Chinook Bend Natural Area
Site Management Guidelines

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Daryl Grigsby, Division Director

King County Water and Land Resources Division

King County
Department of Natural Resources and Parks
Water and Land Resources Division

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Acknowledgements

Planning Team:

Michael D. Beevers, Natural Resource Planner, Natural Resource Lands Management Program, King County Department of Natural Resources and Parks (DNRP).

Kirk Anderson, Snoqualmie Basin Steward, Land and Water Stewardship Services, King County DNRP.

David Kimmett, Resource Coordinator, Parks and Recreation Division, King County DNRP.

Report produced by:

Natural Resource Lands Management Program
Office of Rural and Resource Programs
King County Department of Natural Resources and Parks
201 South Jackson Street, Suite 600
Seattle, WA 98104-3855

(206) 263-3723

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Executive Summary

Chinook Bend Natural Area is a King County Department of Natural Resources and Parks Ecological Land managed for the protection of ecological values and where appropriate public access. The Chinook Bend Natural Area is located approximately two miles north of the City of Carnation in unincorporated King County and is a prominent meander on the Snoqualmie River. The 58.88 acre property lies within the Snoqualmie River's 100-year floodplain and is adjacent to the river on three sides. The site contains predominantly pastureland with smaller areas of wetlands and mature deciduous forest cover along the river's edge.

The Chinook Bend Natural Area was donated to King County in May of 2000 by the Nestle USA Corporation. The Nestle USA donation specified use of the property as open space for habitat protection purposes and specifically prohibited the future development of the site for active recreation.

Chinook Bend Natural Area contains significant habitat for a variety of fish and wildlife species. The Snoqualmie River in the vicinity of Chinook Bend Natural Area sustains runs of chinook salmon, which are listed as threatened under the federal Endangered Species Act (ESA). Approximately 20% of the chinook salmon that return to the Snoqualmie River watershed spawn in the Chinook Bend reach. The site is identified as a wildlife habitat corridor in the King County Comprehensive Plan and an active bald eagle nest is located on the site.

Current public use at Chinook Bend Natural Area supports a relatively low number of visitors engaged in recreational activities such as fishing and nature observation. No formal public trails exist on the site, although pedestrians use two access roads as trails. The current level of public use appears to have no adverse effect on the ecological resources of the site. A small, undeveloped parking area just west of the Carnation Farms Road Bridge provides limited public access.

The Chinook Bend Riparian Restoration Project has been underway on site since the fall of 2000. The project aims to restore the lowland-forested conditions to the riparian buffer and floodplain in order to provide erosion protection, enhance wildlife habitat and improve recreation. The restoration project is scheduled through 2005 and to date over 8,100 trees have been planted.

The goals for the Chinook Bend Natural Area are 1) to conserve and enhance ecological value, and 2) accommodate appropriate public uses that do not harm ecological resources. The following are planning and management recommendations that are designed to support these goals.

- Consider levee removal to enhance the natural floodplain processes.
- Consider enhancing the openwater wetland by blocking the outlet pipe to restore hydrologic connectivity to the river.
- Monitor the ecological systems on site to provide insight into changes and trends in ecological systems.
- Plant native trees and shrubs and control noxious, invasive and non-native plant species to provide a structurally diverse and functioning forested floodplain.
- Implement preserve and protect measures to limit inappropriate public use in rare and sensitive areas.
- Repair or relocate public access to ensure public safety and provide for appropriate public use.
- Monitor public use, types of use and impacts on the ecological systems to inform management decisions.
- Enhance educational opportunities to provide the public with an "outdoor classroom" highlighting the site's valuable natural and cultural resources.

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Site Management Guidelines

Introduction

Chinook Bend Natural Area 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 access and educational 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, an analysis, and a list of management objectives and recommendations for Chinook Bend Natural Area. These site management guidelines were developed using guidance established in the King County Ecological Lands Handbook (2003).

Part 1. General Property Information

The Chinook Bend Natural Area is located approximately two miles north of the City of Carnation in unincorporated King County and is a prominent meander on the Snoqualmie River. The 58.88-acre site lies adjacent the Snoqualmie River on three sides for the distance of 1.2 miles from RM 22.5 to RM 21.3 and lies within its 100-year floodplain (King County Department of Parks, Planning and Resources, 1990 and King County Department of Natural Resources, 2000). The western edge of the property is bordered by NE Carnation Farms Road and Nestle property. The site contains largely pastureland with smaller areas of mature deciduous forest cover along the river's edge. The habitat provided by Chinook Bend Natural Area is important for salmonids ascending the Snoqualmie River to spawn. A levee system extends much of the site with one levee between RM 21.8 and RM 21.6 and another stretching from RM 22.8 – RM 22.4.

The Chinook Bend Natural Area is zoned A-35 in accordance with the 2000 King County Comprehensive Plan. The zoning designation refers to agricultural land use with a minimum of 35-acres. The purpose of the agricultural zone (A) is to preserve and protect irreplaceable and limited supplies of farmland well suited for agricultural uses by their location, geological formation and chemical and organic composition and to encourage environmentally sound agricultural production. The Chinook Bend Natural Area lies within the Snoqualmie River Agricultural Production District (APD). Until 1996, cattle occupied the site.

The APD was designated under the requirements of the Washington Growth Management Act (GMA) as "agricultural lands that are not already characterized by urban growth and that have long-term significance for the commercial production of food or other agricultural purposes. Under the GMA "a county or a city may use a variety of innovative zoning techniques in areas designated as agricultural lands of long-term commercial significance to conserve agricultural lands and encourage the agricultural economy. The GMA also states that the non-agricultural uses should be encouraged in the APD on lands with poor soils or other wise no suitable for agricultural purposes. Although the Chinook Bend Natural Area is within the APD it is not available for agricultural purposes because the donation agreement limits the site to habitat protection and open space uses.

Land use in the upper Snoqualmie basin above Snoqualmie Falls is varied. Much of the upper watershed area contains National Forest land, land managed by Washington State Department of Natural Resources and land that is primarily managed for timber by private companies. A majority of the watershed has been logged since the turn of the 20th century with little or no old growth forest remaining, except in those areas set aside as reserves such as the Alpine Lakes Wilderness. As King County continues to grow, cities in the upper basin will have expanding commercial and residential development.

The lower Snoqualmie River basin below the falls is largely dominated by agricultural land use (70.4%) and rural residential land use (22.2%) (Solomon and Boles, 2002). The valley floodplain passes through the communities of Fall City, Carnation and Duvall. While these communities have historically supported rural land use activities such as agriculture both urban land use and population is increasing. Between 1980 and 2000, the population in the Snoqualmie Basin nearly doubled, from just under 20,000 to approximately 40,000 residents. The Puget Sound Regional Council (2001) predicts that the population will further increase to over 70,000 residents by 2020. Private timber companies also intensively harvest trees in the Raging River, Tolt River, Griffin Creek and Tokul Creek watersheds (King County Department of Natural Resources, 2001).

Table 1. Chinook Bend Natural Area General Information.

Best Available Address	310th Avenue NE and NE Carnation Farms Road, Carnation
Thomas Guide Map Location	Page 539
Legal Description	Section 9, Township 25 N, Range 7 E, WM
Acreage	58.88-acres
Drainage Basin	Snoqualmie River
WRIA	7
Council District	3
King County Sensitive Areas	100-year floodplain, wetlands, erosion and seismic hazards, channel migration zone

Table 2. Chinook Bend Natural Area Parcel Information.

Parcel Number	Acreage*	Recording Number	Purchase Date	Ownership type/price	Previous Names	Zoning	Funding Source
0925079008	58.88	20000509001356	5/3/2000	Owned in Fee Donation	Nestle USA	A-35 APD	Donation

*Acreage taken from King County Assessor's data.

Part 2. Acquisition, Funding Source and Deed Restrictions

The acquisition of the Chinook Bend Natural Area was initiated by King County Water and Land Resources Division. It was acquired for its restoration potential, strategic location and importance to the recovery of chinook salmon.

The Chinook Bend Natural Area was donated to King County in May of 2000 by the Nestle USA Corporation. Initially, King County approached Nestle about the parcel in 1999 in an effort to implement early action habitat protection for endangered chinook salmon. King County offered to purchase the property from Nestle, but Nestle chose to donate it. Nestle specifically requested the express prohibition of future development of the site for active recreation purposes, such as ballfields. The Real Estate Donation Agreement restricts King County's use of the property. In the words of the agreement:

> 1. **Donation:** Transfer of title to the Property will be by charitable donation and shall be given in consideration of Buyer's agreement to hold the Property in perpetuity and maintain said Property for open space and passive recreational purposes.
>
> 13. **Acknowledgement of Donation:** Donee agrees to devise an appropriate acknowledgement of Donor's contribution of the Property for the preservation of habitat and open space pursuant to the Donee's policies and procedures. Donee reserves to the Metropolitan King County Council its authority to select, define, characterize and design acknowledging signs, plaques or alternative means of recognition.

In 2003 it was discovered that the Chinook Bend Natural Area has a water right attached to it (D. Kimmett, Personal Comm., 2003). The water right was established in 1892 to water cattle. King County DNRP is applying with the Washington State Department of Ecology to convert the water right for the purposes of watering restoration plantings.

Part 3. Ecological Resources

This section describes the existing natural resources and ecological processes present at Chinook Bend Natural Area.

Topography and Soils

The Chinook Bend Natural Area is predominantly flat and lies within the Snoqualmie River's 100-year floodplain. The maximum elevation is approximately 67 feet above sea level and the minimum is approximately 45 feet above sea level.

The Soil Survey, King County Area, Washington (Snyder et al, 1973) maps soils within the Chinook Bend site boundaries as Puget silty clay loam, riverwash and oridia silt loam. All three soils are listed as hydric soils. These soils were developed under conditions representative of floodplain landforms sufficiently wet to support the growth and regeneration of hydrophytic vegetation. Hydric soils such as those underlying Chinook Bend are predominantly saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions (Natural Resources Conservation Service, 1999).

The soils in the pasture area show little soil structure and do not meet the criteria for hydric soils (King County Department of Natural Resources, 2001). This is most likely a result of past mixing and filling related to the sites' past agricultural practices and regular sediment deposition due to flood events.

A large borrow pit is present on the western portion of the natural area most likely used to mine soil for top dressing and to fill low spots on the property. On the east and southeast portion of the property evidence of gravel mining exists (King County Department of Natural Resources, 2001).

The site is also recognized as a seismic and erosion hazard according to the King County Sensitive Areas Ordinance, King County Code Chapter 21.54 (King County Department of Parks, Planning and Resources, 1990).

Snoqualmie River Basin Hydrology

The Snoqualmie River originates in the Cascade Mountains and flows a total of 85 miles to the confluence with the Skykomish River. The Snoqualmie River basin comprises 692 square miles and nearly a third of the Snohomish River Basin (Watershed Resource Inventory Area [WRIA] 7). Approximately 75% of the Snoqualmie Watershed lies within the Forest Production District (Solomon and Boles, 2002). A system of levees and revetments have fundamentally altered the dynamic flooding processes of the Snoqualmie River in terms of its in-channel and riparian habitat, sediment load, channel migration and interaction with its floodplain.

The upper basin above Snoqualmie Falls has three principal tributaries, the Middle, North and South forks of the Snoqualmie River. These tributaries are characterized by moderate to steep channel gradients and relatively broad river channels with portions of the tributaries confined by valley walls. Emerging from mountainous terrain the three tributaries converge just upstream of the city of Snoqualmie where channel gradients begin to decline. The decline continues as the river approaches Snoqualmie Falls. Slack-water conditions caused by geologic features just above Snoqualmie Falls form an effective coarse sediment trap for most of the material transported from the upper basin. Snoqualmie Falls, which plunges 267 feet over the bedrock ledge, is an upstream fish-passage barrier (King County Department of Natural Resources, 2001).

In the lower basin below Snoqualmie Falls the river drops only 100 feet in 40 river miles. The channel follows a strongly meandering course through the lower Snoqualmie Valley. The Tokul River, the Raging River and the Tolt River are the major contributors of coarse sediment to the Snoqualmie River. Minimal coarse sediment is carried all the way to the Snohomish River and is instead distributed as substantial gravel and cobble bars below each of the respective confluences (King County Department of Natural Resources, 2001).

River Morphology within the Chinook Bend Reach

The Snoqualmie River meanders for most of its course across a broad alluvial floodplain through the lower Snoqualmie Valley. The river immediately upstream of Chinook Bend is anomalously straight with the channel located at the base of the west valley wall. The river has been forced into this alignment by the alluvial fan of the Tolt River, which enters at the head of this straight reach (King County Department of Natural Resources, 2001). The alluvial fan also constricts the width of the valley bottom available for the Snoqualmie River flood conveyance. This natural confinement terminates a short distance upstream of the Chinook Bend site. The reduction in channel and floodplain confinement allows for flood flows to occupy more of the valley floor and hence results in decreased flow depth and velocity (King County Department of Natural Resources, 2001). In turn this reduces the competence of the river to transport sediment and encourages deposition. The Tolt River currently supplies a large amount of coarse sediment to the Snoqualmie River with 90% deposited in the vicinity of the Chinook Bend site (Parametrix, 2003).

Evidence suggests that under historical conditions (prior to active flood control and channel stabilization), the river in the vicinity of Chinook Bend was aggrading and actively migrating laterally (Collins and Sheikh, 2002). Reduction in confinement, combined with the proximity of the Tolt sediment supply accounts for the strong depositional environment in the reach. Analysis of early historical information (1936) indicates that the channel alignment upstream from Chinook Bend, adjacent to the Tolt fan, has been stable (King County Department of Natural Resources, 2001 and Collins and Sheikh, 2002). However, it also indicates changing channel behavior downstream of the Tolt fan where the channel begins to migrate actively with evidence of both rapid meander growth and multiple channel avulsions. This suggests that historically, the Chinook Bend reach of the river was actively depositing sediment and that the channel itself was actively migrating in response to this deposition (King County Department of Natural Resources, 2001).

Later historical evidence (1964) suggests that the multiple channels and active bars, which characterized the reach, appear to be have been noticeably reduced (King County Department of Natural Resources, 2001 and Collins and Sheikh, 2002). While several levee and revetment projects were completed shortly before 1964, it is too recent to account for the apparent change in river character. Instead, active dredging of sediment, at and downstream from the mouth of the Tolt River, is the likely cause. Therefore, the sediment removal most likely accounts for the initial stabilization of the channel location and the reduction in braided character (King County Department of Natural Resources, 2001).

Recent observations (1993) show that the river is largely single thread, although a pronounced island exists at the downstream side of the apex of the bend (K. Anderson, Personal Comm., 2003). However, historical evidence suggests that the width of the active channel has declined (Collins and Sheikh, 2002). This is most likely due to the extensive flood management and bank stabilization projects along the reach.

Wetlands

The property contains one inventoried wetland (125b), which is present in the southwest portion of the site adjacent to the Carnation Farm Road (King County Department of Parks, Planning and Resources, 1990). The “b” indicates that it has been mapped in the U.S. Fish and Wildlife Service National Wetlands Inventory, but its location has not been verified. It is classified as palustrine, emergent and seasonally flooded (Cowardin et al, 1979). The wetland is approximately 3-acres in size and about one-half of the wetland is open water. It is a class 2 wetland according to the King County Wetland Classification

System (KCC 21A.06.1415). A 50-foot buffer width measured from the wetland edge is required (KCC 21A.24.320).

A spring to the west (across the Carnation Farm Road) and flooding events provide hydrologic input to the wetland. The wetland outlets to the north through a 300-foot long "ditch" and travels under the service road into a 12-inch culvert. (The "ditch" itself is considered to be part of the wetland and therefore subject to the same regulations as the rest of the wetland.) From that point the flow is piped to the Snoqualmie River where it terminates approximately ten feet above the high water mark (King County Department of Natural Resources, 2001).

Three other wetlands are indicated on the National Wetland Inventory. One wetland on the southeast portion of the property no longer exists, possibly due to levee-building activities. A second wetland, classified as palustrine, forested, and seasonally flooded is shown on the north "island." And a third wetland, classified as riverine, lower perennial, unconsolidated shore and seasonally flooded, is located on the northeast portion of the property (King County Department of Natural Resources, 2001).

Vegetation

A majority of the (45 acres) of the property is a former cow pasture, vegetated exclusively with pasture grasses. In 1999, 25 acres was cultivated and seeded with perennial orchard and rye grass mixtures. Reed canary grass (*Phalaris arundinacea*) and velvet grass (*Holcus lanatus*) is found in the pasture as well. Past pasture management practices have likely prevented the establishment of trees in the floodplain. Poison hemlock (*Conium maculatum*), a noxious weed, is spreading rapidly on the southern portion of the pasture (King County Department of Natural Resources, 2001).

The vegetation composition of the open-water wetland (125b) buffer consists mainly of a large patch of reed canary grass and soft rush (*Juncas effusius*) (King County Department of Natural Resources, 2001).

A deciduous forest buffer is found on about 15 acres of the north and northeast portion of the property, dominated by mature black cottonwood trees (*Populus tricocarpa*). Many individuals within the stand are showing signs of decline due to structural damage and failure brought on by physical maturity. Evenly interspersed among the cottonwoods are other deciduous species including red alder (*Alnus rubra*), red-twig dogwood (*Cornus sericea*) and Sitka willow (*Salix sitchensis*). The under story shrubbery is dominated by Himalayan blackberry (*Rubus discolor*) with lesser amounts of salmonberry (*Rubus spectabilis*), Japanese knotweed (*Polygonum cuspidatum*) and reed canary grass. Also found in lesser amounts within the buffer are snowberry (*Symphoricarpos albus*), red elderberry (*Sambucus racemosa*) and evergreen blackberry (*Rubus laciniatus*) (King County Department of Natural Resources, 2001).

In the levee area on the southeast portion of the property the dominant vegetation consists of black cottonwood, Sitka and Pacific willow, Douglas spirea (*Spiroea douglasii*), reed canary grass and several varieties of non-native and noxious weeds, including Himalayan blackberry, common tansy (*Tanacetum vulgare*) and clematis (*Clematis ligusticifolia*). Also found in the area are red alder, one western red cedar (Thuja plicata), salmonberry, big-leaf maple (*Acer macrophyllum*), evergreen blackberry, and noxious weeds such as common burdock (*Arctium minus*) and bull thistle (*Cirsium vulgare*).

Non-native plant species are prevalent on about five percent of the site. Many species are on the King County Noxious Weed List (2002) and their control is strongly encouraged.

Japanese knotweed, poison hemlock, common tansy, bull thistle and reed canary grass are all weeds of concern according to the King County Noxious Weed List and occur on the Chinook Bend site. Evergreen blackberry, Himalayan blackberry, clematis and common burdock are not listed the King County Noxious Weed List, but are plant species that impact the site.

Fish and Wildlife

The Snohomish River system sustains two genetically distinct runs of chinook salmon (*Oncoryhnchus tshawytscha*); the fall run uses the Snoqualmie River system (Washington State Department of Fisheries, 1993). The Snohomish River fall chinook salmon are listed as threatened under the federal Endangered Species Act and are part of the larger Puget Sound chinook salmon evolutionary significant unit (Washington State Department of Fisheries, 1993). Adults generally start to enter the Snoqualmie River system in August and the spawning period lasts from the last half of August through October. The Washington State Salmon and Steelhead Stock Assessment (1993) describes the stock as native with wild production.

The annual escapement from 1965 to 1976 to the Snohomish River system averaged 1,187 fish while the annual escapement from 1987 to 1998 averaged 1,778, a nearly 50% increase over the base period (Snohomish Basin Salmonid Recovery Technical Committee, 1999). The range of escapements between 1987 and 1998 has been from a low of 908 to a high of 2,725 fish (Snohomish Basin Salmonid Recovery Technical Committee, 1999). Other numbers show average escapement from 1996 to present as 2,005 fish (K. Anderson, Personal Comm., 2003). This positive trend is somewhat surprising considering the frequent flooding episodes and habitat problems in the Snohomish River system. However, recent data provided by the Puget Sound Salmon Forum (2001) indicates that annual escapement from 1996 to 2000 averaged only 1,200 fish. This seems to indicate a considerable decrease in the chinook's annual escapement in the Snoqualmie River.

Chinook Bend has been identified as a chinook spawning "core area" by the King County Department of Natural Resources (King County Department of Natural Resources, 2001). A core area is defined as part of the watershed that directly supports high levels of salmonid use for one or more of four basic functions: 1) spawning, 2) juvenile rearing and outmigration, 3) adult migration and holding, and 4) refuge from disturbance. To sustain healthy populations of chinook salmon a watershed needs to provide habitat for these basic functions.

Likewise, Chinook Bend has been identified as a "focus area" in the Snohomish River Basin Chinook Salmon Near Term Action Agenda (2001). Focus areas are regarded as important links to the recovery of chinook salmon evolutionary significant units and are determined from biological data on the level of habitat use. Chinook Bend lies within the Focus Area IV, a three mile reach on the Snoqualmie River that extends from Harris Creek to the Tolt River. About 20 % of chinook salmon that return to the Snoqualmie River watershed spawn in this reach (Snohomish Basin Salmon Recovery Forum, 2001).

The Snohomish River Basin Salmonid Habitat Conditions Review (2002) evaluated the Snoqualmie River's mid-mainstem habitat conditions (RM 23.9 – RM 9.8) including the Chinook Bend Natural Area reach. The review indicates that habitat conditions are "moderately degraded" or "degraded" in terms of the basin processes and habitat structure essential for the natural productivity of chinook salmon and other salmonids.

The upstream section of Chinook Bend at RM 22.4, approximately 500-feet downstream from Stossel Bridge (RM 22.5), represents the first notable high-use spawning area employed by chinook salmon as they migrate upstream. A long, riffle crest distinguishes the chinook spawning area. A consistent flow regime through a gravel bar offers optimum spawning opportunity (King County Department of Natural Resources, 2001). The site is hydraulically fed by a lengthy scour-pool tailout. The scour pool is characterized by an adverse-sloped channel bottom, created in part by a combination of high-energy flows and the channel constraints imposed by the levees (King County Department of Natural Resources, 2001).

Downstream of RM 22.4 fewer areas are used by chinook salmon for spawning purposes. The lowermost limit of chinook salmon spawning is approximately RM 20.5. Only a few pockets are used for spawning elsewhere at Chinook Bend (King County of Natural Resources, 2001).

Several other salmonid species may use Chinook Bend for spawning and/or rearing purposes. They include coho salmon (*O. kisutch*), chum salmon (*O. keta*), odd-year pink salmon (*O. gorbuscha*),

anadromous (steelhead) and resident forms of rainbow trout (*O. mykiss*), anadromous (sea-run) and resident forms of cutthroat trout (*O. clarkii*) and possibly bull trout (*Salvelinus confluentus*).

The Snoqualmie River corridor at the Chinook Bend Natural Area is identified as a wildlife habitat corridor in the King County Comprehensive Plan (2000). Chinook Bend provides high quality habitat for a variety of resident and migratory bird species. An active bald eagle (*Haliaeetus leucocephalus*) nest is located within a grove of cottonwoods on the northern portion of the Chinook Bend site. Bald eagles are often seen in the area. Both breeding-resident and wintering-migrant bald eagle populations are present in the lower Snoqualmie River valley. The bald eagle is listed as a threatened species under the Endangered Species Act. The site also provides habitat for red-tailed hawks, great blue heron and waterfowl.

Generally, Chinook Bend offers significant habitat for a variety of mammalian wildlife, especially those species that thrive in clearings or in the forest edge. Blacktail deer are abundant on the site. The existence of coyote scat indicates that coyote frequent the general area as well as cougar, black bear and bobcat. Raccoons are believed to exist along the river's edge along with aquatic species such as beaver, river otter, muskrat and mink. Small mammals such as shrews, mice, voles, squirrels and weasels most likely exist on the site.

Amphibians and reptiles are believed to inhabit the wetland areas. However, no inventory has been conducted.

Part 4. Land Use and Infrastructure

This section describes public use, access points, and site infrastructure such as trails and roads at Chinook Bend Natural Area.

Current and Public Use

Public use of Chinook Bend Natural Area is minimal since it was previously private land and therefore has no history of regular public use. In addition, the site's limited access and general undeveloped character discourage use. However, as people become more aware of the site and its recreational opportunities visitation will increase. Informal passive recreational activities such as walking, nature observation, bird watching, and fishing occur on the site. The previous owners of the property have traditionally allowed fishing access along the dike.

Access

Currently, two entrances serve the property. One is on the southeast portion of the property, just west of the Carnation Farm Road Bridge. This entrance is used by the public to access the site and by United States Geological Survey (USGS) for maintenance of the flow gage. There is a small, undeveloped parking area with room for several vehicles here. The entrance is poorly located which limits sight distance eastward on Carnation Farms Road.

The second entrance is off of the Carnation Farms Road near the western property boundary. The entrance is connected to a service road that bisects the property. The road currently serves as an access point for restoration work and access by King County staff. A locked gate has been installed here to prevent unauthorized vehicular use.

Trails and Roads

Chinook Bend Natural Area offers no formal public trails, although pedestrians use the two access roads as trails. These roads provide public users with river access and as a means of bisecting the property. A gate is located at the southeastern access road to keep out vehicles.

USGS Flow Gauge

A United States Geological Survey flow gage (USGS gage #12149000) is located on the site. Since 1929 the USGS has maintained a stream gage station at the Chinook Bend site to foster the collection of comprehensive and reliable streamflow data. The streamflow data is documented to forecast flow extremes, make water-management decisions, assess water availability, manage water quality, and meet legal requirements. The flow gage provides data in real time and has nearly three-quarters of a century of flow statistics. Data can be accessed at http://wa.waterdata.usgs.gov/nwis/.

King County Stewardship and Restoration Activities

In October 2000, King County demolished a 300-ft. cattle shed and concrete slab that occupied the southern portion of the property. The debris was removed and the site hydroseeded. Several light posts adjacent to the shed were left to serve as raptor perches. A former pumphouse, which once brought water from a spring on the hillside west of the property remains standing, although the pump is no longer functional. Also in October 2000, a fence was erected along the northwestern portion of the property between the Chinook Bend Natural Area and the adjacent Nestle property. In addition, two small King County Park signs were installed at the two access points to inform the public of the site's name ("Chinook Bend Habitat Resource Area"), its purpose ("to conserve and restore habitat") and how it was acquired ("Nestle donation").

The Chinook Bend Natural Area's yearly on-going maintenance and stewardship is provided by King County DNRP staff under the direction of the Water and Land Resource Division and documented in the annual Site Maintenance Plan (SMP). The SMP's document on-site tasks including but not limited to: site inventory, natural area monitoring, park inspection, conflict resolution/public relations, natural area restoration, and invasive non-native weed removal and litter/garbage pick-up.

The Chinook Bend Riparian Restoration Project funded through the Small Habitat Restoration Program (Project 1G1798) has been underway since the fall of 2000. The project's goals are to restore lowland-forested conditions to the riparian buffer and floodplain. The benefits of the restoration will include the creation of a mixed deciduous and coniferous forest buffer and floodplain, erosion protection during flood events and enhanced wildlife habitat and recreation. The project will be implemented over a period of five years.

In the fall of 2000 the restoration project planted approximately 400 plants on the northeast portion of property in and adjacent to the mature cottonwood stand along with 150 plants adjacent to the fenceline between the Chinook Bend and Nestle properties. Restoration in 2001 and 2002 included the planting of about 7,000 alder, 500 cottonwood and 50 spruce on 20 acres of the Chinook Bend site. Maintenance of the restoration efforts includes mowing the pasture grasses to reduce competition and occasional watering to ensure success.

Restoration efforts during the 2003/2004 planting season will include continued tree plantings in the pasture areas and in the buffer of the wetland (125b) outlet. In addition, restoration efforts may include plugging the outlet pipe of the openwater wetland to restore hydrologic connectivity to the river and possibly provide refuge and rearing habitat for coho salmon (King County Department of Natural Resources, 2001).

Flood Reduction

Flooding of the Chinook Bend Natural Area occurs with relative frequency. Aerial photos show the site underwater during the December 1989 and November 1995 flood events (King County Department of Natural Resources, 2001). The southeast portion of the site, on the left bank of the Snoqualmie River, contains a levee (Carnation Farms Upper) to protect the river from flooding. While the levee is primarily a training levee which directs flows away from the site, it does not prevent flooding on the site (King County Department of Natural Resources, 2001). High flows primarily enter at the low spot at the upper end of the levee near the Stossel Bridge and through upwelling behind the levee (King County

Department of Natural Resources, 2001). Floodwaters will overtop the levee at 20,000 cubic feet per second, a phase three flood alert on the Snoqualmie River (King County Department of Natural Resources, 2001). The levee has been breached twice in the last 25 years by flooding events and subsequently set back and rebuilt using imported materials (King County Department of Natural Resources, 2001).

King County Department of Natural Resources has completed an analysis, the Chinook Bend Feasibility Study (2001) to document the feasibility of permanently removing the levee at Chinook Bend. The analysis develops cost projections, evaluates restoration alternatives and addresses the potential benefits and risks associated with removal. The analysis conditionally recommended alternative one, which consists of 1) removing the existing levee, 2) constructing woody debris jams and 3) constructing an overflow/backwater channel on the downstream side of the meander.

The King County Flood Hazard Reduction Plan (1993) called for one potential project. The Carnation Farms Upper Project (#204) called for increasing overbank vegetation to increase resistance to erosion and strengthen the existing levee system. A gravel removal study is also being conducted on the Snoqualmie River near the Chinook Bend Natural Area to respond to community concerns that sediment accumulation is causing flooding (King County Department of Natural Resources and Parks, 2002). However, the listing of salmonid species as threatened under the Endangered Species Act may affect the likelihood of these flood reduction projects.

Part 5. Site Management Chronology

This section chronicles management activities at the Chinook Bend Natural Area. When known, costs associated with these activities are included.

Date	Action	Associated Costs (if known)
October 2000	Fence construction on west property line with Nestle	Cost: $3,475
October 2000	Demolition of 300' loafing shed and concrete slab	Cost: $18,600
November 2000	Volunteer tree and shrub plantings: Approximately 400 planted on NE portion of property, in and next to mature cottonwood stand and approximately 150 planted along fenceline between KC and Nestle properties.	
On-going 2001-2002	Chinook Bend Riparian Restoration Project (Small Habitat Restoration Program) including 5 volunteer events. Planted approximately 7,000 alder, 500 cottonwood, and 50 spruce on about 20-acres.	Cost: $35,000
	Two signs installed	
Summer 2003	Maintenance of Chinook Bend Riparian Restoration Project.	

Part 6. Analysis

This section is intended to integrate site-specific information, public access considerations, and the larger landscape considerations described in the conservation principles section of the King County Ecological Lands Handbook (2003). This section presents the analysis from which site management recommendations will be made.

Species of Concern

Documented evidence of three threatened species listed under the federal Endangered Species Act, chinook salmon, bull trout and bald eagle, make habitat preservation and enhancement the central priorities at the Chinook Bend Natural Area. Activities that have potential to harm these species or their habitat should be undertaken cautiously, if at all. Habitat for these species should be protected and enhanced where necessary and appropriate.

It is important to note that management decisions do not affect the above species equally. For example, management strategies to aid in the recovery of chinook salmon and bull trout (i.e. addressing processes) may have negative impacts on the structure essential to bald eagles (i.e. nest site). Although it is assumed that in the long-term reestablishment of natural processes will ultimately benefit eagles (i.e. food sources, improved riparian habitat conditions) it is not assured.

Ecological Processes

Ecological processes must be maintained for ecosystems and habitats to be sustained. Current conservation theory suggests that where ecological 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 the basic ecological processes the greater the severity and longevity of the effects (King County Ecological Lands Handbook, 2003). If systems are not functioning properly, management activities should focus on system-wide processes instead of affected elements. Ultimately, management actions that do not consider the processes are less sustainable.

Bearing this concept in mind, management interventions within the Chinook Bend Natural Area should strive to maintain and restore basic ecological processes through floodplain reconnection activities, if possible. As a result of levee construction that constrained the river, the Chinook Bend Natural Area has been deprived of the free-flowing movement of water in the river channel, which sustains the floodplain. When a river is constrained, the river's natural processes, such as meandering and flooding are curtailed, thus diminishing riparian ecosystem complexity, diversity and function. Meandering, a natural response to sediment deposition, allows for habitat complexity and the recruitment of large woody debris, both critical for creating habitat features (log jams, pools and side channels) necessary for healthy salmon habitat. Flooding carries rich silt and seeds of plants onto the floodplain for the natural regeneration of riparian forests. Essentially, without the dynamic natural ecological processes associated with natural floodplain conditions, restoration will be difficult.

At the Chinook Bend Natural Area many strategies exist to conduct floodplain reconnections and hence target the enhancement of ecological process. Complete levee removal is a preferred option at Chinook Bend for this purpose. The Snohomish River Basin Near Term Action Agenda (2001) proposed levee removal within Chinook Bend to "restore the river's capacity to develop side channels and capture large woody debris" and "lessen redd scour that could be caused by channel constriction." The Chinook Bend Feasibility Study (2001) also concludes that removing the existing levee would provide the greatest ecological benefit, with the least chance for damage as a result of initiating channel migration. Although the exact response is impossible to predict, levee removal would: 1) again allow the floodplain hydrology to interact with the Snoqualmie River during flood events, 2) provide a rearing and refuge access link to nearby core spawning area for chinook salmon and 3) facilitate the development of a more complex channel edge habitat, allowing the Snoqualmie River riparian corridor and floodplain to naturally evolve

into a biologically diverse array of habitat types (King County Department of Natural Resources, 2001). More significantly, the study finds that the recovery of fish and wildlife habitat and functional channel features may not be possible in the presence of levees (King County Department of Natural Resources, 2001).

Removing the levee also has its constraints. Agricultural land and structures downstream of the Chinook Bend Natural Area may be at an increased risk from channel migration (Department of Natural Resources, 2001). In addition, levee removal is expensive, with total estimated costs of more than $900,000 (King County Department of Natural Resources, 2001). Levee removal will also likely impact the current ecological structure and function on site, including restoration projects, wetlands and potentially the bald eagle nest. Possible alternatives to levee removal might include implementing a "scaled-down" levee removal project or leaving the levee intact while pursing other floodplain reconnection strategies.

Over the short-term levee removal may have undesirable effects on the ecological structure and public use opportunities on site. However, levee removal will likely help restore ecological processes over the long-term. Thus levee removal will likely lead to improved ecosystem diversity, riparian habitat and succession as well as improved water quality by increasing residence times for sediment, water and nutrients. As a result it would also likely provide greater rearing and refuge for downstream migrating salmon.

Ecological processes could also be enhanced by blocking the outlet pipe (culvert) of the openwater wetland to improve natural hydrologic connectivity to the river. The enhancement would possibly provide a back channel refuge environment for salmon and expand wetland conditions for terrestrial and amphibian habitat. The wetland outlet would follow the natural site topography thereby resurrecting historic hydrologic conditions and the dynamic ecological processes on site. Topographic surveys and flow analysis should be performed to avoid any water-related problems such as flooding.

Ecological Structure and Function

Although addressing the ecological processes is a top management priority the uncertainty of doing so on Chinook Bend Natural Area makes it appropriate to restore structure as an interim measure.

A structurally diverse and functioning forested floodplain area provides numerous ecological benefits such as shading the river, trapping sediment and detritus in the floodplain, preventing excessive erosion during flood events, delivering large woody debris and creating a canopy that shades out noxious and invasive plant species. Chinook Bend offers opportunities for restoring the floodplain through native tree and shrub plantings as well as controlling noxious, invasive and non-native species.

The Chinook Bend Riparian Restoration Project currently being implemented on site has planted over 8,100 trees since the fall of 2000. The plantings represent a mixture of coniferous and deciduous species commonly associated with riparian areas in western Washington. Inherent in the restoration efforts are attempts to maintain and improve structural complexity, plant diversity and multiple canopy layers as well as provide a source of large woody debris. It is important to note that restoring structure to the site through tree plantings provides future benefits to some species (salmon and songbirds) while potentially degrading habitat conditions for others (raptors and deer).

In the event that the levee removal projects are implemented to restore ecological processes, current restoration projects to restore structure and function may be lost in the short-term due to processes of hydrologic connectivity, flooding and river meander. However, over the long-term structure and function will likely be restored by these processes.

Monitoring

There are two types of monitoring: 1) monitoring of management actions to determine if they are succeeding in their objectives; and 2) monitoring processes on lands where no management action is taking place and to determine if management action is needed (King County Ecological Lands Handbook,

2003). Since natural and social systems are uncertain, dynamic and in a constant state of flux, monitoring information is used to adaptively manage.

A regular monitoring regime of the Chinook Bend Natural Area would provide an early warning of changes that occur on the site. A systematic method for recording and storing monitoring information is essential for long-term management and should be maintained. Regular photographic evidence would also be helpful in order to visualize short and long-term changes.

Public Use

Aquatic and riparian habitats are especially vulnerable to recreational activities (Washington Department of Fish and Wildlife, 1997). Current public use at Chinook Bend Natural Area supports low numbers of visitors engaged in recreational activities such as fishing and nature observation. The current level of public use appears to have no adverse effect on the ecological resources. However, future public use of Chinook Bend Natural Area will likely increase as King County Department of Natural Resources and Parks publicizes the site, public access improves and the public becomes more aware. If public use does increase substantially, improved public use opportunities should be explored.

Regardless of the amount of public use on the site, recreational use should be funneled only to particular areas and away from rare and sensitive portions of the site. Rare and sensitive areas, such as shorelines and wetlands, lack the capability to resist changes in environmental conditions and/or lack the resilience to recover from change. Since public use is likely to be concentrated next to the river, particular attention should be made to reducing impacts and dispersing activity. At this time, there appears to be no reason to install improved trails on site, as the access roads are adequate and public use limited. Monitoring changes in public visitation, types of use and impacts on the ecological systems will alert land use managers to needed management adjustments.

Chinook Bend Natural Area's location on the Snoqualmie River makes it ideal for educational activities. The significance of the site, in terms of salmon recovery efforts and habitat restoration, could provide an "outdoor classroom" to educate visitors about salmon, basic ecology, water quality, wetlands, watersheds and resource management. Chinook Bend also provides an excellent example of King County's dedication to the preservation and conservation of the region's valuable natural and cultural resources. Educational opportunities might include a salmon viewing area, interpretative kiosks, a site brochure or interpretive nature walks. The selection of any specific educational themes and strategies should be devised in conjunction with the conceptual recommendations in the King County Draft Interpretive Master Plan (Bucy and Associates, 2002). Chinook Bend Natural Area was not included as a site prioritized for an interpretative focus in the Interpretive Master Plan.

Public access at Chinook Bend needs to be improved to ensure public safety since the primary entrance to the property is poorly located. A capital improvement project should be explored which would provide the public with a safe parking area. Two possible alternatives exist. The first is to improve the current primary parking area in the southeastern portion of the property to make it safe. The advantages of this alternative are that the area is already heavily impacted and is nearby the access road used as a trail. The disadvantage is that if a levee is removed in the future it may affect the parking facilities. The second alternative is to build a primitive parking area at the maintenance entrance on the western portion of the property. The main advantage is its relatively safe location with adequate sight distance for vehicles. The disadvantages of this alternative are that construction would irreversibly impact the property and possibly funnel public use into the central portion of the site. The choice of possible alternatives should address 1) vehicular and pedestrian safety, 2) potential ecological damage, 3) public use implications, 4) impacts from possible levee removal, and 5) access to USGS gauging station. In addition, King County should approach the Washington State Department of Transportation in an effort to install highway signs on NE Carnation Farms Road indicating a 'hidden driveway' at the Chinook Bend Natural Area.

In the future King County may want to expand the Chinook Bend Natural Area through conservation easements and/or the acquisition of adjacent lands to establish greater habitat connectivity and to better

preserve the integrity of this important reach of the Snoqualmie River. However, a key consideration in the acquisition process must be its impact on neighboring agricultural lands and regional agriculture.

At this point in time no revenue generating opportunities are foreseeable at the Chinook Bend Natural Area.

Part 7. Management Goals, Objectives, and Recommendations

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 Chinook Bend Natural Area when new information from site monitoring programs and other initiatives indicate a need for a change in management strategies.

Goals for Chinook Bend Natural Area

The King County Department of Natural Resources and Parks staff will strive to:

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

The objectives and recommendations that follow are designed to support these goals when practicable at Chinook Bend Natural Area. The corresponding matrix (Table 3) designates the King County Department of Natural Resources and Parks staff involved in implementing the specific recommendations.

Objective: Enhancement of natural floodplain conditions

➢ *Recommendation: Consider levee removal*

King County Department of Natural Resources and Parks should continue to consider efforts to remove the levee at the Chinook Bend Natural Area. The Chinook Bend Feasibility Study (2001), which conditionally recommended levee removal states that levee removal: 1) best facilitates the recovery of ESA listed species by improving aquatic and terrestrial habitat, 2) provides the best opportunity for the site to achieve its natural floodplain conditions and 3) provides the greatest potential for ecological benefits. However, agricultural lands and structures downstream of the Chinook Bend Natural Area may be at an increased risk from channel migration due to levee removal activities. Extensive final design work and permitting, as documented in the feasibility study, is required before implementation.

➢ *Recommendation: Consider enhancing wetland connectivity*

King County Department of Natural Resources and Parks should continue to explore blocking the outlet pipe (culvert) of the openwater wetland to restore natural hydrologic connectivity to the river. The enhancement would improve floodplain conditions by providing a possible back channel environment and improving aquatic and terrestrial habitat. A topographic study and flow analysis is recommended to avoid any water-related problems such as flooding of Carnation Farms Road or neighboring properties. The blocking of the outlet pipe is included as part of the Chinook Bend Riparian Restoration Project.

➢ *Recommendation: Monitor ecological systems*

King County Department of Natural Resources and Parks ecologists and technicians should design an appropriate long-term monitoring regime, which provides insight into the changes and trends in ecological systems on site. The management objectives, which seek to enhance natural floodplain conditions, will affect ecological processes, structure and function at Chinook Bend Natural Area. This has the capability of altering species distributions, habitats and ecosystems. An adaptive framework and monitoring plan would seek to evaluate the effectiveness of management activities (i.e. levee removal)

through scientifically rigorous objectives, hypothesis testing and appropriate measurement, sampling and evaluation.

➢ *Recommendation: Plant native trees and shrubs*

King County Department of Natural Resources and Parks staff should work to plant native trees and shrubs on site to facilitate the enhancement of the forested floodplain. Staff should initiate opportunities such as volunteer tree planting events and solicit donations of native tree starts. Priority areas for planting should be identified.

Native tree and shrub plantings in Chinook Bend Natural Area have been on-going since the fall of 2000 as part of the Chinook Bend Riparian Restoration Project. The plantings are likely to continue through 2005.

King County Department of Natural Resources and Parks staff should continue yearly mowing to reduce competition of grasses (and the proliferation of noxious, invasive and non-native plant species) until monitoring indicates the trees will prosper without such protection measures. All plantings should be monitored often to estimate tree survival and health as well as to assess watering needs, disease, animal damage and competition.

King County Department of Natural Resources and Parks staff should consider future long-term enhancement programs that seek to plant native trees and shrubs since current projects are proposed only through 2005. Funding sources and grants should be established to cover expenses. Overall goals and objectives of the Chinook Bend Natural Area will require long-term commitments to future enhancement projects, studies and monitoring.

➢ *Recommendation: Control noxious, invasive and non-native plant species*

King County Department of Natural Resources and Parks staff should manage the noxious, invasive and non-native plant species that infest a portion of the Chinook Bend Natural Area. To accomplish this task efficiently, staff should prioritize areas of high infestation. As a control strategy yearly mowing of infested areas should continue until unwanted plant species are deemed under control.

Methods of control should include cutting plant species where they are found and using weed fabric or similar materials to cover infested areas until monitoring indicates success. If the situation warrants, staff should explore and implement alternative methods of control as part of an Integrated Pest Management program. After several years, successful tree plantings should also begin to shade out noxious, invasive and non-native plant species in the Chinook Bend Natural Area.

Objective: Allow levels of public use that do not impact ecological resources

➢ *Recommendation: Implement preserve and protect measures*

The Chinook Bend Natural Area should include some limited low-impact public use. Attempts should be made to limit public use in rare and sensitive areas of the floodplain. King County Park staff should recommend, install and maintain any necessary capital improvements to protect the site from inappropriate public uses. This may include signs, bollards and boundary markers.

King County Park staff should install and maintain new and improved signs at access points. The signs currently on site were installed temporarily and are small and difficult to read. The signs should indicate King County's ownership of the property, reference to the donation by Nestle (as indicated in Real Estate Donation Agreement) and the site's importance to regional salmon conservation efforts. Staff should explore installing a "rules" sign if public use warrants.

➢ *Recommendation: Repair or relocate public access*

Improving public access at Chinook Bend needs to be a management priority since the primary entrance to the property is potentially unsafe. The recommendation is to improve the current primary parking area in the southeastern portion of the property. The parking area should remain primitive and take into consideration projected public use and the site's public use capacity. Discussions with King County Department of Natural Resources and Parks staff indicated that space for approximately ten vehicles is appropriate.

King County Department of Natural Resources and Parks should explore funding for a capital improvement project to be undertaken to improve road access.

➢ *Recommendation: Monitor public use*

King County Park staff should note and record changes in visitor numbers and types of public use activities at the Chinook Bend Natural Area. Noticeable visitor impacts on the ecological values of the site should be recorded. This information should be reported to King County's Natural Resource Lands Program for updating and adapting site management guidelines.

➢ *Recommendation: Enhance educational opportunities*

Chinook Bend Natural Area offers significant educational opportunities. King County Department of Natural Resources and Parks staff should develop strategies to communicate to the public Chinook Bend's salmon recovery efforts and habitat enhancement activities. This should be done in conjunction with the conceptual recommendations in King County's Draft Interpretive Master Plan to select appropriate themes and strategies.

Objective: Implement Site Management Guideline Recommendations

➢ *Recommendation: Site Maintenance Plan Creation*

King County Park staff should prepare a site maintenance plan for Chinook Bend Natural Area that incorporates these site management plan recommendations. King County Natural Resource Lands staff and the Snoqualmie River Basin Steward should collaborate on this effort.

➢ *Recommendation: Coordinate implementation of Site Management Guideline Recommendations*

King County Natural Resource Lands staff should monitor the recommendations in the site management guidelines and coordinate with the various programs responsible for implementing these recommendations to facilitate their timely accomplishment.

King County Natural Resource Lands staff should coordinate with Snoqualmie River Basin Steward and King County Park staff to revise the site management guidelines as needed.

Table 3. Matrix of Chinook Bend Natural Area Management Recommendations

Recommendations	Cost	Year	Park Resource Staff	Basin Steward	WRIA Project Coord.	CPOSA/ Contract	WEAT	GIS	NRL staff
Priority One									
Repair or relocate public access		2004	X			X			X
Implement preserve and protect measures		On-going	X						
Site maintenance plan creation		Annual	X						X
Monitor public use		On-going	X						
Priority Two									
Consider levee removal		N/A	X	X	X	X	X		X
Control noxious, invasive and non-native plant species		On-going	X	X		X			
Plant native trees and shrubs		2003-2005	X	X		X			
Consider enhancing wetland connectivity		2003-2005	X	X		X			
Monitor ecological systems		On-going	X	X			X		
Coordinate implementation of site management guidelines recommendations		On - going	X	X					X
Enhance educational opportunities		On-going	X	X					X

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