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Hanford Site Biological Resources Mitigation Strategy

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United States
Department of Energy
Richland, Washington

Executive Summary

S.1 Overview

This document is intended to describe the recommended process that should be followed to ensure that Hanford Site missions are accomplished without significant impacts to important biological resources. Mitigation may entail both the prevention of adverse impacts and the replacement of resources if impact prevention is not practical. However, the highest priority for mitigation should always be prevention of adverse impacts, and all avenues for prevention should be explored before resource replacement is considered. This policy will ultimately be best for the resources of concern and will least affect project budgets and schedules.

Mitigation is a series of prioritized actions that reduce or eliminate adverse impacts to biological resources. The hierarchy for these actions is to: 1) avoid the impact, 2) minimize the impact, 3) rectify impacts onsite, and 4) compensate for the impact away from the site. This hierarchy can be applied to all species and habitats of concern. Avoidance and minimization are considered impact prevention, while rectification and compensation are considered resource replacement.

Specific resources that will be subject to mitigation of adverse impacts are defined in the *Biological Resources Management Plan (BRMaP) for the Hanford Site* (DOE 2001a). The mitigation strategy described here applies only to mitigable resources as defined in BRMaP, not to all species and/or habitats on the Hanford Site. In general, mitigable resources include plant and animal species of concern (state or federal endangered, threatened, candidate, or sensitive species), habitats for these species, rare or unusual plant assemblages as defined in the *Washington Natural Heritage Plan* (WDNR 1995), habitats with high native plant or animal diversity, habitats lacking significant anthropogenic disturbance, and habitats specifically protected under state or federal regulations, such as jurisdictional wetlands.

The emphasis on biological resource values implied in this document is not meant to override other important considerations such as human health, worker safety, or even budget concerns. Biological resource values should be evaluated in tandem with these other considerations. Except in unusual or emergency situations, these considerations are not mutually exclusive.

S.2 Purpose

The *Biological Resources Mitigation Strategy* (BRMiS), as part of a broader biological resource policy, is designed to aid the U.S. Department of Energy, Richland Operations Office (DOE-RL) in balancing its primary missions of waste cleanup, technology development, and economic diversification with its stewardship responsibilities for the biological resources it administers. This strategy will be applied to all DOE-RL programs as well as all contractor and sub-contractor activities.

This BRMiS will fulfill the following needs:

- ensure consistent and effective implementation of mitigation recommendations and requirements.
- ensure mitigation measures for biological resources meet the responsibilities of DOE-RL under both the National Environmental Policy Administration (NEPA) and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA).

- enable Hanford Site development and cleanup projects to anticipate and plan for mitigation needs via early identification of mitigation requirements.
- provide guidance to Hanford personnel in implementing mitigation in a cost-effective and timely manner.
- preserve and protect Hanford's highly valued biological resources while facilitating balanced development and site cleanup activities.

The BRMiS provides guidance on accounting for habitat protection or improvement as part of the project planning process. This strategy also provides guidance and a reference for the preparation of project-specific Mitigation Action Plans (MAPs) under NEPA implementation procedures (10 CFR 1021). Although this strategy is neither intended to replace or define the specific contents of future MAPs—nor to provide specific procedures to conduct habitat improvements or protection for specific projects—it will aid and simplify the preparation of future MAPs.

S.3 Implementation

The mitigation strategy described in this document is based on the following three principles:

1. A project should begin mitigation with avoidance of deleterious impacts to valued biological resources and move to the next action level only if all reasonable options for the previous level are exhausted.
2. If, early in a project's life, careful consideration is given to avoiding and minimizing adverse impacts before they occur, the need for more expensive forms of mitigation (rectification and compensation) can be greatly reduced or eliminated. This will save time, money, and is most beneficial to resources of concern.
3. When residual adverse impacts to resources of concern remain after avoidance, minimization, and onsite rectification, compensatory mitigation should be performed, preferably as part of a centralized mitigation bank.

Avoidance and minimization of adverse impacts are normally accomplished during the impact management portion of the ecological compliance review process. This is a process by which potential adverse project impacts are identified, and means to alleviate those impacts are devised and incorporated into the project plans. This process is described in detail in the *Ecological Compliance Assessment Management Plan* (ECAMP) (DOE 1995a).

The BRMiS provides the framework for compensatory mitigation via rectification and while stressing the overriding importance of initial avoidance and minimization of adverse impacts. Mitigation requirements should be determined on the basis of impacts to specific resources or habitats, and not on a strict land area basis. This policy is intended to encourage projects to locate in areas of low existing habitat value because mitigation actions, if any, required for such areas will be considerably less than those associated with high-quality habitat areas.

Quantification of habitat value should be based on the habitat evaluation procedures developed by the U.S. Fish and Wildlife Service (USFWS). These procedures also should be used to determine mitigation threshold levels, below which compensatory mitigation would not be required.

Projects required to perform compensatory mitigation should consider participation in a centralized compensatory mitigation system or bank. Mitigation banking is the establishment of habitat for managed resources (or establishment of the resources themselves) in areas other than at the impact site to compensate for unavoidable habitat value losses that result from project development.

In a true mitigation bank, the resource establishment is performed in anticipation of future resource losses. In a pseudo-bank, the resources are established as the impacts occur. Use of a centralized bank (either a true- or pseudo-bank) for compensatory mitigation will simplify the compensation process for all projects because the goals, methodologies, and locations for compensatory mitigation will be pre-defined.

A project will not be required to design and engineer its own compensatory mitigation actions, but would simply pay into the established system or bank. A bank will enable the mitigation requirements for numerous projects to be coordinated and conducted in a manner that will result in the greatest overall improvement in habitat value while reducing collective project costs because of the economy of scale.

Projects are allowed to pay into the bank at any time, but the preferred method of bank operation

is to have habitat improvements under way before use of the credits. This will help ensure that levels of the affected biological resources do not decline between the time of project impact and the time when suitable improved habitat is available to support the resources. Project budgets should be developed to allow credits to be purchased early in the life of project. Mitigation bank credits and debits will be calculated on the basis of habitat value.

S.4 Roles and Responsibilities

The Assistant Manager for Infrastructure and Closure (AMC) through the Closure Division (CLO) will be the focal point for the development and coordination of site- and program-wide biological resources mitigation policies and guidance. Specific CLO responsibilities include the following:

- ecological assessments and impact management, including development of avoidance and minimization recommendations for project impacts
- mitigation reporting and monitoring of mitigation areas or banks, including (when applicable) the development of an accounting system for both bank credits (resulting from habitat improvement actions) and bank debits (resulting from adverse impacts to biological resources that require compensatory mitigation)
- development of models needed to quantify habitat value losses due to project impacts and habitat value gains resulting from improvement actions
- identification of areas that are ecologically sensitive or possess unique habitat characteristics, designation of them as such in land use plans and maps, and assurance that this factor is included in siting decisions
- identification and evaluation of specific areas to be used for a mitigation bank or for compensatory mitigation areas

Early in the project planning process, all Offices within DOE-RL will:

- identify biological resource issues
- identify to CLO adverse impacts to mitigable resources that may result from program activities
- incorporate recommendations for the avoidance and minimization of adverse impacts to biological resources when practicable, and perform rectification or compensatory mitigation for unavoidable impacts
- budget for mitigation requirements.

The Pacific Northwest National Laboratory (PNNL) performs ecological compliance reviews, except for some assessments performed by the Environmental Restoration Contractor (ERC)/River Corridor Contractor (RCC). Environmental compliance reviews will document the presence of any species or habitats of concern at a site and will provide avoidance and minimization recommendations (when applicable).

The PNNL, in coordination with other site contractors, will develop models to determine habitat replacement ratios and mitigation threshold levels and quantify mitigation requirements and success. PNNL also will assist DOE-RL in monitoring mitigation areas and preparing annual reports concerning mitigation, as requested.

The other principal Hanford contractors will be responsible for implementing habitat improvements within mitigation areas or banks and for the continued operation and maintenance of mitigation areas or banks, or portions thereof, that are attributable to their activities.

S.5 Mitigation Interim Guidance

Complete implementation of the strategy described in this document will require developing habitat evaluation models specific to Hanford. These models are not complete, and therefore, cannot be used to determine the quantity of habitat value lost as a result of Hanford activities, the quantity of habitat value gained through replacement or improvement, or mitigation threshold levels. If Hanford Site operations are to meet the intent, if not the letter, of this strategy, specific guidance applicable to normal Site activities is required. Thus, until Site-specific habitat evaluation models are available, the principles outlined in the box on the next page will guide mitigation on the Hanford Site.

Substitution of actions with equivalent benefits for any of the basic replacement unit requirements will be developed and/or considered on a case-by-case basis.

Interim Mitigation Guidance

- Prevention of adverse impacts to mitigable resources is considered a best management practice in project planning and siting. All projects will consider (and adopt when practical) means to avoid and/or minimize impacts.
- All projects should request an assessment of potential impacts to mitigable resources as early as possible in the planning process. This will allow for project modifications that prevent adverse impacts to be incorporated during preliminary instead of final design, and if habitat replacement is still needed, appropriate plans can be developed.
- In those cases when replacement mitigation is appropriate, the habitat improvements for all such projects will be coordinated, at least to the level of one or more common mitigation areas. If the habitat replacement for several projects can be grouped and performed under a single sub-contract, that level of coordination should be pursued.
- Mitigation Thresholds (applicable to the area of mitigable habitat, not to the entire impact area):
  - Replacement mitigation is not required within the 300 Area (fenced areas), 400 Area, and the perimeter roads of the 100 Areas. Replacement mitigation is not required within much of the 200 Areas.
  - In the northeast corner of 200-West Area and the southern portion of the 200-East Area (see Figure 7) the mitigation threshold will be 5 ha (12 acres) of mitigable habitat. In these areas, no distinction is made between rectification and compensatory mitigation, and replacement will be at a ratio of 1:1 (see below).
  - In the 200 Areas corridor (Figure 7) the mitigation threshold will be 1 ha (2.5 acres) of mitigable habitat.
  - In all other portions of the Hanford Site (the 600 Area) the mitigation threshold will be 0.5 ha (1.25 acre) of mitigable habitat. Specific areas where this threshold may apply are shown in Appendix D of BRMaP.
- Disturbances smaller than the applicable threshold will not require replacement mitigation.
- Replacement Ratios
  - Rare plants—1:1 based on individuals
  - Wetlands and riparian—2:1 based on area
  - Upland late-successional shrub-steppe—1:1 for rectification; 3:1 for compensatory mitigation based on area.
- Compensatory mitigation occurs away from the site of disturbance. Rectification (when possible) occurs at the site of disturbance within two planting seasons of the initial impact; if the impact cannot be rectified within two planting seasons, then compensatory mitigation (at 3:1) will be required.
- Replacement Units for late-successional shrub-steppe will consist of 20 transplanted large shrubs/ha (8/acre), 1000 seedlings/ha (400/acre), and a native perennial grass understory.
  - Rectification at a replacement ratio of 1:1 will require one Replacement Unit per hectare of mitigable habitat disturbed; compensatory mitigation at a replacement ratio of 3:1 will require three Replacement Units per hectare of mitigable habitat disturbed
  - Appropriate replacement units for other mitigable habitats will be developed as needed.
- Alternatives to any of the interim requirements may be developed on a case-by-case basis, as long as the functional aspects of the requirements are met.

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1.0

Purpose and Scope of the Mitigation Strategy

1.1 Overview of the Hanford Site Biological Resources Mitigation Strategy

The mission of the Department of Energy (DOE) on the Hanford Site is to: 1) clean up the Hanford Site following the Site's earlier mission of weapons material production and energy development, 2) provide scientific and technical excellence to meet global needs, and 3) partner in the economic diversification of the region. While pursuing this mission, DOE is obligated to appropriately manage the natural resources under its stewardship.

To facilitate a balance between mission elements and stewardship obligations, this *Biological Resources Mitigation Strategy* (BRMiS), as one component of an overall policy described in the *Hanford Site Biological Resources Management Plan* (BRMaP) (DOE 2001a), will:

- ensure consistent and effective implementation of mitigation recommendations and requirements
- ensure that mitigation measures for biological resources meet the responsibilities of DOE under both the National Environmental Policy Act (NEPA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- enable Hanford Site development and cleanup projects to anticipate and plan for mitigation needs via early identification of mitigation requirements
- provide guidance for implementing cost-effective and timely mitigation
- preserve Hanford's biological resources while facilitating balanced development and cleanup activities.

Mitigation is a series of prioritized actions that reduce or eliminate adverse impacts to biological resources. These actions include avoidance, minimization, onsite rectification, and compensatory mitigation. The basis of this strategy is that a project should begin mitigation at the avoidance level of the hierarchy, and only move to the next level if all reasonable options at the previous level are exhausted.

Mitigation actions that rely on improving habitat (rectification and compensatory mitigation) are the main subject of BRMiS. Habitat improvement may be necessary for projects that eliminate or degrade habitat. However, mitigation actions based on avoidance or minimization of adverse impacts (such as changes to project timing or location) are the most important components of the mitigation strategy. These mitigation actions are more fully addressed in the *Ecological Compliance Assessment Management Plan* (ECAMP) (DOE 1995a). Mitigation of impacts to species listed under the Endangered Species Act (ESA) will be determined under the consultation requirements in Section 7 of the ESA.

The BRMiS provides guidance on accounting for habitat protection or improvement as part of the project planning process. This strategy also provides guidance and a reference for the preparation of project-specific mitigation action plans (MAPs) under the DOE National Environmental Policy Act (NEPA) implementation procedures (10 CFR 1021). Although this strategy is not intended to replace or define the specific contents of future

MAPs, it will aid and simplify their preparation. Section 9 of this document provides a brief overview of suggested contents for project-specific MAPs. Additionally, BRMiS is not intended to provide specific procedures to conduct habitat improvement or protection measures for specific projects.

Finally, BRMiS's and BRMaP's emphasis on biological resource values is not meant to override other considerations such as human health, worker safety, or budget concerns. Biological resource values should be evaluated in tandem with these considerations, and except in unusual or emergency situations, these considerations will not be mutually exclusive.

1.2 Relationship of BRMiS to Other Resource Management Documents

The BRMiS is one of several documents that describe how biological and other resources will be monitored and managed on the Hanford Site. Figure 1 provides an overview of these documents and how they relate to each other and various projects and programs. Subsequent sections describe each related document in more detail.

1.2.1 Biological Resources Management Plan

The BRMaP (DOE 2001a) is the umbrella document for biological resource management issues for the Hanford Site. This plan describes the biological resources on the Hanford Site and their regional context; defines what resources need monitoring, protection, impact assessment, and mitigation; prescribes resource management goals and objectives; identifies areas on the Hanford Site that contain habitats or species of concern; and implements an ecosystem management approach to biological resource management on the Hanford Site. The BRMaP is prepared and updated in coordination with the *Hanford Site Comprehensive Land-Use Plan Environmental Impact Statement* (HCP-EIS) (DOE 1999), and other site-wide guidance.

The BRMiS and the ECAMP are second-tier documents under BRMaP. The BRMaP defines which biological resources will be assessed under ECAMP and which resources require mitigation under BRMiS.

1.2.2 Ecological Compliance Assessment Management Plan

The ECAMP (DOE 1995a) describes the process through which project impacts to biological resources are assessed and evaluated via the ecological compliance review process detailed in ECAMP. For most projects, this normally will be the first, and usually the only, interaction with DOE's biological resource management policies. During the ecological compliance review, the site of a proposed project is inspected and evaluated for potential impacts to biological resources. The results of the evaluation, including mitigation recommendations, if any, are reported back to the project to support the project NEPA documentation.

Specific resources considered during the review are those BRMaP determines to be in need of impact assessment. Impact management also is described in ECAMP. This is an interactive process between project and ecological compliance assessment staff. Impact management identifies means by which the project can be temporally, spatially, or structurally altered to avoid and/or minimize adverse impacts to resources of concern. This accomplishes the first two stages of mitigation (see Section 1.3), and in many cases, will eliminate or greatly reduce the need for rectification or compensatory mitigation, thereby reducing mitigation costs.

Because of both the field assessments and the impact management components of ECAMP, it is an integral part of the Hanford Site mitigation strategy. In most cases, it is expected that projects will be able to assess and complete their mitigation requirements within the scope of ECAMP without using the additional mitigation strategy components described in the BRMiS.

1.2.3 Other Site-Wide Guidance

Other site-wide management plans and documents have direct bearing on biological resource management on the Hanford Site. For example, the HCP-EIS (DOE 1999) provides guidance for Hanford Site land-use planning within an ecosystem management and sustainable development framework. This includes analyses of land area needs for various programs such as waste management and environmental restoration, and

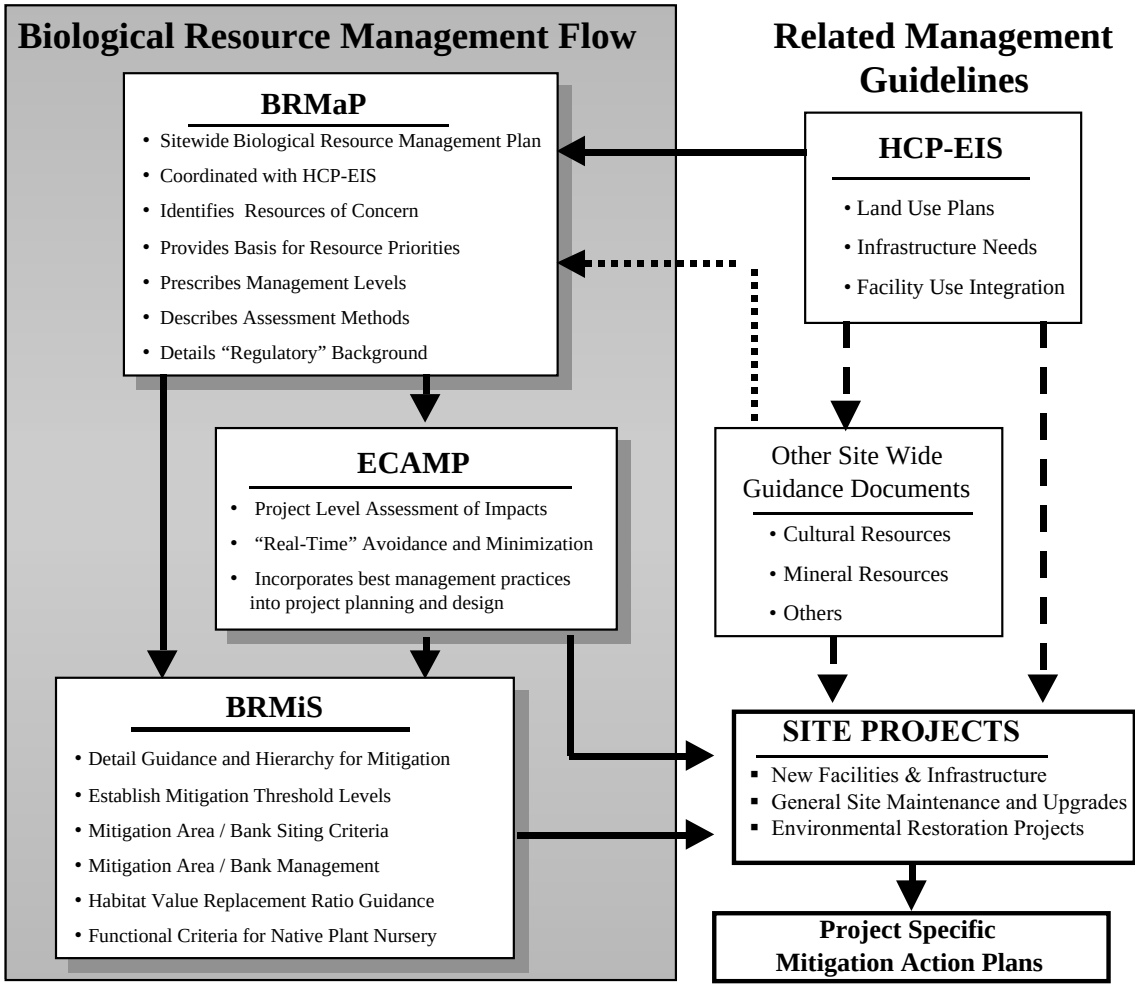

Figure 1. Integration of Mitigation Strategy with Other Resource and Management Plans (HCP = Hanford Site Comprehensive Land Use Plan; EIS = environmental impact statement)

general designations of areas considered sensitive on the basis of ecological, cultural, and historical criteria. Coordination between BRMaP and the HCP is essential for proper identification of biologically sensitive areas, siting mitigation areas, and to aid in siting new facilities to minimize impacts to sensitive and/or mitigable resources.

The *Draft Hanford Cultural Resources Management Plan* (DOE 2001b) affects the siting of facilities and mitigation areas. Cultural values are considered in BRMaP in designating sensitive biological resources, such as plants considered sacred by local tribes, and for siting mitigation areas. Cultural resource reviews are performed concurrently with the ecological compliance reviews, and project planning data are shared by the cultural and ecological review teams.

1.3 Mitigation Order of Priorities

Mitigation of project impacts can range from alterations of timing or location that allow for avoidance of impacts to a more complex and costly approach of replacing project-induced habitat loss with newly created habitat away from the project site. Table 1 shows the order of preference for mitigation.

Onsite protection of quality habitat areas can also be a form of compensatory mitigation. Habitat protection as mitigation is applicable if the area to be set aside is demonstrably threatened with destruction (USFWS Mitigation Policy 46 FR 7644 - 7663). This may be difficult to demonstrate on the Hanford Site. Set aside or protection as mitigation can work well for other agencies, such as the U.S. Forest Service, which can cancel one action, such

Table 1. Types of Mitigation for Biological Resource Impacts

Mitigation	Utilization Preference	Description of Mitigation Means	Example
Avoidance	1st	Eliminate all or part of a project or alter the timing, location, or implementation to **avoid** injury to biological resources of concern	Relocate a proposed excavation from an area with protected plant species to an area without resources of concern
Minimization	2nd	Alter proposed project (timing, location, or implementation) to **minimize** injury to biological resources of concern	Perform habit removal at a time when the nesting activities of migratory birds will not be disturbed
Rectification	3rd	Replace the biological resources on the site to be disturbed	Return pre-existing plant community to excavation site
Compensation	4th	Replace project-induced biological resource losses away from the site to be disturbed	Replant mature sagebrush in a degraded area on Hanford

as a timber sale, as mitigation for other types of impacts such as construction of roads or campgrounds.

Another form of mitigation listed by the Council on Environmental Quality (CEQ) and in the USFWS mitigation guidelines is to "reduce or eliminate the impact over time." The CEQ does not clearly define this form of mitigation, and as defined in the USFWS guidelines, it resembles the monitoring requirements described in later sections of BRMiS. Another interpretation is that the mitigation action is the monitoring of the natural recovery after an impact and taking needed measures to prevent further impacts. This essentially is the mode of mitigation for small projects that (after avoidance and minimization) impact an area of mitigable habitat below the mitigation threshold levels described in Sections 4.3 and 4.4.

1.4 Hanford Site Mitigation Process

The mitigation process on the Hanford Site includes several steps and decision points. Figure 2 diagrams the overall process. Most projects will require only the first three steps (i.e., ecological compliance review through minimization). Larger projects, or those that must be located in more ecologically significant areas, may more appropriately use the latter steps of the mitigation process.

The mitigation process starts with the determination of need for an ecological compliance review as outlined in ECAMP. In general, projects that require an ecological compliance review are those that are conducted outdoors (or inside of abandoned buildings), especially those that also require an excavation permit. This encompasses a wide range of projects—from maintenance work on the outside of buildings to large-scale land development for new facilities.

Historically, the majority of Hanford Site projects have had no adverse impacts on any biological resources of concern. Thus, many projects have proceeded after the ecological compliance review without additional mitigative actions. Of those remaining, most projects proceeded with only minor adjustments, such as moving the site a short distance or performing the action during a time that would not impact nesting of migratory birds. These avoidance and/or minimization forms of mitigation are covered under ECAMP as a portion of the overall site-wide mitigation strategy.

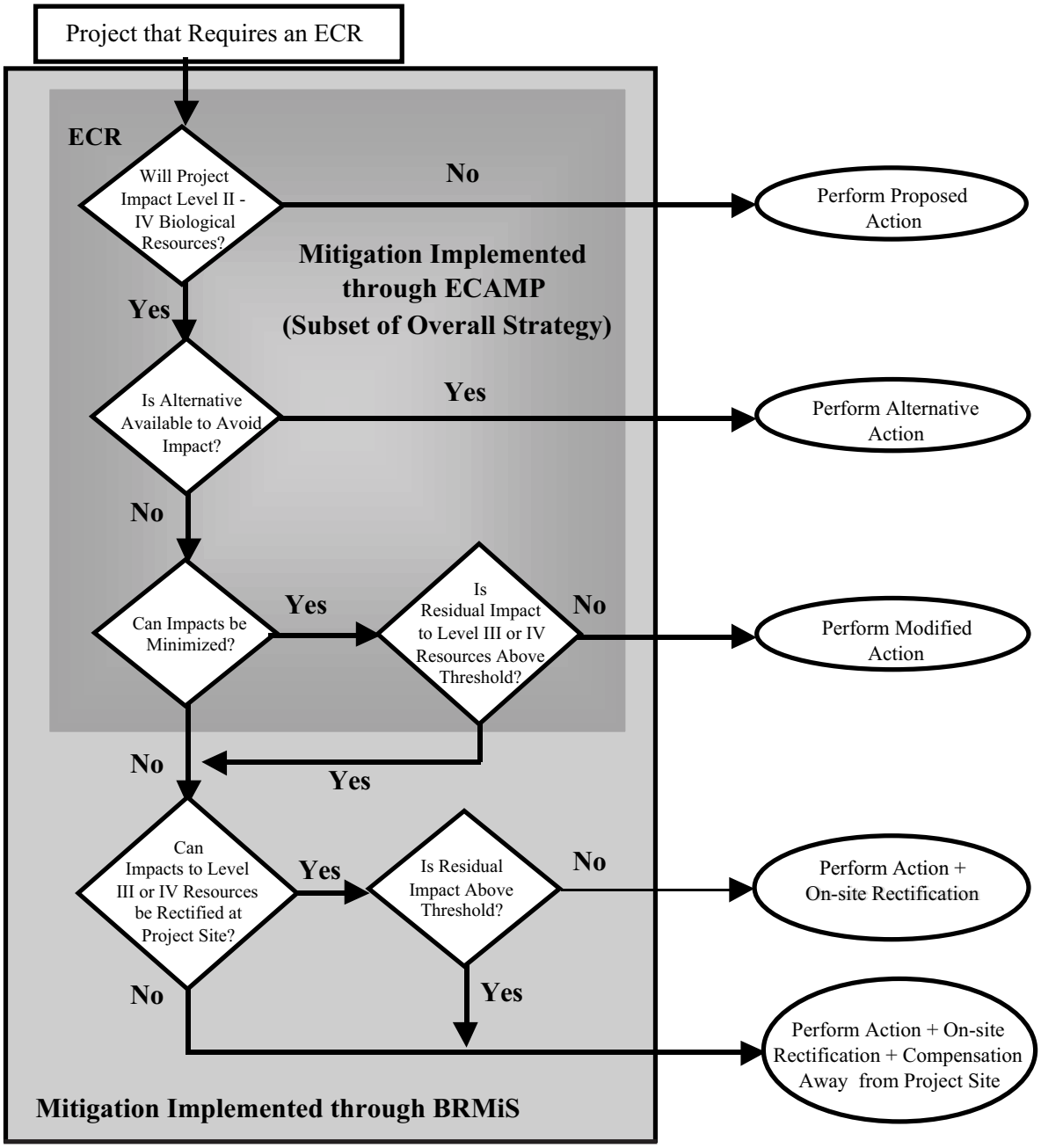

Figure 2. Mitigation Decision Tree and Relationship of Plans

The last stages of rectification and compensatory mitigation are the focus of this document. If significant impacts remain after avoidance and minimization, then the rectification or compensation required of a project will be determined using procedures described in Section 4.

Some projects may require onsite rectification. Rectification may include actions ranging from the replacement of lost resources to preventing habitat degradation, such as erosion prevention or the control of invasive weeds subsequent to land disturbance.

Compensatory mitigation may be needed if a significant impact remains after onsite rectification. For example, an area covered by a new facility that cannot be rectified onsite may need compensatory mitigation to mitigate for habitat loss. The long-term goal of this mitigation strategy is that most compensatory mitigation will be accomplished via participation in a mitigation bank (see Section 5).

1.5 Mitigation Versus Restoration

Confusion can arise when terms or concepts, such as mitigation and restoration, are used interchangeably, especially when some field activities associated with each may be similar (such as revegetating with native plants). For BRMiS, "mitigation" and "restoration" are considered unrelated activities, and neither is equivalent to "remediation."

Remediation, as defined here, is the act or process of removing or neutralizing contamination within the soil, groundwater, or other environmental media.

Mitigation, as defined in this document, is the process of either preventing impacts to mitigable resources (through avoidance and minimization) or replacing lost resources (via rectification or compensatory mitigation) if impact prevention is not practicable.

Therefore, mitigation applies only to the disturbance and/or loss of presently existing mitigable resources that result from a project or action. Remediation of a past practice waste site does not necessarily imply a need for mitigation, unless there is a loss of an existing mitigable resource as a result of the remediation action. Defined as such, mitigation does not apply to resource loss-of-use that may have resulted from the past mission and waste management practices at the Hanford Site. Resource loss-of-use issues associated with past waste sites should be resolved through the CERCLA defined procedures, including coordination with the respective Natural Resource Trustees.

Restoration, as defined here, is the process of creating habitat value at a past practice waste site and is usually the final step in the remediation process. The created habitat may or may not resemble the habitat present before construction of the waste site. The type of habitat created will depend on site-specific objectives and on future land-use considerations as developed by DOE, regulators, resource trustees, and other stakeholders. This mitigation strategy is not intended to define or provide guidance for these land-use considerations.

Figure 3 illustrates one example of the differences between restoration and mitigation. This figure shows the portion of the area affected by a remediation action that potentially would require mitigation and the portion that would fall under restoration. The only portion that would be considered for mitigation is the area containing mitigable habitat.

In this hypothetical example, the required mitigation may include onsite rectification, such as replacing shrubs, grasses, and forbs. The remaining portion of the affected area may require restoration (perhaps by planting native grasses), but not mitigation. In this example, mitigation via rectification would be more expensive than restoration because of the need to replace shrubs. Those costs could be greatly reduced or eliminated if the remedial action could be redesigned to minimize impact to the mitigable habitat.

As with any project or action on the Hanford Site, waste site remediation projects will be required to follow the mitigation process and hierarchy outlined in Section 1.3. These projects should be engineered to avoid and/or minimize impacts to existing mitigable resources, and they will be expected to rectify or compensate for any losses that are unavoidable.

Figure 4 depicts the mitigation process as it specifically relates to remediation projects. The ecological compliance review for remediation projects can be performed as part of the remedial investigation/feasibility study or remedial design phases. Performance of the ecological compliance review relatively early in the remedial design will allow the project to be designed to have minimal impacts on extant mitigable resources, and therefore, will reduce or eliminate the need for further mitigation. Support activities such as the construction of monitoring wells or test pits may require separate ecological compliance reviews.

1.6 Biological Resources Covered Under BRMiS

Specific biological resources that will require impact assessment, monitoring, and mitigation are defined in BRMaP (DOE 2001a). Mitigable resources include plant and animal species of concern (state or federal endangered, threatened, candidate, or sensitive species), habitats for these species, rare or unusual plant assemblages as defined in the *Washington Natural Heritage Plan* (WDNR 1995), habitats with high native plant or animal diversity, habitats lacking significant anthropogenic disturbance, and habitats specifically protected under state or federal regulations, such as jurisdictional wetlands.

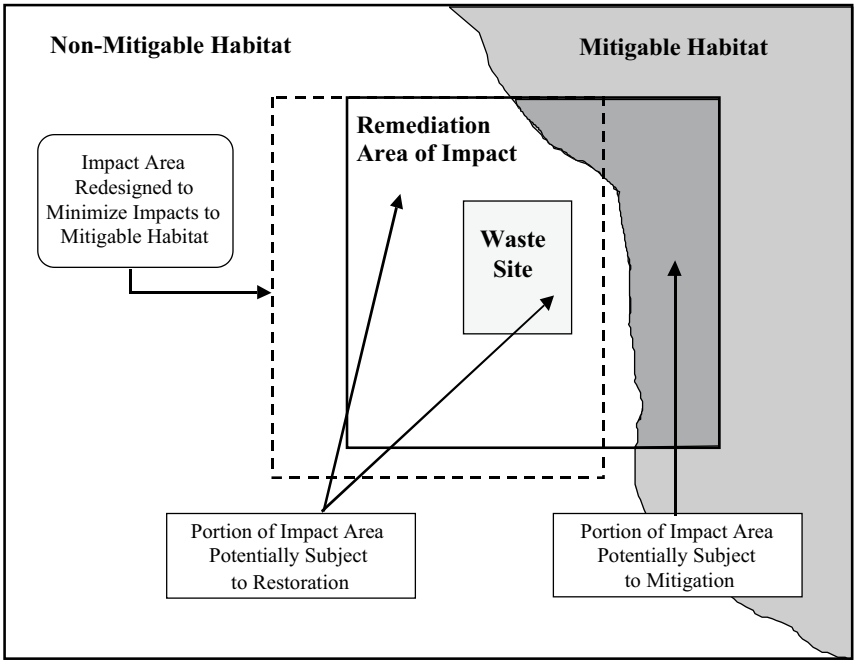

Figure 3. Example of Restoration and Mitigation as Applied to a Remediation Project

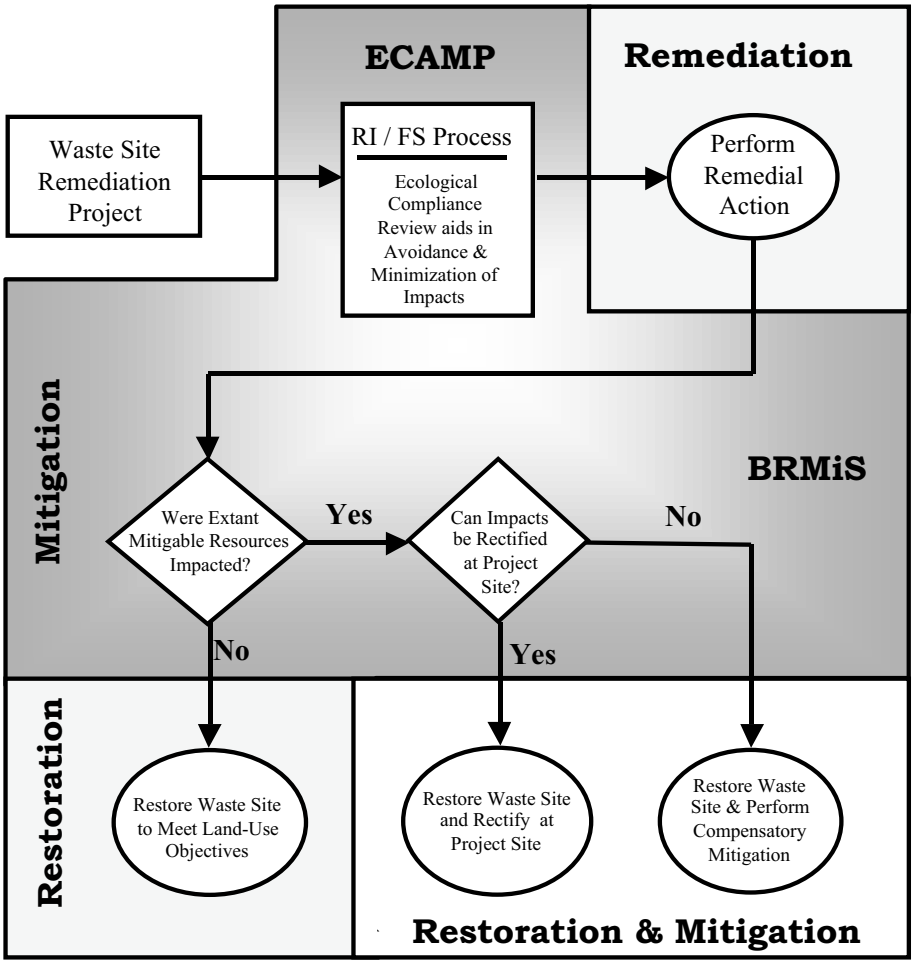

Figure 4. Waste Site Remediation Decision Tree for Mitigation (RI/FS = remedial investigation feasibility study)

2.0

Requirements for Mitigation

Table 2 summarizes acts, regulations, and Executive Orders that pertain to resource management and mitigation on the Hanford Site. Some of these provide fairly explicit guidelines for when and how mitigation is to be implemented (for instance the requirement for a MAP as part of an Environmental Impact Statement [EIS] Record of Decision [ROD] under NEPA) while others (such as the Federal Land Policy and Management Act) provide a framework for the DOE's stewardship responsibilities. Other acts and regulations that may affect specific types of activities on the Hanford Site are listed in Table 3. Published policies and guidelines of state and federal resource management agencies, which form the basis for much of BRMiS, are summarized in Table 4.

Table 2. Acts, Regulations, and Executive Orders Pertaining to Mitigation

Driver	Relation to Mitigation and Resource Management
National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et seq., CEQ regulations at 40 CFR 1501 - 1508; and DOE's implementation procedures at 10 CFR 1021)	• Requires preparation of NEPA documentation (categorical exclusions, environmental assessments (EAs), and environmental impact statements [EIS]) for federally funded projects. • Requires preparation of a Mitigation Action Plan (MAP) to address mitigation commitments expressed in an ROD for an EIS. • Mitigation commitments that are essential to render impacts of a proposed action not significant are included in a Finding of No Significant Impact (FONSI) for an EA, and a MAP is prepared to address those commitments. • If a cooperating agency objects to or has reservations about a proposed action on grounds of environmental impacts, that agency must specify mitigation measures it considers necessary.
Endangered Species Act (ESA) (16 U.S.C. 1531 et seq.)	• Requires protection of critical habitats for listed species. • Requires federal agencies to evaluate actions to determine if impacts to protected species will occur, and if so, to prepare a biological assessment to determine if the action will jeopardize protected species. If the biological assessment concludes that adverse impacts are likely to occur, then formal consultation with the USFWS under Section 7 of the ESA is initiated.

Table 2. contd

Driver	Relation to Mitigation and Resource Management
Federal Land Policy and Management Act [43 U.S.C. 1701(a)(8)]	• Requires federal land be managed to protect the quality of ecological resources. Also identifies fish and wildlife habitat development as a principal federal land use.
Migratory Bird Treaty Act (16 U.S.C. 703 et seq.)	• Makes destruction of nests or eggs, or hunting, pursuing, capturing, taking, or killing any migratory bird illegal. • Compliance requires avoidance and/or minimization of impacts to nesting habitat, at least when the birds are present.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. 9601 et seq.)	• Under certain circumstances, this Act provides for replacement or restoration of injured resources, or the services they provide, when impacts are a result of a CERCLA-regulated release.
Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.)	• Requires federal agencies, in consultation with the Secretary of the Interior, to give wildlife conservation equal consideration with other values when planning activities that affect water resources.
Sikes Act (16 U.S.C. 670a-670o)	• Authorizes development and maintenance of fish and wildlife resources on Department of Defense, Department of Energy, National Aeronautics and Space Administration, U.S. Forest Service, and Bureau of Land Management lands.
Clean Water Act (33 U.S.C. 1251 et seq.)	• Requires a permit from the U.S. Army Corps of Engineers for discharge of dredged material in wetlands. Appropriate and practicable efforts to avoid or minimize adverse impacts are required for the permit. • For unavoidable adverse impacts, appropriate and practicable mitigation is required; preference for onsite, in-kind mitigation.
Executive Order 11990 Protection of Wetlands	• Requires federal agencies to avoid or minimize the loss or degradation of wetlands on federal lands. • DOE policy is to identify, evaluate, and as appropriate, implement alternative actions that avoid or otherwise mitigate adverse impacts (10 CFR 1022.3(d)).
Executive Order 11988 Floodplain Management	• Federal agencies must account for floodplain management in water or land use planning and avoid or minimize adverse effects.

Table 2. contd

Driver	Relation to Mitigation and Resource Management
Executive Order 13186 Protection of Migratory Birds	• Directs each federal agency to develop a Memorandum of Understanding (MOU) with the USFWS to promote conservation of migratory birds. • Among other things, directs agencies to "restore and enhance the habitat of migratory birds" and to "prevent or abate the pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable."
Executive Order 13112 Invasive Species	• Restricts introduction of exotic species into federally owned or managed lands or waters. • Requires monitoring and control of invasive species and restoration of native species. • Revoked the similar E.O. 11987 "Exotic Organisms."

Table 3. Additional Act Potentially Applicable to Specific Situations on the Hanford Site

Act	Relation to Mitigation and Resource Management
Mineral Leasing Act of 1920 (30 U.S.C. 185)	• Pertains to (among other matters) grants of right of ways for construction and operation of pipelines on federal lands, and permits the Secretary of the Interior to issue guidelines dealing with restoration of affected lands. • This act could be pertinent if grants of right of ways for natural gas pipelines are made on the outer areas on the Hanford Site.

Table 4. Federal and State Policies and Guidelines for Mitigation

Agency	Summary
U.S. Fish and Wildlife Service Mitigation Policy (46 FR 7644-7663)	• Provides mitigation recommendations based on habitat value; acre for acre replacement not necessarily recommended. • Establishes four "Resource Categories" to identify areas of high and low habitat values for important species. • Follows the Council on Environmental Quality (CEQ) guidelines for mitigation: avoid the impact, minimize the impact, rectify the impact, reduce the impact over time, and finally, compensate for the impact.
Bureau of Land Management (BLM) Restoration/Mitigation Plans and Guidelines	• Details management guidelines that direct BLM to include habitat management plans in the project planning process. • Requires monitoring of habitat management following project completion to ensure management goals are being met. • Directs BLM to expend maximum effort toward carrying out programs that will restore habitat and populations "to the point that the provisions of the Endangered Species Act are no longer necessary."
Washington Department of Fish and Wildlife (WDFW) Mitigation Policy POL-M5002; January 1999	• Follows CEQ guidelines for mitigation. • States that mitigation should ensure no net loss of habitat or populations. • Provides direction for use of in-kind/out-of-kind, onsite/offsite mitigation. Onsite, in-kind is highest priority. All out-of-kind must be approved case by case. • States that Priority Habitats and Species, defined by the WDFW's Priority Habitats and Species Program, receive additional consideration; in some cases, preservation of Priority Habitats can be considered mitigation. • Includes guidance for documenting terms of mitigation.

3.0

Roles and Responsibilities

Effective implementation of BRMiS and BRMaP requires that the roles and responsibilities be well defined for DOE-RL and each of its contractors. Figure 5 depicts the roles and responsibilities for each organization or group described in the following sections and the overall relationships.

3.1 Department of Energy

The DOE has numerous responsibilities concerning biological resource management in general and mitigation in particular. Specific roles are assigned to various offices within DOE. As part of its cross-programmatic responsibilities DOE will:

- integrate biological resource management goals and administrative procedures into the day-to-day and broader planning activities of facilities or programs to ensure that adverse impacts to biological resources are avoided or minimized when practicable
- as a natural resource steward, mitigate, via prevention or replacement, adverse impacts to natural resources
- as a lead response agency, conduct site activities (e.g., remediation or site development projects) in a cost-effective manner while avoiding or minimizing adverse impacts to natural resources
- as a CERCLA natural resource trustee, coordinate with other natural resource trustees and appropriate resource agencies with respect to natural resource issues associated with CERCLA activities in an open and cooperative manner.

In addition to the broader DOE responsibilities, each program manager will apply the provisions of these policies to each site, facility, or program under his/her responsibility. This will ensure that biological resource protection measures are applied consistently site-wide. Each program manager will:

- identify biological resource issues in the early phases of both remedial actions and new facility projects
- identify to the Division of Closure (CLO) early in the project planning process any potential adverse impacts to mitigable resources that may result from program activities
- incorporate into project plans and implement recommendations to avoid and minimize adverse impacts to biological resources, and rectify and/or compensate for unavoidable impacts, as required by the ecological compliance review and BRMiS
- budget for mitigation requirements early in the project planning process.

The Assistant Manager for Infrastructure and Closure (AMC), through the Division of Closure (CLO) will:

- act as the focal point for the development and coordination of site- and program-wide biological resources mitigation policies and guidance
- be responsible for ecological assessments and impact management, including development of recommendations for avoidance and/or minimization of project impacts
- be responsible for mitigation reporting and monitoring of mitigation areas or a mitigation bank, including (when applicable) development of an accounting system for both bank credits (resulting from habitat improvement actions) and for bank debits (resulting from

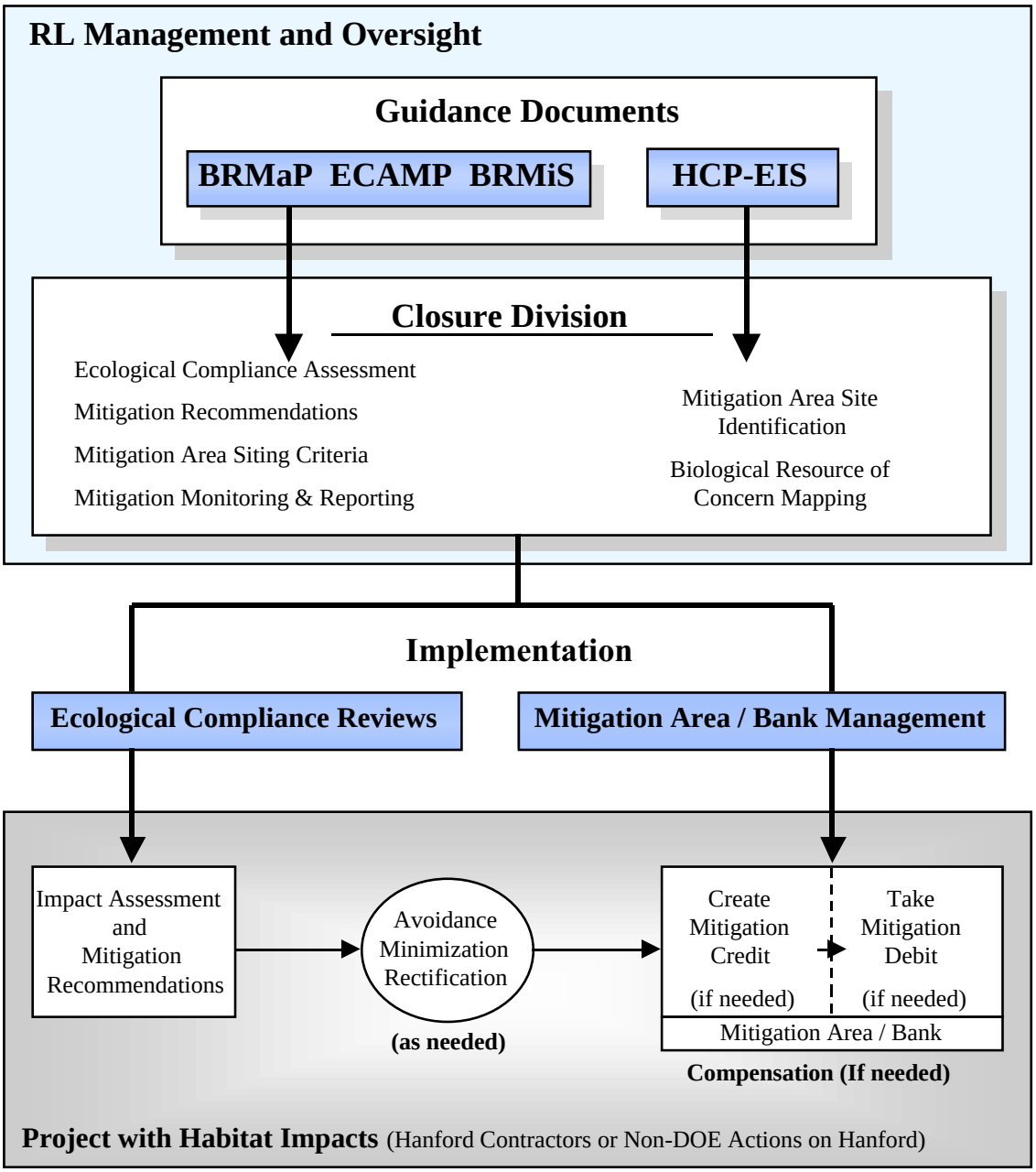

Figure 5. Organization Structure and Flow for Implementation of Biological Resources Mitigation

adverse impacts to biological resources that require compensatory mitigation)

- develop models needed to quantify habitat value losses due to project impacts and habitat value gains resulting from improvement actions.
- identify and designate areas that are ecologically sensitive, or possess unique habitats, and designate them as such in land use plans and maps
- identify potential areas to be used for a mitigation bank or for compensatory mitigation areas

3.2 Contractors

All Hanford Site contractors will incorporate biological resource values into the early phases of project planning. This includes obtaining ecological

assessments for all projects that require an ecological compliance review, as defined in ECAMP, and incorporating any avoidance and minimization recommendations that may be included in the project ecological compliance review.

Contractor personnel will also work with both their DOE-RL program representatives and the AMC/CLO to budget for and implement any rectification or compensatory mitigation for unavoidable impacts to mitigable resources. This may include onsite habitat improvement measures when the project is completed, participation in a site-wide mitigation bank, or other forms of compensatory mitigation if appropriate.

The PNNL is responsible for conducting most ecological assessments as described in ECAMP, the Environmental Restoration Contractor (ERC)/ River Corridor Contractor (RCC) performs some ecological assessments for environmental remediation projects. Recommendations for the avoidance and minimization of project impacts will be included as part of the project review process. PNNL, in coordination with other site contractors and resource agencies, also will be responsible for developing appropriate models to determine mitigation threshold levels, habitat replacement ratios, and the quantification of rectification and compensatory mitigation requirements and success.

PNNL will be responsible for monitoring mitigation areas and for the preparation of annual reports concerning mitigation for most projects. The ERC/ RCC may perform these functions in support its mitigation actions.

All other Site contractors will be responsible for implementing habitat improvements within mitigation banks and for the continued operation and maintenance of the mitigation banks.

4.0

Triggers for Mitigation

Virtually all areas on the Hanford Site, including industrial areas, constitute habitat for some types of plants and wildlife. However, it is not practical, possible, or even desirable to mitigate for any and all changes to the current habitat base. The BRMiS is designed to direct adverse impacts away from areas of significant habitat value and into areas of lower habitat value, or most preferably, into areas that already have been considerably disturbed. The two most obvious benefits from avoiding adverse impacts are reduced costs to projects and preservation of highly valued biological resources and habitats.

Areas with high wildlife usage, as well as undisturbed or rare habitat characteristics, generally will require mitigation of impacts. Areas of low habitat value may have no mitigation requirements. This section provides guidelines to determine types and levels of impacts requiring mitigation.

4.1 Basis for Use of Units of Habitat Value

It is the policy of DOE-RL, through BRMiS, to determine mitigation requirements on the basis of impacts to resource or habitat value rather than strictly on the size of the impacted area. This policy encourages projects to be located in areas with low extant habitat value because the mitigation requirements associated with these areas will be less than the requirements associated with the disturbance of the same acreage of high-quality habitat.

Habitat value is defined as the suitability of an area to support selected animal and/or plant species. Habitat value is a function of both the species selected for evaluation and the habitat characteristics of the site, such as the presence and percentage cover of key plant species. Evaluation species will include species identified in BRMaP as being indicative of a particular habitat type.

4.2 Quantification of Habitat Value

The USFWS habitat evaluation procedures use Habitat Suitability Index (HSI) models to quantify habitat value for evaluation species (USFWS 1980). Habitat Suitability Index models provide an index of "suitability" that ranges from 0 to 1 (USFWS 1981). An index of 0 indicates an area is completely unusable for the evaluation species; an index of 1 indicates optimal habitat conditions. An HSI can be estimated for an area regardless of whether the evaluation species actually occupies or uses the evaluated area; however, the USFWS prefers using species with at least a strong potential of being present on a site. The currency of the Habitat Evaluation Procedure (HEP) is the Habitat Unit (HU), which is a measure of both the quality and quantity of habitat. Specifically:

Habitat units = quality (HSI value) x quantity (area in acres or hectares)

Therefore, 1 HU = 1 (unit) of prime habitat in terms of the performance measures selected for the evaluation species.

Habitat evaluation methods require:

- selection of evaluation species that will serve as representative indicators of overall habitat value
- identification of performance measures for the evaluation species (such as density, home range size, or productivity)

- formulation/adaptation of quantitative models that allow translation of habitat variables into measures of habitat suitability based on performance measures for the evaluation species.

For the Hanford Site, HSI models may be developed for each evaluation species pertinent to key Hanford habitats. Habitat characteristics that represent elements used by an evaluation species will be included in the model. These models will form the basis for determining a mitigation threshold that, when exceeded, triggers the need for mitigation. Additional habitat features such as shape, size, and degree of isolation or connectedness to similar habitats that relate directly to habitat functionality for evaluation species will be incorporated into a mitigation threshold level determination.

Criteria that do not relate directly to habitat functionality for evaluation species, but are important in deriving habitat value and mitigation thresholds, might include:

- habitat scarcity on a local and regional scale
- ease of habitat replacement (through amendment, reclamation, or creation).

Likely evaluation species for sagebrush-steppe habitat are loggerhead shrikes (*Lanius ludovicianus*), sage sparrows (*Amphispiza belli*), and black-tailed jackrabbits (*Lepus californicus*) because of their regulatory status and habitat requirements. Other species may be added as the process develops. Additional mitigable resources are identified in BRMaP, including pristine areas with high percentages of native plant cover, habitats that are locally rare (such as dunes and lithosols), and areas dedicated to ecological research such as the Fitzner/Eberhardt Arid Lands Ecology (ALE) Reserve.

The HEP methodology provides two types of habitat comparisons: 1) the relative value of different areas at the same point in time, and 2) the relative value of the same area at different points in time. Combining these two types of comparisons enables equitable trade-offs to be made between the value of habitats lost to development and the value of replacement habitats.

Figure 6 illustrates one example of this trade-off calculation. Point A indicates the total HUs at a project site when the project is initiated. When impacts occur, the number of HUs at that site drops to point B. If onsite rectification takes place, the number of HUs increases over time to point C. If onsite rectification is not (or cannot be) performed, the total HUs at the project site will remain at point B. Integration over time produces the quantity of HUs lost because of the project and for which compensatory mitigation may be appropriate. Rectification reduces the total number of HUs lost over time. At an offsite mitigation area, the pre-existing quantity of HUs is represented by point D.

If improvements are made at the mitigation area to compensate for impacts at the project site, the quantity of HUs will increase to point F. Integration over time will provide an estimate of the HUs gained at the mitigation area. However, the mitigation area may be expected to experience a natural increase in habitat quality (to point E) over the same period of time, even without the compensatory actions.

The amount of resource improvement that naturally would have occurred at the mitigation area without compensatory improvements should not be included in the calculation of total resource gain. Project mitigation requirements are met when the number of HUs gained through the combination of rectification and compensation equals the quantity lost due to project impacts.

4.3 Mitigation Threshold Levels

Impact thresholds will depend on the point in the mitigation hierarchy at which a project is, as well as the particular resource(s) that may be impacted. In the first two steps of the mitigation process (i.e., avoidance and minimization) no set threshold level exists if managed resources are present. All projects are expected to avoid and minimize impacts to the greatest extent possible and should weight these considerations equally with other project siting criteria. Likewise, all projects are expected to rectify impacts at the project site to the greatest extent practicable.

Some resources, such as jurisdictional wetlands, have no mitigation threshold level and any impact to these resources will require mitigation. Others, such as shrub-steppe, may require compensatory mitigation if the impact (after avoidance, minimization, and onsite rectification) is determined to reduce the habitat value for wildlife.

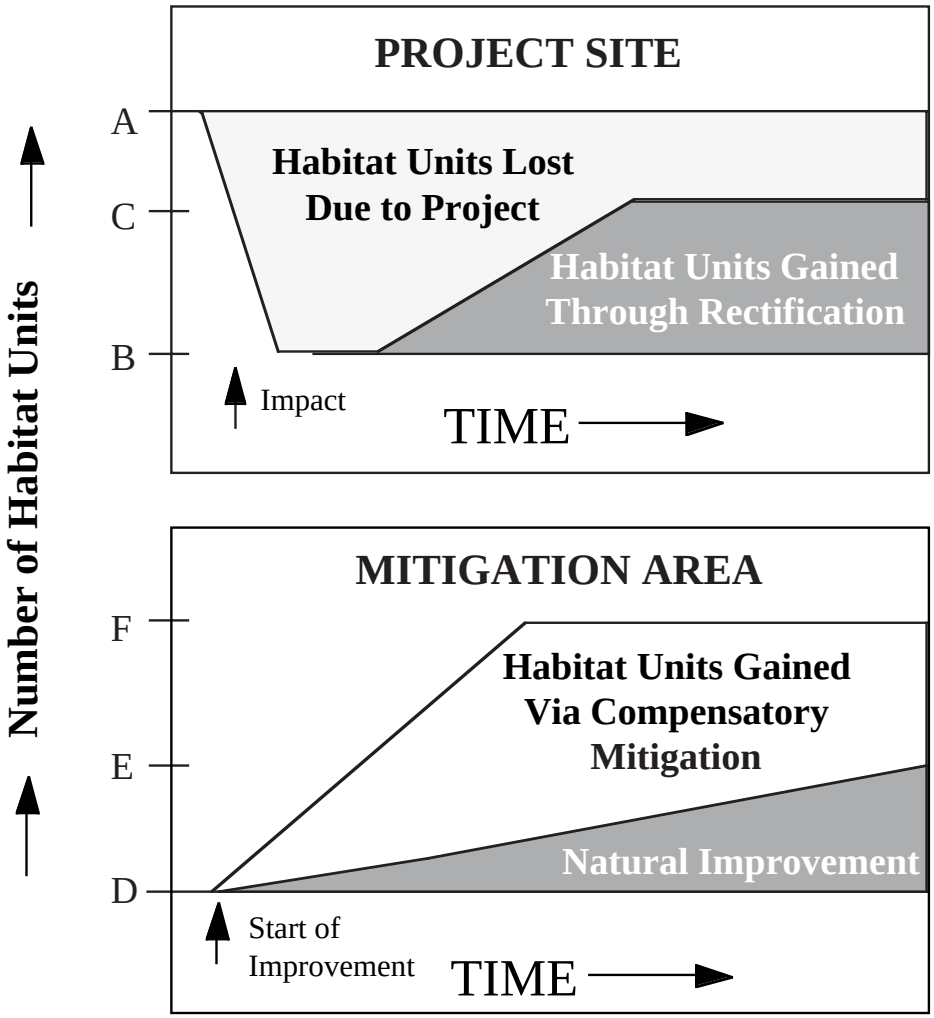

Figure 6. Balance of Habitat Units Lost from Project Impacts and Gained Through Mitigation

Reduction in habitat value will be quantified with a HSI, which will determine the area of impacted habitat needed to support a breeding pair of the evaluation species (or an individual territory, as appropriate). When the area of impact displaces one or more breeding pairs or individuals, as appropriate, of the evaluation species, that level shall be considered the threshold that triggers mitigation. For a specific habitat, such as shrub-steppe, this approach would account for impacts to both mature and recovering areas that have a habitat value greater than zero for the evaluation species.

Mature shrub-steppe has thus far been the impetus for and focus of the development of mitigation guidelines for the Hanford Site. This is due to its relative scarcity in the region, its importance to various wildlife species of concern, and its designation as a priority habitat by WDFW. Noss et al. (1995) classified ungrazed sagebrush steppe in the Intermountain West as a critically endangered ecosystem that has experienced greater than a 98% decline since European settlement. Evaluation species were tentatively selected based on their association with this habitat. Although this habitat is a current priority for mitigation, other habitats and species may be considered mitigable resources under BRMaP. The selection of other evaluation species may be required to assess impacts to other habitat types.

Site-wide habitat deterioration from causes other than projects, such as range fires, may result in declining populations of evaluation species. If these levels fall below critical population levels set for the Hanford Site (as prescribed by BRMaP), the mitigation threshold guidelines may be revised.

4.4 Interim Mitigation Threshold Guidelines

The preferred method to determine mitigation threshold levels, as described in Section 4.3, requires the development of Hanford-specific models of habitat usage by the evaluation species. These models are not currently available. Until such models are developed, land-area-based interim guidelines provided in Table 5 will be followed. These interim guidelines were developed based on the estimated minimum home range size of one potential evaluation species (sage sparrow) and current Hanford Site disturbance and land-use patterns.

Based on data presented in Fitzner (2000), the estimated minimum sage sparrow home range size is 0.5 ha of mature sagebrush steppe. This agrees with an estimate based on body weight (Calder 1984). This interim threshold applies only to areas with mature sagebrush, and not to areas of lower quality habitat. For these interim guidelines, mature sagebrush steppe habitat has at least 10% cover of a climax shrub species such as big sagebrush (*Artemisia tridentata*) or bitterbrush (*Purshia tridentata*), average shrub height of at least 0.5 m, and native species in the understory.

Different interim mitigation threshold levels are set for different regions of the Hanford Site (Table 5). Figure 7 shows different threshold regions in the 200 Area Plateau. Specific plant communities affected by these guidelines are provided in BRMaP.

Table 5 also provides both single-site and project-cumulative mitigation threshold levels. This is because a single portion of a project (such as one well site) may have minimal impact and be below the threshold level, but the cumulative impact of an entire project (for instance 20 well sites) may be detrimental. These guidelines are an attempt to balance the effects of habitat fragmentation that could result from numerous small disturbances with the fact that each individual disturbance may have nominal impact.

Table 5. Interim Mitigation Thresholds (in hectares) for Late-Successional Sagebrush Steppe Habitat Areas

Region	600 Area	200 Areas Corridor	200-East: south half; 200-West: northeast quarter	All other sites within 200, 300, and 400 Area fences, 100 Area perimeter roads, and 1100 Area Industrial Sites
Individual Site	0.5	1	5	No mitigation of habitat loss required other than avoidance and minimization
Project Cumulative	2.5	5	10	

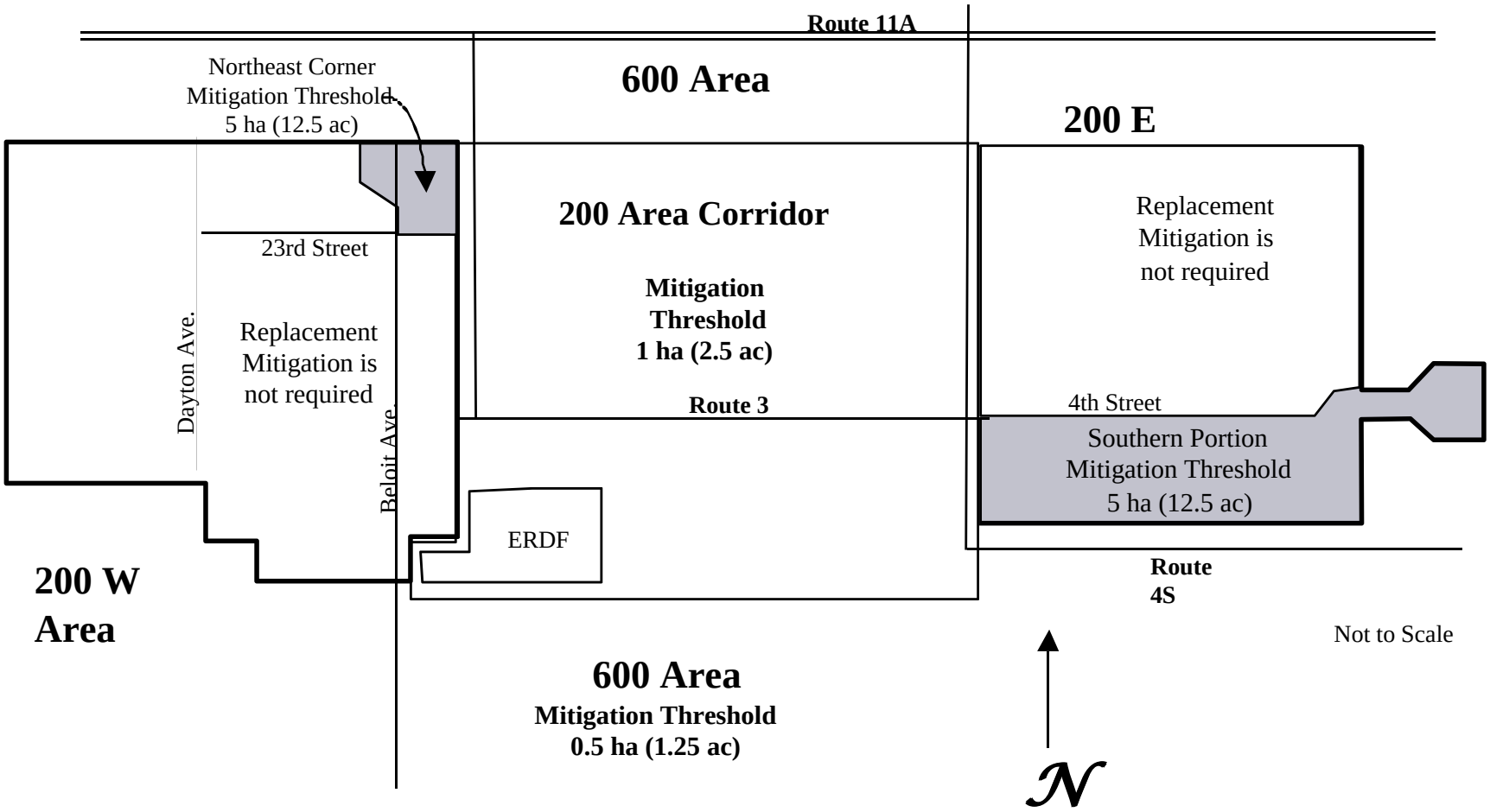

Figure 7. Interim Mitigation Threshold Regions on the 200 Areas Plateau

5.0

Implementation

Implementing BRMiS is a necessary component of biological resources management on the Hanford Site. This strategy can be implemented in a manner that allows mitigation goals to be met without significant effects on budgets or schedules.

Implementation follows the order of mitigation priorities as presented in Table 1. Impacts should be avoided or minimized, if possible, and rectified or compensated only if avoidance and minimization do not satisfy all project mitigation needs. If compensatory mitigation is required away from the project site, mitigation requirements should be met through participation in a mitigation bank, as described in Section 5.4 of this document.

5.1 Mitigation Strategy Goals

The goals of the Hanford Site biological mitigation strategy are to:

- prevent habitat value loss through avoidance and minimization
- provide timely rectification or compensation for habitat value lost through Site development or cleanup activities
- ensure no net loss of habitat value for mitigable resources
- ensure no net loss of key habitats such as natural wetlands and locally rare or pristine communities
- minimize time lags between the loss of habitat value and its replacement
- enhance the function of habitat on a landscape scale (for example, minimize fragmentation and maximize connectivity)
- address biological resource impacts comprehensively and cost effectively.

5.2 Identifying Mitigation Needs

Mitigation should be identified and implemented as early in the project as possible. Preferably, mitigation needs would be identified during the impact management phase of the ecological compliance assessment process. Impact management should occur during the site selection process to address the avoidance and minimization steps of the mitigation process, thereby reducing the need for rectification and/or compensation. Additional mitigation needs may be identified later in the project via the ecological compliance review as described in ECAMP (DOE 1995a).

5.3 Mitigation at a Project Site

Mitigation at the project site includes avoiding, minimizing, or rectifying project impacts (see Table 1). Project impacts can be avoided or minimized by following such steps as:

- implementing non-disturbing alternatives
- locating a project at a less ecologically damaging site
- reducing project land-use requirements
- scheduling project activities to minimize disturbance to biological resources of concern.

Each project should pursue the avoidance and minimization steps of the mitigation hierarchy first. Avoidance and minimization actions are likely to be less costly, have less potential to

adversely impact project schedules, and cause less injury to biological resources than actions that rely on habitat improvement. These two types of mitigation actions are addressed more fully in ECAMP (DOE 1995a).

If ecological disturbance still results after avoidance and minimization, mitigation should occur by rectifying impacts at the project site. Aspects of rectification are also discussed in Section 5.6.1.

5.4 Mitigation Away from a Project Site and Mitigation Banking

Mitigation banking is the establishment of habitat for managed resources (or the resources themselves) in areas other than at the impact site to compensate for unavoidable habitat value losses expected to result from future project development. Use of a centralized bank for compensatory mitigation will simplify the mitigation process for small projects because the goals, methodologies, and locations for compensatory mitigation will be pre-defined. A small project will not be required to design and engineer its own mitigation actions, but would simply pay into the established system or bank. A bank enables the mitigation requirements for numerous projects to be coordinated and conducted in a manner that creates the greatest overall improvement in habitat value while reducing costs because of the economy of scale.

The degree to which compensatory mitigation is coordinated site-wide can range from a project-by-project approach to complete coordination with pre-emptive habitat value replacement. Four basic levels of coordination can be identified as follow:

1. Each project (or program) identifies its compensatory mitigation areas, plans and implements its own habitat improvements, and is responsible for maintaining and monitoring the mitigation areas.
2. One or more common mitigation areas are identified, but each project continues to plan and implement habitat improvements within that area, and is responsible for the continued monitoring and maintenance of its portion of the mitigation area.
3. A pseudo-mitigation bank is created with one or more common mitigation areas. Habitat improvements are coordinated by the bank managers using standardized implementing procedures. Maintenance and monitoring of the mitigation areas are performed by the bank managers. Under a pseudo-bank, credits are created (e.g., through habitat improvement) as a response to project needs, and usually such credits are created after the losses already have occurred.
4. A true mitigation bank is created. This is essentially the same as a pseudo-bank, except that credits are created in anticipation of future project needs and before the project-induced losses occur.

Use of a common mitigation area will save time and money because siting decisions only need to be made once. Use of a banking system saves additional money because projects will not be required to engineer the habitat improvements or set up individual sub-contracts to perform the improvements. Under a bank system, each project would simply pay into a common pool operated by the bank managers (tentatively led by CLO) who would coordinate the habitat improvements for all projects. Use of a true mitigation bank would ultimately be the most cost effective, but it would require that non-project specific "seed money" be identified and appropriated to create the initial bank credits before they are needed by projects.

Advantages of mitigation banking include the following:

- provides overall coordination of site mitigation
- eliminates the project-by-project learning curve
- reduces the time required for preparation of NEPA documents
- provides consistency in mitigation practices
- eliminates extended project durations required for mitigation
- allows projects to adequately budget for mitigation
- ensures that mitigation will be performed by experienced personnel
- ensures impacts of a similar nature are treated in a similar but comprehensive manner.

Mitigation banking provides a means both to minimize the risk to resource health and survival

posed by future projects and to perform habitat improvement and monitoring in a cost-efficient manner. Mitigation banking has been developed for addressing wetland impacts (e.g., Castelle et al. 1992a), but has been less well defined for impacts in other areas. It is recognized as a potential component of mitigation by both the USFWS (46 FR 7644, USFWS 1988) and the WDFW (1999).

Mitigation banking requires that the following components be identified and established:

- bank objectives and currency
- bank site(s), including necessary site protection and controls
- policy for bank operation, including payments, construction, use of credits and debits, and bank management responsibilities
- funds and schedule for monitoring, corrective actions, and reporting on bank operations.

5.4.1 Bank Objectives and Currency

The objectives for mitigation bank(s) on the Hanford Site are to:

- consolidate numerous small mitigation projects into one or a few sites that can meet broader objectives requiring a landscape-level approach
- provide timely compensation for habitat loss resulting from Hanford Site activities
- ensure that lost habitat value is adequately compensated
- maintain mitigable resources within limits of abundance and temporal stability conducive to survival and health of the resources
- preserve the bank's mitigated resources through long-term monitoring and management.

Specific goals must be specified for each type of bank created. Based on expected impacts at Hanford over the next 5 to 10 years, banks may be needed for the following habitats:

- mature sagebrush-steppe
- bitterbrush-steppe
- sagebrush-hopsage steppe.

These habitats provide the basic elements required for many wildlife resources identified as foci for management concern under BRMaP. Cumulative impacts within these habitats are expected to range from moderate to extensive.

Currency for the banks will consist of units of habitat value. Habitat value is defined on the basis of the resources affected by the habitat improvement within the bank. Habitat evaluation methods, thus, are required to quantify habitat value, both at the impact site and at the bank. Habitat improvements at the bank are intended to increase habitat value of the bank site, which constitutes the total credit in the bank available for offsetting project losses.

Ultimately, a fixed dollar fee per hectare, dependent on habitat quality, can be assigned. This fee cannot be determined until the HSI models are available to assess quality, and experience in habitat improvement is gained via field applications. A fixed fee will simplify budget planning and will enable planners to assess both ecological and economic trade-offs when making siting decisions.

5.4.2 Bank Sites, Protection, and Control

Some criteria that affect bank siting are listed below. Section 6.0 provides detailed criteria for siting a mitigation area or bank.

- The site(s) should be of sufficient size to meet the expected need (i.e., the anticipated extent and value of the resources to be impacted over the next 5 to 10 years). Small and isolated sites selected for mitigation of individual small projects may have limited habitat value. By establishing a larger bank to satisfy the mitigation needs of a number of projects, more ecologically valuable areas can be developed and managed. Also, land management, monitoring, and evaluation of mitigation compliance and success are more efficient with a larger mitigation bank.
- A large portion of the site(s) currently should be of relatively low value but capable of successful improvement, thereby allowing for increased use by the managed resources after habitat improvements are complete.
- The site(s) should be set within a favorable habitat context, i.e., must provide functionality at a larger scale than the bank itself.

- The site(s) should be near existing infrastructure needed to support the habitat improvement efforts (e.g., water, roadways).
- The site(s) should not be adversely affected by existing or proposed land uses.

The bank should be created early to take advantage of mitigation opportunities that may disappear over time. As lands become committed for other uses, it becomes more difficult to locate the bank area from a landscape perspective.

Banks sites will be administratively protected. The mitigation bank site(s) will be designated as Level IV (most restrictive category) in BRMaP and the HCP-EIS. Functionally, this will prevent disturbance of the site(s) for as long as DOE maintains administrative control of the area. If deed restrictions are instituted, site protection could continue long after DOE's mission is completed. Protecting bank site(s) in this way will assist DOE and projects in not incurring significant costs. At a minimum, bank site(s) must be protected for the life of the participating projects or until all the habitat value lost as a result of participating projects is replaced, whichever is longer.

Bank credits are normally given only for improvements on lands under the direct control of the bank sponsor. However, lands that are managed by or released to other federal agencies may be eligible for use as bank sites if the receiving party agrees that the bank site will be managed for its resource values. Bank withdrawals should be based on habitat value replacement, not acreage or cost for habitat improvement, land purchase, or management.

5.4.3 Bank Operation Policy

The preferred location for habitat replacement is the site being impacted; however, situations exist where this option is infeasible or would result in substantial time lags in the recovery of lost resource values. For example, converting wildlife habitat to an industrial site severely limits the options for onsite rectification; similarly, removal of habitat for the purposes of waste burial will adversely impact the biological resources during the interval between site clearing and onsite rectification. In these situations, compensatory mitigation away from the project site can be used to ensure maintenance of resources at the prescribed management levels.

When compensatory mitigation is required, mitigation banking is preferable to an uncoordinated project-by-project approach. Operation of the bank will reduce the net loss of total habitat value on a site-wide basis. Because habitat value is used as the currency for mitigation, credits to and debits from the bank must be for "in-kind" rather than "out-of-kind" mitigation.

Mitigation banking is not an alternative to avoiding or minimizing habitat value losses or for performing onsite rectification that would recover habitat value in a timely manner. Mitigation banking should be used only when adverse impacts are unavoidable and all reasonable means of avoidance, minimization, and rectification have been used.

Projects can pay into the bank at any time, but the preferred method of bank operation is to initiate habitat improvements before use of the credits. This will help ensure that levels of the affected biological resources do not decline between the time of project impact and the time when suitable improved habitat is available to support the resources. Project budgets should be developed to allow credits to be purchased the early in the project life (the first year of the project for projects of 3 years or less).

The bank will be managed by DOE-RL, with specific operational responsibility assigned to an appropriate division. CLO will provide short- and long-term management of the banking program. Short-term management responsibilities include developing guidance for operation and habitat improvements within the banking site(s), coordinating habitat improvements within the bank, monitoring the improvements and evaluating improvement methods, and managing credits and debits. Long-term management responsibilities include monitoring, reporting, and determining necessary corrective actions. CLO also will ensure that mitigation bank sites are clearly identified on Hanford Site land-use planning maps.

Habitat improvements within the bank will be temporally and spatially coordinated to minimize habitat fragmentation and maximize benefits in context of the surrounding landscape.

Bank maintenance may include:

- weed control
- minimizing depredation of transplants

- irrigation
- fire control and prevention
- modifying banking guidance, as necessary, to respond to changes in management needs and habitat improvement methodologies.

Bank corrective actions may include:

- replanting if mortality causes habitat values to fall below target levels
- designing and implementing new habitat improvement methodologies.

5.4.4 Bank Monitoring and Reporting

Monitoring is necessary to ensure that the bank meets its resource maintenance and improvement goals, that it can respond to contingent needs and events, and that it functions in a cost-efficient manner. Specific monitoring needs may include the following:

- plant species composition, abundance, and spatial pattern
- shrub survival and growth
- soil microbial activity (nitrification and decomposition)
- wildlife usage
- sources of plant mortality
- trends of wildlife use and landscape patterns on and near the Hanford Site.

Reporting should occur annually and provide information summaries that:

- track the progress of the banking program against its goals
- track the status of the bank with regard to credits and debits
- provide a means for resource agencies, natural resource trustees, and other outside groups to assess the relative success of the program
- provide the information necessary to allow DOE-RL to alter its operational guidance for the bank to better meet its objectives
- provide information to assist outside agencies in developing their own banking programs.

5.5 Mitigation Levels and Ratios

5.5.1 Mitigation Levels

Levels of mitigation range from impact avoidance to compensation (Table 1). Means to accomplish impact avoidance or minimization are identified through the ecological compliance review process before siting and implementation of a proposed project. These two types of mitigation are always preferred over rectification and compensation because they avoid the expense of habitat replacement and minimize the risk of causing a decline in biological resources of concern. Mitigation requirements for a particular project may include a combination of mitigation levels.

Rectifying or compensating for impacts requires some level of habitat improvement. Habitat improvements may be of three general types: amendment, reclamation, and creation. Amendment is the improvement in the function/value of an existing habitat; reclamation is the improvement of the value or function of a degraded habitat; creation is the establishment of a functioning habitat at a site where none currently exists. Examples of each are given in Table 6.

All habitat improvement efforts risk failure, and this risk increases in proportion to the degree of habitat manipulation attempted (Figure 8). The lowest risk involves protecting existing habitats that contain the appropriate biological resources, and making minor improvements to existing habitats to ensure no net loss of the resources. The highest risk involves creating habitat. Rectification of impacts (e.g., replacing habitat in excavated areas) will generally involve habitat creation.

5.5.2 Mitigation Replacement Ratios

A replacement ratio is the ratio of the number of habitat units produced at a compensation site to the number lost at the site of adverse impacts. Sometimes this may translate as the area over which mitigation measures are applied to the area receiving adverse impacts (assuming equivalent habitat value at each site). Alternatively, it can be the ratio of the improved habitat value at the mitigation area to the habitat value at an impacted site (assuming the same land area for each site) (see Figure 9). A combination of area and quality considerations can also be used.

Table 6. Examples of Habitat Improvement Levels for Mitigating Shrub-Steppe Impacts

Manipulation Level	Example
Amendment	Establishing large-statured sagebrush within a naturally regenerating burn area to provide nesting/perching habitat for loggerhead shrikes and sage sparrows.
Reclamation	Establishing shrub-steppe plants in an abandoned old field cheatgrass community.
Creation	Establishing shrub-steppe plants in a former gravel pit.

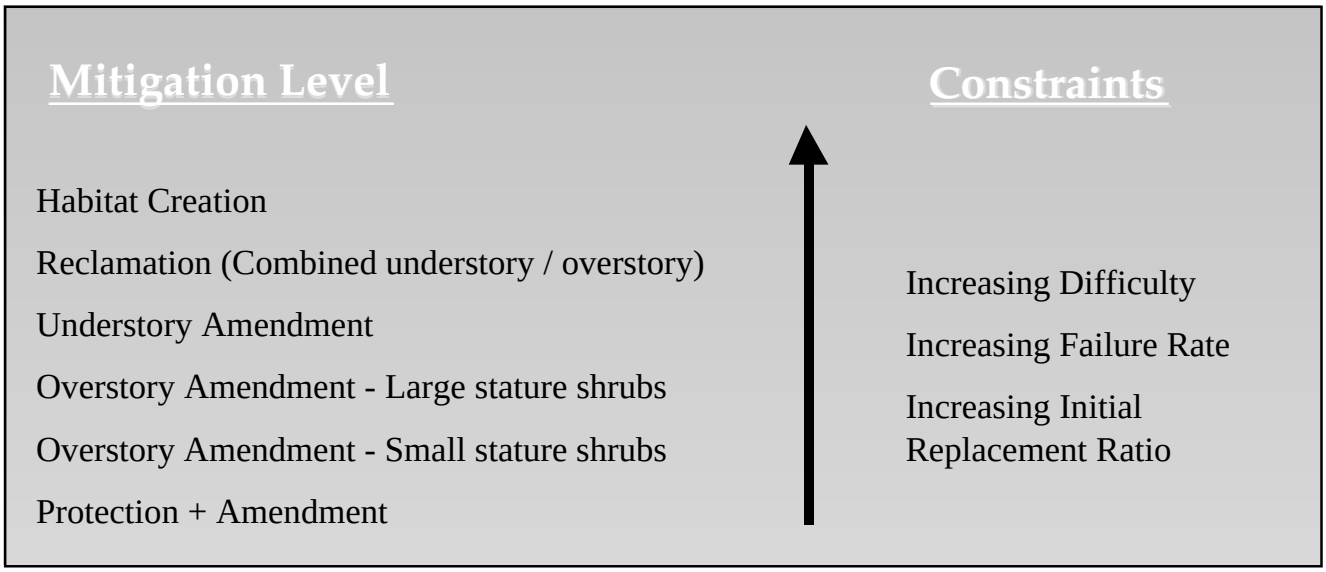

Figure 8. Levels of Mitigation Involving Habitat Improvement

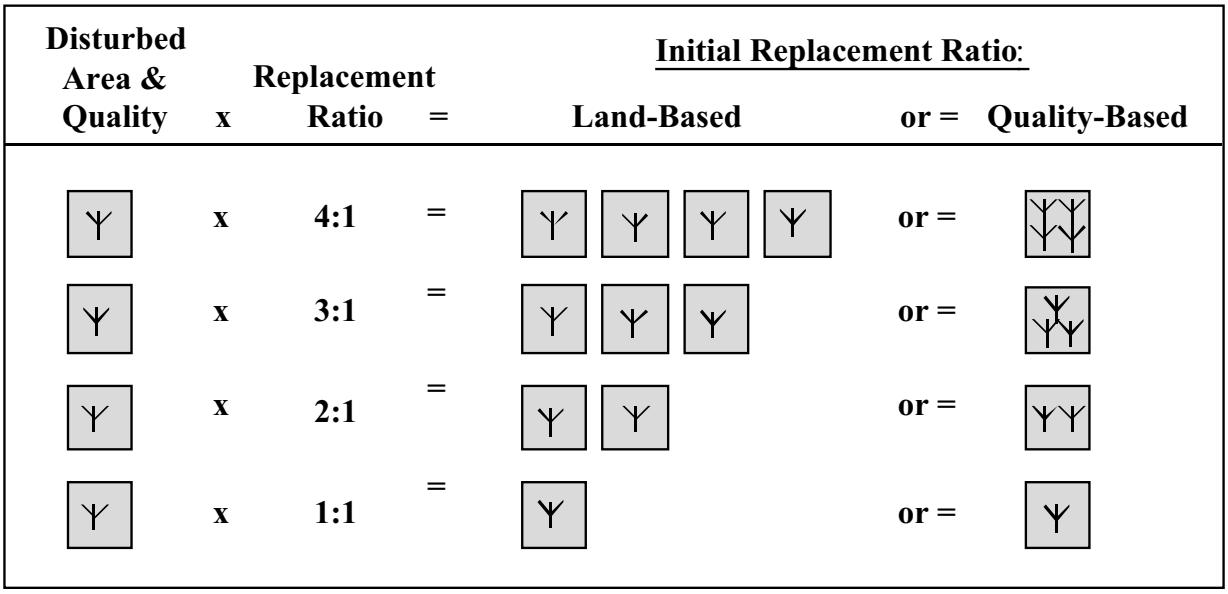

Figure 9. Comparison of Spatial- or Quality-Based Replacement Ratios

The replacement ratio for protected plant species will be 1:1 (individual plants). Replacement ratios for impacts to riparian or wetland habitats will comply with Washington Department of Ecology (Ecology) requirements for wetland mitigation [2:1 on an area basis with equivalent plant species density (Castelle et al. 1992b)]. Replacement ratios for other habitats require a definition of habitat value, which in turn require development of habitat suitability models for the evaluation species selected for that habitat (see Section 4.2). These models are being developed for shrub-steppe habitats. When these models are completed, replacement ratios will be based on quantitative habitat value evaluations at an impacted area.

To meet the desired mitigation endpoints, replacement ratios should be set with both the expected failure rate inherent in habitat improvement activities and the time lag for development of the replacement resources taken into account. Failure rate-based replacement ratios have been used in defining wetlands mitigation by Ecology (Castelle et al. 1992b).

The best source of information on failure rates is Hanford Site experience. Since the mid-1990s there have been a number of projects that have included planting sagebrush plants (Table 7). Survival rates varied considerably between projects and also with the length of the monitoring period. For several projects, notably the mitigation for the Environmental Restoration Disposal Facility, W-112, and W-058, the mitigation sites were lost in the 24 Command fire in June 2000; therefore, further monitoring is not available.

Many projects had sagebrush survival rates that were greater than 60%, at least over the first year, but a significant number had survival rates considerably lower. Additionally, several projects reported significant variation in survival among individual monitoring transects. For instance, Sackschewsky (1999) reported that survival of tublings along 16 individual transects at the W-058 mitigation area ranged between 19% and 88%. Durham and Sackschewsky (2002) reported that survival of bare root plants that were planted in 2000 ranged from 7% to 91% after two growing seasons, depending on soil type and plant community conditions.

There are much less data available concerning transplant survival of other shrub species on the Hanford Site. Gano et al. (1999) reported nearly 100% mortality for a small planting of bitterbrush at the 300-FF-1 site. Additional plants were planted in 2001, and Johnson (2001) reported 55% survival over the first growing season. Brandt et al. (1991a) reported a first year survival rate of 59% for bitterbrush at Basalt Waste Isolation Project borehole sites. Brandt et al. (1991a) reported first year survival rates for hopsage (38%), gray rabbitbrush (79%), and green rabbitbrush (48%).

There is limited information concerning native grasses. Brandt et al. (1991a, 1991b) reported that 60% of the severely disturbed sites that had received understory amendment treatments using native grasses failed to meet percentage cover goals for native grasses because of mortality of seeded grasses. The grass mortality rate continued at 60% into the next year, but declined to near zero by the third year (Brandt et al. 1991a, 1993).

However, it normally takes several years for grasses to become established and contribute significantly to overall plant cover, and in some cases, there is very little of the planted grasses visible during the first one or two years. McLendon and Redente (1997) suggest that no specific level of planted species cover should be used as an evaluation criteria during the first 2 to 5 years after planting, but total cover (i.e., all species) can be used as the criteria. Hanford Site environmental restoration has resulted in the opportunity to re-establish native vegetation in a variety of different settings as waste sites are cleaned up. Some of these plantings have been monitored for several years (Johnson 2001). Most of these plantings appear to be successful, although the variation in planting conditions and restoration goals does not allow for broader conclusions to be drawn at this time.

With additional field data and experience, the failure rate portion of the replacement ratio determination may be either increased or decreased accordingly. Based on the available data, it is reasonable to assume at least 50% survival rate of planted shrubs. Thus, approximately twice the number of shrubs desired at the end-state should be planted—suggesting a 2:1 replacement ratio.

However, the failure rate is not the only consideration in setting a replacement ratio. In arid terrestrial systems, there will usually be a time lag, perhaps measured in decades, between when the mitigation actions are performed and when the mitigation area becomes usable habitat. Therefore, the replacement ratio should be set at a point that will allow the *habitat value* to be replaced in a

Table 7. Sagebrush Survival Rates for Hanford Site Mitigation/Restoration Projects

Project	Plant Material	Survival	Reference
BWIP Restoration	Tublings	58% after 1 year	Brandt et al. (1991a)
ALE sagebrush planting	Bareroot	80% after 4 years	T. Feldpausch and J. L. Downs (unpub.)
ERDF Mitigation	Bareroot Tublings Mixed bareroot and tublings	87% after 1 year 66% after 1 year 62% after 1 year	Johnson et al. (2000)
Wahluke Slope	Salvage plants (Aug. planting) Salvage plants (Oct. planting)	5% after 1 year 78% after 5 years	Gano et al. (1999) Johnson (2001)
300-FF-1	Container grown plants	42% after 4 years	Johnson (2001)
200-ZP-1 pipeline	Tublings	29% after 2 years	Gano et al. (1999)
216-A-25	Tublings	65% after 2 years	Gano et al. (1999)
116-C-1	Tublings (imported topsoil) Tublings (cobble substrate)	66% after 3 years 94% after 3 years	Johnson (2001)
116-B-5	Tublings	99% after 1 growing season	Johnson (2001)
W-058 Mitigation	Mature shrub transplants Tublings (Feb. 97 planting) Tublings (Nov. 97 planting)	91% after 4 years 76% after 3 years 49% after 2 years	Sackschewsky (1999)
W-112 Mitigation	Tublings	88% after 2 years	R. Roos and A. R. Johnson (unpub.)
W-519 Mitigation	Tublings (1999 planting) Bareroot (1999 planting) Tublings (2000 planting) Bareroot (2000 planting)	37% after 3 years 45% after 3 years 53% after 2 years 62% after 2 years	Durham and Sackschewsky (2002)

reasonable period of time, even if it may ultimately result in a larger number of habitat units decades later (see Figure 6). To account for both the failure rate and the replacement time lag the replacement ratio should be set higher than a simple consideration of failure rates would suggest. Development of quantitative habitat evaluation models (see Section 4.2) will allow for the calculation of ecologically meaningful replacement ratios.

The knowledge base concerning both failure rates and the time required for habitat value replacement will be augmented as this mitigation strategy is implemented, new techniques for habitat improvement are developed and tested, and as habitat evaluation models are developed. Recommendations for replacement ratios will be updated based on experience and technological improvements.

5.5.3 Interim Replacement Ratio Guidelines

Until quantitative models are developed that will allow for assessment of habitat loss and habitat improvement, interim mitigation ratios will be used.

For compensatory mitigation of shrub-steppe habitats, the ratio will be 3:1 based on area. For rectification at the site of impact, the ratio will be 1:1, as long as the replacement can commence within two planting seasons of the initial impact. If the rectification cannot be performed within two planting seasons, the 3:1 ratio will apply, and compensatory mitigation will be required.

An exception applies to the portions of the 200 Areas with a mitigation threshold of 5 ha (i.e., the northeast corner of the 200-West Area and the southern portion of the 200-East Area; see Table 5 and Figure 7. In these areas, the replacement ratio will be 1:1, and no distinction is made between rectification and compensation. A project may replace the resources at the point of impact if appropriate or stabilize the soil surface and replace the lost resources at a separate mitigation area. The second option would allow another project to use the disturbed area at a later date without incurring a mitigation commitment.

As stated previously, the replacement ratio for rare plants will be 1:1 based on individuals, and the ratio for wetland or riparian habitats will be 2:1 based on area.

5.5.4 Mitigation Replacement Units

Successful planning and budgeting for mitigation commitments require that the level of effort (i.e., the number of transplanted shrubs, tublings) needed to achieve the mitigation goals be quantified in the early stages of project planning. Ideally, the level of effort is determined based on the habitat value at the project site and the level of improvement possible through rectification or through compensation at a mitigation area. Quantitative habitat value models are required for these calculations.

Until such models are available, projects that disturb late-successional sagebrush steppe should plan for replacement mitigation using standard replacement units. Replacement units for other habitats will be developed as needed.

Therefore, a project that is replacing habitat via rectification at a ratio of 1:1 should plan for 1 replacement unit/ha disturbed habitat. A project that is replacing habitat via compensatory mitigation at a ratio of 3:1 should plan for three replacement units/ha habitat disturbed.

A replacement unit for late-successional sagebrush steppe will consist of:

- 20 transplanted large shrubs/ha (8/acre)
- 1000 seedlings/ha (400/acre)
- native, perennial bunchgrass understory.

This replacement unit is based on the assumption that the tublings will provide the bulk of the shrub density and canopy coverage replacement. Data collected for initial monitoring of the Environmental Restoration Disposal Facility (ERDF) indicates that an average mature sagebrush is 124 cm tall with a cross-sectional area of 1.6 m^2. Therefore, to recreate a shrub community that meets the minimum definition of late-successional sagebrush steppe (10% shrub cover), a minimum of 625 surviving shrubs/ha is required. If a tubling survival rate of 60% is assumed, an initial planting of 1000 tublings/ha is needed.

Transplanted mature shrubs will provide structural diversity and avian perch sites, and will function as immediate seed sources for the community. Transplanted shrubs should be at least 50 cm tall, with at least 20% greater than 100 cm tall. All transplanted shrubs should be of the dominant species in the disturbed area.

Habitat replacement at the point of impact may require that the native understory be recreated. If a selected mitigation area already has suitable cover of native perennial grasses, additional understory manipulations may not be required.

Alternatives to any of the interim requirements may be developed on a case-by-case basis, as long as the functional aspects of the requirements are preserved. For example, instead of transplanting mature shrubs, a project may choose to increase the seedling density and install artificial perches; this would increase plant density, provide future seed sources, and provide some physical structure, thus preserving the functional contributions of the mature shrubs.

5.6 Mitigation/Restoration Methods

Methods used for habitat improvement will vary according to specific site conditions and mitigation goals. Methods to be considered include salvaging plant material and topsoil, site preparation, soil amendments, plant species selection, and planting methods. McLendon and Redente (1997) provide an overview of many habitat improvement methods applicable to the Hanford Site.

5.7 Native Plant Nursery and Grass Farm

Mitigation actions that involve habitat amendment, reclamation, or creation will require plant material that is both native and locally adapted. To meet these needs, DOE-RL supports the concept of native plant nurseries and/or native grass farms to provide locally derived plant material for revegetation purposes. Several approaches to the creation and operation of such facilities are possible as described below:

- create a nursery and/or farm located on the Hanford Site that would be constructed and operated with DOE funding by one or more of the existing Site contractors
- create a nursery and/or farm located on or near the Hanford Site that would be constructed with DOE funds and operated under contract by either a private vendor or by DOE in cooperation with Natural Resource Trustees, Tribes, or resource agencies
- create a nursery and/or farm located on or near the Hanford Site that would be constructed and operated by a private vendor.

5.7.1 Native Plant Nursery

Many native species, including shrubs, perennial forbs, and some grasses, are most effectively planted as transplants. These transplants can be either plants salvaged from local areas undergoing disturbance or plants grown from locally collected seed. In either case, a nursery may be required either to maintain salvage plants or to propagate enough material to meet the mitigation needs of the Hanford Site.

A native plant nursery must be able to provide a large number of shrubs and perennial forbs each year. These plants must originate from the Hanford Site, either as seed or salvaged plants. The nursery should be capable of providing shrubs in both the form of seedlings or 1-year-old tublings and as larger plants in at least 5- to 10-gal pots. Perennial forbs should represent the full range of native species diversity that occurs in all areas that will require mitigation.

Perennial bunchgrasses also should be grown in the nursery to support improvement of small mitigation sites, increase the grass diversity in larger mitigation areas, and for sites where direct transplanting is desired because existing shrubs could be damaged by direct seeding methods.

5.7.2 Native Grass Farm

Mitigation actions that require establishing perennial grasses on a large scale are not cost effectively accomplished using transplants. Drill or broadcast seeding native grasses results in considerable cost and time savings.

A native grass farm should be constructed and operated to provide a sustainable crop of locally adapted seed that can support all revegetation activities on the Hanford Site. The crops should be propagated from locally collected seed and grown in an agricultural setting that will maximize seed yield. Species that should be included in the farm are Sandberg's bluegrass (*Poa sandbergii*), Indian ricegrass (*Oryzopsis hymenoides*), needle and threadgrass (*Stipa comata*), sand dropseed (*Sporobolus*

cryptandrus), and other species if desired. The grasses should be planted to allow for efficient seed harvesting using standard agricultural equipment.

Ideally, the native grass farm will be constructed in an area that is currently of low habitat quality and dominated by alien annuals. The site should be near a water source for periodic irrigation to allow for maximum seed yield during dry years.

The DOE, through the ERC contractor, has contracted with a private grower to produce Hanford-derived grass seed. This program has been successful, and similar programs should be pursued in the future.

6.0

Locations for Mitigation Areas or Banks

If onsite mitigation actions do not provide full replacement of lost habitat value, the project may compensate for this loss by improving habitat on lands away from the project site. In most cases, this will be accomplished via participation in a mitigation bank. Some projects may adversely impact unique resources not covered in an established bank, or may have large mitigation requirements that cannot be met by an established mitigation bank. The following sections describe siting criteria applicable to siting a mitigation bank or siting project-specific compensatory mitigation areas.

6.1 Prioritized, Landscape-Scale Siting Criteria

A number of factors affect the selection of a mitigation area to be used for compensation of habitat value lost at a project site. These factors, which involve mitigation goals, land ownership, and land-use patterns, establish a set of prioritized criteria that affect site selection at the landscape scale. The criteria and their hierarchy are as follow:

1. The mitigation area should be contained either wholly within DOE-administered or managed lands or on the Hanford Reach National Monument.

   a. The mitigation area should be located near, within, and/or surrounding lands that possess significant habitat value as identified in BRMaP.

   b. The mitigation area should include lands that will allow for in-kind replacement of habitat value lost at project sites.

   c. The mitigation area should be placed in regions designated within the HCP-EIS as conservation or preservation.

2. If sufficient land area for in-kind mitigation is not available on lands intended to remain under DOE control or on the Monument, then the mitigation area may include nearby federal or state owned lands that are managed for natural resource values. This may require that protection provisions, such as deed restrictions or conservation easements, be part of land transfer agreements.

3. When land fitting neither of the above categories is available, then the mitigation area may include non-DOE-managed and unprotected lands used to achieve in-kind replacement of resources or for protection of at-risk habitat. Thus, these resources could be presently degraded or could be resources of significant habitat value threatened with development.

The first three criteria (1a, 1b, and 1c) must be considered together, and the alternative location criteria (2 and 3) should be followed in order. These criteria are designed to achieve no net loss of in-kind habitat value and a net increase in the acreage of in-kind habitat protected from future development.

Mitigation areas should be designated on land use plans/maps or protected through deed restrictions for at least the duration of the impacts of the project. For this reason, mitigation areas should be located on lands that will remain under DOE or federal administrative control to ensure this protection.

A crucial part of resource management is protecting at-risk, high-quality habitats. Areas recommended to be protected for their resource values are identified in BRMaP. To ensure proper ecological functioning of the mitigation area, site selection should account for these protected areas, and if possible, augment them.

At-risk lands do not include the Monument, because this will be protected for reasons not associated with mitigation. If, however, habitat improvements on Monument lands can result in an increase in the functioning and connectedness of Hanford Site resources, then habitat improvement on these lands is an option for compensatory mitigation.

The lowest priority means of achieving compensatory mitigation is the protection of adjacent, non-DOE-managed resources via acquisition or by other means. Acquisition is an option if habitat improvement or protection of acquired lands can increase the functioning and connectedness of the Hanford resources to be mitigated. Although a last resort, acquisition of non-DOE-managed land is feasible when options for mitigation are reduced on DOE-managed lands.

6.2 Technical Siting Criteria

To achieve in-kind compensation of lost habitat value, a proposed mitigation area must satisfy several technical siting criteria as described below. These criteria include factors such as proximity to the project site, local environmental conditions, landscape features, wildlife usage, and the presence of species of concern. The order in which the criteria are listed does not imply any prioritization, and a selected site may satisfy some criteria to a greater extent than other criteria.

- The mitigation area should be adjacent to areas that are already protected or to areas with complementary habitat if management objectives include preserving a mosaic of habitat types.
- The mitigation area should be sited near the location of a project's impact to increase the likelihood that animals displaced from the project site can use the mitigation area.
- The mitigation area should be capable of serving as a travel corridor for wildlife, as well as a core area of wildlife usage. Corridors may connect habitat areas within the Hanford Site or connect the Hanford Site to adjacent non-DOE lands.
- The mitigation area should be able to balance the effects of large-scale disturbance and habitat fragmentation.
    - Wildlife may not respond to habitat loss in a 1:1 manner. For example, population viability may depend on the presence of a minimum amount of contiguous habitat. Species that require a core area of unfragmented habitat may fail to use small parcels of quality habitat because of edge effects and insufficient patch sizes. Thus, wildlife use in fragmented habitats may be less than expected if based on the summation of individual habitat parcels.
    - Large-scale disturbance can be natural or human in origin. For instance, fire is a disturbance that is highly destructive to shrub-steppe habitat. The siting of a mitigation area should consider the local fire history, the fire potential at and around the mitigation area, and the impact of different fire protection schemes as part of the selection process. The objective is to ensure that both the mitigation area and the remaining native stands of shrub-steppe will not be lost because of a single large fire. A mosaic of habitat types may help reduce the potential for losing all remaining stands of mature shrub-steppe habitat.
    - Although fragmentation and large-scale disturbances are competing concerns, the siting objective is to achieve a balance that will minimize the severity of either impact.
- The mitigation area should be capable of addressing project impacts that affect species of concern. Thus, the selection of a mitigation area may be partially driven by the requirements of a particular species of concern.
- Site selection should be viewed in the context of the surrounding landscape, including lands adjacent to Hanford. This requires information about the distribution of resources as well as land uses both on and adjacent to Hanford.
- Projections of foreseeable mitigation needs will enable the proper sizing of the mitigation area or bank. Potential future expansion of the mitigation area also should be addressed.
- The mitigation area should be capable of achieving in-kind habitat value replacement via habitat improvement. Therefore, the habitat potential of the mitigation area and the project

impact area must be similar. If planting shrubs will be the primary mechanism for increasing habitat value, areas with healthy native understories and relatively undisturbed soils should receive priority consideration.

- The site should not be in a radiological control area or other hazardous materials management areas.
- The mitigation area should be capable of a cost-effective increase of in-kind habitat value. Figure 10 illustrates an example using habitat manipulation resulting in mature shrub-steppe as is the mitigation goal. Three potential mitigation areas are compared: A) a recovering burn area with few or no shrubs present, B) a recovering burn area with many young shrubs, and C) a cheatgrass field.
  - For the same financial commitment, site A is the most cost-effective mitigation area. Site B will naturally reach full ecological functioning in a relatively short period of time; therefore, the increase in habitat value due to manipulations will be limited. Site C is more resistant to habitat manipulations; therefore, the increase in habitat value for the same dollar commitment is less.

6.3 Methods for Selecting a Mitigation Area for Compensation

Evaluating a potential mitigation area using the criteria listed in the previous sections will require the pooling and analysis of information from a number of different sources and databases. Sites can be considered on a landscape basis using Geographic Information Systems (GIS) and databases currently in use onsite. Data layers for land ownership and use, landscape features, topography, vegetation, soils, and habitat use are generally available through the Hanford GIS and the Hanford Environmental Information System (HEIS). Some information is also available through the ecological databases maintained by PNNL.

A GIS analysis will help screen out areas of incompatible land use or highly disturbed areas to help define potential mitigation areas. Additional analyses of vegetation, soils, and topographic conditions will elucidate which areas are most similar in habitat potential to project impact areas. These locations then can be ranked according to the other siting criteria. Thus, potential mitigation areas can be identified that minimize habitat fragmentation and maximize core habitat areas and wildlife travel corridors.

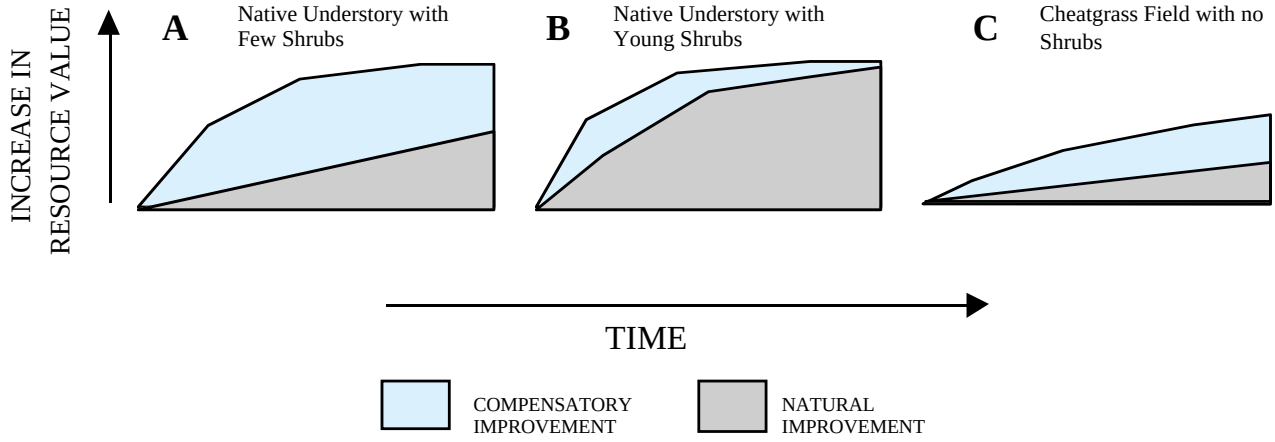

Figure 10. Comparison of Habitat Improvement Potential at Three Possible Mitigation Sites (Comparisons assume equivalent monetary investment)

Gap analysis and habitat evaluation procedures may also be useful in selecting mitigation areas. Gap analysis examines the actual and potential distribution of resources and compares these with the degree to which these resources are protected. The analysis enables protection schemes to be devised. Habitat evaluation procedures specific to particular species and their habitats provide information about key habitat components.

Because the mitigation area must be protected for at least the duration of the impacts of the project(s), the selection of a mitigation area must account for current land ownership, possible land transfers or easements, risk of future development to existing unprotected habitat areas, and long-term commitments to land usage as a mitigation area.

The initial screening for potential mitigation areas will start with the entire Hanford Site and assume the current condition of each part of the landscape. At subsequent levels of analysis, specific categories of Hanford land will be excluded from consideration in the following sequence:

1. Currently developed lands (roads, buildings, waste burial sites, etc.).
2. Lands not yet developed, but identified as being an irretrievable or irreversible commitment of resources in an approved NEPA document or other comparable environmental analysis.
3. Lands determined to be of concern for ecological, cultural, or social reasons, in the HCP-EIS and/or BRMaP.
4. Lands proposed for development, ranked according to the stage of the planning process the proposal is in. Planning stages may range from projects awaiting final NEPA signatures (highest ranking for land exclusion) to projects that have not begun the NEPA evaluation process (lowest ranking for land exclusion).
5. Non-specific land use guidance, such as that provided in the final report of the Hanford Future Site Uses Working Group (HFSUWG 1992).
6. Other documents or considerations about land use.

This approach will ensure that the selection of potential mitigation areas considers the entire Hanford Site and is ecologically based in the broadest sense. This approach may also identify lands more suited for development than for protection of natural resource values.

Comparing the selection of a mitigation area across different levels of screening will indicate the tradeoffs involved between resource protection and site development. This comparison also may suggest alterations to proposed land uses that will enable mitigation goals to be met while allowing site development to continue.

7.0

Mitigation Monitoring, Reporting, and Contingencies

Mitigation actions, especially if they include habitat improvements, must be monitored to determine if the mitigation requirements for a project have been satisfied. Monitoring mitigation performance is necessary to:

- ensure that mitigation actions, including a mitigation bank, meet resource maintenance and improvement goals
- evaluate mitigation and habitat improvement methods
- provide information to respond to contingent needs and events
- ensure that mitigation functions in a cost-effective manner.

A monitoring program will require definition of the specific performance measures to be evaluated, the monitoring procedures to be followed, and the reporting procedures that will be used to distribute the monitoring results.

7.1 Mitigation Performance Measures and Monitoring

Performance measures for a mitigation site should be based on the specific mitigation goals for that site. The selection of specific site performance measures may depend on factors such as size and location of the mitigation site, types of mitigation actions performed, and mitigation goals. Performance monitoring should occur at least annually until the mitigation goals of a site or project have been met. Monitoring procedures used will depend on the specific performance measures and goals for a mitigation site. Performance measures may include:

- native plant cover
- shrub survival and growth
- diversity of native plants
- wildlife usage
- alien plant intrusion
- structural composition of the community
- spatial pattern of vegetative components
- physical and geochemical processes such as erosion and soil microbial activity
- recruitment of planted species.

7.2 Performance Reporting

Results of the monitoring efforts should be reported annually. When applicable, this will satisfy the annual MAP reports required by DOE order 5440.1E. Reporting should provide information summaries to:

- track the progress of mitigation actions against goals
- provide means for resource agencies, natural resource trustees, and other interested parties to assess the relative success of the mitigation program
- provide the information needed by DOE-RL to identify additional actions that may be required to meet mitigation goals
- provide information needed by planners to develop efficient and cost-effective mitigation actions.

7.3 Contingencies

All individual project MAPs should include a contingency plan and predefined minimum performance levels that can be used for comparison with mitigation monitoring results. If the performance monitoring indicates that one or more of the performance measures are below satisfactory levels (such as transplant shrub survival is below predetermined action levels, i.e. greater than 50% mortality), the mitigation bank manager, project manager, or the appropriate responsible office within DOE should consider and identify ways and means to redress the deficiencies.

In the event that all or part of a mitigation area is lost due to actions or events under the control of DOE, the mitigation bank manager, project manager, or appropriate responsible office within DOE should plan and provide for replacement or repair of the mitigation area.

In the event that all or part of a mitigation area is lost due to actions or events that are beyond the control of DOE, such as wildfire, the DOE will not be responsible for replacement or repair of the mitigation areas.

8.0

Mitigation for Plant Species of Concern

A number of plant species on the Hanford Site are of concern to federal and state natural resource agencies. These species are found in almost all habitat types on the Hanford Site, and many eventually may be impacted by Hanford Site activities. Provisions should be made to ensure project activities do not result in net losses of any plant species of concern.

8.1 Plant Species of Concern

Currently, at least 47 plant species exist on the Hanford Site that have been listed by federal (under 50 CFR Part 17) and state (WDNR 1997) resource agencies. Three species—Columbia bladderpod (*Lesquellera tuplashensis*), Umtanum buckwheat (*Eriogonum codium*), and northern wormwood (*Artemisia campestris* ssp. *borealis var wormskioldii*)—are federal candidates for listing as endangered or threatened. At least four others are considered species of concern by the USFWS, and 20 (including the three federal candidates and four federal species of concern) are of concern in Washington State (i.e., state endangered, threatened, or sensitive). These 20 species are defined here as plant species of concern (and considered within BRMaP as Level 3 resources).

Impacts to plant species of concern should be avoided, and any loss of these species should be mitigated with a mitigation ratio of at least 1:1. Information about the status and distribution of most plant species of concern is included in Sackschewsky and Downs (2001).

The remaining species include 15 that are on the state review list. These species are of concern to the Washington Natural Heritage Program, but there is insufficient information available to assign a listing status of endangered, threatened, or sensitive. It is assumed that over time these species will either be listed at a higher level or will be added to the state watch list. Review list plant species are considered Level 2 resources within BRMaP. Avoidance and minimization of impacts to these species is highly recommended, but replacement of damaged populations will normally not be required.

There are currently 12 Hanford Site plant species on the Washington State watch list. In general, these species were formerly listed at a higher status level, but were downgraded because it was determined they were either more common or less threatened than previously believed. It should be noted, however, that several species on the watch list (such as stalked-pod milkvetch [*Astragalus sclerocarpus*]) were downgraded because of their abundance and perceived protection on the Hanford Site. Many watch list species also are good indicators of undisturbed native habitats. Watch list species are considered Level 1 resources within BRMaP. Consideration should be given to species on the state watch list during project planning and while project mitigation requirements are being determined.

8.2 Mitigation Procedures

If a plant species of concern is found at a proposed project site, mitigation should follow the hierarchy described in Section 1.3. In many cases, a combination of these mitigation levels may be the optimal means of mitigation. Each level as it applies to plant species of concern, is described in the following sections.

8.2.1 Avoidance

Selecting an alternate project site is the preferred approach for rare species conservation and is the one approach that precludes the need for additional mitigation measures. Circumstances exist, however, when this option is impractical. Moreover, because new populations may colonize an area at any time, a population may not be discovered until after significant investments have been committed to a particular site, or even after several years of site use and development.

8.2.2 Minimization

If avoidance is not possible, minimization may be accomplished by redesigning to avoid most of a population, thereby limiting the overall impact. This should include placement of an administratively controlled zone around the protected population. The control zone should be clearly delineated to prevent inadvertent entry by pedestrians or vehicles, and site workers should be informed of its nature and importance.

The controlled zone should be large enough to: 1) support the population and provide enough habitat to allow for population expansion, and 2) prevent adverse impacts to the population due to its close proximity to high traffic areas, excavations, or areas that may receive herbicide drift. Individual plants outside the administrative control zone can be transplanted within the controlled area. Designation of controlled zone boundaries should be made in consultation with biologists familiar with the species.

8.2.3 Rectification and Compensatory Mitigation

In some cases, it may be impractical to move a project to an alternate location or to use administrative controls to protect the population. Under these circumstances, the next two mitigation options are, in order of preference, replacement of the population on the project site (rectification) and relocation of all or part of the population to an area away from the project site (compensatory mitigation). These options should be considered as a last resort, to be used only when the avoidance and minimization options are infeasible.

If onsite replacement or offsite relocation is necessary, both mature plants from the site to be disturbed and seeds should be collected, if possible, for the mitigation effort. The use of both life stages will increase the probability of re-establishment and help preserve the genetic diversity of the population. The plants should be identified, marked, and provided temporary protection through administrative controls.

Once the plants have set seed, the seeds can be collected and the mature plants transplanted. Successful transplantation is most likely during the period following seed set, as this is typically a quiescent or dormant period during which water and nutrient requirements are low. Transplantation before seed set may result in negligible seed production or in death of the mature plant before it can set seed.

Because many plant species of concern have specific habitat needs (which in most cases are not completely understood), it is preferable to transplant to an area that is physically and biologically similar to the site of the original population. This area may be on the project site, in a nearby undisturbed community, on another site undergoing restoration, or within a mitigation area or bank. The transplant site must remain undeveloped and undisturbed.

Collected seeds should be held in a nursery where they can be vernalized, germinated, and nurtured until the seedlings are ready for outplanting. In most cases, seedling development should be timed to allow for late fall or early spring transplantation. Seedlings should be used to replace or expand the population impacted by project activities. If excess seedlings are produced, some may be introduced to other reclamation sites or to other protected areas on the Hanford Site.

If possible, transplants should be irrigated at the time of planting and on a regular basis thereafter until it can be determined that the plants can survive without supplemental irrigation. In most cases, irrigation can be performed either by hand or with a water truck. Long-term monitoring of the transplanted populations is required to ensure establishment and successful reproduction on the new site and that mitigation requirements and goals are met.

Methods used in transplanting mature plants, collection of seeds, treatment and germination of seeds, and nurturing and outplanting of the seedlings should be documented to allow for methodology evaluations and for continual improvement of the propagation methods.

9.0

Project-Specific Mitigation Action Plans

It is not within the scope of this mitigation strategy to define the specific commitments applicable to any project-specific mitigation action plan (MAP). Each mitigation action plan will be unique in the types and amounts of resources that need to be mitigated as well as the physical and other constraints of the project. Therefore, any project that will result in adverse ecological impacts will be required to prepare a MAP that will state the particular mitigation commitments that DOE will make regarding that project. Although they might be issued for other reasons, project MAPs are usually prepared as part of the record of decision for an environmental impact statement or finding of no significant impact (FONSI) for an environmental assessment.

The project-specific MAP will determine, among other issues, the appropriate:

- compensatory or rectification actions, such as what, how much, and where to plant
- monitoring requirements
- success criteria
- contingency actions if mitigation goals are not met
- reporting schedule.

This mitigation strategy is intended to provide a degree of consistency to the preparation of project-specific MAPs and to provide a basis for the project-specific determinations, recognizing the highly variable nature of mitigation actions on the Hanford Site.

Mitigation Action Plans are usually prepared to describe how a project's impacts will be mitigated, and usually will primarily discuss compensatory mitigation actions. However, in some cases, a project-specific MAP may function as a road map describing how project or programmatic impacts will be avoided or minimized. An example of this type is the MAP prepared for of the remedial action projects in the 100 and 600 Areas Operable units (DOE 2001c).

Mitigation Action Plans for projects that will require rectification or compensatory mitigation should include sections discussing the following areas:

- summary of project
- summary of impacts to be mitigated
- mitigation goals, objectives, and performance standards
- description of mitigation site(s)
- description of mitigation actions
- monitoring plan
- site protection measures
- maintenance activities
- contingencies
- responsibilities
- other mitigation needs (i.e., cultural resources, dust, etc.).

Examples of project-specific MAPs that have used this general outline include those prepared for the Safe Interim Storage of Tank Wastes (DOE 1995b) and for Tank Waste Treatment Privatization Infrastructure development (DOE 1998), and the MAP for the 100 and 600 Area Remedial Action Projects (DOE 2001c).

10.0

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11.0

List of Acronyms and Initialisms

ALE	Fitzner/Eberhardt Arid Lands Ecology Reserve
AMC	Assistant Manager for Infrastructure and Closure
BLM	Bureau of Land Management
BRMaP	Biological Resources Management Plan
BRMiS	Biological Resources Mitigation Strategy
BWIP	Basalt Waste Isolation Project
CEQ	Council on Environmental Quality
CLO	Closure Division, U.S. Department of Energy, Richland Operations Office
CFR	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
EA	Environmental Assessment
ECAMP	Ecological Compliance Assessment Management Plan
ECR	Ecological Compliance Review
EIS	Environmental Impact Statement
E.O.	Executive Order
ERC	Environmental Restoration Contractor
ERDF	Environmental Restoration Disposal Facility
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FR	Federal Register
GIS	Geographic Information System
HEIS	Hanford Environmental Information System
HEP	Habitat Evaluation Procedure
HCP-EIS	Hanford Site Comprehensive Land Use Plan - Environmental Impact Statement
HSI	Habitat Suitability Index
HU	Habitat Unit
MAP	Mitigation Action Plan
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
PNNL	Pacific Northwest National Laboratory
RCC	River Corridor Contractor
RI/FS	Remedial Investigation/Feasibility Study
RL	DOE Richland Operations Office
ROD	Record of Decision
TPA	Tri-Party Agreement
USFWS	U.S. Fish and Wildlife Service
U.S.C	United States Code
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WDOE	Washington Department of Ecology
WNHP	Washington Natural Heritage Program

12.0

Glossary

AVOIDANCE: Mitigation actions that rely on elimination of all or part of a project, or changes to project timing, location, or structural modifications to completely avoid adverse impacts to biological resources. Avoidance is the first step in the mitigation hierarchy.

BANK CREDIT: Increased habitat value derived from habitat improvements on a mitigation banking site. Habitat improvements identified as mitigation banking credits are typically implemented before project impacts take place. Pre-existing habitat value does not count as credit.

BANK DEBIT: Decreased habitat value on project sites that result from project impacts to biological resources. Bank debits are offset by bank credits.

BIOLOGICAL RESOURCE: A biological species, population, species assemblage, habitat, community, or ecosystem. If a biological resource is of management concern, it may also be a mitigable resource.

COMPENSATION: Amelioration of project impacts by replacing lost habitat value away from a project site. Can be accomplished by either habitat improvement or by acquisition and protection of substitute, high-quality resources. Compensation is the last step in the mitigation hierarchy.

CORRECTIVE ACTION (MITIGATION): Actions taken following the unsuccessful implementation of mitigation measures that ensure project-specific mitigation objectives are met.

ECOLOGICAL COMPLIANCE REVIEW: An assessment of the potential for a proposed project to adversely impact biological resources.

ENHANCEMENT: An improvement in the value of an existing habitat. Under USFWS policy, enhancement specifically refers to habitat improvements that are independent of mitigation commitments or waste site restoration actions.

EVALUATION SPECIES: A species selected for analysis in habitat suitability index models.

HABITAT: The combination of biotic and abiotic components that provides the ecological support system for plant or animal populations.

HABITAT AMENDMENT: Increasing habitat value by supplementing an area that already contains some of the desired habitat components with missing habitat components.

HABITAT CREATION: The establishment of a functioning habitat in essentially abiotic areas with little or no existing habitat value. The created habitat may or may not resemble the original habitat of the site.

HABITAT EVALUATION PROCEDURE: A method used to document the quality and quantity of available habitat for selected wildlife species.

HABITAT IMPROVEMENT: An increase in habitat value through amendment, reclamation, or creation.

HABITAT SUITABILITY INDEX: A model-based estimate, ranging from 0 to 1 of the utility of the habitat in a specific area to support an evaluation species. A value of 1 indicates optimal habitat; a value of 0 indicates the area is unusable by the evaluation species.

HABITAT UNIT: The unit of currency in habitat evaluation procedures that takes into account both the quality and quantity of habitat. Habitat Units = Quality (HSI value) x Quantity (area).

HABITAT VALUE: The suitability of an area to support selected animal and/or plant evaluation species.

HOME RANGE: The land area required for an animal species to survive and/or successfully reproduce.

IN-KIND MITIGATION: Replacement of lost habitat value with substitute resources that closely approximate that lost, so populations of species associated with that habitat may remain relatively stable in the area over time.

LANDSCAPE SCALE: A scale of ecological evaluation that includes multiple habitat types, ecosystems, and land uses.

MINIMIZATION: Mitigation actions that rely on changes to project timing, location, or structural modifications that minimize adverse impacts to biological resources. There may still be some residual adverse impacts to mitigable resources following minimization. Minimization is the second step in the mitigation hierarchy.

MITIGABLE RESOURCE: A biological resource (species or habitat) considered rare, threatened, or in need of special management and/or protection. Adverse impacts to these resources may require mitigation actions.

MITIGATION: a series of prioritized actions that, when achieved in full, ensure project impacts will result in no net loss of habitat value or wildlife populations. The sequence of mitigation actions proceeds from the highest to lowest priority as follows: 1) avoid the impact altogether, 2) minimize the impact, 3) rectify the impact by restoring the affected environment, and 4) compensate for the impact by replacing or providing substitute resources or environments.

MITIGATION ACTION PLAN (MAP): DOE document, usually associated with a ROD for an EIS, or if mitigation is specified within a FONSI for an EA, that explains how mitigation commitments will be planned and implemented [see DOE's NEPA implementing procedures (10 CFR 1021.104 and 10 CFR 1021.331)].

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MITIGATION THRESHOLD LEVEL: The level of habitat value reduction that will trigger the requirements for rectification and/or compensatory mitigation.

MONITORING: Collection of specific types of data to determine if the goals and objectives of project-specific mitigation or the mitigation bank are met.

OFFSITE: Away from the project site and, unless otherwise specified, still within the Hanford Site boundary.

ONSITE: The location where project impacts to biological resources occur.

OUT-OF-KIND MITIGATION: Replacement of lost habitat value with substitute resources that are physically or biologically different from those lost.

PRIORITY HABITAT: A habitat designated by WDFW as having unique or significant value to many wildlife species.

PRIORITY SPECIES: Wildlife species designated by WDFW that require protective measures for their perpetuation due to their population status, sensitivity to habitat alteration, and/or recreational importance.

PRODUCTIVITY: The amount of energy or biomass accumulated by an individual, population, or community during a specific time period.

PROJECT: Any activity that has the potential to impact biological resources such as facility modification, privatization, testing, remediation, or construction. This is not equivalent to the DOE 4700.1 "Project Management System" definition of "project," which is limited to classical construction projects.

RECLAMATION: Improvements to the value of habitat degraded by anthropogenic disturbance. Reclamation is intermediate to habitat creation and habitat amendment.

RECTIFICATION: Amelioration of project impacts by replacing lost habitat value at the project site. Rectification is the third step in the mitigation hierarchy.

REMEDIATION (WASTE SITE): Actions taken to remove or isolate physical, chemical, or radiological hazards at a past practice waste site.

REPLACEMENT RATIO: The ratio of the area over which mitigation measures are applied to the area receiving adverse impacts (assuming equivalent habitat value at each site). Alternatively, it can be the ratio of the improved habitat value at the mitigation area to the habitat value at an impacted site (assuming the same land area for each site).

RESTORATION (WASTE SITE): Actions taken to create habitat value at a past practice waste site subsequent to the completion of remediation.

SPECIES OF CONCERN: For fish and wildlife, any federal endangered, threatened, or candidate species; species covered under the Migratory Bird Treaty Act; and any additional species identified as Washington State priority species. For plants, any federal endangered, threatened, or candidate species plus any additional species identified as a Washington State endangered, threatened, sensitive, or monitor species.

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