Kansas
Corporation Commission

KANSAS CORPORATION COMMISSION

Remediation Site Status Report

2012

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

Introduction

During the 1996 legislative session House Substitute for Senate Bill 755 was passed. A part of this legislation created an Abandoned Oil and Gas Well / Remediation Fund with the expressed purpose of providing funds to 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. The legislation also required the Corporation Commission prepare an annual Remediation Site Status Report for the office of the Governor and certain legislative committees. This report for the period January 1, 2013, through December 31, 2013, 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 FY2014 are projected to be approximately $50,000.

Site Inventory

The inventory of sites listed in the current Remediation Site Status Report consists of 56 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, 72 sites have been resolved and 22 sites have been added. The current evaluation period, January 1, 2013, through December 31, 2013, ended with the addition of one site and the resolution of four sites, resulting in a total of 52 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)	75
Public Water Supply	8
Domestic Supply	22
Stock Supply	15
Irrigation Supply	11

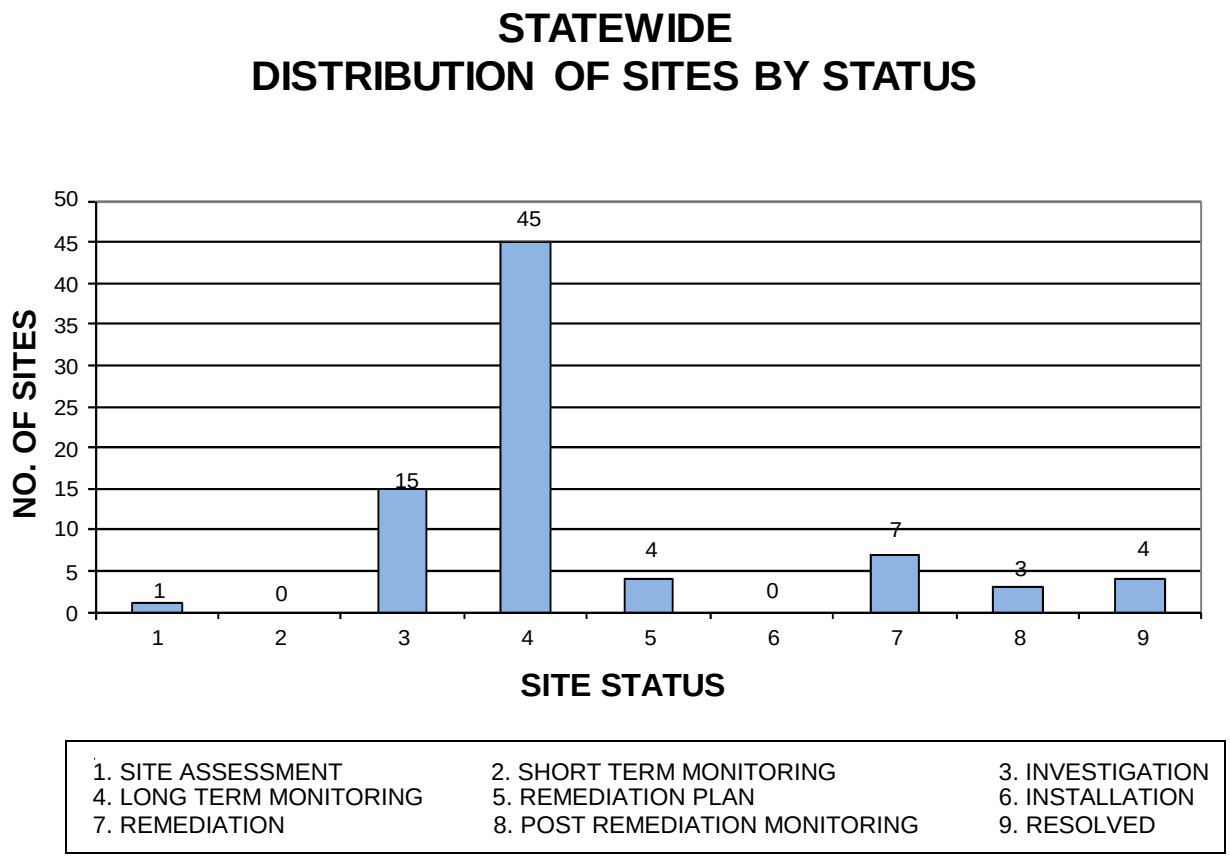
*Some sites have impacts to multiple resources

Distribution of Active Sites with Respect to Immediacy Levels

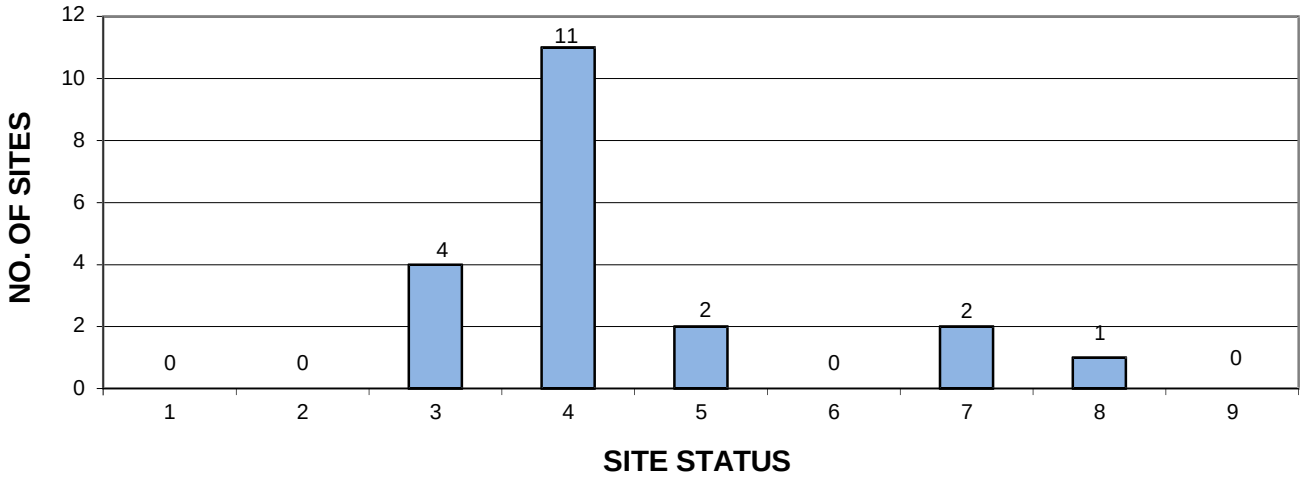
Range of Immediacy Level	No. of Sites
Low & Low to Moderate	25
Moderate	9
Moderate to High & High	11
Other (Under Remediation)	7
Total	52

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 56 listed sites on a statewide and KCC District basis.

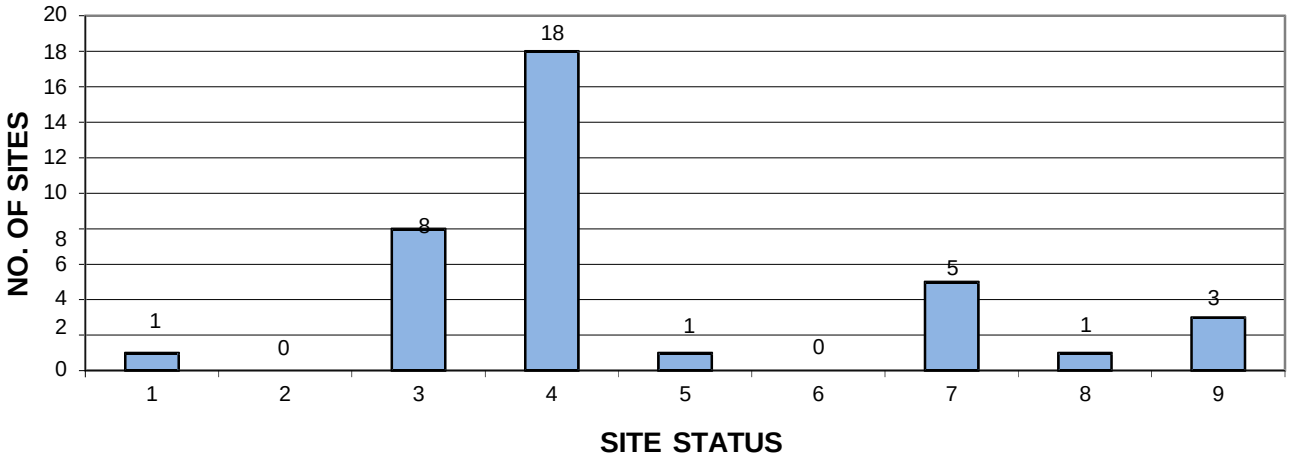


DISTRICT 1
DISTRIBUTION OF SITES BY STATUS



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

DISTRICT 2
DISTRIBUTION OF SITES BY STATUS



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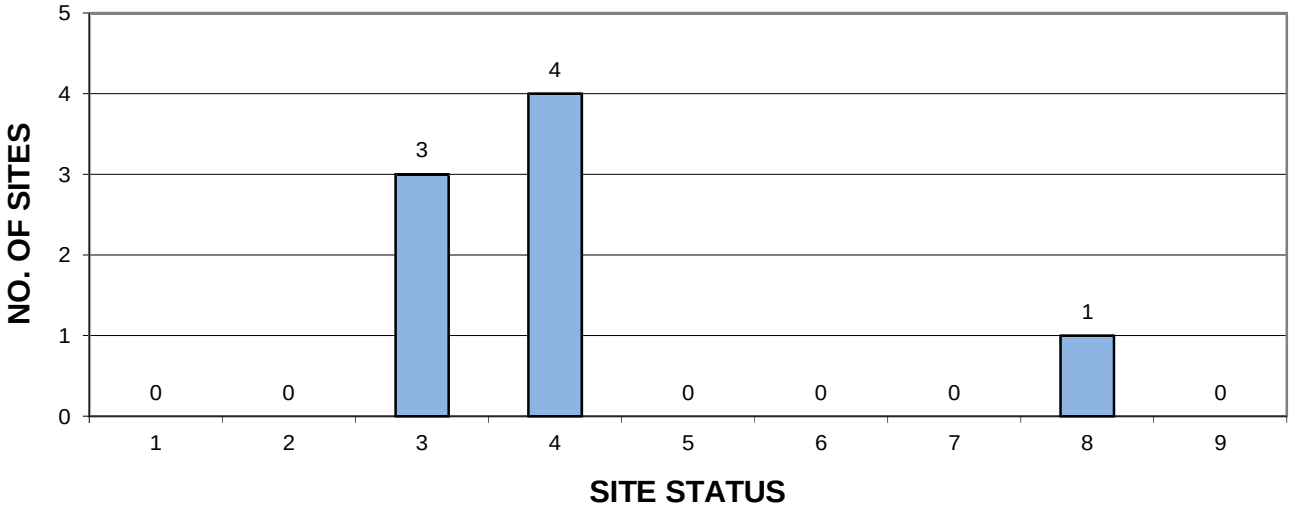
DISTRICT 3
DISTRIBUTION OF SITES BY STATUS



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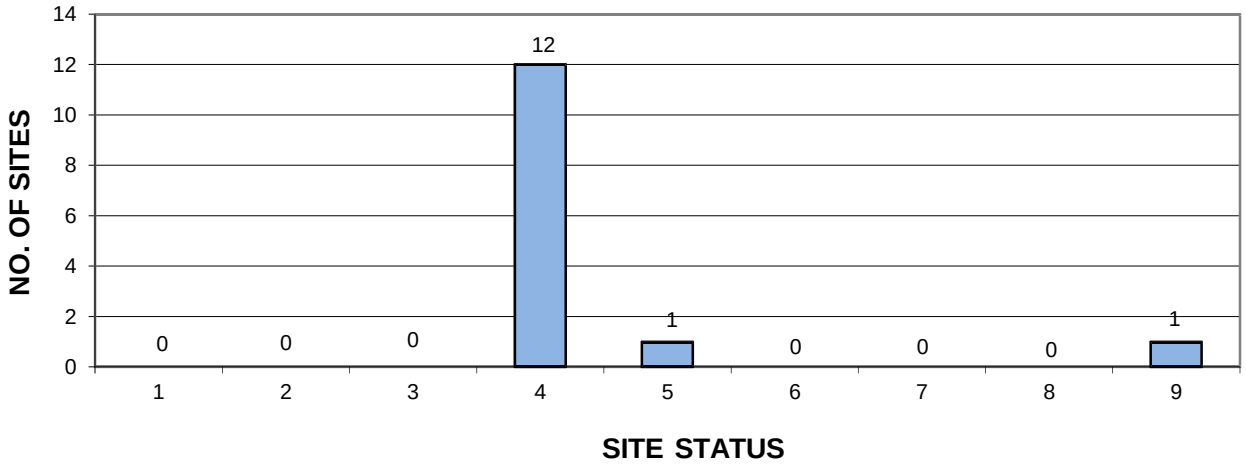
9. RESOLVED

DISTRICT 4
DISTRIBUTION OF SITES BY STATUS



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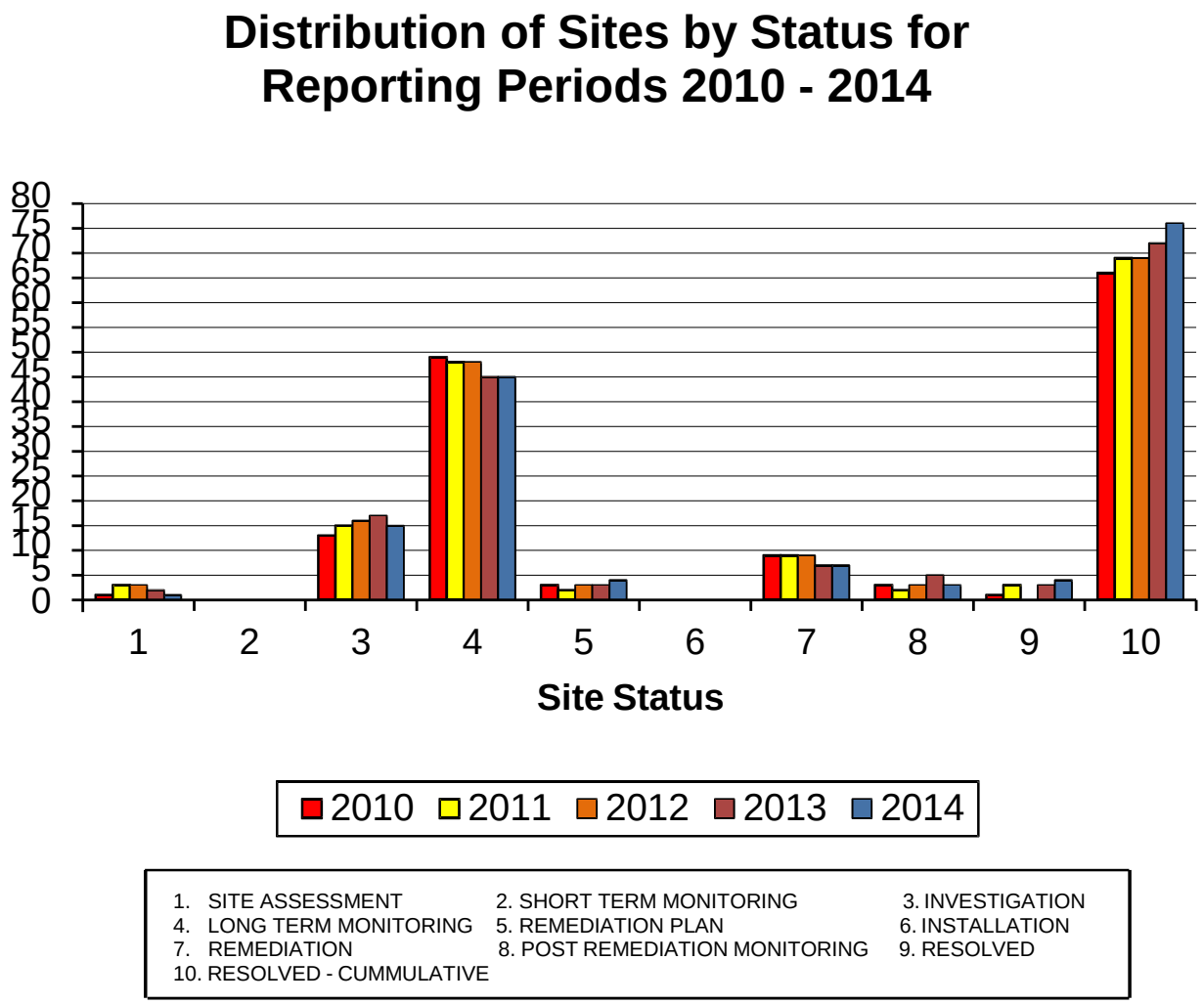
8. POST REMEDIATION MONITORING
9. RESOLVED

This graph depicts the distribution of sites by status for the reporting periods 2010 through 2014.



Conclusions

This report provides information concerning the location, resource impact, immediacy level, and site description and status for 56 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

Site Name	County	KCC District	Impact	Immediacy	Target Level Of Remediation	Unusual Problems	Estimated Total Cost
Arlington	Reno	2	GW / Soil / DM / IR / WSW	UR	250 ppm	Yes	$ 7,500*
Balthazor	Graham	4	GW / Domestic (Sole Source)	Low	250 ppm	Yes	$ 10,000
Benson	Reno	2	Groundwater / Soil	Resolved	Reached	Yes	$ 7,714
Brazil	Neosho	3	SW / GW / PWS / Soil	Low-Mod	500 ppm	No	$ 63,000
Brothers	Rice	2	Groundwater	Low	500 ppm	Yes	$ 4,000
Burrton	Harvey/Reno	2	GW / Domestic / Irrigation	High	Variable	Yes	$3,000,000+
Clawson(Mesa)	Haskell	1	Groundwater / Irrigation	UR	350 ppm	Yes	$ 450(yr)*
Codell	Rooks	4	GW / Public Water Supply	Resolved	Reached	Yes	$ 25,527
Curtis	Stafford	1	Groundwater / Irrigation	Low-Mod	500-1000 ppm	Yes	$ 27,000
Dinkel	Ellis	4	GW / Domestic (SS)	Moderate	250 ppm	Yes	$ 30,000
Dinkler	Butler	2	GW / Domestic / Irrigation	Low	500 ppm	Yes	$ 60,000
EB-3C	Reno	2	Groundwater	Low	No Free Liquid Hydrocarbon	Yes	$ 8,000
El Dorado BTA	Butler	2	Soil / WP (AB Wells)	Resolved	NA	Yes	$ 4,876

Site Name	County	KCC District	Impact	Immediacy	Target Level Of Remediation	Unusual Problems	Estimated Total Cost
Elm Creek	Rooks	4	GW / Domestic / Stock Well	Mod-High	500 ppm	Yes	$ 300,000
Enoch-Thompson	Pawnee	1	Groundwater / Stock Well	Low-Mod	1000 ppm	No	$ 500(yr)*
Fink, Leon	Graham	4	Groundwater / Stock Well	Low	500 ppm	Yes	$ 2,000
Fowler	Montgomery	3	Soil	Low	300 ppm	Yes	$ 4,500
French	Stafford	1	GW / SW / SD / WP	Mod-High	500 ppm	Yes	$ 3,000
Galva City	McPherson	2	Groundwater	UR	500 ppm	Yes	$ 500,000
Harbaugh	Barber	1	GW / Domestic / Stock Well	High	1000 ppm	Yes	$ 450,000*+
Hollow-Nikkel	Harvey	2	GW / Domestic / Irrigation	Moderate	500 ppm	Yes	$ 75,000
Hrencher	Barber	1	GW/ STK / Soil / SW	Mod-High	1000 ppm	No	$ 150,000
Irey - Hrabe	Rooks	4	Groundwater	Low	500 ppm	Yes	$ 4,000
Jennings	Decatur	4	Groundwater / PWSW	Low-Mod	500 ppm	Yes	$ 2,000
Johnson, C	Rice	2	Groundwater / SD	Low	750 ppm	No	$ 2,500
Knackstedt	McPherson	2	WP (Cavity)	Moderate	NA	Yes	$ 5,000
Korf	Hodgeman	1	GW / SW/ Soil	Low	1000 ppm	Yes	$ 2,500*
Leesburg Sink	Stafford	1	WP (Cavity)	Mod-High	NA	Yes	$ 62,000*

Site Name	County	KCC District	Impact	Immediacy	Target Level Of Remediation	Unusual Problems	Estimated Total Cost
Little River	Rice	2	Groundwater / PWS	High	300 ppm	Yes	$ 46,500
Macksville	Pawnee	1	Groundwater / IR	Low	300 ppm	Yes	$ 20,000(yr)*
Mantooth	Montgomery	3	GW / Domestic (SS) / SW	Moderate	500 ppm	Yes	$ 10,000+
Maupin	Russell	4	Groundwater / Stock Well	Low-Mod	500 ppm	No	$ 2,000
McDonald - East	Linn	3	Surface Water	Low	500 ppm	No	$ 1,500(yr)
McPherson LandFill	McPherson	2	GW / DM / SD / INDWSW	UR	500 ppm	No	$ 26,500*
Mount, C. E.	Reno	2	GW / DM / Irrigation / SD	Resolved	Reached	Yes	$ 10,667
Nikkel-Epps	McPherson	2	GW / Domestic (SS)	Mod-High	500 ppm	Yes	$ 20,000
Packard	Barber	1	GW / Water Well / STK	Moderate	1000 ppm	Yes	$ 10,000
Ruder	Ellis	4	Groundwater / SW	Moderate	500 ppm	Yes	$ 29,000
Running Turkey Ck	McPherson	2	DM/PWS/SW/SD/STK/IR	Mod-High	500 ppm	Yes	$ 125,000
Russell City	Russell	4	GW / Domestic / Irrigation	Moderate	1000 ppm	Yes	$ 400,000
Russell RWD #1	Russell	4	Groundwater / PWSW	Mod-High	250 ppm	Yes	$ 33,000
Sample	Sedgwick	2	Groundwater	Low	500 ppm	Yes	$ 2,000
Sander	Russell	4	GW / Domestic / Stock Well	Low	1000 ppm	Yes	$ 300
Schraeder	Hodgeman	1	Groundwater / Stock Well	Low	350 ppm	No	$ 30,000

		KCC			Target Level	Unusual	Estimated

Site Name	County	District	Impact	Immediacy	Of Remediation	Problems	Total Cost
Schruben-Rogers	Rooks	4	GW / Domestic (SS)	Low	250 ppm	No	$ 2,000
Schulte Field	Sedgwick	2	GW / Domestic / PWSW	UR	500 ppm	Yes	$ 300,000
Selzer	McPherson	2	Groundwater / SW	Moderate	500-750 ppm	Yes	$ 20,000
Smith-Finn	Morton	1	Groundwater / Domestic	UR	500 ppm	Yes	$ 200,000*
South Spivey	Kingman	2	GW / DM / SW	Low	750 ppm	Yes	$ 5,000*
South Wichita	Sedgwick	2	GW / PWSW / DM / IR	Low	500 to 750 ppm	Yes	$ 43,000
Stowe-Zaid	Rice	2	Groundwater / Soil	Low	350 ppm	Yes	$ 12,000
Trostle	Kingman	2	GW / Domestic / STK / Soil	Low	500 ppm	No	$ 2,500*
Voshell	McPherson	2	GW / SW / DM / IR / STK	Moderate	500 ppm	Yes	$ 20,000
Wildboy's	Barber	1	GW / SW / PWSW	Mod-High	500 ppm	No	$ **
Wingate	Wilson	3	Groundwater / Soil	Low	500 ppm	Yes	$ 15,000
Yoeman	Kingman	2	GW / DM /Stock Well	UR	NA	Yes	$ 56,000+
Total Estimated Cost							$6,253,034

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 2013/14	TOTAL
ARLINGTON	20030016-001	24	$631.70		
BALTHAZOR	970023-00	10	$251.22		
BENSON	20000034-001	15.5	$414.38		
BRAZIL	990040-001	58	$1,517.78		$10,767.25
BROTHERS	970029-00	20	$514.58		$4.26
BURRTON	970003-00	29	$775.55	$5,292.00	$316,018.31
CLAWSON	970005-00	22	$582.94		
CODELL	970033-00	10	$251.22		$19,491.40
CURTIS	970034-00	10.5	$303.78		$4,199.17
DINKEL	970035-00	4	$102.76		
DINKLER	20050047-001	4	$112.04		$9,642.50
EB-3C	970042-00	10	$269.78		$2,350.00
EL DORADO	20110055-001	10	$269.78		
ELM CREEK	970043-00	22	$529.58		$29,212.25
ENOCH THOMPSON	970044-00	9.5	$248.97		
FINK	970007-00	10	$251.22		
FOWLER	970046-00	13	$348.65		
FRENCH	990002-001	10.5	$285.92		$346.50
GALVA CITY AREA	980033-001	247.5	$6,517.76	$5,404.07	$236,786.66
HARBAUGH	970049-00	44	$1,164.96	$2,565.00	$536,030.90
HOLLOW NIKKEL	970009-00	38	$1,005.90	$3,078.00	$32,322.65
HRENCHER	970051-00	45	$1,130.04		$189.94
IREY-HRABE	970053-00	2	$59.46		
JENNINGS	970054-00	8	$189.36		
JOHNSON	970055-00	16	$413.04		$416.28
KNACKSTEDT	970060-00	17	$446.57		$153.39

SITE NAME	CONTROL NO.	STAFF HOURS	EXPENDITURE FOR STAFF HOURS	REMEDIATION FUND AUTHORIZATION / EXPENDITURE FY 2013/14	TOTAL
KORF	20140017-001	22	$580.62		
LEESBURG SINK	20040003-001	2	$59.46		$6,266.00
LITTLE RIVER	20000057-001	12	$322.36		$3,112.20
MACKSVILLE	970066-00	52.5	$1,334.39	$1,344.00	$73,012.02
MANTOOTH	980058-001	90	$2,348.78		$17,349.00
MAUPIN	970068-00	8	$203.28		
MC DONALD-EAST	970070-00	60.5	$1,573.23		
MCPHERSON LANDFILL	980034-001	9.5	$287.91	$648.00	$19,153.98
MOUNT, C E	20030036-001	18	$480.10		
NIKKLE-EPPS	20100082-001	18	$462.00		$8,318.75
PACKARD	970075-00	20	$500.10		$310.09
RUDER	970082-00	6	$146.06		$12,960.00
RUNNING TURKEY CREEK	20010033-001	25	$649.65		$61,603.07
RUSSELL CITY	970083-00	2	$59.46		$1,192.60
RUSSELL RWD #1	970084-00	10	$251.22		
SAMPLE	970088-00	10	$255.30		
SANDER	970089-00	2	$59.46		
SCHRAEDER	970013-00	10	$253.54		$1,590.90
SCHRUBEN-ROGERS	970014-00	6	$146.06		
SCHULTE	970015-00	207	$5,312.41	$3,799.65	$146,394.68
SELZER	970093-00	22	$585.26	$5,204.25	$12,133.50
SMITH-FINN	970095-00	14	$365.66		
SOUTH SPIVEY	970096-00	18	$462.00		
SOUTH WICHITA	970016-00	42	$1,082.10		$10,767.02
STOWE-ZAID	20000035-001	9	$236.25		$4,057.85
TROSTLE	980038-001	21	$537.25		
VOSHELL	20030059-001	44	$1,145.54	$378.00	$18,974.44
WILDBOY'S	970017-00	19.5	$487.86		

SITE NAME	CONTROL NO.	STAFF HOURS	EXPENDITURE FOR STAFF HOURS	REMEDIATION FUND AUTHORIZATION / EXPENDITURE FY 2013/14	TOTAL
WINGATE	970107-00	48.5	$1,281.95		$8,296.00
YEOMAN	20060021-001	17.5	$494.06		$93,690.76
Totals:		1555.5	$40,552.23	$27,712.97	$1,697,114.32

REMEDIATION

SITES

REPORT

2014

EXISTING SITES

Project: ***Arlington Site***

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

Impact/Immediacy: Impacts are to both soil and groundwater as a result of a large saltwater line leak from August 2000. Initially the spill impacted irrigation well in the SE/4 of Section 11 and a domestic well on the lease in late 2001. The domestic well was abandoned and a new one was drilled, and the irrigation well was taken out of use for several seasons allowing the saltwater plume to migrate back to the southeast and be remediated in the NE/4 of Section 14. This site immediacy level should be classified as moderate.

Site Description: The south half of section 11 and northwestern section 13 is cultivated farmland with various crops grown. There is circle irrigation in both the SW/4 and SE/4 of section 11 and 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 in size from very fine to coarse mixed with clay layers down to the Harper Siltstone, which is the bedrock. 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 forming aquitards. Depth to water ranges from 13 to 17 feet during non irrigation, and 17+ feet during irrigation. The only visible remnant of the line leak at the surface is a soil scar approximately 100 feet by 40 feet that is located near the center of the NE/4.

Unusual Problems: Water quality must be constantly monitored during summer because of offsetting irrigation wells.

Status of the Project: Since 2001 Rama Operating Company has installed 16 monitoring wells and 8 recovery wells within the area of the Arlington contamination Site. Since late 2010, Rama has been allowed to move the site into post remediation monitoring. Up to this time Rama had utilized the recovery wells in an effort to remediate the immediate groundwater onsite. Annual sampling by KCC has shown that the chloride plume has stayed contained in the NE/4 of section 14, with the highest levels of chlorides found in MW #6 (15,500 mg/L). Bedrock mapping of the Harper Siltstone indicates a slight depression along the bedrock at MW #6, therefore containing the highest concentration of saltwater in this feature.

On July 1, 2013, nine groundwater monitoring wells (MW-1, MW-2, MW-3(D), MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10(M), MW-11 MW-14, MW-15) and the eastern irrigation test well, located in section 13 were gauged and sampled. Prior to sampling, groundwater levels were measured in each monitoring well using an electronic water level indicator. Air-lift technology was used to purge a minimum of three well volumes of groundwater from each well, save MW-15 which was pumped via submersible Proactive® Water-Spout water pump. The irrigation well was bailed three times via hand bailer before sampling. Purge water was tested for conductivity and contained in a 250 gallon poly-tank if conductivity was high before disposed of into a deep injection well. Groundwater samples from each monitoring well were collected in one 250 (ml) polyurethane container for analysis at the KCC District #2 Laboratory. Each sample for this monitoring event was analyzed for the presence of Chloride by United States Environmental Protection Agency USEPA Silver Nitrate Buret Titration Method - Method 8225.

Level of Remediation Sought:

Ideal: 30 to 80 ppm (background)
Target: 250 ppm

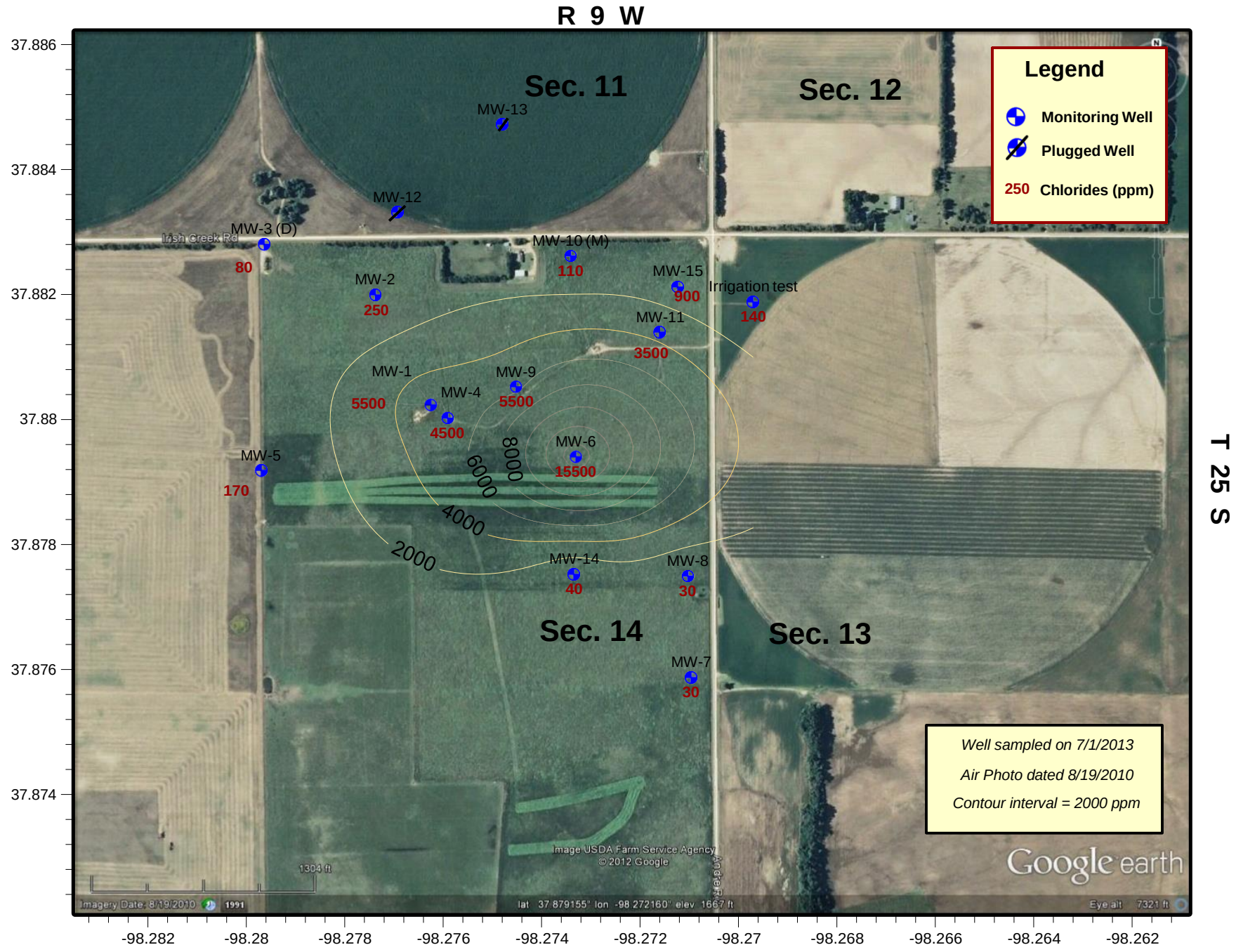
Recommendation for Future Work: It will be suggested to Rama Operating Company, to reactivate Recovery Well No. 8, and any other recovery wells adjacent to MW #6 in an effort to expedite the remediation efforts since natural attenuation will not likely occur anytime soon. RW 8 is the closest recovery well to the "hot spot" in plume, and should have a positive effect on chloride levels. The 2nd 2013 groundwater sampling event is scheduled for late November 2013.

Estimated Total Cost: $2000 for Bi-Annual Groundwater sampling. Staff time perform reviews and research into reports and projects remediating the Site.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14 Total**
20030016-001	**24 Hrs. / $631.70**	

Current Contaminate Level: 15,500 mg/l in MW-6

☐ **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**



Arlington Contamination Site

Sec 14 - T 25 S - R 9 W, Reno County, Kansas

2013 1st Biannual Groundwater Sampling Event Chloride Concentrations

KCC Project Code #20030016-001 - District #2 - D Bollenback -7/10/2013

Project: ***Gil Balthazor Contamination Site***

Site Location: Sections 13, 14, 23 and 24 of Township 9 South, Range 21 West, Graham County.

Impact/Immediacy: Groundwater, affected domestic water well that is the only source of water for the residence. Immediacy level is rated as low.

Site Description: Brine contamination of shallow aquifer.

Unusual Problems: Number of potential sources.

Status of Project: Chloride levels in the old domestic well were at 600 ppm on a sample taken in April of 2002. The landowner no longer uses the old domestic well. Chlorides in the new domestic well were at 2300 ppm in 2011. In 2012 the chloride levels in the new well dropped to 1700 ppm chlorides. In 2013 the chloride levels in the new well dropped to 700 ppm.

Level of Remediation Sought:

Ideal: 250 ppm Chloride
Target: 250 ppm Chloride

Recommendations for Future Work: The source of chlorides for the old domestic well located in 14-9-21W is likely spills from lead line leaks to the west. The source for the new domestic well is likely an old brine pit located in the NW/4 of Sec 23-9-21 W. Continue to monitor.

Estimated Total Costs: $10,000.00+

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970023-00	**10 Hrs. / $251.22**		

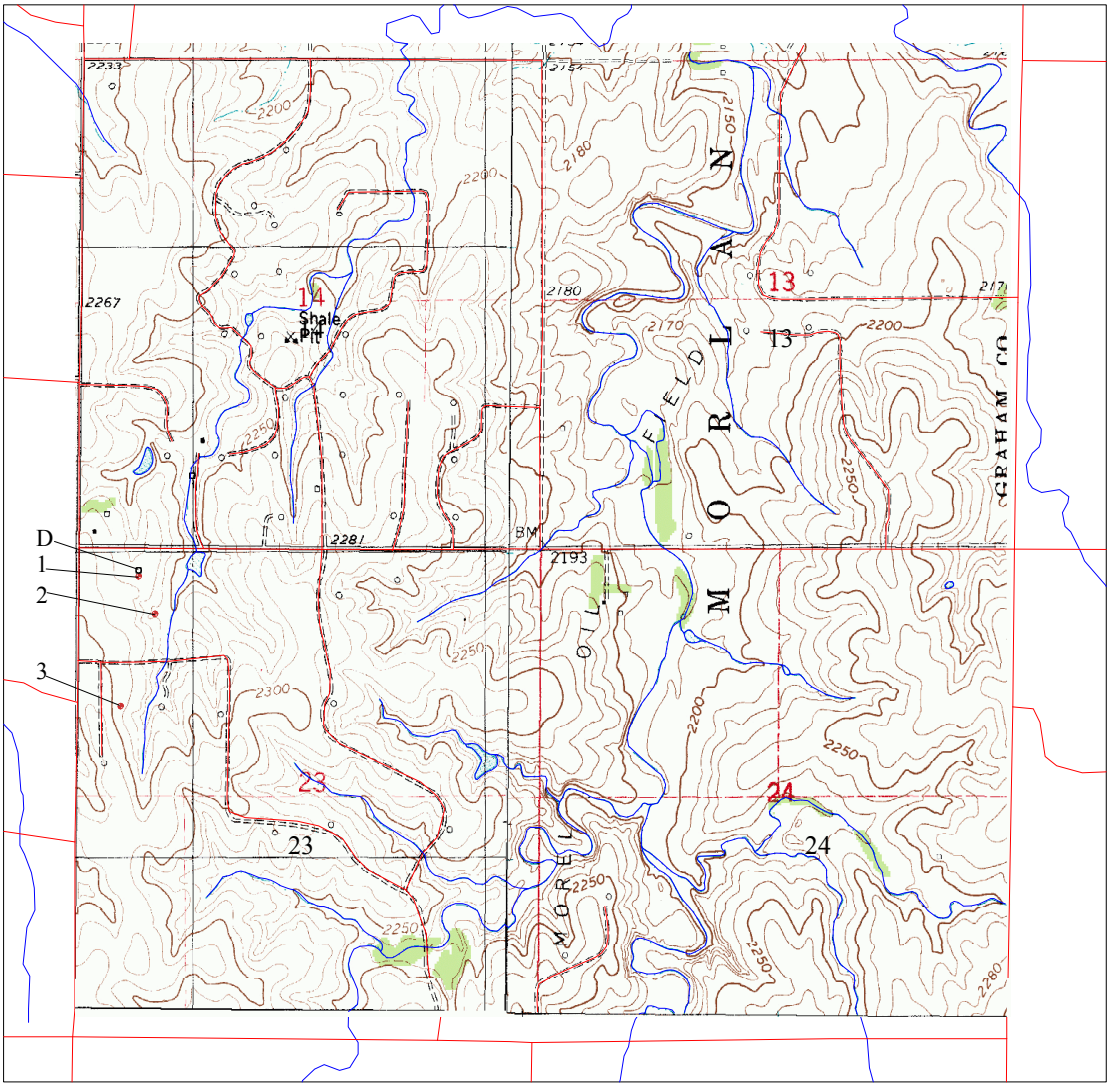
Current Contaminate Level: 700 ppm to 1600 ppm Cl-

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**

R 21 W

T 09 S



Bathazor MW 1 2013 1400 ppm Cl-

Bathazor MW 2 2013 1600 ppm Cl-

Bathazor MW 3 2013 100 ppm Cl-

Bathazor Domestic Well 2013 700 ppm Cl-

0 ft 2190 ft 4380 ft

C. I. = 2190 Ft.

Oil Well
Plugged Oil Well
TA Oil Well
Abandoned Oil Well
Gas Well
Plugged Gas Well
TA Gas Well
Abandoned Gas Well
Disposal Well
Plugged Disposal Well
TA Disposal Well
Abandoned Disposal Well
Injection Well
Plugged Injection Well
TA Injection Well
Abandoned Injection Well

Oil & Gas Well
Plugged Oil & Gas Well
TA Oil & Gas Well
Abandoned Oil & Gas Well
Dual Completed Oil Well
Plugged Dual Completed Oil Well
TA Dual Completed Oil Well
Abandoned Dual Completed Oil Well
Dual Completed Gas Well
Plugged Dual Completed Gas Well
TA Dual Completed Gas Well
Abandoned Dual Completed Gas Well
Water Supply Well
Plugged Water Supply Well
TA Water Supply Well
Abandoned Water Supply Well

Dry Hole
Domestic Well
Plugged Domestic Well
Abandoned Domestic Well
Agriculture Well
Plugged Agriculture Well
Abandoned Agriculture Well
Irrigation Well
Plugged Irrigation Well
Abandoned Irrigation Well
Public Water Supply Well
Plugged Public Water Supply Well
Abandoned Public Water Supply Well
Possible Location
Test Hole
Sample Site

Location
Monitoring Well
Plugged Monitoring Well
Pit
Tank Battery
Gas Storage Monitoring Well
Plugged Gas Storage Monitoring Well
TA Gas Storage Monitoring Well
Abandoned Gas Storage Monitoring Well
Gas Storage Injection Withdrawl Well
Plugged Gas Storage Injection Withdrawl Well
TA Gas Storage Injection Withdrawl Well
Abandoned Gas Storage Injection Withdrawl Well

Kansas Corporation Commission	
Balthazor	
Sec. 14, Twn. 9 S., Rng. 21 W.	
Contaminated Domestic Well	
970023-00	
Date: 21 Oct 2004	District: Hays

Project: ***Benson SWDW Spill***

Site Location: The site is located approximately 1 mile north and 1/3 mile west of Langdon, Kansas. The location is in the SE/4 of Section 17, Township 25 South, Range 9 West, Reno County.

Impact/Immediacy: Impact is to soil and groundwater as a result of numerous saltwater spills. The potential exists to impact domestic, public water supply and irrigation wells in the area. This site should be classified as moderate immediacy level.

Site Description: The topography grades from stable sand dune to low relief / gently rolling cultivated farmland, which is under irrigation. The chloride plume at the present time extends from the source well to the east-northeast. The plume direction to the northeast seems to be controlled by the water gradient and flow and not any aquitard formation. The substrata consist of silt and silty clay mix with sand to a depth of 8 feet and then fine sand and gravel to a depth of 60 feet. The water level of the sand and gravel aquifer in this area is at a depth of 10.5 feet +/-.

Unusual Problems: There is a High School slightly down and side gradient of the plume.

Status of the Project: Phillips Petroleum has installed fourteen monitoring wells and two recovery wells at the Benson Remediation site. Active remediation began at this site in September of 2000. A rebound test during the 2010 year failed and the recovery system was restarted by Phillips Petroleum. The chlorides levels at the project, sample by GSI on 8/22/2012, range from 8.9 mg/l at MW 99-04 to 390 mg/l in the MW 00-09. The chloride levels at the Gaston house well and the school well are near or below background levels. A second rebound test was approved by KCC District #2 for the 2012 year. During this test chloride rebound remained under target levels set at 500 mg/L. KCC requested a post rebound test sampling event of limited well monitoring in 2013 which was performed on 3/29/2013. All wells remained under the 500 ppm target levels. KCC approved closure on 4/3/2013. Bittersweet Energy sent their plan of closure to the KCC on 5/31/2013 which was approved by the KCC District #2 Field office. Work on plugging the wells and removal of the associated equipment began on 9/3/2013 by Bittersweet's contractor GSI, but was halted due to field personnel becoming ill. Work plugging out the site and removal of equipment is to be rescheduled this fall.

Level of Remediation Sought:
Ideal: 50 mg/l (background)
Target: 500 mg/l

Recommendation for Future Work: KCC is waiting on the completion of plugging and closure activities and written reports. Once the Benson site closure work is completed KCC will advise EPR that this site is resolved and should be removed from the Contamination Site list.

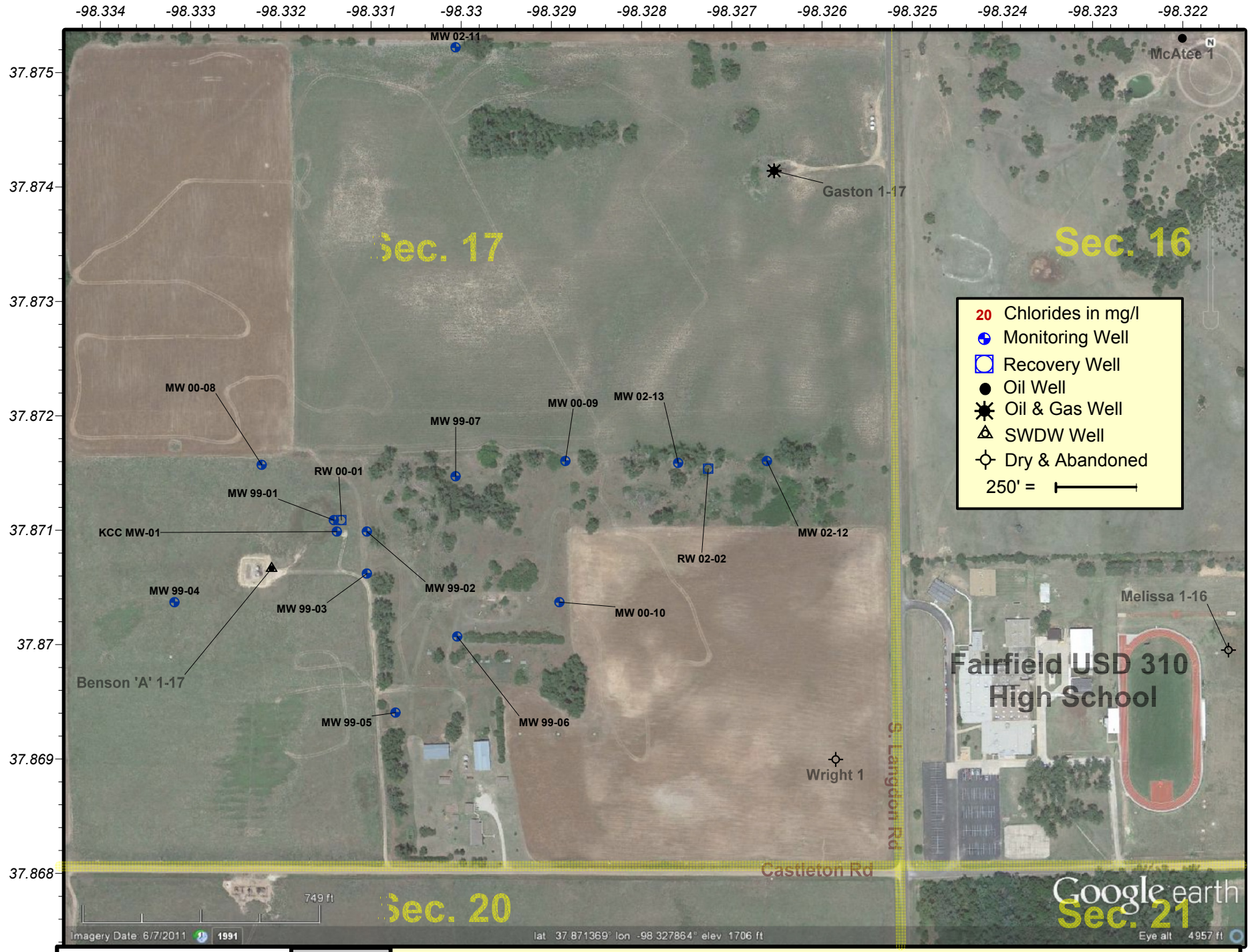
Total Costs: $7,714

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
20000034-001	**15.5 Hrs. / $414.38**		

Current Contaminate Level: All below target levels

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**



Kansas Corporation Commission

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Benson Remediation Site - Phillips Exploration, Inc. - PRP
Section 17 of Township 25 South & Range 9 west, Reno County, Kansas
Well Site Map and Well Locations
District #2 - Wells to be plugged by GSI - Map Drawn on 9/17/2013 by D.Bollenback

Project: ***Brazil Contamination Site***

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 moderate to high 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. 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 has also been leased by Quest Cherokee and six new gas wells have been drilled in this section since 2006. Some drainage modifications have been implemented by Operator. The following sample results were obtained this year on: ***02/06/2013***: Well #MW01; 1,500 ppm Cl-; Well # MW02; 1,300 ppm Cl- ; Well # MW03; 1,400 ppm Cl- and Well # MW04; 500 ppm Cl- . On ***04/29/2013***: Well #MW01; 1,400 ppm Cl-; and Well # MW04; 1,100 ppm Cl- . On ***07/25/2013***: Well #MW01; 1,400 ppm Cl-; Well # MW02; 1,500 ppm Cl- ; Well # MW03; 400 ppm Cl- and Well # MW04; 1,600 ppm Cl- . Overall CL- concentrations trended down slightly for the year.

Level of Remediation Sought:

Ideal: 250 ppm Chloride
Target: 500 ppm Chloride

Recommendation for Future Work: Future work at the site, beyond possible plugging operations, will include collection of additional data from the newly constructed monitoring wells and possible construction of additional monitoring wells. This information will assist in determining the location and extent of the brine impact. All work will need to be coordinated with the current Operator.

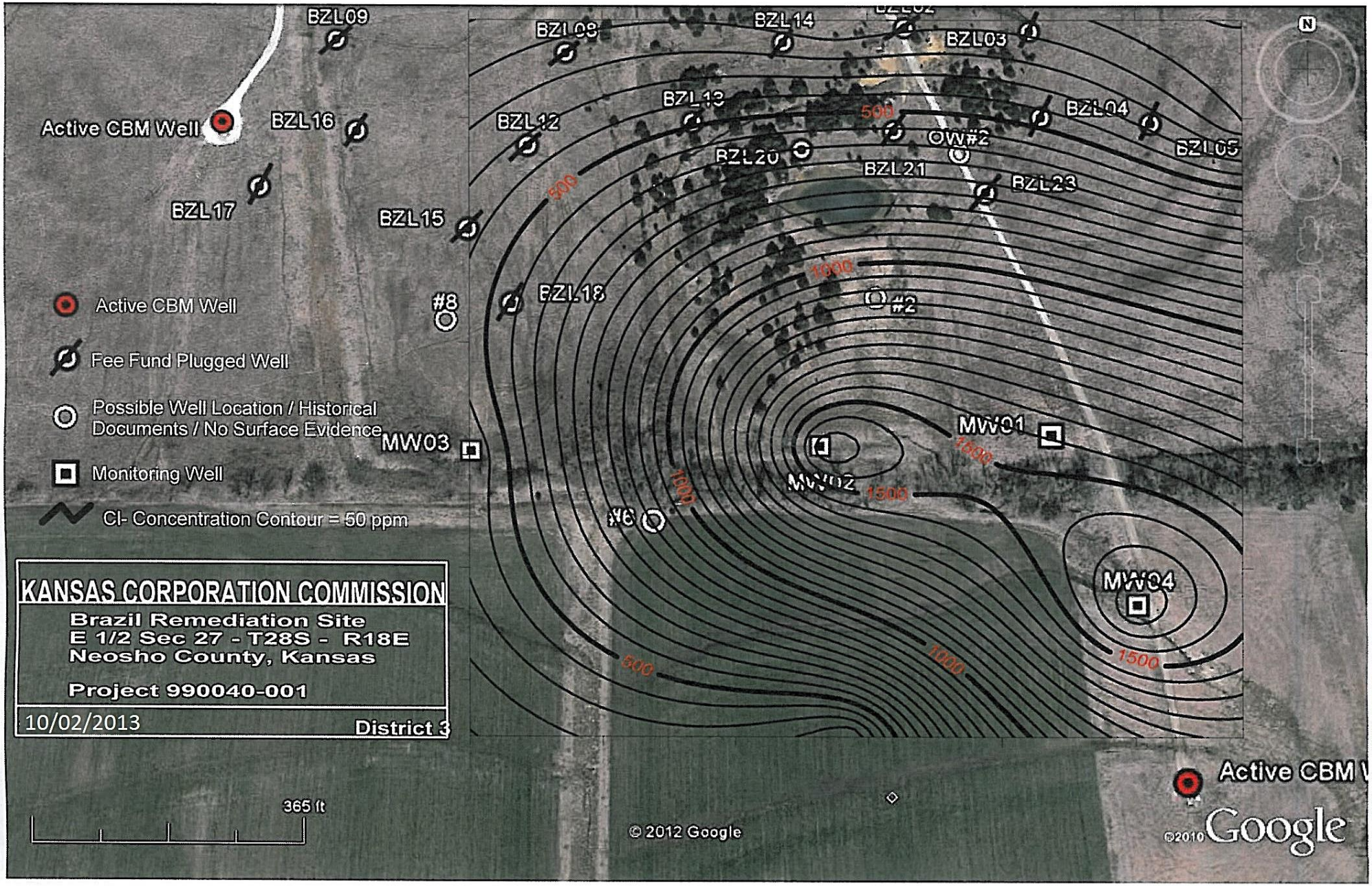
Estimated Total Cost: Plugging cost for this site totaled $57697.10. Monitoring Well Construction completed in early 2012 totaled $8,196.00.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
990040-001	**58 Hrs. / $1,517.78**		**$10,767.25**

Current Contaminate Level: 400 ppm to 1,600 ppm Cl-

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**


BZL09
BZL08
BZL14
BZL03
BZL13
BZL12
BZL04
BZL05
Active CBM Well
BZL16
BZL20
OW#2
BZL21
BZL23
BZL17
BZL15
500
1000
1500
BZL18
#8
#2
#6
MW03
MW01
MW02
MW04
Active CBM Well
Fee Fund Plugged Well
Possible Well Location / Historical Documents / No Surface Evidence
Monitoring Well
Cl- Concentration Contour = 50 ppm
KANSAS CORPORATION COMMISSION
Brazil Remediation Site
E 1/2 Sec 27 - T28S - R18E
Neosho County, Kansas
Project 990040-001
10/02/2013
District 3
365 ft
© 2012 Google
©2010 Google
N

Project: ***Brothers Contamination Site***

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

Impact\Immediacy: Low immediacy. The only water wells within one mile are to the southwest and were drilled in the 1980s as oil field supply wells.

Site Description: The site is located in the Sand Hills of Rice County. The groundwater aquifer is a shallow permeable zone consisting of loose fine-grained sand underlain by a thick clay layer. The groundwater flow is to the south-southwest.

Unusual Problem: Monitoring wells onsite have shown that the aquifer has low deliverability.

Status of Project: KCC visited the site and collected water samples on June 13, 2013. KCC laboratory results of the three monitoring wells show that chloride levels have risen slightly this year in MW-1 and MW -2. MW-3 was slightly lower than 2013 at 2,000 ppm chlorides. MW-2 is screened in the lower aquifer and was still below 100 ppm chlorides. A sample was taken at the pond this year and was tested at 650 ppm chlorides.

Level of Remediation Sought:

Ideal: 250 mg/l Chloride
Target: 500 mg/l Chloride

Recommendations for Future Work: KCC recommends that a Geoprobe® rig be used to probe the area surrounding the site. Probe work could indicate whether or not the chloride contamination is still high in the old drilling pit area. Probe work could also show whether or not this chloride contamination is part of a larger chloride situation from past oil field activities. Data found from a probing event could be used to help plan on a time table for site closure or help indicate other avenues of remediation in order to hasten clean up.

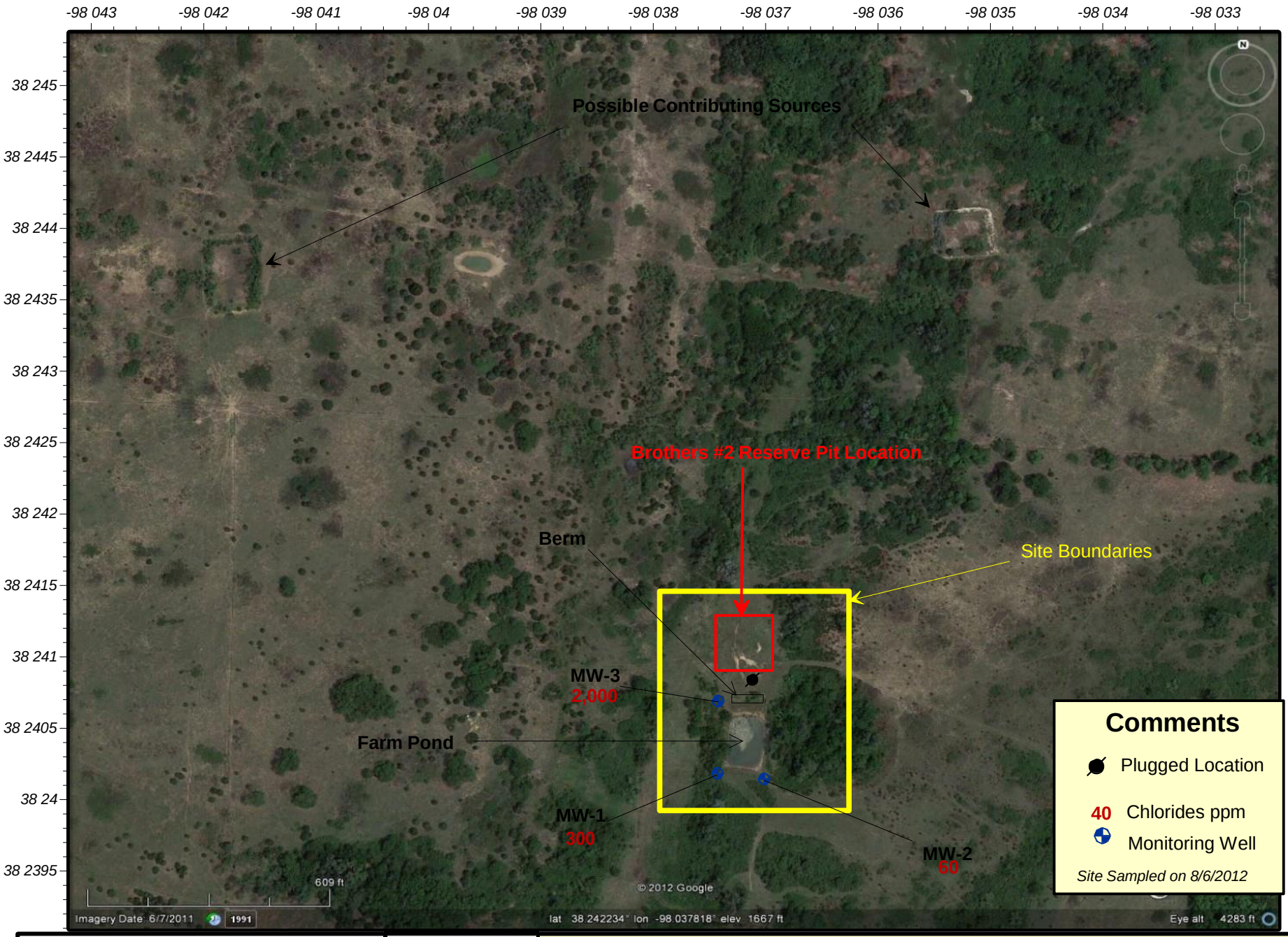
Estimated Total Costs: $4000.00 for Geoprobe work and routine annual sampling events.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970029-00	**20 Hrs / $514.58**		**$4.26**

Current Contaminate Level: 60 mg/l to 2000 mg/l Chloride **8/30/2013**

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**



Kansas Corporation Commission

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Brothers Contamination Site

S/2 NE of 12-T21S-R7W - Rice County

2013 Annual Groundwater Sampling Event - Chloride Levels

KCC Code #970029-00 - District #2 - B. Milner - Drawn: 8/27/2013

Project: ***Burrton Contamination Site***

Site Location: The site is located in western Harvey County and eastern Reno County approximately 18 miles west of the city 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: Presently the contamination site is affecting local domestic and irrigation wells. Hydrogeologic computer modeling shows portions of the plume will intercept parts of the Wichita Well Field within 50 years. The Equus Beds aquifer is a major source of public water supply for much of the population of Sedgwick County. This case is ranked at a high level of immediacy based on the resource impacted and the size of the site.

Site Description: Total maximum area affected by the contamination covers approximately 25 to 30 square miles. In general, the contaminate plume is aligned in a northeast to southwest configuration parallel with the associated producing areas. A water quality-sampling network maintained by the local groundwater management district indicates oil field brine contamination of all three major 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.

Unusual Problems: The lack of suitable disposal facilities and the large area extent of the plume make the clean up of this site very costly. The physical day-to-day maintenance and monitoring of a withdrawal and disposal system of this size would require a large commitment of labor and resources. In addition, 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, thus impacting parts of the aquifer that are not contaminated.

Status of the Project: GMD #2 sampled the monitoring wells in the summer of 2013. This site is currently in monitoring status. Bids were acquired for the laboratory work for water sample analysis which was won by Teklab, Inc. out of Collinsville, Illinois. District #2 continues to investigate private groundwater wells in the area. The Brine plumes in the B and C zones were found to be stable with minor fluctuations in some wells. The A Zone was similar except for an increase in the east of the site at EB15A. This well was not sampled last year.

Level of Remediation Sought:

Ideal: 250 mg/l Chloride

Target: Considering the variable conditions within the aquifer different areas within the contaminate plume would need to be evaluated separately during cleanup to insure that fresh and usable water is not being disposed of needlessly.

Recommendations for Future Work: Continue funding annual water well sampling and analysis of this critical data. KCC will continue to review data for locations for possible additional wells to help delineate the plume. Open communication with the City of Wichita regarding data exchange and future cooperation in addressing the contamination problem and the Wichita Water Well Recharge Project. Continued cooperation and communication with GMD #2 is vital to the monitoring of the brine plume.

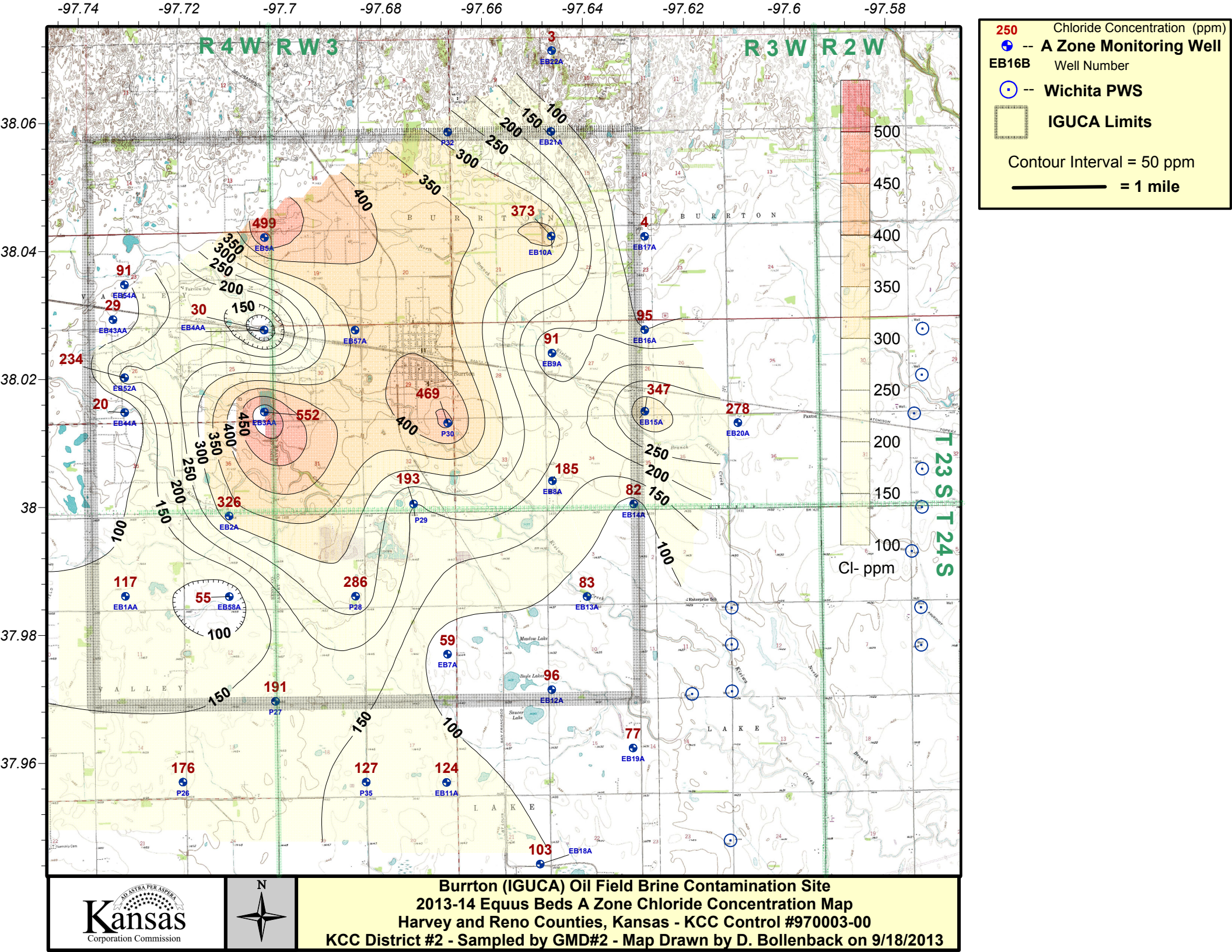
Estimated Total Cost: Cost associated with funding the sampling done by GMD #2, along with KCC staff research and report preparation.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Fund Expenditures Total
970003-00	29 Hrs. / $775.55	$5,292	$316,018.31

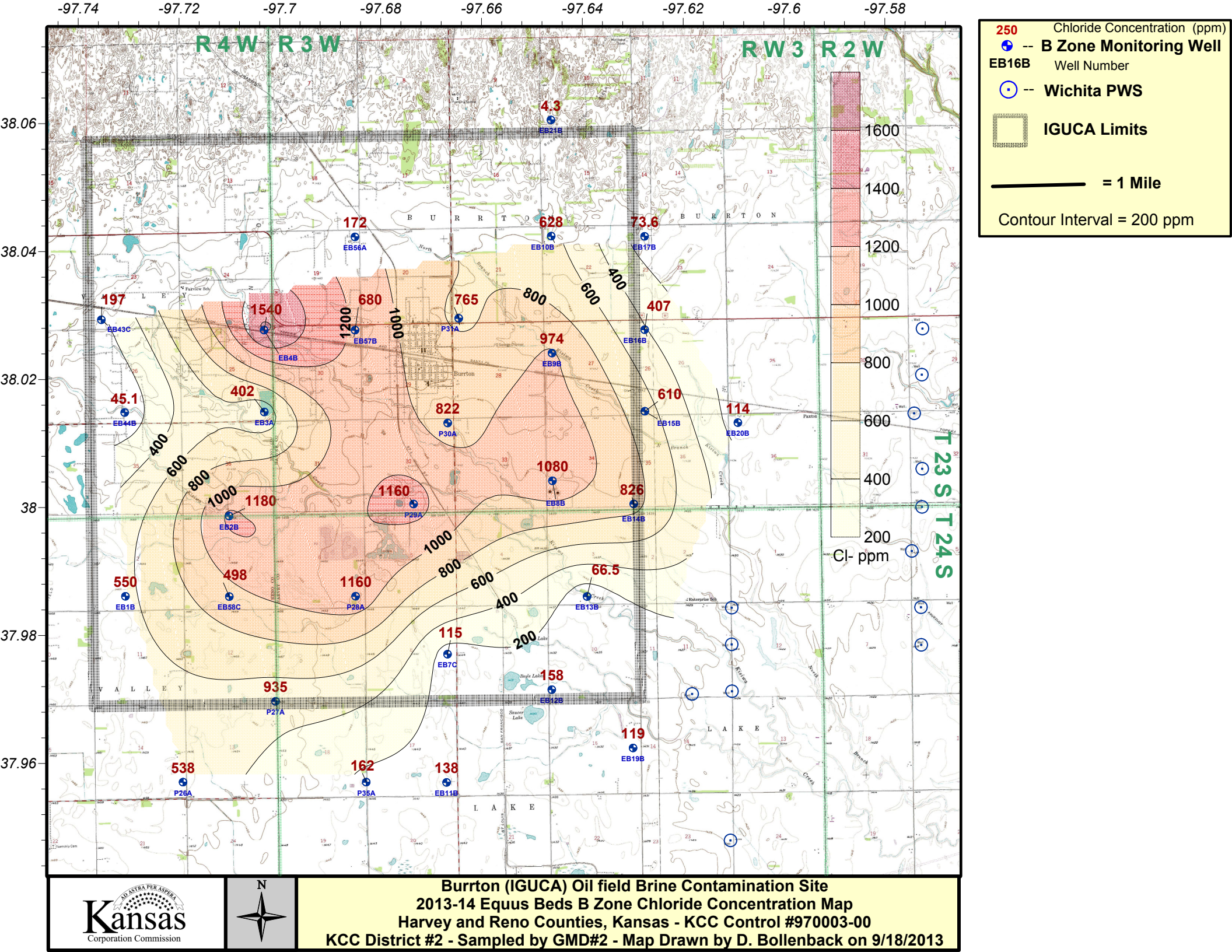
Current Contaminate Level: 3 mg/l EB22A to 1540 mg/l Cl- EB4C/4B

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

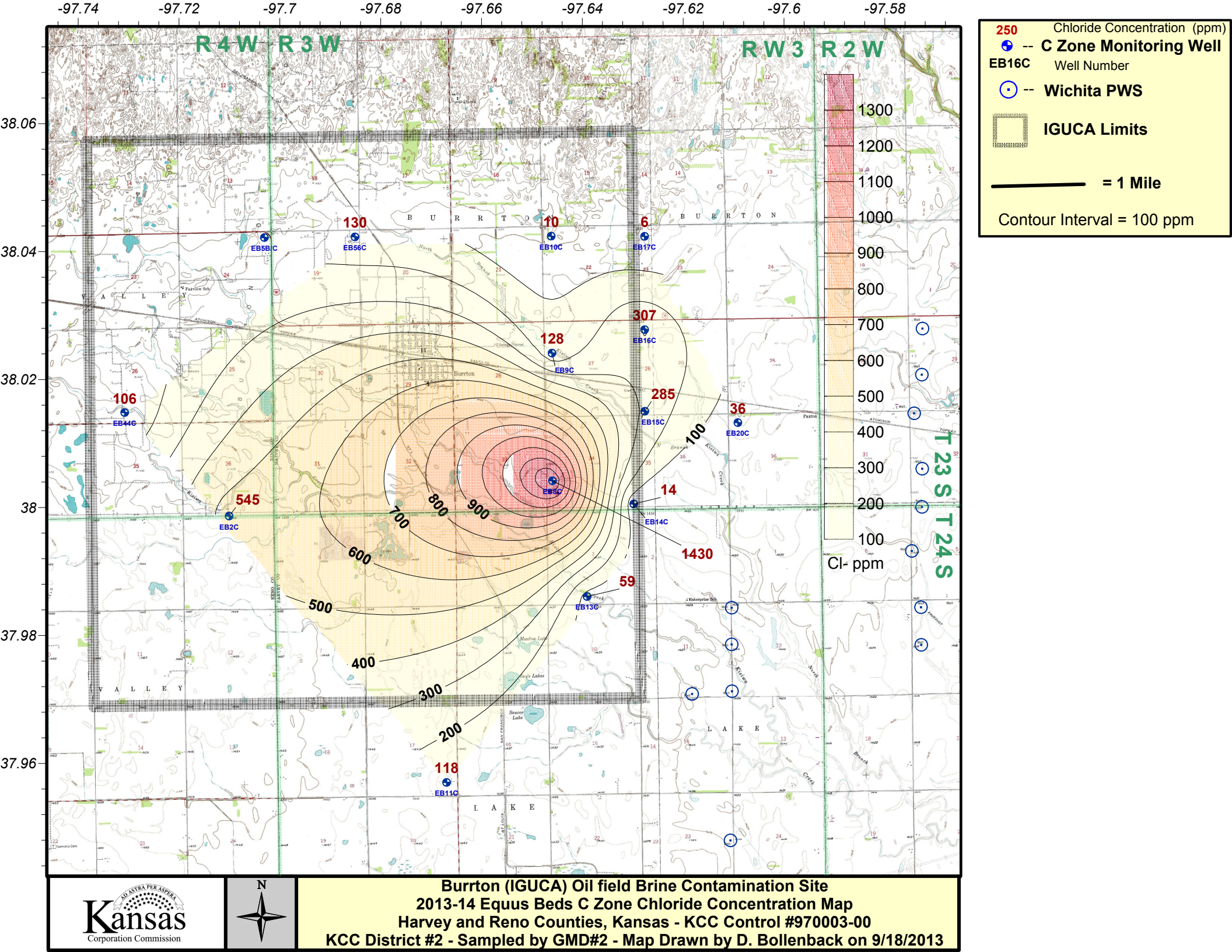


Burrton (IGUCA) Oil Field Brine Contamination Site
2013-14 Equus Beds A Zone Chloride Concentration Map
Harvey and Reno Counties, Kansas - KCC Control #970003-00
KCC District #2 - Sampled by GMD#2 - Map Drawn by D. Bollenback on 9/18/2013



Kansas Corporation Commission

Burrton (IGUCA) Oil field Brine Contamination Site
2013-14 Equus Beds B Zone Chloride Concentration Map
Harvey and Reno Counties, Kansas - KCC Control #970003-00
KCC District #2 - Sampled by GMD#2 - Map Drawn by D. Bollenback on 9/18/2013


-97.74
-97.72
-97.7
-97.68
-97.66
-97.64
-97.62
-97.6
-97.58
38.06
38.04
38.02
38
37.98
37.96
R4W R3W
RW3 R2W
T 23 S
T 24 S
130
EB56C
10
EB10C
6
EB17C
307
EB16C
128
EB9C
285
EB15C
36
EB20C
106
EB44C
545
EB2C
14
EB14C
1430
59
EB13C
118
EB11C
100
200
300
400
500
600
700
800
900
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
Cl- ppm
BURRTON
VALLEY
LAKE
Burrton
250
Chloride Concentration (ppm)
-- C Zone Monitoring Well
EB16C
Well Number
-- Wichita PWS
IGUCA Limits
= 1 Mile
Contour Interval = 100 ppm
Kansas
Corporation Commission
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Burrton (IGUCA) Oil field Brine Contamination Site
2013-14 Equus Beds C Zone Chloride Concentration Map
Harvey and Reno Counties, Kansas - KCC Control #970003-00
KCC District #2 - Sampled by GMD#2 - Map Drawn by D. Bollenback on 9/18/2013

Project: ***Clawson Contamination Site***

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 remediation 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.

Status of Project: The Clawson remediation project has continued to make progress with respect to the size of the plume, as well as the concentration of chlorides are both slowly declining. Annual sampling of the wells was completed on May 7-8 2013 by DBS&A, Inc. One monitoring well and five recovery wells continue to have levels above the usable water level of 500 ppm. Chlorides continue to decrease in all six recovery wells.

Level of Remediation Sought:

Ideal: 250 ppm Chloride
Target: 350 ppm Chloride

Recommendations for Future Work: As the plume continues to dwindle in size, more recovery wells will likely be shut in. It is also probable that some of the monitoring wells will be plugged in the near future. All of these expenses will be covered by the PRP and will only happen with the consent of the KCC. The project will continue to stay in remediation for the time being, but is moving steadily closer to the monitoring phase.

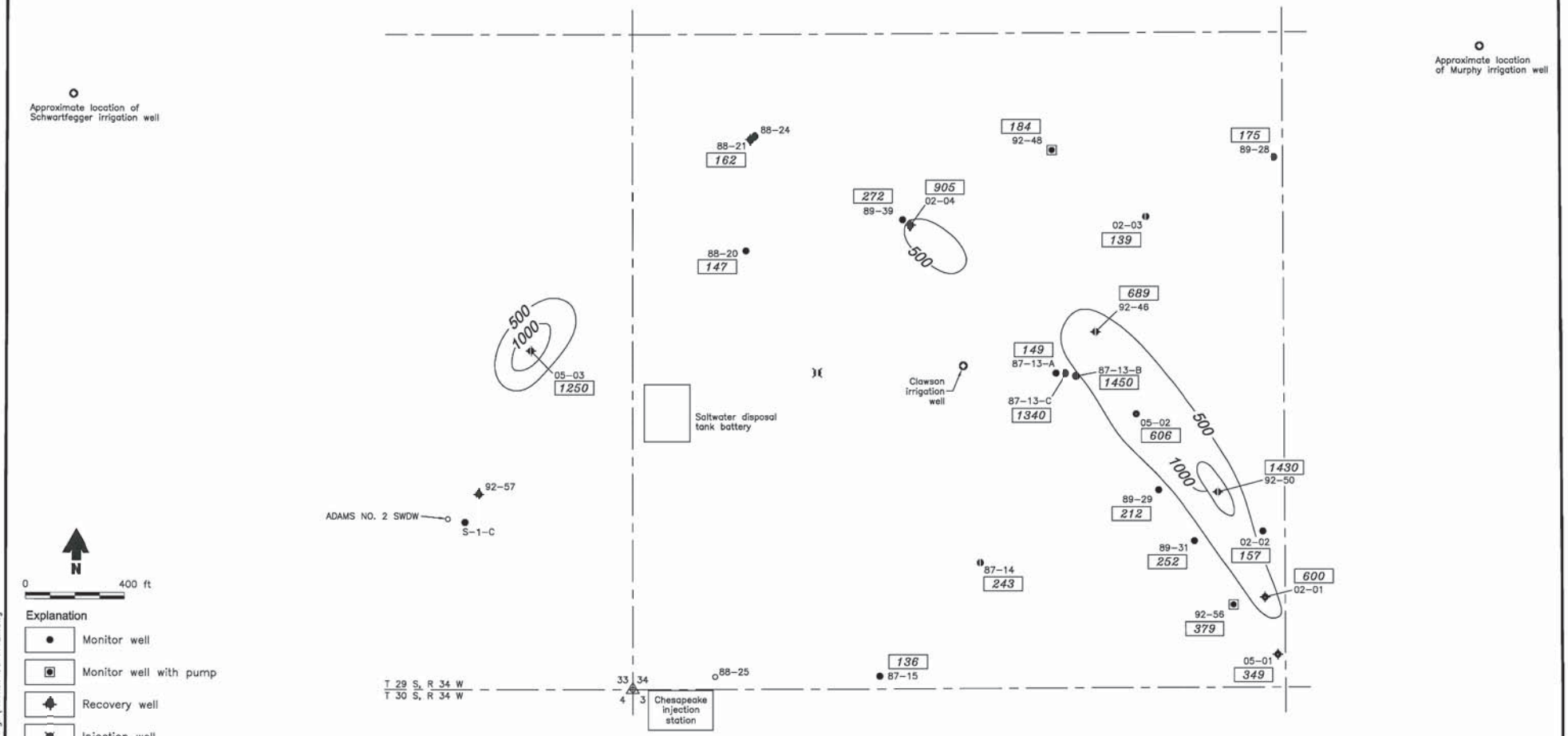
Estimated Total Costs: KCC - $450 a year. PRP – in excess of $2 million.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970005-00	**22 Hrs. / $582.94**		

Current Contaminate Level: 136 ppm Cl- to 1,450 ppm Cl-

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**



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Daniel B. Stephens & Associates, Inc.
6/5/13

Haskell County Brine Cleanup
Haskell County, Kansas
Chloride Concentrations
May 7-8, 2013

Figure 3

Project: ***Codell Contamination Site***

Site Location: Sections 2, 3, and 11 of Township 10 South, Range 17 West, Rooks County.

Impact/Immediacy: Public Supply Well is still below drinking water standards for chlorides. Immediacy level is rated as moderate to high.

Site Description: Brine contamination of shallow aquifer along Paradise Creek. High chlorides were detected in the domestic wells and stock ponds at ranges from 500 to 2,000 ppm from 1977 through 1980. These contaminated waters were thought to be a threat to the Public Supply Well for the city of Codell. No specific source was found during investigations from 1977 through 1980.

Unusual Problems: Very little documentation.

Status of Project: Well net drilled along affected creek.

Monitor well No.	Year	Chlorides	Year	Chlorides	Year	Chlorides
1	2011	240 ppm	2012	300 ppm	2013	300 ppm
2	2011	320 ppm	2012	500 ppm	2013	500 ppm
3	2011	340 ppm	2012	400 ppm	2013	300 ppm
4	2011	220 ppm	2012	300 ppm	2013	300 ppm
5	2011	50 ppm	2012	100 ppm	2013	100 ppm

Level of Remediation Sought:

Ideal: 100 ppm Chloride

Target: 250 ppm Chloride

Recommendations for Future Work: Close this site. The levels of chlorides are well within the realm of fresh and usable water. Wells 1 through 4 are on the north side of Paradise Creek. The City of Codell Municiple well is on the south side of Paradise creek. The samples from this well are at 100 ppm chloride**.**

Total Costs: $25,527.

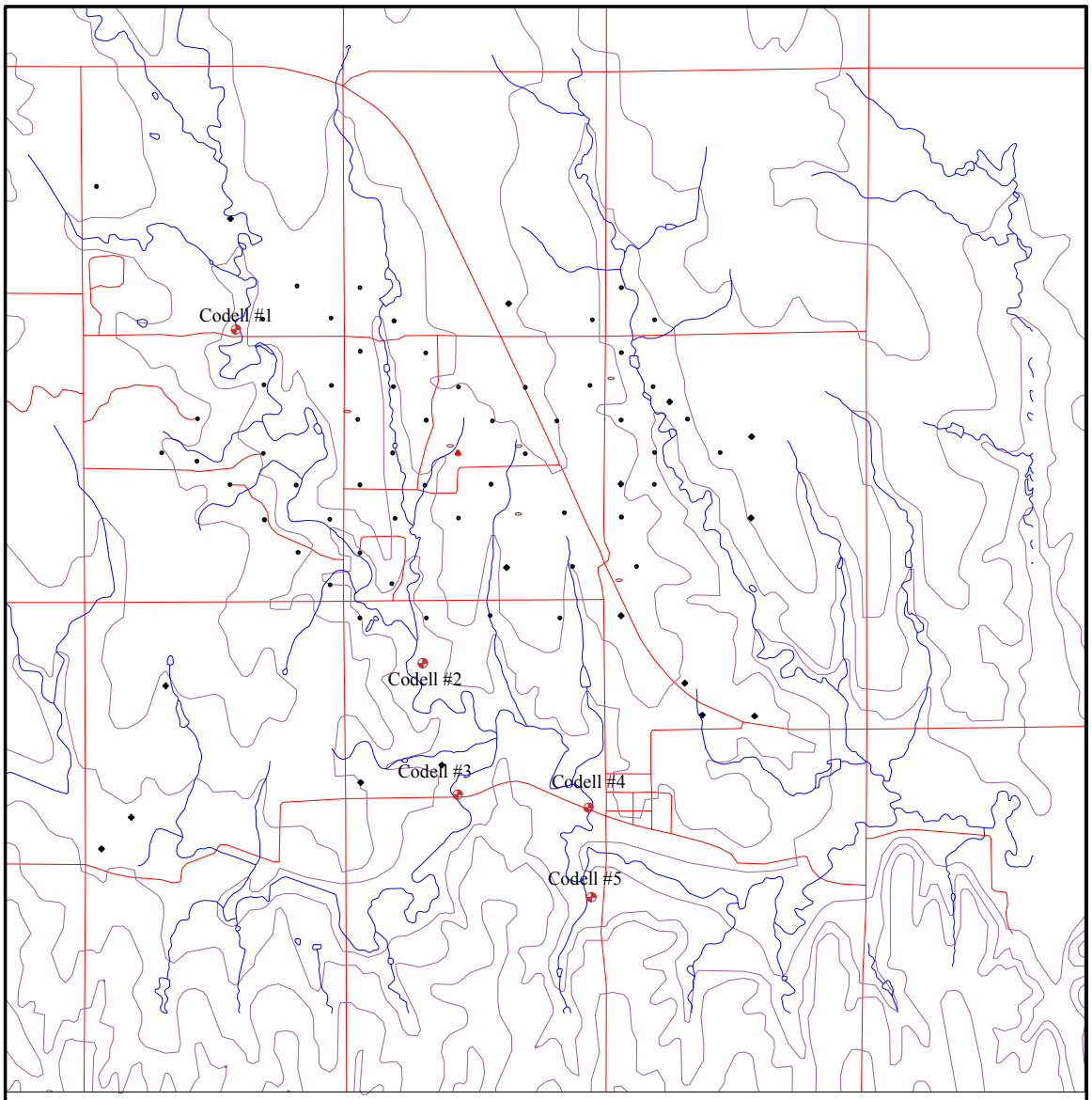
Control No.	**Staff Hours/Expenditures**	**Fund Expenditures**	
		FY 2013/14	**Total**
970033-00	**10 Hrs. / $251.22**		**$19,491.40**

Current Contaminate Level: 100 ppm Cl- to 500 Cl-.

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**

R 17 W



T 10 S

N
W E
S

Codell MW1 2013 300 ppm Cl-
Codell MW2 2013 500 ppm Cl-
Codell MW3 2013 300 ppm Cl-
Codell MW4 2013 300 ppm Cl-
Codell MW5 2013 100 ppm Cl-

CI = 3640 feet

0 3640 7280

Oil Well
Plugged O l Well
TA Oil Well
Abandoned O l Well
Gas We l
Plugged Gas We l
TA Gas Well
Abandoned Gas We l
Disposal Well
Plugged Disposal Well
TA D sposal We l
Abandoned Disposal Well
Injection Well
Plugged Injection Well
TA Inject on Well
Abandoned Injection Well

Oil & Gas Well
Plugged Oil & Gas Well
TA Oil & Gas We l
Abandoned Oil & Gas Well
Dual Completed Oil We l
Plugged Dual Completed Oil We l
TA Dual Comple ed Oil Well
Abandoned Dual Completed Oil We l
Dual Completed Gas Well
Plugged Dual Completed Gas Well
TA Dual Comple ed Gas We l
Abandoned Dual Completed Gas Well
Water Supply Well
Plugged Water Supply Well
TA Wa er Supply We l
Abandoned Water Supply Well

Dry Hole
Domestic We l
Plugged Domestic We l
Abandoned Domestic We l
Agricu tu e Well
Plugged Agricu ture Well
Abandoned Agricu ture Well
Irrigat on We l
Plugged rrigation Well
Abandoned rrigation Well
Public Water Supply Well
Plugged Public Wa er Supply We l
Abandoned Public Wa er Supply We l
Poss b e Locat on
Test Hole
Sample Si e

Location
Monitoring Well
Plugged Monitoring Well
Pit
Tank Battery
Gas Storage Mon tor ng We l
Plugged Gas S orage Moni oring Well
TA Gas Storage Monitorn ng We l
Abandoned Gas S orage Moni orning Well
Gas Storage Injection/Withdrawl Well
Plugged Gas S orage Injection/W thdrawl We l
TA Gas Storage njec on/Wi hdrawl Well
Abandoned Gas S orage Injection/W thdrawl We l

Kansas Corporation Commission

Codell

Sec. 13, Twn 10 S., Rng. 17 W., Rooks County

Old Chloride Plume

970033-00

Date: 21 Oct 2004 District: Hays

Project: ***Curtis Contamination Site***

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 taken from nine monitoring wells in 2013. The chlorides have remained steady in the area. The two irrigation wells in section 19 were not sampled this year because they were not running at the time of sampling.

Level of Remediation Sought:
Ideal: 250 ppm
Target: 500-1000 ppm

Recommendation for Future Work: MW-11 will need to be cleaned out in order to get a sample for next year. The two irrigation wells in section 19 will need to be sampled to see if the chlorides have begun to impact the water quality. Mapping of the coffining layer below the aquifer might reveal if there is a channel the brine is following, or electromagnetic induction profiling (EM), could be run to determine where the chlorides are, and pinpoint the highest impacted areas. This would give a better representation of the chlorides then the thin network of monitoring wells, and would help to pinpoint where future work would need to be focused. An EM survey would also help to identify if there is a current source of chloride intrusion.

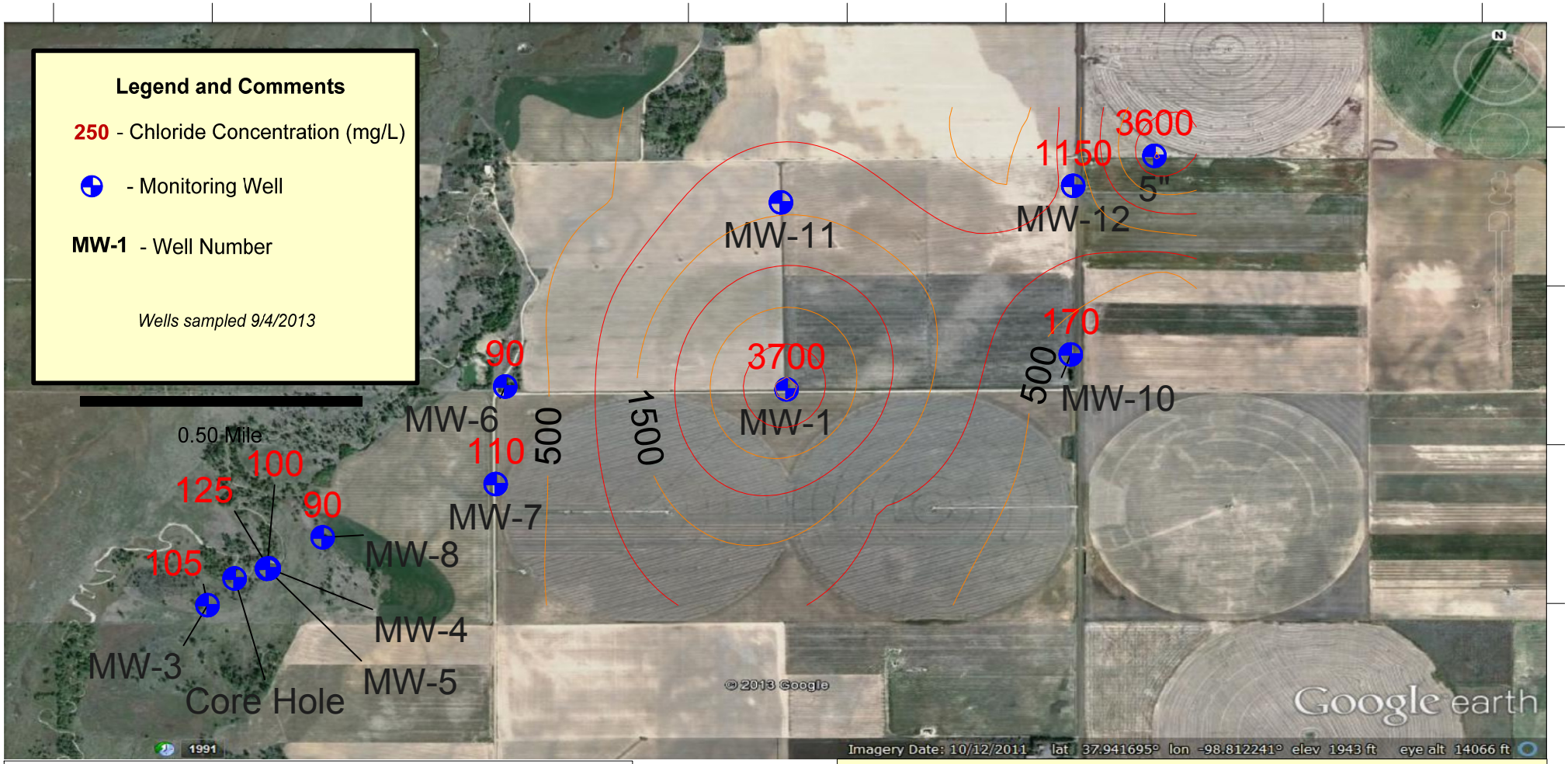
Estimated Total Costs: $27,000.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970034-00	**10.5 Hrs. / $303.78**		**$4,199.17**

Current Contaminate Level: 90 ppm Cl- to 3700 ppm Cl-

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**



Kansas Corporation Commission

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S

Curtis Site

Sections 23/24/25/26-T21S-R20W
Stafford County, Kansas

2013-2014 Area Map with Chlorides

KCC Control # 970034-00 District 1
D. Sellers 9/23/13

Project: ***Jim Dinkle Contamination Site***

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

Impact/Immediacy: Groundwater, affected domestic water well is the only source of water for the residence. Immediacy level is rated as moderate.

Site Description: Brine contamination of a shallow aquifer. Contamination originally thought to be from deicing activities on Interstate 70. Contamination likely from an old brine water evaporation pit (revoked July 1, 1958) and/or a shallow injection well (revoked September 3, 1969).

Unusual Problems: The hydrogeology of the site includes a very tight clay (approx. 8 feet thick) with a lime stone derived clay overlying sands 15 feet in thickness.

Status of Project: Extensive drilling was completed in August and September of 2000. A total of 16 holes were drilled on the site, and three were completed as monitor wells. The major contributor to chlorides in the area old drill pits located south west of the Dinkel domestic well. Landowner is now on rural water.

Chloride levels from samples over the last two years are as follows:

Year	Monitor Well	Chlorides	Year	Monitor Well	Chlorides
2012	Dnkl #5	1060	2013	Dnkl #5	1300
2012	Dnkl #7	880	2013	Dnkl #7	1000
2012	Dnkl#9	1020	2013	Dnkl #9	1200

Level of Remediation Sought:

Ideal: 100 ppm Chloride

Target: 250 ppm Chloride

Recommendations for Future Work: Investigation is completed. Continue to monitor.

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

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14 Total**
970035-00	**4 Hrs. / $102.76**	

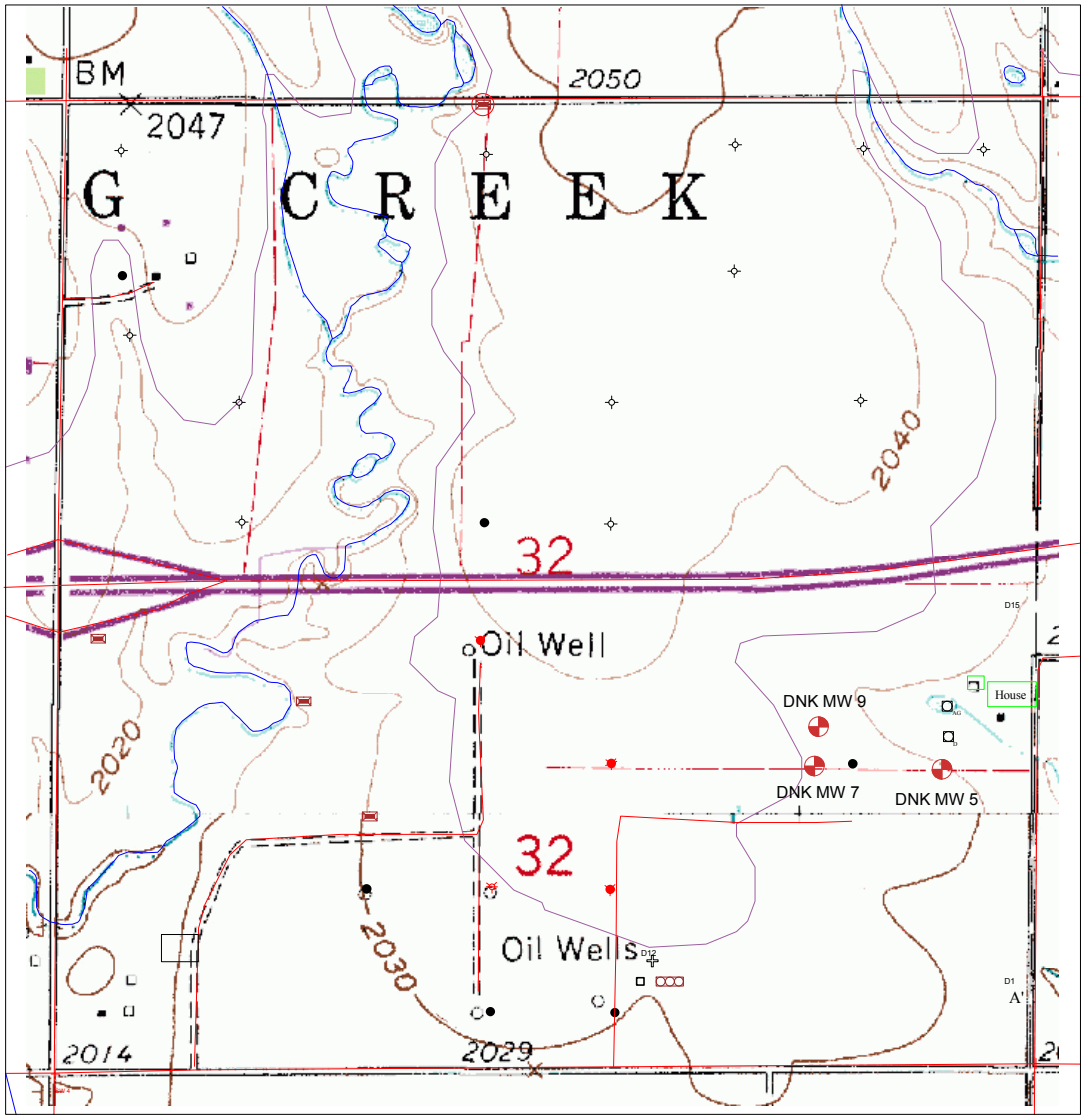
Current Contaminate Level: 1000 to 1300 ppm Cl-

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**

R 17 W

T 13 S



Dinkle MW5 2013 1300 ppm Cl-
Dinkle MW7 2013 1000 ppm Cl-
Dinkle MW9 2013 1200 ppm Cl-
Dinkle Domestic Well 2010-Not in Use
Farmstead is on Rural Water

CI = 1035 feet

0 1035 2070

N W E S

Oil Well
Plugged Oil Well
TA O l Well
Abandoned O l Well
Gas Well
Plugged Gas We l
TA Gas Well
Abandoned Gas We l
Disposal Well
Plugged Disposal Well
TA D sposal We l
Abandoned Disposal Well
Injection Well
Plugged Injection Well
TA njection Well
Abandoned Injection Well
Oil & Gas Well
Plugged Oil & Gas Well
TA Oil & Gas Well
Abandoned Oil & Gas Well
Dual Completed Oil We l
Plugged Dual Completed Oil We l
TA Dual Comple ed Oil Well
Abandoned Dual Completed Oil We l
Dual Completed Gas Well
Plugged Dual Completed Gas Well
TA Dual Comple ed Gas We l
Abandoned Dual Completed Gas Well
Water Supply Well
Plugged Water Supply Well
TA Water Supply Well
Abandoned Water Supply Well
Dry Hole
Domestic We l
Plugged Domestic We l
Abandoned Domestic We l
Agricu tu e Well
Plugged Agricu ture Well
Abandoned Agricu ture Well
Irrigat on We l
Plugged rrigation Well
Abandoned rrigation Well
Public Water Supply Well
Plugged Public Wa er Supply We l
Abandoned Public Wa er Supply We l
Poss b e Locat on
Test Hole
Sample Si e
Location
Monitoring Well
Plugged Monitoring Well
Pit
Tank Battery
Gas Storage Mon tor ng We l
Plugged Gas S orage Mon tor ng We l
TA Gas Storage Monitorn ng We l
Abandoned Gas S orage Mon torning Well
Gas Storage Injection/Withdrawl Well
Plugged Gas S orage Injection/W thdrawl We l
TA Gas Storage njection/Wi hdrawl Well
Abandoned Gas S orage Injection/W thdrawl Well

Kansas Corporation Commission

Dinkel

Sec. 13, Twn. 10 S., Rng. 17 W., Ellis County

Elevated Chlorides in Domestic Well

970035-00

Date: 21 Oct 2004 District: Hays

Project: ***Dinkler Site***

Site Location: The Dinkler site is located within the area of the Four Mile Creek oilfield. The legal description for the site is the west half of section 4 and the north half of section 5, T 28 S- R 3 E in Butler County. Part of the site lies in the north end of the Flint Hills National development.

Impact/ Immediacy: Impact is to the ground water for domestic home sites with water being used for irrigation of lawns and for watering livestock. The site is classified at a low immediacy level.

Site Description: The site is located in grassland underlain by shallow bedrock. The small creeks have down cut into the bedrock producing fingering drainage to the north into the Four Mile Creek, which drains to the east. Four Mile Creek is spring fed and runs through out the year. The aquifer for the water wells in the area is the bedrock limestone with water wells generally being approximately 100 feet deep. The area now has home sites at the Flint Hills National development. This site started with a complaint of a salty domestic yard well in Section 4, Township 28 South, and Range 3 East and was traced to the west-northwest.

Unusual Problems: During the construction of a house on golf course property the surface casing for Graham No. 4 was encountered and oil was found in the casing. A rig was moved in and the well was replugged. Due to the problem encountered with well Graham No.4, Graham No.1 and No. 5 were located with a metal detector on the golf course (2006). Due to the exclusiveness of the golf course and real estate, plugging the unplugged oil wells and adding additional Monitoring wells would be difficult.

Status of Project: In the winter of 2005-2006 unplugged wells identified as the Graham #4 and the Dinkler #2 were plugged by the KCC. Three monitoring wells were installed down gradient to the plugged wells to evaluate water quality. Annual sampling has historically been done on these very low yielding wells. MW #1 was found to have an obstruction approximately 60' down and a decay odor. It appears that a small animal has fallen down the well and become stuck rendering this well unusable. Wells were not sampled during the 2013 summer.

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

Recommendation for Future Work: MW#1 is still obstructed by an unknown blockage assumed to be a dead animal. Attempts to knock down the obstruction proved unsuccessful. This well will need to be acidized to break down the obstruction then sanitized to removed unwanted bacteria. Due to the exclusiveness of the site it is recommended that this site be sampled every other year. There have been no complaints filed by the local residents since the original complaint. KCC has no further plans for this site at this time, and recommends no further action.

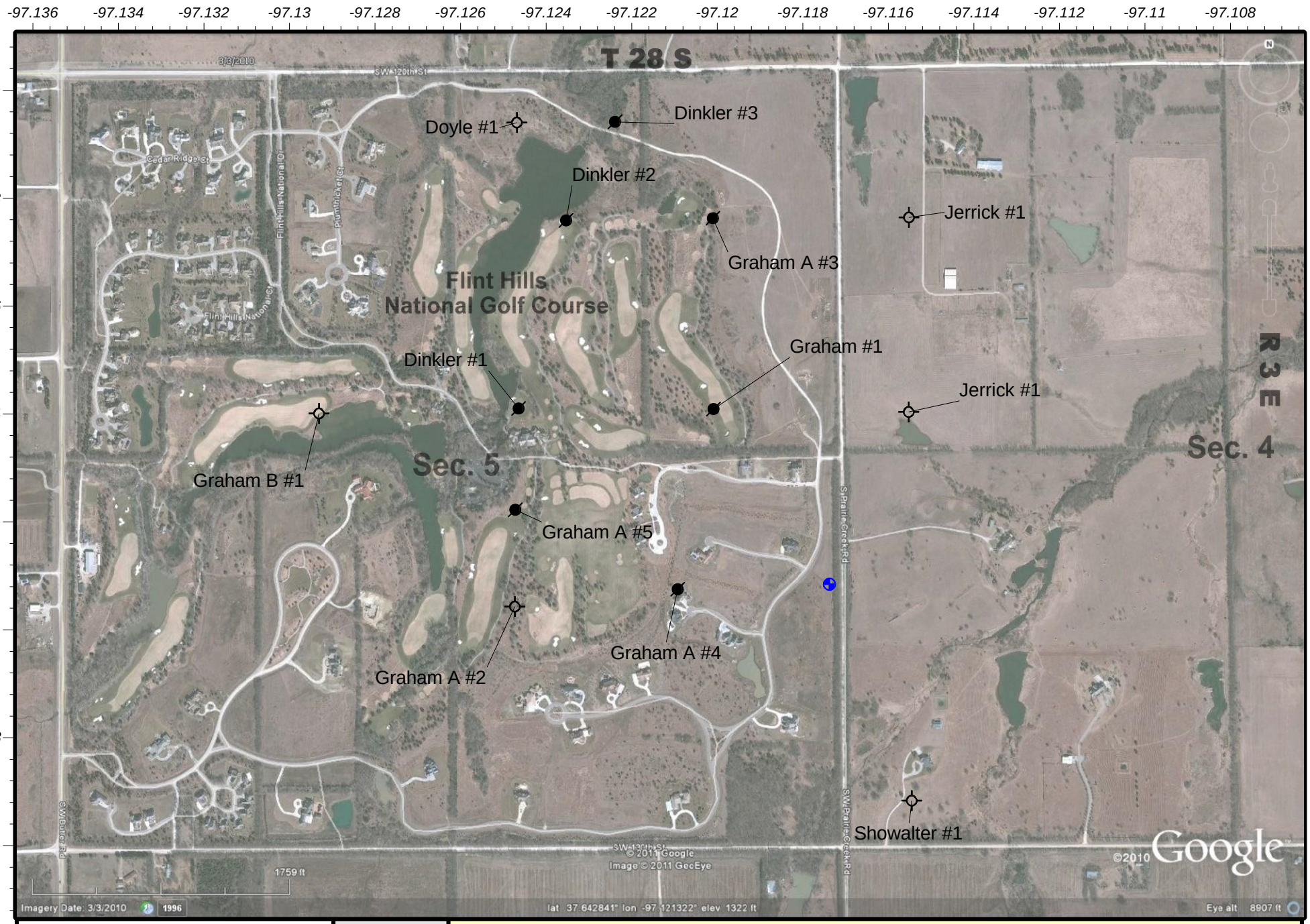
Estimated Total Cost: $50,000+ depending on material and contractor cost to plug both the Graham No. 1 and No. 5 wells.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures**	
		FY 2013/14	**Total**
20050047-001	**4 Hrs. / $112.04**		**$9,642.50**

Current Contaminate Level: Unknown

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**



Dinkler/Flint Hills National Contamination Site

Sections 4 & 5 of T 28 S & R 3 E of Butler County, Kansas

Site Map 2013

KCC Code# 200050047-001 - District #2 - D. Bollenback - 9/30/2013

Project: ***Burrton Crude Oil EB-3C***

Site Location: The EB-3C contamination site is located at a crossroads located at the convergence of Sections 25 and 36, Township 23 South, Range 4 West and Sections 30 and 31 of Township 23 South and Range 3 West, Harvey and Reno County. The site is one mile west and one mile south of Burrton, Kansas.

Impact/Immediacy: Low immediacy level. The spill affects a shallow groundwater aquifer with no residences within a half mile. The area extent of contamination is believed to be less than one acre. No domestic water wells or irrigation wells are immediately down gradient of the site.

Site Description: The site is located in rural Harvey and Reno County. The land use is agricultural. The depth to groundwater is less than ten feet. The affected groundwater is the Equus Beds. The A layer of the Equus Beds is very permeable, is very productive and contains good water quality.

Unusual Problems: This site is a hydrocarbon impacted site with problems different than brine impaction.

Status of Project: KCC has evaluated multiple remedial techniques from natural attenuation, new well installation and hydrocarbon absorbing aqua-socks, and oxygenating chemical injection into the aquifer. KCC district #2 feels that injection of Perm-Ox oxygenating chemical would help speed-up natural breakdown of the hydrocarbons and is currently putting together a scope of work in order to acquire bids to perform the work during the winter of 2013-14.

Level of Remediation Sought:
Ideal: Non –detect of TPH (Aqueous-Phase)
Target: No Free Liquid-Phase Hydrocarbon

Recommendations for Future Work: After the injection of Perm-Ox KCC will also install multiple 1 inch monitoring wells to observe the effects and rate of attenuation. After sufficient improvement is found KCC will close the site.

Estimated Total Costs: Approximately $3,000 to install shallow well/s and inject the remedial compounds.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970042-00	**10 Hrs. / $269.78**		**$2,350**

Current Contaminate Level: NDA

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**

Kansas Corporation Commission

N

Burrton EB-3C - Crude Oil Spill - Control # 970042-00
Section 25, Township 23 South & Range 4 West, Harvey and Reno Counties, Kansas
Annual Site Update Map
District #2 - Drawn on:9/29/2013 by D. Bollenback

Project: ***El Dorado American Legion Golf Course***

Site Location: The American Legion Golf Course is located within the City of El Dorado in the SW/4 of Section 3, Township 26 South, and Range 5 East. The site is located within the El Dorado oil field.

Impact / Immediacy: The site is classified as low.

Site Description: The site is bordered by three streets. These are Central Ave to the North, Haverhill Rd to the west, and Towanda Rd to the South. There is residential housing to the east. Constant Creek transverses through the site from the north to south and is down gradient to the south. The area consists of silty clay loam over silty clay which covers the Ft. Riley and Florence Limestone Formations. A sinkhole exists on the property that is located approximately NW SW SW.

Unusual Problems: It is unknown where the groundwater flow is coming from due to the karsted and jointed limestone bedding in the area.

Status of Project: KCC worked with the City of El Dorado in locating and investigating the old well sites. A Phase III was conducted by the KDHE in early 2011. This study was to investigate near surface soils for contamination before the beginning of the new stadium construction. KCC contracted GPPR from Oklahoma City to perform a Ground Penetrating Radar survey of the NW corner of the golf course in attempt to find the old abandoned wells and test-holes in that area. Unfortunately the survey did not turn up the locations of the wells in the area. In the fall of 2011 there was a groundbreaking ceremony for the stadium construction in the southwest part of the site. As of October 2012, the stadium has been completed and is in use. There was no action during 2013 by the KCC.

Level of Remediation Sought:

Ideal: Find, check, and plug all wells within the site boundaries.
Target: Find, check, and plug if necessary any wells that are developed on.

Recommendation for Future Work: KCC recommend closure of this site as the stadium has now been built and is in current use. KCC will put together the appropriate paperwork during the fall of 2013 in order to move this site into the resolved category.

Total Cost: $4,876.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
20110055-00	**10 Hrs. / $269.78**		

Current Contaminate Level: N/A

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**

Kansas Corporation Commission

American Legion El Dorado Golf Course BTA - SW section 3 of Township 26 South & Range 5 East, Butler County, Kansas
2013-14 Annual Report - Site Map
District #2 - Drawn on 9/30/2013 by D. Bollenback

Project: ***Elm Creek Contamination Site***

Site Location: Sections 19, 20, 29, 32, of Township 7 South, Range 17 West
Sections 5, 6, 8, 17, 20, 28 & 32 of Township 8 South, Range 17 West
Section 1 of Township 9 South, Range 18 West
Sections 1, 6, 8, of Township 9 South, Range 17 West, Rooks County

Impact/Immediacy: Domestic wells and stock wells affected. Area serviced by Rural Water District #3. Immediacy level is rated as moderate to high.

Site Description: Alluvial aquifer contaminated by oil field activity. In the past, this office received numerous complaints about high chlorides from landowners throughout the Elm Creek drainage. The individual sites were put together to form the Elm Creek contamination site. This site covers an area of approximately 38 square miles. Many of the original wells tested have been plugged or are no longer accessible. Chlorides levels in the drainage ranged from 60 ppm to 8000 ppm in 1989. Levels have fallen appreciably since to 150 ppm to 1300 ppm in 1995. Chloride levels in 2013 are now at 40 ppm to 780 ppm. This is significant due to the drought in the area, which would tend to concentrate chloride levels.

Unusual Problems: The area affected is very large. The source or sources have not been delineated.
Status of Project: Phase I, installation of the monitor well net was completed in May of 1998. Phase II, sampling of the monitor for five years was completed. The well net was sampled on a quarterly basis for three years and biannually for two years. Sampling is now by KCC staff. Samples taken in 2013 from the north end of the well net range from 40 to 320 ppm. Samples from the south end of the net range from 120 to 780 ppm.

Level of Remediation Sought:
Ideal: 250 ppm Chloride
Target: 500 ppm Chloride

Recommendations for Future Work: At present, chloride levels within the basin do not warrant drilling out sub-drainages. Long term monitoring is recommended.

Estimated Total Cost: Phase I $29,000+. Phase II 30,000+. Remediation costs are at $100,000 to $250,000 if warranted.

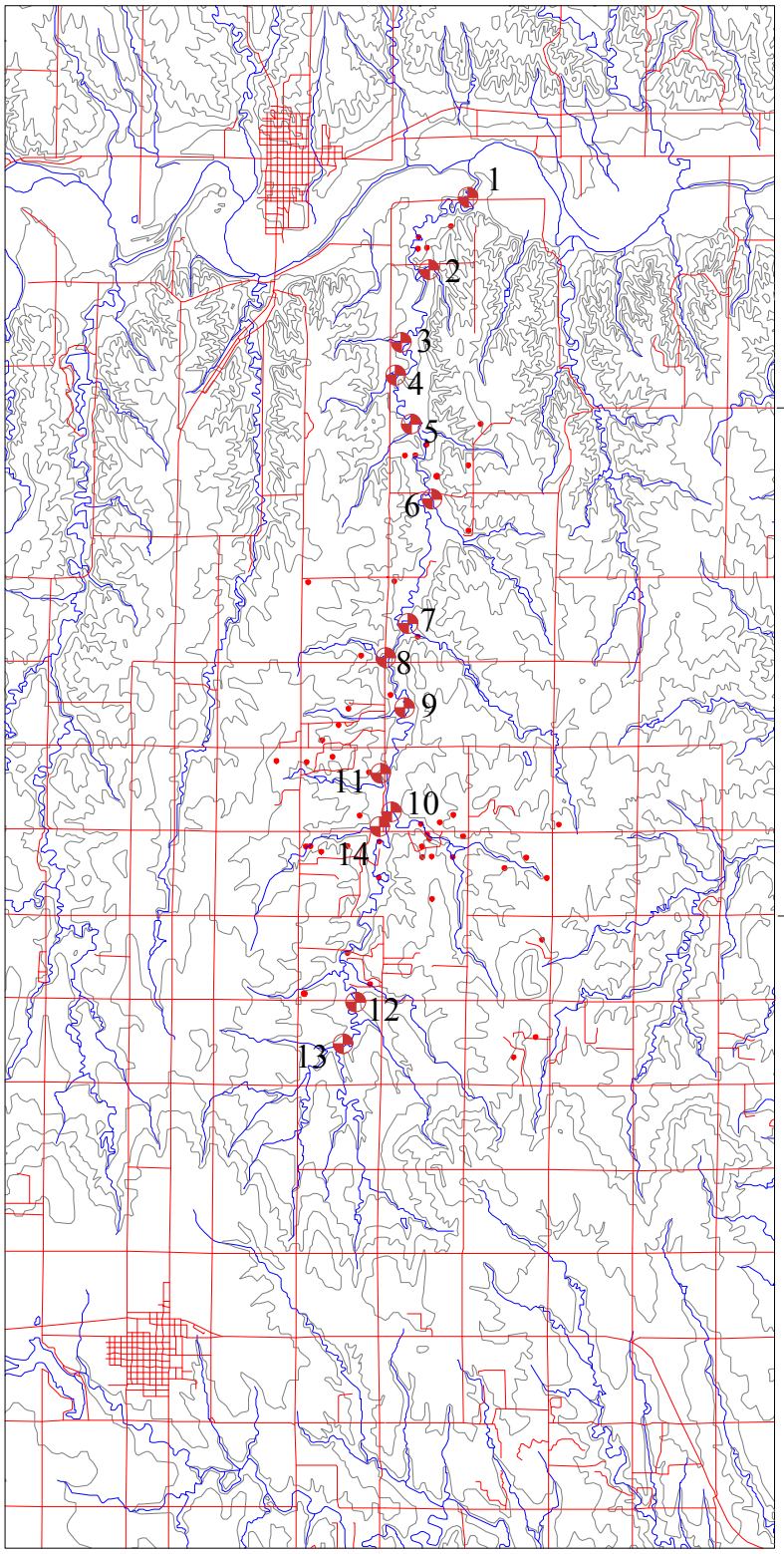
Control No.	**Staff Hours/Expenditures**	**Fund Expenditures**	
		FY 2013/14	**Total**
970043-00	**22 Hrs. / $529.58**		**$29,212.25**

Current Contaminate Level: 40 ppm at north end of creek, 780 ppm at south end of the creek.

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**

R 18 W R 17 W



T 07 S

T 08 S

T 09 S

EC MW1 2013 180 ppm Cl-
EC MW2 2013 40 ppm Cl-
EC MW3 2013 100 ppm Cl-
EC MW4 2013 300 ppm Cl-
EC MW5 2013 160 ppm Cl-
EC MW6 2013 220 ppm Cl-
EC MW7 2013 120 ppm Cl-
EC MW8 2013 160 ppm Cl-
EC MW9 2013 780 ppm Cl-
EC MW10 2013 680 ppm Cl-
EC MW11 2013 540 ppm Cl-
EC MW12 2013 400 ppm Cl-
EC MW13 2013 240 ppm Cl-
EC MW14 2013 620 ppm Cl-

N
W E
S

CI = 12,570

0 12570 25140

O l Well
Plugged O l Well
TA Oil We l
Abandoned O l Well
Gas We l
Plugged Gas Well
TA Gas Well
Abandoned Gas Well
Disposal Well
Plugged D sposal We l
TA D sposal Well
Abandoned D sposal Well
Injection Well
Plugged Injection Well
TA Inject on We l
Abandoned Injection Well

Oil & Gas Well
Plugged Oil & Gas Well
TA Oil & Gas We l
Abandoned Oil & Gas Well
Dual Completed Oil We l
Plugged Dual Completed Oil Well
TA Dual Completed O l Well
Abandoned Dual Completed Oil Well
Dual Completed Gas Well
Plugged Dual Completed Gas Well
TA Dual Completed Gas We l
Abandoned Dual Completed Gas We l
Water Supply Well
Plugged Water Supply Well
TA Water Supply We l
Abandoned Water Supply Well

Dry Hole
Domestic We l
Plugged Domest c Well
Abandoned Domest c We l
Agricu ture Well
Plugged Agriculture We l
Abandoned Agricu ture We l
Irrigation Well
Plugged Irr gation Well
Abandoned Ir igation Well
Public Water Supply We l
Plugged Publ c Water Supply We l
Abandoned Public Water Supply We l
Possible Location
Test Hole
Sample Site

Locat on
Monitoring Well
Plugged Monitoring Well
P t
Tank Battery
Gas Storage Monitoring Well
Plugged Gas Storage Monitoring Well
TA Gas Sto age Monitoring Well
Abandoned Gas Storage Monitorn ng We l
Gas Storage Injection/W thdrawl We l
Plugged Gas Storage Injection/W thdrawl We l
TA Gas Sto age Inject on Withdrawl Well
Abandoned Gas Storage Injection/Wi hdrawl We l

Kansas Corporation Commission

Elm Creek

Twn. 17-18 S., Rng. 7-9 W., Rooks County

Moderate Chloride Contamination in Area

970043-00

Date: 21 Oct 2004 District: Hays

Project: ***Enoch Thompson Contamination Site***

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: Five groundwater samples were collected in 2013. Chloride levels across the board have seen a decrease in all except KDHE-2, which had a slight increase. 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.

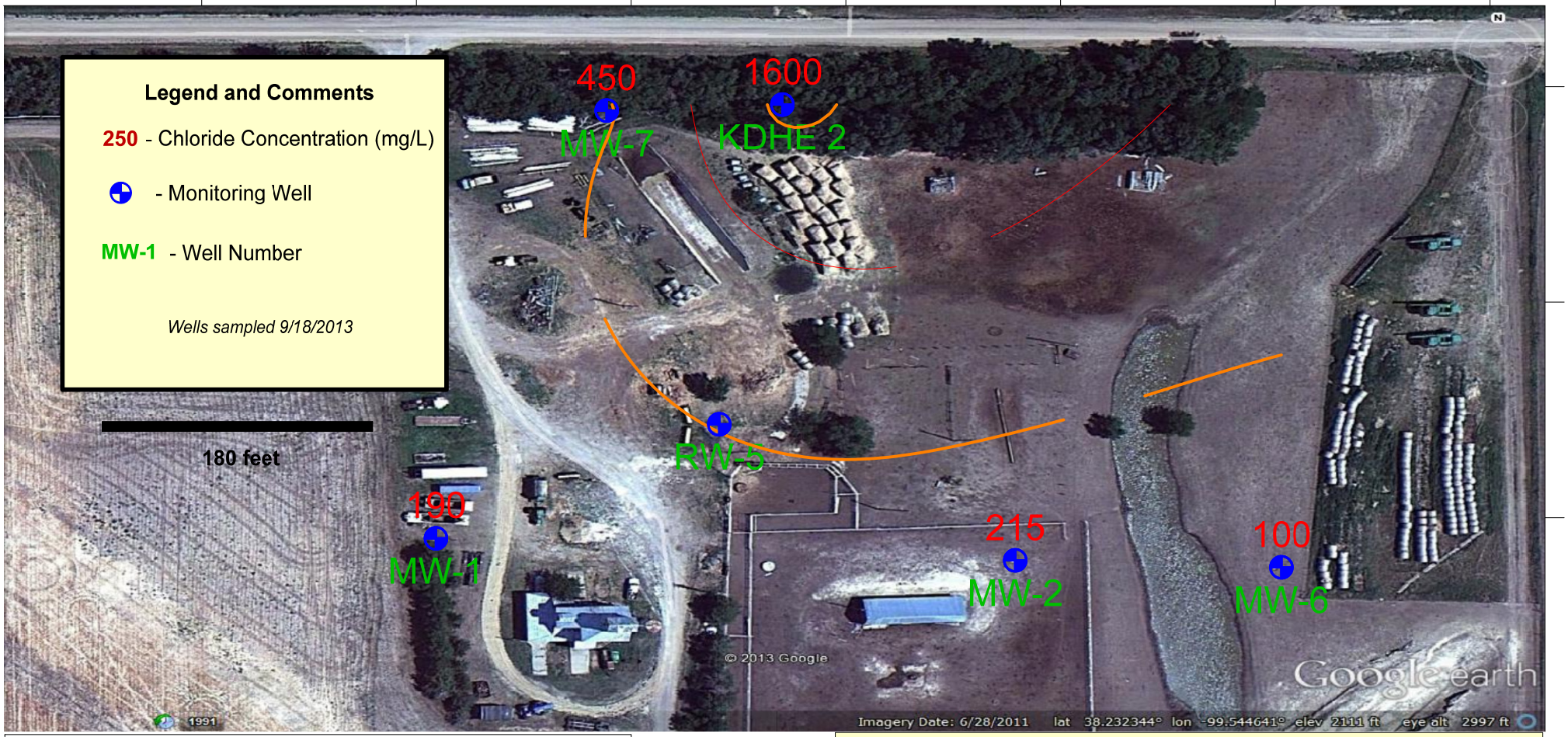
Estimated Total Cost: $500 for yearly sampling.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970044-00	**9.5 Hrs. / $248.97**		

Current Contaminate Level: 100 ppm Cl- to 1600 ppm Cl-

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**



Kansas Corporation Commission

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Enoch Thompson Site

Section 17-T21S-R20W
Pawnee County, Kansas

2013-2014 Area Map with Chlorides

KCC Control # 970044-00 District 1
D. Sellers 9/23/13

Project: ***Fink Contamination Site***

Site Location: NE/4 of Section 27, Twn. 8 S., Rng. 22 W., Graham County.

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

Site Description: Contamination of shallow ephemeral water and Codell water well by oil field brine. Saltwater had moved through the Niobrara chalk and probably into the Codell aquifer. The Codell aquifer is encountered at 300 feet.

Unusual Problems: Codell Sandstone at 250 to 300 feet deep.

Status of Project: The KCC investigated the problem in 1989. Samples from the stock well were still at 3000 ppm during a five-day pump test of the well. A sample of the stock well in 2011 was down to 600 ppm chloride. Chloride levels from a sample taken in 2012 were at 940 ppm. In 2013, the levels have fallen back to the 2011 levels at 600 ppm chloride. The domestic well has not been accessible since 2004. The chloride levels at that time were 200 ppm.

Level of Remediation Sought:

Ideal: 140 ppm Chloride (background levels)
Target: 500 ppm Chloride

Recommendations for Future Work: Continue to monitor.

Estimated Total Costs: $2000.

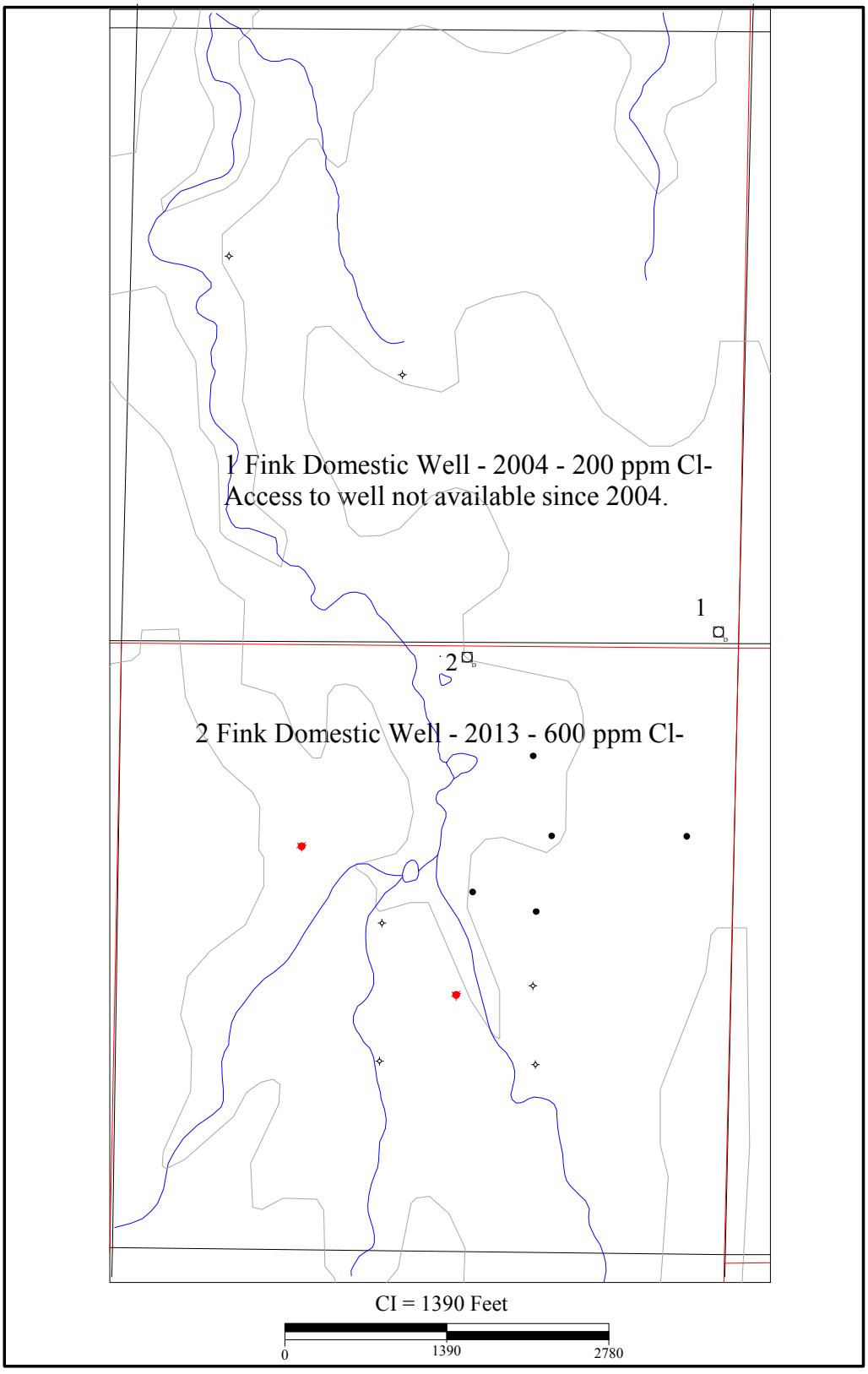
Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970007-00	**10 Hrs. / $251.22**		

Current Contaminate Level: 600 ppm Cl-

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**

R 22 W



T

08

S

Oil Well
Plugged Oil Well
TA Oil Well
Abandoned Oil Well
Gas Well
Plugged Gas Well
TA Gas Well
Abandoned Gas Well
Disposal Well
Plugged Disposal Well
TA Disposal Well
Abandoned Disposal Well
Injection Well
Plugged Injection Well
TA Injection Well
Abandoned Injection Well

Oil & Gas Well
Plugged Oil & Gas Well
TA Oil & Gas Well
Abandoned Oil & Gas Well
Dual Completed Oil Well
Plugged Dual Completed Oil Well
TA Dual Completed Oil Well
Abandoned Dual Completed Oil Well
Dual Completed Gas Well
Plugged Dual Completed Gas Well
TA Dual Completed Gas Well
Abandoned Dual Completed Gas Well
Water Supply Well
Plugged Water Supply Well
TA Water Supply Well
Abandoned Water Supply Well

Dry Hole
Domestic Well
Plugged Domestic Well
Abandoned Domestic Well
Agriculture Well
Plugged Agriculture Well
Abandoned Agriculture Well
Irrigation Well
Plugged Irrigation Well
Abandoned Irrigation Well
Public Water Supply Well
Plugged Public Water Supply Well
Abandoned Public Water Supply Well
Possible Location
Test Hole
Sample Site

Location
Monitoring Well
Plugged Monitoring Well
Pit
Tank Battery
Gas Storage Monitoring Well
Plugged Gas Storage Monitoring Well
TA Gas Storage Monitoring Well
Abandoned Gas Storage Monitoring Well
Gas Storage Injection/Withdrawl Well
Plugged Gas Storage Injection/Withdrawl Well
TA Gas Storage Injection/Withdrawl Well
Abandoned Gas Storage Injection Withdrawl Well

Kansas Corporation Commission

Fink

Sec. 27, Twn. 8 S., Rng. 22 W., Graham County

Contaminated Domestic Well

970007-00

Date: 21 Oct 2004 District: Hays

Project: ***Fowler Contamination Site***

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 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 in 2001. One sample was collected in 2013 on 09/11/2013. This sample tested 340 ppm Cl- from Sample Location #2. No surface fluids were present to sample from Sample Location #2. Brine impacted areas did show visual improvement of vegetative growth.

Level of Remediation Sought:

Ideal: 200 ppm Chloride
Target: 300 ppm Chloride

Recommendation for Future Work: Continued monitoring and treatment again with gypsum and re-seeding when appropriate. Construction of approximately 3-4 monitoring wells to determine if saltwater is migrating into the physical boundary of lease from other sources.

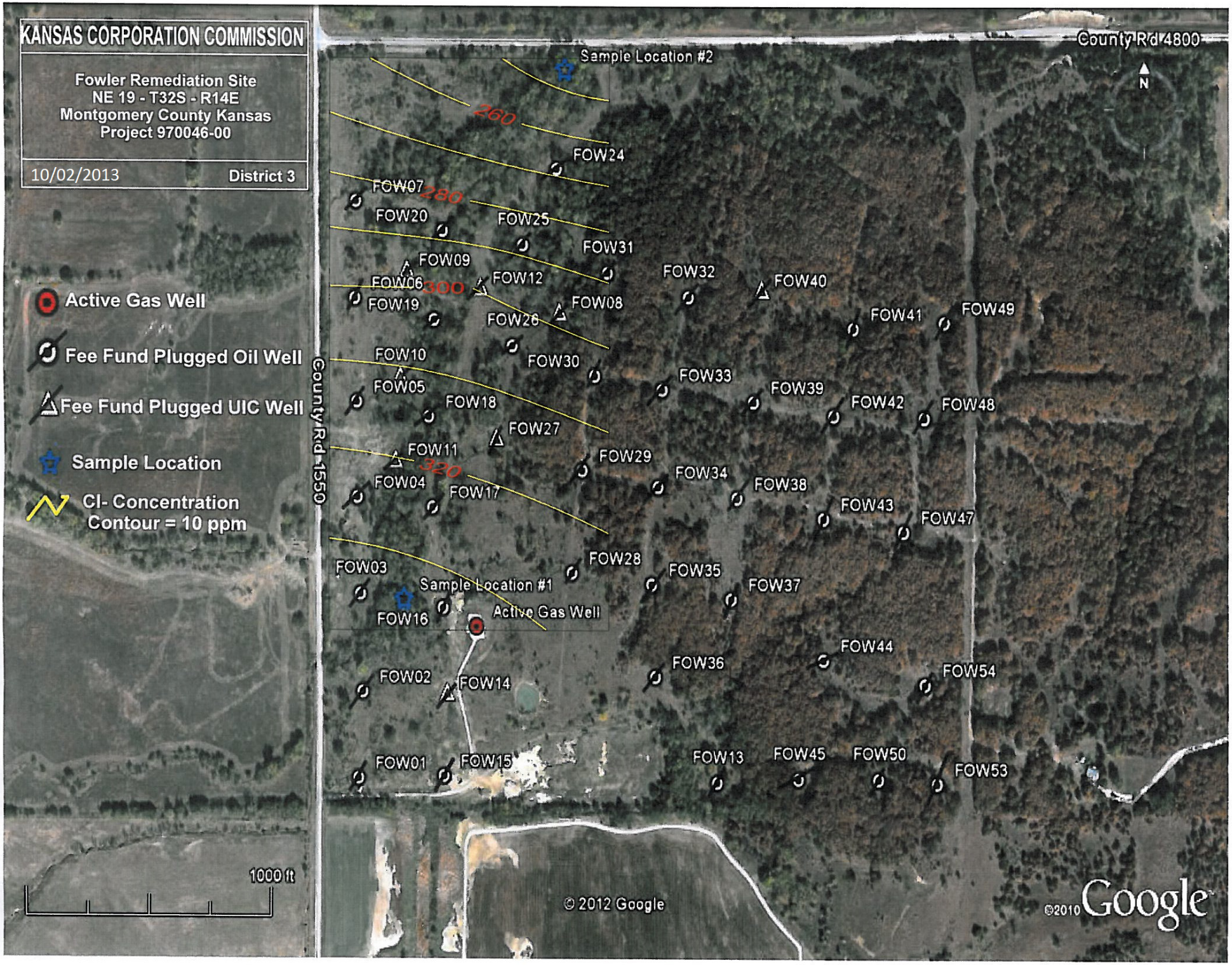
Estimated Total Costs: Monitoring cost approximately $1,500.00 per year.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Fund Expenditures Total
970046-00	13 Hrs. / $348.65		

Current Contaminate Level: 340 ppm Cl-

Status: Active

☐ 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


KANSAS CORPORATION COMMISSION
Fowler Remediation Site
NE 19 - T32S - R14E
Montgomery County Kansas
Project 970046-00
10/02/2013
District 3
Active Gas Well
Fee Fund Plugged Oil Well
Fee Fund Plugged UIC Well
Sample Location
Cl- Concentration Contour = 10 ppm
1000 ft
County Rd 1550
County Rd 4800
N
260
280
300
320
Sample Location #2
Sample Location #1
Active Gas Well
FOW01
FOW02
FOW03
FOW04
FOW05
FOW06
FOW07
FOW08
FOW09
FOW10
FOW11
FOW12
FOW13
FOW14
FOW15
FOW16
FOW17
FOW18
FOW19
FOW20
FOW24
FOW25
FOW26
FOW27
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Project: ***French Contamination Site***

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 shot on 9/30/2013. On average, the sinkhole dropped 1.13 feet this year. The majority of the drop is in the eastern part of the sinkhole, with the most dramatic drop to the northeast. The eastern part of the sinkhole is dropping quicker than in the recent past. The seismic that was shot over it would indicate that the sinkhole will continue to subside to the east. The western part of the sinkhole did not move any during the past year.

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: Monitor stock wells and irrigation wells to the southeast of the depression. Resume the semi-annual survey of the site to establish a current rate of subsidence. Monitor possible second depression to the southeast of the original depression.

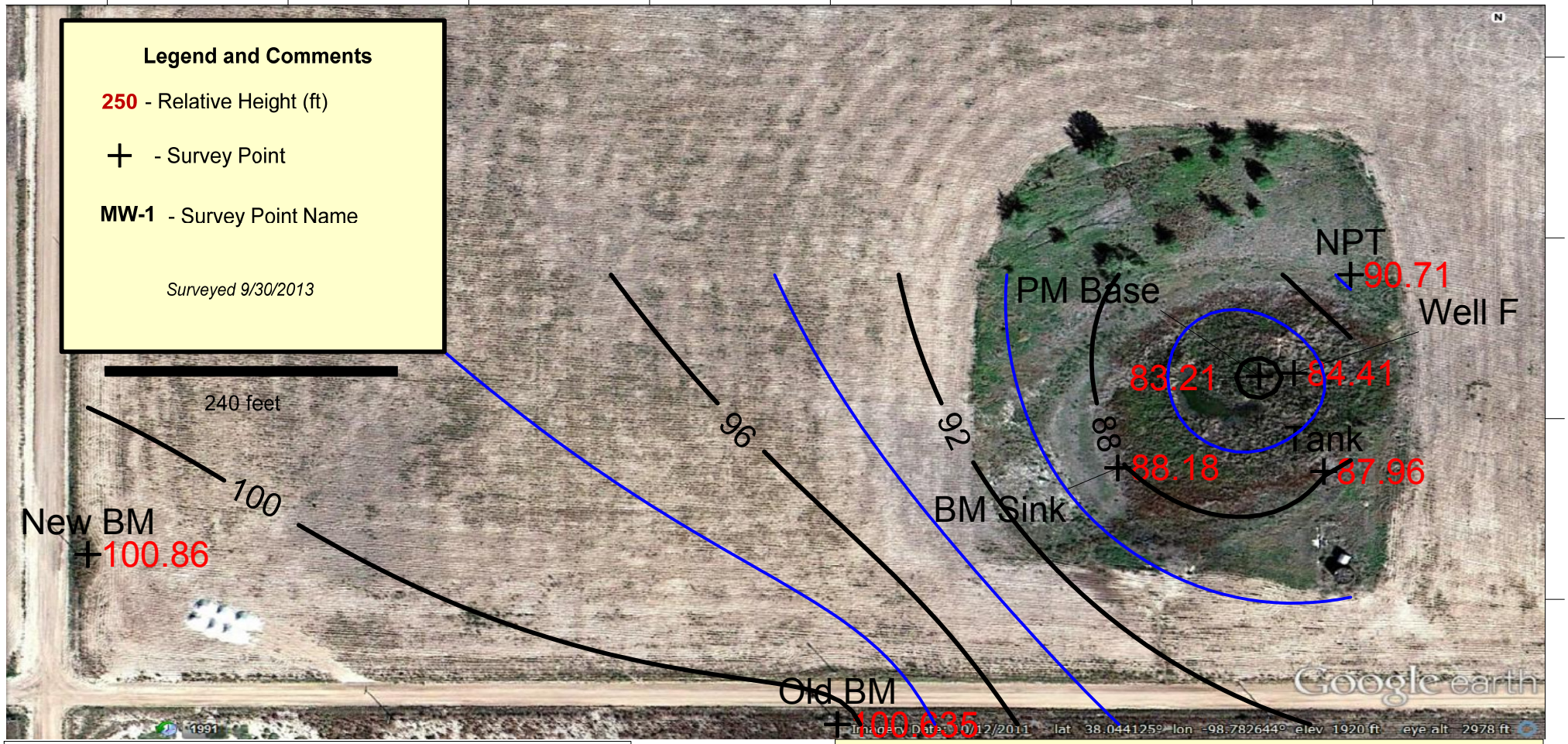
Estimated Total Costs: $3000.00.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Fund Expenditures Total
990002-001	10.5 Hrs. / $285.92		$346.50

Current Contaminate Level: Unknown.

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



Kansas Corporation Commission

N W E S

French Sinkhole

SW/4 Section 17-T23S-R13W
Stafford County, Kansas

Change in Elevation Map-Shot 9/30/2013

KCC Control # 970002-001 District 1
D. Sellers 10/01/2013

Project: ***Galva City Area Contamination Site***

Site Location: This contamination site is located in Section 15 and 22 of Township 19 South, Range 2 West, which is half mile north and quarter mile east of Galva City in McPherson County.

Impact/Immediacy: This site has been up graded to a high level of immediacy. Groundwater has been impacted and the potential for contamination to domestic and **public water supply** at Galva City is very high. A water sample was taken from Galva City Well #3 in July 2006 and the chlorides tested 460 mg/l, 2007 tested 1170 mg/l and in July of 2008 tested 1200 mg/l. A Sample of the same public supply well was taken in 2011 and tested to be 670 mg/l. A sample was not available for 2013.

Site Description: The site is located in a rural area with topography of gentle sloping fields with a small drainage stream located east and west of site with the flow from the north to the southwest. This site is in the Ritz-Canton oil field, which has a past history of utilizing brine pits for the disposal of brine from the wells. The depth to the ground water is 17 $^{+/-}$ feet and the bedrock or aquitard should be encountered at a depth of 60 feet. There are buried paleo-channels in the area where the bedrock is encountered at approximately 90 feet which usually hold the highest chloride levels close to the top of the Wellington Shale.

Unusual Problems: The disposal well will not take the amount of fluid necessary run all four recovery wells at the same time. High Chloride water deteriorates metal pumps, fittings, etc. Recovery pumps have short life spans and the local groundwater has high levels of iron which clog up lines and equipment.

Status of Project: Currently two of the four recovery wells are operational at the Galva Site; repairs are underway to put all the recovery wells online. The disposal system shared with local operators does not allow for more than one recovery well to be operated at a time, but the costs of locating or drilling our own disposal well would be excessive. This remedial system is over 10 years old and need to be overhauled in order to keep it operational for the long term. PVC manifolds, lines, and even the building need attention to limit the amount of equipment failures due to age. The slow rate of chloride removal indicates this system will be online for a considerable amount of time so an overhaul plan along with a proactive scope of work on maintaining the system is necessary.

There has been a significant increase in chlorides near Recovery Well #4. KCC has decided to renter or drill and install a new recovery well at that location in order to begin remedial efforts at that location. KCC attempted to redevelop the well but due to the local iron and bacteria concentration of the aquifer KCC could not repair recovery well #4.

Level of Remediation Sought:

Ideal: 250 mg/l chlorides
Target 500 mg/l chlorides

Recommendations for Future Work: KCC will be putting together a scope of work addressing the issues at the aging Galva City Site and the remedial system that was installed in the early 2000's. This scope will be requesting funds on multiple fronts improving and repairing the remedial system as well as the monitoring well matrix. KCC will be recommending the installation of one or two new recovery wells in order to deal with the increase in chlorides to the west side of the site.

KCC will also be recommending the overhaul of the remedial system and building including multiple valves, lines, meters, as well as new insulation and electrical overhaul of the structure that houses the main manifold. KCC staff could do the majority of this work but the parts and material will have to be purchased.

Finally, KCC recommends that all the broken monitoring wells be repaired or plugged, and that the installation of no less than 5 new wells be drilled in order to delineate the brine plume or replace broken wells in important locations. KCC district staff feels that there needs to be improved delineation to the north and east of the main monitoring well matrix.

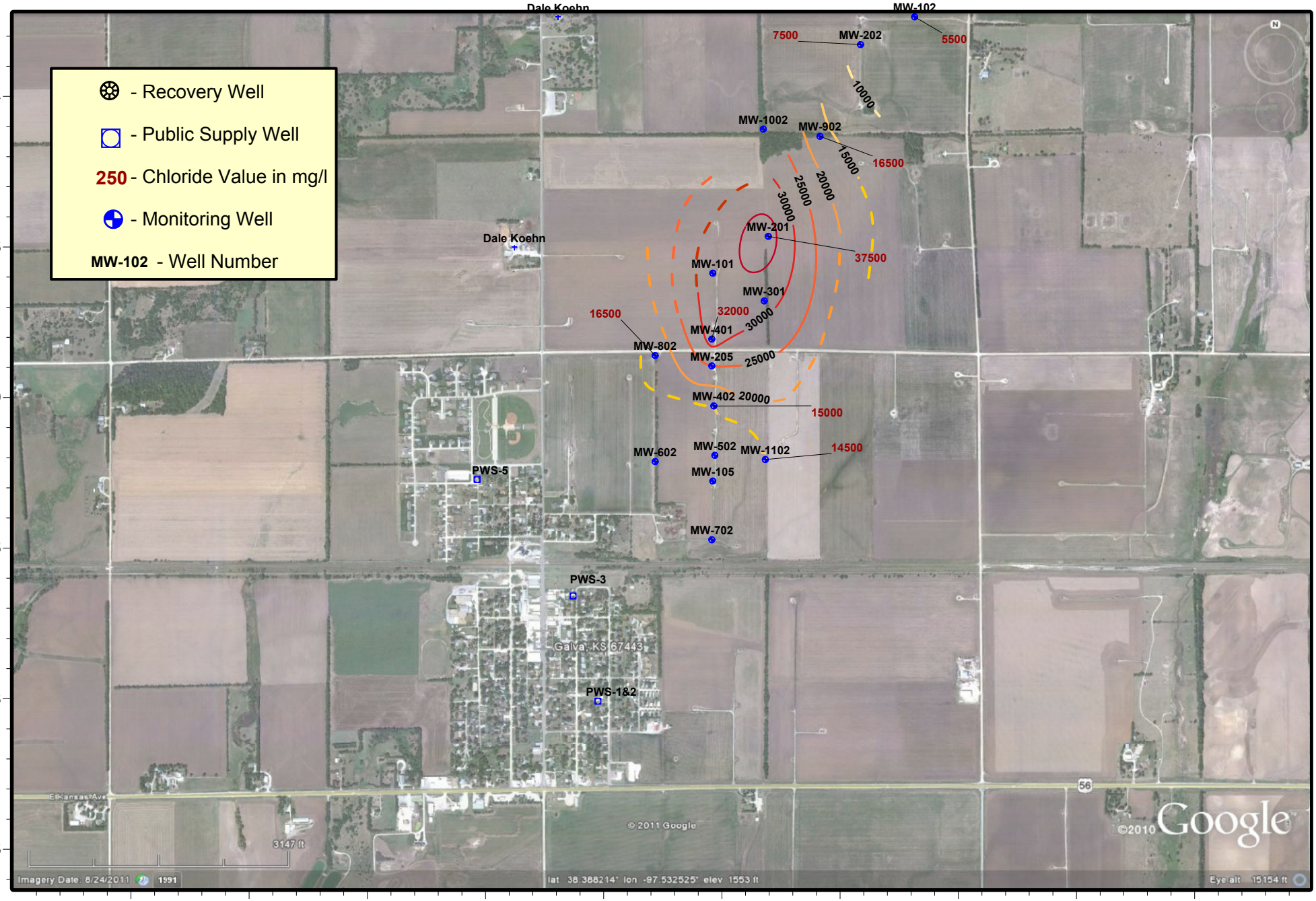
Estimated Total Costs: Annual cost of field inspection is $3500. Field work addressing, modifying, or repairing the remediation system would vary depending on the direction decided upon. The installation of 5 monitoring wells is estimated to be in the range of $15,000 to 20,000. The recovery well/s installation with added plumbing to the system would run in the area of $10,000 to $15,000.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Fund Expenditures Total
980033-001	247.5 Hrs. / $6,517.76	$5,404.07	$236,786.66

Current Contaminate Level: 37500 mg/l (MW 201) to 5,500 mg/l (MW 102) chlorides for 2013

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



Kansas Corporation Commission

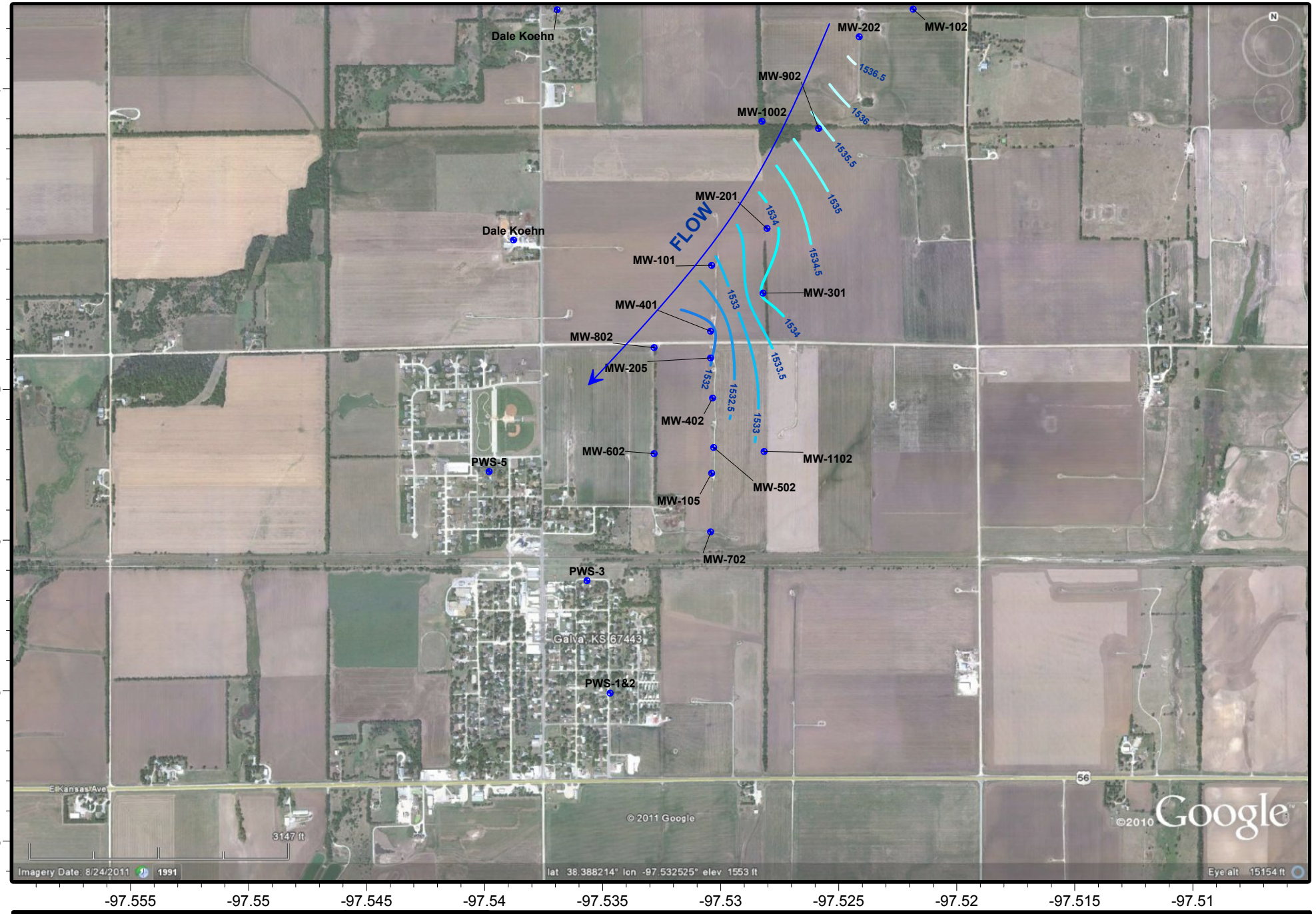
N W E S

Galva City Contamination Site

Sec. 15, 16, 21, &22 - T19S - R2W, McPherson County

2013-14 Chloride Concentration Map

KCC Control #980033-01 - District #2 - D.Bollenback - 9/30/2013



Kansas Corporation Commission

N W E S

Galva City Contamination Site

Sec. 15, 16, 21, &22 - T19S - R2W, McPherson County

2013-14 Groundwater Elevation Map

KCC Code#980033-01 - District #2 - D.Bollenback - 9/30/2013

Project: ***Albert Harbaugh Contamination Site***

Site Location: Legal location is the SE/4 Section 20 & NE/4 Section 29, Township 33 South, Range 11West, 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 others 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: Project is shut-in waiting on repairs to the recovery well header systems and acid treatment stimulation on the disposal well. Thirty-two monitoring and recovery wells were sampled in 2013. Chloride values in the northwest corner of the site continue to be elevated at unacceptable levels, with values ranging from 6300 ppm in RW-1 to 1600 ppm and 1100 ppm respectively in monitoring wells 13 and 26. 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. MW 25 and MW 32 both need repairs. MW 27 was not found, presumed destroyed, and not sampled this year.

Level of Remediation Sought:

Ideal: 250 ppm Chloride
Target: 1000 ppm Chloride

Recommendation for Future Work: Obtain funds for well treatment and infrastructure repairs. Monitor the recovery well system for effectiveness of chloride plume containment. Continue annual sampling of monitor wells and bimonthly sampling of the recovery wells after they have been restarted.

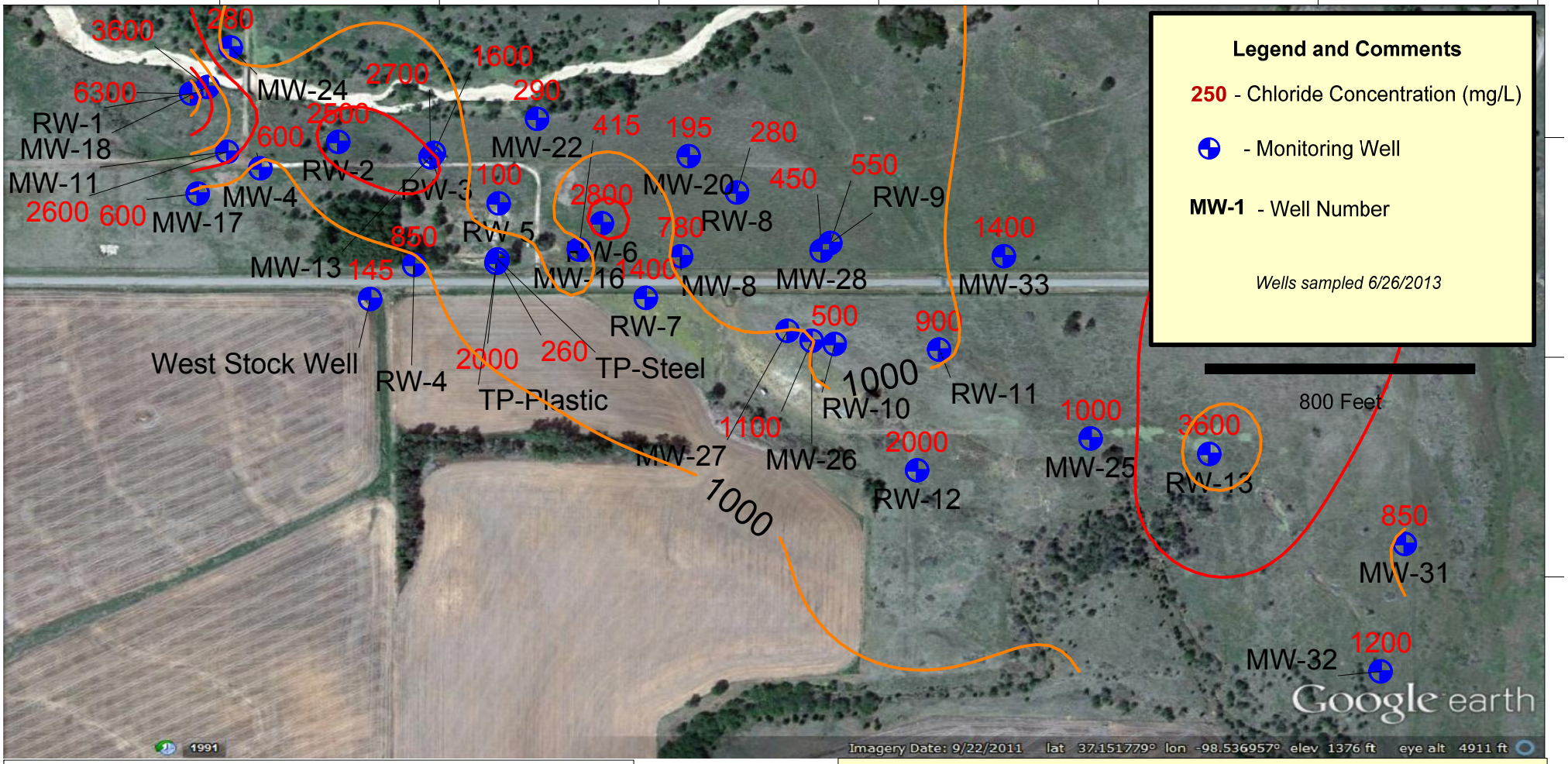
Estimated Total Cost: Total costs have exceeded the original estimate of $450,000. Costs for repairs have not been investigated.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Total
970049-00	44 Hrs. / $1,164.96	$2,565	$536,030.90

Current Contaminate Level: 150ppm Cl- to 6,300ppm Cl-

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



Kansas
Corporation Commission

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Harbaugh Site

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

2013-2014 Area Map with Chlorides

KCC Control # 970049-00 District 1
D. Sellers 9/24/13

Project: ***Hollow-Nikkel Contamination Site***

Site Location: The site is located in northwestern Harvey County approximately eighteen miles northwest of the city of Newton. The site includes parts of Sections 7, 8, 17, 18, 19, 20, 29, and 30 in Township 22 South, Range 3 West.

Impact: Potential impact is to irrigation and rural residential wells. Directly down gradient of the site there are nine domestic wells and irrigation well. This site should be rated at a moderate immediacy level.

Site Description: The project area covers approximately 700 acres with maximum chloride values in the range of 5 to 6100 mg/l in the lower zone of the aquifer. The contaminate plume is aligned in a north to south configuration and is approximately .5 mile wide and 2 miles in length. Plume morphology appears to be controlled by a bedrock channel, which has an alignment similar to that of the plume. Contamination mapped to date is primarily confined to the lower zone of the Equus Beds aquifer, which consists of unconsolidated sand and gravel deposits and lies at a depth of 200 to 250 feet.

Unusual Problems: If remediated, specifically the stage in which a new transportation line would be trenched to a new disposal facility, problems could arise in obtaining right of ways, and costs could also become inflated by difficult road and stream crossings. Loss of participation by the local operator could substantially increase disposal costs.

Status of the Project: The Ground Water Management District was contracted to do annual water sampling with the KCC funding the analysis of the water samples. The plumes in the A, B, and C zones appear to be relatively stable. The District #2 Office began research into the northeast chloride increase.

Level of Remediation Sought:

Ideal: 250 mg/l
Target: 500 mg/l

Recommendations for Future Work: Continue to collect data from GWD #2 on an annual basis for monitoring purposes. Increased research and investigation into the northeastern increase of chloride levels need to be addressed.

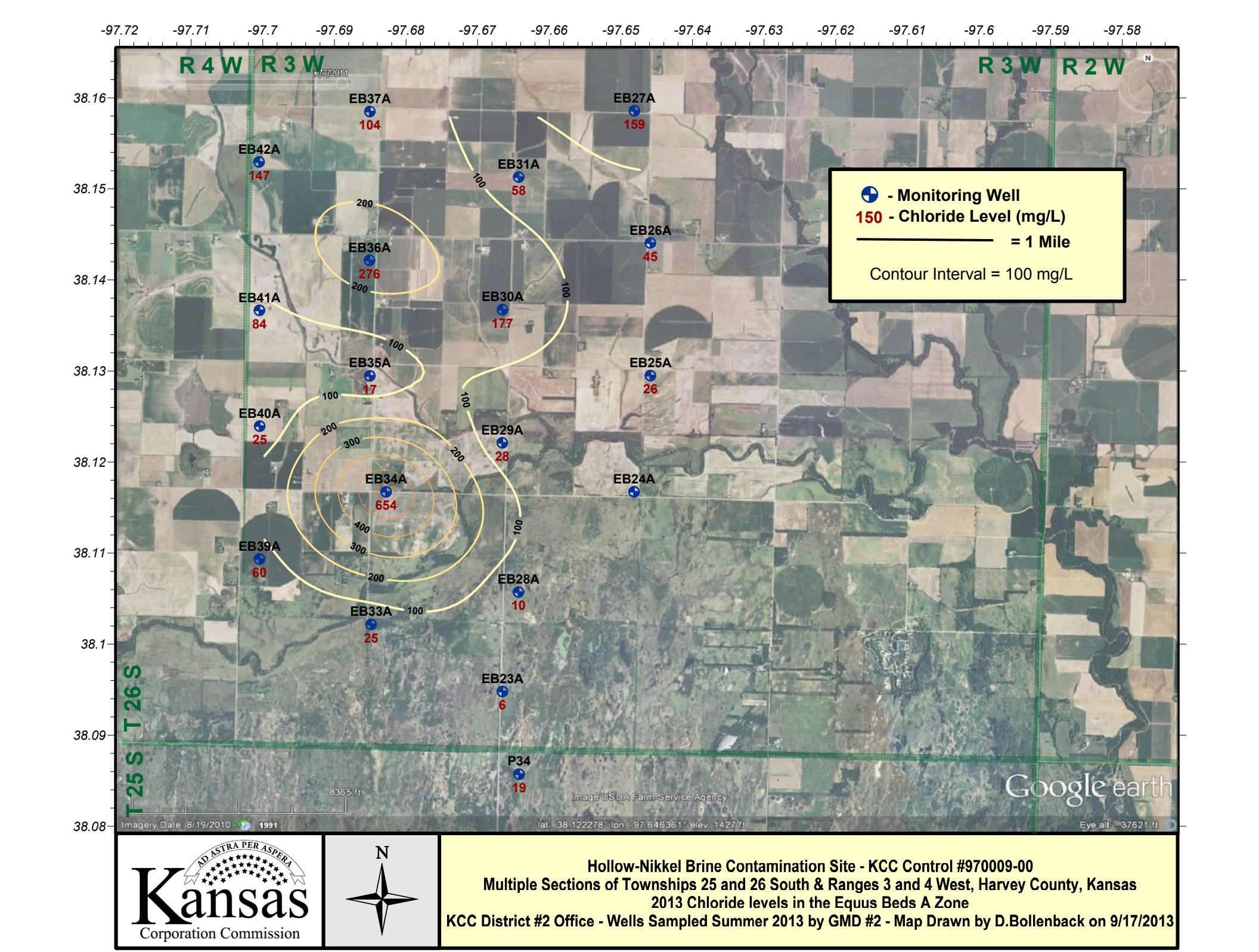
Estimated Total Costs: Time for district personnel to put together and analyze data plus research possible remediation avenues.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures**	
		FY 2013/14	**Total**
970009-00	**38 Hrs. / $1,005.90**	**$3,078**	**$32,322.65**

Current Contaminate Level: Varies; There are hot spots in each zone.

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**



Kansas Corporation Commission

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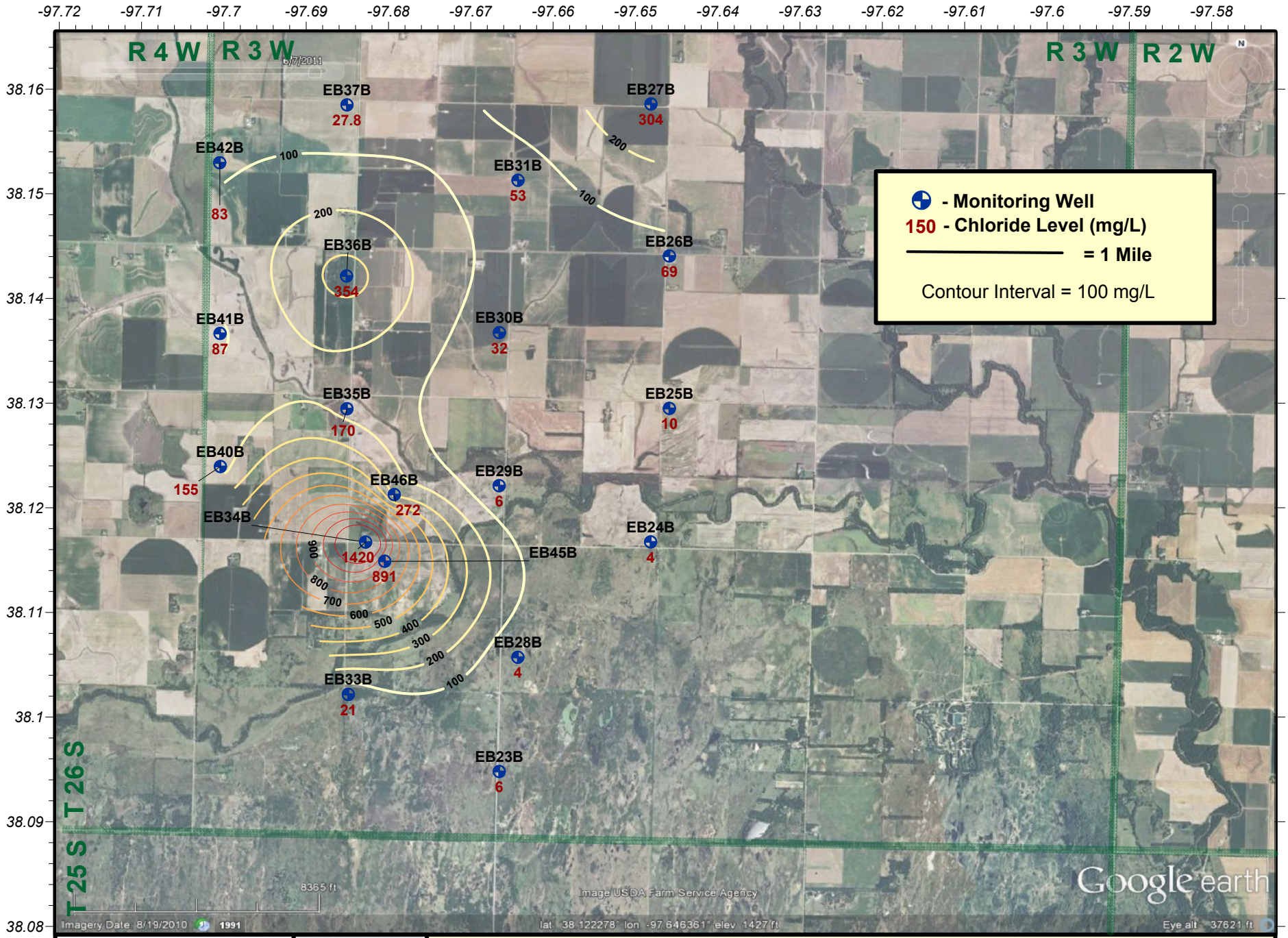
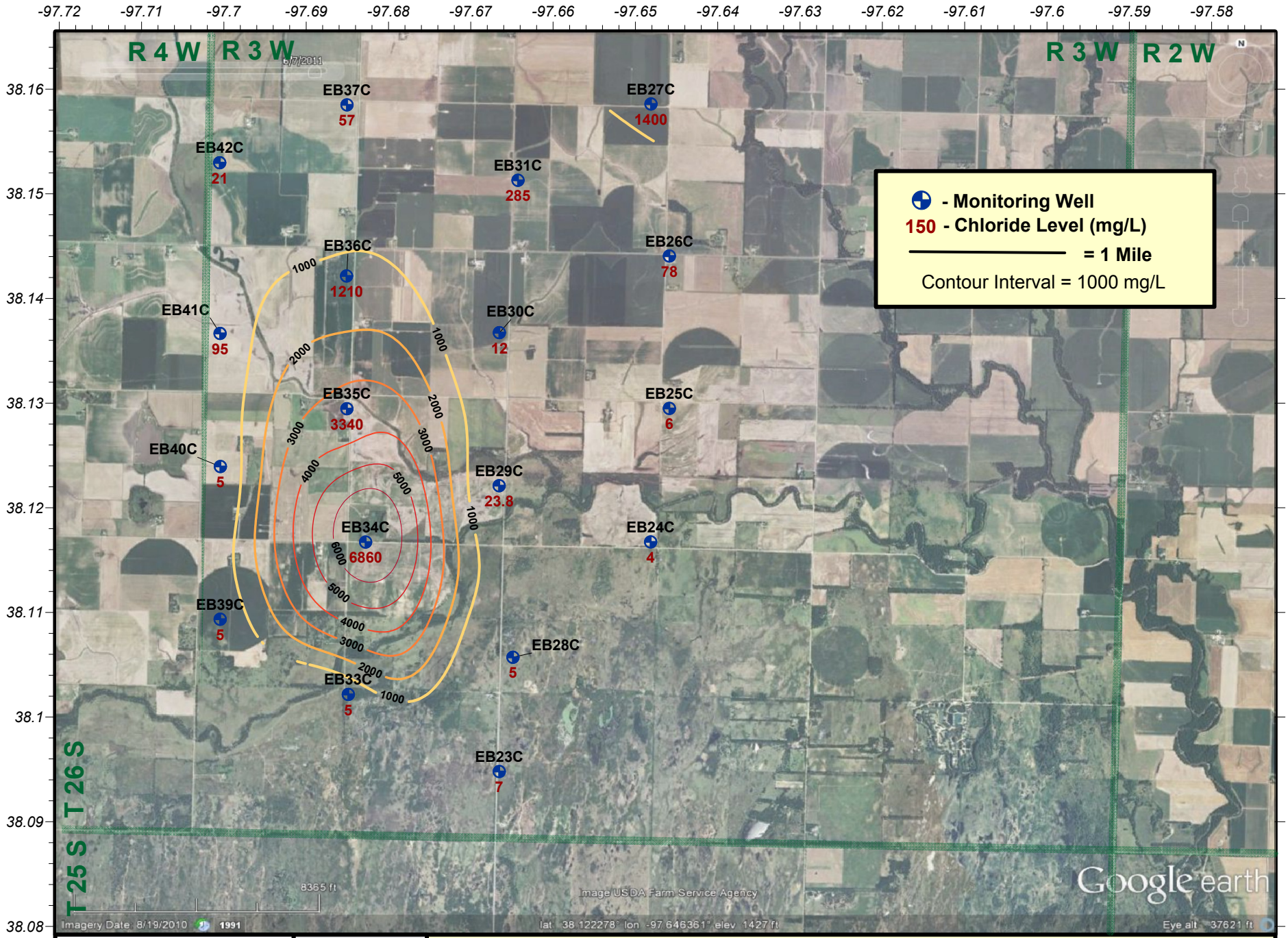
Hollow-Nikkel Brine Contamination Site - KCC Control #970009-00
Multiple Sections of Townships 25 and 26 South & Ranges 3 and 4 West, Harvey County, Kansas
2013 Chloride levels in the Equus Beds A Zone
KCC District #2 Office - Wells Sampled Summer 2013 by GMD #2 - Map Drawn by D.Bollenback on 9/17/2013



Kansas Corporation Commission

N

Hollow-Nikkel Brine Contamination Site - KCC Control #970009-00
Multiple Sections of Townships 25 and 26 South & Ranges 3 and 4 West, Harvey County, Kansas
2013 Chloride levels in the Equus Beds B Zone
KCC District #2 Office - Wells Sampled Summer of 2013 by GMD #2 - Map Drawn by D.Bollenback on 9/17/2013



Kansas Corporation Commission

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Hollow-Nikkel Brine Contamination Site - KCC Control #970009-00
Multiple Sections of Townships 25 and 26 South & Ranges 3 and 4 West, Harvey County, Kansas
2013 Chloride levels in the Equus Beds C Zone
KCC District #2 Office - Wells Sampled Summer of 2013 by GMD #2 - Map Drawn by D.Bollenback on 9/17/2013

Project: ***Hrencher Contamination Site***

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: Eight groundwater samples and one surface water sample was collected in 2013. Chloride levels in the project area have increased slightly from 2013. Current chloride values at the site range from 200 ppm in MW-6 in the northwest area of the site, to 10,500ppm in MW-1. As the plume is followed down gradient, or to the southeast, to MW-12, the chlorides are 4,500 ppm, which is an increase of 1,400 ppm since this well was sampled in 2013. Comparing these values the historical data show a trend that plume is moving very slowly to the southeast. Since 2003 when the last full sampling event has taken place, 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, sampling is scheduled for 2014. As chloride levels have continued to increase down gradient, it may be necessary to design and install a remedial system for this site. Further investigation and sampling will continue to determine if a remedial system is appropriate for this site.

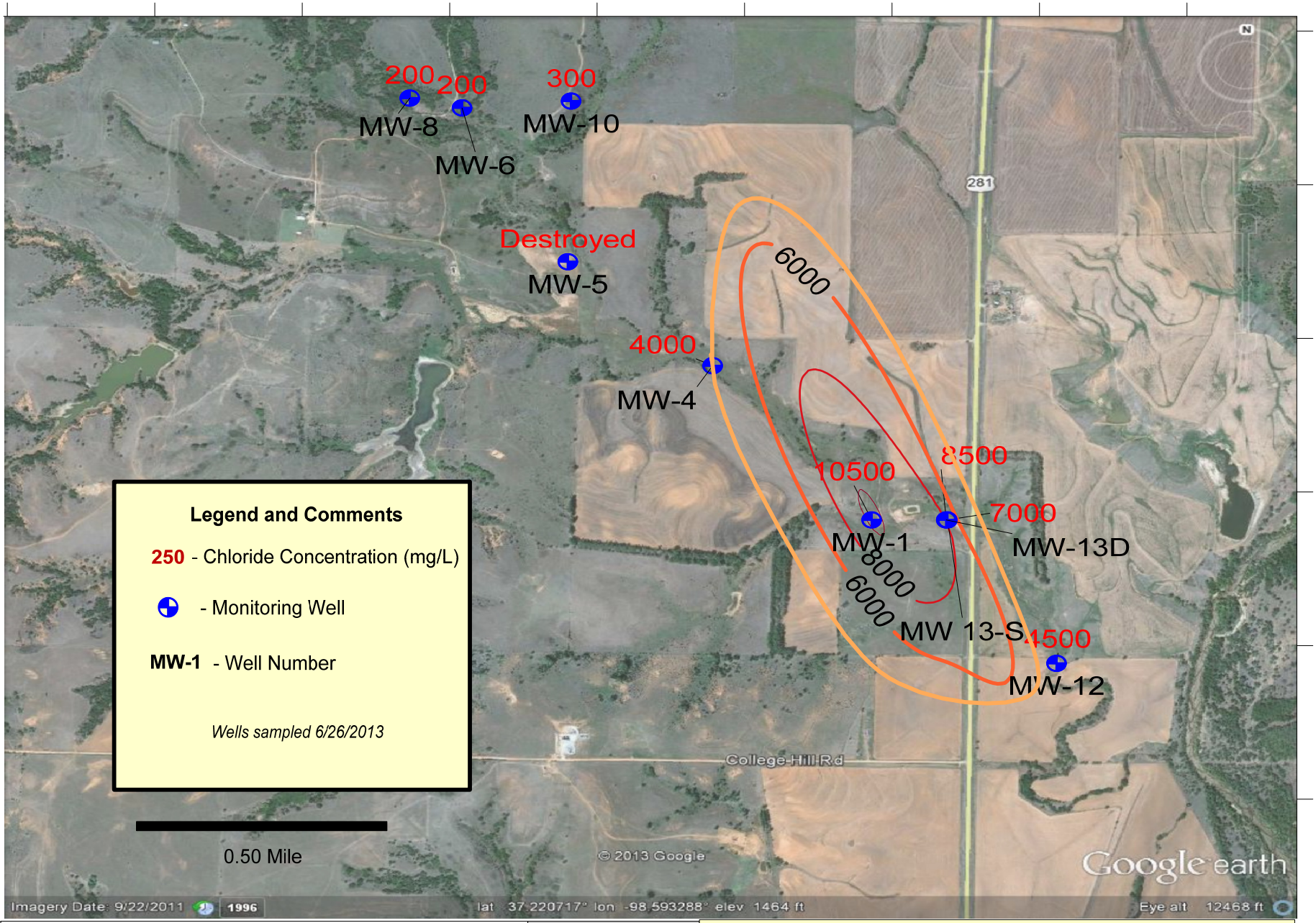
Estimated Total Cost: $150,000 if necessary to install a remediation system.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures**	
		FY 2013/14	**Total**
970051-00	**45 Hrs. / $1,130.04**		**$189.94**

Current Contaminate Level: 200 ppm Cl- to 10,500 ppm Cl-

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**



Kansas Corporation Commission

N W E S

Hrencher Site

Sections 26/35/36-T-32S-R12W
Barber County, Kansas

2013-2014 Area Map with Chlorides

KCC Control # 970051-00 District 1
B. Milner 7/10/13

Project: ***Irey-Hrabe Contamination Site***

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

Impact/Immediacy: Groundwater. Immediacy is rated as low.

Site Description: Groundwater contaminated by poor oil field practices, including abused emergency pits, an illegal shallow injection well (Cedar Hills) and abandoned oil wells.

Unusual Problems: Lack of wells for monitoring purposes.

Status of Project: Site assessment is completed. No apparent problems on the lease. Problem SWD was plugged in November of 1988. Chloride concentrations in the abandoned well increased to 1300 ppm in 2002 and remained at that level in 2003. These levels dropped to 900 ppm in 2004. In October, 2007 the chloride levels in this well were at 1200 ppm. No sample since 2013 due to well being inaccessible.

Level of Remediation Sought:

Ideal: 250 ppm Chloride

Target: 500 ppm Chloride

Recommendations for Future Work: Drill shallow monitor well.

Estimated Total Costs: $4000.

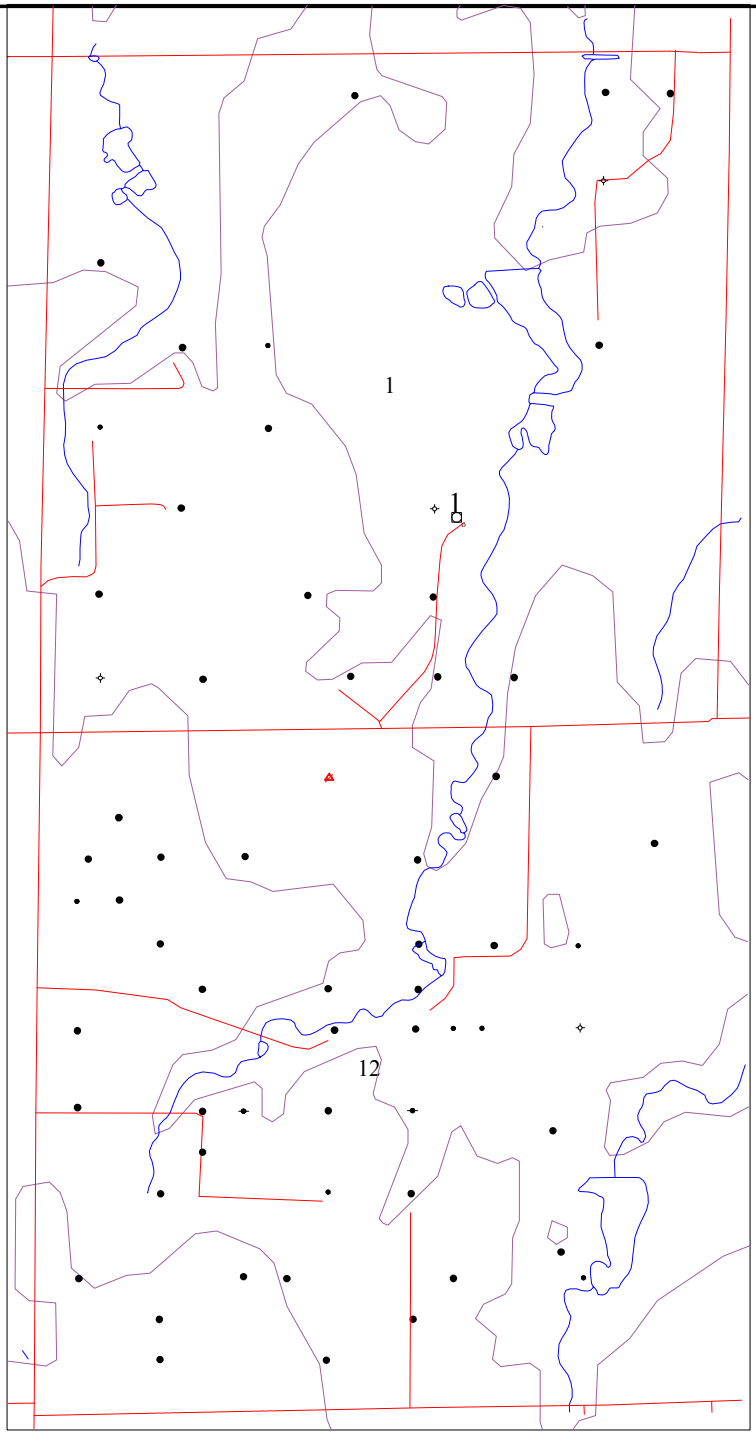
Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970053-00	**2 Hrs. / $59.46**		

Current Contaminate Level: Unknown

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**

R 17 W



T
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CI = 1490

0 1490 2980

1 Irey-Hrabe Well - 2007 - 1200 ppm
No Sample in 2013.

Oil Well
Plugged Oil Well
TA Oil Well
Abandoned Oil Well
Gas Well
Plugged Gas Well
TA Gas Well
Abandoned Gas Well
Disposal Well
Plugged Disposal Well
TA Disposal Well
Abandoned Disposal Well
Injection Well
Plugged Injection Well
TA Injection Well
Abandoned Injection Well

Oil & Gas Well
Plugged Oil & Gas Well
TA Oil & Gas Well
Abandoned Oil & Gas Well
Dual Completed Oil Well
Plugged Dual Completed Oil Well
TA Dual Completed Oil Well
Abandoned Dual Completed Oil Well
Dual Completed Gas Well
Plugged Dual Completed Gas Well
TA Dual Completed Gas Well
Abandoned Dual Completed Gas Well
Water Supply Well
Plugged Water Supply Well
TA Water Supply Well
Abandoned Water Supply Well

Dry Hole
Domestic Well
Plugged Domestic Well
Abandoned Domestic Well
Agriculture Well
Plugged Agriculture Well
Abandoned Agriculture Well
Irrigation Well
Plugged Irrigation Well
Abandoned Irrigation Well
Public Water Supply Well
Plugged Public Water Supply Well
Abandoned Public Water Supply Well
Possible Location
Test Hole
Sample Site

Location
Monitoring Well
Plugged Monitoring Well
Pit
Tank Battery
Gas Storage Monitoring Well
Plugged Gas Storage Monitoring Well
TA Gas Storage Monitoring Well
Abandoned Gas Storage Monitoring Well
Gas Storage Injection/Withdrawl Well
Plugged Gas Storage Injection/Withdrawl Well
TA Gas Storage Injection Withdrawl Well
Abandoned Gas Storage Injection/Withdrawl Well

Kansas Corporation Commission

Irey - Hrabe

Sec. 1, Twn. 9 S., Rng. 17 W., Rooks County

Elevated Chlorides in Domestic Well

970053-00

Date: 21 Oct 2004 District: Hays

Project: ***City of Jennings Contamination Site***

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

Impact/Immediacy: Groundwater contaminated by poor oil field practices since the 1950's. Two city wells inside the city limits have experienced elevated chloride levels of varying intensity since this time. Immediacy level is rated as low to moderate.

Site Description: Brine contamination of a shallow aquifer. Poor oil field practices, spills, and brine line leaks have contributed to the problem since the 1950's. Water quality west and upstream of the tank battery site remains very good. Current city water supply is from a well located west and upstream of the tank battery area. The two contaminated wells in the city limits are used for purposes other than human consumption, such as watering public areas and farm use.

Unusual Problems: Very high concentrations of chlorides in produced brine.

Status of Project: In 2008 the chlorides were at 500 ppm and increased to 600 in 2009 but are back down to 150 ppm in October of 2010. A sample taken in 2011 contained 100 ppm chlorides. A sample in 2012 was also at 100 ppm chloride. This area is directly affected by lease practices. Increased attention by KCC personnel pertaining to lease practices on this lease had contributed to the marked decrease in chloride levels. 2013 levels were up to 200 ppm chloride. This is below municipal drinking water standards.

Level of Remediation Sought:

Ideal: 250 ppm Chloride
Target: 500 ppm Chloride

Recommendations for Future Work: Continue to monitor lease practices. This area is very sensitive to spills from the tank battery site. The produced water is very high in chlorides.

Estimated Total Costs: $2000.

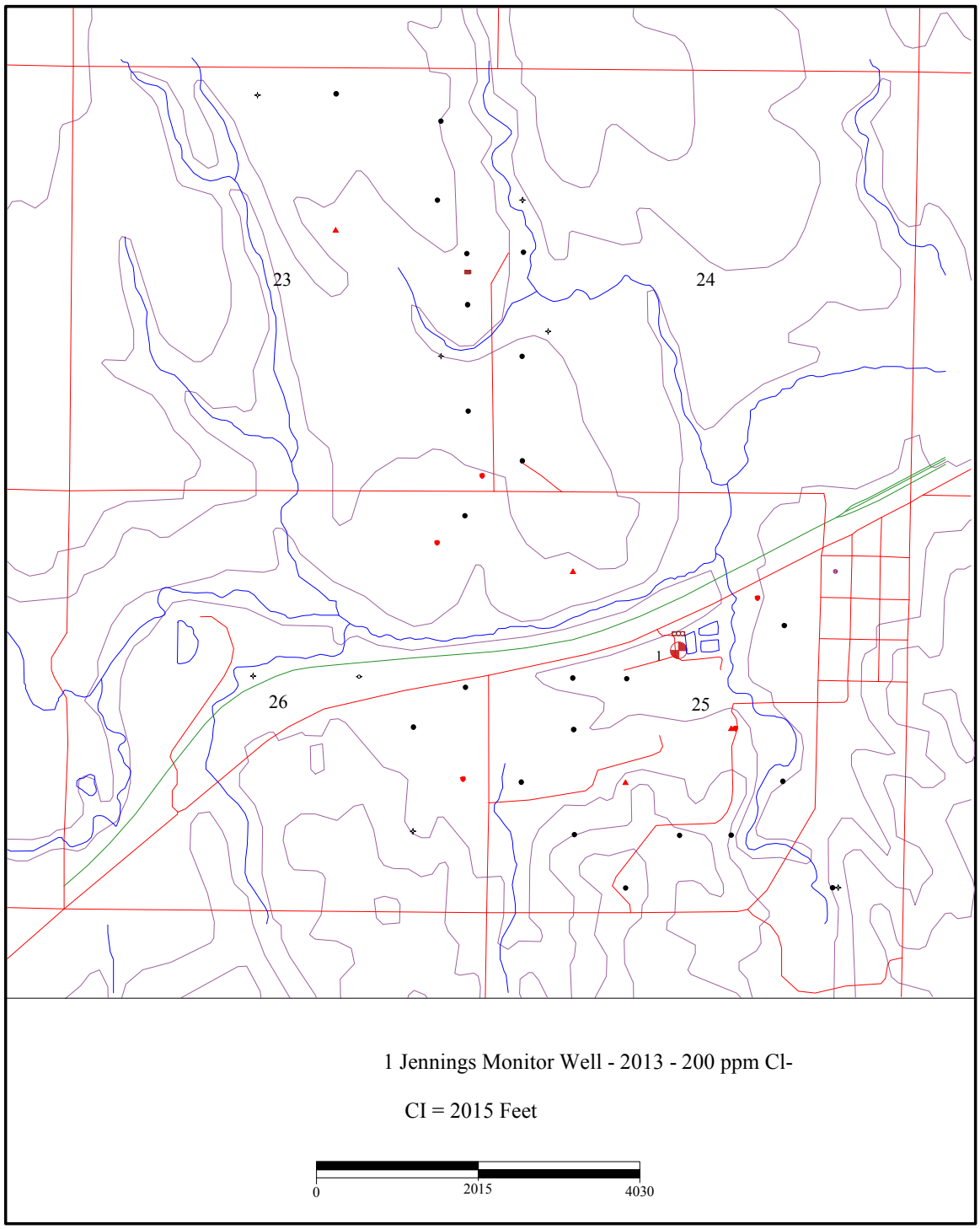
Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970054-00	**8 Hrs. / $189.36**		

Current Contaminate Level: 200 ppm Cl-

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**

R 27 W



T 04 S

1 Jennings Monitor Well - 2013 - 200 ppm Cl-

CI = 2015 Feet

0 2015 4030

N W E S

Oil Well
Plugged Oil Well
TA Oil Well
Abandoned Oil Well
Gas Well
Plugged Gas Well
TA Gas Well
Abandoned Gas Well
Disposal Well
Plugged Disposal Well
TA Disposal Well
Abandoned Disposal Well
Injection Well
Plugged Injection Well
TA Injection Well
Abandoned Injection Well
Oil & Gas Well
Plugged Oil & Gas Well
TA Oil & Gas Well
Abandoned Oil & Gas Well
Dual Completed Oil Well
Plugged Dual Completed Oil Well
TA Dual Completed Oil Well
Abandoned Dual Completed Oil Well
Dual Completed Gas Well
Plugged Dual Completed Gas Well
TA Dual Completed Gas Well
Abandoned Dual Completed Gas Well
Water Supply Well
Plugged Water Supply Well
TA Water Supply Well
Abandoned Water Supply Well
Dry Hole
Domestic Well
Plugged Domestic Well
Abandoned Domestic Well
Agriculture Well
Plugged Agriculture Well
Abandoned Agriculture Well
Irrigation Well
Plugged Irrigation Well
Abandoned Irrigation Well
Public Water Supply Well
Plugged Public Water Supply Well
Abandoned Public Water Supply Well
Possible Location
Test Hole
Sample Site
Location
Monitoring Well
Plugged Monitoring Well
Pit
Tank Battery
Gas Storage Monitoring Well
Plugged Gas Storage Monitoring Well
TA Gas Storage Monitoring Well
Abandoned Gas Storage Monitoring Well
Gas Storage Injection/Withdrawl Well
Plugged Gas Storage Injection/Withdrawl Well
TA Gas Storage Injection/Withdrawl Well
Abandoned Gas Storage Injection Withdrawl Well

Kansas Corporation Commission

Jennings

Sec. 25, Twn. 4 S., Rng. 27 W., Decatur County

Chloride Contaminated Groundwater

970054-00

Date: 11 Oct 2004 District: Hays

Project: ***Johnson/Ramsey Contamination Site***

Site Location: The project is located nine miles east and two and one half miles north of Sterling, Kansas. The site covers the SW quarter of 7-21-6W and SE quarter of 12-21-7W Rice County. The area is considered to be located within the sand hills. The site is in the drainage systems of the Cow Creek and Sand Creek. Cow Creek is a tributary of Arkansas River and flows in a southeasterly direction.

Impact\Immediacy: The contamination impacts a relatively small surface and shallow subsurface area. The immediacy level is rated as low, but there are four domestic water wells in the northwest of section 18-21-6W which could change the immediacy level if found to be impacted.

Site Description: The site is located in grazing pastureland. Sediments at the site consist mainly of unconsolidated Pleistocene, recent to Wisconsinan aged deposits of Dune Sand (KGS bulletin 206). The immediate area is topographically flat, with slopes ranging from 0-2 percent. Based on the site evaluation to date, the underlying material to a depth of approximately 40 feet was found to consist primarily of loose sand, overlying thick dense clay to approximately 35 feet near the eastern edge of the site. The clay shallows to the west and is only 20-22 feet near MW-6. The groundwater moves to the southwest and flows to the surface in section 12-21-7W. The spot where the contaminated groundwater seeps to the surface is approximately two acres in size and is historically barren of vegetation. Recent years have seen the scar shrink in total area but there is still a kill zone in section 13.

Unusual Problems: None.

Status of Project: On September 5, 2013, five groundwater monitoring wells (MW-1, MW-2, MW-3, MW-4, and MW-5) were gauged and sampled. MW-6 could not be sampled this year due to excessive poison ivy around the well area. Prior to sampling, groundwater levels were measured in each monitoring well using an electronic water level indicator. A submersible Proactive® Water-Spout water pump was used to purge a minimum of three well volumes of groundwater from each well before sampling. Purge water was tested for conductivity prior to being discharged onto the ground surface at the Site or contained in a 250 gallon poly-tank if conductivity was high before disposed of into a deep injection well.

Groundwater samples from each monitoring well were collected in one 250 (ml) polyurethane container for analysis at the KCC District #2 Laboratory. Each sample for this monitoring event was analyzed for the presence of Chloride by United States Environmental Protection Agency (USEPA) Method 8225 (Titrimetric, Silver Nitrate). Chlorides ranged from 10 mg/L in the eastern wells to 1500 mg/L in MW-3 in the middle of the site.

Level of Remediation Sought:

Ideal: 250 mg/l Chloride
Target: 750 mg/l Chloride

Recommendations for Future Work: KCC district staff recommends continued sampling for the next few years as chlorides are as high as 1500 mg/L in section 7, and in past years 4100 mg/L in section 12. These levels are lower than past sampling events but still very far away from the target levels originally set. Natural attenuation has been slow, and the only feasible remedial system for the shallow aquifer would entail a shallow interceptor trench. There is no brine disposal facility near-by, so water would have to be trucked from the site. Long-term monitoring is still the recommended remedial program for this site. There is a lack of delineation on the western half of the site, and new monitoring wells would be helpful in plotting the total size of the brine plume. Due to lower priority status KCC does not recommend installation of new wells at the Johnson Site unless higher brine levels are found in the monitoring wells in future events.

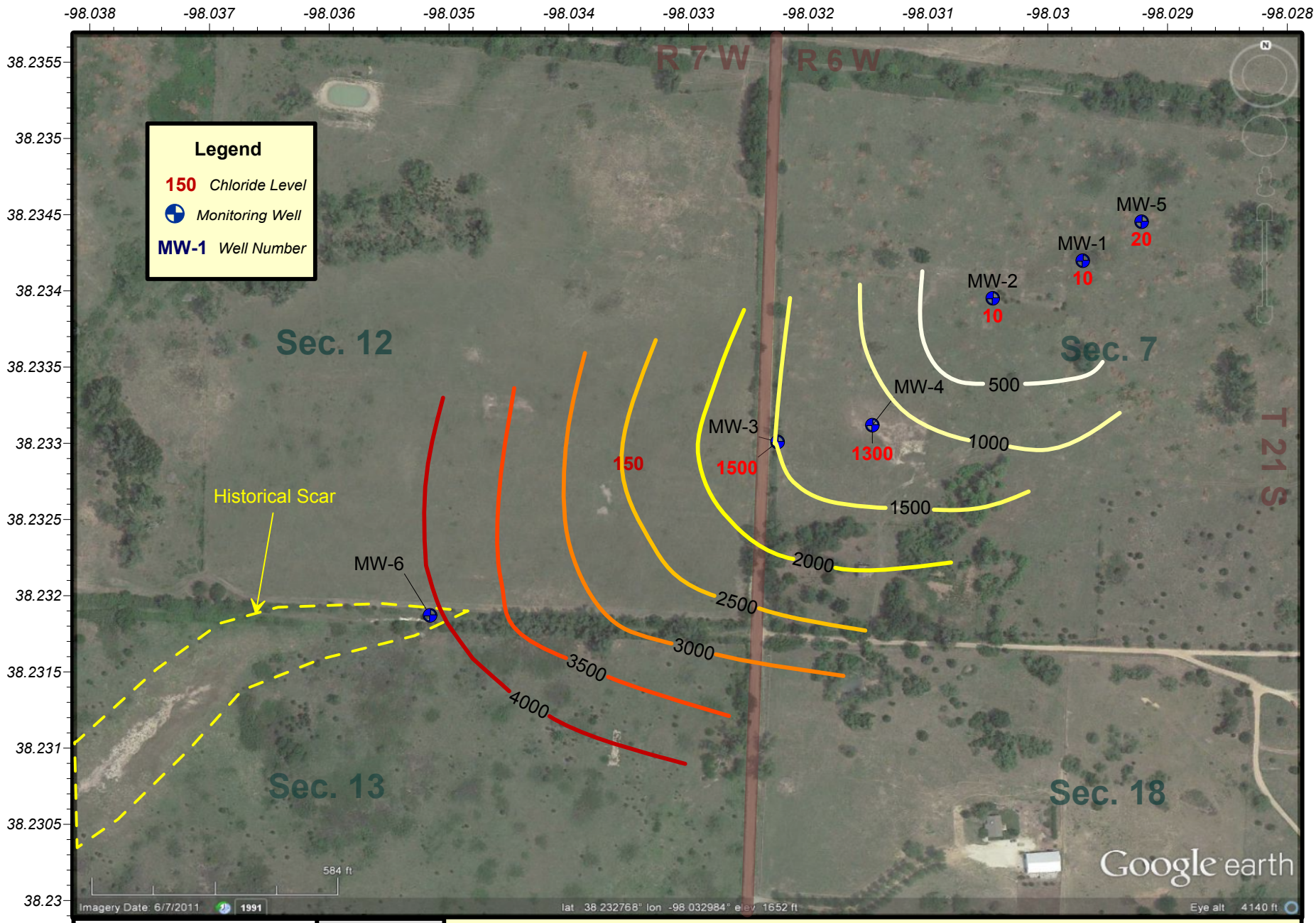
Estimated Total Costs: Total costs next year for annual water sampling, report writing and research: $750.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970055-00	**16 Hrs. / $413.04**		**$416.28**

Current Contaminate Level: 1500 @ MW-3 and 10 ppm @ MW-1

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**



Kansas Corporation Commission

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Johnson/Ramsey Monitoring Site - KCC Control # 970055-00
Section 7 of T 21 S & R 6 W, and Section 12 of T 21 S & R 7 W, Rice County, Kansas
2013 Groundwater Chloride Levels
District #2 - Sampled 9/5/2013 - Map Drawn 9/18/13 by B. Milner

Project: ***Knackstedt Site***

Site Location: The site is located eight miles west and four miles north of Inman. 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: Potential exists for impacts on both rural domestic and stock water resources. Public safety issues have been mitigated with the re-routing of the local roadway affected by this site, the site is still ranked as moderate immediacy level due to the unknown extent of the dissolution.

Site Description: The site consists of an unplugged saltwater disposal well whose operation led to the development of an air filled underground void at an approximate depth of 430 feet. The size of the cavity has not been determined as of this date. The site is located immediately southeast of the intersection of Plum Street and Saxman Road. In 1995 the KCC agreed to provide funding for additional seismic efforts at this site by the Kansas Geological Survey. Land use is agricultural with oil and gas activities in the area.

Unusual Problems: The air filled nature of the cavity makes the design of an acceptable plugging project more difficult. The air filled nature of the cavity also restricts the nature and kind of investigatory methods applicable to this site.

Status of the Project: The cavity in the salt section of the Wellington Formation has been stable with only slight indication of any downward surface movement. Currently the site is under periodic monitoring of surface elevations with respect to possible surface movement. Survey was made of the control points in July of 2013. The results of that survey indicated that the control points and/or benchmark have been compromised over the last two years and are in need of replacement by a licenced surveyor. District Staff is currently in the process of writing up a scope of work to address this issue and plans to have a new system for surveying the depression up and running by the summer of 2014.

Level of Remediation Sought:

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

Target: Study results indicate a reduced need for further or complete cavity stabilization beyond the original well bore and an acceptable plugging procedure can be developed which adequately addresses both fresh water resources and public safety issues.

Recommendations for Future Work: KCC recommends hiring a survey company to install and survey a new set of points along the depression. It is also recommended that a new benchmark be placed in an area of the site which seems to be stable. KCC also recommends continued monitoring of surface elevations in the area of the original well on a bi-annual schedule. One option could be to contract with the KGS for an additional seismic survey at the site including a possible long-term geophone to record shifting or settling strata/rock. The design of an adequate plugging procedure for the well is paramount. Resources should be given so that concrete pit area around SWDW is reconstructed for more security, as it is a safety hazard as of now. The cellar should be filled in with soil or sand with casing brought up to new surface elevation.

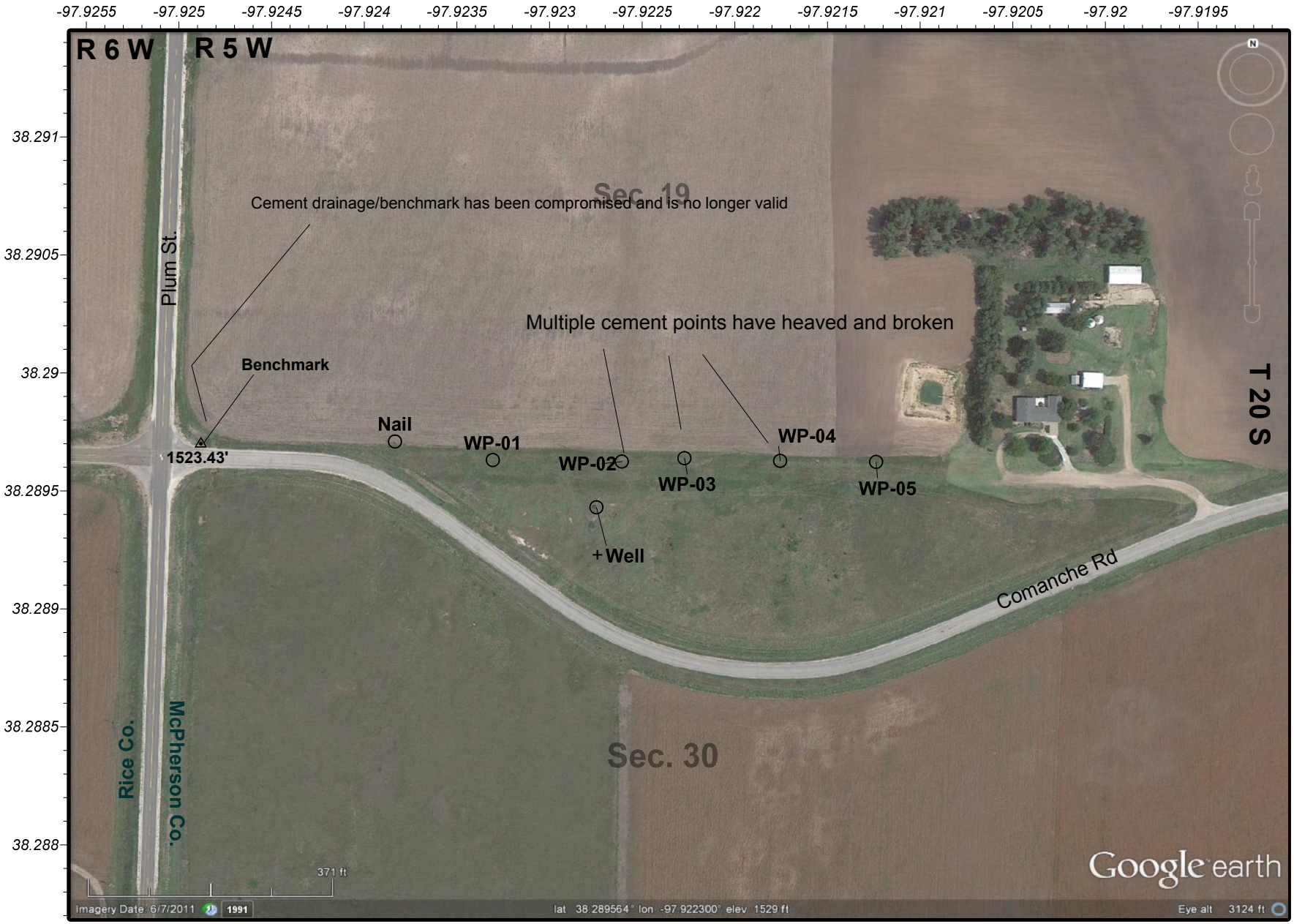
Estimated Total Costs: $2500 to 5000 to have the benchmark/points resurveyed by a licensed surveyor. It will be very costly to attempt to plug this void at this time.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures**	
		FY 2013/14	**Total**
970060-00	**17 Hrs. / $446.57**		**$153.39**

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**



Kansas Corporation Commission

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Knackstedt Depression Site

NW - Sec. 30 - T 20 S & R 5 W, McPherson County, Kansas

2013-14 Survey Map

SITE MAP

KCC Project Code #970060-00 - District #2 - D. Bollenback - 9/23/2013

Project: ***Leesburg Sink Hole Site***

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 shot at 9/27/2013. There has been no change in elevation since the last survey in 2012.

Recommendations for Future Work: The PRP has been surveying the site irregularly. It is recommended the site be surveyed at least biannually to establish a subsidence rate. 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.

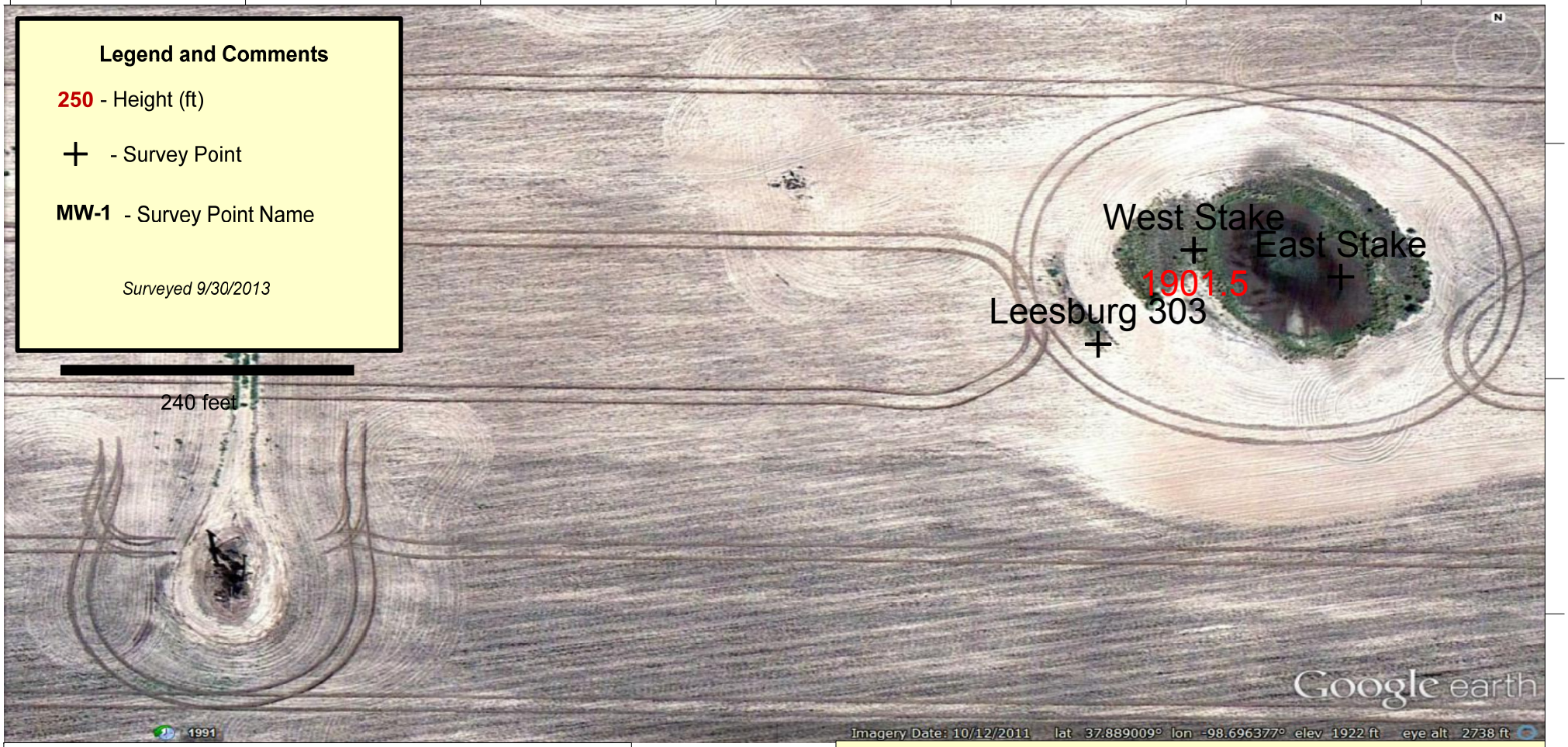
Estimated Total Costs: RP -$62,000, plugging costs, seismic and installation of monitor wells.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Total
2004003-001	2 Hrs. / $59.46		$6,266

Current Contaminate Level: Unknown

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



Kansas Corporation Commission

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Leesburg Sinkhole

Section 12-T25S-R13W
Stafford County, Kansas

Change in Elevation Map-Shot 9/27/2013

KCC Control # 2004003-001 District 1
D. Sellers 10/01/2013

Project: ***Little River Site***

Site Location: The site is located 4 miles north and one east of the southwest 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 T 18S R6W, Rice County.

Impact/ Immediacy: The impact is to the ground water supply for the city of Little River from unknown oil field source. The immediacy level is rated as high because of its potential impact to the existing public water supply wells.

Site Description: The Little River water well field is located in part of the Odessa Oil Field. The ground water table in this area is at a depth of thirty feet in a sandstone aquifer with an aquitard of blue shale at a depth of fifty to sixty feet. The sandstone has its highest increase in conductivity (chlorides) at a depth of 47 to 50 feet as indicated by a conductivity test in MW# 1. The source for the contamination may be from old core soundings, spills, pits, or leaking wells.

Unusual Problems: Unknown source for the contamination.

Status of Project: There appears to be migration of the plume in the SE corner of Section 29 where the highest chloride values are found in KCC MW #1 (1400mg/L) and the unused PWS #7 well (2300 mg/L). MW #1 has increased 800 ppm from last year and needs to be monitored closely as it appears that the brine plume has moved away from PWS#7. PWS #13 in the NE/4 of Section 32 has been brought back online for use by the city and chlorides in 2012 increased from 410 to 600 mg/L.

A review of historical chloride data from 1999 to present show water quality for this site has slightly improved to no change over the past five years except for results of MW #1. Five operating public water supply wells are well within target limits for chlorides ranging from 70 to 170 mg/l. PWS#13 to the west of the other wells is now online and utilized as a public water supply well for the town of Little River. It had a chloride level of 600 mg/l in 2013. This well is mixed with the other wells so the elevated chlorides are diluted before public consumption. If this well continues to increase in the future, it maybe unusable by the city of Little River. MW-1 increased in 2013 substantially while MW-2 remained at 40 ppm.

Level of remediation Sought:

Ideal: 60 mg/l
Target: 300 mg/l

Recommendation for Future Work: If the water quality at any of the existing PWS wells declines due to saltwater contamination staff would recommend that up to 4 monitoring wells/test holes be installed to help delineate the salt-water contamination. PMW#13 is still at 600 ppm but more importantly MW-1 has increased two-fold over the last year. KCC would recommend investigation in the western edge of the plume into chlorides that have migrated away from the crossroads.

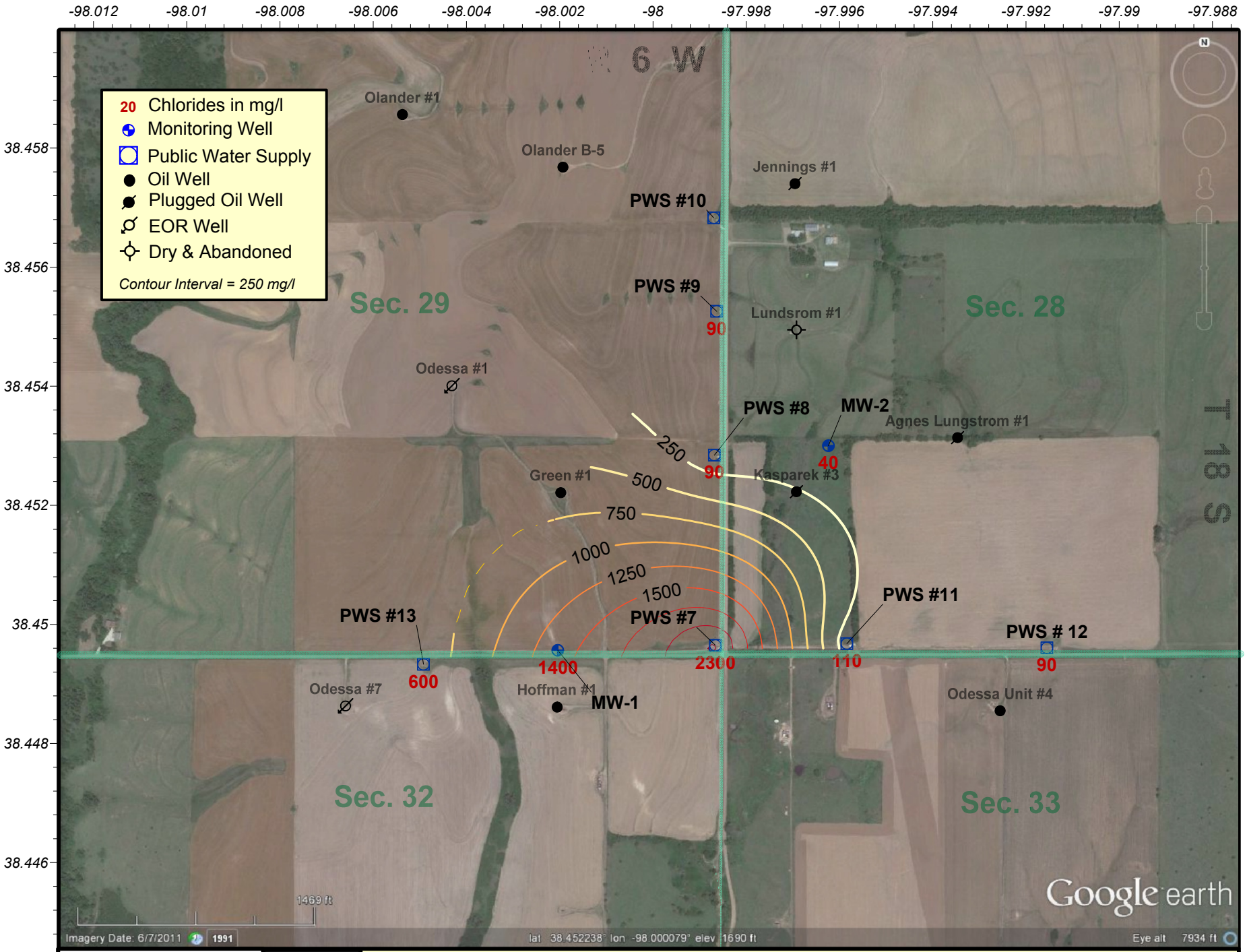
Estimated Total Costs: Time for staff to mobilize to site and sample the wells, perform the laboratory work, data entry, mapping, and report writing. If conditions warrant additional recourses tracking the western brine edge, KCC could put together an investigative scope for approximately $10,000 to $18,000 counting field work and well installs.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures**	
		FY 2013/14	**Total**
20000057-001	**12 Hrs. / $322.36**		**$3,112.20**

Current Contaminate Level: 1400 mg/l Cl^- MW #1 to 40 mg/l MW #2

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**



Kansas Corporation Commission

Little River Groundwater Monitoring Site
Section 29 of Township 18 South & Range 6 West, Rice County, Kansas
2013 Groundwater Chloride Levels
District #2 - Sampled on 9/25/2013 - Map Drawn on 9/30/2013 by D. Bollenback

Project: ***Macksville Contamination Site***

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. As the recovery wells have been down for several years, this well may have been impacted by chlorides, but recent samples have not been taken to confirm this. Immediacy level is rated at low.

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 fresh water aquifer. The aquifer consists of sand and gravel overlying the Wellington Formation of Permian age. The salt-water plume is being monitored by thirty-seven 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: Thirty-seven monitoring wells and one surface water sample was taken in 2013. Chlorides were either stable or rising compared to 2012. Chlorides at this site are below fresh water standards in all except one well, MW-16d where the chlorides are 720ppm. 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 1,310ppm. The rise in chlorides this year may be due to the drought conditions that have been occurring in Central and Western Kansas. The site was surveyed on 9/30/2013. The numbers show the sinkhole rising a half a foot on average. We went back and found surveys from previous years, and we now believe that our benchmark is sinking faster than the sinkhole. The sinkhole has begun moving to the north.

Level of Remediation Sought:

Ideal: 250 ppm Chloride
Target: 300 ppm Chloride

Recommendations for Future Work: Because we believe our benchmark is now sinking, funds will be needed so a new benchmark can be established so accurate surveying can recommence. Funds will also be sought to establish new survey points to track the northern progression of the sinkhole. Funds are sought to rebuild the cellar of the disposal well which has deteriorated. Because of the rising chlorides seen this year, it would be wise to sample the wells again next year and see if the rain the area received helped. If chlorides either stabilize or drop next year, plugging of the monitoring wells should begin. Since only one well currently remains above the fresh water standard it is recommended to begin plugging a majority of the wells at the location, starting with well in the NE/Q, and working back towards the sinkhole, potentially leaving MW-16d available for sampling until the chlorides have fallen below fresh water standards. The site should also continue to be surveyed on an annual basis to track the current rate of subsidence.

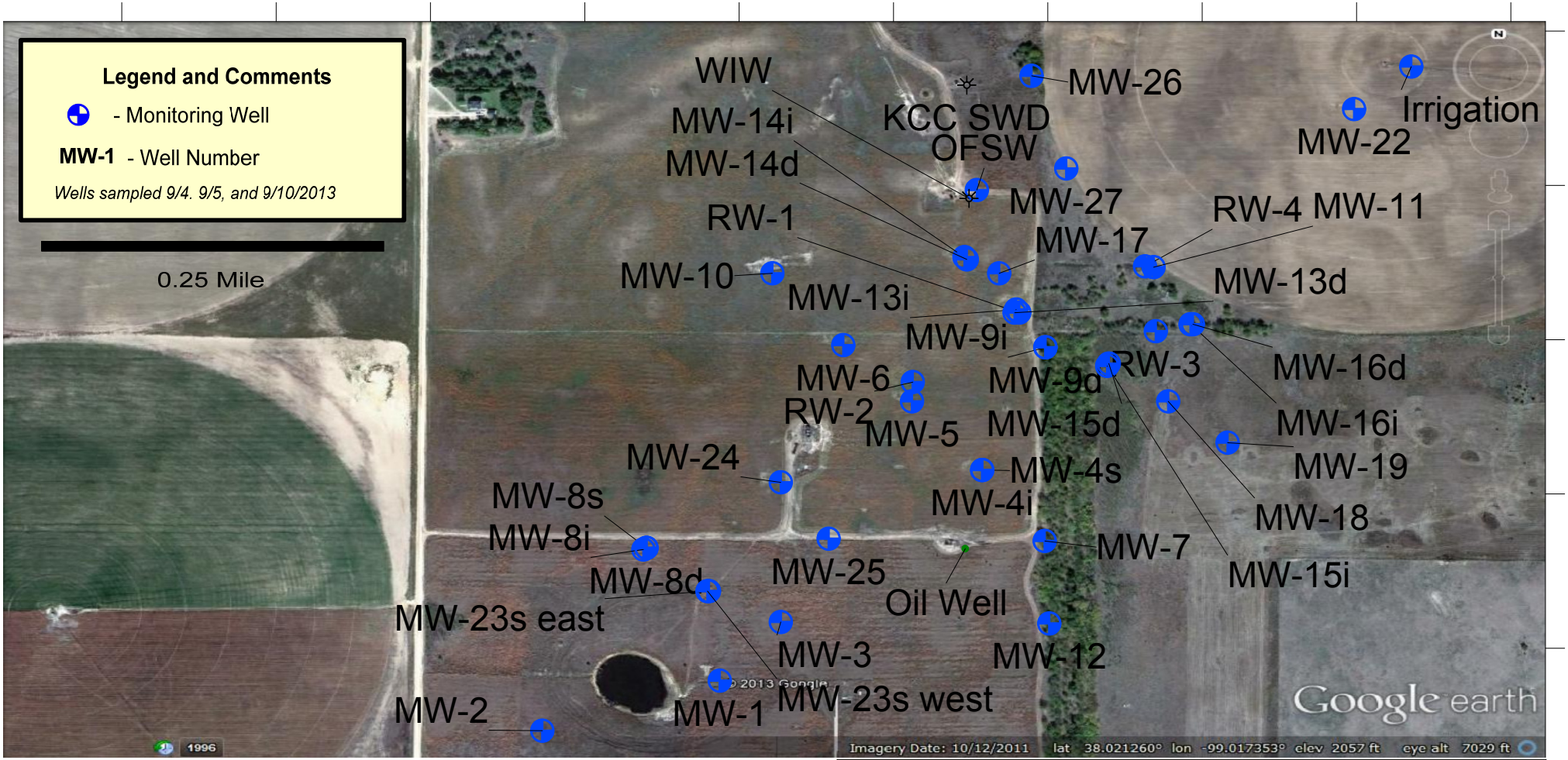
Estimated Total Cost: Costs to plug the wells have not yet been explored.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Total
970066-00	52.5 Hrs. / $1,334.39	$1,344	$73,012.02

Current Contaminate Level: 1,310 ppm Cl-

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



Kansas Corporation Commission

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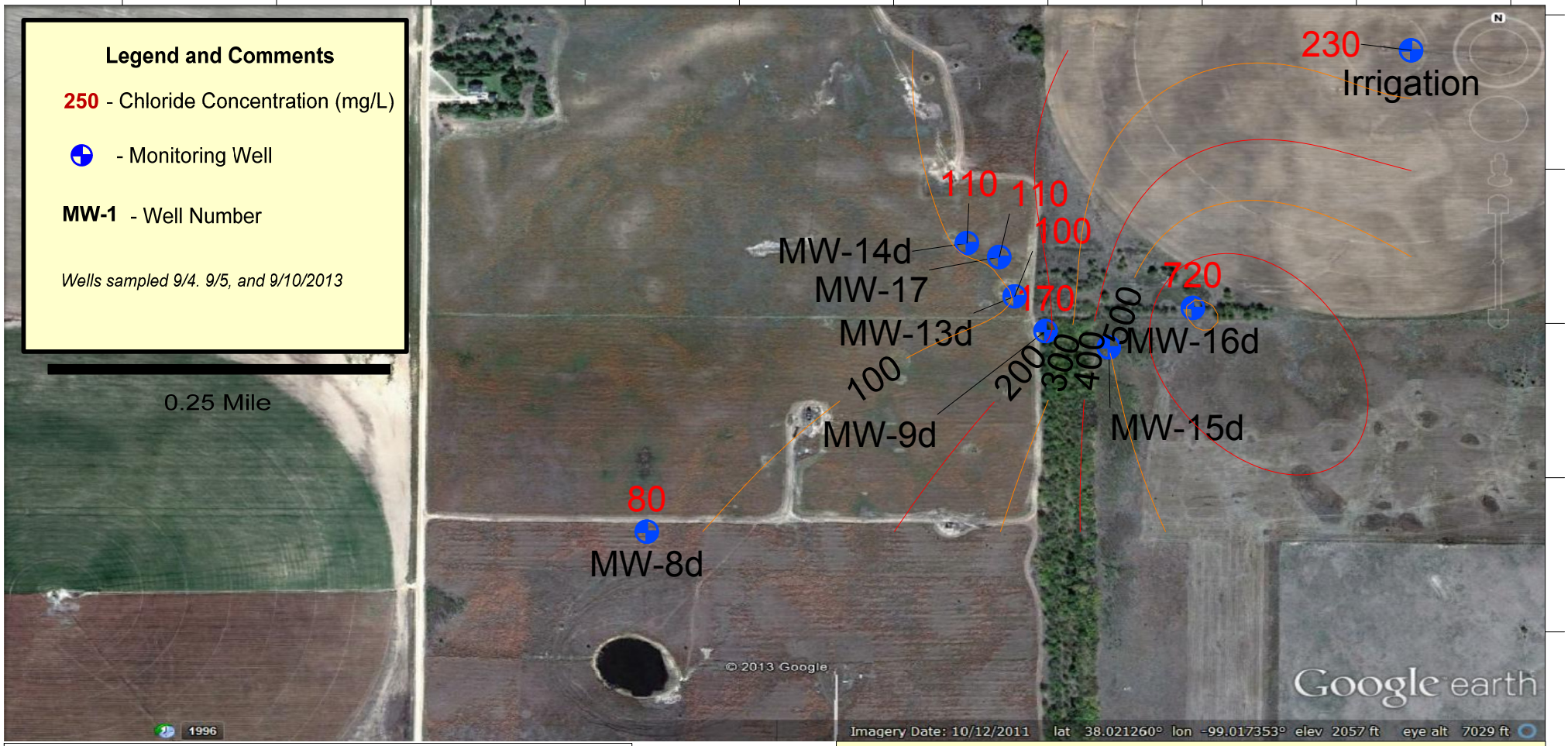
Macksville Site

Section 30-T-23S-R15W
Pawnee County, Kansas

2013-2014 Well Location Map

KCC Control # 970066-00 District 1
D. Sellers 9/25/13



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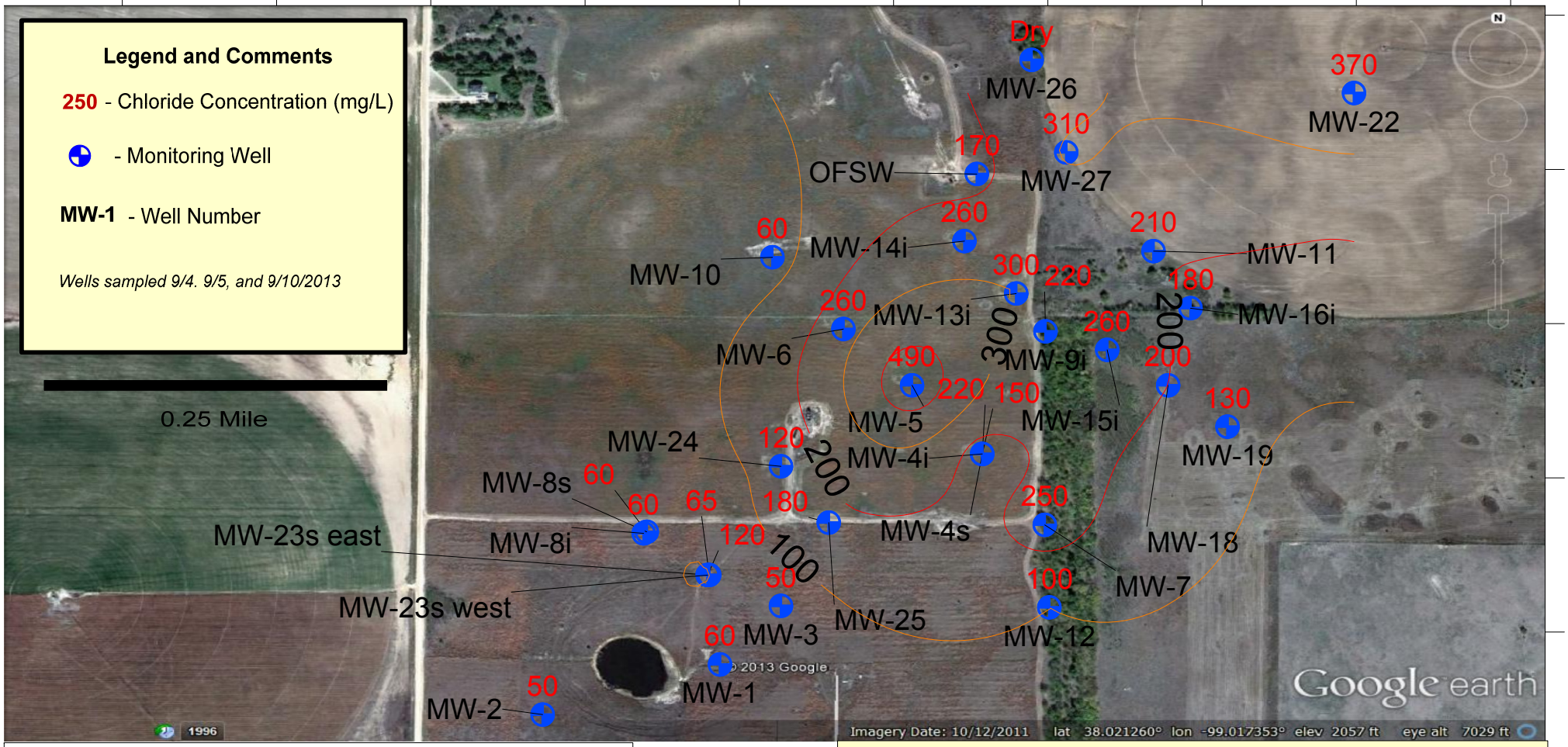
Macksville Site

Section 30-T-23S-R15W
Pawnee County, Kansas

2013-2014 Area Map with Deep Depth Chlorides KCC Control # 970066-00 District 1
D. Sellers 9/25/13



Kansas Corporation Commission

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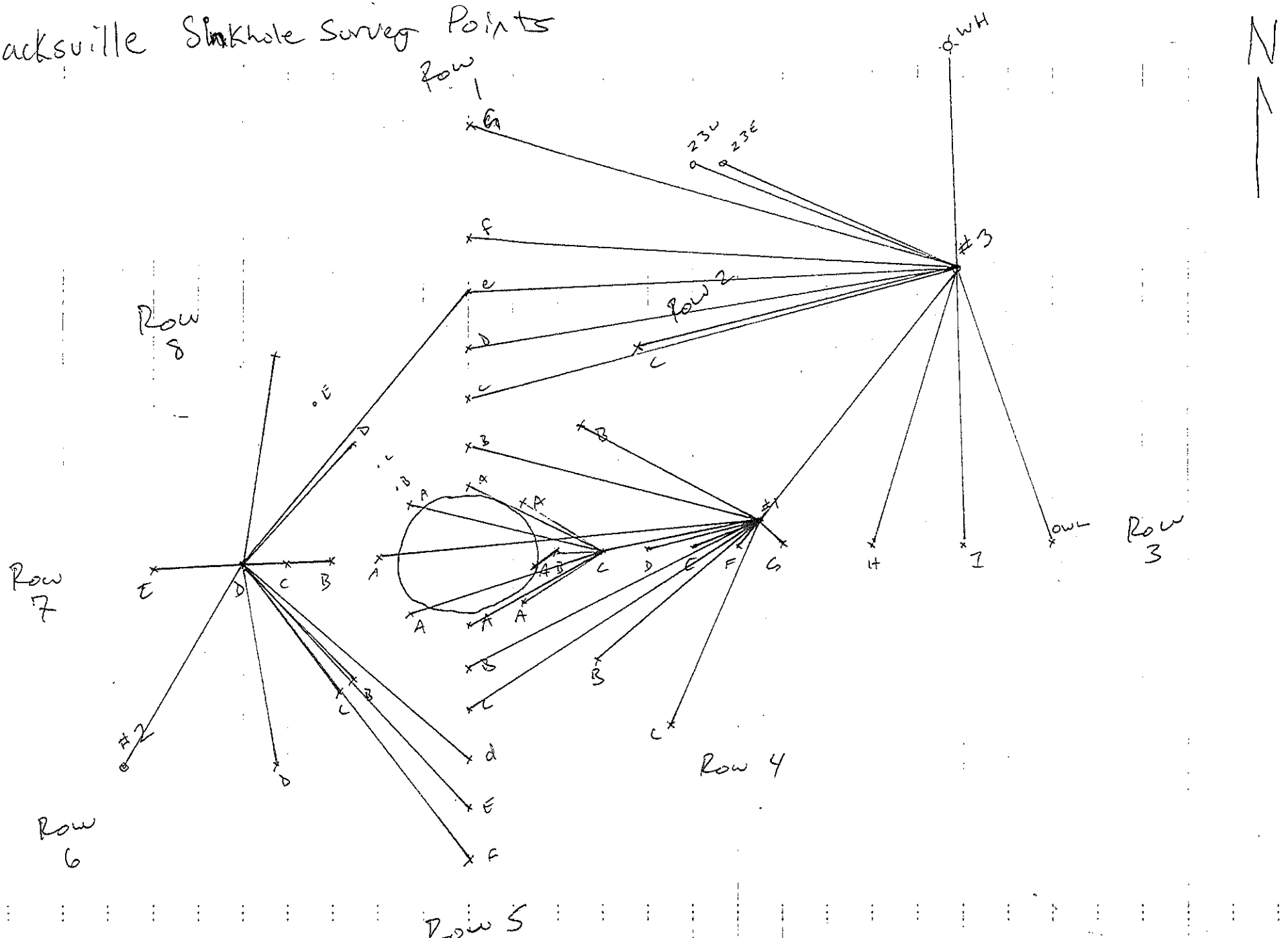
Macksville Site

Section 30-T-23S-R15W
Pawnee County, Kansas

2013-2014 Area Map with Intermidiate Depth Chlorides

KCC Control # 970066-00 District 1
D. Sellers 9/25/13

Macksville Sinkhole Survey Points



Project: ***Mantooth Contamination Site***

Site Location: Section 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 was begun 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 contaminates 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 salt water plume is most likely located in the south half of the project. 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. 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 of this year's sampling:

MWE 01: 4,700 ppm Cl- (01/10/2013); 2,600 ppm Cl- (05/14/2013); 4,700 ppm (08/22/2013); ***MWE 02***: 3,300 ppm Cl- (01/10/2013); 1,400 ppm Cl- (06/06/2013); 3,000 ppm Cl- (09/05/2013); ***MWE 03***: 2,500 ppm Cl- (01/10/2013); 3,300 ppm Cl- (06/06/2013); 3,700 ppm Cl- (09/05/2013); ***MWE 04***: 10,400 ppm Cl- (01/10/2013); 1,900 ppm Cl- (06/06/2013); 4,700 ppm Cl- (09/05/2013); ***MWE 05***: 600ppm Cl- (01/10/2013); 600 ppm Cl- (05/01/2013); 600 ppm Cl- (08/22/2013); ***MWE 06***: 500 ppm Cl- (01/10/2013); 500 ppm Cl- (05/1/2013); 500 ppm Cl- (08/22/2013); ***MWE07***: 500 ppm Cl- (01/10/2013); 500 ppm Cl- (05/14/2013); 500 ppm Cl- (08/22/2013).

Level of Remediation Sought:

Ideal: Less than 250 ppm Chloride
Target: 500 ppm Chloride

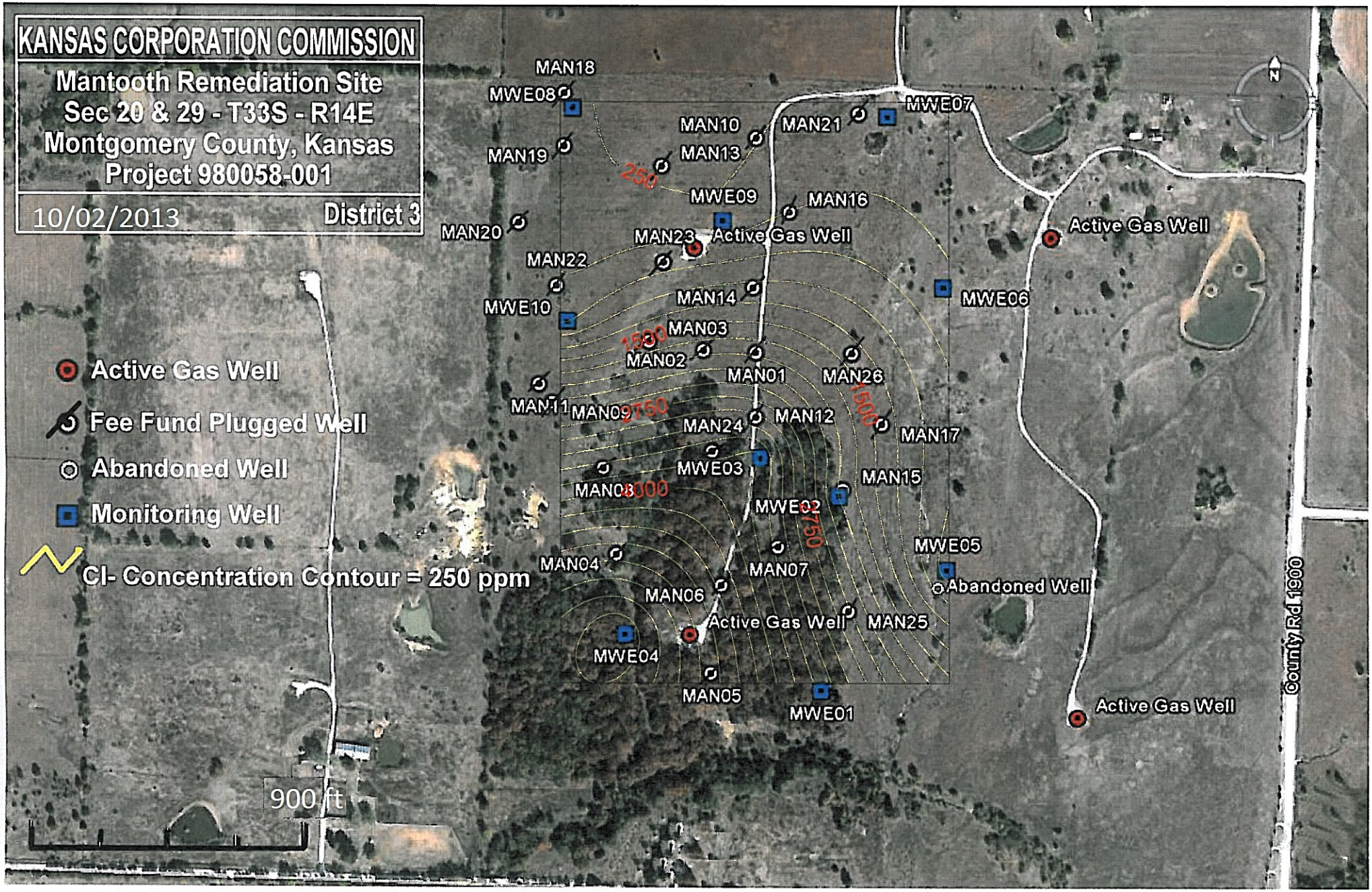
Recommendation for Future Work: Continue monitoring in order to verify whether plugging of the existing abandoned wells eliminates the current source of saltwater contamination within the ground and surface water in the project area. Future work will be based upon the results of the sample analysis of the monitoring wells and Deer Creek. There have been 20 new CBM wells and associated SWD wells drilled in the last few years in section 20 & 29.

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

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Fund Expenditures Total
980058-001	90 Hrs. / $2,348.78		$17,349

Current Contaminate Level: 500 ppm to 10,400 ppm Cl-
Status: Active

☐ 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


KANSAS CORPORATION COMMISSION
Mantooth Remediation Site
Sec 20 & 29 - T33S - R14E
Montgomery County, Kansas
Project 980058-001
10/02/2013
District 3
Active Gas Well
Fee Fund Plugged Well
Abandoned Well
Monitoring Well
Cl- Concentration Contour = 250 ppm
900 ft
MAN18
MWE08
MWE07
MAN10
MAN21
MAN19
MAN13
250
MWE09
MAN16
MAN20
MAN23
Active Gas Well
Active Gas Well
MAN22
MWE10
MAN14
MWE06
1500
MAN03
MAN02
MAN01
MAN26
MAN11
MAN09
2750
MAN24
MAN12
1500
MAN17
MWE03
MAN15
MAN08
3000
MWE02
2750
MWE05
MAN04
MAN07
Abandoned Well
MAN06
Active Gas Well
MAN25
MWE04
MAN05
MWE01
Active Gas Well
County Rd 1900
N

Project: ***Tom Maupin Contamination Site***

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

Impact/Immediacy: Groundwater. A domestic stock well was polluted by brine contamination. Immediacy level is rated as low to moderate.

Site Description: Brine contamination of a shallow aquifer. Source of chloride contamination is from old drill pits and old brine evaporation pits that have leached into the aquifer.

Unusual Problems: None.

Status of Project: Monitoring at the present time. The only two monitoring wells left in the well net are monitor wells 3 and 5. These have always contained the highest chlorides.

Year	Well#	Chlorides	Year	Well#	Chlorides	Year	Well#	Chlorides
2011	MP 3	680 ppm	2012	MP 3	600 ppm	2013	MP 3	600 ppm
2011	MP 5	280 ppm	2012	MP 5	380 ppm	2013	MP 3	1000 ppm

Level of Remediation Sought:

Ideal: 250 ppm Chloride

Target: 500 ppm Chloride

Recommendations for Future Work: Continue to monitor.

Estimated Total Costs: $2000.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970068-00	**8 Hrs. / $203.28**		

Current Contaminate Level: 600 ppm Cl- to 1000 ppm Cl-

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**

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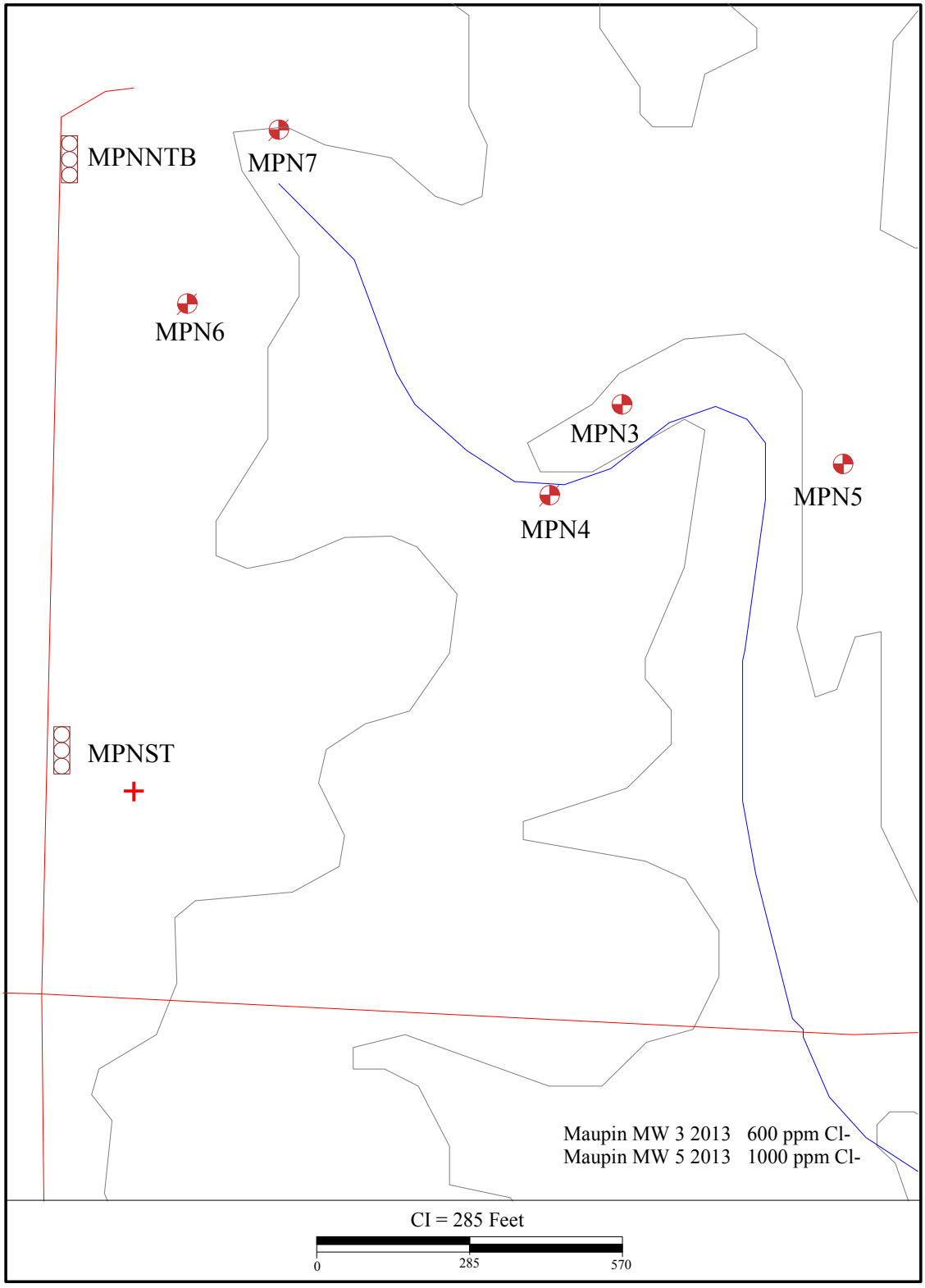

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Oil Well
Plugged Oil Well
TA Oil Well
Abandoned Oil Well
Gas Well
Plugged Gas Well
TA Gas Well
Abandoned Gas Well
Disposal Well
Plugged Disposal Well
TA Disposal Well
Abandoned Disposal Well
Injection Well
Plugged Injection Well
TA Injection Well
Abandoned Injection Well
Oil & Gas Well
Plugged Oil & Gas Well
TA Oil & Gas Well
Abandoned Oil & Gas Well
Dual Completed Oil Well
Plugged Dual Completed Oil Well
TA Dual Completed Oil Well
Abandoned Dual Completed Oil Well
Dual Completed Gas Well
Plugged Dual Completed Gas Well
TA Dual Completed Gas Well
Abandoned Dual Completed Gas Well
Water Supply Well
Plugged Water Supply Well
TA Water Supply Well
Abandoned Water Supply Well
Dry Hole
Domestic Well
Plugged Domestic Well
Abandoned Domestic Well
Agriculture Well
Plugged Agriculture Well
Abandoned Agriculture Well
Irrigation Well
Plugged Irrigation Well
Abandoned Irrigation Well
Public Water Supply Well
Plugged Public Water Supply Well
Abandoned Public Water Supply Well
Possible Location
Test Hole
Sample Site
Location
Monitoring Well
Plugged Monitoring Well
Pit
Tank Battery
Gas Storage Monitoring Well
Plugged Gas Storage Monitoring Well
TA Gas Storage Monitoring Well
Abandoned Gas Storage Monitoring Well
Gas Storage Injection/Withdrawl Well
Plugged Gas Storage Injection/Withdrawl Well
TA Gas Storage Injection/Withdrawl Well
Abandoned Gas Storage Injection/Withdrawl Well

Kansas Corporation Commission

Maupin

Sec. 9, Twn. 11 S., Rng. 15 W., Russell County

Chloride Plume

970068-00

Date: 21 Oct 2004 District: Hays

Project: ***McDonald-East Contamination Site***

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 has 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. There are six monitoring wells located on the McDonald East Site in the NW ¼ of section 27–T19S–R22E. The following Cl- concentrations of sample results were obtained on 02/12/2013; 04/19/2013 and 09/06/2013:

Monitoring well#2 (MCDE02): 500; 500 and 500 ppm Cl-
Monitoring well#3 (MCDE03): 700; 500 and 500 ppm Cl-
Monitoring well#4 (MCDE04): 900; 800 and 1,000 ppm Cl-
Monitoring well#5 (MCDE05): 500; 600 and 600 ppm Cl-
Monitoring well#6 (MCDE06): 600; 500 and No Sample (Dry) ppm Cl-

Overall Cl- levels are trending down. Further monitoring will be necessary as Operator continues to bring lease back into production and designated wells plugged.

Level of Remediation Sought:

Ideal: 200 ppm Chloride
Target: 500 ppm Chloride

Recommendation for Future Work: Continue sampling bi-annually and monitoring injection activity on this lease.

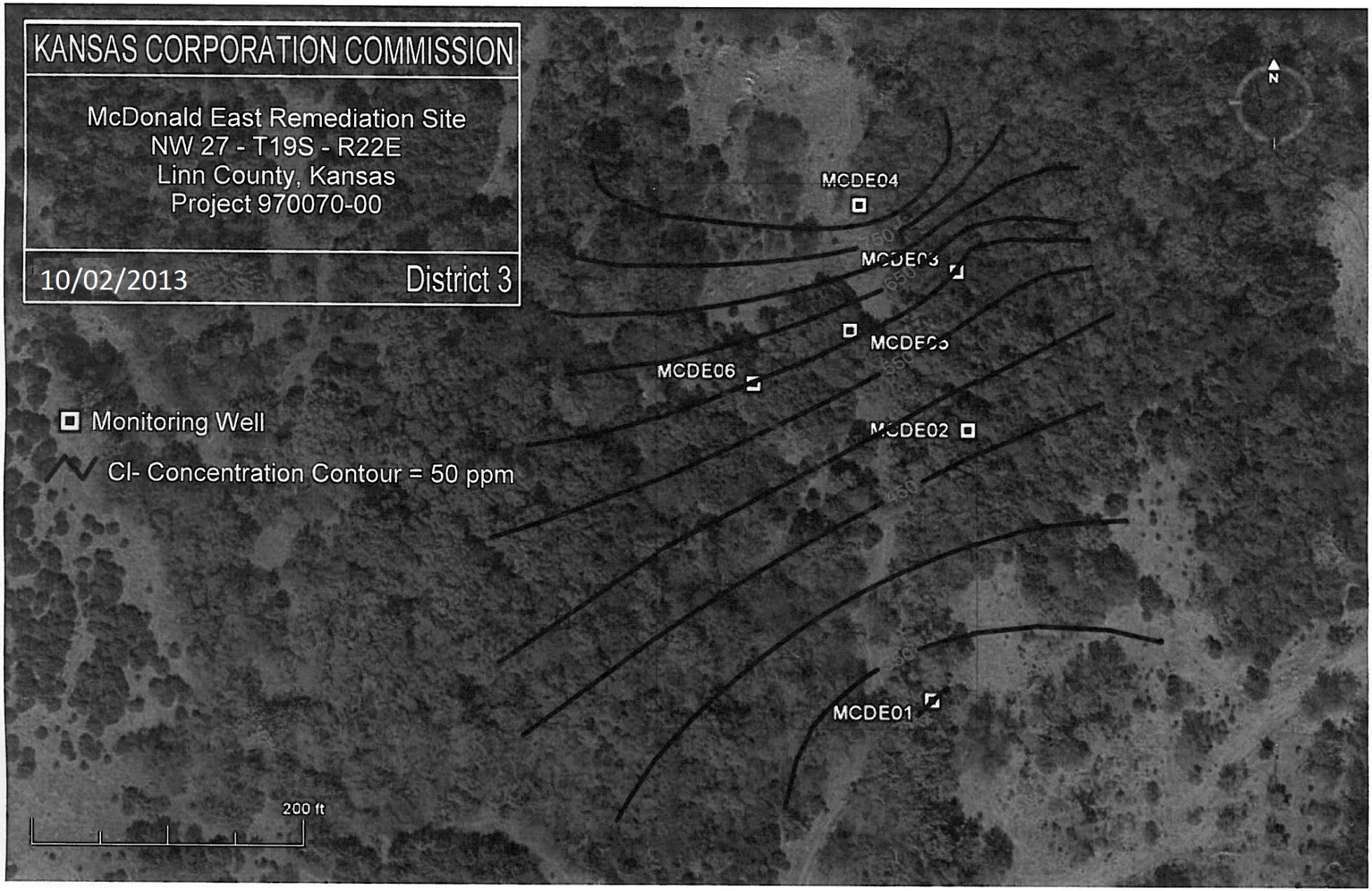
Estimated Total Costs: $1,500.00 yearly.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970070-00	**60.5 Hrs. / $1,573.23**		

Current Contaminate Level: 500 ppm Cl- to 1000 ppm Cl-

Status: Active

☐ **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**


KANSAS CORPORATION COMMISSION
McDonald East Remediation Site
NW 27 - T19S - R22E
Linn County, Kansas
Project 970070-00
10/02/2013
District 3
N
MCDE04
MCDE03
MCDE05
MCDE06
MCDE02
MCDE01
750
650
550
450
350
Monitoring Well
Cl- Concentration Contour = 50 ppm
200 ft

Project: ***McPherson Landfill-Johnson Oil Field Contamination Site***

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 National Cooperative Refinery Association (NCRA), as well as domestic rural water wells. This site has a moderate to high immediacy level.

Site Description: The site is located in rural McPherson County near the landfill and the NCRA 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 NCRA 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. During 2013 6 recovery wells were tested for chlorides, RW 7, 8, 9, 10, 11, and 16. Recovery well 7 tested the lowest at 364 mg/L chlorides, and RW 9 tested the highest at 1,670 mg/L. There are a total of 40 chloride monitoring wells screened at various depths within the aquifer, with the most elevated chlorides found at the base of the aquifer, or at the top of the Wellington formation. Chloride levels in the monitoring wells did not change significantly in the main body of the plume, but did increase in all monitoring wells directly east of the NCRA refinery. Most notable was a 609% increase in MW 114D from 128 mg/L to 907 mg/L. (Tested 5/1/13)
This is not surprising given that MW 118D, just east of 114D has always been elevated and was tested at 2,610 mg/L. The increase could be due to the past 2 year dry period, and/or possibly by water usage onsite pulling the higher chloride water into MW 114D. The McPherson Board of Public Utilities sampled the MW's in 2013 at the old landfill site, but only tested for volatiles and did not have the samples tested for chlorides.

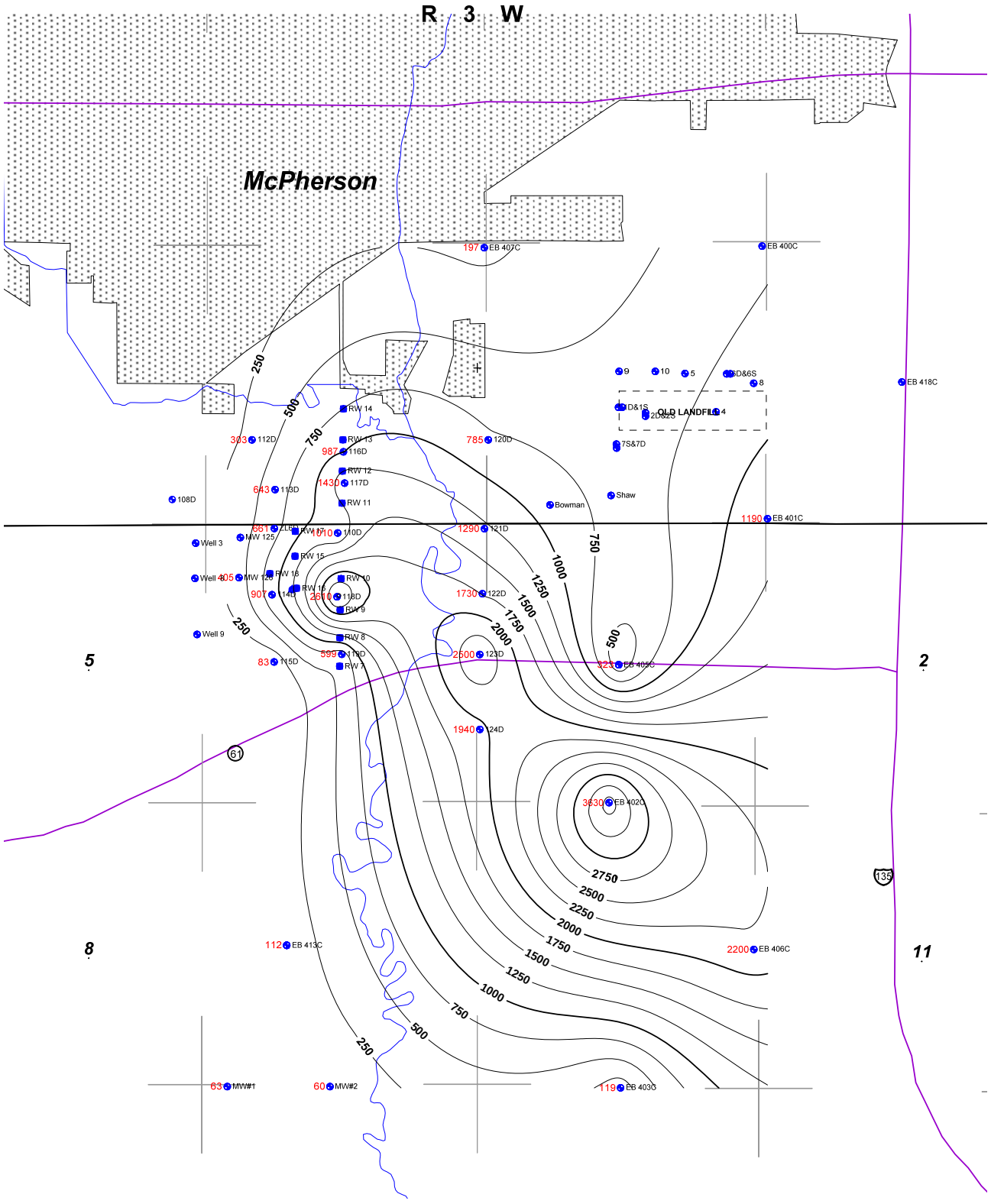
Level of Remediation Sought: Ideal: 250 ppm chlorides **Target:** 500 ppm chlorides.

Recommendations for Future Work: Collect data on an annual basis from NCRA, and GMD2.
Estimated Total Costs: KCC provides funding to GMD2 for sampling surrounding monitoring wells.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Fund Expenditures Total
980034-001	9.5 Hrs. / $287.91	$648	$19,153.98

Current Contaminate Level: 60mg/l (MW-2) to 3,630 mg/l (EB 402C)
Recovery wells ranged from 364mg/l (RW-7) to 1,670mg/l (RW-9)
Status:

☐ 1. Site Assessment	☐ 2. Short Term Monitoring	☐ 3. Investigation
☒ 4. Long Term Monitoring	☐ 5. Remediation Plan	☐ 6. Installation
☒ 7. Remediation (NCRA)	☐ 8. Post Rem. Monitoring	☐ 9. Resolved



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 2013

2013 CHLORIDE CONTOUR MAP

T19S & T20S-R3W, McPheron County, KS

Dist. 2	Control No. 980034-01	9-17-2013	J. Klock

N W E S

SCALE

0 0.25 0.5 0.75 1

MILES

Project: ***C. E Mount***

Site Location: The C.E.Mount Site is located 3 miles north of Haven, Kansas on the south bank of the Arkansas River. The legal location is in the SW ¼ of Section 20, Township 24 South, Range 4 West, in Reno County.

Impact/Immediacy: The impact at the site is mainly to the groundwater with some impact to both soil and vegetative resources in the area. There are domestic and irrigation wells, which could be affected, in the area. This site should be classified at a moderate immediacy level at this time.

Site Description: The topography is a drainage area associated with riverbank deposits. The area is so heavily vegetated to the point it is difficult to move equipment with out damage to the trees. A break occurred in a nine-inch transit disposal line, which crosses under the Arkansas River to a disposal well. This line break spilled saltwater into a drainage area and then into Arkansas River. The bedrock in the area is at an approximate depth of 240 feet. The alluvial material above the bedrock is mostly sand and gravel. The first aquitard is encountered at a depth of 128 feet and it is approximately ten feet thick. The material below the aquitard is sand and gravel with some silty sand.

Unusual Problems: The location of the site in close proximity to the Arkansas River and a private recreation area, as well as the heavy vegetation in the area is problematic. The site was shut down from May 8 thru June 18, 2007, due to floodwaters.

Status of the Project: 2012 the site was placed in a rebound test in order to see if closure activities could begin. After the rebound test no well showed chlorides over the ideal level of 650ppm. On January 13, 2013 Bittersweet Energy the Consultant for the PRP asked to close the site and proposed a closure plan. KCC approved the plan on January 15, 2013. April 30, 2013 Bittersweet and their sub-contractor GSI plugged all the water wells and removed the system per the approved plan. WWC-5 paperwork was sent to the KCC District #2 Office. KCC District recommended closure of the site to EPR on June 3, 2013.

Level of Remediation Sought:

Ideal: 650 mg/l (chloride level in Arkansas River)
Target: 1000 mg/l

Recommendation for Future Work: KCC District #2 considers this site resolved and has asked for the site to be removed from the contamination site list.

Total Costs: $10,667

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures** **FY 2013/14**	**Total**
20030036-001	**18 Hrs. / $480.10**		

Current Contaminate Level: 650 ppm Cl-

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**

Kansas Corporation Commission

N

C.E. Mount Remediation Site - Carl Allam Oil Co. - PRP
Section 20 of Township 24 South and Range 4 West, Reno County, Kansas
2013 Site map - Well Locations
District #2 - Wells Plugged on 4/30/2013 - Map Drawn on 9/17/2013 by D. Bollenback

Project: ***Nikkel-Epps***

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

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

Site Description: The aquifer consists of two to three sand units separated by clay layers. At the base of the aquifer lies the Wellington Shale. The aquifer appears to contain several possible aquitards, which could be impermeable clays separating the sands. It is unknown if these clays are continuous throughout the area. Due to the depth that the saltwater has been found it is assumed that potential pathways down to the Wellington formation exist. The land surface is flat irrigated farmland. Chlorides seem to be settling along the Wellington Shale contact. The top of the Wellington is an erosional disconformity which can allow for high relief channels and bumps with in the shallow aquifer.

Unusual Problems: Like many other chlorides 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.

Status of Project: Research done by Jeff Klock on the Epp's complaint in 2007 found that historically there have been other complaints and records of contamination around the Epp Site. On 3/6/2007 Mike Peterson, of Peterson Irrigation, called the KCC to report that the four irrigation wells he had installed for Ted Nikkel on the Epp's Property had become salty. On 3/7/2007, Jeff Klock with the KCC was onsite to investigate and took samples of the water from the irrigation wells. The Main well tested over 5,000 ppm chlorides. Samples sent to Dr. Donald Whittemore, at the Kansas Geological Survey, were found to have oil field brine as the source of the chlorides. On 8/26/2008, David Bollenback with the KCC returned to the site and sampled the three remaining irrigation wells. Sampling results ranged from 4,500 to 400 ppm chlorides increasing towards the south and the main well. Data from the irrigation logs indicate this maybe due to greater sand development towards the center of the site, which could account for the sinking saltwater plume. A composite sample of all the irrigation wells tested to be 2,300-ppm chlorides and is unusable for agricultural use. KCC recommended that the irrigation well not be used at this time. 6/4/09 KCC sampled the Ratzlaff house well just south of the irrigation wells and lab results at the KCC lab showed that chlorides were 890 ppm. The Ratzlaff's house well is their only source of water at this time.
New monitoring well drilling commenced on November 30, 2011, where MW-1, MW-2, and MW-4 were drilled and completed. Heavy rains limited Rig and truck access until February 1, 2012. MW-3, MW-5, MW-3S, and MW-4S were drilled and installed between February 1 and 2, 2012.
On July 2, 2013, all the groundwater monitoring wells were gauged and sampled for chloride levels. Prior to sampling, groundwater levels were measured in each monitoring well using an electronic water level indicator. Air-lift technology was used to purge a minimum of three well volumes of groundwater from each well before sampling. Conductive measurements were taken during purging to indicate stabilization before sampling. Purge water was tested for conductivity and containerized in a 250 gallon ploy tank for disposal depending on salt content. Groundwater samples from each monitoring well were collected in one 250 (ml) polyurethane container for analysis at the KCC District #2 Laboratory. Each sample for this monitoring event was analyzed for the presence of Chloride by United States Environmental Protection Agency (USEPA) Method 8225 (Titrimetric, Silver Nitrate). Chloride levels ranged from 200 mg/L to 9,000 mg/L in MW-1 indicating that the brine is invading section 18 from the north.

Level of Remediation Sought:
Ideal: <250 ppm
Target: 500 ppm

Recommendations for Future Work: Further soil borings and monitoring wells are needed to the north of the site. A phase II investigation will be wrote up in the fall of 2013 considering that MW-4 increased from 210 ppm Chlorides in 2012 to 900 ppm Chlorides in 2013, which is the eastern side of the plume at this point. New work will need to be focused to the north and east of the current site. It is apparent that the main brine plume has a source(s) in section 7. KCC was notified that the Irrigation wells to the northeast in section 8 became salt contaminated in 2011. Investigation in this direction will also be needed to delineate the plume and then possible remedial actions could be planned if possible.

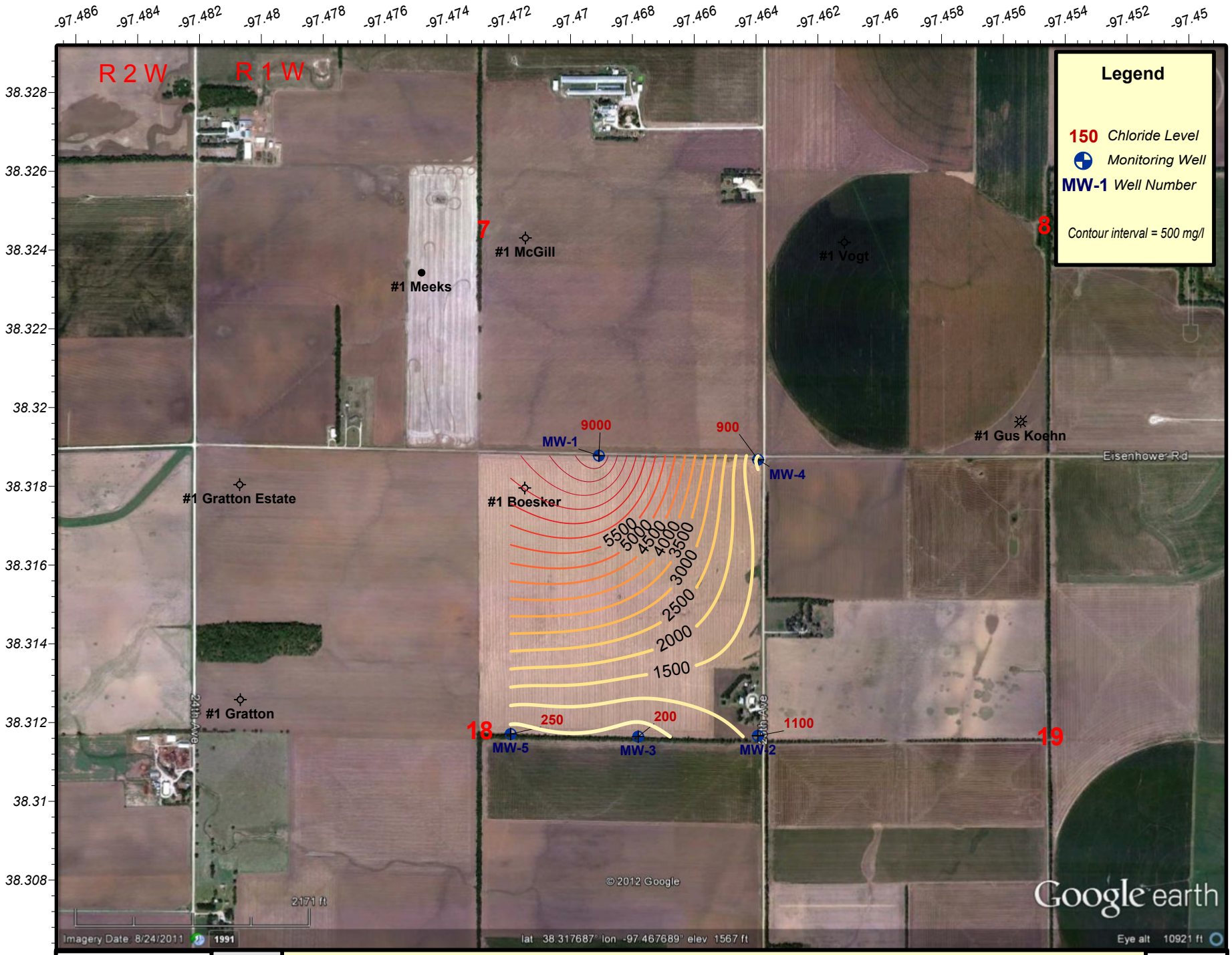
Estimated Total Costs: $10,000 to $30,000 to drill the new wells during a Phase II investigation. The KCC District #2 will also need funding for sampling, research, and report preparation.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Total
20100082-001	18 Hrs. / $462		$8,318.75

Current Contaminate Level: MW-3 200 ppm to MW-1 9000 ppm.

Status:

[X] 1. Site Assessment	[ ] 2. Short Term Monitoring	[X] 3. Investigation
[ ] 4. Long Term Monitoring	[ ] 5. Remediation Plan	[ ] 6. Installation
[ ] 7. Remediation	[ ] 8. Post Rem. Monitoring	[ ] 9. Resolved

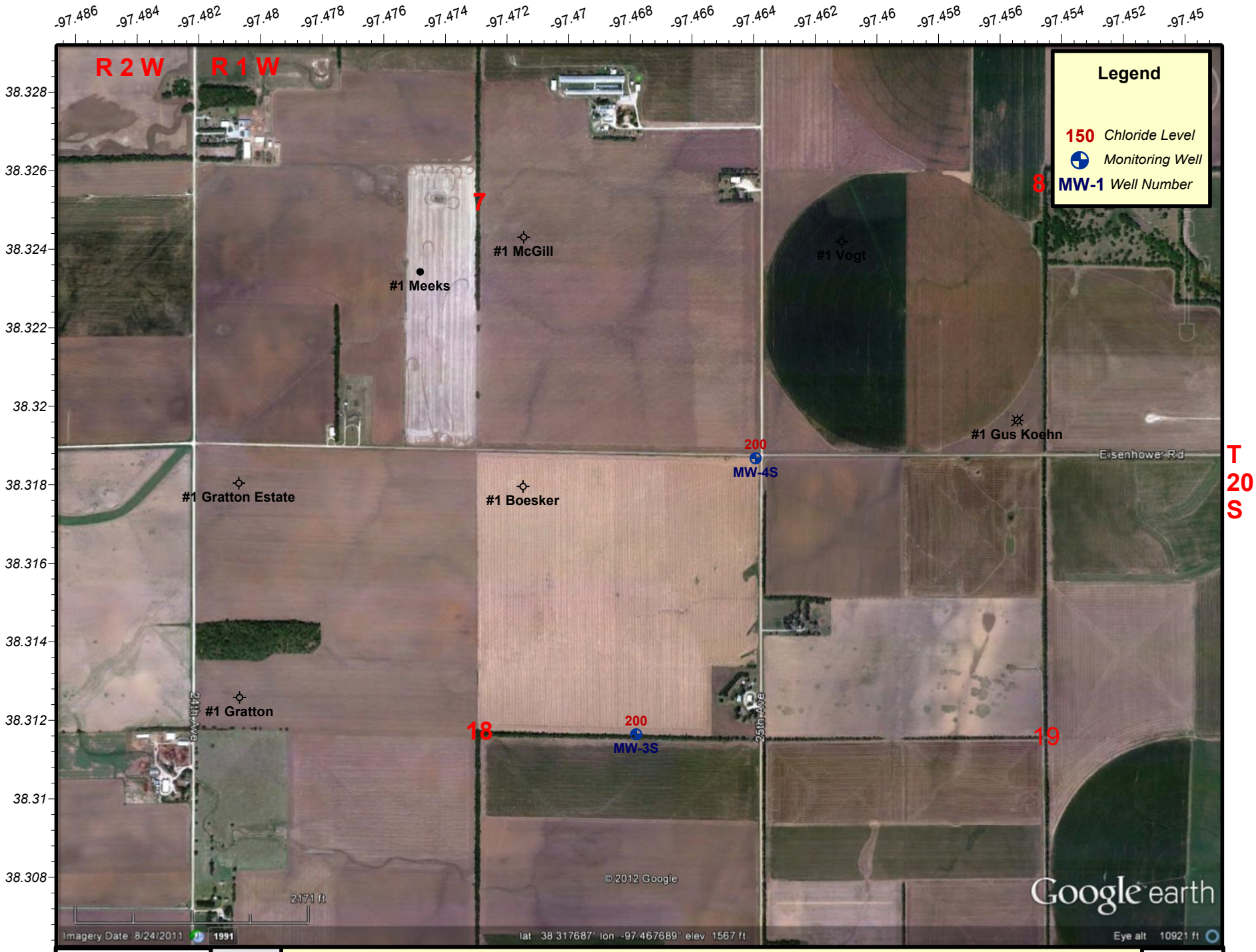


Kansas

N

Nikkel- Epps Contamination Site
NE/4 Section 18 of T20S & R1W, McPherson County, Kansas
2013 Deep Monitoring Well Chlorides
District #2 - Control # 20100082-001 - Drawn on:8/26/13 by B. Milner

Figure 1



Kansas

N

Nikkel- Epps Contamination Site
NE/4 Section 18 of T20S & R1W, McPherson County, Kansas
2013 Shallow Monitoring Well Chlorides
District #2 - Control # 20100082-001 - Drawn on:8/27/13 by B. Milner

Figure 2

Project: ***Packard Contamination Site***

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 nine samples were taken in 2013. Five monitoring wells samples were taken in addition to three supply wells and one surface sample from a spring. Chloride data shows the plume continuing to move to the southeast towards the Medicine Lodge River from the Packard #1. Chlorides in the northern area of the site have trended lower, while chlorides in the southern area have increased during the last sampling event. MW-4 which has historically been fresh, which provided delineation of the plume to the west, has been destroyed since the site was last sampled in 2009.

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 in order 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.

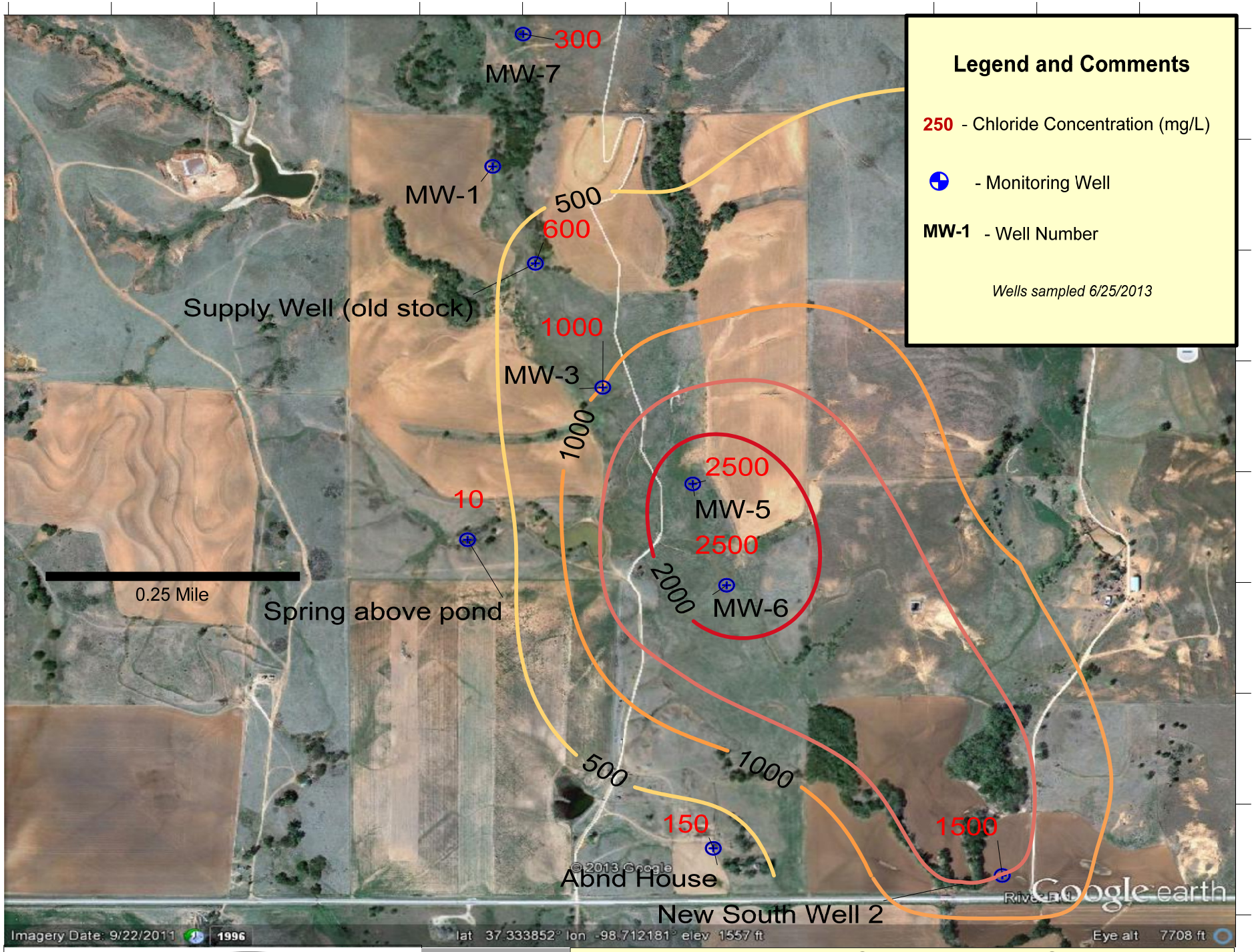
Estimated Total Costs: $10,000.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures**	
		FY 2013/14	**Total**
970075-00	**20 Hrs. / $500.10**		**$310.09**

Current Contaminate Level: 10ppm CL- 2500 ppm CL-

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**



Legend and Comments

250 - Chloride Concentration (mg/L)

- Monitoring Well

MW-1 - Well Number

Wells sampled 6/25/2013

Kansas Corporation Commission

N W E S

Packard Contamination Site

Sections 15/22/23-T31S-R13W
Barber, County Kansas

2013-2014 Area Map with Chlorides

KCC Control # 970075-00 District1-B. Milner 8-6-13

Project: ***Ruder Creek Contamination Site***

Site Location: Section 8 of Township 15 South, Range 18 West, Ellis County.

Impact/Immediacy: Groundwater. Immediacy level is rated as moderate.

Site Description: Alluvial valley fill contaminated by brine ponds and poorly constructed shallow Cheyenne disposal wells. Affected creek drains into the Smokey Hill River upgradient (west) of the City of Hays water supply well field.

Unusual Problems: No exact locations of the shallow disposal wells given in the documentation on this site.

Status of Project: Well net drilled along Ruder Creek in the summer of 1999. Chloride levels have in 2011 to were 1200 in the north and up to 240 in the south of the well net. Levels in 2012 have not changed much since 2011. They range from 1160 in the north to 300 ppm in the south. Choride levels in 2013 are at 1000 ppm in the northern most well, 600 ppm in the middle two wells, and only 200 ppm in the southern most well next to the river.

Level of Remediation Sought:

Ideal: 250 ppm Chloride
Target: 500 ppm Chloride

Recommendations for Future Work: Monitor site.

Estimated Total Costs: $29,000.

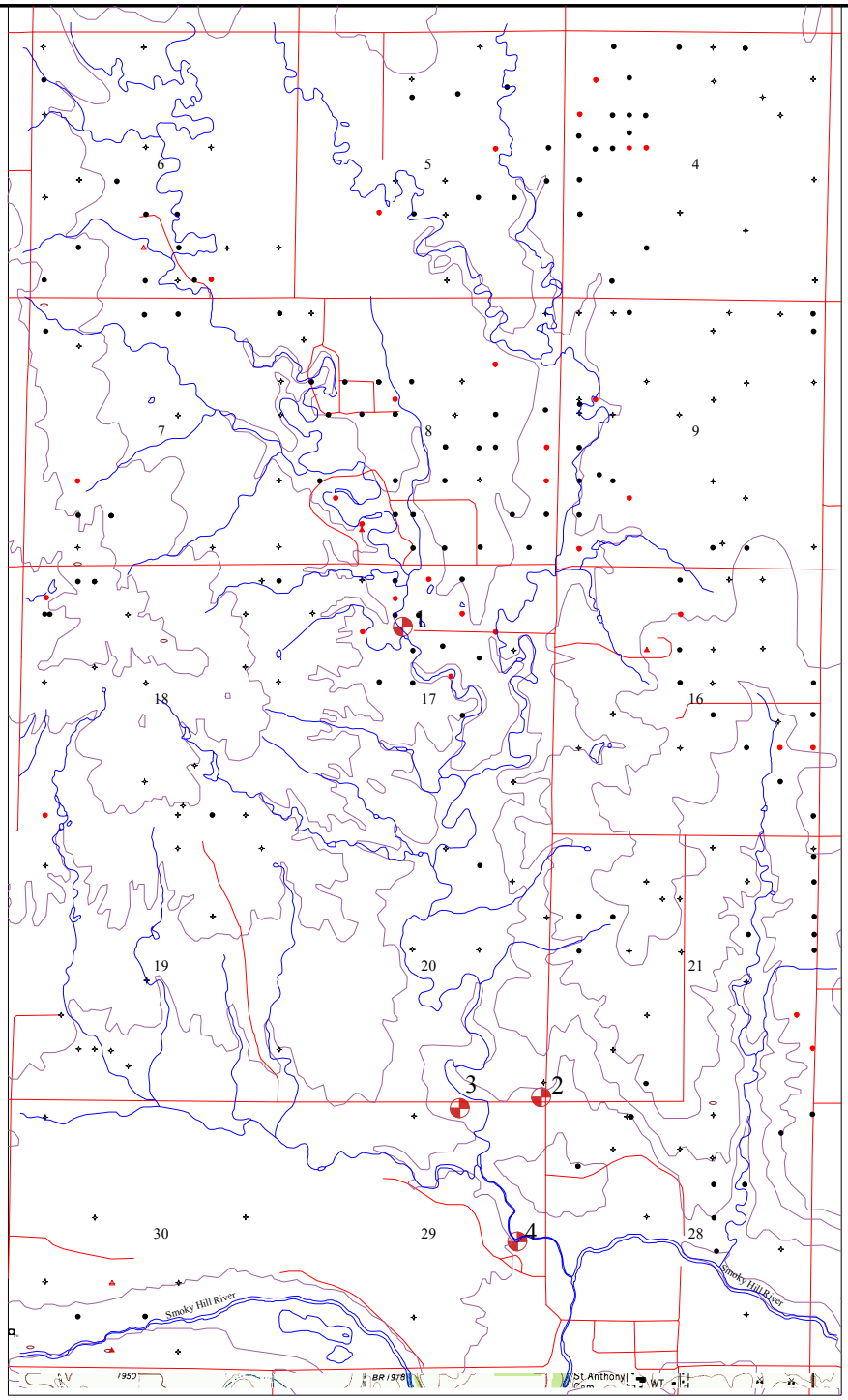
Control No.	**Staff Hours/Expenditures**	**Fund Expenditures**	
		FY 2013/14	**Total**
970082-00	**6 Hrs. / $146.06**		**$12,960**

Current Contaminate Level: 200 ppm to 1000 ppm Cl-

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**

R 18 W



CI = 3640 Feet

0 3640 7280

Ruder MW 1 2013 1000 ppm Cl-

Ruder MW 2 2013 600 ppm Cl-

Ruder MW 3 2013 600 ppm Cl-

Ruder MW 4 2013 200 ppm Cl-

T 15 S

N W E S

Oil Well
Plugged Oil Well
TA Oil Well
Abandoned Oil Well
Gas Well
Plugged Gas Well
TA Gas Well
Abandoned Gas Well
Disposal Well
Plugged Disposal Well
TA Disposal Well
Abandoned Disposal Well
Injection Well
Plugged Injection Well
TA Injection Well
Abandoned Injection Well
Oil & Gas Well
Plugged Oil & Gas Well
TA Oil & Gas Well
Abandoned Oil & Gas Well
Dual Completed Oil Well
Plugged Dual Completed Oil Well
TA Dual Completed Oil Well
Abandoned Dual Completed Oil Well
Dual Completed Gas Well
Plugged Dual Completed Gas Well
TA Dual Completed Gas Well
Abandoned Dual Completed Gas Well
Water Supply Well
Plugged Water Supply Well
TA Water Supply Well
Abandoned Water Supply Well
Dry Hole
Domestic Well
Plugged Domestic Well
Abandoned Domestic Well
Agriculture Well
Plugged Agriculture Well
Abandoned Agriculture Well
Irrigation Well
Plugged Irrigation Well
Abandoned Irrigation Well
Public Water Supply Well
Plugged Public Water Supply Well
Abandoned Public Water Supply Well
Possible Location
Test Hole
Sample Site
Location
Monitoring Well
Plugged Monitoring Well
Pit
Tank Battery
Gas Storage Monitoring Well
Plugged Gas Storage Monitoring Well
TA Gas Storage Monitorning Well
Abandoned Gas Storage Monitorning Well
Gas Storage Injection/Withdrawl Well
Plugged Gas Storage Injection/Withdrawl Well
TA Gas Storage Inject on Withdrawl Well
Abandoned Gas Storage Injection/Withdrawl Well

Kansas Corporation Commission

Ruder Creek

Sec. 8, Twn. 15 S., Rng. 18 W., Ellis County

Elevated Chlorides In Drainage

970082-00

Date: 21 Oct 2004 District: Hays

Project*: Running Turkey Creek*

Site Location: The area of contaminated surface and ground water is in the Running Turkey drainage pattern and appears to start in the N/2 of 26-19S-2W. This area is within the Ritz Canton oil field, east of Galva, and extends south of Highway 56.

Impact/Immediacy: Oil field impact to the soil can be seen through out the area of the oil fields along the drainage basin. Due to the age of the area oil fields many spills, line leaks and old brine pits has caused damage to soil and water resources. Ground water used for domestic, irrigation and potential public water supplies is the largest and problematic resource affected by the contamination zones. The major source of contamination to the ground water appears to be the past use of evaporation pits. The immediacy rating is moderate to high.

Site Description: The topography of the area is flat to gently rolling hills. Most of the land is under cultivation. The ground water also flows generally in a south to southwest direction with minor hydrologic anomalies. The ground water contamination is highest near the bedrock contact.

Unusual Problems: In order to delineate this site a monitoring well matrix may have to spread for miles. It is unknown how many point sources of contamination can be attributed to this plume as it is so large. A very large number of monitoring wells would be needed to delineate this plume.

Status of the Project: This site is in a monitoring phase, though investigations are warranted in order to delineate the plume. The monitoring wells are sampled using submersible pumps or air-lift technology depending on the depth of the well. This site used to be part of a larger monitoring well matrix that extended to Elyria to the southwest. KCC separated those wells from this site as it appears that there is not direct connection between the plumes. The southern wells are now part of the KCC Voshell Contamination Site. Overall the plume within this site has remained stable over 2013. Research is currently being conducted on the best placement of future monitoring wells and other ways of data collection regarding the site.

Level of Remediation Sought:

Ideal: 250 mg/l mg/l
Target: 500 mg/l

Recommendation for Future Works: KCC District #2 plans to put together a scope of work which would entail the plugging/repair of certain wells within the site as well as the drilling and installation of no fewer than 5 new monitoring wells in order to delineate the very highly contaminated area in the northeast of the plume. KCC also is prepared to begin investigation to the north of the site boundaries as there are known brine plumes in that direction. If investigative efforts prove that there is direct connection to the northern plumes KCC will then evaluate and proposed new boundary lines for the site. If the plumes are not directly connected KCC may recommend the creation of a new site for investigative funds.

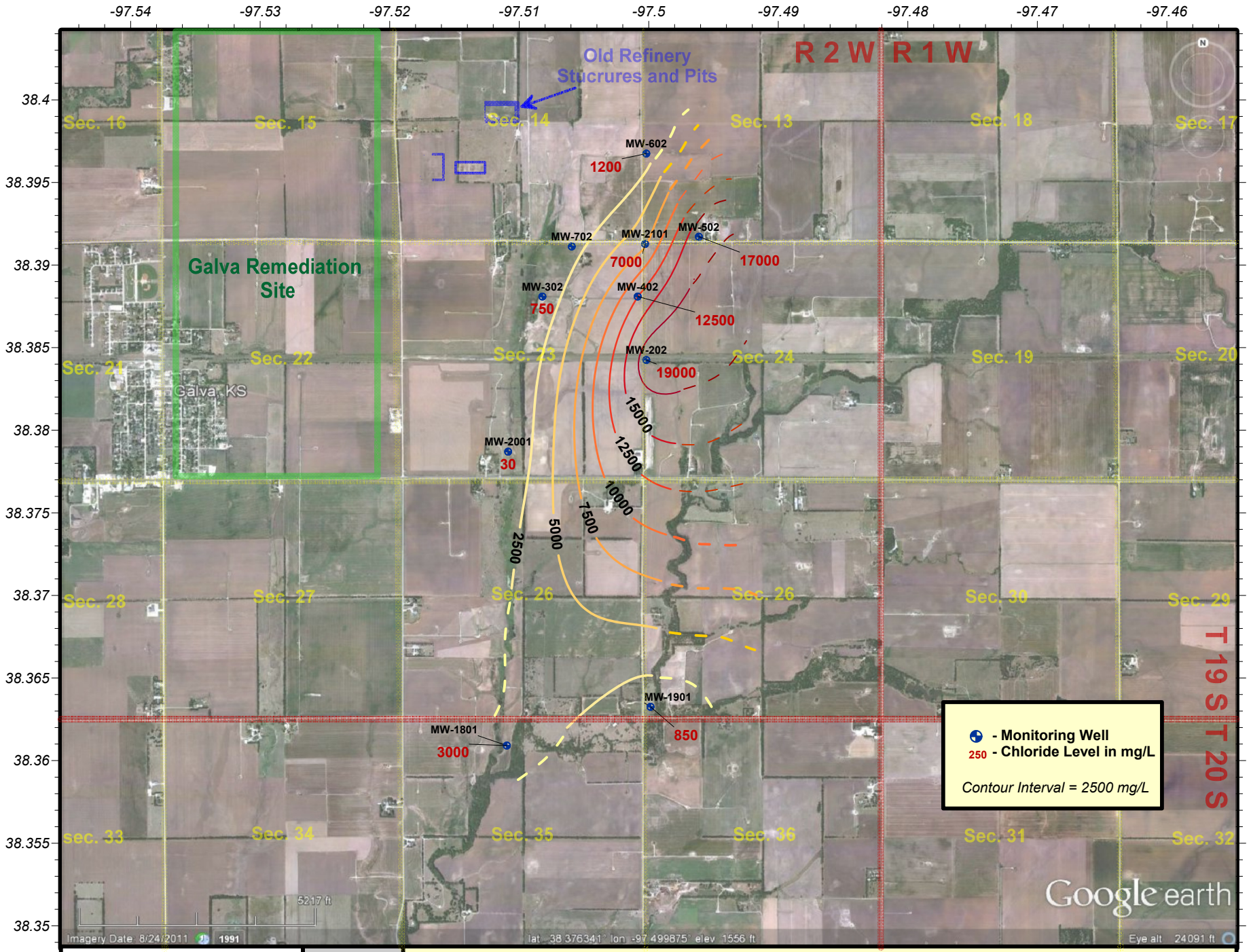
Estimated Total Cost: $15,000 to $25,000 for additional wells depending on the number of wells installed**.**

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures**	
		FY 2013/14	**Total**
20010033-001	**25 Hrs. / $649.65**		**$61,603.07**

Current Contaminate Level: 30 mg/l Cl^- MW 2001 to 19,000mg/l Cl^- MW202 (Aquifer)

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**



Kansas Corporation Commission

N

Northern Running Turkey Creak Contamination and Monitoring Site - KCC Control #20030059-001
Multiple sections in Township 19 & 20 South and Range 2 West, McPherson County, Kansas
2013 Groundwater Chloride Levels
District #2 - Sampled 9/24/2013 - Map Drawn on 10/1/2013 by D.Bollenback

Project: ***City of Russell Contamination Site***

Site Location: City of Russell
S/2 of Section 22, Township 13 South, Range 14 West
SW/4 of Section 23, Township 13 South, Range 14 West
E/2 E/2 of Section 28, Township 13 S., Range 14 West
Sec. 26, 27, 34, 35, Township 13 South, Range 14 West
NE/4 NE/4 Section 3, Township 14 South, Range 14 West
W/2 NW/4 NW/4 Section 2, Township 14 S, Range 14 W, Russell County

Impact/Immediacy: Domestic wells used for irrigation of lawns. Immediacy level is rated as moderate.

Site Description: Brine contamination of very shallow aquifer. Potential sources include the approximately 334 wells drilled either in the city limits or in close proximity to the city limits. The associated drill pits, lead lines, tank battery sites, brine tanks, brine lines, disposal and injection wells, and emergency pits have all contributed to the brine contamination. In addition, there are 36 oil wells and brine disposal wells within this site that are either abandoned or have little or no documentation as to having been plugged.

Unusual Problems: The number of potential contamination sources. Disposal of contaminated water if remediated may be a problem as there are few disposals in the area.

Status of Project: Test holes were drilled in the area during the summer of 2001. The major contributor to the chloride pollution seems to be an old brine pit located to the northwest of the city. However, as the map reveals, there has been extensive drilling in the northwest of Russell, and the contribution from old drill pits and old line leaks cannot be determined. In September 2004, the monitor well tested at 2200 ppm chloride. No sample taken since this time due to inaccessibility of the monitoring well. No sample in 2013.

Level of Remediation Sought:
Ideal: 500 ppm Chloride
Target: 1000 ppm Chloride

Recommendations for Future Work: Test hole drilled to the northwest of the city. Further research may be needed to determine whether remediation is feasible, and what action should be taken. Possibilities include a French drain installed to intercept chloride laden water before it enters the city of Russell. The French drain would be approximately 1700' long to a depth of 12 to 17 feet deep. Another consideration may be digging out the 100' X 100' brine pit and hauling it off to a landfill.

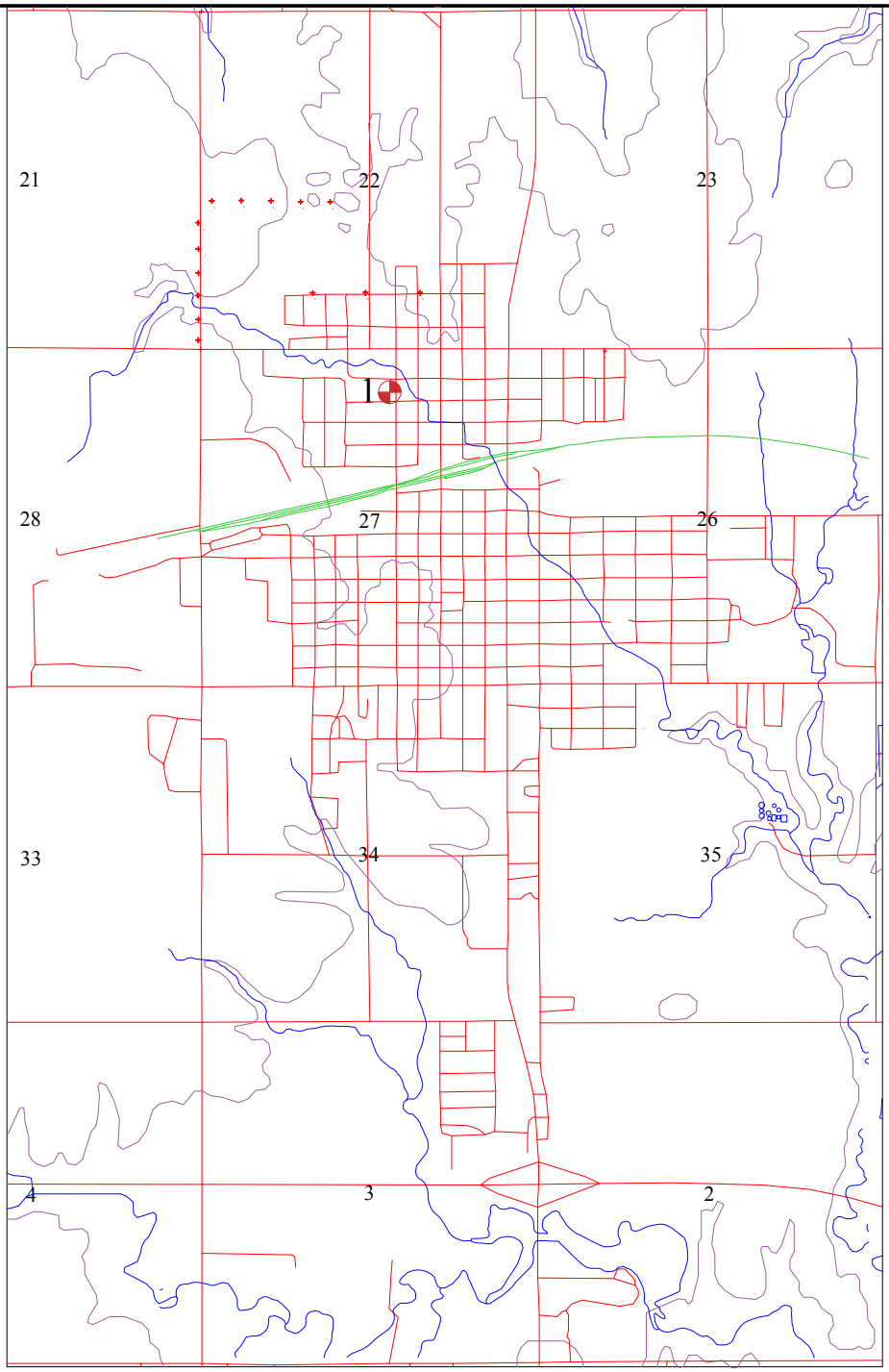
Estimated Total Costs: $400,000.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures**	
		FY 2013/14	**Total**
970083-00	**2 Hrs. / $59.46**		**$1,192.60**

Current Contaminate Level: Unknown
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**

R 14 W



T 13 S

T 14 S

N
W
E
S

CI = 2900 Feet

0 2900 5800

1 Monitor Well 2013 - No Sample
Monitor well not available

Oil Well
Plugged Oil Well
TA Oil Well
Abandoned Oil Well
Gas Well
Plugged Gas Well
TA Gas Well
Abandoned Gas Well
Disposal Well
Plugged Disposal Well
TA Disposal Well
Abandoned Disposal Well
Injection Well
Plugged Injection Well
TA Injection Well
Abandoned Injection Well
Oil & Gas Well
Plugged Oil & Gas Well
TA Oil & Gas Well
Abandoned Oil & Gas Well
Dual Completed Oil Well
Plugged Dual Completed Oil Well
TA Dual Completed Oil Well
Abandoned Dual Completed Oil Well
Dual Completed Gas Well
Plugged Dual Completed Gas Well
TA Dual Completed Gas Well
Abandoned Dual Completed Gas Well
Water Supply Well
Plugged Water Supply Well
TA Water Supply Well
Abandoned Water Supply Well
Dry Hole
Domestic Well
Plugged Domestic Well
Abandoned Domestic Well
Agriculture Well
Plugged Agriculture Well
Abandoned Agriculture Well
Irrigation Well
Plugged Irrigation Well
Abandoned Irrigation Well
Public Water Supply Well
Plugged Public Water Supply Well
Abandoned Public Water Supply Well
Possible Location
Test Hole
Sample Site
Location
Monitoring Well
Plugged Monitoring Well
Pit
Tank Battery
Gas Storage Monitoring Well
Plugged Gas Storage Monitoring Well
TA Gas Storage Monitoring Well
Abandoned Gas Storage Monitoring Well
Gas Storage Injection/Withdrawl Well
Plugged Gas Storage Injection Withdrawl Well
TA Gas Storage Injection/Withdrawl Well
Abandoned Gas Storage Injection Withdrawl Well

Kansas Corporation Commission

City of Russell

Sec. 22, Twn. 13 S., Rng. 14 W., Russell County

Elevated Chlorides in Cities Domestic Wells

970083-00

Date: 21 Oct 2004 District: Hays

Project: ***Russell Rural Water District #1***

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

Impact/Immediacy: Public Water Supply Well. Immediacy level is rated as moderate to high.

Site Description: Public water supply well in alluvial filled valley. Dakota Formation subcrops in this valley.

Unusual Problems: Chloride source could be oil field related, or could be a factor of proximity to the Dakota Formation. During World War II, the Dakota Formation in this area was used as a disposal zone for produced brine waters.

Status of Project: Monitoring. Last chlorides were taken in September of 2001. Chloride levels in the affected well were 600 ppm. The following is a listing of the wells sampled.

Well	Cl-2009	Cl-2010	Cl-2011	CL-2012	CL-2013
MW01	200 ppm	700 ppm	500 ppm	700 ppm	600 ppm
MW02	Plugged	Plugged	Plugged	Plugged	Plugged
MW03	1200 ppm	700 ppm	900 ppm	800 ppm	900 ppm
MW05	950 ppm	900 ppm	800 ppm	900 ppm	800 ppm

Level of Remediation Sought:

Ideal: 100 ppm Chloride

Target: 250 ppm Chloride

Recommendations for Future Work: Continue monitoring.

Estimated Total Costs: This site has been studied extensively. The estimated costs from KCC and KDHE have been $30,000.00+. Continued monitoring costs will be $3,000.00.

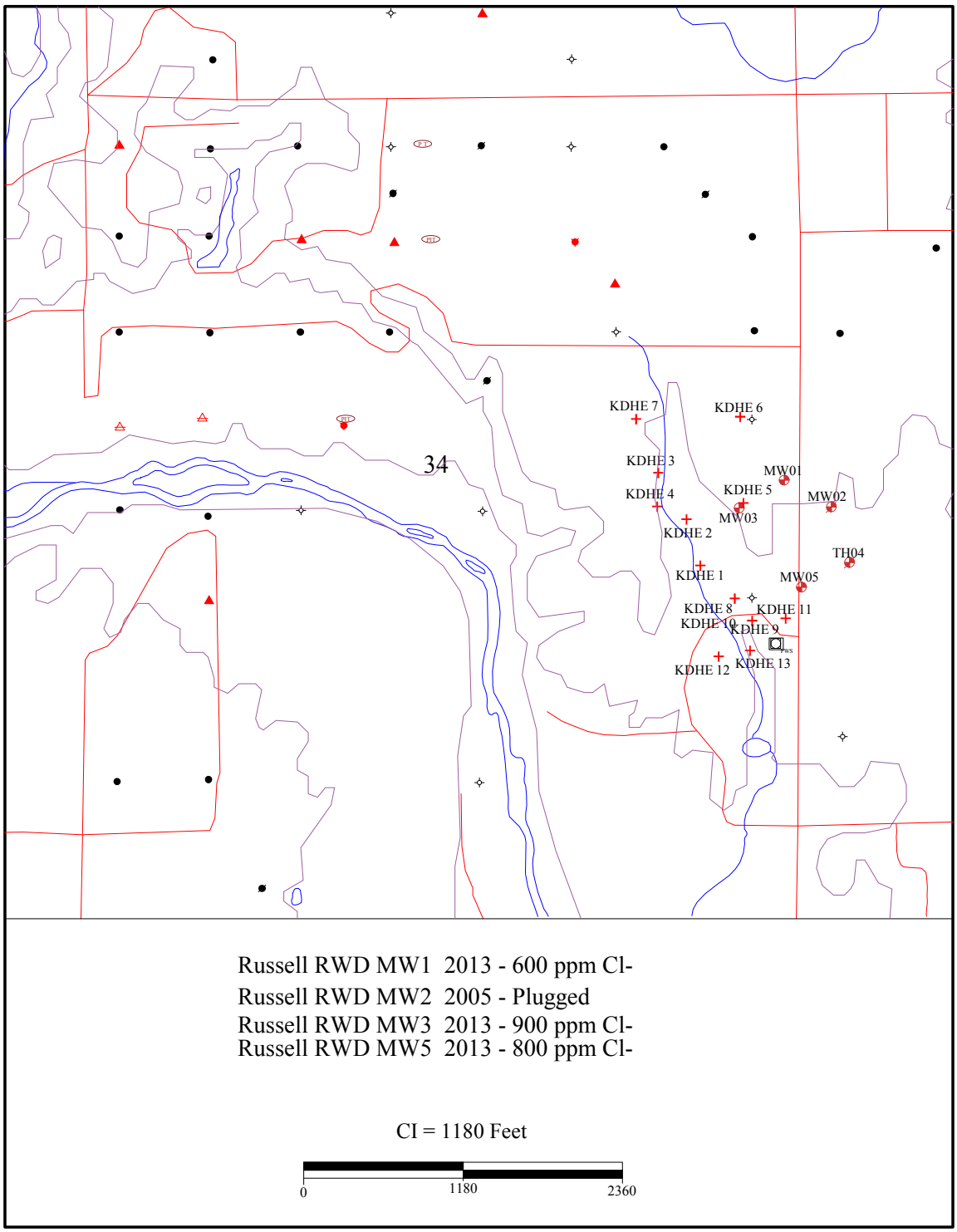
Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970084-00	**10 Hrs. / $251.22**		

Current Contaminate Level: 600 ppm to 900 ppm Cl-

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**

R 14 W



T 14 S

N
W E
S

Russell RWD MW1 2013 - 600 ppm Cl-
Russell RWD MW2 2005 - Plugged
Russell RWD MW3 2013 - 900 ppm Cl-
Russell RWD MW5 2013 - 800 ppm Cl-

CI = 1180 Feet

0 1180 2360

Oil Well
Plugged Oil Well
TA Oil Well
Abandoned Oil Well
Gas Well
Plugged Gas Well
TA Gas Well
Abandoned Gas Well
Disposal Well
Plugged Disposal Well
TA Disposal Well
Abandoned Disposal Well
Injection Well
Plugged Injection Well
TA Injection Well
Abandoned Injection Well
Oil & Gas Well
Plugged Oil & Gas Well
TA Oil & Gas Well
Abandoned Oil & Gas Well
Dual Completed Oil Well
Plugged Dual Completed Oil Well
TA Dual Completed Oil Well
Abandoned Dual Completed Oil Well
Dual Completed Gas Well
Plugged Dual Completed Gas Well
TA Dual Completed Gas Well
Abandoned Dual Completed Gas Well
Water Supply Well
Plugged Water Supply Well
TA Water Supply Well
Abandoned Water Supply Well
Dry Hole
Domestic Well
Plugged Domestic Well
Abandoned Domestic Well
Agriculture Well
Plugged Agriculture Well
Abandoned Agriculture Well
Irrigation Well
Plugged Irrigation Well
Abandoned Irrigation Well
Public Water Supply Well
Plugged Public Water Supply Well
Abandoned Public Water Supply Well
Possible Location
Test Hole
Sample Site
Location
Monitoring Well
Plugged Monitoring Well
PT
Tank Battery
Gas Storage Monitoring Well
Plugged Gas Storage Monitoring Well
TA Gas Storage Monitoring Well
Abandoned Gas Storage Monitoring Well
Gas Storage Injection/Withdrawl Well
Plugged Gas Storage Injection/Withdrawl Well
TA Gas Storage Injection/Withdrawl Well
Abandoned Gas Storage Injection/Withdrawl Well

Kansas Corporation Commission

Russell Rural Water District

Sec. 34, Twn. 14 S., Rng. 14 W., Russell County

Elevated Chlorides in Public Supply Well

970084-00

Date: 21 Oct 2004 District: Hays

Project: ***Sample Contamination Site***

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

Impact\Immediacy: KCC District #2 has lowered this site from medium immediacy level to low. The chloride intrusion affects a groundwater aquifer that is very low volume. Housing development in the area could see rise in water well installation for domestic and heating/cooling systems.

Site Description: The site is located on the outskirts of a metropolitan housing development, but is being encroached on from all sides. The topsoil is hard clay (Wellington formation). The underlying aquifer is a thin low volume zone that is directly affected by precipitation. Total depth of the monitor well is nineteen feet.

Unusual problems: A portion of the chlorides is natural and could not readily be remediated. The aquifer is low volume and difficult to clean up. The urban setting logistically makes remediation difficult. Continued residential development could see increased attempts of use of the groundwater in the area.

Status of Project: A water sample was collected on June 16, 2013, tested 2,500 mg/L chlorides. The chlorides have decreased from 5,000 mg/L in 2012 to 2,500 mg/L in 2013. The change in chlorides could be from multiple factors including more rainwater this year and higher water levels than in previous years.

Level of Remediation Sought:

Ideal: 250 mg/l Chloride
Target: 500 mg/l Chloride

Recommendations for Future Work: Continue to monitor site. Site is located only one mile north of the District #2 Field Office so limited resources are needed to continue monitoring this site. Remediation of this site could be started by pumping fluid from the monitoring well to the oil field salt-water tank located on site. Research and investigate any new domestic wells in the area for contamination and begin sampling domestic wells in the area for annual report.

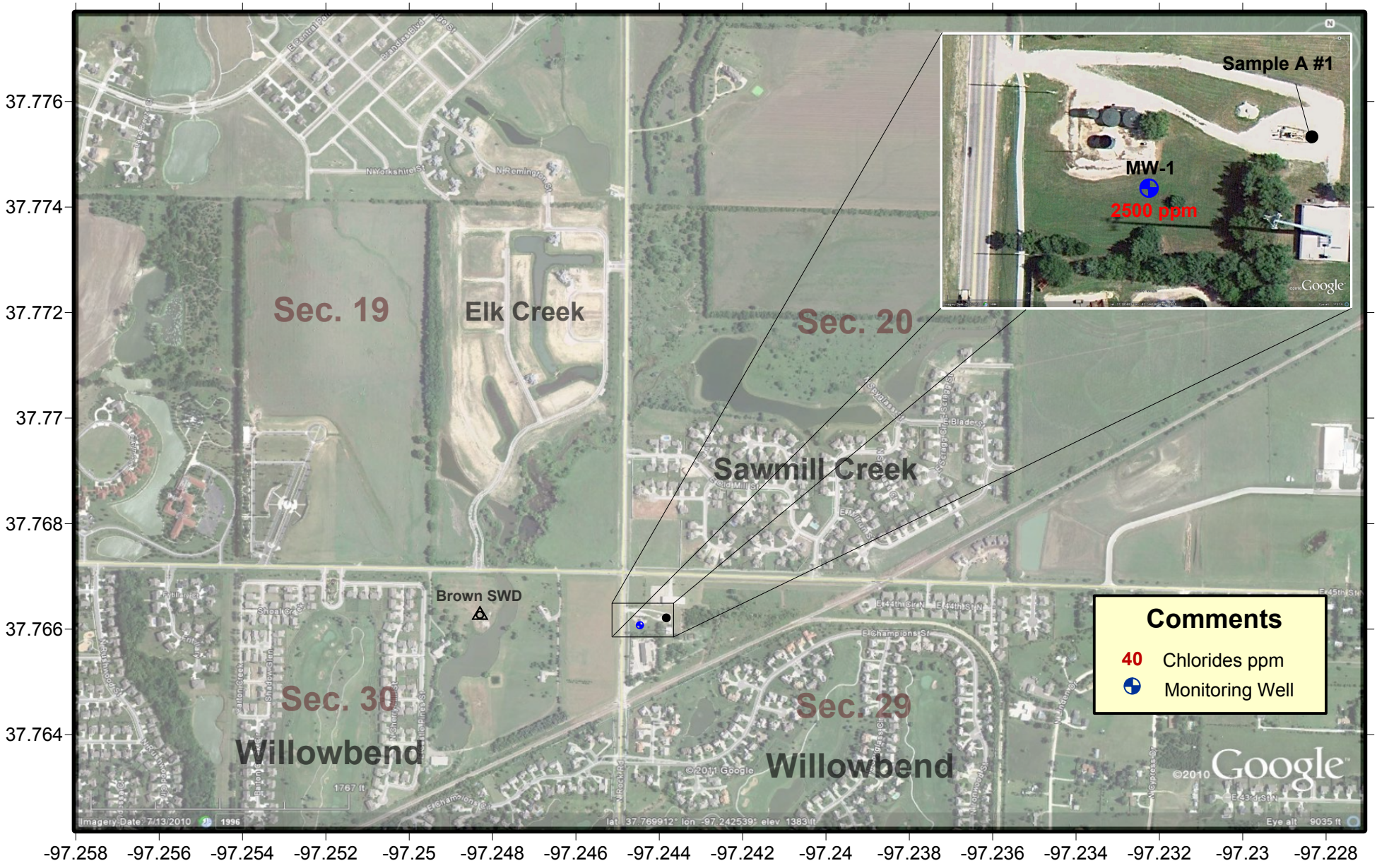
Estimated Total Costs: $500 per year for site inspection, sample collection, and research.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970088-00	**10 Hrs. / $255.30**		

Current Contaminate Level: 2500 mg/l collected 6/19/2013

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**



Kansas Corporation Commission

N W E S

Sample 'A' Contamination Site

NW - Sec. 29 - T 26 S - R 2 E, Sedgwick County, Kansas

2013-2014 Area Map with Chlorides

KCC Project Code #970088-00 - District #2 - B. Milner - 6/27/13

Project: ***Louis Sander Contamination Site***

Site Location: NW/4 of Section 03, Township 14 South, Range 15 West, Russell County.

Impact/Immediacy: Domestic, stock well. Immediacy level is rated as low.

Site Description: Shallow aquifer affected by oilfield activity. Stock well only.

Unusual Problems: No primary source identified.

Status of Project: Chloride levels at 1650 ppm in stock well located in the S2 SE NW NW of section 3 as of October 2005. Chloride levels in this well were 1500 ppm as of September 2007. These levels dropped to 1250 in 2008. No sample was taken in 2013 due to well being inaccessible.

Level of Remediation Sought:

Ideal: 500 ppm Chloride
Target: 1000 ppm Chloride

Recommendations for Future Work: Monitor site.

Estimated Total Costs: $300.

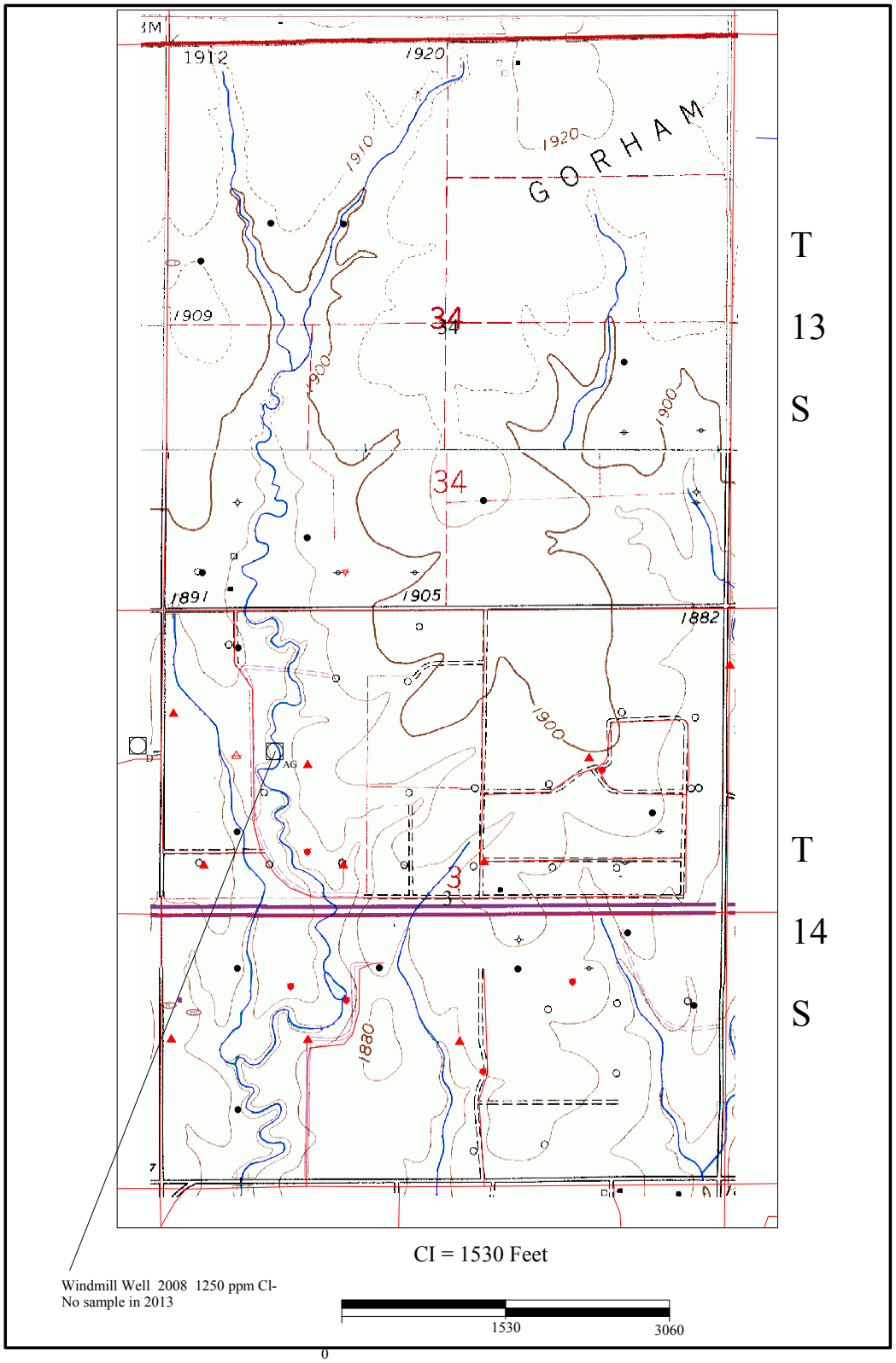
Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14 Total
970089-00	2 Hrs. / $59.46	

Current Contaminate Level: Unknown

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

R 15 W



Oil Well
Plugged Oil Well
TA Oil Well
Abandoned Oil Well
Gas Well
Plugged Gas Well
TA Gas Well
Abandoned Gas Well
Disposal Well
Plugged Disposal Well
TA Disposal Well
Abandoned Disposal Well
Injection Well
Plugged Injection Well
TA Injection Well
Abandoned Injection Well

Oil & Gas Well
Plugged Oil & Gas Well
TA Oil & Gas Well
Abandoned Oil & Gas Well
Dual Completed Oil Well
Plugged Dual Completed Oil Well
TA Dual Completed Oil Well
Abandoned Dual Completed Oil Well
Dual Completed Gas Well
Plugged Dual Completed Gas Well
TA Dual Completed Gas Well
Abandoned Dual Completed Gas Well
Water Supply Well
Plugged Water Supply Well
TA Water Supply Well
Abandoned Water Supply Well

Dry Hole
Domestic Well
Plugged Domestic Well
Abandoned Domestic Well
Agriculture Well
Plugged Agriculture Well
Abandoned Agricultural Well
Irrigation Well
Plugged Irrigation Well
Abandoned Irrigation Well
Public Water Supply Well
Plugged Public Water Supply Well
Abandoned Public Water Supply Well
Possible Location
Test Hole
Sample Site

Location
Monitoring Well
Plugged Monitoring Well
Pit
Tank Battery
Gas Storage Monitoring Well
Plugged Gas Storage Monitoring Well
TA Gas Storage Monitoring Well
Abandoned Gas Storage Monitoring Well
Gas Storage Injection Withdrawal Well
Plugged Gas Storage Injection/Withdrawal Well
TA Gas Storage Injection/Withdrawal Well
Abandoned Gas Storage Injection/Withdrawal Well

Kansas Corporation Commission

Louis Sander

Sec. 3, Twn. 14 S., Rng 15 W., Russell County

Chloride Plume 1963

970089-00

Date: 21 Oct 2004 District: Hays

Project: ***Schraeder Contamination Site***

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: Eight groundwater samples were taken in 2013. Chlorides in these samples ranged from 40ppm chlorides at a new windmill, to 1550ppm chlorides in Well C. These values have decreased slightly from the 2012 samples. 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. Irrigation well B is unable to be sampled. Irrigation well J is available to sample with the help of the landowner, but was unable to be sampled this year due to the landowner's schedule. Windmill F is damaged and not capable of pumping so no sample was taken. Windmill D, at the landowner's residence, was running and was sampled this year. An additional windmill in the NE/4 of section 2 was available for sampling, and was added to the sampling plan this year.

Level of Remediation Sought:

Ideal: 250 ppm Chloride
Target: 350 ppm Chloride

Recommendations for Future Work: The landowner should be contacted to see if access can be granted to enter irrigation wells B and J to obtain a current sample as these wells are up gradient from the residence on the property. The landowner for Windmill F should be contacted to see if repairs are going to be made. If not, the idea of pulling the rods should be explored so the KCC can resume sampling this well. After talking with Mr. Schraeder, we should make sure to keep him advised on all activities, and formally send him a letter advising him of how all the wells on his land tested.

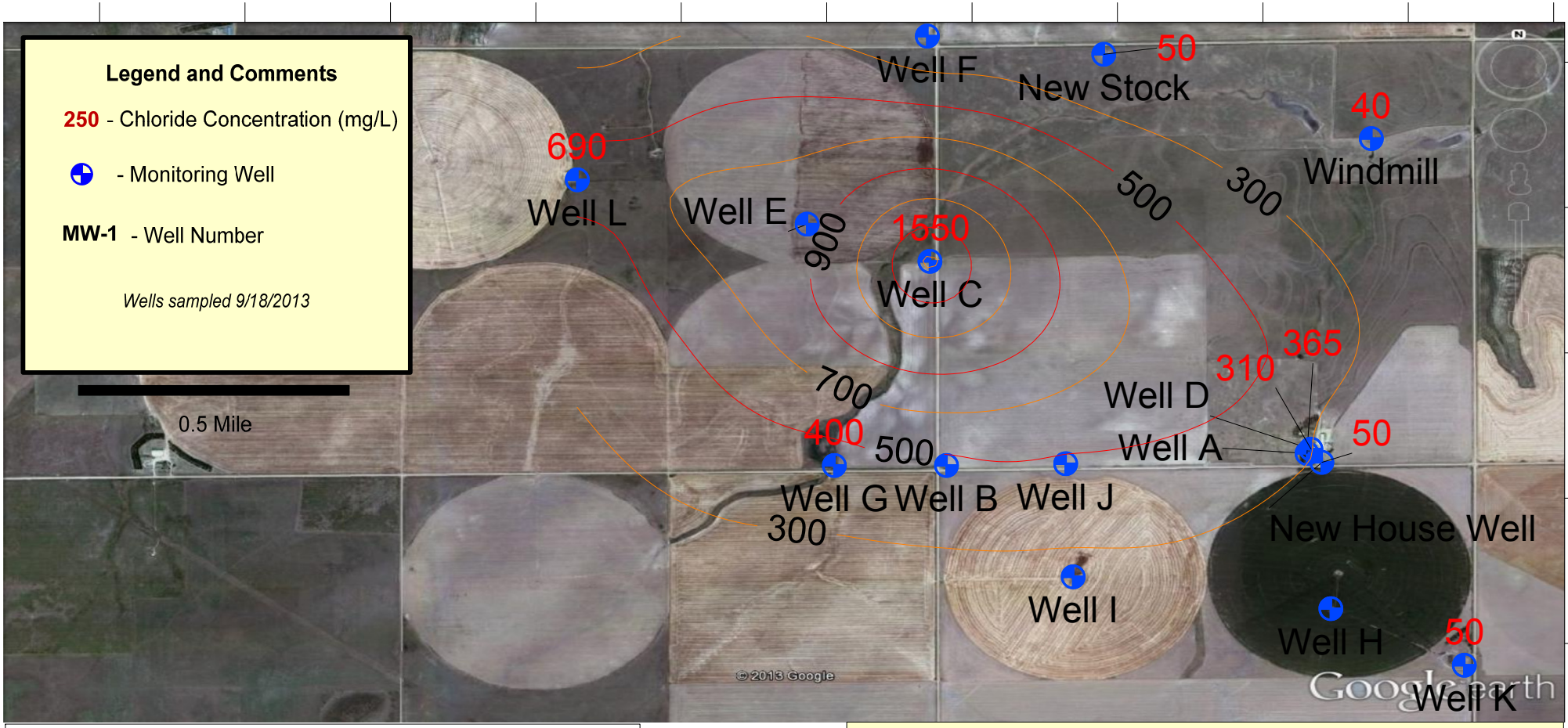
Estimated Total Costs: $30,000.00.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970013-00	**10 Hrs. / $253.54**		**$1,590.90**

Current Contaminate Level: 40ppm Cl- to 1550 ppm Cl-

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**



Kansas Corporation Commission

N
W E
S

Schraeder Site

Sections 2/3/11-T-24S-R24W
Hodgeman County, Kansas

2013-2014 Area Map with Chlorides

KCC Control # 970013-00 District 1
D. Sellers 9/25/13

Project: ***Leo Schruben-Rogers Contamination Site***

Site Location: SE/4 of Section 18, Twn. 7 S., Rng. 17 W., Rooks County.

Impact/Immediacy: Groundwater. Domestic well is the sole source of water for the residence but a reverse osmosis unit is installed. Immediacy level is rated as low.

Site Description: The groundwater was contaminated by oil field brine on two separate occasions. The site is located within terrace alluvium of the South Fork of the Solomon River. Land use in the area in agricultural and oil field production. Area wells consist of domestic water wells.

Unusual Problems: None.

Status of Project: Samples taken in 2011 were at 600 ppm chloride. In 2012 they had fallen to 500 ppm. The chloride levels in 2013 are again at 600 ppm.

Level of Remediation Sought:

Ideal: 100 ppm Chloride (background level)
Target: 250 ppm Chloride

Recommendations for Future Work: Continue to monitor. Domestic well is being used to water cattle. This continued use of the water well helps eliminate the chloride contamination.

Estimated Total Costs: $2000.

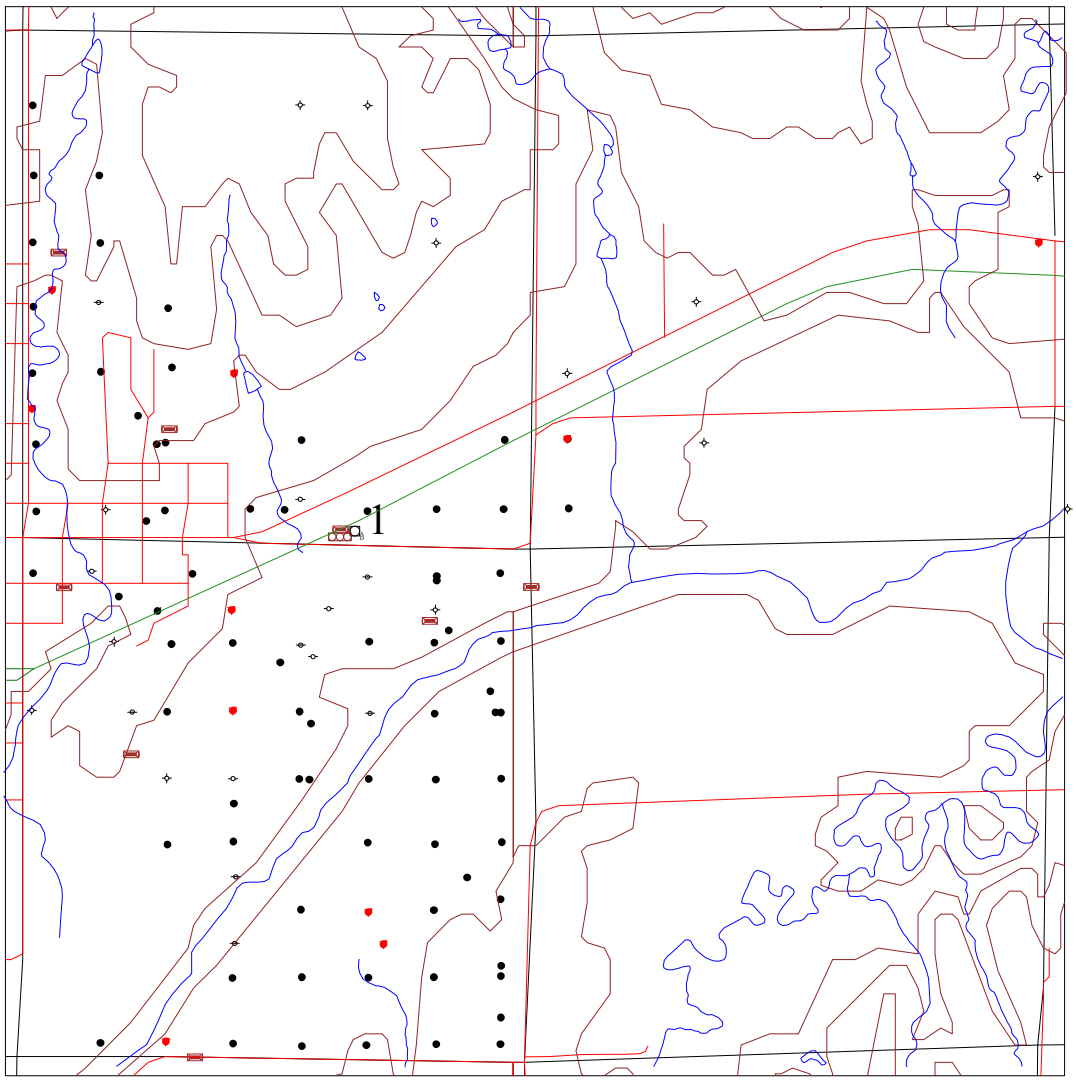
Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Total
970014-00	6 Hrs. / $146.06		

Current Contaminate Level: 600 ppm Cl-

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

R 17 W



T 07 S

N W E S

Schruben-Rogers Domestic Well 2013 600 ppm Cl-

Oil Well	Oil & Gas Well	Dry Hole	Location
Plugged Oil Well	Plugged Oil & Gas Well	Domestic Well	Monitoring Well
TA Oil Well	TA Oil & Gas Well	Plugged Domestic Well	Plugged Monitoring Well
Abandoned Oil Well	Abandoned Oil & Gas Well	Abandoned Domestic Well	Pit
Gas Well	Dual Completed Oil Well	Agriculture Well	Tank Battery
Plugged Gas Well	Plugged Dual Completed Oil Well	Plugged Agriculture Well	Gas Storage Monitoring Well
TA Gas Well	TA Dual Completed Oil Well	Abandoned Agriculture Well	Plugged Gas Storage Monitoring Well
Abandoned Gas Well	Abandoned Dual Completed Oil Well	Irrigation Well	TA Gas Storage Monitoring Well
Disposal Well	Dual Completed Gas Well	Plugged Irrigation Well	Abandoned Gas Storage Monitoring Well
Plugged Disposal Well	Plugged Dual Completed Gas Well	Abandoned Irrigation Well	Gas Storage Injection Withdrawl Well
TA Disposal Well	TA Dual Completed Gas Well	Public Water Supply Well	Plugged Gas Storage Injection/Withdrawl Well
Abandoned Disposal Well	Abandoned Dual Completed Gas Well	Plugged Public Water Supply Well	TA Gas Storage Injection/Withdrawl Well
Injection Well	Water Supply Well	Abandoned Public Water Supply Well	Abandoned Gas Storage Injection/Withdrawl Well
Plugged Injection Well	Plugged Water Supply Well	Possible Location	
TA Injection Well	TA Water Supply Well	Test Hole	
Abandoned Injection Well	Abandoned Water Supply Well	Sample Site	

Kansas Corporation Commission

Schruben-Rogers

Sec. 18, Twn. 7 S., Rng. 17 W.

Contaminated Domestic Well

970014-00

Date: 21 Oct 2004 District: Hays

Project: ***Schulte Brine Contamination Site***

Site Location: The legal description is eastern half of sections 7 & 18, and all of Sections 8 and 17, Township 28 South, and Range 1 West of Sedgwick County, Kansas. To the northeast lies the Wichita Mid-Continent Airport. The site is in the drainage systems of the Cowskin Creek and Dry Creek. Dry Creek is a tributary of Cowskin Creek and flows in an easterly direction across the southern part of the site. The confluence of the two creeks is approximately three miles to the southeast of Schulte.

Impact/Immediacy: The impact is to groundwater resources including public supply wells and domestic water wells. The immediacy level is rated as moderate.

Site Description: The project area consists of a groundwater plume contaminated by oilfield brine moving in an east-southeasterly direction. The apparent source for the contamination is salt-water disposal ponds that were associated with activities in the Schulte oil field and some wells in section 6. The site is situated between Wichita Mid-Continent Airport to the northeast and the unincorporated town of Schulte to the west. The land use is a combination of light industrial, agricultural and residential. The aquifer consists of unconsolidated sand, clay, and gravel deposits. New construction of commercial/industrial complexes have occurred directly east of the recovery wells at the site. Local geology consists of topsoil underlain by a brown to reddish clay to silty clay inter mixed with sand lenses. Upper clay thickness ranges from 8.5 feet to 33 feet from east to west. Below the top clay there is poorly sorted sand and gravel beds intermixed 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 aquatard that can be up to 60 feet in thickness near the west end of the site. Below the middle clay aquatard 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 within the two sand units that reside above the Permian bedrock but in between substantial clay layers. The middle clay aquatard separates the two aquifers and historical investigations suggest that the brine plume has in the past migrated along the top of this aquatard. Groundwater below the aquatard in the area of the plume has been tested and appears to be historically uncontaminated. The groundwater movement is to the east south-east, with almost easterly movement along the eastern edge of the site.

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

Status of Project: Remediation by the KCC began at this site on November 1, 2001. The site currently consists of 2 recovery wells, 11 monitoring wells, and one saltwater disposal well that is used to dispose of brine impacted water. On May 15, 2013, ten groundwater monitoring wells (MW-1, MW-6, MW-7, MW-8, MW-9, MW-15, MW-101, MW-201, MW-301, MW-401) were gauged and sampled. Prior to sampling, groundwater levels were measured in each monitoring well using an electronic water level indicator. A submersible Proactive® Water-Spout water pump was used to purge a minimum of three well volumes of groundwater from each well before sampling. Purge water was tested for conductivity prior to being discharged onto the ground surface at the Site or contained in a 250 gallon poly-tank if conductivity was high before disposed of into a deep injection well. The vault at MW-1 has sunk and J-plugs no longer fit underneath the lid. MW-4 was not sampled due to the tree roots blocking the casing. Groundwater samples from each monitoring well were collected in one 250 (ml) polyurethane container for analysis at the KCC District #2 Laboratory. Each sample for this monitoring event was analyzed for the presence of Chloride by United States Environmental Protection Agency (USEPA) Method 9253 (Titrimetric, Silver Nitrate).

Groundwater levels below the ground surface ranged from approximately 11.89 to 28.90 feet in the sampled wells during the May 15, 2013 event, and decreased an average of 1.53 feet since the May 21, 2012, gauging event. Groundwater flow direction flows to the southeast towards the center of the site before turning to an easterly direction. The western hydraulic gradient was found to be 0.000983302 ft/ft between MW-1 and MW-9, and the eastern gradient was 0.003095395 ft/ft from MW-401 to MW-301. This indicates a slower water movement to the southeast before the gradient increases to the east as it approaches the Cowskin Creek.

Level of Remediation Sought:

Ideal: 250 mg/l Chloride
Target: 500 mg/l Chloride

Recommendations for Future Work: The East Recovery Well Pump has been replaced. The North and East Recovery Wells alternate bi-weekly running. Continue to notify the local water-well contractors of the dangers of constructing wells through both aquifers is needed. KCC plans to approach many of the domestic well owners for permission to sample their well water for Chlorides. The disposal well seems to be taking water at a rapid rate at the current time after being acidized last year.

The data resulting from the May 2013 groundwater sampling event show slight increases in the monitoring wells located down gradient in the center of the plume. Slight increases occurred along the outskirts of the plume in the southern delineation well MW -07. There was a slight decrease in the eastern edge of the plume in MW-401. It is expected that the plume will slowly migrate to the southeast then to the east towards Cowskin creek. The industrial area to the southeast of the plume has many large groundwater wells that could pull the plume to the south further, but this possibility has not been confirmed. Addition down gradient wells would be beneficial for monitoring the plume migration as well as its delineation.

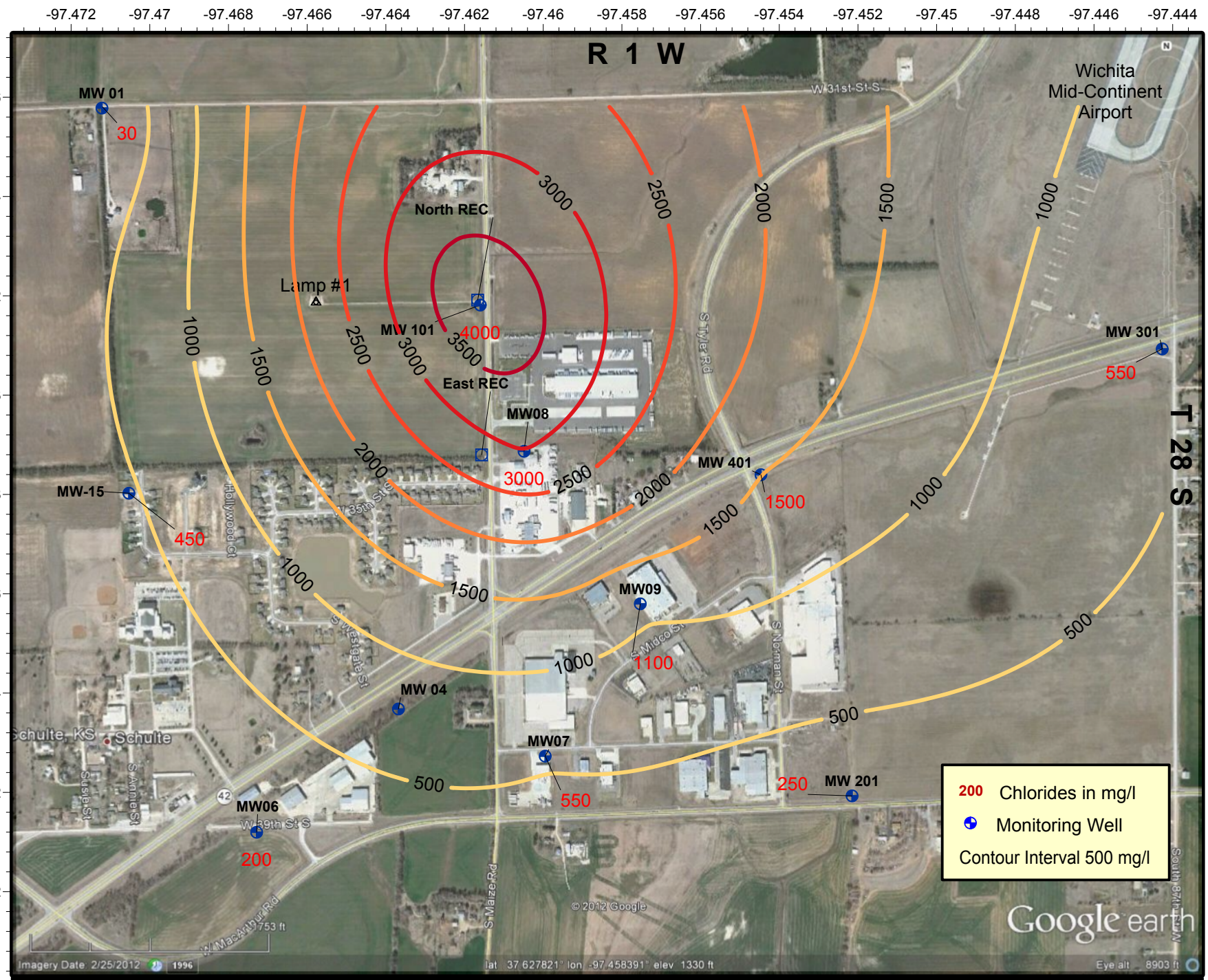
Estimated Total Costs: $8,000-10,000 to upkeep the remediation system, perform annual groundwater sampling, and continue investigation of new water wells currently being installed inside the known plume.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Fund Expenditures Total
970015-00	207 Hrs. / $5,312.41	$3,799.65	$146,394.68

Current Contaminate Level: 30 mg/l in MW #1 to 4,000 mg/l in MW# 101

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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-97.468
-97.466
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-97.46
-97.458
-97.456
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-97.45
-97.448
-97.446
-97.444
37.636
37.634
37.632
37.63
37.628
37.626
37.624
37.622
37.62
R 1 W
T 28 S
Wichita
Mid-Continent
Airport
W 31st St S
MW 01
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Lamp #1
MW 101
4000
3500
3000
2500
2000
1500
1000
East REC
MW08
MW 301
550
S Tyler Rd
MW 401
1500
MW-15
450
Hollywood Ct
W 35th St S
MW09
1100
S Midco St
S Norman St
S Westgate St
MW 04
Schulte, KS
Schulte
MW07
550
MW 201
250
500
MW06
W 39th St S
200
S Maize Rd
W MacArthur Rd
753 ft
© 2012 Google
Google earth
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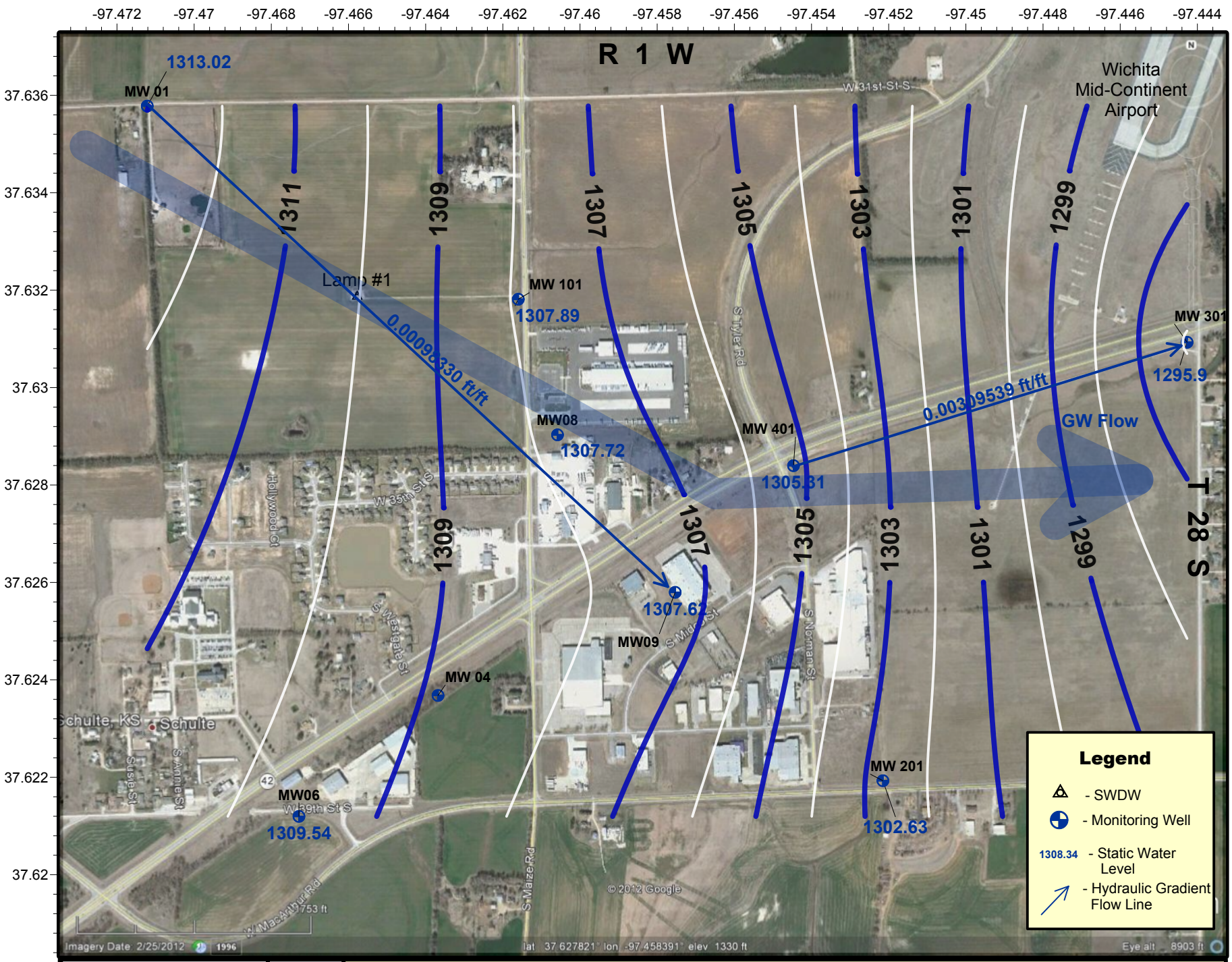
1996
lat 37.627821° lon -97.458391° elev 1330 ft
Eye alt 8903 ft
200 Chlorides in mg/l
Monitoring Well
Contour Interval 500 mg/l
Kansas
N
Schulte Contamination Site - Monitoring and Remediation Wells
Sections 7 & 8, T 28 S & R 1 W, Sedgwick County, Kansas
Groundwater Chloride Concentrations May 2013
KCC Project Number #970015-00 - District #2 - B. Milner - Map Drawn:7/22/13 - Site Sampled:5/15/2013


-97.472
-97.47
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-97.466
-97.464
-97.462
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-97.45
-97.448
-97.446
-97.444
37.636
37.634
37.632
37.63
37.628
37.626
37.624
37.622
37.62
R 1 W
T 28 S
1313.02
MW 01
1311
1309
1307
1305
1303
1301
1299
Wichita
Mid-Continent
Airport
W 31st St S
Lamp #1
MW 101
1307.89
0.00096330 ft/ft
S Tyler Rd
MW 301
1295.9
0.00309539 ft/ft
GW Flow
MW08
1307.72
MW 401
1305.31
1307.62
MW09
MW 04
Schulte, KS
Schulte
MW06
W 39th St S
1309.54
MW 201
1302.63
S Maize Rd
© 2012 Google
Imagery Date 2/25/2012
lat 37.627821° lon -97.458391° elev 1330 ft
Eye alt 8903 ft
Legend
- SWDW
- Monitoring Well
1308.34 - Static Water Level
- Hydraulic Gradient Flow Line
Kansas
N
Schulte Contamination Site - Monitoring and Remediation Wells
Sections 7 & 8, T 28 S & R 1 W, Sedgwick County, Kansas
Static Groundwater Elevations May 2013
KCC Project Number #970015-00 - District #2 - B. Milner - Map Drawn:7/22/13 - Measured: 5/15/13

Project: ***Selzer -Bitikofer Contamination Site***

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 Site currently comprised of agricultural fields, pastures, and residences.

Impact\Immediacy: The site affects West Emma Creek and local groundwater. The immediacy level of the site is listed as moderate.

Site Description: Geologically, the site is located in far eastern edge of the Lower Arkansas River basin, and is characterized by fine textured soil with a silty clay loam surface soil and a strong 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 ranging from 0-3 percent. Based on the site evaluation to date, the underlying material to a depth of approximately 35 feet was found to consist primarily of stiff clay and/or sandy clay, overlying fine to coarse sands of varying thickness. The sand member is underlain by an impermeable dense clay layer that is consistent throughout the site. Bedrock in the area consists of the Kiowa Shale Formation and lies approximately 50-70' below ground surface (KGS Bulletin 79). Bedrock was never encountered during site activities.

Based on groundwater data from the present site investigation, shallow groundwater is found at depths ranging from approximately 6 to 13 feet bgs at the site, and groundwater flow in the surface aquifer beneath the site to the south and southwest and nearly west closer to West Emma Creek. The principal water-bearing formation in the subject site area is thin varying thickness unconsolidated sand that lies between clay layers. This sand varies from fine to coarse grained and pinches off in some locations.

Based on information obtained from the Kansas Rural Water Association, the subject site area is serviced by Marion Rural Water District (RWD) #4. Based on information obtained from the KGS WWC5 Database, there are no public water supply (PWS) wells located within 1-mile from the subject site. There are three domestic wells (Bitikofer, Selzer and Huebert) located within ¼-mile from the subject site, but there known unregistered and open water wells in the area.

Unusual Problems: An aggressive withdrawal system could render the local water wells and West Emma Creek dry.

Status of Project: KCC mobilized to the site and performed Phase II Investigation on June 26, 27, and 28, 2012. Continuous soil samples were collected from 14 logged probe locations and blind pushes in 5 locations. Groundwater was generally encountered at depths ranging from 9 to 14 feet below ground surface (bgs) during the probing investigation. A 6620DT Geoprobe® direct-push, track-mounted drilling unit was utilized to collect soil samples for field logging and/or laboratory analyses from the prescribed probe locations. All probes were advanced to the base of the sand member and into the aquatard. A full written report including scope of work, tables, maps, 3-D models, and conclusions was generated by KCC District #2. KCC is currently using this information to produce a new scope of work that will include additional monitoring well installation in order to delineate the multiple brine plumes.

On September 26, 2013, seven groundwater monitoring wells (MW-1, MW-3, MW-4, MW-5, MW-6, MW-7, Klaassen East) were gauged and sampled. The Klaassen West well had been hit by agricultural equipment and broken off to the surface so it was not sampled. Each sample for this monitoring event was analyzed for the presence of Chloride by United States Environmental Protection Agency Silver Nitrate Buret Titration Method 8225. All monitoring wells were found to be above 250 mg/L chlorides, ranging from 1,400 to 3,500 mg/L. There are currently no monitoring wells capable of delineating either plume.

Level of Remediation Sought:
Ideal: 250 mg/l Chloride
Target: 500 to 750 mg/l Chloride

Recommendations for Future Work: KCC will produce a scope of work that include the installation of monitoring wells and addition investigative borings in order to delineate the three plumes found at the Selzer-Bitikofer Site. Work on this scope should be finished by late fall 2013. Field work should be done before mid-year 2014. KCC plans to plug the Klaassen West well as it is not needed with the MW-6 located just across the street.

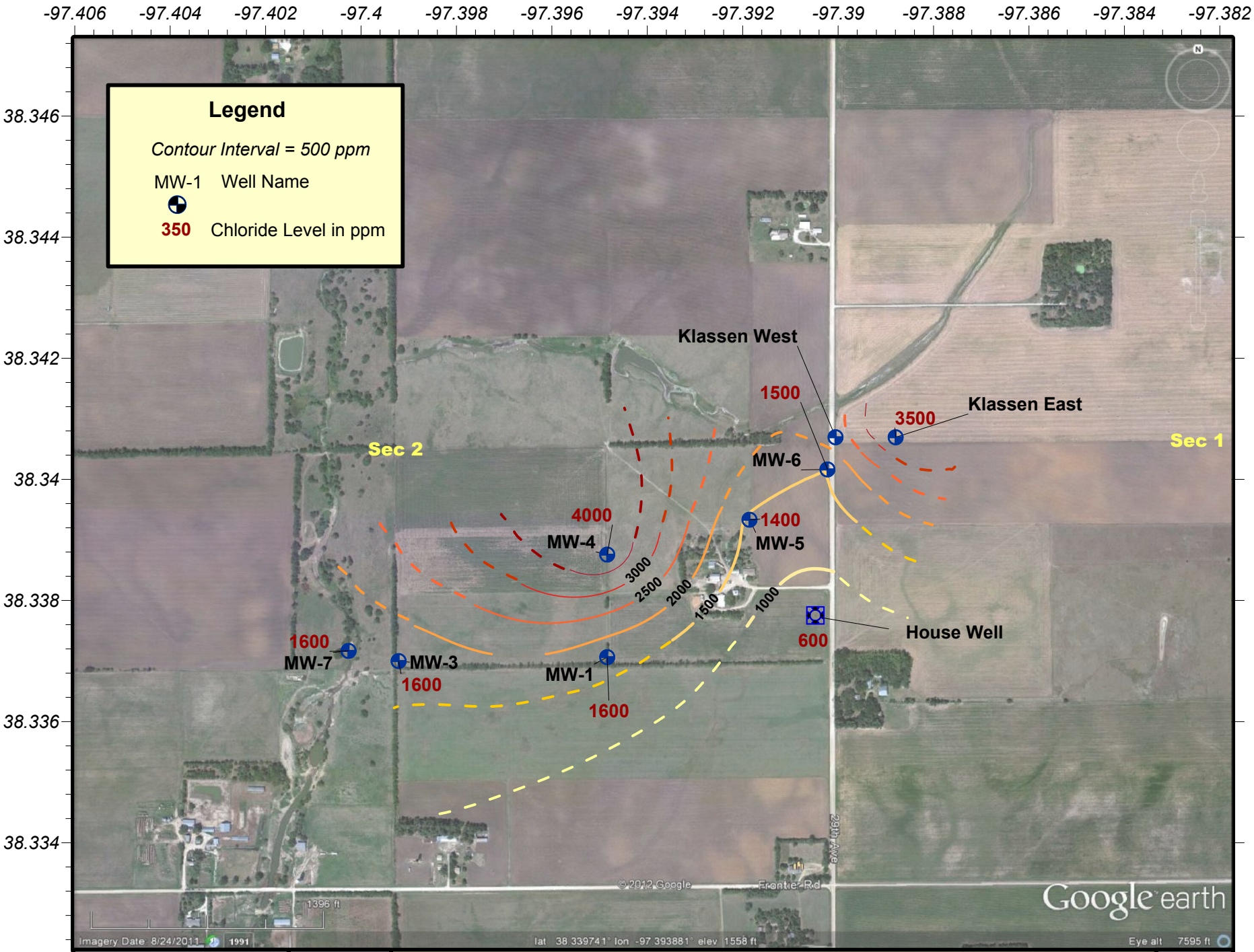
Estimated Total Cost: $20,000 to 25,000 to perform routine sampling, research into the northern plume, and installation of multiple monitoring wells.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Total
970093-00	22 Hrs. / $585.26	$5,204.25	$12,133.50

Current Contaminate Level: 1400 mg/l (MW-5) to 4000 mg/l Cl (MW 4) 9/26/2013

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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-97.396
-97.394
-97.392
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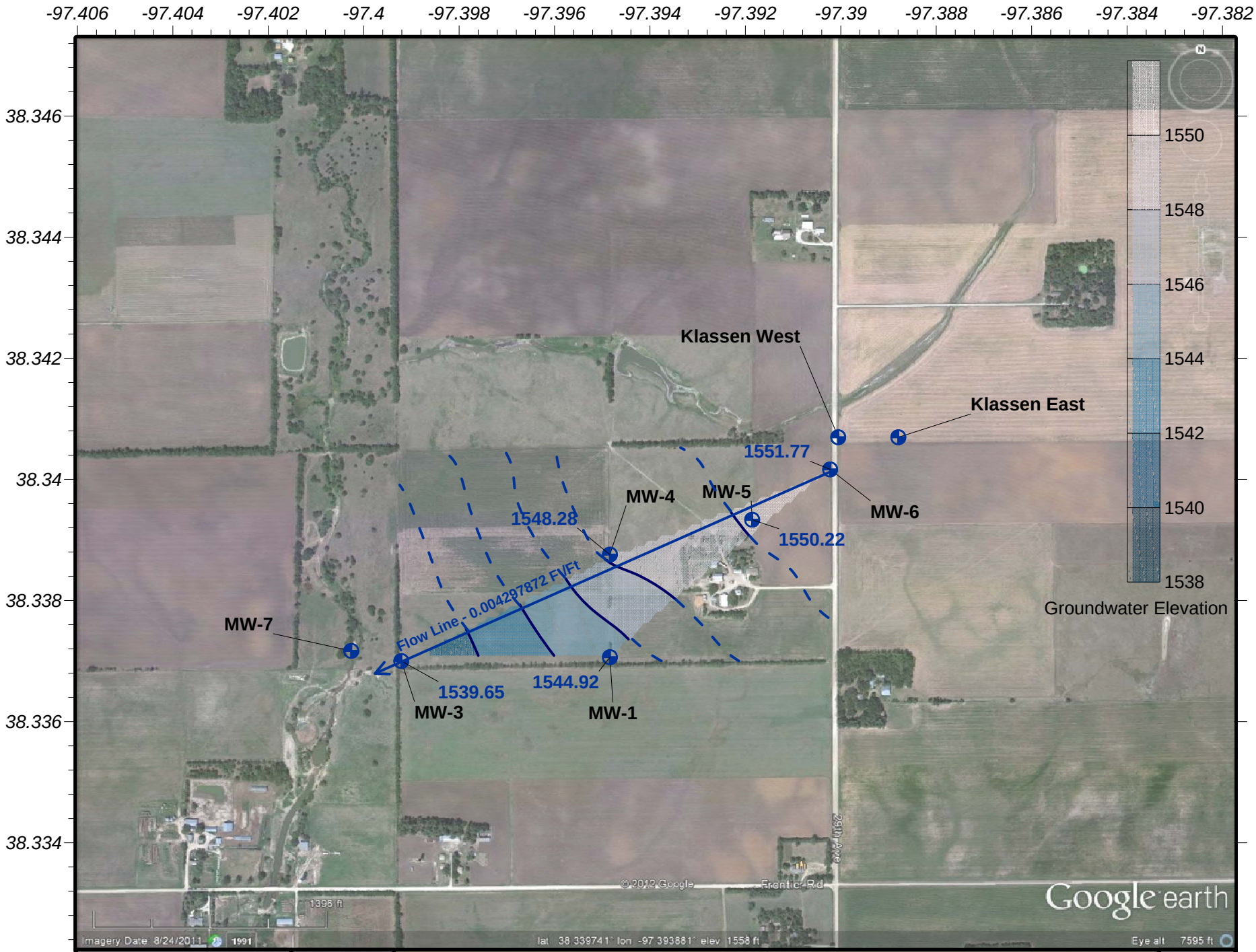
-97.388
-97.386
-97.384
-97.382
38.346
38.344
38.342
38.34
38.338
38.336
38.334
Legend
Contour Interval = 500 ppm
MW-1 Well Name
350 Chloride Level in ppm
Klassen West
Klassen East
1500
3500
Sec 2
Sec 1
MW-6
4000
MW-4
1400
MW-5
3000
2500
2000
1500
1000
600
House Well
1600
MW-7
MW-3
1600
MW-1
1600
29th Ave
Frontier Rd
© 2012 Google
Google earth
1396 ft
Imagery Date 8/24/2011
lat 38.339741° lon -97.393881° elev 1558 ft
Eye alt 7595 ft
N
Kansas
Corporation Commission
Selzer-Bitikofer Contamination Site
KCC Control #9700093-00 - District #2 - Map Drawn on 9/30/2013 by D. Bollenback
2013 Chlorides Map
Sections 1 & 2, T20S and R1W, McMpherson County, Kansas
Figure
1



Kansas Corporation Commission

N

Selzer-Bitikofer Contamination Site

KCC Control #9700093-00 - District #2 - Map Drawn on 9/27/2013 by D. Bollenback

Static Groundwater Elevation Map

Sections 1 & 2, T20S and R1W, McMpherson County, Kansas

Figure 1

Project: ***Smith Finn Contamination Site***

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 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: Progress continues to be made towards closure of the site. Chlorides continue to decrease overall throughout the site. The KCC and Anadarko agreed to plug the MW-9 well. It will be plugged on October 8, 2013. There are ongoing discussions as to whether a replacement well for the MW-9 needs to be drilled. Much of the current work is to find the small areas that are problematic and remediate those areas.

Level of Remediation Sought:

Ideal: 250 ppm Chloride
Target: 500 ppm Chloride

Recommendation for Future Work: It is likely that MW-9, along with MW 10-8, MW 11-8, and MW 12-8 will be plugged in the near future. PW-4 will remain operational until chlorides have dropped close to or into the fresh water standard. The KCC has been in discussion with ARCADIS to determine if a replacement well for the MW-9 needs to be installed when it is plugged. If a decision is made to install a well, it will likely be to the southeast of where MW-9 is currently located. As the site has continued to make significant progress in the removal of chlorides, the project will begin to transition out of a remedial phase, into a monitoring phase.

Estimated Total Costs: $200,000 for PRP.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970095-00	**14 Hrs. / $365.66**		

Current Contaminate Level: 7.46 ppm Cl- to 8,290 ppm Cl-

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**

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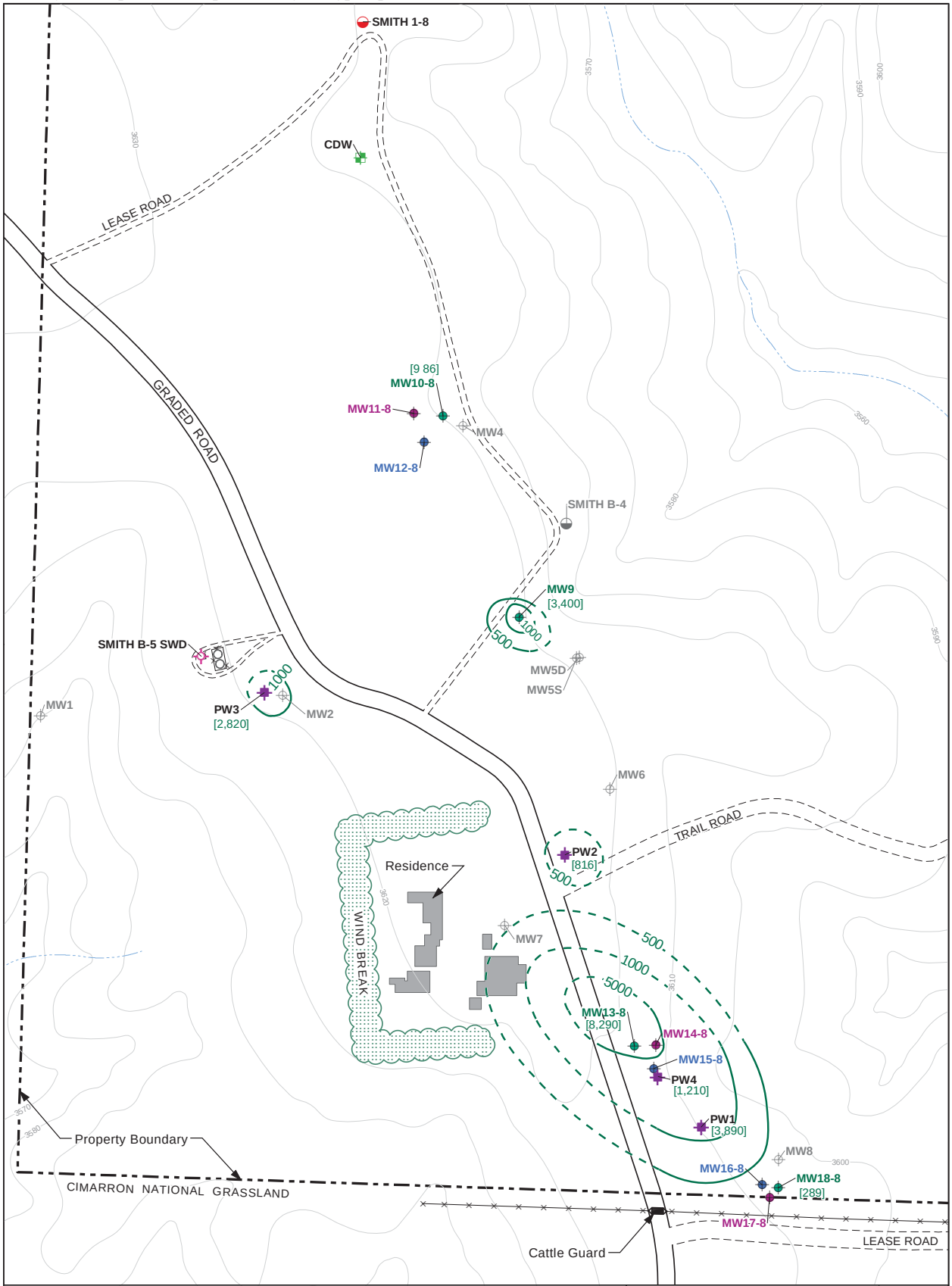

LEGEND

- Shallow Zone Monitoring Well
- Intermediate Zone Monitoring Well
- Deep Zone Monitoring Well
- Plugged and Abandoned Monitoring Well
- Current Domestic Well
- Recovery Well
- Salt Water Disposal Well
- Oil & Gas Well
- Plugged and Abandoned O I & Gas Well

500 — Chloride isoconcentration contour for shallow wells, dashed where inferred

[289] — Shallow well chloride concentration (mg/L)

NOTE

1. MW9 originally screened three water bearing zones. April 2006 monitoring network modifications included plugging off the lower 2 intervals. For the purposes of these figures, MW9 is effectively considered as a shallow zone well.
2. Extraction wells PW1 and PW2 screen both the shallow and intermediate zones. Extraction well PW3 and PW4 screen the shallow, intermediate, and deep zones.
3. All values are in milligrams per liter (mg/L).
4. Chloride isoconcentration maps are interpreted from groundwater analytical results and the geophysical electrical resistivity survey.

N, W, E, S

0 100 200 Feet

Prepared For: Anadarko Petroleum Corporation

Designed: JLB

Title: **Chloride Isoconcentration Map for Shallow Wells November 2012**

Smith Finn - Elkhart, Kansas

Drawn: JC

Checked: DDG

2012 Annual Report

Morton County, Kansas

Revised: NA

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Date: 12/20/2012

Figure: 7

ARCADIS

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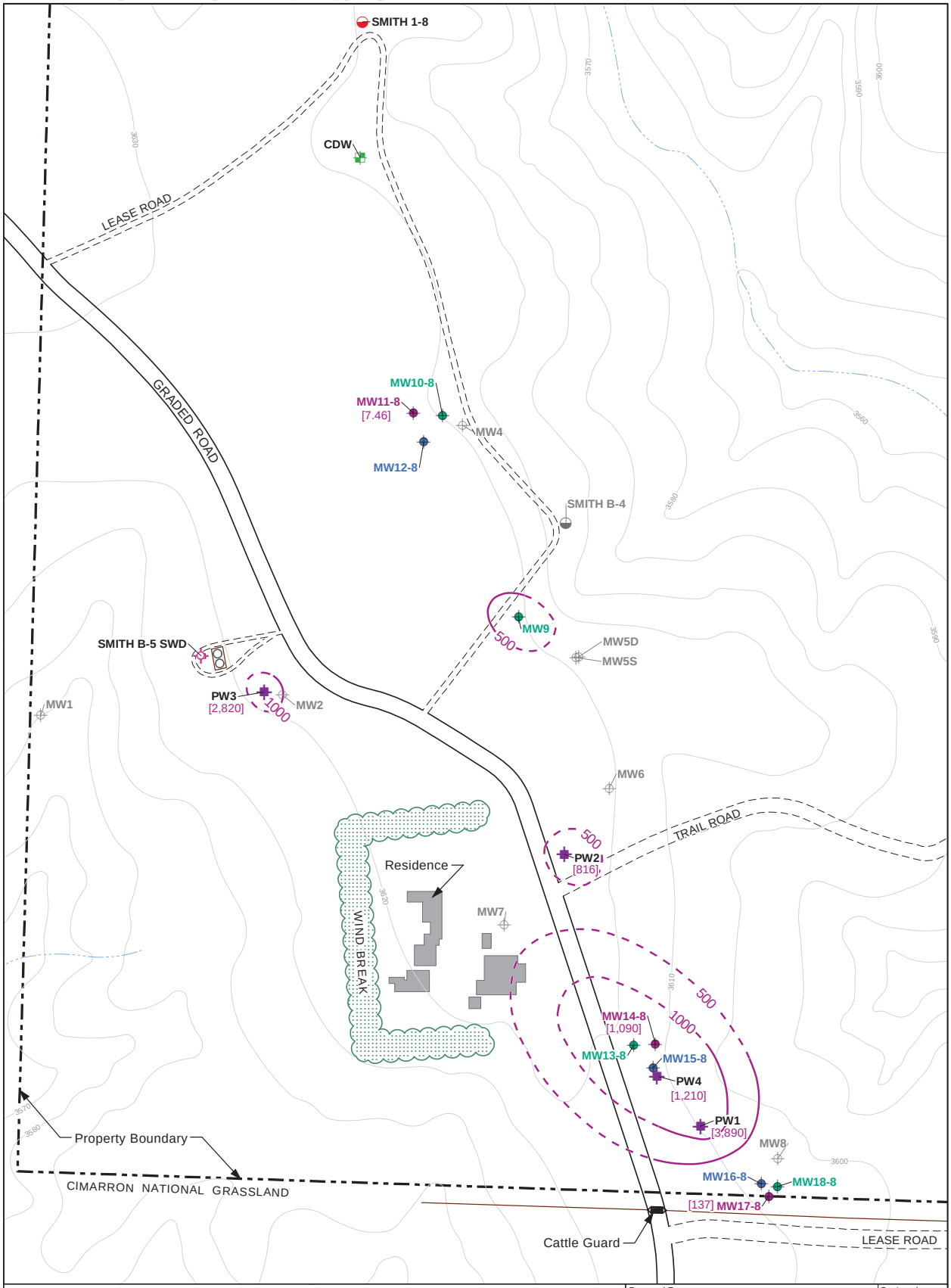

LEGEND

- Shallow Zone Monitoring Well
- Intermediate Zone Monitoring Well
- Deep Zone Monitoring Well
- Plugged and Abandoned Monitoring Well
- Current Domestic Well
- Recovery Well
- Salt Water Disposal Well
- Oil & Gas Well
- Plugged and Abandoned Oil & Gas Well

— 500 Chloride isoconcentration contour for intermediate wells, dashed where inferred

[137] Intermediate well chloride concentration (mg/L)

NOTE

1. MW9 originally screened three water bearing zones. April 2006 monitoring network modifications included plugging off the lower 2 intervals. For the purposes of these figures, MW9 is effectively considered as a shallow zone well.
2. Extraction wells PW1 and PW2 screen both the shallow and intermediate zones. Extraction well PW3 and PW4 screen the shallow, intermediate, and deep zones.
3. All values are in m l igrams per liter (mg/L).
4. Chloride isoconcentration maps are interpreted from groundwater analytical results and the geophysical electrical resistivity survey.

N W E S

0 100 200 Feet

Prepared For: Anadarko Petroleum Corporation

Title: **Chloride Isoconcentration Map for Intermediate Wells November 2012**

Smith Finn - Elkhart, Kansas

2012 Annual Report

Morton County, Kansas

File Q:\GC002026\Fig8_Chloride_IZ.mxd

ARCADIS

Designed	Drawn	Checked	Revised	Date	Figure
JLB	JC	DDG	NA	12/20/2012	8

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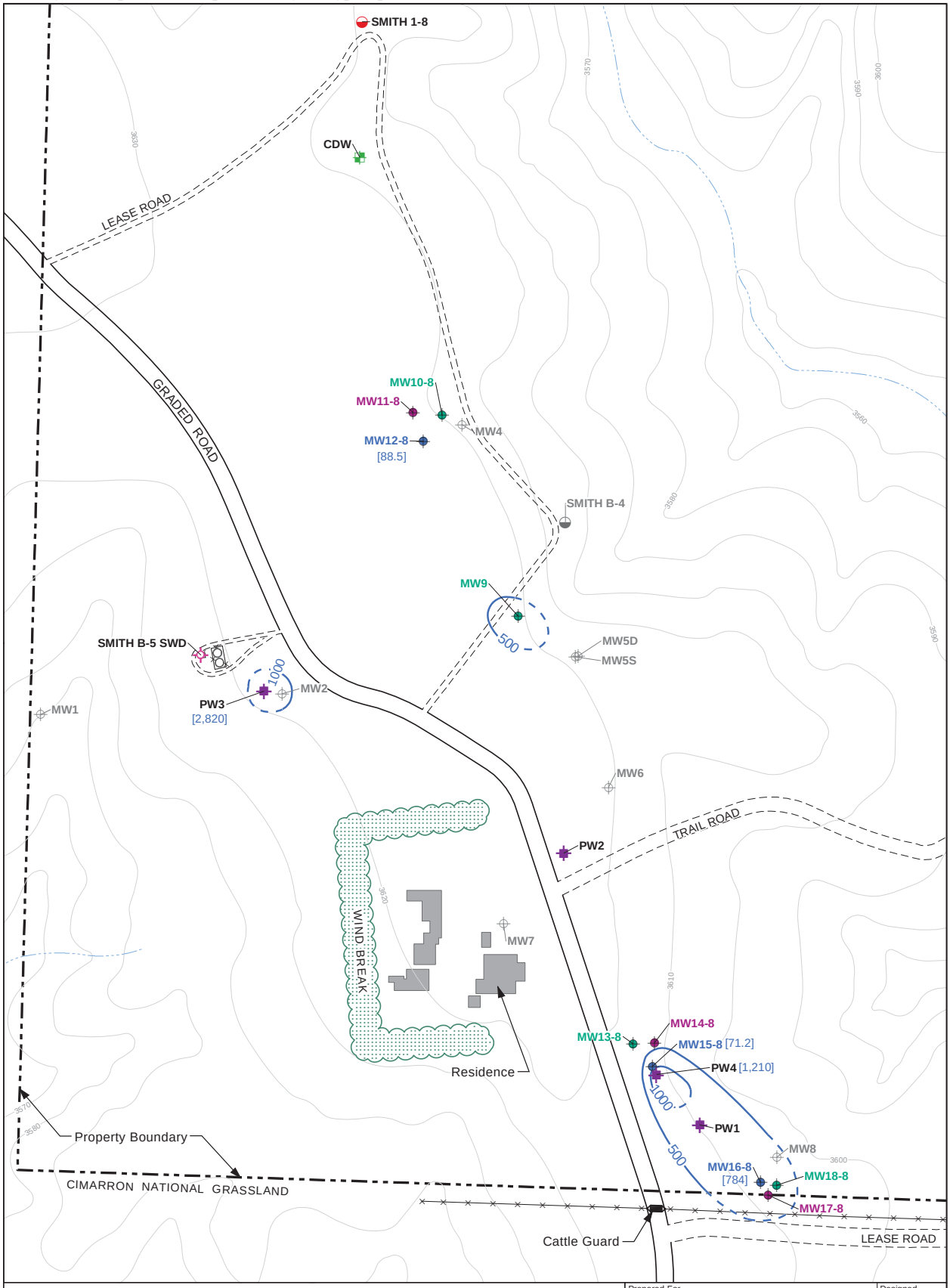


LEGEND

- Shallow Zone Monitoring Well
- Intermediate Zone Monitoring Well
- Deep Zone Monitoring Well
- Plugged and Abandoned Monitoring Well
- Current Domestic Well
- Recovery Well
- Salt Water Disposal Well
- Oil & Gas Well
- Plugged and Abandoned Oil & Gas Well
- 500 — Chloride isoconcentration contour for deep wells, dashed where inferred
- [784] — Deep well chloride concentration (mg/L)

NOTE

1. MW9 originally screened three water bearing zones. April 2006 monitoring network modifications included plugging off the lower 2 intervals. For the purposes of these figures, MW9 is effectively considered as a shallow zone well.
2. Extraction wells PW1 and PW2 screen both the shallow and intermediate zones. Extraction well PW3 and PW4 screen the shallow, intermediate, and deep zones.
3. All values are in milligrams per liter (mg/L).
4. Chloride isoconcentration maps are interpretated from groundwater analytical results and the geophysical electrical resistivity survey.

N W E S

0 100 200 Feet

Prepared For: Anadarko Petroleum Corporation

Designed: JLB

Title: **Chloride Isoconcentration Map for Deep Wells November 2011**

Smith Finn - Elkhart, Kansas

Drawn: JC

Checked: DDG

2012 Annual Report

Morton County, Kansas

Revised: NA

File: Q:\GC002026\Fig9_Chloride_DZ.mxd

Date: 12/20/2012

Figure: 9

ARCADIS

Project: ***South Spivey Contamination Site***

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

Impact: The impacts are to groundwater resources associated with local domestic wells. The site is rated as 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 the grazing of cattle. The surface geology is composed of unconsolidated sand and silt. Underlying this upper layer are fine-grained sands and silts that form the aquifer. The aquifer delivers a small amount of water, but the fluid level is very shallow making the aquifer easily accessible. The depth to the first confining layer is roughly 9 to 12 feet. In December 1994 General Atlantic Resources implemented a remediation plan and began withdrawing contaminated groundwater in the SE quarter of section 27. Due to low water yields the recovery system was shut down in 2000 and the KCC is doing post remediation monitoring.

Unusual problems: Withdrawal rate is low due to low permeability of aquifer.

Status of Project: The KCC has placed the South Spivey Site in an annual sampling program. Natural attenuation of the site is occurring but chloride readings have varied somewhat over the years with the annual precipitation amounts. The contaminated aquifer is so shallow chlorides levels seem to be in direct correlation with precipitation. The highest chloride concentration was from well A-2 and well OB with 1,300 ppm chlorides.

Level of Remediation Sought:

Ideal: 250 mg/l Chloride
Target: 750 mg/l Chloride

Recommendations for Future Work: Continue sampling all monitoring wells and surface waters on an annual basis. No other action is needed at this time.

Estimated Total Costs: $1000 per year for sampling, testing, and research.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970096-00	**18 Hrs. / $462**		

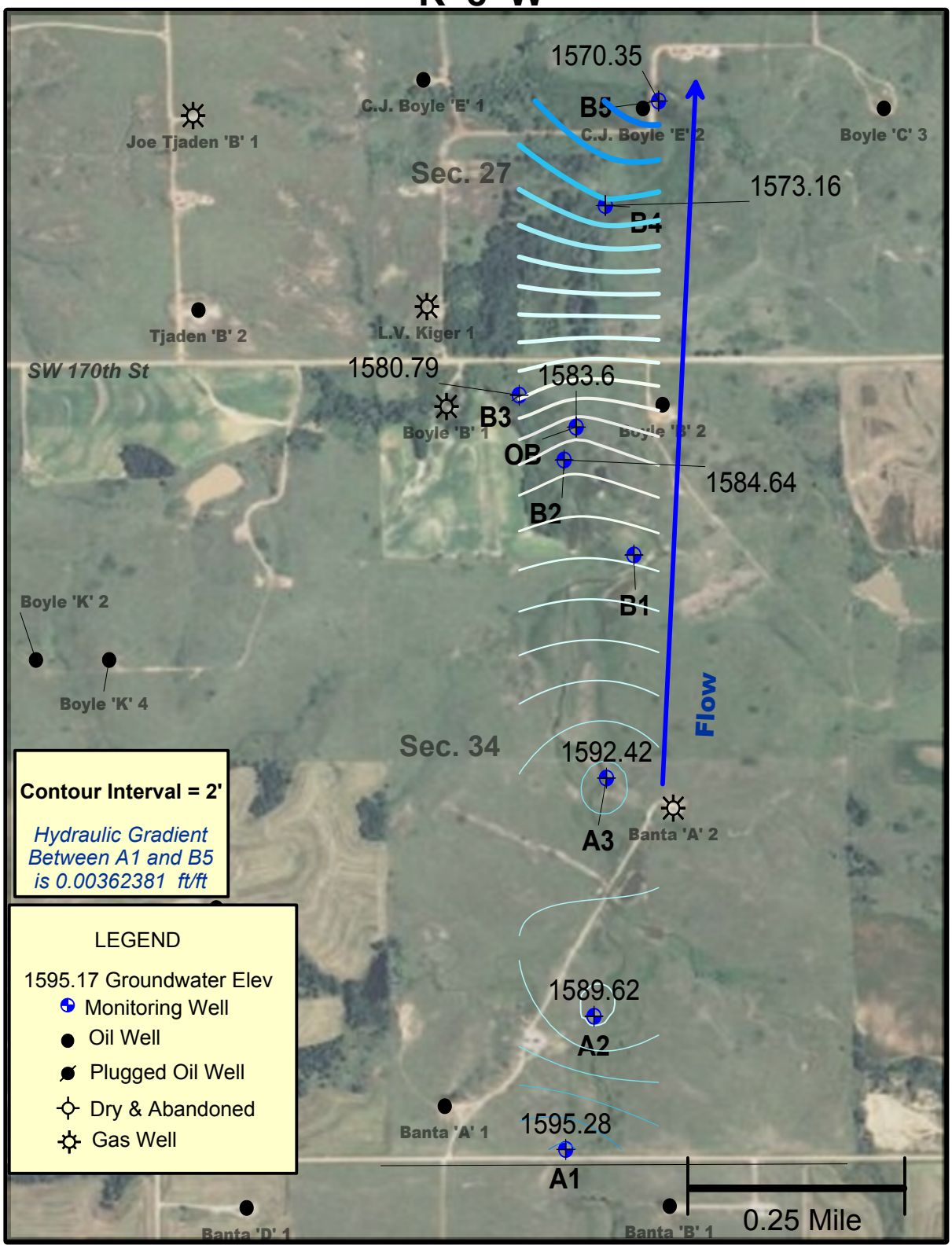
Current Contaminate Level: 10 mg/l to 1,300 mg/l Cl^-

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**

R 8 W

T 30 S



Kansas Corporation Commission

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SOUTH SPIVEY SITE

Control No. 970096-00

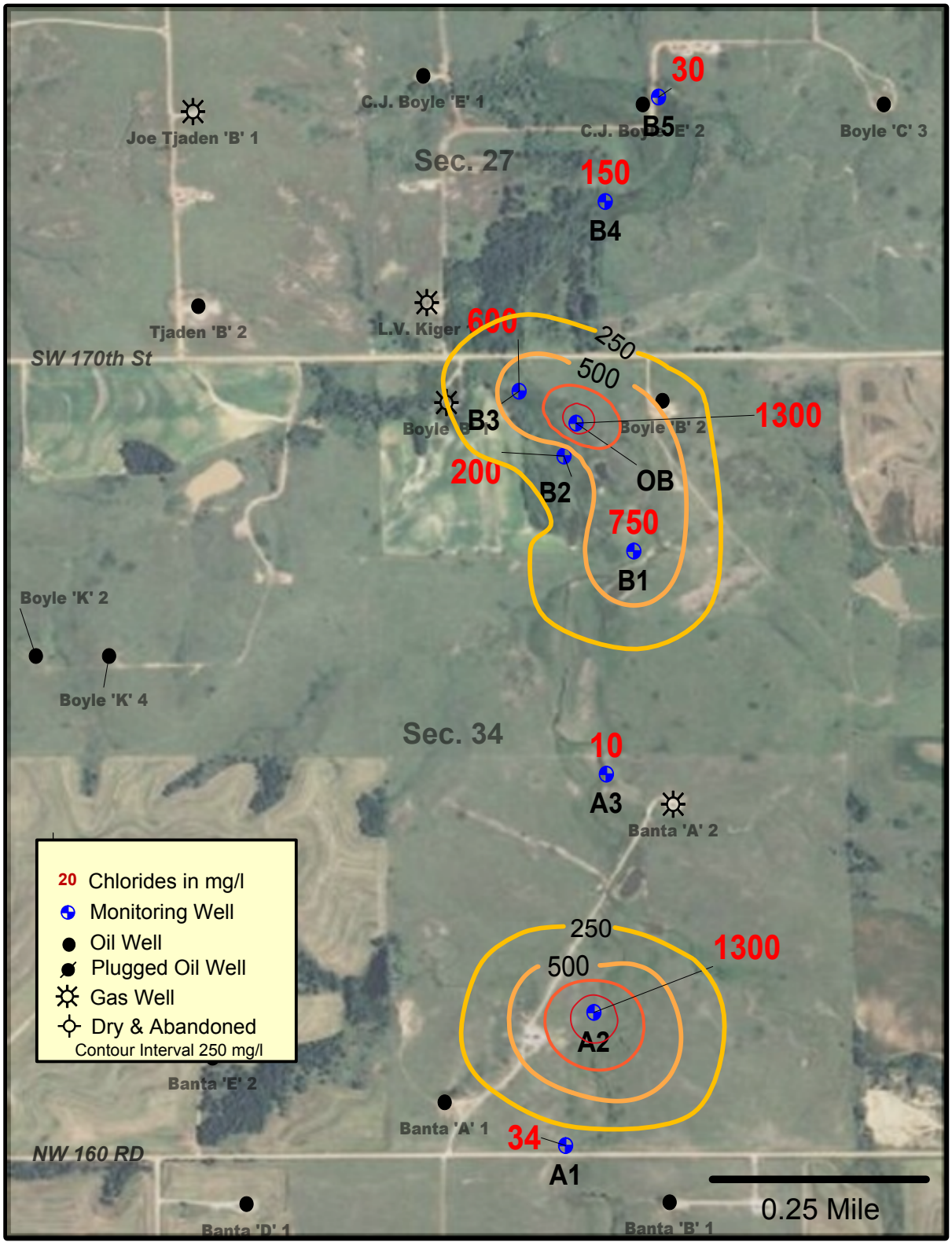
2013-2014 Groundwater Elevation Map

Section 27 & 34 - T30S -R8W, Kingman County

District #2 - B. Milner - 7/26/13

R 8 W

T 30 S



Kansas Corporation Commission

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SOUTH SPIVEY SITE

Control No. 970096-00

2013-2014 Chloride Concentration Map

Section 27 & 34 - T30S -R8W, Kingman County

District #2 - B. Milner 7/25/13

Project: ***South Wichita Chloride Study***

Site Location: The South Wichita site is located near the intersection of the Kansas Turnpike and the Wichita Valley Center Floodway. The site is centered roughly near the intersection of 63rd St. South and Broadway, in south Wichita. The legal location is as follows: Sections 28, 29, 31, 32, 33, and 34 of Township 28 South, Range 1 East and Sections 3 and 4 of Township 29 South, Range 1 East.

Impact: The past impacts or potential impacts are to irrigation, domestic, and municipal water uses. A low level of immediacy is warranted for this site due to the low levels of Chlorides. The area has a very high demand for water resources.

Site Description: The project area consists of a groundwater plume contaminated by oilfield brine moving in a southeasterly direction. The Hydraulic Gradient between Monitoring Wells MW E-1 and MW-399 is 0.000624214 ft/ft as recorded in July 2013. The site is situated in an area that is residential, agricultural, commercial and light industrial many of which utilize the local groundwater aquifer for water. The surface geology is composed of unconsolidated sand and silt. Underlying this zone are sands and gravels that form the aquifer. Historically, the aquifer has delivered large quantities of variable quality drinking water. The depth of most of the domestic water wells in the area range from 30 to 50 feet.

Unusual Problems: The urban setting restricts the placement of monitoring wells and any warranted disposal equipment/wells. Even after 20-plus years many of the public still remember and are interested in the brine pollution in the area. The site was originally discovered at the historically popular Blood Orchard which was ruined by brine contamination and the associated death of the fruit trees, which were never brought back. The brine pollution has caused lingering hard feelings from many of the area residents.

Status of Project: This historical chloride plume from Blood Orchard has moved to the east-southeast at a very slow rate and has continued to decrease in chloride levels every year. Chloride levels in 2013 have continued in the downward trend that we recorded in 2012. MW-K-8 was not sampled and could not be found in the vegetation, it is unknown if the well is still there has recent bridgework may have destroyed it. Only monitoring wells 11A, MW 11-B and MW-801 were above the KDHE standard of 250 mg/l Chlorides and if this trend continues it could be possible to close this site in the next couple of years or move it into a biennial program. Due to the huge public demand for water resources in the immediate area and the lingering but limited petroleum production, it is recommended that after closure that the monitoring well network should be shrunk but some wells maintained as a proactive measure in case of new or unforeseen saltwater contamination.

Level of Remediation Sought:
Ideal: 250 mg/l Chloride
Target: 500 to 750 mg/l Chloride

Recommendations for Future Work: KCC recommends that this site move into a biannual sampling program. Most wells are in the ideal range during the last few events.

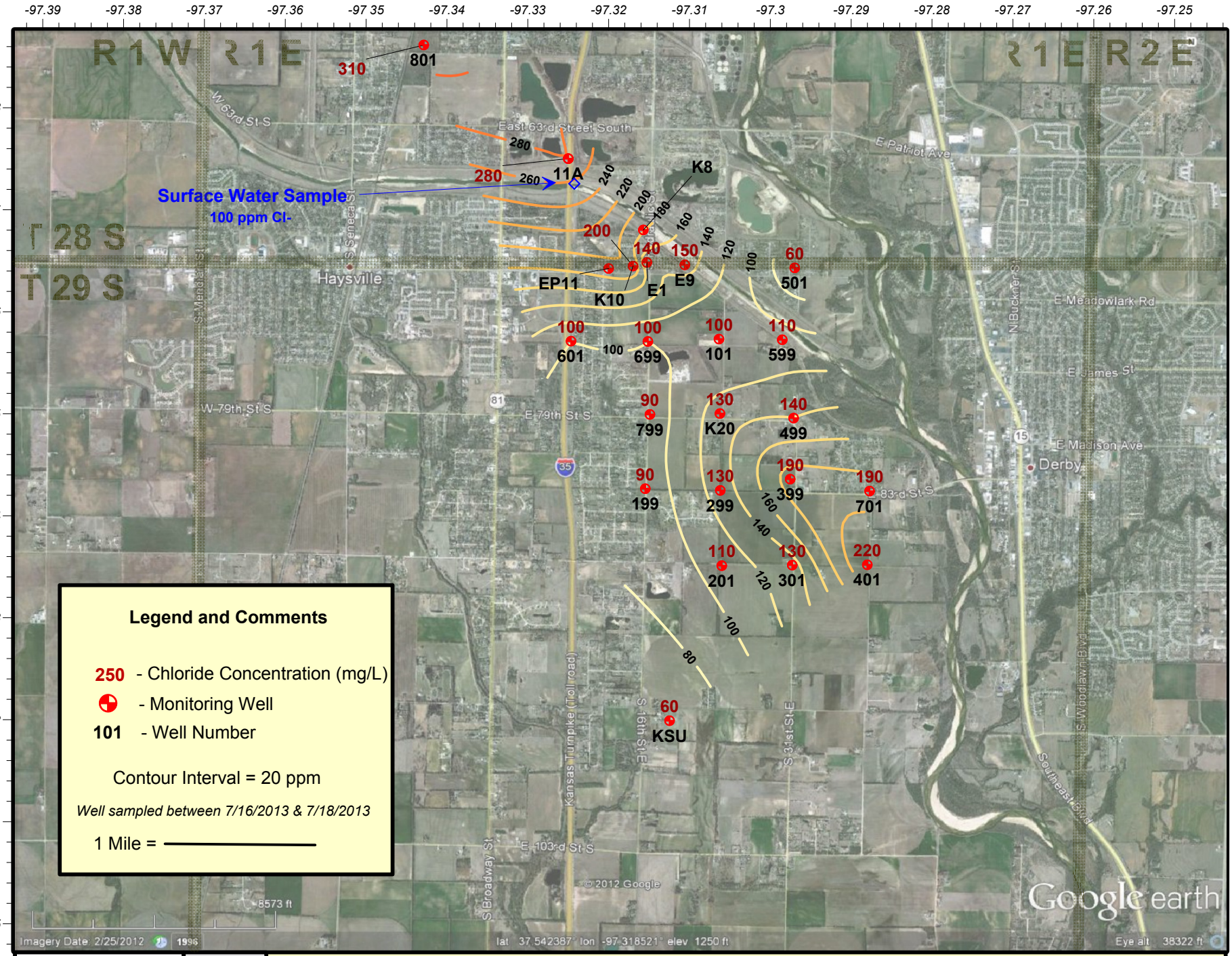
Estimated Total Costs: $6,000 yearly to sample all monitoring wells and perform water analysis.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
970016-00	**42 Hrs. / $1,082.10**		**$10,767.02**

Current Contaminate Level: Highest level is 310 mg/l @ MW-801

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**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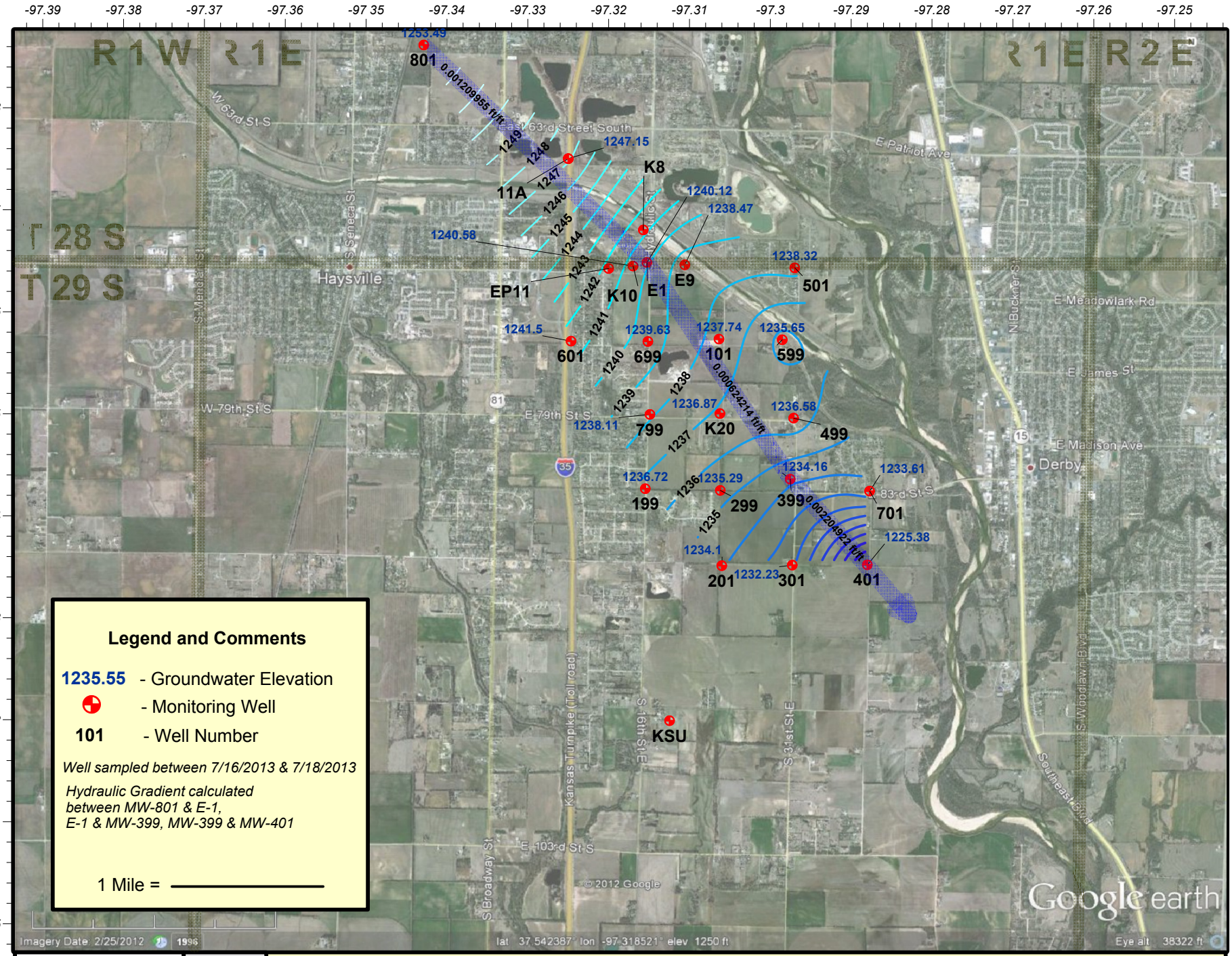
37.58 37.57 37.56 37.55 37.54 37.53 37.52 37.51 37.5
R1W R1E R1E R2E
T 28 S
T 29 S
Surface Water Sample
100 ppm Cl-
310
801
280
280
260
11A
240
220
200
180
160
140
120
100
K8
200
140
150
60
501
EP11
K10
E1
E9
100
601
100
699
100
101
110
599
90
799
130
K20
140
499
90
199
130
299
190
399
190
701
110
201
130
301
220
401
60
KSU
Legend and Comments
250 - Chloride Concentration (mg/L)
- Monitoring Well
101 - Well Number
Contour Interval = 20 ppm
Well sampled between 7/16/2013 & 7/18/2013
1 Mile =
Haysville
Derby
East 63rd Street South
E Patriot Ave
E Meadowlark Rd
E James St
E Madison Ave
W 63rd St S
S Seneca St
S Meridian St
W 79th St S
E 79th St S
83rd St S
N Buckner St
S Broadway St
Kansas Turnpike (Toll road)
S 16th St E
S 31st St E
S Woodlawn Blvd
Southeast Blvd
E 103rd St S
© 2012 Google
Google earth
Imagery Date 2/25/2012
lat 37.542387° lon -97.318521° elev 1250 ft
Eye alt 38322 ft
8573 ft
N
Kansas
Corporation Commission
South Wichita Contamination Site - #970016-00
Multiple Section of T28 & 29 S and R 1 E, Sedgwick County, Kansas
2013 Annual Groundwater Sampleing Event - Chloride Concentrations
KCC District #2 - Drawn by: D. Bollenback on 9/16/2013



Legend and Comments

1235.55 - Groundwater Elevation

- Monitoring Well

101 - Well Number

Well sampled between 7/16/2013 & 7/18/2013

Hydraulic Gradient calculated between MW-801 & E-1, E-1 & MW-399, MW-399 & MW-401

1 Mile = _____

Kansas Corporation Commission

N

South Wichita Contamination Site - #970016-00
Multiple Section of T28 & 29 S and R 1 E, Sedgwick County, Kansas
2013-14 Annual Groundwater Sampleing Event - Groundwater Elevations
KCC District #2 - Drawn by: D. Bollenback on 9/16/2013

Project: ***Stowe- Zaid Contamination Site***

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

Impact/Immediacy: Impact is to the soil and groundwater. This site should be classified as low immediacy with the possibly of effecting 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: Vegetation throughout the scar area has remained the same over the past years. Shallow groundwater levels and underflow are keeping the scar in place, as heavy rains might be pushing chlorides up onto the surface. The farmer planted wheat on the land in 2013; large areas of scar were still clearly visible. The Little Arkansas River is located half mile to the southwest of the site and that is the direction of the ground water flow, northeast to southwest. Investigations have shown that drilling pits and a tank battery could be the sources of the pollution.

Unusual Problems: The ground water table is very shallow due to the close proximity to the Arkansas River.

Status of the Project: The auger data from 2001 along with old aerial photos indicates the source area to be located northeast of the scar area. Up gradient and down gradient delineation has not been achieved to this date. The 2013 water sampling was done July 17, 2013. The lower aquifer tested at 170 mg/l chlorides. The upper water horizon was dry in shallow MW 1, so there is no data for MW-1S in this report. MW-2 at the toe of the scar tested slightly higher in 2013 at 1,100 mg/l. Evidence appears to show that an aquatard is preventing the chlorides from moving down to the lower aquifer.

Recommendation for Future Work: Continue to sample monitoring wells. Due to the shallow nature of the contaminated aquifer it maybe possible to recover chloride polluted water via shallow recovery wells or trench system, but there is no disposal scenario available nearby to dispose of the fluids. In light of this fact long term monitoring is suggested for the site.

Level of Remediation Sought:

Ideal: 50 mg/l
Target: 350 mg/l

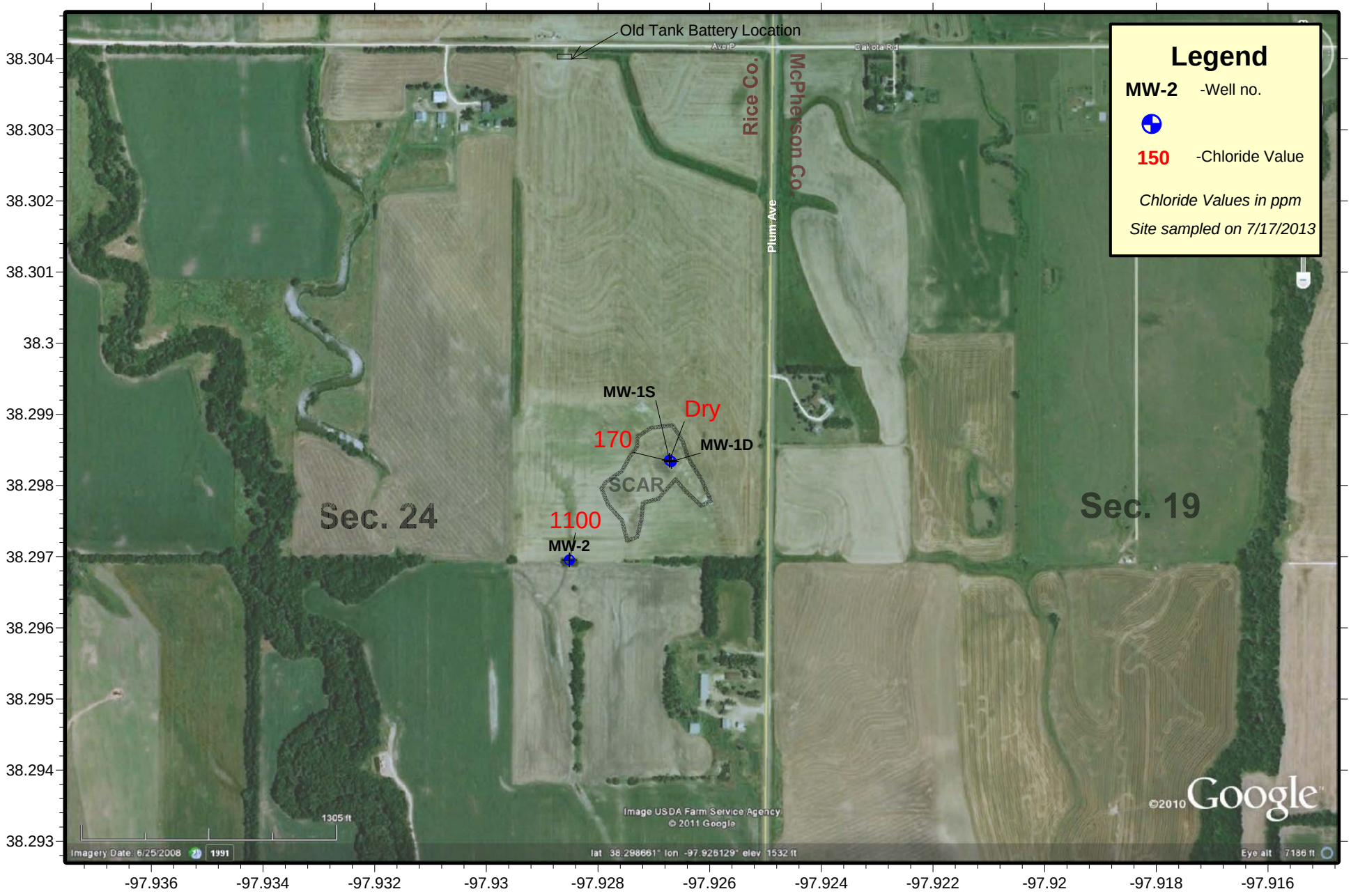
Estimated Total Costs: $800 annually for field inspection and monitoring, and research into ideas/alternatives to remediating the site or at least expediting the attenuation.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
20000035-001	**9 Hrs. / $236.25**		**$4,057.85**

Current Contaminate Level: 1,100 mg/l, MW #2, 7/17/2013
170 mg/l Cl- Deep Aquifer 7/17/2013

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**



Kansas Corporation Commission

N W E S

Stowie-Zaid Contamination Site

NE/4 - Sec. 24 - T 20 S - R 6 W, Rice County, Kansas

2012-13 Chloride Concentrations

KCC Project #20000035-001 - District #2 - B. Milner - 7/23/2013

Project: ***Trostle Contamination Site***

Site Location: The site area is 2.3 miles west and 2.75 miles south of the town of Murdock, Kansas. The legal description is 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 which is located 1 mile north of the site. Sand Creek is a tributary of the South Fork Ninnescah River.

Impact\Immediacy: The high chlorides will impact the ground water affecting stock wells in the immediate area, as well as low lying draws which are usually dry, but containing water with high chlorides after a rainfall. The aquifer is very low yielding. There are erosion effects to the terrain where there is no vegetation. Site is classified as low immediacy.

Site Description: The area most affected is around the Trostle salt-water disposal well. There are seven monitoring wells below the Trostle salt-water disposal well that also have elevated chlorides. The most likely cause was something related to the salt-water tank such as discharges. This site was historically remediated via an interceptor trench but the system was abandoned after the holding tanks failed and the site was placed into the monitoring phase of 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 hit the impermeable red Ninnescah shale. Groundwater then flows down 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 18, 2013, eleven groundwater monitoring wells were sampled. There were two surface water samples from draws on the west and north that were also sampled this year. A polyethylene disposable bailer was used to attempt purge a minimum of three well volumes of groundwater from each well before sampling. Almost all wells bailed dry before 3 well volumes could be purged, and those wells were sampled after recharge had taken place. Purge water was tested for conductivity and contained in a 250 gallon poly-tank if conductivity was high. All contained water was disposed into an authorized SWDW. Groundwater samples from each monitoring well were collected in one 250 (ml) polyurethane container for analysis at the KCC District #2 Laboratory. Each sample for this monitoring event was analyzed for the presence of Chloride by United States Environmental Protection Agency USEPA Silver Nitrate Buret Titration Method - Method 8225.

The data resulting from the August 2013 groundwater sampling event show a marked increase in chlorides in MW-2 and MW-3. There was a marked decrease in MW-4, MW-6, MW-8, MW-10, and MW-11. There was a surface sample taken in the north draw that tested 4,000 mg/l chlorides, and a sample taken in the west draw that tested 1,400 mg/l chlorides. All other monitoring wells were similar levels to 2012. As mentioned above, there were no water levels taken for 2013 due to a malfunctioning water level tape.

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

Recommendations for Future Work: The KCC should sample all monitoring wells and two surface water locations annually over the 2013-14 year in continuance of the current monitoring phase of this site. Due to the isolated nature of this site remediation is not recommended.

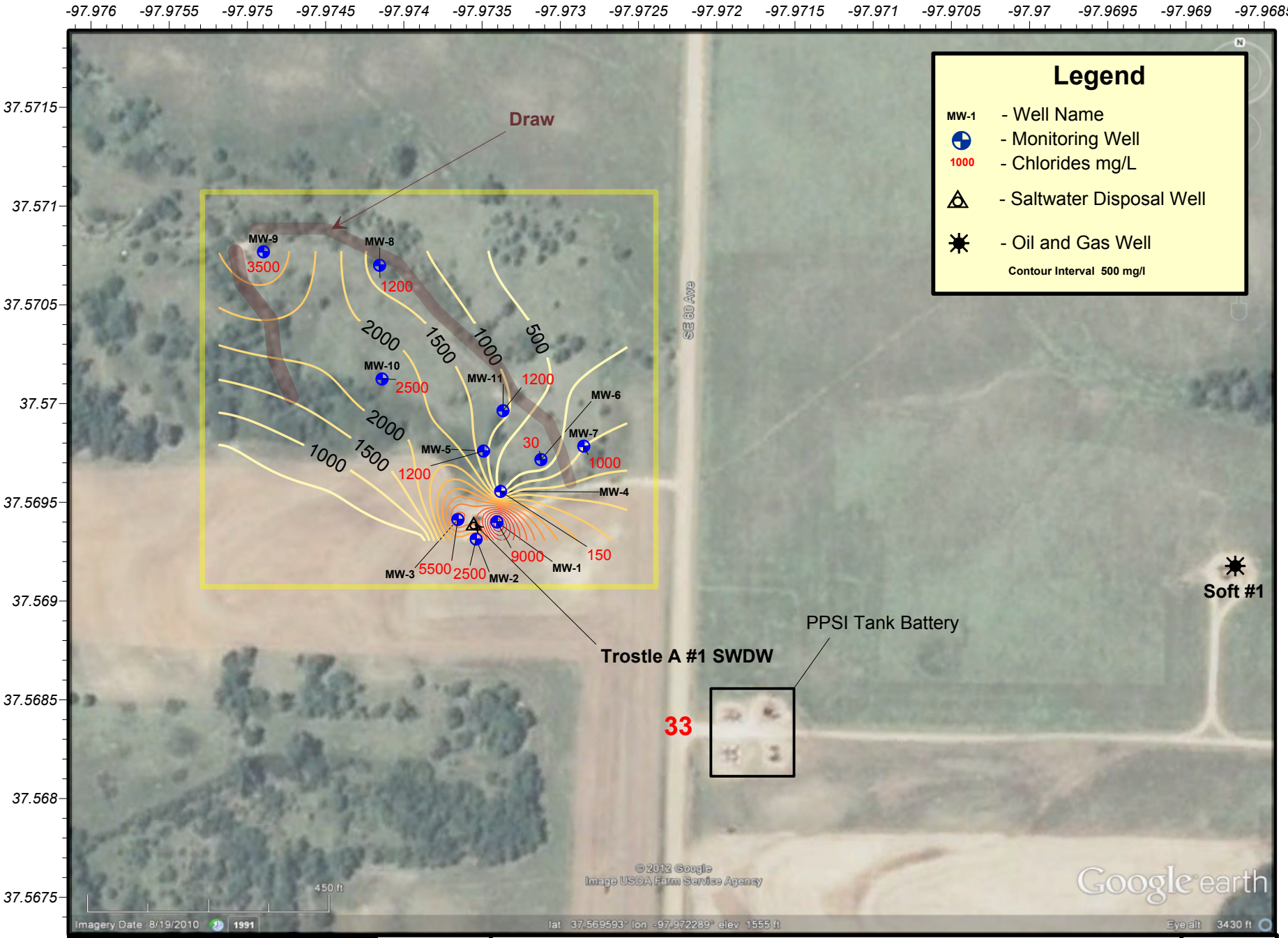
Estimated Long Term Cost: The estimated cost to the KCC will be $800 per year for inspection of site, running an analysis of the water, repair MW-10, and data and report preparation.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Fund Expenditures Total
980038-001	21 Hrs. / $537.25		

Current Contaminate Level: 30 mg/l in MW-6 to 9,000 mg/l chlorides in MW-1

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



Kansas Corporation Commission

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Trostle Contamination and Monitoring Site
2013 Groundwater Sampling - Chloride Concentration Isopact
Section 33 of T28S and R6W, Kingman County, Kansas
KCC Control Number:#980038-001 - Map Drawn 9/20/2013 by B. Milner

Figure 1

Project: ***Voshell Site***

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 to the shallow Equus Beds underlying the Voshell Oil Field, which has been affected by elevated chloride levels. Resources impacted include domestic and irrigation wells. The site is classified as moderate immediacy level.

Site Description: The land surface is flat irrigated farmland, which is dissected by Dry Turkey Creek and Running Turkey Creek. The aquifer ranges in thickness from eighty feet in the east of the site area to approximately two hundred feet in the west. The axis of the relatively thick McPherson channel 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 appears to contain several aquitards, which may or may not be continuous throughout the area.

Unusual Problems: Movement of the chloride plume toward irrigation wells has been somewhat accelerated by the effect of well pumping. The plume will continue to migrate toward the McPherson channel located to the west of the Voshell Oil Field as long as there is deep pumping of the Equus Bed aquifer. New irrigations wells are drilled every year in the immediate area, and can cause erratic hydraulic movements of the plumes.

Status of the Project: In May of 2004, a cooperative agreement between the Kansas Corporation Commission (KCC) and the Equus Beds Groundwater Management District No. 2 (GMD 2) was entered into for the drilling of 10 groundwater monitoring wells in the Voshell oil field. The GMD 2 is responsible for water sampling and providing water quality data to the KCC of those wells. The initial seven wells were drilled north to south through the project area, and were drilled down to the Wellington shale bedrock. Approximately 21 wells associated with the Running Turkey Creek site monitored by the KCC have been moved under the control number of the Voshell site since 2012.

The KCC wells were sampled by KCC District #2 staff in August of 2013. There are multiple wells that are in need of repair or need to be plugged due to age or damage. Due to a malfunction of the water level indicator equipment throughout most of the sampling, KCC was unable to put together a groundwater elevation map of the site.

Level of Remediation Sought:

Ideal: 250 ppm Chloride
Target: 500 ppm Chloride

Recommendation for Future Work: KCC plans to plug and/or repair all wells needing remedial work during the winter of 2013-14. KCC has discussed with GMD #2 adding additional monitoring wells west of the line of GMD wells on the west edge of the site. KCC and GMD could join resources in achieving this. Some detail delineating within the site boundaries are also recommended especially near the high chloride plume within the Voshell Oil Field. KCC will put together a scope of work in order to initiate this work during the winter of 2013-14. Field work could commence as early as the summer of 2014. The KCC District Office will continue putting together hydrologic maps in the future once new equipment is purchased.

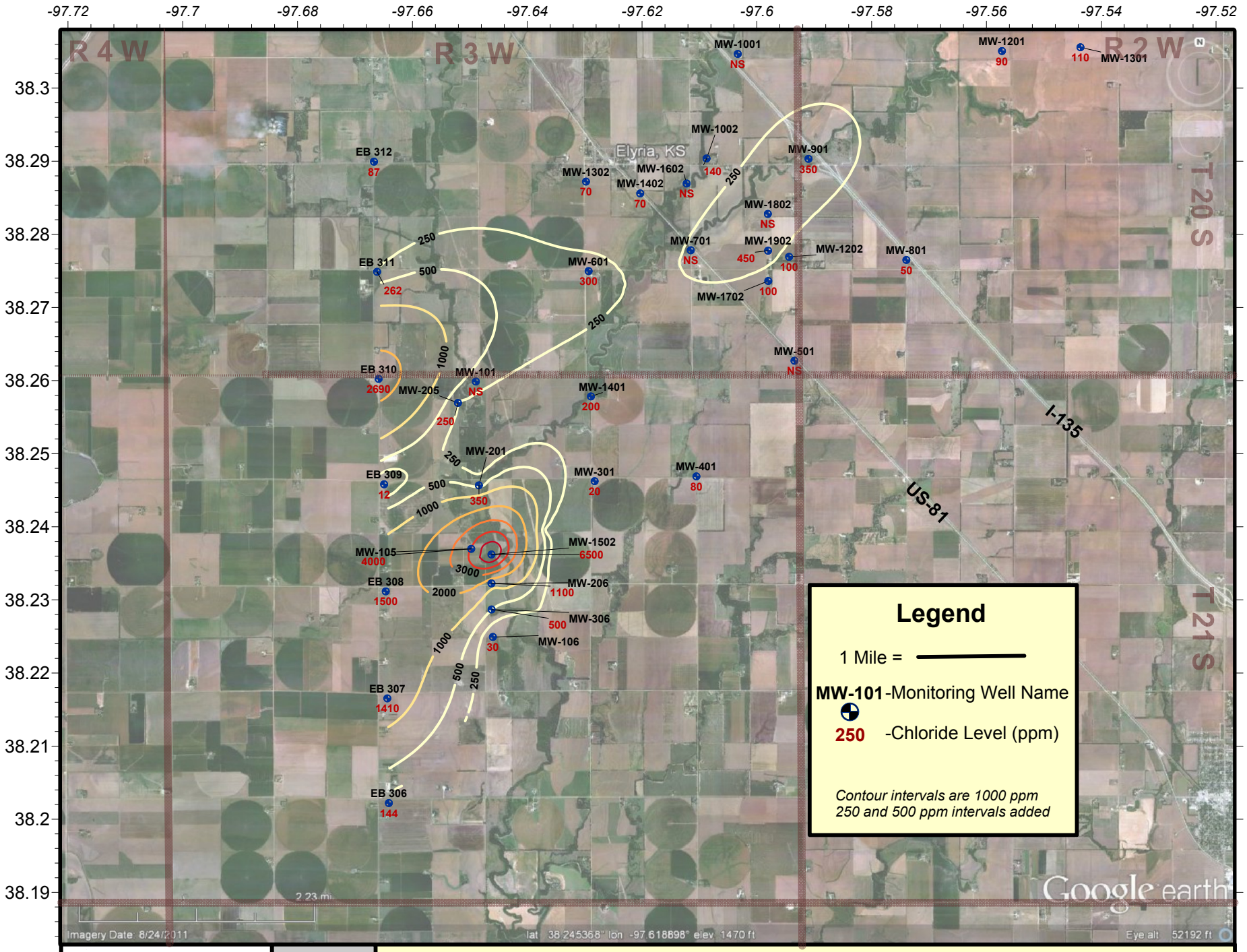
Estimated Total Costs: Funding provided by the KCC for this monitoring program will not exceed $20,000 without written mutual agreement of both parties. KCC believes a cost estimate of $10,000-$25,000 dollars will be needed for the installation of new monitoring wells to delineate the site during 2014.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures**	
		FY 2013/14	**Total**
20030059-001	**44 Hrs. / $1,145.54**	**$378**	**$18,974.44**

Current Contaminate Level: MW-1502 – 6,500 mg/l.

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**



Voshell Contamination Site
Multiple Section of Townships 20 & 21 South and Range 2 & 3 West, McPherson County, Kansas
2013 Groundwater Chloride Levels Map
District #2 - Control Number #20030059-001 - Sampled in August 2013 - Drawn on 10/1/2013 by D.Bollenback

Project: ***Wildboy's Land & Cattle Contamination Site***

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: During 2013, a total of five samples were taken, three from monitoring wells and two from stock wells. The oil field supply well could not be sampled this year. In general, the chlorides at this site have been quite variable. Since the last sampling event in 2012, chlorides have been relatively higher. Current chlorides at the site are between 300 ppm in the western most stock well, and 4000ppm in MW-2. Current number of monitoring wells does not provide adequate coverage of the plume in order to evaluate the extent to the south and southeast. MW-1 has been destroyed since the last time it was sampled in 2007, when the chlorides were 1000ppm.

Level of Chloride Sought:

Ideal: 250 ppm Chloride
Target: 500 ppm Chloride

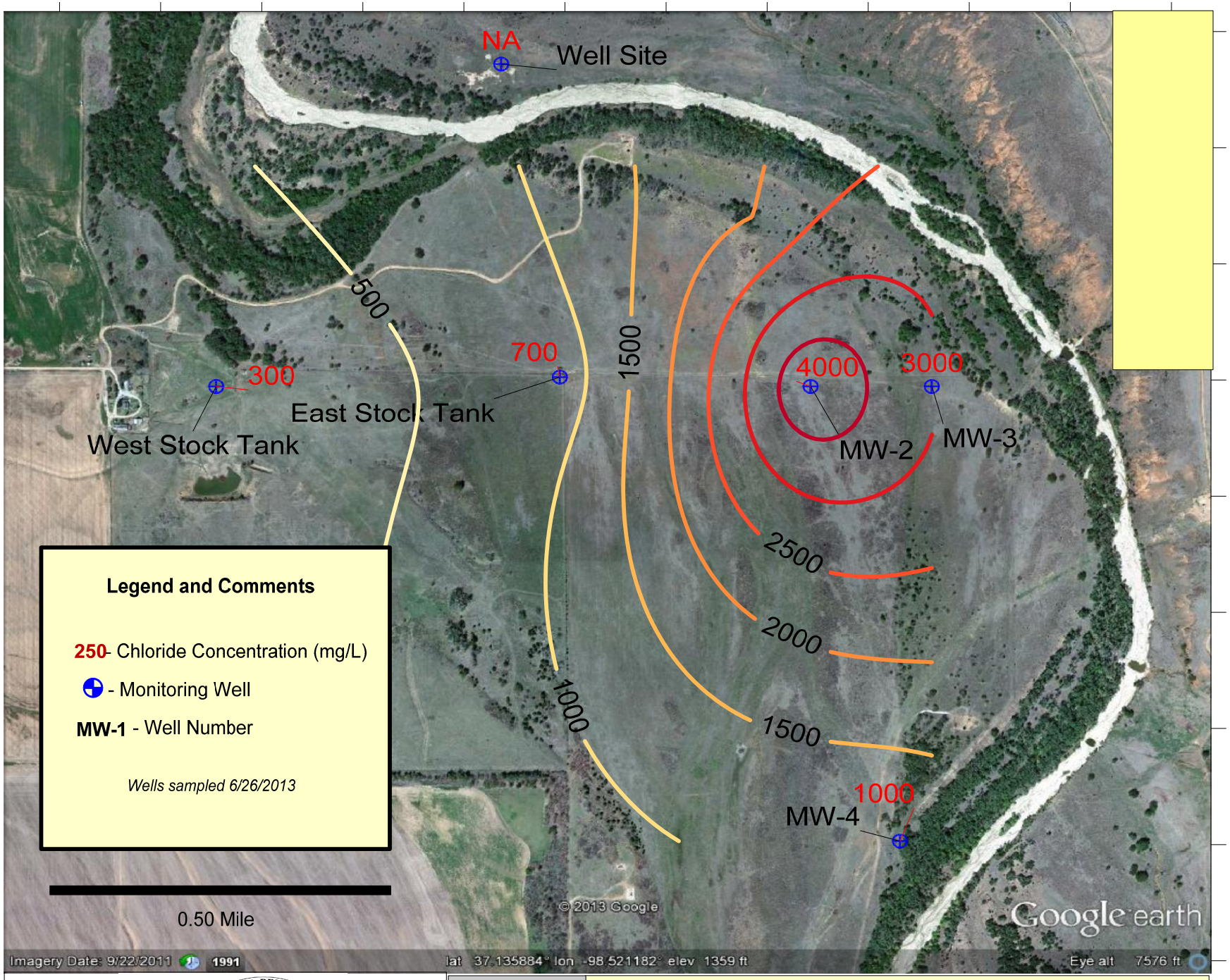
Recommendations for Future Work: Additional monitoring wells or temporary sampling points (auger holes) should be added to the site in order to evaluate the extent of the plume to the east and southeast. The site will be assessed to determine where additional sample points are needed, and for the installation of a permanent down gradient monitoring well. Should chloride levels change significantly in future sampling, implementation of a remedial system will be investigated.

Estimated Total Cost: 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 2013/14	Total
19.5 Hrs. / $487.86	See Harbaugh	Current Contaminate Level: 300ppm Cl- 4000ppm Cl-	

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



Kansas Corporation Commission

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Wildboys Site

2013-2014 Area Map with Chlorides

Sections 28/33-T-33S-R11W
Barber County, Kansas
KCC Control # 970017-00 District 1
B. Milner 8/7/13

Project: ***Wingate Contamination Site***

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 Quest Cherokee. The Mary Douglas property located in the next ¼ section east contains 22 abandoned wells, many of which have high fluid levels and are 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. These wells were sampled three times in 2013 on the following dates: 02/06/2013; 04/29/2013; and 07/29/2013. Overall Cl- concentrations are trending down. The results of these samples are as follows:
WIN1: 9,200; 2,550 and 3,700 ppm Cl-: ***WIN2***: 1,600; 1,800 and 9,900 ppm Cl-
WIN3: 1,200; 1,100 and 1,900 ppm Cl-: ***WIN4***: 2,500; 2,400 and 2,300 ppm Cl-

Level of Remediation Sought:
Ideal: 250 ppm Chloride
Target: 500 ppm Chloride

Recommendation for Future Work: Sample semi annually. This site should possibly be expanded to include the Mary Douglas property located in NW 16-T29S-R17E WL Co. Sampling in 2013 indicates that the primary source of brine is coming from the SSE of this project. Further monitoring of existing wells and possible additional monitoring wells will help to delineate the extent and condition of this aquifer.

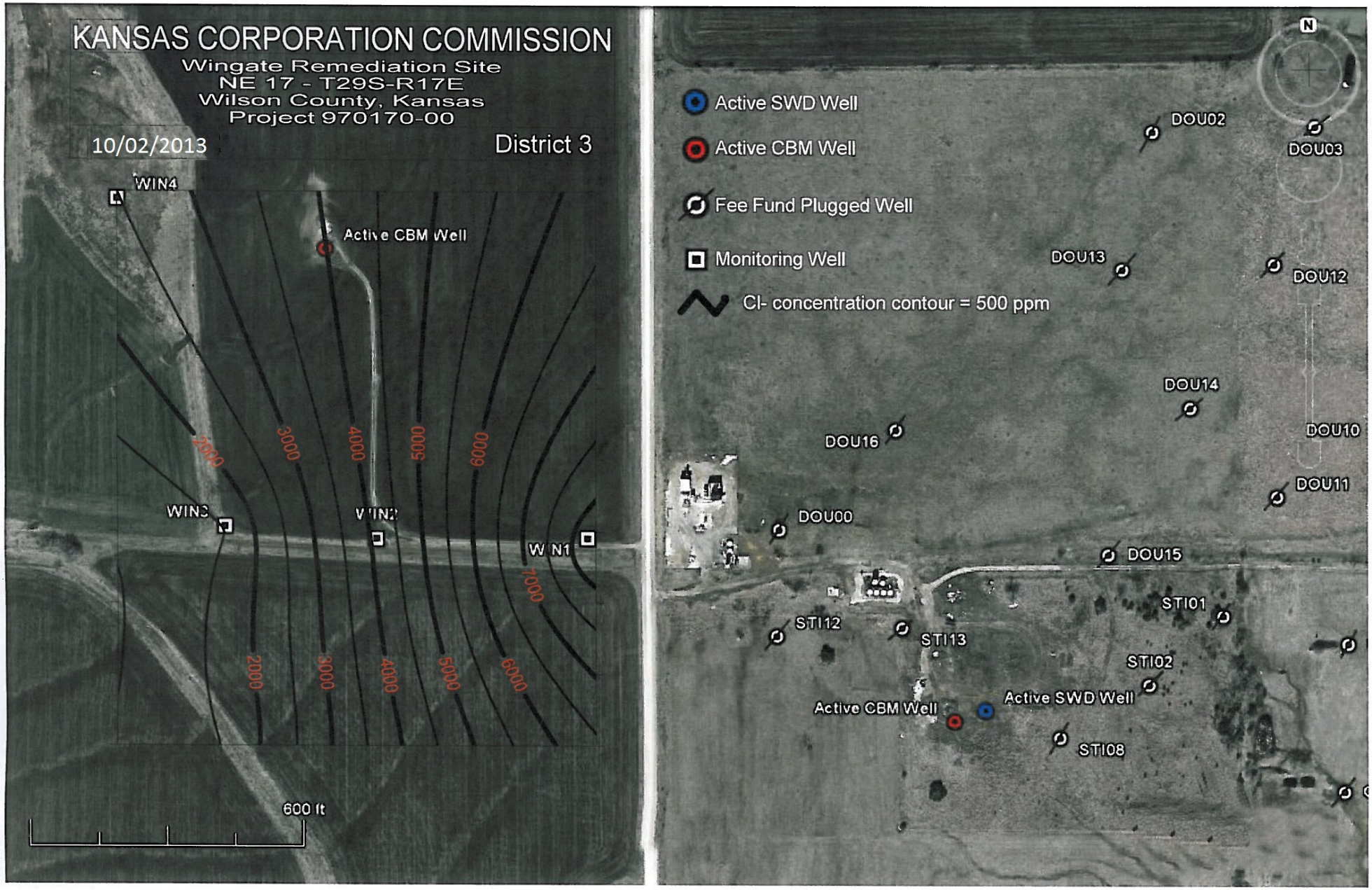
Estimated Total Costs: Four new monitoring wells were completed at a cost of $8,196 in 2012.

Control No.	Staff Hours/Expenditures	Fund Expenditures FY 2013/14	Fund Expenditures Total
970107-00	48.5 Hrs. / $1,281.95		$8,296

Current Contaminate Level: 1,100 ppm Cl- to 9,900 ppm Cl-

Status:Active

☐ 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


KANSAS CORPORATION COMMISSION
Wingate Remediation Site
NE 17 - T29S-R17E
Wilson County, Kansas
Project 970170-00
10/02/2013
District 3
WIN4
Active CBM Well
WIN3
WIN2
WIN1
2000
3000
4000
5000
6000
7000
600 ft
N
Active SWD Well
Active CBM Well
Fee Fund Plugged Well
Monitoring Well
Cl- concentration contour = 500 ppm
DOU02
DOU03
DOU13
DOU12
DOU14
DOU10
DOU16
DOU11
DOU00
DOU15
STI01
STI12
STI13
STI02
Active SWD Well
Active CBM Well
STI08

Project: ***Yeoman Site***

Site Location: The Yeoman site is located in the center of the southeast quarter of section 35 T 28S R7W. This area is five miles south and three miles east of the city of Kingman in Kingman County.

Impact/Immediacy: The abandoned Yoeman #1 located in the center of the SE/4 has charged up shallow zones in the Permian Red Beds with gas. The site classification is high due to the remaining gas in place even after producing the gas from 5 monitoring / recovery wells.

Site Description: The Yeoman #1 is located in 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 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.

Unusual Problems: In early 2009, KCC staff became aware of gas coming up an abandoned water well in the SW corner of Sec. 30-28-6W, over a mile away from the Yeoman #1. The property owner is Harold Reida, and the water well is referred to as the Reida water well.

Status of the Project: Currently there are five monitoring / recovery wells directly offsetting the Yeoman #1 that are being produced by Don Graber (Gra Ex LLC, KCC Lic. #33921) under an agreement with the KCC. Mr. Graber has been producing the recovery wells since November 2009 and has recovered a total of 85,826 Mcf as of August 1, 2013. For the past 12 months the five monitoring / recovery wells have averaged 60.4 Mcf per day into the sales line. This is down from 67.13 Mcf per day for the prior 12 months. A total cumulative amount of 144,208 Mcf of gas has been recovered from these 5 recovery wells starting back in April 2006. (From KGS Production Data)

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 varying from 15 to 37 psi. The Permian red beds were encountered as shallow as 14 feet in MW #8 in the NE corner of section 36 as compared to 44 feet in MW #6 that was drilled in the SE/4 of section 35 and is the closest monitoring well drilled to the 5 recovery wells.

Consistent recovery has occurred over the last 4 years, and recovery amounts are slowly declining. KCC is researching the area for possible new monitoring/recovery wells to help elevate the shallow gas issue.

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: Continue to monitor gas production very closely with Don Graber. KCC staff recommends that Mr. Graber produce gas from MW #6, the closest MW to the 5 recovery wells in an attempt to accelerate the depletion of the gas in the charged up zone. KCC also recommends that additional monitoring/recovery wells be installed to delineate and investigate the extents and amounts of gas in the local area.

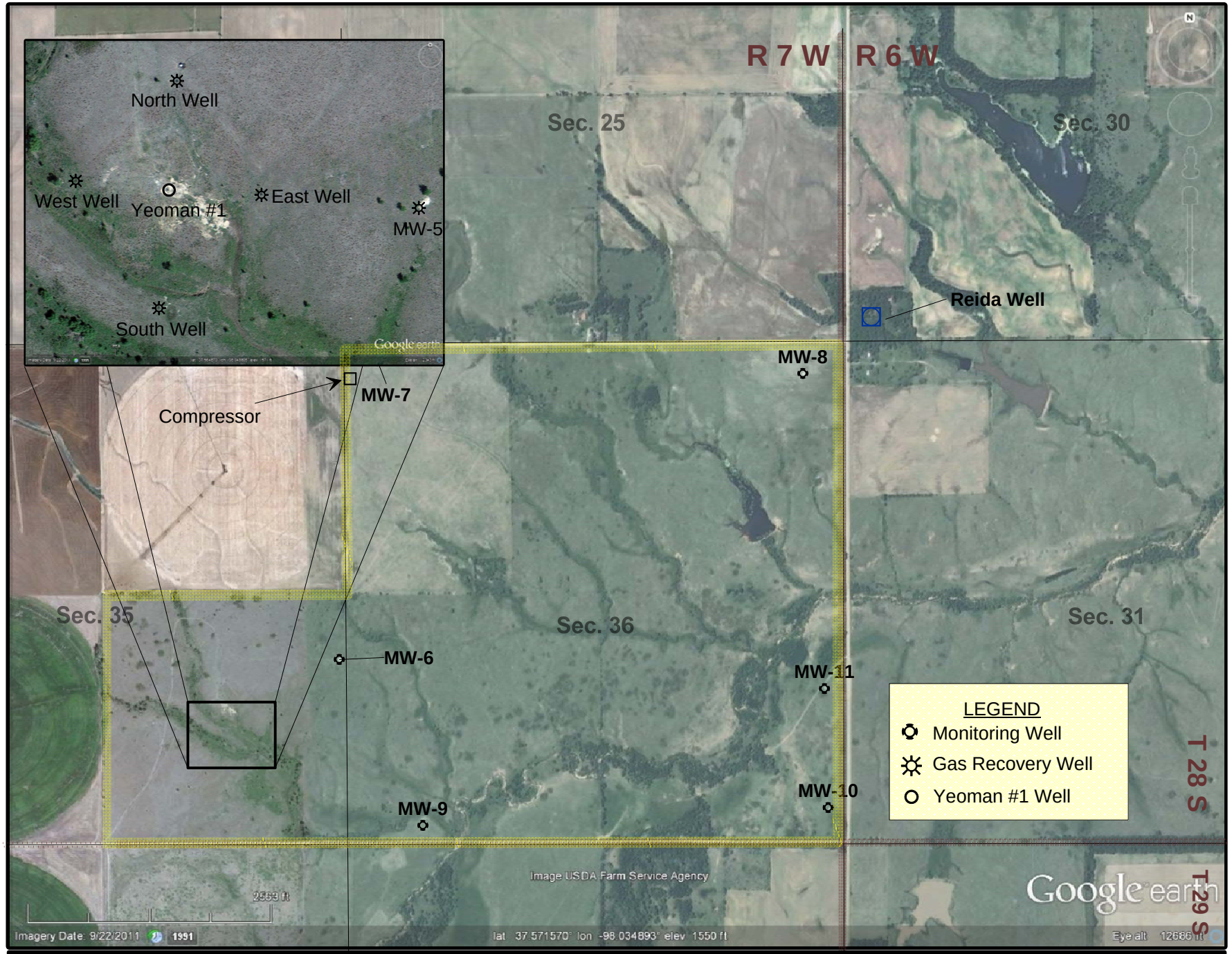
Estimated Total Costs: Plugging of the Yeoman #1 will be less than $25,000 and can be done through KCC fee fund. Additional installation of wells plus staff time on research and investigation would be an estimated $20,000.

Control No.	**Staff Hours/Expenditures**	**Fund Expenditures FY 2013/14**	**Total**
20060021-001	**17.5 Hrs. / $494.06**		**$93,690.76**

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: 144,208 Mcf (KGS Production Data) *Last year's total was reported as 175,360 Mcf which was taken from operator's data and not reported production.

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**



Kansas Corporation Commission

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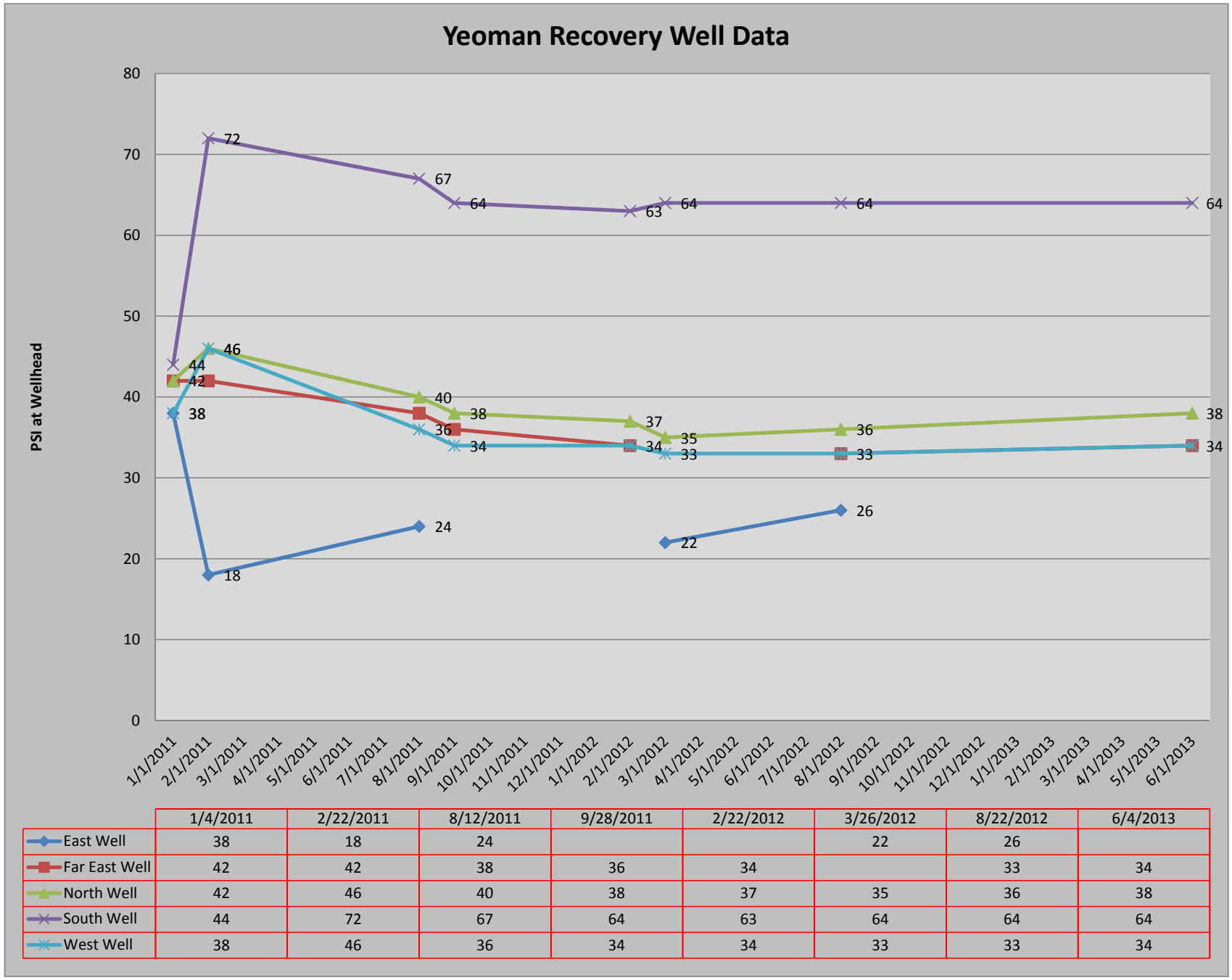
Yeoman Escaped Shallow Gas Site
SE/4 of Section 35 and All of Section 36-T28S-R7W, Kingman Co., KS
Site Map for 2013-14 Legislative Reports
District #2 Control No. 20060021-001 9-19-2013 D. Bollenback

Yeoman Recovery Well Data



	1/4/2011	2/22/2011	8/12/2011	9/28/2011	2/22/2012	3/26/2012	8/22/2012	6/4/2013
East Well	38	18	24			22	26	
Far East Well	42	42	38	36	34		33	34
North Well	42	46	40	38	37	35	36	38
South Well	44	72	67	64	63	64	64	64
West Well	38	46	36	34	34	33	33	34

REMEDIATION

SITES

REPORT

2014

NEW SITES

Project: ***Korf Contamination Site***

Site Location: Legal location is the SE/4 of the SE/4 of the NE/4, Section 7, Township 23 South, Range 22 West, Hodgeman County.

Impact\Immediacy: There is a very slight chance of the plume impacting the area to the northeast. The site has a low rating.

Site Description: There are currently six monitoring wells on the site which are sampled on an annual basis. Land use is agricultural with oil activities to the south. The site is located at the bottom of a small valley carved by an intermittent stream. The aquifer is a mixture of weathered shale, clay, and some clayey sand sitting on top of the Cretaceous Dakota shale.

Site History: A saltwater tank overflowed on the Korf SWD #3 which was discovered on May 15, 2007. The spill was initially estimated at 1200-1500 barrels of saltwater. Recovery efforts at the site picked up 2300 barrels of saltwater. The spill ran downhill into an intermittent stream valley to the north of the SWD. It affected the soil and the uppermost aquifer in the area. Pintail Petroleum LTD retained Bittersweet Energy to make recommendations and assist in the cleanup of the site. Six monitoring wells were drilled per the recommendations of Bittersweet Energy with the approval of the KCC. Wells were initially monitored quarterly, which was switched to semi-annual monitoring in 2009. Annual monitoring began in 2012. Historically, the chlorides in the samples have been erratic due to the nature of the aquifer.

Status of Project: The project is currently in a monitoring phase. The saltwater plume is moving very slowly to the north northeast along the draw. The samples from the monitoring wells, while erratic at times, show a slow decrease in chlorides. A surface sample was taken from a puddle inside the draw and it tested at 100 ppm chlorides. The soil has grass and other plants growing in it.

Unusual Problems: The aquifer is composed of weathered shale, shale, with some clayey sand. Due to this, water does not flow quickly through the area. This makes normal methods of treating the aquifer difficult to accomplish.

Recommendations for Future Work: Continue monitoring work until the aquifer reaches the target level.

Level of Remedation Sought:

Ideal: 250 ppm

Target: 1000 ppm

Initial Cost: Costs covered by PRP.

Long Term Costs: Costs covered by PRP. The cost to KCC will be for meetings and field inspections along with yearly reports at an estimated cost of $500 a year.

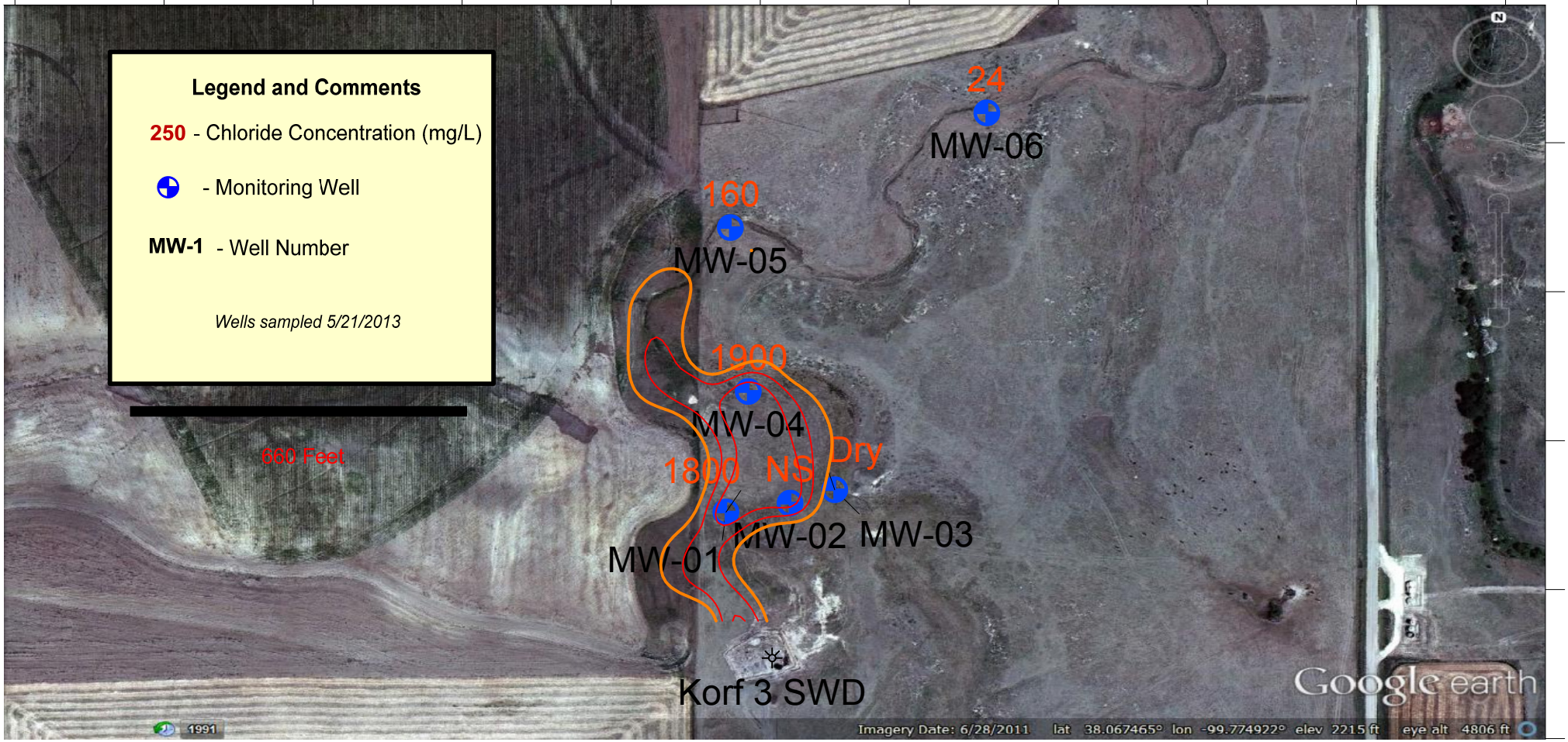
Korf Contamination Site
Hodgeman County

Control No.	Staff Hours/Expenditures	Fund Expenditures
20140017-001		FY 2013/14 Total
	22 Hrs. / $580.62	

Current Contaminate Level: 24 ppm to 1,900 ppm Cl-

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



Kansas Corporation Commission

N W E S

Korf Site

Sections 7-T-23S-R22W
Hodgeman County, Kansas

2013-2014 Area Map with Chlorides

KCC Control # 20140017 District 1
D. Sellers 9/24/13