US Army Corps of Engineers ®

**Regulatory Program**

# State of Iowa Stream Mitigation Method
# Version 2.0

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This document has been developed in consultation with the following public agencies:

**U.S. Army Corps of Engineers (Corps)**
**U.S. Environmental Protection Agency (USEPA)**
**USDA-Natural Resources Conservation Service (NRCS)**
**Iowa Department of Natural Resources (IDNR)**
**Iowa Department of Transportation (IADOT)**
**U.S. Fish and Wildlife Service (USFWS)**
**Iowa Department of Agriculture and Land Stewardship (IDALS)**

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# A. Introduction

This document describes the method for quantifying unavoidable stream impacts associated with the review of permit applications submitted for authorization under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act. The Iowa Stream Mitigation Method (ISMM) will typically be applied on those permit evaluations where a pre-construction notification is required to be submitted to the Corps, and the Corps determines that compensatory mitigation is necessary to offset unavoidable stream impacts associated with the permit evaluation. The ISMM in no way determines when stream mitigation is required. The project manager completes the project evaluation process prior to consulting the ISMM. Once it has been determined, during the evaluation process, that in order to offset unavoidable adverse stream impacts, mitigation is required, then the ISMM is applied. This method is district policy only, not regulation. Section 332.3(f) of the Corps and USEPA joint regulation for Compensatory Mitigation for Losses of Aquatic Resource; Final Rule (Federal Register / Vol. 73, No. 70 Pages 19594-19687, April 10, 2008) (herein referred to as Mitigation Rule), specifies that functional or conditional assessment methods or other suitable metrics should be used where practicable to determine how much compensatory mitigation is required. Therefore, this document has been developed and modified using the best available information and applies scientific concepts to assist regulatory agency personnel in determining a value which represents the loss of aquatic functions at an impact or project site (debits).

Another key element of the ISMM is to address the requirements for making a determination of credits identified in Section 332.4(c)(6) of the Mitigation Rule. The ISMM does not replace any other mitigation plan requirements or components identified in the rule. All mitigation plan documentation must be prepared in accordance with the Mitigation Rule, which governs planning, implementation, and management of permittee-responsible and third party compensatory mitigation projects. Therefore, the ISMM is intended to serve as a tool for determining the amount of stream mitigation credits that a proposed project will generate based on the mitigation plan prepared for Stream Mitigation Banks, Individual In-Lieu Fee Stream Project Approvals, or Permittee-Responsible Mitigation Sites within the State of Iowa.

This method has been established to supplement current policy and provide a consistent rationale to determine appropriate compensatory stream mitigation. It does not require detailed geomorphic, hydrologic, biologic, or chemical assessments at all project sites. Careful assessment of existing conditions, quantified estimation of environmental enhancements using appropriate scientific methodology, and post-construction monitoring are necessary to ensure project success. This will be the preferred method when assessing mitigation requirements for all types of stream systems (perennial, intermittent, and ephemeral) that are determined to be jurisdictional "Waters of the United States" as defined by 33 CFR 328.3 (streams are natural, man-altered, or man-made tributaries that flow directly or indirectly into traditional navigable waters). **In some cases, the evaluation of the permit application may reveal the proposed stream compensation measures are not practicable, constructible, or ecologically desirable; therefore, all determinations involving projects requiring stream mitigation will be made on a case-by-case basis at the discretion of the reviewing Corps district.** Examples where discretion would apply, are mitigation proposals that demonstrate no appreciable ecological, geomorphic and/or hydrologic benefit that can be reasonably expected to result from the proposed in-stream or stream bank activities.

The policies and regulations regarding mitigation can change, and it is possible that new guidance will result in periodic modifications to this ISMM. Efforts have been made in the preparation of this document to incorporate the most recent Corps policy. If a discrepancy with any relevant Corps policy is discovered, users should notify the Corps of the item, and the Corps will review relevant policy, obtain clarification, and modify this ISMM as necessary.

## A1. Regulatory Authorities & Guidelines

Authority for implementing the ISMM is granted through the following:

**Section 10 of the Rivers and Harbors Act of 1899** authorizes the Corps of Engineers to regulate all work in, over, and under navigable waters of the United States.

**Section 404 of the Clean Water Act,** as amended in 1977, authorizes the Corps of Engineers to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. The purpose of the Clean Water Act is to restore and maintain the physical, chemical, and biological integrity of the nation's waters.

**Section 230.10 (d) of the Section 404 (b) (1) Guidelines states** that "no discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken, which will minimize potential adverse impacts of the discharge on the aquatic ecosystem." The Section 404 (b) (1) Guidelines require that every effort must be made to first, avoid impacts, and second, to minimize impacts. Compensatory mitigation is required for unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization have been accounted for.

**Section 401 of the Clean Water Act** provides authority to each state to issue a 401 Water Quality Certification for any project that needs a federal license or permit to conduct any activity, which may result in any discharge. To provide consistency to applicants, the ISMM will also assist the Iowa Department of Natural Resources (IDNR) in their evaluation of projects for Section 401 state water quality certification. The 401 Certification is a verification prepared by the state that the project(s) will not violate water quality standards. IDNR works with applicants to avoid and minimize impacts to waters as part of the 401 Certification. IDNR may require special conditions on projects in order to protect water quality as a condition of the certification.

**Relationship to other federal, tribal, state, local programs:** Except for projects undertaken by federal agencies, or where federal funding is specifically authorized to provide compensatory mitigation, federally funded conservation projects undertaken for purposes other than compensatory mitigation cannot be used for the purpose of generating compensatory mitigation credits for activities authorized by Department of the Army permits. However, compensatory mitigation credits may be generated by activities undertaken in conjunction with, but supplemental to, such programs in order to maximize the overall ecological benefits of the conservation project (See regulations at 33 CFR 332.3 (j) and 40 CFR 230.93 (j)). If a supplemental ecological benefit cannot be identified to the federally funded conservation project undertaken for purposes other than compensatory mitigation, then compensatory mitigation credit cannot be given.

The ISMM is not certified for use in Corps Civil Works ecosystem restoration and mitigation projects. The Corps uses a Model Certification process known as the Planning Models Improvement Program (PMIP) to review, improve and validate analytical tools and models for Corps Civil Works business programs [Engineering Circular (EC) 1105-2-407]. The EC requires use of certified models for all planning activities and tasks the Ecosystem Restoration Planning Center of Expertise (ECO-PCX) to evaluate the technical soundness of models used in ecosystem restoration and mitigation projects. The ISMM is not encumbered by the EC and will undergo separate evaluation by ECO-PCX should Corps Civil Works Planning have an interest in using this methodology.

**Compensatory Mitigation for Losses of Aquatic Resources, Final Rule,** dated 10 April 2008, identifies the regulations governing compensatory mitigation for activities authorized by permits issued by the Department of the Army. The regulations establish performance standards and the use of Permittee-responsible compensatory mitigation, mitigation banks, and in-lieu programs to improve the quality and success of compensatory mitigation projects. This Final Rule can be found at **33 CFR Part 332**.

**Regulatory Guidance Letter (RGL) 05-05 –** Ordinary High Water Mark Identification. This document provides guidance for identifying the ordinary high water mark. RGL 05-05 applies to jurisdictional determinations for non-tidal waters under Section 404 of the Clean Water Act and under Sections 9 and 10 of the Rivers and Harbors Act of 1899.

**Regulatory Guidance Letter (RGL) 08-03 –** Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving the Establishment, Restoration, and/or Enhancement of Aquatic Resources. This document provides guidance on minimum monitoring requirements for compensatory mitigation projects, including the required content for monitoring reports.

**Additional Links and Further Guidance:** Several references to external websites, forms and documents are used in this document. A list of all documents and websites can be found at the Rock Island District regulatory website: http://www.mvr.usace.army.mil/Missions/Regulatory.aspx

## A2. Stream Mitigation Philosophy

The goal of this method is not only to prevent the net loss of stream function when impacts are unavoidable, but also to encourage users to plan carefully, to make changes that address the underlying causes of stream instability and contribute to the long-term health of Iowa's waterways. The most successful projects will be those that consider the long-term evolution of stream channels and their surrounding landscapes, and aim to mimic natural systems. Users of this method are encouraged to follow the principles of natural channel design methodology (e.g., Harman and Starr, 2011, Rosgen 1996). If quantitative physical, biological, or chemical data are available, these data will be considered in the review process, and may override qualitative criteria.

## A3. Scoring Instructions

The items discussed in sections B (Adverse Impact Factors), C (In-stream Mitigation Credit Factors), D (Riparian Buffer Work), and E (Aquatic Life Passage) assist regulatory agencies, mitigation bankers, in-lieu fee providers, and permit applicants in determining the amount of impact (debits) from the proposed project and the mitigation applicable benefits (credits) that are generated as part of a mitigation plan when developed in accordance with the Mitigation Rule.

Adverse impacts are calculated using the factors described in Sections B1-B5. A worksheet for performing these calculations is provided in Appendix I-B. Each impact activity should be evaluated separately in its own column. Where multiple impacts occur simultaneously within the same footprint along a given stream reach, all impacts should be noted, but only the activity with the highest impact factor should be used in the calculation of debits. Stream footprints with multiple impacts will not be counted more than once. For example, the construction of a recreational pond would require a minimum of two columns in the impact worksheet. One column would account for the complete loss of stream where the dam or water control structure is located and the second column would be used to account for the total stream length that is converted into an impounded area (pond). If there is armoring done immediately upstream of the dam or in any area within the pond the activity should be noted but would not be included in the calculations for total impacts as the impoundment adverse impact factor (2.2) is higher than that of armoring (0.5).

In-stream and riparian corridor improvements are totaled using the factors listed in sections C, D, and E. Any proposed in-stream mitigation work should be evaluated using the In-stream Worksheet located in Appendix I-C, riparian buffer credit should be calculated using the Riparian Buffer Worksheet located in Appendix I-D, and credit for aquatic life passage should be calculated using the Aquatic Life Passage Worksheet in Appendix I-E.

Justification for all selections made using either the calculator or the worksheets must be included as part of the mitigation plan and supporting documents. This attachment must reference each row's selection and all calculations completed as a result of the proposed project and mitigation site. Color coded aerial maps that identify impact locations and activities, as well as, a separate map identifying the mitigation site and locations of structures/work, must be included in any mitigation plan as supporting documentation.

When compensatory mitigation requirements will be fulfilled with an approved third-party mitigation provider, then the Adverse Impact Worksheet (Appendix I-B) will be completed. The total credits required (debits) on the worksheet will be the total credits required for purchase from the mitigation bank or in-lieu-fee program. For permittee-responsible mitigation to be acceptable to the Corps, the Mitigation credits discussed in Sections C, D, and E, and those credits generated from the evaluation of a compensatory mitigation plan, should equal or exceed the total credits required on the Adverse Impact Worksheet. When added together the credits and debits do not have to equal exactly zero. Project managers have discretion as to whether or not a project's credits are reasonable and would provide a net benefit to the stream where mitigation is being proposed. Generally, the value of credits required for a mitigation site should be no less than 95% of the debit values created by the project's impacts. The worksheet in Appendix I-A is provided as a summary of the detailed worksheets (I-B – I-E). Any work that requires seeding shall not include any species identified by the most up to date "Iowa Noxious Weeds" list and/or those listed on the Corps "Excluded Species Plant List". Both of these lists can be located on the Rock Island District Regulatory Webpage.
**User Note:** Mitigation credits generated as part of a permittee-responsible mitigation plan should be designed to

provide an environmental lift that equals or exceeds the required credits calculated on the Adverse Impact Factors Worksheet. Exceedance of credit to debit values does not guarantee approval by the Corps. It is the Corps' discretion to determine whether or not credits proposed do provide the claimed or sufficient environmental lift and/or a project is practicable, constructible or ecologically desirable. Any mitigation credit shortage may be compensated by modifying the mitigation plan in an attempt to accrue more mitigation credit, purchasing of credits from an approved mitigation bank, paying a fee to an approved in-lieu fee provider, or combination thereof. Final decisions regarding how or where any mitigation credit shortage shall be compensated rests with the Corps.

# B. Adverse Impact Factors

The items discussed in this section assist the regulatory agencies and permit applicants in determining the adverse impacts of a project and the amount of mitigation required to offset stream losses within the permit area.

## B1. Stream Types

| Stream Type | Adverse Impact Factor | In-stream Benefit Factor |
|---|---|---|
| Ephemeral | 0.3 | 0.15 |
| Intermittent | 0.4 | 0.2 |
| Perennial (1st and 2nd Order) | 0.6 | 0.3 |
| Perennial (3rd and 4th Order) | 0.8 | 0.4 |
| Perennial (≥5th Order) | 1.0 | 0.5 |

For use of this method, streams are classified into one of the following five categories based on the long-term status of the stream. The use of stream order is in accordance with the Strahler Stream Order Method (Strahler, A.N., 1952; Horton, R.E., 1945). Applicants must defend their determination of the stream type by such means as multiple observations at different times of the year under normal climate conditions, generally accepted knowledge, size of drainage area, known water sources including lakes, wetlands, springs or tile lines, stream gage data, use of mapping or modeling, ground photographs and data, etc. Justification for hydrologic stream type must be included in any mitigation plan. The use of historical and recent aerial and/or ground photos should be used for this defense.

All stream segments included in IDNR's "stream order" coverage are considered perennial unless the applicant provides data justifying a different classification. These can be found on the Iowa Geodata website under stream centerlines, Iowa.

**<u>Ephemeral Streams</u>**
*(Impact factor = 0.3, In-stream benefit factor = 0.15)*

Streams that only have flowing water in response to precipitation events during a normal precipitation year. Ephemeral streambeds are located above the water table year-round. Groundwater is not a source of water for stream flow. Runoff from precipitation is the primary source of water for stream flow. Ephemeral streams typically support few aquatic organisms. When aquatic organisms are found, they typically have a very short aquatic life stage.

**<u>Intermittent Streams</u>**
*(Impact factor = 0.4, In-stream benefit factor = 0.2)*

Streams that have flowing water seasonally (at least 3 months of the year), groundwater is a source of water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from precipitation is a supplemental source of water for stream flow. The biological community of intermittent streams is composed of species that are aquatic during a part of their life history or move to perennial water sources during dry periods. Intermittent streams with perennial pools are included in this category.

**First or Second Order Perennial Streams**

*(Impact factor = 0.6, In-stream benefit factor = 0.3)*

Perennial streams have flowing water year- round during a normal precipitation year. The water table is located above the streambed for most of the year. Groundwater is a primary source of water for stream flow. Runoff from precipitation is a supplemental source of water for stream flow. Perennial streams support aquatic organisms year-round. A first order stream is one which has no other perennial tributaries feeding into it. A second order stream results from the combination of two first order streams. Streams in this category are often considered headwater streams and will exhibit a steeper slope with very few meanders. They also have a narrow width which results in greater shading and the presence of macroinvertebrates and some small vertebrate species.

**Third or Fourth Order Perennial Streams**

*(Impact factor = 0.8, In-stream benefit factor = 0.4)*

Perennial streams that result from the joining of at least two second order streams would be classified as third order streams. Similarly, the joining of third order perennial streams would result in the creation of a fourth order stream. Third and fourth order streams exhibit more of the riffle-pool complexes and have much more pronounced meandering. These streams will generally have a more pronounced riparian corridor and are much wider than first and second order streams. The aquatic biodiversity is much higher as some larger fish such as bass and pan fish species are regularly observed in these streams.


**Fifth Order Perennial Stream or Greater**

*(Impact factor = 1.0, In-stream benefit factor = 0.5)*

Large perennial streams resulting in the combination of fourth order or greater streams are generally considered to be rivers. These streams have extensive watersheds with a shallower slope and slower flow. Examples of this category in our region would be the Iowa River (6-7$^{th}$ order) and the Des Moines River (6-7$^{th}$ order) among others.

***User Note:*** The joining of a first order stream to a second order stream does not result in a third order stream. To increase order, a stream must be joined by an equal order stream, such as a second order with a second order, which would result in a third order stream.

## B2. Priority Waters

The value of a stream is categorized below for the purpose of determining adverse impacts and also for determining the in-stream benefits of mitigation. This classification is designed to protect those areas with significant ecological, recreational, hydrological, or socio-economic value. As new technology and new assessment information is available, a stream may be reclassified on a case-by-case basis. The priority waters are divided into four categories: restored reach, primary, secondary, and tertiary.

| Priority Waters | Adverse Impact Factor | In-stream Benefit Factor |
|---|---|---|
| Restored Reach | 1.5 | NA |
| Primary | 0.8 | 0.4 |
| Secondary | 0.4 | 0.2 |
| Tertiary | 0.1 | 0.05 |

**Restored Reach**

*(Impact factor = 1.5, In-stream benefit factor = NA)*

In reaches of stream where credit has been previously given for re-connecting aquatic life passage due to the removal of a dam or other structures where aquatic passage was precluded (i.e. raised culvert), the placement of any new structures preventing free passage of aquatic organisms will be reviewed at a higher impact factor. These areas will be mapped by the Corps, and information regarding their location can be found on the regulatory website in the Iowa Stream Method section.


## Primary

*(Impact factor = 0.8, In-stream benefit factor = 0.4)*
These streams provide important contributions to biodiversity on an ecosystem scale or high levels of function contributing to landscape or human values. Impacts to these streams should be rigorously avoided or minimized. If a primary stream must be impacted, compensation for impacts should emphasize replacement nearby and in the same watershed. Designated primary priority waters include:

- Outstanding National Resource Waters - currently none listed in Iowa
- Outstanding Iowa Waters*:
- Iowa Protected Water Areas*:
- Waters with known mussel beds**
- Waters with known populations of state or federally listed Endangered and Threatened Species**
- Rivers and streams adjacent to and likely to affect a known mitigation site (bank, in-lieu fee, or permittee-responsible).
- Waters identified by the Corps as those that are protected under Section 10 of the Rivers and Harbors act of 1899.
    - Mississippi River
    - Des Moines River (Fort Dodge Mile 315 to the Mississippi River)
    - Missouri River
    - Iowa River (Mile 3 near Toolesboro to the Mississippi River)

* These coverages are available for download from the Iowa Geodata website. Should one require data that cannot be located on the referenced site, the data will be made available upon request, barring any legal or security restrictions. Also, for individuals without geospatial software, the IDNR hosts interactive mapping services.

** These waters are identified with non-specific species information and generalized location information by using the IPAC tool located on the USFWS website. If the applicant's project could potentially impact endangered species identified using this application, the applicant should contact the USFWS-Ecological Services Office which can be reached at (309) 757-5800 and an IDNR environmental reviewer. Instructions for requesting a state environmental review prior to permit application can be found on the Iowa DNR website for conservation of threatened and endangered species.

## Secondary

*(Impact factor = 0.4, In-stream benefit factor = 0.2)*

Secondary priority waters include:

- Areas known or mapped as important to life cycles of aquatic Species of Greatest Conservation Need listed in Tables 3-3, 3-4, 3-8, 3-9, 3-10, and 3-12 listed in the most recently approved Iowa Wildlife Action Plan located on the Iowa DNR wildlife stewardship page.
- Rivers and streams of the same or lower order upstream or downstream of primary priority waters, if the project is determined likely to affect the priority water.
- Streams within 2 stream miles upstream or downstream of waters located within publically owned natural or recreational areas and mapped private conservation lands.

### Tertiary

*(Impact factor = 0.1, In-stream benefit factor = 0.05)*

These areas include all other freshwater systems not ranked as primary or secondary priority waters.

## B3. Existing Condition

The existing functionality of each stream segment is assessed where an impact activity is proposed. Streams are assumed to be moderately functional unless the stream is determined by the Corps to be fully functional or functionally compromised, as described below. Applicants should be prepared to defend their determination of the stream type by such means as multiple observations at different times of the year under normal climate conditions, generally accepted knowledge, size of drainage area, known water sources including lakes, wetlands, springs or tile lines, stream gage data, use of mapping or modeling, ground photographs and data, etc.

| Existing Condition | Adverse Impact Factor |
|---|---|
| Fully Functional | 1.6 |
| Moderately Functional | 0.8 |
| Functionally Compromised | 0.2 |

### Fully Functional

*(Impact factor = 1.6)*

These are stream segments that have been shown to, or are likely to, support healthy aquatic communities. These stream segments also have natural hydrologic variability and responses to precipitation events. Fully functional stream segments are characterized by a combination of little modification, relatively stable bed and banks, lacking artificial dam structures, water quality sufficient to support diverse aquatic life, and undisturbed riparian corridors. A fully functional stream represents a least-disturbed condition, and therefore exhibits the conditions used to establish performance standards for restoration and mitigation.

The stream segment is considered fully functional if four or more of the following criteria are met:

- Is unaltered in any significant manner by human activities. It has not been channelized, impounded, significantly constricted by structures, or had its flow significantly altered.
- Is not impaired for aquatic use as defined by the most current Clean Water Act Section 305(b)/303(d) Integrated lists as Category 4 or 5 as developed by IDNR or USEPA.
- Is stable and does not exhibit head cutting, incision, or excessive aggradation, and the stream banks are not subject to excessive erosion or disturbance.
- Is connected to its overbank floodplain supporting normal hydrological functions.
- Has a riparian buffer of at least 25 feet in width on both sides of the stream that sustains deep-rooted, native vegetation over 90% or more of the impacted length.

  ***User Note**: If a stream segment is impacted by a minor structural alteration along a stream that is otherwise considered fully functional, but the structural alteration does not significantly alter the stream reaches above and below the structure, the segment from 0.25 miles above to 0.25 miles below the alteration should be considered a separate segment that is moderately functional.

OR, if one or more of the above criteria are met and monitoring data indicates that the stream has the capacity to support an exceptional biological community based on any of the following three criteria:

- One or more assessments of the Eco regionally-adjusted Fish Habitat Index (EFHI) within 1.5 miles of the stream segment have resulted in a score exceeding 60 based on physical habitat assessment data within the past 10 years. These stream segments are capable of supporting a fish assemblage that is considered “very good” or “excellent” by the DNR’s Fish Index of Biotic Integrity (FIBI). Use the Iowa DNR’s Standardized Operating Procedures for collecting biological sampling and physical habitat assessment data.

- One or more biological assessments of the stream within 1.5 stream miles of the segment has resulted in a score within the "excellent" category using the DNR's benthic macroinvertebrate index of biotic integrity (BMIBI), fish (FIBI), or freshwater mussels (MIBI) within the past 10 years. The BMIBI and FIBI scores are currently housed in the DNR's BioNet database.

- If the stream is considered a **non-wadeable stream** (drainage areas greater than 500 square miles), it is classified as "fully supporting" its designated aquatic life use based on the Iowa DNR biological assessment methodology, which can be found in Attachment 2 of Iowa DNR's methodology for water quality assessments and impaired waters listings pursuant to sections 305(b) and 303(d) of the Federal Clean Water Act. These listing are available in the Iowa DNR's Water Quality Assessment database, ADBNet, which can also be accessed through BioNet.

**Exception:** The Corps, at its discretion, may designate the largest streams within an Ecological Drainage Unit or 8-digit Hydrologic Unit Code (HUC) as fully functional, regardless of whether they meet the criteria above, based on the stream's recreational, commercial, or water supply values.

## Moderately Functional

*(Impact factor = 0.8)*

These are streams that show a limited degree of disturbance; however, system recovery has a moderate probability of occurring naturally. These streams support many, but not all, of the hydraulic and geomorphic functions characteristic of fully functioning streams of similar order in the watershed. All stream segments that **do not meet** the definition of fully functional or **do not have** the characteristics of a functionally compromised stream segment are considered moderately functional.

## Functionally Compromised

*(Impact factor = 0.2)*

These are streams that have been degraded and lack resilience characterized by the loss of one or more functions. Recovery is unlikely to occur naturally unless a substantial rehabilitation project is undertaken. A stream segment may be considered functionally compromised if it fails to meet any fully functional conditions and meets three or more of the following criteria:

- All BMIBI (benthic macroinvertebrates), FIBI (fish) and MIBI (freshwater mussels) scores calculated from samples on the stream segment, or within 1.5 miles of the stream segment, in the past 10 years fall into the "poor" category unless there is evidence of chemical water quality impairment(s) that results in less aquatic life than expected given the available habitat. The BMIBI and FIBI scores are currently housed in the DNR's BioNet database.
- The stream is channelized or straightened.
- Is confined by a levee, impounded, or is otherwise artificially constricted.
- Is entrenched or contains active head-cuts (i.e. abrupt drops in stream bed, both banks failing).
- Has less than 10 feet of riparian buffer (average width throughout meander belt or observed corridor) of deep-rooted vegetation on one or both sides of the stream channel.
- Has banks that are extensively eroded (i.e., tree roots showing, soil abutments hang over the water) or unstable with obvious bank sloughing and/or erosional scars.
- Has four or more stream impacts within 0.5 miles upstream of the proposed stream impact including culverts, pipes, or other manmade modifications, and these stream impacts individually or cumulatively exceed 100 feet in length.

## B4. Impact Activity

The following are considered impact activities:

| Impact Activity | Adverse Impact Factor |
|---|---|
| Complete Loss | 2.5 |
| Impoundment | 2.2 |
| Pipe | 2.0 |
| Morphological Change | 1.5 |
| Detention Facility | 0.75 |
| Conservation Impoundments | 0.7 |
| Armored Revetments/Indirect Effects | 0.5 |
| Below Grade Culvert | 0.3 |

### Complete Loss

*(Impact factor = 2.5)*

Examples include, but are not limited to, the filling of a stream channel resulting in a total loss of stream habitat, the relocation of a stream channel (even if a new stream channel is constructed), conversion of a stream to a grassed waterway, and the placement of fill to create an impoundment.

### Impoundment

*(Impact factor = 2.2)*

Conversion of stream(s) to open water (pond or lake) through the construction of a dam or similar structure that modifies the natural stream flow, reduces or precludes fish passage, and interrupts transport of sediment. Channel impacts where the water control structure is located are considered a "complete loss" activity. The resulting upstream inundation, as well as the scour hole created downstream, will be considered when calculating the linear feet of impact for an impoundment. Certain Activities may qualify for the "Conservation Impoundments" category, see below for instruction.

**User Note**: To determine the upstream length of stream impacted, find the elevation in the upstream pool that is equal to the elevation of the top of the water control structure (dam). The distance between this upstream point and the top of the structure would represent the upstream linear feet of stream impacted. An example of a way that this can determined would be using a survey instrument and rod to establish the elevation at the top of the dam, at a point midway across the channel. Then collect survey points of the stream channel's normal pool elevation in an upstream direction until the pool elevation becomes higher than the dam. Determine the stream channel distance from this break point in elevation to the downstream structure. The downstream impact from the dam is the scour hole and the initial displacement of that sediment. The downstream scour hole development caused by the structure does not create a continuous increase in sediment transport through the system so downstream impacts are limited. Determine the downstream length of stream impacted by measuring the maximum size of the scour hole from the edge of the base of the dam to the downstream edge of the scour hole, which is often the highest streambed elevation immediately downstream of the scour hole. Multiply that distance by two. This multiplier is to account for the scour hole and the initial movement of the finite amount of displaced sediment downstream. The actual depth of the scour hole is not directly accounted for with this technique but is indirectly included in the multiplier because, under most circumstances, the scour hole length increases as scour hole depth increases.

### Pipe

*(Impact factor = 2.0)*

Routing a stream through pipes, box culverts (over 100 linear feet), or other enclosed structures.

**User Note:** If a piped channel section fails to follow the existing channel alignment, the Regulatory Project Manager will determine whether the "pipe" or "complete loss" impact activity factor will be used.

### Morphologic change

*(Impact factor = 1.5)*

Alteration of the established or natural dimensions, depths, or limits of an existing stream channel through straightening, widening, dredging, excavating, or channelizing (leaving the channel in the same alignment). Examples include creation of a hardened open channel such as one lined with concrete or rip-rap across its streambed and to the top of both banks, in-channel grading upstream of a detention structure, box culverts (equal to or less than 100 linear feet), lining parallel banks with gabion baskets, concrete or block retaining walls, embedded culvert installation (greater than 100 linear feet) or channel reaming activities. Morphologic change does not include river restoration activities (when the purpose of the project is rehabilitation or restoration) which may include modest stabilization of a bank toe with wood or native stone, planting of native vegetation, excavation of low floodplain or breaching of levees, or otherwise restoring a disturbed or degraded channel to a natural form. When restoration activities are done properly they should exhibit a demonstrable environmental lift to the riverine system, not an impact. These activities will be reviewed on a case-by-case basis, and the final determination is at the Corps discretion.

## Detention facility

*(Impact factor = 0.75)*

Installation of a storm water management facility within a stream channel. These facilities consists of a detention structure and a **temporary** ponding area upstream of the detention structure. The detention structure (i.e., dam or berm) itself is considered a "complete loss" activity as defined above. Water velocities entering the temporary ponding area are typically reduced and may be temporarily held back while outflow is slowly released back into the channel downstream of the detention structure.

**User Note:** If the stream channel upslope of the detention structure is straightened, widened, dredged, excavated, or relocated, determination of whether the impact will be characterized as a "morphologic change" or "complete loss" will be at the Corps' discretion. When making this determination, the Corps may consider the relative diversity of the stream as relates to movements of aquatic life.

## Conservation Impoundments

*(Impact factor = 0.7)*

Activities utilizing a watershed approach that are funded and/or approved technical assistance is provided by a state or federal agency as part of an approved Conservation Practice qualifies for this category. Examples of projects that would qualify for this impact factor are projects issued under Regional Permit #33, #34, or #39 where the NRCS or IDALS has provided funding and is the lead federal agency (RP 33 & 34 only). If projects are being designed, funded, and/or constructed by a private entity (not IDALS) the proposed project must meet all standards and conditions of Regional Permit #39 to qualify for this impact factor. These projects must be designed utilizing a watershed study to identify locations where the greatest overall ecological and water quality benefit will occur as a result of the location and size of the conservation pools. Channel impacts where the structure is located are considered a "complete loss" activity, and the resulting inundation will be considered as a conservation impoundment activity.

## Armored Revetments

*(Impact factor = 0.5)*

To armor with riprap one or both stream channel banks, or the use of other hard methods (e.g., cabled concrete blanket, block retaining wall, or other unnatural structures) on a streambank. This impact category also covers the placement of footings, piers/columns, outfall protection aprons and drilled shafts. If both sides of a stream are impacted by armoring, each side should be calculated on a separate column when using the adverse impact worksheet.

**User Note:** Bank and shoreline protection shall consist of suitable clean materials, free from debris, trash, and other deleterious materials. If broken concrete is used as riprap, all reinforcing rods must be cut flush with the surface of the concrete, and individual pieces of concrete shall not exceed 3 feet in any dimension. Asphalt, car bodies, and broken concrete containing asphalt are specifically excluded from this authorization. This category also covers the placement of footings, piers/columns and drilled shafts. Armoring of the stream bed and both banks with riprap, or installing a retaining wall along both channel banks, should be assessed as a "Morphologic Change."

## Indirect Effects

*(Impact factor = 0.5)*

Indirect effects, also known as secondary impacts that result from the construction of a project, would use this impact factor. Examples where this would apply include, but are not limited to, projects that result in the loss of specific functions such as biological connection to a downstream Traditionally Navigable Waterway (TNW) due to the approval of a project, etc. When impacts directly affect the functions and services of a stream a different impact factor (such as morphological change) should be used. Stream impoundments should be calculated using either the "Impoundment" or "Conservation Impoundments" factor above to account for the indirect effect of creating a ponded area.

## Below-grade (embedded) culvert

*(Impact factor = 0.3)*

The use of this factor is limited to those activities that utilize an embedded pipe, box culvert, or other enclosed structure to route a stream, for the purpose of a transportation crossing (≤ 100 linear feet of stream to be impacted per linear transportation crossing). Impacts greater than 100 linear feet shall be evaluated under the morphological change impact factor. New or replacement culverts should be designed to convey the two year recurrence width of the stream. The culvert shall be embedded and backfilled below the grade of the stream (≥ 1 foot for culverts greater than 48 inches in diameter). On culverts 48 inches wide or smaller, the bottom of the culvert shall be placed at a depth below the natural stream bottom. These projects must be designed to retain a natural sediment load within the culvert to qualify for this factor. Bottomless culverts are acceptable in streams with non-erodible beds (i.e. bedrock or stable clay). Culverts that fail to meet the above design criteria will be evaluated under the impact activity known as Pipe (see definition above).

# B5. Compensation Ratio

The following affects all mitigation projects as a multiplier to the overall impacts. The use of this table ensures that mitigation is in compliance with the 2008 Mitigation Rule and district policies. The higher values account for the temporal lag between project impacts and mitigation completion as well as risk with compliance and IRT control of performance and standards.

| Service Area | Mitigation Bank | In-Lieu Fee with extra released credits | In-Lieu Fee | Permittee Responsible Mitigation |
|---|---|---|---|---|
| Primary | 1 | 1 | 1.2 (1.0 advanced) | 1.5 (1.3 advanced) |
| Secondary | 2 | See Instrument | See Instrument | 2 |
| Tertiary | 3 | See Instrument | See Instrument | 3 |

## Mitigation Bank

A mitigation bank has a previously determined service area(s) as set forth in the applicable final bank instrument that is approved by the Interagency Review Team (IRT) and District Engineer (DE) in accordance with 33 CFR 332.8 of the Mitigation Rule. If the site of the proposed impact activity lies within the service area of a mitigation bank with the appropriate credits available, one must first consider their use as a means of satisfying mitigation conditions unless the permit applicant demonstrates that one of the next three options will result in greater environmental lift. For more information regarding service areas and banks, consult the Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS) website to see accurate and up to date maps of current banks and available credits.

## In-lieu fee with extra released credits

Like mitigation banks, in-lieu fee (ILF) programs have previously determined service area(s) as set forth in the applicable final ILF program Instrument that is approved by the IRT and DE in accordance with the Mitigation Rule in the course of completing a mitigation project which has been approved by the IRT and DE, an ILF program may generate more credits than necessary to fulfill the advance credits previously sold in a given service area. An ILF program with the appropriate number and resource type of released credits available may be deemed to offer compensatory mitigation equivalent to that provided by a bank, as contemplated by 33 CFR 332.3(b)(2). This factor is to be applied to surplus released credits of an ILF program in its primary service area. Should an ILF program choose to make them available for sale, the value is 1.0 as there is no temporal lag associated with the loss of aquatic functions due to the project impacts occurring after completions of the ILF mitigation site. Should a project proponent seek to purchase ILF surplus released credits for an impact site lying in the secondary or tertiary service area of an ILF program, the applicable factor to be used in calculating adverse impact debits must be set forth in the approved final Instrument of the ILF program.

## In-lieu fee

If an ILF program does not have surplus released credits available to compensate for impacts within an applicable service area(s), it may be authorized to sell advance credits pursuant to its Instrument. If a project proponent seeks to satisfy its compensatory mitigation obligation by purchasing ILF advance credits, and the impact site is located within a primary service area of the ILF credit provider, the applicable adverse impact calculation factor is 1.20. Advance credits are at a higher ratio value due to a time lag between the loss of aquatic resource functions caused by the permitted impacts and the replacement of aquatic resource functions at the compensatory mitigation site. The extra 0.2 multiplier takes into account the temporal loss in function that occurs, while acknowledging that the Mitigation Rule prefers ILF advance credits to permittee-responsible mitigation conducted under a watershed approach. Should a project proponent seek to purchase ILF advance credits for an impact site lying in the secondary or tertiary service area of an ILF program, the applicable factor to be used in calculating adverse impact debits must be set forth in the approved final Instrument of the ILF program. An applicant seeking to satisfy compensatory mitigation obligations through the purchase of ILF advance credits must ensure that the ILF program has an approved final Instrument in place (available on the RIBITS website), and that advance credits are available for the service area in which the proposed impact will occur. This should be confirmed directly with the ILF program sponsor in advance of making an application for a Section 10/404 permit, and in accordance with any procedures the ILF sponsor may establish.

## Permittee responsible mitigation

The “service area” used for permittee responsible mitigation (PRM) is not determined by an instrument or other such IRT approved document. Because PRM incurs much higher risk due to a lack of high level review and design along with incurring an inherent temporal lag similar to ILF projects, a higher ratio has been assigned to this value. If approved mitigation is completed prior to project impacts, a lowering of the compensation ratio value by 0.2 may be applicable to account for a lack of temporal lag. The value for PRM where there is no temporal lag equals 1.3. PRM projects can’t be valued lower than ILF projects as there is an inherent risk that needs to be accounted for and the hierarchy as set in the Mitigation Rule requires that the Corps value ILF projects at a higher level than PRM. Service area is selected by the watershed in which impacts from the project are proposed to occur and is determined on a case-by-case basis. For example, if both the impact and mitigation site are in the same HUC 8, then primary would be used. If the project is located in the same HUC 6 and an adjacent HUC 8 to the impacted site, secondary would be used. Mitigation that occurs in the same HUC 6 but a non-adjacent HUC 8 would qualify for the tertiary service area. Permittee responsible mitigation can occur outside of the tertiary service area, however it will incur a much higher ratio, as the impacts are further removed and do not provide as much or any compensation to the impacted watershed. The Mitigation Rule states an express preference for using mitigation bank credits first, then in-lieu fee program credits, then two different kinds of permittee-responsible mitigation (see 33 CFR 332.3(b)(2)-(b)(6)). The factors applicable to permittee responsible mitigation under this Section B5 take into account the basis for the preference hierarchy explained in the prefatory comments of the Mitigation Rule, and the risk associated with permittee responsible sites as historically they have not performed as well as banks.

# C. In-Stream Mitigation Credit Factors

An understanding of stream and riparian functions is required to plan and design successful stream restoration projects. The basic functions that stream and riparian corridors support include: system dynamics, hydrologic balance, sediment processes and character, biologic support, and chemical processes and pathways (Fischenich, 2006). Stream restoration does not necessarily require returning a system to a pre-disturbance condition, as this is seldom feasible (Copeland et al., 2001).

Successful stream channel design, or uncovering what restoration technique best fits a given situation, is highly dependent on regional and local factors. Stream restoration must account for any potential adjustments in channel form and function that may occur within the watershed as a result of the restoration project. Watershed conditions, site selection, baseline information, mitigation objectives, design alternatives, and other feasibility actions must be considered during permit review as critical components of a compensatory mitigation plan prior to the application of this method. It is important to develop stream mitigation plans in consultation with resource and regulatory agencies and use existing watershed assessments, or other available planning documents to make determinations on the appropriate restoration method.

At a minimum, one-quarter (25%) of the proposed mitigation credits for a project, ILF, or mitigation site must be considered in-stream mitigation. In exceptional and unusual cases, this requirement can be waived by the Corps project manager if it is deemed impracticable, unsafe or inadequate to provide the necessary compensation for impacts that are proposed to occur as a result of a project. The waiver documentation must be signed by the Regulatory Section Chief and kept in the permanent file. This option should be considered a last possible resort and may incur a higher ratio of mitigation, at the Corps discretion, to ensure adequate compensation of all impacts. A specific example of when a waiver would apply: the proposed mitigation site is located on a reference quality or stable stream reach where in-stream structures would damage the overall stability of the site. Stability must be demonstrated using a stream assessment methodology with justification and ratios provided.

In-Stream mitigation **should** be designed by a qualified professional with specialized training and experience (e.g. environmental or hydraulic engineer, fluvial geomorphologist, river ecologist or other consultant) to ensure the safety and

## C1. Stream Type

See section B1.

## C2. Priority Waters

See section B2.

| Net Benefits | In-Stream Benefit Factor |
|---|---|
| Excellent | 3.5 |
| Good | 2.4 |
| Moderate | 1.2 |
| Stream Relocation | 0.5 |

## C3. Net Benefits

The categories listed below describe the benefits of the proposed mitigation relative to the restoration or enhancement of physical, chemical and/or biological processes that occur in aquatic ecosystems. Net benefits address functional objectives such as hydrologic balance, sediment transport, water quality and biological support in the context of the existing conditions prior to mitigation activities. The Corps will determine on a case-by-case basis the net benefit of the proposed in-stream mitigation action. Each mitigation proposal will be evaluated to ensure that the documentation fulfills the requirements of the Mitigation Rule. Care should be taken not to add in-stream features to a stable or reference quality stream in order to simply generate credits; i.e., stability problems or habitat deficiencies within the stream should be stated, and applied methods should respond to those problems. In most cases, use of native construction materials for mitigation, such as stone, wood, and native plants, is preferable over use of concrete, metals, or other manufactured materials.

A stream relocated to a new alignment for purposes of accommodating construction of an authorized project in the stream's former location may be construed as a Net benefit if the relocation objectives balance hydrologic and geomorphic processes while incorporating appropriate design features. Under this circumstance, the Corps will determine on a case-by-case basis whether the net benefit of the proposed mitigation activity will provide no compensation, partial compensation, or full compensation for project impact.

## Excellent

*(In-stream benefit factor = 3.5)*

To be classified as "excellent," a restoration project must demonstrate that multiple functions of a stream on a large scale are being improved. The results of an excellent level project should resemble that of a stable reference quality stream. If attaining reference quality is unattainable due to uncontrollable natural issues the project must show such a large beneficial impact that the watershed it is located in will be vastly positively improved (justification for this must be provided). Environmental lift from highly beneficial projects should have large scale results and be discernable throughout the entire upstream drainage area. Combinations of multiple examples found below are required to meet this category as one activity is not expected to reach a watershed level of impact alone. The project should improve water quality immediately downstream and demonstrate improvement of the entire stream reach where mitigation is occurring. The benefits gained as a result of the mitigation project should be consistent with existing conservation, restoration, or watershed plans. The project should be designed by an experienced stream restoration professional or hydraulic engineer in collaboration with a stream biologist familiar with river and stream habitats. Native riparian wetland, valley corridor prairie and woodland buffer plant species, recognized as appropriate to the setting, should be used. The use of natural channel design (Rosgen, 1996 WARSSS) and associated checklist (Harmon and Starr, 2001), or a pre-approved functional equivalent, such as the Iowa DNR River Restoration Toolbox (complete list located on the regulatory webpage) must be used to qualify for the excellent credit level. All described illustrations, figures, tables, and construction drawings and analysis reports for all process benchmarks must be submitted along with digital point files of the existing conditions survey. The applicant must thoroughly respond to all items in the checklist as well as any questions posed by the Corps. Elevation data resulting from surveys must also be included digitally in a spreadsheet or *.csv format for both the reference reach and mitigation reach. Examples of in-stream activities which could be classified as excellent net benefits include, but are not limited to, the following:

- Removing or modifying dams (modification must exhibit the same effects as removal and the applicant must provide adequate justification in order for it to qualify for the excellent category), weirs, pipes or culverts greater than 300 linear feet in length and other manmade in-stream structures such as low-water crossings in ways that restore the natural river channel to a stable state that is neither aggrading nor degrading. The stream should resemble reference conditions at bankfull widths, depths and planform to a relatively similar sinuosity. Habitat considerations and features are incorporated within the project area. Basic criteria for aquatic life passage described in section E must also be considered for all components of the proposed project to be considered as mitigation.
- A project that proposes to significantly benefit biological stream functions as predicted by Iowa DNR's Eco regionally-adjusted Fish Habitat Index (EFHI) protocol or other pre-approved tools. For intermittent or wadeable perennial streams, these projects should raise the estimated regionally-adjusted habitat index a minimum of 25 points above the existing habitat quality of the stream reach using habitat assessment data collected within the past 5 years. Use the Iowa DNR's biological sampling and physical habitat assessment SOP for guidance. For ephemeral streams or large non-wadeable streams where the EFHI is not appropriate, other approaches for evaluating environmental lift may be considered.
- Installation of grade control structures (GCS) that promote fish passage on stream reaches that are channelized or portions of streams suffering from significant bed degradation, such as western Iowa's deep loess soil regions. Loose stone structures designed for stability are preferred, but where suitable stone is cost-prohibitive, grouting may be considered. Basic criteria for aquatic life passage described in section E also must be considered for all components of a project to be considered as mitigation. This does not include the placement of an impoundment structure that impedes the passage of aquatic life.
- Restoring river and stream floodplains or restoring floodplain connectivity (identified by bank height ratio or

entrenchment ratio). Examples include creating bankfull (1 to 2 year recurrence) floodplain in highly entrenched stream channels; artificial levee or dike removal.

- Artificial levee or dike removal, setback, and/or notch where one of these activities itself reconnect the stream channel to at least 50 percent of the 10 year or flood recurrence. Streambanks and floodplains will be planted with regionally native wetland, prairie, and/or woodland species based on research of successful plantings (not included in buffer credit).
- Restoring a stream channel to its former location and/or restoring sinuosity, channel dimensions (width/depth ratio), and bankfull width of a degraded stream reach to appropriate design based on a morphologically stable and appropriate reference stream.
- In the loess soil region, Iowa 303(d) listed impaired waters and identified Outstanding Iowa Waters, stabilizing channel erosion with selected use of woody debris, native stone, live wood check structures, and stabilization plantings targeted to minimize blockage to fish movement. Other activities where the purpose is to significantly enhance the watershed in these identified areas will be considered for the excellent category based on their magnitude and demonstrated significance to those impaired areas.
- Building a new, stable channel at a higher elevation and reconnecting it to its natural overbank floodplain where functionally appropriate.
- Restoring oxbows in low gradient streams or other off channel habitat where Topeka Shiner or other endangered species habitat exists. Designs must be approved by a USFWS or DNR fisheries biologist prior to acceptance.
- Creating floodplain benches adjacent to streams artificially disconnected (i.e. by man-made structures) from their floodplain at a 1 to 2 year recurrence level. Stream banks shall be re-sloped to a 6:1 slope and reshaped and the floodplain bench shall be revegetated with native woody and herbaceous vegetation. Depending on project length (under 100 linear feet of stream channel), this activity may be classified by the Corps as a "good" stream channel restoration project. The newly created bench must be at least ½ of the bankfull width at a 1 to 2 year recurrence.

"Excellent Net Benefit" **does not** include the relocation of a stream channel to accommodate a project.

## Good

*(In-stream benefit factor = 2.4)*

A "good" stream restoration project addresses stream functions on a smaller scale or instances where only one activity/bullet described in the excellent category is completed by itself. These projects provide a limited environmental lift to the mitigated drainage area, and the impacts from the mitigation are of lesser value than the excellent category. The benefits gained as a result of the mitigation project would be localized and not system-wide. Examples of in-stream activities which accrue "good" net benefits include, but are not limited to, the following:

- Projects on wadeable streams that propose to improve the Eco regionally-adjusted Fish Habitat Index (EFHI) of the stream reach category in category one, or raising the index score by a minimum of ten (10) points.
- Removing or modifying dams; removing weirs, pipes or culverts (greater than 300 linear feet may be considered for the excellent category), and other manmade in-stream structures such as low-water crossings in ways that restore the natural stream channel to a stable state. These projects do not meet the standards for "excellent" mitigation.
- Grade control for actively down cutting channels, regardless of location, where no grade control currently exists. Basic criteria for aquatic life passage described in section E also must be considered for all components of a project to be accepted for submittal as mitigation.
- Streambed stabilization can include a combination of methods to counter streambed degradation exhibited by knick points and/or head cuts. Grade control may be achieved with maximum slopes of 5 percent at a minimum thalweg slope. Newbury rock riffles, rock arch rapids, cross vanes, and other structures may be used to control slope.
- Artificial levee or dike removal, setback, and/or notch where one of these activities itself will reconnect the

stream channel to its natural overbank floodplain, with less than 50 but greater than 25 percent of the 10-year interval floodplain reconnected across the entire valley.

- Restoring in-stream channel features (i.e., riffle/run/pool/glide habitat) within a reach but not comprehensively rehabilitating the channel, using methodologies appropriate to the stream type, size, location in the watershed and current watershed condition.
- Where appropriate, restoring stability in highly eroded areas or areas with artificially accelerated erosion, by re-sloping and reshaping banks, applying a relatively small percentage of rock (e.g., stone toe protection), and using non-rigid (soft) methods such as native vegetation. In areas where extreme accelerated erosion is occurring or significant habitat constraints limit biological productivity, more rock structures may be used, but native vegetation must be planted in combination with the rock structures.
- Restoring a highly erosive and entrenched channel to a step-pool sequence type of channel using native stone and wood materials with thalweg slope not to exceed 5 percent over the restored reach using material sizes deemed to be stable on the design slope.
- Naturalizing hard-scaped banks such as abutment walls or riprap revetments by replacing them with softer slopes and a stabilized, natively vegetated bank.
- Restoring oxbows in low gradient streams or other off channel habitat where Topeka Shiner or other endangered species habitat do not exists.
- Creating floodplain benches adjacent to streams artificially disconnected (i.e. by man-made structures) from their floodplain at a 1 to 2 year recurrence level. Stream banks shall be re-sloped to a 4:1 slope and reshaped and the floodplain bench shall be revegetated with native woody and herbaceous vegetation. The newly created bench must be at least ½ of the bankfull width at a 1 to 2 year recurrence.

"Good Net Benefit" **does not** include the relocation of a stream channel to accommodate a project in the stream's former location.

## Moderate

*(In-stream benefit factor = 1.2)*

A "moderate" restoration project addresses stream function on a reach-specific scale. For example, these projects may not significantly change the existing EFHI score along the entire reach, but they will provide localized habitat improvements. Even if applied on a significant length of stream, such practices do not markedly enhance the stream's physical, chemical, and biological processes. Examples of practices which accrue moderate net benefits include, but are not limited to, the following:

- Removing check dams, weirs, car bodies, foreign materials/junk, debris and artificial in-stream structures and/or other structures that are directly contributing to bank erosion, scour or blocking stream processes where significant bed degradation or sediment release is not projected to occur. Must be done in conjunction with other mitigation methods as it will not be given credit if removal of material is the only activity accomplished.
- The use of minor grade control structures with a maximum slope of 5 percent at the thalweg. Newbury rock riffles, rock arch rapids, cross vanes, and other structures may be used to control slope.
- Where appropriate (heavy sloughing of banks, artificially eroding banks, etc.), using streambank stabilization methods that utilize hard natural materials in combination with native vegetation to slow velocities and/or train flow for the purpose of enhancing local channel stability and aquatic habitat. Stabilization methods include toe wood, longitudinal peak stone toe, encapsulated/planted fabric lifts or rolls, stream barbs, cross vanes, straight vanes, j-hook vanes, bendway weirs etc. but *not* rock armoring of streambanks alone. In general, hardened portions of the toe should vary from a maximum of half bankfull elevation to bankfull elevation. Hard natural materials (armoring) may include materials such as native stone or woody debris, but not brick, metal or other non-natural materials. If suitable, hard natural materials are not readily available, with Corps approval, clean, broken concrete may be used where individual pieces of concrete do not exceed 3 feet in any dimension. Asphalt and broken concrete containing asphalt are specifically excluded. Any protruding rebar must be cut flush with the surface of the concrete used.

- Reconnecting abandoned side channels or meanders that were cut off due to channel incision or artificially cut off, blocked, or filled. Depending on project length, this may be classified as a good stream channel restoration (over 100 linear feet of stream channel).
- Creating floodplain benches adjacent to streams artificially disconnected (i.e. by man-made structures) from their floodplain at a 1 to 2 year recurrence level. Stream banks shall be re-sloped to a 3:1 slope and reshaped and the floodplain bench shall be revegetated with native woody and herbaceous vegetation. The newly created bench must be at least ½ of the bankfull width at a 1 to 2 year recurrence.

"Moderate Net Benefit" **does not** include the relocation of a stream channel to accommodate a project in the stream's former location.

Stream Relocation to Accommodate an Authorized Project
*(In-stream benefit factor = 0.5)*

This category is for restoration projects that involve the movement/creation of a stream at a new location to allow an authorized project to be constructed in the stream's former location. A stream moved to a new location to accommodate construction of an authorized project should incorporate natural channel design features consistent with a morphologically stable and appropriate reference stream channel including dimension (cross-section), pattern (sinuosity), and profile (slope), and incorporate measures (grade control, in-stream habitat, riparian plantings, etc.) before consideration will be given by the Corps District to accept the relocated channel as compensatory mitigation. Relocated streams require vegetative buffers of sufficient width that can be evaluated for riparian mitigation credit. Relocations resulting in a reduced channel length will generally require additional mitigation to replace net losses of stream channel length. If the level of environmental lift due to the relocation greatly exceeds that of the baseline condition from the stream impacted, considerations for excellent, good, and moderate may be appropriate. Justification for using a higher level factor must be justified with an assessment of the baseline stream condition and the benefits of the proposed mitigation activities.

## C4. Site Protection Bonus

**Third-party grantee**
*(Benefit Factor = 0.2)*

All land areas included in a mitigation project must be protected from incompatible uses that might otherwise jeopardize the objectives of the compensatory mitigation project. An appropriate legally binding real estate instrument, compliant with the provisions of 33 CFR 332.7(a) and approved in advance by the Corps, will be required to ensure that the mitigation work, whether in-stream and/or out- of-stream, is protected long-term. Instruments such as conservation easements, deed restrictions, and restrictive covenants, or other alternatives may be appropriate for protecting mitigation work depending on the situation. A site protection bonus will be allowed if the title is transferred to a qualified third- party, such as a non-profit land conservancy or government agency, where such third party is granted the right to enforce site protections and provided with resources necessary to monitor and enforce the site protections set forth in the long-term protection instrument.

## C5. Determining Benefited Stream Length

The total linear length in feet that the in-stream mitigation activity will have on the stream channel is considered the benefited stream length. This figure shall be applied in the box labeled *Linear Feet of Stream Benefited (LF)* found on the Instream Worksheet located in Appendix I-C. Credits are not generated by each in-stream benefit if they could be generated for the entire stream reach within a project site. For example, removing a dam and restoring the floodplain would qualify for one factor rather than each activity because the linear feet benefitted from the dam removal encompasses the same reach as the floodplain restoration activities. Eight guidelines have been established to assist users in determining the appropriate length to apply to the corresponding section of the worksheet.

1. Linear credit for the removal or modification of structures such as dams, culverts, or crossings that limit biological movement and associated restoration and grade stabilization work is described in the following paragraph. Increased credit for upstream miles connected shall be considered via the Aquatic Life Passage worksheet or other suitable method and should not be duplicated using the in-stream benefits worksheet, although direct habitat benefits on the site that improve diversity and sensitive species recovery may allow some additional consideration by the Corps. Generally, linear credit for the removal of dams and other such impassable structures, can be calculated by determining the elevation at the top of the structure to be removed and identifying the point at which the stream reaches that elevation upstream of the removed structure. The total linear foot distance from the point upstream of the structure being removed, where the elevations are identical to the elevation at the top of the structure being removed, equals the stream length benefitted. Measuring downstream for linear credit would include the length of stream impacted by the scour pool and multiplying this length by two (2). In the case of a perched culvert, the elevation would be identified by measuring from the point at which water could pass freely through the culvert (invert elevation) to the point at which that elevation can be identified upstream of the structure. Mitigation credit will not be granted for activities which may facilitate the spread of aquatic nuisance species. See Solving Dam Problems, Chapter 3, as a reference for dams considered barriers to the spread of Asian carp.

    - If the removal of a dam or other structure is proposed, a grade stabilization structure meeting the below guidelines is required in the approximate location of the structure being removed.

2. Linear credit for installation of localized lateral streambank stabilization measures will be based on the length of the appropriate-sized structure or bank treatment (shaping, toe reinforcement, bio-engineering, etc.).
3. Linear credit for artificial levee or dike removal, setback, and/or notch will be based on the longitudinal extent where overbank flooding (approximately 5 year interval or less) could occur along the stream channel and where the sponsor or permittee will place an appropriate legally-binding real estate instrument that is approved by the Corps.
4. Linear credit for grade control structures* will be determined on a case-by-case basis taking into consideration overall benefit of the structure to the watershed, survey information, existing upstream or downstream structures, and improvement or preservation of fish passage. Selection of an appropriate net benefit factor is also at the sole discretion of the reviewing Corps district. Maximum slope of the downstream side of structures considered will be 20:1, with greater net benefit allowable for lower-slope structures and projects that offer additional stream function benefits such as native riparian plantings, floodplain restoration, or deep water holding areas throughout the structure. A waiver of the 20:1 mandatory slope may be applied if the applicant adequately justifies a need for a steeper slope where a 20:1 ratio is not feasible. This waiver shall not exceed a 15:1 slope. Generally, the linear feet of stream benefiting from the grade stabilization structure can be identified by measuring the total length of stream where the grade has been improved to a stable state. If several structures are used in conjunction with each other to stabilize a stretch of stream, the entire length where an improvement can be shown in the slope of the stream should be included in the linear feet of stream benefitted. The use of NRCS standards and designs should be considered when doing any stabilization project.
5. Linear credit for stream relocation activities necessary to accommodate authorized projects will be the length of new channel created provided that this activity meets the criteria for consideration of a mitigation activity as described in section (C)(3).

**Linear Credit for Oxbow Restoration**


6. Linear credit for riparian benches will be based on the total length of the constructed benches with a minimum of 3:1 slopes. Due to innumerable situations where benches may be implemented, justification for the volume of anticipated storage, based on stream size, must be included in the mitigation plan provided to the Corps.
7. Linear credit for all other activities will be determined on a case-by-case basis at the discretion of the reviewing Corps district.
8. Linear credit for oxbow restoration is determined by measuring the centerline of the oxbow, as designed, and multiplying that length by two. See diagram on the right.

***User Note:** Grade control is required when an existing in-stream structure providing grade control is removed in an actively incising channel or when channel length is reduced; therefore, additional credit for the installation of these structures will not be considered or approved.

## C6. In-Kind and Out-of-Kind

The factors listed below **only apply to permittee-responsible mitigation projects and purchases from mitigation banks or ILF programs.** Mitigation banks and in-lieu-fee programs cannot be evaluated for this factor during the development stages because they are planned and approved independently of the impacts for which mitigation banks and in-lieu-fee programs are responsible. Also, when mitigation bank and in-lieu-fee programs are being evaluated, watershed needs are considered which, assists in a determination of credit amount and type. This consideration precludes the need to apply the “in-kind” portion of this factor.

### In-kind
*(In-stream benefit factor = 1.0)*

The project is considered “in-kind” if the following condition is met:

1. Hydrologic stream types are not interchanged (i.e., ephemeral/intermittent, perennial).

### Out -of-kind
*(In-stream benefit factor = 0.5)*

The project is considered “out-of-kind” if the following condition is met:

1) Hydrologic stream types are interchanged (i.e., Impact on perennial, mitigated on intermittent or ephemeral).

# D. Riparian Buffer Work

Properly vegetated riparian buffers provide important stream functions including sediment trapping, nutrient cycling, stream shading, energy dissipation, natural moderation of floods, bank stability, natural wetland development, and delivery of organic matter to the stream. Mitigation work within the riparian buffer means implementing physical augmentation or preservation of the stream riparian buffer to improve water quality and/or ecosystem function. Applicants should strive to mimic the native composition, density, and structure of a fully functional stream situated within the same watershed, commonly referred to as a reference reach. When determining buffer width, resource professionals should consider stream size, stream slope, drainage area, need for filtering runoff, stability of the stream, life history requirements of resident species, potential for stream bank erosion, longitudinal and horizontal migration, and floodplain interaction frequency. In most cases, riparian buffer projects are not intended to stand alone as the mitigation projects, and in-stream benefits shall be included in the overall project plan unless the Corps determines waiving the mandatory 25% of in-stream work to be prudent and necessary. Riparian buffers are also not intended to extend beyond the top of a stream’s valley walls (roughly 500 year floodplain) and must drain into the stream where mitigation is being proposed. Buffer credit cannot be obtained for work on the banks/shores of an impoundment as the lost functions and services of the project’s impact must be replaced on a stream. However, care should also be taken not to add in-stream features to a stable or reference quality stream for the sole purpose of making a buffer project work. The Corps will determine on a case-by-case basis whether exceptions are appropriate.

The Riparian Buffer Worksheet is located in Appendix I-D. Total credits generated per column are equal to the sum of the factors (sections D1 – D5), multiplied by area of the buffer (D6), and multiplied by a factor of 0.01. Separate columns must be calculated for each type of net benefit (D1) and each functional zone (D2). Buffers are not required to be uniformly wide and run parallel to the stream bank. Instead, buffers may be highly irregular within the existing meander belt of the stream.

The minimum buffer width (MBW) for which mitigation credit will be considered is 50 feet, as measured perpendicular to flow from top of bank on each side of the stream. 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. Streams that have a high sinuosity value should use the average meander belt width for a distance factor. The approach may vary based on every situation, as not all streams are alike. All credit calculations are subject to ultimate review and approval by the Corps.

An annotated plan-view map with corresponding cross sections should be included in plans that clearly illustrate distinct buffer areas (by both net benefit category and functional zone). LiDAR-derived cross-sections are generally acceptable; however, surveyed cross-sections may be required at the Corps discretion when significant channel migration has occurred or when the top-of-bank is difficult to distinguish using LiDAR.

## D1. Net Benefit Factor

Net benefit is based on the percent of physical augmentation to the riparian buffer. The following criteria are based on present day uses relative to the presence or absence of a riparian buffer.

### Establishment /Creation

*(Buffer benefit factor = 1.6)*

The manipulation of the physical, chemical or biological characteristics present to develop a buffer that did not previously exist. Conversion of an area without perennial vegetative cover functioning as a riparian buffer.

### Restoration/Re-establishment

*(Buffer benefit factor = 1.2)*

Manipulation of the physical, chemical or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded buffer. Undesirable vegetation will be removed, and regionally-appropriate native vegetation will be established in >50% of the buffer area.

### Enhancement

*(Buffer benefit factor = 0.8)*

Manipulation of the physical, chemical or biological characteristics of a riparian buffer to heighten, intensify or improve a specific buffer function(s). Undesirable vegetation will be removed and regionally-appropriate native vegetation will be established in 10-50% of the buffer area. Enhancement does not result in the gain of buffer area present.

### Preservation

*(Buffer benefit factor = 0.6)*

Riparian area will be conserved in its naturally-occurring or present condition to prevent its destruction, degradation, or alteration in order to prevent the decline of functions within the stream it is buffering. For the purposes of this guidance, an area will be considered as riparian buffer preservation if less than 10% of the area would require planting of vegetation to maintain important aquatic resource functions and all five criteria required by the 2008 Mitigation Rule (33 CFR 332.3) are met.

- Must provide important physical, chemical or biological functions for the watershed.
- Must contribute significantly to the ecological sustainability of the watershed.
- Is determined by the district engineer to be appropriate and practicable.
- Resources must be under threat of destruction or adverse modifications.
- The site must be permanently protected through an appropriate real estate or other legal instrument.

**User Notes:**

**1.** Credit cannot be obtained for multiple mitigation activities within the same riparian corridor along the same side of the stream (e.g., credit is not allowed both for preservation of 500 linear feet of existing corridor and for the establishment of 500 linear feet of buffer within the same footprint). The same reach of a riparian buffer cannot be eligible for more than one type of credited activity (i.e., when the broad floodplain is restored, additional credit is not given for that same area's long-term preservation, as that is assumed to be the case after restoration). Only regionally-appropriate native plantings should be used in restoration projects, and elevation relative to the stream should be considered when choosing planting types.

**2.** Separate area columns should be utilized for each specific type of buffer. For example: the area proposed for a project consists of a highly functioning buffer for the first 50 feet perpendicular to the top of bank. The applicant proposes to establish an additional 50 feet of buffer. In this case the area for preservation should be calculated separately from the establishment area (i.e. on the worksheet, Area 1 = preservation Area 2 = establishment).

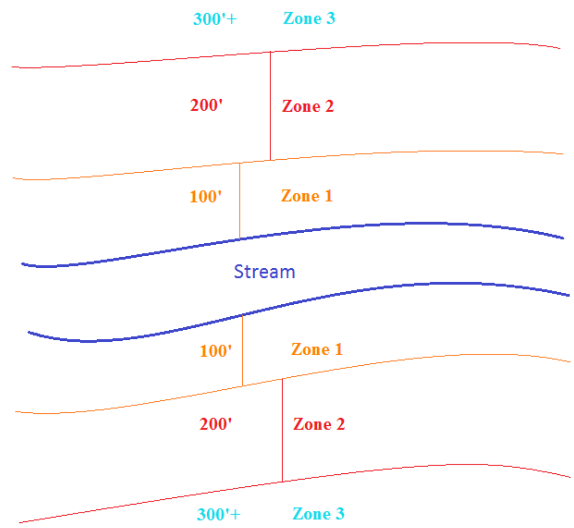
**3.** Streams which are recognizably unstable, entrenched, or otherwise disconnected from their floodplains, and which require extensive stream bed and/or bank restoration are not considered good candidate streams for solely producing riparian buffer credit, unless the mitigation plan is accompanied by in-stream mitigation practices that address the baseline problems. However, under some circumstances the Corps district, in consultation with the reviewing resource agencies, may entertain setback from the top of stream bank to accommodate changes in the stream's dimension, pattern, and profile as the channel responds to regional influences predicted to occur in the watershed. No riparian net benefits will be determined for the setback area due to the instability and eventual loss of ground. However, a net benefit value can be assigned for buffer establishment beyond the setback zone.

## D2. Functional Zone

For most regions of Iowa, lateral stability of streams can be achieved when streams are allowed to meander freely within a belt at least four times as wide as the bankfull width of the stream. Buffers within this zone are likely to provide the greatest physical, hydrological, biological, and chemical benefits to the stream. Additional efforts to protect land and establish regionally-appropriate native vegetation within the broad floodplain and even on steeper valley sides are likely to provide additional benefits to the stream. Areas outside the zones below will not receive buffer credit.

## Zone 1
***(Buffer function factor = 1.2)***

The buffer is in Zone 1 when it is located within 100 linear feet from the top of bank perpendicular to stream flow (average meander belt width may be used to determine distance in cases where streams exhibit high sinuosity values) to the mitigated stream.




## Zone 2 (Perennial Only)
*(Buffer function factor = 0.6)*

This area is located 100 to 300 linear feet from the top of bank, perpendicular to stream flow (average meander belt width may be used to determine distance) to the mitigated stream. Zone 2 can only be calculated for perennial streams. Buffers in this zone will not be given credit unless the newly created buffer is a continuation of a pre-construction or proposed buffer located in the near-stream zone.

## Zone 3
*(Buffer function factor = 0.1)*

This buffer is located outside of 100 linear feet on ephemeral or intermittent streams or 300 linear feet on perennial streams. Only zone 3 buffers that are adjacent to buffers in Zones 1 and 2 are eligible for mitigation credits.

## D3. Site Protection Bonus
*(Buffer factor = 0.2)*

**See Section C4.** A site protection bonus will be allowed for buffer areas when title to the designated buffer areas for which credit is sought is transferred to a qualified third-party and such third party is granted the right to enforce site protections on the designated buffer areas and provided with resources necessary to monitor and enforce the site protections set forth in the long-term protection instrument. The site protection bonus should be applied separately for a given piece of property and applied to either or both in-stream and riparian worksheets, depending on the coverage of the site protection instrument.

## D4. Temporal Lag
*(Buffer factor = 0 to -0.3)*

| Temporal Lag | Buffer Factor |
|---|---|
| Primary Species | - 0.3 |
| Combination of Primary and Secondary | - 0.2 |
| Emergent/Herbaceous/Preservation | 0 |
| Forested Creation | + 0.3 |

Temporal lag takes into account the time required for riparian vegetation in a mitigation area to fully replicate the riparian vegetation size and age class lost at the impact site. Depending on the type of vegetation that is planted at the mitigation site, the riparian buffer targeted for restoration, establishment or enhancement, will require different lengths of time to reach a commensurate level of maturity. Temporal lag only applies to buffer that is created/restored/enhanced. Preservation has no temporal lag, and therefore, should use a buffer factor of "0". The negative factors of this category are only applicable when removing a forested riparian corridor as a result of project impacts. The factor will be applied to the proposed mitigation site. The positive forested creation factor may only be used when a proposed mitigation site exhibits emergent/herbaceous vegetation only (pre-construction) and is proposed to become a forested riparian corridor as a result of the mitigation project.

**Primary Species**

Hardwood species that are slow growing, mast (or hard seed) producing, and generally have close-grained, dense wood. Species considered for this list include but are not limited to: Oak, hickory, walnut, cherry, birch, Ohio buckeye, pecan, Kentucky coffee tree, red maple, hackberry, cypress, honey locust, sugar maple, and sycamore.

**Secondary Species**

Fast growing hardwood species that are generally considered pioneer species for their small seeds, fast growth and aggressive nature. Species considered for this list include but are not limited to: silver maple, black locust, cottonwood, box elder, ash, American elm and willow species. Shrubs included on this list are: nannyberry, dogwood, serviceberry, buttonbush, indigo bush, elderberry, and American currant.

*User Note:* This is not an all-inclusive list as there are hundreds of species of trees and shrubs found throughout Iowa. Justification for selecting the primary or secondary factor for a species not found on this list, must be included in the mitigation plan. Any selected species should be planted in their respective growth zone (link to several sites on the regulatory webpage) to ensure success. Justification for not planting species within their identified growth zones must be included in the mitigation plan.

## D5. Determining Buffer Area

The buffer area is defined by the area for which preservation, enhancement, or restoration of the buffer will occur and does not include the channel between the top-of-banks. All proposed buffer areas must be adjacent to the stream or adjacent to buffer areas existing pre-construction or previously approved for mitigation at the discretion of the Corps. The length of stream and width of buffers should be marked on applicant's maps of proposed buffer areas and noted in the Riparian Buffer Worksheet (Appendix I-D). Buffer area should be determined directly from the dimensions of a digital shape file, applicable survey equipment, aerial map or CAD file. As with all projects involving mitigation, the Corps has the authority to verify all measurements provided in the application and mitigation plan are accurate to ensure compliance.

## D6. In-Kind and Out of Kind

The factors listed below **only apply to permittee-responsible mitigation projects where the impacts result in a loss of forested buffer habitat and replacement is proposed with emergent buffer habitat.** Mitigation banks and in-lieu-fee programs cannot be evaluated for this factor because they are planned and approved independently of the impacts for which mitigation banks and in-lieu-fee programs are responsible. Also, when mitigation bank and in-lieu-fee programs are being evaluated, watershed needs are considered which assists in a determination of credit amount and type. This consideration precludes the need to apply the in-kind portion of this factor. This does not apply to preservation or establishment/ creation mitigation projects or areas where oxbow restoration is being constructed for the purposes of Topeka Shiner enhancement/restoration.

### In-kind
*(Riparian buffer benefit factor = 1.0)*

The project is considered "in-kind" if the following condition is met:

1. Vegetation types are not interchanged (i.e., emergent, hardwood, scrub shrub and combination hard and softwood).

### Out -of-kind
*(Riparian buffer benefit factor = 0.5)*

The project is considered "out-of-kind" if the following condition is met:

1. Vegetation types are interchanged (i.e., Impact on hardwood, mitigated with emergent or scrub shrub).

## D7. Supplemental Credit

Buffers on each side of the channel can generate mitigation credit together. Working on both sides of the stream will generate 1.5x the original total value to match the environmental lift of having buffers on either side of the stream. **The work must occur along the same stream reach on directly opposing banks to obtain this credit.**

# E. Aquatic Life Passage

Dams, road culverts, and other structures can limit aquatic life passage to upstream waters. Carefully designed projects can greatly benefit communities and fisheries. Over 200 dams in Iowa have been pre-scored based on multiple factors that reflect the level of impact on fish movement and other aquatic species impacts due to habitat fragmentation. Scoring factors include difference in species richness downstream and upstream, presence of game species, presence of invasive/undesirable species, presence of mussels, dam height, and fish assemblage research in relation to dams (Pierce et al. 2013, Parks et al. 2014). Together these factors have been used to prioritize dam mitigation projects. Users should note that most dam mitigation projects require a significant investment of time to build community support for such a project, in addition to the extensive planning necessary to ensure a successful project. (See "Solving Dam Problems," Chapter 4: Mitigation Alternatives.) This category applies to all structures that limit aquatic life passage to upstream waters (perched culverts, pipes, detention basins, etc.). The maximum amount of miles that can be used for this credit is 50 linear stream miles.

Basic design criteria for allowable aquatic life passage in regards to mitigation purposes should typically include the following:

1) The lowest portion of the channel should have a profile slope not exceeding 5 percent. If multiple chutes or channels exist, the lowest must favor the low-slope channel designed for fish passage. This can be accomplished by setting its elevation 0.5 feet lower than other chutes at the crest.
2) If project structures are used with slopes at 1 percent to 5 percent, the channel bed should be heavily roughened (Manning's *n* value of 0.5 or greater) in the portion of the cross section used for aquatic life passage. Minimum width from low-flow water's edge to water's edge of the aquatic life passage area should be approximately 10 feet, but can be smaller at the Corps discretion for streams with low-flow width of less than 20 feet.
3) Structure should be deemed stable, using adequate sizing of material to remain competent or grouting to hold the bed together. In the case of grouting, permanent maintenance assurances must be provided to guarantee structural integrity in perpetuity.
4) Grade control structures should be utilized to ensure that the channel does not incise or down cut where the original structure was removed.
5) Further specifications and criteria can be found in the Minnesota DNR's technical manual *Reconnecting Rivers*.

## E1. Benefit Multiplier

*(Aquatic Life Passage multiplier ranges from 0.1 to 1.0)*

Any structure (i.e. perched culvert, etc.) on a perennial stream is assumed to have a minimum value of 0.1. A pre-scored table of dams with watershed greater than 50 square miles is available on the DNR website. Dams in this table have been pre-scored based on multiple factors that reflect level of impact on fish movement and other aquatic species impacts due to habitat fragmentation. These factors include diverse species richness downstream, presence of game species, presence of invasive/undesirable species, presence of mussels, dam height, and fish assemblage research in relation to dams (Pierce et el. 2013, Parks et al. 2014). For dams or other impassable structures not appearing on the table, additional data may be presented to show benefits that raise the multiplier to the maximum allowable value of 1.0. When suitable information is not available, the use of "Bedload transport zone" calculations can be substituted for these values.  Functional Asian Carp barrier dams identified by the Iowa DNR will not be considered for mitigation.

Any structure with a low-flow hydraulic height (from headwater to tail water) of a half foot or less, or that has normal velocities at a range of flows with 2 feet per second or less, will not be considered a fish barrier for mitigation purposes.

## E2. Perennial or Intermittent Stream Miles Upstream

*(Miles range from 1 to 50)*

The number of perennial or intermittent stream miles upstream and downstream of the structure that will benefit from dam removal or modification will be used for credit calculation.  The same type of calculation for protected areas should be considered for this data.  Mileage credit should be calculated using the main-stem of the stream/river where the dam is being removed.  To calculate stream miles, start at the structure and look upstream and downstream until the next impedance is located.  Count the number of miles on the main stem of the stream combining both of the sections.  Branches off of the stream where it changes stream order should not be included in this valuation.  Credit will not be granted for more than 50 miles of total benefit due to diminished geographical effects; therefore, the maximum number of credits for aquatic life passage for each project is 50,000.

***Example:***
Credits for aquatic life passage will be calculated by multiplying the Benefit factor (E1) by the number of linear miles impacted (E2) by 1000.  Thus, the maximum number of credits generated by dam mitigation is 50,000 (1.0 x 50 x 1000).

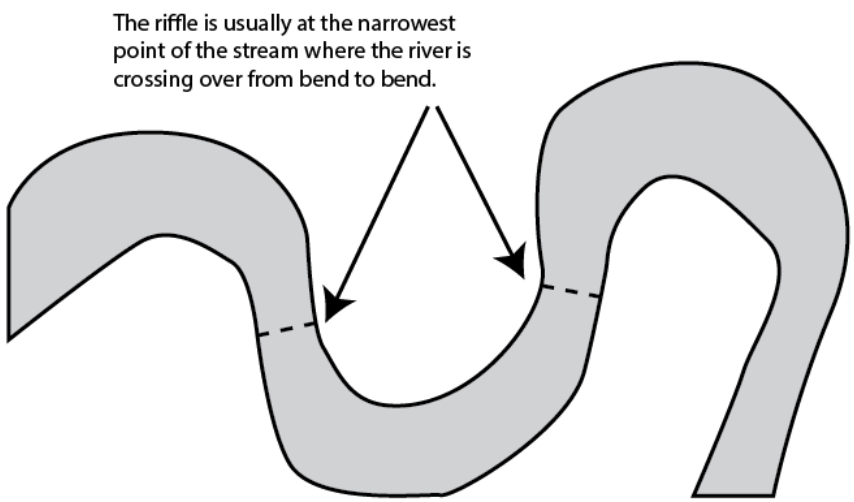
# F. Glossary

The glossary identified below is not intended to be an exhaustive list; rather, this list has been compiled based on those terms that are repeatedly used or where the universal definition of the term has substantial variability. Many of the terms used throughout this document are defined in other sources such as the Mitigation Regulation or the document referenced in Appendix G, "Glossary of Stream Restoration Terms."

**Bankfull Discharge is** the maximum discharge that the channel can convey without overflowing onto the floodplain or bench and is considered the channel forming discharge.

**Bankfull Stage** is the point at which water begins to overflow onto a floodplain.

**Bankfull Width** is the width of the stream channel at bankfull discharge. The bankfull width should be measured perpendicular to the stream in a riffle section (straight section between pools) as shown in the figure below.




In cross-section, the bankfull width is the distance between points on opposing banks where the channel encounters its lowest floodplain. This low floodplain occurs between the one-year and two-year flood recurrence elevation. Bankfull width may be approximated using topographic data and measuring from top-of bank to top-of-bank or by measuring at multiple riffles within or near the project area.

**Biological Processes** are the processes of living organisms in contiguous systems. Biologic processes are influenced by hydrologic, hydraulic, geomorphic, and physiochemical functions. Therefore, restoration projects that are intended to restore biological function must consider all of these functions within the watershed.

**Buffer** means an upland, wetland, and/or riparian area that protects and/or enhances aquatic resource functions associated with wetlands, rivers, streams, lakes, marine, and estuarine systems from disturbances associated with adjacent land uses.

**Channel Dimension** is the stream's cross-sectional area (calculated as bankfull width multiplied by mean depth at bankfull). Changes in bankfull channel dimensions correspond to changes in the magnitude and frequency of bankfull discharge that are associated with water diversions, reservoir regulation, vegetation conversion, development, overgrazing, and other watershed changes. Stream width is a function of occurrence and magnitude of discharge, sediment transport (including sediment size and type), and the streambed and bank materials.

**Channel Features** include riffles, runs, pools, and glide habitat that maintain channel slope and stability and provide diverse aquatic habitat. A **riffle** is a bed feature where the water depth is relatively shallow and the slope is steeper than the average slope of the channel. At low flow s, water moves faster over riffles, which provides oxygen to the stream. Riffles are found entering and exiting meanders and control the streambed elevation. A **run** is characterized by fast-flowing, low turbulence flow. A **pool** is much deeper than the average channel depth and has low -velocity water and a smooth surface. A **glide** is the section of stream that has little or no turbulence.

**Ecological Drainage Units (EDU)** consists of Aquatic Sub-regions within Iowa and are based on combining watersheds containing aquatic assemblages that are relatively similar and are distinct within the context of the surrounding watersheds.

**Enhancement** means the manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s) but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area, but is an improvement to the value of particular aspects of the stream and/or related land resources.

**Entrenchment** refers to the term entrenchment ratio. The entrenchment ratio 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. Ratios of 1-1.4 are considered entrenched. (Rosgen 1994)

**Ephemeral Streams** only have flowing water in response to precipitation events during a normal precipitation year. Ephemeral streambeds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from precipitation is the primary source of water for stream flow. Ephemeral streams typically support few aquatic organisms. When aquatic organisms are found, they typically have a very short aquatic life stage.

**Geomorphic Function** is directly influenced by hydrologic and hydraulic processes. As water flows through streams, it is affected by the kinds of soils and alluvial features within the channel, in the floodplain, and in the uplands. The amount and kind of sediments carried by a stream largely determines its equilibrium characteristics, including size, shape, and profile. Restoration of geomorphic function requires an understanding of how water and sediment are related to channel form and function and on what processes are involved with channel evolution.

**Hydraulic Function** is the transport of water in the channel, on the floodplain, and through sediments. Restoration of hydraulic function requires an understanding of how water flows into and through stream corridors as well as how fast, how much, how deep, how often, and when it flow s (i.e., timing, frequency, duration, magnitude, rate of rise, and rate of decline).

**Hydrologic Balance** is an accounting of all water inflow to, water outflow from, and changes in water storage within a hydrologic unit over a specified period of time.

**Hydrologic Function** is the exchange of water between the channel and watershed. Two formats are especially useful for planning and designing stream corridor restoration: **Flow duration,** which is the probability a given streamflow was equaled or exceeded over a period of time. **Flow frequency** is the probability a given streamflow will be exceeded (or not exceeded) in a year [sometimes this concept is modified and expressed as the average number of years between exceeding (and not exceeding) a given flow].

**Intermittent Streams** have flowing water during times of the year when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from precipitation is a supplemental source of water for stream flow. The biological community of intermittent streams is composed of species that are aquatic during a part of their life history or move to perennial water sources. Intermittent streams with 5 or more perennial pools per 0.5 miles are included in this category.

**Linear Feet** means the length of stream, measured in feet, that will be impacted by an impact activity, as authorized under Section 404 of the Clean Water Act, and for which mitigation will be required.

**Ordinary High Water Mark** (OHWM) is the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a 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 area (for more detail see Regulatory Guidance Letter 05-05 dated 7 December 2005).

**Oxbow Habitats** are off-channel aquatic habitats, sometimes seasonal, that are periodically connected by floods (approximately 10-year recurrence interval or less) to the stream, thus allowing for biological and nutrient exchange.

**Physiochemical Function** involves the chemical processes and reactions that occur between water, soils, rocks, and living organisms, and the transport of chemical components within the watershed over time. Restoration activities may interact in a variety of complex ways with water quality, affecting both the delivery and impact of water quality stressors or enhancers.

**Perennial Streams** have flowing water year-round during a normal precipitation year. The water table is located above the streambed for most of the year. Groundwater is a primary source of water for stream flow. Runoff from precipitation is a supplemental source of water for stream flow. Perennial streams support aquatic organisms year-round.

**Public natural areas** include any land owned by conservation organizations, counties, state or federal agencies, or private easements that are public accessible.

**Riparian Areas** are lands adjacent to streams, rivers, lakes, and estuarine marine shorelines. Riparian areas provide a variety of ecological functions and services and help improve or maintain local water quality.

**Restoration** means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource.

**Streams** include all flowing surface-water systems (perennial, intermittent, and ephemeral) that contain an ordinary high water mark and are determined to be jurisdictional "Waters of the United States" as defined by 33 CFR 328.3 (streams are natural, man-altered, or man-made tributaries that flow directly or indirectly into traditional navigable waters).

**Stream Profile** refers to its longitudinal slope. 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, thus steep streams have a low sinuosity, and flat streams have a high sinuosity.

**Stream Reach** is any defined length of river, creek, or tributary per a "Water of the United States" delineation, identified in engineering plans, or in a compensatory mitigation plan.

**Stream Order** is a ranking system for tributaries defined between points of confluence. Headwater streams are considered first order streams. When two streams of like order meet, the segment downstream is assigned one order greater than those that feed it. For a discussion of the order of tributaries, see Alan Needle Strahler's 1952 article "Dynamic Basis of Geomorphology" in the *Geological Society of America Bulletin.*

# G. References


Copeland, R., Biedenharn, D., and J. Fischenich, 2000. Channel-Forming Discharge. U.S. Army Corps of Engineers, Coastal and Hydraulics Laboratory, U.S. Army Engineer Research and Development Center (ERDC). Technical Note ERDC/CHL CHETN-VIII-5. Vicksburg, MS.

Copeland, R. R., McComas, D. N., Thorne, C. R., Soar, P. J., Jonas, M.M., and J. B. Fripp, 2001. "Hydraulic design of stream restoration projects," Technical Rep. No. ERDC/CHL TR-01-28, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Fischenich, Craig. J., 2006. Functional Objectives for Stream Restoration, Technical Rep. No. ERDC TN-EMRRP SR-52, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Fischenich, Craig. J., 2000. Glossary of Stream Restoration Terms, ERDC TN-EMRRP-SR-01 U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Fischenich, Craig. J., 2000. Preliminary Watershed Assessment, Technical Rep. No. ERDC TN-EMRRP SR-03, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Harman, W., and R. Starr, 2011. Natural Channel Design Review Checklist. US Fish and Wildlife Service, Chesapeake Bay Field Office, Annapolis, MD and US Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Wetlands Division. Washington, D.C. EPA 843-B-12- 005. https://www.epa.gov/cwa-404/natural-channel-design-review-checklist Accessed 6/21/17

Harman, W., Starr, M., Carter, M., Tweedy, K., Clemmons, M., Suggs, K., and C. Miller, 2012. A Function-Based Framework for Stream Assessment and Restoration Projects. US Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Washington, DC, EPA 843-K12-006.

Hoogeveen, Nate. L., 2011. Solving Dam Problems, Iowa's 2010 Plan for Dam Mitigation. Iowa Department of Natural Resources.

Horton, R. E. (1945), "Erosional development of streams and their drainage basins: hydro-physical approach to quantitative morphology", *Geological Society of America Bulletin* **56** (3): 275–370

Missouri River Basins and Watersheds, Missouri Stream Team, http://mostreamteam.org/activity_guide/watershed/missouri_riverBasins_watersheds.htm Accessed 6/21/17

Rosgen, D.L. and H.L. Silvey. 1996. Applied River Morphology. Wildland Hydrology Books, Fort Collins, CO

Rosgen, Dave, 1996. Applied River Morphology, Guide to Identification of Bankfull Stage in the Northeastern United States. USDA, Streams Systems Technology Center, General Technical Report RMRS-GTR_133_CD., January 2005.

Rosgen, Dave, 1996. Applied River Morphology, Watershed Assessment of River Stability and Sediment Supply (WARSSS), USDA, Streams Systems Technology Center. Guide to Identification of Bankfull Stage in the Northeastern United States. General Technical Report RMRS-GTR_133_CD. January 2005.

Strahler, A. N. (1952), "Hypsometric (area-altitude) analysis of erosional topology", *Geological Society of America Bulletin* **63** (11): 1117–1142

United States Army Corps of Engineers, 2008. Final Rule for Compensatory Mitigation for Losses of Aquatic Resources (Federal Register / Vol. 73, No.19594-19642).

United States Army Corps of Engineers, 2008. Regulatory Guidance Letter No. 08-03. Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving the Restoration, Establishment, and/or Enhancement of Aquatic Resources.

# APPENDIX H

H-A: Summary Information Sheet
H-B: Adverse Impact Factors Worksheet
H-C: In-Stream Work Worksheet
H-D: Riparian Buffer Worksheet
H-E: Aquatic Life Passage Worksheet

## H-A: SUMMARY INFORMATION WORKSHEET

**Project Name:**

**Project Sponsor:**

**Proposal Date:**

**Principal Contact:**

**Type of Mitigation:**

Permittee-Responsible Mitigation

In-Lieu Fee Project

Mitigation Bank Project

**Adverse Impact Debits:**

**Credit Summary:**

In-Stream Benefit Credits:

Riparian Benefit Credits:

Aquatic Life Passage Credits:

**Total Credits – Total Debits** =

**Are credits 95% ≥ debits?**

## H-B: ADVERSE IMPACT FACTORS WORKSHEET

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **B1** | **Stream Type** | Ephemeral 0.3 | Intermittent 0.4 | Perennial $1^{st}$ & $2^{nd}$ Order 0.6 | Perennial $3^{rd}$ & $4^{th}$ Order 0.8 | Perennial $\geq 5^{th}$ Order 1.0 | | | |
| **B2** | **Priority Waters** | Tertiary 0.1 | Secondary 0.4 | Primary 0.8 | Restored Reach 1.5 | | | | |
| **B3** | **Existing Condition** | Functionally Compromised 0.2 | Moderately Functional 0.8 | Fully Functional 1.6 | | | | | |
| **B4** | **Impact Activity** | Below Grade Culvert 0.3 | Armoring/Indirect 0.5 | Conservation Impoundments 0.7 | Detention Facility 0.75 | Morphologic Change 1.5 | Pipe 2.0 | Impoundment 2.2 | Complete Loss 2.5 |
| **B5** | **Compensation Ratio (CR)** | | | | | | | | |
| **Service Area** | Mitigation Bank | In-Lieu Fee with extra released credits | In-Lieu Fee | Permittee Responsible Mitigation | | | | | |
| **Primary** | 1 | 1 | 1.2 (1.0 Advanced) | 1.5 (1.3 Advanced) | | | | | |
| **Secondary** | 2 | See Instrument | See Instrument | 2 | | | | | |
| **Tertiary** | 3 | See Instrument | See Instrument | 3 | | | | | |

| | **Impact 1** | **Impact 2** | **Impact 3** | **Impact 4** | **Impact 5** |
|---|---|---|---|---|---|
| Stream Type | | | | | |
| Priority Waters | | | | | |
| Existing Condition | | | | | |
| Impact Activity | | | | | |
| **Sum of Factors (M)** | | | | | |
| Linear Feet of Stream Impact (LF) | | | | | |
| **Debits (D) = M × LF** | | | | | |
| Compensation Ratio (CR) | | | | | |
| **Total Debits = (D × CR)** | | | | | |

## H-C: IN-STREAM BENEFITS WORKSHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **C1** | **Stream Type** | Ephemeral 0.15 | Intermittent 0.2 | Perennial Stream 1st & 2nd Order 0.3 | | Perennial Stream 3rd & 4th 0.4 | Perennial ≥5th Order 0.5 |
| **C2** | **Priority Waters** | Tertiary 0.05 | Secondary 0.2 | Primary 0.4 | | | |
| **C3** | **Net Benefit** | Stream Relocation 0.5 | Moderate 1.2 | | Good 2.4 | Excellent 3.5 | |
| **C4** | **Site Protection Bonus** | Third-party grantee 0.2 | | | No third party grantee 0 | | |
| **C5** | **Kind*** | In-Kind 1.0 | | | Out-of-kind 0.5 | | |

| | Net Benefit 1 | Net Benefit 2 | Net Benefit 3 | Net Benefit 4 | Net Benefit 5 | Net Benefit 6 |
|---|---|---|---|---|---|---|
| Stream Type | | | | | | |
| Priority Waters | | | | | | |
| Net Benefit | | | | | | |
| Site Protection | | | | | | |
| **Sum Factors (M)** | | | | | | |
| Linear Feet of Stream Benefited (LF) | | | | | | |
| **Reach Credits (C) = M × LF** | | | | | | |
| Kind (K) | | | | | | |
| **Total Credits = (C x K)** | | | | | | |

## H-D: RIPARIAN BUFFER WORKSHEET

| | | | | | |
|---|---|---|---|---|---|
| **D1** | **Net Benefit Factor** | Creation/ Establishment 1.6 | Riparian Restoration/ Re-Establishment 1.2 | Enhancement 0.8 | Preservation 0.6 |
| **D2** | **Function Factor** | Zone 1 1.2 | Zone 2 0.6 | Zone 3 0.1 | |
| **D3** | **Site Protection** | Third-party grantee 0.2 | No 3rd-party grantee 0.0 | | |
| **D4** | **Temporal Lag** | Primary - 0.3 | Combination Primary/Secondary - 0.2 | Emergent/Herbaceous/ Preservation 0 | Forested Creation + 0.3 |
| **D5** | **Buffer Area** | Measured in square feet (digital measurements preferred) | | | |
| **D6** | **Kind** | In-kind 1.0 | Out-of-kind 0.5 | | |
| **D7** | **Supplemental Bonus** | Work on Both Sides of Channel 1.5 | Work on One Side of Channel 1.0 | | |

| | | Area 1 | Area 2 | Area 3 | Area 4 | Area 5 | Area 6 |
|---|---|---|---|---|---|---|---|
| For reviewer's information only: | Stream length | | | | | | |
| | Average width | | | | | | |
| Net Benefit Factor | | | | | | | |
| Function Factor | | | | | | | |
| Site Protection Bonus | | | | | | | |
| Temporal Lag | | | | | | | |
| **Sum Factors (M)** | | | | | | | |
| Buffer area in square feet (BA) | | | | | | | |
| Kind (K) | | | | | | | |
| **Buffer Credits Subtotal (C) = M x BA x K x 0.01** | | | | | | | |
| Supplemental Credit (S) | | | | | | | |
| **Total Credits = C × S** | | | | | | | |

## H-E: AQUATIC LIFE PASSAGE WORKSHEET

| | | |
|---|---|---|
| **E1** | **Benefit Multiplier** | Value from 0.1 – 1.0 from DNR table |
| **E2** | **Perennial Stream Miles** | Up to 50 miles |

| | Dam 1 |
|---|---|
| Benefit Multiplier (E1) | |
| Perennial Stream Miles (E2) | |
| **Total Aquatic Life Passage Credits (AP) = E1 × E2 × 1000** | |