King County
Water and Land Resources Division
Ecological Lands Handbook

June 2003

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Department of Natural Resources and Parks
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Table of Contents

Introduction to the Ecological Lands Handbook

The *King County Water and Land Resources Division Ecological Lands Handbook* serves as a collection of materials to guide management of King County Department of Natural Resources and Parks Ecological Lands. This document contains two main elements: (1) the conservation theory that should be used to support King County Ecological Land management activities to ensure the long term ecological integrity of these properties; and (2) guidance for how to write Site Management Guidelines (SMGs) for these properties.

This handbook includes specific guidance on the following:

- a set of conservation principles by which to manage these sites (pp. 4-17)
- integrating the conservation principles into site planning (pp. 18-19)
- public use of Ecological Lands, funding considerations, maintenance needs, and revenue-generating opportunities (pp. 20-21)
- the process of stakeholder cooperation and research to prepare SMGs (pp. 22-23)
- the relationship of SMG objectives, recommendations, and future projects on the site (p. 23)
- a template for SMGs, which outlines how and where each of the above topics should be addressed in the document (pp. 24-31)

Additional materials may be added to the Handbook as they are produced and approved by the Department of Natural Resources and Parks, such as guidance on restoration and capital project planning, maintenance activities, or public access.

What are "Ecological Lands"?

"Ecological Lands" are a category of DNRP properties managed to protect their ecological value. Appropriate public use and interpretive opportunities are accommodated on these sites (King County 2001). The King County Council assigned management responsibility for Ecological Lands to the King County Water and Land Resources Division (WLRD) Office of Rural and Resource Programs (ORRP) in 2001. The Natural Resource Lands Management (NRL) group of ORRP manages these lands.

The Ecological Lands comprise approximately 4500 acres, located primarily in unincorporated areas between the Urban Growth Boundary and the Forest Production District boundary[1] in east King County. These properties range in size from less than one acre to up to several hundred acres.

The Ecological Land classification was created in 2001 when the Department of Natural Resources merged with the King County Department of Parks and Recreation. The former Parks inventory was split into four categories: Ecological, Working Resource, Multi-Use, and Active Recreation. Each category is managed for varying levels of resource protection and public use. Multi-Use sites and Active Recreation parks support higher-intensity recreational activities. Working Resource lands are managed for agriculture or forestry, and public use when appropriate.

Many of the properties in the Multi-use, Active Recreation and Working Resource categories have significant ecological value in addition to their other attributes. The Ecological Lands category is not intended to include all King County lands with ecological value. As King County acquires new properties slated to be managed by the Parks and Recreation Division or WLRD Office of Rural and Resource Programs section, they will be placed in one of the four categories.

When making management decisions, NRL staff coordinate with other divisions and sections within the King County Department of Natural Resources and Parks, including the Parks and Recreation Division's Resource section (resource coordinators) and Property Services section; the Watershed

[1] Urban Growth Boundary was designated by the Growth Management Act RCW 36.70A; Forest Production District boundary was designated in the 1994 *King County Comprehensive Plan.*

Stewardship section (basin stewards); the Science, Monitoring and Data Management section (scientists); Flood Hazard Reduction Services section (planners and engineers); the Capital Projects and Open Space Acquisitions section (real estate specialists, ecologists, and engineers); and the Strategic Initiatives section (planning staff).

Goals for Ecological Lands

The goals[2] for the Ecological Lands are to:

- conserve and enhance ecological value, and
- accommodate appropriate public use that does not harm the ecological resources on site.

Ecological Lands provide an opportunity for the County to maintain and enhance the ecological value of the region because of the ability afforded to preserve, protect, and enhance ecological processes and habitat features. Ecological Lands will be managed for their ecological value, where *ecological value* is defined as biological diversity and ecosystem integrity. Ecological Lands should be managed in a way that both assures the greatest protection of ecological processes and native species on these lands, and assures the highest possible contribution of these lands to ecological protection at larger scales. In other words, the lands should be managed for their sustainability.[3] Biodiversity and ecological integrity will be discussed further at the beginning of the "Conservation Theory" chapter.

The conservation principles presented in this Handbook provide the broad guidance for land managers to refer to when making sound, conservation-based management decisions for Ecological Lands, including public use recommendations.

Public use should be thoughtfully and sustainably integrated into each site by evaluating historic and current public use patterns and identifying environmentally sensitive portions of the site that require maximum protection from human impacts. Public use considerations are discussed in the "Creating Site Management Guidelines" chapter.

[2] These goals are derived from the 2001 WLRD Strategic Plan guidance for managing conservation lands.
[3] A relationship between dynamic cultural, biological, and physical systems associated across the landscape such that the effects of human activities do not threaten the integrity of the processes that provide the context for these activities.

Conservation Theory

This chapter presents the conservation theory that provides the foundation for the remainder of the Handbook. Ecological Lands are to be managed for both the conservation of their ecological value and appropriate public use. Ideally, these lands will maintain a self-sustaining array of dynamic and diverse habitats and ecosystems composed of native flora and fauna. The conservation principles described in this chapter provide a theoretical framework for integrating both natural and human values into all aspects of Ecological Lands resource management.

The *Conservation Theory* chapter consists of three parts:

- Defining Ecological Value
- Assumptions Underlying the Handbook
- The Conservation Principles

Defining Ecological Value

Ecological value, part of the goals for the Ecological Lands as identified in the Introduction to this Handbook, is defined here as biological diversity and ecosystem integrity[4]. The two components of ecological value merit a brief discussion before the conservation principles are examined.

Biological diversity, or biodiversity, is defined to encompass four attributes: (1) species richness; (2) genetic variation within populations; (3) genetic variation across the distribution of the species, a variation that reflects local adaptation and the raw materials for future evolutionary change; and (4) the complex of ecological interactions organisms are involved in (Lidicker 1995). Further, biodiversity depends upon and encompasses *processes*. These processes include biogeochemical cycles; biotic and abiotic disturbances; predator-prey, mutualistic, or parasitic relationships; migrations; and competitive effects (Leslie et al. 1996). Biodiversity depends upon and is indicative of the health of natural ecosystems.

An ecosystem has integrity if it retains its complexity, its health, and sufficient diversity within its structures and functions to maintain self-organizing complexity through time (modified from Iverson and Cornett 1994). The issues of scale and context are implicit within this definition, and as we will soon discuss, scale and context are critical considerations for all conservation planning. The integrity of biophysical systems, for example, are dependent upon their context both spatially (across landscapes) and temporally (multi-generational). Four attributes may be associated with the concept of ecological integrity (Ulanowicz 2000): (1) system "health," that is, the continued successful functioning of the community; (2) the capacity to withstand stress; (3) an undiminished "optimum capacity" for the greatest possible ongoing developmental options; and (4) the continued ability for ongoing change and development, unconstrained by human interruptions.

Maintaining and enhancing the biodiversity and ecological integrity of King County is critical for numerous reasons. Natural processes are complex and interdependent, and it is not possible to predict all the consequences of loss of biodiversity or ecosystem integrity. Experience suggests that the consequences of these losses are worse and affect a greater area than is ever anticipated. When a region's natural or historic level of diversity and integrity is maintained, higher levels of system productivity are supported in the long run and the overall effects of disturbances may be dampened. In this way, biodiversity may provide an extinction buffer for populations against normal environmental variation. Healthy ecosystems support human health and economic well-being by providing direct benefits such as clean water and air. Indirect benefits include natural processes such as biofiltration and pollination, as well as passive recreation and aesthetic values.

[4] For definitions of terms, please refer to the Glossary at the end of the Handbook.

Assumptions Underlying the Handbook

Several assumptions underlie the framework of this Handbook. The working assumptions of this Handbook are:

- *Humans are a part of the landscape*: Humans influence and are influenced by ecosystems, are an integral part of ecosystems, and are fully dependent upon ecosystems for their well being (Kaufman et al. 1994; Grumbine 1994).
- *Times have changed*: Because many of the processes of our ecosystems have been fundamentally changed through human actions, the goals for Ecological Lands cannot realistically be geared toward recreating the past; rather, the goals and objectives for the lands reflect the desired outcome of increased and sustained biological diversity.
- *Nature knows best*: Management should be geared toward allowing natural processes to operate as independently as possible from human intervention. By re-establishing natural processes, ideally structure and function will follow. Without additional human encumbrances, the natural processes will lead to increased and sustained biological diversity. The full restoration of process, structure, and function on these individual sites may be limited because of increasing pressures such as urbanization, water pollution, invasive species, and habitat fragmentation. However, the County can manage its lands and design acquisition strategies to best allow natural processes to occur unencumbered wherever possible.

The Conservation Principles

This chapter of the Handbook outlines the conservation principles to be used in the development of King County Ecological Lands Site Management Guidelines (SMGs). These principles may be considered when planning site-specific management activities; any forthcoming guidance on this topic will be included in the Handbook at a later date. The principles presented in this document are derived from those contained in King County's *Draft Aquatic Conservation Strategy* (ACS).

King County's ACS provides guidance to King County on how to protect and recover aquatic ecosystems, habitats, and species, and prevent future species listings under the federal Endangered Species Act. The ACS is founded on scientific principles derived from conservation biology (landscape ecology, ecosystem ecology, and population biology). The ACS is a proactive, integrative, and comprehensive approach for protecting and restoring the natural functions of ecosystems and their species while carrying out the County's core businesses. It recommends a participatory process involving scientists, policy makers, environmentalists, and other stakeholders.

The ACS identifies basic scientific principles to be considered when planning, designing, and implementing any County action. *Principle* in this context is defined simply as "a rule of action or conduct." These principles address resource management on multiple spatial scales and use an ecosystem perspective to inform management at the more fine-grained scale of individual sites and projects. The principles are intended to form a framework for informed planning and decision making. The nine principles that follow are derived from the conservation principles of the ACS and are based on the best science available and the newest paradigms in conservation biology and restoration ecology. It is inevitable that management issues will arise that are not easily addressed under the principles. Yet these principles, although not prescriptive, will provide guidance on land management and a vision of the future of these lands. The more that land managers are able to integrate these principles into their ways of thinking about planning and management, the greater the chances of conserving ecological value on the County's Ecological Lands now and into the future.

On the following pages, each of the conservation principles is defined, its scientific basis and application in site planning is discussed, and examples are presented that are intended to illustrate each principle in concrete fashion. Some examples are taken directly from specific instances on Ecological Lands and some are more general. The order of these principles is not intended to imply a prioritization; rather, all principles are intended to be integrated in concept and in practice.

Landscape Principle

Consider the context of landscape and watershed.

All natural resource protection occurs within an ecological context. Management should consider not only the immediate site but also the context that surrounds it, influences it, and is influenced by it. For example, watershed[5] boundaries are useful ways to define ecological planning units for resource protection of aquatic systems. Structure and process within a watershed, and the interactions between terrestrial and aquatic components of the watershed, drive and are driven by watershed functions including ecosystem, habitat, and species support.

There is no single appropriate scale of landscape or watershed for all planning and management activities. Various activities will require consideration of different scales—from subbasins of a few square miles to watersheds that contain many hundreds or thousands of square miles. Often, the scale of planning and management is established administratively by such factors as ownership or authority. Effective conservation planning often requires cooperation and collaboration across administrative and political boundaries. Although it may not be possible to plan or manage at the full scale of a species' range, for example, information about conditions within the range should inform planning and management at the smaller scales (e.g., an Ecological Land may provide protection within a key subbasin vital to a larger system).

Because some of the Ecological Lands are small properties, it is fair to ask how it is possible to affect or restore ecological processes and functions when dealing with such a tiny piece of the landscape. The smaller a property is, the more it may be affected by actions on the surrounding landscape. On Ecological Lands, the County may not be able to manage at the landscape level, yet the County should still manage the lands in the context of the landscape. Management of a property within the context of the landscape allows development of: (1) appropriate restoration/management decisions for the site based on the level of alteration of landscape processes; (2) avoidance of expensive restoration actions that may not be sustainable based on level of process alteration; and (3) larger scale subbasin or basin recommendations that will assist in the long-term restoration of processes and sustain recovery of structure and function on-site.

Examples

- Yellow Lake is an example where a single landscape feature was protected without a full understanding of context, as well as an illustration of how all the principles must be used collectively. Yellow Lake is a shallow lake with perimeter wetlands. In the 1980s King County acquired an easement on the lake, at which time a 200-foot buffer was established within which no development or disturbance would occur. Twenty years ago, a buffer of that width was far larger than the King County Sensitive Areas Ordinance required; at the time, it was considered revolutionary. However, it is now apparent that the 200-foot buffer cannot guard the system against the impacts of urbanization. The lake and its buffer are entirely surrounded by development in the basin. The native biological diversity of the place has decreased (in the variety of waterfowl present, for example) as the ecosystem has been altered over the past 20 years. The natural processes of sediment input and eutrophication are accelerated by runoff that brings in massive amounts of siltation; the lake is shrinking, and in time the open water will probably be gone altogether or become unsuitable as wildlife habitat. Yellow Lake was once an area that merited protection because of its rich biodiversity. However, with a greater emphasis on the context of the lake within the entire developing sub-basin (with attention to the context of soils, geology, topography, and hydrology), other protective measures such as larger buffers, connectivity to other systems, and alternative land use patterns might have helped better preserve the system's integrity.

[5] For the purposes of this discussion, "watershed" refers in general terms to any size of hydrologic basin ("watershed" includes drainage basins of all scales from small streams to large rivers). This definition is in contrast to the strict definition in which watershed refers to the largest hydrologic unit (major rivers), and "basin" or "sub-basin" refers to smaller hydrologic units of named streams. (See King County, 2002d, p. 43.)

- When planning a restoration planting project, this principle may be applied by considering adjacent land uses. For example, if herbicides will be used on adjacent lands by farmers and the herbicide drifts, it might kill the newly installed plants. Similarly, if herbicides are employed as a means to control invasive species on County lands, care must be taken to ensure that there is no harm to adjacent agriculture lands and crops.
- If we choose to rehabilitate a wetland by altering its pattern of topography or depth, we do so with the knowledge that there will be a different response from various species to these changes. Altering the topography may favor one species from the existing community over others, or a new species may find the habitat favorable and displace a present species. In any event, the habitat change will result in a new relationship with other habitats in the ecosystem. Further, the new ecosystem alters the relationship among other wetlands in the landscape; thus, the effect of a simple change in depth travels upward and downward through the system hierarchy.
- When planning a planting project, the effects of the planting on the fish and wildlife communities should be considered. For example, by planting trees and shrubs in a pasture, forage opportunities for raptors may be reduced, but songbird habitat may be increased. In general, it is important to consider the biological succession as well as the temporal succession (see Time Principle). A person planning a project should consider what species they wish to promote or what species are likely to benefit as the project matures.

Hierarchy Principle

Interventions should follow this hierarchy:

Maintain and restore basic ecological processes;
Maintain and restore ecological structure;
Maintain and restore ecological function;
Maintain and restore particular ecosystem attributes, habitats, and species.

This principle, like many others, is one of context: the patterns we observe in ecosystems are the result of events occurring at larger and smaller scales, and actions we take will have effects in many directions from our target. The hierarchy represents an ecological relationship where each level is dependent on the other. This principle directs us to consider the order or hierarchy of our actions when we are modifying ecological systems—whether through planning, restoration, enhancement, or other project actions. Sustaining watershed processes must be a key consideration underlying any intervention or management action on the land. An intervention should be selected that can be sustained by the watershed processes currently present.

Ecosystems and habitats suitable for particular species are the result of various geologic, hydrologic, and biologic processes acting on structural characteristics of the system over time and space. Examples of processes may include the movement of water, sediment, nutrients, or energy; structure may include vegetation composition, food webs, or water chemistry; and function may include nutrient cycling and the provision of a diverse array of habitats. Ecological processes must be maintained at their natural rates, variations, and locations for ecosystems to be sustainable and for habitats to be maintained. Where basic processes are intact, systems are likely to recover—or be recovered—more easily from disturbances or inappropriate actions if the actions themselves are not permanent. Conversely, the more interference there has been with basic processes, the greater the severity (and longevity) of effects.

If our interventions do not take into consideration the processes that are currently in place in the watershed, then the less sustainable these actions will be without constant inputs of energy from managers. We often cannot act upon the level of process; we should then focus our actions on structure or function in ways that are sustainable within the context of existing processes. Additionally, the smaller a property is, the more important is its context, but the less we will likely be able to affect the context. The following bullet points summarize how one might think through the hierarchy; all of these steps presuppose an analysis to help determine if restoration measures are appropriate for the level of alteration present:

- If a management action addresses an ecological process, it should result in the restoration of the structural and functional elements affected by that process.
- If we cannot restore the basic processes of a system, we move down the hierarchy, and our actions should be directed to the next lower level of intervention—that of ecological structure. It may be appropriate to temporarily restore a structural element as an interim measure, prior to restoring the process that will sustain it.
- If restoring structure is insufficient to regain system function, then the next level in the hierarchy directs us to restore function indirectly through non-structural means (e.g., limiting access to a sensitive area) or directly, usually through highly artificial means (e.g., fish hatchery, nest boxes, captive breeding programs, control of predators).
- Finally, if we are faced with losing a species or a landscape element, the last resort is to direct our actions to particular habitats and particular species. If we get to this fourth level, the assumption is that the actions we take likely will not be sustainable in the long term—either because driving process can't be restored or because function would take too long to begin working after restoring the process or structure.
- It may be noted that restoration projects that affect structure or function while a process is still constrained may be lost if that process is ultimately restored in the future (e.g., trees and shrubs planted to restore ecological *structure* behind an existing levee may be lost to the river if,

ultimately, the hydrologic *process* of flooding and river meander is restored to the site by removing the levee.)

Examples

- Levee or revetment removal is an example of an intervention geared towards restoring system processes. Within a landscape context, a floodplain is defined by the movement of the river channel. The driving ecological process that defines and sustains the floodplain is a free-flowing river channel that is able to change course through flooding and by recruiting gravel, cobble, and large woody debris. Levees or revetments are intended to constrain meandering river channels. At one of King County's Ecological Lands, Chinook Bend, levee removal is the preferred action, because all other system functioning would likely be restored if the hydrologic connectivity of the system were restored.
- Large woody debris (LWD) is often inserted into streams during restoration efforts in an attempt to re-establish some of the functional processes that lead to healthy fish habitat. However, by installing individual pieces of wood, the action is occurring at the bottom of the hierarchy. In other words, nothing is being changed in the system that will lead to a natural input of LWD over the long-term. If the riparian zone is not intact such that a *source* of LWD is established, or if the hydrology of the stream has been altered so that water velocities will remove all LWD regularly, lots of time and money will be spent inserting wood into streams indefinitely. It may be determined that a short-term solution to helping re-establish stream function would be to manually insert LWD. If analysis of processes shows that the structure and function in this system can be recovered, installing LWD could be performed in conjunction with actions at the level of structure by planting vegetation in the riparian zone so that in time no additional human input will be necessary. Interventions at the lower hierarchy levels should always be selected and designed consistently with the processes present and anticipated.
- Analysis of the limiting factors may help to identify appropriate restoration efforts directed at processes, structures, or functions. It might be that the limiting factor in a particular watershed is confinement of a channel (and not development in the watershed) and that the most appropriate restoration measure to improve hydrologic processes is to increase overbank flooding through purchase of lands where acquisitions can be accomplished.

Information Principle

Use the most accurate historic and current information for planning and management.

Effective planning and management depend on the use of accurate information concerning the distribution and status of species, habitats, and ecosystems, and history of public use. Historical information can inform conservationists of the pathway and timing of events that produced present patterns of habitat and species declines and can provide clues to reversing such declines.

Specific actions for using best information include:

- *Characterize disturbance regime*. It is important to know the character of a disturbance regime when describing current conditions, given the dependence of ecosystems on regular cycles of disturbance and recovery (see Time Principle). "Current" information must not pre-date the most recent relevant disturbance event.
- *Use pre-development conditions as baseline*. Pre-development conditions should be used as the baseline for all comparative analyses of system dynamics. Site-specific pre-development data cannot always be obtained for each property; educated assessments may be made of what likely existed in an area based upon substrate, slope, hydrology, geomorphology, and soils.
- *Establish reference sites*. Evaluations of cause and effect in conservation actions require the establishment of reference sites in order to filter out large-scale environmental fluctuations that may confuse the interpretation of outcomes (see Adaptive Principle). Although reference sites are necessary to establish reliable cause and effect relationships from local actions, conducting this type of research is not realistic for every project. Reference sites should be in equilibrium with current watershed processes (not "remnant" habitat established under a different process regime). Historic information can be used to assess the amount of process change that has occurred in a watershed (i.e., shows level of alteration from one land use to another—see Time Principle).
- *Use reliable, primary information.* When using any information, assess the origin and purpose of the data to better understand its context and the assumptions that underlie it. Conclusions about cause/effect relationships and trends should be based on information and data with definitive source material (origin, purpose, and statistical structure). Primary sources of information should always be consulted, if possible.
- *Establish information database.* One tool that would aid in effectively accessing the best information available would be a database containing all known information about the property. A database such as this might contain information about the original intent of the acquisition. It might also contain a catalog of the capital work that has been done throughout the history of the County's ownership and the public use trends (e.g., types of use, public dumping, vandalism) so that successes as well as failures might be examined.

Example

- Before planning a restoration project, determine the processes that are at work in the area, then determine what functions are targeted for restoration. If a system has been altered dramatically, determine the processes that were historically present in order to best decide what to manipulate and where direct the work. Determine if any of the processes that were working in the past may work again in the future, and if so, how that would affect management actions. For example, if a levee will be removed, how will that affect a planting project? Will all the planted trees and shrubs be flooded or swept off the site by flooding? As another example, consider that although boulders and LWD were removed from many systems historically, not all systems had boulders and LWD. Before incorporating them into a restoration plan, it should be determined if they were present pre-development.

Precautionary Principle

Always act according to the Precautionary Principle.

The Precautionary Principle is reflected in the phrase "Do no harm." The Precautionary Principle suggests that in the face of uncertainty about the workings of ecosystems and the effects of our actions, we should always anticipate harm and err on the side of caution. Incomplete or inadequate data are generally the norm in conservation and resource management activities; however, lack of data should not be used to justify a delay in taking conservation actions. In these cases, conservation actions—or refraining from potentially harmful actions—should be based on the probable consequences to species, habitats, and ecosystems, especially when long-term, or irreversible, consequences are more likely than not (Mundy 1998).

This principle stems directly from the experience that it is often difficult to know when we are doing harm. How many times have projects been undertaken with the best of intentions only to later prove that our reasoning was backwards or lacking critical information? One of the most well-known examples of this sort of faulty reasoning involved the prerogative in the recent past to remove all large woody debris from streams to "clean them up."

One direct application of doing no further harm and trying to reduce obvious harm is that, whenever possible, human activities should occur away from or on the margins of areas that provide important ecological functions. Human uses in the vicinity of sensitive areas should reflect a thoughtful and informed planning, design, construction, and maintenance process that accounts for the sensitivity of the resources within the area. Recreation infrastructure that supports low impact, human uses of natural areas may still, if not carefully planned, create in-routes for invasive species, contribute to degradation of sensitive areas, and disrupt natural processes such as hydrologic connectivity and species movement. The most current ecological design principles for trails, roads, and other points of access should be applied when constructing or maintaining facilities on these lands.

Example

- Trails may exist in areas where they might not have been placed had the Precautionary Principle guided their design. Because a trail is already in existence does not mean it should be maintained, much less improved. The visitor use characteristics, physical condition, and impacts associated with existing trails should be assessed to determine whether the trail merits continued maintenance or abandonment in conjunction with restoration. Spring Lake-Lake Desire provides an example: a steep trail previously went straight up the hill and across a bald (a relatively high-elevation, treeless habitat within an otherwise forested area) that supports dwarf mimulus and chocolate lily as well as other plant species native to but uncommon in King County. The trail took people into the heart of the habitat that supported these unusual species. The trail was rerouted, and the old trail was decommissioned. A sign posted at the top of the bald encourages people to stay on the trail to protect the unusual plant species.

Rarity Principle

Give primary consideration to rare ecosystems, habitats, and species[6]; endemic ecosystems, habitats, and species; species that exhibit wide population fluctuations; areas of high native biodiversity; and key habitats and keystone species.

Species, habitats, and ecosystems that possess the attributes listed in this principle are at greater risk of extinction than those that are widespread and abundant. This principle directs us to give priority in our conservation actions to the key features of biodiversity that are at greatest risk for extinction. As such, this principle helps direct our priorities for conservation—it tells us *what* to protect first, whereas other principles tell us *how* to go about protection and conservation. The following descriptions briefly define rare, endemic, and keystone species, habitats, and ecosystems.

- Rare species, habitats, and ecosystems are those that are few in number or are poorly represented in an area. Rare species often lack the capability to resist changes in environmental conditions or lack the resilience to recover after a change. Species, habitats, and ecosystems may be rare because of the following reasons: changing natural conditions have reduced their range, abundance, or distribution; they depend on specific environmental conditions that are not commonly represented in this area (species or habitats at the edge of their range or occurring as relicts); and anthropogenic (human-related) actions have caused habitat loss or severe decreases in range or abundance.
- Endemic species (or habitats or ecosystems) are those that are native to, and occur only in, a particular area or locale. Endemic species generally have very specific adaptive requirements that are linked to particular habitat or ecosystems that are, themselves, rare (e.g., Townsend's big-eared bats and caves). Even small changes in the ecosystem are likely to cause localized extinctions of these species.
- Keystone species are those that exert a significant effect on the structure of the biological community of which they are a part. These species often prevent dominance by a single species and thereby maintain diversity in the community.

Activities that may harm these species, habitats, and ecosystems should be undertaken cautiously, if at all. Habitat for the special-status plant and animal species described above should be protected and enhanced where necessary and appropriate. The relative scarcity of the land type or resource should be measured by looking at factors such as distribution within the county and region, whether it is in general decline, how much is already protected, if the land supports sensitive species, and whether its protection contributes significantly to the protection of other high priority lands. If rare elements of the landscape are present on an Ecological Land, they should be protected using the other conservation principles, such as the Landscape and Hierarchy principles.

A primary benefit of protecting habitat for rare, endemic, or keystone species is that we end up protecting habitat for many other species as well. For example, the most effective way to protect and enhance native salmonid populations is through protection of those river and stream channels, riparian corridors, lakes, wetlands, headwaters, and watersheds that provide or impact spawning and rearing habitat, food resources, and fish passage. By protecting these areas, hundreds of other species will also benefit, and the result will be protection of entire ecosystems.

This principle is arguably tied most directly with how Ecological Lands can best contribute to conserving the County's biodiversity, a key component of ecological value. Because most of the Ecological Lands are small properties in comparison to the stream reaches, terrestrial habitats, and/or watersheds they are associated with, our ability to effect change on a watershed-wide basis is limited. The functional attributes of Ecological Lands are often at the mercy of processes occurring on surrounding lands. Therefore, many times our best opportunity for using these lands to contribute to conserving native biodiversity will lie in protecting rare ecosystems, habitats, and species where possible on County lands.

[6] "Species" is used throughout to be inclusive of populations.

Examples

- The protection of Rock Creek Natural Area, an area of riparian habitat that is small relative to the entire Rock Creek basin, may preserve bird populations that would otherwise not be sustained in the region. Ideally, many areas such as this should be protected so that if nesting habitat, for example, were disturbed at one site, birds could use the other sites. However, if the protection of riparian areas is not repeated across a landscape, the protection of one area becomes even more important.
- Spring Lake-Lake Desire, located in South King County, contains a variety of land types that are rare or uncommon in King County, from a fragile fen to an uncommon bald. Historically, there has been a signed trail into the fen. Because fens are both rare in King County and highly sensitive to disturbance, the sign has been removed and the trail has not been maintained. These actions thereby reduce impacts to this sensitive system that is rare in King County.

Time Principle

Plan and manage at time frames consistent with ecological cycles and variability.

Our planning efforts should be responsive to the various cycles found in the characteristics of ecosystems, habitats, and species. Common ecological cycles include: population abundance and productivity, predator-prey interactions, disturbance-recovery regimes, forest growth and development, lake eutrophication, and migrations. The lengths of ecological cycles are linked to temporal and spatial patterns of floods, droughts, big storms, fires, tides, and are reflected in the life cycles of plants and animals. The ecological patterns that result from the interaction of these many cycles are quite complex.

Knowledge of these patterns, cycles, and gradients should inform conservation and other management actions. Failure to account for these cycles or gradients can thwart the intent of actions or can result in harm to the system we seek to restore. Information can be misinterpreted easily if the temporal context of the data is not taken into account during the design of ecological experiments or monitoring activities.

The full ecological effects of human activities often are not seen for many years, given variation in ecosystem structure and process and the tendency to overlook low-frequency ecological disturbances (100-year flooding, forest succession). Long-term effects of actions may be classified as delayed impacts (not observable for years or decades) or cumulative effects (the product of many smaller actions).

Restoration of degraded systems is a long-term process that requires a multi-year commitment. A vegetation planting may require years of maintenance to fend off invasive species encroachment in order to restore native canopy and understory structure so that the land can again function properly. The goal is to move a degraded habitat towards a sustainable system that provides for a diversity of structure and functions (and therefore species) that is in dynamic equilibrium with the landscape-scale processes present. Sometimes the processes in a system seem to work so slowly, that without a broad perspective, we can easily and mistakenly believe that nothing is occurring. For example, if revetments were removed from a river, its course may not change immediately, but that does not detract from the importance of allowing the river channel to meander naturally.

Example

- A weir is present in Peterson Creek, just downstream of Peterson Lake. The addition of the weir likely had system-wide effects (e.g., fish migration effects, flow modification). Similarly, if it is removed in order to restore more historic hydrologic processes, the effects will potentially be extensive in terms of physical and biological modifications, and the effects will not likely be realized for a long time. The immediate effects of removing the levee might be a lowered lake level and short-term changes that might initially be undesirable. In the longer term, lower lake levels will possibly favor some fish species over others and some stream bugs over others. The vegetation composition will go through changes as well, and those changes will effect further alterations in the system. In effect, an entirely new system is put into motion with a single action such that in 100 years, the system is totally different.

Integration Principle

Integrate terrestrial and aquatic planning and management activities.

Effective conservation and resource management of aquatic and terrestrial systems requires coordinated planning among departments with authority over development regulations and guidelines, wastewater treatment, flood hazard reduction, transportation planning and road building, water quality, and fish and wildlife conservation. Private citizens often own the majority of land within a landscape; effective conservation planning must include the interests of these landowners in addition to ecological value.

Coordinated planning and management can improve understanding of cumulative effects on terrestrial and aquatic systems. It can also help articulate the roles and responsibilities of each department in conservation. Coordinated planning and management allow a systems-based view of impacts to be described and plans developed to avoid or mitigate for adverse effects. If planning and management are done cooperatively, it should be possible to avoid many of the pitfalls associated with harmful activities and save habitats and species, as well as money.

As indicated in the Landscape Principle, the smaller a property is, the more it may be affected by actions on the surrounding landscape. This fact and the fact that many of the Ecological Lands are small highlights the importance of working with neighboring private or public landowners to expand the protection of ecological resources beyond the boundaries of the Ecological sites.

Examples

- Restoration efforts at Porter Levee in the Green River Basin demonstrate an example of inter-agency and intra-agency coordination efforts. Porter Levee is located upstream of Soos Creek and Auburn Narrows. The Army Corps of Engineers is investigating the possibility of setting back the training levee bordering the Green River at Porter Levee. In the meantime, Parks and Basin Steward staff want to install a native plant restoration project to control noxious weeds and improve terrestrial wildlife habitat. Staff consulted with the geomorphologist contracted by the Army Corps to obtain estimates of where the river would migrate without the levee to avoid planting in areas that would be inundated if levee removal occurs.
- An hypothetical example would be a situation where wildlife biologists from one agency propose restoration of a diked wetland in an estuarine setting as freshwater duck habitat without consultation with local government wetland ecologists in other agencies. Such consultation might reveal that restoration to tidal habitat makes more sense ecologically because estuarine habitat was the limiting factor (feeding, refuge, escape habitat) for fish species in the estuary being considered.

Native Species Principle

Curtail introductions and use of non-native plants and animals.

Introductions of non-native plant, vertebrate, and invertebrate species should be avoided, and existing non-natives should be controlled. Non-native species are often invasive because they did not evolve as part of the ecosystem and do not have natural controls or competition. Because non-native species did not evolve in the ecosystem they are invading, they tend to have unanticipated effects on ecosystem functions. For example, once invasive vegetation becomes established, it often results in areas of non-native species homogeneity, which is in direct contrast with our goal of conserving ecological value.

A corollary to this principle is the need to employ only native species for restoration, landscaping, erosion control, and other similar activities. The County may promote and restore native communities where sustainable, feasible, appropriate to the site, and supported by maintenance funding. Specific guidelines are warranted:

- Use only locally adapted native species for natural area landscaping, restoration, rehabilitation, and erosion control.
- Eradicate invasive, non-native plants and animals from County lands and waterways where practicable.
- Avoid habitat alterations in relatively intact areas that create conditions favorable for non-native invasives.
- Use only species that are well suited to the site conditions and the successional stage.

Best construction and maintenance practices can be prescribed as part of routine maintenance or special projects to minimize the transport of non-native seed banks across Ecological Lands by County staff, volunteers, or contractors. Such practices often include the rinsing off of tools, equipment, and machinery prior to their entrance to a site dominated by native plant communities.

Example

- At Hatchery Park on the Green River, a large portion of the riparian zone was dominated by dense non-native, invasive reed canarygrass that had out-competed the majority of the native vegetation in this area. Restoration plantings in 2000 were designed to promote the establishment of native vegetation in this area using three particular strategies that employ the guidance described in this conservation principle. First, willow stems were harvested from a nearby location to provide locally adapted native stock. Second, weed fabric was installed around each planting in order to control competition from reed canarygrass and allow willows to establish. After two years, the willows are well-established, at approximately 4” diameter at breast height. The weed cloth is still in place on small plots so that the plantings won’t be overwhelmed by the reed canarygrass. The third strategy is that the willows (and some other native tree species) will eventually establish a closed canopy of native vegetation at the site. By shading the site, they will provide natural competition against the shade-intolerant reed canarygrass and allow other native species to establish under the canopy. This planting will eventually restore important riparian zone functions such as energy flow, nutrient cycling, water cycling, hydrologic function, and plant and animal population that have become impaired under degraded conditions.

Adaptive Principle

Be prepared to adapt or modify management actions based on ongoing monitoring results.

To improve our efforts at conservation, we must always be advancing our understanding of the systems under our care. As K. Saterson says in *Measuring Conservation Impact*, "Assessing impact, managing adaptively, and learning from experience are critically important to the sustainability of biodiversity conservation."

Management activities should be crafted as experiments intended to obtain knowledge and test management objectives. Information gathered during the assessment of the activity (monitoring) may be used to modify the management activity and, if necessary, pose new management strategies. The time between information gathering and its use in management should be as short as possible in order to achieve effective conservation results.

There are two general types of monitoring[7] that might occur on Ecological Lands:

- monitoring of our actions to determine if they are succeeding in their objectives (e.g., vegetation surveys of planting projects to determine plant mortality; amphibian population monitoring to determine if wetland restoration work restored biological function; fish surveys to determine if instream work increased fish usage of an area)
- monitoring of processes on lands where we are taking no action and want to determine if we need to take action (e.g., determining if rare populations are increasing or declining; determining impacts of adjacent land use on a particular habitat or species; landscape-level vegetation monitoring using GIS)

Not all activities require an adaptive management strategy (e.g., routine site maintenance). Further, making a research project out of every management action is not feasible for several reasons (budget, time, staff). However, programs that have the capability of altering species distributions, habitats, and ecosystems are good candidates for using adaptive management strategies. With consistent adaptive framework, the knowledge that is gathered can be used to clarify and adjust our management strategies.

In order for a monitoring and adaptive management approach to be feasible, it must become a priority that receives adequate funding. Monitoring is expensive, as is changing management schemes. However, it is likely that money will be saved that might have been unnecessarily spent if activities are managed adaptively. Budget and departmental organization would need to allow for appropriate scientific staff to be involved in a project that uses a monitoring framework. There would need to be criteria for prioritizing monitoring efforts on Ecological Lands.

The following guidelines are a brief summary of the steps to take when applying adaptive management to conservation:

1. Determine the objectives of the management activity;
2. Craft the hypotheses (predictions) for the activity;
3. Develop a set of assessment questions for the activity;
4. Select the appropriate indicators to measure;
5. Develop an appropriate sampling and evaluation design;
6. Compare the outcome of the activity with the predictions;
7. Evaluate the effectiveness of the management activity;
8. Modify the management strategy as required.

[7] The term "monitoring" is frequently used to mean a variety of things, from rigorous, controlled scientific research to qualitative assessment to casual observation. All of these types of inquiry have merit, and which you choose depends on what questions you are trying to answer. In this Handbook and in the SMGs, unless otherwise described, *monitoring* is used in the strict sense of using established protocols to determine trends or detect cause and effect.

Example

- One example of adaptive management is the use of "habitat mounds" in King County's wetland mitigation bank site located on the East Lake Sammamish Plateau. One of the challenges of this site was that nearly half of it was a stand of nearly monotypic *Spiraea douglasii*. The managers of the site sought to provide more diversity in the vegetation and habitat structure in order to support passerine birds. They selected several different construction methods to create habitat mounds based on considerations of cost, ease of construction, and conditions on the site. The projects were installed in 1996, and each test area was subsequently monitored to determine the vegetation survival rate, modifications to the hydrology around the habitat mounds, and usage of each test area by passerine birds. Through the use of alternative methodologies and monitoring, King County was able to determine which design was most cost-effective and produced the highest rate of success in meeting project goals. The most effective design technique has been recreated by numerous consultants in the area to introduce vegetation and habitat diversity into a site.

Creating Site Management Guidelines

This chapter provides direction, procedures, and guidance for land managers to consider when creating Site Management Guidelines for Ecological Land sites. The chapter consists of two parts:

- Site Planning Considerations
- Writing Site Management Guidelines

Site Planning Considerations

This section outlines two sets of considerations for site planning. The first set of considerations translates the conservation principles into useful guidance for writing SMGs. The second set addresses public use, funding source and deed restrictions, current funding, and revenue generating opportunities. Both of these sets of considerations are important in order to integrate sustainable levels of public use with the site's ecological value. Management objectives and recommendations presented in the SMGs should be a result of the synthesis of site information, the conservation principles, and public use considerations.

Applying the Conservation Principles to Site Planning

The conservation principles presented in the "Conservation Theory" chapter of this Handbook provide the broad guidance for land managers to refer to when making sound, conservation-based management decisions for Ecological Lands, including public use recommendations. There are three specific ways in which the conservation principles will directly influence Site Management Guidelines:

- to identify the range of necessary information about the site, landscape, and ecological relationships;
- to identify areas of concern and areas of opportunity from these conditions and relationships, with the insight of the principles' landscape ecology perspective; and
- to help set objectives and recommendations for site management that will address the issues highlighted by information analysis.

For each conservation principle, Table 1 lists considerations that address ecological resources, landscape context, connectivity, history, and future trajectory of the site. These considerations are integrated into the "Site Management Guideline Template" later in this chapter to help identify both the range of information that can be provided in an SMG and where this information should be considered and used in the document. This information and the questions raised in these considerations should help stakeholders create management objectives and recommendations that will be in accordance with the conservation principles.

A further use of the conservation principles is to guide project planning by providing a framework to evaluate proposed actions at the site with regard to their contribution to ecological value. Any forthcoming guidance on applying conservation principles to project planning will added to this Handbook in the future.

Table 1. Conservation Principle Considerations to Guide Site Planning.

Conservation Principle	Site Planning Considerations
Landscape Principle *Consider the context of landscape and watershed*	➲ Characterize various scales of ecological relationships for site: watershed, basin, sub-basin, as well as landscape, ecosystem, habitat, species. ➲ Characterize surrounding region, identifying systems or landscape elements that drive ecological processes on site (e.g., hydrology, riparian areas, sediment loading or erosional features, wetlands, upstream and downstream features) ➲ Note ecological or land use activities and "problem areas" in the vicinity (may include current or historical activities).
Hierarchy Principle *Interventions should follow this hierarchy:* ° *Maintain and restore basic ecological processes;* ° *Maintain and restore ecological structure;* ° *Maintain and restore ecological function;* ° *Maintain and restore particular ecosystem attributes, habitats and species.*	➲ Identify key processes, structures, and functions at the site. Are processes intact on this site or in the neighboring landscape? Are structure and function intact? If not, how have they been disturbed? ➲ Characterize inter-relationships between different levels of hierarchy for any areas of concern (i.e., how structural elements such as LWD or wetlands contribute to or are defined by processes such as hydrologic processes) ➲ Of the ecological structure and processes on the site, which are functioning or not functioning properly? ➲ Consider the level of the hierarchy at which action can be taken. Land use may constrain ecological restoration (e.g., levees can't be removed until the land use behind the levee is changed).
Information Principle *Use the most accurate historic and current information for planning and management*	➲ Detail the management history of site. ➲ Compile historical information on ecological condition and context. Pre-development conditions can serve as baseline in analysis (e.g., substrate, slope, hydrology, geomorphology, soils). ➲ Describe history of activities, on the site or in the area, that have preserved or impacted resources (including current activities).
Precautionary Principle *Always act according to the Precautionary Principle*	➲ Are there any obvious threats to ecosystem health present? What is their spatial and temporal scale? (e.g., on-site, watershed-wide, short-term, long-term) What natural processes and species might they affect, to what degree, and at what scale? ➲ Are past land management actions reversible if necessary (e.g., grazing, ditching, diking)?
Rarity Principle *Give primary consideration to rare ecosystems, habitats, and species, endemic ecosystems, habitats, and species, species that exhibit wide population fluctuations, areas of high native biodiversity, and key habitats and keystone species*	➲ Identify presence of rare or endemic species, habitat, and ecosystems, or other landscape elements on or near property; areas of high native biodiversity; key habitats and keystone species; "system source areas" (e.g., wetland recharge areas, gravel sources). ➲ Describe relative scarcity of these features within the ecological context of the site.
Time Principle *Plan and manage at timeframes consistent with ecological cycles and variability*	➲ Identify *cycles* at site (disturbance, population, succession, etc.). How are these cycles reflected in plant and animal habitats and life cycles? (e.g., at what seral stage is the site (early or late successional)?) ➲ Characterize/estimate delayed effects of disturbance (natural or anthropogenic; including low-frequency disturbances such as fire or geologic events, or more frequently occurring disturbances, such as flooding and channel migration zones). ➲ Identify actions or conditions that have interrupted essential natural cycles.
Integration Principle *Integrate terrestrial and aquatic planning and management activities*	➲ Identify nearby planning or land uses with an influence on the site by King County, other public agencies, community groups, industry, and private sector. ➲ Identify nearby preservation opportunities in areas that could contribute to conservation goals. ➲ Characterize general requirements of presumed terrestrial and aquatic species, and specific requirements of any known rare or unique species or assemblages.
Native Species Principle *Curtail introductions and use of exotic plants and animals*	➲ Identify non-native invasive species presence and extent on site and vicinity. ➲ Identify potential inroads for non-native invasive species. ➲ Identify opportunities to go beyond the property boundaries and work with private land owners.
Adaptive Principle *Always use adaptive management*	➲ Identify any monitoring projects or other research that has occurred on site previously that might be used as baseline data for future studies.

Public Use and Site Management Considerations

King County supports public use on Ecological Lands so long as the use does not degrade a site's natural systems. Public use will be thoughtfully and sustainably integrated into each site through an evaluation of historic and current public use patterns, nearby recreational trail and non-vehicular transportation opportunities, and the identification of those portions of the site that require maximum protection from human impacts. Appropriate levels of public use on Ecological Lands will vary from site to site, and will reflect striking a balance between accommodating the public without diminishing the site's ecological functions.

Site Management Guidelines will identify appropriate levels of public use for each site. Typically Ecological Lands will be used for passive recreational activities; however, in some cases more intensive uses may occur that might require the preparation of a more detailed public use plan. Examples of appropriate low-impact passive recreation activities for Ecological Lands include walking, hiking, picnicking, outdoor education, interpretation, and nature observation. More active recreational uses, such as mountain biking and equestrian activities, will not be encouraged but may be deemed appropriate in locations with relatively low ecological value.

Interpretive and environmental education and outreach strategies often contribute to increased public appreciation of ecological resources, citizen involvement in site stewardship activities, and community enforcement of site regulations. These strategies could include signage and programming as well as volunteer restoration and stewardship opportunities. When evaluating interpretive and environmental education opportunities at a particular site, stakeholders should consider whether the amount of public use the site will receive merits the cost of an interpretive or environmental education recommendation. Stakeholders should also consider the recommendations included in the Draft Interpretive Master Plan for King County DNRP (King County 2002a).

Inappropriate Uses on Ecological Lands

A number of activities occur on Ecological Lands that present a risk to public health and safety, and impact the site's ecological value. Problem activities may include garbage dumping, vandalism and theft of county property and natural resources, target shooting, hunting, poaching, transient activity and squatting, boundary encroachments, drug manufacturing, and use of motorized vehicles. Additional problem uses may be higher-intensity recreational activities that are only selectively appropriate, such as equestrian and mountain biking activities and even the use of informal trails.

All of these activities require extensive staff resources to police and address. Resource Coordinators and park staff already devote extensive resources to these problem activities, and can provide guidance as to the ways these have been addressed on site. In some cases, the King County Park Rules and Regulations or applicable laws may outline fines and other measures that apply to problem activities on these sites. Where these problem activities occur on Ecological Lands, they should be identified in Site Management Guidelines as part of the existing conditions and/or analysis. Recommendations should be made to address these uses on Ecological Lands. King County Code allows recreational activities such as horseback riding and bicycling unless specifically prohibited by signage. Therefore managers should post signage where they have decided to prohibit these uses on certain sites, and this prohibition should be noted in Site Management Guidelines.

Maintenance and Management of Ecological Lands

Ecological Lands may require facilities and infrastructure to support appropriate levels of public use, to ensure public health and safety, and to minimize degradation to a site's ecological functions. Park Resource Coordinators and staff provide the primary input to NRL on the regular, short-term management needs for Ecological Lands. Regular needs may include site inspections, vegetation control, litter collection, facility or infrastructure maintenance, and project maintenance, among other activities. SMGs will reflect this input, will provide a general timeline for activities, and may provide additional recommendations for regular management activities. Because of time delays between property acquisition and site management guideline development, "Site Maintenance Plans" developed

by Park Resource Coordinators will identify and address initial public safety and preserve-and-protect actions for each property. SMG recommendations will expand and refine the tasks defined in the initial Site Management Plans.

Funding Source and Deed Restrictions

The original acquisition funding source, grant funds obtained for improvements, and deed restrictions associated with each Ecological site may present use restrictions or obligations. For example, some of the properties acquired in earlier decades were purchased with grant funds that specified more intensive recreational facility development than would be deemed appropriate today. In cases where KC DNRP chooses to prioritize the ecological value of these lands over facility development objectives specified by the granting or funding contract, approval from the granting authority would be required and conversions, resulting in acquisition of replacement land, may be required. In other circumstances, the conditions of the grant or the language in the grant application may preclude certain types of activities on the land (e.g., constraining forestry operations or extent of impervious area). These funding source and deed restrictions and obligations should be integrated into the preparation of each SMG.

Current Funding Considerations

At the time of writing, maintenance and management of Ecological Lands is funded primarily through Surface Water Management (SWM) and Rural Drainage Program (RDP) funds. SWM/RDP funds can only be used for activities that contribute to water quality and to functioning natural systems throughout a given site. Appropriate uses of these funding sources include routine maintenance of infrastructure and facilities and limited types of capital improvement projects that indirectly benefit water quality. The funding cannot be used for most facilities or other site improvements that support public use (e.g., trails, parking, litter, or restrooms). Funding sources for routine maintenance and capital improvements may change in the future.

Revenue Generating Opportunities

Revenue generating opportunities should not be precluded on Ecological sites as long as they are consistent with the management goals for these lands: to conserve and enhance ecological value, and to accommodate appropriate public use that does not harm the ecological resources on the site. Revenue derived from the sites may help defer the costs of maintenance and management; any revenue generated should be returned to the site from which it is derived or other sites within the Ecological Lands inventory. During development of the SMGs, general considerations of revenue generation may be considered, but it is not expected that a specific and comprehensive list of potential opportunities will be developed. Properties acquired with the intent to generate some level of resource-based revenue (e.g., working farm and forests) should be designated resource lands, and thus should be managed according to the policy and planning direction for that category of lands.

Revenue generating opportunities will vary among Ecological sites depending on the site's location, condition, resources, level of public use, existing infrastructure, and purpose of acquisition. Appropriate activities might include parking fees, land leasing, resource extraction, or special events such as interpretive and/or environmental education programs. Prior to recommending a particular opportunity, stakeholders should ask themselves the following questions: Has a cost/benefit analysis been done to determine the feasibility and level of potential revenue? Will the activity affect short-term or long-term maintenance? Do funding source and deed restrictions preclude a suggested activity? Would a suggested activity negatively impact the ecological value of the site (e.g., by facilitating encroachment into sensitive areas, or by redirecting use to pristine areas of the site)?

For example, stakeholders may identify timber harvest as a potential opportunity at a large site. Stakeholders should first verify that deed, grant, or other funding source restrictions do not preclude this activity. If the activity is allowable, stakeholders should indicate in the Site Management Guidelines what additional analysis may be necessary to consider the impacts of the activity on the property. This work may include evaluating the impact of the harvest activity on the ecological value of the property and a cost/benefit analysis of the action.

Writing Site Management Guidelines

Site Management Guidelines will be written for each Ecological Lands site to direct the management and maintenance of each property. The SMGs will be written by individuals in the Natural Resource Lands Management (NRL) group in cooperation with appropriate stakeholders. This section presents guidance on the steps necessary to create Site Management Guidelines.

Preparation for Writing Site Management Guidelines

Necessary steps to take before writing Site Management Guidelines are to identify the scope and scale of the document, to contact stakeholders, and to gather background information.

Determine Scope and Scale of SMG

The NRL staff writing the SMGs should identify the planning area boundaries (scope) and the level of detail (scale) for the SMG. Most SMGs will be written for individual sites, but some may collectively address multiple adjacent or nearby sites in one document. SMGs applicable to more than one site may be more efficient for staff resources, and it may be more effective to apply ecological recommendations at a scale that bridges site boundaries. For example, it may be useful to present together the SMGs for multiple properties along a single river reach where similar management strategies are applied. Additionally, SMGs may vary in their level of detail according to the size of the property, the sensitivity or importance of habitat resources, and the complexity of public use, land use, or management issues.

Identify and convene the site's land managers and stakeholders

NRL should identify appropriate land managers. Stakeholders' working experience with the sites provides a central source of information for history, management strategies, and project proposals. The primary contacts for the creation of the SMGs are the Resource Coordinators (Parks and Recreation Division) and the Basin Stewards (Land and Water Stewardship Services, WRLD). These two groups, generally, are the people who are most familiar with the properties and are the people who will be using the SMGs most frequently once they are written. Additional groups with an interest in Ecological Lands may include (other groups may be involved who are not listed below):

- King County DNRP Groups: Flood Hazard Reduction Services section, Watershed and Ecological Assessment section, Capital Projects and Open Space Acquisition section, Strategic Initiatives/WRIA Planning section, and Parks and Recreation Division staff.
- Government agencies outside of DNRP, including other King County agencies such as Department of Development and Environmental Services, Department of Transportation, and the Executive's Office of Business Relations and Economic Development (for cultural resource consultation), as well as municipal, state, federal governments.
- Neighboring landowners, stewardship groups, non-governmental organizations, volunteers, and park users may provide important information about public use and stewardship potential.

Gather Information: Site Conditions, History, Constraints, and Opportunities

A substantial body of information about ecological resources and public use should be included in the SMGs. Information about natural resources and processes, opportunities, and constraints helps to construct an ecological framework through which the site should be viewed when making management decisions. Information gathering should focus on both the site and vicinity level (i.e., the ecological relationships that connect the property to the surrounding landscape or stream basin). Background research should also include past and present public use and historic and cultural resources on the property and on neighboring lands. At least one field visit early in the process should be coordinated between NRL staff, the Resource Coordinator, and the Basin Steward, and other relevant stakeholders.

Usually it is not possible to provide all the background information that would be needed for comprehensive land conservation. Information gaps should be noted whenever possible, and recommendations made for research to obtain the data. SMGs will provide the most current information on which to base the best possible management recommendations given any limitations in knowledge.

Relationship of Goals, Objectives, Recommendations, and Projects

The following brief overview of the relationship between goals, objectives, recommendations, and projects is intended to provide guidance in the planning process:

Goals: Give direction for planning. Goals are the ends towards which management efforts are directed. They are general, idealistic, long-term, and may be difficult to attain. A goal for the Ecological Lands is to conserve ecological value.Objectives: The site-specific means of achieving a goal. Objectives are a series of short-term definable targets or strategies that, if achieved, contribute to meeting a long-term goal. Objectives may identify criteria for completion (success) and a time frame. An objective may be to improve fish access to streams

Recommendations: The specific steps for meeting an objective. Recommendations should identify the actions that are needed to implement an objective. A recommendation may be to remove fish-passage barriers at a site.

Projects: Detailed and specific descriptions of actions. Projects are the Who, Where, Why, and How of the Recommendations (which are the What). A project may be to replace a perched culvert. Projects should be consistent with the goals, objectives and recommendations identified in Site Management Guidelines for a site.

Guidance on Developing Objectives, Recommendations, and Projects

The stakeholders involved in writing Site Management Guidelines will establish objectives and recommendations for the property that support the goals established for Ecological Lands. These goals are described in the Introduction to this Handbook. Stakeholders should be familiar with the conservation principles and the mandates to balance public use and ecological value on these lands; these interests should guide the creation of objectives and recommendations.

The recommendations will provide a basis for creating future work plans for various DNRP staff. For instance, Park Resource staff should incorporate the recommendations into their Site Management Plans, and Basin Stewards, CPOSA, and Watersheds and Ecological Assessment staff might consider these recommendations when establishing their annual work plans and making their annual budget requests.

Recommendations should indicate in general terms what work should be done on these lands. Projects will typically not be included in SMGs. Specific project development will occur over time as the Site Management Guidelines' recommendations are prioritized and funded by DNRP management. Projects will be recommended primarily by the Resource Coordinators and Basin Stewards, in consultation with NRL. These projects often may be planned and implemented by the CPOSA section of WLRD as Small Habitat Restoration Projects or larger Capital Improvement Projects; as such, there should be close coordination between CPOSA staff and the three previously mentioned stakeholders to design, install, and monitor projects. Ideally, all projects will be designed to implement the recommendations that were developed by stakeholders in these SMGs, and will thereby reflect the conservation principles. Work priorities and funding availability will drive project development and implementation.

The responsibility for setting objectives and recommendations assumes that informal consensus between stakeholders will be attainable and feasible. If this informal consensus process does not work in all cases, there must be further guidance as to decision-making for Ecological Lands from DNRP management.

Writing Site Management Guidelines—the Template

The contents of each section of an SMG are outlined in the template below. Each section identifies useful sources of information that may already exist for a site or the vicinity. A number of site planning considerations, primarily derived from the conservation principles (from Table 1) and from public use considerations, are included within a number of sections below to help identify information needs.

In accordance with the conservation principles' landscape perspective, Ecological Lands located together spatially and functionally, such as along a river, may be planned for collectively. In these cases a "Collective Chapter" may be prepared with overall ecological context, basin planning, and other general information for the area. The contents of the actual SMGs will provide more site-specific information.

Executive Summary

Short summary of site, landscape context, acquisition, ecological resources, public use, & recommendations.

Introduction

The following text may be included in the SMG to introduce this section:

"[*Site Name*] is a King County Department of Natural Resources and Parks (DNRP) Ecological Land. Ecological Lands are a category of Water and Land Resources Division (WLRD) properties managed for the protection of their ecological value. Appropriate public use and interpretive opportunities are accommodated on these sites where they do not harm the ecological value of the site.

This document provides general property and acquisition information, a description of existing site conditions, a chronology of recent events and management actions, and a list of management objectives and recommendations for [*Site Name*]. These site management guidelines were developed using guidance established in the *King County Water and Land Resources Division Ecological Lands Handbook* (King County 2003; referred to hereafter as the *Handbook*)."

Part 1. General Property Information

CONTENTS:

- ❑ Provide location description
- ❑ Identify land use on parcels in vicinity, how local land use activities may affect site, and nearby parks/open space where applicable.
- ❑ Include the two tables below to present information on location and parcels
- ❑ Note: if this is not a plan with a "Collective" chapter, may include information on general area history, land use, planning efforts in this section. If using a "Collective" chapter, then include only more specific vicinity land use information here

SOURCE OF INFORMATION:

- ❑ Maps, IMAP, GIS system.
- ❑ Acquisition documents.
- ❑ Sensitive Areas layers on IMAP or ArcView.
- ❑ Channel migration zone maps are available for certain sections of the Green, Snoqualmie, Tolt, and Raging Rivers. Consult Ken Zweig for current maps and see web link at http://dnr/wlr/flood/migration.html

Include the two tables below to present information on location and parcels :

Table 1. [*Site name*] General Information.

Best Available Address	(provide if address is available)
Thomas Guide Map Location	(Thomas Guide page and grid number)
Legal Description	(Section, Township, Range)
Acreage	(Total acreage, preferably from Assessor's Office data)
Drainage Basin	(Watershed or basin)
WRIA	(Watershed Resource Inventory Area number)
Council District	(Council District number)
King County Sensitive Areas	(Sensitive Area restrictions applicable at the site; derived from GIS layers of mapped critical areas, or separate channel migration zone maps)

Table 2. [*Site name*] Parcel Information.

Parcel Number	Acreage*	Purchase Date	Ownership type/price	Previous Names	Zoning	Funding Source	Recording Number
(Parcel ID Number; provide one row for each parcel in the site)	(acreage from King County Assessor's Office data (available on IMAP or Metroscan))	(from acquisition documents or Parks databases)	(usually Owned in Fee or Easement; provide price where known from acquisition information)	(any known previous names used in acquisition or Parks documentation)	(zoning/comp. plan land use information from IMAP; note if in Agriculture or Forest Production District)	(indicate all known funding sources for each parcel)	(provide Rec.# from inventory and any other known #s (e.g. Deed of Right))

*acreage from King County Assessor's data.

Part 2. Acquisition, Funding Source and Deed Restrictions

CONTENTS:

- ❑ Identify purpose for acquisition and proponents of acquisition, if possible
- ❑ Identify the funding sources for site, and any associated restrictions
- ❑ Identify other land use or deed restrictions associated with the property

SOURCE OF INFORMATION:

- ❑ Staff responsible for the acquisition of the site (e.g., Basin Steward, Rivers, or responsible CPOSA staff),
- ❑ Acquisition documents, funding source guidance documents or grant applications that may have driven acquisition

Part 3. Ecological Resources

The following text may be included in the SMG to introduce this section:

"This section describes the natural resources and ecological processes present at *[Site Name].* This section describes existing conditions; further analysis will be provided in Part 6 below."

Topography and Soils

CONTENTS:

- ❑ Describe general topography both at the site and in relationship to nearby landscape features
- ❑ Describe soils at the site

SOURCE OF INFORMATION:

- ❑ Field visits
- ❑ Detailed topographic map; existing studies and reports
- ❑ NRCS soil survey

SITE PLANNING CONSIDERATIONS*:*

- ➲ Identify major landforms that exist on and nearby the site.
- ➲ Identify noteworthy information concerning sediment loading or erosional features upstream and downstream.

Hydrology

CONTENTS:

- ❑ Describe surface water features including wetlands and streams, on site and in vicinity
- ❑ May also include flood information, flood protection facilities, or sensitive area information (100-year floodplain, FEMA floodway, channel migration zones) where applicable

SOURCE OF INFORMATION:

- ❑ Field visits
- ❑ Existing studies and reports on the area (e.g., Basin Plans, habitat assessments/EIS, channel migration studies, King County Flood Hazard Reduction Plan)
- ❑ King County Sensitive Areas Folio; Catalog of Washington Streams; National Wetlands Inventory; topographic, FEMA, and channel migration zone maps
- ❑ Consultation with staff (Basin Stewards, Resource Coordinators, Ecologists); King County monitoring data

SITE PLANNING CONSIDERATIONS*:*

- ➲ Identify key hydrologic features of the site and vicinity.
- ➲ Characterize various scales of hydrologic relationships for site: watershed, basin, sub-basin.
- ➲ Identify areas of regular flooding at the site.
- ➲ Identify any problem areas in the surrounding landscape (stresses such as modifications of natural flows, channelization, dams, groundwater depletion, etc.)

Vegetation

CONTENTS:

- ❑ Characterize vegetation types and distribution
- ❑ Note rare species, noxious weeds, and dominant invasive species if inventoried on site
- ❑ Identify restoration planting projects performed on site

SOURCE OF INFORMATION:

- ❑ Field visits
- ❑ Existing studies and reports on the area (e.g., Basin Plans, Stream Plans, habitat assessments/EIS documents for other nearby projects)
- ❑ King County Sensitive Areas Folio; NRCS soil survey, detailed topographic map; Priority Habitats and Species Database; Natural Heritage Database
- ❑ Consultation with staff (Basin Stewards, Resource Coordinators, Ecologists); King County monitoring data

SITE PLANNING CONSIDERATIONS*:*

- Identify presence of rare or endemic species, habitat, and ecosystems, or other landscape elements on or near property; areas of high native biodiversity. Describe relative scarcity of these features.
- At what seral stage is the site? (early, mid, or late successional, for example)
- Identify cycles at site (disturbance, population, succession, etc.). How are these cycles reflected in vegetation types? Characterize/estimate delayed effects of disturbance. Identify actions or conditions that have interrupted natural cycles.
- Identify non-native invasive species presence and extent on site and vicinity. Identify potential inroads for non-native invasive species.
- Identify any monitoring projects or other research that has occurred on site previously that might be used as baseline data for future studies.

Fish and Wildlife

CONTENTS:

- Identify known fish and wildlife species presence and use information; note any rare species
- Note terrestrial and aquatic habitat corridors that connect site to surrounding sites, especially protected lands

SOURCE OF INFORMATION:

- Field visits
- Existing studies and reports on the area (e.g. Basin Plans, Stream Plans, habitat assessments/EIS documents for other nearby projects; GIS land cover information; King County Wildlife Habitat Network information)
- Catalog of Washington Streams; Priority Habitats and Species Database; Natural Heritage Database; StreamNet fish distribution
- Consultation with staff (Basin Stewards, Resource Coordinators, Ecologists); King County monitoring data

SITE PLANNING CONSIDERATIONS*:*

- Identify presence of rare or endemic species; areas of high native biodiversity; key habitats and keystone species. Describe relative scarcity of these features.
- Identify *cycles* at site (disturbance, population, succession, etc.). How are these cycles reflected in plant and animal habitats and life cycles? Characterize/estimate delayed effects of disturbance.
- Characterize general requirements of presumed terrestrial and aquatic species, and specific requirements of any known rare or unique species or assemblages.
- Identify any monitoring projects or other research that has occurred on site previously that might be used as baseline data for future studies.
- Identify major habitat corridors that exist on and near the site. What habitat corridors traverse the property and therefore connect it to others?

Part 4. Site Use and Infrastructure

This section may include a number of subsections if information is available, including Public Use, Access, Trails and Roads. Additional sections may also be needed to address specific infrastructure or facilities on the site.

Actual planning/zoning/land use information should go in Part 1; this information should be site-specific.

The following text may be included in the SMG to introduce this section:

> "This section describes public use, access points, and site infrastructure such as trails, roads, and utilities at *[Site Name]*."

Public Use

CONTENTS:

- ❑ Identify all known types of public use that are appropriate on the site, and the distribution of these uses
- ❑ Identify informal uses or illegal activities of concern (e.g. potential liability issues; uses with negative ecological impacts)
- ❑ Identify landscape attractors (portions of the landscape that people typically gravitate towards, such as open water, view points, higher elevation, or other points of interest)
- ❑ Identify facilities at site to support public use (e.g., trash cans, directional or interpretive signage)

SOURCE OF INFORMATION:

- ❑ Field visits
- ❑ Resource coordinators, Parks staff; other stakeholders
- ❑ Interpretive Master Plan for DNRP (for interpretive opportunities)

Access

CONTENTS:

- ❑ Identify roads and points of entry to site (including encroachments), parking areas

SOURCE OF INFORMATION:

- ❑ Field visits
- ❑ Resource coordinators, Parks staff; Public stakeholders
- ❑ Existing maps or GIS information

Trails and Roads

CONTENTS:

- ❑ Identify trails (formal and informal); internal roads (maintained and non-maintained)
- ❑ Identify relationship to landscape attractors where possible

SOURCE OF INFORMATION:

- ❑ Field visits
- ❑ Resource coordinators, Parks staff; Public stakeholders.
- ❑ Existing maps or GIS information

Part 5. Site Management Chronology

CONTENTS:

- ❑ Chronology of restoration projects and King County management activities, including costs when known
- ❑ Site history prior to acquisition when known
- ❑ Pre-acquisition management activities when known (e.g., logging, levee installation, channelization, road or berm construction)

SOURCES OF INFORMATION:

- ❑ Field visits
- ❑ Local comprehensive planning documents
- ❑ Existing area research and local history resources (Historylink, books, newspapers, community web sites)
- ❑ County staff; associated project documentation, or Parks "Site Maintenance Plan" hour log

SITE PLANNING CONSIDERATIONS*:*

- ➲ Detail management history of site. Describe all known activities that have preserved or impacted resources at the site.

This section may include the following table to present site history information:

Table 3. Primary management activities that have occurred on [*site*].

Date	Action	Associated Costs (if known)

Part 6. Analysis

Typical "Analysis" sections may have the following headings: Species of Concern, Information Gaps, Ecological Processes, Ecological Structure and Function, and Public Use. The tables below are divided into two types of considerations for the analysis, which may be integrated into various sections.

Site Management Guidelines: Template

The following text may be included in the SMG to introduce this section:

> "This section is intended to integrate site-specific information, public use considerations, and the larger landscape considerations described in the conservation principles section of the *Handbook*. This section presents the synthesis and analysis from which site management recommendations will be made."

[Analysis Considerations: Ecological Resources]

CONTENTS:

- ❑ Characterize site and landscape as guided by "Considerations" listed below.
- ❑ Provide broader context for site within the landscape, ecosystem, surrounding land uses, and habitat planning efforts
- ❑ Consider how actions may restore process, structure, and function on the site
- ❑ Note information gaps

SITE PLANNING CONSIDERATIONS:

- ➲ Characterize surrounding region; identify systems and the landscape elements that drive ecological processes on site (e.g., hydrology, riparian areas, sediment loading or erosional features, wetlands, upstream/downstream features).
- ➲ Identify key processes, structures, and functions that characterize this site. Are processes (e.g. hydrology) intact on this site or in the neighboring landscape? Are structure and function intact? If not, how have they been disturbed? Keep in mind any historic information you have gathered.
- ➲ Consider the context and the scale at which you are planning. What are the processes at work in the watershed as a whole, and specifically at the site?
- ➲ Identify species that may use the site that are listed as endangered, threatened, or of concern under the Endangered Species Act, when known.
- ➲ Identify nearby planning and land use activities that influence or are detrimental to ecological value at the site by King County, other public agencies, community groups, industry, and the private sector.
- ➲ Identify land use constraints that may permanently affect the level of the hierarchy at which action is possible. What disturbances are irreversible or permanent, and which processes are impaired that might be restored?
- ➲ Identify nearby preservation opportunities in areas that could contribute to conservation goals, and opportunities to go beyond property boundaries and work with private landowners, community groups, or schools in the vicinity.
- ➲ If processes have been impaired, conservation objectives should be geared towards restoring or repairing those processes where possible. If we can't restore the processes because of budget or time constraints, can we restore structures on site to regain the functions that have been lost? If we have tried unsuccessfully to restore process, why didn't it work? When possible, our actions should result in self-sustaining ecosystems that no longer require our input.
- ➲ Identify information gaps that affect our ability to make further management recommendations. Future projects represent an opportunity to gather additional information.

[Analysis Considerations: Public Use]

CONTENTS:

- ❑ Identify support needed or opportunities for appropriate public use (e.g., infrastructure, facilities, signage, litter policy, interpretation).
- ❑ Identify inappropriate uses, (e.g., trails, activities of concern) and strategies to address these uses.
- ❑ Identify site constraints (e.g., lack of parking).
- ❑ Identify opportunities for or constraints to revenue-generating operations (constraints might include funding/deed restrictions or site conditions).

SITE PLANNING CONSIDERATIONS*:*

- ➲ Identify activities on the site that might be detrimental to ecological value at site. (e.g. Are trails in sensitive areas? If so, can they be relocated? Are informal trails problematic? Are users straying from trails into areas that are erosive?)
- ➲ What was the purpose of the acquisition, and what associated funding restrictions are applicable to site opportunities?
- ➲ Consider existing and potential public use of the site (spatial extent, types, seasonality, access points, landscape attractors, user group conflicts, public health/safety requirements, community involvement, and stewardship).
- ➲ Consider potential resource degradation that may occur from public use (e.g. spatial extent, recurrence, etc.). Is public use more supportable on certain areas of the site (to areas with lower contribution to ecological value)?
- ➲ Consider adjacent property issues: private uses of public lands (near boundaries), special use permits for adjacent property owners, viewshed issues, native/non-native plant issues, drainage issues from properties to public land, etc. Consider connection of the site to regional trails, schools, public transportation, and other community resources.

Part 7. Management Goals, Objectives, and Recommendations

The following text may be used to introduce this section:

> "The objectives and recommendations in this section are derived from the analysis in the previous section. Office of Rural and Resource Programs staff will revise the recommendations for [*Site name*] within five years, or more frequently when new information from site monitoring programs and other initiatives indicates a need for a change in management strategies."

Goals for [Site Name]

Restate Goals for Ecological Lands as stated in introduction to this Handbook:

> "The goals for all King County Ecological Lands are to:
>
> - conserve and enhance ecological value, and
> - accommodate appropriate public use that does not harm the ecological resources on site.
>
> The objectives and recommendations that follow are designed to support these goals at [Site Name]."

Management Objectives and Recommendations

Note: Objectives and recommendations will be developed by NRL and stakeholders to support the goals for Ecological Lands and will be primarily derived from the Analysis section.

CONTENTS:

- ❑ In general, objectives and recommendations may address process, structure, or function of ecological systems, or specific ways to support public use of the lands.
- ❑ Identify the person responsible for implementing the recommendation, and, where possible, a timeline for action.
- ❑ Identify support needed for appropriate public uses, opportunities for informational and interpretive signs, or recommendations for site improvements (e.g., relocating trails or parking lots, boundary delineation) in support of integrating sustainable levels of public use with the site's ecological value.
- ❑ Identify restoration projects, monitoring, or other activities that contribute to ecological process and function. They may include research needs based upon the data gaps identified in the ecological resources section above.
- ❑ Identify opportunities to work with other agencies, form potential partnerships, and obtain funding/grants. May include relationships with adjacent landowners, particularly where landowner is a public agency.
- ❑ Note that recommendations include both "preserve and protect" measures (activities in support of current management and maintenance) and measures designed to achieve a desired future condition (e.g., resource inventory or project design that require a longer timeframe because of funding, permitting, or planning restrictions).

Include the following matrix of recommendations (the following headings include examples of possible stakeholder groups responsible for tasks):

Table [4]. Matrix of [*Site Name*] Management Recommendations

Recommendations	Cost	year	Park Resource Staff	Basin Steward	WRIA Project Coord.	CPOSA/ Contract	WEAT	GIS	NRL staff
Priority One									
[list recommendations requiring immediate funding]		[provide schedule as known]	[identify responsible staff with "x"s]						
Priority Two									
[list recommendations that may be pursued in the future when made a priority and funded]									

References

Include all references and personal communication used to prepare document. This should include "King County. 2003. King County Water and Land Resources Division Ecological Lands Handbook. King County Department of Natural Resources and Parks, Water and Land Resources Division. Seattle, Washington."

Figures

Include the following figures in the SMG, as appropriate to the site:

- ❑ Vicinity Map.
- ❑ Site Map showing relevant natural features on aerial photo (e.g., streams, wetlands, topography, floodplain).
- ❑ Site Map showing other features such as trails, roads, access points, restoration sites, problem areas on aerial photo.

Review and Adoption of Site Management Guidelines

When completed, Site Management Guidelines should be reviewed and accepted by the key stakeholders involved in the planning process (primarily Basin Steward, Resource Coordinator, and NRL). These Guidelines will then be approved by the division director of WLRD.

The SMGs will function as internal guidance for land management. The public distribution of SMGs may vary by site; at a minimum, summaries of site management goals for sites that support public use will be posted on the Internet.

Office of Rural and Resource Programs staff will revise the Site Management Guidelines on a 5 year cycle. Plan revision may be more frequent when new information from site monitoring programs and other initiatives indicate a need for a change in management strategies.

Glossary

Adaptive management: Information gathered during the assessment of the activity (monitoring) is used to modify the management activity and, if necessary, develop new management strategies.

Bald: a relatively high-elevation, treeless habitat within an otherwise forested area.

Biodiversity: The variety of living organisms considered at all levels, from genetics through species, to higher taxonomic levels, and the variety of habitats and the ecosystems in which the species are found. Also referred to as biological diversity.

Biological diversity: "see Biodiversity."

Community: All the organisms that live in a given habitat and affect one another as part of the food web or through their various influences on the physical environment.

Connectivity: The degree to which an organism can move between habitat patches having similar characteristics. Connectivity is most affected by how far apart habitat patches are and if there are barriers or filters to movement between them. See Corridor.

Conservation biology: An integrative approach to the protection and management of biodiversity that uses appropriate principles and experiences from basic biological fields such as genetics and ecology, from natural resource management fields such as fisheries and wildlife, and from social sciences such as anthropology, sociology, philosophy, and economics (Leslie et al. 1996).

Corridor: A route that allows movement of organisms across a landscape. Corridors may or may not provide all of the habitat characteristics required to support an individual over time, but do provide the habitat characteristics that allow an individual to move between suitable patches of habitat. For smaller, less mobile species, corridors may function as strips of habitat that provide for the flow of genetic material between larger patches of habitat over more than one generation.

Disturbance: Most generally, a physical disruption of the structure of a system.

Ecological integrity: The concept of ecological integrity is defined by Ulanowicz (2000) with at least four attributes: (1) system "health," that is, the continued successful functioning of the community; (2) the capacity to withstand stress; (3) an undiminished "optimum capacity" for the greatest possible ongoing developmental options; and (4) the continued ability for ongoing change and development, unconstrained by human interruptions.

Ecological Land: (1) a specific category of King County DNRP properties that support significant ecological value and low levels of public use. These lands are to be managed primarily for the preservation of natural resources, and secondarily for passive recreational use. (2) lands that are to be managed to ultimately maintain a self-sustaining array of dynamic and diverse habitats and ecosystems composed of native flora and fauna.

Ecological sustainability: The tendency of a system or process to be maintained or preserved over time without loss or decline. For instance, sustainable forestry refers to forest-management practices that maintain forest structure, diversity, and production without long-term decline or loss over a region. Land use could be sustainable locally over the long term based on external subsidies from other land areas, but this practice would result in an inevitable loss from the system providing the subsidies and thus would not be seen as sustainable when viewed at the larger scale. Sustainability is widely regarded as economically and ecologically desirable; in the ultimate sense, it is the only viable long-term pattern of human land use.

Ecological value: As defined in this Handbook, biological diversity and ecosystem integrity.

Ecosystem: A dynamic complex of plant, animal, fungal, and micro-organism communities and their associated non-living environment interacting as an ecological unit (Leslie et al. 1996); the organisms living in a given environment, such as a tropical forest or a lake, and the physical part of the environment that impinges on them.

Ecosystem function: What an ecosystem does in the context of its surroundings. Ecosystem function refers variously to the habitat, biological, or system properties of ecosystems (Costanza et al. 1997). Also, the interactions among the spatial units—the flow of energy, materials and organisms among the units. Examples may include fish or wildlife habitat, sediment and erosion control, and water quality purification.

Ecosystem management: The process of land-use decision making and land-management practice that takes into account the full suite of organisms and processes that characterize and comprise the ecosystem and is based on the best understanding currently available as to how the ecosystem works. Ecosystem management includes a primary goal of sustainability of ecosystem structure and function, recognition that ecosystems are spatially and temporally dynamic, and acceptance of the dictum that ecosystem function depends on ecosystem structure and diversity. Coordination of land-use decisions is implied by the whole-system focus of ecosystem management.

Endemic: Species (or habitats or ecosystems) that are native to, and occur only in, a particular area or locale. Endemic species generally have very specific adaptive requirements that are linked to particular habitat or

ecosystems that are, themselves, rare. Endemics may be represented by only a few individuals or confined to small, unique geographic areas.

Eutrophication: The over-enrichment of an aquatic habitat with inorganic nutrients, especially nitrates and phosphates, typically from sewage discharge or agrochemical run-off, such that a proliferation of plant life, especially algae, is promoted that results in the reduction of the dissolved oxygen content and often causes the extinction of other organisms.

Extirpate: To eradicate.

Function: see "Ecosystem function."

Geomorphology: the study of the earth's surface forms and the processes and mechanisms that create them. The three fundamental geomorphic processes associated with flowing water are erosion, sediment transport, and sediment deposition.

Habitat: Space used by an organism, together with the other organisms with which it coexists and the landscape and climate units that affect it; the place where an animal or a plant normally lives and reproduces.

Habitat fragmentation: The alteration of previously continuous habitat into spatially separated and smaller patches. Habitat fragmentation can and often does result from human land-use dynamics, including forestry, agriculture, and settlement, but also can be caused by wildfire, wind, flooding, outbreaks of herbivores or pathogens, and many other disturbances. Suburban and rural development and subdivision commonly change patterns of habitat fragmentation of natural forests and grasslands as a result of adding fences, roads, or driveways and from individual decisions on land management and landscaping. Human activities can both decrease and increase fragmentation.

Homogeneity: The state or quality of being homogeneous; the degree to which attributes in a region are similar.

Indicator species An organism whose characteristics (e.g., presence or absence, population density, dispersion, reproductive success) are used as an index of attributes too difficult, inconvenient, or expensive to measure directly.

Invasive species: also called nonnative, alien, exotic, or introduced species; those species that evolved elsewhere and have been purposely or accidentally relocated into a new area by humans. Introduced species often find no natural enemies in their new habitat and therefore spread easily and quickly.

Keystone species: those species that exert a significant effect on the structure of the biological community of which they are a part. These species often prevent dominance by a single species and thereby maintain diversity in the community.

Land cover: The ecological state and physical appearance of the land surface (e.g., closed forests, open forests, or grasslands) (Turner and Meyer 1994). Change in land cover converts land of one type of cover to another, regardless of its use. Land cover is also affected by natural disturbances, such as fire and insect outbreaks, and subsequent changes through succession.

Land management: The way a given land use is administered by humans. Land management (such as clear-cut versus selective-cut harvesting, lengthening or shortening forest rotation cycles, and conventional-till versus no-till agriculture) can affect ecological processes without changing the basic land use.

Land use: The purpose to which land is put by humans (e.g., protected areas, forestry for timber products, plantations, row-crop agriculture, pastures, or human settlements) (Turner and Meyer 1994). Change in land use may or may not cause a significant change in land cover. For example, change from selectively harvested forest to protected forest will not cause much discernible cover change in the short term, but change to cultivated land will cause a large change in cover.

Landscape: A large area composed of many different kinds of ecosystems. It has repeatable patterns of habitats, physical features, and human influences (Forman and Godron 1986).

Monitoring: A set of procedures for gauging or tracking specific environmental parameters or attributes over time, such that the results can be compared to some standard or detect directional change.

Native species: are those species that grow naturally in an area and where it evolved, or that have moved into an area without direct or indirect human assistance. "Native Vegetation" means any plant community native to the state of Washington. The following sources shall be used in making this determination: Natural Vegetation of Oregon and Washington, J.F. Franklin and C.T. Dyrness, Oregon State University Press, 1988, and L.C. Hitchcock, C.L. Hitchcock, J.W. Thompson and A. Cronquist, 1955-1969, Vascular Plants of the Pacific Northwest(5 volumes). Areas planted with native species for ornamental or landscaping purposes shall not be considered to be native vegetation. [WAC 173-340-7491(2)(c)(i)]

Noxious weeds: A non-native plant (see "Invasive species") with a more narrow definition, as defined by the Revised Code of Washington 17.10.010: a plant that when established is highly destructive, competitive, or difficult to control by cultural or chemical practices. The State of Washington maintains a "State noxious weed list," which is a list of noxious weeds adopted by the state noxious weed control board. The list is divided into three classes:

(a) Class A consists of those noxious weeds not native to the state that are of limited distribution or are unrecorded in the state and that pose a serious threat to the state;

(b) Class B consists of those noxious weeds not native to the state that are of limited distribution or are unrecorded in a region of the state and that pose a serious threat to that region;

(c) Class C consists of any other noxious weeds.

Paradigm: (1) an established pattern of thinking shared by a scientific discipline or community; and (2) the exemplars or models for problem development, analysis and solution within a discipline. The pattern of thinking can be further explained as the family of broad theories that form the foundation of the discipline while the exemplars include both the models for attacking problems and the considerations of what particular problems are important to the discipline.

Passerine: Of or relating to birds of the order Passeriformes, which includes perching birds and songbirds such as the jays, blackbirds, finches, warblers, and sparrows.

Perturbation: a change in a physical system.

Population: A group of individuals with common ancestry that are much more likely to mate with one another than with individuals from another such group.

Pre-development conditions: Conditions present before European settlement (in the Pacific Northwest, generally prior to 1860).

Principle: Broadly, a rule of action or conduct.

Process: As used in this Handbook, underlying ecological drivers (such as flooding, succession, or erosion) that result in the alterations of the structure and function of units on the landscape over time.

Rare species, habitats, and ecosystems: those that are few in number or are poorly represented in an area. They may be rare because of changing natural conditions that have reduced their range, abundance, or distribution; because of their dependence on specific environmental conditions that are not commonly represented in this area; and because of anthropogenic actions that have caused habitat loss or severe decreases in range or abundance. They often lack the capability to resist changes in environmental conditions or lack the resilience to recover after a change.

Revetments: A facing, as of masonry, used to support an embankment.

Settlement: The occupation of land by humans, typically referring to patterns of residential use from dispersed to concentrated along a continuum from rural to village to suburb to city. The term may also include infrastructure and commercial land-use patterns. Types of settlement include urbanization, suburbanization, rural agriculture, and rural subdivision. Settlement often includes ecological simplification of the landscape; modification of disturbance patterns; changes in soil and water quantity and quality; and altered movement of nutrients, organisms, and other elements of ecological systems. Changes through settlement can be dramatic, such as paving over land to construct a shopping mall and parking lots, or less drastic, such as fragmenting the landscape by subdividing agricultural land into four-hectare home sites.

Structure: The spatial relationships—the arrangement—among distinctive landscapes, ecosystem, habitats, populations, species and other "units" on the landscape. Specifically, this refers to the distribution of energy, materials, and species as determined by the kinds, configurations, number, shapes and sizes of ecosystems.

Terrestrial Living on, or referring to, land.

Watershed Resource Inventory Area (WRIA): In 1971 the Washington State legislature passed the Water Resources Act which provided a directive for water resource planning areas (Ch 90.54 RCW); the 1976 Water Resource Management Program established WRIAs for Washington State (Ch 173-500 WAC). (See also Ch 90.82 RCW, the Watershed Management Act of 1998).

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