

Gully Erosion Study – Rangeland Pastures

Summary Report

April 27, 2017

Upper Walnut/El Dorado Lake Watershed Restoration and Protection Strategy (WRAPS)

For

Project Number: 2015-W071

Year 3 SFY 16 FFY 15

Project Start/End Dates: 10/01/2015 – 3/31/17

KS Grant #: 2015-W071 – Project ID# 756

EPA Grant #C9007405-21

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Background:

A concern regarding rangeland gully erosion was brought to light in 2006 when the USDA's Conservation Stewardship Program (CSP) was first announced. Many landowners who signed up their land for this program had to treat erosion issues in native grass pastures in order to be eligible for payments through CSP. Erosion in native pastures has never really been addressed as it was thought native grass provides sufficient cover as well as the deep roots of this region's prairie grasses was sufficient for holding soil in place. The CSP identified there may be more erosion from these native prairie areas than what anyone realized.

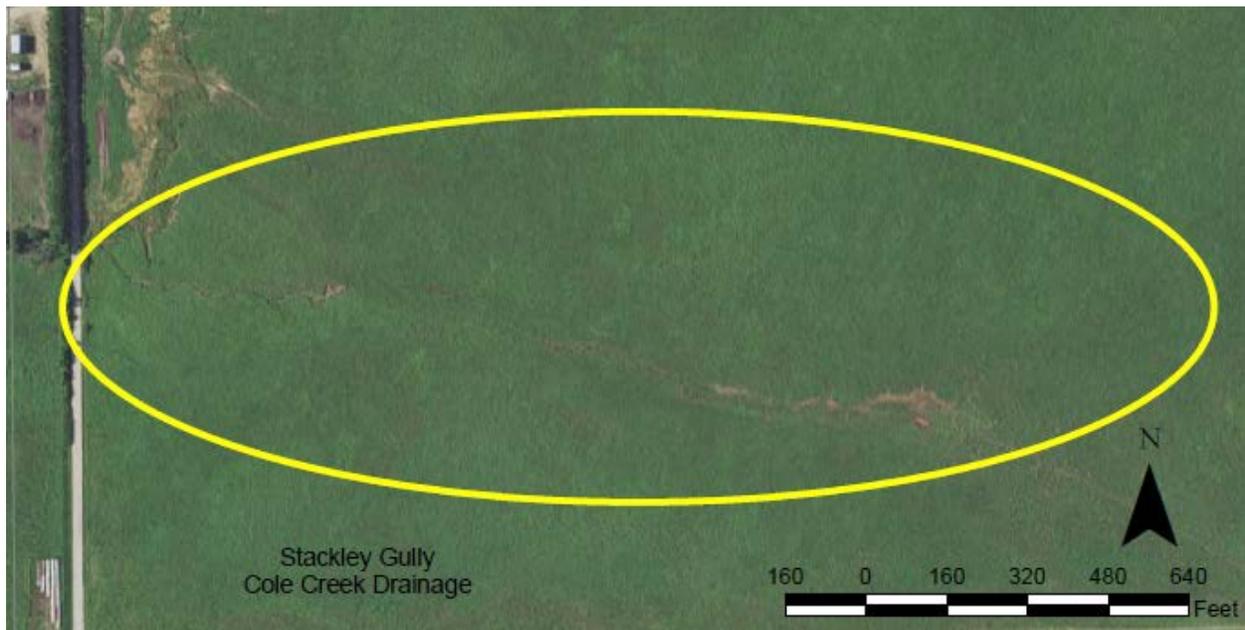
As the El Dorado Lake Watershed is mainly comprised of the native prairie known as the Flint Hills, we thought an assessment should be done to determine if gully erosion is a major issue and if so, what kind of conservation practices might be used in native pastures to control erosion from rangeland gullies.

Funds for this assessment were made available through a grant from the Upper Walnut El Dorado Lake Watershed Restoration and Protection Strategy (WRAPS) (Project #2013-2015 W071; EPA Grant #C9007405-21). The grant spanned 4.5 years from October 2013 to March 2017. Phil Balch, Wildhorse Riverworks, assisted with surveying each of the 3 years.

Rainfall during this assessment window was below the National Weather Service Average (1981-2010) of 37.01 inches in 2014 (26.14 inches was recorded); above average in 2015 (40.34 inches was recorded) and above average in 2016 (43.92 inches was recorded). Rainfall data was collected/reported by the City of El Dorado on the Walnut River below El Dorado Lake. The surveys were conducted in February 2015, 2016 and 2017. Rainfall data from February 2015 to February 2016 included 79 events with an inch or less of rain; 5 events with 1" – 2" of rain and 4 events with over 2" of rain. Rainfall data from February 2016 to February 2017 included 75 events with an inch or less of rain; 11 events with 1" – 2" of rain; 2 events with over 2" of rain and 1 event with over 5" of rain. In most cases, runoff would have occurred with the higher rainfall events (1" or more) and not the rainfall events that were an inch or less. Using the higher rainfall events, it is estimated that runoff occurred through the gullies at least 23 times during the assessment time frame. Keep in mind, as this is a big watershed, rainfall amounts may have varied (more in some areas, less in some areas and/or sometimes not at all) as the rainfall data recorded and used was only collected at one station.

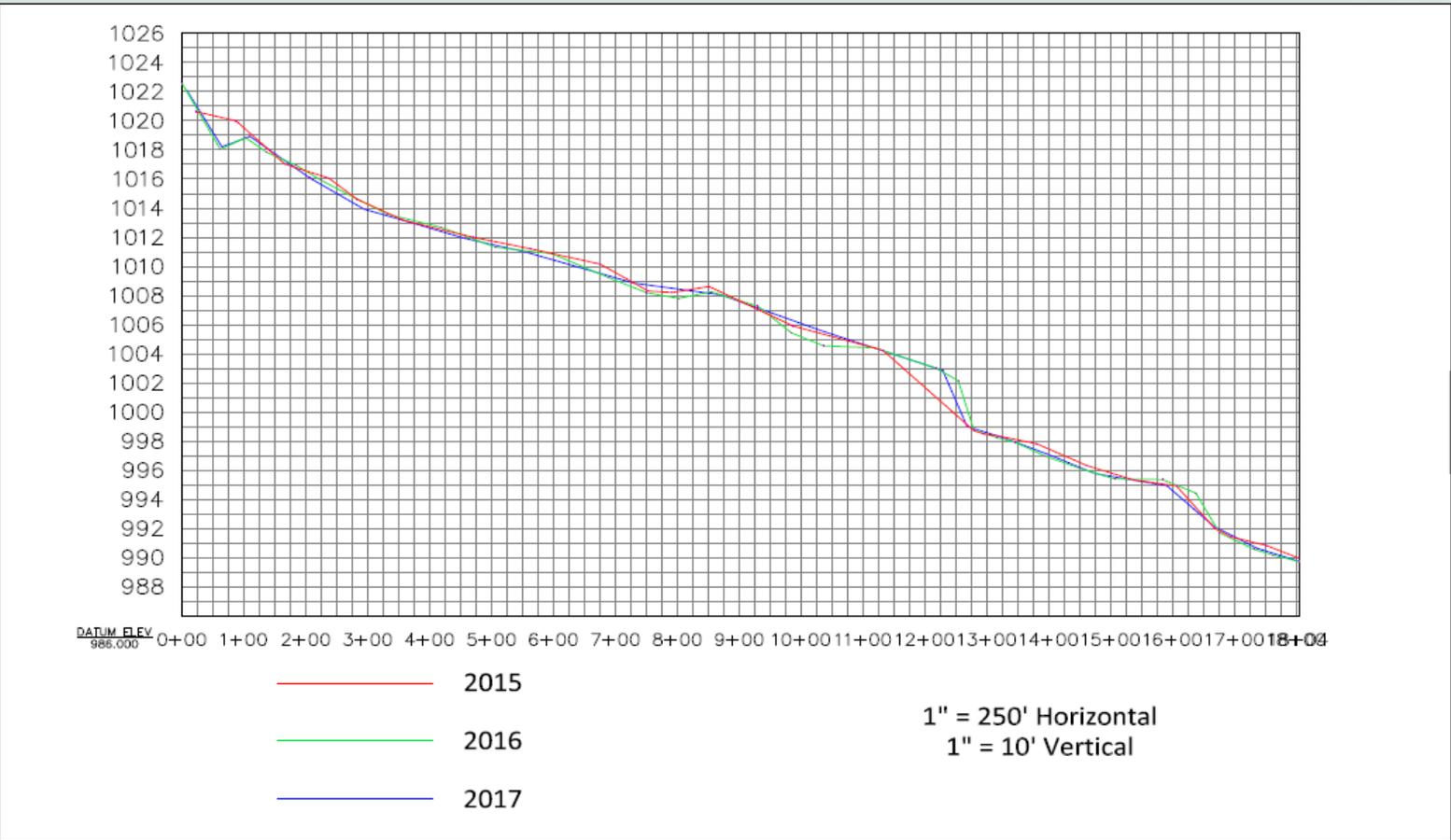
Year	0" to 1"	1" to 2"	2"-5"	Over 5"
February 2015 - February 2016	79	5	4	0
February 2016 - February 2017	75	11	2	1

Cole Creek Gully



The gully surveyed in the Cole Creek drainage area was determined by the Soil and Water Assessment Tool (SWAT) model to be in a high priority area for sediment and nutrient runoff. The soil type of the field where the gully is located is Irwin silty clay loam, 1-3% slope and Labette silty clay loam, 3-7% slope. The operator uses this pasture for calving. Cattle are taken off in early summer to allow grass regrowth; cows are put in the pasture in late fall for anticipated calving in early spring (March-May). The past two summers, we have had above average rainfall in the grazing months as well as in late summer allowing a surge of regrowth in the pastures. It was difficult to walk in the pasture in 2017 as we surveyed because there was so much grass and it was even hard to find the gully in spots because of the dense grass growth. The gully length is approximately 1,920 feet long.

The Longitudinal Profile below shows the survey data collected in 2015, 2016 and 2017. It was noted that cattle tended to walk along the gully leaving trails next to the gully which could increase erosion in these areas due to the bare spots left by the cattle trails. It appeared (and was verified by the landowner) cattle also liked to “muck” in areas of the gully that held water for longer periods of time causing some areas to erode due to the instability of the soil caused by cattle hooves. Overall, though, this gully was fairly stable.



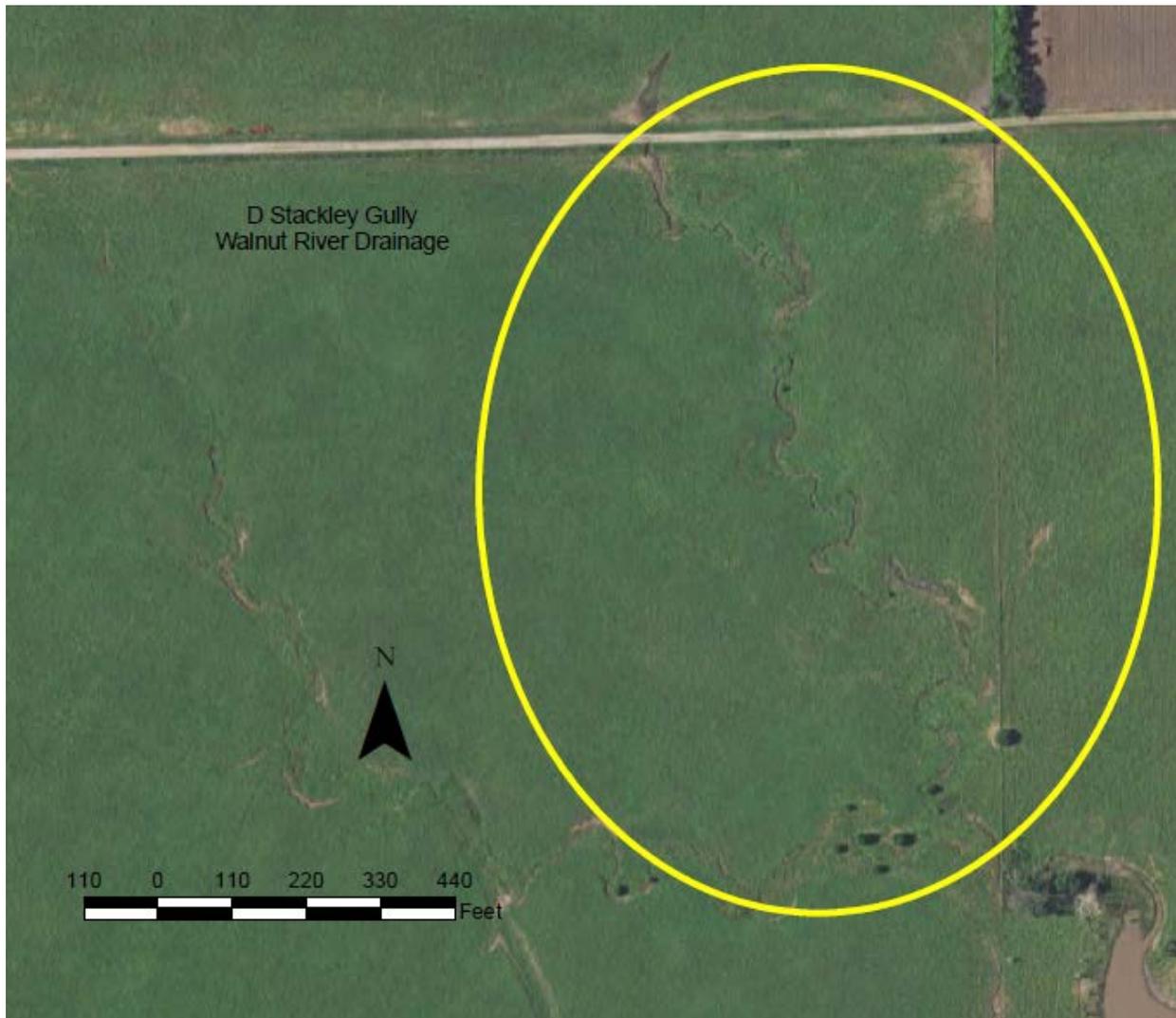
Stackley Gully
Butler County, Kansas
Longitudinal Profile

NO.	BY	DATE	DESCRIPTION

Drawn by: KAB -- 4/10/17
Checked by: PGB -- 4/10/17

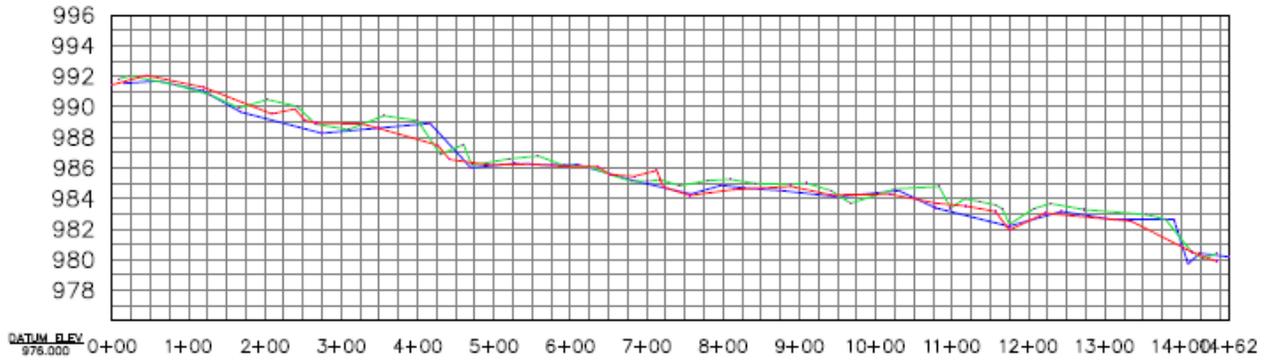
1/4

Walnut River Gully



The gully surveyed in the Walnut River drainage area was determined by the Soil and Water Assessment Tool (SWAT) model to be in a medium priority area for sediment and nutrient runoff. The soil type of the field where the gully is located is Irwin silty clay loam, 1-7% slope. Stocker cattle are put in this pasture and it is grazed more intensively than the Cole Creek pasture; even so, there was still a lot of forage left after the grazing season, especially in 2016. The gully length is approximately 1,700 feet long. Some cattle trailing was noted in and around the gully.

The Longitudinal Profile below shows the survey data collected in 2015, 2016 and 2017. This gully shows a more active erosion pattern from year to year with some cross sections showing more sediment movement as flood events occur.



— 2015
— 2016
— 2017

1" = 200' Horizontal
1" = 10' Vertical



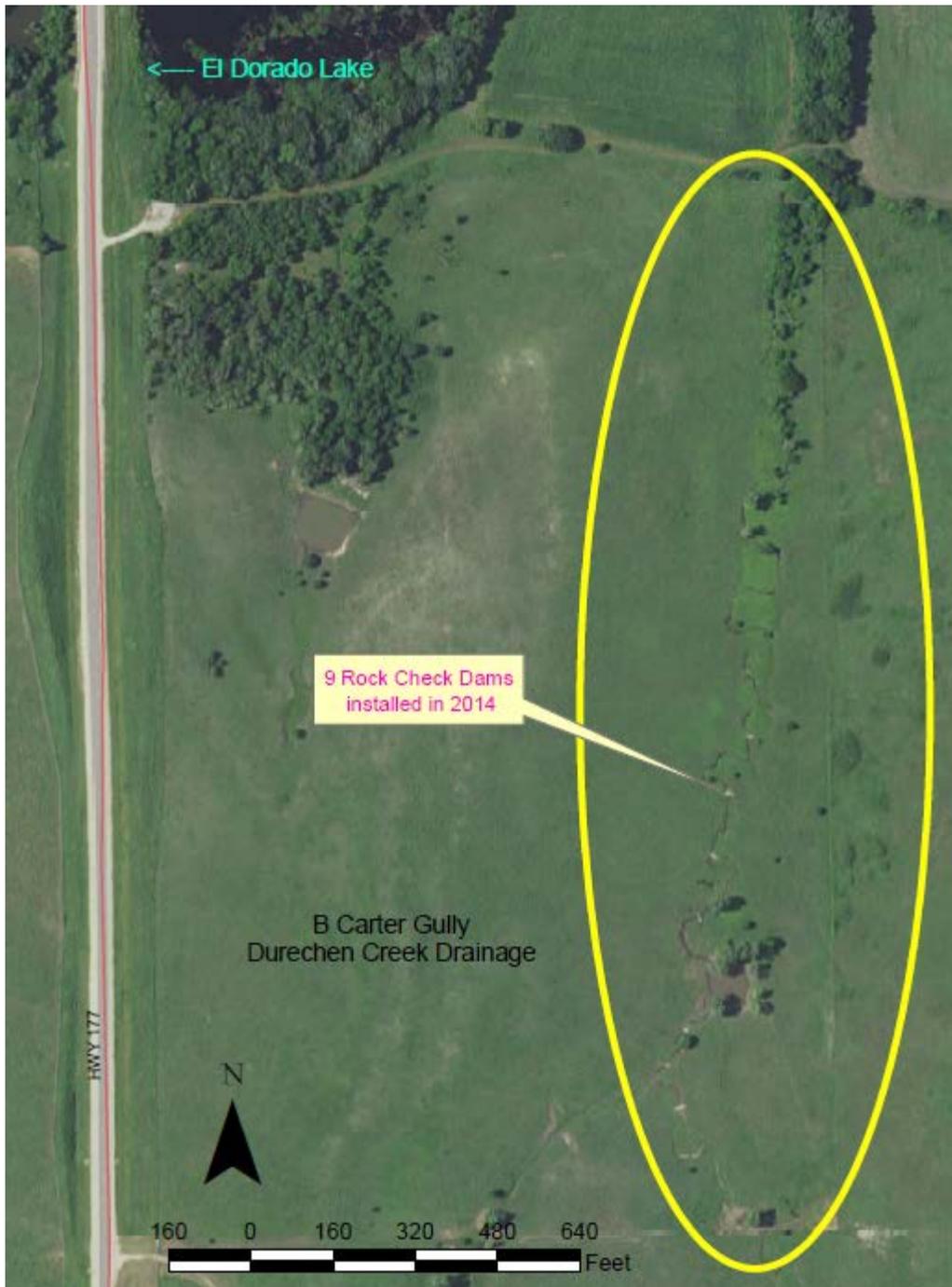
Walnut Gully
Butler County, Kansas
Longitudinal Profile

NO.	BY	DATE	DESCRIPTION

Drawn by: KAB - 4/10/17
Checked by: PGB - 4/10/17

1/4

Durechen Creek Gully

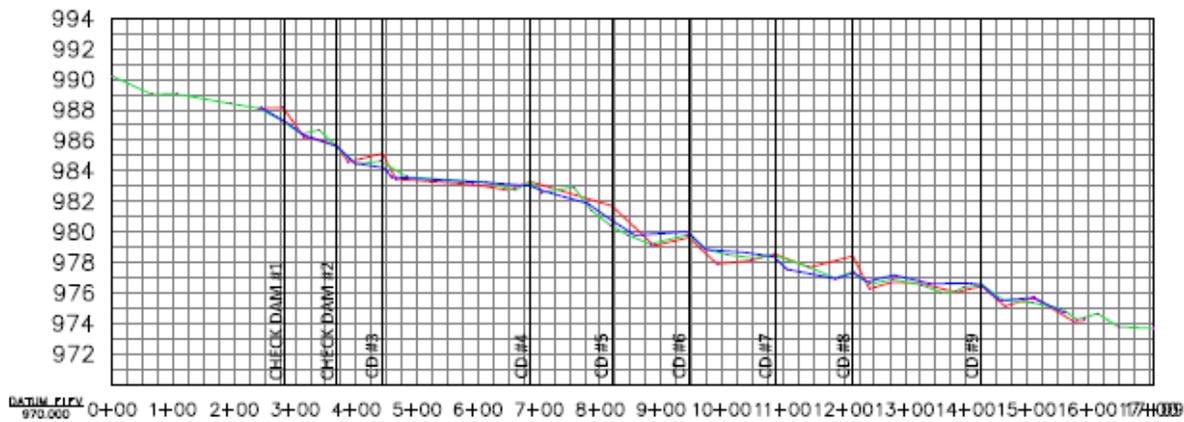


The gully surveyed in the Durechen Creek drainage area was determined by the Soil and Water Assessment Tool (SWAT) model to be in a high priority area for sediment and nutrient runoff. The soil type in the field where the gully is located is Labette-sogn silty clay loam, 0-8% slope. This field is burned on a regular basis (every other year). Stocker cattle are put in this pasture from late April to the end of

July. The gully length is approximately 1,500 feet long. In March 2014, 9 rock check dams were placed in the gully to help control erosion.

There are scattered trees along the gully and other areas where water sets longer after a rain. Cattle tend to either loaf in the shade of a tree or in cases where water stands, “muck” in the mud in those spots. Those areas show an increase in erosion (very evident at rock check dam #3 right above the pond (in the shade of a tree), rock check dam #5 and rock check dam #8 (where water sets longer)); however, most of the areas near the rock check dams are filling in as intended and grass is observed growing in the gully now where bare ground had been in 2014.

The Longitudinal Profile below shows the survey data collected in 2015, 2016 and 2017.



— 2015
— 2016
— 2017

1" = 250' Horizontal
 1" = 10' Vertical



Carter Gully
 Butler County, Kansas
 Longitudinal Profile

NO.	BY	DATE	DESCRIPTION

Drawn by: KAB - 4/24/17
 Checked by: PGS - 4/24/17

1/3



Newly installed rock check dam
March 2014

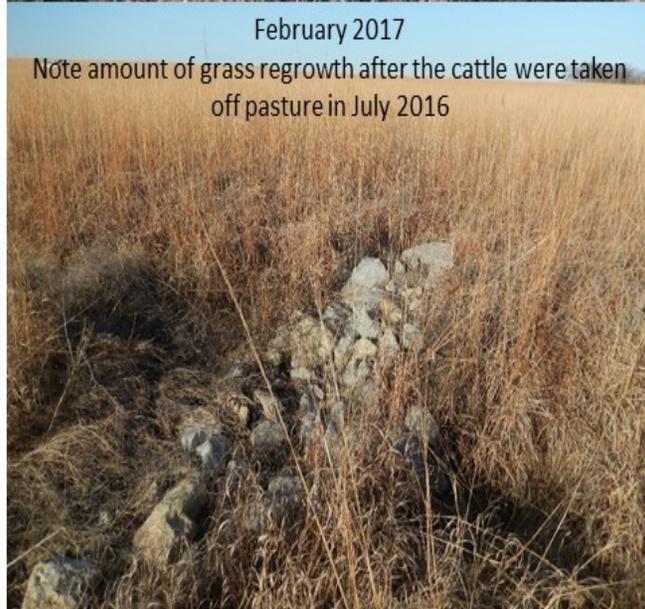


February 2016

Carter Rock Check Dams
Upper Walnut El Dorado Lake
WRAPS
March 2014- February 2017



Note grass growing in the gully
February 2017



February 2017
Note amount of grass regrowth after the cattle were taken
off pasture in July 2016



Note debris caught on rock dam
February 2017

Satchell Creek Gully



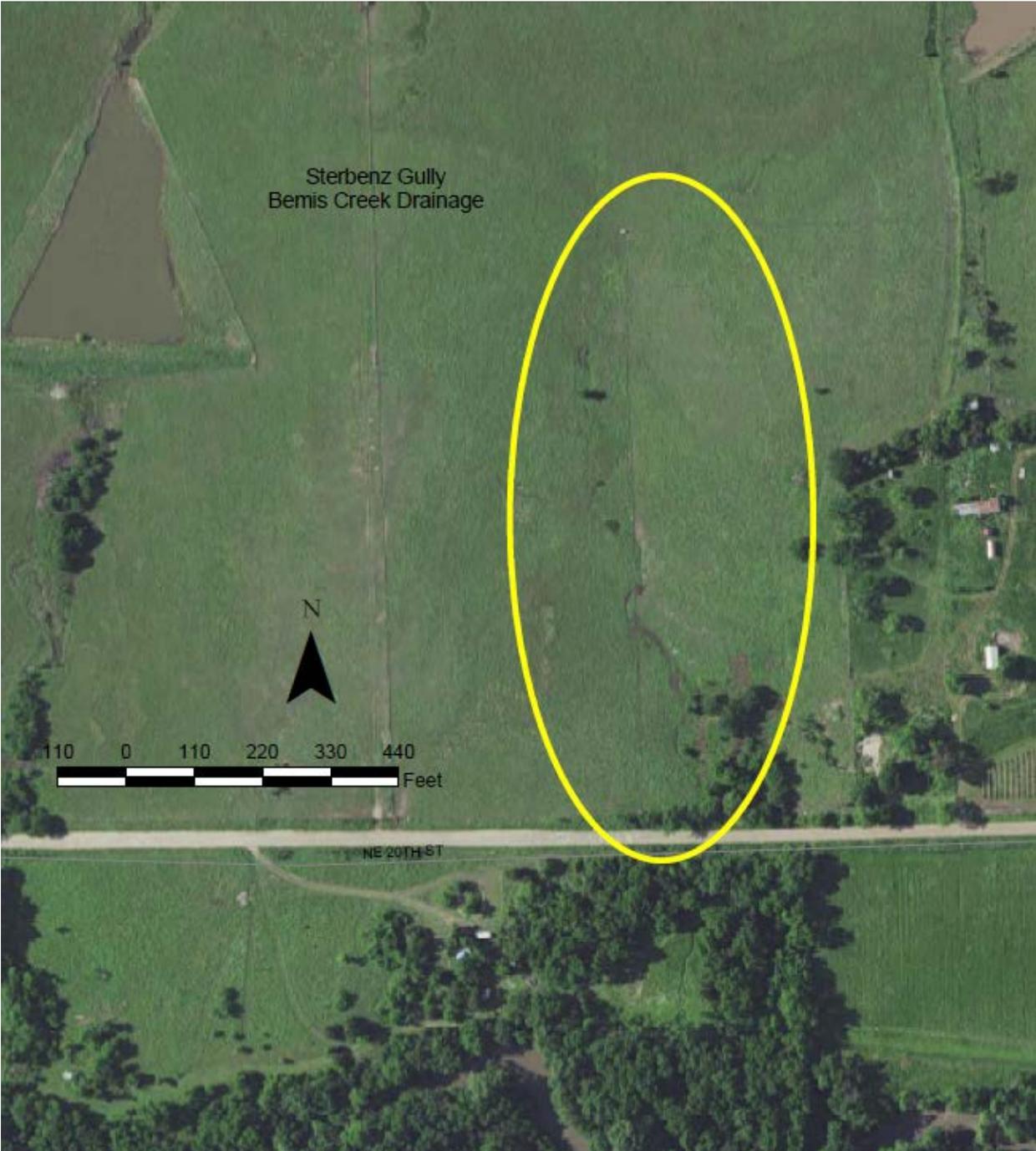
The gully surveyed in the Satchel Creek drainage area was determined by the Soil and Water Assessment Tool (SWAT) model to be in a high priority area for sediment and nutrient runoff. The soil type of the lower part of the gully is Labette-Dwight Complex, 0-3% slope and the soil type in the upper part of the gully is Dwight silt loam, 0-1% slope. The operator uses this pasture for stocker cattle with grazing from May to August. This pasture also had dense grass growth making it difficult to walk in 2017 in addition to making it hard to locate the gully due to the grass. The gully had a few spots that held water where cattle might “muck” around. The gully length is approximately 1,740 feet long. It was noted that cattle tended to walk along the gully on their way to drink water from the pond leaving trails next to the gully which could increase erosion in these areas due to the bare spots left by the cattle trails.



Gully surveying on Satchell Creek Ranch. Water setting in the gully in February 2017 in the upper part of the survey area (note pond behind surveyor; gully winds its way down to the pond)

The Longitudinal Profile below shows the survey data collected in 2015, 2016 and 2017. It is noted on the longitudinal cross section the gully itself shows a downward trend (gully getting deeper) and this is contributed to the cattle trailing to the pond for drinking causing the gully to erode. An alternative water source or sources made available to the cattle in this pasture would help with grazing distribution and reduce the impact of cattle trailing along this gully.

Bemis Creek Gully



The gully surveyed in the Bemis Creek drainage area was determined by the Soil and Water Assessment Tool (SWAT) model to be in a low priority area for sediment and nutrient runoff. The soil type on the lower part of the gully is Vanoss silt loam, 0-3% slope; in the middle is Labette-sogn silty clay loam, 0-8% slope and the upper part of the gully is Sogn silty clay loam, 0-10% slope. A fence separates the pasture on the lower end but does not enclose the pasture. The gully happens to criss-cross the fence in three different places. Cattle are allowed access to the entire 70 acres as the only water source is the pond in the northeast end of the pasture. Several trees are located in the stretch of gully and cattle tend to frequent these areas for shade which can also cause some additional erosion as cattle stomp in the water/mud holes. The pasture was rested the prior year of the first survey and grazed with stocker cattle the other two years of the survey period. The gully length is approximately 1,100 feet long.

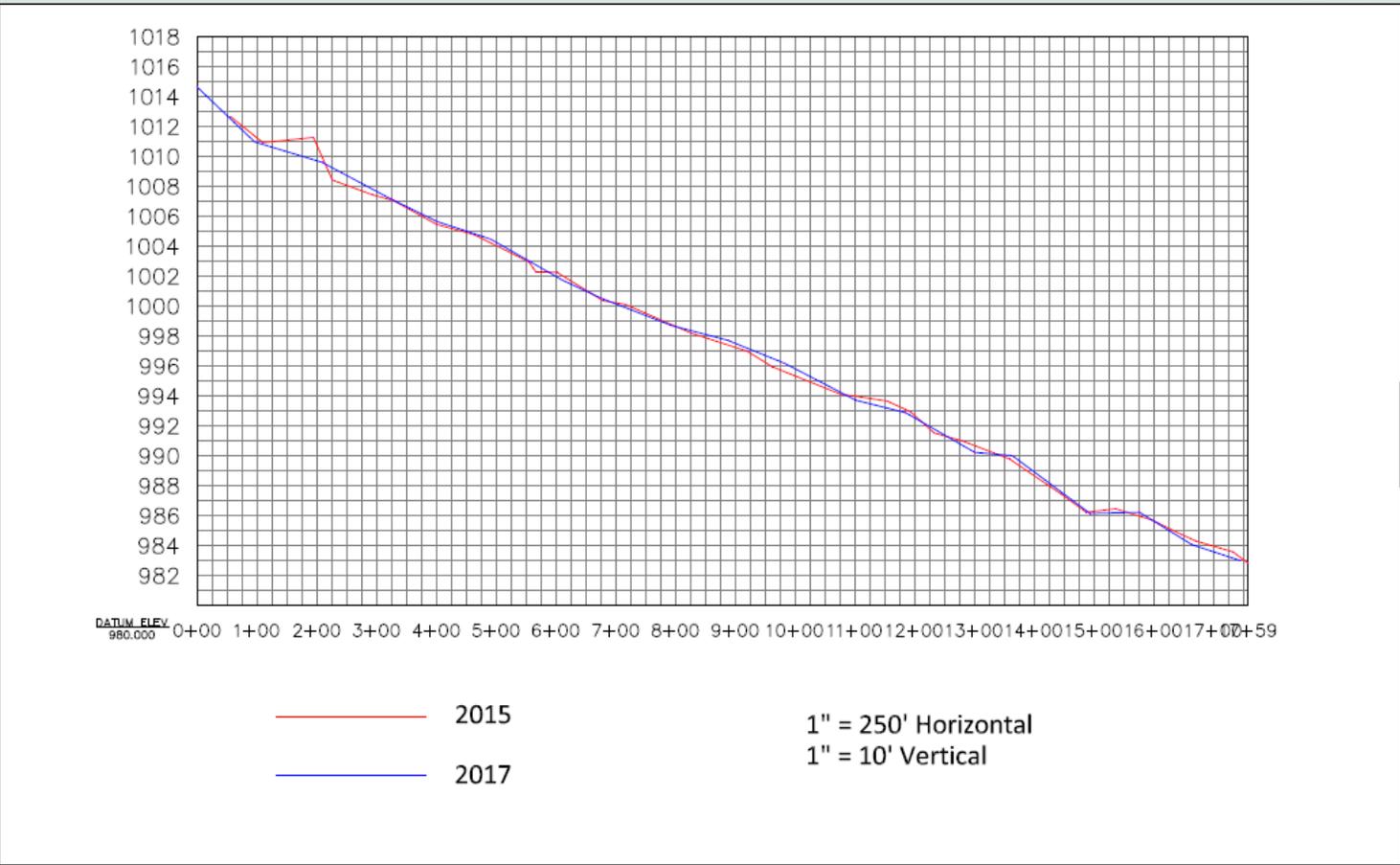
The Longitudinal Profile below shows the survey data collected in 2015, 2016 and 2017. This gully is fairly stable and even shows improvement in some areas. This is attributed to the improved pasture management practices of a new operator who took over at the beginning of the study period. Again, issues occur where the gully criss crosses the fence and where trees are located. Cattle walk the fence/gully area as they graze or go for water and then loaf in areas where trees are located causing bare spots.

Harrison Creek Gully



The gully surveyed in the Harrison Creek drainage area was determined by the Soil and Water Assessment Tool (SWAT) model to be in a low priority area for sediment and nutrient runoff. The soil type on the lower part of the gully is Verdigris, frequently flooded, the soil type in the middle (the majority of the length of the gully) is Florence cherty silt loam, 5-15% slope and the upper part (the last 300 feet) is Irwin silty clay loam, 1-3% slope. A spring is located on the lower end of the gully about 400 feet east of the pond. This gully was only surveyed in 2015 and 2017; as there was a death in the family of the ranch manager during the time we surveyed in 2015. The ranch manager runs stocker cattle on this pasture 9 months out of the year (May to August and November to March). The pasture size is 640 acres. There are 3 ponds on the north end. The gully length is approximately 2,080 feet long.

The Longitudinal Profile below shows the survey data collected in 2015 and 2017. This gully is stable except for the areas where water sets in the gully and cattle loaf leaving bare spots.



Gottsch Gully
Butler County, Kansas
Longitudinal Profile

NO.	BY	DATE	DESCRIPTION

Drawn by: KAB - 4/24/17
Checked by: PGB - 4/24/17

1/4

Conclusions:

- Gully erosion from native pastures is of great concern in the El Dorado Lake Watershed. While this survey only looked at 6 different gullies, the fact that El Dorado Lake Watershed is made up primarily of native grass, there are so many small, intermittent drainages in these pastures collectively that, when all added together, contribute to sediment loading in El Dorado Lake. Visual observation as well as landowner input confirms gully erosion in native pastures should be addressed using structural methods when applicable but more importantly, emphasizing the importance of grassland management practices (grazing management, stocking rates, water supply, etc.).
- Due to drought conditions during the first two years of the survey, not a lot of runoff occurred during the time frame of the study.
- During the last part of the study, above average rainfall occurred during the growing season allowing an excessive amount of native grass regrowth on pastures. The grass provided an additional buffer that protected these sensitive areas from excessive erosion, even though more rainfall occurred.
- It appears from the profiles that sediment may move down the gully during a series of rainfall events, re-establish a grass stand and stabilize on its own for a time.
- From visual observation, cattle do tend to loaf in water holes and wet spots in gullies which loosens the soil and then when a runoff event occurs, the bare areas lose more soil.
- Based on visual observation, cattle trailing along a gully will cause water to flow along this path of least resistance and cause a wider gully than what was originally caused by flow in the gully.
- The more grass left in the pasture, the less erosion occurs and cattle don't loaf in the gullies as much.
- From visual observation, the rock check dams in the Carter gully are slowing down water flow in the gully and depositing sediment upstream the rock dams; as they were designed to do. It did not appear the cattle loafed around the rock check dams (except for the one that was next to a tree) therefore not causing another issue with erosion caused by hoof action.
- There are currently not a lot of conservation practices that are applicable for use in rangeland sites to control gully erosion. Rock check dams are a means of slowing down runoff in long stretches of gully (in gullies less than 3 feet deep), are more economical (compared to concrete structures) to install and can be installed without a lot of undue stress or damage to the rangeland pasture. According to Phil Balch, Wildhorse Riverworks, rock check dams can be effective in gullies deeper than 3 feet. It may take an additional treatment (adding more rock) after several years. Even if the gully does not completely fill in, the check dams are effective at slowing water velocities and trapping sediment.
- Not to be overlooked or taken for granted, grazing management practices such as rotational grazing, checking grazing height, maintaining stocking rates based upon grassland productivity, intensive early stocking, brush management, providing additional watering sources in large pastures (to reduce cattle trailing) and keeping feeding/mineral areas away from gullies would all help to reduce erosion from rangeland gullies and are far less costly in the long run.

Lessons Learned:

- It would have been easier to have uniform cross sections had we set flags/stakes in the pastures so that each year we would have surveyed the exact area; this was not possible due to range burning and livestock/wildlife pulling out stakes.
- February is not the best time for surveying due to winter conditions; however, it is the ideal time to request access from ranchers because it is before range burning and before cattle are put back on pastures in the spring; in other words, our surveying is the least intrusive at that time for ranchers.
- More photos would have been helpful in documentation.

Special Thanks:

- Landowners who allowed us to survey for the 3 years of this study:
 - Arlan and David Stackley
 - Bob Carter
 - Ken and Bessie Sterbenz
 - Satchell Creek Ranch (Ty Kemp)
 - Rosalia Ranch (Bill Oates)
- Phil Balch and Kari Bigham, Wildhorse Riverworks
- Survey assistants/volunteers –
 - Dianne Rollins, Earth Team Volunteer
 - Jeff Parks, Kansas Department of Agriculture/Division of Conservation Technician
 - Isaac Broeckelman, WRAPS Coordinator, Grouse, Silver, Timber Creek WRAPS