

City of Oxford Stream and Riparian Mitigation Plan



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INTRODUCTION

In 2006, the Watershed Institute, Inc. (TWI) and the Kansas City District of the U.S. Army Corps of Engineers (USACE) established an in-lieu (ILF) mitigation agreement. An ILF program involves the restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to an approved natural resource management entity or to a government body by a U.S. Army Corps of Engineers (USACE) permit recipient in order to satisfy compensatory mitigation requirements outlined in the USACE permit (USACE 2010a). The USACE administers a permit program for both the discharge of dredge and fill materials into waters and wetlands of the United States under Section 404 of the CWA and for activities in navigable waters under Section 10 of the Rivers and Harbors Act.

TWI has identified an appropriate mitigation strategy and extent of land to preserve through a conservation easement held by the Watershed Land Trust (WLT) within the city limits of Oxford, Kansas. This stream and riparian mitigation plan will provide information on the mitigation strategy as outlined in, *Compensatory Mitigation Plan Requirements for Permittee Responsible Mitigation Project Kansas City District, Corps of Engineers* (USACE 2010b).

OBJECTIVES

1. Fully offset—using the Kansas Stream Mitigation Guidance (KSMG) mitigation debit and credit calculations—the aquatic habitat lost to impact activities associated with the City of Wichita Armed Forces Readiness Center (NWK-2009-00775).
2. Partially offset the aquatic habitat lost from the construction of Horse Thief Reservoir (NWK-2006-1066).

BACKGROUND

In June 2010, TWI accepted responsibility for the City of Wichita Armed Forces Readiness Center mitigation requirements pursuant to the ILF program with USACE. USACE determined that this project impacted 670 linear feet of channel generating 2,211 mitigation debits. The project is located in the Hydrologic Unit Code (HUC) 8 11030013 watershed. Table 1 summarizes the mitigation debits using; *In-Stream Work/Channel Restoration or Enhancement and Relocation Worksheet* and the *Riparian Buffer Creation, Enhancement, Restoration and Preservation Worksheet* (USACE 2010c) from the Kansas Stream Mitigation Guidance (KSMG).

TWI received a letter from the Department of the Army, Kansas City District; USACE Regulatory Branch dated May 30, 2007 stating that the Horse Thief Reservoir project was authorized to use in-lieu-fee as a mitigation option. In June 2007, TWI accepted responsibility for the Horse Thief Reservoir mitigation requirements pursuant to the ILF program with USACE.

Table 1: City of Wichita Armed Forces Readiness Center Mitigation Adverse Impact Factors and Mitigation Debit Score

Factor	Score
Stream Type Impacted	0.4
Stream Status	0.1
Existing Condition Value	0.1
<i>Formula Total</i>	0.04
Duration	0.3
Activity	2.2
Cumulative Impact	0.2
Sum of Factors (M)	3.3
Linear Feet of Stream Impacted (LF)	670
Total	2,211

Horse Thief Reservoir mitigation obligations were defined as:

1. 4.75 miles of high value perennial stream channel.
2. Assorted Stream Buffer
3. 1,264 linear feet (0.25 acres) of fringe wetlands
4. 35 habitat units of riparian woodlands
5. Monitoring and real estate protection of these mitigation areas.

Horse Thief Reservoir mitigation was prior to Kansas adopting the KSMG and thus mitigation debits were not calculated for adverse aquatic impacts. Linear feet of aquatic impact were the criteria used to assess mitigation obligations. Horse Thief Reservoir is located in the HUC 8 11030006 watershed.

The proposed mitigation activities are located along the Arkansas River—a perennial stream—in the City of Oxford, Kansas within HUC 8 11030013 watershed. The mitigation goals are:

1. Enhance streambank stability along 2,600 feet of the Arkansas River.
2. Preserve 13.1 acres of wooded riparian habitat along to two land parcels adjacent to the Arkansas River.

3. Create 9.9 acres of wooded riparian and native grass habitat adjacent to the Arkansas River.
4. Preserve 3.5 acres of wooded riparian habitat along Lost Creek; an intermittent west tributary to the Arkansas River.

TWI has the required experience to complete successful streambank stabilization projects. TWI is capable of surveying, designing, and overseeing construction. Also, TWI has experience in planting riparian corridors and seeding native grasses and forbs. By protecting the existing wooded riparian corridor through streambank stabilization techniques, creating riparian areas, and preserving riparian areas; the mitigation goals align with watershed recommendations established by Kansas Department of Health and Environment (KDHE). KDHE has assigned a total daily maximum load (TMDL) for the Arkansas River below Wichita. The watershed quality impairment is nutrient load and oxygen demand impacting aquatic life (KDHE 2011). Recommended actions include establishing or reestablishing natural riparian systems and reducing activities within riparian areas in the Lower Arkansas River Watershed (KDHE 2011).

SITE SELECTION

TWI selected this site upon the request of William Jeffries (USACE Kansas State Regulatory Program Manager) in early 2009. Mr. Jefferies also directed TWI to use Horse Thief Reservoir in-lieu fee funds for the Oxford mitigation project. The mitigation project is located in Section 13, Township 32 South, Range 2 East, Sumner County, Kansas (see Appendix A, Figure 1). The property under easement lies immediately south of the City's residential district and adjacent to the city's wastewater lagoon system and the Arkansas River. The easement property includes two separate parcels of land generally bordered on the north by the Atchison & Santa Fe (AT&SF) Railroad right-of-way, the Arkansas River on the east, City of Oxford lands on the west, and private lands on west and south (see Appendix A, Figure 2). The north tract encompasses approximately 22 acres and south tract is about 12.8 acres. Land cover includes floodplain and riparian woodlands, cool and warm season grasslands, and cultivated land. Lost Creek, an intermittent tributary to the Arkansas River, enters the property from the west and flows southeast to its confluence with the Arkansas River. Through the easement area, Lost Creek has been straightened and leveed to reduce flooding of adjacent lands. The centerline of Lost Creek marks the southern boundary of the north parcel. The City's tree and limb dump site lies immediately west of the south parcel.

The Arkansas River is a large perennial stream that has a mean annual flow of 964 cubic feet per second (cfs) (U.S. Geological Survey [USGS] 2011). TWI documented channel widths—from ordinary high water mark—of nearly 1,000 feet. Lost Creek is an intermittent stream that does not have mean annual

flow listed with USGS (2011). Lost Creek typically has water during the spring and will also have backwater from the Arkansas River during periods of high flow. Table 2 lists the flow duration for both channels. The entire easement lies within the Federal Emergency Management Agency (FEMA) 100-

Table 2: Flow Duration (in cfs) for Arkansas River and Lost Creek at Oxford, Kansas (USGS 2011).

Flow Duration	Arkansas River	Lost Creek
90	345.20	0
75	518.98	0
50	954.88	0
25	1,863.28	0
10	4,155.81	0.62

year floodplain (see Appendix A, Figure 3). KDHE has identified designated uses (from KSA 82a-2001) for the Arkansas River that include special aquatic life use, primary contact recreation, domestic water supply, food procurement, ground water recharge, industrial water supply, irrigation, and livestock watering (KDHE 2011). For Lost Creek, designated uses include expected aquatic life use water and secondary contact recreation (KDHE 2011).

There are three soils classified within the easement property. In the north tract, the soils are mapped as Canadian fine sandy loam, rarely flooded. These soils are found in gently sloping terraces or high flood plains (Natural Resource Conservation Service [NRCS] 2011a). The soils are well drained with moderately rapid permeability and little runoff (NRCS 2011a). The parent material is coarse, loamy alluvium (NRCS 2011a). There are two soils mapped in the south tract. The first is Leosho clay loam, occasionally flooded. The soil is found on floodplains and is somewhat poorly drained (NRCS 2011a). The soil is made up of clay loam and loam in the upper 32 inches with sand below (NRCS 2011a). The second soil is Lincoln soils, frequently flooded. These soils are also located on floodplains and are somewhat excessively drained and are made up of loamy fine sand with stratified fine sand to clay loam below 10 inches (NRCS 2011a).

There are no National Wetland Inventory (NWI) wetlands identified within the easement boundary. The lack of hydrology and soils are limiting factors for wetland development.

The mitigation area is within the Great Bend Sand Plains Major Land Resource Area (MLRA) and the site is defined as a sandy terrace (NRCS 2008). The sandy terrace ecological site is found on nearly level terraces above the active floodplain (NRCS 2008). The historic plant community is characterized as

grasslands dominated by tallgrasses that include sand bluestem (*Andropogon hallii*), switchgrass (*Panicum virgatum*), and Indiangrass (*Sorghastrum nutans*) (NRCS 2008). Midgrasses are also common including little bluestem (*Schizachyrium scoparium*), Canada wildrye (*Elymus canadensis*), purple tridens (*Tridens flavus*), sand lovegrass (*Eragrostis trichodes*), purple lovegrass (*Eragrostis spectabilis*), western wheatgrass (*Pascopyrum smithii*), composite dropseed (*Sporobolus composites*), and sand dropseed (*Sporobolus cryptandrus*) (NRCS 2008).

In the floodplains, wooded riparian species are common. Historic species include eastern cottonwood (*Populus deltoides*), hackberry (*Celtis occidentalis*), American elm (*Ulmus americana*), black willow (*Salix nigra*), and peach leaved willow (*Salix amygdaloides*) (Kuchler 1974). Current wooded areas are similar with many cottonwood and hackberry trees.

The aquatic diversity is good along the Arkansas River. Kansas Department of Wildlife and Parks (2006) found good native species richness to stream width proportions especially downstream from Lincoln Street dam on the Arkansas River. In 16 sampling events within the HUC 8 watershed, KDWP captured 46 species of fish and 14 species of mussels including the Wabash pigtoe and yellow sandshell; both species in need of conservation (SINC). The Arkansas River is critical habitat to three endangered Kansas fish species and one federally threatened fish species. The silver chub (*Macrhybopsis storeriana*) habitat is large sandy rivers (KDWPT 2011a). It lives near the bottom and is found in deep water during the summer months (KDWTP 2011a). The Arkansas River speckled chub (*Macrhybopsis tetranema*) prefers shallow channels of permanently flowing stream where water flows over clean fine sand (KDWPT 2011b). Finally, the Arkansas River shiner (*Notropis girardi*) is state listed endangered species and federally listed threatened species. The Arkansas River shiner formerly occurred throughout the Arkansas River main stem, but spawning habitat has been compromised (KDWPT 2011c). The fish is extremely dependent on flood flows from June to August to successfully spawn (KDWPT 2011c). Declining streamflows have restricted the fishes range and numbers (KDWPT 2011c).

SITE PROTECTION INSTRUMENT

Ownership of the mitigation areas will remain with the City of Oxford. However, a conservation easement has been filed with Sumner County, Kansas on October 26, 2011 naming WLT as the grantee. WLT is responsible for preserving and protecting all mitigation measures on the protected property. A copy of the filed conservation easement is found in Appendix B. WLT contact information is listed below.

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BASELINE INFORMATION

In preparation for filing the conservation easement, TWI completed a Baseline Documentation Report (BDR) that includes a detailed mitigation site property description, photographic points, and a summary of grantors' rights and restrictions. The BDR provides detailed information on the easement property location as well as landuse, topography, soils, water and wildlife resources descriptions. The BDR is located in Appendix C.

DETERMINATION OF CREDITS

Mitigation to offset the debits occurs within three reaches:

- Reach 1 – Arkansas River located in North Parcel.
- Reach 2 – Lost Creek located in North Parcel.
- Reach 3 – Arkansas River located in South Parcel.

Mitigation activities include riparian buffer creation, riparian buffer preservation, and streambank stabilization. TWI considered the following information to calculate credits accruing from the proposed mitigation:

Stream Type (Channel) – Arkansas River is a perennial water of the United States. The average channel width at the ordinary high water mark (OHWM) exceeds 400 feet. TWI scored the stream type as perennial with an OHWM width greater than 50 feet = 1.0.

Stream Type (Riparian) – Lost Creek is an intermittent water of the United States. TWI scored the stream type as intermittent with pools = 0.2.

Priority Area (Channel) and Priority Status (Riparian) – The Arkansas River in Sumner County, Kansas is critical habitat for state and federal threatened and endangered species. This includes the federally threatened and state endangered Arkansas River shiner (*Notropis girardi*), the state endangered Arkansas

river speckled chub (*Macrhybopsis tetranema*), and the state endangered Silver chub (*Macrhybopsis storeriana*). TWI scored the Arkansas River as primary = 0.4.

Lost Creek is within ½ mile of primary priority reaches as the confluence with the Arkansas River is just downstream from the north easement tract. TWI scored Lost Creek as secondary = 0.2.

Existing Condition – The Arkansas River at Oxford is listed on the Kansas 303(d) list for total phosphorus, pH, total suspended solids, fecal coliform, and lead. There are two stream impacts just upstream that include the old AT&SF bridge piers and the U.S. Highway 160 Bridge. The Arkansas River fails to meet either the highly functional or functionally impaired characteristics. TWI scored the Arkansas River in both parcels as moderately functional=0.05.

Net Benefit (Channel) – In-channel enhancement includes streambank stabilization along the Arkansas River in the north parcel. Stabilization structures include bendway weirs, rock vanes, and large woody debris. TWI is constrained by the City of Oxford sewage lagoons and thus non rigid stabilization methods are not feasible. TWI scored the net benefit as minimal = 1.0.

Net Benefit (Riparian) – In the north parcel, TWI is preserving the existing wooded riparian corridor. This encompasses 9.2 acres. In addition, TWI is creating 9.9 acres of riparian habitat by planting trees and native grasses. Since riparian creation activities account for 52 percent of the riparian benefit, the activity classifies as riparian creation. The average riparian buffer width along the 2,600 of the Arkansas River is 320 feet. TWI scored the net benefit as 300 feet of riparian buffer creation = 0.56.

Also in the north parcel, TWI will preserve the existing wooded riparian corridor along Lost Creek. The average riparian buffer width along the 1,342 creek reach is 115 feet. TWI scored the net benefit as 100 feet of riparian buffer preservation = 0.8.

In the south parcel, TWI is preserving the existing Arkansas River riparian buffer. The average buffer width along the 700 foot river reach is 245 feet. TWI scored the net benefit as 225 feet of riparian buffer preservation = 0.13.

Control Site Protection – A conservation easement between the City of Oxford and WLT will govern site protection with WLT accepting monitoring and maintenance responsibilities. WLT has filed a conservation easement with the county. This site protection qualifies as a USACE approved site protection recorded with third party grantee, or transfer of title to a conservancy. TWI scored this component as 0.4 for in-channel credits and 0.2 for riparian credits.

Mitigation Construction Timing – All mitigation activities will be completed after the impacts have occurred. TWI scored this component at 0.0.

Using the *In-Stream Work/Channel Restoration or Enhancement and Relocation Worksheet* and the *Riparian Buffer Creation, Enhancement, Restoration and Preservation Worksheet* (USACE 2010c, Appendix D), TWI calculated the total credits to be 13,170 (see Tables 1 and 2).

Table 3: In-Stream Channel Enhancement and Relocation Worksheet

Factors	Reach 1	Reach 2	Reach 3
Stream Type	1.0	-	-
Priority Area	0.4	-	-
Existing Condition	0.05	-	-
Net Benefit	1.0	-	-
Control/Site Protection	0.4	-	-
Mitigation Construction Timing	0.0	-	-
Sum of Factors (M)	2.85	-	-
Stream Length (LF)	2,600	-	-
Credits (C) = M x LF	7,410	-	-
Site Factor (SF)	1.0	-	-
Total Credits = C x SF	7,410	-	-
Sum of In-Channel Credits = 7,410			

Table 2: Riparian Creation, Enhancement, Restoration, and Preservation Worksheet

Factors	Reach 1	Reach 2	Reach 3
Stream Type	0.4	0.2	0.4
Priority Status	0.4	0.2	0.4
Net Benefit	Stream Side A	0.56	0.08
	Stream Side B	-	-
Supplemental Buffer Credit	0.0	0.0	0.0
Control /Site Protection	0.2	0.2	0.2
Mitigation Construction Timing	Stream Side A	0.0	0.0
	Stream Side B	-	-
Temporal Lag	0.0	0.0	0.0
Sum of Factors (M)	1.56	0.68	1.13
Linear Feet of Stream Buffer (LF)	2,600	1,342	700
Credits (C) = M x LF	4,056	913	791
Site Factor (SF)	1	1	1
Total Credits Generated	4,056	913	791
Sum of Riparian Credits = 5,760			

Seventeen percent (or 2,211 credits) of the proposed mitigation credits will be used to offset the mitigation credits required for the City of Wichita Armed Forces Readiness Center. The remaining 10,959 proposed mitigation credits will be used to partially offset mitigation credits required for Horse Thief Reservoir. Since linear feet of stream was the metric used to determine Horse Thief Reservoir mitigation requirements, TWI is proposing the following methodology to determine how much the proposed mitigation will offset Horse Thief Reservoir mitigation requirements. TWI added the lengths (stream length and linear feet of stream buffer) of all mitigation activities and then subtracted 17 percent of the total length that represents the portion used for the City of Wichita Armed Forces Readiness Center. This total equals 6,011 feet or 24 percent of the channel length impacted by Horse Thief Reservoir, and thus the amount that this mitigation project will offset.

MITIGATION WORK PLAN

The mitigation work plan consists of three components. The first component is the streambank stabilization along the west bank of the Arkansas River. TWI has included a set of engineer reviewed and sealed drawings (see Appendix E) that show the design in plan-view form, structure details and geomorphology analysis, and cross section surveys. Also included in Appendix E is a design addendum required to satisfy a “no-rise” in the 100-year FEMA floodplain. TWI has obtained a USACE 404 permit, a Department of Agriculture Division of Water Resources (DWR) Stream Obstruction Permit, and a KDWPT Action Permit. The permit letters are also included in Appendix E.

Construction will begin upon approval of the mitigation plan. Construction methods are outlined in a construction specification document that has been engineered reviewed and sealed (see Appendix F). Construction will consist of building rock bendway weirs and rock vanes. Bank shaping will not be completed as the goal of the mitigation project is to preserve as much of the wooded riparian corridor as possible. Wooded riparian maintenance will be part of the construction process that includes cutting trees that are leaning over the channel. The root wads will be left intact while the cut tree will be placed along the bank toe between the rock structures.

Three hundred one bare root seedlings will be planted as outlined in sheet 4 of the construction drawings (see Appendix E). The species will consist of sycamore, cottonwood, american plum, and golden currant. Bare root seedlings will be planted using a tractor and attached tree planter. Prior to planting, the planting area will be treated with a broadcast application of glyphosate herbicide if vegetation is present. Establishment methods outlined in *Kansas Forestry Technical Note KS-9* (NRCS 2002) will be followed

to ensure proper planting procedures (see Appendix G). T-posts will be installed on the outside of the planned riparian area boundary. In addition, T-post will be installed at the end of each shrub row and every 150 feet within the row. All T-posts will be covered with a white PVC sleeve to increase visibility. Tree tubes will be placed on every fourth tree to protect against deer browse/rub and rodent damage. The stakes associated with tree tubes will be driven 1 foot into the ground. Trees will be planted during the first spring following the approval of this mitigation plan. The goal of the tree planting will be to widen and improve the connectivity of the wooded riparian corridor.

In addition to the riparian plantings, 9.1 acres—that was previously cultivated—will be seeded with a native grass and forb mixture (see Sheet 4, Appendix E). The grass/forb seeding mixture will be planted using a no-till grass drill. The native grass seed mix will be drilled between March 15 and May 15 following approval the mitigation plan. The native grass will provide permanent cover in the Arkansas River floodplain and terrestrial habitat.

OPERATION AND MAINTENANCE PLAN

The operation and maintenance plan describes the maintenance required during establishment to aid in survival of the plant species and to meet performance standards. Establishment is defined as the first three years following planting.

For the bare root seedlings, the following activities will be completed during the first year. A pre-emergent herbicide mixture of Pendulum and Princep or equivalent will be broadcasted over the riparian buffer before grass and weeds are allowed to germinate. In June, the site will be visited to determine if weeds and grass are present. If they are present, a post-emergent herbicide will be applied when vegetation is 6-12 inches tall. For the grass herbicide, Fusilade II or equivalent will be applied, and Transline or equivalent will be applied for broadleaf weeds. In July, the site will be disked between rows no closer than 9 inches to trees and shrubs. Following disking, another pre-emergent herbicide mixture of Pendulum and Princep (or equivalent) will be applied over the planting area.

The following maintenance activities will be completed during the second and third years following the bare root plantings. In mid to late March, a pre-emergent herbicide mixture of Pendulum or Princep (or equivalent) will be applied before weeds and grasses germinate. In June, the site will be inspected to determine if weeds and grass are present. If they are present, a post-emergent herbicide will be applied when vegetation is 6-12 inches tall. For the grass herbicide, Fusilade II or equivalent will be applied, and Transline or equivalent will be applied for broadleaf weeds. In July, the site will be disked between rows

no closer than 9 inches to trees and shrubs. Following disking, another pre-emergent herbicide mixture of Pendulum and Princep (or equivalent) will be applied over the planting area.

For operation and maintenance during the grass planting establishment, the following activities will occur. In June, the seeded area will be inspected for excessive weed growth. If excessive weed growth is present, then either herbicide application or mowing will be used to control the weed growth. Herbicide application will be used to control patches of excessive weed growth. Transline or equivalent will be applied on the weeds when they reach a height of 6 to 12 inches. If excessive weed growth is found consistently in the seeded area, the area will be mowed when the weeds reach a height of 6 to 8 inches. Mowing will not be done on days when the maximum air temperature exceeds 95 degrees and the humidity is below 30 percent to avoid dehydration of the seeded plants (NRCS 2011b). Mowing will not be used later than July 15 except during years of abnormal high moisture that may promote excess weed production (NRCS 2011b).

PERFORMANCE STANDARDS

This mitigation approach will enhance—with in-channel features—approximately 2,600 feet of channel and create and preserve native riparian buffer. The following sections outline performance standards to measure success of the mitigation

Streambank Stabilization Structures

Bendway Weirs and rock vanes with woody debris bank toe will create streambank stability and protect existing riparian corridor from excess lateral erosion. The weirs will also create scour pools and still water providing breeding and nursery areas for amphibians and macroinvertebrates.

Performance Standards

1. Constructed bendway weirs will maintain as-built dimensions and be free from accelerated weathering and displacement.
2. Constructed rock vanes will maintain as-built dimensions and be free from accelerated weathering and displacement.

Riparian Buffer Creation

The riparian buffer is divided into two zones: wood riparian corridor zone and native grass and forb zone. (see Appendix E, Sheet 4).

Performance Standard

1. Wooded riparian buffer plantings will maintain 85% survival of the planted vegetation at the end of five years.
2. Grass/forb riparian buffer will maintain a stand density of 70 percent of the initial planting number rate at the end of five years.

Species listed on the Kansas noxious weed list (see Table 3) will be eradicated upon observation and shall not cover more than 5 percent of the planted areas.

Table 3: Noxious Weeds of Kansas

Scientific Name	Common Name
<i>Cirsium vulgare</i>	Bull Thistle
<i>Ambrosia grayii</i>	Bur Ragweed
<i>Cirsium arvense</i>	Canada Thistle
<i>Convolvulus arvensis</i>	Field Bindweed
<i>Cardaria draba</i>	Hoary Cress
<i>Sorghum halepense</i>	Johnsongrass
<i>Pueraria lobata</i>	Kudzu
<i>Euphorbia esula</i>	Leafy Spurge
<i>Rosa multiflora</i>	Multiflora Rose
<i>Carduus nutans</i>	Musk Thistle
<i>Hoffmannseggia densiflora</i>	Pignut
<i>Agropyron repens</i>	Quackgrass
<i>Acroptilon repens</i>	Russian Knapweed
<i>Lespedeza cuneata</i>	Sericea Lespedeza

MONITORING REQUIREMENTS

TWI will monitor the City of Oxford mitigation project for five years post-construction to ensure that performance standards are met and determine if maintenance or adaptive management is needed. TWI will submit to USACE and IRT an annual monitoring report that includes information described in this section.

Streambank Stabilization Structures

On an annual basis, TWI will inspect the general characteristics of the structures, the condition of each structure, and the condition of bank between structures. Monitoring will be completed during base flow conditions when the structures are the most visible and accessible. General characteristic measurements will include length of weir/vane, spacing between weirs/vanes, top width of each weir, structure slope of each vane, height above bed for each weir/vane, and photos of each weir/vane. TWI will complete a general characteristic of structure worksheet adapted from Rhodes (2003). An example of a worksheet is provided in Appendix H.

To assess the conditions of each stabilization structure, TWI will visually inspect each structure and note whether the structure is visible, below water, buried, fully intact, eroded, vegetated, bare, and whether or not the structure key is visible. TWI will complete a structure condition worksheet adapted from Rhodes (2003). An example of a worksheet is provided in Appendix H.

The streambank assessment will be to visually inspect the bank between stabilization structures. TWI will note bank conditions and complete a condition of bank between structures worksheet that is adapted from Rhodes (2003). Possible conditions include sloping and vegetated, vertical and unvegetated, scalloping of bank between weirs, tension cracks, block failures, and erosion behind key. An example of this worksheet is provided in Appendix H.

Riparian Buffer Creation

On an annual basis, TWI will inspect the bare root seedlings and seeded native grass/forb acreage. Since it normally takes three years to establish the vegetation, the first three years will be devoted to operation and maintenance activities. At the end of the third growing season, TWI will determine the survival percentage of the woody species by inspecting each bare root seedling. If any species falls below 85 percent survival, then seedlings to be replaced will be flagged and replanted the following spring. In year four and five of the monitoring plan, an overall survival percentage will be determined annually. Again, if any species falls below 85 percent survival, the seedlings to be replaced will be flagged and replanted. Natural recruitment of desirable species may count towards the species survival rates. For any replanted tree, TWI will perform operation and maintenance activities for three years as outlined in the operation and maintenance plan, but localized to areas around the replanted trees.

At the end of the third growing season for the native grass/forb area, TWI will perform a stand density. TWI will count a minimum of 10 samples that will result in a representative sample of conditions. For

each sample, TWI will count plants within a standard range clipping frame (24 inch x 11.5 inch). The counts will be recorded in a worksheet that is included in Appendix I. An acceptable stand will be with an average stand count of 2 or more plants. For average stand counts that fall between 0.5 and 2.0 plants, TWI will solicit professional judgment from a NRCS range specialist to determine if reseeding is necessary. If stand counts average less than 0.5 plants, then reseeding will be required. For any reseeded area, TWI will perform operation and maintenance activities for three years as outlined in the operation and maintenance plan.

LONG TERM MANAGEMENT PLAN

WLT will be responsible for long term management. The site's conservation easement will be held in perpetuity and shall stay with the property in the instance that the title of the property is transferred to another entity.

Maintenance of the mitigation property will be carried out by WLT for a minimum of ten years following approval of all performance standards. After the ten years, the in-channel and riparian ecosystems will be self-sustainable. Long term maintenance needs will likely be vegetation management, streambank stabilization maintenance, removal of trash, and property inspections to ensure no activities occur that is inconsistent with the purpose of the conservation easement. WLT will complete annual inspections that will identify maintenance needs. Likely vegetation maintenance activities will be eradication of invasive species and reseeding of bare spots with native vegetation. The streambank stabilization structures are designed for long-term success, but are susceptible to damage from floods and rock degradation. WLT will use a fluvial geomorphologist to assess whether any damages/changes to the streambank stabilization structures require corrective actions. Additional maintenance tasks include trash removal and vandalism repairs. A schedule of maintenance activities and estimated costs are provided in Table 5.

Table 5: Long-Term Maintenance Schedule (Based on 2011 Prices)

Maintenance Item	Requirement	Acres	Percent of Area	Cost per Unit	Schedule	Yearly Cost
Site Inspection	1 Visit	26.5	100	\$41.50	Yearly	\$1,100
Buffer Reseeding	7 # PLS / acre	9.1	5	\$60.00	Yearly	\$27.30
Invasive Species Removal	1 Visit	26.5	1	\$150	Yearly	\$39.75
In-Stream Structure Maintenance	1 visit	N/A	N/A	\$786.80	Every Five Years	\$157.36
Trash removal	1 Visit	N/A	N/A	\$87.50	Yearly	\$87.50
Miscellaneous	1 Visit	N/A	N/A	\$120.00	Yearly	\$120.00
Yearly Total						\$1,531.91

TWI agrees to provide the following financial assurances for work associated with this mitigation project. TWI has paid WLT a sum of \$20,000 U.S. Dollars as a stewardship fee to ensure compliance, monitoring, and legal defense in perpetuity with the conservation easement.

ADAPTIVE MANAGEMENT PLAN

If the project cannot be constructed as designed in Appendix E, TWI will notify USACE. Significant modifications to the original design will be approved by UCACE prior to construction. TWI will use an adaptive management approach to deal with unforeseen issues. TWI has experience with planting bare root seedlings and seeding grass and has the necessary tools to complete operation and maintenance activities. TWI is prepared to complete activities that are necessary as appropriate for the long-term management of the site. Unforeseen activities may include planting alternate, but desirable species and timber stand improvements in preserved riparian areas.

If unforeseen circumstances arise that the mitigation project cannot meet performance standards, then TWI and WLT will approach USACE with suggestions or changes that are commensurate towards meeting mitigation objectives. If necessary, performance standards may require revising. Any revisions will be commensurate or superior to original performance standards.

FINANCIAL ASSURANCES

Once the final construction costs have been determined and any adaptive management initiated, a security fee for the costs necessary to replace 10 percent of the mitigation project will also be deposited with WLT for the balance of the establishment period. The balance of the 10% security fee will be refunded to the Kansas Aquatic Resources Trust Fund (KARTF) at the end of the establishment period, if any.

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APPENDIX A

FIGURES

APPENDIX B

FILED CONSERVATION EASEMENT

APPENDIX C

BASELINE DOCUMENT REPORT

APPENDIX D

KANSAS STREAM MITIGATION GUIDELINE SPREADSHEETS

APPENDIX E

MITIGATION PERMITS AND DESIGN

APPENDIX F

CONSTRUCTION SPECIFICATIONS

APPENDIX G

KANSAS FORESTRY TECHNICAL NOTE KS-9

APPENDIX H

ROCK STABILIZATION STRUCTURE EVALUATION FORMS

APPENDIX I

STAND DENSITY EVALUATION FORM
