# Guidelines for Stream Mitigation Banking and In-Lieu Fee Programs in Ohio

## Version 1.0

## Developed by the Ohio Interagency Review Team

December 2014

**TABLE OF CONTENTS ..... Page**

**SECTION 1: PURPOSE AND GOALS.....3**

**SECTION 2: DEFINITIONS .....4**

**SECTION 3: PROCESSES.....10**

**SECTION 4: SITE SELECTION .....12**

**SECTION 5: LONG-TERM MANAGEMENT & MAINTENANCE OF SITES.....16**

**SECTION 6: FINANCIAL ASSURANCES .....17**

**SECTION 7: ADAPTIVE MANAGEMENT PLANS .....19**

**SECTION 8: PERFORMANCE STANDARDS.....21**

**SECTION 9: MONITORING.....23**

**SECTION 10: CREDIT RELEASE SCHEDULE.....24**

**SECTION 11: DEBIT AND CREDIT CALCULATIONS.....26**

**SECTION 12: DEFAULT PLAN .....31**

**SECTION 13: CLOSURE CRITERIA .....32**

**Appendix 1 Required Components of a Compensatory Mitigation Plan in accordance with 33 CFR 332.4 (c)(2) through (14).....33**

**Appendix 2 Hydrologic Units in Ohio .....35**

**Appendix 3 Useful Elements to include in a Draft Prospectus for Mitigation Bank or Draft Proposal for In-lieu Fee Site Specific Mitigation Plans (This step is optional).....36**

**Appendix 4 Stream Monitoring Report Example.....37**

**REFERENCES .....41**

## SECTION 1: PURPOSE AND GOALS

On April 10, 2008, the United States (U.S.) Army Corps of Engineers (Corps) and the U.S. Environmental Protection Agency (USEPA) published a joint federal rule which established regulations governing compensatory mitigation for activities authorized by Department of the Army (DA) permits issued pursuant to Section 404 of the Clean Water Act and/or Sections 9 and 10 of the Rivers and Harbors Act of 1899. This mitigation rule emphasizes the need to use a watershed approach when making decisions to replace aquatic resource functions lost due to unavoidable impacts to waters of the U.S. authorized through the issuance of DA permits pursuant to Section 404 of the Clean Water Act (33 USC 1344) and/or Sections 9 or 10 of the Rivers and Harbors Act of 1899 (33 USC 401, 403).

The purpose of this document is to provide those interested in stream mitigation banking and in-lieu fee stream mitigation with a statewide guide developed by the Interagency Review Team (IRT). This is to ensure that such mitigation sites to be established in Ohio will have the greatest likelihood of success. The Ohio IRT is composed of representatives from the Buffalo, Huntington and Pittsburgh Districts of the Corps, the USEPA Region V, the U.S. Fish and Wildlife Service, the U.S. Department of Agriculture Natural Resources Conservation Service, the Ohio Environmental Protection Agency, and the Ohio Department of Natural Resources.

The Guidelines for Stream Mitigation Banking and In-Lieu Fee Programs in Ohio (Guidelines) have been developed to increase the likelihood for ecological success and sustainability of aquatic resources developed by mitigation banks and in-lieu fee mitigation programs (ILFPs). The IRT encourages sponsors to follow these Guidelines. In addition, applicable portions of the Guidelines may be useful in the development of permittee-responsible mitigation sites.

The IRT previously produced the *Guidelines for Wetland Mitigation Banking in Ohio March 2011*. Sponsors may refer to that document for development of wetlands within mitigation banks and ILFP sites.

## SECTION 2: DEFINITIONS

*Adaptive Management*: The development of a management strategy that anticipates likely challenges associated with compensatory mitigation projects and provides for the implementation of actions to address those challenges, as well as unforeseen changes to those projects. It requires consideration of the risk, uncertainty, and dynamic nature of compensatory mitigation projects and guides modification of those projects to optimize performance. It includes the selection of appropriate measures that will ensure that the aquatic resource functions are provided and involves analysis of monitoring results to identify potential problems of a compensatory mitigation project and the identification and implementation of measures to rectify those problems (See Section 7).

*Buffer*: 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.

*Coldwater* (OAC3745-1-07(f)): These are waters that meet one or both of the characteristics described in paragraphs (B)(1)(f)(i) and (B)(1)(f)(ii) of this rule. A temporary variance to the criteria associated with this use designation may be granted as described in paragraph (F) of rule 3745-1-01 of the Administrative Code.

*Coldwater habitat, inland trout streams* (OAC3745-1-07(f)(i)): These are waters which support trout stocking and management under the auspices of the Ohio Department of Natural Resources, Division of Wildlife, excluding waters in lake run stocking programs, lake or reservoir stocking programs, experimental or trial stocking programs, and put and take programs on waters without, or without the potential restoration of, natural coldwater attributes of temperature and flow. The director shall designate these waters in consultation with the director of the Ohio Department of Natural Resources.

*Coldwater habitat, native fauna* (OAC3745-1-07(f)(ii): These are waters capable of supporting populations of native coldwater fish and associated vertebrate and invertebrate organisms and plants on an annual basis. The director shall designate these waters based upon results of use attainability analyses.

*Compensatory Mitigation:* The restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

*Compensation Planning Framework:* Framework that is used to select, secure, and implement aquatic resource restoration, establishment, enhancement, and/or preservation activities within an in-lieu fee program.

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

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

*Enhancement*: 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.

*Ephemeral Streams:* A stream that has flowing water only during and for a short duration after precipitation events in a typical 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.

*Establishment* (creation): The manipulation of the physical, chemical or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area and functions.

*Exceptional warmwater* (OAC3745-1-07(c)): These are waters capable of supporting and maintaining an exceptional or unusual community of warmwater aquatic organisms having a species composition, diversity, and functional organization comparable to the seventy-fifth percentile of the identified reference sites on a statewide basis. The attributes of species composition, diversity and functional organization will be measured using the index of biotic integrity, the modified index of well-being and the invertebrate community index as defined in "Biological Criteria for the Protection of Aquatic Life: Volume II, Users Manual for Biological Field Assessment of Ohio Surface Waters," as cited in paragraph (B) of rule 3745-1-03 of the Administrative Code. In addition to those water body segments designated in rules 3745-1-08 to 3745-1-32 of the Administrative Code, all lakes and reservoirs, except upground storage reservoirs, are designated exceptional warmwater habitats. Attainment of this use designation (except for lakes and reservoirs) is based on the criteria in table 7-15 of this rule. A temporary variance to the criteria associated with this use designation may be granted as described in paragraph (F) of rule 3745-1-01 of the Administrative Code.

*In-Lieu Fee Program:* A program involving the restoration, establishment, enhancement and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for DA as well as Ohio EPA Section 401 Water Quality Certifications, Isolated Wetland Permits, and Director's Findings and Orders documents.

*Instrument:* The legal document for the establishment, operation and use of a mitigation bank or in-lieu fee program.

*Intermittent Streams:* A stream that has flowing water during certain times of the year, when ground water 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.

*Interstitial Flow:* Streams with continuous flow that occurs seasonally under the surface of the stream bed within the interstitial spaces of course substrate, or cracks in bedrock. Also called "interrupted flow". Streams with interstitial flow have visually dry stream beds with isolated pools of water that are hydraulically connected by slowly moving water. At times of sustained drought, this type of stream may only have water flowing within the subsurface alluvium. The perennial flow is maintained by either deep groundwater recharge from the water table, or from surface wetlands. These streams can maintain either a Class II (if warm in summer) or Class III type biology (if cold-cool in summer) in isolated pools of water, or in the interstitial spaces of the subsurface hyporheic zone, depending on the origin of the flowing water. The biology in warm water interstitial streams tends toward the intermittent stream type during sustained drought.

*Ledger*: A document to be used in the accounting of credits and debits. Ledgers must be submitted in accordance with 33 CFR 332.8(p and q). Specific ledger content will be defined in each banking instrument or ILFP site mitigation plan.

*Management*: Actions taken within a mitigation bank or ILFP mitigation site to establish and maintain desired habitat conditions.

*Mitigation Bank:* A site, or suite of sites, where aquatic resources (e.g., wetlands, streams, riparian areas) are restored, established, enhanced and/or preserved for the purpose of providing compensatory mitigation for impacts authorized by DA permits. In general, a mitigation bank sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the mitigation bank sponsor. The operation and use of a mitigation bank are governed by a mitigation banking instrument.

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

*Mitigation Plan*: A detailed plan which describes how the bank or ILFP mitigation site will be established and operated. The mitigation plan must include the following 12 items: Objectives of the bank; Site selection; Site protection instrument; Baseline information; Determination of credits; Mitigation work plan; Maintenance plan; Performance standards; Monitoring requirements; Long-term management plan; Adaptive management plan; and Financial assurances. The mitigation plan will be incorporated into the bank instrument. (For a more detailed description of these 12 items see Appendix 1 of this document.)

*Modified warmwater* (OAC3745-1-07(d)): These are waters that have been the subject of a use attainability analysis and have been found to be incapable of supporting and maintaining a balanced, integrated, adaptive community of warmwater organisms due to irretrievable modifications of the physical habitat. Such modifications are of a long-lasting duration (i.e., twenty years or longer) and may include the following examples: extensive stream channel modification activities permitted under sections 401 and 404 of the act or Chapter 6131 of the Revised Code, extensive sedimentation resulting from abandoned mine land runoff, and extensive permanent impoundment of free-flowing water bodies. The attributes of species composition, diversity and functional organization will be measured using the index of biotic integrity, the modified index of well-being and the invertebrate community index as defined in "Biological Criteria for the Protection of Aquatic Life: Volume II, Users Manual for Biological Field Assessment of Ohio Surface Waters," as cited in paragraph (B) of rule 3745-1-03 of the Administrative Code. Attainment of this use designation is based on the criteria in table 7-15 of this rule. Each water body designated modified warmwater habitat will be listed in the appropriate use designation rule (rules 3745-1-08 to 3745-1-32 of the Administrative Code) and will be identified by ecoregion and type of physical habitat modification as listed in table 7-15 of this rule. The modified warmwater habitat designation can be applied only to those waters that do not attain the warmwater habitat biological criteria in table 7-15 of this rule because of irretrievable modifications of the physical habitat. All water body segments designated as a modified warmwater habitat will be reviewed on a triennial basis (or sooner) to determine whether the use designation should be changed. A temporary variance to the criteria associated with this use designation may be granted as described in paragraph (F) of rule 3745-1-01 of the Administrative Code.

*Monitoring*: A specific program of data collection which documents the physical, chemical, and biological characteristics of the mitigation site, for the purpose of determining compliance with performance standards established in the approved mitigation plan (See Section 9).

*Perennial Streams:* A stream that has flowing water year-round during a typical year. The water table is located above the streambed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from precipitation is a supplemental source of water for stream flow.

*Preservation:* The removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in a gain of aquatic resource area or functions.

*Prospectus*: A plan for a compensatory mitigation bank or ILFP prepared by a potential bank or ILFP sponsor and submitted for consideration to the interagency review team. The prospectus provides full discussion of the proposed bank or ILFP and serves as the basis for the public and interagency review comments.

*Re-establishment*: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former aquatic resource. Re-

establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions.

*Rehabilitation*: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area.

*Restoration*: 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. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: reestablishment and rehabilitation.

*Riparian areas*: 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.

*Seasonal salmonid* (OAC3745-1-07(e)): These are rivers, streams and embayments capable of supporting the passage of salmonids from October to May and are water bodies large enough to support recreational fishing. This use will be in effect the months of October to May. Another aquatic life habitat use designation will be enforced the remainder of the year (June to September). A temporary variance to the criteria associated with this use designation may be granted as described in paragraph (F) of rule 3745-1-01 of the Administrative Code.

*Service Area*: The geographic area within which impacts can be mitigated at a specific mitigation bank or an in-lieu fee program, as designated in its instrument.

*Special Waters*: Streams with an antidegradation category of superior high quality water, outstanding national resource water or outstanding state water; state wild and scenic rivers; national wild and scenic rivers; and general high quality water bodies which harbor federal and/or state listed threatened and/or endangered mussel species. (For a current list of Special Categories please see http://www.epa.ohio.gov/Portals/35/401/OhioEPA_SpecialWaters_List.pdf).

*Sponsor*: Any public or private entity responsible for establishing, and in most circumstances, operating a compensatory mitigation bank or in-lieu fee program.

*Warmwater* (OAC3745-1-07(a)): These are waters capable of supporting and maintaining a balanced, integrated, adaptive community of warmwater aquatic organisms having a species composition, diversity, and functional organization comparable to the twenty-fifth percentile of the identified reference sites within each of the following ecoregions: the interior plateau ecoregion, the Erie/Ontario lake plains ecoregion, the western Allegheny plateau ecoregion and the eastern corn belt plains ecoregion. For the Huron/Erie lake plains ecoregion, the comparable species composition, diversity and functional organization are based upon the ninetieth percentile of all sites within the ecoregion. For all ecoregions, the attributes of species composition, diversity and functional organization will be measured using the index of biotic integrity, the modified index of well-being and the invertebrate community index as defined in "Biological

Criteria for the Protection of Aquatic Life: Volume II, Users Manual for Biological Field Assessment of Ohio Surface Waters," as cited in paragraph (B) of rule 3745-1-03 of the Administrative Code. In addition to those water body segments designated in rules 3745-1-08 to 3745-1-32 of the Administrative Code, all upground storage reservoirs are designated warmwater habitats. Attainment of this use designation (except for upground storage reservoirs) is based on the criteria in table 7-15 of this rule. A temporary variance to the criteria associated with this use designation may be granted as described in paragraph (F) of rule 3745-1-01 of the Administrative Code.

*Watershed*: A land area that drains to a common waterway, such as a stream, lake, estuary, wetland, or ultimately the ocean.

*Watershed Approach*: An analytical process for making compensatory mitigation decisions that support the sustainability or improvement of aquatic resources in a watershed. It involves consideration of watershed needs, and how locations and types of compensatory mitigation projects address those needs. A landscape perspective is used to identify the types and locations of compensatory mitigation projects that will benefit the watershed and offset losses of aquatic resource functions and services caused by activities authorized by DA permits. The watershed approach may involve consideration of landscape scale, historic and potential aquatic resource conditions, past and projected aquatic resource impacts in the watershed, and terrestrial connections between aquatic resources when determining compensatory mitigation requirements for DA permits.

*Watershed Plan*: A plan developed by federal, tribal, state and/or local government agencies or appropriate non-governmental organizations, in consultation with relevant stakeholders, for the specific goal of aquatic resource restoration, establishment, enhancement, or preservation. A watershed plan addresses aquatic resource conditions in the watershed, multiple stakeholder interests, and land uses. Watershed plans may also identify priority sites for aquatic resource restoration and protection. Examples of watershed plans include special area management plans, advance identification programs, and aquatic resource management plans.

## SECTION 3: PROCESSES

**Process for Establishment of a Bank or In-Lieu Fee Program**
The bank or ILFP review process occurs in three mandatory steps with an optional additional step as described below. The review process, including timeframes, is detailed in 33 CFR 332.8(d) Mitigation Banks and In-Lieu Fee Programs, Review Process. While the Mitigation Rule does not require the Step 1 draft prospectus, it is highly recommended that Step 1 be initiated for proposals in the state of Ohio. The items required are detailed in 33 CFR 332.8(d); additional items may be provided earlier in the process if the sponsor chooses.

*Step 1* (optional but highly recommended): Draft Prospectus - To initiate preliminary coordination, a brief, concept level proposal should be submitted when initially scoping the concept of a bank or ILFP. The draft prospectus should include, at a minimum, all items listed in Appendix 3 of this document. The sponsor may elect to give a presentation on the proposed site to the IRT prior to submitting a draft prospectus. After review of the draft prospectus by the IRT, comments will be provided to the sponsor.

*Step 2*: Prospectus - To initiate the formal review process, a complete prospectus must be submitted by the sponsor. A Public Notice advertising the prospectus will then be issued by the Corps. Figures provided in the prospectus must be legible, in black and white, and submitted on 8.5 inch x 11 inch paper. The prospectus must provide a summary of the information regarding the proposed mitigation bank or ILFP at a sufficient level of detail to support informed public and IRT comment. The information required to be included in the prospectus is detailed in 33 CFR 332.8(d)(2) "Mitigation Banks and In-Lieu Fee Programs, Review Process - Prospectus." To expedite the review process for banks, the IRT highly recommends the potential sponsor also include a delineation of all aquatic resources on the proposed site. An electronic version of the prospectus should be provided to the Corps on a compact disc (CD). At the end of the comment period, the Corps will provide the sponsor with a written initial evaluation as to the potential of the proposal. If the Corps determines that the proposed mitigation bank or ILFP has potential for providing appropriate compensatory mitigation, the Corps will inform the sponsor that he/she may proceed with preparation of a draft instrument.

*Step 3*: Draft Instrument - After considering comments from the Corps, the IRT, and the public, if the sponsor chooses to proceed with the proposal to establish a mitigation bank or ILFP, the sponsor must submit a complete draft instrument to the Corps. The draft instrument must be based on the prospectus and must describe in detail how the bank or ILFP will be established and operated. The information required to be included in the draft instrument is detailed in 33 CFR 332.8(d)(6) "Mitigation Banks and In-Lieu Fee Programs, Review Process – Draft Instrument." In addition, the draft instrument for in-lieu fee programs must include a compensation planning framework. The document will be distributed to the IRT for review and comment. At the end of the comment period, all comments will be discussed with the IRT and the sponsor in an effort to resolve issues. The Corps will inform the sponsor whether the draft instrument is generally acceptable and what changes, if any, are required. If there are significant unresolved concerns that may lead to a formal objection from one or more IRT members to the final instrument or amendment, the Corps will inform the sponsor of those concerns. The sponsor would have the opportunity to address the stated concerns.

*Step 4*: Final Instrument - To establish a mitigation bank or ILFP, a final instrument must be submitted for approval. This final instrument submittal must include supporting documentation that explains how the final instrument addresses all comments provided by the IRT. The sponsor must provide the final instrument directly to all members of the IRT. The Corps will notify the IRT members whether or not they intend to approve the instrument. If the instrument is approved, arrangements will be made for it to be signed by the appropriate parties. If any IRT member initiates the dispute resolution process, described in 33 CFR 332.8(e), the Corps will notify the sponsor. Following conclusion of the dispute resolution process, the Corps will notify the sponsor of the final decision of whether the instrument will be approved or not.

**Process to add a mitigation site to an approved In-Lieu Fee Program**

In-lieu fee mitigation sites will be reviewed through the instrument amendment process as defined in 33 CFR 332.8(g)(1) and 332.8(j). The request for approval of a mitigation site must include a full mitigation plan with all elements required in the regulations at 33 CFR 332.4(c)(2) through (14) as well as a credit release schedule that is tied to the achievement of specific performance standards.

Each mitigation site proposed will be placed on public notice and will undergo formal review by the Corps and the IRT.

The ILFP sponsor may seek informal feedback from the IRT prior to submittal of the formal request for site approval by providing the IRT with a conceptual mitigation plan for the site.

ILFP sponsors are strongly encouraged to be proactive to identify sites and to seek initial feedback and then formal approval of sites in order to assure that temporal requirements for fulfillment of advance credits are achieved.

The Corps is subject to the Department of Defense (DoD) and the Army Freedom of Information Act (FOIA, 5 U.S.C. 552) Regulations: Department of Defense Freedom of Information Act Regulations, DoD 5400.7-R (Sep 1998); 32 CFR Part 286 and Department of the Army Freedom of Information Act Regulations, 32 CFR Part 518, 22 Feb 2006. FOIA does provide an exemption to "Trade secrets and commercial or financial information obtained from a person and privileged or confidential" ((5 U.S.C. 552(b)(4)). Any such information provided to the Corps during the review of instruments or mitigation plans, or during audits, should be labeled as such and may not be subject to FOIA.

## SECTION 4: SITE SELECTION

Selection of suitable sites is critical to maximize the effectiveness of stream mitigation as well as to ensure the long-term ecological sustainability of that mitigation. All sites must conform to the requirements cited in 33 CFR 332 and include the specific criteria cited in 33 CFR 332.3 for the use of preservation as a mitigation option. Selection of mitigation sites under an ILFP must be consistent with that program's Compensation Planning Framework (CPF).

In general, stream sites should contain features that make the site conducive to the preservation and/or development of high quality streams that can be expected to be stable over time without degradation from current or likely adjacent land uses or from existing or reasonably projected conditions in upstream or downstream reaches. Sites most likely to be accepted by the IRT will include streams with degraded functions, which in the assessment of the IRT, can be restored to a high level of physical, biological and/or chemical quality and whose restoration, taking into account all on-site and off-site conditions, can be expected to be stable and endure over time, including maintaining stability through storm events of rare occurrence.

### Selection Criteria

Potential stream mitigation sites should be evaluated by the sponsor using the criteria listed below. This analysis will provide sufficient detail to the IRT on the existing baseline condition and the potential reasons for loss of function and stability as well as the potential for corrective actions to improve function and stability.

Channel Stability**:** Stream channel processes should be evaluated for aggradation, degradation, streambank erosion, channel enlargement, and channel successional shifts. Specific attention should be given to the sediment loading and ideally the channel stability analysis will take place in comparison to a reference reach. Any manipulations to the stream channel including channelization (straightening of stream), bridge abutments, road crossings, diversions, damming etc. should also be identified and related to the alteration of stream flow.

Floodplain connectivity: Sponsors should evaluate the existing relationship between streams and floodplains in the context of the known dynamics of the streams, and evaluate whether an improved connection is feasible, how it would be accomplished, and whether the connectivity is likely to endure. The presence of suitable floodplain soils as part of any plan to reestablish floodplain connectivity is crucial to provide appropriate water quality function and for the establishment of riparian vegetation.

Riparian buffer habitat: Buffers of adequate size (typically a minimum of 50 feet on each side of all streams, measured from the top of the each bank, from which credit generation is proposed) and plant composition should be included to reduce the negative impacts of adjacent land uses and facilitate the full range of stream functions. Applicants should provide appropriate justification for proposed buffer widths. Some riparian areas will require an annual maintenance for the control/removal of invasive, exotic and undesirable volunteer species within the mitigation corridor.

Substrate and in-stream habitat: The existing substrate composition and in-stream habitat should be evaluated and compared with reference streams. Tools such as pebble counts, Qualitative

Habitat Evaluation Index (QHEI) (OAC 3745-1-03(B)(3)(iv-v)) and the Headwater Habitat Evaluation Index (HHEI) may be useful in evaluating the substrate and in-stream habitat. Streams with appropriate substrate composition for the reference stream type, and those with abundant, high-quality in-stream habitat may be appropriate for stream preservation. Streams with substrate composition that is inappropriate for the reference stream type, and/or which lack the appropriate in-stream habitat, may be candidates for restoration/enhancement. Restoration goals for substrate and habitat must be reasonable and justified given the regional hydrologic, ecological, and geologic settings, stream size, and reference conditions in the watershed.

Faunal assemblage: The faunal assemblages (i.e., fish, macroinvertebrate, and/or amphibian assemblages) should be evaluated using common sampling techniques as appropriate (e.g., Index of Biological Integrity (IBI), Invertebrate Community Index (ICI), and Headwater Macroinvertebrate Field Index (HMFEI)). Streams with diverse and/or unique faunal assemblages may be appropriate for stream preservation. Streams with severely diminished and/or tolerant-dominated faunal assemblages may be candidates for restoration/enhancement. Knowledge of faunal assemblages upstream and/or downstream of the candidate mitigation site may also be useful when evaluating the potential faunal assemblages that could be expected to colonize stream reaches following restoration/enhancement activities.

Water chemistry: When appropriate, water chemistry sampling should be conducted to assess the baseline conditions. Parameters assessed may include specific conductance, water temperature, dissolved oxygen, pH, total acidity, alkalinity, total suspended solids, metals etc. and should be related to proposed improvements within the stream.

Nutrient enrichment: The right balance and level of nutrients are essential for healthy stream ecology. For example, elevated nitrogen or phosphorus can lead to excessive vegetation and low levels of dissolved oxygen. Sponsors should evaluate potential causes if these conditions exist and propose a corrective action.

Hydrology: Each stream on the site under consideration for credit generation should be evaluated as to its flow regime, channel forming discharge, and flooding frequency as appropriate, and, if available, the hydrologic gauge data should be obtained and provided to the IRT.

Adjacent upstream downstream land use: Land use near the bank or ILFP site or along other nearby reaches of a stream may impact the ability to implement or maintain high quality streams. The adjacent or upstream land use may compromise the site's ability to provide functions such as fish and wildlife habitat, flood reduction or water quality protection. The condition of the upstream and downstream reaches of a stream may also affect such functions and preclude making improvements which can be expected to endure. The adjacent land use may also improve the desirability of a site for stream mitigation. Sites that expand or improve the quality of adjacent aquatic resources are preferred; this is particularly beneficial if the adjacent land is publicly owned or under a conservation easement.

Ownership: The proposed ownership arrangements for the bank or ILF site must be provided in the mitigation plan. The site should be owned or under the full control of the sponsor or by

another party willing to be a co-signer of the mitigation plan and/or instrument modification by the time the site's final mitigation plan is submitted for the IRT review. The sponsor should own the full bundle of rights for the site or have a contractual agreement approved by the Corps and the IRT with the property owner. However, the IRT may consider sites where it can be demonstrated that these rights will not negatively impact the ability of the site to be developed, managed and protected as a high quality stream corridor. The sponsor shall provide documentation of ownership in the form of a deed or agreement between the sponsor and the legal owner of the property regarding use of the property and protection in perpetuity. If the property was purchased using public grant money, the sponsor is responsible for providing documentation from the grantor to show that the site's use for a mitigation site is compatible with the grant agreement. If the property is not owned by the sponsor then the property owner should also be a signatory to the mitigation plan approved as a modification of the instrument.

Relationship to other Programs: Except for projects undertaken by federal agencies, or where federal funding is specifically authorized to provide compensatory mitigation, state or federally-funded aquatic resource restoration or conservation projects undertaken for purposes other than compensatory mitigation, such as the Clean Ohio Fund, Wetlands Reserve Program, Conservation Reserve Program and Partners for Wildlife Program activities, cannot be used for the purpose of generating compensatory mitigation credits for activities authorized by the Corps and/or Ohio EPA permits. However, 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 restoration or conservation project.

Unique Features: The presence of unique features such as federally or state-listed endangered species, rare plant communities, dedicated natural areas, and archaeologically or culturally significant sites shall be documented. To be consistent with the intent of federal and state rules, special attention should be placed on unique or high quality streams or wetlands on the site. If any such features are present, the development of the site must not adversely affect these features. However, if protected, the presence of some of these features may improve the value of the site as a mitigation site.

Hazardous Substances: The site shall be free of all state and federal listed hazardous wastes and substances, including, but not limited to, underground tanks, pesticides, petroleum spills, commercial/industrial wastes or illegal dumps. This determination will be confirmed by the completion of an approved environmental assessment, such as ASTM E1527 - 05 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, conducted by an experienced person.

Inclusion in Land Use Plan: Preference should be given to sites that have been identified in approved habitat or water quality preservation or improvement plans. These plans may include watershed action plans, open space plans, habitat restoration plans or other local or regional land use and water quality improvement plans (TMDL, AMDAT). For an in-lieu fee program mitigation site, the site must conform to the program's approved Compensation Planning Framework.

Service Area Considerations: When selecting a bank or ILF mitigation site to propose, the sponsor should consider applicable state and federal rules which specify that mitigation should be located where it is most likely to successfully replace lost functions and services using the watershed approach. In-kind replacement, use of the watershed approach and the location of the compensation site relative to likely impact sites will be considered by the IRT. This approach will prevent substantial impacts from being mitigated at sites too far removed from the site where the functions and services are lost. In order to achieve this goal, the bank service areas will typically be designated as follows:

The primary service area desired for all stream and wetland banks in Ohio is a single 8 digit HUC. The IRT may consider a larger or smaller service area based upon unique economic or ecological specifics affecting particular mitigation sites.

For an ILFP mitigation site, sites must be proposed according to the requirements of the program's Compensation Planning Framework.

Relation of Bank and ILFP Service Areas to other regulatory criteria: Compensatory mitigation, located within the same sub-watershed where the impacts are located, is generally preferred. Acceptability of credits, from a particular bank or ILFP site for use in offsetting particular impacts, is at the discretion of the Clean Water Act Section 404 and 401 reviewers of those regulatory actions.

## SECTION 5: LONG-TERM MANAGEMENT & MAINTENANCE OF SITES

The Mitigation Banks and ILFPs represent a consolidation of mitigation for many different permitted impacts into a single location. Thus, a single mitigation bank or an ILFP site can represent the loss of thousands of linear feet of streams from across the approved service area. It is with this in mind that the IRT requires special provisions to be made to help ensure a site's long-term functionality. A long-term management plan must be provided that describes how the project will be managed after performance standards have been achieved. This will to ensure the long-term sustainability of the resource. A long-term management plan includes the following:

1. The identification of the party responsible for ownership and all long-term management of the site. A major factor in a site remaining viable as high quality habitat is the selection of an adequate long-term manager of the site. It is strongly encouraged for sponsors to develop a partnership with a federal, state or local governmental conservation entity with a proven track record in habitat management, and long-term site viability, to provide for the long-term management and maintenance of the site. Non-governmental conservation organizations (NGOs) or private land managers will be considered and approved on a case-by-case basis. NGOs proposed as long-term managers will be evaluated based on their previous record of habitat management, the future plans for the site, the proximity to the mitigation site, and the organizational long-term viability.

The long-term manager should be one that will provide opportunities for public access for education or various forms of low-impact recreation. The proposed ownership arrangements and a long-term management strategy should be identified at the time the bank prospectus or site mitigation plan is submitted to the Corps. This includes information documenting the agreement between the sponsor and the long-term manager. The long-term manager should be a signatory to the banking instrument or the site mitigation plan. The long-term manager is strongly encouraged to be an active participant throughout the design and approval process.

The long-term manager must protect the mitigation site and the resources it provides, through an appropriate real estate arrangement such as a conservation easement. Documentation of these agreements should be provided in the mitigation banking instrument. Also a statement shall be included in the instrument that requires prior approval by the IRT of any proposed replacement for long-term management should the initial long-term manager become defunct or otherwise abandon the long-term management responsibilities.

2. A description of the long-term management needs, the annual cost estimates of those needs, and the funding mechanism used to meet those needs must be provided. A wide range of factors can dramatically affect the cost of maintaining a restored stream or stream buffer. Projected long-term management needs must be described in the mitigation plan as well as annual cost estimates for those needs and the identification of the funding mechanism that will be utilized to meet the needs (See Section 6: Financial Assurances). The documentation of financial assurance must be provided prior to site approval.

## SECTION 6: FINANCIAL ASSURANCES

Short-term Contingency: The sponsor is responsible for securing financial assurances to cover contingency actions in the event of default or site failure. In determining the financial assurance amount for short-term contingency actions, the DE, in consultation with the IRT, will consider (but will not be limited to) the costs of mobilization, construction, operations, and monitoring, as well as past performance of the sponsor, project complexity, and likelihood of success. Detailed cost estimates must be presented in the site mitigation plan, or earlier if the sponsor chooses. Cost estimates must cover costs for the site design (planning and engineering), purchase (land acquisition), legal fees, construction, grading, re-grading contingency, sediment and erosion control, planting, replanting contingency, invasive plant control, maintenance, and monitoring for all restored (re-established or rehabilitated), established, enhanced or preserved aquatic resources and upland buffers in the mitigation site.

The financial assurances for sites may be in the form of irrevocable letters of credit, escrow accounts, performance bonds, or other appropriate instruments. Once deposited, the funds may not be used or withdrawn by the sponsor unless approved by the DE in consultation with the IRT. Sufficient financial sureties must be maintained until all performance measures have been met, all credits have been sold, and the mitigation site management has been transferred to the long-term manager. The funds will generally be released back to the sponsor incrementally as specified criteria are met (e.g., complete construction, complete plantings, etc.) but the funds will be forfeited by the sponsor in the event of default (see Section 12: Default Plan). A proposed schedule for release of the financial surety following the completion of specific tasks associated with the establishment of the mitigation site must be included in the instrument or ILFP site mitigation plan. The financial assurances must be in a form that ensures that the DE will receive notification at least 120 days in advance of any request for termination or revocation. For third party assurance providers, this may take the form of a contractual requirement to notify the DE at least 120 days before the assurance is revoked or terminated. The DE cannot accept directly, retain, or draw upon financial assurances. However, financial assurances shall be payable at the discretion of the DE to his designee or to a standby trust agreement identified in the financial instrument.

Long-term Management: The sponsor must provide adequate funds for the long-term management of the bank or ILFP site following transfer to the long-term manager. Appropriate long-term financing mechanisms include non-wasting endowments, trusts, contractual arrangements with future responsible parties, and other appropriate financial instruments. The site mitigation plan must include a comprehensive list of long-term management needs and annual cost estimates for those needs. The long-term management needs may include, but are not limited to, invasive plant control, maintenance of water control structures, site access restriction, monitoring, administrative costs, etc. The site mitigation plan must also identify the financing mechanism and detail how the mechanism will generate sufficient long term management funds, including inflationary adjustments and other contingencies. The long-term management fund may be funded fully following the initial credit release or incrementally with each credit release or each credit sale. Transfer of long-term management funds in case of default must also be addressed in the agreement between the sponsor and the long-term manager. Providing the financial assurances for long-term management of the mitigation site is the responsibility of the sponsor, including when the long-term management responsibility is

transferred to a publicly funded entity. The sponsor must document that the long-term management funds transferred to the long-term manager will only be used for the management of the mitigation site.

Annual Reporting: Documented proof of financial assurances (both short-term contingency and long-term management) will be submitted to the DE each calendar year. Annual documentation must show beginning and ending balances including the deposits into and any withdrawals from the accounts providing funds for the short-term contingency and the long-term management. Failure to comply with the requirements of this Section may be grounds for suspension and/or revocation of the bank or ILFP instrument. The annual reports should also include information on the amount of required financial assurances and the status of those assurances, including their potential expiration.

## SECTION 7: ADAPTIVE MANAGEMENT PLANS

The overall goal of adaptive management is to assure the long-term viability of the mitigation bank or the ILFP site. The focus of adaptive management should be the necessary measures to achieve performance standards and to satisfy the objectives defined for the site. Routine monitoring and minor maintenance tasks are intended to assure the long term viability of the mitigation site. The management of the mitigation site's resources will require the annual site investigations and the monitoring of selected characteristics to determine stability and ongoing trends of the restored, established, enhanced, and/or preserved waters. While it is not anticipated that major management actions will be needed, an objective of this management plan is to conduct monitoring to identify any issues that arise, and use adaptive management to determine what corrective actions are appropriate to address those issues.

As part of the instrument, the sponsor must outline a management strategy to address unforeseen changes in site conditions or other components of the mitigation project. An Adaptive Management Plan (AMP) is part of the mitigation plan; it specifies the procedures that will be in place to address potential changes in site conditions or other components of the compensatory mitigation project. The intent of an AMP is to identify a management strategy for corrective action in the event the site does not perform as proposed. An AMP can be thought of as a contingency plan that will provide details of what actions will be taken to correct site-specific issues that arise which prevent the site from meeting the performance measures. Adaptive management includes those activities necessary to address the effects of foreseeable and unforeseen circumstances that affect goals, objectives and the long-term success of the mitigation site. These may include climate change, fire, flood, and other natural or catastrophic events. Examples of some adaptive management actions include, but are not limited to, replacing dead or dying plants, changing hydrological regimes, controlling the degree of erosion, repairing and/or maintaining structures to assure appropriate operating conditions, and removing invasive or exotic species. Adaptive management plans include information regarding corrective actions that will be taken, as well as the party or parties responsible for implementing adaptive management measures.

Any management decisions that deviate from the approved mitigation plan will require an IRT approval. However, a certain amount of responsiveness to conditions on the ground should be built into the mitigation plan itself. Before considering any adaptive management changes to the mitigation plan, the IRT will consider whether such actions will help ensure the continued viability of a mitigation site. Therefore, the sponsor should include the following as part of their AMP:

1. Project Background: state the project objectives, performance standards and methods for monitoring, discuss quality assurance and quality control measures and how the monitoring data will be used for interpretation and reporting.
2. Problem Identification: discuss the rationale for identifying problem areas and/or determining that a site is not meeting the performance criteria and why it would not likely meet the performance criteria, unless corrective action is taken.

3. Corrective Action: identify specific and measurable steps that will be taken to correct identified problems (in step 2), as well as time frame for implementing and monitoring the corrective actions. Additional steps to refine corrective actions should also be discussed.

If the sponsor, in consultation with the IRT, identifies site specific issues that are either foreseeable or affecting performance goals, which have not been addressed in the mitigation plan, then the sponsor will take immediate action to work with the IRT to receive written approval to implement the appropriate adaptive management actions. If the action is necessary due to poor performance (i.e. monitoring data clearly indicates that the site or any portion thereof is not going to meet one or more of the performance goals established in the mitigation plan), the sponsor must develop site specific adaptive management measures to correct the deficiencies.

## SECTION 8: PERFORMANCE STANDARDS

Performance standards should be based on specific measureable metrics. Metrics should be established using standards in current use in Ohio at the time a bank or ILFP site is approved. Full performance goals for streams will be based on measures of, chemical, physical, and/or biological integrity. Goals for interim stream and stream buffer credit releases will demonstrate significant movement toward achieving full performance goals by the end of the monitoring period. Any request for credit release should be accompanied by supporting data. Because each compensatory stream mitigation activity is unique, performance standards will vary with mitigation type, stream type, landscape position, etc. Examples of some possible performance standards follow.

Examples of performance standards for channel form/stability

- Stream meets target stream class through measurement of specific parameters.
- Stream channel is vertically stable and connected to its floodplain-- neither aggrading nor degrading.
- Bank (lateral) Stability:
    - Should be only insignificant change from the as-built dimension.
    - Changes in dimension should be a movement in the direction of channel stability (e.g. decreased width to depth ratio without a decrease in entrenchment ratio)
    - Should be only insignificant change from as-built longitudinal profile.
- Pebble counts demonstrate appropriate substrate composition.
- Appropriate pool/riffle spacing.

Example performance standards for Stream Habitat

Restored streams meet the QHEI score indicated in the mitigation plan (likely based on reference reach).

Example performance standards for Stream Biological Function

Where appropriate for the stream type and mitigation type, streams meet a target biological index score based on protocols such as HMFEI, IBI or ICI.

Examples of performance standards for Water chemistry

Where appropriate for the stream type and mitigation type, the metric should demonstrate an increase/decrease as appropriate such as an increase in pH, decrease in acid loading etc.

Examples of performance standards for riparian restoration

- A minimum of 400 native, live and healthy (disease and pest free) woody plants per acre (of which at least 200 are tree species) must be present at the end of the monitoring period.
- Invasive species coverage does not exceed the level identified in the mitigation plan (e.g., 5%).

In order to provide woody plant density and diversity in the riparian zone, the following planting guidelines are recommended:

- a minimum of 400 native woody plants per acre;
- a minimum of 8 native woody plant species, each of which represents at least 5% of the overall count;
- a minimum of 25% of all native woody plants planted consist of at least 4 species with coefficient of conservatism values from 4 to 10. Coefficient of conservatism values can be found on the internet at: http://epa.ohio.gov/portals/35/wetlands/Ohio_FQAI.pdf;

Lists of species to be planted should be provided with each submittal and require the approval of the IRT. Only species considered to be native within the same Level IV ecoregion as the location of the mitigation should be included in the planting and seeding plan (Woods, A.J., J.M. Omernik, C.S. Brockman, T.D. Gerber, W.D. Hosteter, and S.H. Azevedo. 1998. Ecoregions of Indiana and Ohio [2 sided color poster with map, descriptive text, summary tables, and photographs]. U.S. Geological Survey, Reston, VA. Scale 1:500,000).

It is anticipated that as forested areas develop over time, the community composition will shift to those species best adapted to site conditions. Natural recruitment of native woody species is also expected to occur, and it is not the intention of the IRT to have these volunteers eradicated. In order to ensure that the above numbers are met at the end of the monitoring period, the sponsor may choose to increase the number of initial plantings for trees and shrubs to something greater than 200 of each, especially in areas where natural recruitment of woody volunteers is not likely to occur.

## SECTION 9: MONITORING

The ILFP or the Bank Sponsor will be required to monitor all of the stream mitigation areas for success and to provide written reports describing the findings of the monitoring efforts. Monitoring must be conducted in accordance with the mitigation banking instrument or the approved in-lieu fee site mitigation plan. Procedures used to assess mitigation sites should utilize accepted methodologies commonly used to acquire the type of data specified in the plan.
The monitoring report should document site conditions relative to achievement of performance standards. However, the monitoring requirements will vary greatly and be directly related to data collections necessary to evaluate the performance criteria of a specific site. The credit releases are dependent upon the evaluation of site conditions in reference to performance criteria as documented within the monitoring report. The monitoring must be detailed, precise and scientifically robust and may include the hydrologic monitoring of both the in-stream and the riparian areas, the comprehensive structural assessment (quantitative when appropriate), the vegetative assessment of riparian areas, the in-stream chemical/biological chemical data, and the documentation regarding problems or failure areas.

Please see Appendix 4 for examples of appropriate stream monitoring parameters.

## SECTION 10: CREDIT RELEASE SCHEDULE

Independent credit release schedules will be required for each site mitigation plan.

Below is an example for a potential mitigation site with both Mitigation Type 1 (Restoration) and Mitigation Type 2 (Preservation):

Initial Release: 10% of Mitigation Type 1 potential credits and 80% of Mitigation Type 2 potential credits.

- Approval of the final detailed stream design and planting plans
- Financial assurances in place
- Recording of long-term protection instrument

Completion of Construction: 10% of Mitigation Type 1 potential credits

- All in-stream construction complete and inspected
- Submittal of as-built site drawings

Completion of Planting: 10% of Mitigation Type 1 potential credits

- All plantings complete and inspected
- Submittal of as-built planting drawings

Second Year Monitoring: 20% of Mitigation Type 1 potential credits

- Submission of Monitoring Report (must have at least one documented bankfull event)
- Success evaluated by:
    - In-stream: stability of in-stream pattern, profile and dimension, streambank stability, and appropriate benthic substrates as documented by re-survey of the fixed cross-section and monitoring points including the photographic documentation and narrative descriptions;
    - Riparian Buffer: visual evidence of riparian buffers containing the appropriate target species in composition, diversity and density.
- Site inspection by the Corps/IRT

Fourth Year Monitoring: 15% of Mitigation Type 1 potential credits

- Submission of Monitoring Report (must have at least one documented bankfull event following second year monitoring)
- Success evaluated by:
    - In-stream: stability of in-stream pattern, profile and dimension, streambank stability, and appropriate benthic substrates as documented by the re-survey of the fixed cross-section and monitoring points including the photographic documentation and the narrative descriptions;
    - Riparian Buffer: visual evidence of riparian buffers containing a positive trend in target species in composition, diversity and density.
- Site inspection by Corps/IRT

Sixth Year Monitoring: 15% of Mitigation Type 1 potential credits

- Submission of Monitoring Report (must have at least two documented bankfull events

following second year monitoring)

- Success evaluated by:
    - In-stream: stability of in-stream pattern, profile and dimension, streambank stability, and appropriate benthic substrates as documented by re-survey of the fixed cross-section and monitoring points including photographic documentation and narrative descriptions;
    - Meeting 5th year proposed QHEI
    - Meeting 5th year proposed IBI
    - Riparian Buffer: visual evidence of riparian buffers containing a minimum of three years of positive growth of species. Positive trend in target species in composition, diversity and density towards achieving success criteria.
- Site inspection by Corps/IRT

Eighth Year Monitoring: 10% of Mitigation Type 1 potential credits

- Submission of Monitoring Report (must have at least two documented bankfull events following second year monitoring)
- Success evaluated by:
    - In-stream: stability of in-stream pattern, profile and dimension, streambank stability, and appropriate benthic substrates as documented by re-survey of the fixed cross-section and monitoring points including photographic documentation and narrative descriptions;
    - Riparian Buffer: visual evidence of riparian buffers containing a minimum of five years of positive growth of species. Positive trend in target species in composition, diversity and density towards achieving success criteria.
- Site inspection by Corps/IRT

Tenth Year Monitoring: 10% of Mitigation Type 1 credits and 20% of Mitigation Type 2 credits

- Submission of Monitoring Report (must have at least three documented bankfull events following second year monitoring)
- Success evaluated by:
    - In-stream: stability of in-stream pattern, profile and dimension, streambank stability, and appropriate benthic substrates as documented by re-survey of the fixed cross-section and monitoring points including photographic documentation and narrative descriptions;
    - Meeting 10th year proposed QHEI
    - Meeting 10th year proposed IBI
    - Riparian Buffer: documented evidence of riparian buffers containing a minimum of eight years of positive growth of species. Target species achieving success criteria in composition, diversity and density.
- Site inspection by Corps/IRT

## SECTION 11: DEBIT AND CREDIT CALCULATIONS

In order to appropriately apply the debit/credit calculations, the sponsor must know the existing use and/or designated use of existing streams. For all streams that do not currently have a designated use as defined in the Ohio Water Quality Standards (OAC 3745-1), it will be the responsibility of the sponsor to provide the Ohio EPA with sufficient data (as determined by Ohio EPA) to verify the existing use for the stream. An existing use is defined as the use actually attained in the water body on or after November 28, 1975 (OAC 3745-1-05(A)(8)). The data collection may take the form of biological, chemical, and/or physical. The Ohio EPA will be responsible for verifying of the all data collected and submitted by the sponsor and for verifying the "existing use" determination/verification that results from each sampling effort. All streams intended to serve as mitigation without designated uses are subject to the sampling mentioned above.

**a) Debit Calculations:** For the purpose of calculating stream debit units, streams have been assigned into three groups:

- Group 1 includes ephemeral streams with bedrock/boulder/cobble/gravel dominated substrates, intermittent streams with sand/silt/muck/clay/artificial dominated substrates, ephemeral streams with sand/silt/muck/clay/artificial-dominated substrates, Limited Resources Waters, and Modified Warmwater streams.
- Group 2 includes intermittent streams with bedrock/boulder/cobble/gravel dominated substrates, and headwater perennial warmwater habitat equivalent.
- Group 3 includes headwater perennial/interstitial streams, Coldwater, Seasonal salmonid, Special Waters, and Exceptional Warmwater streams.

**Table 11-1. Suggested Debit Ratios**

| GROUP | STREAM TYPE | Debit Ratio |
|---|---|---|
| 1 | Ephemeral streams with sand/silt/muck/clay/artificial dominated substrates | 1:1 |
| 1 | Limited Resource Waters | 1:1 |
| 1 | Ephemeral streams with bedrock/boulder/cobble/gravel/sand mixed substrates | 1.5:1 |
| 1 | Intermittent streams with sand/silt/muck/clay/artificial dominated substrates | 1.5:1 |
| 1 | Modified Warmwater and Modified Warmwater Habitat Equivalent | 1.5:1 |
| | | |
| 2 | Intermittent with bedrock/boulder/cobble/gravel/sand mixed substrates | 2:1 |
| 2 | Warmwater and Warmwater Habitat Equivalent | 2:1 |
| | | |
| 3 | Headwater Perennial/Interstitial - Cold Water Habitat Equivalent (generally less than 3 square mile drainage area) | 3:1 |
| 3 | Coldwater and Coldwater Habitat Equivalent | 3:1 |
| 3 | Seasonal Salmonid | 3:1 |
| 3 | Special Waters | 3:1 |
| 3 | Exceptional Warmwater | 3:1 |

**To illustrate use of the ratios the following examples are provided:**

- 100 linear feet of an ephemeral stream with bedrock/boulder/cobble/gravel dominated substrates is filled. This stream type is found in Group 1 and assigned a debit ratio of 1.5:1. 100 linear feet multiplied by 1.5 results in a debit of 150 units.
- 100 linear feet of an intermittent stream is enclosed. Intermittent stream type is found in Group 2 and has been assigned a debit ratio of 2:1. 100 linear feet of piping multiplied by 2 results in a debit of 200 units.
- 100 linear feet of headwater perennial stream is mined through. Headwater perennial stream type is in Group 3 and assigned a debit ratio of 3:1. 100 linear feet of mine through multiplied by 3 results in a debit of 300 units.

**b) Credit Calculations:** For the purpose of calculating stream credit units, compensatory mitigation options have been assigned into four mitigation types: restoration/enhancement, preservation, buffer work, and extra buffer efforts. Within each mitigation type, activity levels have also been identified:

- Mitigation Type 1 - restoration/enhancement has four defined activity levels.
- Mitigation Type 2 - sole preservation has two defined activity levels (0-50 horizontal feet).
- Mitigation Type 3 - buffer work only has two defined activity levels (0-50 horizontal feet).
- Mitigation Type 4 - extra buffer has three defined activity levels (greater than 50 horizontal feet).

**Table 11-2 identifies the potential credit ratio for each mitigation type and respective activity level.**

**Table 11-2. Suggested Credit Ratios**

| MITIGATION TYPE | ACTIVITY LEVEL | CREDIT RATIO |
|---|---|---|
| 1. Restoration/Enhancement Efforts | 1 | Up to 2:1 |
| | 2 | Up to 1.75:1 |
| | 3 | Up to 1.5:1 |
| | 4 | Up to 1:1 |
| | | |
| 2. Preservation | 1 | Up to 1:3 |
| Note: All preservation must comply with 33CFR332.3(h) | 2 | Up to 1:6 |
| | | |
| 3. Buffer Work Only | Re-establishment | Up to 1:2 |
| | Rehabilitation | Up to 1:4 |
| | | |
| 4. Extra Buffer | Re-establishment | Up to 1:4 |
| | Rehabilitation | Up to 1:8 |
| | Preservation | Up to 1:16 |

NOTE: The IRT serves as the final decision maker on all applicable credit ratios for the mitigation activities reviewed under and authorized by the mitigation banking and ILF Instrument. Other compensatory mitigation activities not specifically addressed in Table 11-2 or the remainder of Section 11 (e.g., dam removal, acid mine drainage abatement) may be appropriate as well. Credit ratios for these activities will be determined on a case by case basis.

**To illustrate use of these ratios the following examples are provided:**

- Activity Level 1 Restoration of a Modified Warmwater stream for 10,000 linear feet could obtain up to 20,000 credit units.
- Activity Level 2 Restoration of a Modified Warmwater stream for 5,000 linear feet and the Preservation of 3,000 linear feet of a High Quality Group 3 stream could obtain up to 9,750 (up to 8,750 for restoration and up to 1,000 for preservation) credit units.
- Activity Level Buffer Work Only to 5,000 linear feet of an intermittent stream consisting of 2,000 linear feet of Re-establishment and 3,000 linear feet of Rehabilitation could obtain up to 1,750 (up to 1,000 for re-establishment and up to 750 for rehabilitation) credit units.

**Mitigation Type 1 - Restoration/Enhancement:**

**Activity Level 1 applies to both larger scale perennial and intermittent streams (as determined by the IRT on a case by case basis).**

Activity Level 1 applies to both perennial and intermittent streams. The associated activities may include, but are not limited to a full-extent channel restoration involving dimension, pattern and profile work to provide for a stable stream that is reconnected to its original floodplain by using a relic channel or constructing a new channel. Stream restoration plans should be developed in conjunction with a reference reach assessment. Stream size may influence the credit determination.

Activity Level 2 applies to both perennial and intermittent streams. The associated activities may include, but are not limited to a full-extent channel restoration involving dimension, pattern and profile work to provide for a stable stream. This involves the re-establishment of a new floodplain at the stream's existing level or higher but not at the original level. For example, it is not always possible to reconnect a channel to its natural floodplain. In these cases, the construction of a channel with appropriate pattern (meandering) that incorporates benches, that function as flood plains creating/restoring some natural alluvial processes, would be appropriate. Stream restoration plans should be developed in conjunction with a reference reach assessment. Stream size may influence the credit determination.

Activity Level 3 applies to all stream types. The associated activities may include but are not limited to full-extent channel restoration involving dimension, pattern and profile work to provide for a stable stream. Some stream segments may present difficulties in re-establishing a natural channel pattern when the segment is laterally contained or has limitations in the available belt width. Physical constraints, such as high-gradient stream systems (defined as >4% channel slope), typically require the creation of a step/pool bed morphology with less sinuosity than a

riffle/pool bed morphology with greater sinuosity. Stream restoration plans should be developed in conjunction with a reference reach assessment. Stream size may influence the credit determination.

Activity Level 4 (defined as enhancement) applies to all stream types. The associated activities include physical alterations to the channel which does not constitute restoration but directly augments channel stability, water quality and stream ecology in accordance with a reference condition. These activities may include but are not limited to in-stream and/or streambank activities, but in total fall short of restoring one or more of the geomorphic variables: dimension, pattern and profile. Below are six examples of enhancement activities: 1) In-stream structures to improve pool habitat (cross vanes, j hooks and etc.); 2) Habitat structures to provide cover (root wads, fish boards and etc); 3) Bankfull bench creation to reduce bank erosion; 4) Laying back banks to reduce bank erosion; 5) Bioremediation techniques; and 6) Streambank planting (e.g. live stake willows planted below the top of bank). Stream size may influence the credit determination.

NOTE: For all Restoration/Enhancement Activity Level 1-4, a minimum the 50-foot buffer, measured horizontally from the top of each bank should be restored and protected with an appropriate real estate instrument such as an environmental covenant or a conservation easement. No additional credits will be generated for these buffers as the functional worth of the buffer has already been considered in the basic restoration/enhancement ratio. Extra Buffer Efforts (beyond 50' on each bank) may generate additional credits as discussed in Mitigation Type 4. In cases where the desired buffer as described above cannot be established, the project may be approved at a reduced credit ratio. This activity includes the installation of plants other than seed along the immediate stream bank area. This is primarily done for streambank stabilization, shading and organic inputs. This activity includes live stakes, dormant post/stakes, branch layering, and the installation of plants.

**Mitigation Type 2 - Preservation:** This mitigation type is the permanent protection of ecologically important aquatic resources. Preservation includes protection of the stream and their intact adjacent buffer areas or other habitats necessary to ensure protection of the aquatic ecosystem.

Activity Level 1 applies to Group 3 streams and Activity Level 2 applies to Group 2 and Group 1 ephemeral streams with a bedrock/boulder/cobble/gravel dominated substrate. In accordance with 33CFR332.3(h)(1), sponsors proposing preservation activities must comply with all of the following criteria:

(i) The resources to be preserved provide important physical, chemical, or biological functions for the watershed;

(ii) The resources to be preserved contribute significantly to the ecological sustainability of the watershed. In determining the contribution of those resources to the ecological sustainability of the watershed, the district engineer must use appropriate quantitative assessment tools, where available;

(iii) Preservation is determined by the district engineer to be appropriate and practicable;

(iv) The resources are under threat of destruction or adverse modifications; and

(v) The preserved site will be permanently protected through an appropriate real estate or other legal instrument (e.g., easement, title transfer to state resource agency or land trust).

**Mitigation Type 3 - Buffer Work Only: The activity levels within this Mitigation Type are identified as re-establishment and rehabilitation.**

Re-establishment credit is typically given for the re-establishment of the riparian buffer when no functional buffer exists.

Rehabilitation credit is typically given when an existing degraded buffer is substantially improved through supplemental planting or invasive species removal etc.

**Mitigation Type 4 - Extra Buffer Work:** This mitigation type applies to the buffers extending from 51-150 horizontal feet, measured from top of bank, on each side of the stream channel. The activity levels within this mitigation type have been defined as re-establishment, rehabilitation, and preservation. For re-establishment and rehabilitation the same process is used to determine the incentive for the extra buffer work as described above. Since the extra buffer area has less influence on stream channel stability, water quality and in-stream habitat, the incentive percentages are reduced. To be applicable for the above-described incentives beyond a 50 foot buffer, a permanent protection is required on all of the buffer extents claimed via a legal real estate instrument. Extra buffer re-establishment and rehabilitation, less than 150 feet from each bank, may also be considered for credit generation (at a reduced credit ratio).

Preservation of intact buffers extending from 51-150 horizontal feet, measured from top of bank, and on each side of the stream channel, may also generate additional credit as determined on a case-by-case basis. This is the added protection of stream through the implementation of appropriate legal real estate instruments. Preservation of extra buffer less than 150 feet from each bank may also be considered for credit generation at a reduced credit ratio.

NOTE: Buffer proposals greater than 150 feet in width on either side of the stream must be approved on a case-by-case basis. When a mature stand of trees is proposed to be removed in order to perform restoration or enhancement activities, the areas to be replanted cannot be credited toward total or supplemental buffer revegetation. These areas will be assessed as Preservation only. No area of buffer can be credited under more than one buffer category. A successful buffer zone area shall be well-balanced and composed of native vegetative strata (tree, shrub and herb).

## SECTION 12: DEFAULT PLAN

Should the IRT determine that the Sponsor is in material default of any provision of a bank or the ILFP instrument (including mitigation plans), the District Engineer (DE) will notify the Sponsor that the sale or transfer of any credits will be suspended until the appropriate deficiencies have been remedied. Upon notice of such suspension, the Sponsor agrees to immediately cease all sale or transfer of mitigation credits until the DE informs the Sponsor in writing that sales or transfers may be resumed. Should the Sponsor remain in default, the DE may terminate the Mitigation Banking or In-Lieu Fee Program Instrument and any subsequent operations. Upon termination, the Sponsor agrees to perform and fulfill all obligations under the instrument relating to credits that were sold or transferred prior to termination.

In the cases of In-Lieu Fee Program noncompliance and/or default, the mitigation rule defines the authority of the DE to direct actions as below:

i. The DE can instruct the sponsor on how to use funds in the ILFP account in case of program, service area, or project default;
ii. The DE can suspend advanced or fulfilled credit sales for the ILFP as a whole;
iii. The DE can suspend advanced or fulfilled credit sales within a Service Area;
iv. The DE can suspend advanced or fulfilled credits for an ILF mitigation site;
v. The DE can decrease the available credits at an ILF mitigation site;
vi. The DE can terminate the entire program instrument or terminate the program within a specific Service Area;
vii. The DE can require/direct adaptive management actions at a mitigation site;
viii. The DE can modify the credit release schedule for an ILF mitigation project;
ix. The DE can direct the contingency funds, Long-term Management and Maintenance (LTMM) funds and/or land surcharge funds for mitigation sites that are not in compliance or are underachieving;
x. The DE can direct the funds to alternative mitigation (e.g., buying credits from a bank); and/or
xi. The DE can refer the non-compliance actions to the Department of Justice if the sponsor does not comply with DE directives.

## SECTION 13: CLOSURE CRITERIA

### Site Closure

Prior to closure of a mitigation bank or in-lieu fee site, the IRT will perform a final compliance inspection to evaluate whether all of the performance measures have been met. Closure will occur upon the DE determining, in consultation with the other members of the IRT and the Sponsor, that:

1. all applicable performance measures have been achieved;
2. all available credits for that bank or in-lieu fee site have been debited;
3. the Sponsor has prepared a Long-Term Management and Maintenance (LTMM) Plan that has been approved by the IRT;
4. the Sponsor has prepared and submitted a GIS shapefile or similar exhibit depicting the location and extent of the mitigation bank or in-lieu fee site;
5. the Sponsor has either: (i) assumed responsibilities for accomplishing the LTMM Plan, in which case the Sponsor will fulfill the role of Long-Term Manager, or (ii) has assigned those responsibilities to another Long-Term Manager;
6. the Long-Term Management and Maintenance Fund has been funded;
7. the contents of the Long-Term Management Fund have been transferred to the Long-Term Manager; and,
8. the Sponsor has complied with all other terms of the Instrument.

Upon bank or in-lieu fee site closure, no further credit transfer may occur and the period of long-term ownership and preservation will commence. The DE will issue a written certification of satisfaction to the Sponsor and the escrow agent and thereafter any remaining monitoring and maintenance fund will be released to the Sponsor.

### Program Closure

The Sponsor or the DE may terminate an instrument within 90 days by providing written notification to the other party. In the event that an instrument is terminated, the sponsor remains responsible for fulfilling all prior mitigation obligations assumed including the successful completion of ongoing mitigation projects, relevant maintenance, monitoring, reporting and long-term management requirements. In other words, the sponsor will remain responsible for the fulfillment of all credits sold until such time as the long-term financing obligations have been met and the long-term ownership of all mitigation lands has been established. The funds remaining in the ILF Program accounts after these obligations are satisfied must continue to be used for the re-establishment, establishment, rehabilitation, preservation and enhancement of aquatic resources in the same service area from which the credits were sold. The DE may direct that these funds be turned over to another mitigation provider.

**Appendix 1 Required Components of a Compensatory Mitigation Plan in accordance with 33 CFR 332.4 (c)(2) through (14)**

*Objectives* ***(2).*** A description of the resource type(s) and amount(s) that will be provided, the method of compensation (restoration, establishment, preservation etc.), and how the anticipated functions of the mitigation project will address watershed needs.

*Site selection* **(3).** A description of the factors considered during the site selection process. This should include consideration of watershed needs, onsite alternatives where applicable, and practicability of accomplishing ecologically self-sustaining aquatic resource restoration, establishment, enhancement, and/or preservation at the mitigation project site.

*Site protection instrument* **(4).** A description of the legal arrangements and instrument, including site ownership, which will be used to ensure the long-term protection of the mitigation project site.

*Baseline information* **(5)**. A description of the ecological characteristics of the proposed mitigation project site (and in the case of an associated application for a DA permit, the impact site). This may include descriptions of historic and existing plant communities, historic and existing hydrology, soil conditions, a map showing the locations of the mitigation site(s) or the geographic coordinates for those site(s), and other characteristics appropriate to the type of resource proposed as compensation. The baseline information should include a delineation of waters of the United States on the proposed mitigation project site.

*Determination of credits* **(6)**. A description of the number of credits to be generated including a brief explanation of the rationale for this determination.

*Mitigation work plan* **(7)**. Detailed written specifications and work descriptions for the mitigation project at the bank, including: the geographic boundaries of the project at the bank site; construction methods, timing, and sequence; source(s) of water; methods for establishing the desired plant community; plans to control invasive plant species; proposed grading plan; soil management; and erosion control measures.

*Maintenance plan* **(8)**. A description and schedule of maintenance requirements to ensure the continued viability of the resource once initial construction is completed.

*Performance standards* **(9)**. Ecologically-based specific and measurable standards that will be used to determine whether the project is achieving its objectives.

*Monitoring requirements* **(10)**. A description of parameters monitored to determine whether the bank is on track to meet performance standards and if adaptive management is needed. A schedule for monitoring and reporting monitoring results to the Corps must be included. The monitoring plan should include a site plan which shows where all hydrological monitoring wells and plant sampling locations will be established.

*Long-term management plan* **(11)**. A description of how the bank will be managed after performance standards have been achieved to ensure the long-term sustainability of the resource,

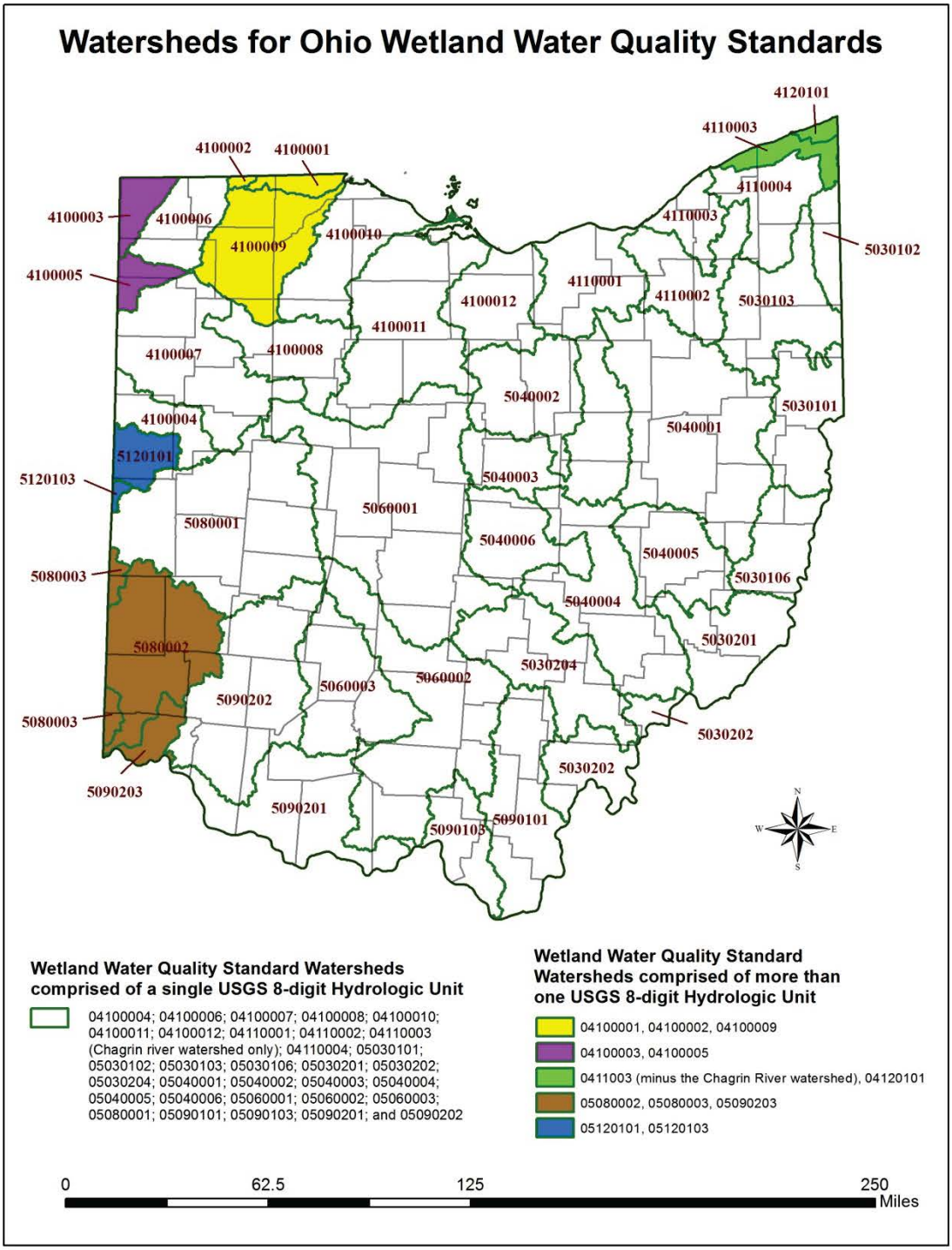
including long-term financing mechanisms and the party responsible for long-term management.

*Adaptive management plan* **(12)**. A management strategy to address unforeseen changes in site conditions or other components of the project, including the party or parties responsible for implementing adaptive management measures.

*Financial assurances* **(13)**. A description of financial assurances that will be provided and how they are sufficient to ensure a high level of confidence that the mitigation project at the bank will be successfully completed, in accordance with its performance standards.

*Other information* **(14)** as required to determine the appropriateness, feasibility, and practicability of the mitigation bank.

## Appendix 2 Hydrologic Units in Ohio



**Appendix 3 Useful Elements to include in a Draft Prospectus for Mitigation Bank or Draft Proposal for In-lieu Fee Site Specific Mitigation Plans (This step is optional)**

A. Proposed Bank Name-Use a short name based on a geographic feature if possible; include Mitigation Bank/In-lieu Fee Program in name

B. Bank/Program Contacts-include the name, address, phone, fax, email, and role in project

C. General location map and address of the proposed bank property

D. Accurate current map of the proposed bank property on a 7.5 minute USGS map showing boundaries of the site

E. Aerial photo of the bank site and surrounding properties

F. Soils map of the bank site and surrounding properties

G. Map of the proposed service area

H. Current site conditions including
    a. Potential wildlife habitats and species known or potentially present
    b. Photos of the site
    c. Description of potential wetlands and waters present on site
    d. Hydrology description
    e. Approximate acreage of existing wetlands and waters to be restored
    f. Site history including past land uses
    g. Surrounding land uses and zoning
    h. Anticipated future development in the area
    i. Mineral rights (surface and subsurface)

I. Conceptual site plan

**<u>Appendix 4 Stream Monitoring Report Example</u>** - *The information below provides a number of examples of the monitoring requirements that might be required to document progress in meeting performance standards for stream restoration. The actual monitoring activities required for each bank/ILF site will be based on the activities the mitigation provider is undertaking and will be identified in the monitoring plan. For example some restoration projects may only involve buffer and floodplain work, while other projects may include channel restoration work. The type and duration of monitoring will vary depending on the type of mitigation activity.*

General

a. Each report should clearly identify the specific monitoring period the report is intended to represent, as well as the calendar year the monitoring occurred. The report should also provide a summary of the current status, which compares the previous years' monitoring information with the current report including graphs and tables showing trends, etc.

b. Each monitoring report should contain a list of species planted in all of the mitigation areas.

c. The first year report should include plan views and cross sections of the as-built mitigation area including the location and types of planting.

d. At a minimum, annual reports should contain updated drawings sized 11" by 17" or larger (to scale) reflecting the current conditions, corrective or other actions that occurred, changes in dominant vegetation, and other pertinent information.

   Each annual report should include photographs to be collected as follows:

   i. An adequate number of fixed observation points should be selected, with no fewer than three fixed observation points per distinct mitigation area, to provide representative overviews of each distinct mitigation area. The use of stakes with unique numbers to designate photo locations is recommended.

   ii. Photographs should be taken from these points at the same position and angle during the growing season of each monitoring year. The fixed observation points should be captured using GPS, their coordinates recorded and then marked on the annual monitoring base map.

   iii. Additional photographs of areas of interest within each distinct mitigation area should be marked on the base map and provided in each monitoring report.

1. Site Drawings
At a minimum, annual reports should include longitudinal profile and cross-sectional measurements of the mitigation stream and should be taken to include those measurements necessary to determine sinuosity, meander wavelength, belt width, radius of curvature, and meander arc length for a minimum of two meander bends.

Cross sectional measurements that may be included (based on performance criteria)

- Bankfull width, bankfull maximum depth, flood prone area width, entrenchment ratio, bankfull cross-sectional area, bank height, and bank height ratio;

- Cross sectional measurements should encompass two consistent permanent cross sections or 1 cross section per 30 bankfull widths (whichever number of cross sections is larger) for each analysis; and,

- Lowest bank height elevations should be collected where those differ significantly from bankfull stage.

Longitudinal profile measurements should:

- Include those measurements necessary to determine average water surface slope, riffle slope, pool slope, and riffle/pool or step/pool sequences over the entire measured reach; and,

- Provide elevation data for the thalweg, water surface, and bankfull stage over the entire measured reach.

2. Substrate Sampling
Wolman pebble counts distributed proportionally over the profile reach in accordance with the percentage distribution of streambed features (60% from pools, 30% from riffles, and 10% from steps). The minimum total number of particles to be collected is 100.

3. Stream Stability Rating
Observations of the stream mitigation channel and banks, including up and downstream, should be made. Signs of negative effects from the stream mitigation such as excessive bank erosion, sedimentation, headcutting, aggradation, entrenchment, or degradation should be noted in the annual report, and corrective actions should be taken.

4. Water Chemistry
Monitoring water chemistry sampling should address a specific contaminant of concern at a mitigation site.

5. Hydrology Monitoring
Water level data and estimated flow should be collected in May and late August of each monitoring year. Ground water levels should be measured in the absence of inundated conditions. Observations should be made at base flow conditions. Large rain events or drought conditions occurring within the immediate watershed should be noted in this section. Additional hydrology data should be collected if monitoring events occur outside of normal conditions to document the flow regime of the stream.

6. Vegetation Monitoring
   a. The location and name of each plant community type within the mitigation area and buffer area should be marked on a scaled drawing or scaled aerial photograph (base map) and named. The dominant plant species should be visually determined in each vegetation layer of each community type, and the scientific names of these species should be included in the report.
   b. For forested riparian buffers, standard forestry measurements (e.g., frequency, density, dominance, and importance value) for all woody species should be calculated. These data should be graphed against time to demonstrate that each of these areas is developing into a functional forested ecosystem. Vegetation should be assessed with the use of 10 X 10 meter fixed plots.

7. Qualitative Habitat Evaluation Index (QHEI)
QHEI assessments, using the most current version of that document available at the time the assessment is performed, should be completed yearly.

8. Qualitative Macroinvertebrate Sampling.
Macroinvertebrate sampling should be performed during the sampling index period which extends from June 15$^{th}$ through September 30$^{th}$, and done in accordance with the *Biological Criteria for the Protection of Aquatic Life, Volumes I, II, and III*. This sampling should be performed in years specified within the mitigation plan. A narrative rating should be assigned. Qualitative sampling is appropriate if the stream's drainage is less than 20 mi² but larger than 1 mi² OR if the stream doesn't have sufficient flow or depth to cover the artificial substrate sampler for a six week sampling period.

9. Invertebrate Community Index (ICI)
Macroinvertebrate sampling should be performed during the sampling index period which extends from June 15$^{th}$ through September 30$^{th}$, and must be done in accordance with the *Biological Criteria for the Protection of Aquatic Life, Volumes I, II, and III*. This sampling should be performed in years specified within the mitigation plan. An Invertebrate Community Index (ICI) score should be calculated from each sampling event. ICI should be used if the streams drainage is over 1 mi² OR pools deeper than 40 cm AND if the stream had sufficient flow or depth to cover the artificial substrate sampler for a six week sampling period.

10. Index of Biotic Integrity (IBI)
Fish sampling should be performed during the sampling index period which extends from June 15th through September 30th, and must be done in accordance with the *Biological Criteria for the Protection of Aquatic Life, Volumes I, II, and III*. This sampling should be performed in years specified within the mitigation plan. An Index of Biotic Integrity (IBI) should be used for streams over 1 $mi^2$. A Modified Index of Well Being (MIwb) score should be used if the stream is over 20 $mi^2$.

11. Amphibian/Salamander sampling in accordance with an approved survey protocol (for example a Visual Encounter Survey) should be performed in years specified within the mitigation plan. Sampling for salamanders is best conducted during the spring and summer months.

## REFERENCES


Andreas, Barbara K., John J. Mack, and James S. McCormac. 2004. Floristic Quality Assessment Index (FQAI) for vascular plants and mosses for the State of Ohio. Ohio Environmental Protection Agency, Division of Surface Water, Wetland Ecology Group, Columbus, Ohio. 219 p.

ASTM International. E1527-05 Historical Standard: ASTM E1527-05 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process. Retrieved from http://www.astm.org/DATABASE.CART/HISTORICAL/E1527-05.htm

Biological Criteria for the Protection of Aquatic Life, Volumes I, II, and III. State of Ohio Environmental Protection Agency, October 30, 1987 (Updated January 1, 1988). Retrieved from http://www.epa.ohio.gov/Portals/35/documents/Vol2.pdf

Federal Register. April 10, 2008. Part II Department of Defense, Department of the Army, Corps of Engineers, 33 CFR Parts 325 and 332, Environmental Protection Agency, 40 CFR Part 230: Compensatory Mitigation Losses of Aquatic Resources, Final Rule.

Index of Biotic Integrity (IBI) is contained in:

Biological Criteria for the Protection of Aquatic Life, Volume II, User Manual for Biological Field Assessment of Ohio Surface Waters. State of Ohio Environmental Protection Agency, October 30, 1987 (Updated January 1, 1988) and appropriate updates. Section 3: Field Methods and Data Analysis Requirements and Section 4: Biological Data Evaluation - Fish http://epa.ohio.gov/Portals/35/documents/Vol2.pdf

AND

Biological Criteria for the Protection of Aquatic Life, Volume III, Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities. State of Ohio Environmental Protection Agency, October 30, 1987 (Updated September 30, 1989) and appropriate updates. Subsection 4: Fish http://epa.ohio.gov/portals/35/documents/Vol3.pdf

Invertebrate Community Index (ICI) is contained in:

Biological Criteria for the Protection of Aquatic Life, Volume II, User Manual for Biological Field Assessment of Ohio Surface Waters. State of Ohio Environmental Protection Agency, October 30, 1987 (Updated January 1, 1988) and appropriate updates. Section 3: Field Methods and Data Analysis Requirements and Section 5: Biological Data Evaluation - Macroinvertebrates http://epa.ohio.gov/Portals/35/documents/Vol2.pdf

AND

Biological Criteria for the Protection of Aquatic Life, Volume III, Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities. State of Ohio Environmental Protection Agency, October 30, 1987 (Updated September 30, 1989) and appropriate updates. Subsection 1: Macroinvertebrates http://epa.ohio.gov/portals/35/documents/Vol3.pdf

Headwaters Macroinvertebrate Field Evaluation Index (HMFEI) is contained within: Ohio EPA. 2012. Field Evaluation Manual for Ohio's Primary Headwater Habitat Streams. Version 3.0. Ohio EPA Division of Surface Water, Columbus, Ohio. 117 pp. Section 6 - Level 2 and Level 3 Assessments: Biological Sampling http://epa.ohio.gov/portals/35/wqs/headwaters/PHWHManual_2012.pdf

Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI). Retrieved from http://epa.ohio.gov/portals/35/documents/QHEIManualJune2006.pdf.

Ohio Administrative Code, Chapter 3745-1 Water Quality Standards. Retrieved from http://codes.ohio.gov/oac/3745-1

USGS 8-Digit Hydrologic Unit Codes. Retrieved from http://water.usgs.gov/GIS/huc html

Woods, A.J., J.M. Omernik, C.S. Brockman, T.D. Gerber, W.D. Hosteter, and S.H. Azevedo. 1998. Ecoregions of Indiana and Ohio [2 sided color poster with map, descriptive text, summary tables, and photographs]. U.S. Geological Survey, Reston, VA. Scale 1:500,000