Determining Appropriate Compensatory Mitigation Credit for Dam Removal Projects in North Carolina

Developed cooperatively by:
US Army Corps of Engineers, Wilmington District
US Environmental Protection Agency, Region 4
US Fish and Wildlife Service
NC Division of Water Quality
NC Wildlife Resources Commission, and
NC Division of Water Resources
Version 7.1
February 13, 2008

Although dam removal projects are expected to result in the restoration of natural stream systems that have been previously impacted, until now, there was no established procedure to identify when and how dam removal should be utilized as compensatory mitigation for loss of streams and stream functions, due to permitted development projects. The following guidance has been prepared to address these issues and is intended to provide the regulated community of North Carolina with joint guidance from the US Army Corps of Engineers (Corps) and N.C. Division of Water Quality (NCDWQ).

The intent of this guidance is to provide a consistent method to determine mitigation credit derived from appropriate dam removal projects across North Carolina. Dam removal proposals will be considered on a case-by-case basis by the Ecosystem Enhancement Program's (EEP) Program Assessment and Consistency Group-Technical Committee (PACG-TC) or an Interagency Review Team (IRT), as appropriate. Dams which are required to be removed by the NC Division of Land Quality, Dam Safety Program, or any other state or federal agency will not be considered for compensatory mitigation credit.

Generally, this guidance is intended to apply to larger run of the river dams, with channels wider than 20 feet. Removal of smaller dams may provide project-specific compensatory mitigation opportunities, utilizing channel restoration that follows the typical natural channel design methods.

The Corps and DWQ intend to use this guidance once the public interest review process is completed. These guidelines should not be construed as affecting the

applicability of the Clean Water Act (CWA) 404(b)(1) Guidelines, found at 40 CFR Part 230, the February 6, 1990, Memorandum of Agreement between the Environmental Protection Agency and the Department of the Army (DA) on the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines, the pending revisions to 40 CFR Part 230 (Compensatory Mitigation for Losses of Aquatic Resources), or the review process outlined in DWQ's rules (15A NCAC 2H.0506).

The agencies believe that there is a benefit in dam removal projects. However, dam removal projects should be used cautiously and on a limited basis as compensatory mitigation, until a better understanding of the benefits and consequences of dam removal projects is gained. Furthermore, compensatory mitigation credits generated through dam removal will constitute no more than half of the required mitigation for any particular impact, with the exception of those projects involving the discharge of fill material and subsequent impoundment of upstream waters. Any remaining required credits will be generated from other stream projects following the Stream Mitigation Guidelines in North Carolina (available on-line at the Corps' website: http://www.saw.usace.army.mil/WETLANDS/Mitigation/stream mitigation.html). This guidance is subject to periodic revision based on the review and monitoring of these projects. This guidance relates to dam removal projects only and is not intended to address other types of potential compensatory stream mitigation projects.

Finally, the agencies recognize that not all dams are able to be removed in their entirety due to such potential obstacles as historical significance, public sentiment, adjacent wetlands, sediment load, access, and dam composition. Accordingly, proposals for partial dam removal or other activities (i.e., rock arch weir, etc.) that reestablishes valuable functions will be reviewed on a case-by-case basis.

Debit/Credit Process

Credit amounts and release schedules for dam removal projects proposed as a part of a commercial mitigation bank, will be determined through the mitigation bank process involving an IRT and subsequent execution of a Mitigation Banking Instrument (MBI). Credit amounts for dam removal projects proposed as assets for the EEP, will

be determined by the PACG-TC. All proposals must be adequately described in a planning document that is subject to review and approval by the appropriate agencies. Once it has been determined that a project may proceed under these guidelines, specific Department of the Army permit requirements for removal of the dam and any associated structures will be determined by the Corps.

I. General criteria that will be considered when determining mitigation credit.

The criteria listed below will be considered by the reviewing agencies when determining the amount of baseline credits and maximum potential credits for a proposed dam removal project. The calculation of credits is discussed in Section III.

Not all dam removal projects will be suitable for compensatory mitigation. If the dam removal does not meet at least two of the four general criteria listed below, then it is unlikely that the Federal and State agencies will support removal of the dam as compensatory mitigation.

Proposals which include credits for one or more tributaries impounded by the dam should document that each tributary meets at least two of the criteria below. In addition, the IRT or PACG-TC may require buffers for a tributary, on a case-by-case basis, in order to allow credit. Any project which is allowed credit for tributaries will be required to provide a similar level of effort (as required on the mainstem) for baseline information and pre- and post- removal monitoring, to document functional improvements to those tributary reaches. Depending on the number of tributaries proposed for credit, the IRT or PACG-TC may allow a representative sub-sample of the tributaries to be monitored.

A. **Water quality issues**: Documented impairments to water quality in the impoundment or tailwater that would be alleviated by removal of the dam. These include comparisons to current Water Quality Standards, low dissolved oxygen levels, altered temperature regimes, elevated chlorophyll a, nutrient or toxicant levels, and altered downstream flow regimes. Other considerations

include listing of the waterbody on the state's 303(d) list; known, repeated violations of water quality standards; and High Quality Water or Outstanding Resource Water classification above or below the dam.

B. **Rare, endangered and threatened aquatic species**: State or Federally listed rare, endangered or threatened aquatic species which are likely to colonize the restored stream reach. Credits under this category will be divided into 3 parts and released upon the demonstration of each of the following:

1. Restoration of the required physical, chemical or water quantity habitat.

2. Recolonization of species that are often found with the target species, such as recolonization of darters in a stream targeted for rare, endangered, or threatened riffle mussel and fish fauna, provided concurrence is obtained from either the U.S. Fish and Wildlife Service (USFWS) or the North Carolina Wildlife Resources Commission (NCWRC).

3. Documentation of the target State and/or Federally listed rare, endangered, or threatened species in the restored habitat with the identification and location confirmed by a recognized expert (someone possessing the appropriate permit to sample the species in question or a State or Federal agency biologist). The number of individuals and/or observations required to meet this criterion will be different depending on the taxon (fish, mussel, etc.), species, and location in question. This should be determined on a case-by-case basis by the USFWS and/or the NCWRC prior to dam removal. The number should be a minimum population level that indicates use of the habitat at similar levels to existing populations in similar habitats adjacent to the restored reach.

It is recognized that in some instances actual documentation of a rare, endangered, or threatened species will be unlikely within the

typical 5 years of monitoring. For this reason, some of the credit generated under this category will be held in abeyance until documentation of the target species within the restored reach occurs (as discussed in Section III). In cases where there are no known associate species, then one-half of the credit would be released for restoration of required habitat and the remaining one-half for documentation of a viable population. If monitoring fails to demonstrate credits under these categories, credit amount and/or release of future credits may be adjusted by the IRT or PACG-TC. Furthermore, the monitoring period should not exceed 10 years, unless agreed upon in writing by the IRT or PACG-TC.

In some instances, reintroduction of species by the appropriate agencies may be done in conjunction with the project. However, release of credits would occur only after the species proves to be a viable population as determined by the appropriate resource agency.

C. **Establishment of an appropriate aquatic community:** Removal of the dam may result in the restoration of the appropriate aquatic community. Lotic conditions are considered to be successfully returned to an impounded or bypassed stream reach following a dam removal when a significant number of filter feeding organisms can be found. These organisms, such as hydropsychid caddisflies, Oligoneurid mayflies, and blackflies, require flowing water to bring them food, and are an integral part of any flowing stream. Biological uses are returned to a stream when the macroinvertebrate or fish community meets or exceeds bioclassification (DWQ, BAU, 2001) of the free flowing segment either immediately above (rarely) or below (usually) the previously impounded area. For example, success criteria for this category may be based upon a demonstrated improvement of water quality based upon pre- versus post-monitoring. Use of DWQ's Benthic Macroinvertebrate stream rating system or similar metrics may be used to measure this criterion within the impoundment.

Finally, restoration of appropriate stream community fish species within the impoundment, such as Darters, may also receive mitigation credit on a case-by-case basis. The credit would be based upon documented restoration of the fragmented aquatic habitat.

D. **Anadromous fish passage:** To qualify for anadromous fish passage credit, the barrier must be confirmed as a barrier to anadromous fish movement by determining that anadromous fish are found in concentrated numbers immediately downstream of the barrier. Credits within the impoundment are included as the 25% criterion utilized in the baseline calculation.

For credits generated above the impounded reach: The applicant can select a predetermined amount of credit or conduct research that will better determine the extent to which anadromous fish are using newly accessible habitat. If the applicant can satisfy the Research Option criterion, it may be possible to receive mitigation credit exceeding the amount given with the predetermined option. If the research indicates that the amount of mitigation credit given with the predetermined option was excessive, mitigation credit will not be revoked. As more information about anadromous fish use of previously inaccessible habitat becomes available, criteria for mitigation credit may be modified.

<u>Predetermined Option</u>
Mainstem - Credit will be given at a 10:1 ratio for the stream length along the mainstem, above the impoundment, to 1) the next movement barrier (Figure 1) or 2) to a point upstream where the drainage area is 75% of the drainage area at the barrier location (Figures 2 and 3), whichever occurs closer to the barrier location. Credit will be given along the mainstem at a 15:1 ratio for the stream length that is < 75% or > 40% of the drainage area at the barrier location. No credits will be given for linear footage above 40% of the drainage area.

Figure 1. Anadromous fish mitigation credit ratio (CR) for predetermined option (for illustrative purpose only).

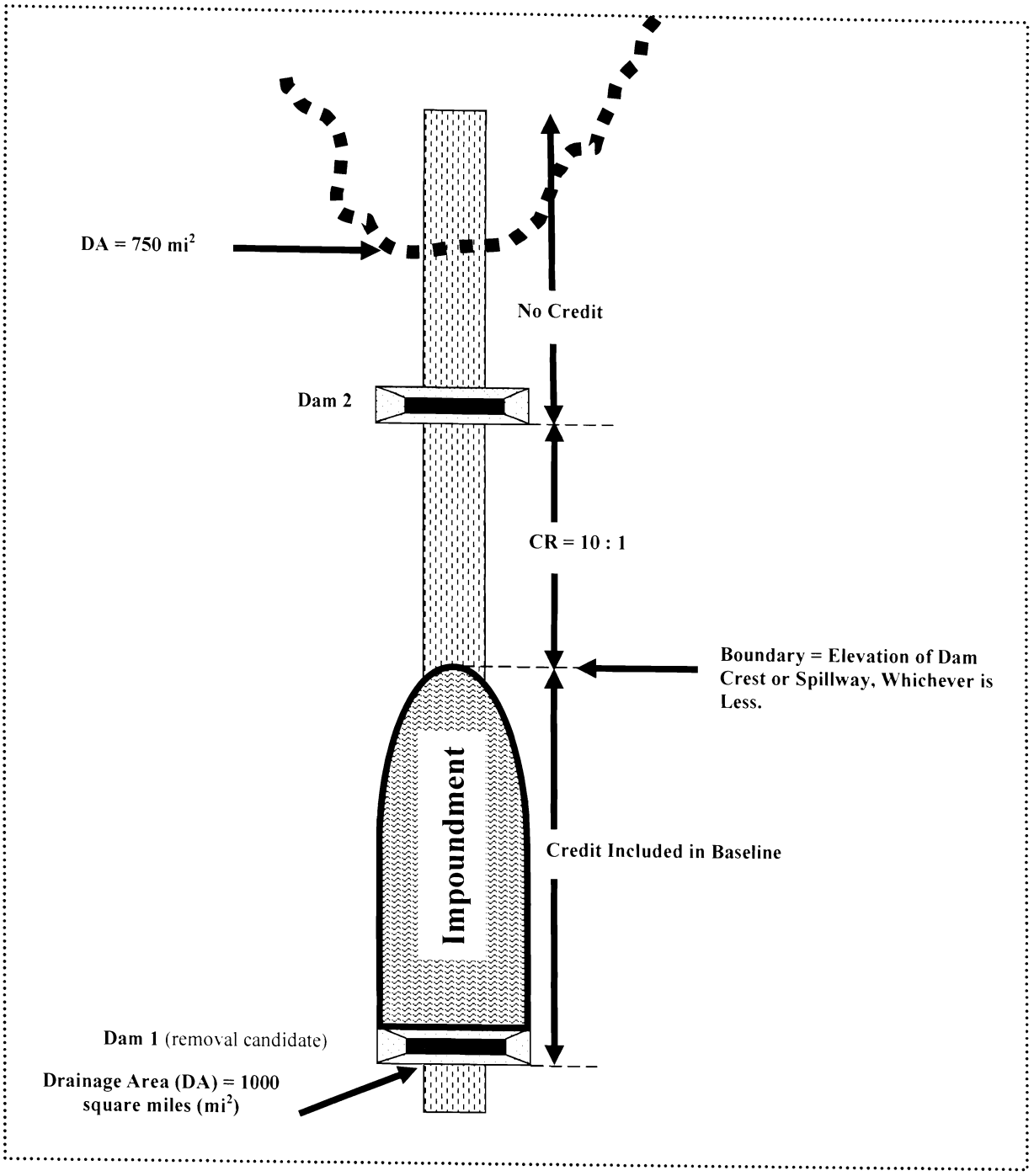


Figure 2. Anadromous fish mitigation credit ratio (CR) for predetermined option (for illustrative purpose only).

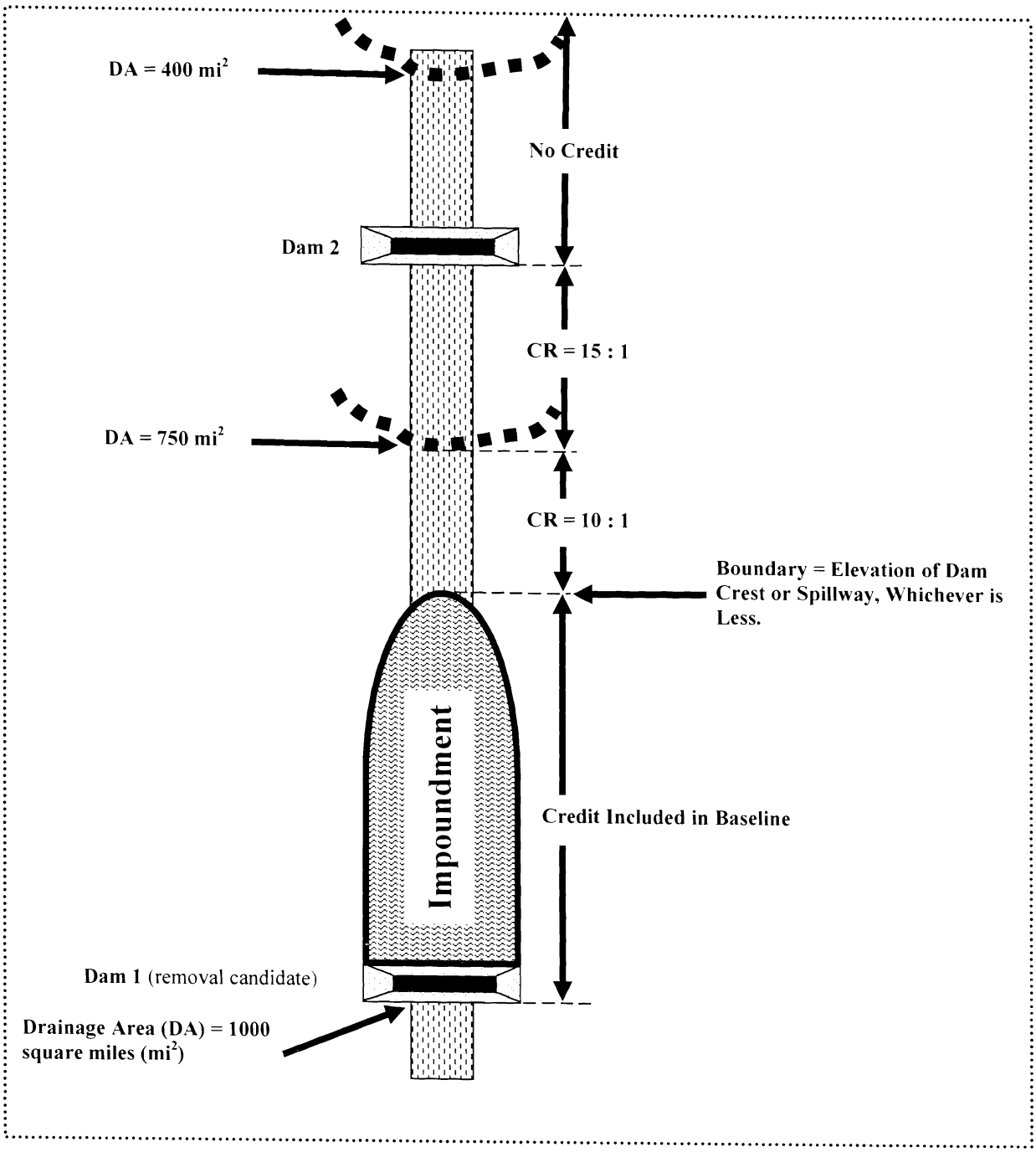
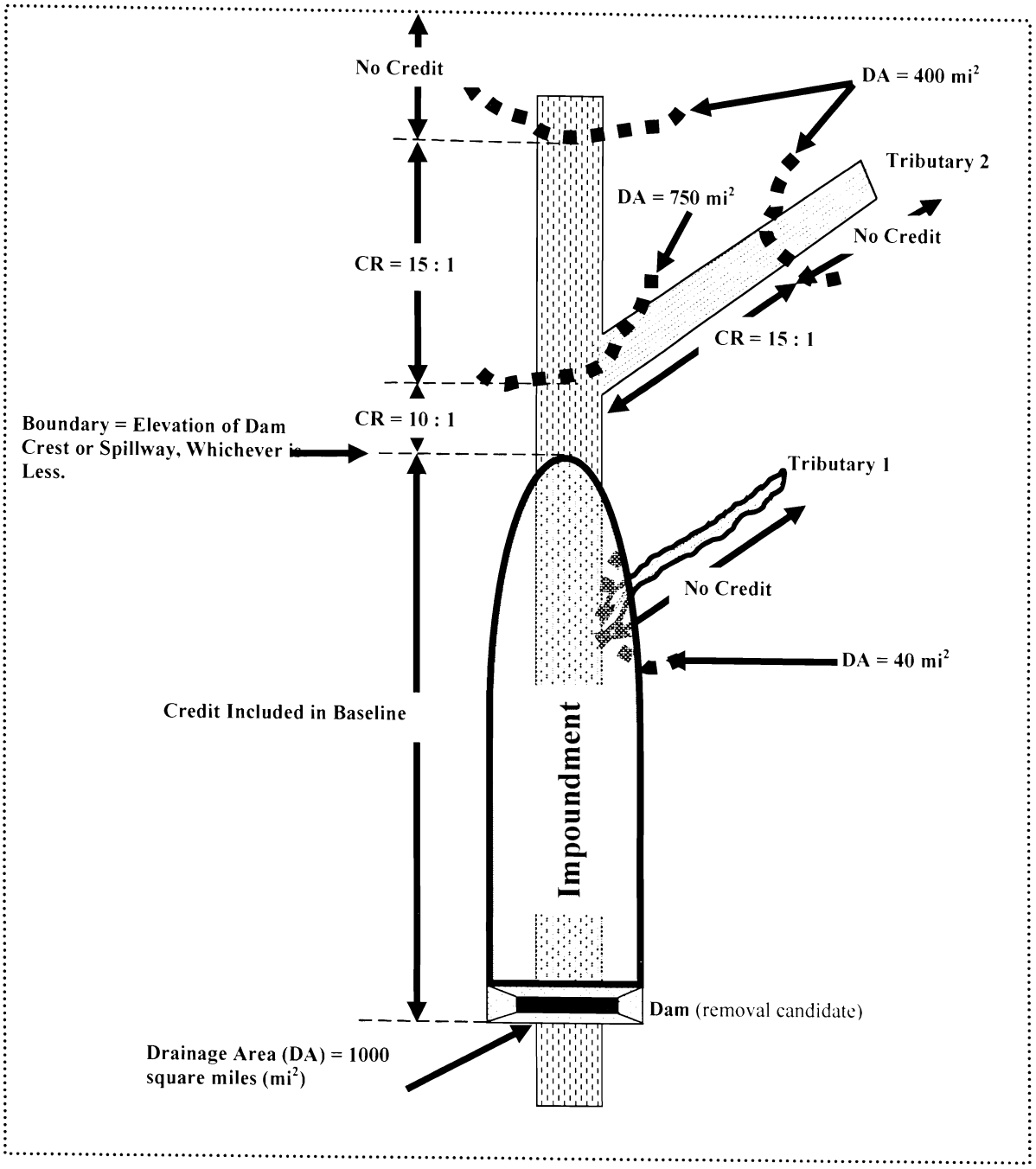


Figure 3. Anadromous fish mitigation credit ratio (CR) for predetermined option (for illustrative purpose only).



Tributaries - Credit will be given at a 15:1 ratio of tributary length for each tributary that meets the following: 1) no other barrier (physical, water quality or behavioral) would prevent access in the tributary after dam removal, and 2) the drainage area of the tributary (at the confluence with the mainstem) is ≥40% of the total drainage area at the barrier location. Credit will be given for the length of the tributary from the confluence to a point that drains up to 40% of the drainage area at the barrier location (Figure 3). No credits will be given above this point.

Research Option

The applicant must provide data indicating 1) the presence of adult anadromous fish in spawning condition upstream of the barrier location and 2) evidence of anadromous fish spawning upstream of the barrier location. The applicant will have 5 years to document anadromous fish use. Because low flow years may reduce the number of anadromous fish reaching the barrier location or impacts from dam removal may delay recolonization, a finding of adult presence and evidence of spawning is only required for 3 of the 5 years after barrier removal.

1) To receive any credit through the research option, the applicant must demonstrate that ≥50% of the adult anadromous fish in spawning condition located immediately downstream of the barrier location are passing upstream. This criterion must be satisfied for 3 or more of the 5 years after dam removal. This can best be determined by tracking the movement of tagged fish to determine if at least 50% of fish reaching the barrier location move past it.

2) The applicant must also show that anadromous fish are spawning upstream of the barrier location for 3 or more of the 5 years after dam removal. This should be demonstrated by collecting anadromous fish eggs or larvae upstream of the barrier location.

To determine the extent of upstream habitat use within the mainstem and tributaries, the credit applicant must locate (i.e., capture, track) anadromous fish upstream of the barrier location. Credit will be given at a 5:1 ratio for the distance that two or more anadromous fish of the same species are collected from the upstream edge of the normal pool of the impoundment; this applies to the mainstem and any tributary in which two or more fish are documented.

When reviewing projects pertaining to either rare, endangered, or threatened species and/or anadromous fish criteria, the IRT and/or PACG-TC will solicit the expertise of the USFWS and/or the National Marine Fisheries Service (NMFS) for federally listed species and the NCWRC and/or the North Carolina Division of Marine Fisheries (NCDMF) for state listed species. These agencies will determine the viability of the restoration of endangered or threatened species and/or their habitat or anadromous fish for the project and provide feedback to the IRT or PACG-TC on the project proposal.

II. Additional site-specific factors that may be considered during the review of dam removal projects for mitigation credits

A. **Wooded buffers:** This guidance recognizes the benefits that wooded buffers provide and encourages their establishment, where possible. More favorable mitigation credits will be provided where either existing or restored buffers are fully protected on both sides of a waterbody through conservation easements. Buffers (measured horizontally) of at least 50 feet in the coastal plain and piedmont or 30 feet in the mountains are considered the minimum for water quality benefits while buffers up to 300 feet wide are often cited as valuable for wildlife habitat and corridors, or where threatened or endangered species are present. In watersheds subject to existing buffer rules (such as the Neuse River or Tar-Pamlico), buffers must exceed the width already required in order to

receive additional credit. The provision of wooded buffers will be treated as a significant factor for the amount of credit available from the site as described in Table 1.

B. **Human values:** If the project is designed to provide or enhance direct human benefits including recreational use (such as parks, trails, marked canoe trails, boat access, and signage for environmental education) or scientific research conducted beyond the required monitoring of the project (such as an effort similar to a Ph.D. dissertation or Master's thesis), then additional credit may be generated. It should be noted that features added to a project to replace features lost as a result of the project in coordination with operator of the feature, will not add to the overall mitigation credit (e.g., if the existing site has a boat ramp which is made inaccessible due to the project, a new ramp would be required with no additional credit generated). Credit for recreational use will not be provided for habitable structures in the stream or adjacent buffer.

An additional bonus of 10% of generated credits could be available, as determined by either the IRT or PACG-TC (with no more than 5% for each category [recreational use or scientific research], and the total not to exceed the maximum credit). The bonus should be calculated using the baseline credit for the project and applied to the baseline credit. It must be noted that a project which meets all four criteria in Section I (Water Quality; Rare, endangered, or threatened species; Establishment of an appropriate aquatic community; and Anadromous fish) will not receive any additional credit for human values.

The purpose of this provision is to encourage dam removal applicants to provide these additional benefits to the public. These activities offered by the applicant, may offset any negative public perception associated with the dam's removal. The provision of new

recreational opportunities may also help offset any change in existing recreational uses such as traditional hunting or boating. Recreational and/or educational facilities constructed and/or operated with public funds (with the exception of EEP and NCDOT funds) may not be used to generate additional credits.

C. **Demonstrated downstream benefits**: While a reach of river immediately downstream of the dam may exhibit aquatic life and stream bank stability benefits due to the restoration of natural flows, there is the likelihood of temporal adverse impacts to downstream populations and stability. Accordingly, the proposal would need to demonstrate a substantial improvement over baseline conditions in order to receive credit. Credit may be available for this stream reach or a previously bypassed stream reach on a case-by-case basis based on monitoring and evaluation by the appropriate agency review.

III. **Calculation of compensatory mitigation for dam removal.**

A. **Maximum Potential Credit**: The maximum potential credit (in linear feet) that may be generated by a single project will be the sum of the following:

1. Length of stream restored to flowing condition (as modified by any mainstem buffer using Table 1, below), measured from the dam to the upstream edge of the normal pool (as indicated by the elevation of the crest of the dam for run-of-river dams or the spillway, whichever is lower in elevation).

2. Any credit for downstream benefits as discussed in Section II.C. (as modified by any mainstem buffer using Table 1, below).

3. Length of any perennial or intermittent tributaries within the impounded area (as modified by any buffer on each tributary, using Table 1, below).

4. Any credits generated for anadromous fish spawning habitat above impounded reach as determined under paragraph I.D.

Table 1. Adjustment of Maximum Potential Mitigation Credit based on the extent of protected riparian buffers

Percent of stream length Protected	Average Width[1] (feet) of Riparian buffer	Divide linear footage by
100[2] to 75%	50 to 150	0.75
	150 to 300	0.70
74 to 50%	50 to 150	0.85
	150 to 300	0.80
49 to 25%	50 to 150	0.95
	150 to 300	0.90
24 to 0%	50 to 150	1.0
	150 to 300	1.0

[1] A minimum riparian buffer width of 30 feet can be substituted for the 50-foot threshold for projects in the mountains.
[2] Note that to facilitate calculation of riparian buffer credits, the extent of the pre-project perimeter of the impoundment is equivalent to 100% of the buffer.

B. **Baseline Mitigation Credit calculations:** To establish the baseline mitigation credit or credit which is available for the project, the maximum potential credit (as calculated above) will be adjusted based on the number of general criteria met.

If two of the four criteria identified in Section I. A-D are met, then 50% of the maximum credit will be available. If three criteria are met, then 75% of the maximum credit will be available. If all four criteria are met, then 100% of the maximum credit will be available.

C. **Reserve Credit for Human Values.** Credits generated from Human Values (paragraph II.B.) are to be utilized only in the instance where less than 100% of the maximum credit is available (fewer than four criteria are met). Reserve credits will be calculated by multiplying the baseline credit by 5% for each category (recreational use or scientific research, as appropriate), and then added to the baseline credit. In no instance are the total credits

generated by a proposal to exceed the maximum potential credit generated from paragraph III.A.

D. **Calculation of Credit Release for Rare, Endangered, and Threatened Species.** If the project receives credit for this criterion, the release of credits will be calculated as follows.

The credit for rare, endangered, and threatened species is 25% of the maximum potential credit for any project where it meets the criteria. Credits under this category will be further divided into 2 or 3 parts, as appropriate, and released as requirements in Section I.B are met:

7.5% of the maximum potential credit will be released upon restoration of the required physical, chemical or water quantity habitat (this amount is 12.5% in the instance where there are no associate species).

7.5% of the maximum potential credit will be released upon recolonization of species that are often found with the target species.

10% of the maximum potential credit will be released upon documentation of the target species in the restored habitat (this amount is 12.5% in the instance where there are no associate species).

IV. Other factors to consider on a case-by-case basis in the Debit/Credit Process:

A. **Wetlands:** Removal of some dams will result in a net gain of wetland acreage while others will result in a net decrease in wetland acreage. A careful evaluation of the effect that the removal of a dam would have on wetlands should be made. This would involve considering wetland functions, values, and eco-region context, as well as possible restoration of these functions prior to dam removal. Protection of any drained wetland areas through conservation easements would be helpful. Any net increase of wetland acreage may be counted as wetland mitigation credit while any net decrease could result in the need for compensatory mitigation to offset those impacts.

B. **Sediment and Debris Management Plan:** The proponent must submit a Sediment Management Plan addressing how the dam will be removed to minimize downstream sediment impacts. The first part of a Sediment Management Plan will be a tiered contaminant evaluation of the sediments behind the dam. If the sediments are found to contain a high level of contaminants, the dam will not be considered for removal unless the contaminants are adequately addressed.

The dam demolition sequence should be accomplished so the initial diversion of stream flow is into the bed of the new channel, which will reduce bank erosion and repositioning of the new stream channel. Furthermore, aquatic organism spawning and nursery periods should be considered when timing dam removal. The sediment management plan must contain a description of stream profile immediately above and below the dam and describe the nature of sediments that are immediately above and below the dam.

The Sediment Management Plan must describe potential contingency plans for action when turbidity or bed load transport of sediment becomes a problem during demolition of the dam and during the 5-year monitoring period. The plan will contain a provision to monitor newly flowing channels within and above the restored impoundment (if necessary) for headcut formation and bedload. Finally, the plan must include a proposal to minimize the amount of new sediment these headcuts could put into the systems, which may include planting vegetation along the eroding stream banks.

C. **Monitoring:** The purpose of monitoring is to document the projected benefits of the dam removal, identify any problems encountered, and propose solutions. In addition, the results of the plan will justify the amount of credit and the credit release schedule for the project. Monitoring of the biological, chemical, and physical effects of dam removal will be required before, during, and after dam removal. Annual reports to the relevant agencies are also

required. If problems are identified, action plans should be developed, approved by the permitting agencies and implemented to address any problems found during the monitoring period. Monitoring should be conducted for five (5) years after the initiation of dam removal, along with one year of pre-dam removal monitoring. The monitoring should document baseline conditions within the existing impoundment and downstream of the dam within the area considered for compensatory mitigation credit. Dam removal proposals should consider monitoring fish and macrobenthos, habitat, limited water chemistry, flow, and stream bank stability and reestablishment of a stable channel within the former impoundment. Finally, the monitoring plan must document how the project has resulted in an improvement to any of the criteria upon which the project was based. Existing data may be useful in this regard. If monitoring does not support the expected credits based on the success criteria as identified and agreed upon by either the IRT or PACG-TC, then the number of credits should be adjusted, as appropriate.

D. **Remedial action:** If problems are identified before, during or after dam removal, a remedial action plan must be developed which adequately addresses these issues. For instance, if the newly exposed stream banks are experiencing erosion, then a temporary seeding of a non-invasive annual plant may be needed until the native vegetation can stabilize these sites. Similarly, if downcutting occurs in the tributaries to the dam, measures to stabilize these streams may be necessary. Monitoring programs must be designed to identify these (and other) potential problems so they can be addressed adequately. If active measures are needed, then the use of natural channel design is recommended.

E. **Long-term protection of the dam site:** The dam site must be protected with a conservation easement to ensure that construction of a new dam will not occur. The extent of long-term protection of the remainder of the restored

stream corridor will determine, in part, the mitigation credits as outlined in the buffer protection portions of this guidance. In cases where removal of the dam results in the creation of developable floodplain or lakebed, it is desirable that the entire floodplain or lakebed should be restored through traditional restoration measures and preserved through conservation easements, deed restrictions or public ownership to preclude future development of these areas.

F. **Rare, threatened and endangered species:** Dam removal in habitat known to support state or federally listed rare, threatened or endangered species must be coordinated with the appropriate state and Federal agencies to ensure that upstream and downstream habitat is not adversely affected.

G. **Exotic species:** The project area should be thoroughly surveyed to ensure that the dam removal does not facilitate the colonization of exotic flora and fauna to the detriment of upstream or downstream resources.

H. **Downstream flow alteration:** Following the removal of a dam, possible downstream flow alterations should be examined. Possible alterations could include changes in the regulated floodplain, alterations in the downstream channel morphology and low flow implications for wastewater dischargers.

I. **Existing physical constraints:** Existing features such as roads parallel to the channel, utilities or structures need to be considered with respect to the practical amount of buffer that can be restored or protected. If some of these features cannot be moved, then the maximum of possible buffer credit should be adjusted accordingly.

J. **Downstream flooding:** In most situations, it is likely that dam removal will have a negligible effect on downstream flooding. However, if this factor is of concern to the public or the agencies, then modeling may be needed to evaluate this factor.

K. **Water supply protection:** It is unlikely that dams will be approved for removal as compensatory mitigation if they are being actively used as water supplies. In any event, project proponents should check the classification of the water, as well as local water supply plans and water withdrawal registrations maintained by the NC Division of Water Resources, to be certain that it is not being used as a public water supply, industrial water supply, or major irrigation source.

V. Credit Release Schedule

For dam removal projects where credit release schedules are appropriate (i.e., mitigation banks), the agencies propose to follow the agreed upon, joint federal and state credit release schedule for stream mitigation. The above release schedule is to be utilized as a guideline, but can be modified by either the IRT or PACG-TC in the event that monitoring reveals that identified success criteria are being met prior to the outlined release schedule. Credit release for the credits associated with rare, endangered, and threatened species will follow the guidelines provided in Sections I.B. and III.D.

Appendix

Credit Calculation Examples

Example 1

The dam proposed for removal impounds 1,000 linear feet of mainstem, and 500 linear feet of a large tributary. The sponsor proposes that 250 linear feet of the mainstem and the entire impounded length (500 linear feet) of the tributary will be buffered with a 50-foot buffer on each side. There are no credits available for downstream benefits. The IRT or PACG-TC has determined that the project (for mainstem and tributary) meets two criteria from Section I (Water quality and Establishment of an appropriate aquatic community). There are no rare, endangered, or threatened species, and no anadromous fish in the stream. The project proposal includes construction of a boat ramp for Human Values Credit.

Maximum Credit is the sum of 1) Mainstem credit (modified by buffer factor in Table 1) and 2) tributary length (modified by buffer factor).

Maximum Credit = (1,000 ÷ 0.95) + (500 ÷ 0.75)
= 1,720 credits

Baseline Credit (before human values credit) = 1,720 x 0.5
= 860 credits

Human Value Credit = 860 x 0.05
= 43

Total Baseline Credit = 860 + 43
= 903 credits available for the Project

Example 2

The dam proposed for removal impounds 1,000 linear feet of mainstem. The proposal includes no riparian buffer preservation. There are no tributaries proposed for credit. Also, no credits are available for downstream benefits. An endangered mussel species has been documented in the stream reach downstream of the dam and is expected to benefit from the dam removal. Anadromous fish have been documented in concentrated numbers below the dam. The proposal utilizes the pre-determined credit option for anadromous fish. The length above the impoundment to the point where the mainstem drains 75% of the watershed is 3,000 linear feet. The length of mainstem from that point (draining 75% of the watershed) to the point draining 40% of the watershed is 1,000 linear feet. The IRT or PACG-TC have determined that this project meets all four criteria from Section I (Water Quality, Establishment of an appropriate aquatic community, Rare, endangered, or threatened species, and Anadromous fish). Since all four criteria are met, there is no opportunity for Human Values Credit.

Maximum Potential Credit is the sum of Mainstem Credit and Anadromous Fish Credit (Pre-determined Option - Section I.D).

Anadromous Fish Credit = (3,000 ÷ 10) + (1,000 ÷ 15)
= 367

Maximum Potential Credit = 1,000 + 367
= 1,367 credits

Baseline Credit = 1,367 Credits available for the project.

Credit release for the endangered species (which comprises 25% of the baseline credit):

- 7.5% (102.5) of maximum potential credit is available upon restoration of required habitat.
- 7.5% (102.5) of maximum potential credit is available upon documentation of the recolonization of darters or other "associate" species in the restored habitat.
- 10% (136.7) of maximum potential credit is available upon documentation of the target species in the restored habitat.

Example 3

The dam proposed for removal impounds 10,000 linear feet of mainstem. The proposal includes establishment of 50-foot buffers along 2,500 linear feet of the mainstem. There are no tributaries proposed for credit. Also, no credits are available for downstream benefits. Anadromous fish have been documented in concentrated numbers below the dam. The project sponsor proposes to use the research option to determine anadromous fish credits. The IRT or PACG-TC has determined that this project meets three of the four criteria from Section I (Water Quality, Establishment of an appropriate aquatic community, and Anadromous fish). The project sponsor is also proposing to fund scientific research (a doctoral thesis) above and beyond the monitoring requirements for the project.

Five years after the dam has been removed, the project sponsor has met the requirements of I.D. for Anadromous fish credit – Research option, and has documented the capture of 2 anadromous fish at a point on the mainstem, 10 miles (52,800 linear feet) above the upstream edge of the former impoundment.

Maximum Potential Credit is the sum of Mainstem Credit (modified by buffer factor from Table I) and Anadromous Fish Credit (Research Option - Section I.D).

Maximum Credit = (10,000 ÷ 0.95) + (52,800 ÷ 5)
= 10,526.3 + 10,560
= 21,086.3 credits

Baseline Credit (before human values) = 21,086.3 x 0.75
= 15,814.7 credits

Human Values Credit = 15,814.7 x 0.05
= 790.7 credits

Final Baseline Credit = 15,814.7 + 790.7
= 16,605.4 credits available for the project