Ecosystem Restoration and Management Philosophy for the Cedar River Watershed Habitat Conservation Plan

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1. Introduction

This Ecosystem Restoration and Management Philosophy provides a foundation for understanding and guiding decisions necessary for planning and implementing restoration and management actions under the Habitat Conservation Plan (HCP)[1] for the Cedar River Municipal Watershed (CRW). Articulating a common restoration and management philosophy that clearly states our assumptions about the goals, objectives, and implementation of watershed restoration and management in the CRW will help focus Watershed staff toward a unified and collective goal, provide consistency among projects, and offer insight to stakeholders and customers about our mission and our work. This philosophy also helps to ensure that restoration and related management actions in the CRW are consistent with the requirements and spirit of the HCP.

This document articulates a Ecosystem Restoration and Management Philosophy for the CRW and has the following objectives:

- provide a definition for ecosystem restoration that can be used across all types and degrees of restoration actions and related management decisions in the CRW, and a rationale for that definition;
- identify a set of elements that frame a philosophy for designing, implementing, and prioritizing restoration and management actions in the CRW; and
- define a set of guidelines for implementing this Restoration and Management Philosophy.

Section 2 of this document begins with a guiding statement of the philosophy, which defines ecosystem restoration and management for the CRMW and outlines how this definition applies to the HCP. This is followed by a "dissection" of the statement to further elaborate on specific points, both to explain and to exemplify what the guiding statement means in the context of implementing the HCP.

Section 3 describes a set of additional elements of the philosophy that follow from the guiding statement or address how it applies to specific issues in watershed management and restoration. Such issues include spatial and temporal scale, regional and global context, uncertainty, and long-term management of assets.

Section 4 provides specific guidelines for implementing the philosophy. This section addresses such questions as: How does the philosophy apply to Watershed operations? How can it be used in prioritizing restoration actions? How can restoration strategies and actions address ecosystem processes and function? When is restoration action preferred over inaction?

Section 5 briefly discusses the long-range use and potential evolution of the HCP ecosystem restoration and management philosophy.

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[1] Final Cedar River Habitat Conservation Plan, City of Seattle, 2000. This Plan was developed and adopted after extensive comment and public review to allow for the incidental take of threatened and endangered species and to guide subsequent watershed management activities.

2. Guiding Principles for the HCP Ecosystem Restoration and Management Philosophy

Guiding principles for restoration begin with how it is defined, but every natural resource management setting has a unique set of circumstances to which a definition of restoration must be applied. After briefly discussing a variety of viewpoints on defining restoration, we present and elaborate on a restoration philosophy for the CRW that attempts to integrate ecological restoration and management under the HCP with the use of the CRW as a municipal water supply.

2.1 Defining Restoration

A dictionary definition of restoration includes "a return of something to a former, original, normal, or unimpaired condition." (Urdang 1973). However, defining ecological restoration is extremely challenging because it can encompass a very wide range of ecological settings; causes and history of degradation or disturbance; degrees, extent, and reversability of ecological change; and desired objectives. For example, returning a disturbed ecosystem to its former state may not be possible due to the changes in the historical circumstances (e.g., climate, presence of new species or removal of others, management constraints) since the pre-disturbance condition.

Given these difficulties, it is not surprising that ecological restoration has been defined in a variety of ways. For example, the National Research Council (1992) takes a straightforward, somewhat "purist" approach by defining restoration as:

> *The return of an ecosystem to a close approximation of its condition prior to disturbance.*

The NRC contrasts "restoration" from "rehabilitation", "reclamation", and "enhancment", defining these as follows:

> Rehabilitation: *…improvements of a visual nature to a natural resource: putting back into good condition or working order.*
>
> Reclamation: *A process designed to adapt a wild or natural resource to serve a utilitarian purpose.*
>
> Enhancement: *…any improvement of a structural or functional attribute.*

The Society for Ecological Restoration (2002) takes a broader view of restoration but leaves the interpretation of this definition unclear (e.g., what is "ecological integrity" or a "critical range of variability"):

> *Ecological restoration is the process of assisting the recovery and management of ecological integrity. Ecological integrity includes a critical range of variability in biodiversity, ecological processes and structures, regional and historical context, and sustainable cultural practices.*

Within the context of managing forest ecosystems for both timber and non-timber values, Apfelbaum and Chapman (1997) define ecological restoration as:

…a practical management strategy that uses ecological processes in order to maintain ecosystem composition, structure, and function with minimal human intervention….ecological restoration's goal is the establishment of sustainable, productive ecosystems that humans subsequently benefit from.

From this small sample of the restoration literature, it is clear that restoration can mean very different things to different people. The CRW HCP addressed the problem of defining restoration by taking an inclusive approach in which restoration includes a range of activities, from the purist National Research Council approach to more limited efforts, such as enhancement or rehabilitation. The following passage from the HCP discussion of aquatic and riparian mitigation and conservation strategies articulates the HCP's approach to defining restoration:

The City will use the term restoration in a general sense …to characterize different types of active intervention that have the objective of increasing the quality of aquatic and riparian habitats that have been disturbed by past human activities or of returning aquatic and riparian habitats closer to more "natural" (predisturbance) conditions and ecological functioning. The strategies in this HCP for the Aquatic and Riparian Ecosystem use a holistic approach that incorporates aspects of restoration as well as efforts that could be better categorized as preservation, rehabilitation, enhancement, and/or mitigation, or some combination of these categories. (CRW HCP, 4.2-23)

This document follows the HCP's more general approach to defining restoration and does not further try to resolve the ongoing debate of a restoration definition. Instead, it provides a statement of an ecosystem restoration and management philosophy to guide our efforts in carrying out the variety of activities that we include under the term "restoration." In Section 3, we elaborate on this statement and discuss a number of topics pertaining to how this restoration and management philosophy is applied.

2.2 A Statement of the Philosophy

Ecosystem restoration and management of the CRW is a strategy that attempts to repair the composition, structure, processes, and/or function of human-disturbed ecosystems. To the extent possible, we seek to maintain them as self-regulating natural systems that are integrated with current ecological landscapes and land use and that eventually require minimal human intervention.

For purposes of the CRW HCP, restoration will be within the limits set by the use and management of the CRW as a municipal water supply, including reservoir operations, the presence of a functional road system, and minimizing risk of catastrophic forest disturbance due to fire, insects, or disease. At the same time, watershed management and operational activities should (where possible) avoid and minimize further disturbance, while contributing to the restoration of Watershed ecosystems .

Restoration in the CRW will include a wide range of individual on-the-ground projects to promote the recovery of ecosystem composition, structure, processes, and function. Restoration may also entail management decisions to undertake no such projects in some locations or under some circumstances. These individual project actions and management decisions need to be coordinated and planned in a strategic manner toward the goal of landscape-scale restoration of the CRW and its component ecosystems.

2.3 Dissecting the Philosophy

In this section, we examine each element of the statement presented just above. Each element is further explained, and examples are provided to illustrate it.

2.3.1 Ecosystem Restoration and Management Defined

> *Ecosystem restoration and management of the CRW is a strategy that attempts to repair the composition, structure, processes, and/or function of human-disturbed ecosystems. To the extent possible, we seek to maintain them as self-regulating natural systems that are integrated with current ecological landscapes and land use and that eventually require minimal human intervention*

Within the CRW, and as described in the HCP, restoration includes but is not limited to accelerating the development of old-growth forest conditions and restoration of previously logged landscapes, enhancement of habitat for species of concern, restoring natural biodiversity, protection and enhancement of aquatic and riparian systems, removal of blockages to fish passage, and decommissioning and improvement of forest roads. Although not specifically directed toward "repair," other management activities and decisions in the Watershed may also need to be considered with our strategy toward ecosystem restoration and management (see Sections 2.3.4 and 2.3.5 below). Restoration in response to future disturbance may also address large-scale disturbance of natural origin (such as wildfire and wind throw) that threaten water quality, as well as human-caused changes to the watershed.

Because ecosystems prior to recent human settlement are the product of climatic, geologic, and biological processes acting over thousands of years, it is impossible to reconstruct exactly what existed prior to impacts such as timber harvest, road building, and water regulation. In addition, it is now widely recognized that humans have had an impact on many "natural" ecosystems in North America for thousands of year, particularly in the use of fire to maintain vegetation in early successional stages; however the extent of Native American impacts in forested ecosystems of the Cascade Mountains was probably minor (Agee 1993). Although there are certainly limitations in using pre-settlement conditions as reference conditions for restoration, they are the best representation we have of a self-sustaining natural ecosystem, and we should use them to guide our restoration efforts.

The focus of restoration should be towards restoring ecological functions and processes, which are dynamic in time, rather than seeking to restore a particular suite of ecological attributes that were present at a specific point in time. In restoring a disturbed ecosystem we seek creation of ecosystems that support and enhance natural ecological functions and processes, even though these are not always well understood. We need to be thoughtful and explicit about what ecological functions and processes we are attempting to restore.

Ecosystem composition, structure, function, and processes (which collectively we refer to as "ecosystem conditions") are defined as follows. The **composition** of an ecosystem consists of the species and populations that occur within it. Ecosystem **structure** includes the physical elements provided by both biotic and abiotic features (e.g., tree canopies and boles, snags, mosses, pools/riffles/runs in a stream, emergent plants in a marsh, rock outcrops, etc.). **Function** is the role that ecosystem composition and structure have for a particular species or ecological process (e.g., nesting sites provided by snags, storage of flood waters by wetlands, creation of pools by large woody debris in streams). Functions are sometimes referred to as "ecological services." **Processes** are the ongoing interactions among physical and biological components of an ecosystem, such as vegetation succession, creation of forest gaps, sediment movement through a stream, natural disturbance events, recruitment of large wood into streams or onto forest floors, nutrient cycling, and food webs. Most ecosystem functions are the result of one or more ecological processes. For example, recruitment of down wood in a forest (a process) provides important structure (a function) for a host of organisms. An individual element of an ecosystem – such as a western redcedar tree, a fungus, or a spotted owl – may be considered as part of any one of these aspects of an ecosystem. Thus, rather than being mutually exclusive categories, ecosystem composition, structure, function, and processes are useful concepts for organizing and analyzing the elements of an ecosystem to show their interrelationships. Collectively, an ecosystem's composition, structure, function, and processes might be considered as its biodiversity.

2.3.2 Waters Rule!

"For purposes of the CRW HCP, restoration will be within the limits set by the use and management of the CRW as a municipal water supply, including reservoir operations, the presence of a functional road system, and minimizing risk of catastrophic forest disturbance due to fire, insects, or disease."

The primary consideration in management of the CRW is the maintenance of a clean and safe drinking water supply. Habitat restoration is a major element of the HCP, which must be implemented for the City to be in compliance with the federal Incidental Take Permit related to continued diversion of water and other City activities. But habitat restoration cannot compromise water quality, and protection of water quality must be considered in the design or implementation of restoration and management actions.

2.3.3 Tread Lightly

"At the same time, watershed management and operational activities should (where possible) avoid and minimize further disturbance, while contributing to the restoration of Watershed ecosystems."

Although the CRW must be managed to assure and maintain a high quality water supply, the management and operational activities that are conducted need to be consistent with the goals of habitat conservation and restoration as described in the HCP. Negative impacts to native species and habitats need to be considered and minimized, consistent with the Incidental Take Permit, when planning and implementing management and operational activities within the CRW. Unavoidable impacts need to be mitigated in a manner consistent with the HCP (see Section 4.1).

2.3.4 Do It, Or Don't

"Restoration in the CRW will include a wide range of individual on-the-ground projects that attempt to improve ecosystem composition, structure, processes, and function. Restoration may also entail management decisions to undertake no such projects in some locations or under some circumstances."

Restoration is typically thought of as one or more physical actions that are directed at moving an ecosystem from its current degraded set of ecosystem conditions toward a target, or reference, set of conditions. In contrast to this typical idea of "active" restoration, there is an alternate approach of "passive" restoration. Passive restoration entails eliminating the source of the disturbance that resulted in degraded conditions, protecting that ecosystem from other disturbances, and allowing the ecosystem to recover on its own and at its own pace (DellaSala et al. 2003, Kauffman et al. 1997).

Analysis and planning of restoration should recognize that either of these approaches, or some combination of them, may be appropriate for a given site, stream reach, or landscape. Passive restoration may be preferred over active restoration where additional benefits of active restoration are expected to be minimal, risks of active restoration are considered too high, or predictability of a project's outcome is too low. Passive restoration should not be considered as passive management, since it is selected as a strategy only after careful analysis and planning (DellaSala et al. 2003). One argument for passive restoration is that we cannot really engineer the reassembly of a natural ecosystem, or some approximation of it, because we do not adequately understand the complexity of most ecosystems. In some cases, the reestablishment of ecosystem processes that underlie a natural ecosystem might best occur on their own; our attempts to manipulate one or a few of these processes might not achieve ecosystem restoration–and may actually retard restoration. However, passive restoration may be ineffective or considered too slow where the developmental pathway without intervention is outside of the ecosystem's natural range of conditions. In that case, an active restoration strategy is likely to be more appropriate.

It is not our intention to argue which of these two approaches to restoration is better. The point is we should consider each approach when developing restoration programs or plans. In developing restoration strategies and plans, it is important to thoroughly assess the history of degradation, how ecological processes were disturbed, and how current conditions vary relative to those prior to degradation. From this analysis,we should explicitly evaluate the limitations, risks, and uncertainties of both active and passive restoration. Passive and active restoration should be considered as equally legitimate management options when developing restoration programs or plans

2.3.5 Seeing the Forest for the Trees

"These individual project actions and management decisions need to be coordinated and planned in a strategic manner toward the goal of landscape-scale restoration of the CRW and its component ecosystems."

By definition, watershed restoration implies a watershed-scale approach, which is in turn nested within a broader landscape-scale perspective of restoration. Upland, riparian, and aquatic components of a watershed are interrelated, particularly through the movement of water, sediment, organic matter, and living organisms from one component to another. Programmatic restoration (i.e., upland, aquatic, and riparian restoration) need to be integrated to ensure that restoration is planned and conducted on a truly watershed or landscape scale.

For example, in planning restoration of aquatic ecosystems we need to consider upslope conditions in order to assess potentials for further sediment input or magnitudes of peak flows. To effectively restore riparian areas, we need to consider channel gradient, present and projected instream habitat conditions, and the role of riparian areas to various wildlife species. Prioritization of upland restoration might be based, in part, on the synergistic effects of combining upland with riparian and aquatic restoration in the same subbasin. Restoration actions within a subbasin and larger watershed may affect the biology and habitat of aquatic species, such as bull trout, that live downstream of where these actions occur. In other words, fish and other aquatic organisms integrate the effects of restoration across the watershed.

Planning upland restoration efforts needs to explicitly address key landscape processes, such as dispersal, fire risk, habitat patch size and distribution, fragmentation, and corridors at a landscape scale. For example, ecological thinning may have more benefit to species such as northern spotted owls if it accelerates development of old-growth conditions in areas that connect existing old-growth patches rather than in isolated areas far removed from existing old growth.

3. Beyond the Guiding Principles: Additional Elements of the CRW Restoration and Management Philosophy

The statement of the restoration philosophy and the dissection of that statement in Section 2 articulate the main components of the CRW Restoration Philosophy. However, we have identified a number of other elements of this Restoration Philosophy that are either implied from the statement or apply it to specific issues that come up in developing restoration plans and projects. This section identifies 15 additional elements of the CRW Restoration Philosophy that build on the guiding principles put forth in the statement of the philosophy.

3.1 The HCP as the Primary Guidance for Restoration and Management

The goals and objectives of the HCP are the primary guidelines for ecosystem restoration and management in the CRW. The HCP is the outcome of years of planning and negotiation about how the CRW will be managed for the next 50 years. Implementing the HCP is a condition of the legal agreement between the City of Seattle and the United States government (i.e., the Incidental Take Permit) that allows the City to use the CRW as a source of water and hydropower, while meeting the requirements of the ESA. As such, watershed management actions and decisions, including restoration, need to be consistent with the HCP and directed towards achieving its goals and objectives.

3.2 Restoring a Range of Variability

Restoration of ecosystem structure and function within the CRW will be toward a range of variability rather than a single set of target conditions. Range of variability can refer to a wide variety of ecosystem attributes at widely different spatial scales (e.g., tree species basal area, forest horizontal heterogeneity, arthropod species richness, number and volume of LWD per stream mile, pool/riffle ratios, etc.). Since there is natural variability in virtually every ecosystem attribute, one particular target value is not ecologically realistic. No two geographical areas on the landscape exhibit the same exact set of biological conditions. Many attributes of a location such as aspect, slope, elevation and existing vegetation are site-specific. These attributes create variability across the landscape. Restoration actions need to consider these site-specific conditions, which set constraints on what we can do but also provide opportunities and advantages for restoration that are often unique to a site or area. The appropriate range of variability for restoration objectives will depend on how the natural range of variability intersects with site-specific conditions and management constraints.

3.3 Regional Context

Restoration activities should be identified and prioritized within the context of a broader ecoregional assessment designed to determine the status and condition of ecological integrity and the appropriate spatial relationship among core reserve areas, landscape connections, and restoration areas needed to maintain or enhance that integrity (DellaSala et al. 1996). Managing an ecological reserve in this context of surrounding development, changing land use, and cumulative effects presents significant opportunities and challenges.

The CRW is surrounded by a diversity of land uses and ownerships, including residential developments, commercial forestland, Washington State Department of Natural Resources (DNR), and the U.S. Forest Service. Effective land management decisions and actions will have considered this regional context and the evolution of the land use matrix proximal to the CRW. For example, the lower Watershed lies in the *Tsuga heterophylla* Zone of western Oregon and Washington (Franklin and Dyrness 1973), which has experienced significant development pressure and disturbance. While habitats in the lower Watershed have partially recovered from previous harvests and are now largely in a mid-seral stage of forest development, adjacent lands continue to be impacted by development, fragmentation, and habitat loss. Thus, restoration actions in the lower Watershed are in an area that is increasingly a "peninsula" of recovering forest extending into a "sea" of developing or intensively managed commercial forestland. In contrast, the upper Watershed lies within a land-use matrix influenced by significant public ownership, greater topographic relief, and different patterns of timber harvest. This setting demands that particular attention be paid to habitat connectivity both within and adjacent to the Watershed.

The regional context, setting, and ownership of the CRW lead to management challenges related to recreation, adjacent and regional timber harvest, and trespass. Many of these challenges are beyond our control, but we nonetheless should consider them in our planning. It would be worthwhile to track decisions and actions of adjacent and regional landowners to better understand how the regional context and setting may be changing and affecting ecological processes within the CRW. For example, changes in land cover at a regional scale could affect how home range requirements of particular species are being met, which has implications for how we design and implement forest restoration. Depending on regional conditions, the CRW could act as a source or a sink for particular species, which we would want to consider in developing restoration strategies. Another consideration is the CRW's role as a migration corridor across significant elevation gradients. As a final example of the relevance of regional context, the participation of the CRW in regional recreational planning may be a means to enhance effective ecological restoration.

3.4 Spatial and Temporal Scale

The HCP addresses the entire CRW, yet actions will be taken over discrete areas of limited extent. At the same time, biodiversity and ecological processes occur across all spatial scales from microscopic to global. Consequently, consideration should be given to the relationship of particular restoration and management action to the Watershed as a whole and to the spatial scale at which biodiversity and key ecological processes affected by the action are believed to operate.

For example, promoting habitat connectivity requires attention to landscape-scale patterns of past habitat and harvest activity, existing fragmentation patterns, and conditions within existing fragments. Trying to reassemble ecosystems requires considering the distribution of organisms (i.e., source populations) and their dispersal capabilities over space and time. Similarly, changes in hillslope conditions can affect watershed processes at much greater spatial scales, with effects cascading downstream through the stream network. Stream systems can also affect hydrologic function upstream, as when a drop in stream bed elevation at a rebuilt stream crossing causes downcutting and sediment mobilization upstream. Natural disturbance processes occur at a wide range of spatial scales. A single tree fallen by windthrow may affect an area of only 0.01 ha, while fire in forested ecosytems of the western slopes of the Cascade Mountains typically occur on a scale of thousands of hectares (Agee 1993).

Spatial scale needs to be addressed explicitly as part of strategic planning, project design, and assessment of impacts for restoration actions within the Watershed. Since spatial scale of an action is likely to affect scales (e.g., orders of magnitude) immediately below and above the targeted ecological function or process, spatial scale should be considered at least across this range and, preferably, across a greater range of scale. As an example, consider a thinning project of a stand 100 hectares in size. In such a project, ecological processes at the patch scale (1 to 10 hectares) and the landscape scale (1,000 to 10,000 hectares) should be evaluated. Likewise, a stream restoration project at the reach scale (100 m) should consider habitat effects (1-10 m) and stream network effects (1,000-10,000 m).

Restoration strategies and actions under the CRW HCP also need to consider temporal scale. Ecological processes occur at time scales ranging from seconds (sunflecks on the forest floor) to thousands of years (soil development). Our expectations of restoration outcomes are tied to the time frame of the human life span and our more immediate attention spans; that is, we want to see results soon, and certainly within our lifetime. In the present, effects hundreds of years into the future are only abstractions. The HCP spans 50 years , which is relatively short ecologically, yet our restoration actions may affect trajectories that will be played out over hundreds of years under possibly quite different environmental and economic conditions and social attitudes (see Section 3.11). Effects of restoration actions will be realized over widely different time frames. For example, the effects of putting large wood in a stream should be seen almost immediately as it provides habitat for fish and begins affecting stream hydraulics. However, effects of actions to accelerate development of old-growth forest may not be realized for many decades, if not centuries. The time scale of human support also needs to be considered, since implementation of some restoration strategies may require multiple interventions. The question of when an ecosystem should become self-regulating, not requiring further human support or subsidy, should be addressed for each restoration action or strategy (also see Section 2.2.3).

Temporal scale, thus, needs to be addressed in any restoration strategy or project. This should include recognition of the time scales at which relevant ecological processes, effects of restoration, and future management actions may occur. We need to adjust our expectations for our restoration and monitoring programs to ecologically realistic time frames. Because monitoring provides the thread of information that links our actions now to outcomes that may not be seen for hundreds of years, the importance of documenting our work takes on crucial importance. Although we may not personally gain the satisfaction of seeing all the fruits of our labors, we should take pride in leaving a legacy that will benefit future generations of all species that use or depend on CRW ecosystems.

3.5 Restoring What We Don’t Understand

The HCP is directed at restoring ecosystem composition, structure, function, and processes. However, our understanding of what constitutes a fully functional ecosystem is incomplete. As a result of our limited understanding, habitat needs of individual or groups of species are often used to identify what structural/functional aspects of an ecosystem need restoration.

For example, if old-growth dependent birds require snags, restoration of upland forests should include snag recruitment into the forest structure. Alternatively, restoration and management actions may be directed at a particular ecosystem process with the idea that affecting this process will provide better habitat (e.g., reducing sediment input from roads to improve fish spawning habitat). In some cases, we may have general, but lack any specific, understanding of ecological processes leading to a naturally functioning ecosystem. As an example, how a forest develops into old growth under natural (e.g., post-fire) versus post-logging conditions is not well known, which significantly restricts our certainty in the outcome of moving CRW second-growth forests toward old-growth conditions.

It is important that we acknowledge these uncertainties and approach restoration with humility rather than hubris and that we design restoration in a manner that allows us to learn to do it better over time. Accordingly, we need to recognize that outcomes of restoration are not entirely predictable, which means that effects analysis (Section 3.6) and adaptive management (Section 3.9) are of critical importance. Utilizing a formal adaptive management approach to restoration projects can significantly contribute to reducing uncertainty in the outcome of restoration actions by leading to a better understanding of ecosystem function and to more effective restoration techniques.

3.6 Effects Analysis and “Do No Harm”

In planning and implementing any restoration or management action in CRW, it is critical to evaluate all reasonably possible outcomes and impacts. The risk of potential negative impacts (i.e., risks) should be determined and weighed against the positive impacts (i.e., benefits) of the action. Likewise, the risks of not taking any restoration or management action need to be considered within appropriate spatial and temporal scales.

Although well intended, management or restoration actions may have consequences that have detrimental effects on species, habitat, water quality, or other important aspects of watershed health. Just as physicians treating their patients abide by the credo of “do no harm,” restoration planners in the CRW need to consider the potential for “harm” to the Watershed and its resources. Short-term impacts may be inevitable and acceptable in comparison to the long-term benefits of an action, but they should nonetheless be considered. Negative impacts from restoration actions, or lack of actions, may in some cases be obvious, but in other cases are apparent only with careful and considerable assessment of the project and its effects. An example of an obvious effect is the ground disturbance resulting from an ecological thinning project. The negative impacts of ground disturbance by logging or skidding equipment are readily predicted, but are presumably outweighed by the greater benefits of the thinning treatment. A hypothetical example of a bank erosion control project presents less obvious negative effects: if the bank erosion project results in reduced gravel input to the stream, there may be a change in channel geometry and loss of gravels for spawning habitat.

3.7 Conservation of Alternatives

Deciding *if*, *when*, and *where* to act are critical management decisions for the CRW. Once an action is taken at a given location, the same range of action may no longer be available. In evaluating possible actions, consideration should be given to the conservation of alternatives. That is, what options for future actions are given up by acting now? Waiting to undertake an action may also alter the suite of potentially beneficial actions that could be taken at later points in time as the structure and composition of the ecosystem change. On the other hand, waiting may also increase the risk of negative outcomes. For example, waiting to intervene in a degraded stream may limit restoration options and reduce the chances of restoration success; or delaying a thinning treatment may result in reduced effectiveness in promoting greater tree growth. We need to explicitly consider how acting at a particular time and place will affect opportunities for restoration in the future by considering the potential trajectories of ecosystems with and without interventions.

3.8 Maximizing Benefits to Costs

Restoration actions in the CRW should be cost effective and realize maximum benefits for the cost and effort required to implement them. That is, there should be a good "bang for the buck." Since resources (budgets, personnel) are limited and the Watershed is extensive, restoration actions need to be targeted and realize as much benefit as possible for the resources expended. Benefits can be evaluated from a variety of perspectives, such as:

- the immediate and projected positive effects of the action on habitat or species,
- the time-frame in which benefits will be realized,
- how well the project restores natural ecosystem processes and function,
- the spatial extent of the proposed action, and
- the relationship of the action to surrounding areas and other projects.

Costs can be evaluated in terms of project budget, resource allocation (a truck or person used for Project x is unavailable for Project y), and reduced ecological services (e.g., a large tree girdled to create a snag has lost its habitat value as a live tree now and in the future). There is also an element of uncertainty about costs, since potential negative outcomes (i.e., risks) also become costs if they occur. Because restoration actions under the HCP are primarily intended to improve habitat, benefits will primarily also be in terms of ecological services (e.g., the value of the tree as a snag). Although non-monetary costs and benefits are notoriously difficult to quantify, it is nonetheless critical to weigh benefits and costs against one another, at least on a qualitative level, as an essential criterion in prioritizing restoration actions at the programmatic level and again in deciding whether to implement individual projects.

3.9 Adaptive Management

Restoration actions in the CRW will be conducted within an adaptive management framework. An adaptive management framework implies that:

(1) there is some level of uncertainty about the outcome of our restoration or management action;
(2) where such uncertainty exists and it is feasible to do so, we should design, implement, and monitor projects as experiments with specific measurable objectives, with the explicit goal of learning from the projects' outcome (i.e., reduce uncertainty); and
(3) we will use what we learn to correct and improve future plans and activities.

Restoration actions in CRW will range from projects conducted as experiments having the primary objective of learning to large-scale treatments having the primary objective of restoring ecosystem function and processes. Most restoration projects will combine both of these objectives to varying degrees. Learning from adaptive management applies to costs and efficiencies of project implementation, as well as to understanding the scientific basis of ecosystem processes.

3.10 Native and Exotic Species

Because non-native organisms are typically present as a result of human introduction or disturbance, restoration should seek to reduce their presence, as well as prevent future introductions, consistent with state laws. In the case of state-listed noxious weeds, this may be required by state law. Only native plant species will be used in restoration and management of the CRW. Native plant species used in revegetation projects should also be from genetic stocks that are at least regionally specific (i.e., west of the Cascades, northern Oregon to southern British Columbia).

Although some may argue that non-native species can serve similar ecosystem functions as native species, our understanding of ecosystems is too limited to know all the functions of a given native species or the effects of a non-native species. For example, the population size of native organisms is often controlled by native predators, parasites, or host defensive mechanisms. Introduced organisms often do not have these population controls, resulting in unchecked population increases (Noss and Cooperrider 1994). Since restoring natural biodiversity is one of the underlying goals of the HCP, non-native species generally have no role in ecosystem restoration in the CRMW. We acknowledge, however, that there may be some introduced species that we will not seek to reduce, such as Rocky Mountain elk and Walsh Lake kokanee (possibly introduced). Non-native elk were introduced following the extinction of the native Roosevelt elk and are of current importance to Muckleshoot tribal members. The origin of the population of kokanee in Walsh Lake is not known, and it may possibly be a native population. Even if it is a non-native population, it's value as a self-sustaining salmonid population is of biological significance and may be of value in gaining a better understanding of kokanee life history strategies in the Lake Washington system.

3.11 Life After the HCP: the Role of Resource Managers as Asset Managers

Ecosystem restoration as a land management strategy is often undertaken to support long-term goals focused on biodiversity, ecosystem functioning, and related issues. The HCP contains no commitment or mention as to what will happen in the CRW once the HCP and its activities expire at the end of its 50-year lifespan, although the HCP could be extended under the Implementation Agreement. During the 50-year HCP period, the value of assets within the CRW will continue to increase as a result of natural tree growth, ecosystem recovery, and HCP management actions. These values increase no matter how those assets are considered now: as commercial timber value, the value of secondary forest products, or the quantity and quality of natural capital (including habitat, clean water, and clean air). Unlike human-built infrastructure, like pipelines and reservoirs, ecosystem assets in the CRW will generally increase in both ecological and monetary value over time.

Although ecological objectives (i.e., increasing the value of ecological assets) are the primary drivers of land management decisions under the HCP (i.e., habitat improvement, ecological and restoration thinning), it is possible that commercial objectives may be reconsidered following the HCP time frame. Restoration planners in the CRW are thus asked to consider three realities: 1) the forest in the CRW and related secondary forest products have significant and increasing commercial value; 2) these forested habitats are not *guaranteed* by the City to remain forever on trajectories toward late seral and old-growth conditions; and as a result, 3) CRW land managers are *de facto* commercial asset managers in addition to managing ecological assets.

This Restoration Philosophy recognizes that maximizing ecological value is the primary focus of our management activities but acknowledges the enhancement of commercial value as a potential benefit. This raises intriguing questions. Just how different are the goals of these two endeavors? Are they in fact consistent (that is, will HCP forest interventions effectively preserve or increase commercial value)? Should we conduct our HCP activities to simultaneously meet HCP objectives *and* enhance commercial value? How is this potential asset management responsibility conveyed to the public in light of the existence of the HCP?

Ecological and commercial objectives are not necessarily mutually exclusive and we expect that management for ecological value under the HCP will enhance commercial value (although such management may not *maximize* future commercial value). Management of forests under the HCP will not only result in larger trees through thinning treatments, but should confer greater resistance to fire and insect damage as a result of greater heterogeneity in forest structure. Over long time frames, future commercial value could possibly be even higher under such a management regime, given reduced risks of fire and disease and increases in potential secondary forest products (e.g., understory species). In addition, future commercial value is difficult to evaluate due to changes in wood and secondary forest product markets, milling infrastructure, and other factors.

A related issue to potential future commercial harvest of CRW forests is the time frame of HCP actions in relation to when ecosystem benefits from these actions will be realized. Many of the intended benefits of actions, interventions and management decisions occurring within the immediate, 50-year HCP time frame may not occur for a hundred years or more. By that time political, social, and economic conditions, and City policies, may be quite different. Despite this uncertainty about future management objectives in the CRW, implementation of the restoration goals and objectives prescribed by the HCP should leave ecosystem assets of the CRW with much higher value as measured by either ecological or commercial criteria, or some combination of the two.

3.12 Integrating Other Watershed Management Responsibilities into the Restoration and Management Philosophy

Managing resources in the CRW is complex, requiring attention to the operation and maintenance of infrastructure, conservation of natural resources, curation/preservation of cultural resources, cooperation with interested parties (such as the Muckleshoot Indian Tribe), public education/involvement, adjacent recreation activity, and neighboring land uses. Restoration activities conducted under the HCP need to be closely coordinated with activities conducted under these other obligations. Conflict may arise among these different activities and resolution will need to be pursued in those cases. In many cases, however, such activities are complementary and can achieve a high degree of synergy and benefit if planned accordingly.

For example, with HCP implementation now underway, the CRW has become an excellent laboratory for studying watershed processes, biological conservation, and environmental planning. As such, the Watershed offers unparalleled opportunities to expose students and volunteers to a broad range of issues and skills ranging from planning and conducting watershed research and restoration; to using sophisticated technologies such as GIS, GPS, and remote sensing; to identifying and understanding biota. Students and volunteers are potentially exposed to the social, cultural, and biological legacies of the CRW using a multitude of learning methods, technologies, and experiences. If planned appropriately, such public education and involvement elements could often directly support implementation of HCP elements.

3.13 Restoration in the Context of Global Warming

Global warming offers significant challenges to watershed restoration planners. The effects of global warming and the rates at which these effects develop are not known, but they could result in conditions that are quite different from those under which existing or recently disturbed ecosystems developed. Consequently, we need to be cautious in using existing, undisturbed ecosystems as references, or models, for ecosystem restoration. In a sense, we need to "hedge our bets" when planning restoration to anticipate a range of possible climatic scenarios. For example, in underplanting trees we may want to use a greater variety of species to increase the probability that species suited to future conditions are present.

Also as a result of global warming, the CRW may be a regionally important refugium or migration corridor in this region's biological response to the effects of global warming, since it provides or will provide important connectivity and large patch sizes of old-growth ecosystems. In planning and implementing management of restoration actions, land managers may need to evaluate the success or impacts of their actions in the face of a changing regional and global climate, and should consider and plan for alternative future conditions by selecting different approaches or tools in planning or conducting those actions.

Restoration in the CRW also offers an opportunity for the City to directly mitigate global warming. Carbon sequestering is a product of moving the CRW toward late successional and old-growth conditions. This sequestering reduces atmospheric CO_2 levels and their effect on global warming. While this effect is certainly small on a global scale, it nonetheless demonstrates the relationship of our local actions on much broader scales, even to that of the Earth itself.

3.14 Management of Newly Acquired Lands

New lands are expected to be added to the CRW over the 50-year lifespan of the HCP. Unless amended, the Incidental Take Permit and the HCP do not cover such new areas. Consequently, decisions will need to be made on a site-specific basis with regard to how the elements of this Restoration Philosophy apply to newly acquired lands.

3.15 Restoration Following Natural Disturbance

Restoration strategies and actions as described in the CRW HCP primarily address disturbance resulting from prior human activities and interventions. Accelerating the rate at which early- and mid-successional forests develop old-growth conditions, restoring large woody debris to streams, and underplanting conifers in riparian areas are all actions taken in response to past human-caused disturbance.

The HCP largely restricts the potential for future wide-scale human disturbance, but future "natural" disturbance, such as catastrophic fire, windthrow, land movement, disease, insect infestations, or flood could affect large areas of the Watershed. These types of disturbance events are referred to in the HCP (Section 4.5.7) as "changed circumstances" or, if at a larger spatial scale, as "unforeseen circumstances." Under the HCP, there are general contingency plans for response to "changed circumstances" caused by natural disturbances, but responses to "unforeseen circumstances" of greater spatial scale would be determined by consultations between the City and Services, as described under the "No Surprises Rule."

Although these disturbance agents are natural, they would be occurring in a generally modified landscape, possibly due to the effects of past human disturbance. Furthermore, a large-scale disturbance event, regardless of its cause, could threaten water quality, and measures to protect water quality would be taken, as specified in HCP Section 4.5.7. Where natural disturbance does not threaten water quality or watershed operations and does not appear to be due to conditions resulting from previous human disturbance, it should be considered a natural process and restoration should be allowed to occur on its own (i.e., passive restoration, as described in Section 2.2.6).

If catastrophic natural disturbance occurs within the CRW, it should be evaluated to determine the need for restoration. Prioritization of restoration actions in response to natural disturbance should be considered with other identified actions needed in fulfilling the obligations and commitments of the City in providing high quality water and meeting HCP commitments.

4. Guidelines for Implementing a Restoration and Management Philosophy

Applying the conceptual aspects of this document to planning and on-the-ground actions is not necessarily straightforward. This section provides guidelines and recommendations for implementing the CRW Restoration Philosophy presented in Sections 2 and 3. We intend that these guidelines and recommendations be used in developing restoration strategic plans and projects and during project implementation. Where appropriate, the elements of this Restoration and Management Philosophy should also be used in the development of specific Standards, which would of course also be based on other policies, guidelines, and workplace expectations developed by SPU and WMD sections. This recommendation for developing Standards reflects the December 2000 Division Retreat goal to "Develop realistic, tangible standards for Operations work and Watershed functions."

We provide a few examples of standards that readily come to mind, but we do not make such specific standards or prescriptions. That responsibility lies within the individual sections or work groups. However, we anticipate that this document will be periodically revisited and evaluated regarding how well the guidelines presented here are incorporated into the different sets of Standards developed within the WMD.

4.1 Minimizing Further Disturbance in Watershed Operations, Management, and Restoration.

Rather than separate restoration from other activities within the watershed, relevant activities of watershed operations and management have been included within the domain of a CRW Restoration Philosophy, because so many of these activities are linked. Indeed, implementation of many restoration projects is part of watershed operations (e.g., road abandonment), and the Operations Section has taken a proactive role in reducing the spread of exotic plants. At the same time, many of the activities of the Operations Section are directed at maintaining the infrastructure within the watershed to ensure a high quality water supply. We hope that this Restoration Philosophy can help to guide these latter activities in ways that contribute to restoring natural ecosystem functions within the watershed.

Guideline 4.1.1: Where maintenance of high water quality or other essential watershed management functions are not compromised, and recognizing that watershed operations must meet designated objectives, watershed operations and management should contribute to watershed restoration by minimizing further ground and vegetation disturbance.

Recommendations:

1. To the extent possible while still meeting operational objectives, minimize the extent of ground and vegetation disturbance during road maintenance and select less sensitive locations that must be disturbed (e.g., away from high quality habitat).

2. Minimize the spread of exotic plants via road maintenance equipment.

4.2 Prioritizing Restoration Actions

Given the variety of possible restoration actions and sites, criteria are needed for prioritizing what and where restoration actions are to occur. These criteria necessarily reflect professional judgements, which in turn reflect a philosophy of restoration. Several elements of the CRW Restoration Philosophy address prioritizing restoration actions, and the guidelines that follow reference these elements by document sub-section number.

Prioritization of restoration actions is a process that requires planning over large spatial scales and across disciplines. One strategy that integrates most, if not all, of the above elements is to plan and prioritize restoration actions by subbasin (e.g., major subbasins as delineated in HCP Map 1) or a landscape-scale management unit. That is, focus a wide array of restoration actions within a particular subbasin to better link restoration projects and leverage their effects. Subbasin-or landscape-scale planning takes advantage of the multiple connections among upland, riparian, and aquatic processes – actions directed at one of these watershed components can be coordinated with those in other components to achieve synergistic benefits and more effective restoration. In addition, a subbasin or landscape strategy is likely to be logistically more advantageous. Monitoring can be better coordinated, and roads can be abandoned sooner when restoration actions are completed in tandem. Whether or not restoration projects across disciplines are planned in a coordinated fashion, restoration of individual components needs to be done within the context of conditions and activities occurring elsewhere in a subbasin.

Maximizing benefit to cost ratio, within the constraints of HCP commitments and management objectives, is an obvious and important criterion for prioritizing restoration actions (Section 3.8). One question that arises in evaluating benefit is how to compare positive effects among sites to be prioritized for treatment. For example, how does one compare the benefits of treating an upland forest site that already has substantial structural diversity to those of treating a forest site in the “stem exclusion” stage that largely lacks structural diversity? The assumptions that lie behind making the evaluations of benefit in such a comparison need to be made explicit. How a project contributes to the overall landscape restoration strategy is an important criterion in determining its benefit.

Severity of the effects of environmental degradation are obviously also important to consider in determining the urgency for restoration. For example, if there is a problem that is critically affecting an important population, such as bull trout, fixing that problem might take precedence over other restoration needs. Severity of effects is also considered as part of a cost-benefit analysis, since the benefit of restoration is partly determined by the severity of the problem being addressed by restoration.

Guideline 4.2.1: Restoration actions should be planned strategically within a subbasin- and landscape-scale context (Section 2.2.7). Strategic planning and prioritization of restoration actions should assess the severity of environmental degradation and the benefits of restoration across a landscape unit, subbasin, or stream network, rather than on a site-specific scale. Strategic planning and prioritization also includes operational efficiency and coordination of projects.

Guideline 4.2.2: Restoration actions linked to other actions resulting in synergistic benefits are preferred over site-specific actions conducted independently. (Section 2.2.7). Linkage of projects to gain synergistic effects is tied closely to Guideline 4.2.1, since linked projects would most likely address a range of problems occurring within a single subbasin or landscape unit.

Guideline 4.2.3: Cost effectiveness (i.e., the ratio of benefits to cost) of a restoration action should be relatively high (Section 3.7). Benefits should be evaluated on a range of scales from site-specific to subbasins to landscapes. Costs should be evaluated, at least qualitatively, in terms of budget, resource allocation, and potential reduction in some ecological services. The important point is to reasonably consider the various benefits and costs of a project and weigh them against one another.

Recommendations:

1. Criteria for prioritizing restoration should include:
   - the degree to which a proposed project(s) contributes to a strategic plan for restoring ecosystem processes and function across a subbasin or stream network, or even the entire watershed;
   - synergistic benefits obtained by linkage with other projects;
   - high benefit to cost ratio; and
   - severity of environmental degradation and urgency for restoration.

2. An explicit process utilizing these and perhaps other criteria should be developed to prioritize restoration projects over 5 to 10 year time-frames and the entire HCP period.

4.3 Designing Restoration Strategies and Actions that Address Ecosystem Processes and Function

Restoration actions typically entail the modification of physical or biological characteristics of the ecosystem: cutting trees during ecological and restoration thinning; underplanting conifers in an alder dominated stand; placing pieces of large wood in a stream; removing fill from a road prism. Conducting these physical actions can be done to manipulate habitat directly on a site-specific scale or to influence ecosystem processes that indirectly alter habitat, typically across larger spatial scales. This Philosophy of Restoration emphasizes the latter approach, and the challenge is to plan and design restoration actions that address ecological processes that act across larger spatial and longer temporal scales and are often less tangible than direct habitat manipulations. These guidelines attempt to provide help in directing our restoration strategies and actions toward ecosystem processes and function.

Guideline 4.3.1: Restoration strategies, plans, and project designs should explicitly address how they will be tied to and contribute to the restoration of ecosystem processes and function (Section 2.2.2).

Recommendation:

1.Develop a conceptual model of ecosystem processes that will potentially be affected by the project(s) and then assess the effects of key restoration actions within the framework of that model.

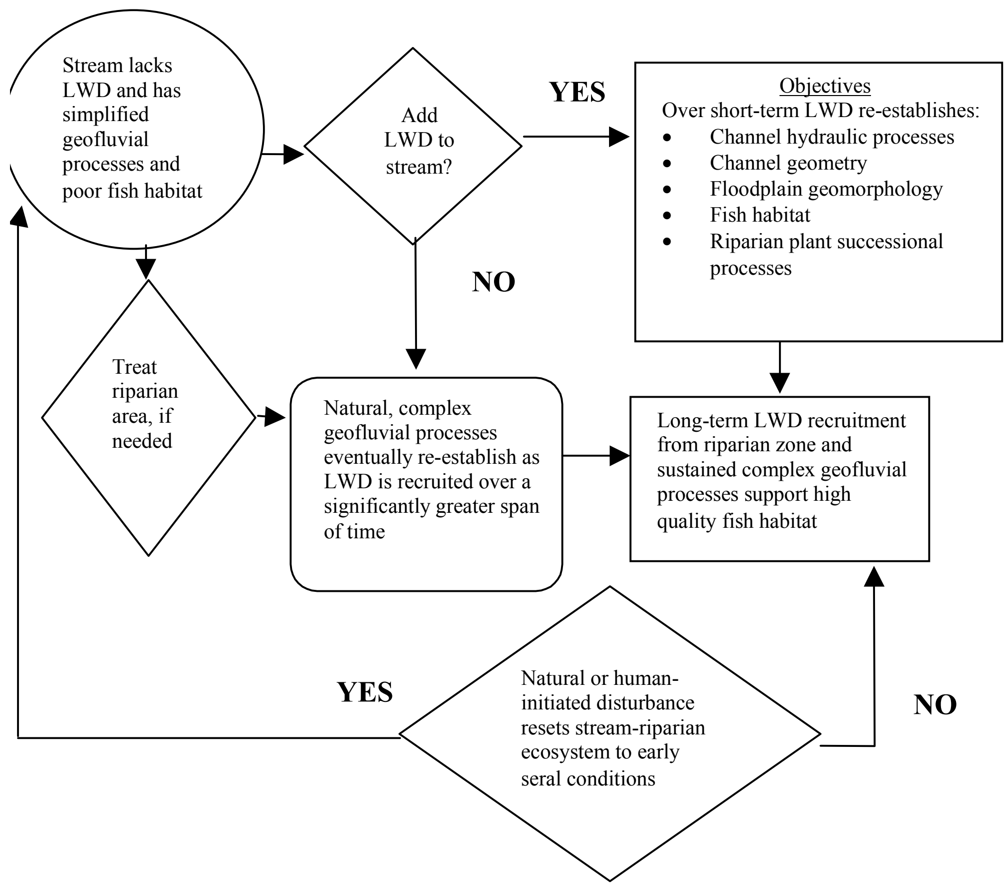

FIGURE 1. An example of a simple ecosystem model depicting the establishment of large woody debris (LWD) to streams.

Guideline 4.3.2: Establish short-term predictions and benchmarks and use them to evaluate the altered trajectory of restored ecosystems toward long-term desired outcomes. Using an adaptive management framework (Section 4.6), develop criteria and contingency plans for correcting trajectories that will likely lead to undesired outcomes.

Guideline 4.3.3: Evaluate and predict long-term outcomes of a restoration action in terms of whether or not it will be self-sustaining or at least require minimal additional input (Section 2.2.3). If ecosystem processes and function are restored (i.e., Guideline 4.3.1), then a self-sustaining system should result, but it is useful to assess as best as possible what the long-term outcome of restoration action will be to address this issue.

4.4 Effects Analysis

As Samuel Johnson once said (although he was not the first to say it), “The road to hell is paved with good intentions.” We do not want our good intentions for restoration leading us down the road to unintended negative effects. To prevent that from happening, we must be aware of what possible negative effects our actions, or inactions, might have. (Not too long ago resource managers were taking wood *out* of streams to help fish.) Because our understanding of the processes and function of complex ecosystems is incomplete, we need to recognize the uncertainty in the outcome of restoration actions, be vigilant for unintended consequences, and consider all restoration projects as experiments (Section 4.6).

Guideline 4.4.1: In planning, designing, and implementing restoration actions, specifically address the potential negative effects of the actions, as well as not taking any action. These include risks to species and ecosystems, human safety, and water quality.

Recommendation :

1. Every strategic and project plan for restoration should have a section on effects analysis. Potential negative effects should be identified to the extent reasonably possibly and evaluated in the plan.

4.5 Active versus Passive Restoration

As discussed in Section 2.2.6, either active or passive may be more appropriate for restoration of a given site or area. Natural recovery, or passive restoration, may be the best alternative in a particular case for several reasons:

- because of the complexity of ecosystems and our limited understanding of them, the “natural” reassembly of a disturbed ecosystem is more likely to result in restoring processes and function than an engineered approach;
- risks of negative outcomes or indirect negative effects of an action are too high;
- the benefit gained for the cost of restoration is too low.

In contrast, active restoration is probably the best alternative when:

- ecosystem processes are not likely to recover on their own due to one or more barriers,
- the time-frame of natural recovery is considered too long,
- the risks of inaction are too great.

Because resources (budget, personnel) for restoration are limited, we need to identify where passive restoration is the preferred approach and why it is the preferred approach at that location. Similarly, we should be able to justify an active over a passive restoration approach to maximize the benefits from our resources applied to restoration.

Guideline 4.5.1: In strategic planning for restoration, consider both active restoration and natural recovery/passive restoration as alternatives to meeting restoration goals.

Guideline 4.5.2: For each planned restoration project, consider the questions:

- How will the results of active restoration compare to those of natural recovery in this area or at this site?

- Are the expected results of active restoration vs. passive restoration worth the cost?
- How will the time-frames of active vs. passive restoration differ?
- Are ecosystem processes and function amenable to active restoration or are they more likely to be restored naturally?

4.6 Using Adaptive Management

Adaptive management programs are generally designed to provide guidance for implementing long-term restoration, land management, and conservation plans. Application of monitoring and adaptive management programs for the timeframe of the HCP must be scaled in scope and purpose to effectively examine the progress of actions implemented. Because adaptive management programs rely on effective documentation and communication, such programs need to be purposefully designed to document new knowledge and to transfer that information to present and future planners.

Specific adaptive management actions can cover the broadest spectrum of activities, ranging in scope from conducting a project under rigorous experimental conditions to conducting periodic staff meetings to discuss what was generally observed or learned from a particular experience. Yet, no matter how formal or informal, effective adaptive management activities are designed to result in the following outcomes:

- Objectives of project-specific adaptive management plans are well-defined and measurable.
- Roles and responsibilities are clearly defined and predictable, and can be understood by managers as well as stakeholders.
- All relevant information is gathered and reposited according to agreed upon standards, and is coordinated to evaluate management decisions and actions at the local, watershed, and regional scales.
- Knowledge of ecosystem processes and functions is increased.
- Institutional course corrections occur at predetermined milestones to ensure continual progress toward specific, measurable goals and objectives.
- Institutional environments and tools are improved as necessary.

Guideline 4.6.1: The adaptive management component of the Strategic Monitoring Plan should be consulted whenever any project is being undertaken. The Strategic Monitoring Plan can assist project managers in determining what level of intensity to use in designing their adaptive management plan, and what timelines, processes, and intermediate products would assist in successfully implementing that plan.

Guideline 4.6.2: Responsibility for tracking progress or successes of each HCP project should be clearly defined and documented in the data management system. Typically, this will be a single point-person, such as a project manager, ID team leader, or work unit lead. Consistent with SPU's asset management approach, a single-point person helps to ensure accountability for both project implementation and follow-up. This person should be responsible for ensuring that any adaptive management aspects of a project are implemented. If an HCP project point person leaves the organization, these responsibilities should be formally reassigned.

In addition, this point-person has a responsibility to communicate successes, failures, and lessons learned from a project as part of the annual reporting process for the HCP. As appropriate, this information should be compiled and disseminated by the designated point-persons through internal reports, press releases, newsletters, seminars, and other tools to share these experiences and lessons with other City staff and the public. This process would continue until the HCP is completed.

4.7 Alien Organisms

Guideline 4.7.1: Because alien species may pose significant threat to the protection of water quality and the integrity of ecosystems, all attempts should be made to prevent new alien species from entering and establishing in the Watershed. Invasive alien plant species already established in the CRW should be managed with the goal of controlling their spread into new areas, or preferably, eradicating established populations consistent with state laws on noxious weeds.

4.8 Use of Herbicides

Guideline 4.8.1: The City of Seattle's Cedar River Watershed Secondary Use Policies prohibit the use of herbicides on Watershed lands managed by the City (Ordinance 114632, Policy 6-13). This ordinance imposes a moratorium on the use of herbicides and requires weeds to be managed using hand or mechanical methods.

4.9 Large Scale (Beyond the Watershed) Issues

While the Watershed is a relatively large area, it does not exist in isolation. It shares common boundaries with numerous landowners, it transitions through a number of ecological communities from below 500 to above 5,000 feet in elevation, it provides important habitat connectivity in the western Cascades ecoregion, and, as managed under the HCP, it sequesters carbon that helps mitigate global warming. Decisions to take action, or not, should be informed by this regional and ultimately global context. For example, modeling habitat connectivity should consider the condition and management intentions of areas outside but adjacent to the Watershed, not just within the watershed.

Guideline 4.9.1: Nurture data sharing arrangements with adjacent landowners (i.e. Washington DNR, U.S. Forest Service) relative to habitat status and management plans.

Guideline 4.9.2: Explicitly consider regional and possibly global context in planning restoration actions.

5. Implementation and Review of the CRW Restoration and Management Philosophy

As stated in the Introduction, a primary purpose of this Restoration and Management Philosophy is to provide a common understanding about our assumptions, goals, and objectives for restoration in the CRW. Hopefully, this document addresses most of the fundamental issues that should be considered in developing restoration strategies and plans and implementing them. However, review and implementation of this Philosophy will undoubtedly identify other issues and concepts that were not discussed in the present document, as each person brings their own personal experience and perspectives to restoration of the CRW under the HCP. As a result, we expect that this Restoration Philosophy will evolve in response to new ideas and to experience in implementing it, as well as continued development of restoration science and methodologies.

In order for a restoration and management philosophy to be useful, it is important that it be read, discussed, and used in the planning and doing of restoration in the Watershed. Referencing this Restoration and Management Philosophy in planning or other documents produced by WMD staff would be one way that its use can be demonstrated. The Restoration Philosophy ID team hopes that the concepts presented here will be tested at every level in the restoration process, and those concepts refined and, if necessary, revised in response to this learning. Although the Restoration Philosophy ID team was intended to be active only until this document is completed, we recommend that the ID team be reformed at periodic intervals (3 to 5 years would seem appropriate) to incorporate what we have learned, what insights we have gained, and recent advances in restoration science.

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Appendices

Appendix A

Minutes of ID team meetings showing highlights of discussions in developing a restoration philosophy. These minutes can be found in Shedcat under the key words “restoration philosophy.”