Appendix 8-F

Rationale for the Guidance on Recommended Ratios for Compensatory Mitigation

8F.1 Introduction and Background on Mitigation Ratios

This appendix provides some background information on ratios for compensatory mitigation (mitigation ratios), and the rationale and assumptions used in establishing ratios based on the Washington State wetland rating systems in Appendices 8-C and 8-D. The reader should become familiar with Appendices 8-C and 8-D before reading the rationale in this appendix.

The acreage of creation, restoration (re-establishment or rehabilitation), and enhancement that is required by regulatory agencies, including local governments, to compensate for impacts to wetlands is usually greater than the acreage of impact. This difference is expressed as a ratio (a mitigation ratio) of the area required for compensation vs. the area of impact. For example, a ratio of 3:1 means that 3 acres of compensatory mitigation are required for every acre of impact to a wetland.

> See Appendices 8-C or 8-D for definitions of creation, re-establishment, rehabilitation, and enhancement as types of compensatory mitigation.

There are two major reasons why the ratios are greater than 1:1. The first is based on the risk of failure of a project designed to compensate for impacts to wetlands (hereafter called *mitigation project*), and the second is based on the loss or reduction of functions during the time it takes a mitigation project to achieve the targeted level of performance for all of its functions (called "temporal loss").

First, all of the studies of compensatory mitigation summarized in Volume 1 (see Chapter 6) indicate that a fairly large percentage of mitigation projects do not successfully replace all the functions lost. The result is an overall net loss of wetlands and their functions. Thus, at a programmatic level, more wetland area should be created or restored than is impacted to ensure that wetland functions and area are adequately replaced.

Secondly, the studies reviewed in Volume 1 also indicate that functions in wetlands may take decades, if not centuries, to develop fully. By requiring a ratio greater than 1:1, the temporal loss of functioning is addressed by providing more acreage of wetland that may not be performing as well as the impacted wetland. The trade-off is that a smaller wetland with a higher level of functioning is replaced with a larger wetland that does not function as well for many years.

Therefore, higher ratios should be set if there is an increasing risk of not adequately compensating for the functions lost, and as the time needed to establish the lost functions increases. If, however, compensatory mitigation is done in advance of impacts and is fully successful, it is reasonable to reduce the ratios to as low as 1:1.

Kusler (2003) has summarized some of the factors that should be considered in evaluating the risks of success or failure of compensatory mitigation and temporal loss and thereby establishing an appropriate mitigation ratio:

1. **The functions present in the impacted wetland and those proposed for the "replacement" wetland.** Larger ratios are justified where a replacement wetland will have fewer functions and values or perform the functions at a lower level. The net loss of function per acre of wetland has to be compensated by increasing the area of compensation required.

2. **The overall ecological conditions of the impacted wetland and the "replacement" wetland.** Larger ratios are justified where a "replacement" wetland will be less persistent, diverse, or has less ecological integrity than the original wetland. The risk of losing "ecological integrity" has to be compensated by increasing the area of mitigation required.

3. **The probable success for wetlands of the type proposed as "replacement."** Larger ratios are justified for wetland types that have proven to be difficult to restore or create, thereby increasing the risk of failure.

4. **The expertise and experience of the agency or consultant proposing to carry out the project.** Larger ratios are justified for proponents who are less expert and less experienced. Lack of experience increases the risk that the project will not be successful.

5. **Threats to the "replacement" site.** Larger ratios are justified where there are threats to the site such as possible changes to the water regime, sedimentation, or pollution. These threats increase the risk that functions will be impaired in the future (See Chapters 3 and 4 in Volume 1).

6. **Whether the site will be susceptible to "mid-course" corrections.** Larger ratios are justified when there is little capability for correcting problems as they develop, and smaller ratios are justified where that capability exists. Projects where problems have been corrected tend to be more successful than those that have not (See Chapter 6 in Volume 1).

The ratios discussed in this appendix were developed to provide a starting point for further discussions with each proponent of compensatory mitigation. The ratios provided as guidance are based on the factors discussed in this appendix including the likelihood of success of compensatory mitigation, the amount of temporal loss, and the risk at a programmatic level. They <u>DO NOT</u> address the specific considerations and risks of any particular individual project.

8F.2 Assumptions Used in Establishing the Recommended Ratios

8F.2.1 Baseline Ratios for Creation and Re-establishment

Creation and re-establishment both lead to the formation of wetlands in areas that are currently not wetlands. As a result, there can be a no net loss of wetland area if the area of compensatory mitigation is at least as large as the area of impact. However, the study by Johnson et al. (2002), summarized in Chapter 6 of Volume 1, found that only about half of the mitigation projects in Washington State that created or re-established wetlands were "moderately successful" or "successful" at replacing the functions lost. This means that overall there is about a 50 percent risk of failure. Other studies of the success of mitigation projects, summarized in Chapter 6 of Volume 1, suggest the risk of failure is even higher. These data suggest that a minimum ratio of 2:1 is needed to ensure no net loss of functions at a programmatic level.

As previously mentioned, this ratio also needs to be adjusted to account for the temporal loss of functions. There are no scientific studies that have quantified the temporal loss in terms of how many acres of additional wetlands are required. Trying to quantify this experimentally is not possible because the data are not compatible; one cannot equate time with area.

As a result, the additional area required to compensate for the temporal loss of functions is a value judgment. *How highly do we value the loss of some functions for 5 to 10 years, some for 30 years, and others for 100 years or more?* As a starting point for discussion, it is suggested that the compensation for the temporal loss of functions be equal to the area of impact**.** Thus, the basic 2:1 ratio proposed to compensate for the risk of failure should be increased to 3:1 to account for the temporal loss of functions**.**

Thus, one-third of the ratio is assigned to the temporal loss of function. In the case of temporal losses of functions due to conversion of vegetation, however, we recommend a ratio for temporal losses of functions that is one-quarter that of creation or re-establishment (e.g., in the construction of pipelines – see section 8C.2.4 or 8D.2.4). The ratios recommended are different because in the case of creation or re-establishment, most of the functions (e.g., improving water quality and hydrologic) will also take some time to develop. In the case of a pipeline construction and conversion of forest to emergent, we do not expect to have a temporal loss of these other functions because the wetland already exists.

The basic 2:1 ratio proposed to compensate for the risk of failure should be increased to 3:1 to account for the temporal loss of functions.

8F.2.2 Baseline Ratios for Rehabilitation and Enhancement

Rehabilitation and enhancement of existing wetlands (see Appendices 8-C or 8-D for definitions) are also used in compensatory mitigation. Rehabilitation and enhancement activities are conducted on an existing wetland, therefore if either of these types is used as the only form of compensation, there will always be a net loss of wetland area. Thus the ratios for these two types of compensatory mitigation will need to be higher than for creation or re-establishment since a net loss of wetland area will result.

Furthermore, the information on the risks associated with enhancement indicates this type of compensatory mitigation has even a lower rate of success than creation or re-establishment. Only about 10% of the enhancement projects analyzed in Washington State were even moderately successful at replacing the functions lost (Johnson et al. 2002). No data were available on the success of rehabilitation.

The recommended ratio for using rehabilitation as compensation is two times that for using re-establishment or creation based on the need to compensate for the loss of wetland area. Thus, two acres of rehabilitation are equivalent to one acre of re-establishment or creation in determining the acreage needed to replace an impacted wetland.

The recommended ratio for using enhancement alone as compensation is four times that for using re-establishment or creation based on the need to compensate for the loss of wetland area and the fact that enhancement tends to be even less effective at replacing the functions lost. This means that four acres of enhancement are equivalent to one acre of re-establishment or creation in determining the acreage needed to replace an impacted wetland.

The ratio for rehabilitation is less than that for enhancement alone because the former often focuses on restoring environmental or hydrologic processes that have been disturbed or altered by previous or ongoing human activity. These actions are more likely to replace a full suite of wetland functions than enhancement. Enhancement typically involves actions that provide gains in only one or a few functions and can lead to a decline in other functions.

The recommended ratios for rehabilitation or enhancement are based on a multiplication factor that is applied to the ratio for creation or re-establishment (2x for rehabilitation and 4x for enhancement). This applies to all the different ratios for creation and rehabilitation recommended in Tables 8C-9 and 8D-9.

8F.2.3 Adapting the Ratios Based on the Wetland Functions

The baseline ratios for each type of compensatory mitigation described above can be applied to or modified based on the four categories in the rating systems for Washington State (Hruby 2004 a,b). It is assumed, first, that the basic ratios described above apply to mitigation projects where the proposed compensatory mitigation site is the same category as the affected wetland (e.g., impacts to a wetland rated Category II for its functions are compensated by creating, re-establishing, rehabilitating or enhancing a wetland that will become a Category II wetland based on its score for functions). Second, it is assumed that the hydrogeomorphic (HGM) class or subclass of the wetland proposed as compensation is the same as the category and class or subclass of the wetland being altered (e.g., impacts to a Category II riverine wetland are compensated by a Category II riverine, wetland). This is considered to be the *average condition*.

The studies of compensatory mitigation by Johnson et al. (2002) found that the highest rating that could usually be expected in a compensatory project was a Category II when the wetland was rated based on its functions, and this category was chosen as the average from which to develop the ratios for other categories.

The basic ratios may be modified if the conditions for the proposed mitigation project are different from the average condition. For example, the ratios recommended for compensating impacts to Category III wetlands (based on the score for functions) in Tables 8C-9 and 8D-9 are lower (2:1 instead of 3:1). The ratios are lower because it is assumed that the risks are lower with mitigating impacts to a Category III wetland. First, it is assumed that there is a better chance for a successful creation or re-establishment of a Category III wetland than a Category II wetland because the wetland does not have to function at the same level. Second, Category III wetlands usually have simpler structure, and it may take less time to establish the required level of functions (i.e., temporal losses of functions are reduced). The ratios for rehabilitation and enhancement only are also lower because they are based on the lower ratio for creation and re-establishment. At present, however, these are assumptions that need to be validated by more thorough monitoring.

The recommended ratio to compensate for impacts to Category IV wetlands is even lower (1.5:1 rather than 3:1) because it is assumed that the risks and temporal losses are less than with creation or restoration of a Category III wetland.

On the other hand, the ratio for impacts to a Category I wetland are higher (4:1 rather than 3:1) for the opposite reasons. First, it is assumed that there is a reduced chance for successful creation or restoration of a Category I wetland than a Category II wetland because the wetland has to function at the highest levels. The data from existing studies (see Chapter 6 in Volume 1) indicates that creation or re-establishment to these levels rarely, if ever, happens. Second, Category I wetlands usually have a more complex structure, and it may take more time to establish these structures and the resulting functions (i.e., temporal losses are increased).

8F.2.4 Adapting the Ratios Based on Special Characteristics Defined in the Rating System

8F.2.4.1 Ratios for Category I Forested Wetlands

Studies of mitigation projects (see Chapter 6 in Volume 1) have shown that forested wetlands may take over 100 years to become established (the studies didn't specifically state if the forests were mature or old-growth). The recommended ratio (6:1) is designed to compensate for the additional temporal loss of the functions of a Category I mature or old-growth forested wetland during the long time it takes to establish this type of wetland.

8F.2.4.2 Ratios for Wetlands that are Difficult to Create (Natural Heritage, Bogs, Alkali Wetlands, Estuarine Wetlands, Wetlands in Coastal Lagoons)

No data are available for mitigation projects that involved creating Natural Heritage wetlands, alkali wetlands, estuarine wetlands, or wetlands in coastal lagoons from uplands. Bogs are the only type of wetland for which studies on compensation through creation have been attempted. This information indicates that it is not possible to re-create the necessary physical, hydrologic, and chemical conditions needed to replace a bog through compensatory mitigation (see Chapter 6 in Volume 1).

Until more data are available, the authors of Volume 2 assume that, in addition to bogs, it is not possible to create Natural Heritage wetlands, alkali wetlands, estuarine wetlands, or wetlands in coastal lagoons from uplands or to enhance wetlands of other types to reproduce their special characteristics and functions. We do not fully understand the hydrologic and biological conditions that lead to the formation of these wetlands, so we cannot assume that it is possible to create them without this understanding.

As a result, the authors of Volume 2 recommend that compensation for impacts to these types of wetlands should involve the rehabilitation of degraded wetlands of a similar type, rather than creation or enhancement. Rehabilitation has proven to be successful for estuarine wetlands (Simenstad and Thom 1992), and it is assumed that rehabilitation of the other types is also feasible. It is more feasible, at least, than attempting to create these wetlands or enhance a wetland of another type in order to try to recreate the necessary ecological conditions.

In the absence of any definitive information on the success of such rehabilitation, the recommended ratio for rehabilitation is 6:1 to be consistent with the other ratios. Mitigation projects that propose enhancement as compensation for impacts to these wetlands will have to be evaluated on a case-by-case basis. Enhancement would involve a net loss of acreage as well as an extremely high risk that the functions represented by these wetland types will not be replaced.

References

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