Final Report

Critical Area Channel Restoration in the Illinois River Watershed

CA # C9-00F91801, FY 2014, §319(h), Project 1

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EPA Region 6

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1.0 Introduction

1.1 Project Location and Background

One of Oklahoma's highest priority watersheds, the Illinois River straddles the OK/AR border covering 1,069,530 total acres, of which 54% occurs in Oklahoma (Figure 1). Most of the river and its major tributaries (Barren Fork and Flint Creek) are classified as state scenic rivers, and along with Lake Tenkiller, are some of Oklahoma's most popular recreational destinations supporting a sizeable tourism industry in the region. The Illinois River, Lake Tenkiller and some of the principal tributaries in the watershed are violating water quality standards for nutrients, bacteria, and other issues. In addition to municipal and agricultural sources, multiple studies/reports cite unstable and degrading streambanks as a significant contributor of gravel, sediment, and associated nutrient loads. The nine-element WBP for the Illinois River references streambank stabilization both as a significant source of NPS pollution and as one of the preeminent NPS management measures which must be addressed in any strategy to restore the river (OCC 2011).

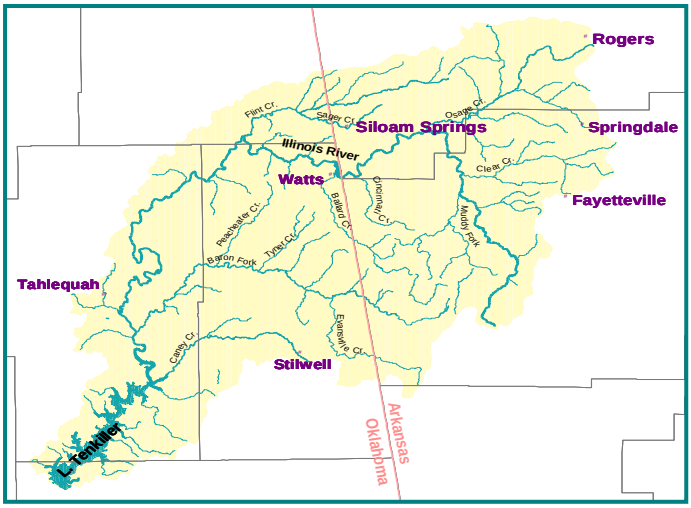

Figure 1. Illinois River Watershed.

A 2009 EPA ARRA Clean Water State Revolving Fund (CW SRF) project identified at least 35 sites in the Illinois River Watershed with significant bank erosion where landowners and land managers were requesting assistance to address sustained streambank erosion. The CW SRF project invested $1.2 million to install restoration projects at 11 of these sites and USFWS service invested an additional $100,000 to address one site. Oklahoma Department of Transportation (ODOT) has planned a minimum of $1.6 million of state funds to address two of the largest additional sites over the next four years and the Oklahoma Department of Wildlife Conservation (ODWC) is investing another $200,000 to address multiple sites within the next two years. These sites range in size of both the erosional area and the stream order affected, but all have been contributing significant amounts of sediment through the years. One example is the ODOT project on the Illinois River just upstream of the OK51/US62 bridge in Cherokee County, Oklahoma (Figure 2). ODOT engineering analysis shows that from 1995–2012, the bank lost 80,374 cubic yards of material, with channel movement along the reach ranging from 14.7' to 132'. An analysis of the more recent ten years (2003-2012) shows acceleration of the issue as the majority of the bank loss and channel movement took place during this time (74,240 cubic yards; 21.29 feet to 87.29 feet in channel movement). This loss of material equates to as much as 800,000 pounds of

phosphorus and 10.4 million pounds of nitrogen released from the streambank soils into the river column since 1995.

Figure 2. Project Site Example Showing the Illinois River Reach Threatening State Highway 10 (Proposed Project Area Outlined in Red).

Recent reconnaissance of the watershed by the Grand River Dam Authority (formerly Oklahoma Scenic Rivers Commission) and researchers from Baylor University suggest that the need for natural channel design restoration is greater than ever, with many desperate landowners seeking to stabilize their significantly eroding banks without permits and with inferior techniques. Significant investment is slated from program partners to address several of the most significant candidate sites already in queue from previous ranking efforts. The additional support from this EPA §319 project will help fill in significant gaps and justify additional state funds toward the completion of additional or larger, more erosive site restorations in the watershed.

1.2 Project Objectives and Outcomes

One objective of this project was to partner with ODOT, Oklahoma Department of Wildlife Conservation (ODWC), and other entities in a streambank stabilization effort to address one or more critically compromised stream reaches in the Illinois River watershed to mitigate loss of private property, alleviate threat to state highway infrastructure, and reduce significant delivery of gravel, sediment and associated nutrient loads to the Illinois River.

The use of EPA §319 funds with support from the Oklahoma Secretary of Energy and Environment (OSEE) facilitated the program's ability to require participating landowners to enroll the restored sites in a long-term conservation agreement in partnership with the Grand River Dam Authority. This guaranteed project investment and additional load reduction through long-term protection of the restoration sites. Landowners who received assistance with stabilizing stream channels were required to agree to maintain a conservation focused land management strategy.

This project was a collaborative effort of several partners, including primarily the Oklahoma Conservation Commission (OCC), ODOT, ODWC, US Fish and Wildlife Service (USFWS), Cherokee and Adair County Conservation Districts, Natural Resources Conservation Service (NRCS), Grand River Dam Authority (GRDA), U.S. Army Corps of Engineers (USCOE), Oklahoma Department of Environmental Quality (ODEQ), and participating landowners.

1.3 Project Tasks

Task 1. Project Management

OCC served as the project lead and worked with program partners to oversee project completion. Partners worked together to select restoration sites based on partner needs, funding requirements, as well as estimated erosion rates and approximate restoration costs.

Task 2. Contracting Fluvial Geomorphology Work

OCC worked through the Oklahoma state process to contract with a service provider proven in fluvial geomorphology (FGM) design and construction. OCC's contracting rules allow contracting for design-build, meaning one contractor is engaged for both project design and implementation. OCC used the state's design-bid-best-value process, which facilitates contractor bids based on what they can accomplish for the total project amount. This guaranteed project results for the money, versus the award-to-low bid process which often results in contractors who are unable to meet the project goals due to unplanned expenses.

Task 3. Project Design and Implementation Planning

The FGM contractor conducted site visits, necessary surveys, and data collection to draft an engineering design and implementation plan to address streambank instability and channel migration at selected sites. Part of this effort involved a basic pre-treatment FGM analysis of stream channel characteristics in accordance with widely used Rosgen techniques. During this time, the contractor and OCC worked together to pursue the necessary permits required to perform construction in the stream channel.

Task 4. Project Construction

The FGM contractor implemented final project design at approved sites. OCC oversaw progress and photo-documented design implementation. General construction and associated plantings were be completed during the dormant period following construction.

Task 5. Project Evaluation and Final Report

As part of the routine design process, the contractor conducted pre and post construction engineering surveys that included estimates of sediment delivery through the project reach. OCC used these

numbers and known streambank nutrient values from a nearby stream in a simple multiplication and unit conversion exercise to estimate reductions in both sediment and associated nutrient loads. No samples or original data were collected during this project.

2. Tasks and Accomplishments

Task 1. Project Management

The OCC met with partners on numerous occasions to tour eroding banks in portions of the watershed and consider potential sites for restoration work. Although OCC had entered into an agreement with ODOT to oversee state-funded FGM work on the Illinois River along Highway 10 near the confluence with highway 62, federal EPA funds from this project as well as state and USFWS funds from the Southeast Aquatic Resources Partnership (SARP) Aquatic Habitat Restoration Funding Assistance Program allowed additional sites to be restored in the watershed.

A site on the Barren Fork River was initially selected by partners for restoration work based on landowner cooperation, erosion rates, and potential to restore aquatic habitat. Landowners signed cooperative agreements and the OCC began the bidding solicitation process through the state Office of Management and Enterprise Services (OMES) Construction and Properties Division (CAP). A mandatory pre-bid meeting was held on-site and attended by several qualified firms with FGM experience. Unfortunately, bids submitted by all three eligible firms were nearly double available funding for the project, which forced partners to cancel the agreement with landowners and look for an alternative site.

A second site on the Barren Fork River was also considered based on landowner interest and perception of the extent of unstable bank compared to completed projects in the watershed. This site was also visited by several firms who were interested in working on a restoration project. The site visitation was helpful in that once again, qualified FGM firms clarified that available funds would not cover sufficient work on that particular site to best insure a lasting and effective restoration project.

In order to limit the potential for future poor site selection, the OCC contracted with an experienced FGM firm whose work schedule would not allow them to bid on this project, to review potential sites for restoration purposes and to provide cost estimates for restoration work. In January 2016 staff from this firm, Watershed Conservation Resource Center, reviewed sites on the Barren Fork, Tyner Creek and Flint Creek.

A report in Appendix A provided some relative cost projections as well as extent of project required for each potential site, which would affect both the cost and the challenges in permitting the projects. Table 1.

Table 1. Summary of design and construction costs and annual establishment cost.							
Site	**Design & Construction Estimated Cost ± 25%**	**Annual Establishment Cost Estimate ± 25% (not part of design/construction cost)**					
		Year 1	Year 2	Year3	Year 4	Year 5	**Total**
Barren Fork	**$670,800**	$67,000	$30,000	$30,000	$15,000	$15,000	**$157,000**
Tyner Creek	**$265,400**	$27,000	$15,000	$15,000	$10,000	$8,000	**$ 75,000**
Flint Creek	**$287,700**	$29,000	$15,000	$15,000	$10,000	$8,000	**$77,000**

The information on projected design and construction costs was helpful in determining that the Barren Fork site was outside the budget range for the project. However, further discussions with the Watershed Conservation Resource team and other project partners about the Flint Creek versus the Tyner Creek site weighed the pros and cons of completing a project at the very bottom of a watershed (Flint Creek) versus a project further up in a watershed, but at a location where a previous restoration had been completed in 2012 and been relatively stable for several years through several bankfull events, but was later damaged by a December 2015 flood of record and in need of redesign and repair.

After much consideration, the partners selected to focus the project on the Tyner Creek site, but to also complete more moderate repair work on some other sites in the Illinois River watershed where previous bank stabilization efforts had been undermined by the December 2015 flood (Figure 1). In addition, partners worked with ODOT to complete restoration on the Illinois River at Highway 10 using state ODOT funds. Using EPA 319 and required state matching funds, plus USFWS, ODWC, and additional state funds, partners solicited bids from qualified firms through the OMES bidding process in an effort that ultimately determined to complete restoration repair work at the Tyner Creek site, Felts Park, and History Trail Park sites. However, the final selected contractor produced a projected cost for the first three sites that was low enough to also allow repair work to be done at the Illinois River Ranch Site. These sites had been originally restored in 2012 but were later damaged in December 2015 Flooding.

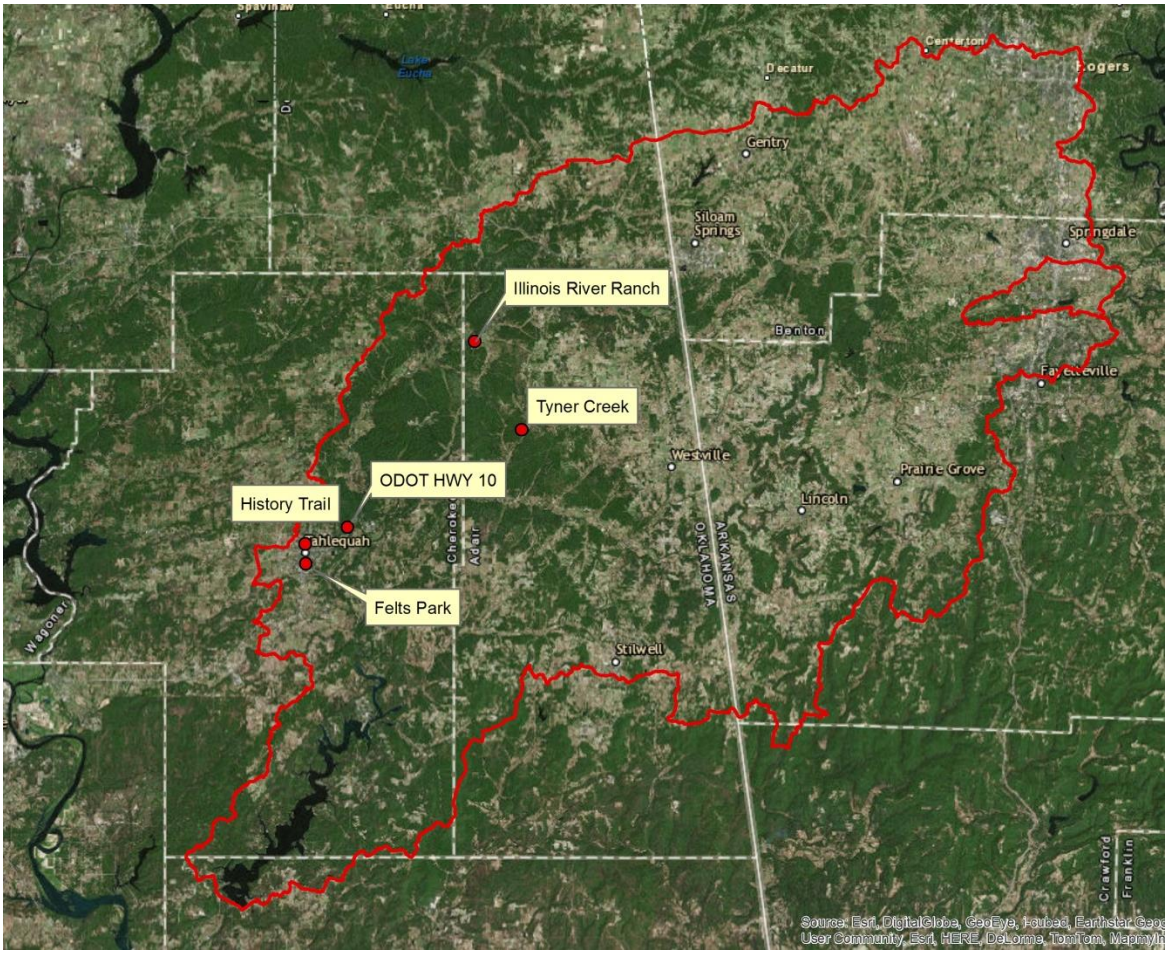

Figure 1. Map of selected sites for bank restoration projects.

Task 2. Contracting FGM Work

OCC and partners worked through the OMES CAP design-build process to select a qualified, experienced firm. The ODOT project was bid separately from work on the other three because it was originally scheduled to be completed in 2015. Partners were also hoping that bidding the two projects separately would encourage additional qualified firms to participate in the process and ultimately complete projects in Oklahoma. Although several firms participated in the process, the company ultimately selected for the design and construction work for both projects was NorthState Environmental, working in partnership with 5 Smooth Stones Restoration, PLLC. This team had implemented the largely successful restoration projects in 2012 and were invested in repairing and improving these sites. This investment and interest in maintaining successful projects likely enabled work to be completed at more sites than would have been possible with a less-invested restoration firm. The bid package for restoration work at the Tyner, History Trail, and Felts Park sites is seen in Appendix B.

Although work had originally been planned on the ODOT Highway 10 site for the previous year, challenges with land rights raised during the permitting process led ODOT to enter into an agreement with a landowner to purchase property on the opposite bank to mitigate against potential impacts to neighboring landowners. This effort, along with increasingly wet weather, resulted in the project being substantially delayed until late fall/early winter of 2016, which was beneficial in that the contractor was able to complete work at all five sites concurrently, which enabled some sharing of live and native plants and other materials between sites that would have been more challenging if the ODOT project was conducted earlier. In addition, had the work on the ODOT project been able to be substantially completed in fall of 2015 as originally intended, it would likely have been significantly damaged by the flood of December 2015.

Task 3. Project Design and Implementation Planning

One benefit of using the same firm that had completed the work in 2012 was that they had significant historical data on the sites that other firms would not have had. They had detailed data of the four 2012 sites from before the 2015 flood and a better understanding of how the sites performed during highflow events. However, detailed surveys were necessary to prepare design plans and to allow for U.S. Army Corps of Engineers (USACE) permitting. This field work was completed in September 2016 for the four repair sites and in spring and fall of 2015 and fall of 2016 for the ODOT project.

The footprint of repair work on the four sites remained within the original design footprint, and therefore USACE did not require a permit update or modification. The permit for the ODOT project was approved in July of 2015 (Appendix C).

During the permitting and planning process, the OCC negotiated with landowners for access permission, but also developed long-term maintenance agreements that best insure the longevity of the projects. Unfortunately, the 2015 flood damage and need to repair the project caused the Tyner Creek landowner to have to back out of his U.S. Department of Agriculture Farm Services Agency Conservation Reserve Enhancement Program contract as it would not allow land disturbance. However, all cooperating landowners signed agreements that eliminated or restricted vegetation removal to invasive species and also eliminated livestock access and grazing in the riparian area.

Task 4. Project Construction

ODOT Project Construction

Project construction on the ODOT site began in November of 2015. The construction project began with construction of an access road, recontouring the river bed and placing some bank toe stabilizing riprap below the waterline along the curve and reshaping of the west bank to construct a deformable bench. The deformable bankfull bench design feature was added after the NorthState team had more information about bank material and historical records of bank migration.

The purpose of this grading or cut was to create a bankfull bench that could establish riparian vegetation before the Illinois River applies a high-extreme shear force or near bank shear stress to this graded and

vegetated bankfull bench. The existing bank was predicted to erode and migrate west at a rate of 1.0 ft/yr. There is some existing vegetation and resistance to deformation on the existing right bank of the river. Worried about the potential for significant bank erosion to occur before new vegetation was firmly established, the team designed a bankfull bench that could allow the Illinois River to deform the existing bank until the new bank had time to vegetate and stabilize.

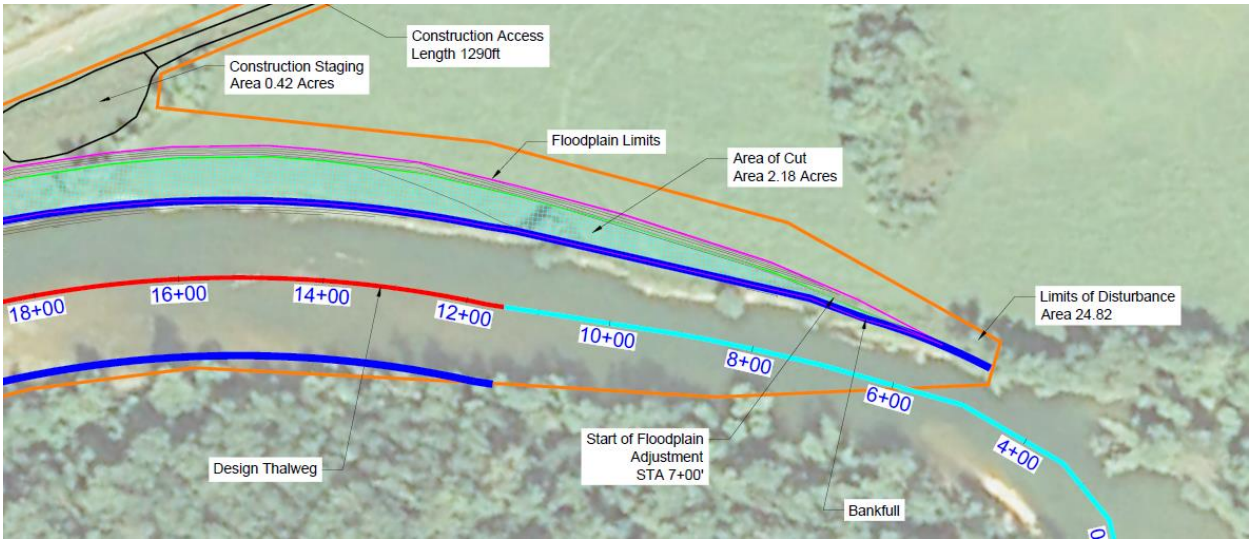

Figure 2: Plan View of Deformable Bankfull Bench

The bankfull bench was designed to have 30'-55' of bank to erode before the bankfull bench would be activated by the eroding existing right bank of the Illinois River. Cross-Section #1 and Cross-Section #2 displays a top bankfull bench top width 60 – 70 feet. With a predicted bank erosion rate of 1'yr -2'/year, it was expected that the Illinois River will have at least 15 years for riparian vegetation to establish before the River will apply a high shear force to the bankfull bench.

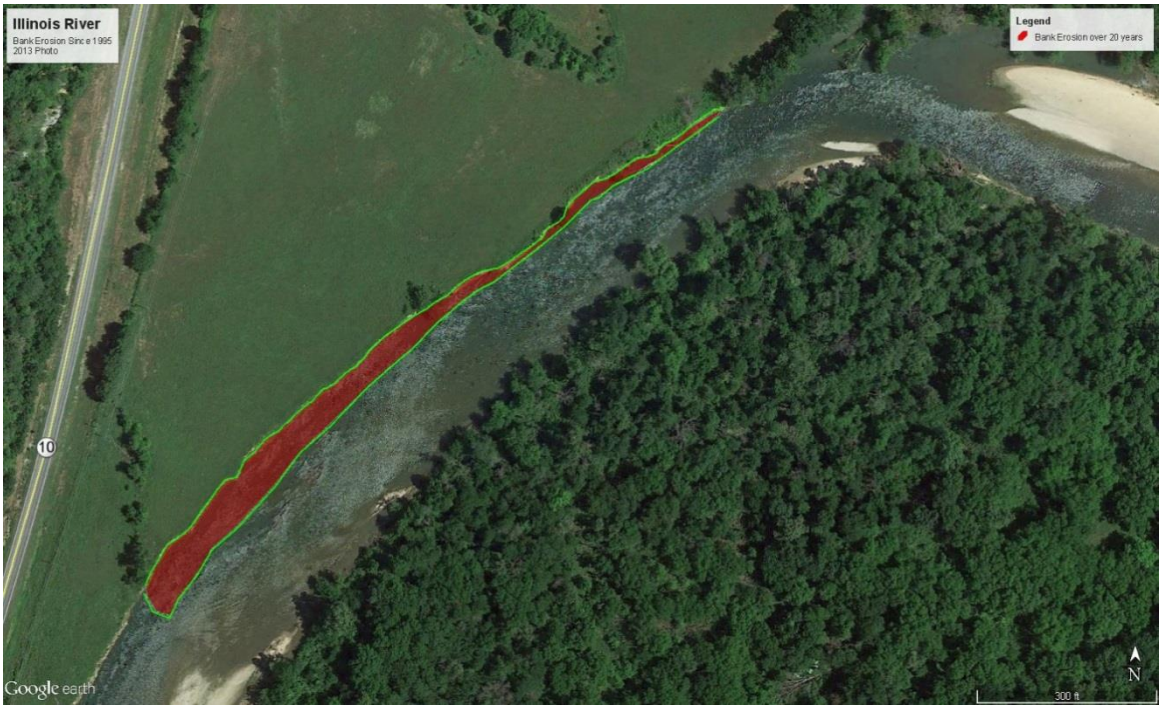

Figure 2: Bank Erosion since 1995 with 2013 Photo

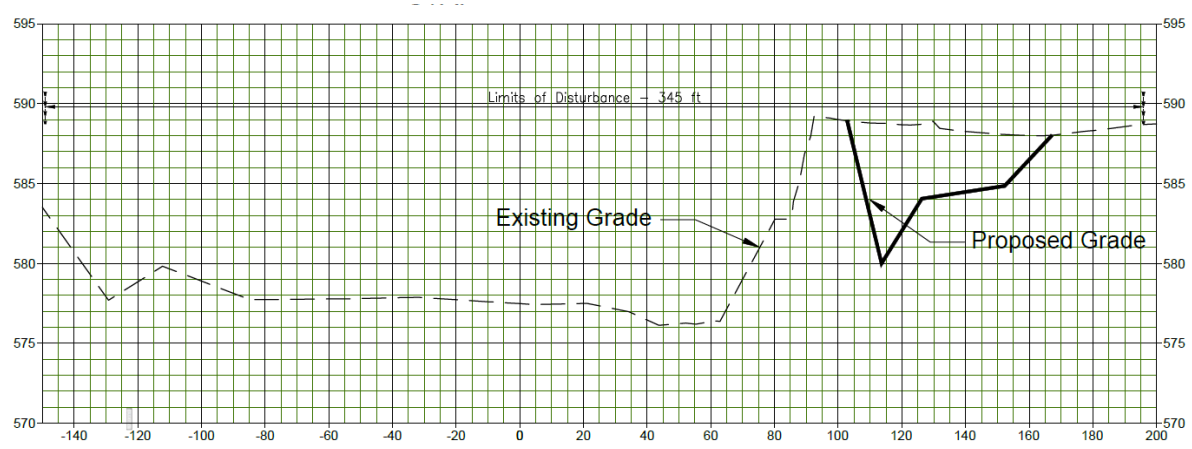

Figure 3: Cross-Section #1 Station13+88.56' showing the difference between existing bank and deformable bench.

Figure 4. Construction of Bankfull Bench and Channel Reconfiguration begun in Fall 2015.

Unfortunately, as this new bank and channel were being constructed, fall rains began and continued. The river remained too high and ground too saturated. After more than two weeks of limited site access, the decision was made to postpone the work until after the winter holidays. The team planned to return after the first of the year.

However, the flood of December 2015 did cause some damage to the site which led the team to reconsider the design (Figure 6). On a positive note, although there was some damage to the site, many of the features that had been constructed held up well to a period of record event.

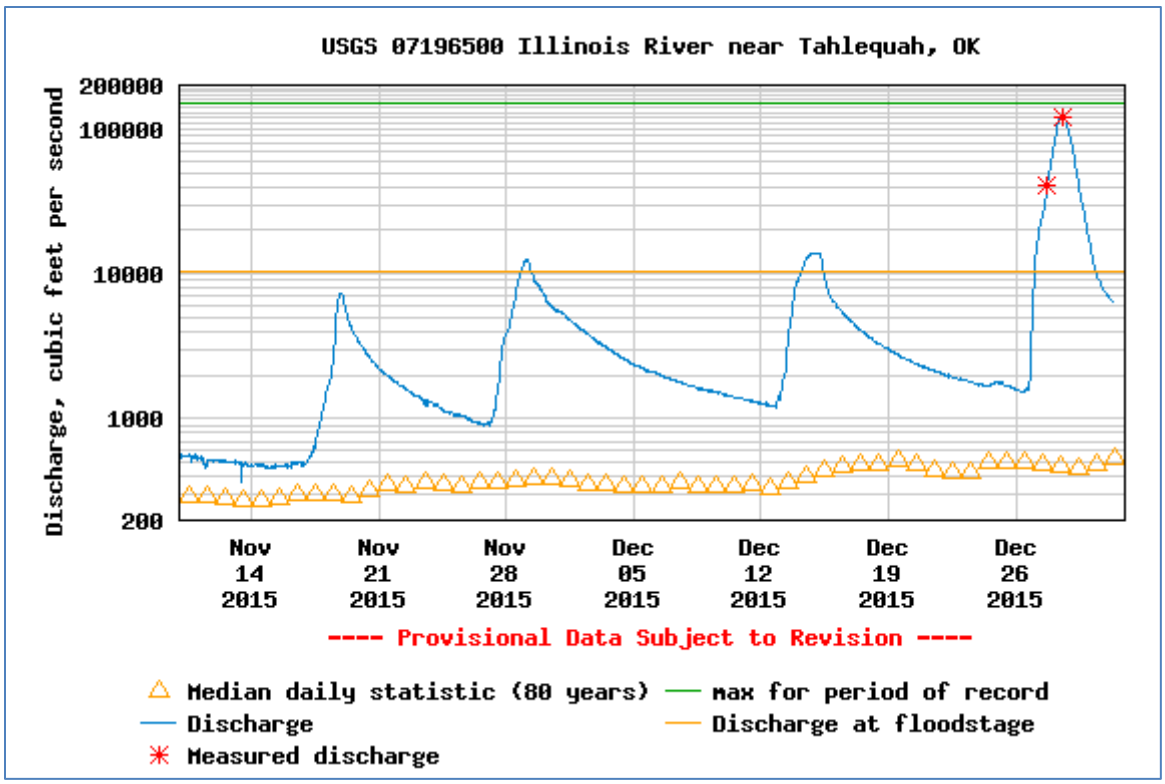

Figure 5. Discharge Record for Flood of 2015.

Examples of positive response to the flood include a relative small migration of the bank of concern after the flooding. In the area where the bank was closest to the road and therefore of greatest concern, in most places, the bank only migrated 0.9 feet. Overall, the average bank erosion rate at the site was about 1.8 feet, which was not as bad as expected for a period of record flood event at a site with a disturbed bank and bed (Figures 6 and 7).

Figure 6. Photo describing post-flood bank migration.

Other positives included that the soil and fill that had been stockpiled on site was not eroded away and only minor erosion occurred on the newly constructed bench. Also, erosion at the bankfull bench averaged 4.2 feet during the storm event or a rate of about 1.3 feet/year, which is within the expected annual erosion rate that was anticipated with less extreme flooding events.

At that point, the team determined to mulch and seed the disturbed riparian areas, and to revisit the site and design the following year, allowing for scheduling of other projects, and rainfall patterns and river levels.

Figure 7. Map of bank migration over the majority of the ODOT site.

Construction started again in September 2016. By mid-October, the project was substantially complete in terms of grading, although full planting wasn't completed until December after full vegetative dormancy. Comparison of photos in Figure 8 to the location of telephone poles in Figure 6 show how far the main channel was moved away from the highway through construction of a stable bench and more gradual bank slope.

Although the project experienced some relatively high flows during the winter of 2016/17, by April, vegetation had come in nicely along the planted banks while transplanted and newly planted trees were beginning to leaf out (Figure 9). The final restoration included 2,830 feet of restored bank.

Figure 8. Preliminary mulching and seeding occurred in late October, although full planting was planned for December. Trees were transplanted from the opposite bank and rootballs placed near the water level to promote optimal survivability.

Figure 9. ODOT project in April 2017, looking downstream.

Repair Projects at Tyner Creek, Illinois River Ranch, Felts Park, and History Trail Sites

Design plans were finalized and construction began at the four sites in late October 2016. The site at Felts Park had degraded in the historic December 2015 flood (Figures 10 and 11). The stabilizing toe-wood had washed out allowing the bank to slough and the channel to migrate west. This allowed gravel from upstream to bury structures and further push the channel toward the less stable bank.

Figure 10. Before and After Photos of Restoration at Felts Park in 2012.

Figure 11. Damage to Felts Park Restoration in December 2015.

The plan for Restoration at the Felts Park site included moving the channel back in line with the 2012 installed structures, replacing material and re-grading the west bank slope, and replacing the toe wood with a boulder to anchor (Figure 12). In addition, material was moved from the downstream section of the west bank in order to better tie in the downstream end and reduce potential backup of flood waters at the site that might impact longevity.

The result was a project that was back in line with the original structures and had a better anchored and sloped west bank which should allow better growth of stabilizing vegetation (Figure 12 and 13). Additional live-stake trees were planted along the upper banks and at the water line along with stabilizing annual and perennial grasses. The final project restored 250 linear feet of eroding bank.

Figure 12. Felts Park right (west) bank looking upstream (spring 2016).

Figure 13. Right (west) bank looking downstream immediately following construction (Fall 2016).

The History Trail site had also degraded in the December 2015 floods, moving almost back to the original position before the 2012 restoration (Figure 15). The damage removed the toe and slope and supporting vegetation that had been added to protect the walking path and sewer pipe beneath it. The restoration plan included reforming and armoring more of the left bank bench with rock as well limiting the channel back to the width of the original structures. The sloped bank would then be replanted with native trees and grasses (Figure 16).

Construction was completed on the 200 linear foot project in November 2016 and vegetation began to grow in quickly. By the following spring, grass coverage was very good on the slope and many of the trees were showing signs of life (Figures 17 and 18).

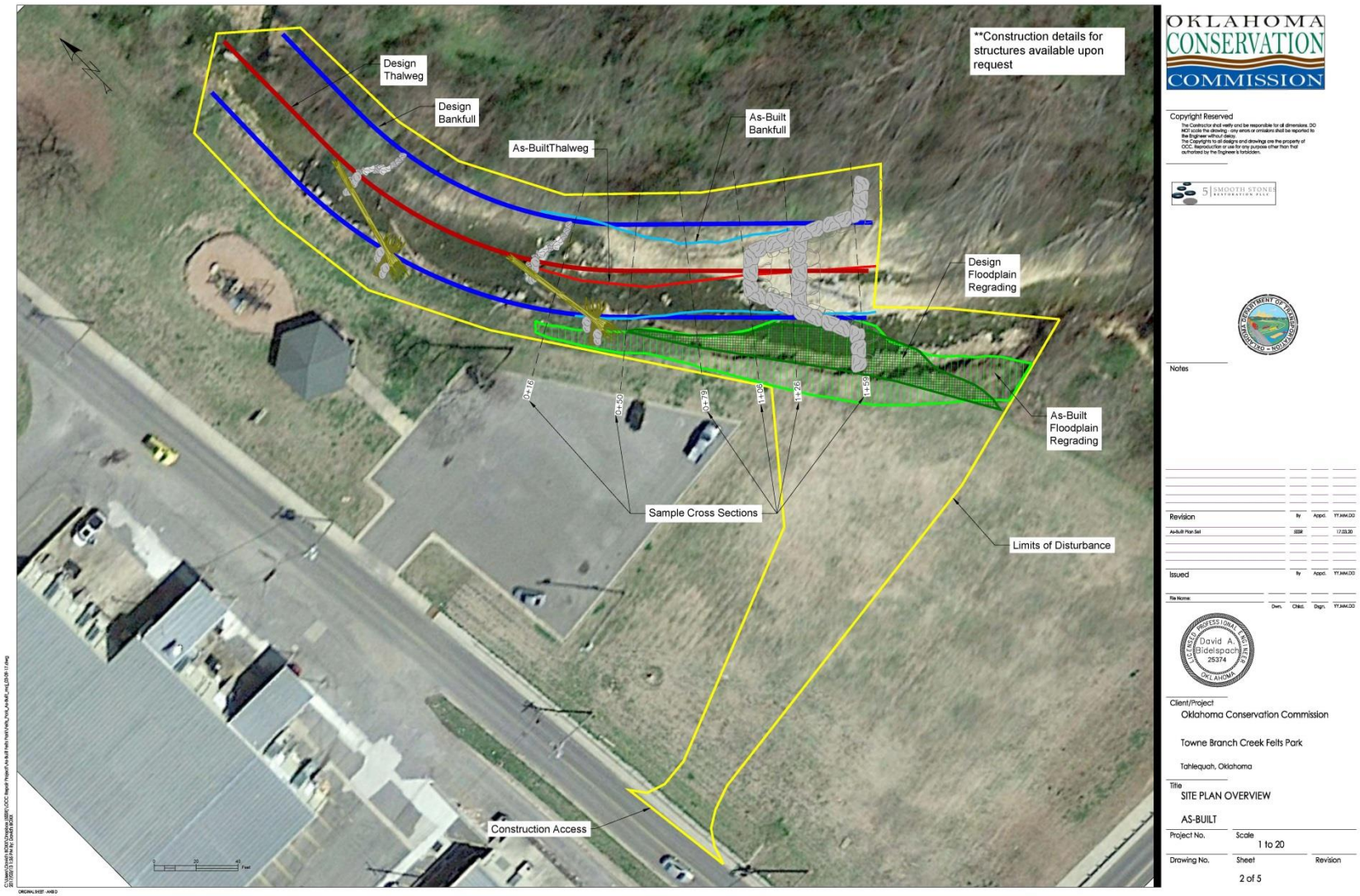

Figure 14. Design plan for repair work at Felts Park Site.

Figure 15. History Trail before (top left) and after (top right) 2012 restoration as well as after 2015 historic flood (bottom).

Figure 16. Design plan for History Trail Restoration. New features include toe boulders armoring the benches along much of the left bank but also along vulnerable portions of the right bank.

Figure 17. History Trail in Spring 2017 left bank looking downstream. The bench has been reconstructed, anchored with boulders, and replanted with trees and grasses.

Figure 18. History Trail from right bank looking downstream depicts the left bank boulder placement utilized to stabilize the bank toe.

Repair work at the Illinois River Ranch site was a priority for the project partners but also for the NorthState Environmental Team. The site, restored in 2012, had undergone several big floods in the intervening years with very little change to the design. Deposition was occurring on the constructed benches, vegetation was improving and the landowners on both sides of the river were very happy with the improvements that had been made. The upstream bridge underwent a substantial overhaul in 2014 that necessitated building a low-water crossing downstream, but few impacts of that effort were seen on the downstream project (Figure 19).

Then, the flood of record in December 2015 removed a portion of the bench protecting the previously eroded (left) bank, although again, most of the rock structures remained intact (Figure 20). Stabilizing vegetation was washed away and the channel widened, creating some scour pools near the base of the eroded bank. The bench that had been created on the right bank was also washed downstream in many places. In addition, a point bar had formed near the upper end of the site that pushed water back toward the left bank.

With limited budget, the repair plan for the site did not allow for complete restructuring of the site. Instead, NorthState opted to remove material from the point bar (pink shaded area in Figure 21) to

Figure 19. Illinois River Ranch site before (top left) and after (top right) 2012 restoration work. The lower photo depicts the site after a bankfull flood in April of 2013 left no evident damage.

Figure 20. Upstream (top) and downstream (bottom) photos of damage to Illinois River Ranch site which occurred during December 2015 flooding.

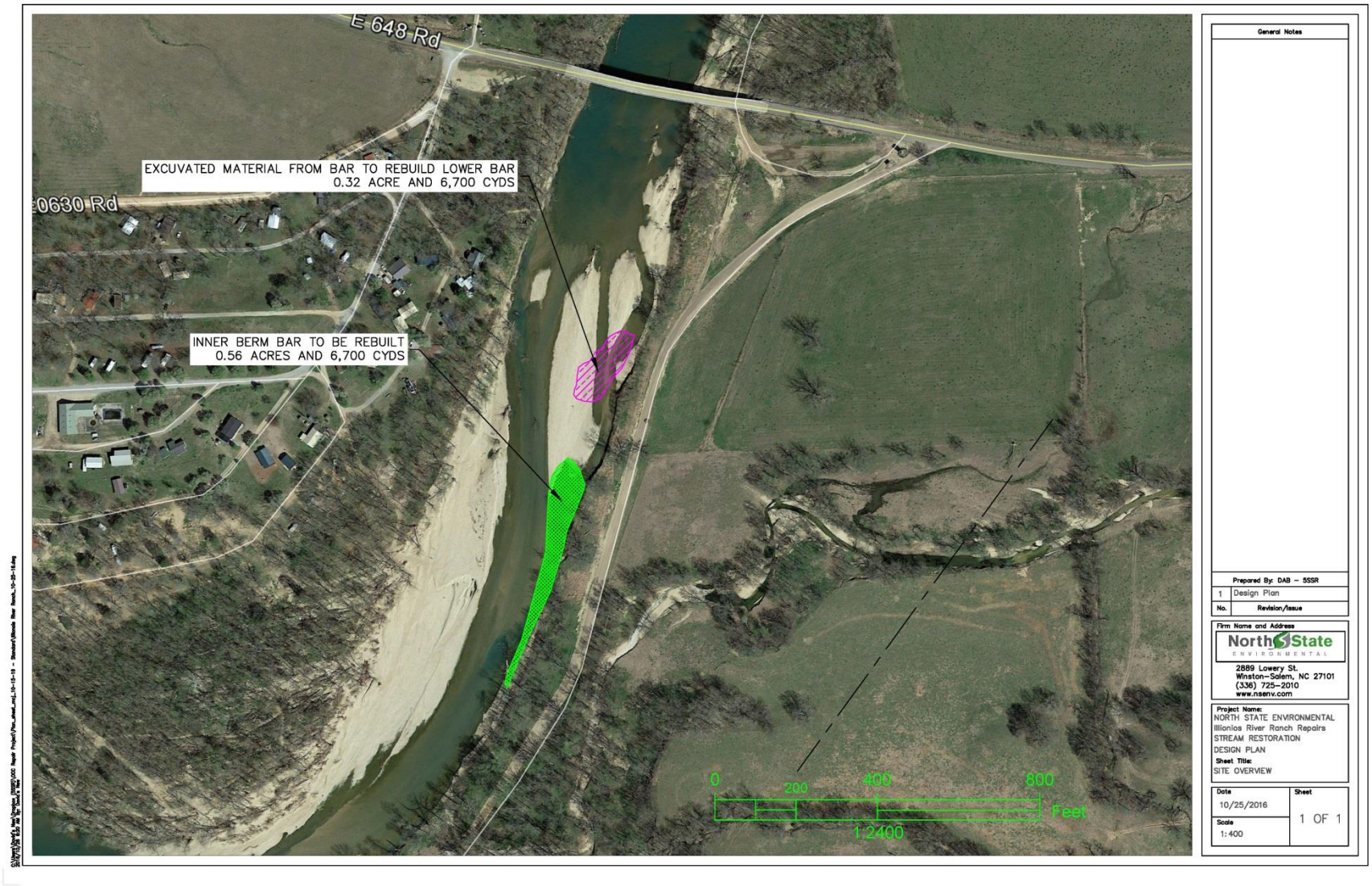

Figure 21. Plan for repair work at the Illinois River Ranch.

rebuild the bench around structures on the lower project (green shaded area in Figure 21). Construction was completed on the 1,583 linear foot project in November 2016 and reformed the bench around the structures, reduced the size of the point bar, and created a borrow pit/wetland area in the upper portion of the project (Figures 22 and 23). The thought process behind this plan was that the point bar was likely to remain and the borrow pit would likely fill in with gravel in some future flood event. But the rock veins and growing vegetation should hopefully stabilize the bench along the lower portion of the project.

Figure 22. Restored Illinois River Ranch site from Bridge looking downstream in November 2016.

Figure 23. Restored Illinois River Ranch Site from left bank upstream (top) and showing the borrow pit/wetland area anticipated to sediment in at a later date (bottom).

Tyner Creek is a small tributary in the Illinois River Watershed with a great history of work completed on it. In addition to serving as the control watershed in the 1990s and early 2000s §319 National Nonpoint Source Paired Watershed Study program project, it was also a site of stream restoration in the 2012 restoration project. The cooperating landowner signed an agreement to enroll in the USDA Conservation Reserve Enhancement Program that would begin once restoration work was complete in 2012. The 2012 restoration project resloped a 6 – 7 foot tall cutbank (left bank) along a curve and stabilized a newly created bench toe with toe wood (Figure 24). The newly sloped bank was then planted with live stakes and native annual and perennial grasses.

Although some minimal damage occurred to portions of the site during highflow events prior to the 2015 flood event, the 2015 event heavily damaged the site. Damage included complete washout of the bench and toewood, resulting in reforming of the cutbank. Although the site did not erode fully back to the original cutbank, it would eventually move there without repairs. Figure 25 depicts the site as restoration work began in December 2016.

The restoration plan called for the use of more rock and less wood than the original project had (Figure 26). The flood of 2015 had convinced partners that rock rather than wood was required to anchor toe placement because flood frequency and magnitude did not allow stabilizing vegetation to fill in quickly enough to maintain toewood placement.

The plan was slightly modified during construction as the amount of fill necessary to move the channel was greater than anticipated and an insufficient amount of material could come from the excavated pool. As a result, the lower right bank portion of the project was not as well tied into the downstream stable bank as the designer and project partners would have liked. A secondary channel had to remain in place at the lower end; however, the anticipated problems from this change are minimal as the downstream right bank is a rock bluff. Also, as a later addition at the request of the landowner, rootwads were anchored at the very upper portion of the restoration site to better armor the bank upstream in the transition between treated versus non-treated area.

Through the restoration project, the channel was moved west, away from the eroding left bank and anchored in place with a series of rock veins (Figures 27 - 29). In addition, the point on the lower end of the site was shaved and contoured to create less restriction and more of a pathway for floodwaters to move downstream. A pond was created (Figure 28) from an area in order to have enough fill to move the channel. Although the pond was anticipated to gradually fill in with future flood events, it was intended to provide some habitat refugia for fish.

Restoration on this 690 linear foot project was funded in partnership with the USFWS and ODWC and therefore, in addition to improving the stability of the reach and reducing sediment and nutrient loading downstream, restoration was also intended to improve aquatic habitat quality in Tyner Creek. In addition to the refugia pond, riffles, pools and runs were created as part of the project to maximize the habitat diversity (Figure 29). Rock veins and root wads create scour pools but also provide instream structure that attracts fish.

Figure 24. Tyner Creek site before (upper left) and after (upper right) 2012 restoration project. Lower image depicts the site the following spring in 2013 after green-up was beginning.

Figure 25. Tyner Creek site at the onset of restoration work in late fall 2016.

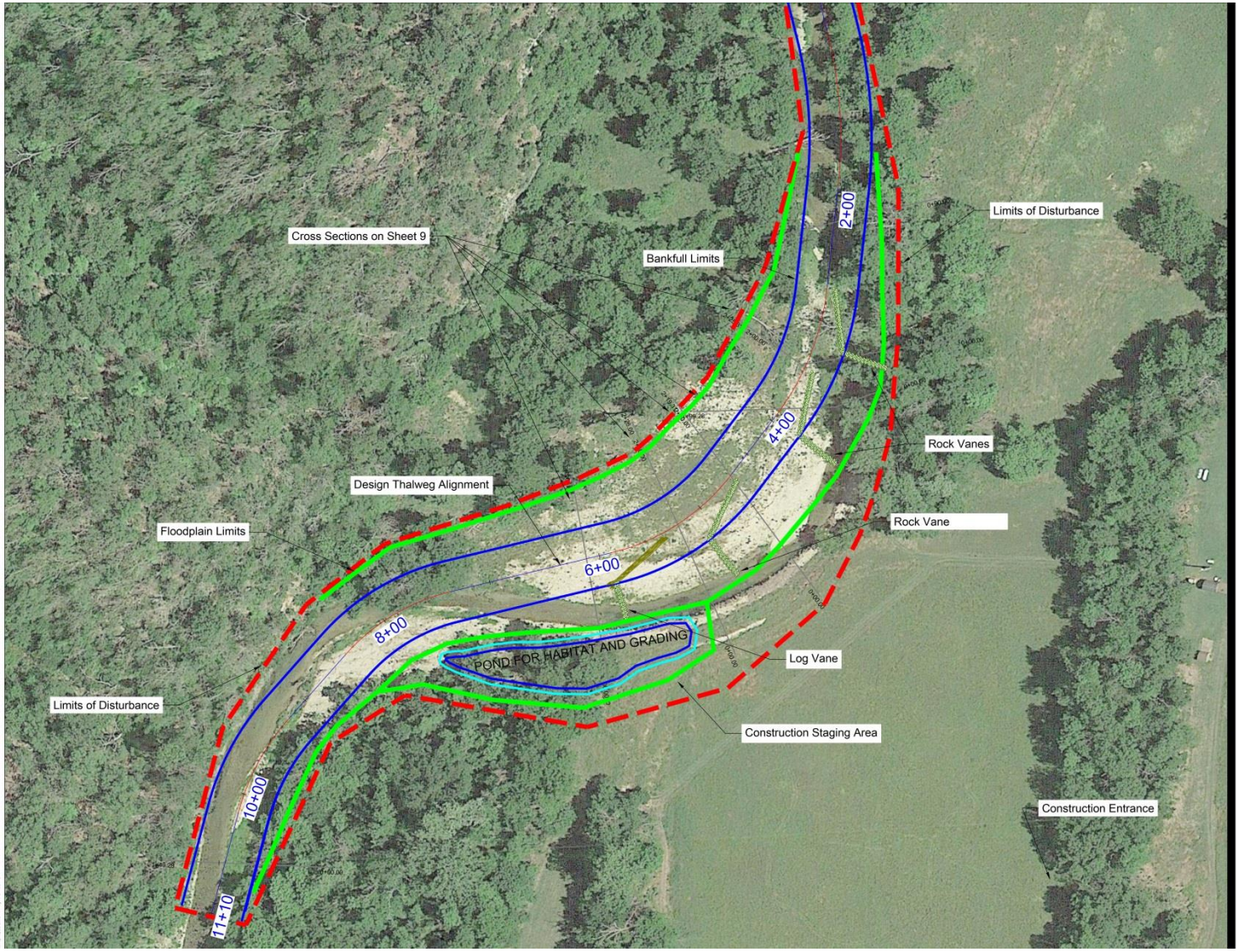

Figure 26. Restoration plan for Tyner Creek repairs.

Figure 27. Restored Tyner Creek site near the upper end looking downstream immediately following construction (upper) and later in Spring 2017 (lower).

Figure 28. Restoration from left bank looking upstream (upper) and aquatic habitat and refugia pond (lower).

Figure 29. Restoration was completed to stabilize the reach but also to construct a variety of habitats.

Task 5. Project Evaluation and Final Report

River restoration projects are challenging in that they rely on many pieces coming together for optimum performance. The entity designing and completing the construction work must have a good understanding of river hydrology and experience with successful projects in similar types of systems. Weather can significantly affect project timelines as water levels must be low enough to work safely and without causing additional erosion or sedimentation. Flood events can affect timeline and impact a less than complete project, which affects your timeline and budget. Finally, landowners and public review can affect the permitting process. Even though all landowners within the project area may have signed on to cooperate in a project, adjacent landowners may object which could require project modifications in timeline, budget, or other parts of the scope. This project encountered all of these challenges, but the team was able to work through them via partner communication and commitment to the end goals.

The project was an excellent example of partnership. Numerous partners came together, some bringing financial resources, others bringing watershed knowledge and technical knowledge to solve the problems and meet a variety of goals. $300,000 of federal EPA §319 funds were matched or leveraged with $1.2 million of state and USFWS funds to complete restoration at 5 sites in an important river watershed (Table 2). The Oklahoma Illinois River Watershed Plan approved in 2010 recognizes that

Table 2. Financially-contributing project partner goals and contributions.

Partner	Partner Project Objective	Source of Funds	Amount
ODOT	Protect Highway 10 along the Illinois River in a manner appropriate to protect resources in a scenic river	State ODOT funds	$893,962.11
ODWC/USFWS	Stop bank erosion and improve aquatic habitat	USFWS and ODWC	$35,000
OCC, EPA, OSEE	Repair eroding banks to reduce sediment and nutrient loading but also to demonstrate natural processes and encourage landowners to maintain natural areas.	EPA 319 and OCC state funds	$400,000 total ($300,000 federal $100,000 state)
Total			$1,328,962.11

streambank stabilization projects including riparian protection and natural channel design restoration will be necessary to improve water quality in the watershed.

At the same time restoration work was stabilizing approximately 5,553 linear feet of bank, reductions in bank erosion resulted in a calculated load reduction of at least 5,932 lbs of nitrogen per year, 1,974 lbs of phosphorus per year, and 4,524 tons of sediment per year. These estimates were made using sediment and nutrient contribution rates from a series of similar bank restoration projects in the Illinois River and similar nearby watersheds (Formica 2012 and Formica 2017).

Conclusions

Stream restoration projects can be challenging and costly to complete. Weather patterns, permitting, landowner concerns, and other factors can increase the uncertainty of these projects related to timelines, costs, and efficiencies. These projects were completed at a rate of approximately $239 per linear foot, a figure which is within the range of similar projects reported in a study completed by Clemson University (Templeton et al. 2008).

These projects offer an excellent opportunity for partnerships and multiple sources of funding to come together to accomplish goals that protect water quality and protect infrastructure.

Literature Cited.

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Templeton , S. R., C. F. Dumas, and W.T Sessions. 2008. Estimation and Analysis of Expenses of Design-Bid-Build Projects for Stream Mitigation in North Carolina. Published at: https://ageconsearch.umn.edu/record/187456/files/Estimation%20and%20analysis....pdf.

Appendix A: Cost Estimates to Restore Three River Sites in the Illinois River Watershed

Cost Estimates to Restore Three River Sites in the Illinois River Watershed

Submitted by the Watershed Conservation Resource Center

To the Oklahoma Conservation Commission

May 2, 2016 DRAFT

The Oklahoma Conservation Commission contracted with the Watershed Conservation Resource Center (WCRC) to provide a cost estimate to restore three river sites with accelerated streambank erosion in the Illinois River watershed. Staff members from both organizations visited the following sites on January 12, 2016:

- Barren Fork
- Tyner Creek
- Flint Creek

In addition to the site visit, the WCRC reviewed both recent air photos and historical air photos when available. Conceptual restoration designs were developed and costs of design, materials, and construction for each site was estimated based on the conceptual designs. An estimate of maintenance costs following construction for five years was also estimated. Cost estimates are predicted to be within approximately 25% of the actual cost if similar designs are implemented. The main component of the conceptual designs is the construction of a toe-word bench. If bedrock is 8 feet or less below the base flow water surface elevation, it is recommended that the toe wood feature be built to bedrock. A cross-section of the toe-wood design is shown in Figure 1. This design is only applicable if it is built on bedrock. If bedrock is greater than 8 feet, it is recommended that the toe wood still be built 6 to 8 feet below the water surface, but a modified design would need to be developed. A modified design for this situation will not significantly affect the total estimated costs presented here.

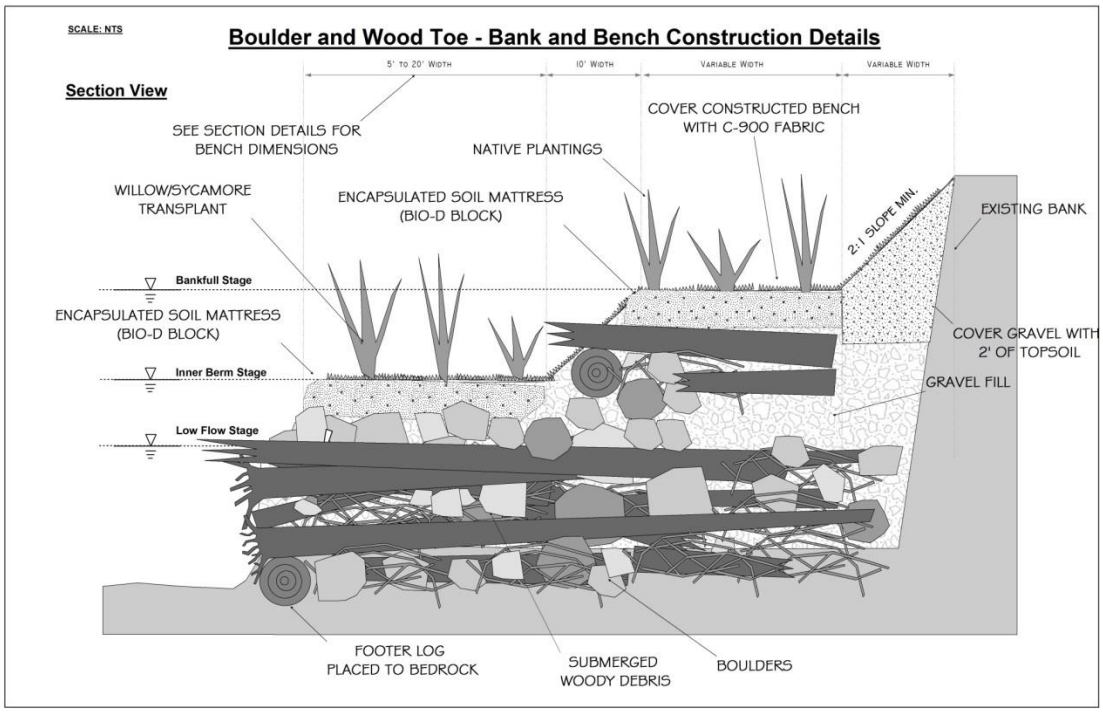


Figure 1 Toe-wood bench design when constructing on bedrock. Drawing also shows inner berm and bankfull elevations.

Figure 1 also show the encapsulated soil mattresses used to establish an inner berm and bankfull elevation and provide a growing medium for native plants.

Specific design variables, such as the radius of curvature, bankfull elevation, and channel dimensions should not be based on the conceptual designs that are provided. A geomorphic survey should be conducted at each site and this data used to determine the value of design variables. These surveys should be provided along with construction drawings. Construction oversight is strongly recommended and costs are based on either the project engineer or manager to be at the site. If this is not the case, then this value will be lower. Though volunteers could be used to assist with planting, the labor costs include labor needed to incorporate plants into bio-D blocks and other locations during construction. Use of volunteers during this phase of construction is not recommended.

To help ensure long-term success, funding for ongoing maintenance and minor repairs is needed at least the first five years following construction. Annual establishment funding was estimated separate from design and construction. Any money not spent annually should be reserved for potential repairs from catastrophic flooding. It is recommended that this funding be a separate contract, since it needs to be held in reserve if it is not used immediately. Establishment funding does not include the cost for major damage from catastrophic flooding.

A summary of the estimated costs to design and construct streambank restorations at each site along with the annual establishment funding over five years is shown in Table 1. Discussions of designs and costs for each site follow. Detailed costs for each site are presented in Tables 2-4.

Table 1: Summary of design and construction cost and annual establishment cost

Site	**Design & Construction Estimated Cost ± 25%**	**Annual Establishment Cost Estimate ± 25% (not part of design/construction cost)**					
		Year 1	Year 2	Year3	Year 4	Year 5	**Total**
Barren Fork	**$670,800**	$67,000	$30,000	$30,000	$15,000	$15,000	**$157,000**
Tyner Creek	**$265,400**	$27,000	$15,000	$15,000	$10,000	$8,000	**$ 75,000**
Flint Creek	**$287,700**	$29,000	$15,000	$15,000	$10,000	$8,000	**$77,000**

Restoration Cost Estimate - Barren Fork, near Christie, OK

The estimated cost to design and construct a streambank restoration project on Barren Fork near Christie, OK (Figure 2) is $670,800 ± 25%. This estimate is based on a site visit on January 12, 2016 and review of air photos. A conceptual planform design was developed and is shown in Figure 3. The design consists of constructing a toe-wood bench with a maximum width of 140 feet and length of 1200 feet. The bench will have flood plain/terraces with elevations that correspond with an inner berm, bankfull bench, and terrace or top of bank (Figure 1).

Specific cost items related to the Barren Fork site can be found in Table 2. The cost for soil is based on excavating a pond on-site. If this is not possible, then soil will need to be purchased and this line item will increase significantly.

Total cost of ongoing maintenance and minor repairs is estimated to be $157,000 over five years with $67,000 for year one, $30,000/yr years two and three, and $15,000/yr years 4 and 5.

Figure 2 also shows the movement of the streambank over time based on historic aerial photographs that were available. Since 1995, the streambank has eroded approximately 300 feet, generating 140,000 cubic yards of sediment over approximately 21 years. Using data collected from streambank samples collected in NW Arkansas, the erosion has generated an estimated 182,000 tons of sediment and 54,000 pounds of phosphorus during this time period.

Figure 2 Eroding Streambank on Barren Fork

Table 2: Restoration Cost Estimate - Barren Fork, near Christie, OK					
Construction Contractor Costs	Qty	Units	$/Unit	Cost	
Mobilization	1	l.s.	20000	$20,000	
Bonds and Insurance	1	l.s.	15000	$15,000	
Toe Wood	1200	feet	75	$90,000	
Channel Relocation	24000	c.y.	10	$240,000	
Bio-D Block Installation	4000	feet	15	$60,000	
Labor for Planting Vegetation	240	hours	25	$6,000	
Excavate and Move Top Soil	6000	c.y.	3	$18,000	A pond will need to be constructed to obtain the topsoil. 50'Lx50'Wx2.5'D(Mean)
Grading of Topsoil on BKF Bench	40	hours	125	$5,000	
Installation of Erosion Control Fabric	10000	s.y.	2	$20,000	
Materials Costs					
Trees	800	each	75	$60,000	
Boulders	250	ton	50	$12,500	
Shot Rock	300	ton	40	$12,000	
Bio-D Block	3600	feet	8	$28,800	
Plants (Trees and Shrubs)	3000	each	2	$6,000	
Native Seed, Nursery Seed, Straw	1	l.s.	3000	$3,000	
Erosion Control Lower 1/3 Bench (C700)	4000	s.y.	2	$8,000	
Erosion Control Upper 2/3 Bench (CC4 - Natural)	6000	s.y.	1.5	$9,000	
Hardwood Stakes and Sod Staples	5000	each	0.5	$2,500	
Seed and Straw	1	l.s.	3000	$3,000	
Engineering and Oversight Costs					
Survey Work	160	hours	100	$16,000	
Design Work	120	hours	100	$12,000	
Permitting	40	hours	100	$4,000	
Oversight	200	hours	100	$20,000	
			Total	$670,800	

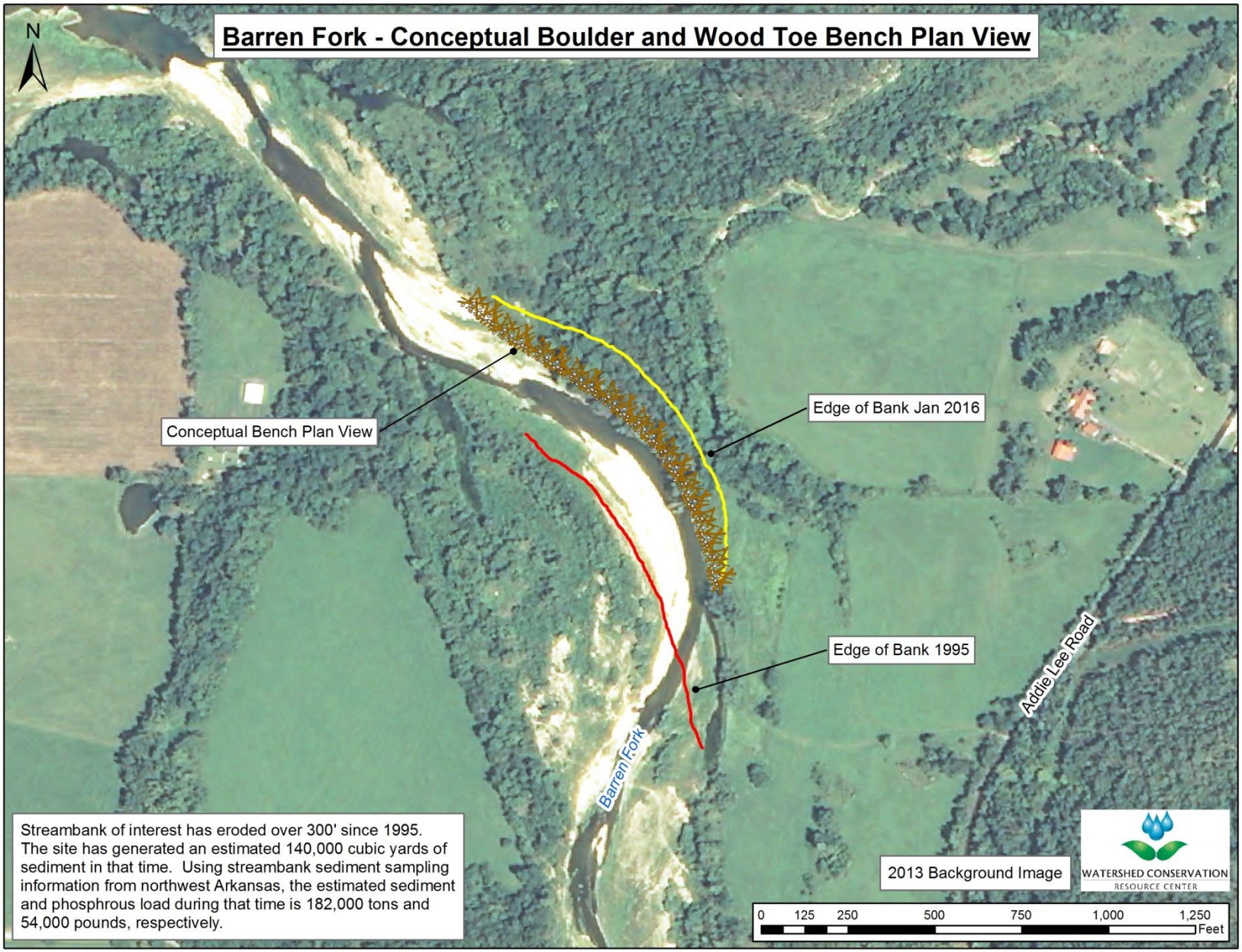


Figure 3 Barren Fork: History of streambank migration and conceptual restoration design

Restoration Cost Estimate – Tyner Creek, near Proctor, OK

The estimated cost to design and construct a streambank restoration project on Tyner Creek near Proctor, OK (Figure 4) is $265,400 ± 25%. This estimate is based on a site visit on January 12, 2016 and review of air photos. A conceptual planform design was developed and is shown in Figure 5. The design consists of constructing a toe-wood bench with a maximum width of 100 feet and length of 600 feet. The bench will have flood plain/terraces with elevations that correspond with an inner-berm, bankfull bench, and terrace or top of bank (Figure 1). Specific cost items related to the Tyner Creek can be found in Table 3.

Total cost of ongoing maintenance and minor repairs is estimated to be $75,000 over five years with $27,000 for year one, $15,000/yr years two and three, $10,000/yr year 4, and $8,000 for year 5.

Figure 5 also shows the movement of the streambank over time based on historic aerial photographs that were available. Since 2008, the streambank has eroded approximately 60 feet, generating 3,000 cubic yards of sediment over approximately 8 years. Using data collected from streambank samples collected in NW Arkansas, the erosion has generated an estimated 4,000 tons of sediment and 1,200 pounds of phosphorus during this time period.

Figure 4 Eroding streambank on Tyner Creek

Table 3: Restoration Cost Estimate - Tyner Creek, near Proctor, OK				
Construction Contractor				
Mobilization	1	l.s.	15000	$15,000
Bonds and Insurance	1	l.s.	8000	$8,000
Toe Wood	600	feet	60	$36,000
Channel Re-alignment	6000	c.y.	10	$60,000
Bio-D Block Installation	1200	feet	15	$18,000
Labor for Planting Vegetation	200	hours	25	$5,000
Installation of Erosion Control Fabric	4000	s.y.	2	$8,000
Materials				
Trees	375	each	75	$28,125
Boulders	200	ton	50	$10,000
Shot Rock	300	ton	40	$12,000
Bio-D Block	1000	feet	8	$8,000
Plants (Trees and Shrubs)	1500	each	2	$3,000
Erosion Control Lower 1/3 Bench (C700)	1500	s.y.	2	$3,000
Erosion Control Upper 2/3 Bench (CC4 - Natural)	2500	s.y.	1.5	$3,750
Hardwood Stakes and Sod Staples	3000	each	0.5	$1,500
Seed and Straw	1	l.s.	2000	$2,000
Engineering and Oversight				
Survey Work	100	hours	100	$10,000
Design Work	120	hours	100	$12,000
Permitting	40	hours	100	$4,000
Oversight	180	hours	100	$18,000
			Total	$265,375

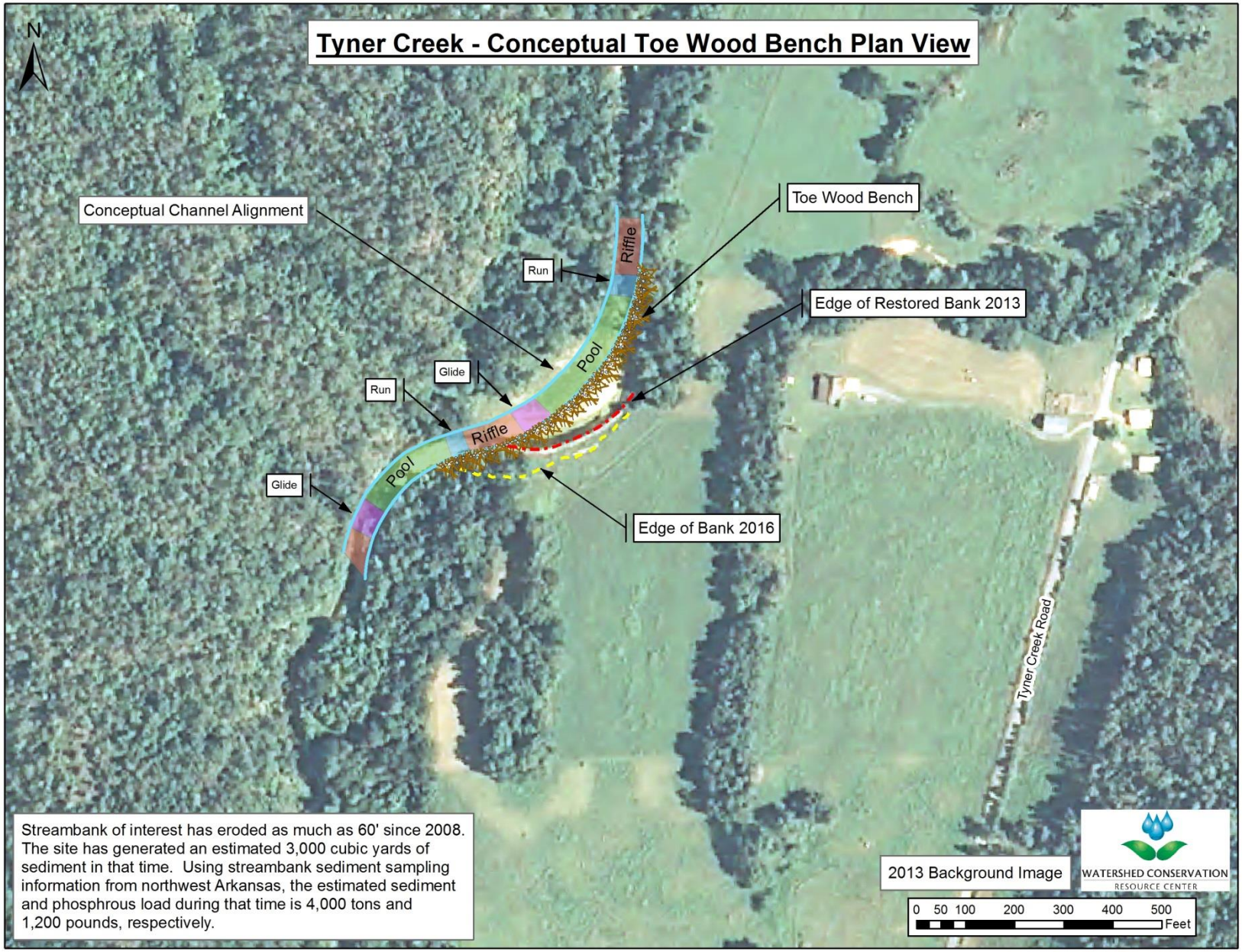


Figure 4 Conceptual plan form of stream restoration on Tyner Creek

Restoration Cost Estimate – Flint Creek, near Dripping Springs, OK

The estimated cost to design and construct a streambank restoration project on Flint Creek near Dripping Springs, OK (Figure 6) is $287,700 ± 25%. This estimate is based on a site visit on January 12, 2016 and review of air photos. A conceptual planform design was developed and is shown in Figure 7. The design consists of constructing a toe-wood bench with a maximum width of 40 feet and length of 600 feet. The bench will have flood plain/terraces with elevations that correspond with an inner-berm, bankfull bench, and terrace or top of bank (Figure 1). Specific cost items related to the Flint Creek can be found in Table 4.

Total cost of ongoing maintenance and minor repairs is estimated to be $77,000 over five years with $29,000 for year one, $15,000/yr years two and three, $10,000/yr year 4, and $8,000 for year 5.

Figure 7 also shows the movement of the streambank over time based on historic aerial photographs that were available. Since 2008, the streambank has eroded approximately 100 feet, generating 28,000 cubic yards of sediment over approximately 8 years. Using data collected from streambank samples collected in NW Arkansas, the erosion has generated an estimated 36,000 tons of sediment and 8,400 pounds of phosphorus during this time period.

Figure 6 Eroding terrace on Flint Creek, near Dripping Springs, OK

Table 4: Restoration Cost Estimate - Flint Creek, near Dripping Springs, OK				
Construction Contractor				
Mobilization	1	l.s.		$15,000
Bonds and Insurance	1	l.s.		$8,000
Toe Wood	600	feet	75	$45,000
Channel Re-alignment	7000	c.y.	10	$70,000
Bio-D Block Installation	1500	feet	15	$22,500
Labor for Planting Vegetation	200	hours	25	$5,000
Installation of Erosion Control Fabric	3000	s.y.	2	$6,000
Materials				
Trees	400	each	75	$30,000
Boulders	250	ton	50	$12,500
Shot Rock	300	ton	40	$12,000
Bio-D Block	1200	feet	8	$9,600
Plants (Trees and Shrubs)	800	each	2	$1,600
Erosion Control Lower 1/3 Bench (C700)	1000	s.y.	2	$2,000
Erosion Control Upper 2/3 Bench (CC4 - Natural)	2000	s.y.	1.5	$3,000
Hardwood Stakes and Sod Staples	3000	each	0.5	$1,500
Seed and Straw	1	l.s.	2000	$2,000
Engineering and Oversight				
Survey Work	100	hours	100	$10,000
Design Work	100	hours	100	$10,000
Permitting	40	hours	100	$4,000
Oversight	180	hours	100	$18,000
			Total	$287,700

Figure 7 Conceptual toe wood bench layout for bank stabilization on Flint Creek near Dripping Springs, OK

Appendix B: Winning Bid Proposal

North State ENVIRONMENTAL

Cherokee and Adair Counties, Oklahoma Stream Bank Restoration Projects

for:

servation
on
Boulevard,
0
ty, OK

Prepared by:

North State Environmental, Inc.

2889 Lowery St.

Winston Salem, NC

27101

5 | SMOOTH STONES RESTORATION PLLC

Table of Contents

OKLAHOMA CONSERVATION COMMISSION

1 Executive Summary

The Oklahoma Conservation Commission and Oklahoma Department of Wildlife Conservation are seeking design/build teams to implement Stream Bank and Restoration, on four sites in Cherokee and Adair Counties, Oklahoma.

The proposed team has the capacity, experience and in-depth understanding required to complete the requested restoration work for OCC. For this design/build project North State Environmental has teamed with 5 Smooth Stones Restoration. North State and 5SSR have worked together on numerous projects for the past 13 years.

North State and 5SSR have an excellent working relationship that is proven by stable design and implementation that achieve objectives while restoring habitat and optimizing ecological function.

The proposed team includes industry-leading stream restoration experts specializing in the areas of hydraulic engineering, hydrology, fluvial geomorphology, riparian ecology and in-stream construction implementation. Our technical expertise in engineering and natural resources allows us to provide our clients with innovative and cost-effective solutions for stream improvement projects, from planning phases through design, construction, and post-project monitoring.

Our team is interested in consulting with the Oklahoma Conservation Commission and stakeholders during the design phase as a member of our design team to ensure that all goals and objectives are met. Our stream restoration design for each of the sites will seek to restore in-stream stability, riparian buffer zones and aquatic/ terrestrial habitat. The benefit of restoration design by our team is the educational and outreach opportunities, the inclusion of OCC as an active design member, ecological function enhancement, native fish passage and long term stream stability.

2 Project Understanding

In December of 2015 a flood of record devastated the Illinois River corridor and its surrounding tributaries and waterways in Cherokee and Adair Counties. The four sites requiring attention within the RFP were all negatively affected by the swollen flow regimes. Lateral migration of the streambanks in the more vulnerable areas due to the high flows and incision of adjacent reaches, was the most common reasons causing the near bank stress and erosion. While it's understood that due to budget constraints the design/build team may not be able to address all four of the projects to their entirety, our team will address and apply best management practices to achieve all of the goals and objectives with in the RFP and of the stakeholders.

3 Proposed Team

North State Environmental and 5SSR use principles of Natural Channel Design as the foundation to achieve stakeholder goals and objectives for stream and ecosystem restoration projects. The proposed project team has worked together for many years and have formed a collaborative partnership that results in successful restoration projects. Our team has a unique commitment to education and outreach that co-instructed Natural Channel Design and Implementation workshops between North State Environmental and 5SSR. Our team has cooperated in stream restoration workshops related to design, permitting, assessment, optimization, construction, and adaptive management and monitoring in 8 states with a variety of stakeholders and project goals.

3.1 Prime Consultant – North State Environmental

North State Environmental, Inc. (North State) is known for its aptitude and proven ability in the areas of stream restoration and wetlands mitigation. The company is trained in "Natural Channel Design" methodology and construction methods to deliver the highest quality stream restoration and wetlands mitigation projects. North State was founded in 1994 as an erosion control contractor, and quickly expanded services into the area of stream restoration in 1998. Addition areas of expertise include wetland mitigation, storm water management, bio-engineering, reforestation and landscaping. North State Environmental provides world-class restoration services to consulting firms; private mitigation firms; private builders; universities; parks; and city, county, state and federal departments. North State Environmental, Inc. has worked in and holds a General Contractors license in the following states: AK, AL, AR, CA, CO, GA, KY, MI, MN, MS, NC, NJ, OK, SC, TN, VA, WV, AND WY, and UT.

North State has 51 personnel that include experienced project managers, superintendents, foremen, laborers, truck drivers, equipment operators, mechanics and administrative staff. We have the expertise from our employees along with company vehicles and equipment to accomplish the jobs we set out to do. We also have well established relationships with our lenders, bonding company, insurance agent, IT company and CPA to help us meet our goals.

Our current staff includes:

- *2 Corporate Officers/Project Managers*
- *1 Project Engineer/Project Manager, Estimator*
- *1 Assistant Estimator*
- *2 Assistant Project Managers*
- *1 Erosion Control/Planting Manager*
- *5 Superintendents*
- *3 Project Foremen*
- *16 Heavy Equipment Operators*
- *3 Truck Drivers*
- *Skilled Laborers*
- *Office Personnel*
- *Maintenance Staff*

3.2 Sub Consultant – 5 Smooth Stones Restoration

5 Smooth Stones Restoration, PLLC (5SSR) is a small stream and river restoration design engineering firm based in Livermore, Colorado. 5SSR was founded to focus on engagement and empowerment of river restoration clients and other design professionals related to the practical application of river restoration. 5SSSR employs the principals and practice of geomorphic based Natural Channel Design, with education of optimization and risk analysis modeling for others within the industry. 5SSR's commitment to education and training and their specialization in concept design, alternatives analysis, risk assessment and QA/QC are hallmarks of the firm. The 5SSR team has conducted geomorphic assessments on more than 300 miles of stream throughout North America, has been involved in the construction and design of over 100 river restoration and stabilization projects over the past 15 years. For this project the 5SSR team will be composed of David Bidelspach as project manager/engineer with assistance from Michael Geenen when necessary. 5SSR's has adopted a S.H.A.R.E.D philosophy that assists our team and subcontractors in the intentional pursuit of sharing with others to promote excellence in river restoration and applied fluvial geomorphology.

- ***S**hare knowledge and experience with humility*
- ***H**ave patience and discernment for technical innovations*
- ***A**dvocate for technical excellence as a primary business objective*
- ***R**espect the uncertainty and unknowns of rivers, "The Answers are in the River"*
- ***E**mpower others to question and challenge to seek excellence*
- ***D**ocument uncertainty, risk and unexpected results to share with others*

Our team is committed to sharing knowledge to advance the practice of Natural Channel Design with team members, clients, industry colleagues, and all others. Our qualifications include certification of the following items as required for submission in the RFP:

- *Rosgen Training through Level IV*
  - *David Bidelspach completed in 2005*
  - *Michael Geenen completed in 2010*
- *Years of experience working on Natural Channel Design and River Restoration Projects*
  - *David Bidelspach 14 years of experience*
  - *Michael Geenen 9 years of experience*

Total 23 years of combined experience in Natural Channel Design

3.3 Project Experience

Project Name	Client	Location	Brief Description
Illinois River Project Design Engineer: David Bidelspach, PE	Oklahoma State University	Tahlequah, OK	Stabilization of the eroding channel and banks to prevent sedimentation from entering the Illinois River Watershed System, to create habitat diversity, and proper stream function. **Dimensions: 13 different sites with a total of 5500 lf of stream restoration. Bankfull Width 8ft-275ft**
Encampment River Grand Valley Design Engineer: David Bidelspach, PE	Saratoga-Encampment-Rawlins Conservation District (SERCD)	Carbon County, WY	Fish passage and removal of a seasonal need for push up dam at the Grand Valley Ditch. Channel construction and in-stream structures were completed to ensure adequate flows to an existing water rights holder with access to the river by head gate. **Dimensions: 1150 lf; bankfull benches 75 ft.**
Rio Grande River Restoration Design Engineer: David Bidelspach, PE	U.S. Fish & Wildlife	Alamosa, CO	Removal of a large earthen embankment and re-establishment of POD for New Ditch Dam. Channel restoration back to a natural channel by creating bankfull benches, bank stabilization and a fish habitat. **Dimensions: 3500 lf; bankfull channel width 105 ft.**
Chuck Lewis Yampa River Restoration Design Engineer: David Bidelspach, PE	Yampa River Charitable Trust	Routt County, CO	Stream restoration and pike habitat uplift with one POD structure. Channel work for the impaired channel, structure placement, and plantings. Also included a detail water surface model to ensure flooding would not be created. **Dimensions: 3500 lf; bankfull channel width 88 ft.**
Tiawassee Creek Stream Restoration Design Engineer: Greg Jennings, PE	City of Daphne, AL	Daphne, AL	Stream restoration and bank stabilization on the Tiawassee Creek and an unnamed tributary. In-stream revetments consisted of log grade sills, rock cross vanes and j-hooks. **Dimensions: 1145 lf.**

3.4 Key Personnel

Darrell Westmoreland, Project Manager (North State Environmental)

- Responsible for project implementation and management.
- Helped establish the company in 1994 and is a driving force behind the company's successful reputation in stream restoration, wetlands, mitigation, and storm-water management
- Trained under the Rosgen River Course Levels 1-5 and have overseen multiple stream and river restoration projects since 1998

Brandon Spaugh, Assistant Project Manager (North State Environmental)

- Responsible for assisting project implementation and management
- Began career at North State in 2004 as a heavily skilled Equipment Operator, moving to Foreman position and servicing over 30 projects.
- Promoted to Assistant Project Manager and has overseen the completion of over 225,000 LF of stream restoration.

Mike Stanley, Site Supervisor and Skill Operator (North State Environmental)

- Responsible for construction management and site supervision.
- Began career at North State as a heavily skilled equipment operator, and has over 20 years' experience.
- Rosgen training Levels 1 – 2, with the completion of over 150,000 LF of stream restoration.

David Bidelspach, PE, Technical Manager (5SSR)

- Responsible for senior QA/QC of all engineering components of the fieldwork, design, and final plans.
- Responsible for education and outreach related to river design, assessment, construction and monitoring.
- Conducted geomorphic assessments along more than 300 miles of rivers (including BANCS assessments and geomorphic surveying), including projects throughout North America, including many in Colorado.

4 Individual Project Approach

4.1 Felts Park

The project approach to the Felts Park site will be to re-grade the point bar by re-aligning the river's velocity vectors to generate a softer approach to the existing boulder cross vane. The NSE/5SSR team will also build a bankfull flood prone bench by constructing geo-lifts with coir matting and suitable/fertile soils to ensure adequate vegetation establishment. The terrace slope will be graded and permanently seeded to a 3.1 slope. The pre-existing log vane will be backfilled with onsite suitable sub-straight material to help eliminate future scouring in this area. All areas within the project reach that identifies signs of slight erosion caused by near bank stress will be addressed by the NSE/5SSR team during construction. All pre-existing pools that were filled with deposition during the 2015 storm event will be excavated to design depth to assist with energy dissipation.

Comment [BS1]: For this site we discussed the method of re-aligning the thalweg to center flows. Also discussed alternatives to include woody plantings. Left this part of the meeting agreeing that we could make changes within the budgeted items under "permanent seeding".

4.2 History Trail

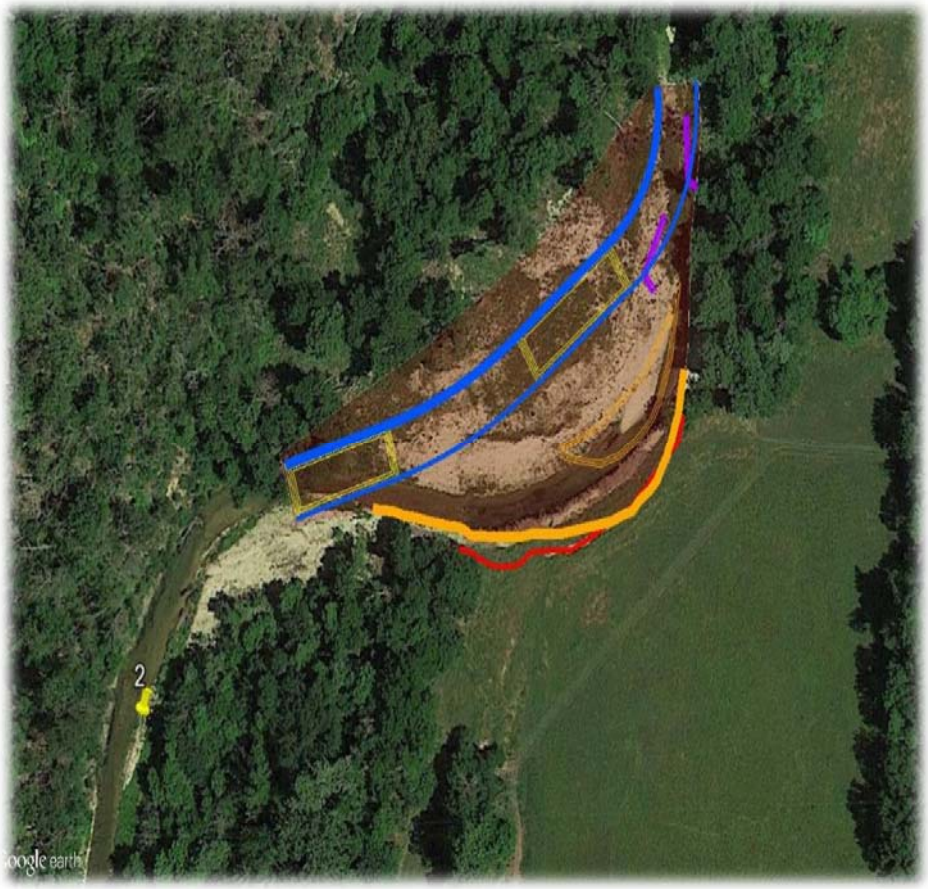
The approach for the History Trail site will be to construct a flood prone bankfull bench with Coir Geo-Lift on river left to serve as toe stabilization. This approach will help maintain the pattern, profile, and dimensions that are necessary to ensure adequate sediment transport. All areas within the project reach that identifies sign of slight erosion caused by near bank stress will be addressed by the NSE/5SSR team during construction. All pre-existing pools that were filled with deposition during the 2015 storm event will be excavated to design depth to assist with energy dissipation.

Comment [BS2]: The interview team appreciated the concept of the geolifts at this location to help with bank stabilization and erosion issues. Jeri stated that there may need to be an adjustment to the "permanent seeding" items to substitute woody plantings into the budget for this site. She also stated that there had been some of the riparian plants removed from just upstream that may need to be replanted for some of this project budget.

4.3 Tyner Creek

The project approach that the NSE/5SSR team will take for the Tyner Creek site, is to re-align the river though the point bar to allow flood flows to access the flood prone bench and balance the sheer stress throughout the project reach. Two boulder J-Hooks will be installed into the first meander to make sure that recipient flows are not directed into the relic channel that will be filled up to the bankfull elevation. There will be two constructed riffles installed with onsite sub-straight material to maintain the design pool slopes and to also serve as spawning areas for aquatic organisms. All disturbed areas will be re-vegetated with native grasses and plantings.

Comment [BS3]: This project alignment will be as shown in the proposal submitted by the team, but the landowner of this particular property will be upset if the toe protection/ bank stabilization is not boulders. He does not trust the toe wood revetments that were installed in the initial project. With that said, it would be expected that there would still be geolift on top of the boulder toe protection. This additional rock for the toe protection may increase the price for this site. They would also like to see floodplain sills all the way over to the terrace on river left at the j-hook locations. Again, the "permanent seeding" will be adjusted (like the other projects) to install some woody planting to fit within the budget.



4.4 River Ranch Alternative

If there are additional funds remaining in the budget, the NSE/5SSR team would like to offer several alternatives that will address the issues at the River Ranch Project Site. Alt 1: The NSE/5SSR design team can meet with the stakeholders of the project to determine the goals and objectives of the site so that a preliminary design can be generated relative to the budget constraints. Alt 2: The NSE/5SSR team can assist with obtaining permits for future construction once the preliminary design has been approved by the stakeholders. Alt 3: The NSE/5SSR team can assist with any onsite maintenance to ensure stability for a short term program until adequate funding is obtained.

Comment [BS4]: Several alternatives were discussed of what to do with the additional money that OCC has available for these projects. The most likely alternative was that NSE would give a "time/material" pricing for several projects that need slight repair attention. The most talked about site was a boat ramp access location. IF all of the other 3 sites do not require additional funding for any additions, the remaining funding will be $69,000.

5 Schedule & Project Milestones

August 12, 2016 – Proposal due with initial design ideas

August 22, 2016 – Interviews

August 25, 2016 – Design/Build Firm Selected

September 2016 – Notice to Proceed

September 2016 – Begin data collection for each site

October 7, 2016 – 30% Design

October 14, 2016 – Stakeholders review of 30% Design

October 21, 2016 – Stakeholders comments addressed in 30% Design for permit submittal

October 31, 2016 – Permit Submittal

January 4, 2017 – Begin Construction

February 10, 2017 – Construction Complete

Comment [BS5]: It was asked if this could be pushed up to allow mobilization immediately after the I-10 completion, I informed them that NSE could possibly begin earlier if the plans and permits were completed and in compliance, but that it may or may not be a reduction in mobilization cost due to the size of the equipment differences between the I-10 project and these repairs.

6 Cost Proposal

6.1 Felts Park

Item Description	Estimated Quantity	Unit	Unit Bid Price	Bid Amount
Engineered 100% Design	1	LS	$10,000.00	$10,000.00
Construction Surveying	1	LS	$2,500.00	$2,500.00
Mobilization and Demobilization	1	LS	$15,000.00	$15,000.00
Temporary Construction Access Roads	1	LS	$5,000.00	$5,000.00
Grading Balanced Bankfull Bench (15% Uncertainty)	1,500	CU YD	$12.00	$18,000.00
Coir Soil Lifts for Toe Stabilization	75	LF	$180.00	$13,500.00
Clearing and Grubbing (As directed on the upper point bar less than 5 trees)	.3	AC	$5,000.00	$1,500.00
Constructed Riffle with In-Situ Material	1	EA	$2,500.00	$2,500.00
Mulch Straw	.5	AC	$5,000.00	$2,500.00
Temporary Seeding	.5	AC	$5,000.00	$2,500.00
Permanent Seeding	.5	AC	$10,000.00	$5,000.00
			Total Bid Estimate	$78,000.00

6.2 History Trail

Item Description	Estimated Quantity	Unit	Unit Bid Price	Bid Amount

Engineered 100% Design and Oversight	1	LS	$9,000.00	$9,000.00

Item Description	**Estimated Quantity**	**Unit**	**Unit Bid Price**	**Bid Amount**
Engineered 100% Design and Oversight	1	LS	$16,000.00	$16,000.00
Mobilization and Demobilization	1	LS	$15,000.00	$15,000.00
Temporary Construction Access Roads	1	LS	$5,000.00	$5,000.00
Grading Balanced Bankfull Bench (15% Uncertainty)	500	CU YD	$12.00	$6,000.00
Coir Soil Lifts for Toe Stabilization	100	LF	$180.00	$18,000.00
Backfill Construction Riffle with Material from Offsite	50	TN	$150.00	$7,500.00
Mulch Straw	.25	AC	$5,000.00	$1,250.00
Temporary Seeding	.25	AC	$5,000.00	$1,250.00
Permanent Seeding	.25	AC	$10,000.00	$2,500.00
			Total Bid Estimate	$67,500.00

6.3 Tyner Creek

Construction Surveying	1	LS	$2,000.00	$2,000.00
Mobilization and Demobilization	1	LS	$20,000.00	$20,000.00
Temporary Construction Access Roads	1	LS	$2,500.00	$2,500.00
Grading Balanced (15% Uncertainty)	6,100	CU YD	$12.00	$73,200.00
Clearing and Grubbing (As directed on the upper point bar less than 20 trees)	.25	AC	$6,000.00	$1,500.00
Rock J-Hook or Rock Vanes (100 Tons each 1-2 Ton boulders)	2	EA	$11,150.00	$22,300.00
Constructed Riffle with In-Situ Material	2	EA	$1,500.00	$3,000.00
Temporary Construction Entrance	1	EA	$5,000.00	$5,000.00
Mulch Straw	1.75	AC	$5,000.00	$8,500.00
Temporary Seeding	1.75	AC	$5,000.00	$8,500.00
Permanent Seeding	1.75	AC	$10,000.00	$17,000.00
			Total Bid Estimate	$179,500.00

7 Assumptions

The following lists the key assumptions included for the proposed scope of work.

1) *The NSE/5SSR team will have open access to the project site.*
2) *Existing biophysical data and engineering information known and generated for the property to date will be provided.*
3) *Based on local site conditions (topography and vegetation), 5SSR assumes survey grade GPS units will be sufficient to collect PLS level survey and geomorphic data.*
4) *Designs and plan sets will be drafted and provided in AutoCAD.*
5) *North State/5SSR will respond to one (1) set of comments on 30% design due to time constraints.*
6) *Stakeholder involvement will include no more than two (2) meetings in Oklahoma prior to construction.*
7) *Cost estimate assumes no field work delays due to unplanned lack of landowner access, severe weather, etc.*

OKLAHOMA CONSERVATION COMMISSION

Appendix C: United States Army Corps of Engineers Permit

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

July 29, 2015

Regulatory Office

Ms. Shanon Phillips, Director
Water Quality Division
Oklahoma Conservation Commission
4545 N. Lincoln Blvd., Suite 11A
Oklahoma City, OK 73105

Dear Ms. Phillips:

Enclosed is an executed copy of your Department of the Army Permit No. SWT-2014-636. Please retain this copy for your files.

We request that in conjunction with this permit, you complete and return the enclosed self-addressed "Permittee Construction Schedule" form. Should construction be initiated prior to 30 days from receipt of this letter, please return the completed form as soon as possible. If you prefer, you may contact Mr. Shane Charlson at 918-669-7395 to inform this office regarding the construction start date.

Following completion of your proposed activity, complete and return the enclosed self-addressed "Permittee Compliance Certification" form, as required by Permit Special Condition 2.

If you desire to complete a "Customer Service Survey" on your experience with the Corps Regulatory Program, you are invited to visit http://corpsmapu.usace.army.mil/cm_apex/f?p=regulatory_survey on the internet at your convenience and submit your comments.

Sincerely,

Andrew R. Commer
Chief, Regulatory Office

Enclosures

cc:
Mr. Patrick Rosch, P.E., Oklahoma Department of Environmental Quality

DEPARTMENT OF THE ARMY PERMIT

Permittee: Mr. Andrew Wells, Estate of Clair Wells

Permit No.: SWT-2014-636

Issuing Office: U.S. Army Corps of Engineers, Tulsa District, Regulatory Office

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description: The right descending bank and the riparian corridor of the Illinois River shall be restored to protect State Highway 10. Approximately 2,900 linear feet of the Illinois River channel shall be stabilized from erosion. Approximately 2,000 cubic yards of stone shall be used to restore the eroded bank. Approximately 9,000 cubic yards of river gravel shall be removed from a point bar in the middle of the river by track hoe and placed behind the restored bankline. Approximately 6,000 cubic yards of soil shall be placed about 1 foot deep over the river gravel. Four rock arm vanes sized about 95 feet long with approximately 200 cubic yards of 40 cubic foot boulders shall be placed along the western bank for a total of 800 cubic yards. Gray riprap stone and rock from local quarries shall be used. The right descending bank riparian corridor shall be enhanced through implementation of this project. The existing channel shall be realigned and reshaped to provide equilibrium for riffle-pool morphology, effective sediment transport, and improved habitats. The right descending bank riparian corridor shall be planted with native riparian buffer vegetation to support long-term erosion resistance, streambank stability, habitats, and water quality. Sod mats shall be laid and sycamores shall be transplanted along disturbed areas of the banks. Seed mixes, bare root trees, and live stakes shall be planted throughout the riparian and upland areas. All work shall be performed in accordance with the attached mitigation plan "Illinois River Restoration/State Highway 10 Protection Project Mitigation Plan" dated October 1, 2014. All construction plans, including the modified vegetation plan, presented in the original 404 application shall be implemented.

Project Location: The proposed project is located in Section 23, Township 17 North, Range 22 East, near Tahlequah, Cherokee County, Oklahoma. The site is located approximately one-half mile north from the SH 62 and SH 10 junction on the east side of SH 10 and stretches approximately 2,900 feet north. The project site can be found on the Tahlequah, Oklahoma 7.5 Minute USGS Quadrangle map at North Latitude 35.93507 and West Longitude 94.92419.

Permit Conditions:

General Conditions:

1. The time limit for completing the work authorized ends on August 1, 2018. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

1. Permittee Construction Schedule: Prior to commencing construction, ODOT/OCC shall complete and return the "Permittee Construction Schedule" form. Should construction be initiated prior to 30 days from validation of this permit, return the completed form as soon as possible. If you prefer, you may telephone 918-669-7400 to inform the U.S. Army Corps of Engineers regarding the construction start date. A copy of the "Permittee Construction Schedule" form will accompany the validated permit and final authorization letter.

2. Compliance Certification: Following completion of the authorized activity, the ODOT/OCC shall submit a signed certification regarding the completed work and any required mitigation. A copy of the "Permittee Compliance Certification" form will accompany the validated permit and final authorization letter.

3. Responsibility: Your responsibility to complete the required compensatory mitigation as set forth in Special Condition 5 will not be considered fulfilled until you have demonstrated compensatory mitigation project success and have received written verification of that success from the U.S. Army Corps of Engineers.

4. Future Operations: The permitee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

5. Mitigation Plan: ODOT/OCC shall implement the mitigation plan "Illinois River Restoration/State Highway 10 Protection Project Mitigation Plan" dated October 1, 2014. All construction plans, including the modified vegetation plan, presented in the original 404 application shall be implemented.

6. Monitoring for Stream Impacts: ODOT/OCC shall monitor the river channel for destabilization upstream and downstream of the project within the Illinois River for a period of 5 years. If destabilization occurs during this period, the permittee shall notify the Regulatory Office immediately in writing. This report shall assess the condition of the river. The permittee shall include photographs of the stream channel and degraded area. After notification is made, the permittee may be required to submit a proposal to correct the destabilization of the river channel.

7. Deed Restriction: The permittee shall protect the mitigation property by securing a perpetual easement restriction designating the property for river and riparian mitigation. The protected area shall restrict grazing or farming practices within a buffer area of a minimum of 95 feet from the Illinois River's edge. Use of the enclosed "Notice of Restriction" form is recommended. Use of other instruments or agreements must be first approved by

the Corps. The permittee shall provide the Corps, within 180 days of the date of the permit, a copy of the notarized and filed deed restriction as evidence of protection.

8. Erosion Control Measures (ECM): You shall implement best management practices during the duration of the construction project. ECM such as silt screen barriers shall be implemented and maintained during construction. Barriers shall remain in place and effective until sufficient vegetation coverage on exposed areas is established. Upon inspection of erosion control barriers, if there is any damage to the barrier, it shall be replaced or repaired within 24 hours of discovery. All exposed earthen areas, disturbed or newly created by the construction, shall be seeded immediately, replanted, or provided equivalent protection against subsequent erosion.

Further Information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:
(X) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).
(X) Section 404 of the Clean Water Act (33 U.S.C. 1344).
( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization:

a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability: In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision: This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (see 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions: General Condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

Sharon Phillips 7-20-15

(PERMITTEE) (DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

for Mark R. Cruz 7/28/2015

(DISTRICT COMMANDER) (DATE)

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFEREE) (DATE)

SCOTT A. THOMPSON
Executive Director

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

MARY FALLIN
Governor

October 7, 2014

Ms. Shannon Phillips
Oklahoma Conservation Commission
4545 Lincoln Boulevard Suite 11A
Oklahoma City, OK 73105

RE: Application No. SWT-2014-636

Dear Ms. Phillips:

The Department of Environmental Quality (DEQ) has received your request for a Water Quality Certification under Section 401 of the Federal Clean Water Act [33 U.S.C. §1251 et seq. (1972)], for activities in the Illinois River to be permitted under Section 404 of the Act. DEQ rules governing 401 Water Quality Certification are contained in Oklahoma Administrative Code (O.A.C.) § 252:611-3 (2011) pursuant to 27A O.S. § 2-6-103(C)(2) (OSCN 1999). For copies of the DEQ rules and regulations related to the 401 procedures, please access it online at www.deq.state.ok.us/rules/611.pdf or contact the DEQ Office of External Affairs at (800) 869-1400.

We have reviewed and examined the proposed project as described in Public Notice No. SWT-2014-636 and your application. The Illinois River is assigned the following beneficial uses in the Oklahoma Water Quality Standards (WQS): Public and Private Water Supply, Cool Water Aquatic Community, Agriculture: Livestock and Irrigation, Primary Body Contact Recreation, Aesthetics, and Outstanding Water Resource (OAC 785:45 Appendix A, Table 1). To obtain a copy of the most recent version of the Oklahoma WQS, please contact the Oklahoma Water Resources Board at (405) 530-8800 or go online to http://www.owrb.ok.gov/util/rules/pdf_rul/RulesCurrent2011/Ch45-Current2011.pdf.

The application is for the bank stabilization of a portion of the Illinois River. The applicant proposes to remove a temporary fix of rip rap that was done several years ago and stabilize approximately 2,900 linear feet of the river channel. The unstable existing channel will be realigned and reshaped to provide riffle pool morphology, effective sediment transport, and improved habitats. The right-bank floodplain bench will be planted with native riparian buffer vegetation to support long-term erosion resistance, stream bank stability and water quality. Four rock arm vanes sized about 95 feet long with approximately 40 cubic foot boulders would be placed along the western bank. Grey riprap stone and rock from local quarries would be used. Approximately 9,000 cubic yards of river gravel would be removed from a point bar in the middle of the river by track-hoe and used against the bank-line structures described above. Sod mats would be laid and sycamores would be transplanted along the disturbed areas of the banks. Also seed mixes, bare roots, and live stakes will be planted throughout the riparian and upland areas.

The project is located on the Illinois River in Section 23 of Township 17 North, Range 22 East, in Cherokee County, Oklahoma. The project site can be found on the Tahlequah Oklahoma 7.5 Minute USGS Quadrangle map.

The conditions attached to this conditional Certification will be terms of the 404 permit. The state may require compliance with these conditions under state and/or federal law. Failure to comply with the conditions or any other applicable state requirements may result in proceedings brought by the state for the

suspension, termination, modification or revocation of this Certification and/or for injunctive relief, damages and/or penalties as allowed by law. This Certification may be revoked or modified upon subsequent amendments or revisions to Oklahoma's Water Quality Standards requirements or upon expiration of the federal permit for the described activity.

This conditioned Water Quality Certification does not supersede the requirements of a Section 404 permit from the U.S. Army Corps of Engineers, a permit required by the local floodplain board, or any other permit required for this project.

The certification is granted subject to the following conditions:

1) All spills of fuel or other pollutants in excess of five gallons shall be reported to the DEQ, within twenty-four (24) hours, to the pollution prevention hotline at 1-800-522-0206.
2) All fueling and servicing of vehicles and equipment shall be done above the Ordinary High Water Mark (OHWM).
3) Activities authorized by Department of the Army permits sometimes require floodplain development permits. Communities participating in the National Flood Insurance Program are required by that program to review all proposed development to determine if a floodplain permit is required.
4) Permittees shall provide access to the property to the DEQ for inspection purposes.
5) Any material and fuels used in the project shall be stored and/or stockpiled above the Ordinary High Water Mark (OHWM) and shall be removed from a likely flood zone prior to any predicted flood.
6) Environmental control practices, including but not limited to, effective erosion control measures must be utilized during construction.
7) All excess fill material, waste materials, construction debris, etc., must be removed from the site upon completion of the project.

If you have any questions concerning this matter, please contact Elena Jigoulina at 405-702-8200.

Sincerely,

Mark Derichsweiler, P.E., Engineering Manager
Watershed Planning and Storm Water Permitting Section
Water Quality Division

cc: Shane Charlson, Regulatory Branch, U.S. Army Corps of Engineers, Tulsa
Richard Hatcher, Director, Oklahoma Department of Wildlife Conservation
Kevin Burgess, U. S. Fish and Wildlife Service, Tulsa
Derek Smithee, Water Quality Programs Division, Oklahoma Water Resources Board
Brooks Tramell, Monitoring, Assessment and Wetlands Programs, Oklahoma Conservation Commission
Sharon Parrish, EPA Region 6 (6WQ-EM)
Tom Bates, Public Protection Unit Chief, Attorney General of Oklahoma

Illinois River Restoration/State Highway 10 Protection Project
Mitigation Plan

October 1, 2014

Prepared for:
Tulsa District
U.S. Army Corps of Engineers
Tulsa, Oklahoma

Prepared by:
Oklahoma Conservation Commission
Oklahoma City, OK
in consultation with
Stantec Consulting Services, Inc.
Ft. Collins, Colorado

OKLAHOMA
CONSERVATION
COMMISSION
Our Land • Our Heritage • Our Future

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OBJECTIVES

The objective of this project is to achieve stream enhancement goals relative to geomorphic sustainability and aquatic habitat quality. The existing unstable channel must be realigned and re-shaped to provide equilibrium riffle-pool morphology, effective sediment transport, and improved habitats. The right-bank floodplain bench planted with native riparian buffer vegetation is necessary for long-term erosion resistance, streambank stability, habitats, and water quality. Impacts are minimized by working within the existing stream corridor and maintaining the existing left-bank riparian forest buffer intact. This project is considered self-mitigating as it restores the west bank riparian buffer, which has been severely impacted by erosion, improves channel morphology and leaves the existing east bank forested riparian buffer intact.

SITE SELECTION

No site outside of the stream corridor was selected for mitigation. This ensures mitigation efforts are contained in the impact area, rather than improving something outside the stream corridor. Due to the improved channel morphology and reestablishment of riparian vegetation this project is considered self-mitigating

SITE PROTECTION INSTRUMENT

The owner of the west bank of the river, where the majority of the work will be conducted understands the importance of maintaining a healthy riparian area. In consideration of the Right-of-Way agreement to work on his property, the landowner has asked that trees be planted in the construction area to provide protection of his property. Additionally, the landowner is considering enrolling their property in both the Conservation Reserve Enhancement Program and the 319 BMP program, both of which restrict grazing or farming practices within a specified buffer area with a minimum of approximately 35 feet from the water's edge.

BASELINE INFORMATION

1. Location

The site is located in Section 23, Township 17 North, Range 22 East, near Tahlequah, Cherokee County, Oklahoma. The site is located approximately ½ mile north of the SH 62 and SH 10 junction, along the east side of SH 10 and stretches approximately 2,900 feet north. The site is located on both private property owned by the Claire Wells Estate and Oklahoma Department of Transportation right-of-way.

2. Impact Site

This mitigation plan is being prepared for stream impacts as a result of the riverbank and riparian corridor restoration project occurring in the same location. While no jurisdictional wetlands will be impacted as a result of this project, enhancement to the stream channel and improvement of the riparian area will occur, which make this project self-mitigating. A water dependency statement determination is unnecessary as no special aquatic sites are being permanently impacted.

Currently, the site contains minimal vegetative native cover, contains riprap that has eroded into the stream, steep un-vegetated areas that contribute sediment to the river and little to no trees or shrubs in the riparian corridor. The left river bank currently is heavily forested and is stable and will not be impacted by this project. A 10' bench will be established below the ordinary high water mark on the left bank, which will further protect this area.

3. Land Use

Current land use on the west side of the project is agricultural, and highway and utility right-of-way. The agricultural use is primarily hay production and pasture for horses. Land use on the east side was formerly a gravel mining operation, which has ceased operation. Currently, the land has significant vegetative cover with no development or agriculture use and is considered stable.

4. Wetland Delineation

A jurisdictional wetland determination was conducted by Stantec Consulting Services, Inc. They identified a total area of 0.037 acres of wetland and the total length/acres of the TNW within the project area is 3,169 linear feet/ 12.839 acres. The total project area is 21.005 acres. The isolated wetland, wetland WA (0.037 acres), is located along the eastern toe of slope of OK Highway 10 and west of the Illinois River just south of the project area midpoint. This is a linear stormwater wetland associated with a culvert that conveys local runoff. The only vegetation observed was herbaceous and was dominated by Andropogon gerarridi around the edges of the open water. The soil for this wetland exhibits a depleted matrix and common prominent redox concentrations beginning at the soil surface and extending into the Bt subsurface soil horizon. This wetland will not be impacted by the project.

DETERMINATION OF CREDIT

1. Compensatory Mitigation

The enhancements to the stream channel include realignment and reshaping to provide equilibrium for riffle-pool morphology, effective sediment transport and improved habitat. The right-bank floodplain bench will be planted with native riparian buffer vegetation and monitoring for invasive species will occur. Additionally, sod mats will be used on the newly constructed floodplain bench; the mats are being relocated from an upland area which has already been treated to ensure invasive Johnson grass is not transplanted.

Additionally, the landowner has indicated a desire to enroll in both the CREP and 319 BMP programs offered in this watershed, which will require tree planting, riparian area exclusion fencing and maintenance of established upstream forested area.

Due to the ecological benefits this project will provide, it is considered self-mitigating.

2. Mitigation Credits

Oklahoma currently does not have an approved mitigation bank or in-lieu fee program; therefore no credits can be produced.

MITIGATION WORK PLAN

North State Environmental has been contracted to carry out the actual construction and planting. The contractor will work from a set of construction plans provided by Stantec and approved by OCC and ODOT. Information on the design and a vegetation plan is included with the original application Information presented includes existing contours, details for features to help enhance/restore hydrology and a planting plan. However, the vegetation plan has been modified to address comments from Oklahoma Department of Agriculture Food and Forestry and has been forwarded to the Corps. The earthwork involved in the project is related to the stream restoration and enhancement. Invasive vegetation is not expected to be a problem on the site but should it become a concern, species will be identified along with appropriate remedial measures in the annual monitoring report. Details such as

staging and stockpiling areas are identified on the construction drawings. Appropriate erosion control measures such as silt fence and erosion control matting will be used where needed.

MAINTENANCE PLAN

The site will be assessed for any problem areas during the yearly monitoring visit. Problem areas will also be noted during other site visits. Items to be assessed include planted vegetation survivability, invasive vegetation control, hydrologic success, and fence maintenance. Maintenance will occur annually after monitoring unless the action is high priority. Any vegetation establishment will take place during appropriate planting season for each species.

It is not anticipated that invasive plant species will be a significant problem on this site. There is some Johnson grass present along the project but it does not represent a threat to the site and sod mats that will be used have already been treated to address the Johnson grass. During the monitoring visits, any invasive species problems will be noted and specific management/removal options will be proposed including spraying with herbicide rated for use within or near aquatic environments.

The contract for the project includes a one-year warranty on vegetation and construction after construction and planting is complete. The site will be monitored routinely during that time period. After the warranty expires OCC staff and Oklahoma Scenic Rivers Commission staff will monitor the site regularly, as the site lies along the highway used to get to the OSCR office and OCC staff has 12 other restoration sites that are routinely monitored. If the land is indeed enrolled in the CREP program, monitoring requirements are outlined in that contract. If vegetation is not meeting their required specifications it requires re-vegetation occur.

PERFORMANCE STANDARDS

The vegetative success of the area will be evaluated based on the percent cover of desirable species. Vegetative cover shall be at least 80%. Native volunteers will be included in the cover estimations.

Vegetative success also will be measured by the absence of noxious weed as identified by the Oklahoma Invasive Plant Council.

MONITORING REQUIREMENTS

Monitoring by the contractor will occur twice in the years of 2015 and 2016. Monitoring beyond 2016 will be done by both OCC and ODOT to ensure the project is meeting its purpose of protecting SH 10. The hydrology, vegetation establishment, and presence of invasive species will be assessed via visual assessment.

LONG-TERM MANAGEMENT PLAN

The landowner will be responsible for the long-term maintenance of the site.

ADAPTIVE MANAGEMENT PLAN

If it is determined that the project is not meeting its success criteria, depending on the issue some of the options for remediation include, but are not limited to, replanting vegetation, or adjustment to the right bank structures.

UPLAND BARE ROOT / LIVE PLANTINGS SCHEDULE (PLANTING AREA 2)					
SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	SPACING (FT O.C.)	SF	QUANTITY
TREES					
~~*Liriodendron tulipifera*~~	~~Tulip Poplar~~	~~FACU~~			
Cercis canadensis	Eastern redbud	FACU	10		1,790
Acer negundo	Boxelder Slippery	FAC			
Ulmus rubra	Elm Pecan	FAC			
Carya illinoensis	Hickory	FAC	10		1,790
Quercus alba	White Oak	FACU			
Quercus rubra	Northern Red Oak	FACU	10	125,028	1,790
~~*Quercus phellos*~~	~~Willow Oak~~	~~FACW~~			
Plantanus occidentalis	American Sycamore	FACW			
Ulmus americana	American Elm	FACW			
Quercus palustris	Pin Oak	FACW	10		1,790
~~*Quercus nigra*~~	~~Water Oak~~	~~FAC~~			
Quercus macrocarpa	Bur Oak	FAC	10		1,790
SHRUBS					
Hamamelis virginiana	American Witchhazel	FACU	10	125,028	1,790
Lindera benzoin	Northern Spicebush	FAC	10		1,790

RIPARIAN BARE ROOT / LIVE PLANTINGS SCHEDULE (PLANTING AREA 1)					
SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	SPACING (FT O.C.)	SF	QUANTITY
TREES					
~~*Fraxinus pennsylvanica*~~	~~Green Ash~~	~~FACW~~			
Fraxinus americana	White Ash	FACU	10		2,045
Betula nigra	River Birch	FACW	10		2,045
Acer rubrum	Red Maple	FAC			
Acer saccharinum	Silver Maple	FACW	10	218,653	2,045
~~*Liriodendron tulipifera*~~	~~Tulip Poplar~~	FACU	10		2,045
Acer negundo	Boxelder	FAC	10		2,045
~~*Quercus nigra*~~	~~Water Oak~~	FAC	10		2,045
SHRUBS					
Sambucus canadensis	Elderberry	FACW	10		2,045
Cornus drummondii	Rough-leaved Dogwood	FAC	10		2,045
Hamamelis virginiana	American Witchhazel	FACU		218,653	
Cephalanthus occidentalis	Common Buttonbush	OBL	10		2,045
Lindera benzoin	Northern Spicebush	FAC	10		2,045
ONSITE TRANSPLANTS					
Platanus occidentalis	American Sycamore	FACW	10	14,523	ALL
Arundinarea gigantea	River Cane	FACU	10	7,822	ALL
NA	Sod grass mats	NI	NA	58,325	ALL

LIVE STAKE PLANTING SCHEDULE (PLANTING AREA 3)					
SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	SPACING (FT O.C.)	SF	QUANTITY
Salix nigra	Black Willow	OBL	3		4,550
Sambucus canadensis	Elderberry	FACW	3	40,932	4,550
Cornus drummondii	Rough-leaved Dogwood	FAC	3		4,550