# Tyner Creek Watershed Stream Stability Assessment

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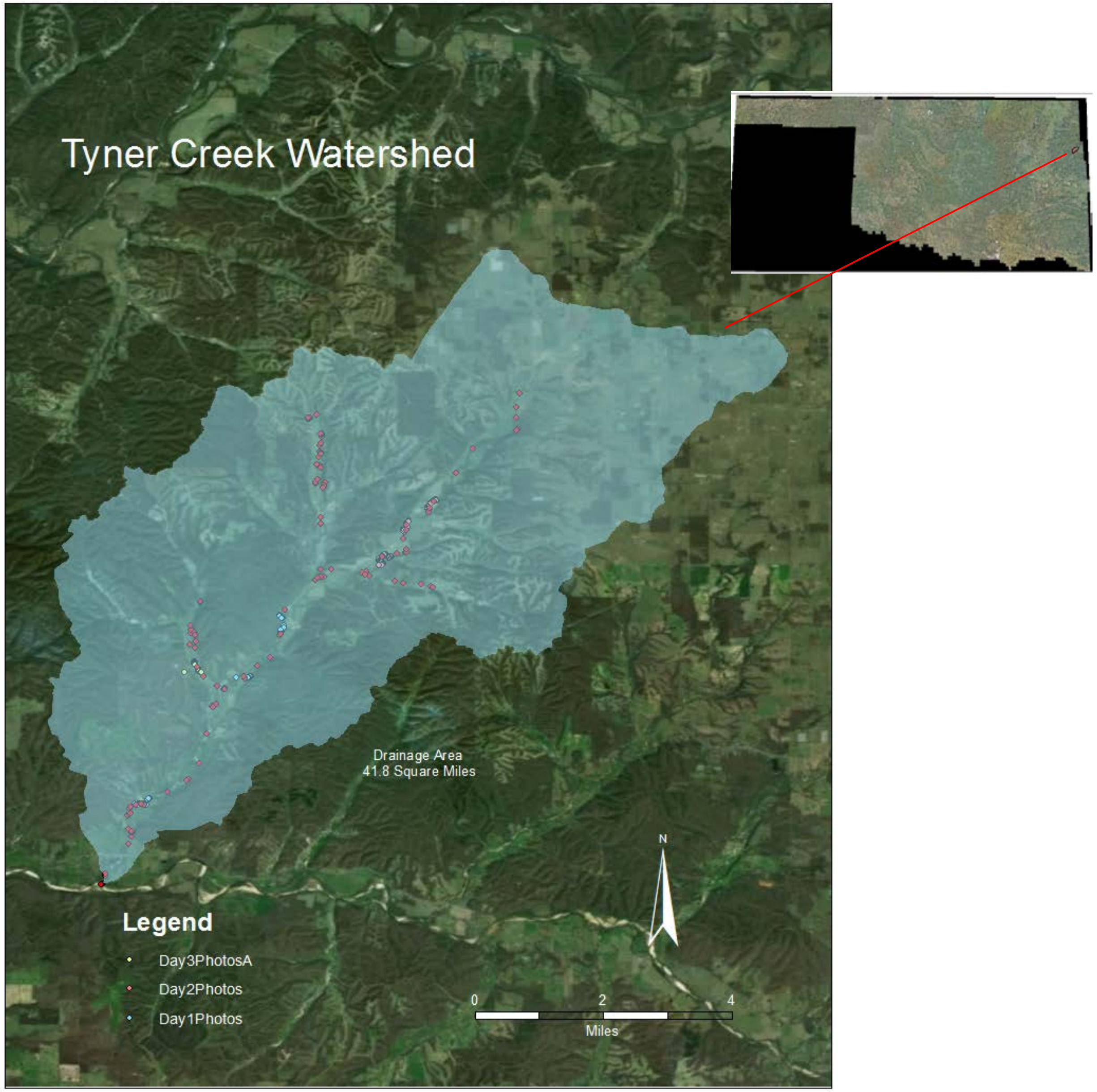
# Presentation Outline

- Introduction
- Assessment Objectives
- Assessment Tasks
- Estimated cost of natural rehabilitation of the assessment reaches
- Summary

# Introduction

- Tyner Creek is a tributary to the Baron Fork River.
- The confluence is located near Proctor, Oklahoma, approximately 11 miles ENE of Tahlequah.
- The Tyner Creek watershed has a drainage area of 41.8 square miles.
- The natural hydrology and sediment transport characteristics of the watershed have been altered.
- This has induced channel instability in Tyner Creek and its tributaries…
- Which has resulted in increased sediment loading and reduced aquatic habitat.

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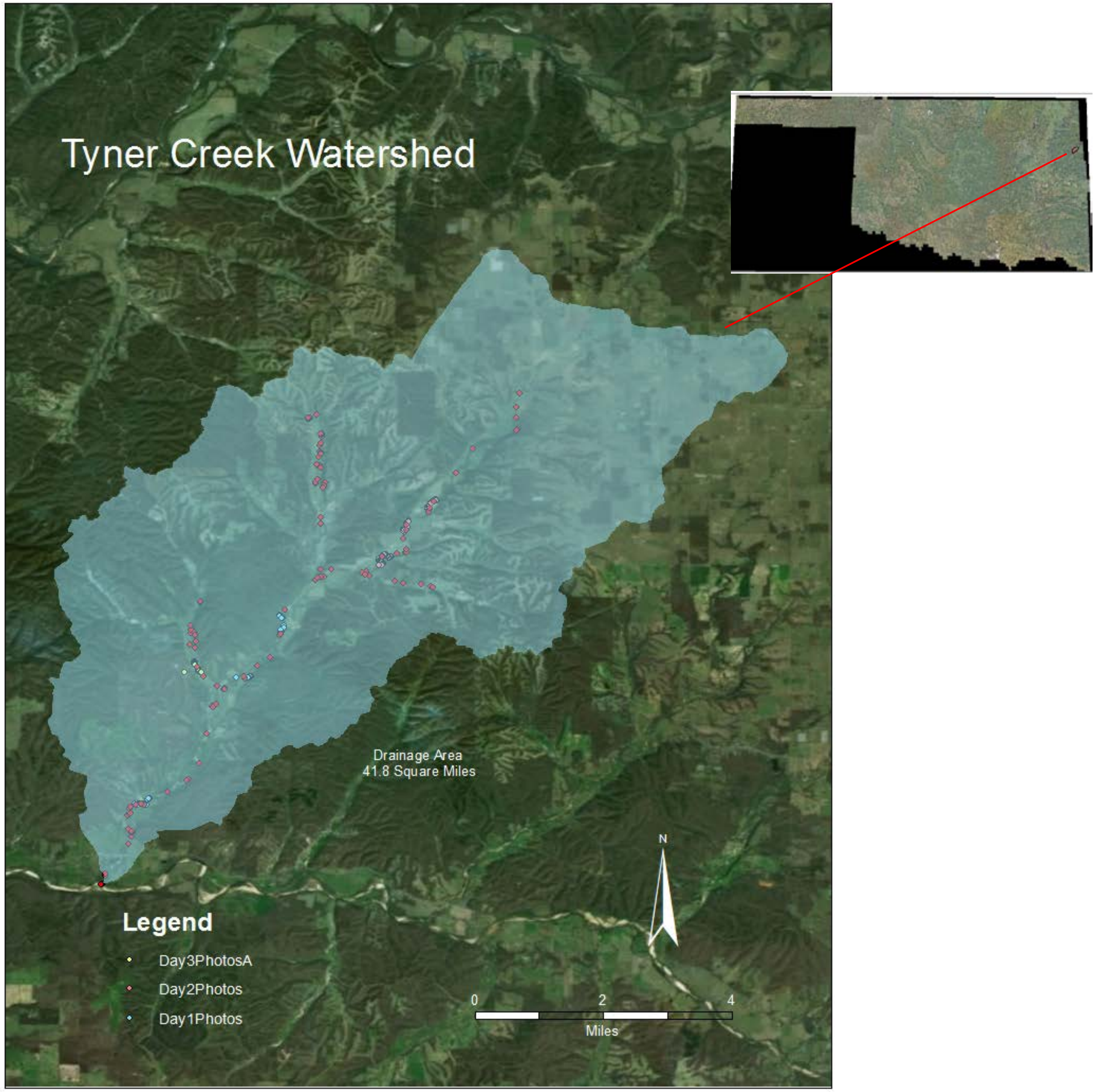
# Introduction

- The Oklahoma Conservation Commission (OCC) is interested in applying natural stream rehabilitation methods to mitigate some of these impacts.
- OCC contracted with Olsson Associates and Riverman Engineering PLC to conduct a stream stability assessment in the watershed.



# Assessment Objectives

- Identify unstable reaches of creek channels within the Tyner Creek watershed.
- Prioritize unstable reaches for potential application of natural stream rehabilitation methods.
- Develop preliminary construction cost estimates for rehabilitation of the high priority reaches.

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# Assessment Tasks

Task 1: Identify the extent of the stream channel network to be assessed.

Task 2: Define the assessment reaches.

Task 3: Select method of assessment.

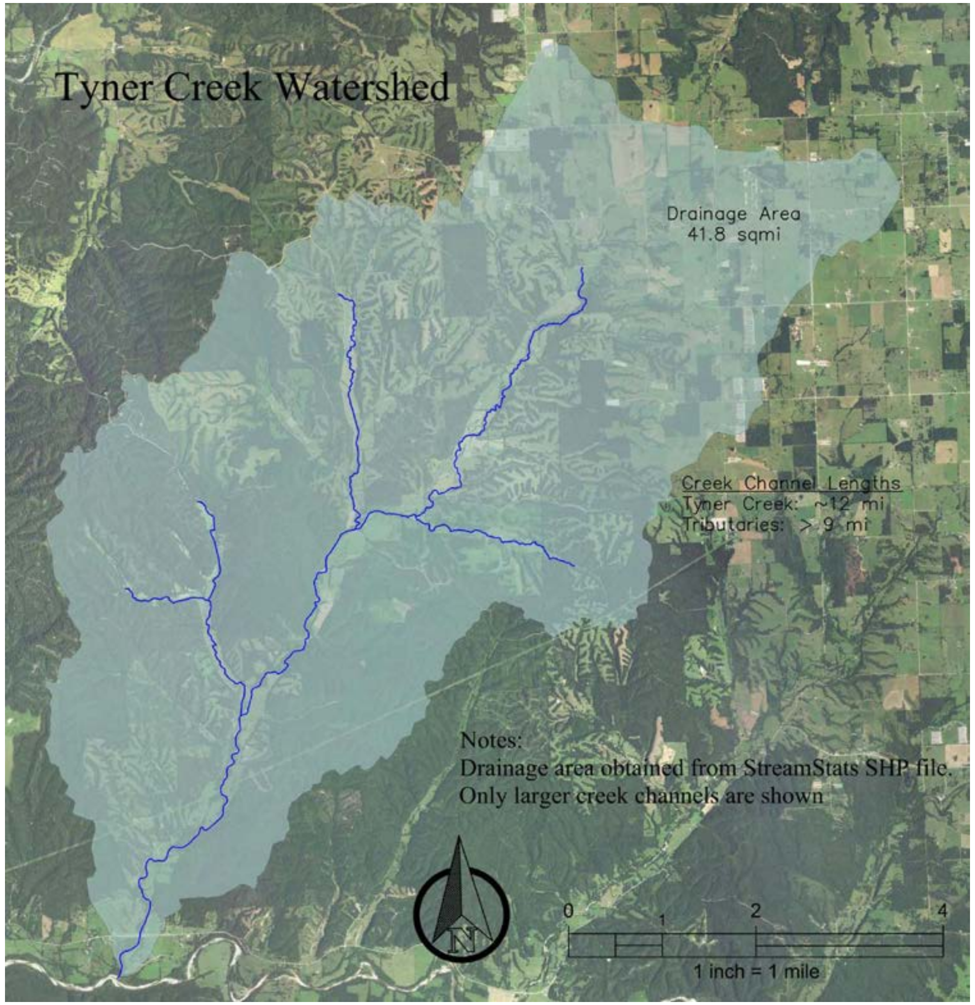
Task 4: Conduct field assessment of Tyner Creek and major tributaries.

Task 5: Prioritize assessed reaches for potential natural rehabilitation.

Task 6: Estimate cost of natural rehabilitation of the high priority reaches.

Task 7: Report writing and production of the final deliverables.

# Task 1: Extent of the stream channel network to be assessed.




- Stream channels were identified by tracing the channels from the “ogi NAIP 2015 Composite” WMS connection to the Oklahoma Map Server, within AutoCAD Civil 3D.
- Google Earth imagery from March 2, 2017 was used to locate the channels when they were under tree canopies and difficult to locate in the 2015 imagery.
- The main stem of Tyner Creek extends more than 12 miles from the confluence with Baron Fork to the headwaters.
- There are more than 9 miles of tributary creek channels flowing into Tyner Creek.
- Note that there are many more channels within the watershed than shown in the figure, which includes only the channels deemed to be the most significant channels based on the 2015 and 2017 imagery.

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# Task 2: Delineation of the assessment reaches

- Initially it was anticipated that the assessment reaches would be identified by conducting a ground reconnaissance of the channels identified in Task 1.
- Instead, after a suggestion by Ed Fite, and some discussion, it was decided that the assessment reaches would be defined utilizing a drone outfitted with a camera.
- Mike Laird, with Olsson Associates flew a drone for us on October 6-7, 2017.
- The project engineers, observing the condition of the stream channel on a TV monitor in the back seat of a truck, would ask the pilot to stop the drone, and take a snap shot when a "site of concern" was observed.
- The still images thus taken are geographically referenced (i.e., the latitude and longitude are provided), allowing for precise location of the site photographed.

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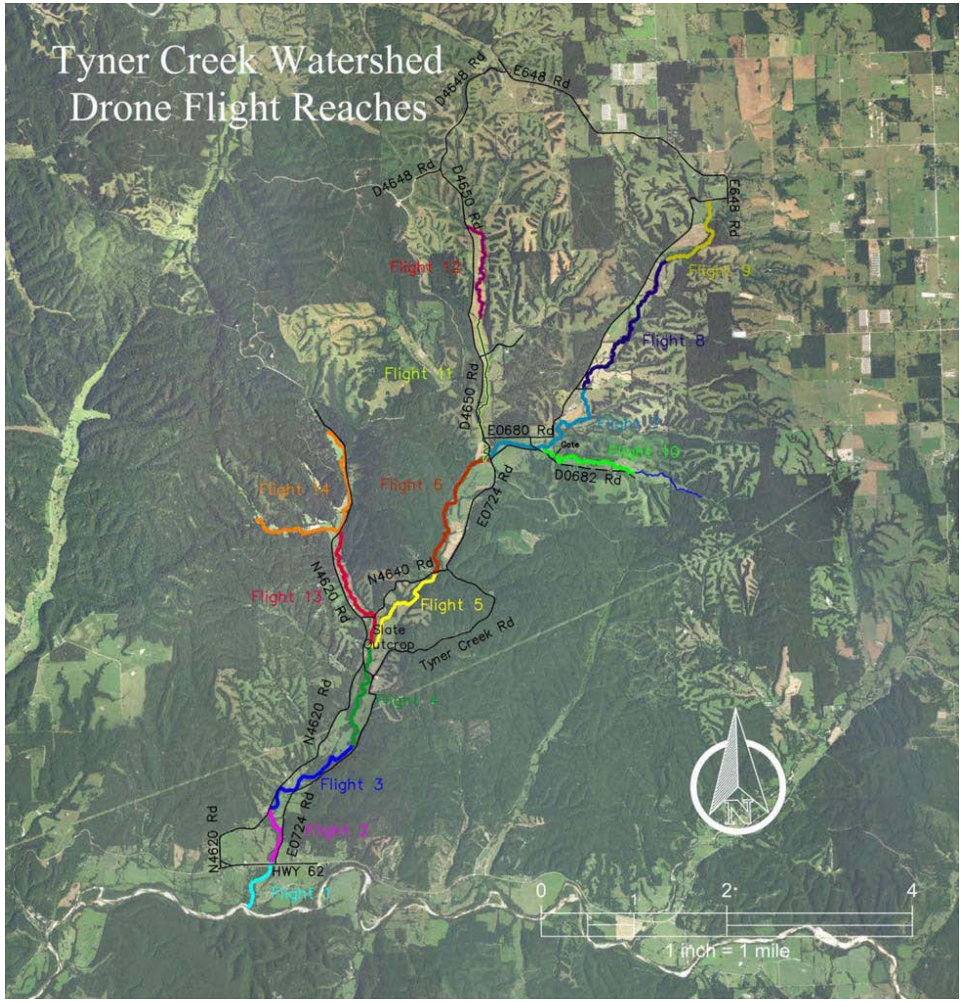
# Task 2: Delineation of the assessment reaches

- The range of the drone is limited to approximately 1½ miles
- 14 "launch sites" were required to cover the channels identified in Task 1.
- The image shows the 14 reaches flown from these "launch sites".
- 71 snap shots were taken at "sites of concern".

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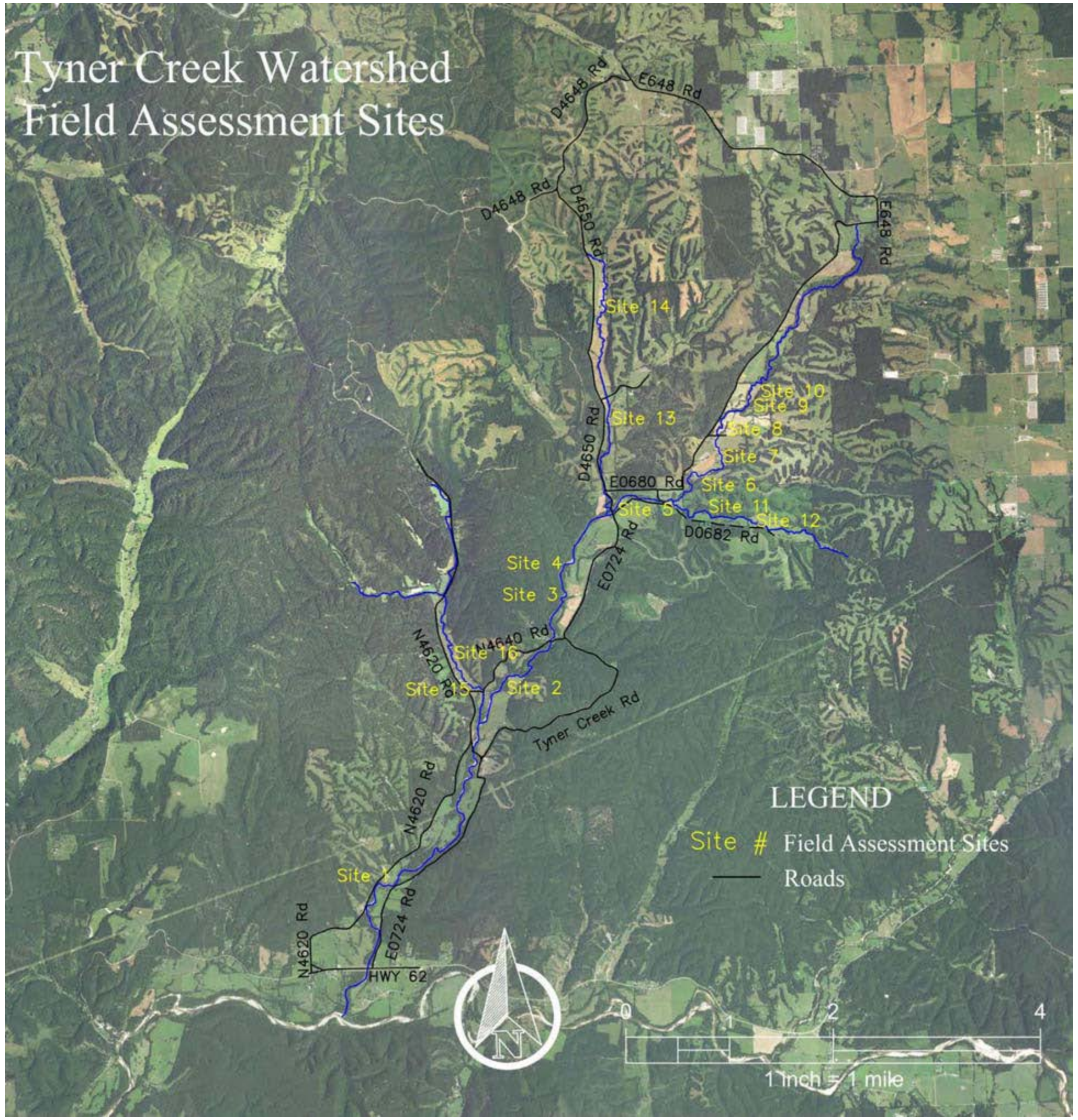



# Task 3: Method of assessment

- Having access to the drone data and snap shots altered the approach taken to assess the reaches identified in Task 2.
- The day after the drone flights of the watershed had been completed, the data obtained by the drone were reviewed.
- Focusing on the 71 sites of concern, the bed and bank characteristics of the channel and the condition of the riparian area at each site was observed.
- Using our best professional judgement (BPJ), and decades of collective experience assessing and restoring stream channels, we identified 16 priority reaches for field assessment.

# Task 4: Field assessment of Tyner Creek assessment sites

- Field assessments of the 16 sites identified in Task 3 were conducted October 9-11, 2017.
- At 14 of the 16 sites, the entire length of each reach, varying from less than 100 yards to almost 800 yards, was walked, and the site was rated from “Very Low” to “Very High”. (Two of the sites were not walked because the reaches were observed from the road and determined to be “Low” priority).
- Each of the project engineers applied their BPJ and independently rated the reaches from “Very Low” to “Very High”, prioritizing each site for restoration from a fluvial geomorphic perspective ((i.e., the benefit restoration of the site would provide the river).
- On the rare occasions where their initial assessments differed, it was discussed until they were in agreement.

# Task 4: Field assessment of Tyner Creek assessment sites

## Assessment Site Descriptions

**Site 6**

Site Location:

Geographical:

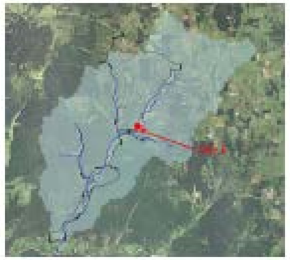
Latitude: 36.03317°; Longitude: -94.71120°

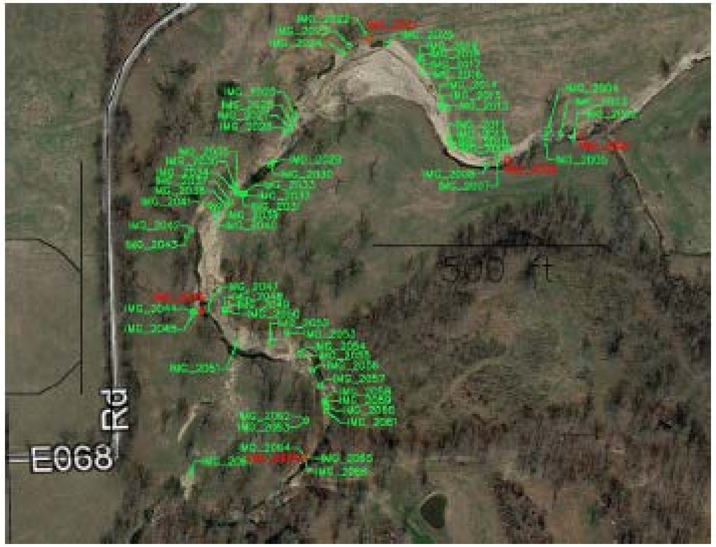
UTM Oklahoma (South Plane):

Easting: 2940723.45'; Northing: 392560.74'

Reach Length: ~630 yards

Est. Project Cost: ~$1,234,000






# Task 4: Field assessment of Tyner Creek assessment sites

## Field Assessment Data Summary

| New Site # | Total Length (yds) | Bank No | Bank Length (yds) | Bank Height (ft) | Cost Est ($/ft) | Priority |
|---|---|---|---|---|---|---|
| 1 | 498 | 1 | 56 | 10 | 500 | Very High |
| | | 2 | 123 | 7 | | |
| | | 3 | 92 | 11 | | |
| 2 | 257 | 1 | 178 | 16 | 800 | Very Low |
| 3 | 204 | 1 | 57 | 6 | 700 | Med |
| | | 2 | 55 | 7 | | |
| | | 3 | 57 | 7 | | |
| 4 | 180 | | | | 800 | Very High |
| 5 | 294 | 1 | 40 | 6 | 600 | High |
| | | 2 | 87 | 8 | | |
| | | 3 | 30 | 6 | | |
| | | 4 | 43 | 12 | | |
| 6 | 633 | 1L | 30 | 6 | 650 | Very High |
| | | 2R | 35 | 6 | | |
| | | 3L | 70 | 9 | | |
| | | 4R | 65 | 5 | | |
| | | 5R | 108 | 7 | | |
| | | 6L | 75 | 5 | | |
| | | 7R | 18 | 4 | | |
| | | 8R | 121 | 6 | | |
| | | 9R | 46 | 5 | | |
| | | 10L | 65 | 11 | | |
| 7 | 757 | 1L | 55 | 8 | 650 | Very High |
| | | 2L | 35 | 3 | | |
| | | 3R | 102 | 6 | | |
| | | 4R | 65 | 7 | | |
| | | 5L | 75 | 11 | | |
| | | 6R | 90 | 6 | | |
| | | 7L | 176 | 7 | | |
| | | 8R | 59 | 8 | | |
| | | 9L | 50 | 8 | | |
| | | 10L | 50 | 5 | | |

| New Site # | Total Length (yds) | Bank No | Bank Length (yds) | Bank Height (ft) | Cost Est ($/ft) | Priority |
|---|---|---|---|---|---|---|
| 8 | 457 | 1R | 60 | 11 | 650 | Med |
| | | 2L | 46 | 7 | | |
| | | 3R | 73 | 10 | | |
| | | 4L | 61 | 7 | | |
| | | 5R | 45 | 6 | | |
| | | 6L | 35 | 5 | | |
| | | 7R | 79 | 11 | | |
| | | 8L | 58 | 6 | | |
| 9 | 137 | 1L | 79 | 7 | 600 | Low |
| | | 2R | 58 | 6 | | |
| 10 | 325 | 1R | 75 | 8 | 500 | Low |
| | | 2R | 48 | 10 | | |
| | | 3L | 65 | 8 | | |
| 11 | 91 | | 91 | 10 in HC pool | 350 | Very High |
| | | | | | | |
| 12 | | | | | 100 | Low (Fencing) |
| 13 | 210 | 1 | 150 | 2.5 | | Low-Med |
| | | 2 | 60 | 3.5 | | |
| 14 | | | | | 100 | Low (Fencing) |
| 15 | 229 | 1L | 61 | 5 | 100 | Low (Fencing) |
| | | 2R | 32 | 3 | | |
| | | 3L | 20 | 3 | | |
| 16 | 127 | 1L | 32 | 7 | 550 | Low |
| | | 2R | 51 | 6 | | |
| | | 3L | 29 | 5 | | |

# Estimated sediment load reduction

- Reduced sediment loading is one of the primary benefits of natural channel rehabilitation; so much so, in fact, that even though it was not listed as a project task, estimates of the sediment load reduction that would be provided by implementation of a project at each site were included in the assessment.
- This was accomplished using aerial photography from 2008 and 2015, and two different but similar methods.
- In one method, the product of the field measured bank lengths and heights were multiplied by the average bank erosion distance observed in the aerial imagery.
- In the other method, the bank height measured in the field was multiplied by the area of the bank eroded as observed in the aerial imagery.
- The estimates provided by the two methods are similar.

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# Task 5: Prioritization of assessed reaches for potential natural rehabilitation

Factors deemed important in prioritizing the sites for natural rehabilitation include:

- The geomorphic priority assigned to the reach.
- The estimated sediment loading reduction provided by implementing a natural rehabilitation project at the site.
- Existing infrastructure at the site.
- The social and political implications of implementing a project at the site.

| Site # | Geomorphic Priority | Total Est. Sed. Load ($yds^3$/yr) | Infrastructure | Soc./Pol. |
|---|---|---|---|---|
| 1 | Very High | Insignificant | County Rd. | High |
| 2 | Very Low | 1,040 | None | Low |
| 3 | Med | 410 | None | Low |
| 4 | Very High | *** | None | Very High |
| 5 | High | 190 | LW x-ing | Med |
| 6 | Very High | 1,620 | None | Low |
| 7 | Very High | 1,400 | None | Low |
| 8 | Med | 580 | None | Low |
| 9 | Low | 240 | None | Low |
| 10 | Low | 370 | None | Low |
| 11 | Very High | *** | None | Low |
| 12 | Low (Fencing) | *** | None | Low |
| 13 | Low-Med | 120 | None | Low |
| 14 | Low (Fencing) | *** | None | Low |
| 15 | Low (Fencing) | 100 | None | Low |
| 16 | Low | 150 | None | Low |

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# Task 6: Estimated cost of natural rehabilitation of the assessment reaches

- Estimating the cost of implementing a natural rehabilitation project is difficult to do without a design.
- Project engineers independently estimated the cost per linear foot of constructing a project at the site.
- If their initial estimates differed, it was discussed until they were in agreement.

| Site # | Total Length (yds) | Cost Est (/ft) | Total Est. Sed. Load ($yds^3/yr$) | Est. Project Cost ($) | Sed. Reduction Cost Est. ($/yds^3/yr$) |
|---|---|---|---|---|---|
| 1 | 498 | $ 500 | Insignificant | $747,000 | *** |
| 2 | 257 | $ 800 | 1040 | $616,800 | $593 |
| 3 | 204 | $ 700 | 415 | $428,400 | $1,032 |
| 4 | 175 | $ 800 | *** | $420,000 | *** |
| 5 | 294 | $ 600 | 194 | $529,200 | $2,734 |
| 6 | 633 | $ 650 | 1622 | $1,234,350 | $761 |
| 7 | 757 | $ 650 | 1437 | $1,476,150 | $1,028 |
| 8 | 457 | $ 650 | 583 | $891,150 | $1,528 |
| 9 | 137 | $ 600 | 240 | $246,600 | $1,028 |
| 10 | 325 | $ 500 | 373 | $487,500 | $1,307 |
| 11 | 91 | $ 350 | *** | $95,865 | *** |
| 12 | ? | $ 100 | *** | *** | *** |
| 13 | 210 | $ 100 | 116 | $63,000 | $545 |
| 14 | ? | $ 100 | *** | *** | *** |
| 15 | 229 | $ 100 | 101 | $68,700 | $683 |
| 16 | 127 | $ 550 | 153 | $209,550 | $1,366 |

# Summary

## Site Prioritization Factors Summary

| Site # | Total Length (yds) | Geomorphic Priority | Cost Est (/ft) | Total Est. Sed. Load ($yds^3$/yr) | Est. Project Cost ($) | Sed. Reduction Cost Est. (/$yds^3$/yr) | Infrastructure | Soc./Pol. |
|---|---|---|---|---|---|---|---|---|
| 1 | 498 | Very High | $500 | Insignificant | $747,000 | *** | County Rd. | High |
| 2 | 257 | Very Low | $800 | 1,040 | $616,800 | $593 | None | Low |
| 3 | 204 | Med | $700 | 410 | $428,400 | $1,045 | None | Low |
| 4 | 175 | Very High | $800 | *** | $420,000 | *** | None | Very High |
| 5 | 294 | High | $600 | 190 | $529,200 | $2,785 | L/W x-ing | Med |
| 6 | 633 | Very High | $650 | 1,620 | $1,234,350 | $762 | None | Low |
| 7 | 757 | Very High | $650 | 1,400 | $1,476,150 | $1,054 | None | Low |
| 8 | 457 | Med | $650 | 580 | $891,150 | $1,536 | None | Low |
| 9 | 137 | Low | $600 | 240 | $246,600 | $1,028 | None | Low |
| 10 | 325 | Low | $500 | 370 | $487,500 | $1,318 | None | Low |
| 11 | 91 | Very High | $350 | *** | $95,865 | *** | None | Low |
| 12 | *** | Low (Fencing) | $100 | *** | *** | *** | None | Low |
| 13 | 210 | Low-Med | $100 | 120 | $63,000 | $525 | None | Low |
| 14 | *** | Low (Fencing) | $100 | *** | *** | *** | None | Low |
| 15 | 229 | Low (Fencing) | $100 | 100 | $68,700 | $687 | None | Low |
| 16 | 127 | Low | $550 | 150 | $209,550 | $1,397 | None | Low |

## Site Prioritization Summary

| Site Rating | Site # | Estimated Repair Cost |
|---|---|---|
| 1 | 4 | $420,000.00 |
| 2 | 6 | $1,234,350.00 |
| 3 | 1 | $747,000.00 |
| 4 | 11 | $95,865.00 |
| 5 | 7 | $1,476,150.00 |
| 6 | 5 | $529,200.00 |
| 7 | 3 | $428,400.00 |
| 8 | 8 | $891,150.00 |
| 9 | 13 | $63,000.00 |
| 10 | 16 | $209,550.00 |
| 11 | 9 | $246,600.00 |
| 12 | 10 | $487,500.00 |
| 13 | 15 | $68,700.00 |
| 14 | 2 | $616,800.00 |
| 15 | 14 | *** |
| 16 | 12 | *** |

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# Questions?