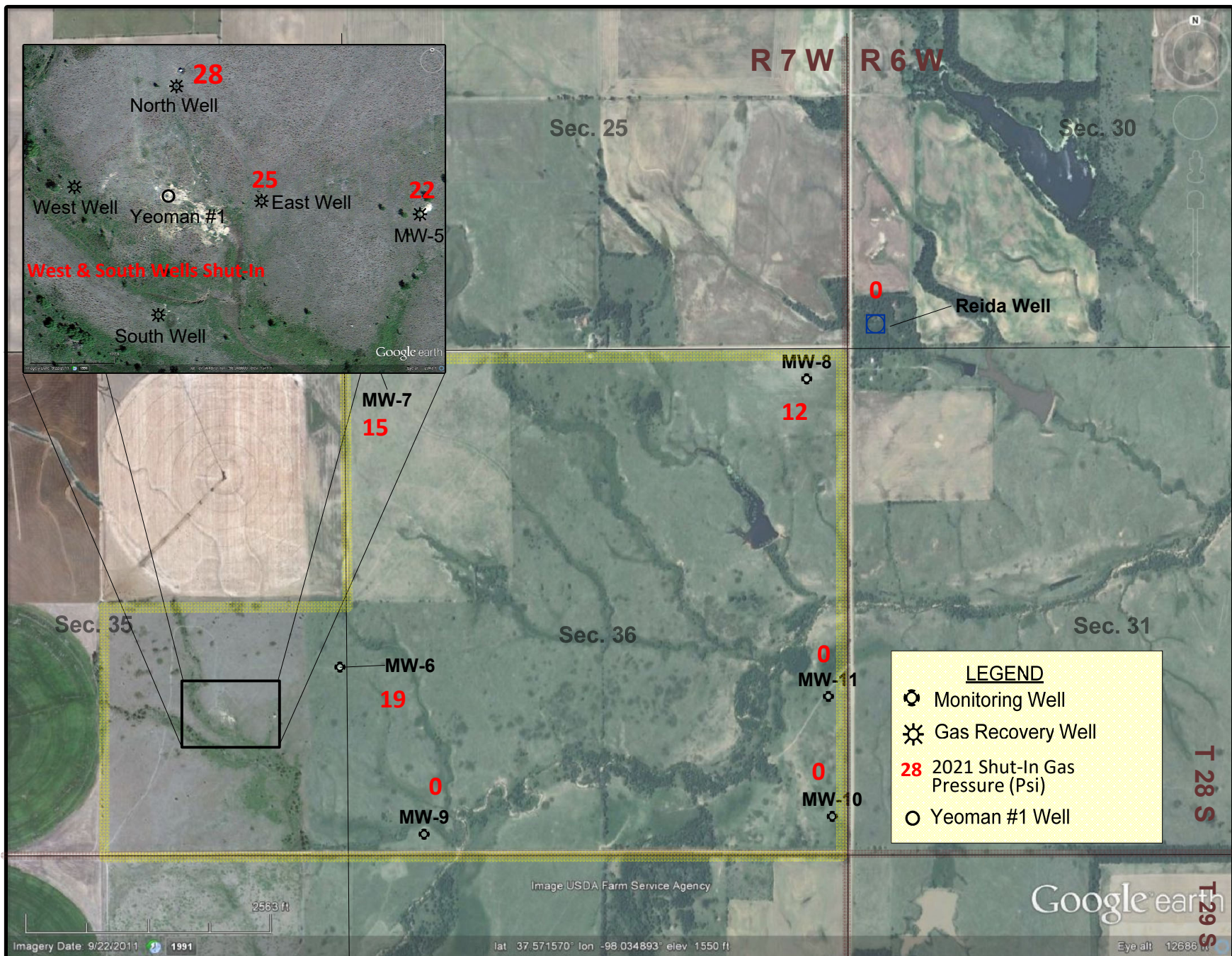
Estimated Total Costs: Plugging of the Yeoman #1 will be done through KCC fee fund.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
20060021-001	19 Hrs. / \$650.53		\$102,690.76

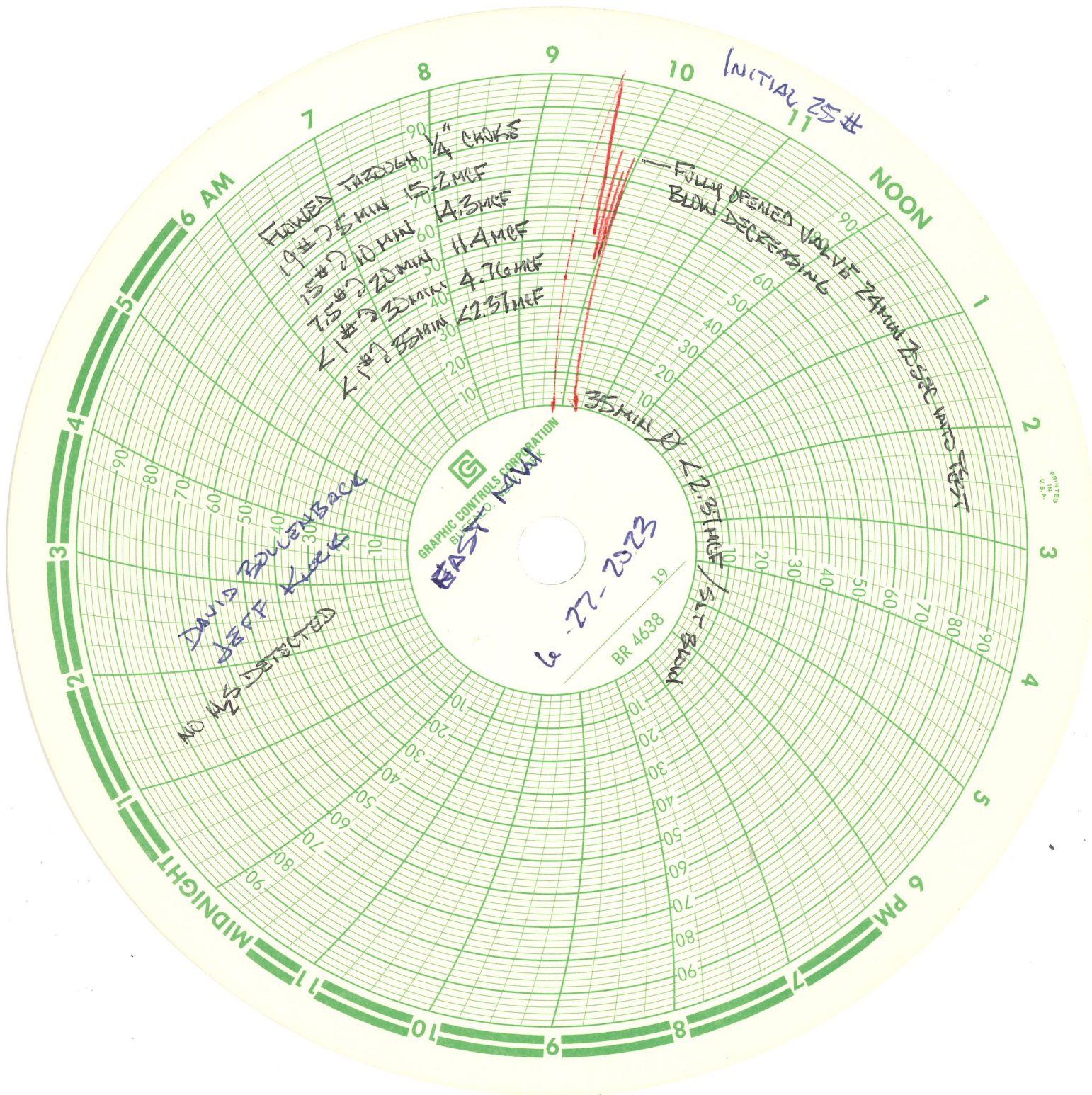
Current Contaminate Level: Shallow Aquifer <70 ppm Cl-
Water from Permian Red Beds tested 625 ppm Cl- in well #5 at 150' TD
Total Gas Produced to Date: 260,027 MCF (KGS Production Data)

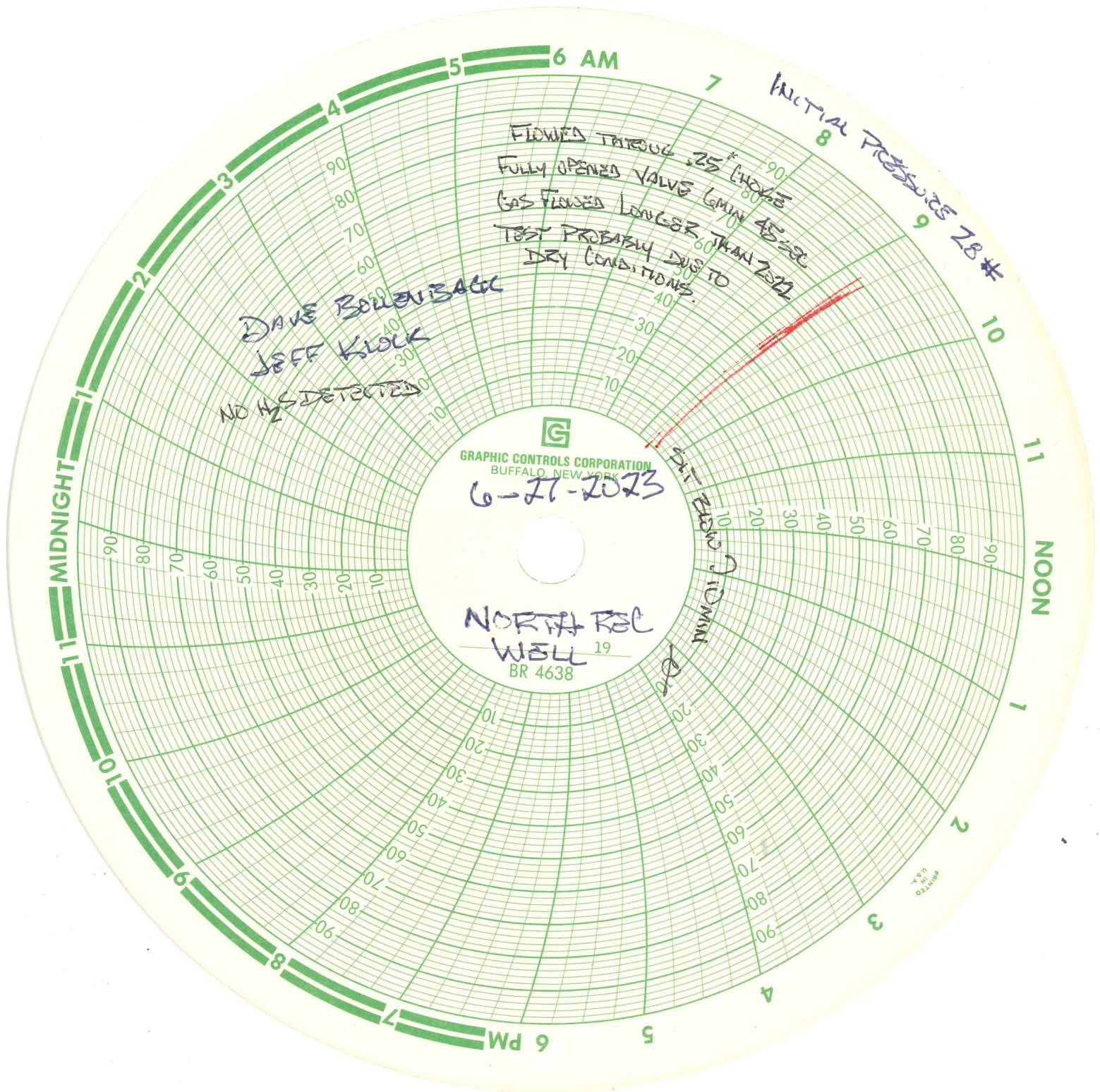
Status:

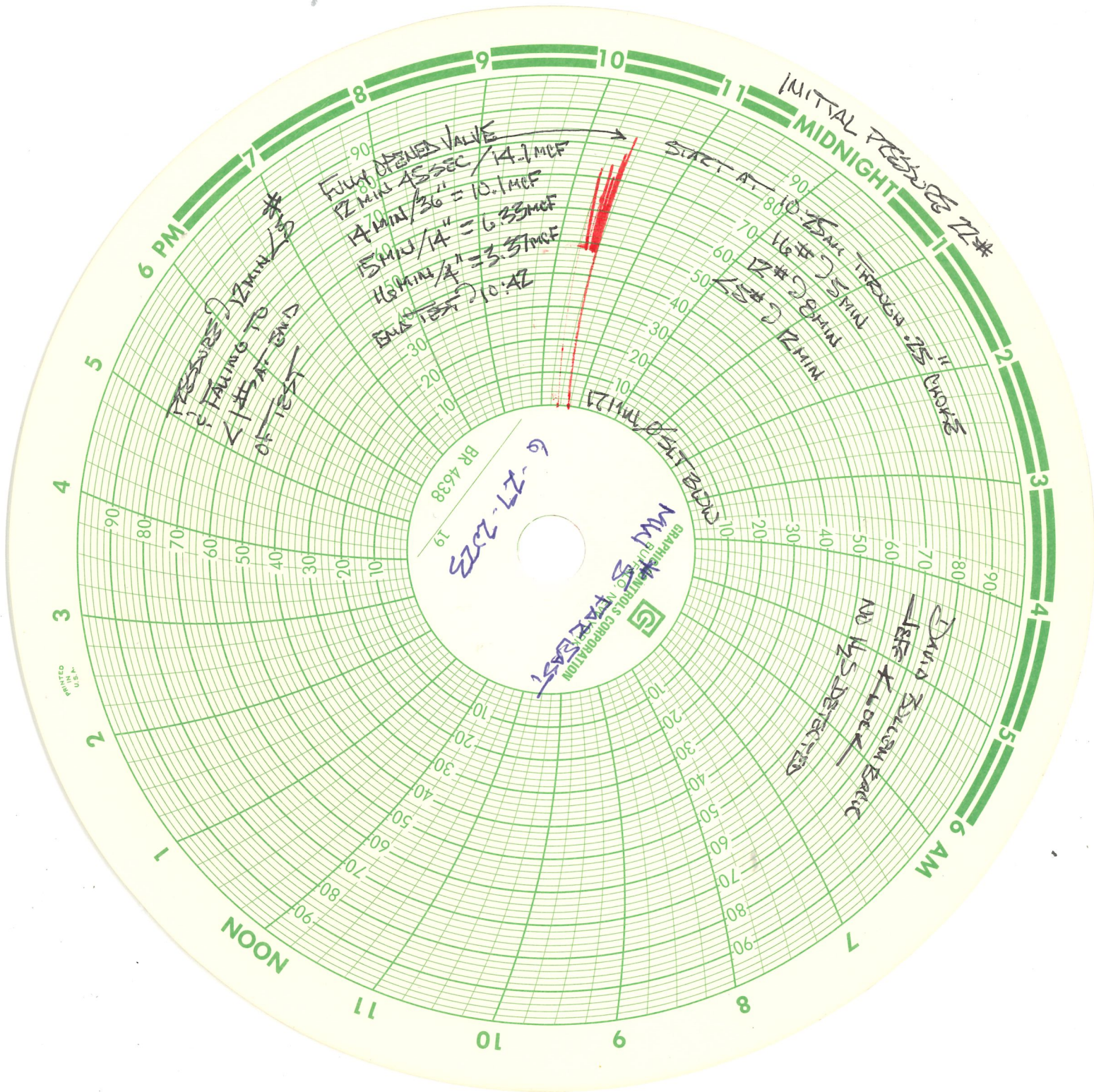
- | | | |
|---|---|---|
| <input type="checkbox"/> 1. Site Assessment | <input type="checkbox"/> 2. Short Term Monitoring | <input type="checkbox"/> 3. Investigation |
| <input checked="" type="checkbox"/> 4. Long Term Monitoring | <input type="checkbox"/> 5. Remediation Plan | <input type="checkbox"/> 6. Installation |
| <input type="checkbox"/> 7. Remediation | <input type="checkbox"/> 8. Post Rem. Monitoring | <input type="checkbox"/> 9. Resolved |



Yeoman Escaped Shallow Gas Site
SE/4 of Section 35 and All of Section 36-T28S-R7W, Kingman Co., KS
Site Map for 2023 Legislative Report
District #2 Control No. 20060021-001 9-30-2023 J. Klock







Project: McDonald-East Contamination Site, Linn County, District 3

Site Location: NW/4 of Section 27, Township 19 South, Range 22 East, Linn County.

Impact/Immediacy: Impact is to the surface water. Immediacy level is rated as low.

Site Description: This site is located at the bottom of a small, fairly steep drainage in the Cherryvale Shale. A seep originating from this drainage tested 3,300 ppm chloride in 1991, 6,500 ppm chloride in 1992, 750 ppm chloride on September 26, 1995 and 380 ppm chloride on January 26, 1998. Seepage within the drainage is intermittent based on precipitation in the area.

Unusual Problems: None.

Status of Project: The State made an agreement with a local operator to put this lease back into production and plug several of the injection wells and older oil wells. The current operator of the lease is Crude Kin Oil Company, Inc. There are five active monitoring wells located on the McDonald East Site in the NW ¼ of section 27–T19S–R22E. The following Cl- concentrations were obtained from the samples collected this year:

	<u>MWE 02</u>	<u>MWE 03</u>	<u>MWE 04</u>	<u>MWE 05</u>	<u>MWE 06</u>
<u>09/07/2023</u>	<u>100 ppm Cl-</u>	<u>300 ppm Cl-</u>	<u>440 ppm Cl-</u>	<u>400 ppm Cl-</u>	<u>250 ppm Cl-</u>

Cl- levels spiked during 2010 and since then have been trending down. Further monitoring on an annual basis is recommended for this site. The lease operator continues to produce this lease and future monitoring will determine if production activity has any impact on site.

Level of Remediation Sought:

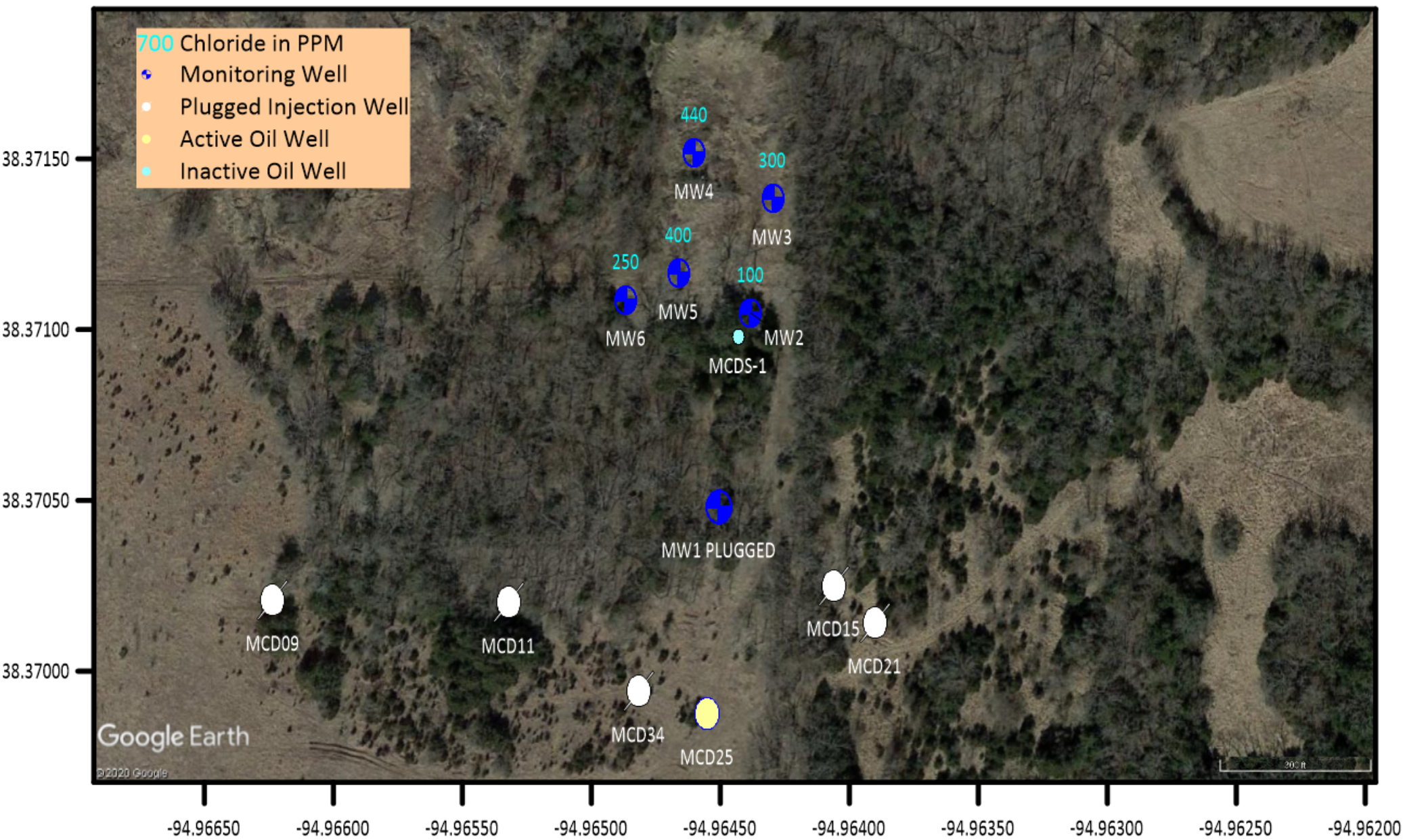
Ideal: 200 ppm Chloride

Target: 500 ppm Chloride

Recommendation for Future Work: Continue sampling annually and monitoring injection activity on this lease. The new ability to download and overlay historic aerial imagery will be utilized to help identify undocumented well locations within and near the site boundary.

Estimated Total Costs: \$1,500 yearly.

Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
970070-00	9 Hrs. / \$283.43		
Current Contaminate Level: 100 ppm Cl- to 440 ppm Cl-			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



McDonald East Remediation Site
 NW27-T19S-R22E Linn County, Kansas
 2023 Groundwater Chloride Levels - District #3 Sampled 9/7/2023
 Map Drawn on 9/18/2023 by L. Short
 Project 970070-00



Project: *Galva City Area Contamination Site, McPherson County, District 2*

Site Location: The Galva City Site is in Sections 15 and 22 of Township 19 South, Range 2 West, a half-mile North and a quarter-mile east of Galva in McPherson County.

Impact/Immediacy: This site is at a very high level of immediacy. Groundwater impactation and the potential for contamination of the domestic and public water supply at Galva City are very high.

Site Description: The site is a rural area with a topography of gently sloping fields with small drainage streams located east and west, with the overall flow to the southwest. This site is in the Ritz-Canton oil field, which utilized brine pits for brine disposal from oil production. The depth of the groundwater is 17 ^{+/-} feet. There are buried paleo-channels where the bedrock is encountered at approximately 60-100 feet. These channels usually hold the highest chloride levels near the top of the Wellington Shale. KCC has operated a recovery system at this site since 2005. In August 2014, KCC completed the Phase III package, including installing five monitoring wells and one recovery well. Data obtained from these additional wells shows a significant chloride source to the east/northeast of the remedial site in section 14. There are multiple suspected pits in that section, including the distillation refinery's last location and associated pits operational in the forties. Chlorides follow along the paleo-valley slope (top of the Wellington Formation) located northeast of Galva and pool in low areas. There is a paleo high directly below the city and its PWS wells. This high suggests the only reason the public water supply is still viable is brine water settling in the aquifer's lower zones. Chlorides from multiple sources are still incoming from section 14. Bedrock orientation and chloride levels in MW-114 support this idea.

Unusual Problems: The disposal well cannot take the necessary fluid to run all four recovery wells simultaneously. The well pumps must be rated similarly for the site to run multiple wells simultaneously. High Chloride water deteriorates metal pumps, fittings, and other system equipment. Recovery pumps have short life spans, and the local groundwater has high iron levels that clog up lines and equipment. The site's age requires constant inspection and proactive and reactive repairs/modifications to keep it online.

Status of Project: The extremely high chlorides across the site increased in 2023 in many monitoring wells. KCC noted that the increases seem to reverse many of last year's decreases. KCC noted that RW-3 was recovering fluid during the sampling event in most years, but in 2023, RW-1(southern recovery well) was in operation. KCC is not sure if this change in dynamics during sampling may attributed to the higher chlorides and may investigate and test wells during different recovery wells operational periods to see what impact each well has on chloride levels. The region is currently experiencing an extreme drought, which could also impact the site's chloride level. Some increases were substantial, with MW-401, MW-1102, MW-205, and MW-114 all increased by 3,000 mg/L or more. It should be noted that most of these wells save MW-114, which may be directly affected by the running of RW-3, which was not in operation during the sampling event. RW-3 was the central recovery well that ran throughout 2023 but is now on a planned schedule. In September 2023, RW-1 had chloride levels of 5,000 mg/L, RW-2 was 6,050 mg/L, and RW-3 was 15,000 mg/L. Compared to nearby monitoring wells, these lower levels show that the chloride is stratified, and coning is occurring, allowing fresher fluids to enter the pump.

KCC Galva remedial system meter readings show that the system had recovered approximately 13,088,900 gallons (311,640 bbls) of brine-impacted water as of October 1, 2023. The KCC disposal well had many issues during the last year, which inhibited it from disposing of water as successfully as it had in the past years. In 2023, KCC injected the well with acid twice via an acid truck. KCC also siphoned small amounts of acid mid-year to attempt to open the well up to total capacity. Acid injection seemed to help the well for a short time, but around one month later, the well lost vacuum and had limited disposal capacity again. In the spring of 2023, KCC hired a service company to check the bottom-hole pressure of the disposal well. This data was utilized in investigating the issues with the disposal well but was also given to the Kansas Geological Survey to add to their database regarding Arbuckle studies.

The Galva PWS#3 well was tested and showed the impactation of benzene, naphthalene, and other hydrocarbons in late 2020. KDHE opened an investigation, including sampling all of KCC monitoring wells and performing geoprobe borings to find a source of the contamination. As of the time of this report, results have been inconclusive. KCC, KDHE, and the City of Galva and their consultants have had multiple face-to-face meetings regarding the City's water supply issues in 2022 and 2023. State agencies recommended that the city not use PWS#3 due to the reoccurring problems and put resources into finding a new water well location. KCC understands that with the help of KDHE, the city of Galva is currently moving toward that goal. In September 2023, city personnel approached the KCC and KDHE regarding a possible treatment plant, but this idea is now on hold to concentrate resources on finding a new water source. KCC is drafting an RFP to install 4-5 new monitoring wells close to the city's northern public supply well. These wells will help give the town better knowledge and understanding

of any future brine contamination that approaches the PWS.

Level of Remediation Sought:

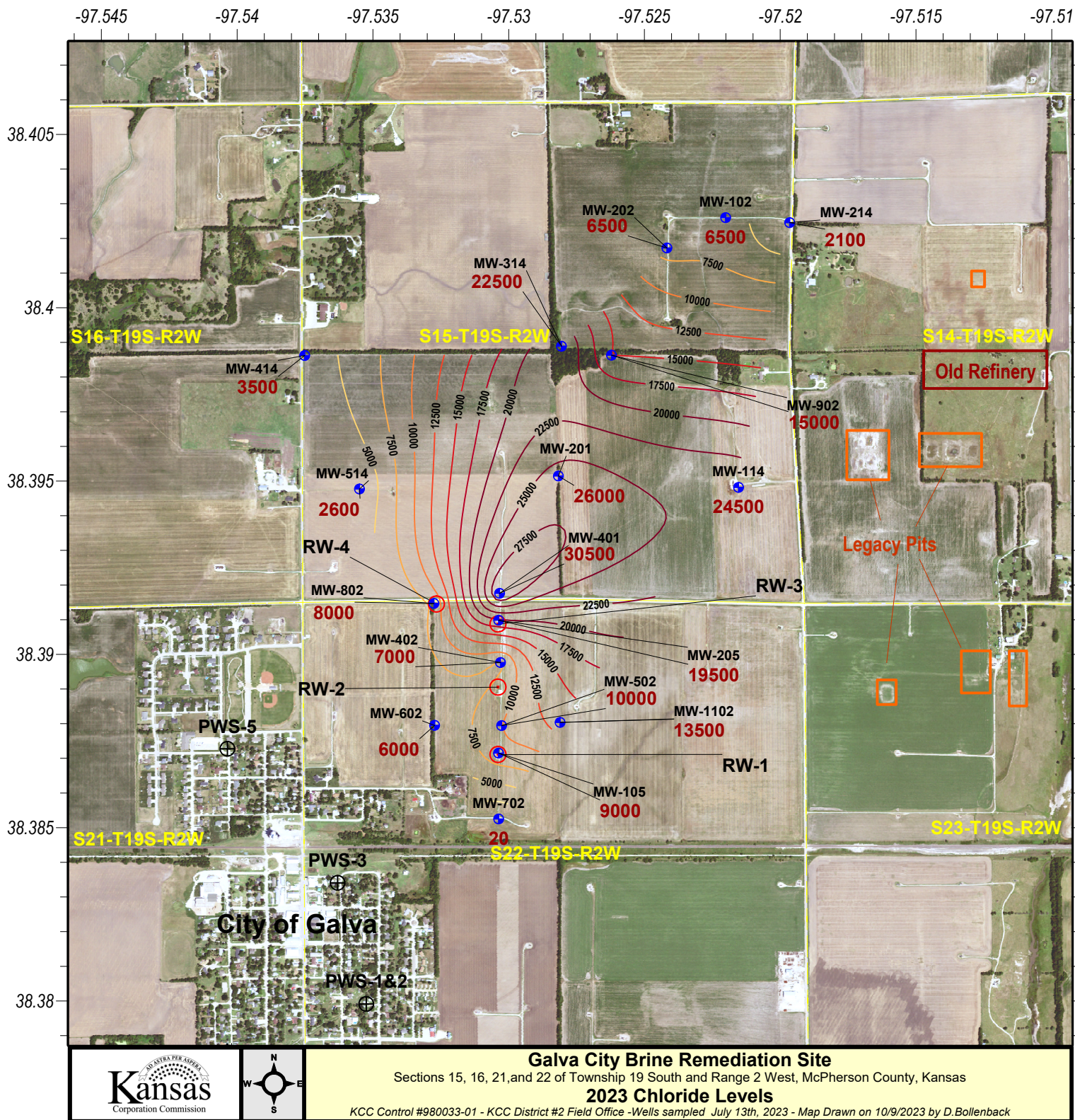
Ideal: 250 mg/l chlorides

Target 500 mg/l chlorides

Recommendations for Future Work: If the issues with the disposal well continue, KCC plans to hire a service company to enter the disposal well and clean it out to bring it back to total capacity. KCC plans to perform another minor sampling event on wells near the recovery system before next year when RW-3 is running to see what differences are occurring during its operation. KCC hopes to drill the proposed wells by late fall 2023 or as soon as the work can be set. KCC will continue to work with the City of Galva, KDHE, and other entities regarding the many water issues. KCC has worked with geochemical consultants for the last two years to test recovery fluids with new products that inhibit iron scale formation in the system. Putting together a chemical treatment plan may help maintain the site's remedial system.

Estimated Total Costs: Regular annual costs are approximately \$4,000-6,000. This includes fieldwork repairs on the remediation system, inspections, groundwater sampling, research, and report writing. Monitoring well installation could cost \$50,000 to \$100,000 depending on the type of drilling and amount of wells. The cleaning out of the KCC disposal well could cost upwards of \$50,000. Finally, drilling a new disposal well would cost upwards of \$350,000, but the associated cost of tanks, plumbing, and other expenditures would be well over \$500,000.

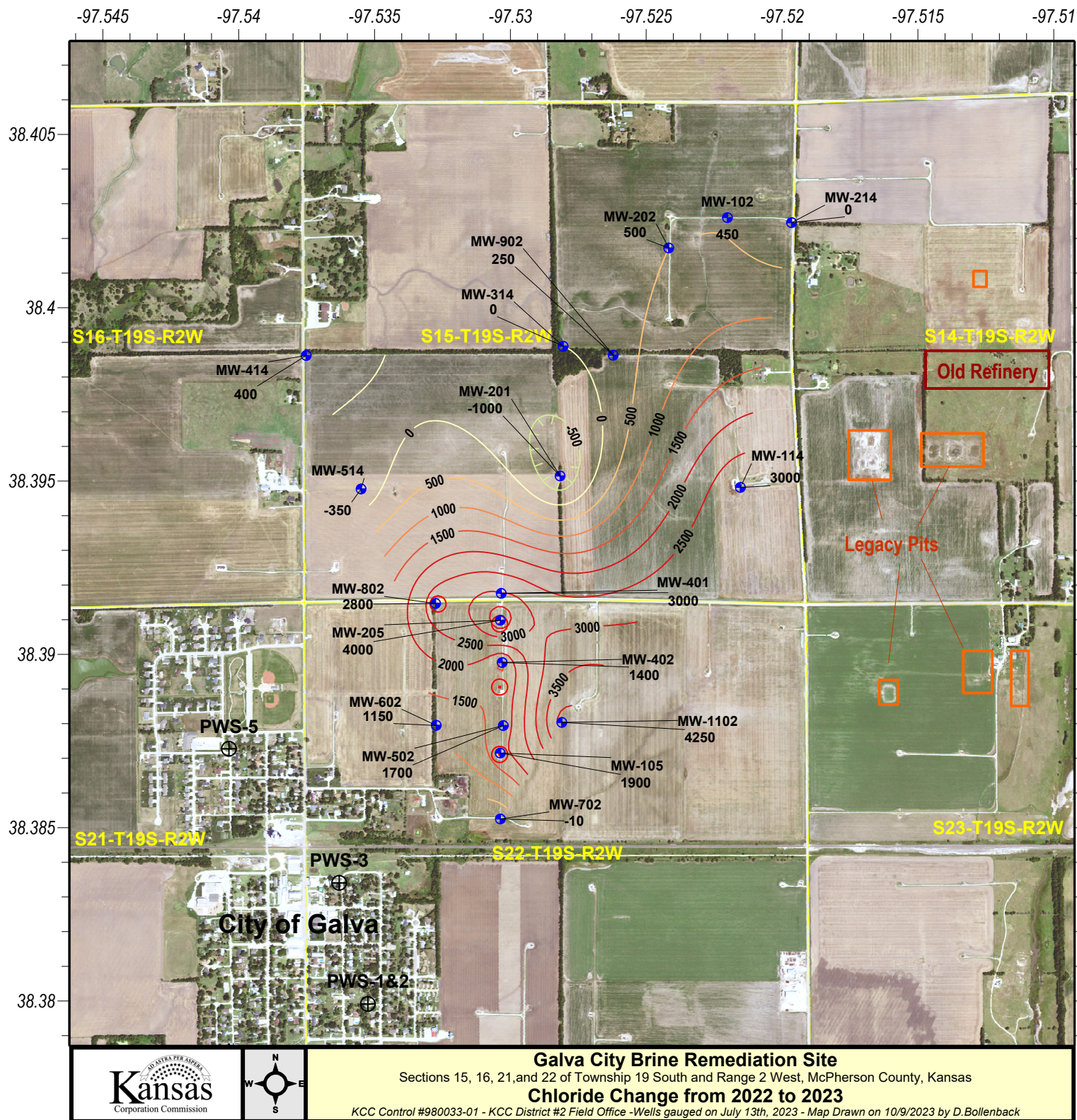
Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
980033-001	304 Hrs. / \$10,017.05	\$13,701.74	\$356,441.23
Current Contaminate Level: 30,500 mg/L (MW 401) to 20 mg/L (MW 702) chlorides for 2023			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input checked="" type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Key

- MW-101 Well No.
 ● - Monitoring Well
 2500 Chloride Level
- - Recovery Well
- ⊕ - Public Water Well

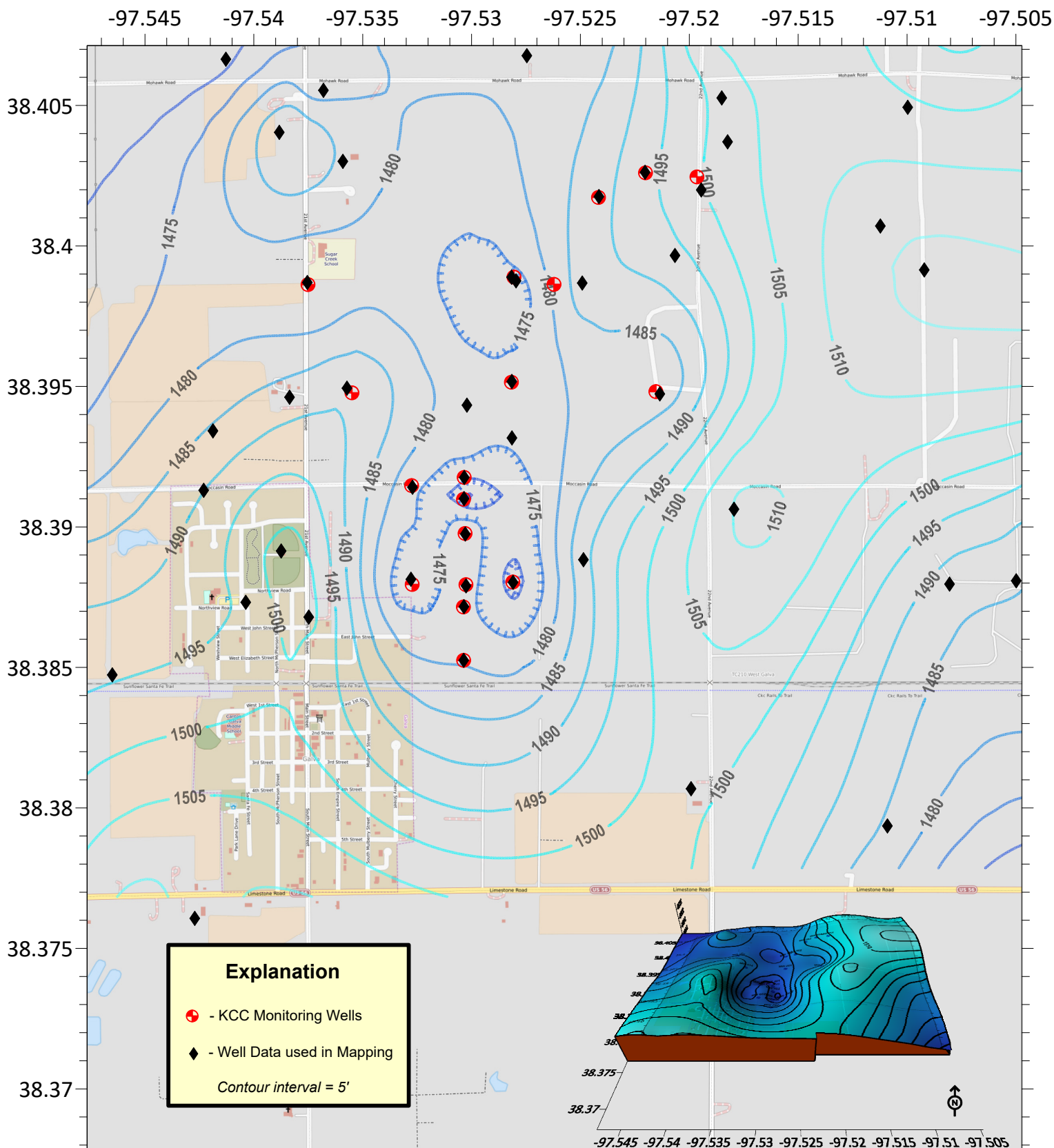
Contour Interval = 2,500 mg/L

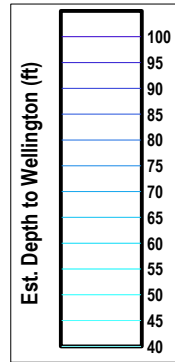


Key

- MW-101** Well No.
- - Monitoring Well
- 2500 Change mg/L
- - Recovery Well
- ⊕ - Public Water Well

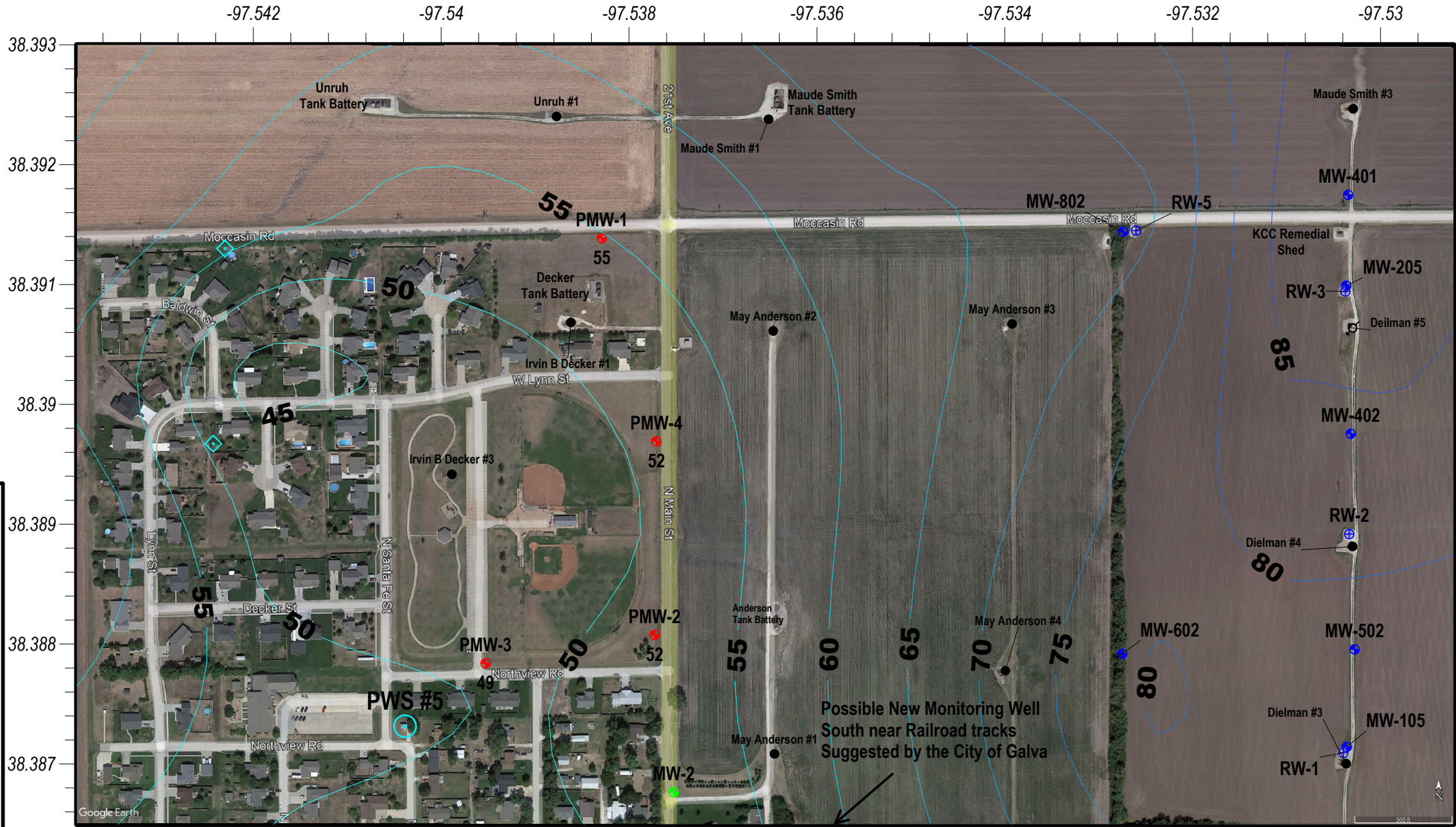
Contour Interval = 500 mg/L





Legend

- KCC MW
- KDHE MW
- Proposed MW
- PWS Well
- Oil Well
- EOR Well
- KCC Rec. Well
- Domestic Well



Galva City Brine Remediation Site
Sections 15, 16, 21, and 22 of Township 19 South and Range 2 West, McPherson County, Kansas
Proposed Monitoring Well Locations
KCC Control #980033-01 - KCC District #2 Field Office Map Drawn on 6/15/2023 by D.Bollenback

Project: *Knackstedt Site, McPherson County, District 2*

Site Location: The site is eight miles west and four miles north of Inman, Kansas. The legal location is N/2 N/2 NW NW of Section 30, Township 20 South, and Range 5 West, in McPherson County.

Impact/Immediacy: Rerouting the local roadway affected by this site has mitigated public safety issues. The site is still ranked at a moderate immediacy level until the KGS completes a complete report on the time-lapse, high-resolution seismic reflection imaging.

Site Description: The site involves the unplugged Knackstedt #5 SWD that Fell Oil & Gas Company was operating. The well failed an MIT on 12/3/1983, and upon investigating the loss of the static water level with a wireline video, it was discovered there was an absence of any casing and any borehole walls between 318 and 478 feet in depth. Casing failure led to the dissolution of the Hutchinson Salt Section and the development of an air-filled void around the well. The site is located immediately southeast of the intersection of Plum Street and Saxman Road. Land use is agricultural, with oil and gas activities in the area.

Unusual Problems: The cavity's air-filled nature makes the design of an acceptable plugging project improbable. In 1993, the KCC drilled an exploratory hole approximately 100 feet east of the Knackstedt SWD and did not encounter a large void but various zones or fingers of dissolution in the salt section. The top of the Hutchinson Salt was encountered at 427' from the surface and drilled to 500 feet before being plugged. An attempt was made to fill the air-filled void with sediment, but it was abandoned after little success. The KGS completed a seismic survey in 1988 that provided a rough estimate of the void. A house is near the site to the east, but past ground-level elevation surveys indicate that surface elevations have been stable.

Status of the Project: To re-establish good elevation control points on the site and get a current void profile, the KCC worked with the Kansas Geological Survey (KGS) to perform a new Time-Lapse, High-Resolution Seismic Reflection Image of the void. On September 25th and 26th of 2019, the KGS shot an initial Phase I 2-D east/west line approximately 3,650 feet long across the site. The length of this line was long to gather native subsurface conditions away from the void and to provide control for future north / south seismic lines. On April 5, 2021, KGS shot three north / south high-resolution seismic lines for Phase II of the project. Three lines were laid with the middle main line running approximately 1,600' in length, two adjacent parallel lines spaced about 240' east and west of the main line, and 800' in size.

Rick Miller, Senior Scientist in Geophysics with the KGS, has indicated the resolution is quite good and is working to tie all data together to represent the salt section adequately. He has indicated that a Paleo subsidence feature can be seen immediately east of the Knackstedt SWD. The hydraulic connectivity between this feature and the solution voids directly around the disposal well provides the outlet/drainage for any fluids, resulting in air-filled voids. A second Paleo Sinkhole can be seen to the east, halfway to Lone Tree Creek. Mr. Miller has indicated that the central void is directly around the old Knackstedt SWD, not a vast void extending away from the well. Based on the vertical extent of the void and the amount of sediment that remains within the original Hutchinson Salt interval where solutions are evident on seismic sections, Mr. Miller says the cavity does not appear to have sufficient volume to accommodate the collapse of the entire column of overburden. KGS plans to utilize new AI analysis and possibly new higher bandwidth seismic lines in the field before completing the full report on the Knackstedt void issue. KGS is looking at the spring of 2024 for another seismic run.

Level of Remediation Sought: The Knackstedt Site will be monitored and surveyed in the long term.

Recommendations for Future Work: Install additional control points/benchmarks once the seismic lines have been processed, have them initially surveyed by a licensed surveyor, and perform a quarterly site survey.

Estimated Total Costs: The KCC paid the KGS a fixed rate of \$14,803.00 for acquiring the new time-lapse, high-resolution seismic reflection image of the void in 2019. Once new control points are installed, it is estimated that it would cost \$1,200 to have the control points surveyed by a licensed surveyor. Staff time would involve the installation of the new control points and future surveying.

Control No.

Staff Hours/Expenditures

Fund Expenditures

970060-00

7.5 Hrs. / \$237.35

FY 2023/24

Total

\$29,759.39

Current Contaminate Level: Unstable well cavity

Status:

☐

1. Site Assessment

☐

2. Short Term Monitoring

☐

3. Investigation

☒

4. Long-Term Monitoring

☐

5. Remediation Plan

☐

6. Installation

☐

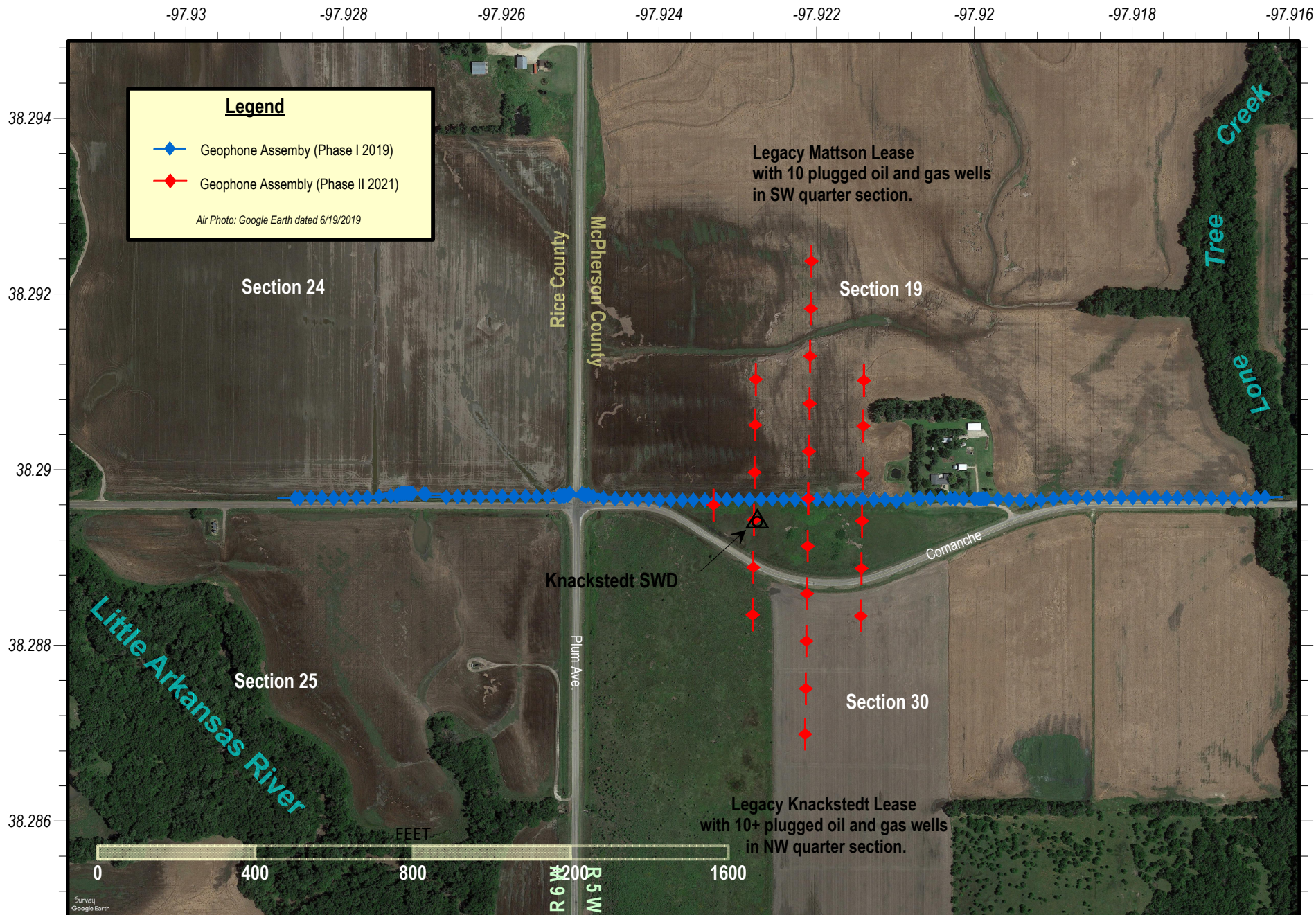
7. Remediation

☐

8. Post Rem. Monitoring

☐

9. Resolved



Knackstedt Site

NW of Section 30 of Township 20 South and Range 5 West, McPherson County, Kansas

Phase I and II Seismic Geophone Locations

KCC Project Code #970060-00 - KCC District #2 Field Office - Map Drawn on 9/29/2022 by D.Bollenback

PHOTOGRAPHIC RECORD

Photo No.:1

Photographer:
D. Bollenback

Date:
8/31/2023

Direction:
East

Description:
Photo looking east
down the old
roadway towards Mr.
Fisher's residence

LAT/LONG:



Photo No.:2

Photographer:
D. Bollenback

Date:
8/31/2023

Direction:
West

Description:
Looking towards the
intersection of Plum
and Comanche Rd

LAT/LONG:



Annual Report Photo Log
Site/Lease Name: Knackstedt
Site Location: Sections 19 & 30-T20S-R5W
McPherson County, Kansas

PHOTOGRAPHIC RECORD

Photo No.:3

Photographer:
D. Bollenback

Date:
8/31/2023

Direction:
SE

Description:
Looking away from
the Knackstedt well
towards the curved
Comanche road.

LAT/LONG:



Photo No.:4

Photographer:
D. Bollenback

Date:
8/31/2023

Direction:
South

Description:
What remains of the
Old Knackstedt
SWDW

LAT/LONG:



Annual Report Photo Log
Site/Lease Name: Knackstedt
Site Location: Sections 19 & 30-T20S-R5W
McPherson County, Kansas

Project: McPherson Landfill-Johnson Oil Field Contamination Site, McPherson County, District 2

Site Location: The McPherson Landfill itself is located in Section 34, Township 19 South, Range 3 West, in McPherson County, approximately .75 miles southeast of the city of McPherson. The affected areas include Sections 33 & 34, Township 19 South, Range 3 West, and Sections 3, 4, & 5, Township 20 South, Range 3 West.

Impact/Immediacy: The contamination has impacted industrial water supply wells for the CHS Refinery formerly the National Cooperative Refinery Association (NCRA), as well as domestic rural water wells. This site has a moderate immediacy level.

Site Description: The site is located in rural McPherson County near the old landfill and the CHS refinery. The area of contamination lies on the west side of the Johnson Oil Field, which is the probable source of the high salinity in the ground water.

Unusual Problems: None.

Status of Project: Since 2003 CHS has annually provided a report on their East Refinery Groundwater Quality Improvement Project and the Groundwater Monitoring Plan. A full report from the consulting company, Trihydro Corporation, is on file with the KCC. The goals for this project include mitigating chloride impacted oil field brine water migrating from the Johnson Oil field east of the refinery, and preventing lateral movement of the identified hydrocarbon plume beneath the refinery toward the chloride remediation system. The remediation system consists of 12 recovery wells, RW-7 through RW-18, which are all screened in the lower portion of the Equus Beds aquifer. From Jan-Dec 2022 a total of 1017 acre-feet of chloride impacted water was recovered from 5 of the recovery wells (RW). The RW wells utilized (RW 10, 11, 12, 13 & 17) ranged from 327 mg/L in RW 13 to 1290 mg/L in RW 10 in 2022. According to the annual report, recovered water is treated on-site using a reverse osmosis system and used as refinery process water. The processed water not meeting standards is injected into a Class I non-hazardous disposal well. Overall, the 2022 Trihydro report stated that the recovery project was meeting its goals.

The September 2023 sampling of 13 deep screened CHS monitoring wells showed varied changes in chloride values. The two areas that continue to exhibit very elevated chlorides are around EB 402C (5,190 mg/L) and MW 118D (2,170 mg/L). EB 402C increased by 940 mg/l to 5,190 mg/l. These increases in chloride values have been seen throughout the district in 2023 due to drought conditions. The highest impact to groundwater is still around EB 402C which is located in Section 3, southeast of the refinery, and appears to be trapped chlorides along the bedrock. Those values have always fluctuated between 4,000 to 5,000 mg/L since 2005.

Level of Remediation Sought:

Ideal: 250 ppm chlorides

Target: 500 ppm chlorides

Recommendations for Future Work: Collect data on an annual basis from CHS, GMD2 and the old landfill.

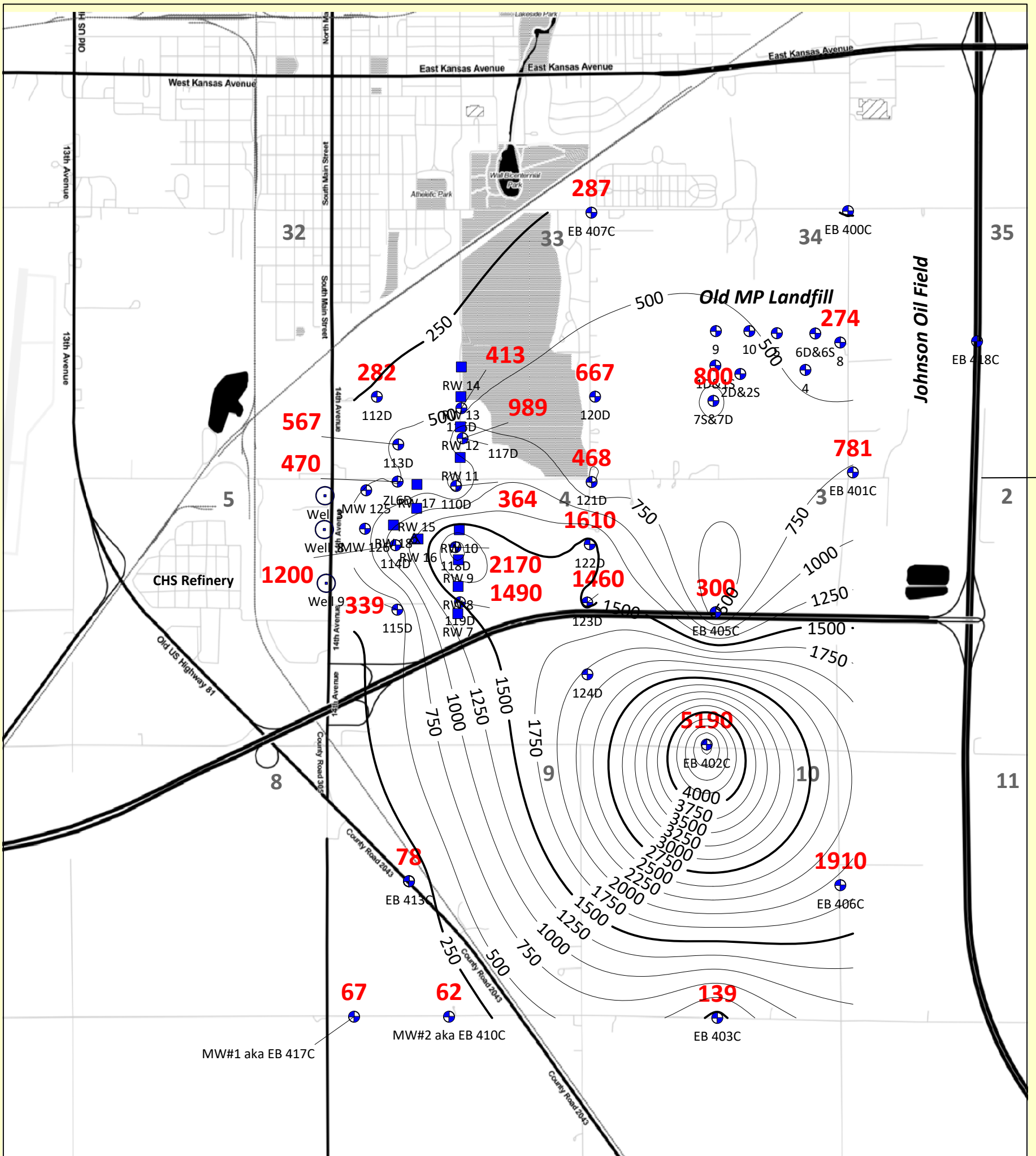
Estimated Total Costs: KCC provides funding to GMD2 for sampling surrounding EB monitoring wells.

Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
980034-001	11.5 Hrs. / \$432.08	\$533.40	\$25,154.20




Current Contaminate Level: 67 mg/L (MW-1) to 5,190 mg/L (EB 402C) 2023
Recovery wells ranged from 339 mg/L in RW 13 to 1120 mg/L chlorides in RW 10 in 2023
Note: Not all RW were sampled during the 2023 sampling event.
Status:

- | | | |
|---|---|---|
| <input type="checkbox"/> 1. Site Assessment | <input type="checkbox"/> 2. Short Term Monitoring | <input type="checkbox"/> 3. Investigation |
| <input checked="" type="checkbox"/> 4. Long Term Monitoring | <input type="checkbox"/> 5. Remediation Plan | <input type="checkbox"/> 6. Installation |
| <input checked="" type="checkbox"/> 7. Remediation (CHS) | <input type="checkbox"/> 8. Post Rem. Monitoring | <input type="checkbox"/> 9. Resolved |

R 3 W



LEGEND

-  Monitoring Well
-  NCRA Recovery Well
-  NCRA Water Supply Well

1880 🌐 118D *Numbers in RED are Chloride Values*
Numbers in BLACK are Monitoring Well Numbers

Contour Interval = 250 mg/l

KANSAS CORPORATION COMMISSION

McPherson Landfill-Johnson Oil Field

2023 DEEP CHLORIDE MAP

T19S & T20S-R3W, McPheron County, KS

Dist. 2

Control No. 980034-01

10-4-2023

J. Klock



Project: *Nikkel-Epps, McPherson County, District 2, McPherson County, District 2*

Site Location: The Nikkel-Epps contamination site is NE/4 of Section 18, Township 20 South, Range 1 West, in McPherson County.

Impact/Immediacy: Medium-high immediacy level. Chlorides affect a shallow groundwater aquifer with multiple residences within a half-mile; some use the aquifer as the sole water source. There is crop irrigation in the area side and down gradient of the plume.

Site Description: The Nikkel-Epps site had known brine water contamination since 1953 when a local homestead complained that the domestic well had become unusable due to saltwater intrusion. KCC first investigated the issue in 2007 when an irrigation well battery was drilled in the northeast corner of section 18 and killed the soybean crop planted that year. KCC's research into past oil and gas practices in the area revealed many land owner and state agency communications regarding the pits southwest of the center of section 7. Paper trail documented pond fluids testing 32,000 chlorides by state agency personnel on occasion. However, most agency interaction occurred after the pond policy was changed, and the push for deep disposal was necessary to curb brine intrusion into local aquifers.

The aquifer resides in the McPherson Formation, consisting of two to three sand units separated by clay layers. At the base of the aquifer lies the Wellington Shale. The aquifer contains several possible aquitards, impermeable clays separating the sands. It is unknown if these clays are continuous throughout the area. Due to the depth of the saltwater found, KCC believes that potential pathway(s) down to the Wellington Formation exist. The land surface is flat irrigated farmland. Chlorides seem to settle on top of the Wellington Shale contact, which is the bedrock in the area. The contact with the McPherson sediments is an erosional disconformity. The erosion of the Wellington Formation has left high relief channels and bumps at the bottom of the local shallow aquifer. Evidence suggests that the main brine plume has a source(s) in section 7, upgradient of the site. There are known legacy evaporation pits locations to the north.

Unusual Problems: Like many other chloride problems in the area, the chlorides can be hit and miss and contained in 'hot spots' down-gradient of old evaporation pits and settling in deeper pockets within the aquifer. Farming practices have destroyed half of the monitoring wells installed by the KCC.

Status of Project: On August 25, 2023, MW-2, MW-3, and MW-5 groundwater monitoring wells were gauged and sampled for chloride levels. MW-2 has historically had the highest chloride levels but decreased from 2022. MW-3 and MW-5 had slight increases in chlorides. Due to the drought, water levels were over one foot lower than last year. KCC has approached GMD#2 regarding plugging the four irrigation wells drilled in 2007, as they are still in the agricultural field with poor surface control. KCC also discovered no plugging report for the closest oil and gas well, the #1 Boesker, but there is no supporting evidence at the surface of issues regarding this well. KCC developed a plan to install new monitoring wells to replace broken wells and help delineate the local plume. Wellington Shale mapping has suggested that bedrock lows in the northeast and south of the Nikkel-Epps possibly allow chloride migration to the south.

Level of Remediation Sought:

Ideal: <250 ppm

Target: 500 ppm

Recommendations for Future Work: KCC recommends additional and replacement monitoring wells at the Nikkel-Epps Site. Without the northern monitoring wells, the site is currently hard to interpret regarding chloride migration. Due to local domestic wells, the Nikkel-Epps Site is medium-high on the priority list. No delineation to the north or south of the site exists. During the next two to three years, KCC recommends the installation of five monitoring wells. These wells would facilitate the KCC in devising a suitable remediation plan or assist the Ratslaff homestead in finding a new water source. In addition, other domestic and irrigation wells in the next section south of the site could be affected if the plume migrates. These new monitoring wells could warn those irrigators of the plume approach. KCC plans to locate the #1 Boesker and perform soil borings to check for chloride contamination in the soil. With heavy crop rotation, this has not been easy to accomplish. If found, KCC could excavate the well and check the status of the plug of the early 1930s D/A well.

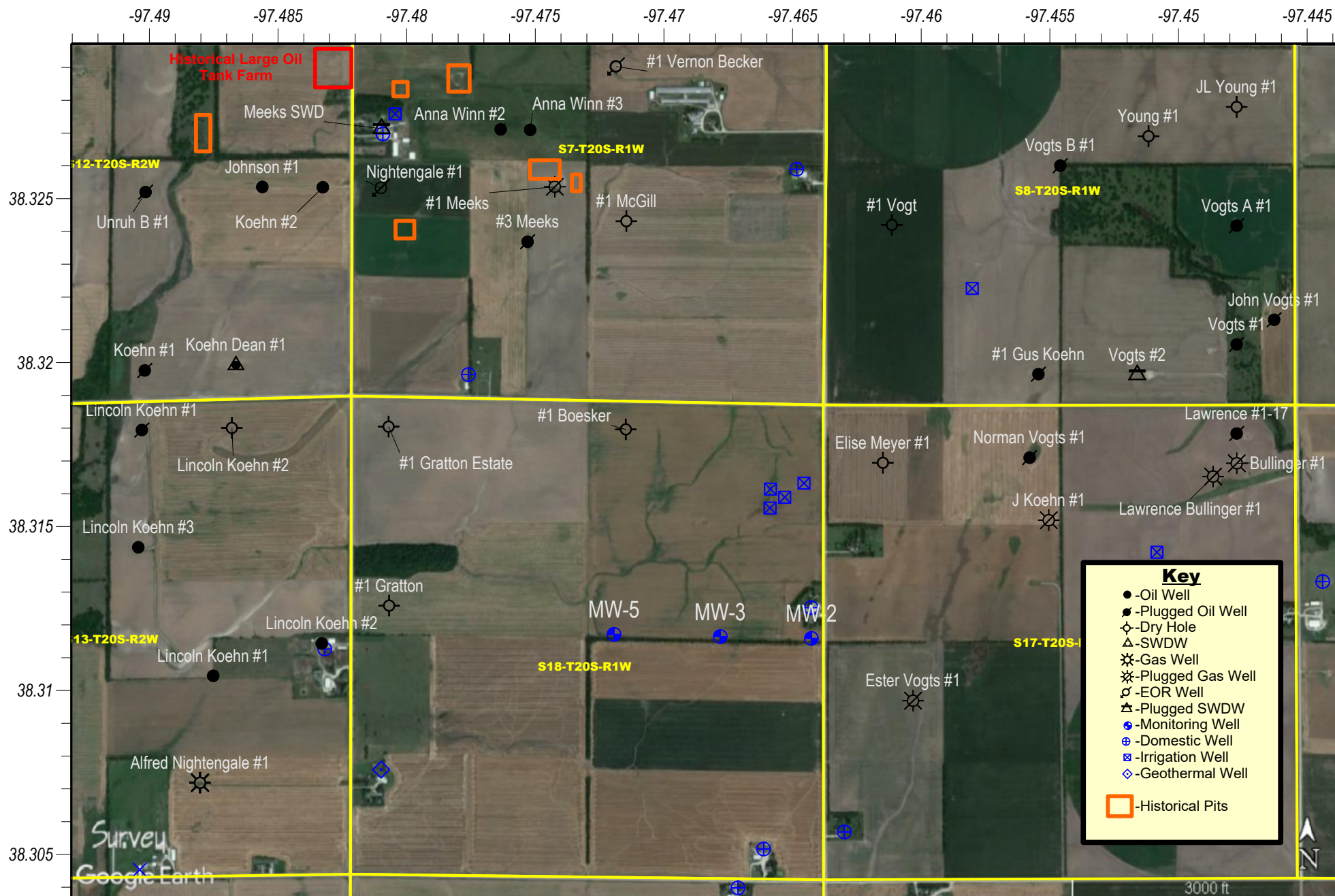
Estimated Total Costs: Future expenditures range from \$25,000 to \$75,000 to drill the new wells and repair broken wells during a Phase II investigation. KCC staff sampling, research, and report preparation time would be needed.

Control No.	Staff Hours/Expenditures	Fund Expenditures
		FY 2023/24 Total
20100082-001	10 Hrs. / \$314.15	\$8,318.75

Current Contaminate Level: MW-5 350 mg/L to MW-2 1,400 mg/L

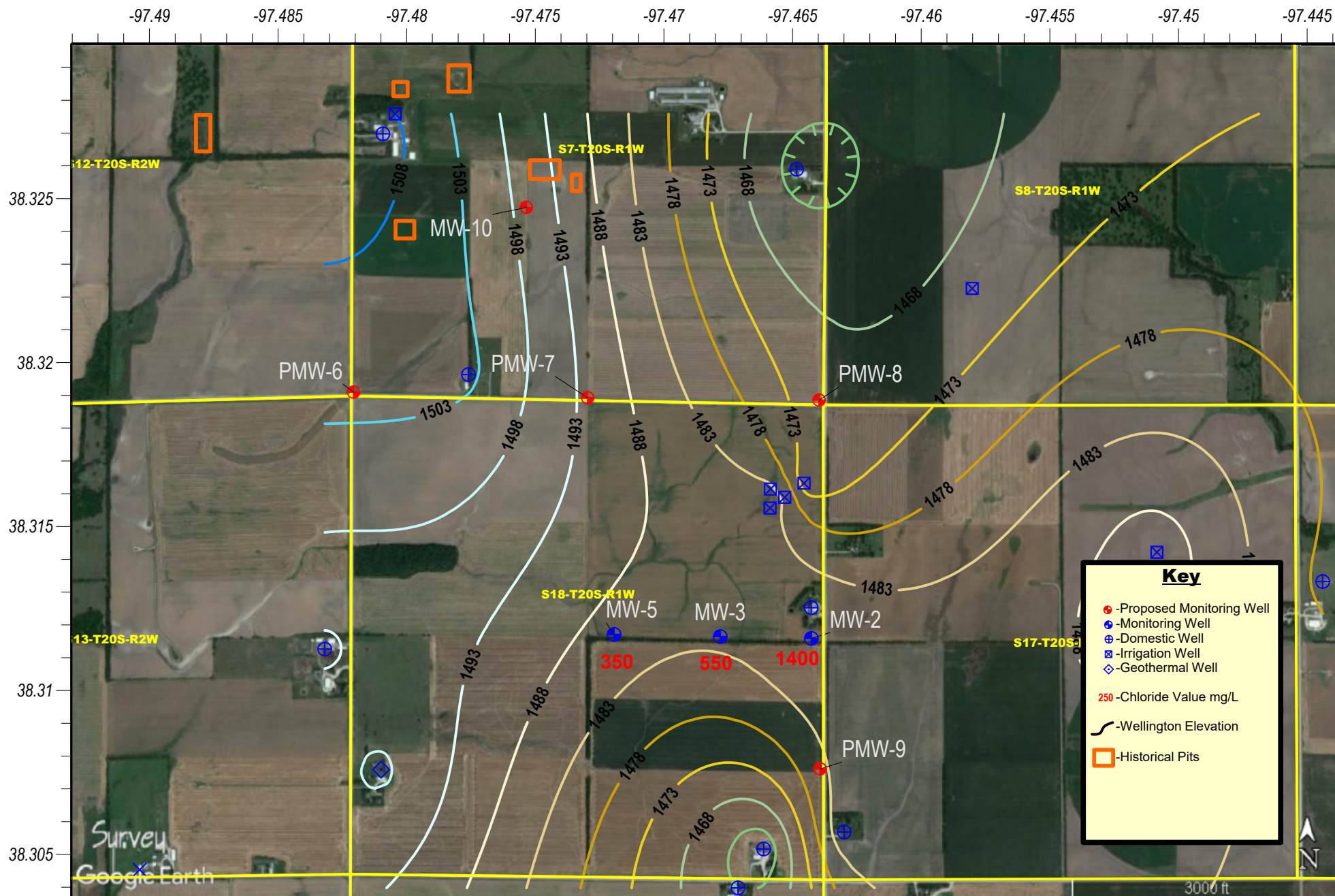
Status:

- | | | |
|---|---|--|
| <input type="checkbox"/> 1. Site Assessment | <input type="checkbox"/> 2. Short Term Monitoring | <input checked="" type="checkbox"/> 3. Investigation |
| <input checked="" type="checkbox"/> 4. Long Term Monitoring | <input type="checkbox"/> 5. Remediation Plan | <input type="checkbox"/> 6. Installation |
| <input type="checkbox"/> 7. Remediation | <input type="checkbox"/> 8. Post Rem. Monitoring | <input type="checkbox"/> 9. Resolved |



Nikkel- Epps Contamination Site NE Section 18 of T20S & R1W, McPherson County, Kansas **2023 Site Map**

District #2 - Control # 20100082-001 - Drawn on: 9/26/2023 by D.Bollenback



Nikkel- Epps Contamination Site
 NE Section 18 of T20S & R1W, McPherson County, Kansas
2023 Chloride and Proposed Monitoring Wells Map
District #2 - Control # 20100082-001 - Drawn on: 9/26/2023 by D.Bollenback

Project: *Running Turkey Creek, McPherson County, District 2*

Site Location: The Running Turkey Creek Site is in McPherson County, Kansas, between Galva and Canton, Kansas, in multiple sections in Township 19 South and Range 2 West. The site has contaminated groundwater within the Running Turkey Creek drainage. It is estimated to be approximately 8 square miles, extending from Mohawk Road south to Iron Horse Road in a 2-mile by 4-mile wide strip. This site is within the boundaries of the Ritz-Canton Oilfield.

Impact/Immediacy: There are no public water supplies within the current site, but many domestic wells utilize the aquifer in the area. Historically, wells are found in areas yet affected by the plume or are completed higher in the aquifer to avoid most chlorides residing along the bedrock. Therefore, the immediacy rating is moderate to high.

Site Description: The area's topography is flat, with gently rolling hills. Most of the land is under cultivation. The groundwater also flows generally in a south-to-southwest direction with minor hydrologic anomalies. The groundwater contamination is highest near the bedrock contact. Local geology consists of fine-textured soils that exhibit strong clay-pan development. These soils underly loess deposits of the Quaternary Age, which lay on McPherson Formation sands and gravels. Depth to sands in the area ranges from as little as 5 feet to 60 feet. The Wellington Shale forms the bedrock in the area. The Wellington had been eroded before the McPherson deposition and is an erosional contact with various paleo-valley and related structures. KCC has documented numerous historical evaporation pits via historical air photos and documents. These pits are believed to be the source of the contamination in the area.

Unusual Problems: A monitoring well matrix may have to spread considerably for site delineation. Ritz-Canton Oil Field brine contamination can have multiple sources, complicating delineation. In addition, it is unclear if the direct connection of the north and far south (South of Highway 56) wells is occurring or if they are separate plumes.

Status of the Project: This Site is in a monitoring phase currently, as a remedial option is very economically expensive, and gaining access to a disposal well could be problematic. KCC sampled the monitoring wells using air-lift technology. Since last year's sampling event, most monitoring wells have been stable regarding chloride concentration. MW-502, located in the site's northern part, has been hit by farming equipment and is unusable. MW-202 has once again increased by 500 mg/L chlorides since 2022. MW-202 has risen by 1750 mg/L since 2021. This well has historically been the highest chloride-contaminated well and is currently 22,000 mg/L. Most other monitoring wells also increased in chlorides since 2022 to a lesser degree. This could be related to the current drought or that the plume is moving to the south. MW-2101 was found to be destroyed in 2021 by agricultural equipment during the sampling event and is considered lost. In 2023, KCC found that MW-501 had been hit with agricultural equipment and broken below ground surface. KCC plans to dig out the well to repair it if possible.

This area is now within the GMD#2 boundaries, but no water-quality wells have yet been drilled by GMD #2. In addition, the known plume is not delineated north, south, and east. KCC put together a Well installation package in early 2020 comprised of 10 new monitoring wells, and this project was out for bid. However, only three of the ten landowners would grant permission to install a monitoring well on their property; therefore, the monitoring well expansion project is on hold now. KCC is investigating using right-of-way, utility easements, or other similar locations to install monitoring wells.

Level of Remediation Sought:

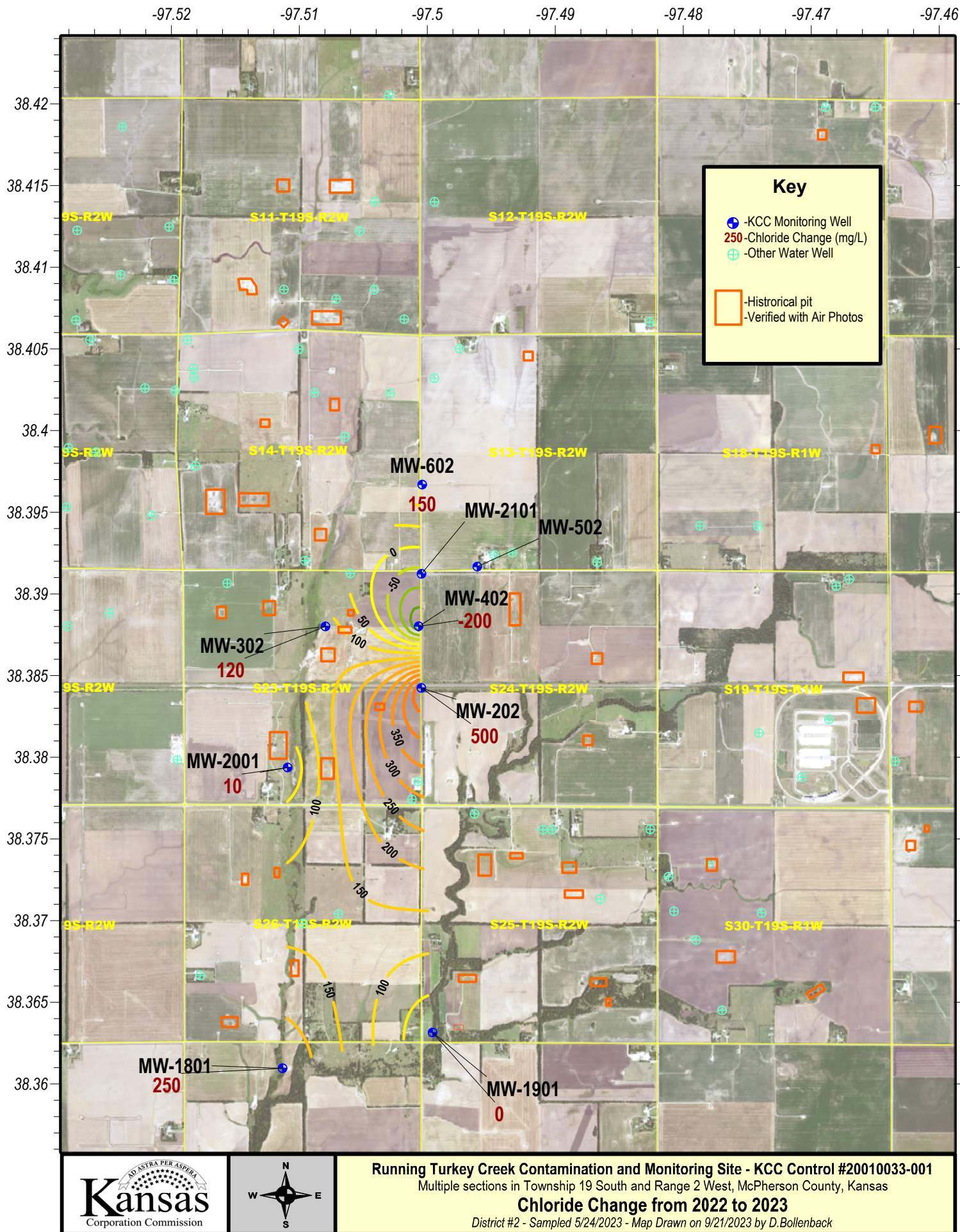
Ideal: 250 mg/l mg/l

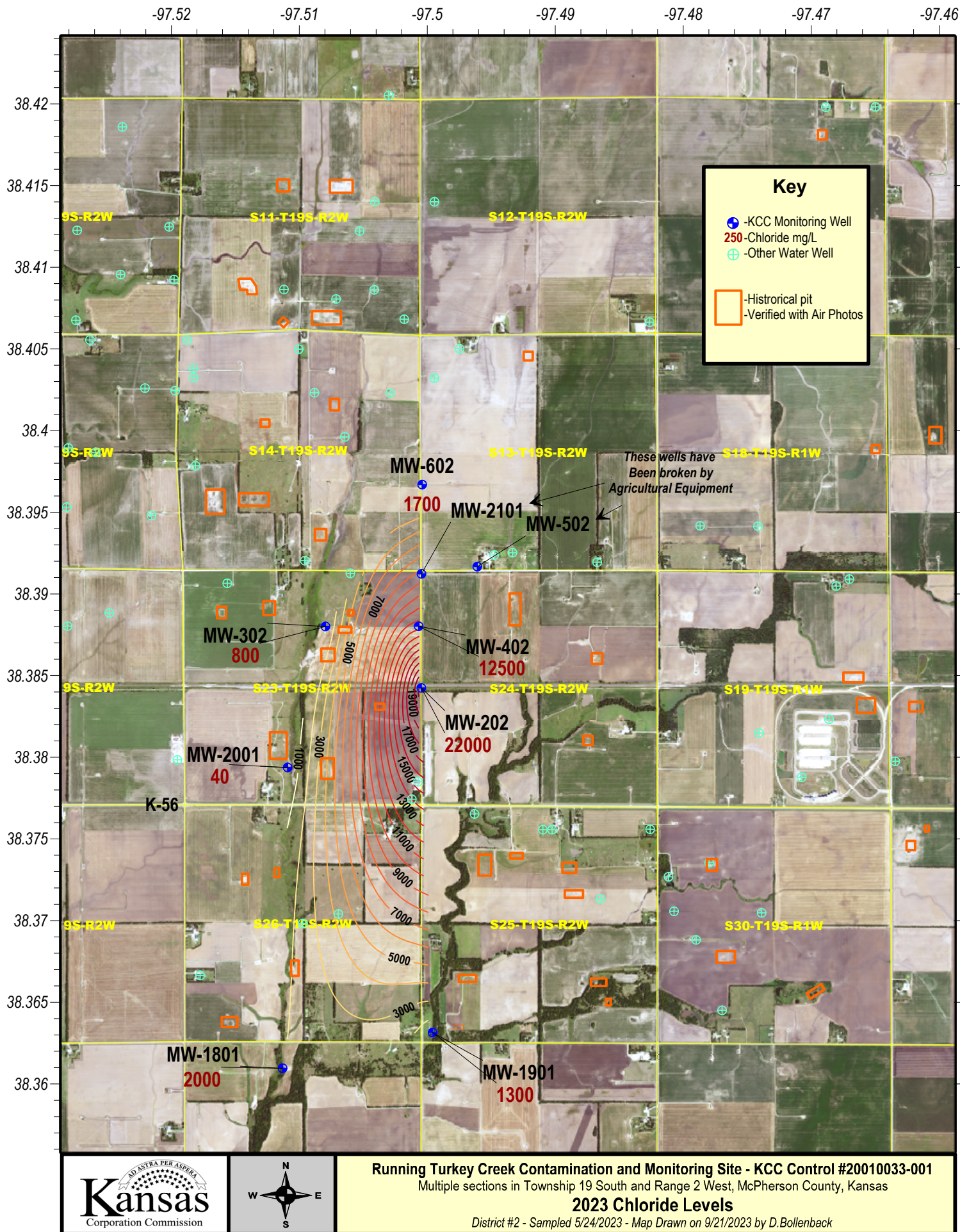
Target: 500 mg/l

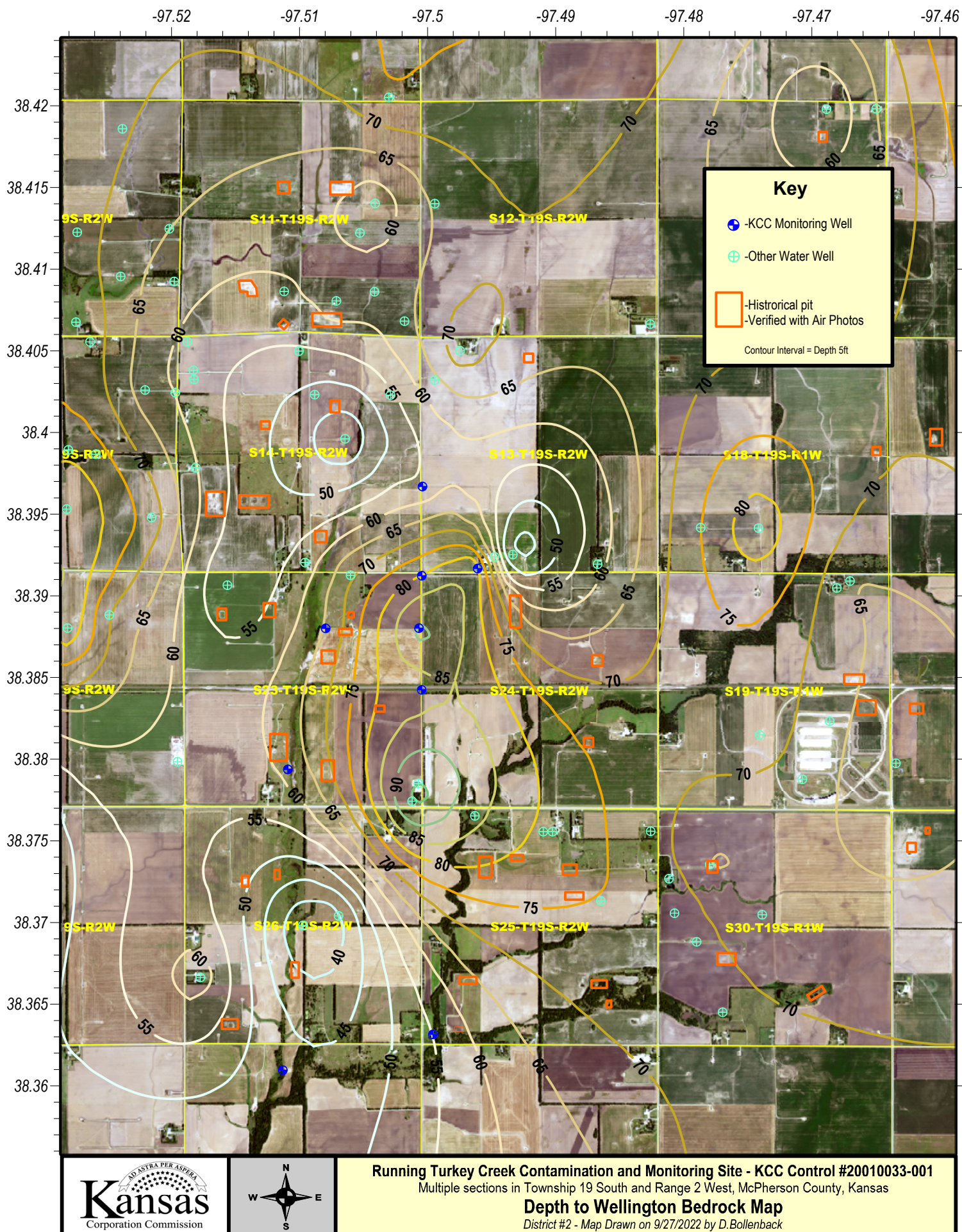
Recommendation for Future Works: KCC recommends the continued annual monitoring of the site as the highest chlorides are still over 20,000 mg/L chlorides. The Running Turkey Site is the right candidate for a remedial withdrawal system with high chloride values. Unfortunately, it would be a substantial economic expense for future operation and management. KCC continues re-evaluating the monitoring well installation project and looking for alternative locations that benefit the chloride investigation. It is unclear if the downgradient plume is related or if more sources are south of the main plume. KCC is investigating the installation of additional protective equipment around current and future monitoring wells, especially near agricultural fields.

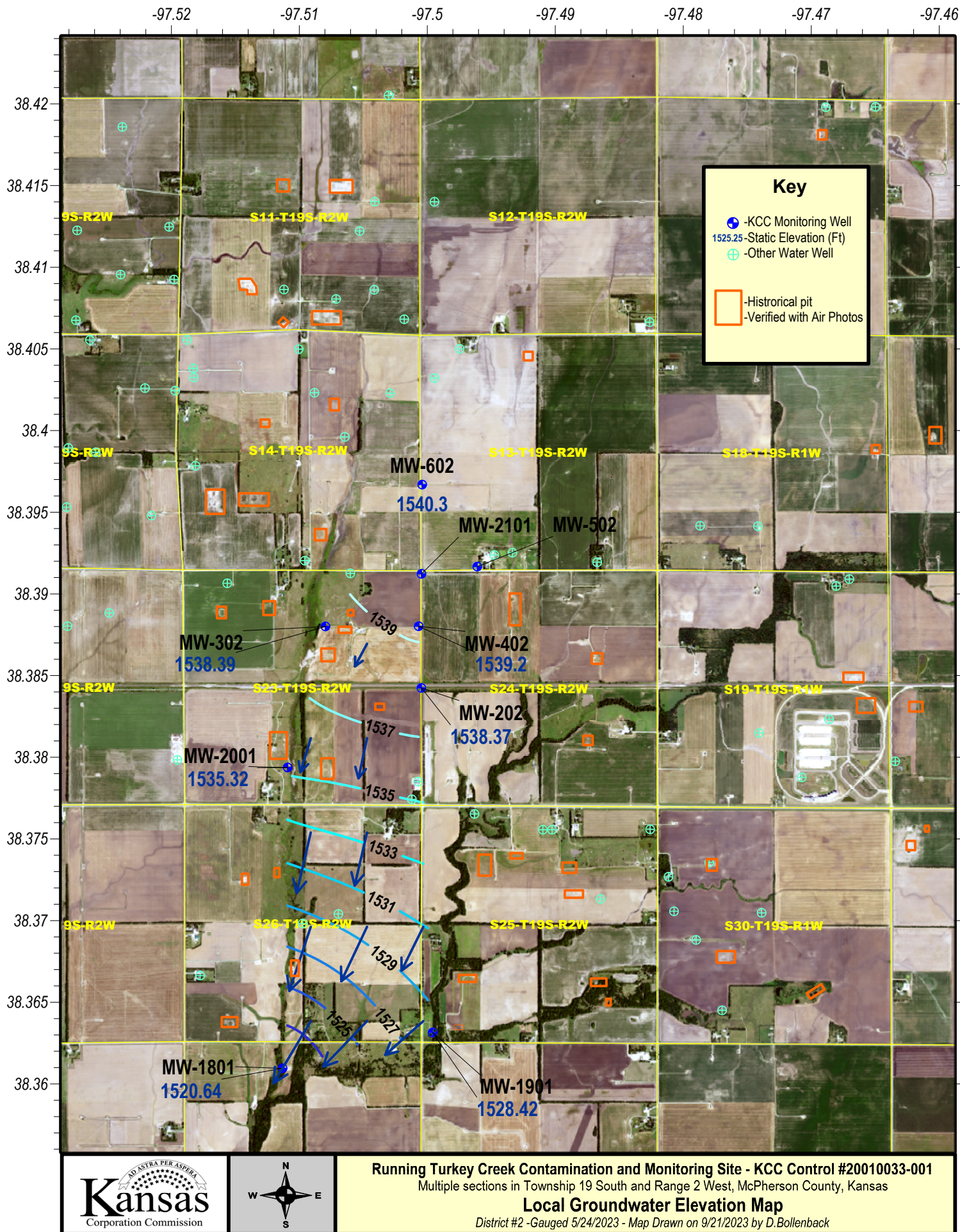
Estimated Total Cost: Annual sampling and research should be approximately \$1,000. Installing more monitoring wells would range from \$20,000 to \$30,000. The planning and building of a remedial recovery system could cost over \$250,000, depending on whether a new disposal well must be drilled or a good workover candidate is identified.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
20010033-001	22 Hrs. / \$742.69		\$61,603.07
Current Contaminate Level: 40 mg/l Cl⁻ MW-2001 to 22,000 mg/l Cl⁻ MW-202 (Aquifer)			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	









Project: Selzer-Bitikofer Contamination Site, McPherson County, District 2

Site Location: The Selzer-Bitikofer Site is two miles east and 2 miles south of Canton, McPherson County, Kansas, centered approximately at the corner of Iron Horse Road and 29nd Avenue, in Sections 35 and 36, Township 19 South, Range 1 West, and sections 1 and 2, Township 20 South, Range 1 West. The Selzer-Bitikofer resides in agricultural fields, pastures, and residences.

Impact/Immediacy: The site affects West Emma Creek and local groundwater. KCC set the immediacy level of the site as moderate.

Site Description: Geologically, the site is located on the far eastern edge of the Lower Arkansas River basin and is characterized by fine-textured soil with a silty clay loam surface and a healthy clay pan development. Sediments at the site consist mainly of unconsolidated Pleistocene deposits of the McPherson Formation (KGS bulletin 79). The immediate area is topographically flat, with slopes of 0-3 percent. Based on the site evaluation, the underlying material to a depth of approximately 35 feet consists primarily of stiff clay or sandy clay, overlying fine to coarse sands of varying thickness. The sand member underlies an impermeable dense clay layer consistent throughout the site. Bedrock consists of the Kiowa Shale Formation and lies approximately 50-70' below the ground surface (KGS Bulletin 79). There are no documented encounters with Bedrock during site activities for verification.

The groundwater flows within the perched aquifer to the south and southwest before turning west, approaching West Emma Creek. The principal water-bearing formation in the subject site area is thin, unconsolidated sand between clay layers. This sand varies from fine to coarse-grained and pinches off in some locations. Based on information from the Kansas Rural Water Association, the subject site area has access to the Marion Rural Water District (RWD) #4. However, not all farms have connected water services, including the Bitikofer Farm. Based on information from the KGS WWC5 Database, no public water supply (PWS) wells are within one mile of the subject site. There are three domestic wells (Bitikofer, Selzer, and Huebert) within a ¼-mile from the subject site, but there could be unregistered and other water wells in the area.

KCC investigations have shown that the southern contamination may be from a legacy evaporation pit east of the Klaassen homestead. Geoprobe borings indicate the pit, including the drainage, leaving the pit location to West Emma Creek as the source. In addition, other chloride plumes in the north of the site need investigation. Other possible sources include unproperly plugged wells, legacy evaporation and workover pits, and historical spills.

Unusual Problems: An aggressive withdrawal system could dry the local water wells and West Emma Creek. Currently, there are no monitoring wells capable of delineating the multiple plumes.

Status of Project: On October 2, 2023, four groundwater monitoring wells (MW-1, MW-5, MW-6, and Klaassen East) and the Bitikofer House well were sampled by the KCC field staff. The Klaassen West Well remains damaged by agricultural equipment. MW-7 was nearly dry, with only inches of water in the bottom of the well. MW-3 and MW-4 are broken below the ground surface and are no longer viable monitoring wells. KCC gauged the water level this year and found the groundwater levels to be much lower due to the drought that is occurring in the region. All Selzer Site monitoring wells were analyzed to be above 500 mg/L chlorides, ranging from 1,052 to 4,245 mg/L. Chloride levels could be affected by the lack of moisture during 2022 and 2023. The farthest eastern well, Klaassen East, increased chlorides by 445 mg/L over the last year. All other monitoring wells had slight decreases from 2022. MW-7, across the creek from the additional monitoring wells, and the main plume did not have enough water to sample. MW-7 tested to be 1,825 mg/L chlorides in 2022. The Emma Creek was dry save for sporadic pools of standing water and could not be sampled this year.

The Bitikofer House water well tested at 140 mg/L chlorides, a decrease of 235 mg/L from last year. However, this well has shown chloride results lower than the KDHE RSK value of 250mg/L in 2021. These lower levels are a good sign for the Bitikoter Farm, but there are still high chlorides to the north and east. The House has been as high as 600 mg/L in the past. The spring in the Bitikoter pasture was dry with only mud and could not be sampled. This spring resides in the drainage that transverses the site's northern part and contains many healthy turtles, fish, and other biotas. KCC has put together an initial work plan for additional monitoring wells at the Selzer-Bitikofer site if needed for future work.

Level of Remediation Sought:

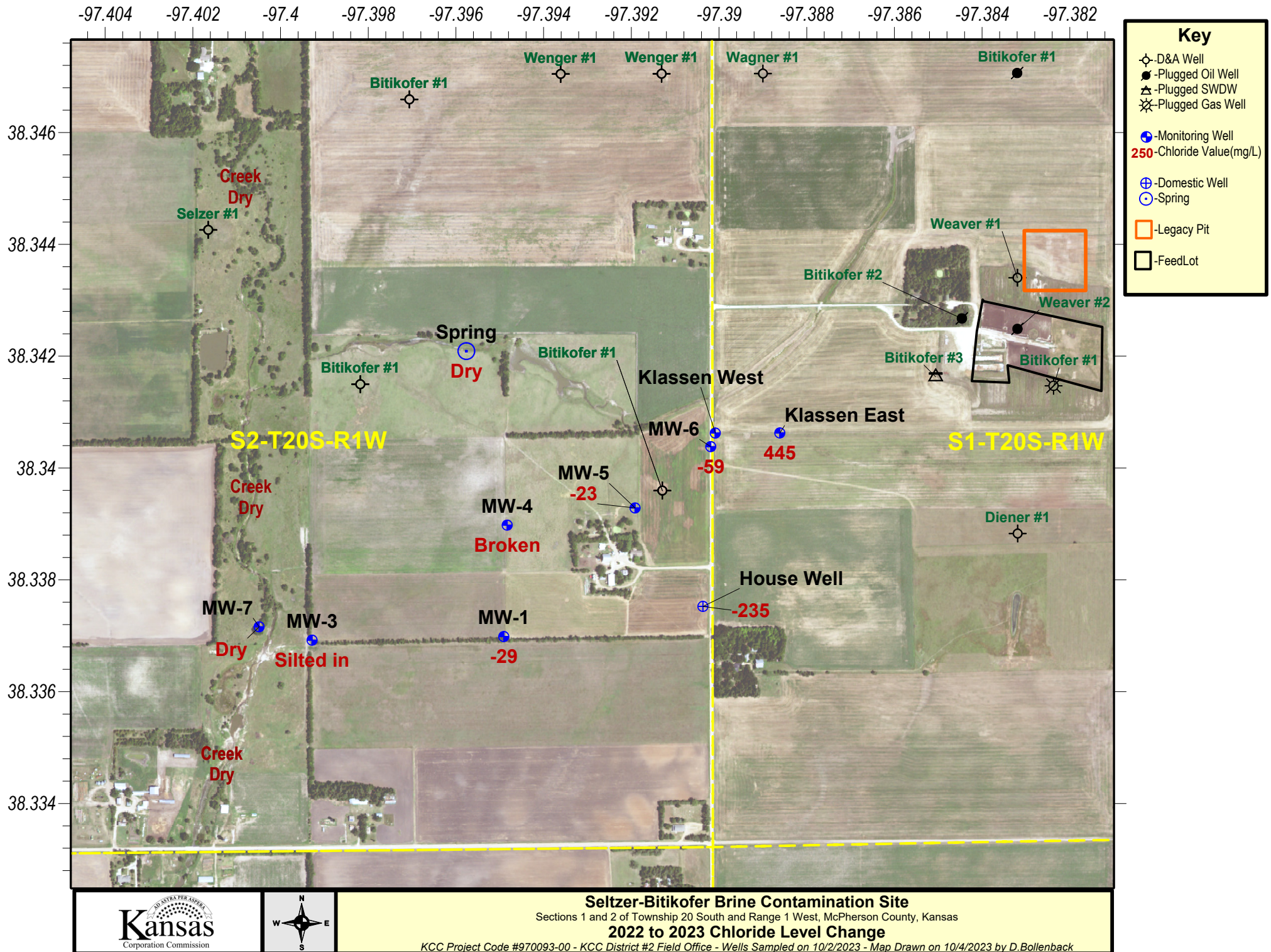
Ideal: 250 mg/l Chloride

Target: 500 to 750 mg/l Chloride

Recommendations for Future Work: Four monitoring wells are no longer usable at the Selzer site, therefore KCC has started a written scope of work to install multiple monitoring wells and investigatory borings. With elevated chlorides in most wells surrounding the Bitikofer house well, KCC recommends installing new monitoring wells within the next two years. KCC recommends the installation of these new monitoring wells to the north and east of the current well matrix. Replacement of internal plume delineation wells that are no longer usable is also warranted. These new wells are necessary to delineate and predict the future of the chloride migration at the Selzer Site. A deep soil boring down to the Kiowa Shale would be beneficial to increase our knowledge of the local geology. Some historical oil and gas wells in section 36, north of the site, could be uncovered and investigated for plug integrity.

Estimate Total Cost: Moving forward with additional monitoring, well installation could cost around \$50,000, but this depends on the number of new wells. Continued monitoring would cost from \$1,000-1,200. Plugging old monitoring wells would cost \$500 for grout, equipment, and staff time.

Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
970093-00	14 Hrs. / \$437.04		\$12,133.50
Current Contaminate Level: 140 mg/l (House Well) to 4,245 mg/l Cl ⁻ (Klassen East)			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Project: Voshell Site, McPherson County, District 2

Site Location: The Voshell site includes a portion of the Voshell Oil Field and a large area between Elyria and Moundridge, Kansas. Parts of Townships 20 and 21 South and Ranges 2 and 3 West are within the Site boundaries.

Impact/Immediacy: Impact is on the shallow Equus Beds underlying the Voshell Oil Field, which has been affected by elevated chloride levels. Resources impacted include domestic and irrigation wells. Therefore, KCC has classified Voshell as a high-level site.

Site Description: The land surface is flat irrigated farmland, dissected by Dry Turkey Creek and Running Turkey Creek. The aquifer ranges in thickness from forty feet east of the site area to approximately two hundred feet west. The relatively thick McPherson channel axis can be mapped from the center of Section 31, T21S, R3W to the NW corner of Section 19 to the center of Section 5 and then northward from that point. The aquifer contains several aquitards, which may or may not be continuous throughout the area. In May 2004, the Kansas Corporation Commission (KCC) and the Equus Beds Groundwater Management District No. 2 (GMD 2) agreed to drill ten groundwater monitoring wells in the Voshell oil field. The GMD 2 is responsible for water sampling and providing water quality data to the KCC regarding those wells. The initial seven wells were drilled north to south through the project area, and the Wellington shale bedrock was intercepted. In addition, KCC moved approximately 21 wells associated with the Running Turkey Creek site to the Voshell site's control number in 2012.

Unusual Problems: The movement of the chloride plume toward irrigation wells can be somewhat accelerated by the effect of extensive irrigation well pumping. The plume continues to migrate toward the McPherson channel west of the Voshell Oil Field. In addition, new irrigation wells are often drilled in the immediate area, which can cause the plumes' erratic hydraulic movements.

Status of the Project: KCC staff sampled the Voshell monitoring wells on August 7 and 8, 2023. The known plumes appear to have slowly moved to the southwest historically. The KCC has been performing water record research into the area west of the site, including building a bedrock map. New monitoring wells are planned with GMD#2 to delineate the plumes to the west at some point. Chloride levels decreased throughout the Voshell site's main body and northeastern area. The western EB monitoring wells had modest chloride drops this year, saving EB-306 and EB-307, which rose very slightly. In the middle of the Site at MW-601, chloride increased by 415 mg/L in 2021 but has dropped by 460 mg/L this year. Last year's sample may have been a bust or just a tiny pocket of chlorides passed through during 2021-22. It is now back at the previously stable lower levels but future sampling will allow for a better determination of the changes over the last two years. The northeastern wells are shallower than the southwestern region of the site. Therefore, they are most likely affected by precipitation, with the influx of freshwater potentially moving chloride-impacted water down the gradient. The highest chloride plume centered around MW-1502 had another decrease this year, but MW-105 increased by 300. MW-105 could be intercepting chlorides from MW-1502.

Hydrological data shows the overall groundwater movement to the west-southwest. KCC has no data west of the western line of monitoring wells to evaluate plume migration past the EB wells. However, research indicates that bedrock drops quickly west of the EB Wells. KCC hydrological data indicates the area has been severely affected by the recent drought, with water levels over one foot lower than last year.

Level of Remediation Sought:

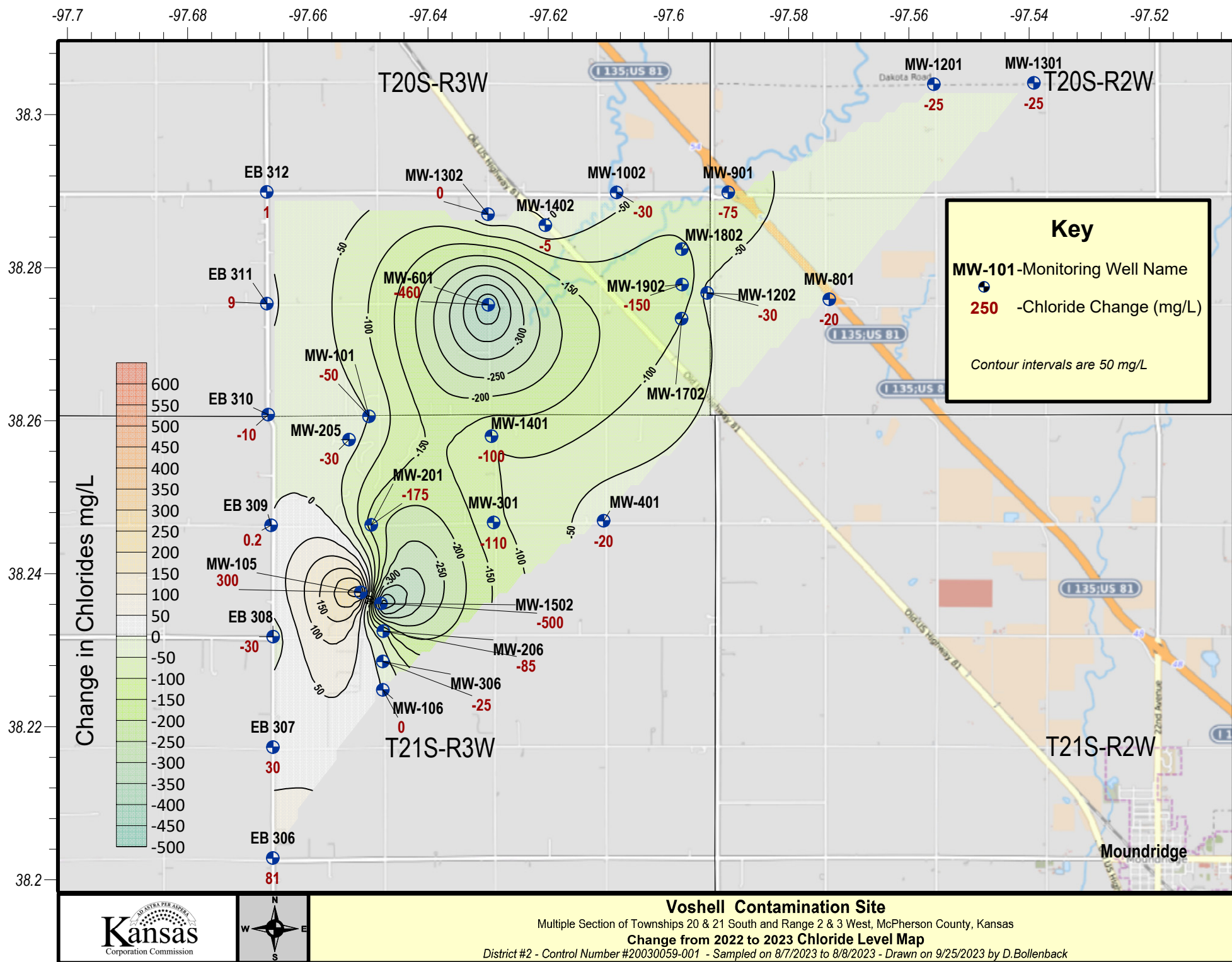
Ideal: 250 ppm Chloride

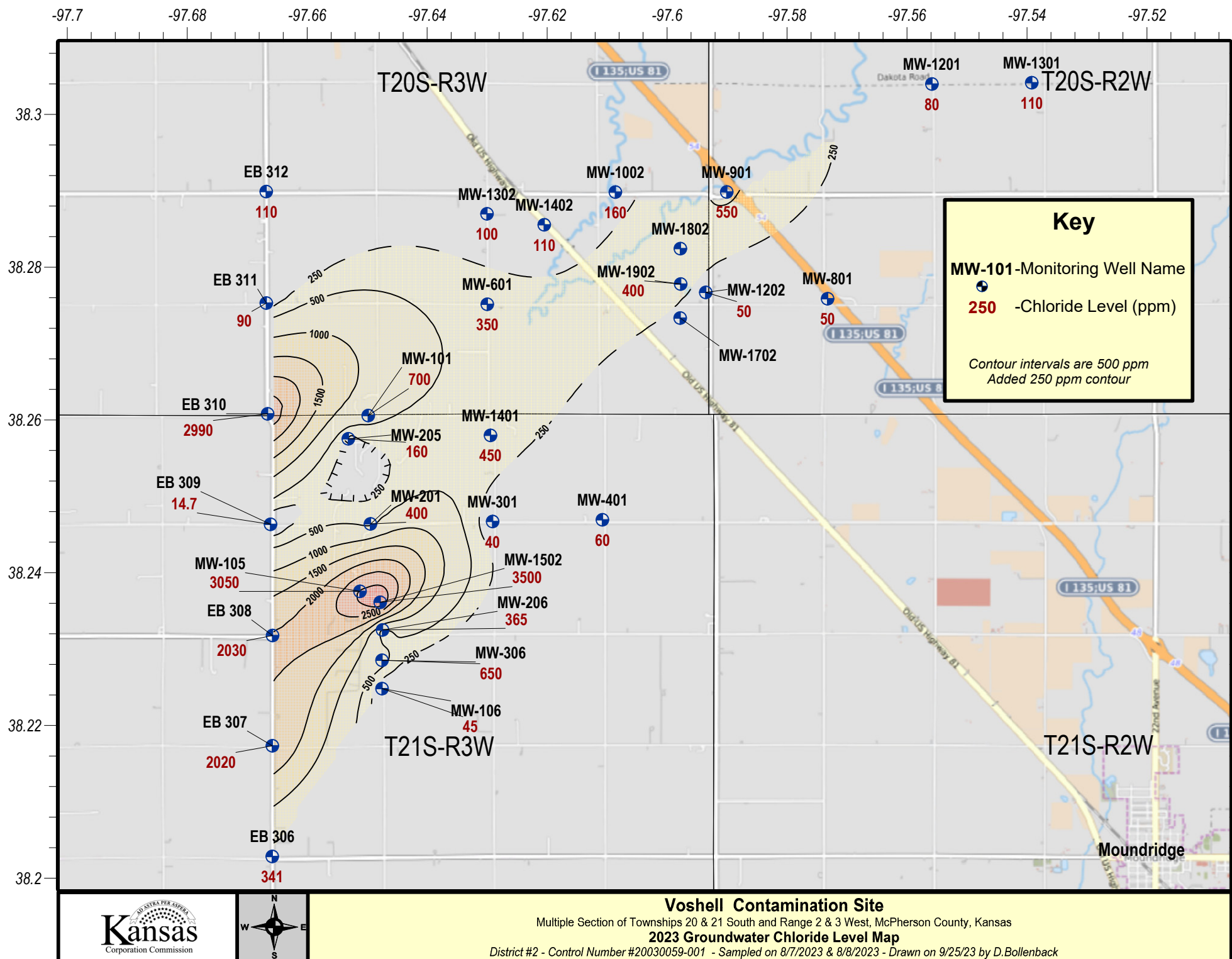
Target: 500 ppm Chloride

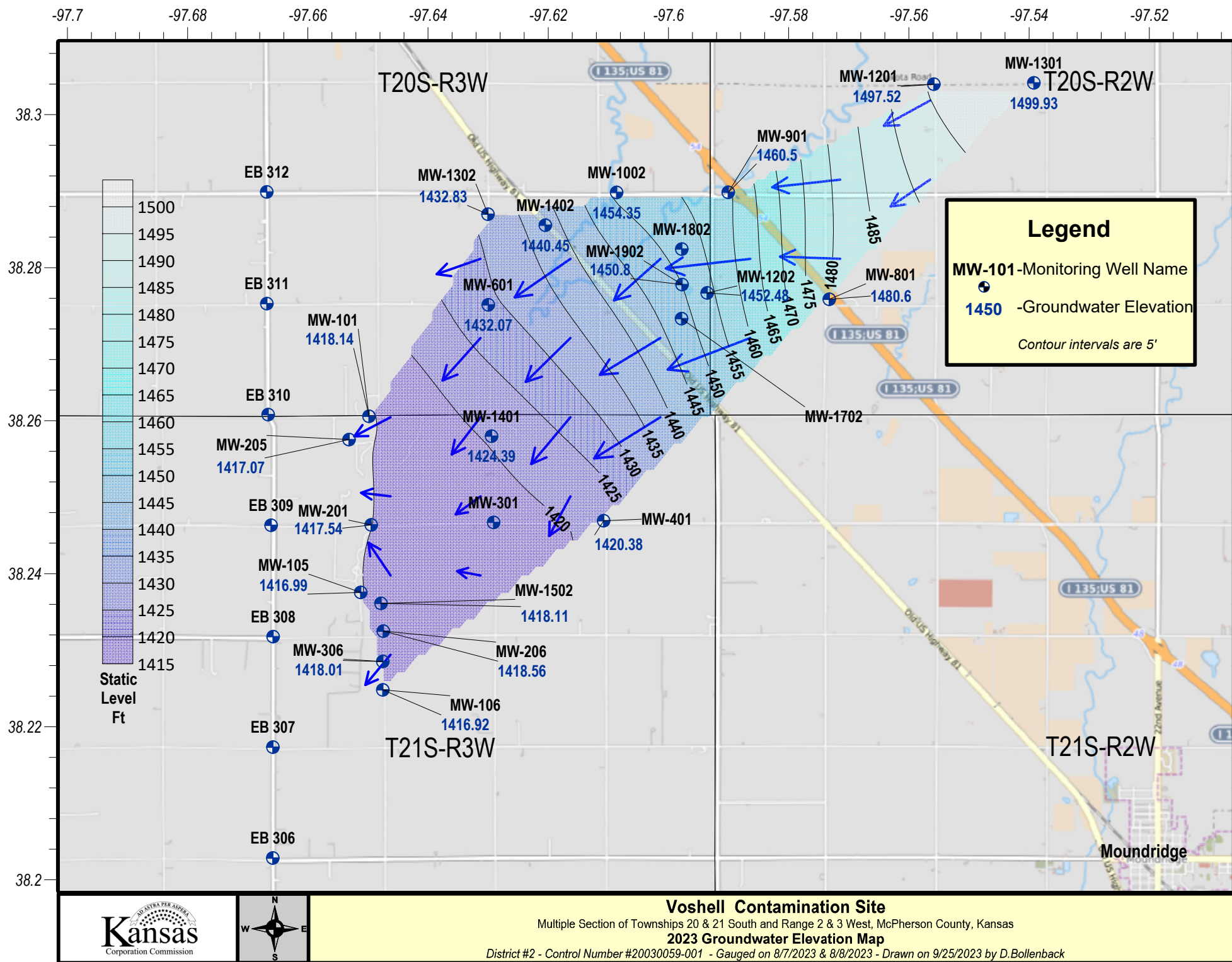
Recommendation Future Work: KCC has discussed with GMD #2 about adding additional monitoring wells on the west edge of the site. Adding other monitoring wells is becoming increasingly critical, with high chlorides in some EB wells. Plume delineation within the site boundaries is also recommended, especially around known high-chloride plumes. KCC and GMD#2 could work together on well locations for new wells for appropriate placement. KCC continues to sample the Voshell monitoring wells and fund the sampling of the GMD2 EB monitoring wells. KCC plans to put together a multiple-well installation scope of work with the assistance of GMD#2 within the next two years. A remedial system cost would be very high, and chloride levels are not high enough for effective improvement via a removal system.

Estimated Total Costs: The cost of funding fieldwork on sampling should be approximately \$1,000-1,500. Office research into expanding the monitoring well network costs staff time only. KCC believes a cost estimate of \$50,000 to \$100,000 is needed to install new monitoring wells to delineate the site, depending on the number of wells installed.

Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
20030059-001	49 Hrs. / \$1,614.10	\$311.15	\$22,012.73
Current Contaminate Level: MW 1502 – 3,500 mg/L			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long-Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	







Project: *Fowler Contamination Site, Montgomery County, District 3*

Site Location: NE/4 of Section 19, Township 32 South, Range 14 East, Montgomery County.

Impact/Immediacy: Impact is to the soil. The immediacy is rated as low.

Site Description: Site is located below an old three-cell storage/settling pond.

Unusual Problems: Access to dependable sample locations and lack of monitoring wells.

Status of Project: Monitoring of a small creek running through project area. The Fowler lease was approved for a Fee Fund Project in the fall of 2000. Approximately 112 wells were plugged by the end of the project. No surface water samples were collected in 2023 due to dry conditions. The small creek was inspected on September 11, 2023, and no surface water was observed in the creek. Brine impacted areas continue to show significant improvement of vegetative growth as shown on 2022 aerial imagery.

Level of Remediation Sought:

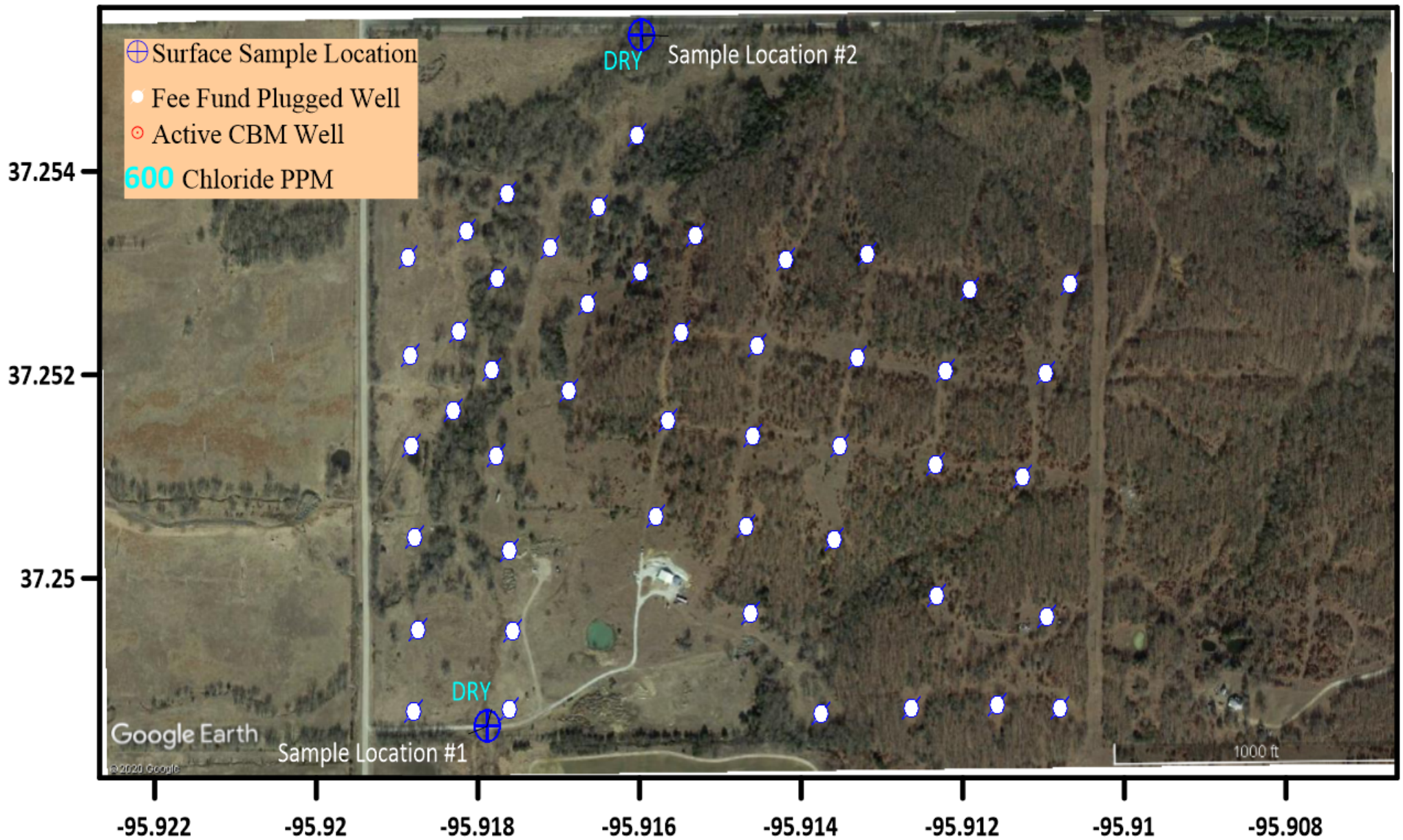
Ideal: 200 ppm Chloride


Target: 300 ppm Chloride

Recommendation for Future Work: Future work on this site will consist of post remediation monitoring. Brine impacted area below old 3 cell storage pit has successfully been remediated and landowner has filled the eastern third with construction debris consisting of soil, rock, and asphalt. The property to the South will be further investigated for potential buried well locations that have not been discovered.

Estimated Total Costs: Monitoring cost approximately \$1,500 per year.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970046-00	9 Hrs. / \$283.43		
Current Contaminate Level: 400 ppm Cl- to 1300 ppm Cl- (2022)			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input checked="" type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	





Fowler Remediation Site


NE 19-T32S-R14E Montgomery County, Kansas

2023 Surface Water Chloride Levels - District #3 Inspected 09/11/2023

No Samples Collected, Dry Creek Conditions

Map Drawn on 09/12/2023 by J. Shaffer

Project 970046-00



Project: Mantooth Contamination Site, Montgomery County, District 3

Site Location: Section 20 & 29, Township 33 South, Range 14 East, Montgomery County.

Impact/Immediacy: Impact is to surface water and groundwater. The immediacy level is rated as moderate.

Site Description: The initial investigation began in May of 1996 by personnel from the Chanute Office, in response to a complaint of brine in Deer Creek. At that time the site consisted of an abandoned oil lease with as many as 41 abandoned well locations, some of which were leaking brine at or near the surface and effecting both surface water and groundwater resources. The site is situated immediately north of Deer Creek, a tributary of the Caney River in the Verdigris River Basin. In the spring of 1999 funds were approved for the excavation of abandoned well sites on this property. During that investigation 25 abandoned wells were confirmed and referenced by GPS.

Unusual Problems: Lack of detailed lease data concerning the number and location of wells drilled in the area is a significant problem in properly and completely assessing potential contaminate source areas for this site. However, to date there have been 25 wells plugged in 1999 and an additional 10 wells in 2013. There are also several potential sources being investigated outside the physical lease boundaries of this site.

Status of Project: The Primary Fee Fund Project for this site was completed in the summer of 2000. Twenty-five abandoned wells were plugged. In 2012 the area of interest was expanded resulting in the discovery and plugging of an additional 10 wells in 2013. Data gathered from the well plugging operations and monitoring well sampling indicates that the source of the saltwater plume is most likely located in the south half of the project. RedBud Oil & Gas Operating, LLC is the current operator of the coal bed methane wells located on the project site. Leases immediately bordering this site are being inventoried and referenced by GPS to identify further environmental threats outside the original area of concern. The overall Cl- concentrations are still trending down, but MWE 04 continues to show noticeable fluctuations in Cl- concentration ranges. Six additional monitoring wells were completed in early 2012 to further evaluate the extent and to help determine the possible brine source. The following are the Cl- concentrations for this year's sampling:

	<u>MWE 01</u>	<u>MWE 02</u>	<u>MWE 03</u>	<u>MWE 04</u>	<u>MWE 05</u>	<u>MWE 06</u>	<u>MWE 07</u>
<u>09/20/2023</u>	2800 ppm Cl-	1700 ppm Cl-	1600 ppm Cl-	6100 ppm Cl-	400 ppm Cl-	600 ppm Cl-	500 ppm Cl-

Level of Remediation Sought:

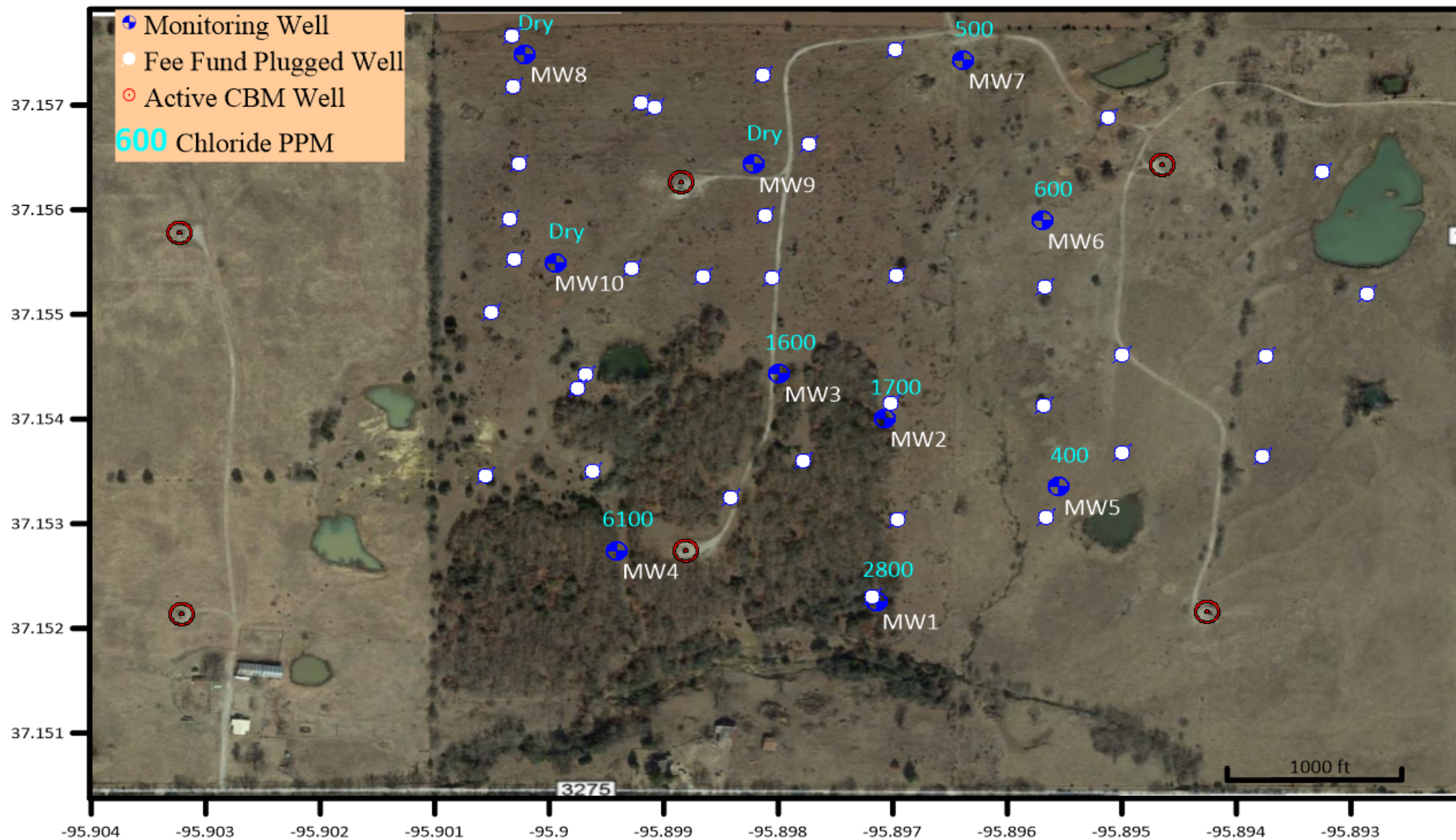
Ideal: Less than 250 ppm Chloride

Target: 500 ppm Chloride

Recommendation for Future Work: Continue monitoring to verify whether plugging of the existing abandoned wells eliminates the current source of saltwater contamination within the ground and surface water in the project area. Future work will be based upon the results of the sample analysis of the monitoring wells and Deer Creek. There have been 20 new CBM wells and associated SWD wells drilled in the last few years in sections 20 & 29. The new ability to download and overlay historic aerial imagery will be utilized to help identify undocumented well locations within and near the site boundary. Possible well locations that are referenced on a recently discovered historical lease map of the site area will be investigated in the future.

Estimated Total Costs: Fee Fund Plugging of 10 abandoned wells cost \$77,926.

Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
980058-001	19 Hrs. / \$590.65		\$17,349.00
Current Contaminate Level: 400 ppm to 6,100 ppm Cl- Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Mantooth Remediation Site

Sec 20 & 29-T33S-R14E Montgomery County, Kansas

2023 Groundwater Chloride Levels - District #3 Sampled 9/20/2023

Map Drawn on 9/22/2023 by J. Shaffer

Project 980058-001



Project: Smith Finn Contamination Site, Morton County, District 1

Site Location: Legal location is SE/4 of Section 8, Township 34 South, Range 43 West, in Morton County.

Impact/Immediacy: The impact is to a house domestic well, which has exhibited high chloride levels. The original PRP (Anadarko) drilled a new domestic well in January of 1989. This site has a moderate immediacy level.

Site Description: The project consists of a localized pollution of the groundwater in the Ogallala Formation. The area is on the south edge of the high plains as the terrain begins to break downward to the Cimarron River valley, which is located one and one-half miles to the south.

Unusual Problems: The threat of contaminated groundwater moving from the Smith-Finn property to land owned by the BLM. Multiple sand layers with different levels of contamination.

Status of Project: On October 16, 2020, PRP spudded on a new SWD well for the recovery system. After the work and permitting was completed, the recovery system was restarted in April of 2021. PRP consultants are cycling pumping operations between two wells at a time and determining the most effective use of the recovery system. Overall, the chlorides have remained consistent since previous sampling events.

Level of Remediation Sought:

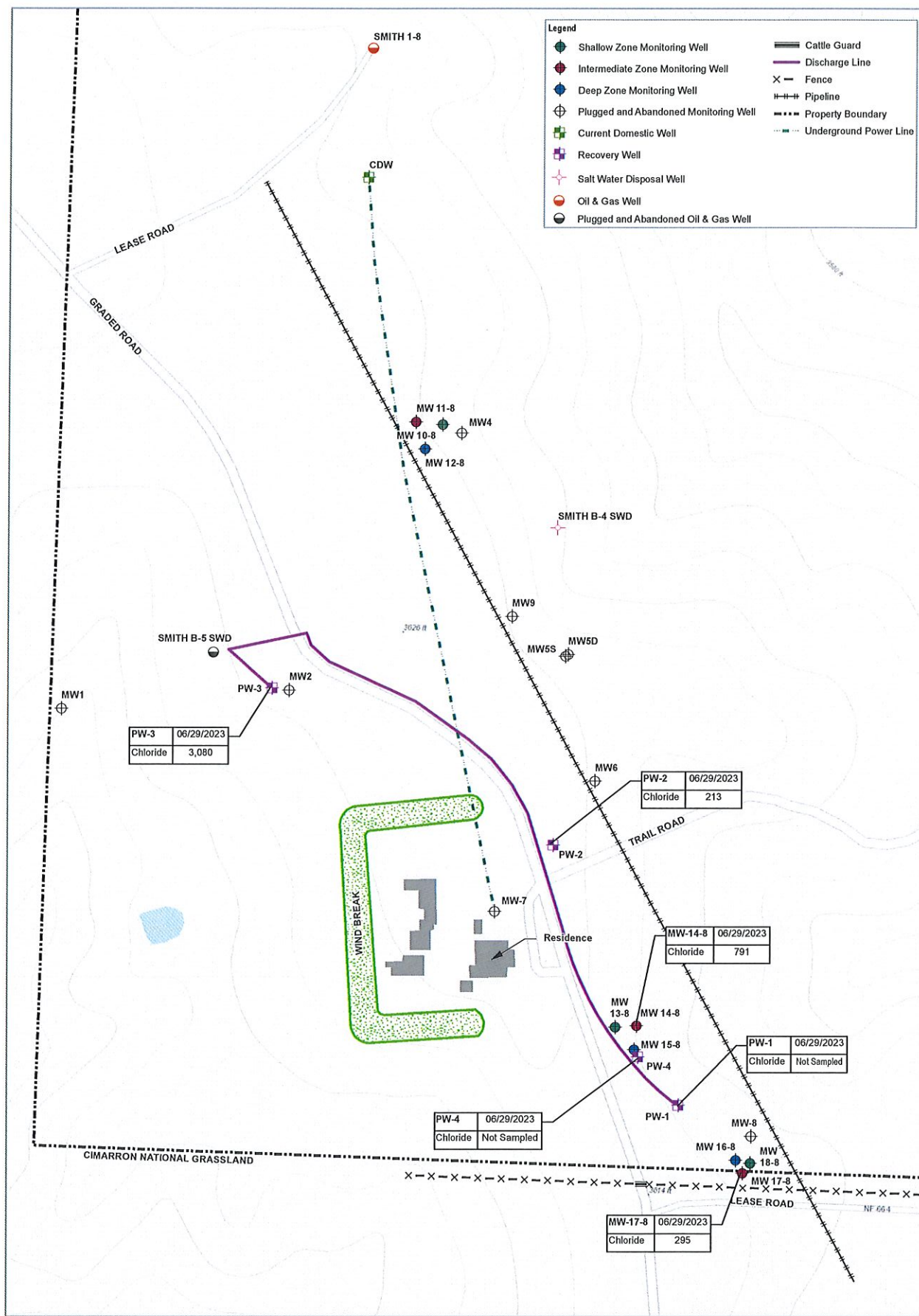
Ideal: 250 ppm Chloride

Target: 500 ppm Chloride

Recommendation for Future Work: Consultants will continue to sample quarterly. They will continue to simultaneously pump two wells at a time and alternate every three months.

Estimated Total Costs: \$200,000 for RP.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970095-00	3 Hrs. / \$99.10		
Current Contaminate Level: 213 ppm Cl- to 10,200 ppm Cl-			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input checked="" type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input checked="" type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Project: Brazil Contamination Site, Neosho County, District 3

Site Location: Section 27, Township 28 South, Range 18 East, Neosho County.

Impact/Immediacy: Chloride contamination at this site has verified impacts to both surface water and soil resources with a strong potential for ongoing impact to groundwater resources. The immediacy level is rated as low to moderate for water resources and low to moderate for soil resources.

Site Description: The site consisted of an abandoned oil lease with 30 abandoned wells. Surface runoff over areas of past brine spillage and near surface leakage from abandoned wells is affecting both surface water and soil resources. The surface drainage through this lease is a minor tributary to the Neosho River, which is a public water supply source.

Unusual Problems: None.

Status of Project: The Fee Fund Plugging Project for this lease was completed in early spring of 1999. Twenty-three wells were plugged while seven of the wells were determined to already have been plugged. River Rock Operating is the current Operator of the CBM wells. Post Rock (previous Operator) plugged an additional break out well in 2006. Four new monitoring wells were constructed in early 2012. These wells were specifically located to further determine the extent and possible source area of the chlorides impacting the area groundwater and surface soils. This property was leased by Post Rock and seven new gas wells have been drilled in this section since 2006. Two additional surface casing only wells that were cut off below surface were discovered and then plugged in 2018. The following sample results were obtained this year:

	<u>MWE 01</u>	<u>MWE 02</u>	<u>MWE 03</u>	<u>MWE 04</u>
<u>09/21/2023</u>	<u>1000 ppm Cl-</u>	<u>900 ppm Cl-</u>	<u>500 ppm Cl-</u>	<u>1100 ppm Cl-</u>

Overall CL- concentrations remain consistent with a gradual downward trend from the project initiation.

Level of Remediation Sought:

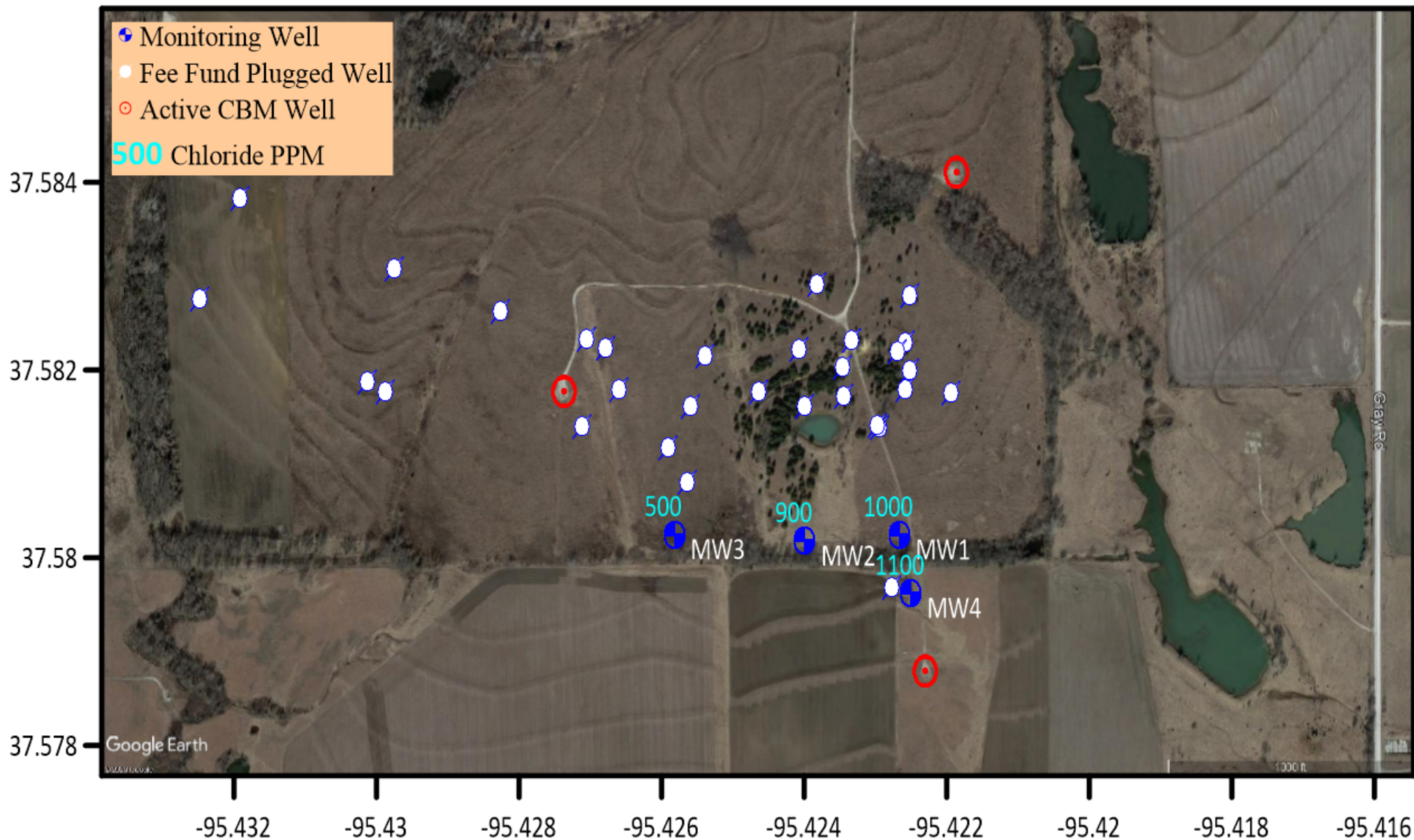
Ideal: 250 ppm Chloride

Target: 500 ppm Chloride

Recommendation for Future Work: Future work at the site will include correlation of KGS well information with data collected from monitoring wells, google earth imagery, historical documents and focused metal detector surveys. The sampling of constructed monitoring wells will continue and possible construction of additional monitoring wells may be necessary. Additional field work will be performed to locate possible unplugged abandoned wells or old wells in which the initial plugs have failed along with utilizing the new ability to download and overlay historic aerial imagery. This information will assist in determining the location and extent of the brine impact.

Estimated Total Cost: Plugging cost for this site totaled \$57697.10. Monitoring Well Construction completed in early 2012 totaled \$8,196.00.

Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
990040-001	17 Hrs. / \$529.21		\$10,791.18
Current Contaminate Level: 500 ppm to 1,100 ppm Cl-			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Brazil Remediation Site

E1/2 27-T28S-R18E Neosho County, Kansas

2023 Groundwater Chloride Levels - District #3 Sampled 09/21/2023

Map Drawn on 9/22/2023 by J. Shaffer

Project 990040-001



Project: *Enoch Thompson Contamination Site, Pawnee County, District 1*

Site Location: Legal location is NW/4 Section 17, Township 21 South, Range 20 West, Pawnee County.

Impact/Immediacy: Stock well was damaged by chlorides from a line leak found near the SWDW. An irrigation well is located to the southwest of the site in the direction of the plume flow. Potential responsible parties drilled one recovery well and a replacement stock well in October 1988, thereafter the chlorides of which dropped through the years. The site is rated moderate to low in immediacy.

Site Description: The contamination is confined to a narrow alluvial scour channel filled with sandy gravel and silty clay. The high concentrate of brine water moved from the source area in the north to the south and contaminated Mr. Thompson's stock well.

Unusual Problems: None.

Status of Project: Three groundwater samples were collected in 2023. Chloride levels saw a moderate decrease across the site during this sampling event. The recovery system has been down since 2003 following P&A of the disposal well due to wellbore problems. KDHE-1, which has historically been the highest in terms of chlorides, was destroyed December 2003. The chloride plume continues to be localized in a relatively small area of alluvial scour between the recovery well and the plugged disposal well. It is unlikely that without the recovery well operational, the site will see any significant change in chlorides.

Level of Remediation Sought:

Ideal: 250 ppm Chloride

Target: 1000 ppm Chloride

Recommendation for Future Work: Continue groundwater sampling on an annual basis to monitor movement of chloride plume through the area. Should a disposal well be drilled nearby, the feasibility of restarting the recovery well should be evaluated.

Estimated Total Cost: \$500 for yearly sampling.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970044-00	6 Hrs. / \$187.84		
Current Contaminate Level: 240 ppm Cl- to 1,900 ppm Cl-			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	

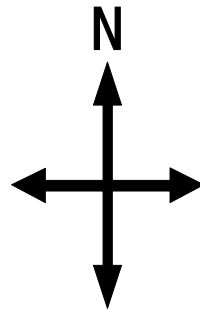
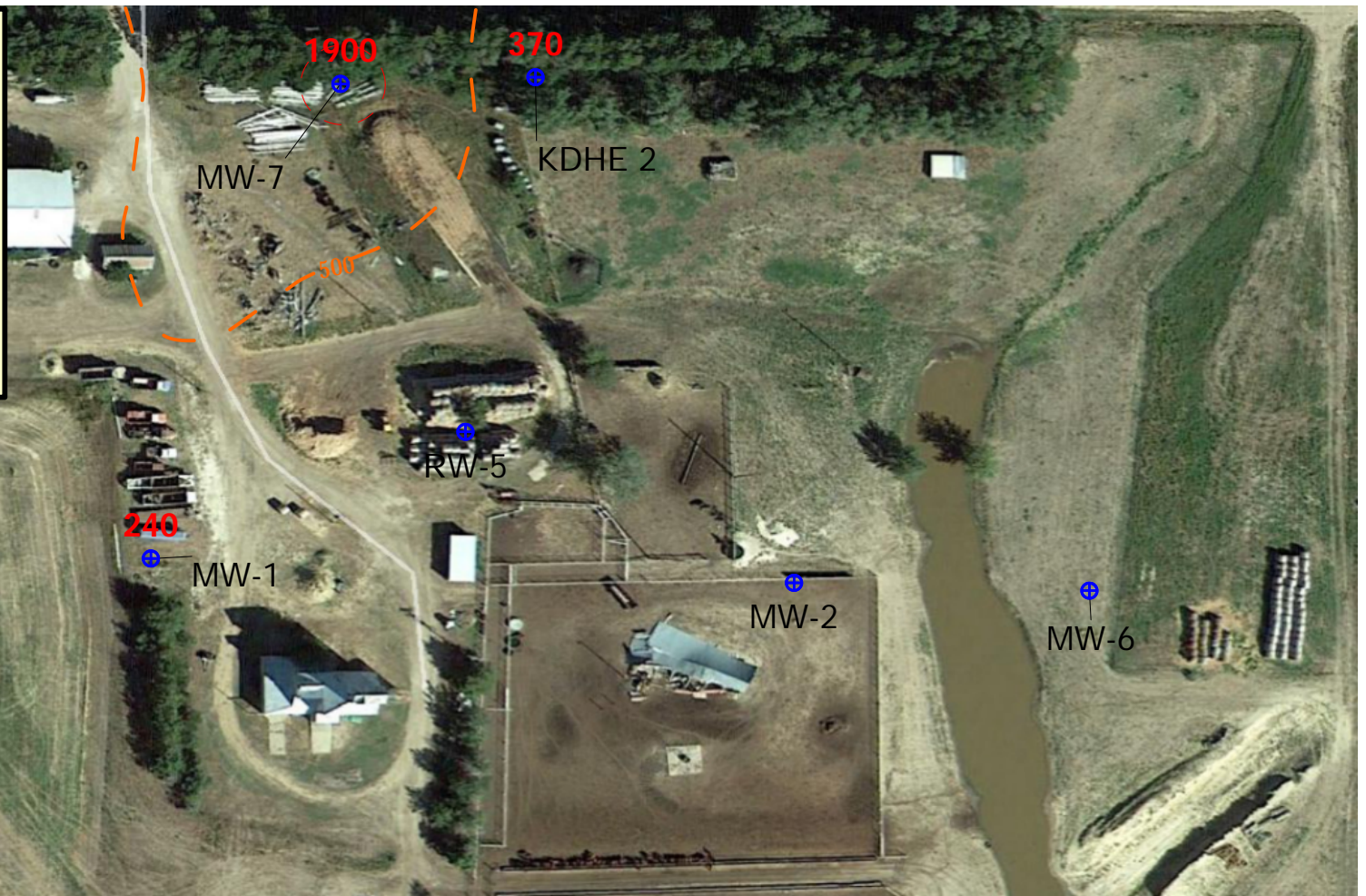
Legend and Comments

250 - Chloride Concentration (mg/L)

⊕ - Monitoring Well

MW-1 - Well Number

Wells sampled 5/11/2023



Enoch Thompson Site

Section 17-T21S-R20W
Pawnee County, Kansas

2023 Area Map with Chlorides

KCC Control # 970044-00 District 1
N. Feldkamp 9/18/2023

Project: Macksville Contamination Site, Pawnee County, District 1

Site Location: Legal location of the site is in the S/2 SW Section 30, Township 23 South, Range 15 West, in Pawnee County.

Impact/Immediacy: An irrigation well is located in the NE/4 of this section which is in direct line with the natural flow of the groundwater. A new irrigation well was drilled and is being used to irrigate corn. Sampling shows that while the water in the well has been impacted, the water is below drinking water standards. The sinkhole itself seems to be growing to the north. Immediacy level is rated at Moderate-High due to the growing sinkhole.

Site Description: A sinkhole developed around an abandoned salt-water disposal well on July 21, 1988. Brine from the old well and possibly other sources entered the freshwater aquifer. The aquifer consists of sand and gravel overlying the Wellington Formation of Permian age. The salt-water plume is being monitored by six wells. The plume is moving to the northeast from the sinkhole area towards an irrigation well.

Unusual Problems: Ground usage is lost over several acres due to the development of the sink. The depression is still increasing in size.

Status of Project: Samples were collected from five monitoring wells and the pond in 2023. Chlorides overall saw a decrease with the 2020 event. Chlorides at this site are below ideal water level standards in all wells except two. Overall, the chlorides at this site have been steadily declining due to natural attenuation but will likely remain elevated over background chlorides due to the higher chlorides that still reside in the pond formed by the sink, which are at 1,600ppm. The only recovery well that is operational on this site is #1, and it is outside of the fugitive plume that is found in MW-16d.

Level of Remediation Sought:

Ideal: 250 ppm Chloride

Target: 300 ppm Chloride

Recommendations for Future Work: Chlorides, overall, have been stable for several years with a couple exceptions. Since only one well currently remain above the usable water standards it is recommended to begin plugging a majority of the wells at the site, starting with well in the Southwest quarter, and working back towards the fleeting plume. The feasibility of purchasing a new pump to drain the pond will be considered. The site should also continue to be surveyed on an annual basis to track the current rate of subsidence.

Estimated Total Cost: Costs to plug the wells have not yet been explored.

Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
970066-00	9 Hrs. / \$280.01	\$1,585.00	\$93,209.98
Current Contaminate Level: 60-320 ppm Cl-			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input checked="" type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	

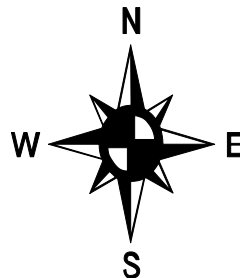
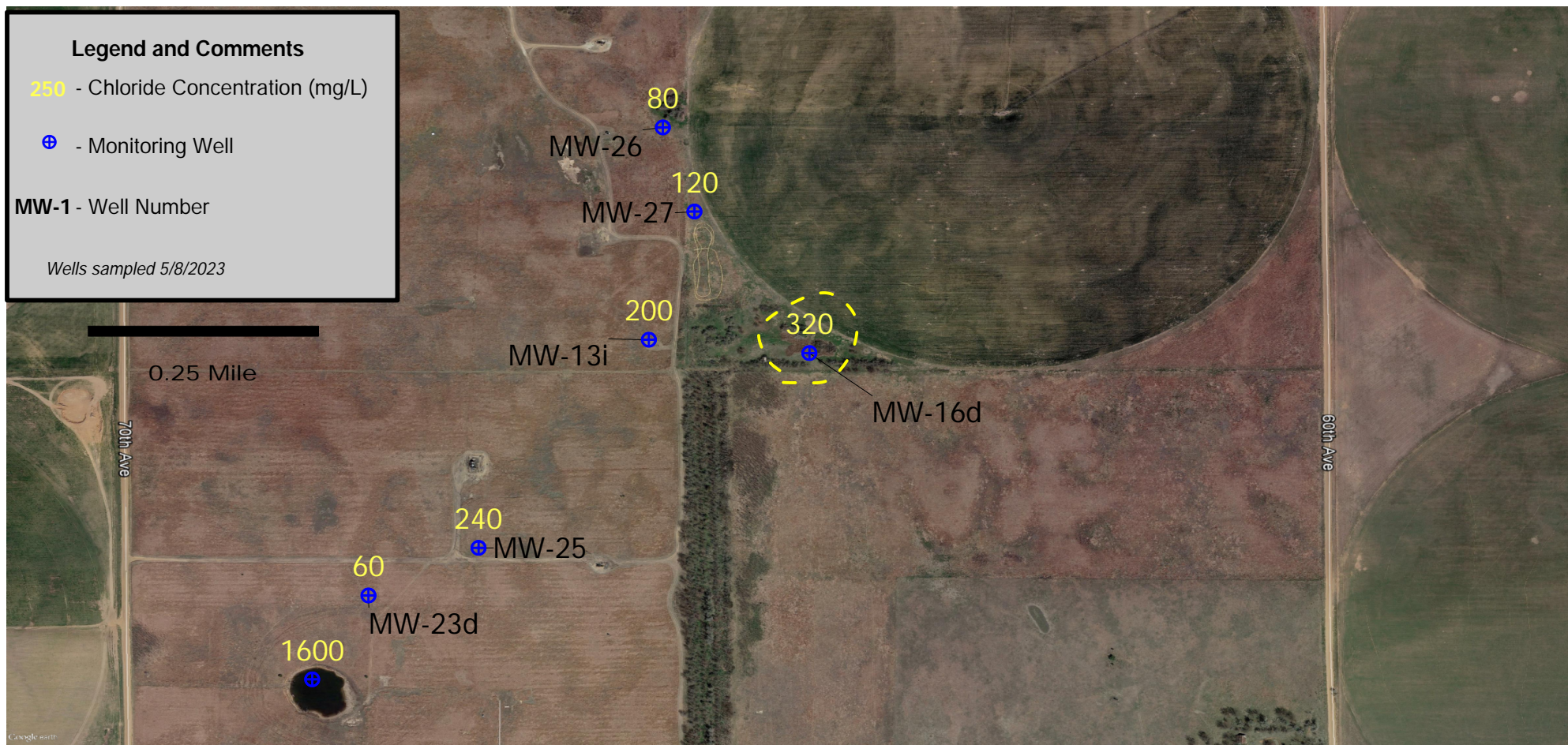
Legend and Comments

250 - Chloride Concentration (mg/L)

⊕ - Monitoring Well

MW-1 - Well Number

Wells sampled 5/8/2023



Macksville Site

Section 30-T-23S-R15W

Pawnee County, Kansas

2023 Area Map with Chlorides

KCC Control # 970066-00 District 1

N. Feldkamp 9/18/2023

Project: Arlington Site, Reno County, District 2

Site Location: The site is approximately 5 miles west and 1 mile south of Arlington, Kansas. The brine spill, which was the source of the contamination, took place on the Henson lease located in the NE/4 of Section 14, Township 25 South, Range 9 West, of Reno County. Rama Operating Company is the Primary Responsible Party and past operator of the Henson lease. The Henson lease was plugged and abandoned in 2009.

Impact/Immediacy: There are impacts on soil and groundwater locally due to a massive saltwater line leak in August 2000. Initially, the spill impacted irrigation wells in the SE/4 of Section 11 and a domestic well on the lease in late 2001. As a result, The PRP relocated the domestic well north of section 14. In addition, the irrigation well in Section 11 was taken out of use for several seasons, allowing the saltwater plume to migrate back to the Southeast, where a remediation system was installed in the NE/4 of Section 14. KCC lists that this site has a moderate immediacy level.

Site Description: The south half of section 11 and northwestern section 13 is cultivated farmland with various crops grown. There is circle irrigation in the northwest of section 13. The north half of section 14 is in CRP, and the topography is relatively flat, with only eleven feet of total relief across the area. The subsurface strata consist of 3 to 4 feet of topsoil and brown clay grading into sands ranging from very fine to coarse mixed with clay layers down to the Harper Siltstone. Bedrock depths range from 47 to 56 feet. The highest chlorides have been found on the bedrock, indicating the clay layers across the area are not contiguous aquitards. The visible remnant of the line leak at the surface is a soil scar approximately 20 feet by 5 feet located near the center of the NE/4. This scar has shrunk substantially over the years.

Since 2001, Rama Operating Company has installed 16 monitoring wells and eight recovery wells within the area of the Arlington contamination Site. Due to high chloride levels, the PRP (Rama) installed a pump and lines to RW-8 and ran that recovery well during the summers of 2014-2018. In those years, Rama disposed of recovery water into their Banium 1-12 disposal well. However, a routine Mechanical Integrity Test on the Banium 1-12 failed in early 2019. As a result, the plugging of the Banium 1-12 occurred on 4/8/2019. Without the disposal well, the Arlington site could not dispose of recovery water and shut down the remedial system.

Unusual Problems: Water quality can fluctuate during the summer growing season because of offsetting irrigation wells to the east. This location is highly susceptible to plume movement due to irrigation in a limited aquifer. Due to the site's age, it is difficult to determine the top of the surveyed casing. There is no longer a disposal well near the location to run a remediation system.

Status of the Project: On April 21, 2023, KCC was onsite to sample the monitoring wells. KCC used air-lift equipment to purge groundwater from each well. Due to sediment entering the well screens, this method helps clear the well casing during sampling. Groundwater samples from each monitoring well were collected in one 250 (ml) polyurethane container for analysis at the KCC District #2 Laboratory. KCC analyzed each sample for this monitoring event for the presence of Chloride utilizing the United States Environmental Protection Agency USEPA Silver Nitrate Buret Titration Method - Method 8225. All purge water with elevated chlorides was trucked to a KCC disposal well via KCC equipment. The water level at the Arlington site was lower than the last 15 years of documented level checks. The extreme drought throughout Kansas contributes to these lower groundwater levels.

During this year's sampling event, KCC had the Wichita State University Geohydrology class onsite. The Students actively participated in sampling and performed survey work on the locations. This work and minor well repairs made by the KCC at individual well locations will help build a better hydrological model during future sampling events. The Arlington site is in a long-term monitoring status. During this year's sampling event, the east battery of irrigation wells ran throughout the day. KCC's hydrological mapping of this year shows the significant change of gradient towards the irrigation wells while they are running. Annual sampling by KCC had shown that the chloride plume stayed mainly in the NE/4 of section 14, but the use of the irrigation well battery east of the site may draw chlorides in that direction. KCC believes the plume would typically trend to the southeast into section 13, but the alluvium aquifer shallows and may trap the chlorides in lows near MW-6. Groundwater naturally flows to the southeast, but the irrigation wells in the northeast corner of section 13 could pull the plume farther north than it would typically.

Bedrock mapping of the Harper Siltstone indicates a slight depression along the bedrock at MW #6 (7,250mg/l); this also contains the highest concentration of saltwater at the site. Overall chloride values for the area decreased to the east compared to 2022 values, with only minor increases in the middle to the western part of the site. The highest increase was MW-4, which rose by 75 mg/L. In the past, MW-8 (790 mg/l) was a delineating well with low chlorides, but the last three years have shown it to be

now inside the plume, but this year, the chlorides dropped almost 600 mg/L. KCC found that MW-9 was destroyed by an unknown cause in 2022. This well is within the heart of the plume and utilized for modeling plume movement. All delineating wells to the north of the site have been destroyed or plugged over the years.

Level of Remediation Sought:

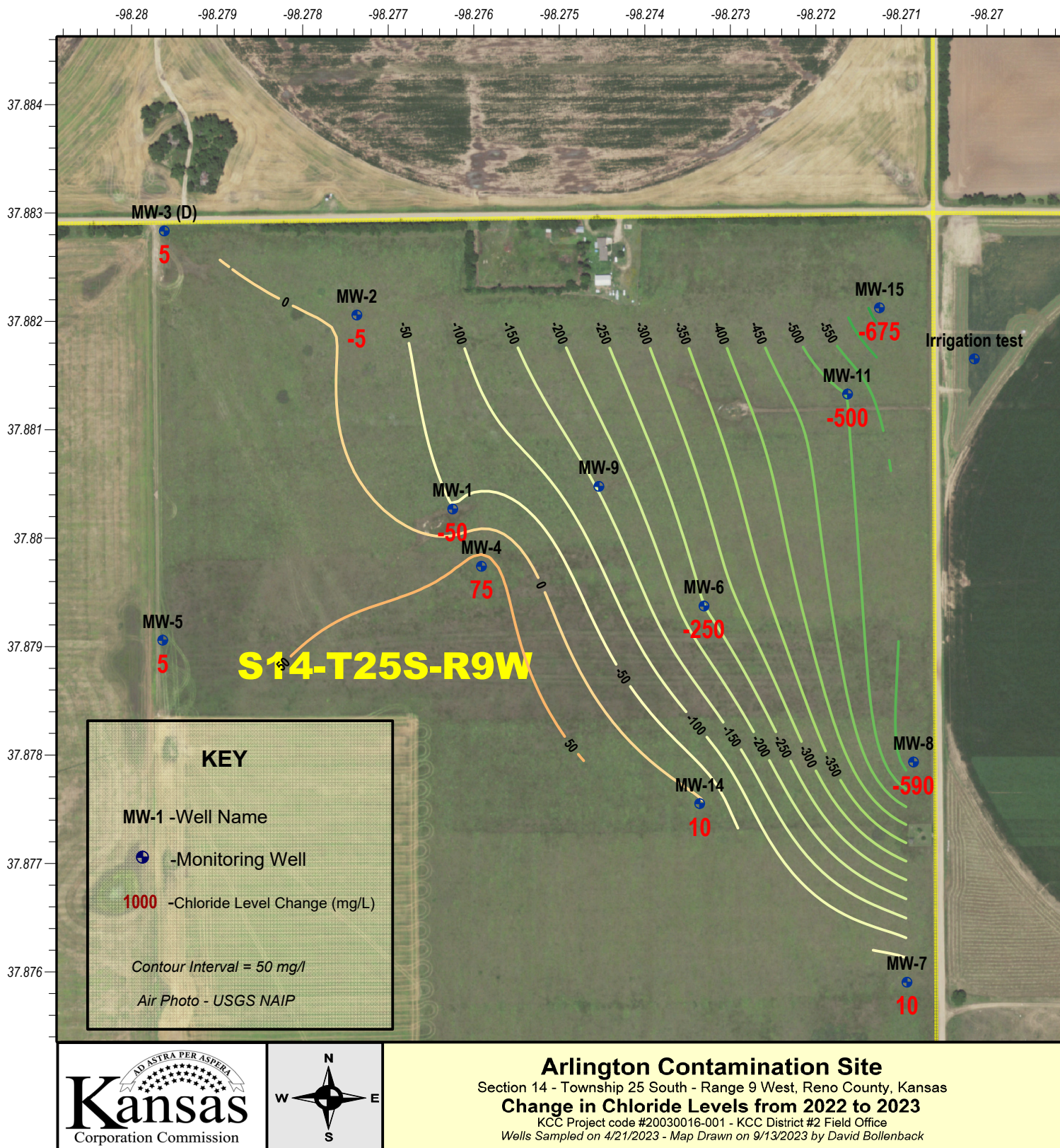
Ideal: 30 to 80 ppm (background)

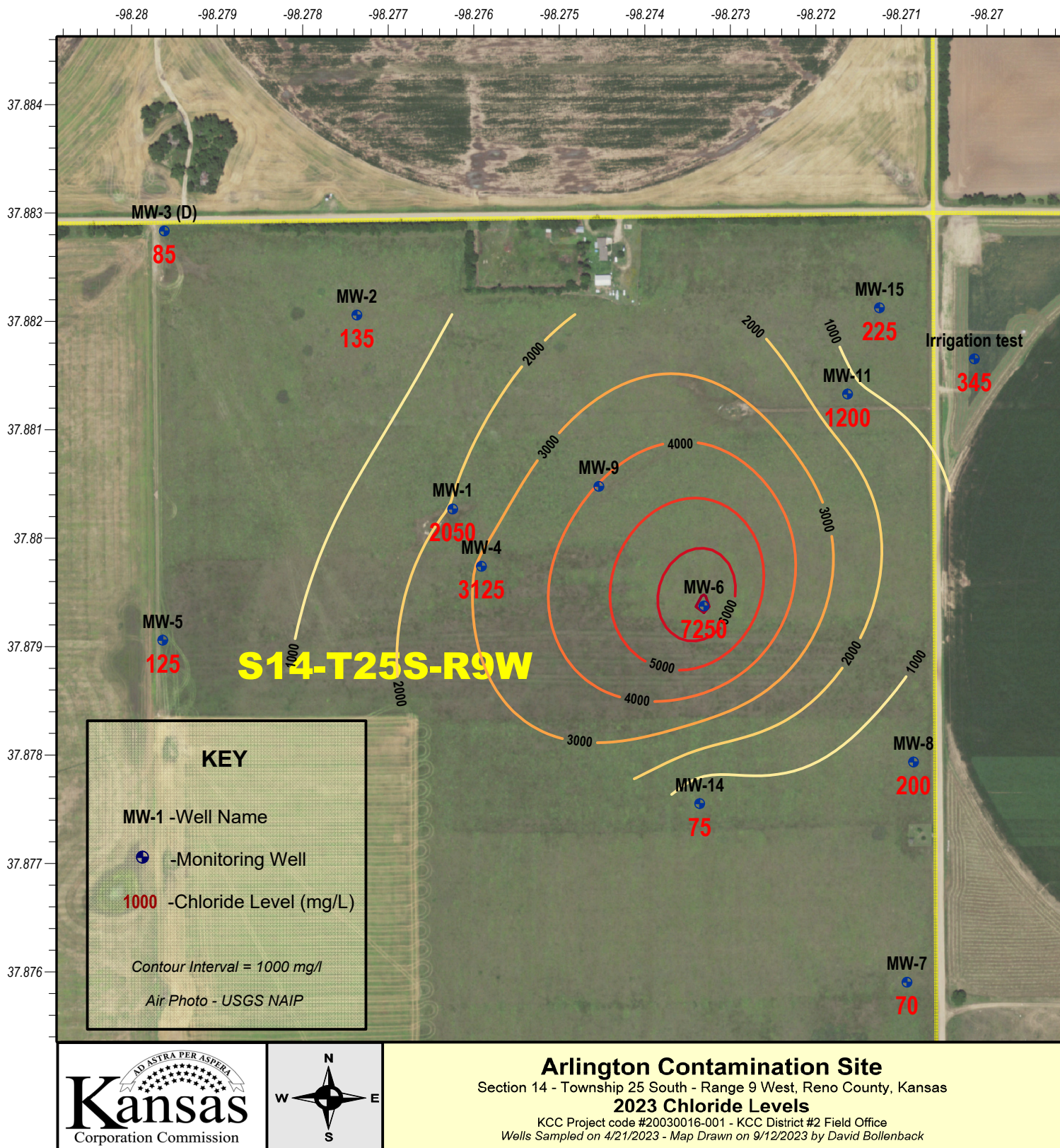
Target: 250 ppm

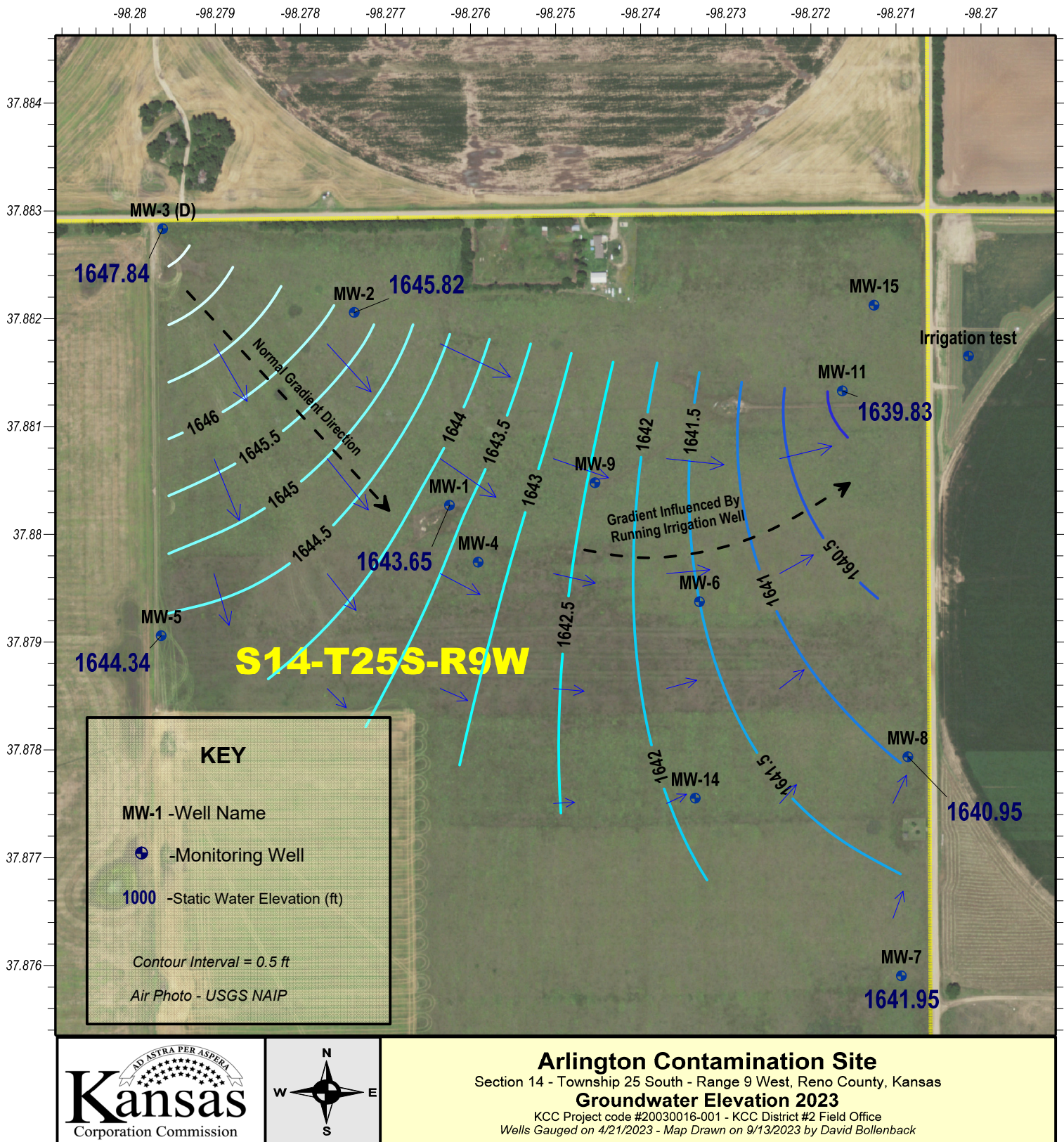
Recommendation for Future Work: As remedial efforts have stopped, some older recovery wells could be plugged by the PRP or used as monitoring wells. KCC recommends the site be sampled biannually by the District #2 Office in 2024 and inform Rama Operating Company of any plume movement offsite. The irrigation wells in the northeast corner of section 13 should be sampled before the irrigation season.

Estimated Total Cost: Costs for 2022 should be \$1,600 for Annual Groundwater sampling, well repair, and surveying.

Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
20030016-001	36.5 Hrs. / \$1,128.29		
Current Contaminate Level: 7,250 mg/l in MW-6			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	







Project: *Brothers Contamination Site, Rice County, District 2*

Site Location: The Brothers contamination site is nine miles east, two and one-half miles north of Sterling. The legal location is S/2 NE of Section 12, Township 21 South, and Range 7 West, Rice County, Kansas.

Impact/Immediacy: Low immediacy. There are residential wells over a mile to the southeast, which is side gradient to groundwater flow. Most contamination resides in the upper sands, which are too shallow for use as domestic wells.

Site Description: The location is in the Sand Hills of Rice County. The contaminated groundwater aquifer is a shallow permeable zone of Pleistocene Dune Sand, consisting of poorly sorted medium to fine sands with silt lenses. Below the upper sands, the Sandborn formation contains dark brown silty clay interbedded with coarser materials, which occurs as an aquitard at the site. The Sandborn changes into the Meade Formation, good water bearing coarse gravel and sand aquifer. The Meade Formation appears protected from contamination at the Brothers' site. The groundwater flow is south-southwest within the Meade, but the upper sands are perched and move via topographic highs and lows during precipitation on top of the Sandborn.

Unusual Problem: Monitoring wells in the Pleistocene Dune Sand onsite has shown that the aquifer has low deliverability in the upper aquifer and is limited, especially during periods of drought. Hydrology in the upper perched aquifer directly connects with precipitation and has a varying aquitard elevation stopping penetration. This variable elevation can create issues with the entrapment of chlorides and water movement, which does not align with the actual downward gradient.

Status of Project: KCC visited the site and collected water samples on April 14th, 2023. This site now only has two monitoring wells and the pond, which KCC samples annually. KCC laboratory results of the two monitoring wells and pond water show that chloride levels have increased slightly since 2022 within the upper sands. The pond water rose from 150 mg/L to 400 mg/L chlorides. KCC notes that the region has experienced a potent drought the last two years, which could be contributing to the pond's higher chlorides. The screened interval at MW-2 intersects in the Meade Formation, and lab results showed 20 ppm chlorides in 2023, the same as last year. Stable chlorides over the years at MW-2 indicate that the lower aquifer is still somewhat protected at the Brother site. MW-3 showed a slight chloride rise from 2022, possibly from the drought. There has been current and past visual evidence of frogs, deer, turkeys, turtles, and other biotas in or around the pond. WWC-5 water well record research showed a new stock well 0.5 miles South/Southeast of the site. This well is 58 feet deep and completed into the shale. KCC noted that the well only had 16 feet of grout protecting it from the surface. Due to the distance from the site, KCC does not anticipate it to be a receptor. WWC-5 records of old oil water supply wells are downgradient with no plugging records. Upper sand water could enter the Meade Formation gravels if those wells are unplugged and compromised.

KCC researched the surrounding oil and gas wells and found issues in the records of some wells. One well was called the Brothers David #1 or Pallister David #1 on some forms and showed production until 1995. KCC was on site in 2020 and found what appears to be the well location buried in the fine sand but has not excavated the site to check on the well's condition. KCC could not find plugging forms on RBDMS, KGS, or Walter's Digital Library. David #1 is approximately 1,200 feet northwest of the Site. The #1 Lena Colle, drilled and completed in 1969, is located near a large pit scar in the northeast corner. This well produced sporadic oil for two years. The pit was confirmed related to this well by historical air photos. Other historic oil and gas wells have multiple API numbers, which adds to the confusion regarding the status of a few wells.

Level of Remediation Sought:

Ideal: 250 mg/l Chloride

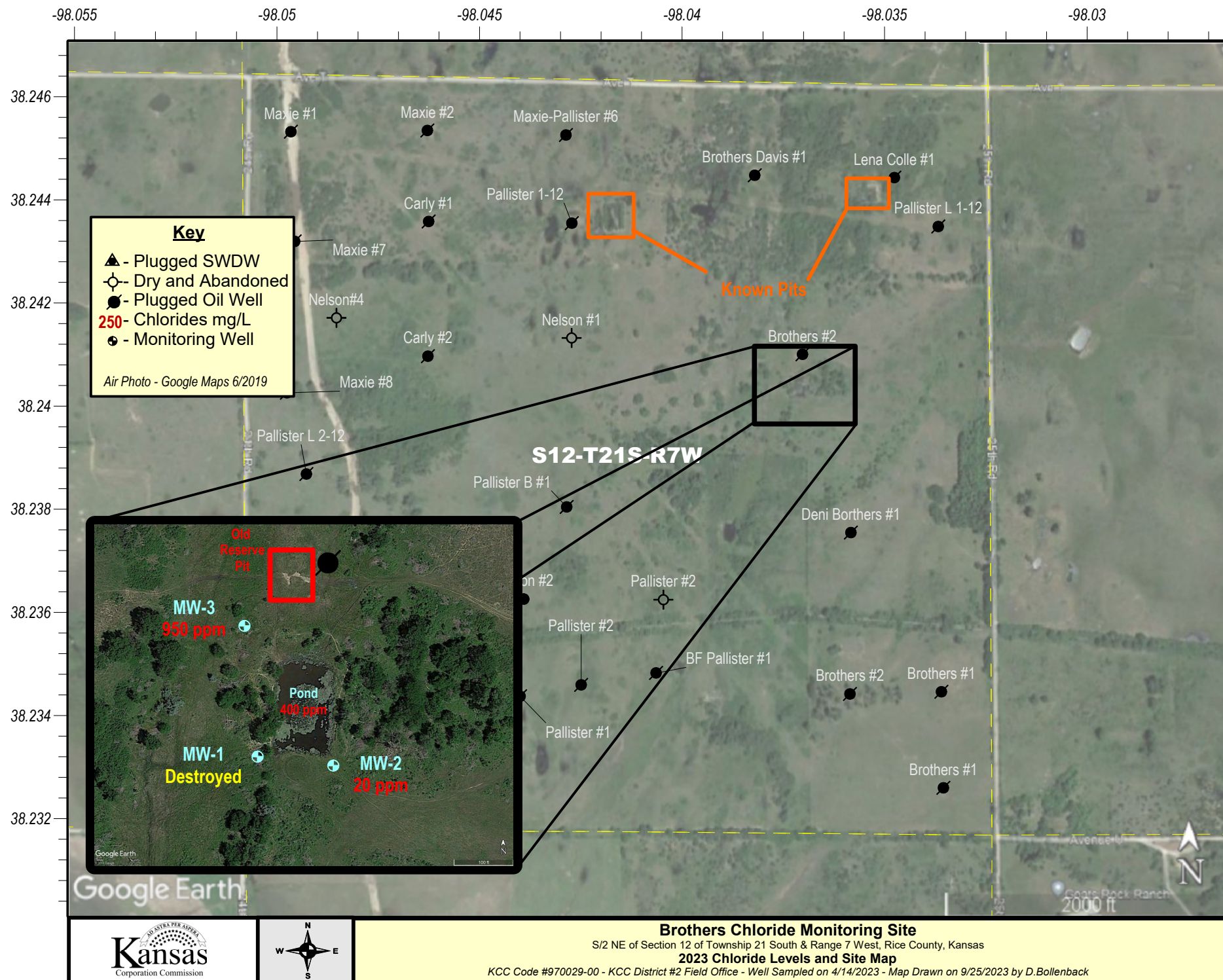
Target: 500 mg/l Chloride

Recommendations for Future Work: KCC recommends that the site remain in the monitoring phase due to the lack of priority on the site. There is now only one monitoring well in the upper aquifer, which severely limits hydrological studies of the site. The excavation of the Brothers Davis #1 could confirm that it does not contribute to the local contamination. Further research into other local historical oil and gas wells would help clear up any other potential contamination sources. A Geoprobe® rig used to probe the site's area would indicate chloride levels in the old drilling pit area associated with the Deni Brothers #2 drilled in 1984. This well was the closest well to the monitoring wells and pond. Geoprobe® rig used to probe the site's area would indicate chloride levels in the old drilling pit area associated with the Deni Brothers #2 drilled in 1984. This well was the closest well to the monitoring wells and pond. Geoprobe® rig can also drill and install shallow monitoring wells or inexpensive 1' piezometers if necessary. Data from a probing event could help plan a

timetable for site closure.

Estimated Total Costs: \$500 for monitoring, research, and report writing. Geoprobe work would cost around \$4,000. Finding and digging up the Brothers David #1 would be about \$750, while plugging would possibly be over \$25,000, depending on any issues with the well.

Control No.	Staff Hours/Expenditures	Fund Expenditures
		FY 2023/24 Total
970029-00	8.5 Hrs / \$268.07	\$4.26
Current Contaminate Level: 20 mg/l to 950 mg/l Chloride		4/14/2023
Status:		
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved



Project: Little River Site, Rice County, District 2

Site Location: The Little River site is 3.5 miles north and 0.5 miles east of the northeast edge of the city of Little River. The area of contamination is in the SE/4 of Section 29 and NE/4 of Section 32 Township 18 South and Range 6 West, Rice County.

Impact/Immediacy: The impact is on the groundwater supply for the city of Little River from unknown oil field sources. The KCC has rated the immediacy high because of its potential impact on the existing public water supply wells.

Site Description: The Little River water well field is part of the Odessa Oil Field. The groundwater table in this area is at a depth of thirty feet in the upper Kiowa Sandstone with an aquitard of a blue Kiowa Shale at fifty to sixty feet. Groundwater moves slowly toward the south-southeast. The source of the contamination may be old core soundings, spills, pits, or leaking lines.

Unusual Problems: There appear to be multiple sources of contamination from past oil and gas production. It is difficult to know if samples taken from PWS wells are properly purged. KCC utilizes conductivity readings during the purging of each well to check for stabilization of conductivity before sampling.

Status of Project: KCC sampled the Public Water Supply Wells (PWS) and Monitoring Wells (MW) on August 31st, 2023. PWS-7 is not sampled anymore as bailers can become caught on an unknown object in the unused well. This well is usually locked to protect the chlorination system for the Public Water supply, but the well is not in use. The last sampled event for PMW-7 was in 2021, which tested at 200 which is significantly lower than past sampling events. All other PWS wells decreased in chlorides from 2022 levels, except PWS-11 which went up by 10 mg/L. PWS#13 decreased by 225 mg/L, but during the sampling event, it was noted that the well was running full throttle. The KCC chloride levels in MW-1 decreased from 1,125 to 900 mg/L. Historically MW-1 has been as high as 1500 mg/L chlorides. MW-2 was stable with a chloride level of 40 mg/L. KCC airlifted both wells instead of using the downhole electric pump.

Level of remediation Sought:

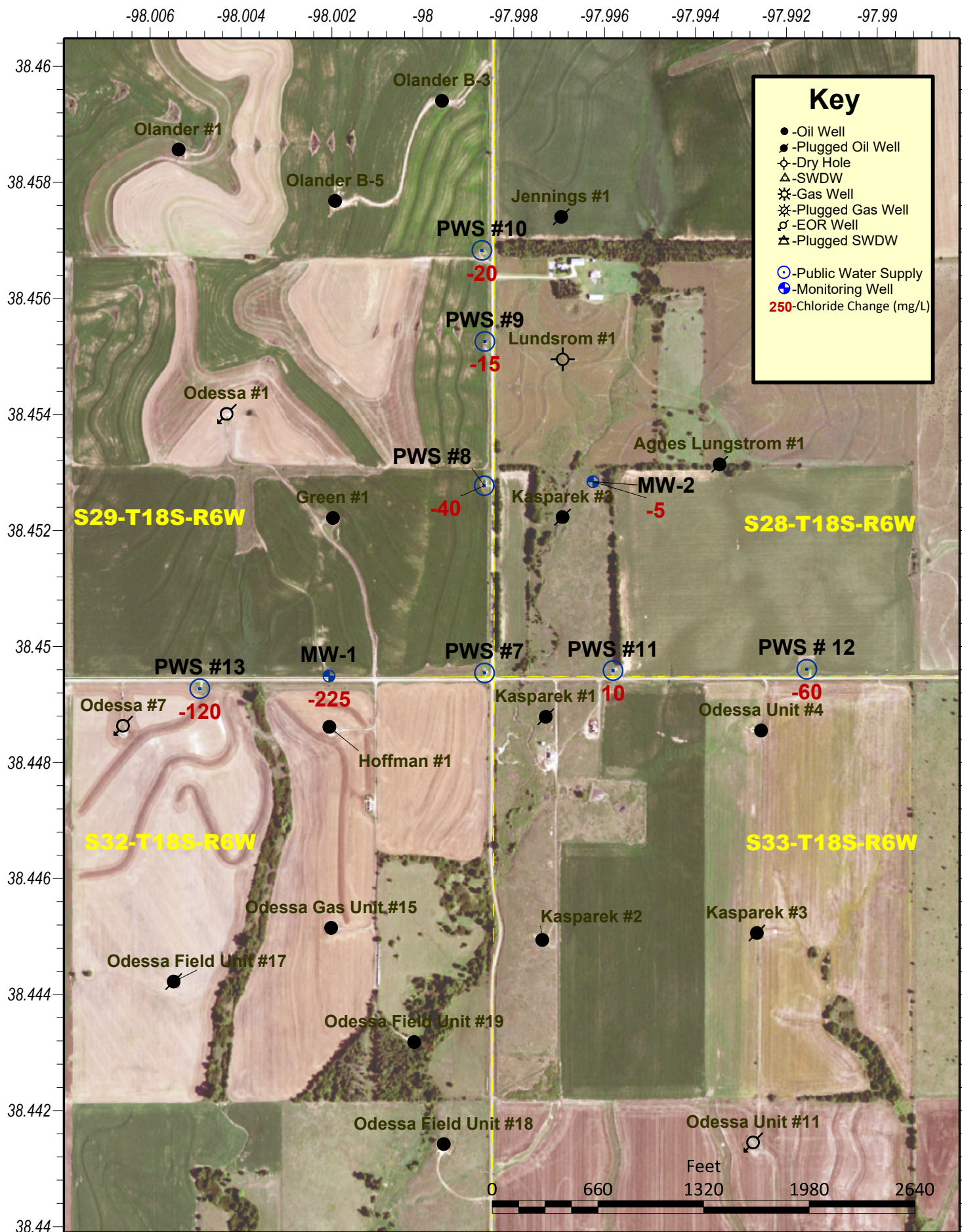
Ideal: 60 mg/L

Target: 300 mg/L

Recommendation for Future Work: Due to the threat to the public water supply, KCC recommends annual sampling of the public water supply and monitoring wells for 2024. Remedial work is not economical as chlorides are too low for proper removal techniques, and the aquifer capacity dynamics are too low for recovery wells.

Estimated Total Costs: Time for staff to mobilize to the site and sample the wells over the next year, perform the laboratory work, data entry, mapping, and report creation. Costs should be in the range of \$500-\$700.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
20000057-001	14 Hrs / \$437.04		\$3,112.20
Current Contaminate Level: 40 mg/L Cl- in MW #2 to 900 mg/L Cl- in MW #1			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	

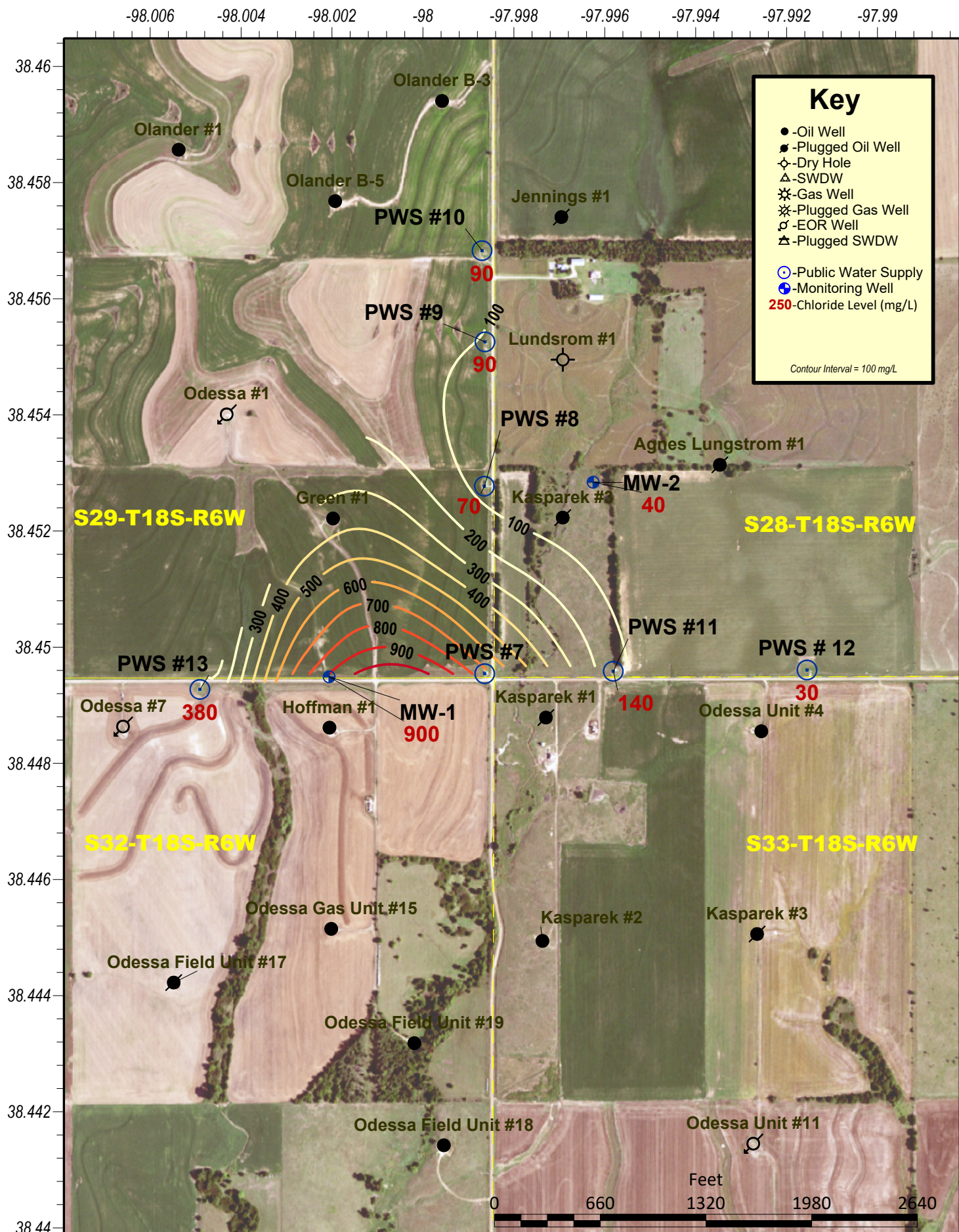


Little River Groundwater Monitoring Site - #2000057-001

Section 29 of Township 18 South & Range 6 West, Rice County, Kansas

Change in Chloride Levels from 2022 to 2023

District #2 - Sampled on 8/31/2023 - Map Drawn on 9/18/2023 by D.Bollenback



Project: Stowe- Zaid Contamination Site, Rice County, District 2

Site Location: The site is five miles south of US 56 and Plum Street on the east side of Rice County. This site is in the northwest part of the Welch-Bornholdt oil field, and the lease no longer has oil and gas production. The location is the SE/4 NE/4 Section 24, Township 20 South, and Range 6 West, of Rice County.

Impact/Immediacy: Brine contamination impacts are on the local soil and groundwater. KCC has classified this site as low immediacy. KCC monitors this site due to the possibility of this chloride plume affecting domestic and stock wells and the aquifer of the Little Arkansas River. There is a rural water line in the area, which can provide service to the homes.

Site Description: Permian contact with the Quaternary sediments transects this site from northwest to southeast. The erosion of the Ninnescah Shale by the Little Arkansas River has filled the floodplain with alluvium. There are approximately 40-50 feet of elevation change in the northeast corner of the section. There has been a historical scar in the alluvium just south and west of this contact. A 1954 air photo shows that there were oil and gas wells in the northeast of section 24. Historically, a tank battery was located on the west side of Plum Road and northeast of the scar. The battery was positioned within the Ninnescah Shale beds and at a higher elevation to the scar. Higher historical elevation suggests that possible spills and leaks from the tank battery may have entered the subsurface and flowed down a gradient on top of the shale or through fractures and bedding planes until entering the Floodplain Alluvium, including the location of the scar. Significant remnants of evaporation pits exist in the section north and the section east of the site.

Unusual Problems: The groundwater table is very shallow due to the proximity to the Arkansas River. MW-2 is located at an agricultural boundary which the local farmer plants within a foot of each other making access difficult. KCC has had to repair this well multiple times over the years.

Status of the Project: KCC performed groundwater sampling on August 31, 2023. Due to crops and access issues, KCC hiked to the wells and hand-bailed them instead of utilizing a submersible pump. The lower aquifer (MW-1D) well tested at the KCC lab at 240 mg/l chlorides, almost the same as last year's 245 mg/L. This well has risen in chlorides over several years except for the last two years. MW-2 at the toe of the scar also showed the same chlorides from 2022 at 1,900 mg/l. The area has had lower than average precipitation for the last year as the regional drought continues which could be concentrating the chlorides at the well location.

Recommendation for Future Work: KCC recommends the continued sampling of the monitoring wells. The site has only two monitoring wells, one in the shallow toe and the other in the deep aquifer. If the immediacy of this site increases, the first step would be to drill and install more monitoring wells to delineate the plume. In addition, long-term monitoring is suggested for the site unless the lower aquifer continues to substantially increase in chlorides, which would warrant further investigation into the source. The trigger for a deep aquifer investigation would be if the deep aquifer (MW-1D) reaches the 350 mg/L target level.

Level of Remediation Sought:

Ideal: 50 mg/l

Target: 350 mg/l

Estimated Total Costs: This site should cost \$350 annually for field inspection, monitoring, reporting, and well repair. KCC plans to research ideas/alternatives to remediating the site or at least expediting the attenuation.

Control No.

Staff Hours/Expenditures

Fund Expenditures

20000035-001

7 Hrs. / \$221.99

FY 2023/24

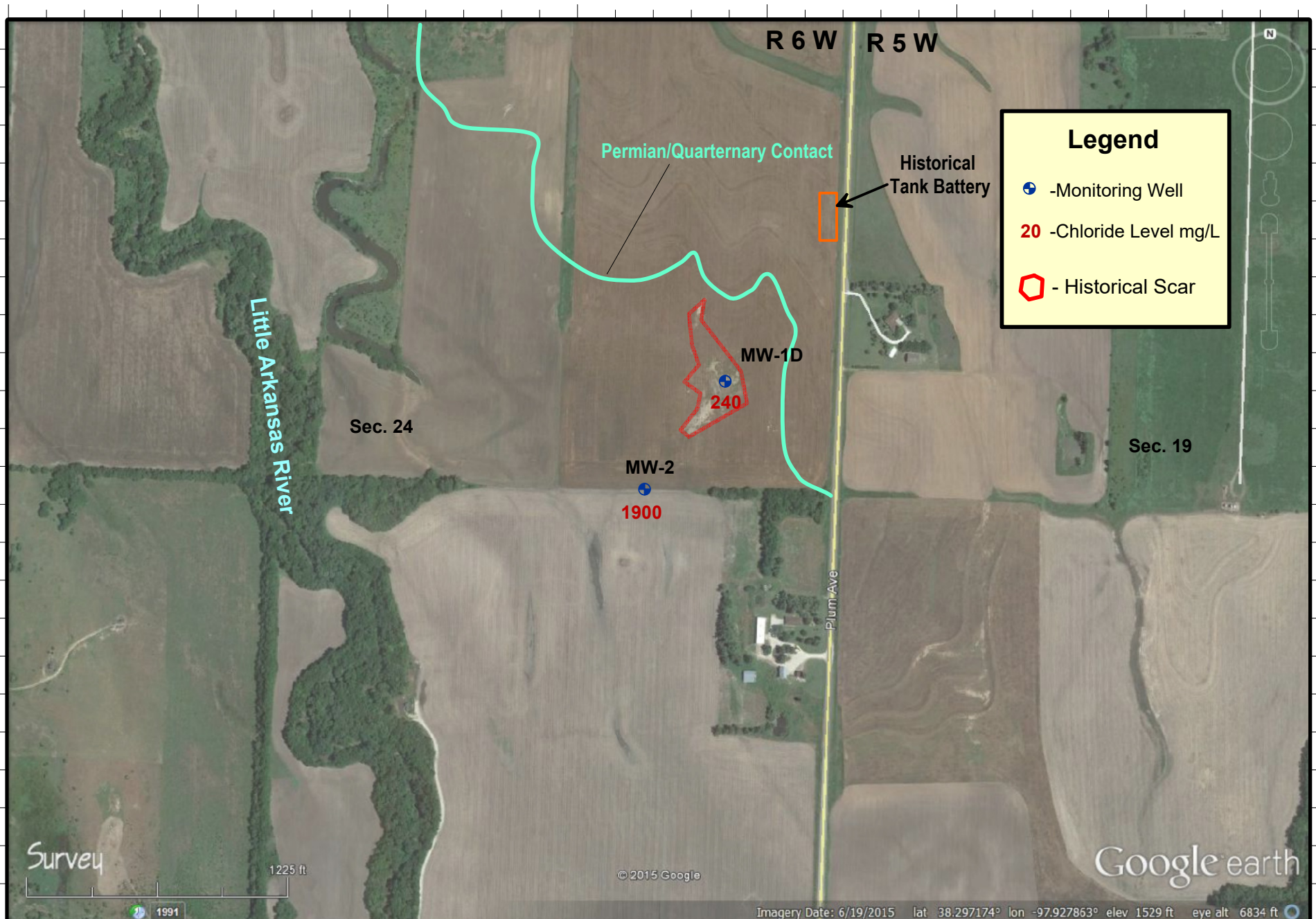
Total

\$4,057.85

Current Contaminate Level: 1,900 mg/l Cl⁻, MW-2
240 mg/l Cl⁻, MW-1 Deep Aquifer

Status:

- | | | |
|---|---|---|
| <input type="checkbox"/> 1. Site Assessment | <input type="checkbox"/> 2. Short Term Monitoring | <input type="checkbox"/> 3. Investigation |
| <input checked="" type="checkbox"/> 4. Long Term Monitoring | <input type="checkbox"/> 5. Remediation Plan | <input type="checkbox"/> 6. Installation |
| <input type="checkbox"/> 7. Remediation | <input type="checkbox"/> 8. Post Rem. Monitoring | <input type="checkbox"/> 9. Resolved |



Stowe-Zaid Shallow Brine Monitoring Site
 Section 24 of Township 20 South and Range 6 West, Rice County, Kansas
2023 Chloride Levels

KCC District #2 Field Office - KCC# 20000035-001- Wells sampled on 8/31/2023 - Map drawn on 9/18/2023 by D.Bollenback

Project: *Elm Creek Contamination Site, Rooks County, District 4*

Site Location: Sections 19, 20, 29, 30, 31, and 32 of Township 7 South, Range 17 West
Sections 5, 6, 7, 8, 17, 18, 19, 20, 29, 30, 31, and 32 of Township 8 South, Range 17 West
Sections 5 and 6 of Township 9 South, Range 17 West, Rooks County

Impact/Immediacy: The Elm Creek alluvial aquifer has been contaminated by past oil field activity. Both domestic and stock wells are affected. The area is serviced by Rooks County Rural Water District #3, and the immediacy level for this site should be rated as moderate to high.

Site Description: Elm Creek is a tributary to the South Fork Solomon River, which it enters just downstream of Stockton, Kansas. Numerous complaints beginning in the mid 1900's led to wide-spread sampling, and the designation of approximately 20 square miles as the site. A series of monitoring wells were completed in the alluvial deposits of the drainage near the confluences of other streams with Elm Creek in an attempt to constrict the size of the contamination site by identifying the direction from which pollution originated. The installation of the monitor well net was completed in May of 1998, and sampled for 5 years by a third party. Following the sunset of the sampling contract, the well net was sampled quarterly for three years, and biannually for two years. Sampling is now performed annually by KCC staff.

Unusual Problems: The history of contamination in the Elm Creek area is extensive, and many of the possible sources of pollution were insufficiently documented. Additionally, the large areal extent of the site poses challenges for investigation and remediation.

Status of Project: Long-term monitoring has revealed that the chloride concentrations in the monitoring wells have remained the highest near the south end of the site. Presently, the chloride level in even the most severely impacted areas of the site do not preclude use of the water for stock use, irrigation of certain plants, or general non-potable use. Five monitoring wells contain chloride ions in concentrations which are above what is considered to be fresh water (500 ppm), none below the freshwater threshold, but above drinking water standards (250 ppm), and eight wells are at or below the chloride concentration threshold for water suitable for human consumption. One well has been destroyed.

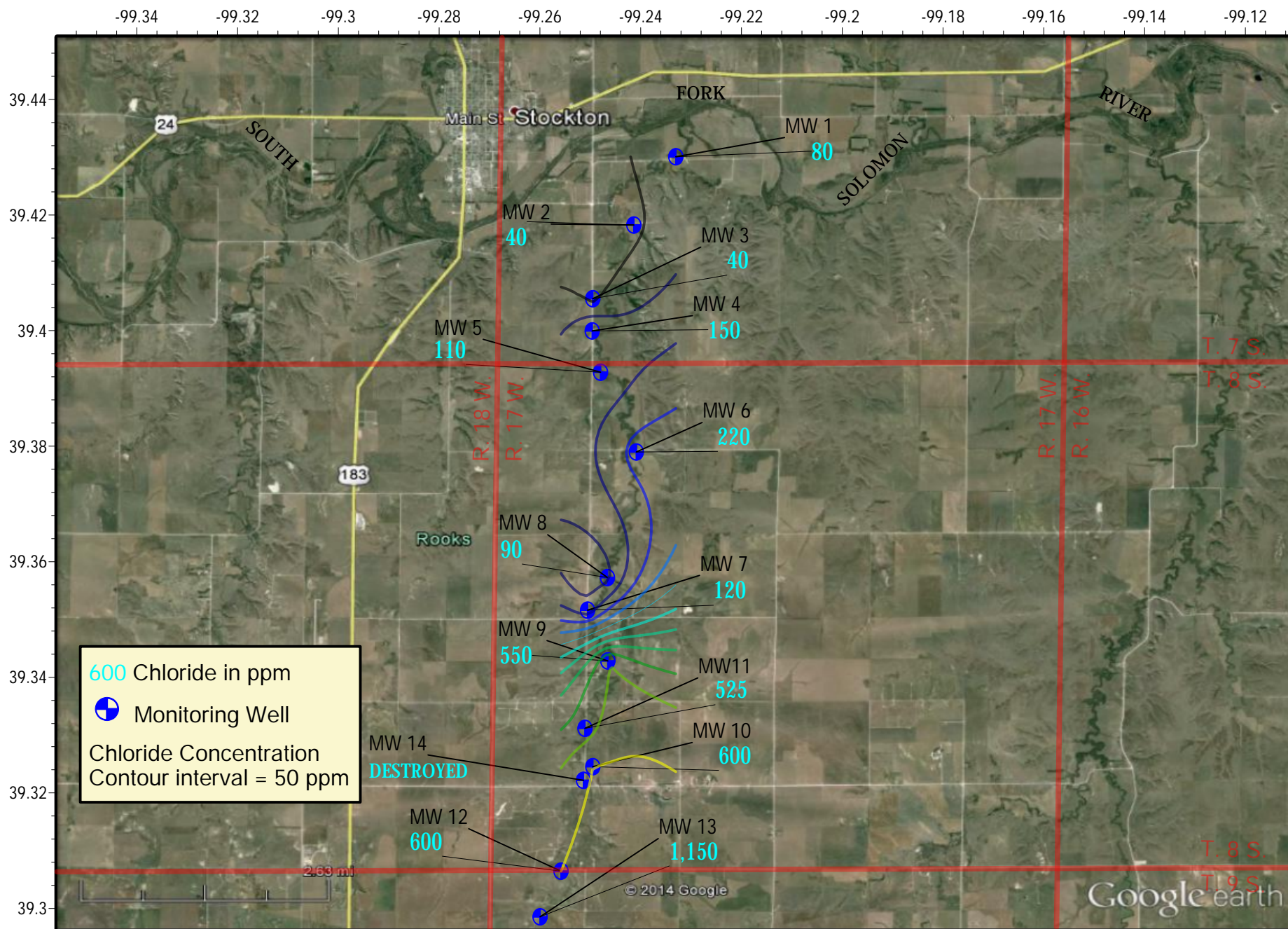
Level of Remediation Sought:

Ideal: 250 ppm Chloride
Target: 500 ppm Chloride

Recommendations for Future Work: While the trend in contamination distribution has remained relatively stable, long-term monitoring should continue until the target level is reached, or the site parameters change in such a way as to warrant further investigation and remedial efforts.

Estimated Total Cost: If warranted, remediation costs could reach a total of \$250,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970043-00	9 Hrs. / \$283.43		\$29,212.25
Current Contaminate Level: 40 ppm Cl ⁻ to 1,150 ppm Cl ⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Elm Creek Groundwater Monitoring Site

Multiple Sections of Townships 7, 8, and 9 South, Range 17 West, Rooks County, Kansas

2023 Groundwater Chloride Levels

District #4 - Sampled 8/23/2023 and 8/24/2023 - Map Drawn on 9/28/2023 by C. Neeley



Project: Ireys-Hrabe Contamination Site, Rooks County, District 4

Site Location: Section 1 and Section 12 of Township 9 South, Range 17 West, Rooks County.

Impact/Immediacy: The groundwater near a former homestead has been impacted by repeated releases of brine on the surface and in the subsurface. The immediacy for this site is rated as moderate.

Site Description: A subtle drainage runs through the site from south to north, and an abandoned farmstead is situated near this draw. Six water wells were dug on the property, and the historical information indicates that these may be producing water from the Codell Sandstone and near surface deposits. However, this has not been confirmed. Contamination at the site can be attributed to an injection well which had pressurized a number of near-surface formations through failed casing, over pressurization, the numerous spills that have occurred over a period of 50 years, as well as multiple surface pits.

Unusual Problems: None.

Status of Project: The open wells were sampled early in 2017, and the concentrations of chlorides had dramatically increased to 44,000 ppm in one, and 7,500 ppm in another. The well closest to the abandoned farmstead was 1,150 ppm. The open wells with the highest chlorides were pumped out, and the water was taken to a SWD well. The groundwater coming into the south well was sampled and determined to be approximately 3,500 ppm. Test holes were hand augured to a depth of 6' to 10' in 2018, and the concentrations ranged from 1,100 ppm to 17,000 ppm. These tests conform to the known site history, and will be used to plan future exploratory and remedial work. In 2022, the three hand dug windmills were 9,000 ppm, 7,250 ppm, and 1,550 ppm. In 2023 they are 8,000 ppm, 3,000 ppm, and 1,750 ppm.

Level of Remediation Sought:

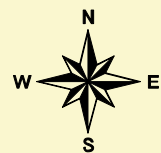
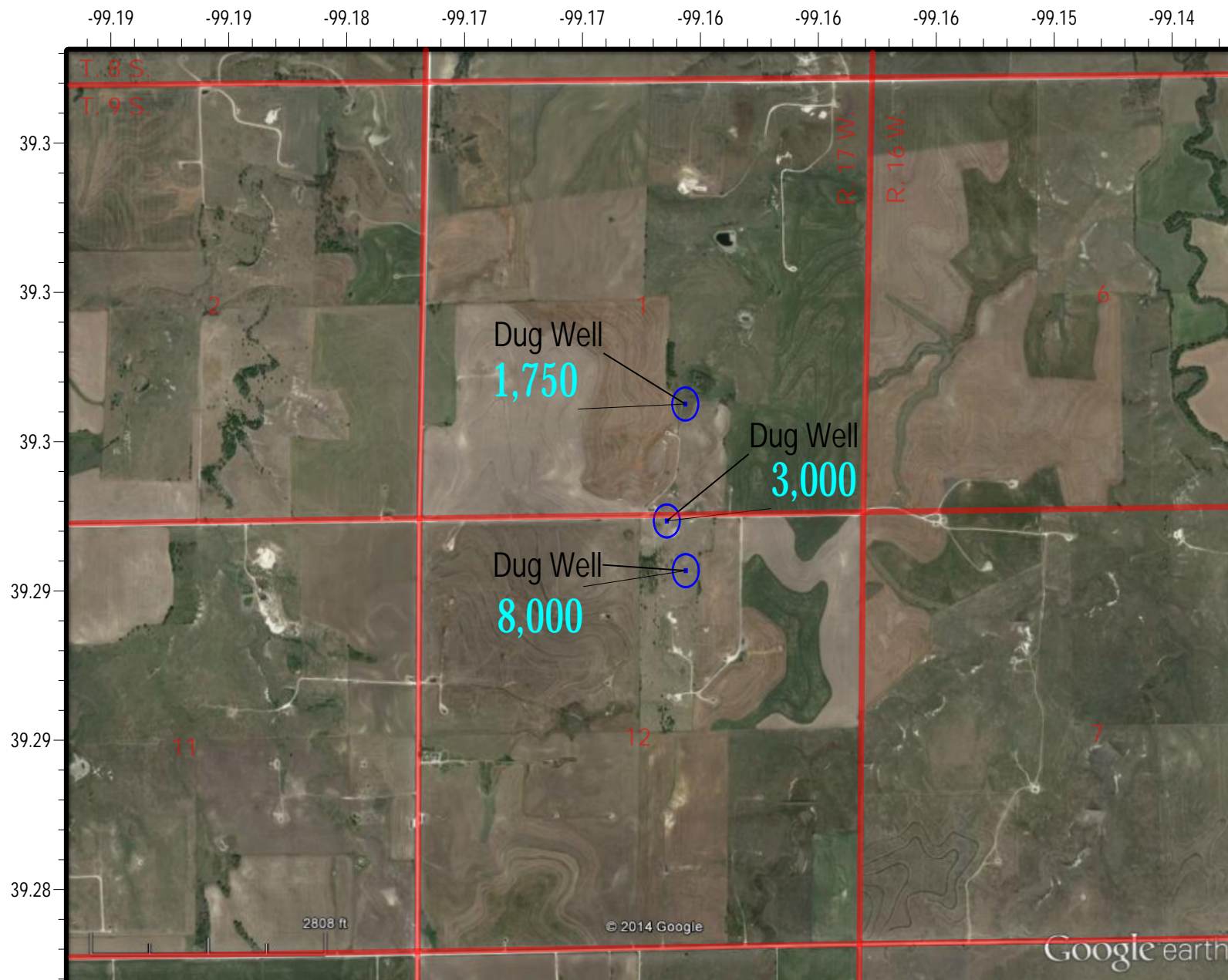
Ideal: 250 ppm Chloride

Target: 500 ppm Chloride

Recommendations for Future Work: While samples have been collected through existing wells, these do not meet quality control standards for groundwater sampling. A network of monitoring wells and exploratory test holes should be drilled at this site to delineate the extent of the pollution. The open wells will be pumped out on a periodic basis.

Estimated Total Costs: \$15,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970053-00	5 Hrs. / \$160.54		
Current Contaminate Level: 1,750 to 8,000 ppm Cl ⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Irey-Hrabe Groundwater Monitoring Site
 Sections 1 and 12, Township 9 South, Range 17 West, Rooks County, Kansas
 2023 Groundwater Chloride Levels
 District #4 - Sampled on 9/25/2023 Map Drawn on 9/28/2023 by C. Neeley



Project: *Schruben-Rogers Contamination Site, Rooks County, District 4*

Site Location: SE/4 of Section 18, Township 7 South, Range. 17 West, Rooks County.

Impact/Immediacy: Groundwater contained in an alluvial aquifer has been impacted by oil field brine. The Immediacy for this site is rated as low.

Site Description: This site is located on the eastern edge of the City of Stockton, approximately one third of a mile from the South Fork Solomon River. The water wells in the area are used primarily for lawn and garden and stock purposes, and draw water from an alluvial terrace. The soil in the area of the impacted wells is rapidly permeated by contaminants, making the water quality sensitive to lease practices. Extensive past studies failed to identify a primary source for the brine, but a number of potential causes of the pollution were noted. These potential sources are generalized as oil field practices rather than delineated definitively, and contribute to an accumulative effect. Remediation was not initiated because a significant reduction of the chloride in the area wells was observed, and the availability of other methods for obtaining water, i.e. municipal sources and reverse osmosis treatments.

Unusual Problems: None.

Status of Project: Several potential sources of pollution in the area have been removed over the last several years. The chloride concentration in the well on the Rogers' property has fallen appreciably since 1986, when the chloride concentration was 8,450 ppm. Since 2008, the chloride levels have remained relatively stable in the range of 500 ppm to 750 ppm. In 2017, the chloride concentration was determined to be 500 ppm, 400 ppm in 2018, 325 ppm in 2019, and 375 ppm in 2020. In 2021 the concentration was 450 ppm, 475 ppm in 2022, and 550 ppm in 2023.

Level of Remediation Sought:

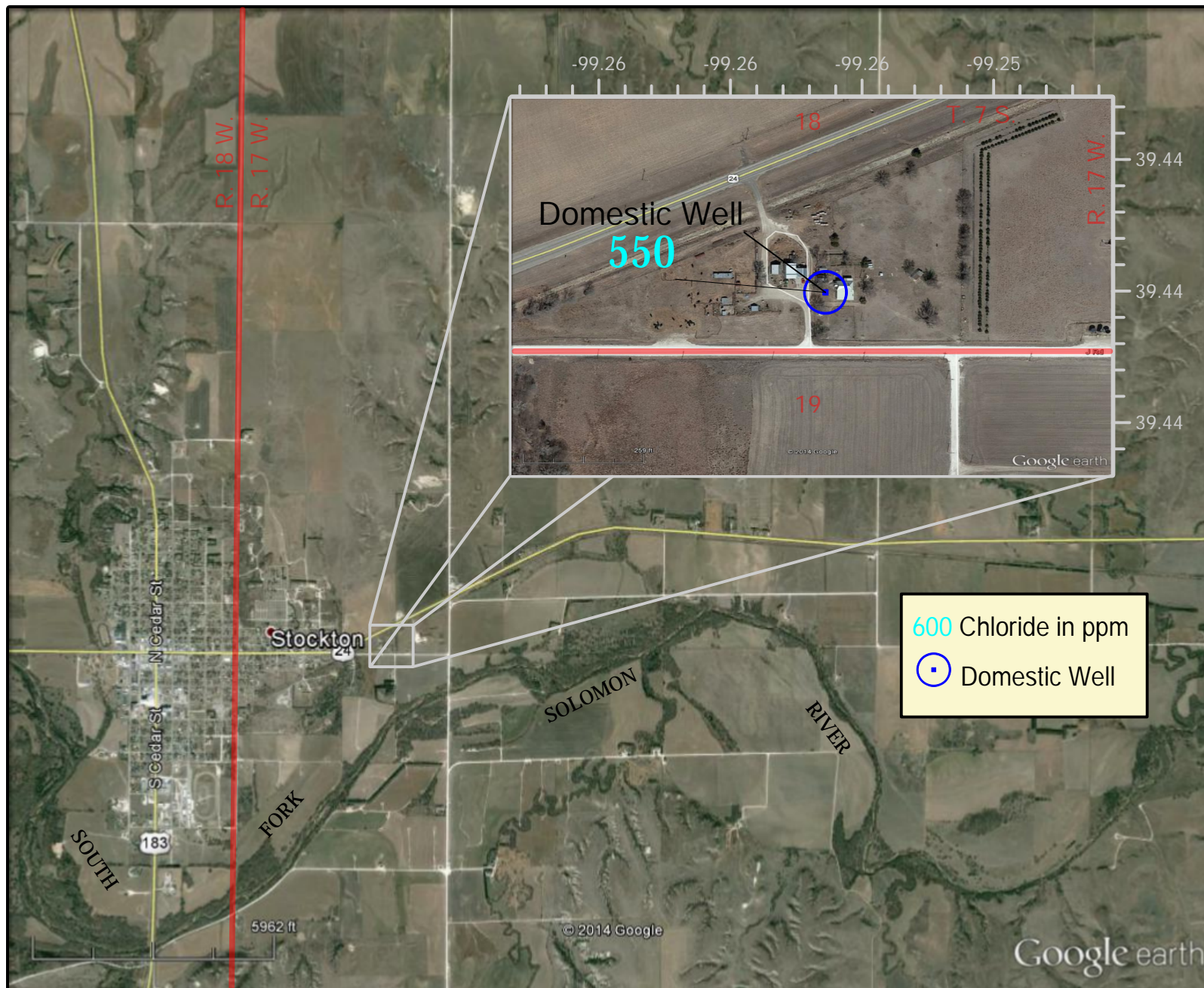
Ideal: 100 ppm Chloride

Target: 250 ppm Chloride

Recommendations for Future Work: This site will be monitored annually to determine if the removal of potential sources has contributed to the reduction in contaminant levels. If additional work is warranted due to a rise in contaminant levels, additional geophysical and field research may be conducted in an effort to better delineate a source.

Estimated Total Costs: \$2,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970014-00	4 Hrs. / \$122.98		
Current Contaminate Level: 550 ppm Cl ⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring.	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Schruben-Rogers Groundwater Monitoring Site

Section 18, Township 7 South, Range 17 West, Rooks County, Kansas
2023 Groundwater Chloride Levels

District #4 - Sampled 6/16/2023 - Map Drawn on 9/28/2023 by C. Neeley



Project: *Maupin Contamination Site, Russell County, District 4*

Site Location: SE/4 of Section 9, Township 11 South, Range 15 West, Russell County.

Impact/Immediacy: Brine contamination of a shallow aquifer and spring which is utilized for cattle. Immediacy level is rated as low.

Site Description: The site is rangeland at the head of a drainage within the Saline River Basin. Originally, the primary source of water for cattle in the pasture was a spring which had been developed by diverting its water to an open stock tank. Nearby water wells and ponds were experiencing increases in chloride concentration by 1956, and a complaint regarding high chlorides in this spring was made in 1991. Following an investigation, five monitoring wells were drilled on the location, and the waters of this basin ranged in chlorides, including the spring, from 200 ppm to 3,400 ppm throughout the history of sampling. While the pollution has never caused the water to become unusable, the concentration of chloride in the spring is near the upper limit for stock use if it is the sole source of water for the cattle. The pasture is now served by Ellsworth Rural Water District #1, and an additional stock tank filled by this source is available for the cattle to consume.

Unusual Problems: None.

Status of Project: The chloride concentrations in the monitoring wells are 325 ppm at monitoring well 3 and 650 ppm at monitoring well 5. The concentration of the spring-fed stock tank is 775 ppm. At this time, these levels do not warrant additional action.

Level of Remediation Sought:

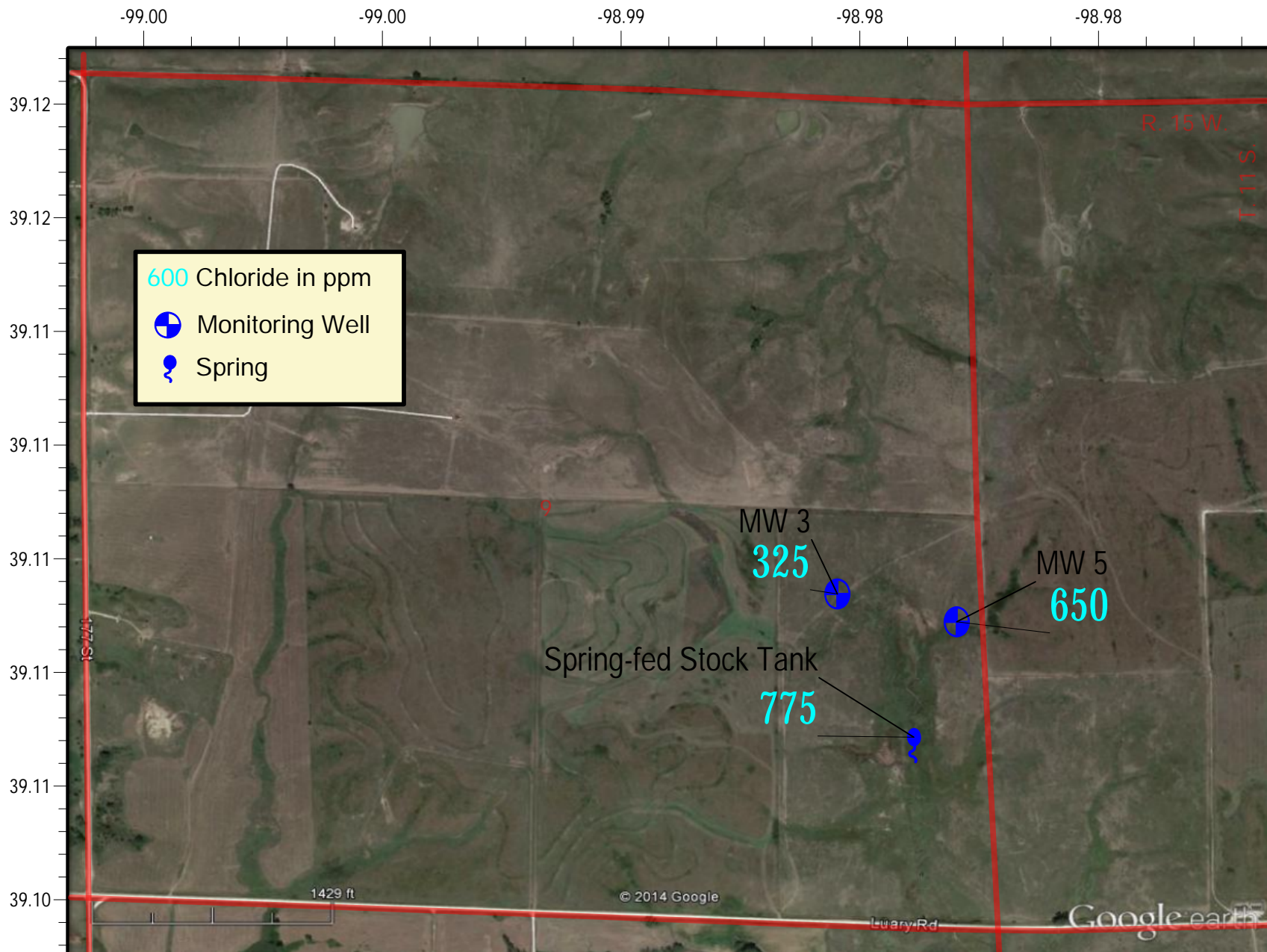
Ideal: 250 ppm Chloride

Target: 500 ppm Chloride

Recommendations for Future Work: This site will continue to be monitored on an annual basis until closure.

Estimated Total Costs: \$2,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970068-00	4 Hrs. / \$129.82		
Current Contaminate Level: 325 ppm Cl ⁻ to 775 ppm Cl ⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Maupin Groundwater Monitoring Site

Section 9, Township 11 South, Range 15 West, Russell County, Kansas

2023 Groundwater Chloride Levels

District #4 - Sampled on 8/3/2023 Map Drawn on 9/28/2023 by C. Neeley



Project: *City of Russell Contamination Site, Russell County, District 4*

Site Location: Within and around the City of Russell, in Parts of Township 13 South, Range 14 West and Township 14 S, Range 14 W, Russell County

Impact/Immediacy: Brine contamination of a shallow aquifer utilized primarily for lawn and garden purposes such as irrigation of lawns. Immediacy level is rated as low.

Site Description: Potential sources include the approximately 334 wells drilled either in the city limits or in close proximity to the city limits, and the associated drill pits, lead lines, tank battery sites, brine tanks, brine lines, and emergency pits. In addition, there are 36 oil wells and UIC wells within this site that are either abandoned or have little or no documentation to confirm that they have been plugged. Test holes were drilled in the area during the summer of 2001 in an effort to delineate the source of the contamination. Data collected through the test holes and other research indicated that the major contributor of chloride ions may be a former brine pit located to the northwest of the city. However, there has been extensive oil and gas development in the same vicinity, and the contribution from old drill pits and old line leaks has not been determined.

Unusual Problems: The investigation of all potential contamination sources would be costly and not without challenges. If remediation is initiated, the disposal of contaminated water would incur severe costs and logistical problems. Access is an issue for this site, as there are no KCC owned monitoring wells. Monitoring is achieved through the use of privately owned wells.

Status of Project: Between 2019 and 2023, three wells have been sampled. The three wells form an east-west line of evenly spaced wells approximately 350' in length at the north end of the neighborhood, near a small drainage running southeast through town. The western-most well was sampled last in 2019 and was 700 ppm. A well across the street to the east was sampled in 2020 and was 670 ppm. In 2021 and 2022, it was 650 ppm, but increased to 1,250 ppm in 2023. The eastern well was sampled in 2021, and was at 1,600 ppm.

Level of Remediation Sought:

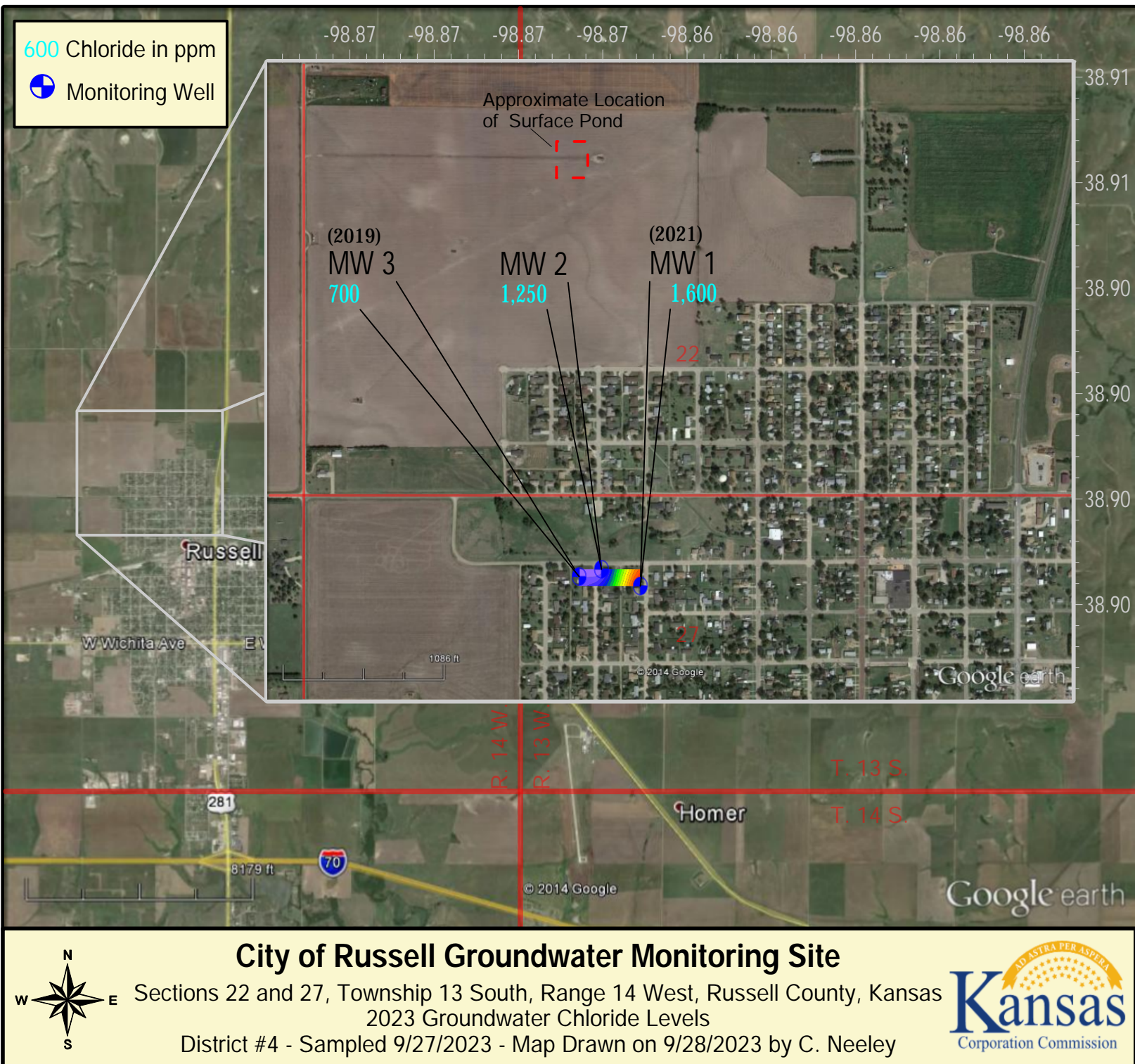
Ideal: 500 ppm Chloride

Target: 1000 ppm Chloride

Recommendations for Future Work: Further research may be needed to determine whether remediation is justifiable, and what action should be taken. Additional samples will be collected in the future to determine the configuration of the brine plume.

Estimated Total Costs: \$400,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970083-00	3 Hrs. / \$99.10		\$1,192.60
Current Contaminate Level: 700 ppm Cl⁻ to 1,600 ppm Cl⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input checked="" type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Project: *Russell Rural Water District #1, Russell County, District 4*

Site Location: Section 34 and 35, Township 14 South, Range 14 West, Russell County.

Impact/Immediacy: A public water supply well is producing water with elevated chloride content. The immediacy level is rated as low to moderate.

Site Description: The hydrology of the area is complicated through the interaction of a shallow drainage mantled with alluvium, the Smoky Hill Aquifer, and the Dakota Sandstone Aquifer. The public water supply well was drilled to the north of the river, in hope of utilizing the alluvium. However, the well is sufficiently deep to be drawing water directly from either the Smoky Hill Aquifer, or the Dakota. Additionally, the geology of the area may not provide a seal between the otherwise fresh shallow aquifers and the Dakota Aquifer. Although the area has undergone significant oil and gas development, no active sources for pollution have been identified. Furthermore, the Dakota Sandstone was an early disposal formation in the area.

Unusual Problems: Research conducted by the Kansas Geological Survey in 1991 and 1992 showed that the chloride content of the Smoky Hill River in the vicinity of this site ranged from 843 ppm to 1,879 ppm, with oil field brines contributing 11% to 29% of the total concentration. The major natural chloride source is the dissolution of natural salt deposits in Permian strata, which migrates into and through the Dakota Sandstone into the alluvium and river itself. Because of the difficulty in locating the source of the oil field brines, and the natural input of saline water, remediation of this site would not be feasible; however, each household served by the RWD is utilizing a reverse osmosis filtration system, mitigating the problem to some degree.

Status of Project: Over the previous 5 years, the chloride concentrations of the monitoring wells have remained steadily between 500 ppm and 900 ppm. Presently, the wells contain chloride concentrations of 400 ppm in MW 1, and 650 ppm in MW 3, and 700 in MW 5.

Level of Remediation Sought:

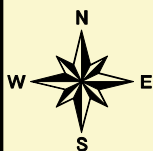
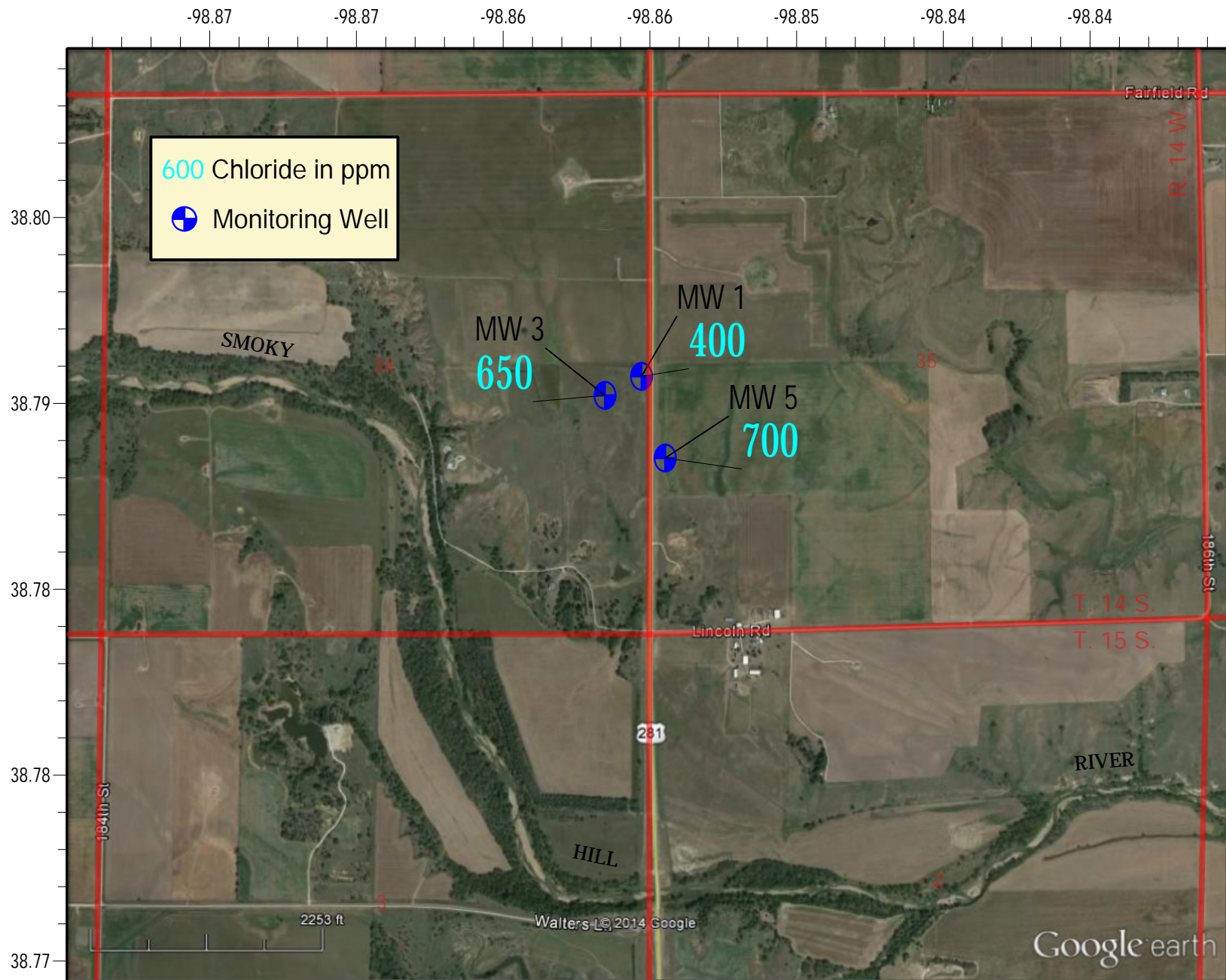
Ideal: 100 ppm Chloride

Target: 250 ppm Chloride

Recommendations for Future Work: This site should be monitored on an annual basis.

Estimated Total Costs: The estimated costs to KCC and KDHE for extensive studies in the past have been \$30,000 or greater. Continued monitoring costs will be \$3,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970084-00	4 Hrs. / \$122.98		
Current Contaminate Level: 400 ppm Cl ⁻ to 700 ppm Cl ⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Russell Rural Water District #1 Groundwater Monitoring Site

Sections 34 and 35, Township 14 South, Range 14 West, Russell County, Kansas
2023 Groundwater Chloride Levels

District #4 - Sampled 6/13/2023 - Map Drawn on 9/28/2023 by C. Neeley



Project: *Sander Contamination Site, Russell County, District 4*

Site Location: Section 3, Township 14 South, Range 15 West, Russell County.

Impact/Immediacy: A shallow aquifer and small drainage have been impacted by poor oil field practices. A stock well serves as the monitoring well. The immediacy level for this site is rated as low.

Site Description: The site is situated near the head of a small, intermittent tributary to Big Creek. The soils are Harney and Roxbury silt loam, and the area is divided equally between pasture along the creek, and cultivation in the higher portions of the location. Near-surface geological information is limited to data obtained through a few water well records covering many square miles; however, a reasonable hypothesis would be to expect topsoil to a depth of approximately six feet, atop a sand about ten feet thick. Shale bed rock is likely to be encountered at a depth of 15 to 20 feet below the surface, and a common depth for the area water wells is roughly 30 feet. The site is located within the Gorham oil field, which was discovered in 1926, and multiple water flood projects have been implemented within the field.

Unusual Problems: None.

Status of Project: Chloride levels were at 1,650 ppm in the stock well when it was tested in October 2005. Chloride concentrations dropped to 1,500 ppm in 2007 and to 1,250 ppm in 2008. Samples were not collected between 2008 and 2014, due to the pump on the well being in disrepair, and incapable of lifting a sample. The sample gathered in 2014 was obtained from a domestic water well to the north in Sec. 34, T. 13 S., R. 15 W. The sample from this well was tested and contained 300 ppm chloride. Neither well was available to district staff in 2015. The stock well is now equipped with an electric pump and float switch, which will enable sampling to be carried out. A sample collected from a stock tank set at the pump was 675 ppm in 2016 and 975 ppm in 2017. In 2018, the sample was collected directly from the well, and was 900 ppm. In 2020 the level was 1,000 ppm. The well was at 1,400 ppm in 2021, 1,200 ppm in 2022, and 850 ppm in 2023. The site will continue to be sampled.

Level of Remediation Sought:

Ideal: 500 ppm Chloride

Target: 1000 ppm Chloride

Recommendations for Future Work: Continue to monitor in the short term.

Estimated Total Costs: \$300.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970089-00	3 Hrs. / \$99.10		
Current Contaminate Level: 850 ppm Cl ⁻			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input checked="" type="checkbox"/> 2. Short Term Monitoring	<input type="checkbox"/> 3. Investigation	
<input type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	

Project: *Sample Contamination Site, Sedgwick County, District 2*

Site Location: The contamination area is located at the intersection of 45th Street North and Rock Road in Wichita. The legal location is the NW NW of Section 29 Township 26 South Range 2 East, Sedgwick County.

Impact/Immediacy: This site has very low immediacy. The chloride intrusion affects a groundwater aquifer that is a meager volume. Housing development in the area could see a rise in water well installation for domestic and heating/cooling systems.

Site Description: The site is located in northeast Wichita and is bordered by Elk Creek Addition in Bel Aire to the northwest, Sawmill Creek in Wichita directly north, and Willowbend Golf Course to the south. The topsoil is hard clay (Wellington formation). The underlying aquifer is a thin, low-volume zone in clay and shale that is directly affected by precipitation.

Unusual problems: A portion of the chlorides are natural and cannot readily be remediated. The aquifer is low volume and difficult to clean up. The total depth of the monitoring well is 19 feet and it continuously pumps off after one volume of water is removed. The urban setting logistically makes remediation difficult. Continued residential development could see increased use of groundwater in the area.

Status of Project: The water sample collected during 2022 tested 2,450 mg/L chlorides, one of the lowest values measured since 1995 when KCC took the site over from KDHE. In 2023, MW-1 tested 4,696 mg/L, nearly twice as high as last year. The change in chlorides fluctuates as this is a perched water table in the Wellington shale and is influenced by rainfall. Most of the state of Kansas during 2023 experienced an extreme drought, which may affect these higher chloride levels. With limited amounts of fresh water from precipitation to dilute the local mineralization and the low permeability of the shale, drought could be the reason for this uptick in chlorides.

Level of Remediation Sought:

Ideal: 250 mg/L Chloride

Target: 500 mg/L Chloride

Recommendations for Future Work: A water sample from the monitoring well tested by the Kansas Geological Survey for a bromide/chloride ratio test could see where this falls in the range of oilfield brine. Sampling the well at the business at the corner of 45th Street or other local wells would help KCC check the water quality over the larger area. If deeper zones indicate chloride values less than 250 mg/L and a bromide/chloride test shows a mixing of natural and oil field brines, KCC will close this site. With no information regarding this monitoring well, KCC believes it was installed due to a release before 1995 when KCC took over the site.

Estimated Total Costs: \$300 per year for site inspection, sample collection, and research.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970088-00	4 Hrs. / \$129.82		
Current Contaminate Level: 4,696 mg/L Chlorides			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input checked="" type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Project: Schulte Brine Remediation Site, Sedgwick County, District 2

Site Location: The legal description is the eastern half of Sections 7 and 8, Township 28 South, and Range 1 West of Sedgwick County, Kansas. To the northeast lies the Eisenhower Airport. The site is in the drainage systems of Cowskin Creek and Dry Creek. Dry Creek is a tributary of Cowskin Creek and flows easterly across the site's southern part. The confluence of the two creeks is approximately three miles southeast of Schulte.

Impact/Immediacy: The effect is on groundwater resources, including public supply wells and domestic water wells. KCC has rated the immediacy level as moderate.

Site Description: The location is regionally in the Arkansas River valley. The valley consists of unconsolidated alluvial deposits ranging in age from the late Pleistocene to Holocene. The Permian-aged Wellington Shale underlies these deposits and reportedly has a depth of approximately 120 feet. The apparent source for the contamination is saltwater disposal ponds associated with activities in the Schulte oil field in sections 6 and 7. The site resides between Wichita Eisenhower Airport to the northeast and the unincorporated town of Schulte to the west.

Land use is a combination of light industrial, agricultural, and residential. The aquifer consists of Pleistocene unconsolidated sand, clay, and gravel deposits. New construction of commercial/industrial complexes has occurred directly east of the recovery wells at the site, and a new industrial building between the two recovery wells in section 7. Local geology consists of topsoil underlain by a brown to reddish clay to silty clay intermixed with sand lenses. Upper clay thickness ranges from 8.5 feet to 33 feet from east to west. Below the top clay, poorly sorted sand and gravel beds intermix with thin clay and silt lenses. This sand unit thins to the west, unlike the clays above. Under that top sand unit is a brown to red clay silty-clay aquitard that can be up to 60 feet in thickness near the west end of the site. Below the middle clay aquitard is another sand unit. This sand unit is poorly sorted, fine to coarse-grained with gravel and inter-bedded clay and silt layers. A bottom clay layer separates the sand from the blue Wellington Formation bedrock.

Local hydrology is based on the two sand units above the Permian Wellington Formation bedrock but between substantial clay layers. The middle clay aquitard separates the two aquifers, and historical investigations suggest that the brine plume has, in the past, migrated along the top of this aquitard.

Groundwater below the aquitard in the plume area has been tested and appears historically uncontaminated. The groundwater movement is to the east-southeast and almost easterly along the site's eastern edge. Remediation by the KCC began at this site on November 1st, 2001. The site currently consists of 2 recovery wells, 11 monitoring wells, and one saltwater disposal well used to dispose of brine-impacted water. The recovery wells were not utilized during 2023.

Unusual Problems: The construction of new structures over the possible plume downgradient of the recovery system limits future recovery in that direction. Much of the area is for sale for future industrial expansion and could complicate the continuance of the site's remediation.

Status of Project: On May 11th, 2023, ten groundwater monitoring wells (MW-1, MW-6, MW-7, MW-8, MW-9, MW-15, MW-101, MW-201, MW-301, and MW-401) were gauged and sampled. KCC pumped all monitoring wells utilizing a Proactive submersible pump to purge the wells. KCC took conductivity measurements continuously, and fluids with high salinity were containerized for disposal. Lab results have shown possible plume movement over the last year down gradient across Maize road towards MW-8. Smaller increases further down the gradient support that plume movement is occurring, but future data will be beneficial in determining the extent of the migration.

KCC did not utilize the recovery system during 2023, as it was determined that chloride levels of recovered water were too low to remove from the local hydrological system. Lamp #1 SWDW, usually operated by the KCC for disposal of recovery fluid, was not used during 2023. KCC has offered the use of this well to the KGS for the studies of the Arbuckle formation, but this possibility has yet to be confirmed. Using a sonic meter, KCC checked the #1 Lamp's fluid level periodically during 2023. Fluid Levels were stable at approximately 124' below the ground surface.

KCC Annually participates with the Wichita State University Geology Department, providing the Schulte Site for field work done by geology students. WSU students take static water measurements from each monitoring well and build hydrological maps and interpretations for their hydrogeology class. WSU was onsite during the Fall of 2022. The next field trip with WSU is scheduled for the Fall of 2023.

Level of Remediation Sought:**Ideal:** 250 mg/l Chloride**Target:** 500 mg/l Chloride

Recommendations for Future Work: KCC recommends installing 4-5 new monitoring wells to delineate the plume's northern side when resources are available. The area of concern is currently on agricultural land, but KCC believes that further industrial and residential growth and construction will occur. Knowledge of the current hydrological status, especially groundwater mineralization, would benefit local land use planning. Once the recovery work is complete, KCC shall plug the Recovery Wells and disposal well unless the KCC finds other uses for the SWDW. However, monitoring the plume should be a long-term project. Plume delineation is vital to tracking potential brine impaction down gradient.

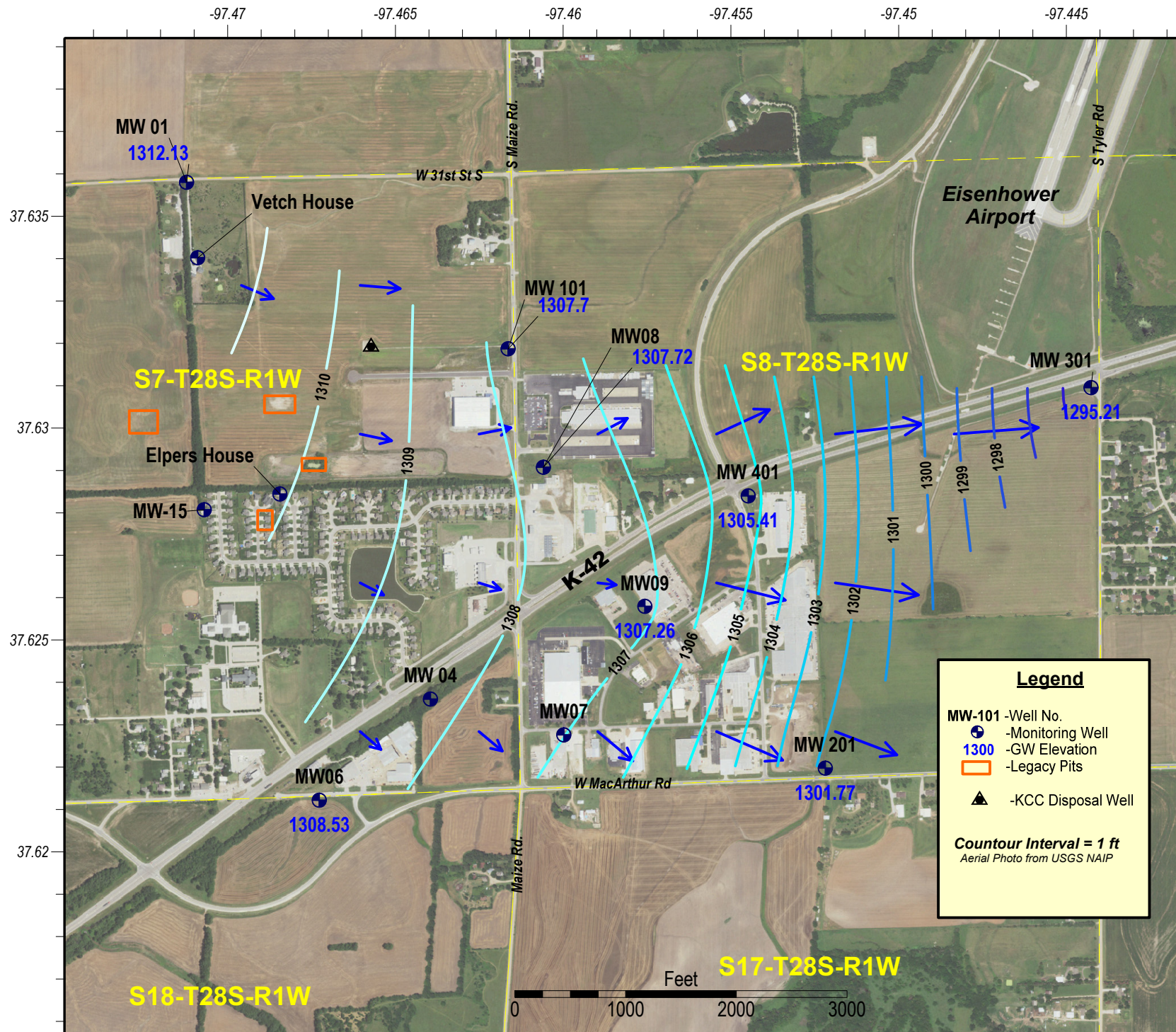
Estimated Total Costs: \$2,500 to upkeep the remediation system, perform annual groundwater sampling and continue investigating new domestic water wells installed inside the known plume. \$15,000-25,000 to drill and install new monitoring wells. \$3,000-4000 if KCC replaces the North recovery well pump. \$20,000 to plug the Lamp SWDW if needed.

Control No.**Staff Hours/Expenditures****Fund Expenditures****FY 2023/24 Total****970015-00****62 Hrs. / \$2,007.50****\$363.91****\$183,424.71****Current Contaminate Level: 30 mg/L in MW #1 to 2,800 mg/L in MW# 101****Status:**

- | | | |
|---|---|---|
| <input type="checkbox"/> 1. Site Assessment | <input type="checkbox"/> 2. Short Term Monitoring | <input type="checkbox"/> 3. Investigation |
| <input checked="" type="checkbox"/> 4. Long Term Monitoring | <input type="checkbox"/> 5. Remediation Plan | <input type="checkbox"/> 6. Installation |
| <input checked="" type="checkbox"/> 7. Remediation | <input type="checkbox"/> 8. Post Rem. Monitoring | <input type="checkbox"/> 9. Resolved |







Project: Curtis Contamination Site, Stafford County, District 1

Site Location: The legal location is Sections 23, 24, 25 & 26 of Township 24 South, Range 14 West, Stafford County.

Impact/Immediacy: The impact is to groundwater resources that have been contaminated by the flow of salt water from an old core drill hole. The core hole thought to be the source of contamination was plugged in 1988. This site has a low to moderate immediacy rating.

Site Description: This site was investigated after the Curtis irrigation well was reported salty. The aquifer in this area consists of unconsolidated material consisting mostly of sand and gravel, and is in general ninety feet thick. Several thin aquitards were encountered in the unconsolidated material. Bedrock consists of clay shale of various colors and was encountered at approximately 90 to 100 feet. The Curtis irrigation well tested salty upon completion and it was reportedly never used. It was also reported that no preliminary test boreholes were made before drilling the irrigation well. The irrigation well was probably drilled into the top of the bedrock and may have pumped chloride contaminated water from this zone.

Unusual Problems: The old core hole may have allowed cross flow of brine into the groundwater aquifer of the Rattlesnake Creek for more than forty years. The plume from this massive intrusion of brine extends to the northeast approximately two miles from the original source area.

Status of Project: Samples were collected from four monitoring wells in 2023. The chlorides have remained steady in the area. The plume remains confined around MW-1. Only two of the wells remain above the ideal level of 250ppm chloride.

Level of Remediation Sought:

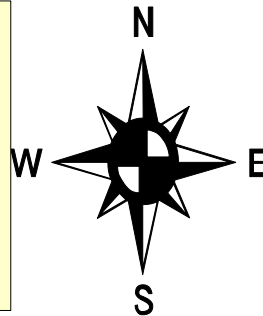
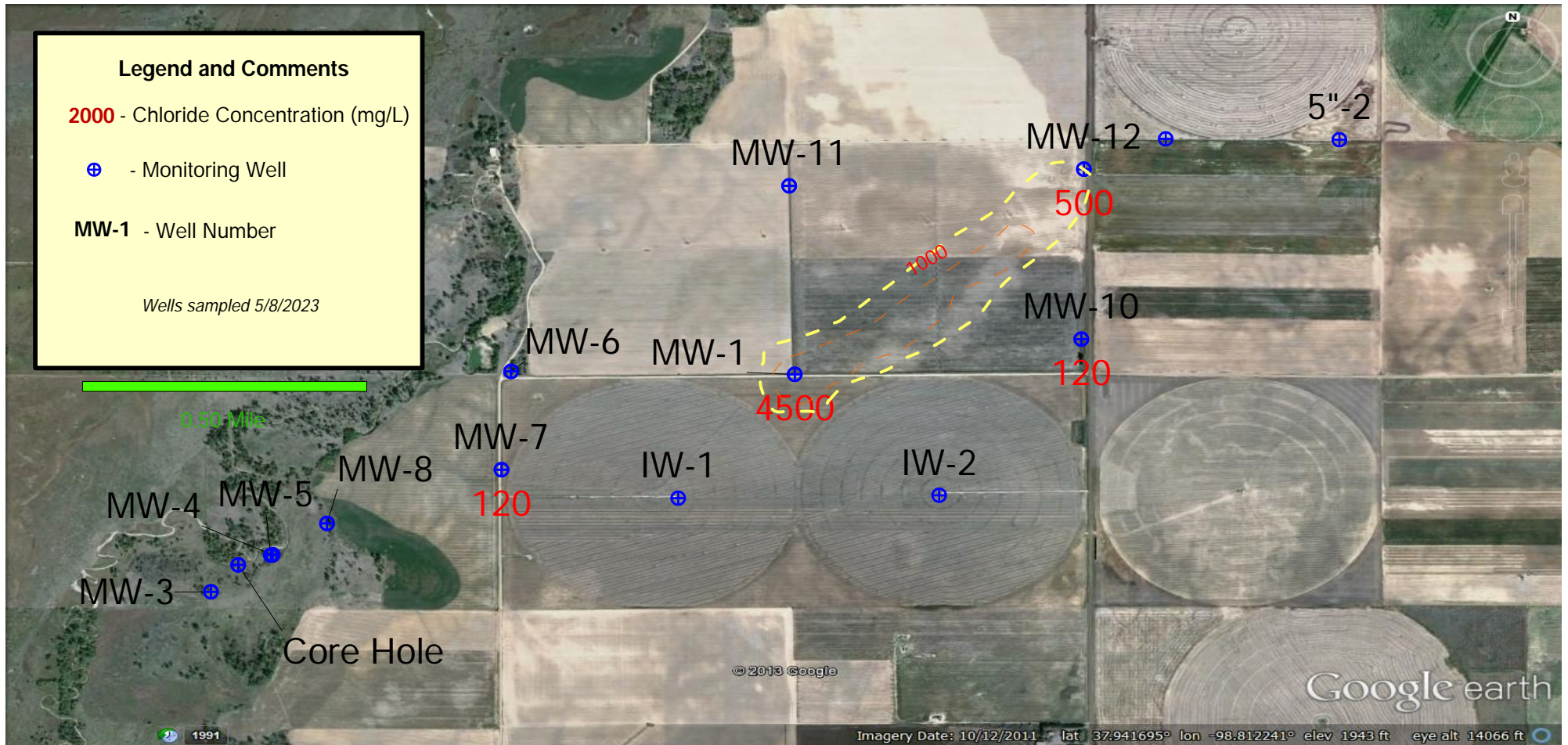
Ideal: 250 ppm

Target: 500-1000 ppm

Recommendation for Future Work: Continued monitoring of the site is recommended. The plume has migrated to the Northeast away from the original location near the old core hole. Monitoring wells 3-10 should be plugged as they have remained fresh for several sampling cycles. The possibility of repairing MW-11 or drilling a replacement well will be explored.

Estimated Total Costs: \$27,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970034-00	5 Hrs. / \$157.12		\$4,199.17
Current Contaminate Level: 120 ppm Cl- to 4500 ppm Cl-			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Curtis Site

Sections 19/23/24/25/26-T24S-R14W
Stafford County, Kansas

2023 Area Map with Chlorides

KCC Control # 970034-00 District 1
N. Feldkamp 9/18/2023

Project: *French Contamination Site, Stafford County, District 1*

Site Location: The site is located in Section 17, Township 23 South, Range 13 West, Stafford County.

Impact/Immediacy: Potential exists for impacts on stock and irrigation resources. Subsidence around the French “A” 1 has developed into a sinkhole. Worst-case scenario would be a catastrophic collapse taking part of an east-west county road and several acres of farm ground. Probable action is a gentle downward movement of the area until stable. The site has a moderate to high rating.

Site Description: The site consists of an unplugged saltwater disposal well whose operation led to the development of a solution cavity. The site is located in a rural setting 330’ north of a county road. Land use is agricultural with oil activities in the area. The subsidence at the site now covers an area of approximately 600 x 1000’ in size.

Unusual Problems: A solution cavity was determined to exist under the existing location by a seismic survey conducted by the KGS. The seismic survey indicates the cavity is approximately 60’ thick.

Status of the Project: Elevations were not able to be shot in 2023 because the benchmark has been destroyed. The recommendations for future work will be completed in 2024. See map for proposed benchmark and new sample points.

Level of Remediation Sought:

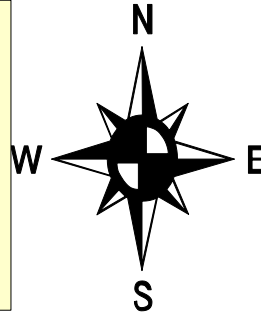
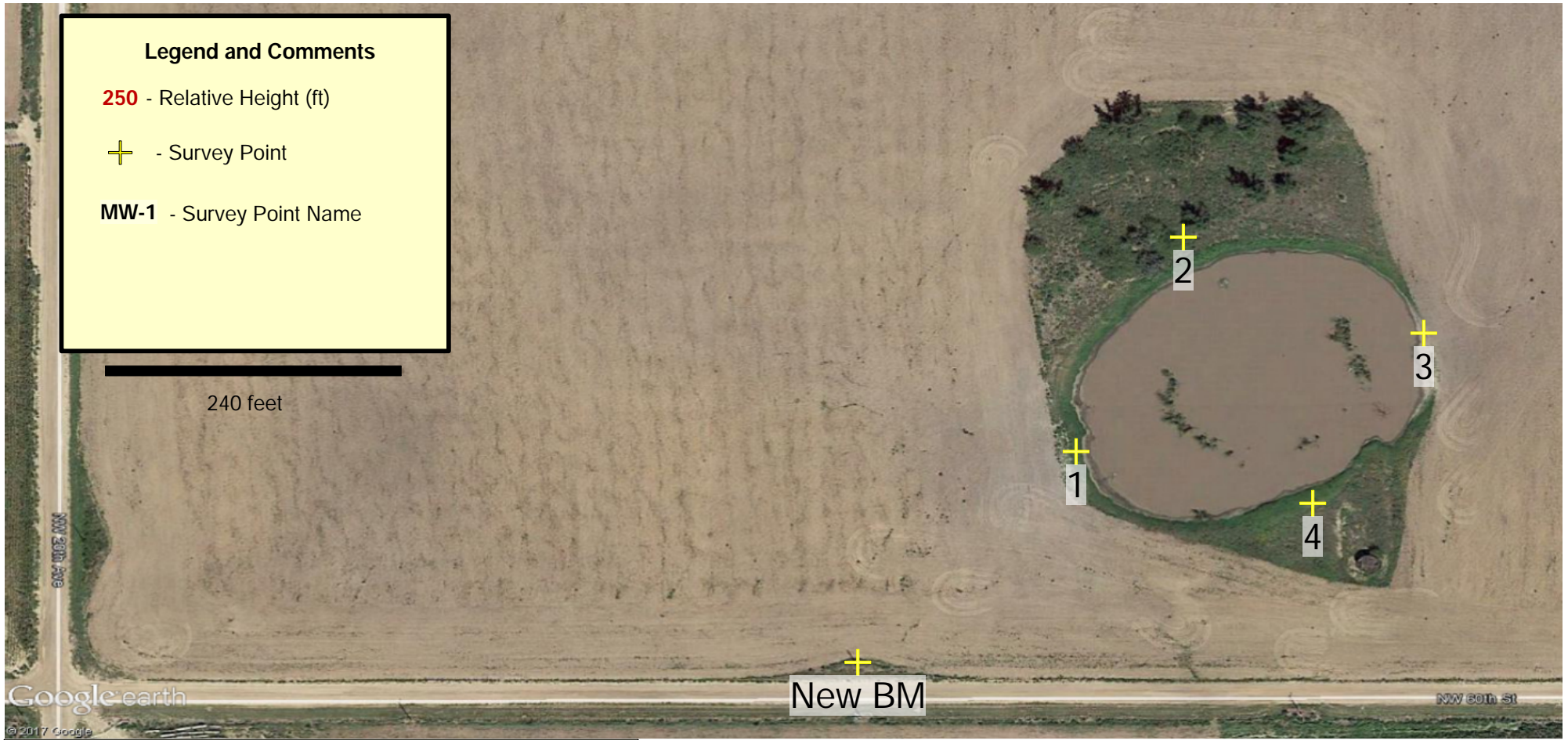
Ideal: Stabilize cavity and plug well bore in accordance with KCC rules and regulations.

Target: Safely monitor site. Determine an acceptable plugging procedure, which will adequately address groundwater resources.

Recommendations for Future Work: Set a new bench mark located closer to the sinkhole for more accurate surveys. Look at adding a few more survey points. Resume the annual survey of the site to establish a current rate of subsidence.

Estimated Total Costs: \$3,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
990002-001	3 Hrs. / \$99.10		\$346.50
Current Contaminate Level: Unknown			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



French Sinkhole
SW 1/4 Section 17-T23S-R13W
Change in Elevation Map
KCC Control #970002-001 District #1
N. Feldkamp 10/30/2023

Project: *Leesburg Sink Hole Site, Stafford County, District 1*

Site Location: The site is located in Section 12, Township 25 South, Range 13 West, Stafford County.

Impact/Immediacy: Potential exists for impacts on stock and irrigation resources. Subsidence around the Leesburg #302 and Leesburg #303 may develop into a sinkhole. Worst-case scenario would be a catastrophic collapse taking several acres of farm ground. Probable action is a gentle downward movement of the area until stable. The site has a moderate to high rating.

Site Description: The site consists of a plugged saltwater disposal well whose operation led to the probable development of a solution cavity. The site is located in a rural setting approximately 990' FEL and 2310' FSL of section 12. Land use is agricultural with oil activities in the area. The subsidence at the site now covers an area of approximately 350'x400' in size.

Unusual Problems: A solution cavity is thought to exist under the existing location.

Status of the Project: Elevation was shot on September 29, 2023, by Advantage Elevations. The point remained the exact same as previous shot in 2021. It was noted the water level has receded since last event. The average rate of subsidence is 0.33' per year. Sinkhole was dry at the time of elevation survey, was able to shoot elevation at the lowest point.

Recommendations for Future Work: It is recommended the site continued to be surveyed annually. The ground level at the stake on the east side should be surveyed in addition to the Leesburg 302 if it is accessible (low/no water). Additional points on the north and south edges of the sink, as well as a point in the center of the sink should be added in order to more thoroughly describe the movement.

Level of Remediation Sought:

Ideal: Stabilize cavity.

Target: Safely monitor site.

Estimated Total Costs: RP -\$62,000, plugging costs, seismic and installation of monitor wells.

Control No.	Staff Hours/Expenditures	Fund Expenditures	
		FY 2023/24	Total
20040003-001	3 Hrs. / \$99.10		\$6,266.00
Current Contaminate Level: Unknown			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



OIL FIELD SURVEYORS

BOX 8604 - PRATT, KS 67124
(620) 672-6491

929235

INVOICE NO.

LYONS & LYONS INC.

OPERATOR

SINKHOLE

NO.

SAUNDER LEASE

FARM

STAFFORD CO. KS
COUNTY

12 25s 13w
S T R

NW NE SE

LOCATION

ELEVATION: 1901 GR



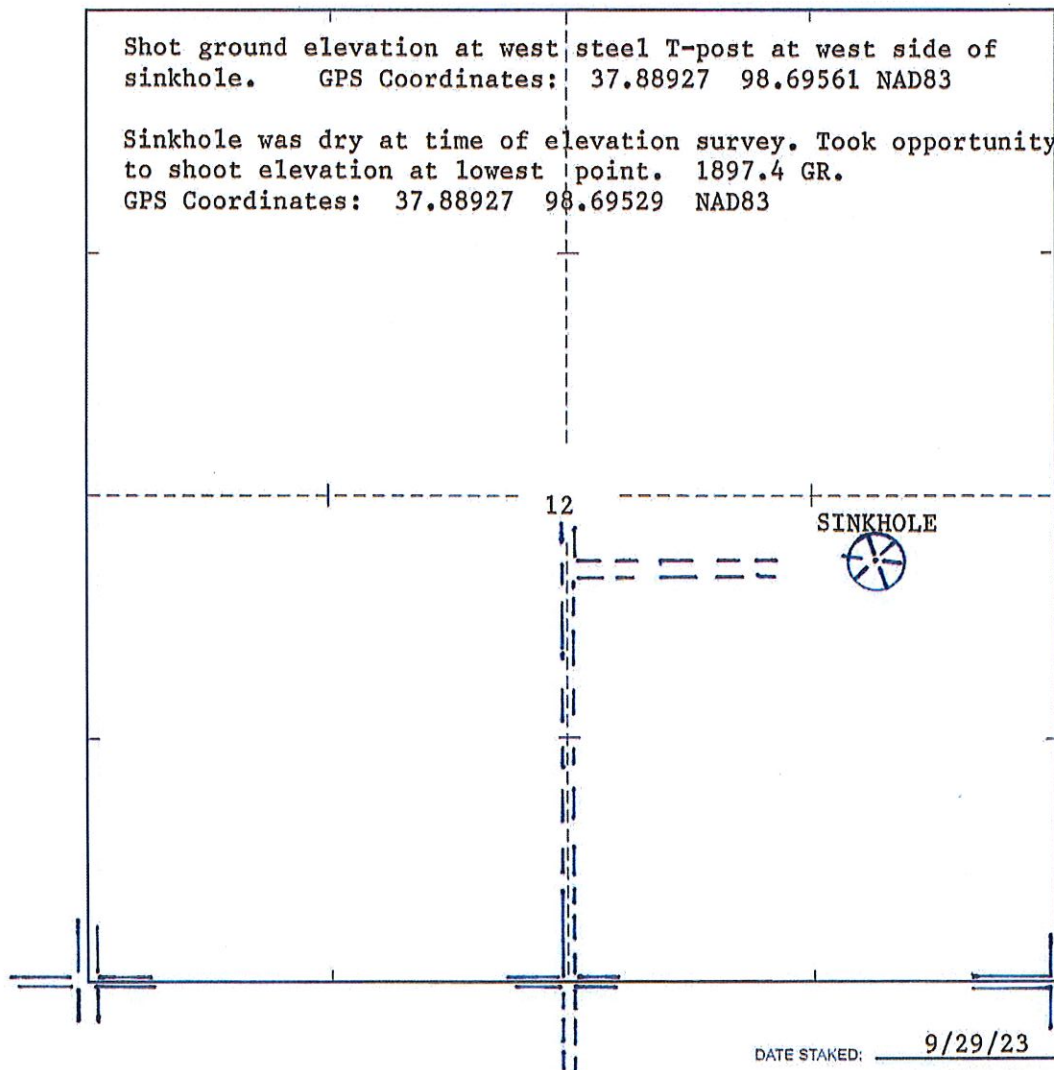
LYONS & LYONS INC.
1519 S. Baltimore Ave.
Tulsa, OK 74119

AUTHORIZED BY: _____

SCALE: 1" = 1000'

Shot ground elevation at west steel T-post at west side of sinkhole. GPS Coordinates: 37.88927 98.69561 NAD83

Sinkhole was dry at time of elevation survey. Took opportunity to shoot elevation at lowest point. 1897.4 GR.
GPS Coordinates: 37.88927 98.69529 NAD83



DATE STAKED: 9/29/23

Project: *Wingate Contamination Site, Wilson County, District 3*

Site Location: NE/4 of Section 17, Township 29 South, Range 17 East, Wilson County.

Impact/Immediacy: Impact is to the groundwater and soil. Immediacy level is rated as low.

Site Description: This site is located on gently sloping land used for agriculture. Much of the scar is located in a low-lying drainage area next to or within a waterway. Brine seepage originates from the Thayer coal bed or Cottage Grove Sandstone Member, which overlies the Chanute Shale in the higher areas.

Unusual Problems: This property is leased by River Rock Operating. The Mary Douglas property located in the next ¼ section to the East contained 22 abandoned wells, many of which had high fluid levels and were old style completions. These abandoned wells are contributing to the source of the brine commingling with the shallow aquifer impacting the Wingate property. These wells were plugged by the State and the project was completed in February of 2009.

Status of Project: Four new monitoring wells were constructed on this project in early 2012. Statistical analysis of samples collected from these four new monitoring wells indicates Cl- concentrations are directly impacted by precipitation events and oil & gas producing activities within the immediate vicinity. The sample results for 2023 are as follows:

	<u>MWE 01</u>	<u>MWE 02</u>	<u>MWE 03</u>	<u>MWE 04</u>
<u>08/23/2023</u>	<u>1500 ppm Cl-</u>	<u>900 ppm Cl-</u>	<u>1500 ppm Cl-</u>	<u>1400 ppm Cl-</u>

Level of Remediation Sought:

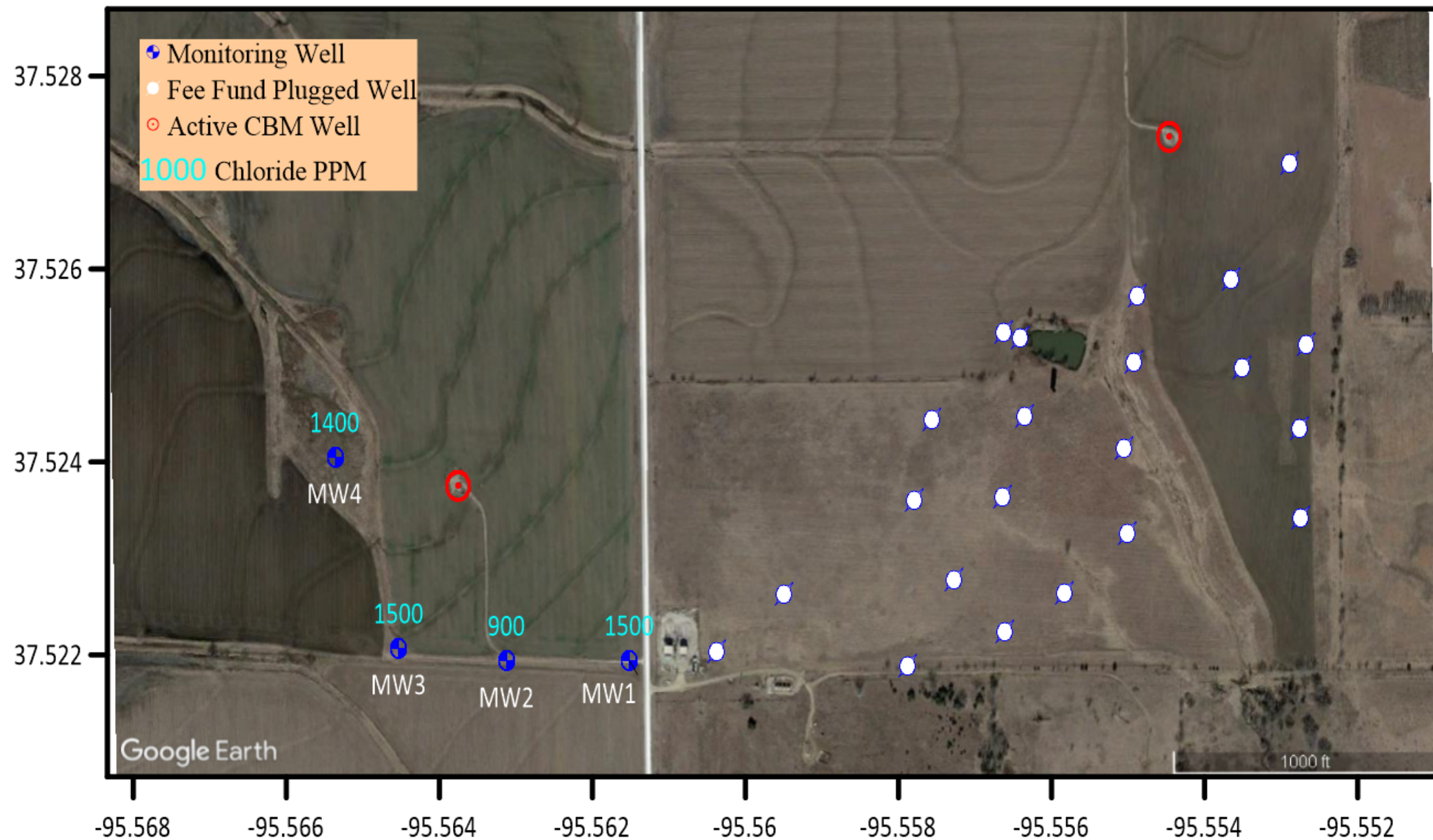
Ideal: 250 ppm Chloride

Target: 500 ppm Chloride

Recommendation for Future Work: Sample site annually. This site should possibly be expanded to include the Mary Douglas property located in NW 16-T29S-R17E WL Co. and the SE 17-T29S-R17E. Graphical analysis of the Cl- concentrations in these four wells indicates that chlorides are on a downward trend since the project was initiated. Factors such as an increase in flood and or disposal fluids from active operations completed within the same zone or CBM wells that have been shut in or pumping at reduced rates can temporarily increase formation pressures allowing greater communication with possible undiscovered open bore holes and an increase in chloride levels. Further monitoring of existing wells and possible additional monitoring wells will help to delineate the extent and condition of this aquifer. Further review of KGS well data and GIS information along with the new ability to download and overlay historic aerial imagery may provide information on additional possible locations of abandoned wells for further field investigation.

Estimated Total Costs: Four new monitoring wells were completed at a cost of \$8,196 in 2012.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2023/24	Total
970107-00	10 Hrs. / \$314.15		\$8,296.00
Current Contaminate Level: 900 ppm Cl- to 1,500 ppm Cl-			
Status:			
<input type="checkbox"/> 1. Site Assessment	<input type="checkbox"/> 2. Short Term Monitoring	<input checked="" type="checkbox"/> 3. Investigation	
<input checked="" type="checkbox"/> 4. Long Term Monitoring	<input type="checkbox"/> 5. Remediation Plan	<input type="checkbox"/> 6. Installation	
<input type="checkbox"/> 7. Remediation	<input type="checkbox"/> 8. Post Rem. Monitoring	<input type="checkbox"/> 9. Resolved	



Wingate Remediation Site

NE 17-T29S-R17E Wilson County, Kansas

2023 Groundwater Chloride Levels - District #3 Sampled 08/23/2023

Map Drawn on 9/6/2023 by J. Shaffer

Project 970170-00





Ryan A. Hoffman, Director of Conservation

266 N Main Street, Suite 220 | Wichita, KS 67202-1513 | <https://kcc.ks.gov/>