Monitoring Requirements and Performance Standards for Compensatory Mitigation in North Carolina

North Carolina Interagency Review Team – February 8, 2013

I. Purpose

The U.S. Army Corps of Engineers (USACE), Wilmington District, has prepared this guidance document in coordination with the North Carolina Interagency Review Team (NCIRT) to provide updates to existing District monitoring and performance standards for compensatory mitigation. These standards are required for stream and wetland mitigation projects that are used to satisfy the requirements of Department of the Army (DA) permits issued in accordance with Section 404 of the Clean Water Act (CWA) and Sections 9 and 10 of the Rivers and Harbors Act of 1899. In particular, these updates are intended to bring District monitoring requirements up to the standards established in 33 CFR part 332 – Compensatory Mitigation for Losses of Aquatic Resources (Mitigation Rule), issued in April, 2008, and Regulatory Guidance Letter (RGL) 08-03, issued in October, 2008, which establishes minimum monitoring requirements for compensatory mitigation projects.

Mitigation is intended to replace lost functions to stream and wetland systems and return them to a stable condition, but fully replacing lost functions may take much more time, perhaps decades. Because of this, the intent of monitoring is to demonstrate that a site is trending towards success, and is on target to meet the goals and objectives stated in the Mitigation Plan. It is critical that all Mitigation Plans are developed with appropriate and attainable goals and objectives. The fundamental purpose of a monitoring program is to provide reliable data upon which valid conclusions can be reached regarding the success or failure of a mitigation site and to demonstrate whether the goals and objectives of the Mitigation Plan are being met. Success is documented through the use of performance standards, which are defined in the Mitigation Rule as "observable or measurable physical (including hydrological), chemical, and/or biological attributes that are used to determine if a compensatory mitigation project meets its objectives". Other aspects of monitoring that aren't captured in the performance standards, such as visual observations, can also help demonstrate that desired site conditions are being attained. Another goal of having consistent performance standards is the ability to compare data across the state and evaluate whether current practices are working or if changes are needed. The intent of monitoring is to demonstrate that a site is trending towards meeting the overall goals and objectives of the

Mitigation Plan. Failure to meet any particular performance standard will not necessarily result in a determination that the goals and objectives of the Mitigation Plan have not been met. The final decision regarding the success of specific performance standards, the suitability of a site to be used as compensatory mitigation for authorized impacts, or the amount of credit generated by a site shall be made by the District Engineer in consultation with the NCIRT.

II. Applicability

These guidelines are intended to provide a predictable and consistent approach to monitoring mitigation sites. They apply to all sources of stream and wetland mitigation, including permittee-responsible mitigation sites, mitigation banks (public, private, and single-client), and In-Lieu Fee (ILF) projects, which includes all projects implemented by the North Carolina Ecosystem Enhancement Program (NCEEP). The standards established within this document are the minimum acceptable monitoring requirements for compensatory mitigation sites. If deviations to the requirements of this document are proposed by the permittee or mitigation sponsor, the Mitigation Plan should explicitly identify those changes and provide a detailed explanation for the proposed changes. Exceptions to the requirements of this guidance shall be made on a case-by-case basis only by the USACE bank manager for mitigation banks, the NCIRT Chair for NCEEP projects in consultation with the NCIRT, and the USACE project manager for permittee-responsible mitigation sites.

This guidance is applicable to both stream and wetland mitigation. Individual sections within this document specifically identify what type of mitigation they apply to (i.e., Preservation, Restoration, Enhancement, and Creation) and whether they apply to stream sites and/or wetland sites. Some sections are also applicable to projects developed in accordance with the document entitled *Information Regarding Stream Restoration With Emphasis on the Coastal Plain, Version 2*, dated April 4, 2007, here after referred to as the Coastal Headwater Stream Guidance (available on the Wilmington District RIBITS website at http://geo.usace.army.mil/ribits/index.html). This guidance is not applicable to non-forested wetland (coastal or freshwater marsh) mitigation; however the credit release schedule for non-forested wetlands is included here for reference.

The requirements of this document do not apply to mitigation sites that were initiated prior to the date of this guidance, regardless of whether they are umbrella bank sites, ILF mitigation sites, or permittee-responsible mitigation sites. This document does apply to all modifications of existing bank and ILF instruments that are initiated after the date of this guidance where additional sites are added to the instrument as part of the modification. For the purposes of this document, the term "initiated" is defined as occurring on the date when the District is in receipt of a complete prospectus for new mitigation bank, a complete proposal to modify an existing mitigation bank, or a complete DA permit application that includes a proposal for permittee-responsible mitigation. For NCEEP, the term "initiated" is defined in the NCEEP Instrument, approved on July 28, 2010, and also includes any projects submitted for any Requests for Proposals advertised prior to the date of these guidelines.

Piedmont, Coastal Plain and Mountain Counties – For the purposes of this guidance document, any reference to mountain counties applies to the following twenty-five North Carolina counties: Alleghany, Ashe, Avery, Buncombe, Burke, Caldwell, Cherokee, Clay, Graham, Haywood, Henderson, Jackson, Macon, Madison, McDowell, Mitchell, Polk, Rutherford, Stokes, Surry, Swain, Transylvania, Watauga, Wilkes and Yancey. All other seventy-five North Carolina counties are considered either piedmont or coastal plain counties.

III. Relationship to Other District Guidance Documents

These guidelines have been prepared in accordance with the Mitigation Rule. The requirements provided in this guidance document are intended to replace the monitoring requirements found in existing District mitigation guidance, including Section 11 of the 2003 Stream Mitigation Guidelines (SMGs). Where conflicts exist between the requirements of this document and previous District guidance, the requirements of this document shall supersede those of other documents (not to include Federal regulations or RGLs).

IV. General Monitoring Requirements

This section deals with general monitoring requirements for all compensatory mitigation sites, with the exception of Preservation sites. As a rule, all monitoring of mitigation sites must adhere to the minimum standards provided in RGL 08-03 (attached).

A. Site monitoring for all stream and wetland compensatory mitigation projects shall occur for seven years post-construction, except in those circumstances provided for in this guidance where specific monitoring activities may be terminated as early as five years. If performance standards have not been met by year seven, or if remedial actions are required, additional monitoring may be required to ensure that a site is stable and that the target community is established on the site, otherwise the project may be deemed to have failed.

B. Unless otherwise specified in the Mitigation Plan or banking instrument, monitoring reports shall be completed for all seven years and provided to the Corps of Engineers for review no later than April 1 of the year following the monitoring. If the monitoring reports indicate that replanting or other remedial action are necessary, additional monitoring may be required if the activities cannot be accomplished during the planting season (see Section V(A)). Failure to provide monitoring reports by this deadline may result in additional monitoring, withholding the release of credits, and/or suspension of credit sales.

C. Monitoring reports shall be prepared in accordance with RGL 08-03, which identifies specific contents and formatting of the report. Monitoring reports shall include the data collected from all applicable sections of this guidance; however, not all monitoring reports will include the same information (e.g., monitoring reports submitted in years four and six will not typically include vegetation plot data). In general, it is preferable to provide monitoring reports as soon as possible. Performance standards, as provided in the Mitigation Plan or in the permit conditions, must be restated verbatim in the monitoring report. Additionally, each monitoring report shall include data from preceding monitoring years. Where graphs are provided, the graphs should be overlaid with as-built data and data from preceding monitoring years.

D. As-built surveys for mitigation projects shall be completed immediately following the completion of construction to document baseline conditions. As-built surveys shall include photo documentation at all cross-sections and structures, a plan view diagram, a longitudinal profile, and vegetation information (type, number and location of species

planted). As-built surveys shall also indicate the locations of all monitoring activities (permanent vegetation plots, groundwater and surface water gauges, crest gauges, cross-sections, bank pins, water quality and aquatic biota sampling points, etc.). As-built reports shall be submitted to the USACE within 60 days of project construction. As-built surveys are not required for Preservation-only stream or wetland projects.

V. Planted Vegetation Monitoring

The following requirements apply to all stream and wetland mitigation projects that include planting of woody vegetation.

A. Vegetation Planting and Monitoring Requirements

1. Vegetation plots shall be monitored for 7 years, with monitoring events occurring on years 1, 2, 3, 5, and 7. If the Sponsor/Permittee chooses to conduct supplemental monitoring, results may be considered toward meeting performance standards.

2. Vegetation planting/replanting shall be conducted between November 15 and March 15, unless otherwise noted in the approved Mitigation Plan or remedial action plan.

3. Vegetation monitoring shall be conducted between July 1st and leaf drop. (It is strongly recommended to monitor later in the growing season to capture any effects of climatic or other conditions that may adversely affect vegetation survival. Failure to identify these effects may result in additional years of monitoring. Further, for early season monitoring, it is recommended to start monitoring sites in the mountain region before those in the piedmont or coastal plain.)

4. Planted vegetation must be in the ground for at least 180 days prior to the initiation of the first year of monitoring (Year 1).

5. Permanent plots to sample vegetation shall be randomly located in each of the target communities. Plot sizes for the determination of stem density and vigor (height) shall be a minimum of 0.02 acre in size, and should typically be square or rectangular. For projects that include stream channels, plots should not overlap the stream (top-of-bank to top-of-bank).

6. Vegetation monitoring plots shall be located across the site to provide a random sampling of all the vegetation community types reestablished on the site. The monitoring plots shall make up a minimum of 2% of the planted portion of the site with a minimum of 4 plots. Exceptions to this requirement may be provided on a case-by-case basis for very small sites or for large, uniform sites. All exceptions to this requirement shall be specifically noted in the approved Mitigation Plan.

7. Upon initial establishment of vegetation plots (as-built baseline/year 0), the plot corners shall be identified in the field with markers, the plot shall be divided into a grid pattern and each planted stem shall be identified for future monitoring according to its grid location within the plot.

8. Within each plot, vegetation data collected shall include:
   - species, height, date of planting, and grid location of each planted stem
   - species, height and total number of volunteer woody stems in the plot

9. Individual plot data for planted species must be provided. Plot data shall not be averaged across plots over the entire site to obtain a single figure for stem density for the purposes of meeting performance standards. Averages may be considered by the USACE, in consultation with the NCIRT, on a case-by-case basis.

10. The density of planted species in each plot shall be reported as the number of living, planted stems per acre. "Stems" are defined as individual plants, where plants with multiple shoots are treated as a single stem.

11. Any planted stems that have been in the ground for less than two growing seasons shall not count toward meeting performance standards for years three, five and seven.

12. For projects that include stream channels, live stakes planted on the stream banks and brush mattresses shall not count toward meeting the stem density performance standards.

13. Volunteer plants growing within plots may be considered by the USACE on a case-by-case basis in determining whether a project has met the overall goal of reestablishing the target vegetation community; however, volunteer plant data shall be presented separately from planted vegetation in the monitoring reports.

14. Monitoring events should be used to evaluate the site for the presence of invasive species, which should be noted in the monitoring report. (Implementation of invasive species control measures should be conducted in accordance with the Adaptive Management Plan, and may be required on a case-by-case basis as determined by the USACE in consultation with the NCIRT.)

15. Planting in rows to facilitate mowing between planted species is acceptable. Mowing may be conducted once annually between monitoring years one and five to reduce the competition by volunteer species, but no mowing activities shall be conducted between March 1st and June 30th.

16. Application of fertilizers may be conducted once at the time of planting only, unless approved on a case-by-case basis as part of a remedial action plan. Herbicides may be used to control volunteer and invasive vegetation, but they must be applied in accordance with product labeling by a licensed applicator and any herbicides used near streams must be approved for aquatic use. Aerial application of herbicides shall not be conducted.

B. Planted Vegetation Performance Standards

1. Within planted portions of the site, a minimum of 320 three year old planted stems per acre must be present at year three; a minimum of 260 five year old planted stems per acre must be present at year five; and a minimum of 210 seven year old planted stems per acre must be present at year seven.

2. For projects located in the coastal plain and piedmont counties, planted vegetation in each plot must average 7 feet in height at year five and 10 feet in height at year seven. For projects located in the mountain counties, planted vegetation in each plot must average 6 feet in height at year five and 8 feet in height at year seven. Alternative performance standards for vegetation vigor may be proposed in the Mitigation Plan for sites with unique considerations (e.g., sites proposed to be planted with slow growing species or woody shrub species).

3. No single planted or volunteer species shall comprise more than 50% of the total composition within any plot at year three, year five, or year seven. If this occurs, remedial action as specified in the Adaptive Management Plan or as directed by the USACE may be required. Exceptions to this requirement may be provided on a case-by-case basis for sites with conditions that limit the planting list. All exceptions to this requirement shall be specifically noted in the approved Mitigation Plan.

4. If performance standards 1 through 3 are fully successful through year five and no other problems with planted vegetation have been identified during the visual monitoring of the site at year five, monitoring of vegetation on the site may cease with written approval from the USACE. In the event that the termination of vegetation monitoring is approved, all other forms of monitoring and future credit releases shall continue as originally scheduled until project closeout.

VI. Stream Channel Stability and Stream Hydrology Monitoring

The purpose of the monitoring requirements and performance standards included in this section is to demonstrate that the proposed in-stream work has effectively corrected channel bed and bank instability when it is identified as a primary objective in the Mitigation Plan. Accordingly, the requirements in this section apply to all stream mitigation reaches that utilize a Restoration or Enhancement Level I approach, and also to all Enhancement Level II reaches where in-stream work is conducted that alters the channel dimensions below the bankfull elevation (e.g., laying back the stream banks below bankfull elevation or raising/lowering the bed elevation). For the purposes of this guidance document, a "reach" is defined as a continuous section of an individual tributary where a similar design approach is applied (e.g., Priority 1 Restoration, Priority 2 Restoration, Enhancement Level I, Enhancement Level II, or Preservation). A reach is limited to a single tributary. These performance standards do not apply to wetland mitigation or channels constructed in accordance with the Coastal Headwater Stream Guidance.

A. Stream Channel Stability and Stream Hydrology Monitoring Requirements

1. Channel stability (i.e., cross-sections, bank pins, etc.) shall be monitored for 7 years, with monitoring events occurring on years 1, 2, 3, 5, and 7. If the Sponsor/Permittee

chooses to conduct supplemental monitoring, results may be considered towards meeting performance standards. It is recommended that stream surveys for both project construction and project monitoring generally follow the methodology contained in the *USDA Forest Service Manual, Stream Channel Reference Sites* (Harrelson, et.al, 1994 - available on the Wilmington District RIBITS website at http://geo.usace.army.mil/ribits/index.html).

2. Reference stakes, indicating the surveyed station and corresponding to the as-built survey and longitudinal profile, shall be installed in the riparian buffer near the stream bank every 100 feet along the length of the stream.

3. A longitudinal profile of the thalweg, water surface, bankfull, and top of bank, shall be collected during the as-built survey of the constructed channel to compare with future geomorphological data, if necessary. Additional longitudinal profiles are not required during routine channel stability monitoring (years 1 through 7) unless the monitoring efforts demonstrate channel bank or bed instability, in which case additional longitudinal profiles may be required by the USACE along channel reaches of concern to track changes in the channel and demonstrate stability.

4. Permanent, monumented cross-sections shall be installed at an approximate frequency of one per 20 bankfull-widths, measured along the thalweg of the channel. In general, the locations should be selected to represent approximately 50% pools and 50% riffle areas. Flexibility in the location and frequency will be allowed for cross-sections and should be based on best professional judgment. The selection of locations should always include areas that may be predisposed to potential problems, such as particularly tight meanders, meanders just downstream from channel confluence points, or areas where in-channel work corrected existing bank failures. In the case of very narrow streams, two cross-sections per 1,000 linear feet will generally be sufficient. All channel cross-sections within riffles shall include measurements of Bank Height Ratio (BHR) and Entrenchment Ratio (ER), which shall be documented in monitoring reports.

5. At each monitored cross-section located on a stream bend (typically at pool locations), a bank pin array shall be installed along the outer bend of the stream. Bank pins may consist of chain, rebar, or wire driven horizontally into the bank face, and should be a minimum of 3 feet long. A minimum of one pin per 2 feet of bank height shall be installed at each location, with the lowest pin installed just above the normal water line and additional pins installed at 2-foot intervals vertically above the first pins to the top of the bank. Vertical series of pins should be installed in at least three locations - at the monumented cross-section, the upstream third of the meander bend, and downstream third of the meander bend. The pins shall be installed perpendicular and flush to the face of the stream bank, and the length of exposed pin shall be measured and reported during each cross-section monitoring event. Once the exposure has been measured, the pin should be hammered or cut flush with the face of the bank. Lateral movement of the stream banks as indicated by pin exposure shall be reported in all monitoring reports. Additional bank pin arrays may be required by the USACE to document erosion along particular reaches of channel where concern over channel stability is identified during routine monitoring events.

Bank pins are not required on channels with a bankfull width of less than 5 feet, unless indicated by the results of the monitoring or required by the USACE.

6. Crest gauges shall be installed to document the occurrence of bankfull events. A minimum of one gauge must be installed on each tributary that is greater than 500 feet in length, with one gauge required for every 5000 feet of length on each tributary, and a maximum of 5 gauges per tributary. For all Priority 1 projects and any project that is designed to reconnect the stream to its floodplain, gauges shall also be capable of tracking the frequency and duration of overbank events (e.g., pressure transducer gauges).

B. Stream Channel Stability and Stream Hydrology Performance Standards

1. All stream channels shall receive sufficient flow throughout the monitoring period to maintain an Ordinary High Water Mark (OHWM) in accordance with the requirements of RGL 05-05, dated December 7, 2005, which establishes the extent of USACE jurisdiction for non-tidal waters for CWA Section 404.

2. BHR shall not exceed 1.2 at any measured riffle cross-section. This standard only applies to reaches of the channel where BHR is altered through design and construction. Exceptions to this requirement may be approved on a case-by-case basis, but all exceptions must be included in the final approved Mitigation Plan.

3. ER shall be no less than 2.2 at any measured riffle cross-section. This standard only applies to reaches of the channel where ER is altered through design and construction. Exceptions to this requirement may be approved on a case-by-case basis, but all exceptions must be included in the final approved Mitigation Plan.

4. BHR and ER at any measured riffle cross-section shall not change by more than 10% from the baseline condition during any given monitoring interval (e.g., no more than 10% between years 1 and 2, 2 and 3, 3 and 5, or 5 and 7).

5. Individual bank pin measurements (i.e., length of pin exposed due to lateral movement of the bank) shall not exceed 10% of as-built bankfull width during any given monitoring interval (e.g., no more than 10% between years 1 and 2, 2 and 3, 3 and 5, or 5 and 7), and individual bank pin measurements shall not exceed 20% of as-built bankfull width over the duration of monitoring.

6. The stream project shall remain stable and all other performance standards shall be met through four (4) separate bankfull events, occurring in separate years, during the monitoring years 1 through 7.

VII. Stream Water Quality and Macroinvertebrate Monitoring

The purpose of the monitoring requirements included in this section is to track changes to several water quality parameters, including acidity (pH), temperature, dissolved oxygen, and conductivity, and to record changes to the macroinvertebrate community found within restored or enhanced reaches of streams. These parameters can be used as indicators of the different functions provided by stream

systems that are intended to be restored or enhanced by stream mitigation activities. Accordingly, the requirements in this section apply to all stream mitigation reaches that utilize a Restoration or Enhancement Level I approach, and also to all Enhancement Level II reaches where in-stream work is conducted that alters the channel dimensions below the bankfull elevation (e.g., laying back the stream banks below bankfull elevation or raising/lowering the bed elevation). In certain cases, the information provided by the water quality and macroinvertebrate monitoring may also be used as supplemental information in determining if a project has met the overall goals and objectives stated in the Mitigation Plan. These monitoring requirements do not apply to stream Preservation reaches or streams developed using the Coastal Headwaters Stream Guidance.

These water quality and macroinvertebrate indicators are inherently sensitive to changes that occur anywhere within the watershed draining to the mitigation project, such as land use changes, meteorological changes (droughts, storms, etc.), or pollution entering the watershed (e.g., herbicide use, fertilizer application, road runoff, etc.). Improvements to these indicators may also occur slowly since they develop in response to other modifications, such as buffer replanting or in-stream habitat improvements. For macroinvertebrates, there may also be a lag period for re-colonization by the desired species. For these reasons, Mitigation Plans should always include a brief narrative describing land uses within the watershed(s) draining to the project that may have an effect on water quality or macroinvertebrate communities, which will aid the analysis of the data results. Nevertheless, it is possible that the monitoring of water quality and macroinvertebrates may not always demonstrate a measurable improvement over pre-construction conditions through the seven year monitoring timeframe, and consequently, project success should not be tied these metrics. Accordingly, while water quality monitoring and macroinvertebrate sampling is now required by this guidance, performance standards associated with water quality and macroinvertebrate data have not been developed at this time. These monitoring requirements have been added to provide the USACE and the NCIRT with information that will be used to support future guidance related to reliable, measurable, and achievable performance standards.

A. Water Quality Monitoring Requirements

1. Water quality sampling shall be conducted prior to construction and twice a year throughout the monitoring period. It is recommended, though not required, that the sampling is done while conducting the required visual monitoring of the site. At least 5 months shall separate each visual monitoring event. In general, water quality measurements should be taken during the same time of year to minimize seasonal differences in the data from year-to-year.

2. Water quality sampling shall include measurements of pH, temperature, dissolved oxygen, and conductivity. Sampling of different water quality parameters may be proposed on a project-by-project basis, particularly if they support specific goals identified in the Mitigation Plan, such as a reduction in fecal coliform or nutrient levels.

3. Each tributary on the site that is longer than 500 feet should be sampled at two locations, with sampling points located as close as possible to the upper and lower end of the reach. If possible, the upstream sampling points should be located just upstream from the start of Restoration or Enhancement activities. Sampling points

should be located where water is freely flowing and with sufficient depth to allow sampling to be conducted without disturbance to streambed sediments.

4. Sampling for water quality should be conducted during normal flow conditions, at least 48 hours after any precipitation events totaling one inch or more, as determined by the nearest weather station or on-site precipitation gauges, if available.

B. Macroinvertebrate Monitoring Requirements

1. Macroinvertebrate sampling shall be conducted prior to construction and once a year during monitoring years 3, 5, and 7.

2. Sampling shall be conducted on every tributary that is greater than 1000 feet in length, with one sample point required for every 5000 feet of length on each tributary, with a maximum of 5 sampling points per tributary. Sampling points should be located on riffles, with the first sampling point located in the lowest riffle on the tributary, if possible. Flexibility in the location is allowed based on riffle conditions and should also be based on best professional judgment. For example, post-construction sampling points may be located in different spots than during the monitoring period sampling to ensure that appropriate habitat is included in the sample (e.g., riffles, leaf packs, undercut banks, woody debris, etc.).

3. A reference location should also be sampled for comparison purposes. The reference point should be located on a relatively stable reach in an undisturbed setting, located as close to the mitigation site as possible, and preferably within the same watershed. The reference sampling point should be on a stream with similar watershed characteristics (drainage size, ecoregion, imperviousness, etc.). The reference location may be located within an on-site Preservation reach, or upstream of the mitigation site if stream conditions are appropriate, but should not be located downstream of mitigation activities, regardless of whether it is on-site.

4. The sampling should be conducted in accordance with the Qual 4 macroinvertebrate sampling protocol, which is described in the most current version of the *Standard Operating Procedures for Collection and Analysis of Benthic Macroinvertebrates*. If the stream is large (greater than a 3 square mile watershed), a mix of Qual 4 and the Standard Qualitative (Full Scale) methods may be appropriate. Samples should be collected by someone trained in and experienced with the method. In general, sampling should be conducted during the same time of year to minimize seasonal differences in the data from year-to-year. Additionally, sampling should be conducted at the same time as water quality monitoring, and within the index period referenced in the North Carolina Division of Water Quality (NCDWQ) document entitled Small Streams Biocriteria Development, dated May 29, 2009. Both documents reference above are available on the NCDWQ Biological Assessment Unit homepage (http://portal.ncdenr.org/web/wq/ess/bau) under the Benthos Links section. The number of samples collected should be based on the size and complexity of the site. Macroinvertebrate samples should be identified to the lowest practical taxonomic level (usually Genus) by a qualified taxonomist (this qualification can be demonstrated by being a NCDWQ certified laboratory for macroinvertebrates). Results should be

presented, at a minimum, as a list of taxa collected at each site for each sampling event, including an enumeration of the Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa and a Biotic Index. Other summary or comparison statistics may also be acceptable on a case-by-case basis.

VIII. Coastal Headwater Stream Monitoring

The Coastal Headwater Stream Guidance allows for Restoration of streams that do not typically require construction of pattern, dimension, and/or profile. Restoration of the streams in these systems should be achieved through the reestablishment of appropriate hydrology and hydraulics, which leads to the passive development of coastal headwaters stream geomorphology over time. Site construction may include some less invasive construction measures, such as: ditch filling, field crown removal, planting bed/crop row leveling, and the return of hydrology to historic braids or channels (if still present). The requirements in this section apply to all stream mitigation reaches that utilize the Coastal Headwaters Stream Guidance. The requirements for constructed channels included in Section VI (Stream Channel Stability and Stream Hydrology Monitoring) and Section VII (Stream Water Quality and Macroinvertebrate Monitoring) are not applicable to these streams. These systems shall be subject to the monitoring and performance standards identified below:

A. Coastal Headwater Stream Monitoring Requirements

1. Coastal headwater stream monitoring shall be conducted for 7 years, with monitoring events occurring every year as described below.

2. Surface water flow shall be documented using gauges (flow meters, pressure transducers, etc.). Gauge stations should be located within the anticipated primary path of flow within the low point of the valley to ensure recordation of all flow events. Gauge stations should also be placed along the topographic low point of the valley as necessary to document the upstream end of channel forming flows. The number of gauge stations to be installed should be based on relevant factors, including pre and post-construction site conditions, valley slope and length, watershed size, adjacent wetlands, etc., and should be sufficient to document the upper end of stream formation when considered with the required field indicators listed in the performance standards (see Section VIII(B) below).

3. Channel formation within the valley or crenulation must be documented through the identification of field indicators consistent with those listed in RGL 05-05. Identified field indicators (listed in the performance standards below) shall be documented using data sheets and photographs, and their location shall be shown on a plan view of the site to be included with the annual monitoring report. Additional monitoring and/or analysis may be necessary in the event of abnormal climactic conditions.

B. Coastal Headwater Stream Performance Standards

1. Continuous surface water flow within the valley or crenulation must be documented to occur every year for at least 30 consecutive days during the prescribed monitoring period. Additional monitoring may be required if surface water flow cannot be documented due to abnormally dry conditions.

2. Channel formation must be documented using indicators consistent with RGL 05-05 in accordance with the following schedule:
    a. During monitoring years 1 through 4, the preponderance of evidence must demonstrate a concentration of flow indicative of channel formation within the topographic low-point of the valley or crenulation as documented by the following indicators:
        - Scour (indicating sediment transport by flowing water)
        - Sediment deposition (accumulations of sediment and/or formation of ripples)
        - Sediment sorting (sediment sorting indicated by grain-size distribution within the primary path of flow)
        - Multiple observed flow events (must be documented by gauge data and/or photographs)
        - Destruction of terrestrial vegetation
        - Presence of litter and debris
        - Wracking (deposits of drift material indicating surface water flow)
        - Vegetation matted down, bent, or absent (herbaceous or otherwise)
        - Leaf litter disturbed or washed away

    b. During monitoring years 5 and 7, the stream must successfully meet the requirements of standard 2(a) above and the preponderance of evidence must demonstrate the development of stream bed and banks (i.e., an ordinary high water mark) as documented by the following indicators:
        - Bed and banks (may include the formation of stream bed and banks, development of channel pattern such as meander bends and/or braiding at natural topographic breaks, woody debris, or plant root systems)
        - Natural line impressed on the bank (visible high water mark)
        - Shelving (shelving of sediment depositions indicating transport)
        - Water staining (staining of rooted vegetation)
        - Change in plant community (transition to species adapted for flow or inundation for a long duration, including hydrophytes)
        - Changes in character of soil (texture and/or chroma changes when compared to the soils abutting the primary path of flow)

IX. Wetland Hydrology Monitoring – IN DEVELOPMENT

This section is reserved for Wetland Hydrology Monitoring Requirements and Performance Standards, which are currently under development by the USACE in consultation with the NCIRT. Until this section is complete, wetland hydrology monitoring should be conducted in accordance with current District Guidance and as stated in the approved Mitigation Plan.

X. Visual Monitoring

The following requirements apply to all wetland and stream mitigation projects, including Preservation areas as noted below. The goal of visual monitoring is to identify any concerns on a mitigation project that may not be picked up by other routine monitoring activities, such as: encroachments, areas with poor vegetation growth, beaver activity, excessively or inadequately drained areas, stream bank instability, etc. Visual monitoring is intended to cover the entire mitigation site in an efficient manner. The following standards apply to visual monitoring:

A. Visual monitoring of all sections of the mitigation project shall be conducted twice per monitoring year throughout the required seven year monitoring period to identify areas of concern. Generally, one visual monitoring event should be done in conjunction with other monitoring activities (e.g., water quality and macroinvertebrate monitoring, vegetation plot monitoring, stream channel stability monitoring of cross-sections, bank pins, etc.). At least 5 months shall separate each visual monitoring event.

B. Visual monitoring shall be conducted by traversing the entire mitigation site to identify and document areas of low stem density or poor plant vigor, prolonged inundation, native and exotic invasive species, beaver activity, herbivory, encroachments, indicators of livestock access, or other areas of concern.

C. A brief narrative of the results of the visual assessments shall be included in the Annual Monitoring Report. The narrative in the Annual Monitoring Report should include the results from both of the visual assessments conducted in that monitoring year. Any areas of concern shall be annotated on a plan view of the site with GPS coordinates provided in decimal degrees, with photographs, and with the written narrative describing the features and issues of concern. Once a feature of concern has been identified, that same feature shall be reassessed on all subsequent visual assessments. Photographs should be taken from the same location year-to-year to document the current condition of the concern. The Monitoring Report shall identify all recommended courses of action, which may include continued monitoring, repair or other remedial action to alleviate the concerns.

D. For stream projects, visual monitoring within the channel corridor shall be conducted along the entire length of each reach to identify and document movement of the channel pattern, dimension or profile (e.g., lateral bank migration, bank instability, instability/failure of in-stream structures, structure piping, headcuts, aggradation/excessive sediment deposition, etc.), beaver activity, excessive live stake mortality, invasive species, or other potential problems with the channel. Visual monitoring of streams shall be conducted only by individuals that have the appropriate training and/or expertise to assess the stability of streams and the condition of in-stream structures.

E. Within Preservation areas, visual monitoring shall be conducted only for the purpose of ensuring that no activities are occurring that are in violation of the restrictions included in the preservation mechanism prior to the site being transferred to the long-term steward after project closeout.

XI. Early Closure Provision

If the monitoring of the site demonstrates that the site is successful by year 5 and no concerns have been identified (vegetation, hydrology, stream stability, encroachments, etc.), the Permittee/Sponsor may propose to terminate monitoring of the site and forego the monitoring requirements of years 6 and 7. This provision is only for high-quality sites that have consistently and fully met all performance standards and have not had any major or reoccurring problems reported during the visual monitoring events. Requests for early closure must be submitted in writing along with the year 5 or 6 monitoring report and justification for the request. In the case where early closure (project closeout) is approved under this provision, all remaining credits shall be released with the approval for early closure.

XII. Remedial Actions

Mitigation Plans are required to include an Adaptive Management Plan, which should address how problems on sites are resolved. In addition, if monitoring results indicate that all or some portions of the site will fail to meet one or more of the required performance standards, the monitoring report must provide a remedial action plan (based on the Adaptive Management Plan) to address the deficiency and the USACE mitigation contact shall be notified as soon as possible if a situation is discovered that will require remedial action. The remedial action plan, at a minimum, must describe the failure, the source or reason for the failure, a concise description of the corrective measures that are proposed, and a time frame for the implementation of the corrective measures. Additional monitoring, as prescribed by this guidance, may also be required.

A. Vegetation

If monitoring indicates that portions of the site are not going to meet required vegetation performance standards, replanting of all or part of the site may be required. If supplemental plantings are required that exceed 10% of the total planted area of the site (measured cumulatively), additional monitoring shall be required within these areas to demonstrate success in accordance with the vegetation performance standards. Remedial action plans should take into account reasons for failure and provide for corrective measures if applicable. For instance, if inundation is determined to be a cause for poor vegetation performance, the replanted species may be adjusted to include species more tolerant to inundation.

In the event that a site is not meeting the vegetation vigor standards, the remedial action plan should seek to identify the cause of the problem and remediate the problem if possible. This may include one or more of several options, such as deep ripping portions of the site and replanting, mowing or herbicide use to release the vegetation, fertilization, beaver control, or replanting with species less subject to herbivory. In certain instances, it may be determined that it is not practicable to perform remedial actions to address the factors limiting the vigor of planted vegetation, and that no further work will improve the conditions. In this situation, the USACE, in consultation with the NCIRT, will determine what level of credit, if any, may be generated by portions of the site that are not meeting performance standards.

B. Stream Instability

Stream stability may be identified as a concern with stream mitigation projects even though all performance standards may be met at monitored cross-sections. Visual monitoring of the channel is intended to identify potential problems and allow them to be tracked and addressed, if necessary. In general, repairs shall be required when stream stability issues are identified that continue to worsen, pose a threat to other portions of the stream (headcuts), or are symptomatic of more serious issues with the design and/or construction of the project. If problems continue to persist, repairs may be discontinued and mitigation credits will be adjusted accordingly. These decisions will be made on a case-by-case basis by the USACE in consultation with the NCIRT.

C. Invasive Species

As more stream and wetland mitigation projects have been established, problems with native and exotic invasive vegetation or otherwise undesirable plant species have become more prevalent. A list of these species is available as an appendix to the NC SAM Users Manual (available on the Wilmington District RIBITS website at http://geo.usace.army.mil/ribits/index.html). No specific performance standards have been established in this guidance for controlling invasive species, although sites should be routinely monitored for the presence of invasive species during both the visual assessments of the channel and vegetation plot monitoring events.

Although a site may rapidly be dominated by one or more invasive species, in many cases the desirable or planted materials have survived and exhibited adequate growth to ensure that they will, at least over the short term, continue to survive. Efforts should be taken immediately upon the identification of invasive species on the site to eradicate or at least control their recurrence, and may include chemical or physical eradication methods. In either case, extreme care must be exercised such that the desirable species are not adversely impacted. Efforts taken to control invasive species shall always be noted in the monitoring reports.

D. Beaver

The presence of beaver on stream and wetland mitigation projects has become prevalent. Beaver management is a topic that should be addressed in the Adaptive Management Plan portion of all Mitigation Plans. In general, it is understood that perpetual management of beaver on a mitigation site beyond the required monitoring period is not practicable; however, it is expected that beaver should be actively managed for the duration of the monitoring phase of every site. Managing beaver is important because it provides an initial period of growth for planted vegetation to get established. For stream projects, beaver control is also necessary to maintain channel flow and provide conditions necessary for the proper evaluation of stream performance standards. Habitation of sites by beaver is often temporary, so it important to demonstrate that a stable channel exists for the site to revert back to in the event that beaver intermittently occupy a site after its closure.

Management may entail trapping or otherwise removing beaver from mitigation sites and breeching any beaver dams. Generally, dams should be removed by hand whenever possible. Depending on the method of dam removal (e.g., mechanical, explosives, etc.), it may be necessary to obtain a DA permit from the USACE county Project Manager prior to conducting the work. Once beaver are noted on or adjacent to a site, management should be conducted as frequently

as necessary to maintain the site in an unobstructed flow condition. Beaver management activities associated with the project shall be tracked and included in the monitoring reports. This shall include dates of trapping, number of beaver removed, and the number and location of dams that are removed. Additionally, the locations of dams shall be shown on the plan view of the site.

E. Monitoring Schedule

The following schedule lists the monitoring requirements for each year. Monitoring events conducted after year 7 shall be specified on a case-by-case basis by the USACE in consultation with the NCIRT. Stream mitigation conducted in accordance with the Coastal Headwater Stream Guidance shall be monitored following the schedule outlined in Section VIII above. Wetland hydrology monitoring activities listed below should be conducted in accordance with the approved Mitigation Plan. Please note that the table below is a general list of monitoring requirements, and is not meant to be a comprehensive list of monitoring requirements. Individual Mitigation Plans may specify different monitoring activities and/or schedules.

Monitoring Event	Monitoring Activities Required	
	Streams	**Wetlands**
Pre-Construction	• Water Quality Monitoring (Section VII(A)) • Macroinvertebrate Monitoring (Section VII(B))	• Per Mitigation Plan
Year 0 (As-Built)	• As-built Survey (includes longitudinal profile)	• As-built Survey
Year 1	• Vegetation Plot Monitoring (Section V) • Stream Channel Stability/Hydrology Monitoring (Section VI) • Water Quality Monitoring, two times (Section VII(A)) • Visual Monitoring, two times (Section X)	• Vegetation Plot Monitoring (Section V) • Wetland Hydrology Monitoring (Section IX) • Visual Monitoring, two times (Section X)
Year 2	• Vegetation Plot Monitoring (Section V) • Stream Channel Stability/Hydrology Monitoring (Section VI) • Water Quality Monitoring, two times (Section VII(A)) • Visual Monitoring, two times (Section X)	• Vegetation Plot Monitoring (Section V) • Wetland Hydrology Monitoring (Section IX) • Visual Monitoring, two times (Section X)
Year 3	• Vegetation Plot Monitoring (Section V) • Stream Channel Stability/Hydrology Monitoring (Section VI) • Water Quality Monitoring, two times (Section VII(A)) • Macroinvertebrate Monitoring (Section VII(B)) • Visual Monitoring, two times (Section X)	• Vegetation Plot Monitoring (Section V) • Wetland Hydrology Monitoring (Section IX) • Visual Monitoring, two times (Section X)
Year 4	• Water Quality Monitoring, two times (Section VII(A)) • Visual Monitoring, two times (Section X)	• Visual Monitoring (Section X) • Wetland Hydrology Monitoring (Section IX)
Year 5	• Vegetation Plot Monitoring (Section V) • Stream Channel Stability/Hydrology Monitoring (Section VI) • Water Quality Monitoring, two times (Section VII(A)) • Macroinvertebrate Monitoring (Section VII(B)) • Visual Monitoring, two times (Section X)	• Vegetation Plot Monitoring (Section V) • Wetland Hydrology Monitoring (Section IX) • Visual Monitoring, two times (Section X)
Year 6	• Water Quality Monitoring, two times (Section VII(A)) • Visual Monitoring, two times (Section X)	• Visual Monitoring, two times (Section X)
Year 7	• Vegetation Plot Monitoring (Section V) • Stream Channel Stability/Hydrology Monitoring (Section VI) • Water Quality Monitoring, two times (Section VII(A)) • Macroinvertebrate Monitoring (Section VII(B)) • Visual Monitoring, two times (Section X)	• Vegetation Plot Monitoring (Section V) • Visual Monitoring, two times (Section X)

XIII. Credit Release Schedules

The standard release schedule for mitigation bank and ILF credits generated through stream and wetland mitigation projects has been modified to meet the new standards for the monitoring timeframes provided in this guidance document. For mitigation banks, the first credit release (15% of the bank's total stream Restoration and/or Enhancement credits) shall occur upon establishment of the mitigation bank, which includes the following criteria: 1) execution of the MBI or UMBI by the Sponsor and the USACE; 2) approval of the final Mitigation Plan; 3) the mitigation bank site must be secured; 4) delivery of the financial assurances described in the Mitigation Plan; 5) recordation of the long-term protection mechanism and title opinion acceptable to the USACE; and 6) 404 permit verification for construction of the site, if required. For mitigation sites that include Preservation-only credits, 100% of the Preservation credits shall be released with the completion of the six criteria stated above.

For ILF sites (including all NCEEP projects), no initial release of credits (Milestone 1) is provided because NCEEP ILF programs utilized advance credits, so no initial release is necessary to help fund site construction. To account for this, the 15% credit release associated with the first milestone (bank establishment) is held until the second milestone, so that the total credits release at the second milestone is 30%. In order for NCEEP get this 30% release (shown in the table as Milestone 2), they must comply with the credit release requirements stated in Section IV(I)(3) of the approved NCEEP Instrument.

The following conditions apply to the credit release schedules:

A. A reserve of 10% of a site's total stream credits shall be released after four bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than four bankfull events occur during the monitoring period, release of these reserve credits shall be at the discretion of the NCIRT.

B. The Sponsor must complete the initial physical and biological improvements to the mitigation site pursuant to the Mitigation Plan no later than the first full growing season following initial debiting of credits generated by the site.

C. After the second milestone, the credit releases are scheduled to occur on an annual basis, assuming that the annual monitoring report has been provided to the USACE in accordance with Section IV (General Monitoring Requirements) of this document, and that the monitoring report demonstrates that interim performance standards are being met and that no other concerns have been identified on site during the visual monitoring. All credit releases require written approval from the USACE in consultation with the NCIRT.

D. The final 10% of credits will be available for sale only upon a determination by the NCIRT of functional success as defined in the Mitigation Plan.

The tables below list the updated credit release schedules for stream and wetland mitigation projects developed by bank and ILF sites in North Carolina:

Credit Release Schedule and Milestones for Forested Wetlands					
Credit Release Milestone	**Release Activity**	**Banks**		**ILF/NCEEP**	
		Interim Release	**Total Released**	**Interim Release**	**Total Released**
1	Site Establishment (includes all required criteria stated above)	15%	15%	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	15%	30%	30%	30%
3	Year 1 monitoring report demonstrates that interim performance standards have been met	10%	40%	10%	40%
4	Year 2 monitoring report demonstrates that interim performance standards have been met	10%	50%	10%	50%
5	Year 3 monitoring report demonstrates that interim performance standards have been met	15%	65%	15%	65%
6*	Year 4 monitoring report demonstrates that interim performance standards have been met	5%	70%	5%	70%
7	Year 5 monitoring report demonstrates that interim performance standards have been met	15%	85%	15%	85%
8*	Year 6 monitoring report demonstrates that interim performance standards have been met	5%	90%	5%	90%
9	Year 7 monitoring report demonstrates that performance standards have been met	10%	100%	10%	100%

*Please note that vegetation plot data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the USACE in consultation with the NCIRT.

Credit Release Schedule and Milestones for Non-forested Wetlands					
Credit Release Milestone	**Release Activity**	**Banks**		**ILF/NCEEP**	
		Interim Release	**Total Released**	**Interim Release**	**Total Released**
1	Site Establishment (includes all required criteria stated above)	15%	15%	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	15%	30%	30%	30%
3	Year 1 monitoring report demonstrates that interim performance standards have been met	10%	40%	10%	40%
4	Year 2 monitoring report demonstrates that interim performance standards have been met	15%	55%	15%	55%
5	Year 3 monitoring report demonstrates that interim performance standards have been met	20%	75%	20%	75%
6	Year 4 monitoring report demonstrates that interim performance standards have been met	10%	85%	10%	85%
7	Year 5 monitoring report demonstrates that performance standards have been met	15%	100%	15%	100%

Credit Release Schedule and Milestones for Streams					
Credit Release Milestone	**Release Activity**	**Banks**		**ILF/NCEEP**	
		Interim Release	**Total Released**	**Interim Release**	**Total Released**
1	Site Establishment (includes all required criteria stated above)	15%	15%	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	15%	30%	30%	30%
3	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%	10%	40%
4	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50% (60%**)	10%	50% (60%**)
5	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60% (70%**)	10%	60% (70%**)
6*	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%**)	5%	65% (75%**)
7	Year 5 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%**)	10%	75% (85%**)
8*	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%**)	5%	80% (90%**)
9	Year 7 monitoring report demonstrates that channels are stable, performance standards have been met	10%	90% (100%**)	10%	90% (100%**)

*Please note that vegetation plot data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the USACE in consultation with the NCIRT.

**10% reserve of credits to be held back until the bankfull event performance standard has been met.