US Army Corps of Engineers
Kansas City District

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Kansas City District Regulatory Office

KANSAS STREAM MITIGATION GUIDANCE – Version 3 – August 13, 2018

(*Versions dated 30 October 2008 and 25 June 2010 are obsolete*)

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General Information

Purpose and Applicability. This guidance document establishes an understandable and consistent method for use by applicants and project managers. It is to be used for determining compensatory mitigation for unavoidable adverse impacts to waters of the United States (WOUS), as authorized by issuance of Department of Army (DA) permits pursuant to Section 404 of the Clean Water Act (CWA) and/or Section 10 of the Rivers and Harbors Act of 1899, within the state of Kansas, including Indian Country. It describes a method for quantifying adverse impacts (debits) and acceptable compensatory mitigation (credits) for DA permitted activities that result in adverse impacts to rivers or streams (hereafter referred to as streams). It does not determine compensatory mitigation for unavoidable adverse impacts to wetlands. Note the following:

- All types of streams (i.e., ephemeral, intermittent, perennial) can be evaluated herein. Adverse impacts to streams are determined by assessing existing stream conditions and the proposed types of impacts in combination with the linear footage of stream proposed to be adversely effected. The value calculated is defined as debits.
- Section 404(b)(1) guidelines, other applicable documents regarding avoidance and minimization, sequencing, and jurisdictional determinations are separate processes and are not detailed herein. Information regarding regulatory authority, 404(b)(1) guidelines, and jurisdictional determinations can be found at: www.nwk.usace.army.mil/Missions/Regulatory-Branch.
- This document is not intended for use as project-design criteria. Appropriate application of the information herein should minimize uncertainty in the development and approval of mitigation plans and allow expeditious review of applications. However, this document should not be interpreted as a guarantee of project assurance, approval, or mitigation acceptability. Project site specifics might warrant alternative mitigation requirements. To minimize delays and objections during the permit-review process, applicants are encouraged to seek the advice of resource and regulatory agencies during the planning and design of mitigation projects. For mitigation proposals that include credits attained by habitat creation and other complex mitigation projects, such consultation is likely to improve mitigation success and reduce permit-processing time.
- This document is subordinate to national guidance (i.e., Corps regulatory guidance letters and the "Mitigation Rule" published at 33 Code of Federal Regulations (CFR) Parts 325 and 332). It was developed by referencing other Corps district stream-mitigation-guidance procedures and in coordination with federal and state agencies. Requirements for compensatory stream mitigation are determined on a case-by-case basis. As additional data are gathered and analyzed, this document may be periodically reviewed and revised.
- Mention of any trade names or commercial products does not constitute endorsement or recommendation for use. This document is not a regulation itself, nor does it change or substitute for statutory provisions and regulations. Other federal, state, or local agencies may require compensatory mitigation separate from this process.

Compensatory Mitigation for Losses of Aquatic Resources; Final Rule (hereafter referred to as the Mitigation Rule), dated 10 April 2008, specifies regulations governing compensatory mitigation for activities authorized by permits issued by the DA. The regulations require performance standards and the use of permittee-responsible compensatory mitigation, mitigation banks, and in-lieu-fee (ILF) programs to improve the quality and success of compensatory-mitigation projects for activities authorized by DA permits. The Mitigation Rule can be found at: www.nwk.usace.army.mil/Missions/Regulatory-Branch/Mitigation-Tools-and-Guidance.

The purpose of compensatory mitigation is the restoration and maintenance of the chemical, physical, and biological integrity of the Nation's waters by replacing unavoidable lost stream functions as closely

as possible to the impact site. Additionally, the Mitigation Rule addresses siting preference for mitigation banks, ILF mitigation, and watershed-based mitigation. All such mitigation actions relate to one or more of the following:

- **Biological Integrity** involves the natural state of all living organisms using aquatic systems. Biological functions include shelter, food production, reproduction, movement, etc.
- **Chemical Integrity** involves the natural composition and properties of inanimate substances within aquatic systems. Chemical functions include nutrient cycling, particulates retention, organic carbon export, removal and sequestration of elements and compounds, and water quality.
- **Physical Integrity** involves the natural contiguity of aquatic systems. Physical functions include natural-flow regime, flood attenuation, storm-surge reduction, groundwater exchange, maintenance of suitable thermal regimes, etc.

Debit/Credit Calculations.

- **Debit (impact) Calculation**. Debits are calculated based on the existing condition of the stream before project implementation. The stream reach proposed for alteration shall be evaluated as it existed prior to any recent (within approximately two years) anthropogenic alterations such as clearing, ditching, sedimentation, etc. (i.e., via use of aerial photography or imagery).
- **Credit (mitigation) Calculation**. Credits are calculated based on the proposed conditions that provide environmental lift to the riverine system. For example, when a mitigation action removes an impounded water body and restores a stream, credits will be calculated based on the environmental lift provided. The final credit calculation is based on a combination of linear feet and mitigation actions that convert to credits. Measurements for linear feet of streams shall be along the centerline of the channel, except for some features that involve work only on one bank of larger streams, where the length of project on each bank may be considered.

Note: Proposed credits (PC) must be equal to or greater than the debits. Mitigation tables (Appendix C, page 24) and definitions of adverse impact factors (Part I, pages 6-8) are included in this document.

Adverse Impact(s) Area. The area of adverse impact(s) includes stream areas impacted by filling, excavating, inundation, draining, clearing, channelizing, straightening, shortening, canalizing, piping, incising/entrenching, culverting, or other adverse actions. The terms effects or impacts includes:

- direct effects, which are caused by the action and occur at the same time and place, and
- cumulative effects which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions.

Mitigation Options. In general, there are four options available to an applicant to implement compensatory stream mitigation. The options below are listed in order of preference as determined by the Mitigation Rule. The first option is to purchase credits from an established stream mitigation bank. The second option is to pay a calculated fee to an In-Lieu Fee Sponsor. The third option is project-specific permittee-responsible mitigation designed to compensate for impacts associated with a proposed project. The fourth option is a combination of two or more listed options. The cost of compensatory mitigation will vary according to the option(s) selected by the applicant.

- **Bank Credits**. The applicant may elect to purchase credits from an approved Mitigation Bank. In this case, the bank sponsor will determine the cost per credit and total cost for purchasing an appropriate number of credits.

General Information

- **In-Lieu Fee**. The applicant may elect to pay a fee to an ILF sponsor. Fees will be calculated based on a per-credit basis. The process described in this guidance determines the number of required credits.
- **Project-Specific Permittee-Responsible Mitigation**. The applicant may prepare his/her own mitigation proposal or hire a consultant to prepare a mitigation plan and, if approved by the Corps, implement and ensure success of the plan at their own expense.
- **Combination of above**. With approval from the Corps, above options may be combined to satisfy a compensatory mitigation obligation.

Mitigation Area. In general, the required compensatory mitigation should be located within the same watershed as the impact site and should be located where it is most likely to successfully replace lost functions and services, taking into account watershed scale features such as aquatic habitat diversity, habitat connectivity, relationships to hydrologic sources, trends in land use, ecological benefits, and compatibility with adjacent land uses (Mitigation Rule 2008).

Mitigation Area Credit Accrual. A compensatory mitigation area may not be provided credits under more than one mitigation category or credited more than once under any category. For example: A restored stream/riparian area may be credited as either restoration or preservation, but not both. A stream/riparian area that contains some restoration and some enhancement could be subdivided into a restoration area component and an enhancement area component, or the entire area could be lumped together and given one net enhancement/restoration credit calculation. Whether or not an area is subdivided or lumped for the purpose of credit calculations is a case-by-case decision based on what is reasonable and appropriate within the mitigation proposal.

Mitigation Plan. Compensatory mitigation plan requirements may be found at: http://www.nwk.usace.army.mil/Missions/Regulatory-Branch/Mitigation-Tools-and-Guidance/.

- **Regulatory Guidance Letter (RGL) 08-03** provides guidance on minimum monitoring requirements for compensatory mitigation projects, including the required minimum content for monitoring reports. RGL 08-03 can be found at: www.nwk.usace.army.mil/Missions/Regulatory-Branch/Mitigation-Tools-and-Guidance.

Mitigation Costs. Costs for mitigation are dependent upon a combination of relatively specific costs for design, construction, monitoring and contingencies, and maintenance. Other less readily definable costs associated with mitigation banks and an ILF program includes costs for securing real-estate instruments (e.g., easement, fee title, title search, covenants, enforcement protection, administration, etc.), and overall management of an ILF Program. All costs are the responsibility of the applicant. Financial assurances in the form of a bond or other similar binding document may be applied to assure funds will be available to complete mitigation via a bank or directly with the applicant.

Mitigation Bank. When this document is used in the establishment of a mitigation bank, the Corps will consult with the Interagency Review Team (IRT) with the goal of achieving a consensus of the IRT regarding the factors, elements, and design of the Mitigation Banking Instrument.

Lakes, Ponds, and Impoundments. Construction of lakes, ponds, and impoundments will not be acceptable compensatory mitigation for unavoidable adverse impacts to riverine systems.

Variance/Approval. The Corps, at its discretion, may determine that the final calculated mitigation value is not appropriate based upon Section 404(b)(1) guideline analysis, public interest review factors, threatened or endangered species concerns, or other appropriate factors. In the event it is determined that the final calculated mitigation value is inappropriate for the identified adverse impacts, the Corps will consult with relevant agencies when appropriate and determine an alternate level or type of

mitigation. The final calculated mitigation value generally will be used as a baseline. The Corps, in administration of its regulatory authority, may waive any provision of this document, or use alternate assessment methodologies, provided the variance is documented and the final mitigation plan is determined to comply with the Mitigation Rule.

Point of Contact. This document is available on the Kansas City Regulatory District website (www.nwk.usace.army.mil/Missions/Regulatory-Branch). Questions regarding use of this document for specific projects must be addressed to the project manager handling the action. General inquiries or comments regarding this document may be addressed to Mr. Brian Bartels, USACE, Kansas State Regulatory Office, 2710 NE Shady Creek Access Road, El Dorado, KS, 67042 or by phone at 816-389-3745, or fax at 316-322-8259 or by email at brian.c.bartels@usace.army.mil.

Authorizing Signature. By the signature given below, this document is authorized for use.

13 August 2018
Date

Mark D. Frazier
Chief, Regulatory Branch
Operations Division

Compensatory Stream Mitigation - The Process

Compensatory mitigation will be determined by using the following definitions, tables, and worksheets.

Part I: Adverse Impact Debit Factors (see Appendix C, page 24, Table 2)

Stream Type. For purposes of this document, three categories of streams are defined: ephemeral/intermittent without pools, intermittent with pools, and perennial (see Appendix A for definitions).

Stream Priority Status. Determines the importance of the stream that is adversely impacted and/or selected for a mitigation action. If a stream qualifies for more than one category the higher priority status will be utilized. Use the three categories below to determine a stream's priority status.

- **Primary**
  - National Wild and Scenic Rivers and streams listed on Nationwide Rivers Inventory,
  - Outstanding National Resource Waters,
  - Exceptional State Waters,
  - Special Aquatic Life Use Waters,
  - waters within federal or state protected areas (e.g., parks, designated natural areas, wildlife refuges, etc.),
  - stream reference reach sites,
  - *waters with federal or state-listed endangered or threatened species, or
  - *designated fish-spawning habitat/native freshwater-mussel refuges.

    *These areas are determined on a case-by-case basis in coordination with the U.S. Fish and Wildlife Service (USFWS) and Kansas Department of Wildlife, Parks and Tourism (KDWPT).
- **Secondary**
  - Waters on the 303(d) list (for additional information contact Kansas Department of Health and Environment (KDHE) Planning and Standards Unit at 785-296-8229 or https://maps.kdhe.state.ks.us/kstmdl, http://www.kdheks.gov/tmdl/methodology.htm),
  - streams adjacent to an approved mitigation bank or mitigation site,
  - stream reaches within ½ mile upstream or downstream of primary priority reaches, or
  - stream reaches within high-growth areas (e.g., urban areas with increased population growth, infrastructure expansion, etc.) that are not ranked as a primary priority area. Contact a Corps employee for any district designations.
- **Tertiary**
  - Streams not ranked as primary or secondary priority.

Existing Condition. A measure of the stream's natural stability and resilience relative to the physical, chemical, and biological integrity of the riverine system. The 303(d) list of impaired waters (see aforementioned contact information) can be consulted to help determine the existing condition of many Kansas streams. Use the definitions below to determine a stream's existing condition.

- **Highly Functional Stream** means that the physical geomorphology of the stream reach is stable and is representative of an appropriate stream hydrograph for the topographical setting and watershed characteristics. The biological community, as appropriate to the stream, is diverse and

unimpaired by excessive anthropogenic inputs. For purposes of this document, a highly functional stream reach must meet all the following characteristics:

- Has no adverse stream impact for 0.5 stream miles up and downstream within the stream order of the proposed impact or mitigation site. Adverse impacts include: perched culverts, pipes, impoundments, or other man-made modifications (that are less than 30 feet of impacted stream reach). Note: low-water crossings and properly sized/constructed culverts that permit aquatic organism passage typically are not considered an adverse impact,
- considered stable (see definition of stable stream on page 20) (e.g., does not exhibit channel incision, head cutting, etc.),
- not listed on the Section 303(d) list for impaired waters, and
- the existing riparian buffer is minimally 50-feet wide on each side of the stream and consists of native vegetation appropriate for the ecoregion.

Exception: The Corps, at its discretion, may designate the largest streams within an 8-digit HUC as highly functional, regardless of whether they meet the criteria above. Contact a Corps regulatory project manager for district designations.

- **Moderately Functional Streams** fail to meet either the highly functional or functionally impaired characteristics.
- **Functionally Impaired Stream** means that there is an excessive loss of stream stability and resilience that is characterized by loss of one or more integrity functions. The stream is unlikely to recover unless restoration is undertaken. For purposes of this document, a functionally impaired stream reach generally exhibits one or more of the following characteristics:
  - The stream has five or more stream impacts within 0.5 stream miles up and downstream within the stream order of the proposed stream impact or mitigation site. Adverse impacts include: perched culverts, pipes, impoundments, or other man-made modifications (that are less than 30 feet of impacted stream reach),
  - has been channelized and shows no evidence of self-recovery, is leveed, impounded, or artificially constricted,
  - has extensive accelerated sedimentation,
  - has little to no riparian buffer that consists of native vegetation appropriate for the ecoregion on each streambank, and
  - is considered unstable (e.g., shows bank failure related to bank incision, lack of meander, minimal riparian buffer, etc.).

Duration. The amount of time the adverse in-stream impact is expected to last.

- **Temporary**. The impact occurs within a period of less than 12 months and recovery of riverine system integrity will follow completion of the activity or restoration of the site. For example: temporary structure(s) removed and site restored to pre-project or stabilized conditions.
- **Short Term**. The impact remains evident after one year and will not exist after two years.
- **Permanent**. The impact remains for greater than 2 years. Examples: armoring, detention, morphological change, impoundment, piping, and channelization.

Impact Activity. The type of impact that will diminish the functional integrity of the riverine system. Seven categories of impact are used.

- **Below Grade Culvert** means to route a stream through an embedded pipe, box culvert, or other enclosed structure. The culvert flowline including head and toe-walls shall be set to a depth of no less than 12-inches below thalweg of the flowline out. If bedrock exists throughout the culvert area, a bottomless culvert should be considered. To deter aggradation, the below grade culverts' pilot cell(s) should be further designed to pass bankfull flow, while flows greater than bankfull should be passed through other cells with their flowline set at the bankfull elevation. Culverts should be designed to allow for the passage of aquatic organisms and other natural stream processes to occur unimpeded.
- **Armor** means to riprap, bulkhead, or use other hard methods to contain stream channels, leaving the stream bed unaltered. Examples: riprap, gabions, retaining walls, etc. (e.g., bridge ends protected by riprap will be categorized as armor). Note: Assess armoring of the stream bed as a morphologic change.
- **Diversion/Weir** means to place a weir in a stream to decrease the speed of flow or to divert water to a channel when bankfull is reached. The structure should be designed to allow for the passage of flows below bankfull stage and aquatic organisms. Example: cofferdams, etc. Note: Assess impacts to the stream channel where the structure is located as fill.
- **Morphologic** change means to alter the established or natural dimensions, depths, patterns, or limits of an existing stream channel by using channelization, dredging, or other activities that alter the stream's morphology. Examples: Constructing a concrete lined channel, rerouting/removing the flow from a stream channel without filling, or excavation of a basin area upstream or downstream of a detention structure or dam, and workpads, etc.
- **Impound** means to install a dam or similar structure that modifies the stream by converting the stream to a ponded (i.e., lentic) state.
- **Pipe** means to route a stream through a pipe, culvert, or other enclosed structure.
- **Fill** means the fill of a stream channel including the relocation of a stream channel (even if a new stream channel is constructed), or other fill activities. Examples: footprints for a dam, channel block, low-water crossing, etc.

Cumulative Impact. The scaling factor used in Table 2. Adverse Impact Factors Worksheet to address the scope of impacts for each individual stream impact. Cumulative impact refers to the linear feet impacted by the individual stream impact (0.0003 x length of stream impacted).

Linear Impact. The length of stream (in feet) that will be impacted and for which mitigation will be required.

Part II: Stream Mitigation Credit Factors (see appendix C, page 25, Table 3)

Possible Mitigation Actions. The following types of mitigation actions will be used to calculate net-benefit credits, riparian-area credits, and additional credits, when applicable. Note: The Corps will determine whether or not proposed mitigation actions are suitable on a project-specific basis. Mitigation actions that constitute restoration/improvement include, but are not limited to: stream channel restoration, non-rigid (soft) bank stabilization, impoundment removal, road crossing improvements, removal of foreign objects from streams, fish screens and fish passage features, re-vegetation of riparian areas, removal of exotic/invasive species, creation or reconnection to floodplain, or other similar actions, such as restoration of in-stream flow in a dewatered stream. Preservation of existing exceptional-quality aquatic and upland resources in riparian buffer areas also is a component of stream mitigation. All restoration/enhancement actions should be designed with the goal of

improving one or more of the following: biological habitat, stream geomorphological integrity, and water quality.

- **Stream Channel Restoration.** Stream stability is morphologically defined as the ability of the stream to maintain, over time, its dimension, pattern, and profile in such a manner that it is neither aggrading nor degrading and is able to transport, without adverse consequence, the flows and detritus of its watershed (Rosgen, 1996). A number of factors can alter the stability and function of streams including changes in stream flow, sediment regime, land use within the watershed, and direct disturbances (e.g., channelization, culverts, bridges, and loss of bank stabilizing riparian vegetation). Restoration of natural stream stability may require careful study by experts trained in stream geomorphology. It may involve changing channel width, bank stabilization measures, flow modification, grade control, stream routing changes to increase sinuosity and/or other measures to appropriately handle stream energy and reconnect the stream with its floodplain. It may entail changes in the stream's dimension, pattern and profile, consistent with appropriate stream type and valley slope, to re-establish stability. Reference reach data from a stream or stream(s) of the same target stream type and valley type, both being from the same ecoregion, should serve as a template for the design of the dimensions, pattern, profile, bed material, and erosional processes of the stream targeted for restoration (Rosgen, 1996 and 2006). It is important to develop restoration plans in consultation with appropriate resource and regulatory agencies.

- **Streambank Modification.** The baseline level of bank erosion is an integral component of a streams overall stability and character. Erosional rates and locations depend on the hydrology, geology, vegetation, and land use at any one point in time. The benefits of bank erosion include the introduction of materials from which point bars are created or extended, that in-turn provides substrate for riparian vegetation establishment, habitat creation, and maintenance of morphological characteristics. However, accelerated bank erosion can be viewed as a process that needs correction before it results in damages to adjoining property. In many instances, anthropogenic actions result in accelerated rates of bank erosion that can exceed the streams sediment transport capacity, causing local deposition and stream aggradation over a given reach, which in-turn leads to high width/depth ratios and additional erosional issues. Bank stabilization can be accomplished using a variety of techniques. Techniques that use materials natural to the stream and that mimic the appropriate stream morphology, including in-channel features, are preferred over those that harden or armor streambanks such as concrete or riprap. Structures designed to reduce energy at the bank, and that use native stone, may be acceptable if needed to reestablish proper channel geometry and erosion/ deposition rates. However, the installation of certain types of channel structures may not be successful in certain stream types. The quantity of stone used should be the minimum amount required to stabilize the eroding reach. Structures combined with bank shaping/sloping and vegetation reestablishment will receive higher credit than those using stone alone. Specific success criteria should be developed for each technique used in the mitigation project to ensure the proposed project has no adverse secondary impacts. Note: Broad watershed assessment should be made as bank instability may be an indicator of a more complex systemic problem to establish/maintain proper channel morphology, erosion and deposition rates, meander patterns and riparian vegetation. This assessment would also help ensure long term project success.

- **In-stream Habitat Recovery.** In-stream habitat recovery is controlled by factors such as stream flow, channel structure, cover, water quality and condition of riparian corridors. Generally, to improve in-stream habitat, proposals including riparian management (creation/enhancement/preservation) and/or creation of pool and riffle habitat are encouraged. For the purposes of this guidance, man-made structures are generally considered less desirable than

those features of a stable channel. Therefore, project designs should mimic natural features to the greatest extent practicable. Stable stream channels normally provide adequate habitat and caution is needed to ensure that proposed fish habitat structures such as rock/log vanes, cross-vanes, check dams and weir structures do not result in upsetting natural stream processes or improve one type of habitat at the expense of another. Depending on the level of complexity, proposals may require morphological analysis to ensure that they do not alter the appropriate dimension, pattern, and profile for the stream type and introduce features that are inconsistent to the stream. In addition, differing stream types may be incompatible with certain prescribed habitat structures (i.e., placing riffles in sand bed stream systems). Where such man-made structures are deemed beneficial, periodic review and/or maintenance should be incorporated into project plans.

- **Impoundment Removal.** Dams adversely affect and fragment stream systems by altering the movement of aquatic organisms, water, sediment, organic matter, and nutrients; thereby creating physical alterations in both tailwaters and downstream riparian zones and biological effects both upstream and downstream of the impoundment. Dam removal, if done properly, can restore natural stream functions. However, without sufficient evaluation, dam removal may result in bed and bank instability and increased sediment loads. These impacts will occur until the stream reaches a state of dynamic equilibrium. Important elements to consider when doing dam removal include restoring Aquatic Organism Passage (AOP), revegetating the reservoir area, and long term monitoring of sediment transfer, water quality, stream channel morphology and aquatic ecology.
- **Road Crossing Improvements.** Properly constructed road crossing improvements can reconnect natural floodplains, maintain/reestablish natural flow regimes, and prevent downstream scour and/or upstream ponding. It should be noted that removal and/or maintenance of culverts could initiate instability of the stream channel. Improvements include, but are not limited to:
  - removal of culverts and bridges or replacing them with one that allows formation and creation of proper dimension, pattern, and profile,
  - providing floodplain culverts in existing roadbeds, and/or
  - resetting or resizing culverts which block aquatic organism passage/life movements and/or interfere with stream processes.
- **Establishment of Riparian Buffers.** Riparian buffers provide functions such as surface runoff filtration, bank stabilization, stream shade, wildlife corridors, and contribution of woody debris and detritus. Buffer enhancement can be accomplished by revegetating with appropriate native riparian species and/or removal of exotics. For purposes of obtaining buffer enhancement credit, buffer widths should be a minimum width of 50 feet landward from top of streambank (see requirements for minimum buffer width, page 15). Buffer zones can include aquatic and/or upland resources that can be preserved as is or enhanced for additional credits.
- **Creation or Reconnection to Floodplains.** In some instances, natural or anthropogenic activities sever the floodplain from the active stream channel (e.g., levee or berm construction along a stream channel, or channel degradation), resulting in channel incision/entrenchment, increased bed and bank erosion, lowering of the water table, reduced productivity in the riparian area, etc. Measures that reconnect the channel to its floodplain will receive credit under this program. The floodplain may be upland, wetland or a combination thereof.
- **Other Enhancement.** The Corps, in consultation with other resource and regulatory agencies, will determine, on a case-by-case basis, the net benefit of mitigation actions that do not involve direct manipulation of a length of stream and/or its riparian buffers.

Stream Type. See Part I, page 6

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Stream Priority Status. See Part I, page 6

Existing condition. See Part I, pages 6-7

Net Benefit. The evaluation of the proposed mitigation action relative to the restoration, enhancement, creation, and preservation of the chemical, biological, and physical integrity of the Nation's waters. Five stream mitigation methods are covered under these guidelines: 1) stream channel restoration/stream enhancement, 2) stream relocation, 3) riparian creation, 4) riparian enhancement/restoration, and 5) riparian preservation. The Corps will determine, on a case-by-case basis, the acceptability of debit/credit analysis.

Note: Net improvement for stream channel restoration is a measure of restored stream channel stability. Stable streams (as defined on page 20) are in dynamic balance and have proper morphology relative to the physical characteristics of the watershed. Improvements in stream stability relate directly to improvements in stream functions.

- **Substantial** stream channel restoration actions address multiple functions on a large scale and include, but are not limited to:
  - removing stream impoundments, pipes, culverts, or other man-made structures, then restoring the stream reach to a stable, appropriate channel configuration, as per reference stream reaches (if available for comparison),
  - replacing inappropriately designed culverts with a span bridge,
  - restoring appropriate bankfull discharge width, stream sinuosity (i.e., meander), entrenchment ratio, and length and width/depth ratio to a referenced morphologic pattern,
  - building a new, morphologically stable channel at a higher elevation to connect it to the floodplain,
  - creating or reconnect floodplains adjacent to streams that have been artificially disconnected from their floodplain,
  - where relocation of an incised stream is impracticable, modifying the existing channel and re-establishing a floodplain *in situ*, but not at the abandoned/disconnected floodplain elevation,
  - removing a dike, levee, or berm that is within the 100-year floodplain to reconnect the floodplain to the stream channel,
  - reconnecting abandoned side channel or meanders that were artificially cutoff, blocked, or filled where functionally appropriate, and
  - removing riprap and reconstructing the streambanks to the proper radius of curvature, at the appropriate bank heights, then stabilizing all disturbed surfaces with either biodegradable erosion control fabric, native sod mats, and/or seeding with native vegetation from the appropriate ecoregion, and if necessary, streambank modifications (see page 9 for guidance).
- **Moderate** stream channel restoration actions address multiple or single functions on a smaller, reach-specific scale and include, but are not limited to:
  - restoring stability in highly eroded areas or areas with artificially accelerated erosion by using non-rigid (soft) methods such as native vegetation for stabilization, root wads with a relatively small percentage of rock, re-sloping and reshaping banks and creating a vegetated floodplain bench,
  - restoring natural channel features (i.e., riffle/run/pool/glide habitat) by using the appropriate morphology to target stream type, but not a comprehensive channel reconstruction/relocation,

- where relocation of an incised stream is not practicable and modification of an existing channel to create a stable stream-channel is impracticable because of belt-width constraints (limited land width available to form the meanders necessary for C or E stream types, Rosgen Stream Classification), modifying the existing channel and floodplain at its current elevation to create a stable channel. This converts the stream to a new stream type at the existing elevation of the channel but without an active floodplain,
- routing a stream around an existing impoundment by creating a morphologically stable reach,
- constructing fish ladders or other fish passage structures where appropriate, and
- replacing inadequate culverts/structures with bottomless culverts or low-water crossings.

- **Minimal** stream channel restoration actions address single or no functions and include, but are not limited to:
  - restoring streambank stability by hardening the existing channel in place where accelerated erosion is documented. It should only be allowed when there are insurmountable constraints to using other restoration solutions, as may be the case in urban settings. Some proposals undertaken by this method may be considered to have adverse aquatic impacts and require compensatory mitigation,
  - incorporation of a bankfull planting bench into a rock riprap project,
  - connecting floodplains at existing road crossings by using culverts to facilitate flood flows,
  - replacing inadequate culverts with a conservation culvert/buried culvert that conforms to the appropriate configuration based on hydrology and AOP, and
  - removing check dams, weirs, car bodies, foreign materials/junk, debris, and artificial in-stream structures and/or other structures that directly contribute to bank erosion, scour, or block natural stream processes and aquatic organism movements without any additional measures.

Note: Mitigation credit is not provided for either constructing channels that do not incorporate the principles of natural channel design or replacing a span bridge with any structure that is not designed for aquatic organism passage.

Control/Site Protection. An appropriate legally binding real estate instrument, approved in advance by the Corps, will be required to ensure that the mitigation work, land, and aquatic resources offered are protected in perpetuity from anthropogenic changes that would compromise the aquatic resource. Five types of protection are recognized with varying levels of security of which one should be selected per appropriateness for the subject property depending on the situation. Third party grantee protection will receive higher credit value and may be required to ensure adequate real estate protection. The Corps will decide which level of protection is appropriate.

- **Non-Third Party.**
  - **Permit Conditions** means the mitigation site does not have any legal encumbrance protecting it other than special conditions associated with a Corps permit. This alternative may not be acceptable in all cases.
  - **Deed restriction** means a provision in a deed limiting the use of the property and prohibiting certain uses. The District approves mitigation areas and requires deed restrictions to protect and preserve mitigation sites. If the applicant can demonstrate that the mitigation activity will occur within a right-of-way easement and if the easement will offer protection and preservation of the site, such as associated with highway projects, the credit will be considered the same as that for deed restriction of the mitigation site.

- **Restrictive covenant** means a legal document whereby an owner of real property imposes perpetual limitations or affirmative obligations on the real property.

- **Third Party.**
  - **Conservation easement** means a legally binding recorded instrument approved by the district to protect and preserve mitigation sites by giving protection and enforcement rights by real estate interest to a qualified, experienced, third party.
  - **Fee Title** means a transfer of complete ownership to a qualified, experienced, non-profit conservation organization or government agency. Non-profit organization means an entity recognized and operating under the rules of the Internal Revenue Service for non-profit purposes.

Mitigation Construction Timing. No additional credits are generated for this factor if the mitigation action in a reach is primarily riparian buffer preservation.

- **Schedule 1**. All mitigation (100%) is completed before the impacts occur.
- **Schedule 2**. At least 75% of the mitigation is completed and approved prior to and/or concurrent with the impacts. The other 25% of the mitigation could be completed after the impacts.
- **Schedule 3.** Less than 75% of the mitigation will be completed prior to and/or concurrent with the impacts.

Temporal Lag. Compensates for the time required for a mitigation area to fully replace functions lost at the impact site. Different systems will require different times to reach levels of functional capacity level with the impact site. For example: A riparian forest buffer would have a greater temporal lag than a riparian grass buffer.

Site Factor. In-kind replacements are stream losses or riparian buffer losses, which are replaced by a stream/riparian buffer that is established, restored, enhanced, or protected of the same physical and functional type. This is required when the impacted resource is locally important.

Use a site factor of 1.0 for: 1) all in-kind aquatic resource or riparian buffer replacements and permittee constructed mitigation proposed within the 8-digit HUC watershed in which the impacts occurred, or 2) impacts within a mitigation bank service area and proposing to go to a bank.

Out-of-kind replacements replace aquatic resources or riparian buffers of a different physical and functional type. This is appropriate when it provides more environmental benefit and is more practical by providing more ecological or watershed benefits than in-kind.

Use a site factor of 0.5 for: 1) all out-of-kind aquatic resource or riparian buffer replacements, 2) impacts not within a mitigation bank service area but proposing to go to a bank, or 3) permittee constructed mitigation proposed outside of 8-digit HUC watershed in which the impacts occurred.

Site factors for in-lieu fee mitigation will be determined when the instrument is proposed.

Additional credits. Activities such as a culvert replacement or dam removal can receive additional credit if the Corps determines that the replacement/removal is either minimal, moderate, or substantial net benefit by allowing the passage of aquatic organisms. The credit values in the chart below may be applied to in-stream credit in addition to the actual footprint of the structure replaced/removed to calculate for the benefit of removing a stream obstruction. The formula used to calculate these values is: stream type x net benefit x 5,000 = additional credit.

Net Benefit	Stream Type					
	Ephemeral/ Intermittent w/o Pools 0.2	Intermittent w/ Pools 0.4	Perennial Stream Average Width			
			<15' 0.4	15'-30' 0.6	30'-50' 0.8	>50' 1.0
Minimal 1.0	1000	2000	2000	3000	4000	5000
Moderate 2.0	2000	4000	4000	6000	8000	10000
Substantial 3.5	3500	7000	7000	10500	14000	17500

Mitigation credit may be provided on a case-by-case basis for additional data deemed beneficial and necessary for adequate project and/or mitigation evaluation. For example: Survey data with elevations, monitoring data that is above and beyond what is required, or habitat improvements for state or federally-listed endangered or threatened species.

Part III: Riparian Area Credit Factors (see Appendix C, page 26, Table 4)

Credits may be obtained for creation, restoration, enhancement, and preservation of riparian buffers.

Riparian Buffer Creation. The manipulation of the physical, chemical, and/or biological characteristics present to develop a riparian buffer on an upland where it did not previously exist.

Riparian Buffer Restoration/Enhancement. The implementation of rehabilitation practices within a stream riparian buffer zone to improve water quality and/or ecological function. Riparian buffer enhancement may include increasing or improving upland and/or wetland habitat within or adjacent to riverine systems. Restoration programs should strive to mimic the composition, density, and structure of a reference reach habitat, when available. For the purposes of this document, an area will be considered as riparian buffer restoration if 51-100% of the area would require planting of vegetation to restore streambank stability and improve wildlife habitat. An area will be considered as riparian buffer enhancement if 10-50% of the area would require planting of vegetation to restore streambank stability and improve wildlife habitat.

Riparian Buffer Preservation. The conservation, in its naturally occurring or present condition, of a riparian buffer to prevent its destruction, degradation, or alteration in any manner not authorized by the governing authority. For the purposes of this document, an area will be considered as riparian buffer preservation if less than 10% of the area would require planting of vegetation to restore streambank stability and improve wildlife habitat.

***Requirements for Minimum Riparian Buffer Width: The minimum width (MBW)** for which mitigation credit will be earned is 50 feet on one side of the stream as measured from the top of the streambank and perpendicularly away from the stream channel on a planar view. Smaller buffer widths may be allowed on a case-by-case basis for small streams and consideration for a reduced buffer width will be based on issues related to construction constraints, land ownership, and land-use activities.

Table 1. Riparian Buffer Creation, Restoration, Enhancement, and Preservation

Buffer width (on one side of the stream) Equal to or greater than	**Percent buffer that needs planting**		
	***Buffer Creation and Restoration** Exotic Removal and (51-100%) Planting	**Buffer Enhancement** Exotic Removal and (10-50%) Planting	**Buffer Preservation** (<10%) Planting
300 feet	0.56	0.28	0.140
275 feet	0.54	0.27	0.135
250 feet	0.52	0.26	0.130
225 feet	0.50	0.25	0.125
200 feet	0.48	0.24	0.120
175 feet	0.44	0.22	0.110
150 feet	0.40	0.20	0.100
125 feet	0.36	0.18	0.090
100 feet	0.32	0.16	0.080
75 feet	0.24	0.12	0.060
50 feet (MBW)	0.16	0.08	0.040

Table 1 provides net benefit values for the riparian buffer creation, restoration, enhancement, and preservation mitigation worksheet. Note: Riparian buffers on each bank of the stream reach will generate mitigation credit separately (i.e., stream side A and stream side B).

Note: Credits may not be provided for riparian widths deemed excessive to providing benefits to the aquatic system. Credits will not be provided for portions of riparian areas that are outside the drainage area of the buffered stream (e.g., portions of buffers that extend beyond a ridge top into an adjacent drainage area). Should the proximity of a break in the drainage area (e.g., a ridge top) to the buffered stream preclude attainment of the required minimum buffer width, the net improvement may be calculated based on the minimum width on the chart above. If both sides of the stream are owned or could reasonably be obtained by the applicant, buffering of both sides of the stream is recommended because buffering both sides of the stream is beneficial to the riverine system.

Note: Net-benefit credit for riparian restoration is based on the percent of the riparian corridor proposed for restoration in the approved mitigation plan. Credit for riparian restoration falls into one of the following categories: buffer creation (51% - 100% plantings), buffer enhancement (10% - 50% plantings), and buffer preservation (<10% plantings). Preservation credit will only be provided if the Corps determines that the subject area is of exceptional environmental quality. Credit cannot be provided for multiple restoration activities within the same riparian corridor along the same side of the stream (i.e., credit is not allowed for preservation of 500 linear feet of existing corridor and for the

creation of 500 linear feet of additional corridor along the same side of a stream reach). Riparian credit is assigned a single net-benefit value, see Table 1.

Supplemental Buffer Credit. Additional mitigation credit may be provided if proposed riparian mitigation activities include minimum width buffers on both sides of a stream reach.

References

Dunne, T. and L.B. Leopold. 1978. Water in Environmental Planning. W.H. Freeman and Col, San Francisco, California. 818 pps.

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The Federal Interagency Stream Restoration Working Group. 1998. Stream Corridor Restoration; Principles, Processes, and Practices. National Technical Information Service, Springfield, Virginia.

United States Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS). 1996. Stream bank and shoreline protection. In Engineering field handbook, Part 650, Chapter 16.

Appendix A
Glossary and References

Adverse effects as used in this document means any adverse ecological effect on waters of the United States resulting from a regulated discharge of dredge or fill material in jurisdictional waters. See also the definition of effects in this glossary.

Aggradation is a raising of local base level due to sediment depositional processes.

Aquatic organism passage (AOP) is the unimpeded movement of all aquatic species within the stream network.

Aquatic site means any water of the United States, including special aquatic sites such as wetlands or pool and riffle complexes.

Bankfull discharge is the discharge that is most effective at moving sediment, forming or removing bars, forming or changing bends and meanders, and doing work that results in the average morphologic characteristics of channels. The bankfull stage is the point at which water begins to overflow onto a floodplain and is commonly referred to as the discharge with a frequency of occurrence of between 1.5-1.7 years. Bankfull may not be at the top of the streambank in incised or entrenched stream (Dunne and Leopold, 1978).

Braided stream system means a multiple-thread channel system with a high width to depth ratio (>40), variable stream gradient (.039 to <.001) and individual channels with highly variable bank full width. These streams can have extensive, well-vegetated floodplains and associated wetlands (Rosgen, D.A. 1996. Applied River Morphology).

Channel features as found in natural streams are sequences of riffles and pools or steps and pools that maintain channel slope and stability and provide diverse aquatic habitat.

- **Riffles** are bed features with gravel or larger size particles where the water depth is relatively shallow and the slope is steeper than the average slope of the channel. At low flows, water moves faster over riffles, which provides oxygen to the stream. Riffles are found entering and exiting meanders and control the streambed elevation because of a concentration of the larger rock found naturally in an alluvial channel.
- **Pools** are typically located on the outside bends between riffles. Pools have a flatter slope that the average channel slope and greater depth than the average depth of the stream.
- **Riffle and pool complexes** are special aquatic sites under the Section 404(b)(1) guidelines. Riffle and pool complexes sometimes characterize steep gradient sections of streams. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a course substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. A slower stream velocity, a streaming flow, a smooth surface, and a finer substrate characterize pools.
- **Steps** are vertical drops often formed by large boulders, downed trees, or bedrock outcrops. Deep pools are typically found at the bottom of each step. Step/pool sequences are found in higher gradient streams.

Compensatory mitigation is the restoration, creation (establishment), enhancement, or in exceptional circumstances, preservation (protection/maintenance) of wetland and/or other aquatic resources for the purpose of compensating for unavoidable adverse impacts that remain after all appropriate and practicable avoidance and minimization has been achieved. Compensatory Mitigation for aquatic areas addressed by this document includes:

- **Creation** means the conversion of non-aquatic habitat to aquatic habitat. Creation usually includes grading; establishment of appropriate pattern, dimension and profile; providing suitable substrate, hydrology, and establishment of native vegetation.
- **Enhancement** means increasing or improving one or more of the functions or values of an existing aquatic area.
- **Preservation** means the protection of an area to prevent its destruction or degradation.
- **Restoration** means actions taken to correct previous alterations that have destroyed, diminished, or seriously impaired the character and function of stream systems. Restoration is the process of returning an unstable, altered, or degraded stream corridor to its natural or referenced stable condition, considering recent and future watershed conditions. This process may include restoration of the stream's geomorphic dimensions, pattern and profile and/or biological and chemical integrity, including transport of water and sediment produced by the streams' watershed in order to achieve natural equilibrium. For those situations where major restoration of appropriate stream dimension, pattern and profile are warranted, credits will reflect the following priority system.

Credit means a unit of measure (e.g., a functional or areal measure or other suitable metric) representing the accrual or attainment of aquatic functions at a compensatory mitigation site. The measure of aquatic functions is based on the resources restored, established, enhanced, or preserved.

Debit means a unit of measure (e.g., a functional or areal measure or other suitable metric) representing the loss of aquatic functions at an impact or project site. The measure of aquatic functions is based on the resources impacted by the authorized activity.

Degraded stream is a factor of impairment of biological/chemical/morphological condition as compared to the historical quality/value.

Degradation is a lowering of local stream base level due to channel incision processes.

Entrenchment ratio is an index value used to describe the degree of vertical containment of a river channel. It is the ratio of the width of the flood-prone area to the surface width of the bankfull channel. The flood-prone area width is measured at the elevation that corresponds to twice the maximum depth of the bankfull channel as taken from the established bankfull stage (Rosgen, D.A. 1996. Applied River Morphology).

Ephemeral/Intermittent streams without pools have flowing water only during and for a short duration after precipitation events in a typical year. Streambeds are generally located above the water table. Groundwater is not a primary source of water for the stream. Runoff from precipitation is the primary source of water for stream flow. These streams are commonly 1st order and some 2nd order streams or streams that transition from ephemeral to intermittent. Given the unique flow patterns and habitat considerations of these streams, they are assessed differently from other types of waters.

Flood-prone area width is the width of the flood-prone area as measured in the field at an elevation twice-maximum depth at bankfull. Maximum depth is the difference between the bankfull stage and thalweg elevations in a riffle section (Rosgen, D.A. 1996. Applied River Morphology).

Groundwater is water beneath the earth's surface, contained in porous spaces in consolidated or unconsolidated material. This encompasses near-surface flow, through-flow, perched aquifers, recharge or discharge flow paths, water table water and all other sub-surface water.

Intermittent streams with pools have flowing water during certain times of the year with groundwater influencing stream flow. During dry periods, intermittent streams may not have flowing water but retain seasonal and/or permanent pools. Runoff from rainfall is a supplemental source of water for stream flow.

IRT stands for Interagency Review Team. An interagency group designated to review and consult with proponents regarding Compensatory Mitigation Bank and In-lieu fee proposals.

Loss of waters of the United States for purposes of the nationwide permit program: Waters of the United States that are permanently adversely affected by filling, flooding, excavation, or drainage because of the regulated activity. Permanent adverse effects include permanent discharges of dredged or fill material that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody. The acreage of loss of waters of the United States is a threshold measurement of the impact to jurisdictional waters for determining whether a project may qualify for an NWP; it is not a net threshold that is calculated after considering compensatory mitigation that may be used to offset losses of aquatic functions and services. The loss of stream bed includes the linear feet of stream bed that is filled or excavated. Waters of the United States temporarily filled, flooded, excavated, or drained, but restored to pre-construction contours and elevations after construction, are not included in the measurement of loss of waters of the United States. Impacts resulting from activities eligible for exemptions under Section 404(f) of the Clean Water Act are not considered when calculating the loss of waters of the United States.

Mean depth at bankfull is the mean depth of the stream channel cross-section at bankfull stage as measured in a riffle section.

MOA stands for memorandum of agreement.

Native plants refers to those species occurring within state boundaries prior to European contact, according to best scientific and historical documentation. It also includes those species understood as indigenous (i.e., endemic to the ecosystem where the mitigation area is located), occurring in natural associations in habitats that existed prior to significant human impacts and alterations of the landscape (Kansas Native Plant Society).

NWP stands for US Army Corps of Engineers Nationwide Permit.

Ordinary high water mark (OHWM) means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

Perennial streams have flowing water year-round in a channel with a defined bed and bank during a typical year and will go dry only during prolonged periods of drought. The water table is located above the streambed for most of the year. Groundwater is a primary source of water for a stream's base flow. Runoff from precipitation is a supplemental source of water for stream flow. Perennial streams support a diverse aquatic community of organisms year round and are typically the streams that support fisheries.

Practicable means feasible and reasonable after considering cost, logistics, and technology available to the project proponent.

Reference reach data describe the stable morphological form of dimension, pattern and profile for a particular stream and valley type, slope, channel materials, riparian vegetation and other measurable variables to develop dimensionless relationships for natural channel design parameters.

Riparian area refers to lands adjacent to a water body that are transitional between terrestrial and aquatic ecosystems, through which surface and subsurface hydrology connects water bodies with their adjacent uplands.

Riparian buffer means an area designed to separate one functional area from another (i.e., any vegetated upland or wetland area next to a waterbody that separates the water from developed areas, including agricultural lands). The existing buffer can be preserved as is or enhanced for additional credits.

Riverine, as used in this document, means rivers, streams, and similar natural flowing water bodies together with their associated wetlands and riparian zones.

Sinuosity of a stream is defined as the ratio of channel length/valley length. In addition to slope, the degree of sinuosity is related to channel dimensions, sediment load, stream flow, and the bed and bank materials.

Special aquatic sites means wetlands, vegetated shallows, mud flats, riffle and pool complexes, sanctuaries, and refuges as defined at 40 CFR 230.40 thru 230.45.

Stable stream is one that maintains its dimension, pattern, and profile over time such that the stream does not degrade or aggrade. Naturally stable streams must be able to transport the sediment load supplied by the watershed. Instability occurs when scouring causes the channel to incise (degrade) or when excessive deposition causes the channel bed to rise (aggrade) (Dunn and Leopold, 1978).

Stream pattern describes the view of a stream channel as seen from above. Streams are rarely straight; they tend to follow a sinuous path across a floodplain.

Stream profile refers to the longitudinal slope of the stream. At the watershed scale, channel slope generally decreases in the downstream direction with commensurate increases in stream flow and decreases in sediment size. Channel slope is inversely related to sinuosity, so steep streams have low sinuosity and flat streams have high sinuosity.

Stream class as used in this document refers to the Rosgen Stream Classification System (Rosgen, 1996), which categorizes streams based on channel and floodplain morphology so that consistent, reproducible and quantitative descriptions can be made.

Thalweg is a line connecting the lowest or deepest points along a streambed channel.

Threshold means the level, point, or value above which something is true or will take place and below which it is not true or will not take place. For the purposes of this document, the thresholds herein are considered to be the level of adverse impacts caused by the proposed project above which the project fails to meet the conditions, limitations, restrictions, or other requirements specified in relevant laws or regulations.

Width/Depth ratio is an index value that indicates the shape of the channel cross-section. It is the ratio of the bankfull width divided by the mean depth at a bankfull discharge.

Appendix B
Sample Project

The applicant proposes to construct an impoundment. The impoundment will be 9-surface acres at the principle spillway elevation. The bottom width of the dam (i.e., fill), constructed on Stream A, will be 250-feet wide (Impact 1). Additionally, 1500 feet of Stream A (Impact 2) will be inundated (i.e., impound) and 600 feet of Stream B (Impact 3) will be inundated (i.e., impound).

Stream A
Stream Type = Intermittent with pools
Stream Status = Secondary
Existing Condition = Moderately Functional

Stream B
Stream Type = Ephemeral
Stream Status = Secondary
Existing Condition = Moderately Functional

Proposed Mitigation
The applicant plans to mitigate for unavoidable stream impacts with both in-stream and riparian buffer work. Proposed mitigation includes:

- replacement of a 50-foot long perched culvert on an intermittent (with pools) stream channel with a properly sized culvert buried at least 1 foot,
- removal of a dam on a perennial stream channel (15 to 30 feet wide) and restoring 1,150 feet of stream channel by using natural stream channel design, and
- as part of the stream restoration, a 100-foot wide riparian buffer will be created along both sides of the 1,150 feet of stream channel.

Table 2. Adverse Impact Factor Worksheet – SAMPLE PROJECT

Factor	Impact 1: Fill	Impact 2: Impound	Impact 3: Impound
Stream Type Impacted	0.6	0.6	0.4
Stream Status	0.4	0.4	0.4
Existing Condition Value	*0.8*	*0.8*	*0.8*
Formula total	0.48	0.48	0.32
Duration	0.3	0.3	0.3
Activity	2.5	2	2
Cumulative impact	0.075	0.45	0.18
Sum of Factors = M	4.355	4.23	3.6
Linear Feet of Stream Impacted = LF	250	1500	600
M x LF	1088.75	6345	2160
Total Mitigation Credits Required = 9593.75			

Table 3. In-stream Credit Worksheet – SAMPLE PROJECT

Factors	Buried Culvert	Stream Restoration
Stream Type	0.4	0.6
Priority Area	0.05	0.05
Existing Condition	0.4	0.4
Net Benefit	1	3.5
Control/Site Protection	0.4	0.4
Mitigation construction Timing	0	0.3
Sum Factors (M)	2.25	5.25
Stream length in Reach (LF)	50	1150
Credits (C) = M x LF	112.5	6037.5
Site Factor (SF)	1	1
Additional Credits (A)	2000	
Total Credits Generated (C x SF) + A =	2112.5	6037.5
Total In-stream Channel Credits Generated = 8150		

Table 4. Riparian Buffer Worksheet – SAMPLE PROJECT

Factors	Benefit 1
Stream Type	0.2
Priority Status	0.05
Net Benefit (stream side A)	0.32
Net Benefit (stream side B)	0.32
Supplemental Buffer Credit	0.32
Control / Site Protection	0.2
Mit. Construction Timing (side A)	0
Mit. Construction Timing (side B)	0
Temporal Lag (years)	0
Sum Factors (M) =	1.41
Linear Feet of Stream buffer (LF)	1150
Credits (C) = M x LF	1621.5
Site Factor (SF)	1
Total Credits Generated C x (SF)	1621.5
Total Riparian Buffer Credits Generated = 1621.5	

SAMPLE PROJECT

Stream Mitigation Summary Worksheet		
Required Mitigation	Debits	
A. Total Debits (Table 2)	9593.75	
Non-Banking Credit Summary	Credits	Linear Feet
B. Riparian Buffer Work	1621.5	1150
C. In-stream Work	8150	1200
D. Total Proposed Non-Bank Mitigation = B + C	9771.5	2350
Banking Credit Summary	Credits	Linear Feet
E. Riparian Buffer Work	0	
F. In-stream Work	0	
G. Total Proposed Bank Mitigation = E + F	0	
In-Lieu Fee Credit Summary	Credits	Linear Feet
H. Riparian Buffer Work	0	
I. In-stream Work	0	
J. Total Proposed In-Lieu Fee Mitigation = H + I	0	
Grand Totals	Credits	Linear Feet
K. Total Riparian Mitigation B + E + H (Table 4)	1621.5	1150
L. Total In-stream Mitigation C + F + I (Table 3)	8150	1200
M. Total Proposed Mitigation = K + L	9771.5	2350
	Yes/No	
Proposed Mitigation Credits (M) = Total Debits (A)	Yes	

Appendix C
Worksheets

Table 2. Adverse Impact Factors Worksheet

FACTORS	OPTIONS						
Stream Type pg. 6	Ephemeral/Intermittent w/o Pools 0.4		Intermittent w/Pools 0.6		Perennial 0.8		
Stream Priority Status pg. 6	Tertiary 0.1		Secondary 0.4		Primary 0.8		
Existing Condition pgs. 6-7	Functionally Impaired Stream Type x 0.1 = .04, .06, or .08		Moderately Functional Stream Type x 0.8 = .32, .48, or .64		Highly Functional Stream Type x 5.0 = 2, 3, or 4		
Duration pg. 7	Temporary (<1yr.) 0.05		Short Term (1-2 yr.) 0.1		Permanent (>2yr.) 0.3		
Impact Activity pgs. 7-8	Below Grade Culvert 0.3	Armor 0.5	Diversion/ Weir 0.75	Morphologic 1.5	Impound 2.0	Pipe 2.2	Fill 2.5
Cumulative Impact pg. 8	0.0003 x linear feet of stream impacted						

Factor	Impact 1	Impact 2	Impact 3	Impact 4	Impact 5	Impact 6
Stream Type Impacted						
Stream Priority Status						
Existing Condition						
Duration						
Impact Activity						
Cumulative Impact						
Sum of Factors	M =					
Linear Feet of Stream Impacted pg. 8	LF=					
M x LF						
Total Mitigation Credits Required * = (M x LF) = _____						

Table 3. In-Stream Credits Worksheet

Stream Type pg. 6	Ephemeral/Intermittent w/o Pools 0.2	Intermittent w/ Pools 0.4	Perennial stream avg. width at OHWM			
			<15’ 0.4	15’-30’ 0.6	30’-50’ 0.8	>50’ 1.0

Stream Priority Status pg. 6	Tertiary 0.05	Secondary 0.2	Primary 0.4
Existing Condition pgs. 6-7	Not Applicable 0	Functionally Impaired 0.4	Moderately Functional 0.05
Net Benefit pgs. 11-12	Minimal 1.0	Moderate 2.0	Substantial 3.5
Control/Site Protection pgs. 12-13	Corps approved site protection without third party grantee 0.1	Corps approved site protection recorded with third party grantee, or transfer of title to a conservancy 0.4	
Mitigation Construction Timing pg. 13	Schedule 1 0.3	Schedule 2 0.1	Schedule 3 0

Factors	Benefit 1	Benefit 2	Benefit 3	Benefit 4	Benefit 5	Benefit 6
Stream Type						
Stream Priority Status						
Existing Condition						
Net Benefit						
Control/Site Protection						
Mit. Const. Timing						
Sum Factors (M)						
Stream length in Reach (do not count each bank separately) (LF)						
Credits (C) = M x LF						
Site Factor (SF) pg. 13						
Additional Credits (A) pg.14						
Total Credits Generated (C x SF) + A =						
Total In-Stream Channel Credits Generated = _____						

Table 4. Riparian Buffer Worksheet

Stream Type pg. 6	Ephemeral/ Intermittent w/o Pools 0.05	Intermittent w/ Permanent Pools 0.2	Perennial 0.4	
Stream Priority Status pg. 6	Tertiary 0.05	Secondary 0.2	Primary 0.4	
Net Benefit (for each side of stream) pgs. 11-12	Riparian Creation, Enhancement, Restoration, and Preservation Factors (select values from Table 1) (MBW = Minimum Buffer Width = 50')			
Supplemental Buffer Credit pg. 16	Condition: MBW restored or protected on both streambanks To calculate: (Net Benefit Stream Side A + Net Benefit Stream Side B) / 2			
Control/Site Protection pgs. 12-13	Corps approved site protection without third party grantee 0.05	Corps approved site protection recorded with third party grantee or transfer of title to a conservancy 0.2		
Mit. Const. Timing pg. 13	Schedule 1 0.15	Schedule 2 0.05	Schedule 3 0	
Temporal Lag (years) pg. 13	Over 20 -0.3	10 to 20 -0.2	5 to 10 -0.1	0 to 5 0

Factors		Benefit 1	Benefit 2	Benefit 3	Benefit 4	Benefit 5	Benefit 6
Stream Type							
Stream Priority Status							
Net Benefit	Stream Side A						
	Stream Side B						
Supplemental Buffer Credit							
Control/Site Protection							
Mit. Const. Timing	Stream Side A						
	Stream Side B						
Temporal Lag							
Sum Factors (M) =							
Linear Feet of Stream Buffer (LF)							
Credits (C) = M x LF							
Total Credits Generated (C) x Site Factor (SF)							
Total Riparian Buffer Credits Generated = _____							

Stream Mitigation Summary Worksheet

	Required Mitigation	Debits
A.	Total Debits =	

	Non-Banking Credit Summary	Credits	Linear Feet
B.	Riparian Buffer Work		
C.	In-stream Work		
D.	Total Proposed Non-Bank Mitigation = B + C		

	Banking Credit Summary	Credits	Linear Feet
E.	Riparian Buffer Work		
F.	In-stream Work		
G.	Total Proposed Bank Mitigation = E + F		

	In-Lieu Credit Summary	Credits	Linear Feet
H.	Riparian Buffer Work		
I.	In-stream Work		
J.	Total Proposed In-Lieu Mitigation = H + I		

	Grand Totals	Credits	Linear Feet
K.	Total Riparian Mitigation = B + E + H		
L.	Total In-stream Mitigation = C + F + I		
M.	Total Proposed Mitigation = D + G + J		

The total proposed mitigation credits (Row M) must be equal to or greater than the total debits (Row A) for the proposed mitigation to be acceptable. The other requirements given in the document must also be satisfied. If the answer to the question below is no, then the proposed mix and/or quantity of mitigation does not comply with requirements herein and the proposed plan should be revised, unless a variance is approved.

	Yes	No
Proposed Credits (PC) ≥ Debits Or (in words) Are credits (M) greater than or equal to debits (A)?		