COTTONWOOD RIVER C104
STREAMBNAK STABILIZATION PROJECT

LYON COUNTY, KANSAS

Prepared for:

State of Kansas
Department of Agriculture Division of Conservation

Prepared by:

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C104	Lyon	Cottonwood River

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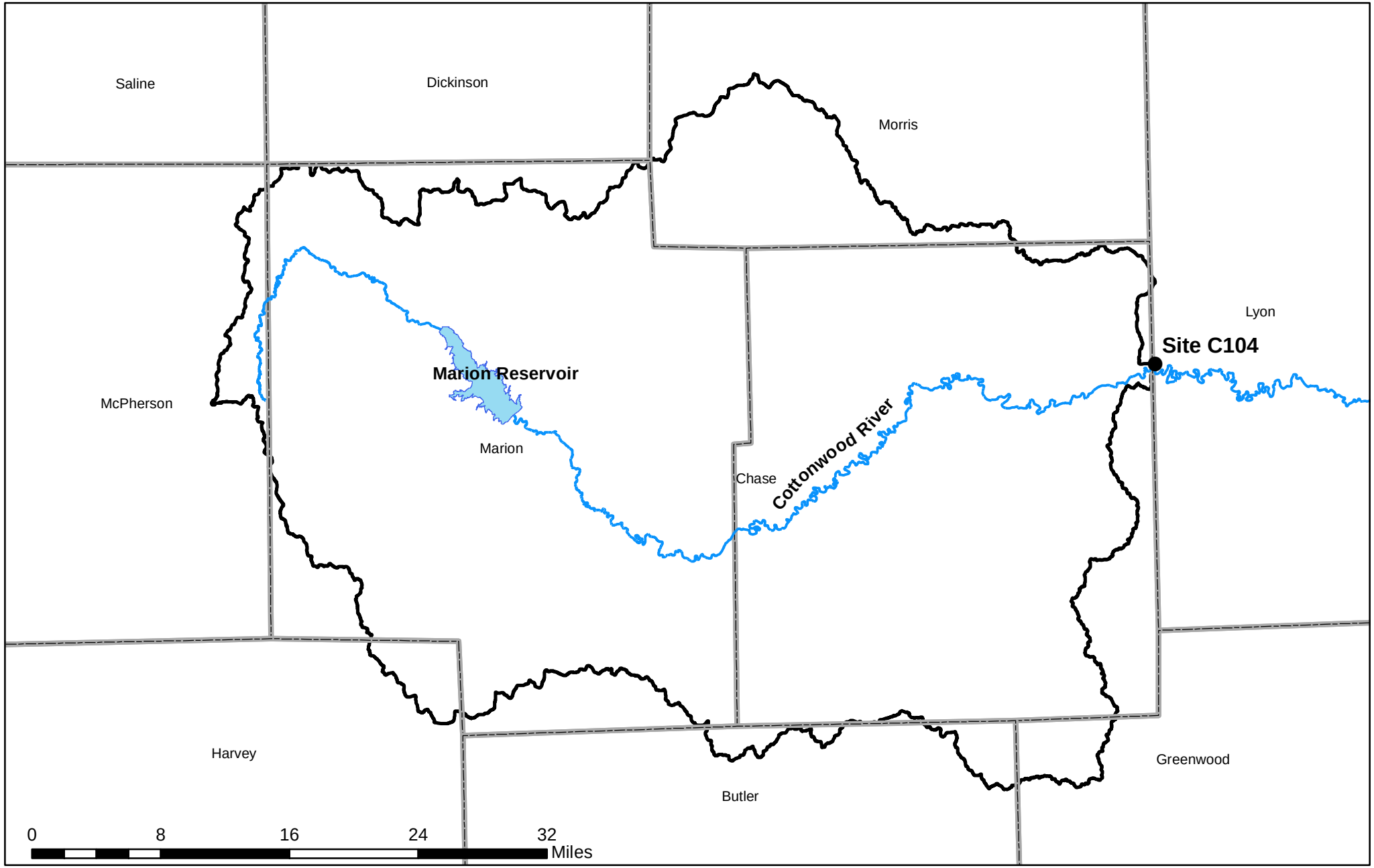

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Figure 1
Drainage Area Map

DOC Streambank Stabilization Project
Cottonwood River Site C104

Date: January 2020

Source: https://kansasgis.org/

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Figure 2
Field Drainage Map

DOC Streambank Stabilization Project
Cottonwood River Site C104

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Date: January 2020

Source: https://kansasgis.org/

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Figure 3
Soil Map

DOC Streambank Stabilization Project
Cottonwood River Site C104

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Date: January 2020

Source: https://datagateway.nrcs.usda.gov/GDGOrder.aspx, https://kansasgis.org/

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Figure 4
Streambank Erosion Map

DOC Streambank Stabilization Project
Cottonwood River C104

Date: January 2020

Source: TWI 2019

Cottonwood River C104
Streambank Stabilization Project
Lyon County, Kansas

Photo Number: 1	
Client: Kansas Department of Conservation	
Description: Drone photo of project looking downstream.	
Direction: South	
Photographer: Austin Roth	
Date: November 15, 2018	
Photo Number: 2	
Client: Kansas Department of Conservation	
Description: Drone photo of project looking upstream.	
Direction: North	
Photographer: Austin Roth	
Date: November 15, 2018	

Cottonwood River C104
Streambank Stabilization Project
Lyon County, Kansas

Photo Number: 3	
Client: Kansas Department of Conservation	
Description: Slumping along left top of bank looking downstream.	
Direction: South	
Photographer: Brock Emmert	
Date: November 15, 2018	
Photo Number: 4	
Client: Kansas Department of Conservation	
Description: Looking upstream toward upstream end of project.	
Direction: North	
Photographer: Brock Emmert	
Date: November 15, 2018	

Cottonwood River C104
Streambank Stabilization Project
Lyon County, Kansas

Photo Number: 5	
Client: Kansas Department of Conservation	
Description: Left top of streambank during survey.	
Direction: North	
Photographer: Brock Emmert	
Date: October 1, 2019	
Photo Number: 6	
Client: Kansas Department of Conservation	
Description: Left streambank bank looking upstream near riffle.	
Direction: North	
Photographer: Brock Emmert	
Date: October 23, 2019	

Photo Number: 7	
Client: Kansas Department of Conservation	
Description: Left streambank looking downstream from riffle.	
Direction: South	
Photographer: Brock Emmert	
Date: October 23, 2019	
Photo Number: 8	
Client: Kansas Department of Conservation	
Description: Large woody debris from recent slumping.	
Direction: West	
Photographer: Brock Emmert	
Date: October 23, 2019	

CONSTRUCTION SPECIFICATIONS

Prepare for:

Kansas Department of Agriculture
Division of Conservation

COTTONWOOD RIVER C104
STREAMBANK STABILZATION

July 7, 2020

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SECTION 01001 – GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 GENERAL

A. These General Requirements are incorporated herein to clarify and expand the provisions previously set forth in the Contract Documents which these specifications and drawings are a part thereof.

B. In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

1. The Agreement
2. Addenda, with those of later date having precedence over those of earlier date
3. The Supplemental General Conditions
4. The General Conditions of the Contract for Construction
5. Drawings and Specifications
6. Latest version of the NRCS Specifications

C. In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the more stringent condition shall be provided in accordance with the Engineer's interpretation.

D. The quality of workmanship shall be an important consideration in acceptance or rejection of work. It is expected that the Contractor shall provide qualified workmen who can produce a first quality project, as defined by approved samples. Work that fails to achieve a first quality standard may be considered defective and rejected. Such work shall be removed and replaced with new work of first quality, as defined by approved samples.

E. The Contractor, being experienced in his/her trade, prior to submitting his/her bid, having made an inspection of the existing facilities and conditions; a thorough review of the Contract Documents; understanding that all systems are new; acknowledges that the installation of these systems must be complete and operational. Accordingly, all necessary parts, equipment, accessories and components must be supplied and installed, and must pass all final testing and operations. If a system component is missing in the Contract Documents, notify Engineer for clarification.

1.2 DRAWINGS AND SPECIFICATIONS

A. Do not scale drawings for dimensions. Accurately layout such work from dimensions indicated on engineering drawings or by use of field verified dimensions. Consult the Engineer for interpretations concerning locations of equipment.

B. Where drawings indicate a portion of the work and the remainder is shown in outline, the parts drawn out apply to other like portions of the work. Where detail is indicated by starting only, such detail shall continue to apply throughout the courses or parts in which it occurs and apply to similar parts of work unless otherwise indicated.

C. Unless otherwise indicated, a detail indicates the general application of work at all locations where it logically applies, and other related work incident thereto shall be provided as

required to fully complete the work in a manner consistent in the detail and other related details, and as approved by Engineer.

1.3 ENGINEER'S SELECTION AND APPROVAL OF MATERIALS

A. Where approval of Engineer for material or equipment is required, secure such approval prior to bidding in a written request.

B. The aesthetic values of every material and installation, such as shape, proportion, texture, finish and color, will be an important consideration to the Engineer and his/her decisions concerning same shall be final, within the scope of the Contract Documents.

1.4 APPROPRIATE MATERIALS AND INSTALLATIONS

A. Furnish materials and equipment that have been properly inspected and tested in accordance with accepted industry standards. Make field laboratory test where specified herein, the cost of such being paid for by the Contractor, unless otherwise specified.

B. Before submitting any bids, the Contractor, and the Contractor's subcontractors and material suppliers shall observe the drawings and project manual and should any material and/or its installation be indicated or specified in a manner not approved by the material manufacturer, notify the Engineer and receive his/her instructions.

1.5 SITE ACCESS

A. Contractor shall provide adequate access to the site at the locations shown on the attached map, or other access routes that may be negotiated with individual homeowners by the contractor with approval of the Department of Agriculture Division of Conservation (hereinafter, the "Sponsor") or Contracting Officer.

1.6 USE OF SITE

A. Site storage shall be confined to areas indicated on the site plan or as directed by Sponsor.

B. The Contractor shall obtain and pay for any additional storage or work areas needed for construction operations.

C. The Contractor shall be responsible for site maintenance within the construction area. Site maintenance includes trash pickup, and other actions that are required to maintain a neat and orderly site.

D. The Contractor shall be responsible for maintenance beyond the construction area for areas affected by construction operations. Maintenance includes removal of trash, mud, gravel, and other debris.

E. The Contractor is responsible for the security of the work area and for any building materials and equipment stored on the site. Maintain security of existing buildings where affected by work of this Contract.

1.7 PROTECTION OF WORK AND PROPERTY

A. The Contractor shall take charge of and assume full responsibility for proper protection of the construction areas.

B. Protect existing buildings and previously placed work by suitable coverings or other protections during installation of subsequent work. Clean off any foreign materials accidentally deposited on finish surfaces and, where such would stain, corrode or otherwise disfigure, clean it immediately with material that will not damage finished work.

C. Protect work in place requiring job finishing until such finishing has been completed. In cold weather, protect work form damage from frost and freezing. In hot weather, protect work from rapid drying.

D. Dumping on site of any liquid wastes including oils, fuels, concrete or mortar cleaning activities, paint, etc., is prohibited.

1.8 INSTALLATION

The Contractor shall:

A. Furnish, apply, install, connect, erect, clean and condition manufactured articles, materials and equipment per manufacturer's printed directions, unless otherwise indicated or specified.

B. The manufacturer's printed directions must be on job prior to and during installation of materials and equipment.

C. Make field check of actual dimensions before fabricating products.

D. Install materials only when conditions of temperature, moisture, humidity, and condition of adjacent components are conducive to achieving best installation results.

E. Handle materials in a manner to prevent scratching, abrading, distortion, chipping, breaking or other disfigurement.

F. Fabricate and install materials true to line, plumb and level, unless indicated otherwise. Leave finished surfaces smooth and flat or of smooth contour where indicated, free from wrinkles, warps, scratches, dents and other imperfections.

G. Conduct work in a manner to avoid injury to previously placed work.

1.9 CLOSING-IN WORK

A. Notify the Engineer to inspect any work when placing of subsequent work would prevent observation of previous work.

1.10 DEFECTIVE WORK

A. Unless the Engineer grants permission to repair any defective work, remove defective work from project and replace with new work in accordance with Contract Documents. If permission is granted, repair according to Engineer's direction. Permission to repair any such work shall not constitute a waiver of Engineer's right to require complete replacement of

defective work if repair operation does not restore quality and appearance of member or surface to Engineer's satisfaction.

1.11 UNSUITABLE CONSTRUCTION CONDITIONS

A. During unfavorable weather, wet ground, or other unsuitable construction conditions, the Contractor shall confine operations to work which will not be affected adversely thereby. No portion of the work shall be constructed under conditions which would adversely affect the quality of efficiency thereof, unless special means of precautions are taken by the Contractor to perform the work in a proper and satisfactory manner.

1.12 PERFORMANCE

A. Where Drawings and/or Specifications designate a standard of performance, the completed installation shall perform at least to the designated standard.

1.13 TESTS OF MATERIALS

A. Furnish materials and equipment that have been properly inspected and tested in accordance with accepted industry standards. Make field or laboratory tests where specified herein, the costs of such being paid for by Contractor, unless otherwise specified.

B. Should such tests or visual observation indicate failure of materials or construction to meet requirements of the Drawings and/or Specifications, Contractor shall make and pay for additional tests, as directed by Engineer until compliance has been proven, and should such work fail to comply, Contractor shall replace it at his/her expense.

1.14 RECEIVING AND STORING MATERIALS

A. On receipt of materials, check for in-transit damage in ample time to replace any damaged materials prior to installation time.

B. Store materials in a manner to prevent deterioration, staining, soiling, and intrusion of foreign materials. Provide waterproof, well-ventilated enclosures for materials subject to deteriorating by dampness. Adequately protect those materials subject to damage by freezing and frost.

C. Remove from premises and replace with new, any materials showing deterioration or damage.

1.15 EXISTING UNDERGROUND INSTALLATIONS

A. Existing underground installations such as water mains, gas mains, oil pipelines, sewers, telephone lines, power lines, and buried structures in the vicinity of the work to be done hereunder are indicated on the drawings only to the extent such information has been made available to or discovered by the Engineer in preparing the Drawings. There is no guarantee as to the accuracy or completeness of such information, and all responsibility for the accuracy or completeness thereof is expressly disclaimed. Generally, service connections are not indicated on the Drawings.

B. It is the Contractor's responsibility to contact 1-800-DIG-SAFE. The Contractor shall be solely responsible for contacting all utility companies and locating all existing underground installations, including service connections, in advance of excavating or trenching, by contacting the owners thereof and prospecting. The Contractor shall use his/her own information and shall not rely upon any information shown on the drawings concerning existing underground installations.

C. Any delay, additional work, or extra cost to the Contractor caused by existing underground installations shall not constitute a claim for extra work, additional payment, or damages.

1.16 PRESERVATION OF MONUMENTS AND STAKES

A. The Contractor shall carefully preserve all monuments, benchmarks, property markers, reference points, and stakes. In case of his/her destruction thereof, the Contractor will be charged with the expense of replacement and shall be responsible for any mistake or loss of time that may be caused. In the cases of permanent monuments or benchmarks which must be removed or disturbed, the Contractor shall furnish material and assistance for the proper replacement of such monuments or benchmarks.

1.17 APPROPRIATE MATERIALS AND INSTALLATIONS

A. Before submitting bid, Contractor, his/her subcontractors, and material suppliers shall observe existing conditions, Specifications, Drawings, and Addenda thereto and should any material and/or its installation be indicated or specified in a manner not approved by the material manufacturer, notify Engineer and receive his/her instructions. Failing to do so, Contractor shall provide other equivalent materials, suitable for the installation, as selected by Engineer or if not discovered until after installation, Contractor shall replace materials with such other equivalent suitable materials as approved by Engineer, and in either event at no added cost. If additional or other types of work are required for desired satisfactory results and specified guarantee, the additional or other work shall be included in bid amount and shall not constitute a basis of claim for "extra work" during or upon completion of this project.

1.18 CONSTRUCTION REQUIREMENTS

A. Staking: A survey with benchmarks located is included in the Drawings for Contractor's use. All other surveying and staking will be the responsibility of the Contractor at his/her own expense unless otherwise stated in the Drawings.

B. Geotechnical Reports: Subsurface data has not been obtained for design purposes. The bidder shall make his/her own interpretations of existing conditions and shall be expected to obtain additional data at his/her own expense if required to satisfy himself/herself as to the conditions to be encountered.

C. Storage: All equipment and materials to be incorporated into the work shall be stored in a manner to prevent damage from the elements, work, or handling. The Engineer will not accept damaged or deteriorated materials. All storage, to include Owner-provided items, will be at the expense of the Contractor.

1.19 ADMINISTRATIVE REQUIREMENTS

A. Coordination: The Contractor shall perform the activities necessary to properly coordinate the material and equipment procurement and the work provided by him/her and his/her subcontractors. The Contractor also shall coordinate his/her work with the Sponsor when required for the best overall coordination of the project.

B. Progress Meetings: The Contractor shall hold on-site progress meetings with the Sponsor and Engineer, to discuss job-related problems. Persons designated by the Contractor to attend and participate in the meetings shall have all required authority to commit the Contractor to solutions agreed upon in the project meeting.

C. Progress Schedule: The Contractor shall submit to the Sponsor, prior to construction, a progress schedule. The schedule shall be detailed enough to reasonably allow the Sponsor to follow the progress of the work. The schedule shall be updated periodically as required by the work and as requested by the Sponsor.

D. All materials resulting from clearing and grubbing activities shall be removed and disposed of in an acceptable manner at an acceptable facility conforming to all applicable regulations.

END OF SECTION 01001

SECTION 01002 – SPECIAL CONDITIONS

PART 1 – GENERAL

1.1 RELATIONSHIP TO GENERAL CONDITIONS

A. Should conflict occur between these Special Conditions and the General Requirements, these Special Conditions shall take precedence. When these Special Conditions modify a portion of the General Conditions, the unaltered portions of the General Conditions shall remain in effect.

1.2 LOCATIONS, LINES AND LEVELS

A. Contractor shall establish location of new work on property and establish and maintain all other grades, lines, levels, and benchmarks; check and compare all drawings, verifying grades, lines, levels, and dimensions indicated thereon, and report all inconsistencies to Engineer and receive Engineer's instructions before commencing work.

1.3 DOCUMENTS FURNISHED

A. Contractor will be responsible for obtaining all necessary Drawings and Project Manuals, including all modifications thereof, as required, including distribution to subcontractors and suppliers.

B. Contractor shall pay the actual cost of reproduction for all additional sets requested by him/her.

1.4 LAWS TO BE OBSERVED

A. The Contractor shall at all times observe and comply with all federal and state laws, local laws, ordinances, orders, decrees and regulations existing or enacted subsequent to the execution of the Contract, which in any manner affect the prosecution of the work. The Contractor and his/her Surety shall indemnify and save harmless the Department of Agriculture Division of Conservation (hereinafter, the "Sponsor"), the Sponsor's Architects, Engineers, and their representatives, agents, and employees against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by himself/herself, his/her employees, or his/her subcontractors.

1.5 CONSTRUCTION OBSERVATION

A. The undertaking of periodic site visits by the Engineer or representative shall not be construed as supervision of actual construction nor make him/her responsible for providing a safe place for the performance of work by contractors or contractor's employees, or those of suppliers or subcontractors, or for access, visits, use, work, travel, or occupancy by any person.

1.6 CONSTRUCTION COORDINATION

A. Before starting any construction, a meeting shall be held with Sponsor, Contractor, Subcontractors, and Engineer to plan and coordinate the schedule of construction and to

review intent of Contract Documents. Contractor and Subcontractor shall follow instructions received at this meeting in prosecuting the work.

END OF SECTION 01002

SECTION 01003 – SUMMARY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents
2. Type of Contract
3. Use of premises
4. Owner's occupancy requirements
5. Work restrictions
6. Specification formats and conventions

B. Related Sections include the following:

1. Division1 Section "General Requirements" for limitations and procedures governing temporary use of Department of Agriculture Division of Conservation's (hereinafter, the "Sponsor") facilities.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work consists of the following:

1. The site work including addition of wooden, soil bioengineering, and rock structures, reconfiguration of existing streambank, planting of cover crop, mulching, and native plantings.

1.4 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.5 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings.

B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.6 OWNER'S OCCUPANCY REQUIREMENTS

A. Partial Owner Occupancy: Homeowners will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Homeowners during

construction operations to minimize conflicts and facilitate homeowner's usage. Perform the Work so as not to interfere with Homeowners' operations.

1. Provide not less than 72 hours' notice to homeowner of activities that will affect Homeowner's operations.

1.7 WORK RESTRICTIONS

A. On-Site Work Hours: Contractor's normal working hours are acceptable. Any work expected during evenings or weekends should be coordinated with Homeowner's schedule.

1. Provide not less than 72 hours' notice to Homeowners of activities outside normal working hours.

B. Existing Utility Interruptions:

1. Notify Engineer and Sponsor not less than three days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Engineer's written permission.

1.8 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

3. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

END OF SECTION 01003

SECTION 02102 – CLEARING AND GRUBBING

PART 1 – GENERAL

1.1 WORK INCLUDED IN THIS SECTION:

A. Clearing and grubbing required for this work includes, but is not necessarily limited to:

1 Removal of trees, stumps, debris, and brush.
2 Trimming and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal.
3 Removal and disposal of miscellaneous abandoned subsurface structures and debris that may be discovered during the work.

1.2 RELATED WORK IN OTHER SECTIONS:

A. Excavating, Filling and Grading Section 02200

1.3 JOB CONDITIONS:

A. Dust Control:

1. Use all means necessary to control dust on and near the work and on and near all borrow areas.

1.4 LINES AND GRADES:

A. All clearing and grubbing shall be done within the lines and grades shown on the drawings.

PART 2 – INSTALLATION

2.1 CLEARING:

A. Contractor shall only clear trees, stumps, brush, snags and other vegetation when necessary for the installation of the overall project. All other trees and vegetation shall be left standing. Trees and vegetation to be left standing shall be protected from damage during the completion of the work.

2.2 GRUBBING:

A. In areas requiring excavation, Contractor shall grub and remove material to a depth necessary to complete excavation to the limits indicated and complete required work. Material to be grubbed shall include stumps, roots larger than one inch in diameter, matted roots, and any miscellaneous subsurface structures and debris that may be encountered. Trees shall be Trees and plants to be relocated: Any tree or plants moved shall be done in a timely manner so as not to delay construction progress. The Contractor shall take extra measures to protect trees during the relocation by erecting barricades, staking, trimming, etc. as required. Trees shall be completely removed with stump ground down to a minimum depth below the grade of six (6) inches.

2.3 PROTECTION:

A. Contractor shall take precautions to protect any trees, vegetation, structures, benchmarks and survey stakes, and utilities not intended to be removed. Prior to beginning work, Contractor shall be responsible for field verifying that there are no utilities within the work area. Contractor shall be responsible for repairing and/or replacing, at no additional cost to the Department of Agriculture Division of Conservation (hereinafter, the "Sponsor"), items that are damaged during construction that were not intended to be removed.

2.4 DISPOSAL OF MATERIAL:

A. All materials resulting from clearing and grubbing activities shall be removed and disposed of in an acceptable manner at an acceptable facility conforming to all applicable regulations. Materials suitable for use as aquatic habitat enhancement (stumps, logs, etc.) shall be stockpiled as directed by the Engineer.

PART 3 – MEASUREMENT AND PAYMENT

3.1 METHOD OF MEASUREMENT:

A. The quantity of Clearing and Grubbing will not be measured for payment unless the construction limits are changed. Clearing and Grubbing shall be considered subsidiary to Excavating, Filling, and Grading. No adjustment will be made for changes involving less than 0.1 acre (0.04 ha).

3.2 BASIS OF PAYMENT:

A. The amount of work completed and approved, as stated above, shall be paid for as part of the contract lump sum price. Such payment shall constitute full compensation for all labor, equipment, tools and all other items necessary and incidental to completion of the work.

B. In the event of a change in construction limits, the Contractor shall submit a unit price for Clearing and Grubbing to be approved by the Engineer.

END OF SECTION 02102

SECTION 02200 – EXCAVATING, FILLING AND GRADING

PART 1 – GENERAL

A.1 WORK INCLUDED IN THIS SECTION:

A. Excavating, filling and grading required for this work includes, but is not necessarily limited to:

1. Excavating, filling and backfilling for streambank stabilization.

2. Rough and finish grading of streambank.

3. Preparation of sub-grade for areas to be seeded, planted with trees and shrubs, and/or mulched.

1.2 RELATED WORK IN OTHER SECTIONS:

A. Clearing and Grubbing: Section 02101

1.3 JOB CONDITIONS:

A. Dust Control:

1. Use all means necessary to control dust on and near the work and on and near all offsite borrow areas, if such dust is caused by the Contractor's operations during performance of the work, or if resulting from the condition in which the Contractor leaves the site.

B. Protection: Use all means necessary to protect all materials of this section before, during, and after installation, and to protect all objects designated to remain. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Department of Agriculture Division of Conservation (hereinafter, the "Sponsor"). Protect tops, trunks and roots of existing trees on project site which are to remain.

C. Notification: The Contractor shall notify the Engineer prior to installation of specified portions of the work to allow the inspector sufficient time to inspect the work and shall obtain approval of all material prior to commencing construction. Any portion of the work installed without inspection may be removed to allow for inspection. Any eventual difficulty or loss of time caused by the Contractor failing to meet permit requirements shall be borne solely by the Contractor.

1.4 LINES AND GRADES:

A. All excavation, filling and backfill shall be done to the lines and grades shown on the drawings.

1.5 BENCH MARKS AND MONUMENTS:

A. Maintain carefully all bench marks and reference points, which are shown on the drawings. The Contractor shall pay for the replacement of such reference points if disturbed by the Contractor during construction.

1.6 REFERENCES:

A. The publications listed below form a part of this specification. The latest revision of the following standards shall apply to work hereunder:

Associated General Contractors of America, Inc.
"Manual of Accident Prevention in Construction"

PART 2 – PRODUCTS

2.1 FILL MATERIAL, GENERAL:

A. All fill material for embankment construction shall come from onsite unless otherwise specified by the Engineer. All fill material shall be subject to approval of the Engineer.

2.2 IMPORTED FILL MATERIAL:

A. If imported fill material is required to finish embankments or sub-grade. The Contractor shall be responsible for providing a borrow area for imported fill.

2.3 TOPSOIL:

A. All areas disturbed by construction operations, which are not to be paved or rocked under this contract, shall be provided with a 12-inch uncompacted layer of topsoil approved by the Engineer. Topsoil from areas within the project limits may be stockpiled and used where such topsoil is considered satisfactory to sustain plant growth. Additional materials, if required, shall be brought to final grade, as shown on the drawings, and shall be lightly compacted.

2.4 OTHER MATERIAL:

A. All other materials not specifically described, but required for proper completion of the work of this section, shall be as selected by the Contractor, subject to the approval of the Engineer.

PART 3 – INSTALLATION

3.1 GENERAL:

A. Familiarization: Prior to all work in this section, become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this section.

B. Backfilling Prior to Approval

1. Do not allow or cause any of the work installed to be covered up or enclosed by work of this section prior to all required inspections, tests, and approval.

2. Should any of the work be so enclosed or covered up before it has been approved, uncover all such work at no additional cost to the Sponsor.

C. Site Drainage: During construction, excavation and fill shall be performed in a manner and sequence that will provide drainage at all times.

3.2 EXCAVATION AND FILLING:

A. General: Excavation, as hereinafter specified, shall comprise the satisfactory removal and disposition of all material. After topsoil removal has been done, excavation of every description and of whatever substances encountered, shall be performed to the lines and grades indicated on the drawings. After backfilling of key trenches has been completed, any surplus of excavated material shall be known as "waste" and shall be disposed of at the location approved by the Engineer. Any additional fill material required, that is not available from excavation within the immediate project area, shall be obtained from borrow area locations approved by the Engineer. During construction, excavation, key trenching, and backfilling shall be performed in a manner and sequence that will provide drainage at all times.

1. Classification of Excavation: Excavation shall be unclassified.

2. Earth and Rock Excavation shall be unclassified. Earth and Rock Excavation shall include earth, clay, silt, sand, gravel, hard pan, loose shale, loose stone masses, boulders, rock material in ledges, bedded deposits, unstratified masses, and conglomerate deposits so firmly cemented that they possess the characteristics of solid rock, which cannot be removed without systematic drilling.

B. Depressions Resulting from Removal of Obstructions: Where depressions result from, or have resulted from, the removal of surface or subsurface obstructions, open the depression to equipment working width and remove all debris and soft material, as directed by the Engineer.

C. Sloped Surfaces: Sloped ground surfaces steeper than 1 vertical to 4 horizontal, on which fill is to be placed, shall be plowed, stepped (benched) or broken up, in such manner that the fill material will bond with the existing surface.

D. Fill and Backfill: All fill or backfill material shall consist of earth or other approved material with all undesirable material removed. Unless otherwise specified, all fill shall be uniformly placed uniform layers to achieve a 3H:1V slope or as specified by the Drawings and then compacted in 9-inch lifts by equipment.

E. Over-excavation: Backfill and compact all over-excavation areas, as specified for fill, at no additional cost to the Sponsor.

F. Unfavorable Weather: Ground frozen or too wet - do not place, spread, or roll any fill material during unfavorable weather conditions. Do not resume operations until moisture content and fill density are satisfactory to the Engineer.

G. Overbank flow: To prevent erosion of finished slopes from overland flow, provide berms and rock chutes or slope drain devices along sections of disturbed bank where drainage is towards the disturbed bank.

H. Soften Sub-grade: Where soil has been softened or eroded by flooding or placement during unfavorable weather, remove all damaged areas and re-compact as specified for fill and compaction below.

I. Dewatering: Provide and maintain at all times during construction, ample means and devices with which to promptly remove and dispose of all water from every source entering the excavations or other parts of the work. Dewater by means, which will insure dry excavation and the preservation of the final lines and grades of bottoms of excavation.

3.3 BACKFILLING:

A. General Backfill: Unless otherwise specified by the Drawings, all channel slopes shall be shaped to a 1-foot vertical to 3-foot horizontal slope which smoothly transitions into the existing slope at each end of the project.

B. Responsibility of Contractor for Backfill Settlement:

1. The Contractor shall be responsible for the satisfactory compaction and maintenance of all backfill of any description required under this contract. If, prior to the final acceptance of this entire contract, any backfilled areas are found to have settled, they shall immediately be reworked by the Contractor and restored to the specified grades.

3.4 FINISH GRADING

A. The finishing of side slopes, cuts and fills shall be to reasonably smooth uniform surfaces that will merge with the adjacent terrain without noticeable break. Finishing shall be done in accordance with grades shown on the drawings, and without variations that are readily discernible.

B. Finish grading shall be performed to the lines and grades shown on the drawings. All areas disturbed by the Contractor during construction operations shall be bladed smooth, shaped, and compacted, as specified herein before. The finished grade shall provide for topsoil that is free from perennial vegetation and is loosened to depth of twelve (12) inches for areas disturbed under this contract.

C. Newly graded areas shall be protected from traffic, erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes. Damaged areas shall be re-vegetated, if necessary.

D. Haul roads into the work sites shall be ripped to loosen compacted soils prior to removing equipment from the project site.

3.5 BORROW AND SPOIL AREAS:

A. Borrow and spoil areas shall be graded to promote positive drainage at the completion of the work. No borrow or spoil slopes shall be greater than 1-foot vertical to 3-foot horizontal.

B. Erosion controls shall be implemented to prevent erosion into waterways.

C. Borrow and spoil areas shall be seeded and mulching shall be applied at the completion of construction.

3.6 CLEANING UP:

A. Upon completion of the work of this section, immediately remove all debris and excess earth materials from the site.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT:

A. Work will be measured by bid quantity of cubic yards of soil. Contractor shall maintain weight tickets for soil trucked to the site. Material moved on site by earth moving equipment will be paid at the contract unit price and units indicated.

4.2 Basis of Payment:

A. The amount of work completed and approved, as stated above, shall be paid for at the contract unit price. Such payment shall constitute full compensation for all labor, equipment, tools and all other items necessary and incidental for the completion of the work.

END OF SECTION 02200

SECTION 02900 – PROTECTION OF SOIL AND VEGETATION

PART 1 – GENERAL

1.1 WORK INCLUDED IN THIS SECTION:

A. This section governs measures and sets environmental protection performance, restoration, and design standards for protecting and restoring native soils and vegetation that are impacted by heavy construction equipment and other site construction activities.

1.2 RELATED WORK IN OTHER SECTIONS:

A. Excavating, Filling and Grading Section 02200

1.3 REFERENCES:

A. The following standards are referenced directly in this section. The latest version of these standards shall be used.

1. NRCS Planning and Design Manual, NRCS, 1998

2. Home Landscapes, Planting, Design and Management, E.C. Martin, Jr., and Pete Melby, Timber Press

3. American Standard for Nursery Stock

PART 2 – PRODUCTS:

2.1 STANDARDS

A. All materials used during this portion of the work shall meet or exceed applicable federal, state, county and local laws and regulations. The use of any herbicide shall follow directions given on the herbicide label. In the case of a discrepancy between these specifications and the herbicide label, the label shall prevail.

2.2 MATERIALS

A. Prior to delivery of any materials to the site, submit to the Engineer a complete list of all materials to be used during this portion of the work. Include complete data on source, amount and quality. This submittal shall in no way be construed as permitting substitution for specific items described on the plans or in these specifications unless approved in writing by the Engineer.

PART 3 – INSTALLATION

3.1 GENERAL

A. Selective Clearing is removal of undesirable trees and underbrush around specimen trees and brush as designated on the drawings and/or instructed by the Engineer.

B. Soil and specimen trees as shown on the drawings and/or instructed by the Engineer to save, shall be protected from damage incident to clearing, grubbing, and construction operations.

3.2 PLANT PRESERVATION

A. The Engineer shall mark all plant materials on the site to be saved and/or relocated. No plant material may be removed from the site prior to the Engineer's inspection. All plant material to be saved/or relocated will be protected from injury to the roots and to the branches, to a distance five feet beyond the drip-line. No grading, trenching, pruning, or storage of materials may go in this area, except as approved by the Engineer.

B. Trees and plants to be relocated: Any tree or plants moved shall be done in a timely manner so as not to delay construction progress. The Contractor shall take extra measures to protect the tree during the relocation by erecting barricades, staking, trimming, etc. as required.

3.3 FIELD QUALITY CONTROL

A. Qualifications of workmen: provide at least one person who shall be present at all times during execution of this portion of the work, who shall be thoroughly familiar with this type of work and the type of materials being used. Said person shall be competent at identification of soils and plant materials to be removed and to be preserved during the season (summer, winter) work is to be completed. Said person shall also direct all work performed under this section.

END OF SECTION 02900

SECTION 02901 – CHANNEL BANK VEGETATION

SUMMARY: The work described herein consists of furnishing, transporting, and installing seeds, trees, and other materials as required for the rehabilitation and establishment of stream side vegetation. It is the Contractor's responsibility to perform soil preparation, cover crop planting, native grass planting, bare root seedling planting, management, and such additional extra and incidental work as may be necessary to complete the work in accordance with the specification and plans. The Contractor shall furnish required materials, equipment, tools, labor, and incidentals, unless otherwise provided in the specifications or Drawings.

PART 1 – GENERAL

1.1 DESCRIPTION:

A. Planting required—cover crop, native grass, and trees—is indicated as plantings. Plantings on the Drawings and, in general, include, but are not limited to:

1. Procurement, storage and protection of listed grass seed.

2. Preparation of planting sites.

3. Planting areas.

4. Maintenance of plantings installed by Contractor.

B. Related Work in Other Sections:

1. Clearing and Grubbing: Section 02102

2. Excavating, Filling and Grading : Section 02200

1.2 QUALITY ASSURANCE–NATIVE GRASS SEEDING

A. Qualification of Workmen: Provide at least one person who shall be present during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct work performed under this Section.

B. Standards:

1. Seeds shall meet or exceed the specification of Federal, State, and County laws requiring inspection for plant disease and insect control.

2. All seeds shall be true to species and shall be tagged with the name and percent pure live seed in accordance with accepted industry standards for grass seed.

3. Seed shall meet or exceed specifications of Federal, State and County laws requiring inspection for plant disease and insect control and shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act.

1.3 QUALITY ASSURANCE–TREE PLANTING

A Qualification of Workmen: Provide at least one person who shall be present during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct work performed under this Section.

B Standards:

1. Bare root seedlings and cuttings must be grown from locally adapted seed or cuttings of known origin and meet height and caliper standards listed in the NRCS Kansas Forestry Technical Note KS-9.

1.4 JOB CONDITIONS:

A. Time of Planting:

1. The Contractor shall complete cover crop seeding immediately following construction during favorable weather conditions.

2. The Contractor shall complete native grass seeding during normal and accepted planting seasons listed in the NRCS Critical Area Planting – Practice 342. And during favorable weather conditions.

3. The Contractor shall complete tree plantings during normal and accepted planting seasons listed in the NRCS Kansas Forestry Technical Note KS-9 and during favorable weather conditions.

1.5 SUBMITTALS:

A. Materials list include, but not limited to, the following:

1. Quantities, Signed and Dated by Supplier(s).

1.6 DELIVERY, STORAGE AND HANDLING:

A. Delivery, Storage and Handling:

1. The Contractor shall deliver seed, bare root seedlings, and cuttings to the project site in good condition.

2. The Contractor shall use all means necessary to protect the seed, bare root seedlings, and cuttings before, during, and after installation and to protect the installed work and materials of other trades.

B. Replacement: In the event of damage during construction, the Contractor shall immediately make repairs and replant necessary to the approval of the Engineer and at no additional cost to the Department of Agriculture Division of Conservation (hereinafter, the “Sponsor”).

1.7 SITE DISTURBANCES:

A. It is the Contractor's responsibility to take precautions insuring that equipment and vehicles do not disturb or damage existing grading, seeding, or other site improvements.

B. The Contractor shall repair and/or return to original condition any damage at no cost to Sponsor.

PART 2 – MATERIALS

2.1 PLANT MATERIALS:

A. General: Furnish seed that is true to name and type representative of the species or variety.

B. Plant materials

1. Native grass seeding shall follow recommendations in NRCS Critical Area Planting – Practice 342.

2. Bare Root seedlings and tree cuttings shall follow recommendations in Kansas Forestry Technical Note No. KS-9.

3. Cover crop seeding shall follow recommendations in NRCS Cover Crop – Practice 340.

C. Mulching: Other materials not specifically described but required for a complete and proper planting installation shall be as selected by the Contractor, subject to the approval of the Engineer

2.2 WATER:

A. Water, hose, and other watering equipment required for the work shall be furnished by the Contractor.

2.3 HERBICIDE:

A. Herbicides shall be applied according to manufactures label instructions and adhere to State, Federal, and local laws.

PART 3 – INSTALLATION

3.1 SURFACE CONDITIONS:

A. Inspection:

1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where these installations may properly commence.

2. Verify that planting, seeding and related construction work may be completed in accordance with the original design and the referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Engineer.

2. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

3.2 SPREADING OF TOP SOIL:

A. Finish Grading: Finish grading will be performed according to Section 02002 of these Specifications, in graded areas.

3.3 PLANTING NATIVE GRASS SEED:

A. Preparation:

1. Roughly grade seed beds with equipment, leave few ridges and depressions and making areas into a continuous, firm plane that ensures proper drainage.

B. Planting:

1. Native grass seed shall be planted by hand broadcast method as approved by the Engineer. Seeding of native grass should follow recommendation in NRCS Critical Area Planting – Practice 342.

2. For site-specific native grass mix, reference the design drawings.

3.4 PLANTING BARE ROOT SEEDLINGS

A. Preparation

1. Roughly grade channel bank slope with equipment, leave few ridges and depressions and making areas into a continuous, firm plane that ensures proper drainage. The planting area must be free of living sod and perennial weeds before planting. Vegetation from native grass seeding is acceptable.

B. Planting

1. Cuttings and bare root seedlings should follow recommendations in Kansas Forestry Technical Note KS-9.

2. For site-specific information on cutting and bare root seedlings, reference the design drawings.

3.5 MULCHING:

A. Mulching shall immediately follow native grass seed planting.

B. Mulch shall be an organic substance capable of eventual complete decay. The mulch shall be native prairie hay, brome hay, or straw and shall be applied at a rate of 4,000 pounds per acre. Native prairie hay is the preferred mulch.

C. Mulch shall be evenly distributed over the entire seeding area.

3.6 INSPECTION:

A. In addition to normal progress inspections, the Sponsor shall schedule and conduct the following formal inspections, giving the Engineer at least 24-hours prior notice of readiness for inspection:

1. Inspection of plant locations, to verify compliance with the Drawings.

2. Final inspection after completion of native grass seeding and final inspection after completion of cuttings and bare root seedling plantings; schedule these inspections sufficiently in advance, and in cooperation with the Engineer, so that final inspections may be conducted within 24 hours after completion of native grass seeding and tree planting.

3. Final inspection at the end of the maintenance period provided that previous deficiencies have been corrected. The maintenance period consists of the first three years following native grass seeding and tree planting.

3.7 CLEAN-UP:

A. During the progress of this work, and upon completion, the Contractor shall thoroughly clean the project area and remove and properly dispose of resultant dirt, debris and other waste materials.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT:

A. The quantity of seeding and mulching will be measured in pounds of pure live seed and mulch applied. Seeding and Mulching shall be considered subsidiary to grass planting and the overall construction project.

4.2 BASIS OF PAYMENT:

A. The amount of work completed and approved, as stated above, shall be paid in lump sum as part of the contract unit price. Such payment shall constitute full compensation for all labor, equipment, tools and all other items necessary and incidental for the completion of the work. Two payment requests should be made based on native grass seeding and tree planting complete. The first payment request shall follow native grass seeding and mulching. A separate payment request shall be made after the cuttings and bare root seedlings are planted.

END OF SECTION 02901

SECTION 02906 – MULCHING

PART 1 – GENERAL

1.1 DESCRIPTION:

A. Mulching is the application of organic material to the soil to protect it from raindrop and sheet flow erosion. Mulching shall be used on native grass and tree planting areas when so directed by the engineer. In general, mulching shall include, but is not limited to:

1. Procurement, storage and protection of all listed material

2. Maintaining plantings installed by Contractor.

B. Related Work in Other Sections:

1. Excavating, Filling and Grading : Section 02200

2. Channel Bank Vegetation: Section 02901

C. Purpose:

1. This practice shall be used to reduce soil erosion, aid in seed germination and establishment of plant cover, and conserve soil moisture.

1.2 QUALITY ASSURANCE:

A. Qualification of Workmen: Provide at least one person who shall be present during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct work performed under this Section.

B. Standards:

1. Mulch materials shall be native prairie hay, brome hay, wheat straw, or hydromulch. Materials should be of good quality and free from mold or decay.

1.3 JOB CONDITIONS:

A. Site preparations: Soil surface shall be prepared prior to the application of mulch in order to achieve optimum contact between soil and mulch. Areas to be mulched should be reasonably free from rills and gullies.

B. Time of mulching: Mulching shall be performed during favorable weather conditions immediately following final grading.

1.4 SUBMITTALS:

A. Materials list shall include, but not limited to, the following:

1. Hay or straw quantities by weight with scale ticket, Signed and Dated by Supplier(s).

2. Hydromulch bag labels.

3. As-Installed Plan: During course of the installation, carefully record in red outline on a print of the planting drawings actual mulching location.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Pick up materials in accordance with any special handling instructions and deliver to project site in good condition.

B. Use means necessary to protect plant materials before, during, and after installation and to protect the installed work and materials of other trades.

1.6 SITE DISTURBANCES:

A. Take precautions to insure that equipment and vehicles do not disturb or damage existing grading, seeding, plantings or other site improvements.

B. Repair and/or return to original condition damage at no cost to Owner.

PART 2 – MATERIALS

2.1 MULCH MATERIALS.

A. General: Materials shall consist of natural, biodegradable material such as plant residue to include, but not limited to, the following:

1. Native Prairie Hay

2. Brome Hay

3. Wheat Straw

B. Materials shall be free from diseased plant residue and noxious weed seed.

C. Hydromulch shall be Flexterra HP FGM, manufactured by Profile Products, LLC. or approved equal.

D. Miscellaneous Materials: Materials not specifically described but required for a complete and proper planting installation shall be as selected by the Contractor, subject to the approval of the Engineer

PART 3 – INSTALLATION

3.1 SURFACE CONDITIONS:

A. Inspection:

1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where these installations may properly commence.

2. Verify that planting, seeding and related construction work is completed in accordance with the original design and referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Engineer.

2. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

3.2 GRADE SURFACE:

A. Finish Grading: Finish grading will be performed according to Section 02200 of these Specifications, in areas that are graded.

B. Fine Grading: Fine mechanical grading shall be conducted on areas where it can be done without posing a danger or hazard to the equipment and operator.

3.3 APPLICATION TIMING:

A. Mulch shall be applied upon completion or within 24 hours of native grass seeding.

B. Hydromulch shall be applied with both cover crop and native grass seeding following construction

3.4 APPLICATION RATE:

A. Mulch shall be applied at the rate of 4,000 pounds per surface acre.

B. Hydromulch shall be applied at the rate specified on the Drawings, or bag label for slopes greater than 1:1.

3.5 CRIMPING:

A. If required by the Engineer, mulch shall be crimped immediately after spreading with a mulch crimper or equivalent devise consisting of a series of dull flat blades with notched edges spaced approximately 8 inches apart. The mulch shall be crimped into the soil to a depth of 1 to 3 inches. Crimping shall be performed in areas where it can be done safely, without posing a danger or hazard to the operator or equipment.

3.6 INSPECTION:

A. In addition to normal progress inspections, schedule and conduct the following formal inspections, giving the Engineer at least 24-hours prior notice of readiness for inspection:

1. Final inspection after completion of seeding, planting and mulching; schedule this inspection sufficiently in advance, and in cooperation with the Engineer, so that final inspection may be conducted within 48-hours after completion of mulching.

2. Final inspection at the end of the maintenance period provided that previous deficiencies have been corrected.

3.7 MAINTENANCE:

A. General: The Contractor shall inspect the site within 48 hours of precipitation event that produces 0.5 inches or more of rain in a 24-hour period. Mulch that is displaced shall be reapplied and anchored. Maintenance shall be completed as soon as possible with consideration of site conditions.

B. Maintain seeding, planting, and mulching starting with the planting operations and continuing for 30 calendar days after mulching is complete and approved by the Engineer.

C. Work Included:

1. Protect planted areas against damage, including erosion, and drought by providing and maintaining proper safeguards such as periodic watering.

D. Extension of Maintenance Period: Continue the maintenance period at no additional cost to the Owner until all previously noted deficiencies have been corrected, at which time the final inspection shall be made.

3.8 CLEAN-UP:

A. During the progress of this work, and upon completion, thoroughly clean the project area and remove and properly dispose of resultant dirt, debris and other waste materials.

END OF SECTION 02906

SECTION 03162 – CONCRETE AND ROCK STABILIZATION STRUCTURES

PART 1 – GENERAL

1.1 DESCRIPTION:

A. This section covers concrete and rock stabilization structure to be used at various locations within the project area as shown on the project design sheet. Items include, but are not limited to:

1. Rock gradation, procurement, storage, and handling.

2. Sub-grade preparation prior to rock installation.

3. Rock installation.

B. Types of structures covered by this specification:

1. Rock Vanes

2. Rock Bendway Weirs

3. Longitudinal Peaked Stone Toe Protection (LPSTP)

4. Rock Chutes

5. Stream Barbs

6. Rock Blankets

7. Rootwad Revetments

8. Cross Vanes

9. Rock Check Dams

10. Rock Berm

C. Related Work in Other Sections:

1. Excavating, Filling, and Grading: Section 02200

1.2 REFERENCES:

A. The publications listed below form a part of this specification to the extent referenced. The latest revision of the following standards shall apply to work hereunder:

1. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

2. ASTM C 127-88: Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate

3. ASTM D 5312-92: Standard Test Method for Evaluation of Durability of Rock for Erosion Control under Freezing and Thawing Conditions

1.3 LINES AND GRADES:

A. Rock placement shall conform to the lines and grades shown on the technical drawings.

PART 2 – PRODUCTS

2.1 MATERIALS:

A. Material shall be reasonably free from dirt, clay, sand, rock fines and other materials not meeting the required gradation limits.

B. Except as otherwise specified, the rock shall be angular to sub rounded in shape. The rock shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering. The least dimension of an individual rock fragment shall not be less than one-third the greatest dimension of the fragment. Except as otherwise provided, the rock shall be tested and shall have the following properties:

1. Bulk Specific Gravity (saturated surface-dry basis) shall not be less than 2.4 when tested in accordance with ASTM C 127.

2. Absorption shall not be more than 4 percent when tested in accordance with ASTM C 127.

3. The weight loss in 5 cycles shall not be more than 20 percent when sodium sulfate is used or more than 25 percent when magnesium sulfate is used when tested in accordance with ASTM C 88 for soundness

4. Rock that fails to meet the requirements stated above in 1, 2, or 3 may be accepted if similar rock from the same source has been demonstrated to be sound after 5 years or more of service under conditions of weather, wetting and drying, and erosive forces similar to those anticipated for the rock to be installed under this specification.

C. Poorly sorted rock materials shall be reasonably well graded by weight and poorly sorted by size. Shot rock is stone resulting from drilling and blasting or other various methods of excavation. Shot rock may be subsequently sized using heavy equipment or other suitable methods. Shot rock shall be quarry run with no more than 10 percent passing the 1-inch sieve as determined by visual inspection. Poorly sorted rock materials shall be within the limits in the tables below or as stated on the Drawings.

Aggregate Gradation A (D_{50} = 24 in.)

Size (lbs)	Percent Heavier
10	90
450	50

1000	0-10

Aggregate Gradation A (D_{50} = 18 in.)

Size (lbs)	Percent Heavier
10	85-100
100	60-80
250	30-60
600	0-10

Aggregate Gradation A (D_{50} = 12 in.)

Size (lbs)	Percent Heavier
5	85-100
50	50-70
100	5-15
400	0

D. Sorted riprap rock material shall be well graded by weight and size; within the limits stated below or on the Drawings to meet the following requirement. Riprap shall be free from earth, soapstone, shale, shalelike or other easily disintegrated material that decreases material durability after placement.

Aggregate Gradation B (D_{50} = 18 in.)

Size (lbs)	Percent Heavier
5	90
100	50
250	0-10

Aggregate Gradation B (D_{50} = 12 in.)

Size (lbs)	Percent Heavier
5	90
75	50
200	0-10

E. Crushed rock for filter course material shall be within the limits stated blow or on the Drawings to meet the following requirement.

Aggregate gradation C (Crushed Rock)

Size (In.)	Percent Retained on Sieve Size
No. 4	70-95
3/8	55-85
1	25-60

2	10-40
4	0-5

PART 3 – INSTALLATION

3.1 INSTALLING ROCK STRUCTURES:

A. The sub-grade surfaces on which the rock, filter, bedding, or geotextile is to be placed shall be cut and graded to the lines and grades shown on technical drawings. The surface to which the rock is to be placed shall be reasonably smooth and free of mounds, dips, or windrows.

B. The rock shall be placed by equipment on the surfaces and to the depths specified. The rock shall be installed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying material. The rock shall be delivered and placed in a manner that will ensure the rock shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Rock shall be placed in a manner to prevent damage to existing structures. Hand placing will be required as necessary to prevent damage to new and existing structures.

C. Side slopes should be the natural angle of repose, which approximates 1.5-foot. horizontal to 1-foot. vertical.

3.2 MAINTENANCE:

A. If, before 12 months after the completion and acceptance of the work, there shall be settlement requiring repairs to be made along the line of work, or should any defect appear in the work due to neglect, carelessness or improper construction on the part of the Contractor, the Contracting Officer will notify the Contactor to make such repairs and remedy defects. The Contractor shall, within 5 days after such notice, begin and carry out such repairs at no additional cost to the owner.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT:

A. Work will be measured by tons of rock placed.

4.2 BASIS OF PAYMENT:

A. The amount of work completed and approved, as stated above, shall be paid for at the contract unit price.

END OF SECTION 03162

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATIONS

CRITICAL AREA PLANTING

1. Scope

The work shall consist of establishing vegetation on sites with existing or expected high erosion rates or degraded sites that usually cannot be stabilized by ordinary conservation treatment and/or management. This specification (including references made within to other conservation practice standards and technical notes), Form KS-ECS-4, Grass Seeding, and/or Form KS-ECS-5, Tree/Shrub Planting, shall be used to design the practice. Practice application will be documented on Forms KS-ECS-4 and/or KS-ECS-5 and in the conservation plan. See also Critical Area Planting Statement of Work (SOW) for additional information on design, installation, and certification requirements.

2. Site Preparation

Necessary shaping and smoothing shall be made before seedbed preparations are started. Where practical, the area should be shaped and graded to allow the use of conventional equipment for seedbed preparation, seeding, and mulching.

Where needed to aid with revegetation, topsoil shall be salvaged from borrow areas and re-spread onto shaped and graded areas. Topsoil may be replaced in lifts no greater than six inches. Prior to topsoil application, the re-graded area will be deep chiseled or ripped to reduce soil movement and to promote root penetration.

3. Seedbed Preparation

Seedbed preparation is to take place immediately after final shaping and grading. All tillage operations should be performed across the general slope of the land. The seedbed should be tilled to a depth of three inches. All loose soil will be smoothed and packed to a degree that results in a firm seedbed. A seedbed is considered sufficiently firm when a person walking across the field leaves a footprint no deeper than 1/8 of an inch. All debris, such as wood, stones, and other objects that will interfere with seeding and/or maintenance will be removed.

Soil fertility and pH level will be amended to meet the needs of the planned plant species and to support the intended purpose. Soil amendments when applied should be based on results of a soil test. However, at the discretion of the responsible technician, fertilizer application rates may be based on the general recommendations provided in Table 1 in lieu of using results from the soils test. If native species are to be used, nitrogen is not recommended to be applied until plants are established.

Manure may be substituted for commercial fertilizer on the basis of one ton of manure being equivalent to ten pounds of nitrogen, five pounds of phosphate, and ten pounds of potassium, or according to material analysis test results. Manure shall be incorporated within 24 hours of application to retain nutrient value and reduce potential nutrient losses.

Table 1. Fertilizer Application Rates

Seeding Zone	Pounds Per Acre			
	Nitrogen	Phosphate	Potassium	Lime
Western	20-30	*	*	
Central	30-40	40-60	*	
Eastern	40-50	60-80	*	*

* In areas of known phosphate, potassium, and lime deficiencies, apply the amount recommended locally for ag production or the amount recommended by a soils test.

On sites where suitable topsoil exists, do not apply nitrogen fertilizer in the establishment year where native plant species are to be seeded.

4. Vegetation Seeding

- **Seedbed**

Seeding of permanent vegetation may be made into the following types of seedbeds:

Standing cover – Drill or broadcast (depending on slope) a suitable, non–competitive cover crop such as sorghum or hybrid sudangrass. See Conservation Practice Standard 340, Cover Crop, for a listing of suitable species and seeding rates.

Surface mulch – Crop stubble, non-growing weeds, or other plant residue (dead litter cover) that is left on the surface through chemical or non inversion-type of tillage operations. Various mulching material may also be applied before or after the permanent seeding takes place. For mulching materials and amounts, see Conservation Practice 484, Mulching.

Clean tilled – Prior to planting, the seedbed shall be prepared by using tillage equipment which will penetrate 2 to 3 inches and leave a firm but friable seedbed. This may not be an option where erosion is a concern unless proper amounts of mulching material are applied after seeding.

- **Seeding Method**

A grass drill is preferred. The drill should be equipped with double–disk openers, depth-control device for proper seed placement, and press wheels or drag chains. The drill should be operated across slope. The seed should be planted to a depth of ¼ to ¾ of an inch. On areas too steep for equipment operation, seed mixtures may be broadcast or hydroseeded. For broadcasting, the seed will be incorporated by harrowing, packing, raking by hand, or other suitable operation. For hydroseeding, the selected seed mixture and mulching material shall be applied according to manufacturers' recommendations.

- **Seeding Dates**

Seeding periods will be as follows:

- Cool-season species: Aug 15 – Oct 1; Dec 1 – Apr 15
- Warm-season species: Dec 1 – May 15
- Bermuda grass sprigs: Mar 1 – May 15

An extension of two weeks to the cut-off seeding date may be given by the district conservationist, based on favorable moisture and temperature conditions.

When it is not practical to wait for the seeding periods as noted above and at the discretion of the responsible technical, permanent seeding may be completed as soon as construction work is completed. Where soil erosion is a concern or at the discretion of the responsible technician, mulch will be applied according to Conservation Practice 484, Mulching, immediately following completion of the permanent seeding.

- **Plant Species Selection**

For approved plant species varieties, refer to Kansas Plant Materials Technical Note KS-1 (Rev 6), Grass and Forb/Legume Varieties Approved for Use in Kansas. For seeding zone delineation, see Figure 1. Where varieties are not available or are not adapted to the site, common (native harvest) seed from a source location as near to the area being seeded as possible may be utilized. For mileage restriction, native grass seed will not be used more than 250 to 400 miles north of or 100 to 150 miles south of its point of origin. An increase of elevation of 1500 feet is equivalent to a move of roughly 150 miles to the north. Seed from a southern source will be given preference over seed from a northern source. Seed source must be identified to the state and county level in order to certify mileage and elevation adequacy.

Seed labeling, quality, and seed testing shall be in accordance with Kansas Seed Law. For Kansas Seed Law, the germination test is valid for nine months after the end of the month the test was made so long as the seed remains in Kansas. Federal Seed Law pertains to seed shipped across state lines and the germination test is valid for five months after the end of the month the test was made.

For seed purchased during the valid period of the germination test, the analysis report may be considered current for the full seeding period in effect at the time of purchase. For example, if seed is purchased March 1 and the germination test date expires March 31, the analysis report may be considered current if the seed is planted by May 15. If the seed is to be planted during a later seeding season, a new germination test shall be performed.

A cooperator who raises and/or harvests seed for personal use must have a seed analysis performed. A copy of the report must be furnished to certify that quality and mileage restrictions are met.

5. Vegetation Sprigging

Vegetation may be established through the use of sprigs. Bermuda grass is typically established in this method, although seed type varieties of Bermuda grass are currently available.

- **Seedbed**

Sprigs should be planted into a firm, moist seedbed.

- **Sprigging Method**

It is desirable to plant Bermuda grass sprigs that are still dormant. Use freshly dug sprigs from areas where the top growth has been removed. Sprigs should be planted within 24 hours after they are dug. Keep sprigs moist until planted. Plant the sprigs with a mechanical sprigger or hand plant at a rate of 16 to 24 bushels per acre in 36 to 42 inch row spacing. Sprigs should be covered with 1 to 3 inches of soil and be well packed after planting. Subsequent fertilizer application shall be based on soil test, Table 1, or local extension recommendations.

Sprigging is also used as a method to establish vegetation on upstream berms of earth dams. Prairie cordgrass and common reed are typically planted as sprigs and are used to provide vegetative wave protection to the embankment. A row of sprigs shall be planted at the normal pool elevation along with a minimum of three rows planted below and three above the normal pool elevation. Rows should parallel the centerline of the dam and be spaced no greater than three feet apart. Sprigs within the rows should be placed every foot at a depth of 2 to 4 inches. Care should be taken to place prairie cordgrass sprigs with the growing point up. Sprigs should be planted while they are still dormant. Sprigs should not be permitted to dry out.

It may be necessary to control the water level of a structure to facilitate the establishment of the sprigs on the berm. Once prairie cordgrass and common reed become well established, both can tolerate extended periods of inundation. However, during the establishment period, seedlings of both species may be damaged by extended inundation periods.

- **Sprigging Date**

Sprigging should take place when soil moisture conditions are optimum during the period March 1 to May 15.

- **Plant Species Selection**

For approved plant species varieties, refer to Kansas Plant Materials Technical Note KS-1 (Rev 6).

6. Vegetation Planting Trees/Shrubs

Refer to Kansas Forestry Technical Note KS-9, Tree/Shrub Establishment and Maintenance Guidelines, for planting information and the electronic Field Office Technical Guide (eFOTG), Section II, Windbreaks and Environmental Plantings Interpretations for species suitability. It will be more than likely necessary to

complement the woody planting with a seeding of herbaceous species to aid with erosion control during the woody establishment period.

7. Maintenance

Maintenance will be carried out during establishment to aid in survival of the plant species. To manage weed competition, mow the weeds when they reach a height of 6 to 8 inches. If chemicals are used in lieu of mowing, they must be federally and locally registered and must be applied in strict accordance with authorized registered uses, directions on label, and other federal and state polices and requirements.

Livestock grazing will be excluded from the area during establishment. Flash-grazing for weed control is permissible during plant establishment if the grazing level is closely monitored. Once the plants are established, grazing may take place within the limits of proper management.

Where introduced perennial herbaceous species are used, maintenance will require periodic soil testing to determine fertilizer needs of the species.

8. Specific Treatment for Critical Areas

- **Dunes and Blowouts**

  Blowouts will be enclosed with a permanent fence when they are larger than approximately 2 acres and the area is grazed during the growing season. The fence will be established away from the edges of the blowout.

  Fencing of the blowout is not needed where the adjacent area is not grazed by livestock or is used only during the winter, except in areas of heavy livestock concentrations. Fencing is not necessary if the grassland that contains the blowout is used only occasionally for partial summer use, such as with a planned grazing system.

  Natural recovery (no seeding) by protection is permissible where desirable species are present in sufficient amounts and the character of the blowout will permit stabilization in the desired period of time. A temporary fence is needed to prevent livestock use of the area.

  Seedbed preparation shall consist of establishing a cover crop according to Conservation Practice Standard 340, Cover Crop or in lieu of a cover crop, apply a natural mulch or manure according to Conservation Practice Standard 484, Mulching.

For species selection and seeding rates, see Table 2. For plant species varieties, refer to Kansas Plant Materials Technical Note KS-1 (Rev. 6). Adapted native forbs and/or legumes may be added in addition to the full grass seeding mixture at a rate not to exceed 1 lb. pls/ac. See Table 7 for a listing of forb/legume species.

Table 2. Dunes / Blowout Areas

SPECIES	FULL SEEDING RATE (#PLS/AC)	% OF MIXTURE	REMARKS
Native			
Big bluestem	12	0-10	Use as second choice to sand bluestem
Blue grama	3	0-10	
Indiangrass	12	0-10	
Little bluestem	8	10-20	
Prairie sandreed	8	20-30	
Sand bluestem	12	10-30	
Sand lovegrass	2	10-20	
Sideoats grama	12	0-10	
Switchgrass	6	10-30	

- **Earth Dams**

All construction areas not covered by permanent water and any related area expected to produce sediment shall be seeded to a permanent mixture.

Topsoiling - Topsoil will be placed at a minimum depth of one foot and a maximum depth of three feet on all areas designated for topsoiling. To aid with vegetation establishment, topsoil will be applied as follows:

Frontslope - Where riprap is used, topsoil will be placed from the upper elevation of the riprap to the top of the dam. Where riprap is not used, topsoil placement will begin at the lower elevation of the vegetative berm and extend to the top of the dam.

Emergency Spillway, Principal Spillway Outlet Channel, Dikes, Spoil Areas - For unconsolidated or consolidated material that is determined to be adequate for erosion control and for plant establishment, no topsoiling is needed. Where the material is questionable for plant establishment, but suitable for erosion control, topsoil will be considered when aesthetic and wildlife needs have been identified and are considered important. If the material is not suitable for either erosion control or plant establishment, topsoil will be applied.

Vegetative Treatment of Upstream Berms - Vegetative treatment of the upstream berm for embankment protection (for the flatter designed front slopes) will consist of seeding and/or sprigging. See previous Section 5b on sprigging upstream berms. Vegetative wave protection for the dam embankment will not work well where there is an extreme water level fluctuation for extended periods of time. Under these conditions, it is difficult to get the right type and amount of vegetation established to dissipate wave energy before it reaches the embankment. Procedures for determining the need for special wave protection measures including vegetated berms are included in Technical Release No. 56 and the Engineering Field Handbook. Water level fluctuation, if not too large or too prolonged, may be accommodated by dividing the berm into two different vegetative establishment zones. Each zone would be planted or seeded to species suited to those particular growing conditions. See Table 3 for species selection and seeding rates for Zones 1 and 2. For plant species varieties, refer to Kansas Plant Materials Technical Note KS-1 (Rev. 6).

- Zone 1 will typically be saturated and/or inundated for extended periods of time. This zone is usually six inches in elevation above and 1.5 foot in elevation below the normal pool elevation. The vegetation selected for this zone should be able to tolerate these moisture conditions as well as providing a dense, upright, heavy, and flexible stem that will aid in the dissipation of wave energy.
- Zone 2 typically covers the area from just above the normal pool elevation to the base of the dam embankment. This zone may be inundated for short periods of time, but will mostly be in dryer soil conditions. Species should be able to tolerate these conditions.

Seeding of Earth Dam Components - Seeding of earth dam components will be completed as shown in Table 3. However, for small farm type ponds (two acres or less total disturbance), one seed mixture developed from the Borrow, Waste, and Dam Fill Component Column may be used to seed the entire disturbed area. Adapted native forbs and/or legumes may be added in addition to the full grass seeding mixture at a rate not to exceed 1 lb. pls/ac. See Table 7 for a listing of forb/legume species.

Table 3 Earth Dam

SPECIES		MAXIMUM PERCENT IN MIXTURE			REMARKS
	FULL SEEDING RATE (#PLS/AC)	BORROW AREA WASTE AREA DAM FILL	STILLING BASIN OUTLET, SHORELINE, UPSTREAM BERM	SPILLWAY	
Native					
Big bluestem	12	10	10		Berm Zone 2 adapted
Blue grama	3	20		20	
Buffalograss	10	30	30	30	Berm Zone 2 adapted
Indiangrass	12	10	10		Berm Zone 2 adapted
Little bluestem	8	20	10	20	Berm Zone 2 adapted
Prairie cordgrass			Sprigs		Berm Zone 1, 2 adapted.
Sideoats grama	12	100	10	30	Berm Zone 2 adapted
Switchgrass (Kanlow)	6		40		Berm Zone 1, 2 adapted
Switchgrass	6	100	10		Berm Zone 2 adapted
Virginia wildrye	25		40		Berm Zone 2 adapted
Western wheatgrass	20	100	30	100	Berm Zone 2 adapted
Introduced					
Bermudagrass	5	100		100	
Common reed			Sprigs		Berm Zone 1, 2 adapted
Intermediate Wheatgrass	18	100		100	
Pubescent Wheatgrass	18	100		100	
Smooth bromegrass*	16	100		100	
Tall fescue*	12	100		10	

*Brome and fescue are limited to 50 percent if seeded in conjunction with native specie(s).
For the western seeding zone, brome is limited to 50 percent and fescue is not approved.
Native or introduced forbs/legumes may be added in addition to the grass mixture at a rate not to exceed 1 lb. pls./ac.
See Table 6 for a listing of species.

- **Grassed Waterway**

A mixture of species is preferred over a single species seeding. Native species are in general more tolerant to cropland chemicals than are cool-season introduced grasses.

When a waterway is constructed to meet design criteria for an annually vegetated waterway, the following management and planting recommendations should be taken into account:

- Close grown crops are usually planted in annually vegetated waterways.
- Planting equipment that leaves a ridge less than two inches high should be used.
- Crops may be planted either parallel or perpendicular to the flow of water.
- The bottom should be left relatively flat after all seedbed and seeding operations.

For perennially vegetated waterways, see Table 4 for species selection and seeding rates. Adapted native forbs and/or legumes may be added in addition to the full grass seeding mixture at a rate not to exceed 1 lb. pls/ac. For plant species varieties, refer to Kansas Plant Materials Technical Note KS-1 (Rev. 6).

Table 4. Grassed Waterway, Ephemeral/Classic Gully, and Other Critical Treatment Areas

SPECIES	FULL SEEDING RATE (#PLS/AC)	MAXIMUM PERCENT IN MIXTURE			REMARKS
		WESTERN ZONE	CENTRAL ZONE	EASTERN ZONE	
Native					
Big bluestem	12	10	30	30	If sandy, recommend sand bluestem.
Blue grama	3	20	10	10	
Buffalograss	8	30	10	10	
Indiangrass	12	10	30	30	
Little bluestem	8	20	20	20	
Prairie cordgrass	13		20	20	Adapted to wet sites.
Sideoats grama	12	100	100	100	
Switchgrass	6	100	100	100	Use 'Kanlow' for wet sites
Virginia Wildrye	25	10	30	30	Adapted to wet sites
Western wheatgrass	20	100	100	100	
Introduced					
Bermudagrass	5		100	100	May be sprigged at 16-24 bu /ac
Intermediate Wheatgrass	18	100	100	100	
Pubescent Wheatgrass	18	100	100	100	
Smooth brome*	16	50	100	100	
Tall fescue*	12		100	100	
Tall wheatgrass	20	100	100	100	Adapted to saline areas

* Brome and fescue limited to 50 percent if seeded in conjunction with native specie(s).
Native or introduced forbs/legumes may be added in addition to the grass mixture at a rate not to exceed 1 lb pls./ac.
See Table 6 for a listing of species.

- **Reconstructed mined land.**

Suitable annual cover crops will be established until a suitable seedbed is prepared for the permanent mix. See Conservation Practice Standard 340, Cover Crop. On acid sites, it may require cover crops to be established for a period of 1 to 3 years so that proper soil amendments may be applied. Liming rates to amend soil pH shall be based on results of soil test.

See Table 4 for species selection and seeding rates. For plant species varieties, refer to Kansas Plant Materials Technical Note KS-1 (Rev. 6).

In addition to herbaceous species, woody species may also be planted on reconstructed mined land. See Kansas Forestry Technical Note KS-9 for planting information and the electronic Field Office Technical Guide (eFOTG), Section II, Windbreaks and Environmental Plantings Interpretations for Species Suitability.

- **Urban and developing areas.**

For short, intermediate, and long-term cover crops, see Conservation Practice Standard 340, Cover Crop.

- **Ephemeral and classic gullies.**

Remove excess organic material and other trash from the area to be shaped. Fill existing gullies. All fill material shall be thoroughly compacted.

Where gullies have depths greater than three feet, it may be necessary to slope the sides of the gully prior to filling in order to obtain sufficient compaction. Gully side slopes prior to filling shall not be steeper than 1:1. Gullies deeper than three feet shall be overfilled by 10 percent.

Gully areas shall be shaped to either a trapezoidal or parabolic cross section. A parabolic cross section can be approximated by shaping a nearly level bottom width that is approximately equal to half the finished top width. Minimum construction depth shall be 0.5 foot. The standard dimensions that may be used are provided in Table 5, Kansas Form KS-ECS-20, Critical Area Planting Ephemeral Gully, shall be used for design documentation.

Table 5. Standard Dimensions for Shaping of Ephemeral Gully

CROSS SECTION DIMENSIONS * FEET			MAXIMUM CONTRIBUTING DRAINAGE AREA ACRES		
TOP WIDTH	DEPTH	BOTTOM WIDTH	WESTERN ZONE	CENTRAL ZONE	EASTERN ZONE
8	0.5	2	4	1	1
16	0.5	8	20	3	2

* Table dimensions may be adjusted by 10 percent to accomodate farm machinery.

Grass strips may be individually designed. Each strip must have the capacity to contain runoff from a 5-year, 24-hour storm assuming C retardence. Velocities shall not exceed 4 feet/sec, assuming D retardence. When strip width exceeds 20 feet, they shall be designed and constructed according to Conservation Practice Standard 412, Grassed Waterway.

See Table 4 for species selection and seeding rates. For plant species varieties information, refer to Kansas Plant Materials Technical Note KS-1 (Rev. 6).

- **Other areas needing critical treatment planting (diversions, dikes, or back slopes of push-up terraces, filter strips, field borders, contour buffer strips, wastewater treatment strips).**

See Table 4 for species selection and seeding rates. For plant species varieties information, refer to Kansas Plant Materials Technical Note KS-1(Rev. 6).

Table 6. Listing of Native, Introduced Forbs / Legumes

Native Forbs / Legumes	LEGUME	GROWTH HABIT	AREA OF ADAPTATION		
			EAST	CENTRAL	WEST
Black sampson - Echinacea angustifolia		PERENNIAL	x	x	x
Blackeyed susan - Rudbeckia hirta		PERENNIAL	x	x	
Butterfly milkweed - Asclepias tuberosa		PERENNIAL	x	x	
Clasping coneflower - Rudbeckia amplexicaulis		ANNUAL	x		
Dotted gayfeather - Liatris punctata		PERENNIAL	x	x	x
Englemann's daisy - Engelmannia pinnatifida		PERENNIAL	x	x	x
False sunflower - Heliopsis helianthoides		PERENNIAL	x	x	
Grayhead prairieconeflower - Ratibida pinnata		PERENNIAL	x		
Illinois bundleflower - Desmanthus illioensis	x	PERENNIAL	x	x	x
Indian blanket - Gaillardia pulchella		ANNUAL	x	x	x
Lance-leaf coreopsis - Coreopsis lanceolata		PERENNIAL	x		
Leadplant - Amorpha canescens	x	PERENNIAL	x	x	x
Maximilian sunflower - Helianthus maximiliani		PERENNIAL	x	x	x
Missouri primose - Oenothera missouriensis		PERENNIAL	x	x	
New England aster - Aster novae angliae		PERENNIAL	x		
Pale echinacea - Echinacea pallida		PERENNIAL	x		
Pitcher sage - Salvia azurea		PERENNIAL	x	x	x
Plains coreopsis - Coreopsis tinctoria		ANNUAL	x	x	x
Prairie aster - Aster patens		PERENNIAL	x		
Purple prairieclover - Dalea purpurea	x	PERENNIAL	x	x	x
Roundhead lespedeza - Lespedeza capitata	x	PERENNIAL	x	x	
Shellleaf beardtongue - Penstemon grandiflorus		PERENNIAL	x	x	
Showy partridge pea - Chamaecrista fasiculata	x	ANNUAL	x	x	
Thickspike gayfeather - Liatris pycnostachya		PERENNIAL	x		
Upright coneflower - Ratibida columnifera		PERENNIAL	x	x	x
White prairieclover - Dalea candidum	x	PERENNIAL	x	x	

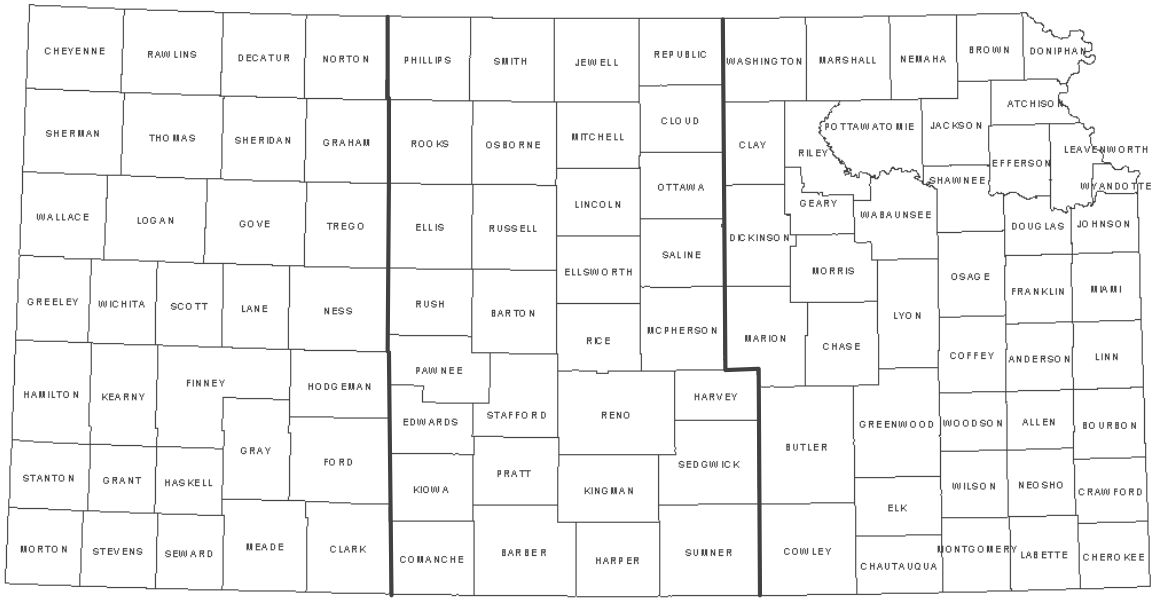
Introduced Legumes

Alfalfa	x	PERENNIAL	x	x	x
Birdsfoot trefoil	x	PERENNIAL	x		
Red Clover	x	PERENNIAL	x		

* Forb/legume species and varieties must be adapted to the site. For guidance on the suitability of species not listed, refer to eFOTG Section II, Rangeland Interpetations (Range Site Description) and Pasture Hayland Suitability Descriptions

**Adapted native forbs and/or legumes may be added in addition to the full grass seeding mixture at a rate not to exceed 1 lb. pls/ac.

Figure 1. Kansas Seeding Zone Delineation



NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATIONS

COVER CROP

1. Scope

The work shall consist of furnishing all materials and performing cultural operations necessary to grow and maintain the cover crop to protect soil, improve soil conditions, conserve moisture, provide temporary protection for permanent vegetative cover, add biomass to the soil, improve infiltration and tilth, reduce compaction, manage pests and nutrients, and/or provide supplemental forage.

2. Materials

Seed. Seed used in this specification will meet the requirements as stated in Kansas Noxious Weed Law (Kansas Statues Annotated [K.S.A]. 2-1314) and the Kansas Agriculture Seed Law (K.S.A. 2-1415).

When seed is purchased, the seed tags will be evidence of the purity and germination of the seed. Time since date of seed test shall not exceed 9 months.

Seed shall be of a quality that weed seed shall not exceed 0.5 percent of the aggregate of pure live seed (PLS) (percent germination x percent purity) and other material.

Fertilizer. All fertilizer shall be labeled in accordance with applicable state regulations and bear the warranty of the producer for the grade furnished.

Inoculants. The inoculants for treating legume seeds shall be a pure culture of Nitrogen fixing bacteria prepared specifically for the plant species and shall not be used later than the date indicated on the container. A mixing medium, as recommended by the manufacturer or approved substitute shall be used to bond the inoculant to the seed. For non-sandy soils with a pH greater than 6.0 and that have previously grown well-nodulated crops of the same species within the last 5 years inoculation is usually not necessary. When planting legumes in sandy soil, inoculant treatment shall be applied if the species has not been grown within the last 3 years.

Chemicals. All pesticides used in performing this practice shall be federally, state, and locally registered and shall be applied strictly in accordance with authorized and registered uses, directions on the label, and other federal or state policies and requirements. Chemical containers shall be properly stored and disposed of in a safe manner.

3. Seeding Mixture and Planting Date

The seed(s) and rate(s) specified on Form KS-ECS-4, Grass Seeding, shall be used.

The seeding rate(s) shall be the weight exclusive of any coating material. Any legume seed used shall be inoculated. Based on bag tags, seeding rates shall be adjusted to ensure the required amounts of pure live seed.

Planting shall be performed during the period that is specified on Form KS-ECS-4.

4. Seedbed Preparation

The area to be planted shall be weed free and have a firm seedbed which has previously been roughened by scarifying, disking, harrowing, chiseling, or otherwise worked to a depth of 2 to 4 inches, except when planting no-till or otherwise specified on Form KS-ECS-4.

Seedbed preparation shall be suspended when soil moisture conditions are not suitable for obtaining a satisfactory seedbed.

When planting legumes requiring inoculation in soils with a pH lower than 6.0, amend the soil pH by liming according to soil test recommendations, prior to planting the legume.

5. Fertilizing and Seeding

Fertilizing. Fertilizer shall be distributed uniformly over the seedbed and applied according to a soil test within the criteria of Conservation Practice Standard 590, Nutrient Management, and as specified on Form KS-ECS-4.

Fertilizer shall be applied in any way that will result in uniform distribution. The fertilizer shall be incorporated into the soil. Incorporation may be as part of the seedbed preparation or as part of the seeding operation unless otherwise specified on Form KS-ECS-4.

Seeding. Seed shall be drilled or broadcast by hand, mechanical hand seeder, or power operated seeder. Seed shall be incorporated into the soil, but not more than one-inch deep unless otherwise specified on Form KS-ECS-4. Drilling is preferred, but the use of row crop equipment may be used for row widths between 20 and 40 inches. Seed may be broadcast if covered with a drag or harrow.

When seeding in standing or growing row crops by air or during the last cultivation, increase seeding rate 1.5 times.

Where wind erosion is a consideration, cover and temporary cover crops planted in rows greater than 20 inches will be planted perpendicular to the prevailing wind during the critical wind erosion management period.

Seeding shall be performed as nearly as practical across the slope unless otherwise specified on Form KS-ECS-4.

6. Irrigation

When specified, irrigation water shall be applied during the establishment period at the times and rates listed on Form KS-ECS-4.

7. Additional Cultural Operations

Managing cover crops.

a. Suppression may be necessary to maintain the practice objectives during the period critical to the practices intended purpose and may be accomplished by mowing, light tillage and chemical applications.

b. Management of the cover crop will be necessary and should be planned for prior to planting the covers.

   (1) Natural termination will be when climatic or growing conditions naturally terminate the cover crop.

   Whenever possible, cover crop plantings will be planned to take advantage of natural termination by way of freezing. Time the plantings to obtain the desired plant height or physiological development prior to the normally occurring killing frost date.

   (2) Mechanical controls will be mowing, tillage, rolling, or grazing.

      (i) Mowing should be done prior to seed development, unless cover crop reseeding is a planned purpose. Height may be determined by other practices being implemented in a conservation plan.

      (ii) Tillage may not provide complete control without repeating the application and may need to be used in a combination with other controls. Consideration should be given to timing and effects of tillage on moisture conservation and the rest of the crop rotation.

      (iii) Rolling will be conducted in a way that will terminate the vascular transport functions of the cover crop. Rollers will be outfitted with horizontal knives or angle irons that are no more than 12 inches apart on the circumference of the roller. Knives or angle irons should not be sharp enough to chop the cover crop but the intended design is to lie over and crimp the plant stalks.

(iv) Grazing should be conducted at rates to allow adequate re-growth to provide the necessary cover for the intended purpose of the practice. Termination may require the application of herbicides or other treatment to control additional growth of the grazed cover crop.

(3) Chemical termination will be through the lethal application of herbicides. Herbicides used to terminate growth shall be applied according to the herbicide label and/or the KSU Extension Bulletin "Chemical Weed Control for Field Crops, Pastures, Rangeland and Non-cropland" prior to seed development or when the cover has accomplished the planned objective and will not create detrimental effects to the crop following, unless required for control of noxious weeds. Follow herbicide labels to determine crop compatibility for the crop following the cover crop.

(4) Grazing should be conducted at rates to allow re-growth to provide the necessary cover for the intended purpose of the cover crop. Refer to Conservation Practice 528, Prescribed Grazing, for grazing of cover crops to ensure adequate forage balance is achieved for the intended purpose of the cover crop and the nutritional needs of the livestock are met (refer to Table 1, Performance and Roles, Good Grazing). Grazing of cover crops used for sole purpose to establish permanent herbaceous cover is not recommended unless managed to meet minimum height and cover requirements.

8. Other Requirements

Other details for the establishment and maintenance of the plants including, but not limited to, the need for livestock and traffic control shall be applied as specified on Form KS-ECS-4.

Measures and methods that enhance fish and wildlife values, protect visual resources, and maintain or establish key habitats shall be performed when specified on Form KS-ECS-4.

For critical or highly erodible areas, increase seeding rates 1.5 times the recommended rate to obtain an effective stand that will control erosion.

For temporary cover for acid sites. For a period of 1 to 3 years after land shaping, a temporary cover of a winter annual is to be used. Wheat, rye, oats, or barley may be seeded at the rate of 80 pounds per acre. Apply needed nutrients as indicated by a soil test.

Prior to planting the second year temporary cover crop, soil tests will be taken as needed to determine lime requirements. Refer to Table 2 for liming rates. Apply nutrients as indicated by the soil test for the second year cover.

Specific soil tests should be conducted on areas of poor establishment of the first year cover to obtain a representative sample of problem areas. Retreat with recommended soil amendments as needed.

A third year temporary cover, nutrient, and soil amendment application may be used if need to obtain an adequate seedbed for permanent vegetation.

The owner, operator, contractor, or other persons shall conduct all work and operations in accordance with proper safety codes for the type of equipment and operations being performed with due regards to safety of all persons and property.

Crop substitutions. Sorghum-sudan grass may be substituted with pearl, proso, or foxtail millet or grain sorghum.

Rows shall not exceed 20 inches except grain sorghum rows can be 30 inches. In Major Land Resource Areas (MLRAs) 72, 73, 77, 78, and 79 where conditions do not permit the establishment of narrow row spacing, forage and grain sorghum in 40-inch rows may be used on sandy soils.

Seeding specifications will be documented with Form KS-ECS-4.

The following charts are reprinted from *Managing Cover Crops Profitably*, 3rd Edition, with permission from the Sustainable Agriculture Network (SAN). SAN is the national outreach arm of the USDA Cooperative State Research, Education, and Extension Service (CSREES) Sustainable Agriculture Research and Education (SARE) program. For more information, see www.sare.org.

9. Cover Crop requirements for seedbed preparation with permanent vegetative cover establishment

A standing cover or surface mulch is important for the success of any seeding in Central and Western Zones. Cover crop residue helps maintain surface soil moisture that is critical to seed germination and permanent root system development.

A standing cover crop or surface mulch is required for any seeding on soils where erosion or moisture conservation is a concern.

A standing cover crop or surface mulch is required for MLRAs 72, 73, 74, 75, 77, 78, 79, and 80A.

a. Standing cover crop. The cover crop should be managed to prevent the production of viable seed.

Maintain a minimum of 12-inch stubble height. A cover crop with growth exceeding 12 inches may be removed by mowing, haying, or grazing.

Small grains are excluded as a standing cover crop option on soils with an "I" value greater than 86.

b. Sorghums. Sorghums may be planted as late as August 1 where sufficient moisture exists to establish a quick stand. Sorghum seed formation can be limited or controlled by use of male sterile (non self-pollinating) hybrids and by planting late so that sorghums are not able to mature and form seed.

(1) Forage sorghum - Seed forage sorghum (includes Sudan grass) during the summer prior to the planting of the range planting mix. Row spacing shall not exceed 20 inches. The seeding rate will be 3 to 12 pounds per acre.

(2) Grain sorghum – Seed grain sorghum the summer prior to planting the range planting mix. Row spacing will not exceed 30 inches. The seeding rate will be 3 to 8 pounds per acre.

(3) Exception: Forage and grain sorghum in 40-inch rows may be used on sandy soils in MLRAs 72, 73, 77, 78, and 79 where conditions do not permit the establishment of narrower row spacing. To have adequate cover of forage and grain sorghums, the following actual residue amounts are required at seeding time. The "I" factor from the Wind Erodibility Index is used to determine minimum residue levels.

	Minimum Lbs. Residue/Acre
"I" Soil Factor	**at Seeding Time**
56 or lower	1,750
86	2,000
134	2,250
220 and higher	2,250*

*If adequate sorghum residue cannot be produced or maintained, additional mulch will be applied until the listed minimum amounts are achieved.

c. Small grain. A minimum residue amount of 1,500 pounds per acre of flat small grain equivalent will be present at range planting time. If adequate flat small grain equivalent residue cannot be produced or maintained, additional mulch will be applied until the 1,500 pounds is achieved.

(1) Oats - Oats may be planted until September 15 in the fall prior to planting the range planting mix. Row spacing will not exceed 20 inches. The seeding rate will be 40 to 60 pounds per acre.

Cover crops of oats will be killed, using the Surface Mulch, chemical method, from the fifth or sixth leaf stage until boot stage and prior to the emergence of the seeded range planting mix.

(2) Winter wheat - Seed winter wheat in the fall prior to planting the range planting mix. Row spacing will not exceed 20 inches. The seeding rate will be 40 to 60 pounds per acre.

Wheat cover crops will be killed, using the Surface Mulch, chemical method, from the fifth or sixth leaf stage until the boot stage and prior to the emergence of the seeded range planting mix.

Seeding into growing wheat that will be grazed-out by May 1 is an acceptable method. Do not graze when fields are wet and subject to compaction.

(3) Rye - Rye or rye hybrids are not approved for use as a cover crop due to the potential allelopathic effects.

d. Surface mulch.

(1) Tillage - Prepare a seedbed by use of tillage operations that leaves a seedbed free of growing vegetation with crop stubble, weeds, or other vegetative material left on the surface. No inversion type of tillage operation is allowed. It may be necessary to repack the soil surface after this tillage operation to provide a firm seedbed.

(2) Chemical - Prepare a seedbed by use of herbicides that suppress existing vegetation and leave mulch which will be seeded into without additional tillage. (Chemicals used must be federally and locally registered and must be applied strictly in accordance with registered uses, directions on label, and other federal or state policies and requirements.)

(3) Clean tilled - Just prior to planting, the seedbed shall be prepared by using tillage implements, which penetrate the soil surface 2 to 3 inches and leave a firm but friable seedbed. It may be necessary to repack the soil surface after this tillage operation to provide a firm seedbed.

Chart 1 - PERFORMANCE AND ROLES

Species	Legume N Source	Total N (lb./A)[1]	Dry Matter (lb./A/yr.)	N Scavenger[2]	Soil Builder[3]	Erosion Fighter[4]	Weed Fighter	Good Grazing[5]	Quick Growth
Annual ryegrass			2,000–9,000	◕	◕	◕	◕	◕	◕
Barley			2,000–10,000	◕	◕	●	◕	◕	◕
Oats			2,000–10,000	◕	◑	◕	●	◑	●
Rye			3,000–10,000	●	●	●	●	◑	●
Wheat			3,000–8,000	◕	◕	◕	◕	◕	◕
Buckwheat			2,000–4,000	○	◑	◔	●	○	●
Sorghum–sudan			8,000–10,000	●	●	●	◕	◕	●
Mustards		30-120	3,000-9,000	◑	◕	◕	◕	◑	◕
Radish		50-200	4,000-7,000	●	◕	◕	●	◑	◕
Rapeseed		40-160	2,000-5,000	◕	◑	◕	◕	◑	◕
Berseem clover	●	75–220	6,000–10,000	◕	◕	◕	●	●	●
Cowpeas	●	100–150	2,500–4,500	◔	◑	●	●	◑	◕
Crimson clover	◕	70–130	3,500–5,500	◑	◕	◕	◕	●	◑
Field peas	●	90–150	4,000–5,000	◔	◑	◕	◑	◕	◕
Hairy vetch	●	90–200	2,300–5,000	◔	◕	◑	◑	◑	◔
Medics	◑	50–120	1,500–4,000	◔	◑	◑	◕	◕	●
Red clover	◕	70–150	2,000–5,000	◑	◕	◑	◕	●	◔
Subterranean clover	●	75–200	3,000–8,500	◔	◕	◕	●	◕	◑
Sweetclovers	●	90–170	3,000–5,000	◔	●	◕	◕	◕	◑
White clover	●	80–200	2,000–6,000	◔	◑	◕	◕	●	◔
Woollypod vetch	●	100–250	4,000–8,000	◑	●	◑	●	◑	◕

[1]**Total N**—Total N from all plant. [2]**N Scavenger**—Ability to take up/store excess nitrogen. [3]**Soil Builder**—Organic matter yield and soil structure improvement. [4]**Erosion Fighter**—Soil-holding ability of roots and total plant. [5]**Good Grazing**—Production, nutritional quality and palatability.

○=Poor; ◔=Fair; ◑=Good; ◕=Very Good; ●=Excellent

NRCS, KS
January 2012

Chart 1 - PERFORMANCE AND ROLES (continued)

Species	Lasting Residue[1]	Duration[2]	Harvest Value[3]		Cash Crop Interseed[4]	Comments
			F*	S*		
Annual ryegrass	◕	◕	◑	◔	●	Heavy N and H20 user; cutting boosts dry matter significantly.
Barley	●	◑	◕	◑	◕	Tolerates moderately alkaline conditions but does poorly in acid soil < pH 6.0.
Oats	◑	◔	◑	◑	●	Prone to lodging in N-rich soil.
Rye	●	◕	◔	◔	◕	Tolerates triazine herbicides.
Wheat	◕	◕	◑	◕	◔	Heavy N and H_2O user in spring.
Buckwheat	○	◔	○	◔	◕	Summer smother crop; breaks down quickly.
Sorghum–sudangrass	◕	●	●	○	○	Mid-season cutting increases yield and root penetration.
Mustards	◔	◑	○	◔	○	Suppresses nematodes and weeds.
Radish	◔	◑	◕	◔	◔	Good N scavenging and weed control; N released rapidly.
Rapeseed	◑	◕	◔	●	○	Suppresses *Rhizoctonia.*
Berseem clover	◑	●	●	◕	◑	Very flexible cover crop, green manure, forage.
Cowpeas	◔	●	◑	◑	◑	Season length, habits vary by cultivar.
Crimson clover	◑	◔	●	◕	●	Established easily, grows quickly if planted early in fall; matures early in spring.
Field peas	◔	◑	●	◕	●	Biomass breaks down quickly.
Hairy vetch	◔	◕	◔	◕	◑	Bi-culture with small grain expands seasonal adaptability.
Medics	◑	◕	◑	◑	◑	Use annual medics for interseeding.
Red clover	◔	◑	●	◕	●	Excellent forage, easily established, widely adapted.
Subterranean clover	◕	◕	◕	○	●	Strong seedlings, quick to nodulate.
Sweetclovers	◕	◕	◕	◑	◑	Tall stalks, deep roots in second year.
White clover	◔	●	◕	◑	◕	Persistent after first year.
Woollypod vetch	◔	◕	◔	◕	◑	Reseeds poorly if mowed within 2 months of seed drop; overgrazing can be toxic.

[1]**Lasting Residue**—Rates how long the killed residue remains on the surface. [2]**Duration**—Length of vegetative stage. [3]**Harvest Value**—Economic value as a forage (F) or as seed (S) or grain. [4]**Cash Crop Interseed**—Rates how well the cover crop will perform with an appropriate companion crop.

○=Poor; ◔=Fair; ◑=Good; ◕=Very Good; ●=Excellent

Chart 2 - Cultural Traits

Species	Aliases	Type[1]	Hardy thru Zone[2]	Tolerances					Habit[3]	pH (pref.)	Best Estab.	Min. Germ. Temp. (F)
				Heat	Drought	Shade	Flood	Low fert.				
Annual ryegrass	Italian ryegrass	WA	6						U	6.0-7.0	ESp, LSu, EF, F	40
Barley		WA	7						U	6.0-8.5	F, W, SP	38
Oats	Spring oats	CSA	8						U	4.5-7.5	LSu, ESp, W in 8+	38
Rye	winter, cereal, or grain rye	CSA	3						U	5.0-7.0	LSu, F	34
Wheat		WA	4						U	6.0-7.5	LSu, F	38
Buckwheat		SA	NFT						U/SU SU	5.0-7.0	Sp to LSu	50
Sorghum–sudan	Sudax	SA	NFT						U	6.0-7.0	LSp, ES	65
Mustards	Brown, oriental, white, yellow	WA, CSA	7						U	5.5-7.5	Sp, LSu	40
Radish	Oilseed, Daikon, forage radish	CSA	6						U	6.0-7.5	SP, LSu, EF	45
Rapeseed	Rape, canola	WA	7						U	5.5-8.0	F, Sp	41
Berseem clover	Bigbee, multicut	SA, WA	7						U/SU SU	6.2-7.0	ESp, EF	42
Cowpeas	Crowder peas, southern peas	SA	NFT						SU/C	5.5-6.5	ESu	58
Crimson clover		WA, SA	7						U/SU	5.5-7.0	LSu, ESu	
Field peas	Winter peas, black peas	WA	7						C	6.0-7.0	F, ESp	41
Hairy vetch	Winter vetch	WA, CSA	4						C	5.5-7.5	EF, ESp	60
Medics		SP, SA	4/7						P/SU	6.0-7.0	EF, ESp, ES	45
Red clover		SP, B	4						U	6.2-7.0	LSu, ESp	41
Subterranean clover	Sub clover	CSA	7						P/SP	5.5-7.0	LSu, ESp	38
Sweetclovers		B, SA	4						U	6.5-7.5	Sp/S	42
White clover	White dutch, ladino	LP, WA	4						P/SU	6.0-7.0	LW, E/LSp, EF	40

Woollypod vetch	Lana	CSA	7	◕	◕	◑	◑	◕	SP/C	6.0-8.0	F	

[1]B=Biennial; CSA=Cool season annual; LP=Long-lived perennial; SA=Summer annual; SP=Short-lived perennial; WA=Winter annual. [2]See USDA Hardiness Zone Map, inside front cover, NFT=Not frost tolerant. [3]C=Climbing; U-Upright; P=Prostrate; SP=Semi-prostrate; SU=Semi-upright.. [4]E=Early; M=Mid; L=Late; F=Fall; Sp=Spring; Su=Summer; W=Winter.

◯=Poor; ◔=Fair; ◑=Good; ◕=Very Good; ●=Excellent

Esp	Sp	Lsp	Esu	Su	Lsu	Ef	F	Lf
2/15-5/15	4/15-5/20	5/10-6/10	6/1-7/1	6/15-8/15	8/1-9/15	9/1-10-15	10/1-11/15	11/1-12/1

Chart 3 - Planting

Species	Depth (in)	Seeding Rate					Inoculant Type	Reseeds[1]
		Drilled		Broadcast				
		lb/A	bu/A	lb/A	bu/A	oz/100 ft^2		
Annual ryegrass	0–0.5	10-20	.4-.8	20–30	.8–1.25	1		R
Barley	0.75–2	50–100	1–2	80–125	1.6–2.5	3-5		S
Oats	0.5–1.5	80–110	2.5–3.5	110–140	3.5–4.5	4–6		R
Rye	0.75–2	60–120	1-2	90–160	1.5–3.0	4–6		R
Wheat	0.5–1.5	60–120	1–2	60–150	1–2.5	3–6		S
Buckwheat	0.5–1.5	48–70	1–1.4	50–90	1.2–1.5	3–4		R
Sorghum-sudangrass	0.5-1.5	35	1	40–50	1–1.25	2		S
Mustards	0.25-0.75	5-12		10-15		1		U
Radish	0.25-0.5	8-13		10-20		1		S
Rapeseed	0.25-0.75	5-10		8-14		1		S
Berseem clover	0.25–0.5	8–12		15–20		2	crimson, berseem	N
Cowpeas	1–1.5	30–90		70–120		5	cowpeas, lespedeza	S
Crimson clover	0.25–0.5	15-20		22–30		2–3	crimson, berseem	U
Field peas	1.5–3	50–80		90–100		4	pea, vetch	S
Hairy vetch	0.5-1.5	15–20		25–40		2	pea, vetch	S
Medics	0.25–0.5	8–22		12–26		2/3	annual medics	R
Red clover	0.25–0.5	8–10		10–12		3	red clover, white clover	S
Subterranean clover	0.25-0.5	10–20		20–30		3	clovers, sub, rose	U
Sweet clovers	0.25–1.0	6–10		10–20		1.5	alfalfa, sweet clover	U
White clover	0.25–0.5	3–9		5–14		1.5	red clover, white clover	R
Woollypod vetch	0.5–1	10–30		30–60		2-3	pea, vetch	S

[1]**R**=Reliably; **U**=Usually; **S**=Sometimes; **N**=Never (reseeds)

Chart 3 - Potential Advantages

Species	Soil Impact			Soil Ecology				Other		
	Sub-soiler	Free P&K	Loosen topsoil	Nema-todes	Dis-ease	Allelo-pathic	Choke weeds	Attract bene.	Bears traffic	Short windows
Annual ryegrass	◑	◑	●	◑	◑	◑	●	◔	●	●
Barley	◑	◑	◕	◔	◑	◕	◕	◑	◑	●
Oats	○	◔	◕	○	◑	◕	●	○	◑	●
Rye	◔	◕	●	◑	◕	●	●	◔	◕	●
Wheat	◑	◕	◕	◔	◔	◔	◕	◔	◑	◑
Buckwheat	○	●	◕	◔	○	◕	●	●	○	●
Sorghum–sudangrass	●	◑	◑	◕	◕	●	●	◑	◑	●
Mustards	◔	◑	◕	◕	◕	◕	◕	◑	◑	◕
Radish	●	◕	◑	◕	◑	◕	●	◔	◔	◕
Rapeseed	◑	◔	◑	◕	◑	◕	◑	◑	◔	◑
Berseem clover	◔	◕	◕	○	○	◔	◕	◑	◔	◕
Cowpeas	◑	◑	◕	○	○	○	●	◕	○	●
Crimson clover	◔	◑	◑	◔	◑	◔	◑	◕	◔	◑
Field peas	◔	◔	◕	◑	◕	◔	◕	◕	◔	◕
Hairy vetch	◑	◑	◕	◔	◑	◑	◕	●	○	○
Medics	◑	◔	◔	◑	◑	◔	◕	◔	◔	●
Red clover	◕	◕	◑	◔	◔	◑	◑	◕	◑	◑
Subterranean clover	○	◔	◑	◔	◔	◕	●	◕	◕	◕
Sweetclovers	●	●	●	◔	◔	◔	◑	◕	◑	○
White clover	◔	◔	◕	○	○	◑	◕	◑	●	◑
Woollypod vetch	◕	◑	◕	◔	◔	◑	●	◕	◔	◑

○=Poor; ◔=Fair; ◑=Good; ◕=Very Good; ●=Excellent

Chart 4 - Potential Disadvantages

Species	Increased Pest Risk			Management Challenges					Comments Pro/Con
	Weed potential	Insects/nematodes	Crop disease	Hinder crops	Establish	Till-kill	Mon-kill	Mature incorporate	
Annual ryegrass	○	◕	◕	◑	●	●	●	◑	If mowing, leave 3-4" to ensure regrowth.
Barley	◔	◔	◔	◑	●	●	●	○	Can be harder than rye to incorporate when mature.
Oats	●	◑	◕	◑	●	●	◔	◑	Cleaned, bin-run seed will suffice.
Rye	◔	◑	◕	◔	◕	◕	●	○	Can become a weed if tilled at wrong stage.
Wheat	◑	◔	◔	◑	●	●	◕	◑	Absorbs N and H20 heavily during stem growth, so kill before then.
Buckwheat	○	◕	●	●	●	●	●	●	Buckwheat sets seed quickly
Sorghum–sudangrass	◑	◕	●	◔	●	◕	◕	◔	Mature, frost-killed plants become quite woody.
Mustards	◔	◕	●	◑	●	●	◔	●	Great biofumigation potential; winterkills at 25° F.
Radish	◑	◕	●	●	●	●	●	●	Winter kills at 25° F; cultivars vary widely.
Rapeseed	◔	◔	●	◑	●	◑	◔	◕	Canola has less biotoxic activity than rape.
Berseem clover	●	◑	◕	●	●	◔	◔	◕	Multiple cuttings needed to achieve maximum N.
Cowpeas	●	◑	◕	●	●	●	●	●	Some cultivars, nematode resistant.
Crimson clover	◑	○	◕	●	◕	◕	◕	◕	Good for under-seeding, easy to kill by tillage or mowing.
Field peas	●	◑	◔	●	●	●	●	◕	Susceptible to *sclerotinia* in East.
Hairy vetch	◑	◑	●	●	◑	◔	●	◑	Tolerates low fertility, wide pH range, cold or fluctuating winters.
Medics	◑	◔	●	◕	◕	◔	◕	◕	Perennials easily become weedy
Red clover	◑	◔	◕	●	◕	◑	◔	◕	Grows best where corn grows well.
Subterranean clover	◑	○	◑	◑	●	◔	○	◕	Cultivars vary greatly.
Sweetclovers	◔	◔	●	◑	●	◑	◕	◔	Hard seed possible problem; does not tolerate seeding year mowing
White clover	◑	◑	◕	◔	◕	○	◑	◕	Can be invasive; survives tillage.
Woollypod vetch	◑	◑	◔	◑	◑	◕	●	◔	Hard seed can be problematic; resident vegetation eventually displaces.

○=Problem; ◔=Could be a moderate problem; ◑=Could be a minor problem; ◕=Occasionally a minor problem; ●=Not a problem

Tree/Shrub Establishment and Maintenance Guidelines

This technical note provides guidance for establishing trees and shrubs as part of the following Natural Resources Conservation Service (NRCS) Field Office Technical Guide (FOTG) Conservation Practices:

Windbreak/Shelterbelt Establishment (practice code 380)
Tree/Shrub Establishment (practice code 612)
Riparian Forest Buffer (practice code 391)
Upland Wildlife Habitat Management (practice code 645)
Hedgerow Planting (practice code 422)
Alley Cropping (practice code 311)
Recreation Area Improvement (practice code 562)

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NRCS, KS
June 2002

CONSERVATION TREE AND SHRUB PLANTING SUITABILITY GROUPS

Refer to the Windbreak Suitability Groups in Section II of the Field Office Technical Guide (FOTG) to determine adaptation and performance of trees and shrubs for the soils of each windbreak suitability group.

PLANT STOCK REQUIREMENTS

Planting stock must be grown from locally adapted seed or cuttings of known origin and meet height and caliper standards listed below. For species that are not native, the seedlings should be produced from seed collected from localities having climate, latitude, and altitude similar to that of Kansas or from seed sources that have been selected and tested in tree improvement programs. Planting stock from out-of-state sources must be certified disease and insect free.

Bare Root Deciduous Seedlings shall not be less than 3/16-inch caliper at 1 inch above the root collar. Bare root deciduous seedlings shall have a shoot (top growth) of at least 12 inches. Rooted planting stock must not exceed a 2:1 shoot-to-root ratio (see Figure 1)**.**

Bare Root Coniferous Stock shall have a minimum stem diameter of 5/32 inch at 1 inch above the root collar. Rooted planting stock should have a well-developed fibrous root system and should not exceed a 2:1 shoot-to-root ratio (see Figure 1).

Vegetative Deciduous Cuttings shall be no less than 1inch diameter at the base (recommend 2 to 3 inch diameter for better survival), have the apical bud and all lateral side branches removed, and produced in lengths long enough to reach a soil depth that remains saturated throughout the growing season, or the site must be irrigated.

Vegetative material should be collected while dormant. Dormancy means no bud swell, no green showing on buds, and no separation of bud scales. Actively growing materials can be used, but survival will usually be lower. Avoid cutting current years growth. The best material is 4 to 5 years old. A horizontal cut at the top and a 45-degree cut at the bottom will aid in planting. The ends of the cuttings may be treated with latex paint. Vegetative material works best if planted within 2 to 3 weeks of harvest. Material may be stored if dormant for a short period of if kept at a temperature of 34 to 38 degrees F. Do not allow stock to dry out for even short periods of time, as survival will be greatly reduced.

Container-grown Stock shall have a seedling height of at least 6 inches. Container-grown stock must be produced in containers that minimize girdling roots or J-roots.

Seeds should be collected as close to the planting site as possible, or purchased from nurseries or other sources that are known to be using locally adapted seed. Seed from walnut and oaks should be collected within a 200-mile radius of the planting site.

Not all seed is viable or sound. The percent of sound seed in a batch can be determined by simply cutting or cracking open a sample of the nuts. Viable nuts have white, sound-looking nut meat; nonviable seeds have darkened or shriveled kernels that may be watery or give off a foul or rancid odor. Floating seed has also been used to determine viability of some species; however, it is not as reliable as a cut test.

There is a large variation in seed quality between species. Some species of trees and shrubs have a high percentage of viable seeds that will easily germinate the first season after planting. Other species have seed that is very difficult to germinate. Even with proper scarification and/or stratification, some species will only show 2 to 3 percent germination 2 years after planting.

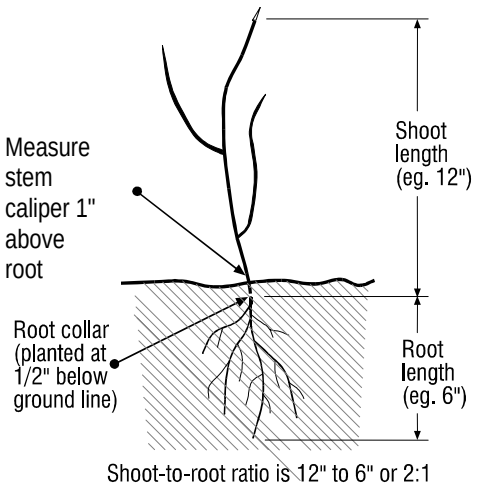


Figure 1: Shoot / Root Ratio

Storage, Care, and Handling Requirements

Rooted planting stock and cuttings will be stored in a cool, moist environment (34 to 38°F) or heeled into the soil. During all stages of handling and storage, keep stock free of mold and roots moist and cool. Keep roots covered at all times. Live cuttings that are not immediately planted after harvest shall be promptly placed in controlled storage conditions (34 to 38°F) and protected until planting time.

Seeds shall be stored in a cool (35 to 40°F), dark area. Depending upon the species, seed storage may require moist or dry conditions. Become knowledgeable of the duration of seed viability. Some species of seeds lose viability within months after maturity. Others, with proper storage, remain viable for years.

Acorns should be collected in breathable sacks as soon as seed falls (late August-November) and soaked in water (running water is best) for 12 to 24 hours, drained for 30 minutes, and stored in a cool dark area. When collecting black walnut, leave husks on for fall planting and store in piles less than 10 inches deep to avoid heat buildup. Removing husks is unnecessary work that can cause seeds to dry out.

Landowners may keep stock for up to one week before planting by storing it in a shaded, cool, moist place. An unheated basement or fruit cellar works very well. Plant bundles should be turned every day when temporarily stored to avoid mold and/or drying problems within the bundle. Ensure roots are moist and not exposed to the air. Do not store in a bucket of water. Trees will commonly break dormancy (begin to leaf out) with this type of storage, resulting in poorer survival.

For longer storage periods, stock may be heeled in. This can be described as high-density planting in a furrow. Locate the heel-in bed in good soil in a protected location. See Figure 2 for details.

Thoroughly soak the trench with water after planting to remove air spaces and improve root/soil contact.

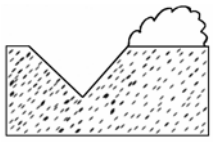


Figure 2A: Dig a trench deep enough for proper root placement.

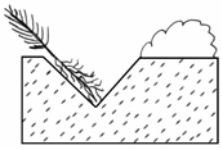


Figure 2B: Break bundles and spread along the trench wall with 2 to 3 inches between each plant.

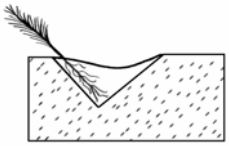


Figure 2C: Immediately cover roots with soil and lightly pack.

Cover roots quickly to minimize exposure to sun and air. Short periods of exposure can greatly reduce survival and establishment. Leaving plants in a heel-in bed for longer than one season increases the difficulty of transplanting and decreases survivability. Moving the transplants to their permanent location should be performed while the material is still dormant.

Roots of bare root stock shall be kept moist at <u>all times</u> during planting operations by placing in a water-soil (mud) slurry, super-absorbent (e.g., polyacrylamide) slurry, or covering with wet peat moss, wet shingletow, or other equivalent material. Do not cover with dry shingle tow, peat moss, etc. and expect to thoroughly wet it afterwards. No matter the amount of water applied, some roots will remain dry.

The rooting medium of container or potted stock shall be kept moist at all times by periodic watering.

Pre-treat stored unrooted cuttings prior to planting by soaking in water for 24-48 hours. Note: There is some debate as to the effectiveness of soaking stored, unrooted cuttings prior to planting. However, soaking will not harm cuttings and <u>may</u> increase survivability.

Keep roots moist and covered throughout the entire planting operation. To further reduce planting shock, stock could be carried during the planting process in buckets of water or slurry. Do not allow rooted conifer stock to be immersed for longer than one hour.

Stock shall not be planted when soil is frozen or dry. Do not handle trees or shrubs when temperatures are freezing or below.

Reduce exposure of bare root seedlings to air and sunshine while loading the planter and during the planting operation. Do not plant on hot, dry, windy days.

PLANTING SITE PREPARATION

Planting sites shall be properly prepared based on soil and vegetative conditions listed below. Avoid sites that have had recent application of pesticides that may be harmful to woody species.

Prior to initiating tree planting, check waiting period restrictions and carryover characteristics of pesticides applied to the planting site in the previous one to two years.

If pesticides are used, apply only as needed within federal, state, and local regulations. Follow label directions and heed all precautions listed on the container.

On sites treated with pesticides, especially tilled sites, be alert to health risks that may result from handling the chemically treated soil or breathing the chemically impregnated dust.

Site preparation may include the whole field, strips, or patches. Individual site preparation for each tree/shrub should provide a minimum 4-foot diameter circle, or a minimum 4-foot x 4-foot square, or a 4-foot-wide strip at each planting spot (2 feet on each side of the planted stock).

The planting area must be free of living sod and perennial weeds before planting.

Tillage Site Preparation

Tillage Site Preparation on Sod-covered Sites (or Sites With Perennial Herbaceous Cover)

Perform sufficient tillage to kill the sod and maintain the entire site in a reasonably weed free condition prior to tree and shrub planting.

Plow or chisel the sod to a minimum 12-inch depth at least one year prior to spring planting. Disc the site through the preplant growing season and immediately before planting to control any species that have resprouted.

Nonselective herbicides may be used to kill sod grasses and other herbaceous species prior to tillage. Follow guidelines under Chemical Site Preparation and instructions found on the herbicide label.

Avoid tilling soils that are wet, to minimize compaction.

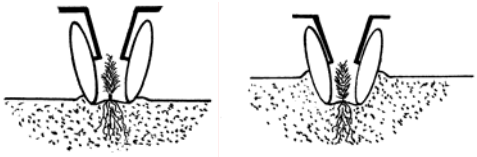
Be alert to potential wind and water erosion risks during the fallow period. Seed an annual cover crop of oats or spring grains to control erosion while minimizing water usage. Oats and spring grains will die over winter, but must be seeded early enough to attain 4- to 6-inch height prior to freeze-up to provide soil protection.

For very erosive sites and no plans for cover crops, till only 5- to 8-foot-wide strips (10 foot strips, if weed control fabric is to be installed after planting) where the trees/shrubs will be planted while leaving and maintaining the existing vegetation between the rows. This will reduce wind and water erosion, sandblasting, provide easier site access, and provide wildlife benefits. If the existing vegetation is fescue or smooth brome, tilled strips are not an option. The entire planting area will be tilled. If the site is very erosive, a cover crop will be established.

Orient tree and shrub plantings on the contour, when possible, to minimize water erosion risks during the fallow period and subsequent planting and maintenance operations.

Avoid deep tillage (greater than 2 inches deep) immediately prior to planting to prevent drying the seedbed.

Firm the seedbed prior to planting by cultipacking, if needed, to reduce soil moisture loss and aid in proper plant placement. A firm seedbed for tree planting should be similar to a firm seedbed for grass seeding where adult human footprints are barely visible and planting equipment leaves a minimal trench. See Figure 3.



This
Firm soil, plants at proper depth.

Not This
Soil too loose, plants pressed too deep.

Figure 3: Effects of Seedbed Firmness

Tillage Site Preparation on Cropland Sites

Shallow tillage immediately prior to planting to remove sprouted annual weeds and grasses is appropriate. Shallow tillage between harvest and freeze-up the year before planting is permitted, if needed. If a compacted plow layer exists, chisel or plow to break up the restrictive layer prior to planting. Be alert to potential wind and water erosion risks during the fallow period. If needed, seed an annual cover crop of oats or small grains to control erosion while minimizing water usage. Oats or small grains will die over winter but must be seeded early enough to attain a 4- to 6-inch height prior to freeze-up to provide soil protection.

Avoid excessive tillage prior to planting. Tillage is not needed or effective if there are no weeds present and may deplete soil moisture as well as to bring up a fresh supply of weed seed to the surface.

Prior to planting, firm the seedbed, if needed, to reduce drying and to aid in proper depth placement of the plant and natural moisture movement within the soil. A firm seedbed for tree planting should be similar to a firm seedbed for grass seeding where adult human footprints are barely visible and planting equipment leaves a minimal trench (see Figure 3).

All precautions concerning erosion and sand blasting on sod-covered sites apply on cropland sites.

Consider tilling only 4- to 5-foot strips where the tree/shrubs will be planted (10 foot strips, if weed control fabric is to be installed after planting), thereby allowing the standing stubble between the rows to act as temporary wind protection for new seedlings.

Scalp Planting Site Preparation

Scalp planting is a method that places plant material in an area cleared of competing vegetation. The area cleared is usually a foot or more wide on each side of the planted row. This operation is usually performed by attachments to the planting machine. It can also be done by other machines in a separate operation, or by hand immediately prior to planting.

Scalp planting into aggressive sods such as smooth brome or fescue is not recommended.

Scalping tends to encourage a rapid flush of annual weeds on the freshly exposed soil that will require a post-plant weed control effort.

When scalping on native range sites, orient plantings in locations that are most conducive to tree/shrub growth. Best tree growing sites are often found in toeslope positions, north facing slopes, or in swales and draws.

When possible, orient rows on a true contour to harvest runoff moisture and reduce erosion.

Chemical Site Preparation

Chemical Site Preparation on Sod-covered Sites (or Sites With Perennial Herbaceous Cover)

Site preparation by herbicides on sod sites should be initiated the growing season before planting.

Follow label instructions so that application technique and timing of herbicide application will lead to a complete control of the vegetation. Repeated applications throughout the fallow year may be necessary.

For sites with rhizomatous and or other competitive grasses such as smooth brome or fescue, completely spray the entire area where the trees/shrubs will be planted, including a 10-foot-wide band around the outside of the planting area.

Spraying of 5- to 8-foot-wide strips where the trees/shrubs will be planted while leaving existing vegetation between rows untreated is an option. This will reduce potential erosion, sandblasting, provide easier access, and provide wildlife benefits. If the existing vegetation is fescue or smooth brome, strip spraying is not an option. The entire planting area will be treated.

Undisturbed dead sod will often provide a season's weed control or suppression after the trees or shrubs have been planted.

Herbicides vary as to their risk of leaching or runoff. Avoid using herbicides with high leach or runoff potential on sites where there is increased risk of polluting surface or ground water sources.

Chemical Site Preparation on Cropland Sites

Apply appropriate burndown chemicals according to label directions prior to planting trees and shrubs, if needed.

Native Grass Cover

Warm season native grass species of blue grama, buffalograss, little bluestem and/or sideoats grama may be seeded between tree/shrub rows to reduce erosion and runoff, prevent sandblasting, and improve wildlife cover.

When using native grasses between rows, it is essential a weed-free zone of at least 4 feet be maintained around each tree or shrub for the first 3 years after planting.

Warm season native grass species initiate growth after trees and shrubs have leafed out, reducing early season competition for water. These warm season grass species are shade intolerant and will be suppressed as growing tree and shrub canopies shade the ground. In no case should a sod-forming and/or an aggressive cool season grass such as smooth brome or fescue be substituted for these species.

Short, warm season grasses are particularly effective between fabric strips. Without tillage between fabric strips, there is no risk of the fabric being hooked by a tillage implement and torn out.

The following pure stand seeding rates are to be used for designing the between-row grass seedings. Reduce rates by the appropriate percentage when using a mix of these grasses.

Blue grama 2# PLS (Pure Live Seed) per acre

Buffalograss 5# PLS per acre

Sideoats grama 6# PLS per acre

Little bluestem 4# PLS per acre

ESTABLISHMENT METHODS

Plant only in the spring of the year after frost is out of the ground. Plant bareroot stock and containerized no later than May 1.

Containerized stock may be planted in the fall (September 15-Octtober 30) if soil moisture is sufficient. Extensions of these planting dates by 10 days may be made by the district conservationist, if local soil moisture and temperature conditions justify it and are documented. Before granting an extension, consider the cooperator's ability and willingness to address the greater need for supplemental watering, wind protection, and/or shade that may be necessary in the weeks immediately following a later planting.

Immediately after, or during planting of all stock, whether by hand or machine, pack soil firmly around each plant to eliminate air pockets. Proper adjustment and operation of the tree-planting machine will eliminate the need to pack the edges of tree rows with tractor tires or feet.

Planting - Bare Root Stock (Seedlings, Transplants, Rooted Cuttings)

Before planting, examine seedlings and discard any with poorly developed root systems and those that do not meet planting stock requirements. Rooted stock will be planted in a vertical position with the root collars approximately ½-inch below the soil surface. (See Figure 4.) The planting trench or hole must be deep and wide enough to permit roots to spread out and down without J-rooting or L-rooting. Trim straggly roots of bare-root stock as needed to prevent J-roots, L-roots, broken roots, or wadded roots that may result from "stuffing" too many roots into the planting shoe. Do not over-trim roots.

Planting – Unrooted Cuttings (Willow, Cottonwood)

Base ends of longer cuttings, or the entire cutting if smaller, should be soaked for 10 to 24 hours before planting.

If cuttings have been stored for more than one week, re-cut the base end at a 45-degree angle to maximize water uptake. Cut dead wood back without damaging the green tissue.

Insert cuttings to the depth required to reach adequate soil moisture with at least one to two buds sticking above the soil surface. Longer cuttings may be planted so that 2 to 3 inches of stem are aboveground to allow for more branching.

Depth to growing season water table must be determined before obtaining cuttings to ensure cuttings are sufficiently long enough to reach the water table.

Planting – Container-grown Stock

Container-grown stock should be planted so the top of the root crown is covered with ½ to 1 inch of soil.

Planting – Direct Seeding

Understand the requirements of each species to know the best time to seed. Most species, however, used for direct seeding should be planted in the fall. Some species need a warm-cold-warm stratification period while others need a cold-warm stratification period. Some species such as bur or chinquapin oak begin sprouting within days after falling from the tree. In other words, some species germinate in the fall and some, like silver maple, germinate in the spring.

For this reason, white oaks (white, bur, swamp white, chinquapin, and post oak) must be planted in the fall because that is when they germinate. White oaks do not require stratification; their acorns germinate soon after they fall to the ground.

Walnut, the red oaks (red, black, pin, and shingle oaks), and most other tree species produce dormant seed that will not germinate unless exposed to a period of moist cold. This period of "stratification" can be satisfied by planting in the fall, storing the seed over winter in a moist stratification pit, or with moist cold storage over the winter. It is important to recognize that seed purchased from vendors is not stratified seed, unless otherwise stated.

Fall planting of nuts is preferred and recommended to take advantage of the natural stratification of dormant seeds. In the fall, plant as soon as the seed has been collected so that seeds can germinate as soon as conditions are favorable. It is important to maintain moisture in the majority of seed used for direct seeding.

Seed can be planted by hand or mechanically. Tree seeds are very particular with respect to depth of planting. Tree seeds generally respond best when seeded to a depth of 1 to 3 times the diameter of the seed. For example, ash and maple seed should be planted ¼ to ½ inch deep, while acorns, walnuts, and hickory, should be planted ½ to 2 inches deep.

Large seeds, such as walnut or acorn, can be broadcast seeded using a fertilizer or lime spreader followed by a light discing operation. Small seeds, such as sycamore or ash, can be broadcast seeded followed by a light harrowing operation. Following the planting operation, the area should be rolled or cultipacked.

To calculate the amount of seed needed:

- Determine the desired number of trees per acre.
- Determine the percent composition of the desired stand.
- Estimate the percent of sound seed, percent germination (can be derived from woody production manuals), and percent survival (predation may be significant) during the first year.

For example, the goal is to have 1,600 trees of a particular species per acre. The seed used is estimated to be 50 percent sound, the average germination is 30 percent, and the initial survival is estimated to be 50 percent. To meet the desired goal, 21,333 seeds per acre would be required [1,600 / (.50 x .30 x .50)]. To estimate the number of seeds per pound, make several seed counts to arrive at this figure.

Planting – Natural Regeneration

It is important to understand the reproductive requirements and characteristics of the species before considering using natural regeneration as an establishment technique. Upstream or adjacent plant sources should be examined during the planning process to determine if desirable species are present. With the exception of species like cottonwood, most species do not produce a good seed crop every year. All nut or mast bearing trees should be observed early in the season to predict the type of seed crop to be expected.

To determine suitability of the site for natural regeneration, refer to Exhibit A.

ESTABLISHMENT CRITERIA

Where natural regeneration is used as the establishment technique, the site shall be monitored for a minimum of three years to document species composition and establishment.

Documentation of establishment should be performed no earlier than August of the third growing season after the initial planting. Table 5 provides establishment criteria. A random sampling method may be used to arrive at percent survival by sampling 10 percent of the planted trees/shrubs or as a minimum for smaller plantings, 100 trees/shrubs should be sampled.

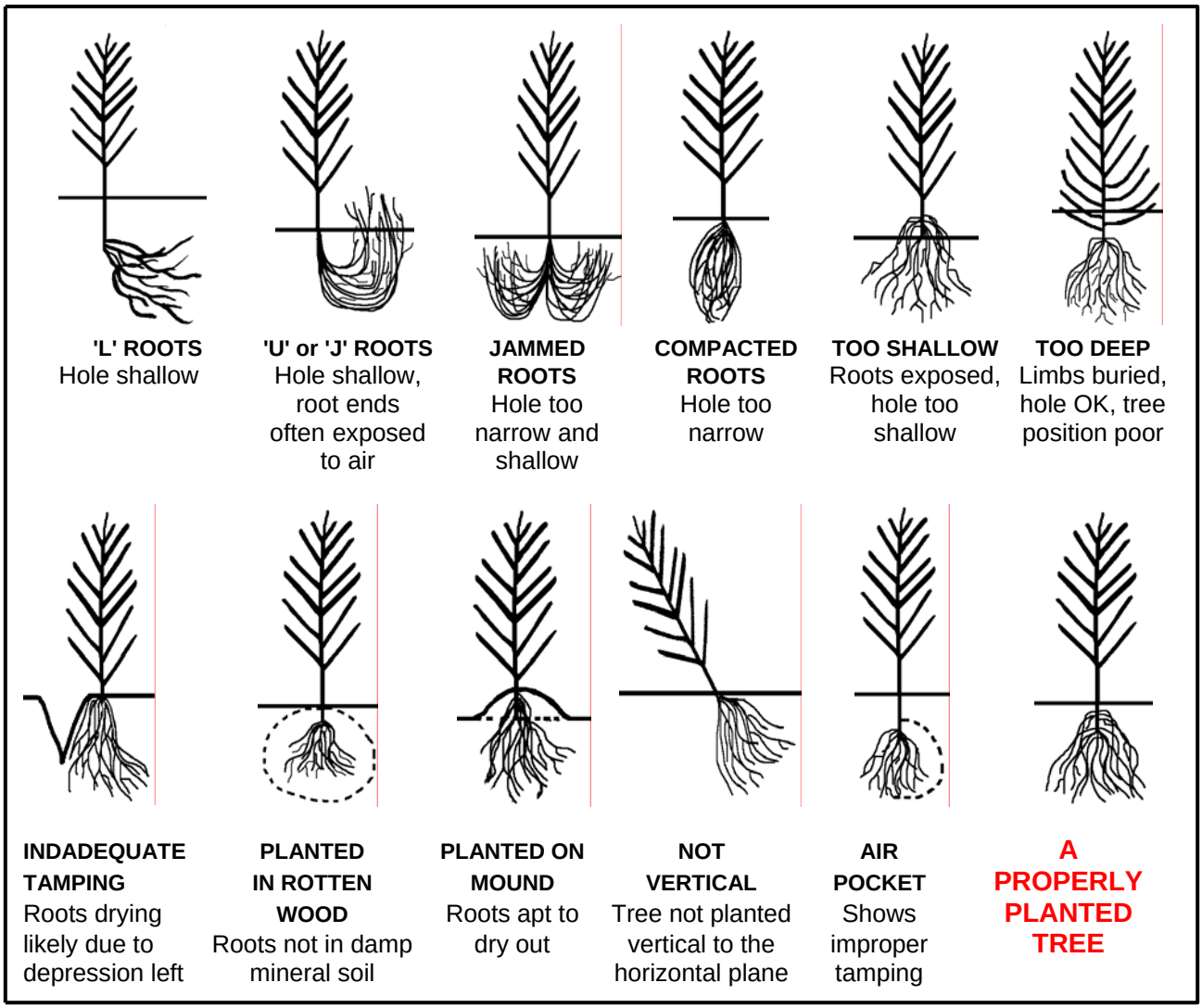


Figure 4: Examples of improperly planted trees.

USDA, KS
June 2002

PRACTICE	ESTABLISHMENT CRITERIA
380 WINDBREAK/SHELTERBELT ESTABLISHMENT	One or two row planting - 90 percent survival
391 RIPARIAN FOREST BUFFER (ZONE 1)	Three or more row planting - 80 percent survival
311 ALLEY CROPPING 391 RIPARIN FOREST BUFFER (ZONE 2) 422 HEDGE ROW PLANTING 612 TREE/SHRUB ESTABLISHMENT 645 UPLAND WILDLIFE HABITAT MANAGEMENT	70 percent survival required on all trees/shrubs planted
DIRECT SEEDING ESTALISHMENT METHOD NATURAL REGENERATION ESTABLISHMENT METHOD	Minimum of 300 trees/shrubs established per acre

Figure 5: Survival rates for woody practices

Replanting

Any tree or shrub that fails within the first three years should be replaced with a similar plant. Replanting is essential to maintain the intended function of the planting and should be compatible with soils and climate. Growth rates of most replants (when replanted within 3 years of the original planting date) are usually such that little if any size difference is noted, across the planting, after 10 years. Dead trees should be flagged late summer before leaf drop. Delays in replanting of longer than 3 years will allow adjacent established tree roots to create greater competition to the replants, resulting in slower growth. On some sites with older established plantings (over 15 years old), replants rarely put on substantive growth nor function as desired.

MAINTENANCE AFTER PLANTING

Competitive vegetation will be controlled for at least 3 years after planting. Specific recommendations for vegetative control should be listed in all tree planting plans for the first 3 years.

Livestock shall be excluded from the planting area.

Mechanical Weed Control

Use caution when tilling around trees and shrubs. Poor tillage techniques (too deep, too close to the trunk) can damage trunks, limbs, and roots. Erosion that may result from indiscriminate tillage may remove several inches of soil exposing roots to severe damage by future tillage operations.

Use tillage only when needed to maintain or improve the health and vigor of the planting. Tillage, when weeds are not growing, wastes moisture and fuel and increases the risk of mechanical injury to trees.

Chemical Weed Control

Specific herbicides, application rates, and timing of application should be listed in tree planting plans for the first 3 years. Plantings should be scouted annually to identify specific vegetation needing control to aid in herbicide selection. Follow label directions when applying the appropriate chemical to control weeds. Adhere to state or local rules that apply to chemical applications on tree and shrub plantings.

Some approved herbicides are nonselective and will kill most weeds but must not come in contact with any part of the tree or shrub. Other approved chemicals prevent weeds from germinating or kill newly germinated weed sprouts but will not kill emerged weeds.

Effectiveness of most herbicides used to control weeds in tree and shrub plantings is very sensitive to different application rates, considerably more so than the common herbicides used to kill weeds in lawns. Too little chemical applied will not provide adequate weed control. Applying too much of some chemicals may damage or kill trees and shrubs.

Use chemicals only when needed to maintain or improve the health and vigor of the windbreak.

Organic Mulches

Organic mulches may include straw, wood chips, chopped corncobs, or other organic byproducts. Mulches are most effective when maintained to the dripline of the tree or beyond. For newly planted stock, they should be placed in a 3- to 4-foot diameter circle around each plant to a depth of about 4 inches. When mulching shrub rows, mulch can be applied in a contiguous 4-foot-wide band (2 feet each side of the plants).

In situations of higher precipitation, frequent irrigation, or on tighter wetter soils, it may be appropriate to maintain a 4-inch mulch-free circle around each trunk to minimize potential trunk problems. In high moisture situations, mulch against the trunk may hold moisture and encourage bacterial growth resulting in bark injury, which could shorten the life of the tree.

If organic mulch is used, a post-emergent herbicide application is sometimes necessary to control unwanted vegetation.

Synthetic Mulch (Fabric) Weed Control

Synthetic Mulch (Fabric)

Fabric shall be of such quality that the manufacturer guarantees the product for at least 3 to 5 years.

Fabric must be black or capable of preventing underlying plant growth.

Fabric may be pin-punched plastic, solid polyethylene, woven polypropylene, or some other rot-resistant material. It must prevent plant shoots from pushing through from below.

The minimum width for continuous rolls of fabric applied by machine will be 6 feet, nominal 4-foot weed control width after installation. Individual fabric squares may be as small as 4 feet square since the full 4-feet, when stapled or pinned, effectively prevents weed growth. In certain planting designs a profusion of root suckers is desired. For these applications, 4- foot-wide rolls of fabric, yielding a nominal 2-foot weed free zone (1-foot each side), are appropriate. This narrow fabric is only appropriate on shrubs capable of profuse suckering. Some shrubs, such as plum, that sucker close to the trunk still may not sucker to any great degree outside the fabric edges . Consider not using fabric on suckering shrubs where a dense thicket is desired.

Improper Weed Control Fabric Installation	Proper Weed Control Fabric Installation
Tree planted in furrow. Fabric bridged over limbs Creates an "oven." Plants can be killed by heat.	Fabric flush to ground surface. All limbs above fabric. Soil around tree is cool and moist.

Figure 6: Improper & Proper Fabric Installation

Fabric Installation

Tilled sites should be firmed and leveled in such a way that the fabric will lie flat against the ground across the entire area covered by fabric. (Sites should be firmed to barely show an adult foot print, prior to planting.) (See Figure 6.)

Fabric should not be bridged over ridges or valleys left by planting operations. Fabric not flush to the ground around the tree can provide a runway for rodents and trap summer heat sufficient to damage or kill the young plant.

If fabric is installed under a no-till situation, excessive vegetation should be removed from the area where fabric will be placed, to reduce rodent habitat and to allow fabric to lie flat against the soil surface.

Openings shall be +, X, C, L or J-shaped. Length of slit should not exceed 12 inches. Do not use I-shaped (straight) slits as abrasion of tree bark can occur. “l”-shaped cuts may also constrict the tree trunk as the diameter increases.

When fabric is placed over plants before openings are made, use care to avoid cutting the plant when making the opening. Trees and shrubs must be pulled through the fabric within minutes after installation to avoid damaging temperatures created by the fabric "oven."

Fabric is not recommended within flood plains. One flooding event could cover the fabric with silt, eliminating its effectiveness, or flood flows could tear out the fabric.

Do not cover weed control fabrics or plastics with organic mulches or gravel. These materials will delay the breakdown of the fabric or plastic, possibly causing damage to the plant, and providing a medium in which weeds can flourish.

Installation of Continuous Fabric Strips.

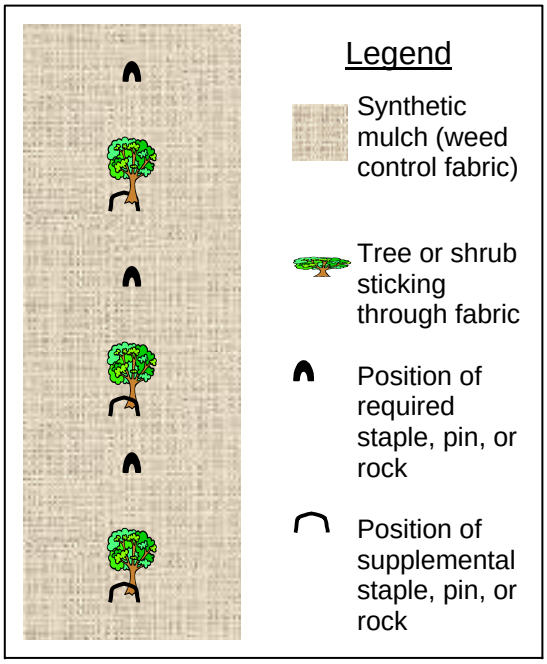


Figure 7: Positions of staples, pins, or rocks for continuous fabric strips.

Site preparation, if tilled, shall be at least 10 feet wide to allow enough loose soil to proper anchor fabric.

Fabric strip splices shall be anchored with staples, pins, or rocks. Staples and pins shall be of a length recommended by the manufacturer for the particular soil texture. Rocks must weigh at least 5 pounds. Do not anchor splices with soil.

About every 10 feet, or between each tree, whichever is greater, the fabric should be anchored with pins, staples, or rocks. In lighter soils, or in high wind areas, an additional pin, staple, or rock may be needed near each opening in the fabric. (See Figure 7.)

Machines must be adjusted to ensure 10 to12 inches of fabric edge are firmly anchored in the soil. After installation, it is often necessary to run a tractor wheel over the edge of the fabric to get a firm seal.

Check-dams across the furrow or slight grading of the site may be necessary on sloping land to prevent water from running along the edge of and uncovering the fabric.

Where fabric crosses larger waterways or areas of concentrated flows, the fabric shall be spliced on either side of the waterway. This is to prevent heavy runoff events from washing out an entire strip of fabric and potentially damaging 300 to 500 feet of tree row. The smaller spliced section may still wash out, but only a small amount will have to be repaired or replaced.

Pins or staples, instead of soil, may be used to anchor fabric edges. The fabric must lay flat against the soil and the pins or staples must be placed every 3 feet along the fabric edge. On sites exposed to extremely high winds or on loose soil, pins or staples may need to be closer than 3 feet.

When installing fabric on curves, use extra care to ensure that 10 to 12 inches along each edge get covered and packed with soil. Ensure the fabric is not so tight that temperature changes pull the fabric loose. Use pins, staples, or rocks to tack excessively large "puckers" to prevent wind damage.

Where fabric is desired on a curved planting with a short radius, it may be better to break the curve into short, straighter segments to ensure better quality and easier fabric installation.

Most fabric mulch will last beyond 5 years. Plantings should be checked annually to make sure that the fabric does not girdle trees as their diameter increases.

Annual Inspection

Inspect plantings annually to spot weather and animal damage needing repair, plants needing replacement, fabric or mulches needing repair, weeds needing treatment, or insect and disease threats that may be developing. Time of the inspection will depend upon the particular threat, but early spring is a good time to spot most problems.

Insects and Diseases

Inspect plantings at least annually to determine if insects or diseases are threatening the planting. If insects or diseases are observed, contact your local county extension agent to determine if control is possible or warranted.

Protective Tree Shelters

A wide assortment of tree shelters exists in the market place. They range from 1 foot tall to 5 feet tall, from solid tubes, to flat sheets that fold into tubes, to plastic meshes. All are effective in preventing certain kinds of damage.

One of the more common tree shelters consist of tubes, or flat sheets that fold into tubes, that range from 2 to 5 feet in height and form a 3 to 5 inch cylinder around the tree. These shelters protect the tree from wind, sun, small mammals, rodents, and deer; encourage faster initial growth; and provide an opportunity for much easier herbicide applications. Once trees grow out of shorter tubes, deer may browse the tops. For this reason, 5-foot shelters are best to prevent deer damage.

Tubes are usually tied to wood stakes with plastic ties. Tubes should not be removed for several years after the tree has emerged from the top of the tube. This period of time is needed for the tree to develop adequate stem diameter to withstand wind. Removal of the tree shelter just as the tree reaches the top of the tube will often result in a tree that "lays on the ground" or is broken off at the first strong wind.

There may or may not be merit in raising the tubes a few inches off the ground in the fall to help the tree "harden off." There is no conclusive evidence to indicate one way or the other. However, some shelters are perforated to aid in this process.

Supplemental Watering

Supplemental watering may be by hand, drip systems, sprinkler, furrow, flood, or other methods. The minimum water requirements discussed below will apply regardless of the watering method.

A common form of providing supplemental water is through drip systems.

The inclusion of a drip watering system as a component part of a tree/shrub conservation practice should be considered a temporary part of the planting. It will help ensure survival of new plantings and provide supplemental water during periods of drought and promote faster growth for more protection and wildlife cover.

Drip watering is based on the concept that prevention of moisture stress (as opposed to correcting moisture stress) will be realized by maintaining favorable soil moisture conditions on only a portion of the root system. Water is applied at slow rates (1 to 2 gallons per hour) for a sufficient period of time to maintain part of the soil at or near field capacity.

Special Considerations:

Usually the installation of a drip watering system is for establishment purposes and is normally limited to new plantings 3 years or less in age.

An adequate water supply shall be required before the system is installed.

Preference should be given to those woody species which are both deep rooted and long lived.

Preference should be given to those plantings which can produce multiple benefits.

Design and Installation:

For design procedure and sample problem, refer to Kansas Irrigation Guide, Procedure for Drip Watering Design for Tree Plantings.

Watering Requirements:

If practical, trees should be watered in at the time of planting. It is impractical to give a standard recommendation on watering rates or water requirements following planting because of varied soil types and variations in weather conditions. The following general guidelines should be followed:

Soak the soil profile thoroughly to a depth of 18 inches to 2 feet when watering and do not water again until the profile has dried. Thorough watering at less frequent intervals is more desirable for root development than frequent, light watering.

Watering two to three times per week will probably be needed for newly planted trees.

The first watering in the spring after the last frost and the last watering in the fall before the first frost are most important to maintain plant vigor.

ADDITIONAL INFORMATION

“Common Insect Pests of the Trees of the Great Plains,” Great Plains Agricultural Publication No. 119.

“Diseases of Trees of the Great Plains,” Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-129.

"Tree Planting Guide"
http://www.kansasforests.org/publications/conservation.htms

"Tips on Planting Trees and Shrubs"
http://www.kansasforests.org/publications/conservation.htms

"Weed Control Options in Tree Plantings"
http://www.kansasforests.org/publications/conservation.htm

"Chemical Weed Control in Tree Plantings"
http://www.kansasforests.org/publications/conservation.htm

"Tips on Installing Weed Barrier Fabric"
http://www.kansasforests.org/publications/conservation.htm

"Weed Barrier Fabric Mulch"
http://www.kansasforests.org/publications/conservation.htm

"Wick Application of Herbicides for Weed Control"
http://www.kansasforests.org/publications/conservation.htm

References

General Resource Reference, Tree Care and Management, Craig Stange, North Dakota NRCS FOTG, Sec 1, Jan 2002.

USDA Forest Service, Seeds of Woody Plants In the United States, 1974. USDA Agriculture Handbook 450.

Exhibit A

NATURAL REGENERATION SUITABILITY KEY

This key is to be used by planners to determine if natural regeneration is feasible as an establishment technique. Natural regeneration may only be used on a wetland site or sites within a riparian zone where hydric soils or frequently flooded soils exist.

1. Hydrology and soil condition marginally altered.	**Go to 2**
1. Hydrology and soil condition significantly altered.	**Go to A**
2. Propagules already exist on site.	**Go to 3**
2. Propagules do not exist on site.	**Go to 5**
3. Desirable species occur on site.	**Go to 4**
3. Desirable species do not occur on site.	**Go to 5**
4. Seed source and crop is adequate to meet planning objectives.	**Go to B**
4. Seed source and crop is inadequate to meet planning objectives.	**Go to 5**
5. Restoration site is adjacent to surrounding seed wall.	**Go to 6**
5. Restoration site is not adjacent to surrounding seed wall.	**Go to A**
6. Seed wall contains desirable species.	**Go to C**
6. Seed wall does not contain desirable species.	**Go to A**

A. Natural regeneration not recommended. Another establishment technique should be considered.
B. Natural regeneration may be recommended for the entire area.
C. Natural regeneration should be considered for the area no greater than 200 feet from the surrounding seed wall.

Seed wall is defined as desirable wetland/riparian plants on adjacent lands that have a good seed crop capable of dispersing to the restoration site by natural drop, wind, water, and or animals.

Propagule is defined as any piece of plant material that will develop into a new plant (i.e. seeds, nuts, rhizomes, or other vegetative material).

Survey Notes, Abbreviations, and Definitions
Cottonwood River C104

Abbreviation	Definition
BAR	Gravel Bar
BKF	Bankfull Indicator
CP	Control Point
FE	Field Edge
G	Ground
LB	Left Bank
LTB	Left Top of Bank
LW	Left Edge of Water
RB	Right Bank
RW	Right Edge of Water
SB	Streambed
TL	Tree Line
TS	Total Station
WP	Work Point

Cottonwood River C104 Survey

Point	Northing	Easting	Elevation	Description
2	4664.133	5087.298	1139.413	WP2
3	5071.541	4880.247	1140.999	CP3
4	5010.220	4613.288	1141.531	CP4
5	4265.893	5155.314	1141.005	CP5
100	4834.523	4934.599	1140.947	TS
101	4978.546	4676.705	1141.316	LTB
102	4978.424	4676.675	1141.359	LTB
103	4973.434	4690.137	1141.457	LTB
104	4963.322	4706.377	1141.521	LTB
105	4957.713	4717.729	1141.643	LTB
106	4937.307	4736.764	1141.330	LTB
107	4934.418	4742.210	1141.409	LTB
108	4925.414	4750.378	1141.245	LTB
109	4910.318	4759.490	1141.201	LTB
110	4901.207	4769.776	1141.464	LTB
111	4891.381	4777.824	1141.384	LTB
112	4880.902	4789.683	1141.497	LTB
113	4869.121	4800.250	1141.520	LTB
114	4856.461	4812.650	1141.478	LTB
115	4847.788	4823.421	1141.521	LTB
116	4841.211	4829.337	1141.323	LTB
117	4830.409	4836.221	1141.138	LTB
118	4820.397	4845.207	1141.272	LTB
119	4809.978	4850.859	1141.148	LTB
120	4801.112	4863.375	1141.418	LTB
121	4791.442	4869.795	1141.205	LTB
122	4777.888	4880.686	1141.242	LTB
123	4772.812	4891.980	1141.452	LTB
124	4768.794	4897.991	1140.904	LTB
125	4752.824	4908.967	1140.625	LTB
126	4743.143	4920.510	1140.574	LTB
127	4730.810	4931.024	1140.413	LTB
128	4719.655	4938.606	1140.402	LTB
129	4702.440	4945.827	1139.979	LTB
130	4687.064	4951.249	1140.178	LTB
131	4672.947	4960.143	1140.432	LTB
132	4659.232	4966.206	1140.361	LTB
133	4581.105	5109.029	1140.563	TS
134	4653.340	4969.347	1140.306	LTB
135	4630.982	4979.773	1140.560	LTB
136	4611.694	5001.036	1140.574	LTB
137	4595.651	5012.235	1140.534	LTB
138	4587.753	5015.919	1140.665	LTB
139	4568.489	5022.692	1140.633	LTB

Point	Northing	Easting	Elevation	Description
140	4554.833	5025.899	1140.745	LTB
141	4540.313	5031.100	1140.879	LTB
142	4530.256	5035.557	1140.899	LTB
143	4518.938	5039.024	1140.837	LTB
144	4509.738	5043.456	1140.959	LTB
145	4498.438	5048.997	1141.021	LTB
146	4480.225	5051.736	1141.047	LTB
147	4467.879	5052.328	1140.743	LTB
148	4447.710	5055.034	1140.936	LTB
149	4430.654	5058.618	1140.947	LTB
150	4410.900	5062.854	1141.043	LTB
151	4389.226	5060.097	1140.923	LTB
152	4368.215	5074.355	1140.971	LTB
153	4360.458	5079.150	1140.996	LTB
154	4349.478	5084.369	1141.126	LTB
155	4338.381	5085.197	1140.845	LTB
156	4326.544	5093.729	1140.967	LTB
157	4311.816	5103.267	1141.003	LTB
158	4298.044	5105.711	1140.956	LTB
159	4289.802	5109.336	1140.975	LTB
160	4285.260	5108.050	1140.861	LTB
161	4280.018	5101.097	1140.934	LTB
162	4269.143	5108.639	1140.708	LTB
163	4257.610	5114.977	1140.686	LTB
164	4246.271	5117.070	1140.936	LTB
165	4236.203	5118.558	1141.109	LTB
166	4221.415	5117.850	1140.569	LTB
168	4548.779	5031.028	1141.166	TS
169	4943.326	4562.814	1111.379	LW
170	4936.036	4571.646	1111.454	LW
171	4930.813	4581.878	1111.419	LW
172	4935.089	4589.169	1111.378	LW
173	4950.386	4568.265	1113.622	LB
174	4938.825	4581.521	1113.974	LB
175	4948.048	4586.732	1120.052	LB
176	4962.971	4569.744	1122.573	LB
177	4974.532	4574.844	1129.639	LB
178	4962.201	4589.753	1128.297	LB
179	4982.304	4579.131	1130.252	LB
180	4977.391	4595.294	1129.394	LB
181	4958.986	4612.446	1124.854	LB
182	4959.132	4612.540	1124.853	LB
183	4967.198	4616.428	1129.308	LB
184	4952.819	4632.361	1123.829	LB
185	4962.367	4632.156	1128.070	LB
186	4964.566	4649.215	1128.883	LB

Point	Northing	Easting	Elevation	Description
187	4953.864	4646.638	1125.384	LB
188	4944.201	4647.450	1115.213	LB
189	4943.597	4662.069	1119.632	LB
190	4940.797	4676.711	1120.678	LB
191	4937.171	4687.343	1121.523	LB
192	4931.143	4704.733	1125.399	LB
193	4918.896	4717.657	1126.412	LB
194	4906.048	4727.344	1125.379	LB
195	4899.612	4744.685	1126.365	LB
196	4911.620	4737.207	1128.674	LB
197	4923.717	4719.950	1127.999	LB
198	4936.670	4704.878	1126.939	LB
199	4833.517	4575.133	1118.806	RB
200	4936.544	4704.774	1126.866	LB
201	4948.069	4695.326	1126.803	LB
202	4825.762	4601.603	1116.972	RB
203	4955.614	4664.928	1126.653	LB
204	4968.298	4679.531	1133.435	LB
205	4958.467	4691.957	1131.656	LB
206	4970.986	4666.233	1134.094	LB
207	4819.339	4623.012	1114.366	RB
208	4949.066	4610.198	1118.363	LB
209	4945.533	4597.502	1117.854	LB
210	4943.447	4585.571	1118.098	LB
211	4938.015	4563.579	1108.677	SB
212	4936.808	4562.516	1107.478	SB
213	4932.789	4556.960	1105.571	SB
214	4925.056	4547.392	1101.830	SB
215	4913.593	4537.663	1102.022	SB
216	4891.291	4531.429	1111.294	RW
217	4901.386	4553.155	1101.887	SB
218	4897.541	4534.615	1106.510	SB
219	4916.813	4564.950	1101.671	SB
220	4926.735	4573.506	1106.356	SB
221	4881.571	4545.683	1111.311	RW
222	4883.318	4549.170	1106.418	SB
223	4929.648	4593.556	1106.853	SB
224	4935.779	4599.270	1111.344	LW
225	4864.172	4557.847	1111.261	RW
226	4923.837	4590.339	1104.348	SB
227	4867.669	4560.990	1107.854	SB
228	4911.667	4577.261	1101.603	SB
229	4892.073	4569.697	1101.837	SB
230	4879.606	4584.623	1102.925	SB
231	4856.722	4573.530	1111.313	RW
232	4889.279	4600.034	1098.679	SB

Point	Northing	Easting	Elevation	Description
233	4856.812	4573.205	1111.272	LW
234	4908.719	4611.637	1100.692	SB
235	4927.083	4619.868	1104.424	SB
236	4859.541	4574.378	1109.166	SB
237	4939.438	4621.594	1111.315	LW
238	4853.763	4581.111	1111.266	RW
239	4938.551	4637.899	1111.257	LW
240	4856.758	4582.988	1108.340	SB
241	4928.313	4633.428	1105.652	SB
242	4849.460	4589.882	1111.286	RW
243	4912.867	4612.666	1101.597	SB
244	4853.441	4591.612	1108.701	SB
245	4855.258	4592.497	1107.397	SB
246	4892.289	4604.447	1097.672	SB
247	4874.698	4597.276	1102.791	SB
248	4864.854	4615.830	1102.236	SB
249	4848.230	4605.153	1106.394	SB
250	4844.376	4603.869	1109.315	SB
251	4841.337	4601.352	1111.255	RW
252	4879.133	4630.615	1096.707	SB
253	4905.368	4644.693	1101.633	SB
254	4838.035	4608.451	1111.331	RW
255	4841.500	4610.796	1107.034	SB
256	4917.936	4653.236	1105.275	SB
257	4929.647	4658.383	1111.270	LW
258	4921.145	4671.702	1108.703	SB
259	4827.988	4631.228	1111.335	RW
260	4922.702	4681.120	1111.368	LW
261	4919.191	4679.437	1107.762	SB
262	4832.216	4635.048	1109.404	SB
263	4907.265	4657.241	1101.698	SB
264	4835.800	4638.546	1107.920	SB
265	4886.286	4645.160	1096.640	SB
266	4863.384	4638.943	1096.936	SB
267	4843.063	4650.900	1101.607	SB
268	4829.926	4646.735	1107.145	SB
269	4863.393	4670.364	1098.575	SB
270	4823.515	4644.856	1108.723	SB
271	4889.391	4692.509	1101.972	SB
272	4817.444	4644.652	1111.332	RW
273	4896.407	4702.582	1105.794	SB
274	4899.895	4706.572	1108.771	SB
275	4901.004	4707.489	1111.365	LW
276	4882.627	4726.911	1111.305	LW
277	4879.885	4724.646	1108.095	SB
278	4801.457	4675.879	1111.323	RW

Point	Northing	Easting	Elevation	Description
279	4864.178	4704.488	1102.396	SB
280	4805.456	4677.221	1107.401	SB
281	4844.951	4694.135	1101.807	SB
282	4808.106	4678.555	1106.900	SB
283	4826.068	4682.846	1104.148	SB
284	4813.609	4679.588	1106.712	SB
285	4811.719	4703.788	1106.365	SB
286	4794.558	4693.966	1111.297	RW
287	4827.781	4723.124	1105.173	SB
288	4799.111	4698.158	1107.494	SB
289	4846.446	4735.434	1105.762	SB
290	4859.989	4744.886	1108.087	SB
291	4865.315	4748.621	1111.284	LW
292	4852.504	4772.133	1111.319	LW
293	4777.389	4721.218	1111.343	RW
294	4843.768	4766.390	1108.948	SB
295	4781.916	4723.821	1109.264	SB
296	4825.023	4755.481	1107.928	SB
297	4791.338	4731.554	1108.664	SB
298	4809.330	4744.674	1107.857	SB
299	4799.962	4738.673	1108.134	SB
300	4801.173	4765.152	1109.769	SB
301	4791.437	4754.871	1109.354	SB
302	4814.242	4779.408	1109.438	SB
303	4781.173	4745.253	1109.463	SB
304	4825.797	4790.940	1109.556	SB
305	4771.415	4735.492	1109.007	SB
306	4829.438	4794.937	1111.322	LW
307	4767.897	4730.681	1111.321	RW
308	4807.480	4810.187	1111.290	LW
309	4748.147	4751.970	1111.316	RW
310	4804.590	4807.510	1109.699	SB
311	4751.445	4755.791	1110.209	SB
312	4797.831	4801.099	1107.574	SB
313	4761.964	4764.468	1110.479	SB
314	4786.496	4788.669	1108.243	SB
315	4774.234	4776.149	1109.272	SB
316	4774.411	4810.256	1107.130	SB
317	4762.511	4798.202	1108.555	SB
318	4782.496	4819.572	1106.521	SB
319	4752.441	4787.188	1110.085	SB
320	4786.734	4825.269	1108.424	SB
321	4742.252	4773.842	1110.998	SB
322	4790.049	4827.270	1111.322	LW
323	4735.019	4764.529	1111.332	RW
324	4779.254	4842.359	1111.334	LW

Point	Northing	Easting	Elevation	Description
325	4718.959	4777.111	1112.084	BAR
326	4776.246	4838.918	1107.895	SB
327	4725.811	4783.538	1111.340	BAR
328	4771.550	4833.919	1106.306	SB
329	4735.202	4792.515	1111.226	BAR
330	4762.140	4821.045	1107.556	SB
331	4737.137	4792.836	1111.206	RW
332	4752.817	4809.484	1108.720	SB
333	4743.798	4800.879	1110.003	SB
334	4735.918	4839.167	1108.865	SB
335	4726.889	4829.220	1109.610	SB
336	4746.948	4853.630	1107.602	SB
337	4718.817	4819.607	1109.661	SB
338	4752.428	4859.152	1107.507	SB
339	4712.177	4810.456	1110.474	SB
340	4757.010	4865.938	1111.285	LW
341	4711.858	4807.563	1111.259	RW
342	4708.874	4803.811	1111.982	BAR
343	4738.188	4878.058	1111.149	LW
344	4701.945	4790.041	1112.749	BAR
345	4734.198	4873.712	1107.493	SB
346	4681.822	4801.775	1113.047	BAR
347	4732.808	4869.994	1106.667	SB
348	4691.691	4814.463	1111.886	BAR
349	4726.380	4861.803	1108.249	SB
350	4695.474	4823.919	1111.218	RW
351	4717.187	4851.405	1109.679	SB
352	4708.731	4842.522	1110.001	SB
353	4698.723	4833.594	1110.619	SB
354	4694.930	4867.990	1110.330	SB
355	4688.565	4861.581	1110.358	SB
356	4706.523	4884.615	1107.436	SB
357	4677.873	4849.450	1111.300	RW
358	4709.655	4891.202	1107.252	SB
359	4665.864	4837.116	1112.085	BAR
360	4714.615	4897.694	1111.176	LW
361	4652.030	4821.977	1113.215	BAR
362	4630.255	4833.773	1113.564	BAR
363	4694.089	4910.936	1111.188	LW
364	4641.102	4848.898	1112.539	BAR
365	4691.220	4907.721	1107.811	SB
366	4651.292	4860.680	1111.698	BAR
367	4666.242	4874.693	1111.277	BAR
368	4670.392	4877.193	1111.147	RW
369	4692.358	4899.258	1107.023	SB
370	4675.932	4882.013	1109.328	SB

Point	Northing	Easting	Elevation	Description
371	4685.193	4895.222	1107.689	SB
372	4678.837	4887.665	1108.918	SB
373	4666.203	4905.905	1107.158	SB
374	4660.293	4899.394	1108.641	SB
375	4655.070	4888.846	1109.761	SB
376	4673.995	4906.122	1105.578	SB
377	4653.763	4882.067	1111.134	RW
378	4646.401	4871.811	1111.644	BAR
379	4672.256	4914.551	1106.957	SB
380	4634.556	4850.766	1112.672	BAR
381	4674.389	4917.829	1108.496	SB
382	4626.660	4835.143	1113.519	BAR
383	4675.473	4919.463	1111.100	LW
384	4658.517	4931.964	1111.099	LW
385	4594.789	4853.014	1113.145	BAR
386	4655.559	4926.776	1107.682	SB
387	4610.088	4869.796	1112.698	BAR
388	4651.863	4917.581	1106.696	SB
389	4624.863	4883.916	1111.789	BAR
390	4641.527	4905.598	1109.009	SB
391	4631.613	4892.646	1111.100	RW
392	4622.688	4919.528	1108.611	SB
393	4618.292	4912.486	1109.699	SB
394	4628.339	4930.673	1106.478	SB
395	4612.619	4903.240	1111.088	RW
396	4605.280	4890.320	1111.967	BAR
397	4633.698	4934.466	1106.740	SB
398	4596.780	4870.211	1112.910	BAR
399	4635.688	4940.501	1108.135	SB
400	4591.181	4856.205	1113.037	BAR
401	4636.642	4941.201	1111.064	LW
402	4562.775	4870.557	1113.838	BAR
403	4617.523	4950.044	1111.161	LW
404	4573.890	4886.778	1113.380	BAR
405	4615.645	4947.562	1107.202	SB
406	4586.981	4905.598	1111.648	BAR
407	4592.099	4913.129	1111.102	RW
408	4598.746	4920.997	1109.520	SB
409	4614.826	4936.591	1105.855	SB
410	4604.931	4929.576	1108.117	SB
411	4590.325	4945.038	1105.840	SB
412	4583.360	4931.710	1108.807	SB
413	4598.533	4952.431	1105.081	SB
414	4579.410	4919.907	1110.118	SB
415	4594.930	4959.495	1107.859	SB
416	4577.899	4916.227	1111.074	RW

Point	Northing	Easting	Elevation	Description
417	4596.322	4962.502	1111.083	LW
418	4574.728	4902.799	1112.163	BAR
419	4567.907	4882.963	1113.612	BAR
420	4563.257	4870.170	1113.846	BAR
421	4541.933	4878.476	1114.822	BAR
422	4576.568	4967.304	1111.007	LW
423	4548.004	4901.587	1113.458	BAR
424	4575.012	4961.116	1106.033	SB
425	4556.011	4921.104	1111.116	RW
426	4560.197	4929.252	1109.521	SB
427	4573.544	4946.942	1105.836	SB
428	4568.024	4940.269	1108.161	SB
429	4544.581	4943.860	1107.765	SB
430	4542.438	4935.213	1109.146	SB
431	4549.462	4950.921	1105.502	SB
432	4539.719	4926.860	1111.108	RW
433	4534.333	4906.336	1113.604	BAR
434	4530.517	4887.695	1113.921	BAR
435	4555.890	4964.854	1106.215	SB
436	4557.529	4969.234	1109.082	SB
437	4557.110	4972.851	1111.135	LW
438	4539.739	4977.047	1111.110	LW
439	4528.911	4950.342	1106.755	SB
440	4538.284	4972.440	1105.682	SB
441	4527.708	4943.015	1108.457	SB
442	4526.559	4933.814	1110.170	SB
443	4526.040	4930.139	1111.108	RW
444	4520.510	4913.117	1113.276	BAR
445	4513.788	4897.056	1113.764	BAR
446	4522.275	4980.175	1111.076	LW
447	4498.292	4904.295	1113.953	BAR
448	4520.848	4977.853	1107.859	SB
449	4502.412	4922.278	1112.695	BAR
450	4510.037	4964.202	1104.215	SB
451	4505.137	4935.179	1111.097	RW
452	4505.351	4943.495	1109.245	SB
453	4509.540	4954.371	1106.176	SB
454	4484.014	4953.279	1108.028	SB
455	4487.139	4962.583	1105.659	SB
456	4482.599	4945.748	1109.787	SB
457	4479.853	4939.969	1111.077	RW
458	4485.419	4975.503	1102.576	SB
459	4479.072	4923.956	1112.608	BAR
460	4475.437	4914.481	1113.964	BAR
461	4496.767	4985.726	1104.477	SB
462	4497.330	4990.378	1111.087	LW

Point	Northing	Easting	Elevation	Description
463	4477.826	4998.310	1111.152	LW
464	4464.211	4942.279	1111.083	RW
465	4476.256	4993.476	1107.145	SB
466	4464.329	4947.850	1109.760	SB
467	4475.727	4984.404	1104.634	SB
468	4466.526	4955.227	1108.467	SB
469	4467.406	4962.879	1106.311	SB
470	4469.725	4966.086	1105.135	SB
471	4434.872	4971.602	1106.900	SB
472	4431.661	4964.690	1108.047	SB
473	4433.467	4986.606	1103.339	SB
474	4429.381	4953.416	1109.050	SB
475	4438.190	5000.861	1101.749	SB
476	4428.183	4945.992	1109.726	SB
477	4439.414	5006.829	1107.717	SB
478	4427.791	4943.858	1111.106	RW
479	4440.800	5010.636	1111.059	LW
480	4422.611	5019.311	1111.163	LW
481	4398.665	4950.289	1111.078	RW
482	4419.822	5012.349	1106.340	SB
483	4399.603	4953.711	1108.936	SB
484	4417.325	5000.320	1102.206	SB
485	4404.014	4961.284	1108.407	SB
486	4413.079	4987.423	1103.814	SB
487	4407.489	4972.559	1107.576	SB
488	4391.259	4984.426	1105.883	SB
489	4389.529	4976.461	1107.865	SB
490	4393.524	4998.302	1103.333	SB
491	4385.307	4968.631	1108.010	SB
492	4393.170	5009.351	1102.033	SB
493	4382.694	4960.410	1109.191	SB
494	4396.198	5022.530	1105.308	SB
495	4380.843	4958.751	1111.129	RW
496	4400.512	5029.658	1111.057	LW
497	4381.102	5033.527	1111.165	SBLW
498	4352.341	4976.473	1111.103	RW
499	4378.299	5027.684	1104.895	SB
500	4354.174	4980.311	1107.457	SB
501	4375.109	5017.796	1102.563	SB
502	4367.872	5002.689	1104.175	SB
503	4359.298	4989.208	1105.844	SB
504	4330.279	4980.823	1111.054	RW
505	4329.241	4986.617	1109.432	SB
506	4331.694	4994.830	1105.954	SB
507	4330.353	4989.311	1108.296	SB
508	4331.106	5010.568	1105.139	SB

Point	Northing	Easting	Elevation	Description
509	4338.336	5026.604	1104.241	SB
510	4342.545	5033.647	1108.310	SB
511	4346.148	5040.938	1107.041	SB
512	4302.303	4977.675	1110.971	RW
513	4302.661	4984.028	1107.848	SB
514	4304.439	4992.698	1107.665	SB
515	4306.854	4997.416	1106.468	SB
516	4406.092	5029.661	1114.145	LB
517	4422.870	5025.964	1117.050	LB
518	4284.733	4996.669	1106.361	SB
519	4421.989	5043.298	1121.340	LB
520	4280.390	4987.104	1107.986	SB
521	4444.236	5043.357	1122.433	LB
522	4279.104	4982.910	1111.044	RW
523	4442.464	5031.711	1120.627	LB
524	4439.309	5018.184	1117.597	LB
525	4464.124	5012.555	1118.395	LB
526	4252.845	4990.007	1111.133	RW
527	4473.052	5040.693	1124.322	LB
528	4254.229	4994.651	1107.456	SB
529	4503.910	5032.035	1125.105	LB
530	4255.245	5001.657	1106.634	SB
531	4500.161	5017.620	1122.159	LB
532	4495.018	4998.121	1117.534	LB
533	4231.315	4995.986	1111.090	RW
534	4525.047	4989.173	1117.551	LB
535	4232.935	4999.633	1108.242	SB
536	4530.448	5004.394	1122.669	LB
537	4234.808	5006.018	1106.865	SB
538	4536.323	5016.783	1124.049	LB
539	4235.761	5010.343	1106.186	SB
540	4566.696	5009.116	1125.686	LB
541	4563.495	4998.882	1124.395	LB
542	4558.305	4987.899	1120.976	LB
543	4210.710	5004.915	1111.155	RW
544	4586.014	5002.948	1126.684	LB
545	4211.799	5009.785	1109.128	SB
546	4589.812	4992.319	1123.466	LB
547	4211.619	5016.085	1107.626	SB
548	4599.013	4990.238	1122.958	LB
549	4590.946	4979.822	1122.962	LB
550	4183.958	5012.031	1111.073	RW
551	4601.263	4982.541	1119.150	LB
552	4185.335	5017.638	1108.589	SB
553	4603.653	4965.030	1113.923	LB
554	4224.598	5119.412	1141.231	TS

Point	Northing	Easting	Elevation	Description
555	4149.097	5109.062	1111.049	LW
556	4144.258	5097.519	1105.940	SB
557	4141.434	5081.487	1104.753	SB
558	4133.598	5061.754	1104.034	SB
559	4128.320	5041.948	1108.007	SB
560	4125.284	5033.783	1111.058	RW
561	4156.982	5018.782	1111.079	RW
562	4160.754	5030.948	1108.167	SB
563	4166.762	5042.533	1109.413	SB
564	4172.958	5057.693	1105.003	SB
565	4201.709	5126.421	1135.675	LB
566	4178.813	5072.771	1104.773	SB
567	4183.673	5086.428	1106.913	SB
568	4192.475	5114.638	1128.600	LB
569	4188.461	5095.821	1111.048	RW
570	4181.762	5119.174	1125.480	LB
571	4218.379	5084.572	1111.068	LW
572	4189.225	5137.446	1130.624	LB
573	4217.009	5075.254	1108.267	SB
574	4214.992	5064.273	1105.720	SB
575	4174.239	5120.074	1119.528	LB
576	4211.122	5048.062	1105.275	SB
577	4181.163	5127.747	1124.518	LB
578	4205.779	5034.949	1106.280	SB
579	4231.016	5015.981	1105.533	SB
580	4183.023	5142.619	1131.178	LB
581	4237.696	5034.793	1105.554	SB
582	4181.285	5141.558	1127.813	LB
583	4243.993	5049.780	1105.042	SB
584	4175.873	5136.021	1124.490	LB
585	4251.736	5065.854	1107.717	SB
586	4254.080	5072.674	1111.080	LW
587	4167.493	5125.518	1118.600	LB
588	4274.241	5067.342	1110.954	LW
589	4161.231	5131.012	1118.968	LB
590	4270.750	5059.321	1109.255	SB
591	4167.833	5147.231	1124.978	LB
592	4159.382	5146.487	1126.197	LB
593	4269.182	5053.498	1106.844	SB
594	4158.629	5131.244	1118.556	LB
595	4267.024	5046.607	1105.171	SB
596	4153.473	5117.203	1117.837	LB
597	4264.147	5035.778	1105.009	SB
598	4151.136	5130.923	1122.375	LB
599	4256.439	5017.125	1105.725	SB
600	4150.509	5143.776	1127.531	LB

Point	Northing	Easting	Elevation	Description
601	4254.990	5003.386	1106.894	SB
602	4161.960	5150.675	1130.619	LB
603	4288.396	4999.322	1106.326	SB
604	4297.132	5016.007	1106.219	SB
605	4146.292	5148.839	1129.297	LB
606	4304.167	5036.109	1104.326	SB
607	4140.538	5131.509	1121.655	LB
608	4311.099	5048.809	1106.346	SB
609	4316.476	5059.627	1111.078	LW
610	4158.147	5119.182	1113.854	LB
611	4343.296	5049.491	1111.192	LW
612	4309.081	5068.394	1115.571	LB
613	4291.973	5071.572	1114.473	LB
614	4296.386	5082.888	1119.144	LB
615	4281.850	5085.592	1122.804	LB
616	4273.046	5090.192	1129.580	LB
617	4268.006	5086.252	1127.059	LB
618	4261.953	5100.548	1127.630	LB
619	4252.510	5096.107	1125.742	LB
620	4244.576	5112.697	1133.599	LB
621	4252.559	5096.291	1125.721	LB
622	4237.120	5112.725	1133.858	LB
623	4242.318	5101.271	1125.798	LB
624	4237.631	5104.301	1129.546	LB
625	4229.045	5097.939	1120.929	LB
626	4228.180	5109.212	1131.307	LB
627	4214.308	5105.735	1122.041	LB
628	4197.646	5105.291	1120.564	LB
629	4983.841	4613.332	1139.439	LTB
630	4987.120	4605.967	1138.986	LTB
631	4980.692	4630.040	1139.938	LTB
632	4978.644	4646.186	1139.234	LTB
633	4975.388	4660.801	1138.506	LTB
634	4984.108	4661.615	1141.419	LTB
635	4972.089	4671.338	1137.667	LTB
636	4218.972	5116.551	1140.573	LTB
637	4212.891	5130.815	1140.848	LTB
638	4200.107	5142.583	1140.663	LTB
639	4192.403	5149.558	1140.788	LTB
640	4179.014	5157.705	1140.556	LTB
641	4170.184	5159.672	1139.864	LTB
642	4178.124	5168.146	1140.517	G
643	4190.931	5179.963	1140.352	G
644	4201.844	5163.193	1140.862	G
645	4217.688	5180.631	1140.424	G
646	4233.668	5157.054	1140.816	G

Point	Northing	Easting	Elevation	Description
647	4246.315	5175.041	1140.509	G
648	4274.542	5148.970	1140.817	TL
649	4270.221	5164.983	1140.969	TL
650	4283.981	5125.198	1141.105	TL
651	4271.166	5200.507	1140.941	TL
652	4274.757	5226.081	1140.944	TL
653	4268.729	5256.127	1140.828	TL
654	4267.459	5278.205	1140.684	TL
655	4255.828	5303.838	1140.561	TL
656	4296.427	5152.796	1141.096	G
657	4294.908	5123.358	1141.039	G
658	4351.321	5141.913	1141.137	G
659	4332.777	5109.046	1141.318	G
660	4381.116	5125.601	1141.120	G
661	4374.886	5093.997	1141.244	G
662	4428.334	5110.574	1140.919	G
663	4418.694	5082.631	1141.053	G
664	4469.341	5103.443	1140.826	G
665	4459.510	5074.505	1141.084	G
666	4514.315	5102.018	1140.508	G
667	4503.410	5065.831	1140.802	G
668	4560.044	5091.800	1140.378	G
669	4547.531	5053.042	1140.524	G
670	4603.612	5079.056	1140.171	G
671	4590.245	5041.451	1140.291	G
672	4642.642	5064.845	1139.713	G
673	4626.709	5023.386	1140.098	G
674	4687.935	5041.561	1139.812	G
675	4670.789	5003.655	1140.219	G
676	4722.835	5013.178	1139.741	G
677	4704.885	4982.460	1140.107	G
678	4757.942	4983.015	1139.659	G
679	4733.229	4956.447	1140.033	G
680	4786.961	4950.996	1140.637	G
681	4772.958	4926.752	1140.778	G
682	4820.728	4918.632	1140.653	G
683	4795.036	4905.064	1140.921	G
684	4826.873	4911.624	1141.269	G
685	4800.825	4898.558	1141.601	G
686	4861.409	4885.698	1141.308	G
687	4838.435	4867.165	1141.449	G
688	4893.129	4856.549	1141.377	G
689	4871.642	4834.993	1141.554	G
690	4926.574	4828.085	1141.422	G
691	4906.335	4799.580	1141.549	G
692	4956.158	4795.953	1141.350	G

Point	Northing	Easting	Elevation	Description
693	4939.511	4767.341	1141.535	G
694	4988.417	4758.973	1141.388	G
695	4971.090	4733.878	1141.527	G
696	5013.324	4722.755	1141.301	G
697	4993.384	4699.470	1141.504	G
698	5036.539	4686.000	1141.221	G
699	4990.545	4654.612	1141.494	G
700	5047.219	4641.604	1141.301	G
701	4994.196	4621.750	1141.180	G
702	5061.744	4605.024	1140.433	G
703	5010.526	4596.924	1141.148	G
704	5051.660	4598.429	1141.251	G
705	5071.630	4617.763	1140.011	G
706	5076.707	4676.731	1139.841	FE
707	5050.918	4677.301	1141.248	G
708	5078.418	4731.928	1139.853	FE
709	5046.523	4730.819	1141.224	G
710	5081.135	4782.287	1139.872	FE
711	5050.542	4781.008	1141.092	G
712	5083.707	4836.812	1139.882	FE
713	5053.360	4835.149	1140.956	G
714	5086.467	4890.492	1139.711	FE
715	5049.316	4887.343	1141.003	G
716	5090.415	4944.591	1139.590	FE
717	5059.165	4942.345	1140.752	G
718	5092.324	5000.419	1139.793	FE
719	5061.904	4995.422	1140.880	G
720	5087.690	5041.394	1140.430	FE
721	5057.450	5021.973	1140.821	G
722	5054.107	5046.054	1140.541	FE
723	5039.788	5026.195	1140.761	G
724	5012.012	5044.625	1140.488	FE
725	5011.790	5025.391	1140.771	G
726	4974.949	5030.014	1140.456	FE
727	4983.332	5016.697	1140.659	G
728	4943.215	5008.653	1140.380	FE
729	4952.865	4995.855	1140.679	G
730	4898.367	4968.774	1140.511	FE
731	4910.832	4952.149	1140.931	G
732	4852.062	4931.695	1140.748	FE
733	4866.567	4915.276	1141.206	G
734	4821.511	4961.029	1140.419	FE
735	4800.434	4980.496	1140.361	FE
736	4787.447	4991.458	1140.073	FE
737	4776.516	5003.039	1139.304	FE
738	4763.903	5014.934	1138.525	FE

Point	Northing	Easting	Elevation	Description
739	4755.150	5021.978	1138.550	FE
740	4739.351	5033.872	1139.438	FE
741	4718.268	5050.656	1139.671	FE
742	4697.643	5063.824	1139.287	FE
743	4675.561	5075.839	1139.161	FE
744	4654.080	5086.586	1139.428	FE
745	4625.862	5097.175	1139.937	FE
746	4597.766	5107.246	1140.181	FE
747	4568.470	5115.023	1140.290	FE
748	4542.617	5122.579	1140.343	FE
749	4510.270	5131.719	1140.663	FE
750	4481.685	5141.160	1140.848	FE
751	4450.109	5151.938	1141.042	FE
752	4419.954	5160.286	1140.798	FE
753	4390.467	5171.300	1140.770	FE
754	4364.824	5186.390	1140.636	FE
755	4354.902	5207.101	1140.844	FE
756	4352.225	5233.426	1140.789	FE
757	4349.736	5274.794	1140.873	FE
758	4344.020	5303.762	1140.889	FE
759	4387.505	5225.944	1140.820	G
760	4442.620	5206.212	1141.338	G
761	4472.983	5197.189	1141.344	G
762	4513.620	5185.460	1141.080	G
763	4552.839	5174.466	1140.660	G
764	4585.517	5164.745	1140.312	G
765	4617.952	5153.959	1140.081	G
766	4655.752	5139.804	1139.883	G
767	4695.108	5120.647	1139.360	G
768	4725.523	5103.808	1138.990	G
769	4753.310	5084.554	1139.292	G
770	4790.247	5055.468	1138.909	G
771	4820.231	5027.915	1139.867	G
772	4846.357	4999.352	1140.119	G
773	4873.876	4971.011	1140.259	G
774	4911.114	4930.481	1140.948	G
775	4937.197	4898.324	1141.043	G
776	4967.308	4866.257	1141.102	G
777	5003.893	4815.238	1141.188	G
778	5012.424	4883.448	1140.901	G
779	5009.285	4960.119	1140.643	G
780	4861.966	4830.607	1141.790	TS
781	4822.452	4515.719	1140.143	RB
782	4845.009	4529.493	1128.216	RB
783	4805.282	4529.402	1140.444	RB
784	4858.706	4534.220	1122.573	RB

Point	Northing	Easting	Elevation	Description
785	4851.372	4560.430	1118.309	RB
786	4837.009	4552.695	1123.320	RB
787	4830.291	4548.013	1124.807	RB
788	4819.468	4562.780	1126.150	RB
789	4827.457	4566.939	1125.011	RB
790	4838.277	4574.484	1119.791	RB
791	4829.648	4594.498	1120.678	RB
792	4818.516	4589.512	1125.707	BKF
793	4796.023	4572.443	1136.598	RB
794	4805.745	4581.153	1127.147	RB
795	4796.630	4600.580	1128.443	RB
796	4808.241	4605.037	1126.497	RB
797	4800.105	4563.270	1135.166	RB
798	4815.975	4609.299	1123.430	RB
799	4812.609	4550.200	1134.251	RB
800	4808.183	4628.153	1122.210	RB
801	4821.899	4543.942	1132.965	RB
802	4802.535	4624.922	1125.403	RB
803	4793.907	4622.016	1127.727	RB
804	4787.665	4564.507	1140.524	RB
805	4802.785	4646.781	1119.117	RB
806	4786.174	4577.973	1140.461	RB
807	4793.132	4641.212	1125.437	RB
808	4782.735	4598.893	1140.609	RB
809	4782.077	4638.341	1128.416	RB
810	4782.740	4617.397	1135.760	RB
811	4789.249	4671.857	1119.839	RB
812	4776.619	4668.176	1126.684	RB
813	4769.849	4665.272	1128.586	RB
814	4783.379	4626.954	1134.954	RB
815	4756.651	4655.051	1134.820	RB
816	4768.170	4640.427	1135.104	RB
817	4742.671	4658.052	1135.418	RB
818	4755.178	4674.091	1132.659	RB
819	4760.169	4632.799	1140.424	RB
820	4762.231	4682.066	1129.720	RB
821	4752.272	4644.319	1139.894	RB
822	4767.659	4685.485	1125.331	RB
823	4778.490	4693.333	1118.576	RB
824	4733.062	4649.340	1140.446	RB
825	4763.318	4713.266	1119.863	RB
826	4720.071	4673.221	1139.913	RB
827	4758.397	4709.443	1120.932	RB
828	4713.470	4685.405	1139.826	RB
829	4743.229	4700.925	1131.909	RB
830	4727.985	4693.768	1132.391	RB

Point	Northing	Easting	Elevation	Description
831	4737.576	4699.678	1133.406	RB
832	4713.576	4703.862	1134.414	RB
833	4723.364	4711.576	1131.652	RB
834	4710.130	4714.121	1134.070	RB
835	4730.461	4719.398	1129.240	RB
836	4739.773	4727.952	1123.646	RB
837	4744.656	4732.490	1120.280	RB
838	4701.350	4705.613	1139.053	RB
839	4748.386	4736.128	1118.916	RB
840	4706.532	4695.170	1139.481	RB
841	4730.567	4751.852	1119.779	RB
842	4724.267	4744.701	1123.146	RB
843	4693.962	4717.995	1138.977	RB
844	4718.028	4739.982	1125.823	RB
845	4713.502	4736.185	1128.521	RB
846	4698.131	4735.617	1134.038	RB
847	4714.269	4770.415	1119.945	RB
848	4692.152	4745.528	1132.407	RB
849	4707.198	4760.870	1124.209	RB
850	4684.030	4754.092	1131.440	RB
851	4698.555	4755.780	1127.212	RB
852	4682.144	4736.186	1135.599	RB
853	4688.364	4792.463	1118.412	RB
854	4672.572	4744.238	1135.149	RB
855	4681.922	4786.678	1121.364	RB
856	4674.542	4725.255	1138.055	RB
857	4671.969	4775.711	1128.066	RB
858	4664.708	4745.085	1138.175	RB
859	4664.923	4769.401	1132.091	RB
860	4648.205	4776.449	1131.031	RB
861	4645.800	4730.919	1138.812	RB
862	4655.834	4785.536	1128.471	RB
863	4654.757	4711.775	1139.950	RB
864	4664.524	4795.045	1123.730	RB
865	4669.503	4677.109	1140.129	RB
866	4666.299	4798.413	1120.725	RB
867	4696.848	4659.934	1140.038	RB
868	4668.230	4802.271	1119.605	RB
869	4646.324	4815.820	1120.053	RB
870	4634.836	4729.922	1139.259	RB
871	4639.966	4807.234	1124.488	RB
872	4659.023	4759.132	1137.902	RB
873	4633.593	4800.207	1127.724	RB
874	4627.947	4756.981	1138.343	RB
875	4628.314	4792.244	1131.380	RB
876	4636.284	4775.010	1137.322	RB

Point	Northing	Easting	Elevation	Description
877	4611.696	4801.058	1131.102	RB
878	4615.742	4788.683	1136.718	RB
879	4617.422	4811.484	1127.627	RB
880	4593.016	4781.115	1137.885	RB
881	4623.572	4820.868	1123.384	RB
882	4597.679	4801.220	1137.136	RB
883	4625.093	4825.483	1120.785	RB
884	4581.774	4812.677	1137.376	RB
885	4576.279	4797.915	1138.339	RB
886	4607.417	4837.086	1121.757	RB
887	4601.920	4822.376	1127.055	RB
888	4594.913	4812.575	1131.253	RB
889	4593.698	4842.038	1121.565	RB
890	4589.650	4835.187	1125.297	RB
891	4582.936	4825.376	1129.525	RB
892	4577.075	4815.439	1136.970	RB
893	4569.900	4804.253	1138.276	RB
894	4545.490	4805.165	1139.573	RB
895	4565.419	4816.447	1138.061	RB
896	4571.708	4830.232	1131.146	RB
897	4576.595	4836.583	1127.312	RB
898	4582.588	4845.654	1122.687	RB
899	4562.776	4860.541	1121.361	RB
900	4558.881	4853.800	1125.367	RB
901	4557.064	4849.528	1128.591	RB
902	4555.822	4839.892	1131.309	RB
903	4552.199	4833.962	1132.129	RB
904	4546.649	4825.522	1138.750	RB
905	4542.672	4807.725	1139.793	RB
906	4515.948	4809.492	1140.246	RB
907	4526.120	4828.382	1138.566	RB
908	4540.154	5038.165	1140.908	TS
909	4524.135	4839.533	1132.081	RB
910	4520.784	4847.319	1131.223	RB
911	4519.931	4854.938	1131.853	RB
912	4528.862	4856.844	1130.208	RB
913	4536.325	4863.621	1127.611	RB
914	4528.864	4873.889	1123.139	RB
915	4520.842	4869.567	1125.041	RB
916	4512.826	4887.431	1121.328	RB
917	4505.830	4880.094	1124.292	RB
918	4494.936	4893.661	1121.566	RB
919	4490.502	4886.414	1124.052	RB
920	4483.109	4884.237	1128.649	RB
921	4482.218	4876.500	1130.301	RB
922	4489.084	4871.481	1130.541	RB

Point	Northing	Easting	Elevation	Description
923	4495.240	4871.155	1130.622	RB
924	4497.324	4877.178	1128.741	RB
925	4491.146	4878.281	1126.488	RB
926	4504.666	4854.257	1130.375	RB
927	4495.885	4842.409	1139.002	RB
928	4488.472	4862.089	1130.919	RB
929	4475.311	4864.834	1131.766	RB
930	4465.730	4871.211	1131.075	RB
931	4454.454	4880.387	1131.106	RB
932	4448.273	4892.556	1129.819	RB
933	4459.333	4890.344	1129.218	RB
934	4472.145	4884.380	1129.645	RB
935	4446.727	4875.680	1134.456	RB
936	4437.368	4868.275	1139.121	RB
937	4448.880	4861.058	1139.460	RB
938	4462.209	4859.587	1139.524	RB
939	4476.967	4847.953	1139.494	RB
940	4492.569	4843.224	1138.915	RB
941	4487.309	4821.244	1139.974	RB
942	4434.303	4853.336	1140.119	RB
943	4474.824	4890.544	1125.465	RB
944	4478.219	4899.939	1122.047	RB
945	4443.430	4837.395	1140.406	RB
946	4464.037	4908.194	1120.584	RB
947	4456.998	4832.586	1140.077	RB
948	4460.696	4900.883	1123.560	RB
949	4444.707	4905.341	1122.945	RB
950	4438.423	4884.771	1134.033	RB
951	4449.137	4918.380	1118.143	RB
952	4432.263	4892.224	1132.639	RB
953	4436.927	4908.117	1123.143	RB
954	4429.735	4885.804	1134.315	RB
955	4434.492	4904.605	1127.415	RB
956	4420.831	4893.148	1133.219	RB
957	4440.297	4921.510	1118.419	RB
958	4418.870	4876.334	1138.693	RB
959	4428.130	4925.042	1119.021	RB
960	4411.445	4868.509	1139.257	RB
961	4424.418	4913.131	1123.230	RB
962	4424.892	4905.544	1125.975	RB
963	4407.644	4885.862	1136.430	RB
964	4426.554	4900.389	1130.118	RB
965	4396.667	4877.171	1138.963	RB
966	4416.174	4893.293	1133.245	RB
967	4387.714	4861.248	1139.815	RB
968	4415.872	4900.725	1127.501	RB

Point	Northing	Easting	Elevation	Description
969	4410.061	4904.690	1127.058	RB
970	4370.436	4873.376	1138.972	RB
971	4421.448	4914.126	1123.490	RB
972	4410.429	4917.972	1124.146	RB
973	4388.676	4885.639	1136.679	RB
974	4429.319	4924.090	1119.363	RB
975	4390.305	4892.540	1133.499	RB
976	4414.535	4924.459	1121.355	RB
977	4377.864	4894.799	1135.440	RB
978	4407.889	4896.361	1132.322	RB
979	4373.151	4888.415	1138.080	RB
980	4403.570	4903.663	1130.308	RB
981	4367.489	4871.705	1139.106	RB
982	4401.786	4911.779	1128.757	RB
983	4352.555	4896.776	1137.887	RB
984	4389.845	4913.676	1129.601	RB
985	4386.264	4904.781	1130.708	RB
986	4359.474	4915.393	1130.929	RB
987	4393.263	4923.199	1124.004	RB
988	4352.489	4927.099	1129.366	RB
989	4396.514	4931.881	1121.079	RB
990	4361.504	4926.290	1127.607	RB
991	4378.959	4944.681	1116.665	RB
992	4342.614	4922.794	1130.368	RB
993	4376.586	4935.043	1121.453	RB
994	4337.793	4901.662	1137.973	RB
995	4361.977	4950.076	1116.678	RB
996	4358.523	4942.799	1120.430	RB
997	4318.242	4900.512	1137.360	RB
998	4345.796	4935.027	1124.719	RB
999	4334.279	4933.648	1129.418	RB
1000	4349.072	4945.591	1120.889	RB
1001	4341.110	4923.361	1130.519	RB
1002	4351.879	4955.272	1115.607	RB
1003	4323.445	4931.092	1130.596	RB
1004	4341.545	4959.032	1115.150	RB
1005	4308.822	4939.286	1129.873	RB
1006	4308.656	4943.998	1128.309	RB
1007	4339.607	4946.916	1122.759	RB
1008	4324.714	4949.041	1122.544	RB
1009	4311.169	4915.968	1132.304	RB
1010	4326.403	4958.764	1116.982	RB
1011	4294.349	4908.793	1137.454	RB
1012	4314.504	4963.452	1116.182	RB
1013	4272.750	4915.226	1136.925	RB
1014	4312.593	4953.961	1122.457	RB

Point	Northing	Easting	Elevation	Description
1015	4307.481	4951.537	1123.060	RB
1016	4301.969	4947.103	1124.607	RB
1017	4278.186	4926.739	1131.254	RB
1018	4303.249	4958.174	1120.933	RB
1019	4292.811	4945.897	1127.907	RB
1020	4304.362	4966.081	1116.227	RB
1021	4299.828	4938.419	1129.739	RB
1022	4292.130	4968.810	1116.935	RB
1023	4297.145	4921.443	1130.415	RB
1024	4288.917	4961.312	1120.697	RB
1025	4276.207	4963.425	1121.927	RB
1026	4308.443	4938.965	1129.921	RB
1027	4277.063	4971.475	1117.046	RB
1028	4304.279	4914.996	1131.710	RB
1029	4263.777	4974.723	1117.510	RB
1030	4277.188	4926.330	1131.483	RB
1031	4263.496	4966.478	1122.894	RB
1032	4283.198	4951.591	1127.461	RB
1033	4250.066	4968.690	1122.346	RB
1034	4249.946	4977.528	1119.135	RB
1035	4265.440	4954.422	1127.975	RB
1036	4241.323	4975.303	1121.855	RB
1037	4255.325	4946.463	1129.670	RB
1038	4230.041	4983.280	1118.773	RB
1039	4247.595	4954.449	1129.476	RB
1040	4228.049	4977.009	1123.096	RB
1041	4246.638	4943.682	1130.665	RB
1042	4237.832	4968.922	1127.236	RB
1043	4231.405	4947.797	1130.992	RB
1044	4222.582	4967.452	1127.517	RB
1045	4228.059	4938.544	1135.518	RB
1046	4212.123	4976.156	1126.163	RB
1047	4217.594	4946.448	1135.033	RB
1048	4208.851	4965.716	1128.146	RB
1049	4209.954	4927.991	1137.460	RB
1050	4218.749	4956.909	1129.801	RB
1051	4204.931	4956.453	1134.548	RB
1052	4205.322	4980.210	1124.970	RB
1053	4194.626	4935.648	1136.820	RB
1054	4201.276	4966.801	1128.387	RB
1055	4175.599	4946.733	1136.319	RB
1056	4216.150	4982.909	1120.637	RB
1057	4174.814	4954.143	1135.629	RB
1058	4203.638	4988.662	1118.663	RB
1059	4162.063	4956.550	1135.915	RB
1060	4197.426	4989.055	1119.422	RB

Point	Northing	Easting	Elevation	Description
1061	4144.918	4954.753	1136.761	RB
1062	4186.878	4994.490	1119.097	RB
1063	4185.430	4960.433	1131.846	RB
1064	4188.503	4982.335	1123.056	RB
1065	4184.380	4967.403	1130.069	RB
1066	4183.563	4976.203	1124.584	RB
1067	4189.954	4974.336	1127.702	RB
1068	4168.200	4977.012	1124.219	RB
1069	4171.699	4969.263	1129.621	RB
1070	4171.015	4986.776	1122.090	RB
1071	4170.190	4963.770	1130.795	RB
1072	4178.472	4998.525	1118.620	RB
1073	4160.239	4957.755	1136.095	RB
1074	4163.377	5001.071	1119.853	RB
1075	4158.538	4989.445	1122.384	RB
1076	4141.651	4954.275	1136.931	RB
1077	4148.838	4997.541	1123.156	RB
1078	4150.481	5005.127	1120.208	RB
1079	4133.310	5012.120	1119.606	RB
1080	4126.228	5001.190	1124.959	RB
1081	4104.260	4991.749	1130.535	RB
1082	4114.421	5013.821	1124.716	RB
1083	4121.806	4986.929	1129.396	RB
1084	4106.471	5003.501	1126.598	RB
1085	4134.052	4992.790	1126.890	RB
1086	4103.588	5025.448	1121.159	RB
1087	4133.454	4980.934	1130.619	RB
1088	4098.770	5015.341	1126.574	RB
1089	4144.037	4987.584	1127.233	RB
1090	4090.823	5003.862	1128.602	RB
1091	4148.814	4982.999	1128.220	RB
1092	4085.186	4993.162	1131.959	RB
1093	4143.281	4975.698	1130.984	RB
1094	4064.969	5003.359	1130.675	RB
1095	4074.628	5013.402	1129.615	RB
1096	4155.929	4974.085	1129.451	RB
1097	4080.115	5018.456	1127.567	RB
1098	4086.594	5025.966	1125.110	RB
1099	4070.270	5033.400	1126.863	RB
1100	4069.472	4971.918	1139.156	RB
1101	4056.987	4987.627	1139.462	RB
1102	4066.406	5019.053	1129.181	RB
1103	4068.481	4994.821	1132.029	RB
1104	4059.371	5002.281	1131.625	RB

Cottonwood River C104 Soil Moving Summary

CADD Surface Cut/Fill Summary

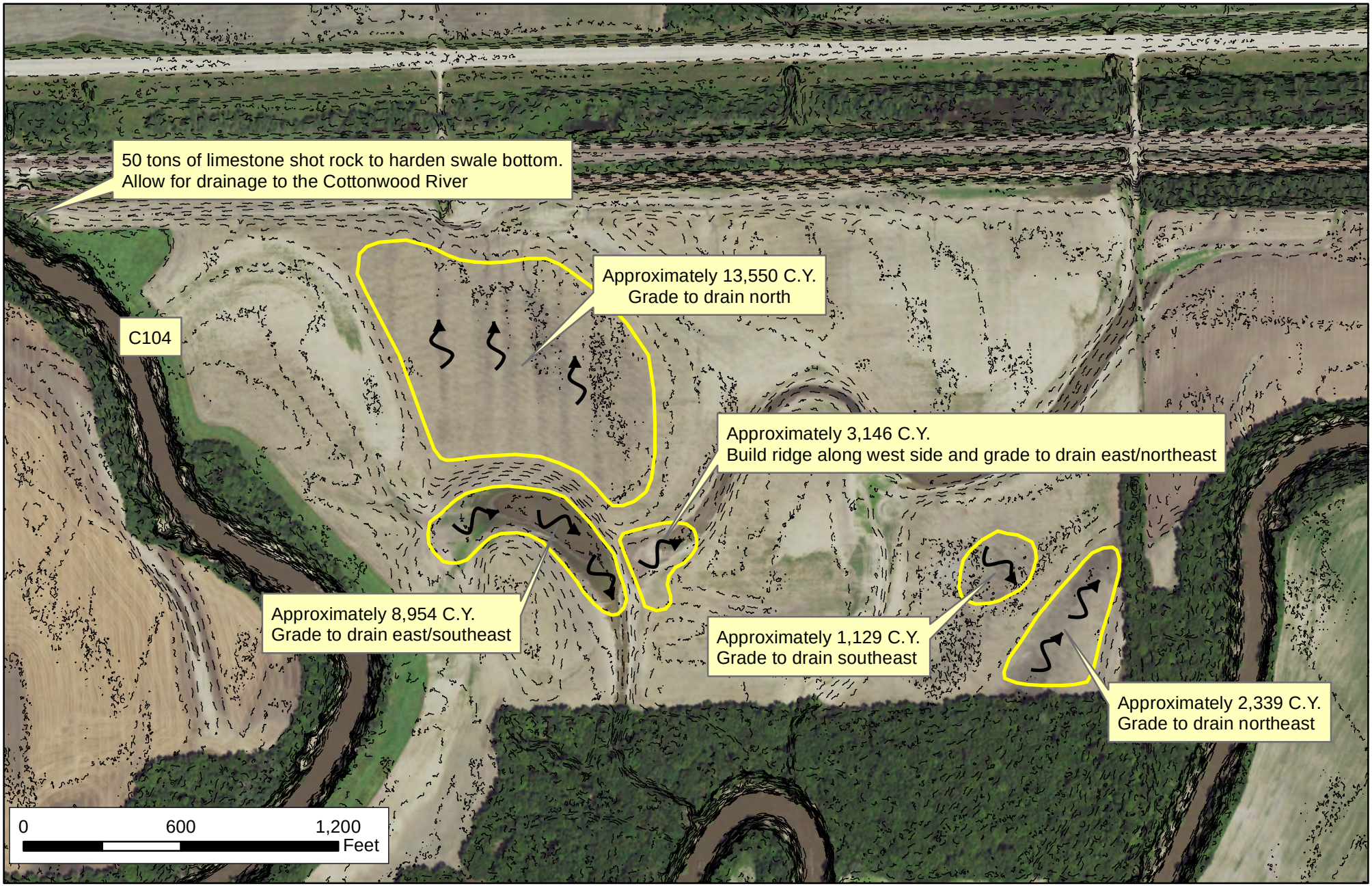
Volume Summary							
Name	**Type**	**Cut Factor**	**Fill Factor**	**2d Area** (Sq. Ft.)	**Cut** (Cu. Yd.)	**Fill** (Cu. Yd.)	**Net** (Cu. Yd.)
Surface1	full	1.00	1.00	95730.81	26817.20	271.45	26545.75<Cut>

Totals				
	2d Area (Sq. Ft.)	**Cut** (Cu. Yd.)	**Fill** (Cu. Yd.)	**Net** (Cu. Yd.)
Total	95730.81	26817.20	271.45	26545.75<Cut>

* Value adjusted by cut or fill factor other than 1.0

C104 Soil Moving Summary (cubic yards)

CADD streambank soil moving volume		26,818
LPSTP soil moving volume		1,689
Stream Barb soil moving summary		271
Rock Vane Key soil moving Summary		678
	Total	**33,104**



THE WATERSHED INSTITUTE

Soil Placement Map

Cottonwood River Site C104
Lyon County, Kansas

N
W E
S

Date: July 2020

Source: http://www.kansasgis.org/

U.S. Army Corps of Engineers (USACE)

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT

33 CFR 325. The proponent agency is CECW-CO-R.

Form Approved - OMB No. 0710-0003 Expires: 01-08-2018

The public reporting burden for this collection of information, OMB Control Number 0710-0003, is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR APPLICATION TO THE ABOVE EMAIL.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: http://dpcld.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	8. AUTHORIZED AGENT'S NAME AND TITLE (agent is not required)
First - Gene Middle - Last - Eidman	First - Brock Middle - Last - Emmert
Company -	Company - Watershed Institute, Inc.
E-mail Address -	E-mail Address - brock@watershedinstitute.biz
6. APPLICANT'S ADDRESS:	**9. AGENT'S ADDRESS:**
Address- 2650 215th Road	Address- 1200 SW Executive Dr.
City - Emporia State - KS Zip - 66801 Country - U.S.	City - Topeka State - KS Zip - 66615 Country - U.S.
7. APPLICANT'S PHONE NOs. w/AREA CODE	**10. AGENTS PHONE NOs. w/AREA CODE**
a. Residence b. Business c. Fax	a. Residence b. Business c. Fax
620-344-2115	785-213-3515

STATEMENT OF AUTHORIZATION

11. I hereby authorize, Brock Emmert to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

SIGNATURE OF APPLICANT — DATE: 2018-12-11

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)
Cottonwood River C104

13. NAME OF WATERBODY, IF KNOWN (if applicable)	14. PROJECT STREET ADDRESS (if applicable)
Cottonwood River	Address
15. LOCATION OF PROJECT	City - State- Zip-
Latitude: ◦N 38.403906 Longitude: ◦W 96.3496	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

State Tax Parcel ID Municipality

Section - 18 Township - 19S Range - 10E

17. DIRECTIONS TO THE SITE

From I-35 in Emporia, travel west 6.8 miles on US 50 Highway, turn left and travel south on County Road A for 0.1 miles. turn left to go east after the second set of railroad tracks. Arrive on site in 0.2 miles.

18. Nature of Activity (Description of project, include all features)

Streambank stabilization and riparian restoration

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

Streambank stabilization and riparian restoration.

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

Streambank stabilization and restoration.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards
1,439 C.Y. Limestone shot Rock		

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres 0.4

or

Linear Feet 1,111 of Cottonwood River

23. Description of Avoidance, Minimization, and Compensation (see instructions)

The project is targeted to reduce streambank erosion and reservoir sedimentation. This reach of Cottonwood River is pool, riffle, and run habitat with water depths ranging from 1- to 8-feet. Rock vanes are sized based on channel geomorphology and will have minimal impacts to aquatic habitats.

24. Is Any Portion of the Work Already Complete? ☐ Yes ☒ No IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list).

a. Address-

City - State - Zip -

b. Address-

City - State - Zip -

c. Address-

City - State - Zip -

d. Address-

City - State - Zip -

e. Address-

City - State - Zip -

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
DWR	Stream Obstruction				
KDHE	NOI				
KDWPT	Action Permit				

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT | DATE | SIGNATURE OF AGENT | DATE

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

Application for Permit

K.S.A. 82a-301-305a Dams, Stream Obstructions and Channel Changes
K.S.A. 24-126 Levees and Floodplain Fills

Use this form to apply for a Division of Water Resources permit to construct or modify a dam, stream obstruction, channel change, levee or floodplain fill. Refer to K.A.R. 5-40 through 5-46 for requirements and definitions.
Send the completed application, worksheet (if applicable), required fees and plans and other materials listed in K.A.R. 5-40-1 through 5-43-5 or K.A.R 5-45-1 through 5-45-18 to:

Kansas Department of Agriculture
Division of Water Resources – Water Structures
1320 Research Park Drive
Manhattan, KS 66502

Land Owner Information	
Owner Name: Eugene Eidman	Contact name: Eugene Eidman
Mailing Address: 2650 215th Road	
City/State: Emporia, KS	Zip Code: 66801
Telephone: 620-344-2115	Email **(required):**
Is the project or activity located entirely on property owned by the permit applicant? ■ Yes ☐ No If no, attach a document listing the names and mailing addresses for all landowners located within the project.	
Applicant Information (if different than owner)	
Applicant Name:	Title:
Mailing Address:	
City/State:	Zip Code:
Telephone:	Email **(required):**
Designer Information	
Firm/Agency: Watershed Institute, Inc.	
Contact Name: Brock Emmert	Title: Project Manager
Mailing Address: 1200 SW Executive Dr.	
City/State: Topeka, KS	Zip Code: 66615
Telephone: 785-213-3515	Email **(required):** brock@watershedinstitute.biz
Project Location and Description	
County: Lyon	Stream Name: Cottonwood River
Legal: Qtr of the Qtr of the NW Qtr	Section: 18 Township(S): 19 Range(E/W): 10E
Project or site name: Cottonwood River C104	
Project description and purpose:	
Streambank stabilization and riparian restoration along left streambank of Cottonwood River.	
Drainage area above the project: acres	1,740 square miles
Area of disturbance (trees and/or vegetation) 3.7 acres	square miles

For office use only	WSN:		ECA:	
Code	Fee $	TR#	Rcpt Date	Check #

Schedule		
Planned or actual **start** date (start of construction, clearing, excavation or fill)	Fall/Winter 2020	
Planned or actual **completion** date (end of construction, stabilization of site)	Fall/Winter 2020	
Construction, excavation and fill will be halted and the Kansas State Historical Society will be contacted when historical sites or artifacts are encountered.	■ Yes ☐ No	
Project Activities and Fee Determination		
Project Activity (check all that apply)	Permit Fee	
☐ Construct, modify or repair a dam	$200	
☐ Construct, modify or repair a stream obstruction		
☐ Construct or repair a channel change		
■ Excavate or dredge within the banklines of a stream		
Drainage area ≤ 5 square miles ☐	$100	
Drainage area between 5 and 50 square miles ☐	$200	
Drainage area ≥ 50 square miles ■	$500	
	Pre-construction	Post-construction
☐ Construct, modify or repair a class A levee (see K.A.R. 5-45-8 for definition)	$100	$200
☐ Construct, modify or repair a class B levee	$300	$600
☐ Construct, modify or repair a class C levee	$500	$1,000
☐ Place fill in a mapped floodway fringe (Zone AE with defined floodway)	$100	$200
☐ Place fill in a mapped floodplain with no defined floodway (e.g. Zone A, AE, AH, AO)	$300	$600
☐ Place fill in an unmapped floodplain (see K.A.R. 5-45-1(i))	$300	$600
☐ Place fill in a mapped floodway (Zone AE floodway)	$500	$1,000
☐ This project qualifies for a General Permit (attach worksheet DWR 2-190) (pipeline/cable crossing, or bridge/culvert replacement)	$100	
The total permit fee required will be the general permit fee if applicable, OR the highest individual fee for the project activities checked above. Make checks payable to **Kansas Department of Agriculture**	Amount enclosed:	

Signature	
Application is hereby made for written consent or permit of the Chief Engineer, Division of Water Resources, for the project described above. By signing below, I certify that the information contained in this application is true, correct and complete, and that I am the owner or I am authorized by the owner to make this application for permit.	
Signature:	Name (print or type):
	Date:

NOTICE OF INTENT (NOI)

For Authorization to Discharge Stormwater Runoff from Construction Activities
In accordance with the Kansas Water Pollution Control General Permit
Under the National Pollutant Discharge Elimination System (NPDES)

Submission of this Notice of Intent constitutes notice that the party identified in Section I of this form requests authorization for coverage under the Kansas Water Pollution Control general permit, or KDHE issued successor permits, issued for stormwater runoff from construction activities in the State of Kansas. Becoming a permittee obligates the discharger to comply with the terms and conditions of the general permit. **Completion of this NOI does not provide automatic coverage under the general permit. Coverage is provided and discharge permitted when the Kansas Department of Health and Environment (KDHE) authorizes the discharge of stormwater runoff from the construction activities identified on the NOI and supporting documentation. A signed and dated copy of the first page of the NOI indicating the Authorization will be provided to the owner or operator, or all three pages for Conditional Authorizations.** Upon authorization of the construction activity discharge, a Kansas permit number and a Federal permit number will be assigned to the construction project. **A complete request for Authorization for coverage under the general permit must be submitted or the request will not be processed (see listing on Page 3 of this NOI).** KDHE will notify owners or operators whose Notice of Intent (NOI) and supporting documentation for Authorization of stormwater runoff associated with construction activities are incomplete, deficient, or denied.
Please Print or Type.

I. OWNER OR OPERATOR ADDRESS, BILLING, CONTACT & RECORDS LOCATION INFORMATION

A. Owner or Operator's Name: Gene Eidman
Company Name:
Owner or Operator's Phone:
Mailing Address: 2650 215th Road
City: Emporia State: KS Zip: 66801

B. Billing Contact Name:
Billing Contact Address (if different):
City: State: Zip:

C. Contact Name: Brock Emmert
Company Name: Watershed Institute, Inc.
Contact Phone: 785-213-3515
Mailing Address:
City: Topeka State: KS Zip: 66615
E-mail Address (optional): brock@watershedinstitute.biz

D. Address where records will be kept (if not on-site):
Records Address: 1200 SW Executive Dr.
City: Topeka State: KS Zip: 66615

II. SITE INFORMATION

A. Project Name: Cottonwood River C104 Project
Site Address:
City: Emporia State: KS Zip: 66801
(Nearest City to Project)
County: Lyon

B. LEGAL SITE DESCRIPTION:
_____ QTR of _____ QTR of NW QTR Section: 18
Township: 19 South; Range: 10E ■ E ☐ W
Latitude: 38 24 14.95, Longitude: -96 21 00.21
Deg. Min. Sec. Deg. Min. Sec.

For Official Use Only:

Received	Amount Paid:	Authorized: ☐ Y; ☐ N
	Date:	Is Authorization Conditional? ☐ Y; ☐ N (if yes, see page 3 of NOI for conditions)
	Initials:	
	Check No.:	
Secretary, Kansas Department of Health and Environment		Reviewer Date

KS Permit No.: Federal Permit No.:

Send completed 3 page NOI form with original signature and all appropriate submittals (see page 3 of NOI) to:

Kansas Department of Health and Environment
Bureau of Water, Industrial Programs Section
1000 SW Jackson, Suite 420
Topeka, KS 66612-1367

Note: A copy of the permit can be obtained at: www.kdheks.gov/stormwater or by submitting a written request to KDHE.

KDHE Contact Information:
Phone: (785) 296-5545
E-mail: stormwater@kdheks.gov

C. EXISTING CONDITIONS/USES

1) Is any part of the project located on Indian Country land? ☐ Y; ■ N
If yes: Contact EPA regarding discharging stormwater runoff from industrial activities on Indian Country land.

2) If stormwater runoff drains to or through a Municipal Separate Storm Sewer System (MS4): MS4 Name: _____

3) Name of the first receiving water, stream, or lake: Cottonwood River, River Basin: Cottonwood

4) Are contaminated soils present on the site or is there groundwater contamination located within the site boundary? ☐ Y; ■ N
If yes: On separate paper please explain in detail the locations, contaminants and concentrations.

5) Are there any contaminated soils that will be disturbed or any contaminated groundwater that will be pumped by the proposed construction activity? ☐ Y; ■ N
If yes: On separate paper provide a description of the special erosion and sediment control measures to be utilized.

6) Are there any surface water intakes for public drinking water supplies located within ½ mile of the site discharge points? ☐ Y; ■ N

7) Are there any known historical or archeological sites present within the site boundary or any historic structures located within 1000 feet of the project site? ☐ Y; ■ N
Note: Include documentation of project-specific coordination with the Kansas Historical Society in making this determination.

8) Is any threatened or endangered species habitat located within the site boundary or in the receiving water body? ■ Y; ☐ N
Note: Include documentation of project-specific coordination with the Kansas Department of Wildlife, Parks & Tourism in making this determination.

9) Will the project impact the line or grade of a stream or does it include dredge or fill of a potential jurisdictional water body or wetlands? ■ Y; ☐ N
If yes: Include documentation of project-specific coordination with the US Army Corps of Engineers and/or the Kansas Department of Agriculture, Division of Water Resources in making this determination.

10) Are any Critical Water Quality Management Areas, Special Aquatic Life Use Waters, or Outstanding National Resource Waters located within ½ mile of the facility boundary? ■ Y; ☐ N
If yes, list the names of all such areas and waters: Cottonwood River, Lyon County

D. PROJECT DESCRIPTION

1) Project Description: Streambank stabilization along 1,111-feet of the Cottonwood River. Activities include installing rock vanes, LPSTP, and stream barbs as well as streambank grading.

2) Does this NOI include all proposed soil disturbing activities associated with the entire common plan of development? ■ Y; ☐ N
If no, explain what development areas of the site are not included in this NOI and provide contact information, if available, for the party or parties that own or have operational control of these areas:

_____

_____

3) Anticipated project Start Date: Fall/Winter 2020, and Completion Date: Fall/Winter 2020

4) Estimated total area to be disturbed: 3.7 Acres Total area of the site: 3.7 Acres

5) Do you plan to disturb ten or more acres that are within a common drainage area? ☐ Y; ■ N
If yes, will a sedimentation basin be installed in that drainage area? (Attach design calculations for each sedimentation basin.) If a sediment basin is not feasible, on a separate sheet explain what similarly effective erosion and sediment control measures will be implemented in lieu of a sedimentation basin. ☐ Y; ☐ N

E. Maps

Include an area map showing the outline of the construction site and the general topographic features of the area at least one mile beyond the project site boundary.

F. EROSION CONTROL PLAN AND BEST MANAGEMENT PRACTICES

1) Provide a site plan showing the existing contour, proposed contour, the erosion control measures and the locations of stormwater management or pollution control features including BMPs. Incorporate details and notes as necessary to describe the erosion control plans and BMPs.

2) Provide a description of the best management practices which will be utilized to control erosion, sedimentation and other pollutants in stormwater runoff during construction.

3) Provide a summary of the sequence of major soil disturbing activities and the corresponding erosion control measures or BMPs.

4) Provide the name and License or Certification Number of the engineer, geologist, architect, landscape architect, or Certified Professional in Erosion and Sediment Control (CPESC) under which the construction stormwater pollution prevention plan has been developed.

John Browning	10599	Engineer
Name	License or Certification Number	Profession or Field (Engineer, Architect, etc.)

III. ANNUAL FEE

Enclose a check for the first year of the annual permit fee specified in K.A.R. 28-16-56 et seq. as amended. Make the check payable to "KDHE". Per K.A.R. 28-16-56, as amended, the current annual permit fee for this general permit is $60. An invoice for the annual permit fee will be sent to the contact person requesting a permit until such time as the permittee submits a Notice of Termination (NOT).

Failure to pay the annual fee will result in termination of the construction stormwater discharge Authorization.

IV. OWNER OR OPERATOR CERTIFICATIONS

I, the undersigned, certify that a Stormwater Pollution Prevention Plan (SWP2 Plan) will be or has been developed for the construction site described in this NOI and supporting documentation. I further certify that the plan will be implemented at the time construction begins, and, as required by the NPDES general permit for Stormwater Runoff from Construction Activity, will revise the SWP2 plan if necessary.

I understand that continued coverage under the NPDES general permit for Stormwater Runoff from Construction Activities is contingent upon maintaining eligibility as provided for in the requirements and conditions of the general permit, and paying the annual fee.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

_____ _____

Signature (owner or operator) **Date**

_____

Name and Official Title (Please print or type. **Form with original signature must be sent to KDHE.**)

Conditions of Authorization - For Official Use Only:

When indicated, Conditions of Authorization are as follows:

_____

_____

_____

_____

_____

_____

_____

A complete request for Authorization for coverage under the general permit must be submitted or the request will not be processed. A complete request for Authorization includes:

- **An NOI form (construction stormwater) with an original authorized signature;**
- **The annual permit fee for the first year; ($60.)**
- **An area map showing the outline of the construction site and the general topographic features of the area at least one mile beyond the project site boundary;**
- **A detailed site plan showing the existing contours, proposed contours, erosion and sediment control features, locations where stormwater runoff leaves the construction site;**
- **A narrative summary of the additional erosion and sediment control and other best management practices that will be utilized to prevent or reduce contamination of stormwater runoff from the construction activities;**
- **Total drainage area, storage capacity and design calculations for each sedimentation basin; and**
- **Copies of letters or e-mails documenting coordination with appropriate local, state or federal agencies.**

COTTONWOOD RIVER C104
STREAMBANK STABILIZATION PROJECT

STORM WATER POLLUTION PREVENTION PLAN FOR
STORM WATER DISCHARGES ASSOCIATED WITH
CONSTRUCTION ACTIVITY

January 2020

Certification Statement

"I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Signed: _____
Brock Emmert, Project Manager
Watershed Institute, Inc.

Date: _____

RECORD OF PLAN AMENDMENTS

Amendment Number	Amendment Date	Authorized By/Title	Description

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1.0 Purpose of Plan

The purpose of this Storm Water Pollution Prevention Plan (Plan) is to demonstrate compliance with the requirements of the National Pollutant Discharge Elimination System (NPDES) in consideration for issuance of a General Permit for storm water discharges associated with construction activity. The General Permit requires the preparation and implementation of such a plan to prevent, as much as practicable, the release of pollutants in storm water runoff from the construction site to waters of the United States.

This Plan provides information concerning the Cottonwood River C104 Streambank Stabilization Project. Stabilization activities include streambank reshaping, construction of rock vanes, stream barbs, longitudinal peaked stone toe protection (LPSTP), and riparian buffer restoration along the Cottonwood River. Administrative requirements and potential storm water and non-storm water pollutant sources are identified. Best management practices to prevent the discharge of non-storm water materials in storm water runoff are also described.

The project site is 1,111 feet in length, along an outside meander bend of the Cottonwood River, Lyon County, Kansas. The project is in Northwest ¼ of Section 18, T19S, R10E and all activity is confined to the left descending bank. The adjacent landuse is hayed pasture and row crop agriculture.

2.0 Site Evaluation

The following sections describe existing conditions at the site.

Topography and Drainage

The project site is a 29.3-foot high streambank along the left descending bank of the Cottonwood River. Storm drainage is difficult to define throughout most of the project area due to the flat topography of the Cottonwood River floodplain. Most of this runoff is captured before the project site and little to no overland flow reaches the streambank.

Soils

The U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) web soil survey map (NRCS 2020) identifies soils within the proposed construction limits as Chase silty clay loam, occasionally flooded and Ivan silt loam, occasionally flooded. Chase silty clay loam, occasionally flooded soils are typically located on floodplain steps and consist of somewhat poorly drained alluvium. Ivan silt loam, occasionally flooded soils are well drained and found on floodplains.

Climate

The climate of Lyon County is sub-humid with an average rainfall of 36.7-inches, conditions typical of the Flint Hills ecoregion (Chapman e al. 2000). Climate patterns are characterized by wide daily and annual temperature ranges. Precipitation is heaviest in the spring and early summer with approximately 70% of the annual rainfall occurring during the growing season. The prevailing winds are southerly.

Hydrology

The project lies within hydrologic unit 11070203 – the Lower Cottonwood Basin. The Cottonwood River enters the project site from the north and bends towards the south creating excessive erosion on the left streambank. Little overland flow runoff reaches the project site as the adjacent field topography is flat.

Sediments

At the project site, sediments are contributed to the Cottonwood River from streambank erosion.

3.0 Site Construction Plan

The following sections describe the proposed site construction plan.

Construction Activities

The proposed project will stabilize the left descending bank to reduce streambank sedimentation of the Cottonwood River. Streambank grading will require earthwork to provide stabilization. Soil disturbing activities will include: grubbing, rough grading, bank shaping, filling, and final grading. After construction, the contractor will seed a cover crop and grass mix at critical area seeding rates. Native grass seeding and mulching will also be done during recommended seeding dates. For slopes greater than 2.5:1, turf reinforced matting (TRM) or hydro-mulching will be used for extra erosion control following construction. There will be two rows of sycamore planted on the slope. The stock will be bare root seedlings and planted the first spring following construction. Tree planting will also follow design guidelines. Long-term protection will accrue through re-vegetation of the streambank with native trees. There are no off-site borrow or stockpile areas needed for this project. A record of the site construction activities, to be maintained as part of this Plan, is provided in Appendix A.

4.0 Storm Water Management Plan

This storm water management system was designed following EPA guidelines. Control of site runoff will be the main means of storm water management. Storm water controls will be installed prior to construction.

General Description of Storm Water Management System

The potential for storm water runoff pollution will be present during project construction. This risk will be minimized through the use of several control measures implemented during the construction sequence.

The storm water management system was designed in accordance with the EPA's guidance document entitled *Storm Water Management for Construction Activities - Developing Pollution Prevention Plans And Best Management Practices* (EPA 832-R-92-005, September 1992). Detention is the main means of storm water management. **It will be the responsibility of the Construction Manager to revise the Erosion and Sediment Control plan sheets, if the location or types of control measures indicated are changed in the field. These documents will supersede the figures shown in this plan.**

Peak Flows

This project will not impact peak flows for existing and future developed conditions for the watershed. All facilities will convey the future developed condition flows.

Stabilization Practices

Temporary and permanent stabilization methods will be used within the project area. Major practices include preserving existing vegetation where possible, and disturbing only the area needed to reshape streambanks. Disturbed portions will be stabilized within 14 days after construction activity has temporarily or permanently ceased. For steep slope areas (greater than 2.5:1 slope), disturbed portions will be stabilized within 7 days after construction activity has temporarily or permanently ceased. Stabilization practices include temporary seeding and mulching, hydro seeding and mulching, permanent vegetation—native trees and shrubs—and rock structures to redirect erosive flow.

5.0 Potential Storm Water Pollutant Sources and Control Measures

Pollutants from various sources have the potential to enter the Cottonwood River during project construction. A description of these potential pollutants and control measures to reduce the risk of storm water contamination is provided below.

Construction Dust

Fugitive dust may be generated during dry weather conditions. Dust control will be directed by the Construction Manager and implemented by the Contractor. Water sprays will be used for dust control.

Offsite Sediment Tracking

Access to the project area is by county gravel roads and a dirt private road. Additionally, the project lies in an area dominated by agricultural land use where offsite tracking of mud, dirt, and rock commonly occurs. As the project will be constructed during dry periods, offsite sediment tracking will not increase over current levels.

Petroleum Products

Construction equipment will require diesel fuel and oil on a regular basis. The potential exists for spills or leaks. All onsite vehicles will be monitored for leaks and receive regular preventative maintenance to ensure proper operation and reduce the chance of leaks. No "topping off" of gas tanks will be allowed to reduce the possibility of spills. Vehicle refueling and maintenance will occur in a designated, contained area.

Petroleum products will be stored in clearly labeled and tightly sealed containers or tanks. Any soil contaminated by fuel or oil spills will be removed and disposed of by the Contractor to an approved disposal site.

Sanitary Wastes

Due to the short time frame for construction, sanitary wastes will not be generated.

Hazardous Materials

No hazardous materials will be used or stored onsite.

Fertilizers

No fertilizers will be used or stored onsite.

Paints

No paints will be used or stored onsite.

Waste Materials

All trash and construction waste material will be collected and transferred to an appropriate solid waste storage facility. No construction waste will be buried onsite. No open burning will be allowed. All site personnel will be instructed by the Construction Manager of the proper waste disposal procedures.

Allowable Non-Storm Water Discharges

The following sources of non-storm water discharges may be combined with storm water discharges from project construction activities.

- Waters used to wash vehicles or to control dust
- Uncontaminated dewatering discharges
- Firefighting waters
- Vegetation watering
- Potable or spring water discharges

6.0 Best Management Practices

Petroleum products and other materials will be used and stored at the construction site. Best Management Practices, such as good housekeeping measures, inspections, containment, and spill prevention practices will be used to limit contact between storm water and potential pollutants.

Good Housekeeping

The good housekeeping practices listed below will be followed to reduce the risk of potential pollutants entering storm water discharges. All construction personnel will be responsible for monitoring and maintaining housekeeping tasks, or notifying the appropriate person of a problem.

- Store only enough product required to do the job
- Store all materials in a neat and orderly manner in the appropriate containers and, if possible, under a roof or within an enclosure
- Keep products in the original container with the original manufacturer's label
- Do not mix products unless recommended by the manufacturer.

- Use all of a product before disposing of the container
- Use and dispose of products according to the Construction Manager's direction or manufacturer's recommendations
- Perform regular inspections of the storm water system and the material storage areas
- When and where appropriate, use posters, bulletin boards, or meetings to remind and inform construction personnel of required procedures.

Hazardous Products

Storage areas for fuels must be provided with secondary containment to ensure that spills in these areas do not reach wetlands or waters of the State. Contingencies for the proper disposal of contaminated soils shall be established (use of licensed hauler, approved landfill) early in the construction period.

Spill Prevention and Response

In addition to the housekeeping and hazardous materials storage procedures described above, spill prevention and cleanup practices will be as follows.

- Construction personnel will be informed of the manufacturer's recommended spill cleanup methods, and the location of that information and cleanup supplies.
- Materials and equipment for the cleanup of small spills (<100 gal) will be kept in the materials storage area. These facilities may include brooms, rags, gloves, shovels, goggles, sand, sawdust, plastic or metal trash containers, and protective clothing.
- All containers will be labeled, tightly sealed, and stacked or stored neatly and securely.

Spill response procedures will be as follows.

Step 1: Upon discovery of a spill; stop the source of the spill, if safe.
Step 2: Cease all spill material transfer until the release is stopped and waste removed from the spill site.
Step 3: Initiate containment to prevent spill from reaching State waters.
Step 4: Notify a Supervisor or the Construction Manager of the spill.
Step 5: The Construction Manager will coordinate further cleanup activities.
Step 6: Any significant spill of toxic or hazardous material will be reported to the appropriate state and/or local agencies at the following numbers:

National Response Center 1-800-424-8802
State Contacts:
KDHE 785-296-1679 (Days)
785-296-0614 (Nights/Weekends)
Adjutant General 785-296-3176
Local Contacts:
Lyon County Emergency Management 620-341-3210
Police or Fire Departments 911

Step 7: Review the storm water pollution prevention plan and amend if needed. Record a description of the spill, cause, and cleanup measures taken.

8.0 Inspection, Maintenance and Record Keeping Procedures

Site inspection and facility maintenance are important features of an effective storm water management system. Qualified personnel will inspect disturbed areas of the site not finally stabilized, storage areas exposed to precipitation, all control measures, and site access areas to determine if the control measures and storm water management system is effective in preventing significant impacts to receiving waters.

Erosion and Sediment Controls

The following procedures will be used to maintain erosion and sedimentation controls.

- All control measures will be inspected at least once a week and after any storm event of ½-inch or more.
- All measures will be maintained in good working order; if a repair is necessary, that repair will be initiated within 24-hours of the report.
- Temporary and permanent seeding and planting will be inspected for bare spots, washouts, and healthy growth.
- Inspect riprap and aggregate covered areas for bare spots and washouts.
- The Construction Manager will select individuals to be responsible for inspections, maintenance, repairs, and reporting. The designated inspectors will receive the necessary training from the Construction Manager to properly inspect and maintain the controls in good working order.
- An Inspection Form (Form 1) will be completed after each inspection.
- The completed Inspection Forms will be kept with this Plan in Appendix B.

Non-Storm Water Controls

The following procedures will be used to maintain the non-storm water controls.

- All control measures will be inspected at least once a week and after any storm event of ½-inch or more.
- All measures will be maintained in good working order; if a repair is necessary, that repair will be initiated within 24-hours of the report.
- The Construction Manager will select individuals to be responsible for inspections, maintenance, repairs, and reporting. The designated inspectors will receive the necessary training from the Construction Manager to properly inspect and maintain the controls in good working order.
- An Inspection Form (Form 2) will be completed after each inspection.
- The completed Inspection Forms will be kept with this Plan in Appendix B.

Record Keeping

Two inspection forms are provided on the following pages for recording inspections and maintenance of the control measures: Erosion and Sedimentation Controls (Form 1), and Non-Storm Water Source Controls (Form 2). All disturbed areas and materials storage areas require inspection at least every 7 days and within 24-hours of a ½-inch or more rainfall. After each inspection, the inspector completes an inspection report and inserts that report in Appendix C of this Plan. Any maintenance required is initiated within 24 hours of the inspection.

A fully signed copy of this Plan and any supporting materials must be maintained at the construction site from the date of project initiation to the date of final stabilization. All records and supporting documents will be compiled in an orderly manner, and maintained for a period of three years following final site stabilization.

The generation of reports, as part of the construction process and inspection or amendment procedures, provides accurate records, which can be used to evaluate the effectiveness of this Plan and document compliance. Changes in design or construction of the storm water management system are documented and included with the Plan to facilitate Plan review or evaluation. Four forms have been developed to assist the Construction Manager with record keeping activities.

- Record of Plan Amendments
- Construction Activity Record
- Erosion and Sedimentation Controls Inspection Form
- Non-Storm Water Source Controls Inspection Form

Plan amendments are documented on the form in the front of this Plan and on the drawings. A record of construction activities is maintained in Appendix A of this Plan. Completed inspection and maintenance forms are kept in Appendix B of this Plan.

INSPECTION FORM 1
EROSION AND SEDIMENTATION CONTROLS

Visually inspect disturbed areas of the construction site that have not been finally stabilized. Inspections are to be completed every 7 days and within 24-hours of a rainfall event of ½-inch or more. Maintenance is to be performed within 24-hours of inspection.

Inspector:

Inspection Date:

Date of last rainfall:

Amount of last rainfall: inches

Report on the condition of the erosion and sedimentation controls installed at the construction site. Check for tears in silt barriers, for securely attached fabric to fence posts, and for depth of sediment in front of the silt barriers. The depth of sediment should not exceed one-third of the barrier height. Seeding/planting areas and rip-rap/aggregate areas should be inspected for bare spots and washouts.

Area	Condition of Control	Maintenance Required/Completion Date

Inspector Signature: _____

INSPECTION FORM 2
NON-STORM WATER SOURCE CONTROLS

Visually inspect material storage and construction areas. Inspections are to be completed every 7 days and within 24 hours of a rainfall event of 1/2 inch or more. Maintenance is to be performed within 24 hours of inspection.

Inspector: Inspection Date:

Date of last rainfall:

Amount of last rainfall: _____inches

Construction Dust - Is there excessive dust at the site that requires watering?

Sediment Tracking - Are the County roads mostly free from mud, dirt, or rock?

Petroleum/Chemical Products - Are spill containment structures secured? Product containers securely sealed?

Construction Waste - Are all construction waste materials collected and secured?

Material Storage Areas Exposed to Precipitation - Are materials handled and stored in a manner to prevent leakage and prevent pollutants from entering the storm water system?

Other Non-Storm Water Discharges - Are waters from line flushing, pavement wash down, and dewatering directed to the storm water system prior to discharge?

Maintenance Required Maintenance Completed Date

Inspector Signature: _____

Certification of Compliance

This Storm Water Pollution Prevention Plan reflects best management practices and erosion and sedimentation control measures for storm water management as recommended by the Environmental Protection Agency.

Contractor Certifications

The Contractor Certification forms provided in this section indicate that each contractor working on the project site understands the terms, conditions, and intent of this NPDES General Permit for Storm Water Discharges Associated with Construction Activity and will implement the measures described in this Plan appropriate to his area of work.

CONTRACTOR/SUBCONTRACTOR CERTIFICATION

I certify, under penalty of law, that I understand the terms and conditions of the National Pollutant Discharge Elimination System (NPDES) General Permit that authorizes storm water discharges associated with construction activity from the site identified as part of this certification.

_____ Date

_____ Name/Title

_____ Firm

_____ Address

_____ Phone

_____ Nature of Contracted Service

_____ Construction Area(s)

Project Completion

Construction is considered complete when the site is 70-percent (density) stabilized. The NPDES may be terminated at this time. A Notice of Termination should be submitted to KDHE requesting termination of the General Permit. The Notice of Termination form is included in this section.

References

Chapman, S.S, J.M. Omernik, J.A. Freeouf, D.G. Huggins, J.R. McCauley, C.C. Freeman, G. Steinauer, R. Angelo, and R.L. Schlepp. 2000. Ecoregions of Nebraska and Kansas (color poster with map, descriptive text, summary tables, and photographs). U.S. Geological Survey (USGS). Reston, Virginia.

U.S. Department of Agriculture Natural Resource Conservation Service (USDA NRCS) 2020. Web Soil survey. Accessed on-line at: http://websoilsurvey.nrcs.usda.gov/app/. August.

U.S. Environmental Protection Agency. 1992. Storm Water Management for Construction Activities - Developing Pollution Prevention Plans and Best Management Practices (EPA 832-R-92-005). September.

APPENDIX A

CONSTRUCTION ACTIVITY RECORD

CONSTRUCTION ACTIVITY RECORD

An accurate and up-to-date record of construction activity must be maintained as a part of this Plan. Record the information below on an ongoing basis.

- Dates when major soil disturbing activities occur.
- Dates when construction activities temporarily cease on a portion of the site.
- Dates when construction activities permanently cease on a portion of the site.
- Dates when stabilization measures are initiated.

Date	Activity
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

APPENDIX B

COMPLETED INSPECTION FORMS

LYON COUNTY
FLOODPLAIN DEVELOPMENT
PERMIT/APPLICATION

430 Commercial Street, Emporia, KS 66801 620-341-3471

Community Name: _____ Date Received: _____ Application# _____

Owner/Developer: Gene Eidman Builder/Contractor: Watershed Institute, Inc.

Address: 2650 215th Road Emporia, KS 66801 Address: 1200 SW Executive Dr. Topeka, KS 66615

Phone: 620-344-2115 Email: _____ Phone: 785-213-3515 Email: brock@watershedinstitute.biz

SITE INFORMATION

S-T-R: 18-19-10 Quarter: NW R/W: _____ Site Address: _____

***Notice: FEMA Elevation Certificate MUST be attached to permit.**

Development Type: ☐ New Structure* ☐ Substantial Improvement to Existing Structure*
☐ Minimum Improvement ☑ Filling ☑ Grading ☑ Excavation
☐ Other: _____

Primary Use: Streambank Stabilization and Riparian Restoration

ALL APPLICATIONS MUST HAVE PLANS ATTACHED THAT INCLUDE SQUARE FOOTAGE OF DEVELOPMENT, VALUE OF IMPROVEMENT AND OTHER INFORMATION THAT MAYBE REQURIED BY THE FLOODPLAIN MANAGER BEFORE APPROVAL IS GIVEN.

FLOODPLAIN INFORMATION

FIRM Panel # 20111C0215D Map Date: February 20, 2008 Floodway? Yes

IF LOCATED IN FLOODWAY, NO-RISE CERTIFICATION MUST BE PROVIDED PRIOR TO THE ISSUANCE OF A PERMIT TO DEVELOP THAT STATES THE PROPOSED DEVELOPMENT WILL.RESULTIN NO INCREASE IN THE BASE FLOOD ELEVATON.

Zone: ☐ A ☑ AE Datum: NGVD: _____ NAVD: 88

BFE (Base Flood Elevation) = _____ft

Site Elevation = _____ft

Lowest Floor of Residential Structure (1' above BFE) = _____ft

Lowest Floor of Non-Residential Structure (1' above BFE) = _____ft

Other Floodplain Elevation information: _____ (Attach to Permit)

Other Permits Required: ☑ 404 Permit ☑ KDA/DWR ☑ Other **ALL COPIES MUST BE ATTACHED**

NOTICE: Read Carefully. This permit is issued with the condition that the lowest floor (including basement) of any new or substantially-improved (over 50% current market value) residential structure will be elevated at least one (1) foot above the base flood elevation. If the proposed development is a non-residential structure, this permit is issued with the condition that the lowest floor (including basement) of any new or substantially-improved non-residential structure will be elevated or flood proofed at least one (1) foot above the Base Flood Elevation. This permit is issued with the condition that the developer/owner will provide a FEMA Elevation Certificate completed by a registered engineer, architect or land surveyor certifying the "as-built" lowest floor elevation of any new or substantially-improved structure covered by this permit. The undersigned agrees that all such work shall be done in accordance with the requirements of the Floodplain Management Resolution and applicable county resolutions and the State of Kansas requirements as contained in K.S.A.12-766. and K.A.R. 5-44-1 through 5-44-6.

Permit: ☐Approved ☐ Denied (attach explanation) the _____ day of _____20 _____

_____ _____

Print Name and Title of Owner or Developer Print Name and Title of Authorizing Community Official

_____ _____

Signature of Owner or Developer Signature of Authorizing Community Official

KANSAS
ACTION PERMIT APPLICATION

APPLICANT INFORMATION: **DATE:** 1/6/2020

Applicant (Action Sponsor): Watershed Institute, Inc.

Contact: Brock Emmert

Address: 2650 215th Road Emporia, KS 66801

City: Emporia State: KS Zip: 66801

Telephone: (620-344-2115) E-mail: _____

Fax: _____

ACTION DESCRIPTION:

1. **Action Location:** Cottonwood River

County: Lyon **GPS** *(decimal degrees)*: N38.40415,W96.35006

Plat Legal: Quarter NW Section 18 Township 19 Range 10E

Approximate Starting Date: Fall 2020

Estimated Completion Date: Fall/Winter 2020

2. Attach plans and information to fully describe the proposed action. The information should include sufficient detail to permit determination of how the action will affect threatened and endangered wildlife. Information needed includes but is not limited to: engineering plans or sketch of proposed work, map showing how the action will alter the landscape, complete description of any construction work to be accomplished including location and size of excavation and fill areas, and any other information pertinent to the proposed action.

3. Attach an aerial photo or sketch map of areas to be affected by the proposed action showing existing land and vegetative cover characteristics. Details to be shown include woodland, rangeland, tame pasture, cropland, wetlands, stream, water impoundments, and any other appropriate characteristics. Description of streams within the affected area including channel geometry (average width, depth, etc) and categorize affected stream habitat as pool, riffle, run, or a combination. Describe the stream bottom (e.g., silt, sand, gravel, rubble, bedrock, etc).

APPLICATIONS WILL BE RETURNED THAT DO NOT HAVE SUFFICIENT DETAIL TO PERMIT A COMPLETE EVALUATION.

SUBMIT COMPLETED APPLICATION TO:

Attn: Ecological Services Section
Kansas Department of Wildlife, Parks and Tourism
512 SE 25th Ave.
Pratt, KS 67124