DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

REPLY TO
ATTENTION OF:

CESAM-RD-C **18 September 2008**
PUBLIC NOTICE NO. SAM-2008-1372-MBM

PUBLIC NOTICE
U.S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT

PROPOSED DRAFT STREAM MITIGATION STANDARD OPERATING PROCEDURES FOR CALCULATING COMPENSATORY MITIGATION REQUIREMENTS FOR ADVERSE IMPACTS TO LINEAR AQUATIC SYSTEMS (STREAMS)

TO ALL CONCERNED: The U.S. Army Corps of Engineers (Corps), Mobile District, is proposing new operating procedures for calculating stream compensatory mitigation pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) and 404 of the Clean Water Act (33 USC 1344). This public notice is being distributed to all known interested persons to assist in developing facts on which a decision by the Corps can be based. Please communicate this information to interested parties.

The U.S. Army Corps of Engineers, Mobile District, Regulatory Branch is soliciting comments on the attached draft document titled "DRAFT STANDARD OPERATION PROCEDURE (SOP), COMPENSATORY STREAM MITIGATION GUIDELINES." The SOP will be applicable to regulatory actions requiring compensatory mitigation for adverse impact linear systems, intermittent and/or perennial streams. It is intended to provide a basic written framework, which will provide predictability and consistency of the development, review and approval of compensatory mitigation plans.

Correspondence concerning this Public Notice should refer to Public Notice Number SAM-2008-1372-MBM and should be directed to the District Engineer, U.S. Army Engineer District, Mobile, Post Office Box 2288, Mobile, Alabama 36628-0001, Attention: Regulatory Branch, in time to be received not later than **20 October 2008**. The comments received will be considered in development of the Final SOP. As of publication of the final SOP all previous versions of the SOP will become obsolete.

If you have any questions concerning this publication, please contact Mr. Michael Moxey, Project Manager, via e-mail at Michael.b.moxey@usace.army.mil or telephone number (251) 694-3771. Please refer to the above Public Notice number.

MOBILE DISTRICT
U.S. Army Corps of Engineers

Attachments

Department of the Army
Mobile District, Corps of Engineers
DRAFT
STANDARD OPERATION PROCEDURE (SOP), COMPENSATORY STREAM MITIGATION GUIDELINES

COMPENSATORY STREAM MITIGATION GUIDELINES

1. GENERAL INFORMATION:

1.1 Mobile District Policy

Compensatory mitigation for impacts to intermittent and perennial streams will require some form of stream restoration or enhancement action. Stream Mitigation means the manipulation of the physical, chemical, or biological characteristics of a stream with the goal of repairing natural or historic functions of degraded stream, resulting in a gain in stream functions. Activities that constitute stream restoration and enhancement actions include, but are not limited to: stream channel restoration; stream bank stabilization; dam and impoundment removal; livestock exclusion; road crossing improvements; and natural riparian buffer establishment. **Riparian buffer preservation may account for no more than 30% of credits generated by the mitigation plan. In addition, a minimum of 30% of needed credits must be generated by restoration or enhancement activities other than buffer enhancement.** For smaller projects, deviation from these percentages may be approved on a case-by-case basis by the Corps project manager in consultation with other resource and regulatory agencies. All of the restoration and enhancement measures should be designed with the goal of improving the entire stream system within a target reach using approved reference stream systems to properly determine appropriate stable stream pattern, profile, and dimension, stable stream bank design, and target species composition and diversity within the adjacent riparian buffer ecosystem. The level of detail required in a mitigation plan will be commensurate with the complexity of the mitigation project.

The Mobile District endorses the use of natural stream channel design for stream restoration projects. This approach incorporates the use of stable "reference reach" streams when designing appropriate pattern, profile, and dimension for stream restoration projects. It is also important to understand upstream land use changes, both at the local and watershed level. These changes are usually the cause of the disequilibrium regarding upstream delivery of water flow and sediment that influences the final stream restoration design necessary to achieve a stable stream restoration project. When initially presenting a stream mitigation project, applicants should be prepared to discuss the current stream condition/type using the Rosgen stream classification system (Attachment 1) as well as the current stage in the Simon Stream Channel Evolution Model (Attachment 2). To provide a consistent framework for organizing river information and communications, this discussion may include the current dimension (vertical stability) metrics including width/depth ratio, bank height ratio, and entrenchment ratio, as well as pattern and profile (lateral stability) metrics including slope, bed features, sinuosity, meander width ratio, and radius of curvature. All streams proposed as mitigation must be protected with riparian buffers. Riparian buffer restoration and enhancement actions must achieve target ecological success criteria, which for wetlands, should be based upon those developed by the Mobile District. For uplands, success criteria should be based upon metrics derived from high quality reference upland riparian buffer systems in the same watershed.

1.2. Regulatory Authorities & Guidelines

Section 10 of the River and Harbor Act of 1899: In accordance with Section 10 of the River and Harbor Act, the Corps of Engineers is responsible for regulating all work in navigable waters of the United States.

Section 404 of the Clean Water Act: In accordance with Section 404 of the Clean Water Act as amended in 1977, the Corps of Engineers is responsible for regulating the discharge of dredged or fill material in waters of the United States, including wetlands. The purpose of the Clean Water Act is to restore and maintain the physical, chemical, and biological integrity of the nation's waters. **Section 230.10 (d) of the Section 404 (b)(1) Guidelines** states that"... no discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem." The Section 404 (b)(1) Guidelines requires application of a sequence of mitigation -- avoidance, minimization and compensation. In other words, mitigation consists of the set of modifications necessary to avoid adverse impacts altogether, minimize the adverse impacts that are unavoidable and compensate for the unavoidable adverse impacts. Compensatory mitigation is required for unavoidable adverse impacts, which remain after all appropriate and practicable avoidance and minimization has been achieved. The Guidelines identify a number of "Special Aquatic Sites," including riffle pool complexes, which require a higher level of regulatory review and protection. This stream guidance document addresses only compensatory mitigation and should only be used after adequate avoidance and minimization of impacts associated with the proposed project has occurred.

2008 Mitigation Rule, 33 C.F.R. 332 - Compensatory Mitigation for Impacts to Aquatic Resources. This regulation addresses the requirements for compensatory mitigation provided to replace aquatic resource functions unavoidably lost or adversely affected by authorized activities. The Mitigation Rule addresses compensatory mitigation requirements including requiring the use of functional assessment tools, ecological performance standards, and monitoring requirements with the purpose of improving the success of compensatory mitigation projects.

2. ADVERSE IMPACT FACTORS:

Streams are complex ecosystems with morphological characteristics that are dependent on appropriate geomorphic dimension, pattern, and profile as well as biological and chemical integrity. They are not simply stormwater conveyances. The following factors will determine the amount of mitigation credits required:

2.1. Stream Types: Perennial Streams flow water most of the time during typical years and the water table is located above the streambed for most of the year. Perrenaial streams also have a defined stream channel (bed and bank). Groundwater is the primary source of water for stream flow. **Intermittent Streams** flow water part of the time in most years, when groundwater provides water for stream flow. Intermittent streams have a defined stream channel. **Ephemeral Streams** flow water in response to heavy rainfall events and do not have a defined bed and bank and typically resemble vegetated swales. **(Projects should utilize EPA guidance for determining characteristics of a perennial stream if there is not consensus on this determination).**

2.2. Priority Area: Priority area is a factor used to determine the importance of the water body proposed to be impacted or used for mitigation. Priority areas are influenced by the quality of the aquatic habitat potentially subject to be impacted or used for mitigation. The priority area factor will influence the amount of stream credits generated. The priority areas are divided in to three categories:

Primary: These areas provide important contributions to biodiversity on an ecosystem scale or high levels of function contributing to landscape or human values. Impacts to these areas should be rigorously avoided or minimized. Compensation for impacts in these areas should emphasize replacement nearby and in the same immediate 8-digit watershed. Designated primary priority areas include:

Waters with Federal or State listed species,
National Estuarine Research Reserves,
River sections in approved greenway corridors,
Wild and Scenic Rivers,
Outstanding National Resource Waters,
Outstanding State Waters,
Essential Fish Habitat

Secondary: Secondary priority areas include:

Waters with Federal Species of Management Concern or State listed rare or uncommon species,
Secondary trout streams (Put and Take Fishery),
Waters adjacent to Federal or State protected areas or Corps' approved mitigation banks,
Waters on the 303(d) list,
State Heritage Trust Preserves,
Anadromous fish spawning habitat,
Designated shellfish grounds,
Stream and river reaches within 0.5 mile upstream or downstream of primary priority reaches,
Stream or river reaches within high growth areas that aren't ranked as primary priority systems,
Stream or river reaches within 0.5 miles of a drinking water withdrawal site

(For the purposes of this stream SOP, a stream reach is the length of a stream section containing a complete riffle and pool complex. If none noted, a suitable length is usually no less than 300 feet long)

Tertiary: These areas include all other freshwater or tidally influenced lotic systems not ranked as primary or secondary priority.

2.3. Existing Condition: The state of the physical, chemical and biological health of a stream at the time of an assessment, as compared to the least disturbed condition of similar streams in the watershed. This is a measure of the stability and functional state of a stream and the stability of the riparian buffer before project impacts. Supporting data and documentation is required to support existing stream condition determinations.

Fully functional stream means that the physical geomorphology of the reach is stable and is representative of an appropriate stream hydrograph for the topographical setting. The biological community is diverse and unimpaired by excessive anthropogenic inputs; streams with listed species, primary trout streams, and streams identified as highly diverse are considered fully functional. For purposes of these guidelines, a fully functional stream is one that has not been channelized; has no culverts, pipes, impoundments, or other in-stream manmade structures on site; has no more than one stream reach within 0.5 miles upstream that has been culverted, piped, or otherwise modified by manmade structures (less than 30' of impacted section); has an appropriate entrenchment ratio and width/depth ratio at bankfull discharge relative to unimpaired stream condition; shows little evidence of human-induced sedimentation; and has at least a minimum width riparian buffer (Section 3.2.1) of deep-rooted vegetation on both sides of the stream.

Somewhat Impaired stream means that stability and resilience of the stream or river reach has been compromised, to a limited degree, through partial loss of one or more of the integrity functions (chemical, physical, biological). System recovery has a moderate probability of occurring naturally. For purposes of these guidelines, a stream segment is considered somewhat impaired if the entrenchment ratio and/or width/depth ratio at bankfull discharge is inappropriate relative to unimpaired stream conditions; human-induced sedimentation is moderate; a moderate riparian buffer of deep-rooted vegetation is present (minimum of at least 10 feet on both sides of the stream); and/or no more than 3 stream reaches within 0.5 mile upstream of the evaluated stream segment have been culverted, piped, or otherwise modified by manmade structures (with less than 100' of impacts).

Impaired stream means that there is a very high loss of system stability and resilience characterized by loss of one or more integrity functions. Recovery is unlikely to occur naturally, with further damage is likely, unless restoration is undertaken. For purposes of these guidelines, a stream is considered impaired if the reach has been channelized or if the entrenchment ratio and/or width/depth ratio at bankfull discharge is inappropriate relative to unimpaired stream condition; has extensive human-induced sedimentation; has little or no riparian buffer with deep-rooted vegetation on one or both sides of the stream; has banks that are extensively eroded or unstable; and/or ≥5 stream reaches within 0.5 miles upstream have been culverted, piped, channelized, impounded, or otherwise modified by manmade structures.

2.4. <u>Duration</u>: Duration is the amount of time adverse impacts are expected to last.

Temporary means impacts will occur within a period of less than 6 months and recovery of system integrity will follow cessation of the permitted activity.

Recurrent means repeated impacts of short duration (such as with on-channel 24-hour stormwater detention).

Permanent means project impacts will be permanent or will occur during spawning or growth periods for Federal and State protected species.

2.5. <u>Dominant Impact</u>:

Armor means to riprap, bulkhead, or use other rigid methods to contain stream channels.

Below Grade (embedded) Culvert means to route a stream through pipes, box culverts, or other enclosed structures (<= 100 LF of stream to be impacted per crossing). The below grade culverts should be designed to pass bankfull flow, and greater than bankfull flow to be passed through other culverts within the floodplain. The culvert bottom including head-walls and toe-walls would be designed to be embedded to a depth of no less than 12 inches below ground line. If rock runs throughout the culvert area, a bottomless culvert should be used. Improperly designed culverts will be evaluated under Dominant Impact Factor for piping. Culverts should be designed to allow fish passage and allow other natural stream processes to occur unimpeded.

Clearing means clearing of streambank vegetation or other activities that reduce or eliminate the quality and functions of vegetation within riparian habitat without disturbing the existing topography or soil. Although these impacts may not be directly regulated, mitigation for these impacts may be required if the impact occurs as a result of; or in association with, an activity requiring a permit.

Detention means to temporarily slow flows in a channel when bankfull is reached. Areas that are temporarily flooded due to detention structures must be designed to pass flows below bankfull stage.

Fill means permanent fill of a stream channel due to construction of dams or weirs, relocation of a stream channel (even if a new stream channel is constructed), or other fill activities.

Impound means to convert a stream to a lentic state with a dam or other detention/control structure that is not designed to pass normal flows below bankfull stage. Impacts to the stream channel where the structure is located is considered fill, as defined above.

Morphologic change means to channelize, dredge, or otherwise alter the established or natural dimensions, depths, or limits of a stream corridor.

Pipe means to route a stream for more than 100' through pipes, box culverts, or other enclosed structures.

Utility crossings mean pipeline/utility line installation methods that require disturbance of the streambed.

2.6. Cumulative Impact Factor : Cumulative impact factor means the length of stream, in feet, that will be impacted by a project, as authorized under Section 404 of the Clean Water Act, and for which mitigation will be required.

3. MITIGATION CREDITS:

3.1. In-Stream Activity

3.1.1. Net Benefit: Net benefit is an evaluation of the proposed mitigation action relative to the restoration, enhancement, and maintenance of the chemical, biological, and physical integrity of the Nation's waters. Four stream restoration methods are covered under these guidelines - stream channel restoration/streambank stabilization, stream relocation, riparian restoration, and riparian preservation. ***The Corps will determine, on a case-by-case basis***, the net benefit of mitigation actions that do not involve direct manipulation of a length of stream and/or its riparian buffers. Stream mitigation within 300 feet of a culvert, dam, or other man-made impact to waters of the United States generally will generate only minimal restoration or preservation credit due to impacts associated with these structures.

3.1.1.a. **Stream Channel Restoration /Streambank Stabilization:** All restored channels and stabilized stream banks must be protected by at least a minimum width buffer of native vegetation, preferably on both sides of the stream. In addition, all stabilized stream banks must be protected by at least a minimum width buffer. This buffer will also generate riparian preservation or restoration mitigation credit. Credit for installation of structures described below under the Good and Moderate restoration actions will be based on 3X the length of the appropriate size structure (e.g., 600' for a 200' tree revetment). Credit for removal of structures described below under the **Excellent** and **Good** restoration actions will be based on the documented length of reach that the structure impacts under current flow conditions. All proposed stream channel restoration/streambank stabilization actions should include design criteria and explain why/how the project will benefit water quality and/or habitat.

- **Excellent stream channel restoration actions include:**

  Priority 1 Restoration - Creating floodplains of appropriate dimensions adjacent to streams with inappropriately low width/depth ratios at bankfull discharge.

  Priority 2 Restoration - Restoring appropriate bankfull discharge width, stream sinuosity, entrenchment ratio, and width/depth ratio in degraded streams to referenced morphologic patterns

  Removing large structures such as dams and large weirs, pipes, culverts and other manmade in-stream structures with > 50 linear feet of direct fill/impact, then restoring the stream channel to referenced, stable morphologic patterns

The excellent mitigation credits can not be used for stream channel or stream bank restoration if the mitigation segment is within 300 feet upstream of a dam or if a channelized/piped section, that is >100 feet long, is within the 300 feet section.

- **Good stream channel restoration/streambank stabilization actions include**

  Priority 3 Restoration – Converting stream type by shaping upper slopes and stabilizing both bed and banks.

  Restoring streambank stability by using non-rigid methods in highly eroded areas.

  Restoring in-stream channel features (i.e., riffle/run/pool/glide habitat) using methodology appropriate to stream type

  Culverting floodplains at existing road crossings and replacing inappropriately sized/designed culverts to allow more natural flood flows.

  Removing weirs, pipes, culverts and other manmade in-stream structures with < 50 linear feet of direct fill/impact.

- **Moderate stream channel restoration/streambank stabilization actions include:**

  Priority 4 Restoration – Stabilize stream channel in place

  Restoring streambank stability using non-rigid methods in moderately eroded areas

  Constructing fish ladders

3.1.1.b. **Priority System Restoration:** Are used when restoring or improving a river that take into account a range of options based on numerous factors. Unfortunately, the most common approach in incised channel stabilization is Priority 4, often the most costly, highest risk and least desirable form of biological and aesthetic viewpoint. In many instances, however, especially in urban settings, Priorities 1 and 2 are not feasible since the floodplain has been occupied. (Stream classifications are noted in the 1996. Applied River Morphology by Rosgen, D.L. and H.L. Silvey.)

Priority 1 Restoration: Re-establish channel on previous floodplain using relic channel or construction of new morphologically stable channel at a higher elevation connected to the original floodplain. The new channel will have the dimension, pattern and profile characteristic of a stable form. Fill in existing incised channel or create discontinuous oxbow lakes that are level with new floodplain elevation.

Priority 2 Restoration: Re-establishing floodplain. Where relocation of an incised stream is impracticable, modifying the existing channel and re-establishing floodplain at their current elevation or higher to create a stable stream. If the existing meander pattern fits the proposed stable stream type, raising the channel back on each riffle reach with grade control to re-connect the floodplain is appropriate. This concept is similar to priority 1 restoration without the need to abandon the incised stream and construct a new channel.

Priority 3 Restoration: Convert the existing unstable stream to a more stable stream at the existing elevation of the channel but without an active floodplain. This Involves establishing proper dimension, pattern and profile by excavating the existing channel to change stream classification (convert streams classified as F and /or G to C or E classification). This restoration concept is implemented where streams are confined (laterally contained) and physical constraints limit the use of priorities 1 and 2 restoration.

Priority 4 Restoration: Stabilize channel in place by the use of stabilization materials and methods that have been used to decrease streambed and streambank erosion including boulders, gabions and bio-engineering methods. This is a high-risk method due to excessive shear stress and velocity. Also, it limits the aquatic habitat. This is the least desirable from a biological and aesthetic standpoint. Some activities undertaken under Priority 4 Restoration may be considered adverse impacts and require compensatory mitigation.

Final stream restoration plans will be completed and presented to the Corps for review. The final plans will incorporate appropriate stream restoration techniques based on a reference stream and will be designed as required by the natural channel design methods for stream restoration and bank stabilization. These design methods will incorporate Rosgen type techniques, as well as any other non-rigid techniques. Deviation from this non-rigid methodology will have to be approved by the Corps.

3.1.1.c. <u>Definitions of Categories of Stream Mitigation Activities</u>:

Stream Re-establishment – is the manipulation of the physical, chemical, or biological characteristics of a stream with the goal of creating natural/historic functions to former stream. Re-establishment results in rebuilding a former stream.

Stream Restoration or Rehabilitation - is the manipulation of the physical, chemical, or biological characteristics of a stream with the goal of restoring natural/historic functions of degraded streams. Rehabilitation results in a gain in stream functions. This can be accomplished by converting an unstable, altered, or degraded stream channel / stream corridor, including adjacent riparian zone and flood-prone areas to its natural or referenced, stable conditions considering recent and future watershed conditions. **Stream channel restoration** methods should be based on measurements taken in a reference reach and may include restoration of the stream's geomorphic dimension, pattern and profile and/or biological and chemical integrity, including transport of water and sediment produced by the streams' watershed to achieve dynamic equilibrium. (Dimension includes a stream's width, mean depth, width/depth ratio, maximum depth, flood prone area width, and entrenchment ratio. Pattern refers to a stream's sinuosity, meander wavelength, belt width, meander width ratio, and radius of curvature. Profile includes the mean water surface slope, pool/pool spacing, pool slope, & riffle slope.)

Stream Stabilization - is the manipulation of the physical characteristics of stream by the stabilization of a severely eroding streambank and stream bed without consideration of reference conditions. Stabilization techniques which include "soft" methods or natural materials (such as tree revetments, root wads, log crib structures, rock vanes, vegetated crib walls and sloping of streambanks) may be considered part of a restoration design. However, stream stabilization techniques that consist primarily of "hard" engineering, such as concrete lined channels, rip rap, or gabions, while providing bank stabilization, will usually not be considered restoration or enhancement in most cases.

Stream Enhancement – is the manipulation of the physical, chemical, or biological characteristics of a (undisturbed but degraded) stream or stream buffer to heighten, intensify, or improve specific function(s) or to change the growth stage or composition of the vegetation present. Enhancement is undertaken for a purpose such as water quality improvement and/or ecological functions (flood water retention or wildlife habitat). This can be accomplished by implementing certain stream rehabilitation practices. These practices are typically conducted on the stream bank or in the flood prone area but may also include the placement of in-stream habitat structures; however, they should only be attempted on a stream reach that is not experiencing severe aggradation or degradation. Care must be taken to ensure that the placement of in-stream structures will not affect the overall dimension, pattern, or profile of a stable stream.

3.1.2. Stream Relocation: Is moving a stream to a new location to allow a project, authorized under Section 404 of the Clean Water Act, to be constructed on the stream's former location. (Note: relocation of a stream is considered fill under these guidelines when the relocation is conducted to allow development of the area where the stream previously was located; impacts associated with stream relocation in these situations must be fully mitigated). Relocated streams should reflect the dimension, pattern and profile of natural, referenced stable conditions; maintain the capacity to transport bedload sediment; and have at least a minimum width buffer of natural vegetation on both sides of the stream to receive mitigation credit; this buffer also will generate riparian preservation or restoration mitigation credit.

3.2. Riparian Buffer Restoration and Preservation:

3.2.1. Net Benefit:

Riparian Buffer Restoration means implementing rehabilitation practices within a stream riparian buffer zone to improve ecological function and water quality. Buffer restoration requires the restoration of both vegetation and hydrology to that of a native reference quality upland and/or wetlands system within the watershed. Restoration programs should strive to mimic the hydrology, and tree and vegetation composition, density and structure of a reference reach habitat.

Riparian Buffer Enhancement means implementing rehabilitation practices within a stream riparian buffer zone to improve water quality and/or ecological function. Buffer enhancement requires the increase or improving the existing upland and/or wetlands habitat either by improving the hydrology or vegetation to that of a reference system within the watershed. Enhancement programs should strive to mimic the tree and vegetation composition, density and structure of a reference reach habitat.

Riparian Buffer Preservation means the conservation, in its naturally occurring or present condition, of a high quality riparian buffer to prevent its destruction, degradation, or alteration in any manner not authorized by the governing authority. For the purposes of these guidelines, an area will be considered as riparian buffer preservation if less than 10% of the area would require planting of deep-rooted vegetation to restore stream bank stability and improve wildlife habitat. **Riparian buffer preservation may account for no more than 30% of credits generated by the mitigation plan.**

Riparian Buffer Restoration and Fencing in Actively-Grazed Pastures: Means restoring vegetation and fencing livestock from pastures, where livestock grazing activities are impacting water quality and/or stream ecological function, thereby minimizing or avoiding streambank degradation, sedimentation, and water quality problems. Livestock exclusion is normally accomplished by fencing stream corridors and can include the construction of stream crossings with controlled access and with stable and protected stream banks. No more than one livestock crossing is allowed per 1,000 linear feet of stream mitigation. The width of the livestock crossing will be deducted from the total length of the stream mitigation segment. Impacted riparian buffers will have to be restored or enhanced and may not be used for preservation purposes only, after cattle have been removed.

Minimum Buffer Width: The minimum buffer width (MBW) for which mitigation credit will be earned is 50 feet on one side of the stream, measured from the top of the stream bank, perpendicular to the channel. Smaller buffers width may be allowed on a case-by-case basis for small urban streams. Intermittent streams may only claim credit for a maximum of a 100-foot riparian buffer. If topography within a proposed stream buffer has more than a 2% slope, 2 additional feet of buffer are required for every additional percent of slope (e.g., minimum buffer width with a +10% slope is 70'). Buffer slope will be determined in 50'-increments beginning at the stream bank. No additional buffer width will be required for negative slopes. For the reach being buffered, degree of slope will be determined at 100' intervals and averaged to obtain a mean degree of slope for calculating minimum buffer width. This mean degree of slope will be used to calculate the minimum buffer width for the entire segment of stream being buffered.

Table 1 below provides appropriate Net Benefit values for the riparian restoration, enhancement and preservation mitigation worksheet. Note that on this worksheet, buffers on each bank of a given reach, generates mitigation credit separately (Stream Side A and Stream Side B).

Table 1. Riparian Buffer Restoration, Enhancement and Preservation

	% Buffer that Needs Vegetation Planted	Buffer Restoration	Buffer Enhancement	** Buffer Preservation
* Buffer Width (on one side of the stream)	4X min. width	1.6	0.8	0.4
	3X min. width	1.2	0.6	0.3
	*** 2X min. width	0.8	0.4	0.2
	**** Minimum width (50 ft)	0.4	0.2	0.1

* No mitigation credit will be given for riparian buffers on impacted streams where no in-stream work is proposed.

** No mitigation credit will be given for preserving impacted stream buffer.

*** Intermittent streams are limited to a maximum 2X buffer width.

**** Smaller buffers width may be allowed on a case-by-case basis for small urban streams.

3.2.2. System Protection Credit: Bonus mitigation credit may be generated if proposed riparian mitigation activities include minimum width buffers on both sides of a stream reach and legal protection of a fully buffered stream channel. (**Condition:** Mitigation plan provides for restoration or preservation of minimum width buffers, as defined in these guidelines, on both streambank of the reach).

3.3. Monitoring and Contingencies:

Monitoring should be in compliance with 33 CFR 332.6 and Regulatory Guidance Letter 05-02, Mitigation Monitoring Requirements. Monitoring and contingency plans are required actions that do not receive mitigation credit and will be undertaken during the mitigation project to measure the level of success of the mitigation work and to correct problems or failures. All projects should include contingency actions that will achieve specified success criteria if deficiencies or failures are found during the monitoring period. Monitoring is a required component of all mitigation plans and should at a minimum, address all success criteria paragraphs. The following monitoring requirements are to be applied to all stream mitigation sites as well as all reference sites.

- **Monitoring (Physical Monitoring):**

  -- **Riparian buffer preservation:** After initial collection of baseline information on vegetation, document any changes in the preserved buffer annually for at least 5 years or the life of the mitigation project. Minimal baseline information to be collected should include vegetation present, species composition, density, and structure including average species height and average species diameter at breast height (dbh). The site should be continually monitored for the presence of exotic species and appropriate actions taken when necessary.

  -- **Riparian buffer restoration and enhancement:** Collection of baseline information on vegetation in the buffer before mitigation is implemented and annually for atleast 5 years or the life of the mitigation project. Minimal information to be collected annually should include vegetation present, species composition, density, and structure including average species height and diameter (dbh). In addition, similar data for planted and naturally recruiting trees and vegetation should be monitored annually, at least for 5 years or the life of the mitigation project, until target success criteria are achieved.

  -- **Stream channel restoration/stream bank stabilization and stream relocation:** Initial baseline data on physical parameters in streams before mitigation is implemented and monitoring of these physical parameters annually, for at least 5 years or the life of the mitigation project, and after mitigation is completed. Physical parameters to be measured include stream pattern, profile, and dimension metrics at sites above, within, and below the restored reach., water temperature, DO, turbidity, pH, stream substrate characteristics, erosion patterns, and biological parameters that may include density and diversity of reptiles, amphibians, fish, freshwater mussels, or other macroinvertebrates and other fauna at sites within the stream.

Monitoring will include items 1, 2 and 3 and may include item 4 listed in Table 2, based on the project review. In the event that the monitoring report for the project review area reveals that success criteria (anticipated Stream SOP scores) are not met during the initial five-year monitoring period as determined by the Corps, corrective action or alternative mitigation shall be required. Adaptive remedial measures may include modification of site hydrology, planting of different species of trees, additional hand clearing, etc.

- **Contingency Plans/Remedial Actions:** In the event the mitigation fails to achieve success criteria as specified in the mitigation plan, sponsor shall develop necessary contingency plans and implement appropriate remedial actions for that phase. In the event the sponsor fails to implement necessary remedial actions within one growing season after notification by the Corps of necessary remedial action to address any failure in meeting the success criteria, the Corps will notify sponsor and the appropriate authorizing agencies and recommend appropriate remedial actions.

Table 2. General criteria used to evaluate the success or failure of activities at mitigation sites and required remedial actions to be implemented should monitoring indicate failure of component.

Mitigation Component (Item)	**Success (Required on action)**	**Failure**	**Action**
1. Photo Reference /Sample Site Longitudinal photos Lateral photos	No substantial instream aggradation, degradation or bank erosion.	Substantial instream aggradation, degradation or bank erosion.	When substantial aggradation, degradation or bank erosion occurs, adaptive management actions will be planned, approved, and implemented.
2. Plant Survival Survival plots Stake counts Tree counts	Within the riparian buffer, achievement of target tree and plant species diversity, composition, and structure as required by Mobile District wetland habitat success criteria or should mimic approved reference reach target habitats in species composition, density and structure. .	Failure to achieve target tree and plant species diversity, composition, and structure as required by Mobile District wetland habitat success criteria or approved reference site	Target species will be re-seeded and or fertilized; live stakes and bare rooted trees will be planted to achieve desired densities. Adaptive management actions will be planned, approved, and implemented.
3. Channel Stability Pattern, Profile, and Dimension, Pebble count	Stable stream with pattern, profile and dimension of similar reference reach type. No evidence of instability (down-cutting, deposition, bank erosion, increase in sands or finer substrate material).	Substantial evidence of instability, not achieving target stream design goals.	When Substantial evidence of instability occurs, remedial actions will be planned, approved, and implemented.
4. Biological Indicators Invertebrate populations Fish populations	Population measurements remain the same or improve, and target species composition indicates a positive trend.	Population measurements and target species composition indicate a negative trend.	Reasons for failure will be evaluated and remedial action plans developed, approved, and implemented.

Substantial or subjective determinations of success will be made by the mitigation sponsor and confirmed by COE and review agencies.

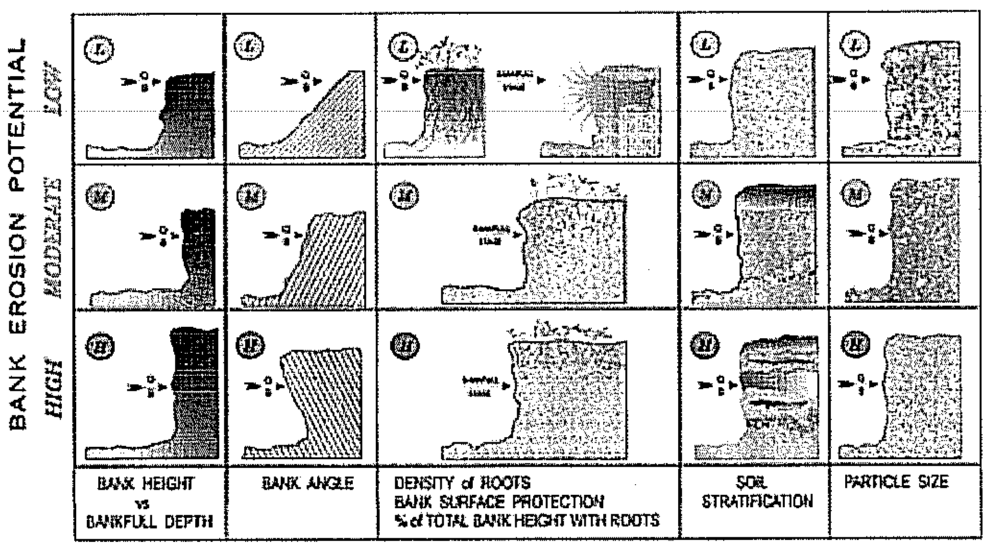
3.4. Control: All compensatory mitigation sites must be deed protected using either a conservation easement of restrictive covenant. A **Conservation easement** is an interest in real property imposing perpetual limitations or affirmative obligations, the purposes of which include protecting, preserving, maintaining and managing waters of the US, riparian buffers, and uplands for their natural and environmental resources, functions, and values. The owner/permittee/bank sponsor must grant the conservation easement to a qualified third party entity. A **Restrictive covenant** is a legal document whereby an owner of real property imposes perpetual limitations or affirmative obligations on the real property.

The conservation easement or restrictive covenant must be approved by the Corps prior to being properly recorded with the appropriate local entity and be in compliance with Mobile District's requirements. They should be conforming to the most recent sample edition located on the Mobile District web page *(http://www.sam.usace.army.mil/op/reg/permmob2.htm).* The sample is subject to change without notice.

3.5 Streambank Stability: This component addresses the existence of the potential for soil detachment from the upper and lower stream banks and its movement into the streams. Some bank erosion is normal in a healthy stream. Excessive bank erosion occurs where riparian zones are degraded; the stream is unstable due to changes in hydrology, sediment load, or loss of access to the floodplain, and when the stream banks are high and steep.

Stable Banks: where the banks are low and at the appropriate elevation to allow the stream appropriate access to the floodplain, and the banks are protected by roots and vegetation that extend to the base-flow elevation. Greater than 33 percent of the surface areas of outside stream bends are protected by roots and/or vegetation.

Moderately Stable Streams: where the banks are low and at the appropriate elevation to allow the stream appropriate access to the floodplain, and the banks are protected by roots and vegetation that extend to the base-flow elevation. Less than 33 percent of the surface areas of outside stream bends are protected by roots and/or vegetation.



Illustrated examples of the five Bank Erosion Hazard Index (BEHI) criteria

3.6 Instream Habitat: This parameter measures the availability of physical habitat diversity within a stream. Each cover type must be present in appreciable amounts and with high likelihood of having a long-term presence to score. This should be assessed within a representative subsection of the stream reach that is equivalent to 5 times the active channel width.

Logs/large woody debris: Fallen trees or parts of trees that provide structure and attachment for aquatic macroinvertebrates and hiding places for fish.

Deep Pools: Areas characterized by a smooth undisturbed surface, generally slow current, and deep enough to provide protective cover for fish (75-100 percent deeper than prevailing stream depth).

Overhanging vegetation: Trees, shrubs, vines, or perennial herbaceous vegetation that hangs immediately over the stream surface, providing shade and cover.

Boulders: Boulders more than 10 inches in diameter or large slabs more than 10 inches in length.

Undercut banks: Eroded areas extending horizontally beneath the surface of the bank forming underwater pockets used by fish for hiding and protection.

Thick root mats: Dense mats of roots (generally from trees) at or beneath the water surface forming structure for invertebrate attachment and fish cover.

Dense macrophyte beds: Beds of emergent or submerged aquatic vegetation thick enough to provide invertebrate attachment and fish cover.

Riffles: Area characterized by broken water surface, rocky or firm substrate, moderately swift current, and relatively shallow depth (usually less than 18 inches).

3.7. Timing of Mitigation: Mitigation should be initiated prior to or concurrent with the start of the authorized project impacts to waters of the U.S.. Any required riparian buffer tree planting must occur within the first growing season of the project. No credits are generated for this factor if the mitigation action in a reach is primarily riparian buffer preservation.

Non-Banks:

Before:	All mitigation is completed before the impacts occur.
During:	A majority of the mitigation is completed concurrent with the impacts
After:	A majority of the mitigation will be completed after the impacts occur.

Banks: Release of credits will be determined by the MBRT on a case-by-case basis.

3.8. Mitigation Factor: It is recommended that stream mitigation be conducted on free flowing streams. However, if a stream segment to be used for mitigation is located within 1 mile of the upstream end of an existing or proposed man made lake and feeds into it, then mitigation credits for this segment of stream will be reduced by 50%. **Use mitigation factor of 0.5 for the above mitigation sites. Use mitigation factor of 1.0 for all other mitigation.**

4. GEOMORPHIC DEFINITIONS:

- **Bankfull Discharge** is the most important stream process in defining channel form and is the flow that is most effective at moving sediment, forming or removing bars, forming or changing bends and meanders, and doing work that results in the average morphologic characteristics of channels (Dunne and Leopold 1978). The bankfull discharge stage is the incipient point at which water begins to overflow the bed and bank channel and onto a floodplain. Bankfull may not be at the top of the stream bank in incised or entrenched streams. On average, bankfull discharge occurs approximately every 1.5 years.

- **Bankfull width** is the width of the stream channel at bankfull discharge, as measured in a riffle section.

- **Bank Height Ratio** is the maximum depth of the stream from top of the lowest bank to the thalweg divided by the maximum depth from bankfull to thalweg. It along with entrenchment ratio is a means to measure vertical stability of a stream.

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

- **Channel Features:** Natural streams have sequences of riffles and pools or steps and pools that maintain channel slope and stability and provide diverse aquatic habitat. A **riffle** is a bed feature where the water depth is relatively shallow and the slope is steeper than the average slope of the channel. At low flows, water moves faster over riffles, which provides oxygen to the stream. Riffles are found entering and exiting meanders and control the streambed elevation. **Pools** are located on the outside bends of meanders between riffles. The pool has a flat slope and is much deeper than the average channel depth. Step/pool sequences are found in high gradient streams. **Steps** are vertical drops often formed by large boulders or downed trees. Deep pools are found at the bottom of each step.

- **Channel Pattern** refers to the plan view of the channel as seen from above. Streams are rarely straight; they tend to follow a sinuous path across a floodplain. Sinuosity of a stream is defined as the ratio of channel length/valley length. In addition to slope, the degree of sinuosity is related to channel dimensions, sediment load, stream flow, and the bed and bank materials. In general, sinuosity increases as valley gradient increases. Stream pattern is defined by measuring meander wavelength, radius of curvature, amplitude, and belt width.

- **Channel Profile** of a stream refers to its longitudinal slope which typically decreases downstream and is inversely related to slope. It is a reflection of irregular profile based upon bed material, riffle/pool spacing, and other variables. At the watershed scale, channel slope generally decreases in the downstream direction with commensurate increases in stream flow and decreases in sediment size. Channel slope is inversely related to sinuosity, so steep streams have low sinuosity and flat streams have high sinuosity.

- **Entrenchment Ratio** is an index value that describes the degree of vertical containment of a river channel. It is calculated as the width of the flood-prone area (elevation at twice bankfull max depth above thalweg) divided by width of bankfull channel..

- **Flood-prone Area** The width of the flood prone area is measured in the field at an elevation twice-maximum depth at bankfull, measured in the thalweg. Maximum depth is the difference between the bankfull stage and thalweg elevations in a riffle section.

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

- **Meander Width Ratio** is defined as the meander belt width divided by bankfull width.

- **Natural Stream Channel Design** is the concept of for determining appropriate stream channel design utilizing stable reference stream reaches that represent the best conditions attainable within a particular stream class within a watershed.

- **Reference Reach/Condition** - A stable stream reach generally located in the same physiographic ecoregion and valley type as the stream restoration project. A reference reach stream is in dynamic equilibrium and is maintaining the fluvial processes and functions of its watershed over time and within the range of natural variability. These streams provide high quality aquatic and riparian habitat with persistent bed features and channel forms (dimension, pattern, and profile) even after periodic disturbances such as flooding events.

- **Slope:** Slope of water surface averaged for 20-30 channel widths.

- **Stable Stream:** A naturally stable stream channel is one that maintains its dimension, pattern, and profile over time such that the stream does not cumulatively aggrade or degrade. Naturally stable streams must be able to transport the water, organic matter, and sediment load supplied by the watershed. Stable streams are not fixed and migrate across the landscape slowly over geologic time while maintaining their form and function. In general, stream stability can be assumed if the stream maintains a stable pattern, profile, and dimension after two bankfull events which typically occur at a 1.5 year interval.

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

Other Enhancement: The Corps, in consultation with the MBRT and other resource and regulatory agencies, will determine, on a case-by-case basis, the net benefit of mitigation actions that do not involve direct manipulation of a length of stream and/or its riparian buffers.

ADVERSE IMPACT
FACTORS FOR RIVERINE SYSTEMS WORKSHEET

Stream Type Impacted	Intermittent 0.1			1st or 2nd Order Perennial Stream 0.8			>2nd Order Perennial Stream 0.4		
Priority Area	Tertiary 0.1			Secondary 0.4			Primary 0.8		
Existing Condition	Impaired 0.1			Somewhat Impaired 0.8			Fully Functional 1.6		
Duration	Temporary 0.05			Recurrent 0.1			Permanent 0.3		
Dominant Impact	Shade/ Clear 0.05	Utility Crossing 0.15	Below Grade Culvert 0.3	Armor 0.5	Detention /Weir 0.75	Morpho-logic Change 1.5	Impound-ment (dam) 2.0	Pipe >100' 2.2	Fill 2.5
Cumulative Impact Factor	<100' 0	100'-200' 0.05	201-500' 0.1	501-1000' 0.2	>1000 linear feet (LF) 0.1 reach 500 LF of impact (example: scaling factor for 5,280 LF of impacts = 1.1)				

Factor	Dominant Impact Type 1	Dominant Impact Type 2	Dominant Impact Type 3	Dominant Impact Type 4	Dominant Impact Type 5
Stream Type Impacted					
Priority Area					
Existing Condition					
Duration					
Dominant Impact					
Cumulative Impacts Factor					
Sum of Factors	M =				
Linear Feet of Stream Impacted in Reach	LF=				
M X LF					

Total Mitigation Credits Required = (M X LF) = ________________

IN-STREAM WORK
STREAM CHANNEL /STREAMBANK RESTORATION AND RELOCATION WORKSHEET

Stream Type	Intermittent 0.05	1^{st} or 2^{nd} Order Perennial Stream 0.4	$>2^{nd}$ order Perennial Stream (Bankfull width) <15' 0.4	15'-30' 0.6	31'-50' 0.8	>50' 1.0
Priority Area	Tertiary 0.05	Secondary 0.2	Primary 0.4			
Existing Condition	Impaired 0.4	Somewhat Impaired 0.05				
Net Benefit	Stream Relocation 0.1	Stream Channel Restoration/Stream Bank Stabilization Moderate 1.0	Good 2.0	Excellent 3.5		
Streambank Stability	Stable Banks 0.4	Moderately Stable Banks 0.2				
Instream Habitat	>5 cover types 0.35	5 cover types 0.25	4 cover types 0.15	3 Cover types 0.1		
Timing of Mitigation	Before 0.15	During 0.05	After 0			

Factors	Stream Segement 1	Stream Segment 2	Stream Segment 3	Stream Segment 4	Stream Segment 5	Stream Segment 6
Stream Type						
Priority Area						
Existing Condition						
Net Benefit						
Bank Stability						
Instream Habitat						
Timing of Mitigation						
Sum Factors (M)=						
Stream length in Reach (do not count each bank separately) (LF)=						
Credits (C) = M X LF						
Mitigation Factor Use (MF) = 0.5 or 1.0						
Total Credits Generated C X MF =						

Total Channel Restoration/Relocation Credits Generated = ____________

RIPARIAN BUFFER RESTORATION, ENHANCEMENT, AND PRESERVATION WORKSHEET

Stream Type	Intermittent 0.05	1st or 2nd Order Perennial Stream 0.4	> 2nd Order Perennial 0.2
Priority Area	Tertiary 0.05	Secondary 0.2	Primary 0.4
Net Benefit (for each side of stream	Riparian Restoration, Enhancement, and Preservation Factors (select values from Table 1) (MBW = Minimum Buffer Width = 50' + 2' / 1% slope)		
System Protection Credit	Condition : MBW restored or protected on both streambanks To calculate:(Net Benefit Stream Side A + Net Benefit Stream Side B) / 2		
Timing of Mitigation	Before 0.15	During 0.05	After 0

Factors		Stream Segment 1	Stream Segment 2	Stream Segment 3	Stream Segment 4	Stream Segment 5	Stream Segment 6
Stream Type							
Priority Area							
Net Benefit	Stream Side A						
	Stream Side B						
System Protection Credit Condition Met (Buffer on both sides)							
Timing of Mitigation (None for primarily riparian preservation)	Stream Side A						
	Stream Side B						
Sum Factors (M)=							
Linear Feet of Stream Buffer (LF)= (don't count each bank separately)							
Credits (C) =M X LF							
Mitigation Factor Use (MF) = 0.5 or 1.0							
Total Credits Generated C X MF =							

Total Riparian Restoration Credits Generated = ________________