Cedar River Habitat Conservation Plan

Annual Accomplishments Report
Year 3

Seattle Public Utilities & Seattle City Light
June 2004

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Executive Summary

The accomplishments described in this Year 3 report chronicle the substantial progress that was made last year in implementing the Cedar River Habitat Conservation Plan. With supporting business and management systems well-established in HCP Years 1 and 2, efforts could be focussed on the important "on-the-ground" work that moved us closer to the HCP's biological goals. Since implementation began in April 2000 with the signing of the agreements with Federal and State agencies, the City of Seattle has implemented 31 capital projects and 30 research and monitoring efforts under the HCP.

This report follows the format of previous years' Accomplishments Reports. The report is organized into three categories: Watershed Management, Landsburg Mitigation and Instream Flows. Within each category, individual projects, and research and monitoring efforts are described in brief program element summaries. Each summary provides information on work accomplished in Year 3, work planned for Year 4, and a financial summary. In addition to the individual program element summaries, this report also includes a Financial Monitoring Report, which compares actual expenditures for each program element to the HCP financial commitments.

HCP Program Management

Overall management of the HCP program during the third year was focused on budget and legal challenges. The economic downturn and subsequent budget-tightening that occurred within all City of Seattle departments during 2002 and 2003 resulted in deferred implementation of some HCP activities. Deferred activities were those that allowed the City to remain in compliance with HCP cost and schedule commitments, and did not compromise the City's ability to meet the HCP's biological goals. Additionally, funding levels in 2005 and beyond will allow project and activity managers to compensate for delays that occurred in 2003 and 2004 in order to meet HCP schedule and performance commitments.

Legal challenges distinguished HCP Year 3. The citizen appeal of the Final Environmental Impact Statement (FEIS) for the Cedar River Sockeye Hatchery occupied HCP program management and Hatchery project staff for several months in 2003. The City Hearing Examiner remanded the FEIS back to SPU for further analysis and issuance of a Supplemental EIS (SEIS). The SEIS is under development and will be available for public review in Fall, 2004. (See Landsburg Mitigation paragraph below). In December, the Muckleshoot Indian Tribe filed a lawsuit against NOAA Fisheries for its issuance of the Incidental Take Permit (ITP) for the Cedar River HCP. In its complaint, the MIT contended that NOAA Fisheries: 1) lacked sufficient information about the impacts of the City's existing or future increased water diversions on chinook salmon to issue the ITP; 2) failed to quantify take specifically related to future increases in water withdrawals; 3) should have evaluated an alternative that would provide greater mitigation and minimization of take than the HCP does; 4) should have included the Ballard Locks and Lake Washington Ship Canal in the action area, not just Cedar River and Lake Washington; and 5) should have prepared an Environmental Impact Statement under NEPA. The City filed a motion to intervene in this lawsuit, which was granted by the U.S. District Court. The City and NOAA Fisheries are currently preparing their independent defenses. A hearing date has been set for November 2004.

Watershed Management

HCP activities in the watershed continued on the two parallel tracks initiated in Year 1: planning and implementing projects on the ground in the near term, and developing long-term, landscape-level plans to guide the performance of work as the program progresses. Interdisciplinary teams

continued to develop long-term strategic plans for characterizing the watershed to support restoration planning, monitoring projects and habitats, prioritizing areas for restoration, and developing an information management system to support these activities. We made substantial progress on many restoration projects, and had the able assistance of many volunteers in getting projects done. More than 200 volunteers contributed a total to 1013 hours removing invasive plants and planting conifers, deciduous trees, and shrubs.

The big event in the watershed in 2003 was the construction of a new Bonneville Power Administration (BPA) transmission line adjacent to the existing line that transects the lower watershed in a north-south alignment. After years of intense negotiations, BPA agreed to significant provisions to protect the watershed and compensate for impacts of clearing and construction. BPA conducted a model project that included many provisions for environmental protection that greatly exceeded its normal procedures. BPA also transferred two parcels of land and $6 million to SPU as compensation for impacts of the project. As part of an agreement for mitigation and compensation for impacts, the City committed to assist BPA with the project. Much City staff time and many resources were devoted to assisting BPA and making sure the project's environmental standards were met. This commitment of resources resulted in less progress on HCP activities than planned.

As a result of considerable work on the BPA project, we decommissioned 5.1 miles of road in 2003. This brings the total for the first three years to approximately 28 miles, a little below the 10 miles per year average expected under the HCP. To reduce sediment loading from watershed roads to water bodies, crews also did improvement work on 12.5 miles of road, including culvert installations, road surfacing, ditching, and slope stabilization with "soil nailing," a new technique used to stabilize roads in a cost-effective manner. We initiated an extensive road inventory project to provide accurate and complete information on roads and their potential environmental effects to support long-term planning and prioritization, and began developing a strategic plan for long-term road management. The inventory data will be used with a sediment model that will allow the evaluation of potential road decommissioning and improvement projects, and maintenance, as means to reduce sediment input to streams, thus supporting strategic planning for roads.

Year 2003 was used to develop a system to identify and prioritize aquatic restoration sites and develop a watershed-specific, instream habitat inventory system based on a U. S. Forest Service methodology. In addition, two large woody debris projects were completed on Rock Creek in 2003, both associated with the BPA project. Streambank stabilization projects in 2003 consisted of removing poorly designed or failed stream drainage structures and redesigning the channel to provide long-term stability for approximately 100 linear feet of stream during road abandonment projects. Streambank revegetation projects included planting 1,950 linear feet of bank with 721 native shrubs and trees using SPU staff, Earthcorp, and volunteers. Two riparian planting projects were also implemented along the main stem of Taylor Creek in the lower watershed, with western hemlock, western red cedar, and Sitka spruce seedlings planted in five different areas.

We also completed the Select Riparian Restoration Thinning project and thinned several other small areas in the lower watershed, as well as thinning approximately 7 acres in riparian habitats in the upper watershed in conjunction with upland restoration thinning.

In 2003 we removed a fish barrier on a tributary to Williams Creek at the 13 Road to allow fish passage, designing the crossing to allow later access for restoration work using a temporary crossing structure. A total of 18 other stream crossings were improved through culvert

replacement to allow 100-year flows to pass without damage to the road and consequent sediment loading to the associated streams.

In 2003, an area of approximately 1,200 acres of young forest was thinned under the Upland Restoration Thinning Program, well in excess of the 800-acre annual target. These areas were primarily in the upper watershed with the Pacific Silver Fir Zone, where most of the younger forest now exists. The first ecological thinning in older forest, the 45 Road Forest Restoration Project, was completed in 2003 after ordinance approval in the fall of 2002. An area of approximately 157 acres was thinned on this site in the lower watershed through use of a contract with a private company. A total of 64 acres in the 45 Road project area was planted for diversity under the Upland Restoration Planting program, which will further increase the species diversity and structural complexity of the site. We also continued work on the next planned ecological thinning project, the 700 Road Forest Restoration Project in the upper watershed. We began work on developing a strategic framework for restoration planting that includes a landscape perspective and the potential "planting" of such nonvascualr plants as mosses and organisms that contribute to small-scale disturbances. This framework is being developed within the context of such landscape-level processes as dispersal, colonization, and restoration of biodiversity across the watershed.

In 2003, we added a new twist to the program for deploying floating nesting platforms for common loons in both the Cedar and Tolt watersheds. Staff developed and installed non-rigid frames over three platforms that were designed to deter bald eagles, which harass the nesting loons and can kill chicks. Initial results of the platform modification experiment were somewhat promising, as the only successful nests in either watershed were those that had been modified.

The adfluvial bull trout population present in Chester Morse Lake spawned in record numbers in core spawning reaches of major lake tributaries during fall/early winter of 2002-03, despite record low flow levels in the Cedar River and tributaries, as well as unusually low reservoir levels. Staff found 504 redds in 2002-3, and 258 redds in 2003-04 (similar to the 236 redds found in several years preceding 2002). For the fourth year in succession, the number of bull trout redds observed in 2003-04 falls well within the range of numbers of redds that would be predicted for a viable, adfluvial bull trout population of this size. In 2003, we also conducted surveying work as part of the bull trout redd inundation study, which will examine the potential effect of reservoir refill on bull trout eggs within the inundation zone of the Cedar and Rex rivers as they enter the reservoir.

With respect to forest habitats, we began installing permanent sampling plots in upland and riparian areas as a means to track long-term changes in habitat over time and to provide sampling data for use now with remote sensing data to characterize the condition of forest habitats. For watershed characterization, we acquired, and began analyzing LiDAR data. LiDAR provides detailed "surfaces for forest canopy and the ground. This data set, if we are able to acquire coverage for the entire watershed, promises to be extremely valuable in characterizing upland forest, riparian habitats, streams, and roads for the purpose of planning restoration work. We also extended the use of effectiveness monitoring to more habitat restoration projects of all types, conducted forest inventory work in the lower watershed to support planning, and continued the development and application of modeling approaches to landscape connectivity.

Landsburg Mitigation

The Landsburg Fish Passage Project was completed in late summer and full operation of the facilities began in time for the annual fall return of spawning salmon l, one year ahead of the HCP-required scheduled. Completion was celebrated at a dedication event held in October. Facilities include new protective water diversion intake screens, a fish ladder (including fish

holding, sorting and transport facilities), and a downstream fish passage gate at the diversion dam, and rock-drop structures providing upstream and downstream passage at the Lake Youngs aqueduct river crossing. Following commencement of operations on September 16, the first adult chinook salmon passed through the facilities beyond the Landsburg Diversion Dam on September 19. During the 2003 brood year a total of 79 adult chinook and 47 adult coho salmon passed upstream. In addition to passage operations, chinook and coho trapping facilities were constructed as a project enhancement , and genetic samples were collected from chinook and coho before being passed above the dam. Genetic sampling will allow for the tracking of family groups in order to assess the relative success of early recolonization above the dam.

Efforts on the Cedar River Sockeye Hatchery project were focussed on design development and environmental review. The project team brought the facility design to the 60% development stage and conducted a formal value engineering (V.E.) process in October, 2003. The V.E. analysis, conducted by a group of independent experts in fisheries and engineering disciplines identified opportunities for project cost efficiencies, many of which were incorporated into the project's design. A Final Environmental Impact Statement and Response to Public Comments document was released in March and was appealed to the City Hearing Examiner by a citizen in April. A hearing was held in October, and in November the hearing examiner issued her decision, which required SPU to issue a Supplemental Environmental Impact Statement (SEIS) that provides additional analysis of environmental effects. Work on the SEIS began in September and is scheduled to be available for public review in the Fall, 2004. The timeline for completion of the facilities has been delayed by one year, to August 2007, as a result of the EIS appeal.

Research and monitoring continued on sockeye, chinook, coho and steelhead. For sockeye fry, work included otolith marking and evaluation, trapping and counting, and short-term fry rearing feasibility assessment in an effort to enable hatchery managers to better understand the performance of the interim hatchery and improve management practices for the existing and replacement hatchery operations. A fall survey of juvenile sockeye in Lake Washington was conducted to enumerate and obtain growth information. For chinook, coho and steelhead, research efforts included studying recolonization above the Landsburg Diversion Dam, study of genetic relationships between rainbow and steelhead trout, and installation of PIT-tag readers at the Ballard Locks to gather information about adult salmon returning to Lake Washington.

Instream Flows

The City manages the Cedar River water supply for multiple objectives: (1) to provide its customers in the region with a high quality, reliable, and adequate supply of drinking water; (2) to protect fisheries resources in the Cedar River and Lake Washington; and (3) to provide a measure of flood protection compatible with the City's primary water supply mission. The instream flow management strategy commits the City to a binding instream flow regime designed to improve habitat conditions for chinook, coho, sockeye, and steelhead in the regulated portion of the Cedar River. The flow regime includes not only minimum instream flow requirements but also adaptive provisions for the allocation of supplemental flows above minimums in years when available, through operation of a multi-agency commission.

The Cedar produced large numbers of juvenile chinook and sockeye in the spring of 2003, indicating good conditions for salmon spawning, incubation and emigration. Although the return of spawning adult steelhead in the spring was again disappointing, all steelhead redds were protected from dewatering with the application of supplemental stream flows. Spring, summer and fall instream flow management efforts were complicated by the need to mitigate the effects of extremely poor snowpack, early snowmelt and an exceptionally warm and dry summer. This was further complicated by the need to coordinate all activities with the construction of fish passage

facilities, construction and testing of fish and flow protection facilities at the Cedar Falls powerhouse and the construction of new water treatment facilities at Lake Youngs.

Despite the difficult hydrologic conditions, sufficient storage was available to augment stream flows to levels that were significantly higher than estimated natural unregulated flows during much of the early portion of the salmon spawning season in the fall. With the fortunate timely return of the fall rains in late October, we were able to continue to supply supplemental high normal flows throughout the salmon spawning season. Flood storage capacity was maintained at sufficient levels throughout the fall and early winter to moderate the detrimental effects of several large storm events that caused substantial egg mortality in many river systems in the Puget Sound region. Preliminary reports from WDFW indicate that the 2004 emigration of naturally produced Cedar River sockeye fry may be the largest since the annual counts began in 1992.

The HCP directs SPU to manage average annual Cedar River diversions in the 98 to 105 mgd range for the first five to ten years of the HCP. In calendar year 2003, mean annual diversion was 83 mgd; in calendar year 2002, mean annual diversion was 79 mgd; in 2001, with water use curtailments in effect for the summer, mean annual diversion was 90 mgd; in 2000, mean annual diversion was 93 mgd.

Work continued on Chinook/Supplemental Biological Studies to increase understanding of relationships between streamflow and habitat. Information from these studies will be used to adapt and improve future instream flow management practices. To this end, nineteen specific study questions were developed, and a number of studies addressing these questions have been conducted and are ongoing.

Seattle City Light completed installation of a fish flow valve at Masonry Dam to ensure continuous minimum river flow between lower Cedar Falls and the powerhouse. At the Cedar Falls powerhouse, City Light carried out testing and improvements to the new tailrace barrier that was installed at the powerhouse in 2002. New downramping requirements below Masonry Dam and Cedar Falls powerhouse were initiated in September with the passage of anadromous fish above Landsburg Diversion Dam.

HCP PROGRAM ELEMENT SUMMARIES

HCP Background

The HCP, approved in April 2000, is a comprehensive, ecosystem based plan for the Cedar River Municipal Watershed and areas downstream affected by river flows. The HCP incorporates more than 10 years of scientific research and monitoring, and commits more than $90 million over the next 50 years to improve conditions for fish and wildlife. The plan will substantially contribute to ensuring that our region has an ample supply of high-quality drinking water well into the 21st century by meeting the requirements of the Endangered Species Act with regard to 83 species of fish and wildlife addressed in the HCP. It addresses many long-standing issues between the City of Seattle and the State of Washington regarding the blockage to anadromous fish posed by the Landsburg Diversion Dam. It also represents the completion of a long-running effort with state and federal agencies to develop technically sound instream flows in the Cedar River to protect salmon.

Because the Cedar River Municipal Watershed contains the headwaters of the major river that discharges into Lake Washington, management of the watershed and the Cedar River's instream flows represent a very important regional opportunity to protect and restore both salmon and other species that are dependent upon late-successional and old-growth forests. The watershed is important not only as the region's primary water supply but also as the major source of downstream river flows necessary to maintain habitat for anadromous salmonids. In addition, the municipal watershed offers one of the few significant opportunities to reestablish a block of mature, late-successional, and old-growth forest below 3,000 ft in a manner that could effectively link this forest block to existing old-growth in other areas of the Cascade Mountains.

As part of the HCP, the City of Seattle has made a 50-year commitment to a wide variety of programs providing significant benefits to fish and wildlife found throughout the entire Cedar River system. These commitments are in three primary categories: **Watershed Management**, **Landsburg Mitigation**, and **Instream Flows**. The HCP includes conservation measures and research and monitoring efforts in all three categories. In developing the Cedar River Watershed HCP, the City understood that undertaking a comprehensive, 50-year habitat protection and restoration program could be successful only with significant commitments to fund and implement monitoring and research activities. This includes: (1) compliance monitoring to determine whether HCP programs and elements are implemented; (2) effectiveness monitoring to determine whether HCP programs and selected elements result in the anticipated changes in habitat or other conditions for the species of concern; and (3) cooperative research to obtain more information on species of concern, test critical assumptions in the plan, and gain understanding needed to refine management decisions to meet plan objectives.

The sections that follow provide a finer level of detail for each program element's first year accomplishments (Program Element Summaries). The Program Element Summaries are organized into the three HCP Categories (Watershed Management, Landsburg Mitigation and Instream Flows) and each section is preceded by an explanation of the HCP Program Category.

Watershed Management Background

The Cedar River Municipal Watershed supports a variety of species that are at risk in the region, largely as a result of habitat degradation and loss. Within the watershed the northern spotted owl, marbled murrelet, bald eagle, and bull trout are found, as well as other terrestrial and aquatic species that are at risk regionally. Since the fish ladders are constructed at the Landsburg Diversion Dam, native anadromous salmonids, such as chinook salmon and steelhead trout, now have access to the Watershed. The HCP's watershed management mitigation and conservation strategies are designed to protect and contribute to the restoration of the habitats of at-risk species, and to contribute to the restoration of ecological and physical processes and functions that create and maintain key habitats.

The proposed mitigation represents a landscape approach to watershed management that includes both a commitment not to harvest timber for commercial purposes within the municipal watershed, effectively creating an ecological reserve that includes all forest outside limited developed areas, and a significant commitment to habitat restoration. These measures were developed collectively to mitigate for impacts of past land management activities, and they were developed in an integrated fashion to foster natural biological diversity and to help restore much of the watershed to more natural conditions.

Following is a listing of the specific components of the City's commitments under Watershed Management:

- Eliminate timber harvest for commercial purposes, effectively creating a watershed ecological reserve that includes all forest outside the few developed areas and that will provide long-term, comprehensive protection of the watershed ecosystem
- Develop and implement a comprehensive program to restore fish and wildlife habitats in the watershed that have been degraded by past activities, such as logging and road construction
- Commit to removing approximately 38% of the forest roads within the watershed by the end of HCP year 20; use restoration thinning, planting, and similar approaches to restore the natural ecological functions and processes in watershed forests that create and maintain habitats for at-risk species
- Design and conduct projects to restore habitat in streams and streamside areas and to improve water quality over the long term
- Design and conduct comprehensive research and monitoring studies that will provide the information needed to improve our ability to achieve the conservation objectives of the HCP over the long term

The following pages provide summaries of the individual HCP PROGRAM ELEMENTS under the Watershed Management program category.

HCP Program Element: Cedar River Watershed Biodiversity Initiative (to support restoration and monitoring in aquatic, riparian, and upland habitats)
HCP Program Category: Watershed Management

Contact: David Chapin, Biologist, and Clay Antieau, Senior Watershed Planner, Watershed Management Division, Cedar River Watershed, Cedar Falls

Objectives & Goals

Protecting, restoring, and monitoring natural biodiversity are stated goals of the HCP. Thus, it is important to have a framework for acquiring, documenting, organizing, and housing biodiversity data during the course of the HCP and beyond. The Cedar River Watershed Biodiversity Initiative (CRWBI) is intended to provide this framework by: (1) defining biodiversity in the context of the HCP; (2) developing a biodiversity database for the Watershed; (3) conducting targeted field surveys and biodiversity research and monitoring; (4) interpreting biodiversity data within the Watershed's biogeographical context; and (5) facilitating biodiversity research in the region. This project is part of the Watershed Characterization project (see separate summary).

Status of Work (2003)

- ***Document information from past ecological and taxonomic studies in the watershed***

  Based on work in 2001, the considerable amount of research that has been conducted in the Watershed over many decades continues to be compiled into an organized bibliography. Staff continues to build on a bibliography of over 350 references, from which we are extracting pertinent biodiversity data.

- ***Collaborate with UW Botany Department on collecting and cataloging vascular plants***

  This project was quiescent during 2003.

- ***Continue studies on presence and distribution of invertebrates***

  Dr. Rick Sugg concluded his survey of terrestrial invertebrates in the Watershed. This work initially focused on ground-dwelling invertebrates across the Watershed.

Looking Ahead (Planned 2004 Accomplishments)

The HCP Biological Diversity Initiative will continue in 2004 with major tasks focused on continuing biological inventory, defining Cedar River Watershed restoration efforts in the context of biodiversity, and identifying research and monitoring priorities that will support Watershed restoration efforts. No specific biological diversity studies are planned for 2004; however, documentation of biodiversity data stemming from other studies will continue.

Financial Summary

This is not an explicit HCP Cost Commitment. Thus, there is no financial summary for this activity.

HCP Program Element: HCP Volunteer Involvement Program
HCP Program Category: Watershed Management

Contact: Clay Antieau, Senior Watershed Planner, Watershed Management Division, Cedar River Watershed, Cedar Falls

Objectives & Goals

Watershed staff support two volunteer programs: a docent program associated with the Watershed Education Center, its collections/displays, and its visitors; and a "Habitat Conservation Plan (HCP) Implementation" program focusing on projects in the Watershed. The Cedar River Watershed's HCP Volunteer Program uses volunteers and "conservation corps" to assist Division staff in implementing HCP elements in the Watershed. As with most citizen-involvement initiatives, Cedar River Watershed managers use this Volunteer Program to renew citizens' commitment to their own communities and resources while benefiting from that volunteer assistance. Thus, essentially all events in which volunteers participate are designed and managed to provide distinct educational, training, or development opportunities to those volunteers.

Status of Work (2003 Accomplishments)

- The HCP Volunteer Program involved over 200 different volunteers in the mission, management, and ecology of the Cedar River Municipal Watershed (CRW).
- The HCP Volunteer Program generated approximately 1013 hours (127 person-days) of volunteer effort in the CRW.
- The HCP Volunteer Program partnered with at least eleven explicit partner organizations: Friends of the Cedar River Watershed, EarthCorps, Bank of America, The Mountaineers, Mountains-to-Sound Greenway, Student Conservation Association, Girls Club of Seattle, YMCA Earth Service Corps, Earth Ministries, Cub Scouts (Boy Scouts of America), and the Environmental Protection Agency (Region 10).
- Japanese knotweed (*Polygonum cuspidatum* complex), a noxious weed, was hand-removed from portions of abandoned Road 16 (within an area of approximately 2 acres).
- Tansy ragwort (*Senecio jacobaea*), a noxious weed, was hand-removed from the 120 Road and portions of the 9 Road. Infestations were also mapped and characterized in those areas (over a linear distance of approximately 15 miles).
- Approximately 700 conifers and other native species were planted on abandoned forest roads and along restored stream crossings in the Lower Watershed.
- Approximately 400 conifers and shrubs were planted in riparian and wetland habitats at the Halmar Gates.
- Approximately 300 conifers and 300 shrubs were planted in riparian areas at the west end of Chester Morse Reservoir.

Looking Ahead (Planned 2004 Accomplishments)

The HCP Volunteer Program will continue in 2004 with major tasks focused on biological inventory, invasive plant species management, and revegetation.

Financial Summary

This is not an HCP Cost Commitment; thus, there is no financial summary for this activity.

HCP Program Element: Watershed Road Decommissioning (C100026)
HCP Program Category: Watershed Road Decommissioning & Improvements

Contact: Chris Anderson, Watershed Operations Manager, Watershed Management Division

Objectives and goals

To reduce the road network to a long-term core road system of approximately 384 miles, the City will remove approximately 236 miles of roads (about 38 percent of the current total), and expects to average about 10 miles of roads per year for the first 20 years of the HCP. The primary purpose of road decommissioning is to minimize sediment delivery to streams and to improve drainage patterns. Decommissioning also will reestablish fish passage between significant amounts of habitat. The basic principles of road deconstruction are to restore the site to approximate pre-road functioning and stability, which involves restoring drainage, placing material in stable locations, and controlling surface erosion. Mineral soils and organic debris are removed from "perched" or otherwise unstable locations and placed either in the roadbed against the cut bank, or hauled to a suitable waste site where they will not be likely to fail and deliver sediment to streams. Culverts are removed. Stream crossings are restored, and stabilized with grade control to avoid eroding into the hillslope. Constructing frequent water bars across the road surface is done to restore cross-slope drainage. All disturbed soils are treated with an approved seed mix and protected with an application of straw or brush to reduce surface erosion. We have had a lot of success with self-seeding of trees, and have occasionally planted seedling trees on deconstructed roads. Some of the roads slated for deconstruction may pass inspection for long-term stability of material and drainage, and may not require any work before declaring them "decommissioned."

Status of work (2003)

In 2003 we abandoned 5.1 miles of road network. The following road sections were abandoned: 64.1A, 64.1B, 64.1C, 64.1D, 64.2, 64.3, 64.4, 64.4A, and 13 Roads. These roads were removed because they were determined to be nonessential for the management of the watershed and they were within basins with special issues. The Taylor Creek basin (64 road system) has a high sediment loading, and the Williams Creek basin is potential anadromous fish habitat. Roads where abandoned by removing drainage structures (culverts), managing the water crossing the road prism by installing water bars, and removing any unstable fill material and moving it to a new stable location. In some situations this meant trucking the material off site to a permanent storage location within the watershed. Road decommissioning projects were linked with other HCP aquatic restoration projects (streambank stabilization and streambank revegetation) whenever possible to increase the ecological benefit of removing the road. The total miles of roads abandoned in 2003 were lower than our annual average because City staff and equipment were needed to perform road improvement on a tight schedule as part of the BPA powerline project. In year 2003 we also began a road inventory that will look at road condition and sediment production from the road prism to help us determine where best to prioritize our work, how best to accomplish reduction of sediment delivery from roads to streams, and improve safety.

Looking ahead (Planned 2004 Accomplishments)

In 2004, we plan on abandoning the 610 (spurs), 640 (spurs) and the Little Mountain (spurs) for a total of approximately 10 miles of Road decommissioning. A road inventory system and long-term road plan will also be continued in 2004 (see account for Road Improvements).

Financial summary

The HCP commits funding of $5,900,000 for HCP years 1-20 (in 2003 dollars). The cost per mile of deconstruction varies with the difficulty of the particular road segments deconstructed. Some of the funding in 2003 was used for road inventory work to support long-term planning. $297,319 for labor, equipment, materials, and related expenses was spent in year 2003 for road decommissioning.

Road Decommissioning			
HCP work Commitment	HCP Cost Commitment in 2003 dollars	HCP work Commitment, completed in 2003	HCP Cost Commitment, spent in 2003
10 miles/per (average)	$295,000 per year (average)	Approximately 5.1 miles of roads and inventory work to support long-term planning	$297,319

Program Element: Watershed Road Improvements (C100023)
Program Category: Watershed Road Decommissioning & Improvements

Contact: Chris Anderson, Watershed Operations Manager, Watershed Management Division

Objectives and goals

The purpose of road improvements is to reduce sediment loading to streams and other water bodies over time. To minimize sediment delivery to streams and to improve drainage patterns, priority stream crossing will be upgraded, and ditches will be sized to control hillslope surface and groundwater flows and to protect the road from surface erosion. Cross-drains will be installed at frequent intervals to move hillslope surface and groundwater across the road in a pattern that approximates the drainage pattern upslope of the road, and unstable sidecast and fill material will be moved. A road may be stabilized by constructing a supported, keyed fill or by reconstructing the cut slope. Road improvements include activities such as applying rock for stability, increasing frequency of cross-drains, stabilizing fills, removing unstable sidecast material and dismantling perched landings.

Status of work (2003)

In year 2003 we accomplished approximately 12.5 miles of road improvements, including culvert installations, road surfacing, ditching and slope stabilization with soil nailing. An additional 5 miles of HCP designated road improvements were associated with the BPA powerline construction project, on roads that were identified as needing improvements under HCP. The road improvement associated with the BPA project was paid for with BPA funds.

Work was also done to develop a new road inventory system to support short-term, logistical planning to accomplish work in a cost-effective manner, and long-term prioritization and planning of road improvement, decommissioning, and maintenance work to meet HCP ecological objectives.

Looking ahead (Planned 2004 Accomplishment)

In 2004, we plan to make improvements to the 9, 50, 70, 100, and 200 systems. In addition, we plan to complete the road inventory described above, which will include a basis and method for prioritizing and sequencing road improvements and decommissioning with regard to HCP ecological objectives. The inventory will be used, with other information, to develop a long-term strategic plan for road management to meet HCP and other objectives.

Financial summary

The HCP commits funding of $2,065,000 for HCP years 1-5 (in 2003 dollars). $413,000 for labor, equipment, materials, and related expenses was spent in year 2003 for road improvement.

Road Improvement			
HCP work Commitment	HCP Cost Commitment in 2003 dollars	HCP work Commitment, completed in 2003	HCP Cost Commitment, spent in 2003
Reduce sediment delivery to stream and improve drainage	$413,000 per year (average)	Approximately 12.5 miles plus 5 miles paid for by BPA	$413,000

HCP Program Element: Watershed Road Maintenance (N541701)
HCP Program Category: Watershed Road Decommissioning & Improvements

Contact: Chris Anderson, Watershed Operations Manager, Watershed Management Division

Objectives and Goals

The primary objectives of road maintenance under the HCP are to minimize sediment delivery to streams, to improve drainage patterns that have been altered by roads, and to provide fish passage, following standards included in the HCP. These standards are designed to maintain a stable, functional road system that minimizes adverse impacts on stream and riparian habitat. The focus is on road segments that are near streams or have the potential to deliver sediment to streams. Other areas are now maintained with more precautions and added cost to protect draws and water crossings.

Status of Work (2003)

In 2003 we accomplished approximately 42 miles of road maintenance on particular roads that have potential to impact the aquatic system. An additional 5 miles of roads that received maintenance are part of the BPA power line project. Roadwork standards for the roads related to the BPA project were reviewed and modified by City staff. Staff hydrologists determined the design flow using USGS regional equations and/or other methodologies (e.g., Washington DNR). The stream channels were also analyzed for stability and debris loading before a culvert size was determined. Significant amounts of applied maintenance were increased in 2003 due to comprehensive ditch cleaning efforts, re-establishing runoff diversion. Also, in identified HCP areas, increased care and time was spent on grading and compacting existing surfaces that were near streams. One of our goals in 2003, in addition to maintaining HCP roads, was to distinguish HCP maintenance objectives from normal road maintenance. This has been an ongoing procedure that has been identified through planning and mapping exercises. During 2003, we were able to identify these areas of immediate maintenance concern and, although road improvements will be necessary in the future for some of these areas, we were able to mitigate potential impacts before those improvements will be made.

Looking Ahead (Planned 2004 Accomplishments)

We will continue road maintenance activities to protect and benefit habitat. In 2004, we plan on continuing maintenance on HCP Roads that are not immediately scheduled for Road Improvements, with emphasis on data collected from the Road Inventory we will be continuing in 2004 (see account for Road Improvements). In 2004, the process will be finalized for accurately identifying road segments for which HCP objectives apply regarding maintenance and more specific identification and accurate tracking will be implemented.

Financial Summary

The HCP commits funding of $547,570 for HCP years 1-5 (in 2003 dollars). $82,198 for labor, equipment, materials, and related expenses was spent in year 2003 for road maintenance.

Road Maintenance			
HCP work Commitment	HCP Cost Commitment in 2003 dollars	HCP work Commitment, completed in 2003	HCP Cost Commitment, spent in 2003
Correcting and avoiding direct road impacts to streams	$109,514 per year (average)	Approximately 42 miles plus 5 miles paid for by BPA	$82,198

HCP Program Element: Large Woody Debris Replacement in Streams (C100019)
HCP Program Category: Stream and Riparian Restoration

Contact: Dave Beedle, Senior Watershed Hydrologist, Watershed Management Division

Goals and Objectives

The objective of this element is to temporarily enhance stream habitat by placing large woody debris (LWD) in selected streams that lack wood as a result of past land management activities. The goal is to help restore ecological functions by enhancing in-channel structural characteristics. This will temporarily improve fish habitat until the adjacent riparian area begins to supply woody debris of appropriate size and quantity. A specific plan was developed for the Cedar River between Cedar Falls and Landsburg. This plan was developed to incorporate specific water supply infrastructure, water quality, and personnel safety concerns.

Status of Work (2003)

Year 2003 was used to develop a system to identify and prioritize aquatic restoration sites and develop a watershed specific in-stream habitat inventory system. The aquatic restoration system developed within the CRW was based on GMUs (Geomorphic Map Units). The system allows the City to achieve the following: 1) identify key watershed processes (hillslope and fluvial) for each GMU which most strongly control/influence the characteristics of the GMU; 2) determine (to the extent possible) the range of variability of these key attributes for each GMU; and 3) use current and historic information to assess the primary threats which jeopardize the short and long –term integrity of these GMUs. The stream inventory methodologies were modified from the US Forest Service Level 2 Stream Inventory Handbook. The modifications where conducted to make the inventory system more useful as a tool to identify and prioritize aquatic, riparian, and road restoration projects. One of the primary uses of the inventory will be to identify and determine the quality of habitat upstream of culverts that potentially block upstream fish passage. The modified stream inventory methodologies were used in 2003 to verify and refine the GMU system and identify and prioritize near-term projects within the Rock and William creek basins. Year 2003 was also devoted to creating a strategic plan with consultants to develop a system (rationale) for identifying and prioritizing locations for aquatic restoration.

Two LWD projects (covering approximately 300 ft) were completed on Rock Creek in 2003. Site 1 (lower site) consisted for placing 12 full-length trees in the channel and floodplain from the adjacent riparian area that was to be harvested for the new power line. Site 2 (upper site) consisted of placing 7 full-length trees in the channel and floodplain from the adjacent riparian area that was to be harvested for the new power line. Minimal HCP funds were used to complete the projects as they were part of the BPA project. The anticipated HCP LWD project was not implemented because additional funding required to move logs into remote reaches of Rock Creek does not become available until 2004.

Looking Ahead (Planned 2004 Accomplishments)

The planned LWD project for 2004 is Rock Creek at the 10 Road. The proposed project will introduce at least 50 LWD pieces into Rock Creek using a hand cable system to move logs up to 24 inches in diameter and 40 feet long into a 300 feet reach of Rock Creek 300 feet upstream of the 10 road crossing. LWD pieces will also be placed in the floodplain to address channel migration issues and riparian restoration objectives.

Financial Summary

The HCP commits funding of $118,000 (in 2003 dollars) for HCP years 1- 8. Approximately $22,712 was spent in 2003 completing two projects.

Large Woody Debris Replacement			
HCP work Commitment	HCP Cost Commitment in 2003 dollars	HCP work Commitment, completed in 2002	HCP Cost Commitment, spent in 2003
1.6 projects per year (average)	$14,750 per year (average)	No projects were completed this year under the HCP, but 2 projects were completed as part of the BPA project and considerable work was done developing GMU framework and inventory for planning restoration	$22,712

HCP Program Category: Streambank Stabilization (C100017)
HCP Program Element: Stream and Riparian Restoration

Contact: Dave Beedle, Senior Watershed Hydrologist, Watershed Management Division

Goals and Objectives

The objective of this element is to minimize excessive rate of streambank erosion caused by forest roads and land management activities. The goal is to improve storm water quality and reduce the magnitude and frequency of disturbance to fish habitat from sediment inputs and bedload movement.

Status of Work (2003)

Year 2003 was used to develop a system to identify and prioritize aquatic restoration sites and develop a watershed specific in-stream habitat inventory system. The aquatic restoration system developed within the CRW was based on GMUs (Geomorphic Map Units). The system allows the City to achieve the following: 1) identify key watershed processes (hillslope and fluvial) for each GMU which most strongly control/influence the characteristics of the GMU; 2) determine (to the extent possible) the range of variability of these key attributes for each GMU; and 3) use current and historic information to assess the primary threats which jeopardize the short and long –term integrity of these GMUs. The stream inventory methodologies was modified from the U. S. Forest Service Level 2 Stream Inventory Handbook. The modifications were conducted to make the inventory system more useful as a tool to identify and prioritize aquatic, riparian, and road restoration projects. The development of the stream inventory methodologies was funded through the Culvert Replacement for Fish Passage project (C100016). One of the primary uses of the inventory will be to identify and determine the quality of habitat upstream of culverts that potentially block upstream fish passage. The modified stream inventory methodologies were also used in 2004 to verify and refine the GMU system and identify and prioritize near-term projects within the Rack and William creek basins.

Specific projects in 2003 consisted of removing poorly designed or failed stream drainage structures and redesigning the channel to provide long-term stability for approximately 100 linear feet of stream during road abandonment projects. Survey and preliminary design was completed in Rock Creek along the 200 road to reduce sedimentation into bull trout spawning areas. Year 2002 was also devoted to creating a strategic plan with consultants to develop a system (rationale) for identifying and prioritizing locations for aquatic restoration

Looking Ahead (Planned 2004 Accomplishments)

Proposed 2004 work will include Rack Creek downstream of the 200 Road and/or channel stabilization through drainage structure removal during road abandonment. The exact sections of streams to be stabilized during road abandonment will depend on the projected cost of the work and will be determined by the final design of the projects

Financial Summary

The HCP commits funding of $186,440 (in 2003 dollars) for HCP years 1-8. Approximately $25,174 was spent in 2003

Streambank Stabilization			
HCP work Commitment	HCP Cost Commitment in 2003 dollars	HCP work Commitment, completed in 2002	HCP Cost Commitment, spent in 2003
197 feet per year (average)	$23,305 per year (average)	Stream and Riparian consultant, stream crossing work during road abandonment, and design survey	$25,174

HCP Program Element: Streambank Revegetation (C100022)
HCP Program Category: Stream and Riparian Restoration

Contact: Dave Beedle, Senior Watershed Hydrologist, Watershed Management Division

Goals and Objectives

The objective of this element is to revegetate streambanks where past upstream or upslope activities have altered the riparian vegetation to the point where excessive streambank erosion is occurring and channel stability has been reduced. The goal is to help restore ecological functions by recovery of vegetation characteristics. This will improve storm water quality and reduced magnitude and frequency of disturbance to fish habitat from sediment inputs and bedload movement.

Status of Work (2003)

The work in year 2003 was anticipated to "catch up" on HCP commitments for this project. 2003 involved planting stream crossings in past road abandonment project areas. Streambank restoration occurred on the 13, 64.1, 64.2, 64.4, and 126 roads. A total of approximately 1,950 linear feet (18,800 square feet) were planted with 721 native shrubs and trees. Planting was accomplished using SPU staff, Earthcorp, and volunteers. Year 2003 was also devoted to creating a strategic plan with consultants to develop a system (rationale) for identifying and prioritizing locations for aquatic restoration.

Looking Ahead (Planned 2004 Accomplishments)

Streambanks with high impacts to the aquatic system will be planted in 2004. The projects will provide vegetative stability to redesigned channels to provide long-term stability at several road abandonment locations. The exact sections of streams to be stabilized will depend on the projected cost of the work and will be determined by the final design of the projects.

Financial Summary

The HCP commits funding of $62,540 for HCP years 1-8 (in 2003 dollars). $32,301 was spent in 2003 for streambank restoration.

Streambank Revegetation			
HCP work Commitment	HCP Cost Commitment in 2003 dollars	HCP work Commitment, completed in 2003	HCP Cost Commitment, spent in 2003
331 feet per year (average)	$7,818 per year (average)	Approximately 1,950 linear feet (18,800 square feet) with 721 native shrubs and trees	$32,301

HCP Program Element: Riparian Conifer Underplanting (C100018)
HCP Program Category: Stream and Riparian Restoration

Contact: Amy LaBarge, Senior Forest Ecologist, Watershed Management Division

Objectives & Goals

The objective of this element is to plant and reestablish conifers near streams and in forested areas around wetlands, ponds, and other non-forested aquatic habitats that were converted to hardwoods as a result of past land management activities. This conifer establishment will help accelerate the restoration of diverse and structurally complex riparian stands within the watershed and promote biodiversity in areas that were disturbed by early timber harvest activities.

Status of Work (2003)

In 2003, two riparian planting projects were implemented along the main stem of Taylor Creek in the lower Cedar River Watershed. These projects were installed in areas that were dominated by red alder overstory with a salmon berry understory. Watershed management division staff planned, designed and implemented the planting projects, and volunteers assisted with the site preparation and planting. A combination of western hemlock, western redcedar, and Sitka spruce seedlings were planted in five different areas (four at Site 1 and one at Site 3). Approximately 500 linear feet of riparian area was affected by these riparian planting projects. Riparian vegetation monitoring, including follow-up monitoring at Webster Creek, Shotgun Creek and Lost Creek, was also accomplished to track the success of these past riparian conifer planting projects. Consultant work was performed on remote sensing image data that will differentiate forest overstory, which will be helpful in long-term planning of riparian restoration activities.

Looking Ahead (Planned 2004 Accomplishments)

In 2004, a riparian planting project will occur along Rock Creek, in conjunction with a Large Woody Debris Placement project. This planting will occur over approximately 800 linear feet of Rock Creek north of the 10 Road in the lower Cedar River Watershed. This area currently hosts an overstory of red alder and an understory of salmon berry.

Longer-term site selection and prioritization of areas to be planted will also occur during 2004 through the interdisciplinary team process. To inform future work, monitoring data will continue to be collected and analyzed that will allow us to assess planting methods, seedling survival, and variety of techniques used in riparian underplanting projects.

Financial Summary

The HCP commits funding of $59.100 for HCP years 1-8 (in 2003 dollars), with an average of $7,395 per year. In 2003, $12,257 was expended for plant materials, consultants, and staff time during planting projects, monitoring, and image data analysis. Volunteer time spent on planting projects was additional cost commitment work with no associated cost to the City.

HCP Program Element: Riparian Restoration Thinning (C100020)
HCP Program Category: Stream and Riparian Restoration

Contacts: Amy LaBarge, Senior Forest Ecologist, Watershed Management Division

Objectives & Goals

The objective of this element is to conduct restoration thinning (in forests under 30 years old) and ecological thinning (in forests over 30 years old) within previously disturbed riparian zones of streams, open water bodies, and wetlands. Riparian thinning will accelerate the growth and structural development of trees, provide greater protection for streams and eventually develop forest structure, composition, and diversity characteristics similar to the natural mature riparian conifer forest originally on the site. Thinning is focused on stands with high tree density and involves cutting trees to a desired spacing to promote more rapid tree growth, improve current habitat, and accelerate the development of older forest characteristics. Thinning in riparian areas also focuses on retaining high tree species diversity, including conifer and hardwood trees and shrubs. In the long-term, riparian thinning will benefit adjacent aquatic ecosystems by contributing shade, large woody debris, stream bank stability, and nutrients.

Status of Work (2003)

In 2003, the Selleck riparian restoration thinning project was completed, and the remaining 11 acres were thinned along an unnamed creek in the lower watershed to improve remaining tree growth and riparian plant species diversity. Restoration thinning contractors implemented this project, and staff conducted compliance monitoring concurrently. Additionally, approximately three acres of dense grand fir were thinned along the main stem of Taylor Creek in the lower watershed. Lastly, approximately 7 acres of riparian restoration thinning occurred in the upper watershed in conjunction with upland restoration thinning.

In 2003, interdisciplinary planning efforts continued to develop a project site selection and prioritization strategy for riparian thinning projects through year 2016. Consultant work was performed on remote sensing image data that will differentiate forest overstory, which will be helpful in long-term planning of riparian restoration activities. Consultant input was also received on riparian thinning strategies.

Looking Ahead (Planned 2004 Accomplishments)

In 2004, three types of riparian thinning projects will occur. First, there will be a small riparian ecological thinning project along Shotgun Creek, wherein snags will be created in order to kill a portion of the overstory trees. No trees will be removed from the site. Second, approximately 350 acres adjacent to Seattle Creek will be thinned under the upland restoration thinning program; much of this acreage is young riparian forest. Third, two other areas in the upper watershed will undergo upland restoration thinning in which substantial streams occur. The riparian forest in these two thinning areas will be treated different from the remaining uplands. Additionally, strategic planning will continue to select and prioritize sites for both riparian restoration thinning and riparian ecological thinning in the watershed through 2016.

Financial Summary

The HCP commits funding of $52,240 for HCP years 1-8 (in 2002 dollars), with an average of $6,530 per year. A total of $12,209 was expended for contractors, consultants, and staff time to implement thinning and conduct associated monitoring and long-term planning.

HCP Program Element: Stream Crossings for Peak Flows (C100016)
HCP Program Category: Watershed Management, Stream and Riparian Restoration

Contact: Marti Spencer, Watershed Engineering Supervisor, Watershed Management Division

Objectives and Goals

Stream crossing projects in this category are designed to improve drainage patterns that have been altered by roads, to minimize sediment delivery to streams and to achieve channel stability at that particular site. There are approximately 1,300 stream crossing structures on non-fish-bearing streams in the Cedar River Municipal Watershed. Many of these crossing structures need to be upgraded in size or an alignment correction made, except where the road is deconstructed, which includes culvert removal. A few crossings, depending on other site-specific conditions, will need more expensive repairs or modifications.

Status of Work (2003)

In 2003, improvements for passage of peak flows were completed on stream crossings in the following areas: 60 Road (6 crossings), 64 Road (6 crossings), and 70 Road (6 crossings). Crossings were designed for each specific crossing to convey a 100-year peak flow and associated sediment or debris. Staff hydrologists determined the design flow using USGS regional equations and/or other methodologies (e.g., Washington DNR). The stream channels were also analyzed for stability and debris loading before a culvert size was determined. These 18 stream crossing upgrades and culvert upsizing were selected to reduce the environmental impacts due to restricting peak flows and reduce road sediment delivery to streams.

Looking Ahead (Planned 2004 Accomplishments)

In 2004, we plan to upgrade crossing structures at the following locations: Cabin Creek at the 200 road, Eagle Ridge Creek at the 100-300 road, Williams Creek tributary along the 30 road, and various smaller unnamed tributaries throughout the watershed.

Financial Summary

The HCP commits funding of $147,500 for HCP years 1-8 (in 2003 dollars). $16,957 for labor, equipment, materials, and related expenses was spent in year 2003 for stream crossings for peak flows.

Stream Crossings for Peak Flows			
HCP work Commitment	HCP Cost Commitment in 2003 dollars	HCP work Commitment, completed in 2003	HCP Cost Commitment, spent in 2003
Improve drainage patterns	$18,438 per year (average)	18 crossing locations	$16,957

HCP Program Element: Stream Crossings for Fish Passage (C100021)
HCP Program Category: Watershed Management, Stream and Riparian Restoration

Contact: Marti Spencer, Watershed Engineering Supervisor, Watershed Management Division

Objectives and Goals

Stream crossing improvements in this category are designed, when both economically and technically feasible, to reestablish fish passage at locations where forest road crossings interrupt connectivity of significant habitat reaches for either anadromous or resident fish. One of the most cost-effective strategies for increasing and/or improving fish habitat can be to restore access to potential habitat by upgrading, replacing or removing blocking culverts on fish-bearing streams. Removal of artificial migration barriers can restore biological connections between upstream and downstream populations and/or make unoccupied habitat available for recolonization. Fish populations can potentially increase when access to spawning and rearing habitat is restored.

Status of Work (2003)

In 2003 we removed a fish barrier on a tributary to Williams Creek at the 13 Road. At this location the crossing was completely removed and the stream channel redesigned to accommodate fish passage. The crossing was constructed with footings for a temporary bridge in case there may be a need to access this area for future stream restoration projects in Williams Creek. The ½ mile of the 13 Road on the far side of this crossing was abandoned to minimize any impacts to Williams Creek and facilitate the removal of the crossing without having to maintain the road on the far side. We also purchased a crossing structure for the 19 Road project for a tributary to Carey Creek, but delayed construction until 2004 because City resources were being used for the BPA powerline project. This 19 Road project is planned to be installed during the 2004 construction season. City staff hydrologists determined the design flow using USGS regional equations and/or other methodologies (e.g., Washington DNR). The stream channels were also analyzed for stability and debris loading before a culvert size was determined.

Looking Ahead (Planned 2004 Accomplishments)

In 2004, we plan to complete the 19 Road project, as described above, on a tributary to Carey Creek by installing an open-bottomed arch; to install a new crossing structure over the tributary to Bear Creek on the 600 Road; and to achieve a fish-passable structure where the Taylor Siphon crosses Webster Creek.

Financial Summary

The HCP commits funding of $1,132,800 for HCP years 1-8 (in 2003 dollars). $134,214 for labor, equipment, materials, and related expenses was spent in year 2003 for stream crossings for fish passage.

Stream Crossings for Fish Passage			
HCP work Commitment	HCP Cost Commitment in 2003 dollars	HCP work Commitment, completed in 2003	HCP Cost Commitment, spent in 2003
Removal of road barriers to fish movement	$141,600 per year (average)	1 project and purchase of one crossing structure	$134,214

HCP Program Element: **Upland Restoration Thinning (C100024)**
HCP Program Category: Upland Forest Restoration

Contacts: Amy LaBarge, Senior Forest Ecologist, Watershed Management Division

Objectives & Goals

The objective of this element is to use thinning in young upland forests (generally less than 30 years old) to accelerate development of late-successional and old-growth forest conditions, to develop habitat that supports diverse native wildlife, and to reduce the chance of catastrophic damage to the forest through wildfire, insect outbreak or disease. These young forests have developed as a direct result of commercial timber harvest that occurred within the watershed during the past several decades. They often have a very high density of trees that results in intense competition for light, water, and nutrients. Restoration thinning involves cutting trees to a desired spacing to promote more rapid tree growth, improve current habitat, and accelerate the development of older forest characteristics. Because the relative value of restoration thinning diminishes as a stand ages, efforts in HCP years 1-16 will focus on thinning large areas of very high tree density.

Status of Work (2003)

In 2003, approximately 1,200 acres were restoration thinned, well in excess of the 800-acre annual target. The target was exceeded because the cost per acre was less than anticipated, and more restoration thinning areas have been identified than can be accomplished at the HCP estimated annual acreage level in 16 years. In 2003, restoration thinning was focused in the upper watershed, which is dominated by the Pacific silver fir forest type. These forests grow more slowly than Douglas-fir forests in the lower watershed, so the age at which restoration thinning is appropriate may be older than 30 years. Staff designed restoration thinning unit locations and boundaries through a landscape analysis approach, and units included young forest of different ages and species compositions. The restoration thinning prescriptions were developed by an interdisciplinary team and were designed to leave existing large trees and retain diverse species. Three different treatments were applied in 2003. Effectiveness monitoring occurred in each of the treatment types to provide baseline data for future monitoring and adaptive management. Compliance monitoring was conducted concurrently with the thinning implementation. Planning occurred for 2004 restoration thinning sites, including the preparation of a site-specific restoration thinning management plan. Surveying was performed to identify and mark City ownership boundaries for 2003 restoration thinning work.

Looking Ahead (Planned 2004 Accomplishments)

Approximately 650 acres will be thinned in 2004. Three types of prescriptions will be implemented on young forests in the upper watershed. Compliance monitoring will be conducted while the thinning is implemented. Effectiveness monitoring activities will document forest stand characteristics before and after thinning to establish baseline information for future effectiveness monitoring and adaptive management. Planning for 2005 restoration thinning areas will continue. The program manager and the interdisciplinary team will continue consulting with experts on forest restoration to develop the most effective approaches to young forest thinning to accomplish HCP objectives. Computer growth models will also be used to investigate different approaches and their outcomes. Additionally, strategic planning will continue to select and prioritize sites for restoration thinning in the watershed.

Financial Summary

The HCP commits funding of $1,909,580 for HCP years 1-8 (in 2003 dollars), with an average of $238,698 per year. A total of $194,732 was expended in 2003, including restoration thinning contractors, surveyors, and compliance monitoring by staff.

HCP Program Element: Upland Ecological Thinning (C100027)
HCP Program Category: Upland Forest Restoration

Contact: Amy LaBarge, Senior Forest Ecologist, Watershed Management Division

Objectives & Goals

The objectives of this element are to use ecological thinning in forests greater than 30 years old to accelerate the development of characteristics associated with older forests, increase biological diversity, facilitate ecosystem function, and reduce the risk of catastrophic events, such as wildfire, insect outbreak or disease. Ecological thinning may use a variety of silvicultural techniques, including variable density thinning and gap and snag creation, and it is focused on stands with relatively high tree density and little structural complexity. Thinning will remove trees to create variable spacing in the remaining forest, retain and develop large trees and trees of varied height and diameter, increase species diversity, and encourage structural complexity. The HCP provides that trees can be removed from an ecological thinning site after the ecological objectives have been met. These surplus trees may be sold under ordinance authority.

Status of Work (2003)

The 45 Road Forest Restoration Project, the first ecological thinning project to be implemented under the HCP, was completed in fall of 2003. This ecological thinning project aimed to accelerate the development of forest structure and habitat typical of old-growth stands, and it implemented variable density thinning, left the largest conifer trees, all hardwood trees and less prevalent conifer trees, all snags given safety considerations, and created down logs by cutting trees. An area of approximately 157 acres was thinned on the project site. The trees that remained after thinning now have more growing space and will therefore maintain or accelerate growth. Pre-treatment effectiveness monitoring was completed before implementation, while compliance monitoring occurred concurrently with implementation. The project area was planted under the Upland Restoration Planting program, which will further increase the species diversity and structural complexity of the site.

An interdisciplinary project team continued planning the 700 Road Forest Restoration Project, developed ecological objectives, and formulated silvicultural prescriptions for the project area. A draft management plan was produced and sent out to experts for review. Treatment area boundaries were marked, engineering assessments were completed, and a cultural resource survey was completed. In addition, consultants inventoried future potential ecological thinning areas in the lower watershed. Strategic planning progressed to select and prioritize sites for ecological thinning in the watershed.

Looking Ahead (Planned 2004 Accomplishments)

Public outreach and education will occur in summer 2004 to discuss questions and address concerns regarding the ecological thinning program with members of the environmental community. The City ordinance needed for the 700 Road Forest Restoration Project will be sought in fall 2004. Subsequently, a contract for implementation will be advertised and awarded. The project is planned for implementation in 2005.

Scoping and planning with occur for future potential ecological thinning project areas. Landscape scale planning will continue in an effort to select and prioritize sites to optimize ecological thinning for forest ecosystem function, wildlife habitat improvement and biodiversity.

Financial Summary

The HCP commits funding of $295,810 for HCP years 1-8 (in 2003 dollars), with an average of $36,976 per year. A total of $14,475 was expended in 2003 for compliance monitoring and engineering consulting on the 45 Road Forest Restoration project and for project layout on the 700 Road Forest Restoration Project. A cultural resource survey conducted on the 700 Road project was funded using revenues from the 45 Road project.

HCP Program Element: Upland Restoration Planting (C100025)
HCP Program Category: Upland Forest Restoration

Contact: Amy LaBarge, Senior Forest Ecologist, Watershed Management Division

Objectives & Goals

The objective of this element is to restore the species diversity and ecological complexity through restoration planting in upland forest ecosystems. Restoration planting will benefit forest biological diversity by increasing plant community diversity to a level similar found in naturally regenerated forests on comparable sites. For example, enhancing the hardwood component in forests currently dominated by conifer trees will increase stand structural complexity and support more diverse wildlife and epiphytic plant species. Planting may include trees, shrubs, and forbs, as well as flora such as lichens and mosses. Projects will be monitored, data analyzed and techniques changed to increase understanding of how desired effects can be achieved.

Status of Work (2003)

Sixty-four acres were planted with diverse conifer and shrub species as part of the 45 Road Forest Restoration project in fall 2003. The planting areas were prepared by a contractor using a rototiller, head-mounted on a tracked machine. Western redcedar, big leaf maple, and red alder were planted with teams of volunteers and staff.

The survey of young, poorly stocked forest areas in the watershed yielded no sites where conifer trees are needed for upland restoration planting. An assessment of techniques for planting non-traditional flora, such as cryptogams (mosses, liverworts, etc.), orchids, mistletoe, and heart rot fungi was initiated and a strategic plan addressing these techniques and their application in the watershed is in progress. A small amount of consulting work occurred, which will help in site selection and prioritization of upland restoration planting sites.

Looking Ahead (Planned 2004 Accomplishments)

Plans for planting trees, shrubs, and nonvascular flora will be developed conjunction with the 700 Road Ecological Thinning project. Upland restoration planting projects will often be integrated with other HCP projects, such as ecological thinning. Volunteer groups may be used to a substantial extent for upland restoration planting projects and data collection. Strategic planning will continue to select and prioritize sites for upland restoration planting in the watershed, assess the presence and diversity of various nonvascular and rare plant species in the forest ecosystem, and experiment with planting these nonvascular and rare species to increase ecosystem function and biodiversity.

Financial Summary

The HCP commits funding of $88,750 for HCP years 1-8 (in 2003 dollars), with an average of $11,094 per year. Approximately $19,227 was spent on plant materials, site preparation, and consulting work. .

HCP Program Element: Common Loon Monitoring (N541811)
HCP Program Category: Watershed Aquatic Monitoring and Research

Contact: Dwayne Paige, Senior Watershed Ecologist, Watershed Management Division

Objectives and Goals

Document the reproductive success of common loons nesting within the Cedar River Watershed, especially those utilizing habitat in the Chester Morse Lake/Masonry Pool complex, and provide alternative nest sites through the deployment of artificial nest platforms at appropriate selected location(s) and under appropriate environmental circumstances.

Status of Work (2003)

Although common loons use many lakes in Washington as foraging and resting habitat, often tolerating high levels of human activity, only 10-12 of these lakes are currently known to have supported active nesting in any given year or on a regular basis at any time during the last decade. Nesting habitat and structures are potentially available in willow-dominated zones of the Cedar and Rex River deltas and in specific small areas of Masonry Pool. This nesting habitat, however, is currently subject to springtime water level fluctuations over the course of the nesting season (April through mid-June) of up to 10 feet or more under the present reservoir operating regime.

Relatively little is known about the historic presence or reproductive success of common loons within the Cedar River Watershed prior to the last 20-25 years. Despite the lack of information before that period, a general knowledge does exist of (1) the historic uses of the watershed, (2) the major habitat changes through time, and (3) the degree of protection that has been afforded Chester Morse Lake over the last 100 years. We can reasonably assume that loons have nested on the shores of the Chester Morse Lake reservoir for many decades and probably on the original natural lake (Cedar Lake) for hundreds of years. In the period of the mid-1970s to late-1980s, loons were frequently sighted on Chester Morse Lake, and young chicks were observed by City staff on the Masonry Pool at least once in each of the years 1979, 1982, and 1988.

In order to reduce adverse effects of reservoir fluctuations on nesting loons, since 1990 the City has been conducting an experimental nest platform program in which artificial floating platforms with native vegetation are deployed at the beginning of the loon nesting season, or when reservoir water levels allow, to provide more stable nest sites. Although the platforms are not sufficient to counteract the effects of reservoir fluctuations of more than about 5-8 feet, such as occur during a prolonged, early season drought, this program has demonstrated some success. Platforms have been used by nesting loons in at least one, and typically two, of the three nesting territories on the reservoir complex in each of the 14 project years during the period 1990-2003; a platform has been used in 13 consecutive years in one territory; and a platform has been used in 10 of 14 years in a second territory. Of 31 nests on the reservoir during the period 1990-2003, 23 (74 percent) have been on platforms. Of the 32 chicks produced during this period, 7 chicks hatched on natural nests and 26 chicks (81 percent) hatched on the platform nests.

Monitoring during four common loon nesting seasons (2000, 2001, 2002, 2003) since implementation of the HCP has extended the long-term data record of loon reproduction on the Chester Morse Lake/Masonry Pool complex with somewhat atypical results. In 2000, two of the three pairs in the system nested on experimental platforms, the third pair did not nest. One platform nest produced two chicks. The other platform nest was lost early to a predator or scavenger, but the re-nesting effort of this pair on a natural nest site produced a single chick. Although disappointing, observations during 2001 documented the first year within the last decade in which no loon chicks were produced in the watershed. This result was significant in that, although nesting conditions in the watershed (e.g., lake levels) were apparently normal, none of the

three pairs nested successfully. The only nesting attempt was on a platform nest that was lost to a predator or scavenger early in the nesting period as in the previous year; however, no re-nest was established in this case.

Observations of loon nesting activity during 2002 regrettably documented the second year within the last decade, and the second year in succession, in which no loon chicks were produced in the watershed. Although one loon pair attempted to nest on an artificial platform, the level of harassment by bald eagles at the platform site was apparently pervasive enough to cause nest abandonment, and no evidence of re-nesting was observed. Although present within their traditional 'territories' on Chester Morse Lake and the Masonry Pool and initially exhibiting behavior indicative of searching for nest sites, there was no definitive indication that the other two loon pairs established nests. As in 2001, the lack of chick production was significant in that, although nesting conditions in the watershed (e.g., lake levels) were apparently normal, none of the three pairs nested successfully. The lack of common loon reproductive success documented in the Cedar River Municipal Watershed in both 2001 and 2002 was not inconsistent with overall results throughout western Washington, which may suggest a regional, rather than local environmental influence on nesting success during these years. Harassment of nesting loons at and in close proximity to nest sites, however, has been observed more frequently during the last several years on the Chester Morse Lake/Masonry Pool complex, as well as at other nest sites in Washington, and may become more of a threat to the nesting success of common loons in the future than has apparently been the case during the previous decade of research and monitoring.

Artificial nest platforms were deployed in each of the three traditional loon nesting 'territories' in spring 2003 as reservoir levels reached appropriate potential nest sites. Subsequent monitoring of loon behavior patterns, habitat use, and nesting activity during the spring/summer period documented the first successful nest in the last three years within the watershed. This nest was located on an artificial nest platform and produced one chick that survived to fledging. Although present within their traditional 'territories' on Chester Morse Lake and the Masonry Pool, and initially exhibiting behavior indicative of searching for nest sites, there was no definitive indication that the other two loon pairs established nests.

Harassment of nesting loons by both adult and juvenile bald eagles at and in close proximity to nest sites has been observed more frequently during the last several years (i.e., 2000-02) on the Chester Morse Lake/Masonry Pool reservoir complex, as well as at other nest sites in Washington than previously reported. This type of harassment has apparently been pervasive enough to cause nest abandonment in some cases (2000-01 in CRW; 2001 in Tolt). If it has occurred particularly late in the season, no evidence of re-nesting has been observed. Because of the potential for continued increases in the level of harassment of nesting adults and scavenging of loon eggs by bald eagles, experimental modifications were made to several artificial nest platforms in both the South Fork Tolt and Cedar River watersheds in an attempt to reduce the risk, and, if possible, avoid adverse effects of bald eagles on nesting loons.

An open, dome-shaped, arching frame of plastic pipe (one pipe from three of the four platform sides joined in the center) was attached to platforms previously used by nesting loons where harassment had been observed or highly suspected (all unsuccessful nests). Sparse vegetation was then attached to the pipe to create the visual effect of 'cover' above the platform deck (and incubating loon on the nest). The non-rigid, 'flimsy' pipe frame was intended to serve as a deterrence to eagle(s) trying to land directly on the platform, or to perch on the frame itself. The vegetation was not intended to totally hide the bird on the platform, but merely to possibly complement the bird's cryptic coloration. Also, any structure added to the previously successful platform design should not restrict the bird's view from the platform deck.

Experimental modification of the successful platform design had several risks associated with it and several relevant outcomes were highly possible: 1) loons would be 'frightened' by the

pipe/vegetation frame and not use the platforms; 2) loons would nest on the platforms, but eagles would not be deterred; or 3) loons would nest on the platforms, eagles would be deterred, and nests would be successful.

Initial results of the platform modification experiment were somewhat promising. A total of three platforms were modified (Tolt–1; Cedar–2) in 2003. Loons nested on two of the three modified platforms and both were successful in hatching chicks (Tolt-2; Cedar-1). The pair in the third territory did not nest in 2003 and had not nested for several years. The only successful nests in either watershed were those that had been modified. One conclusion from this experiment is that the modification did not prevent loons from using artificial platforms and nesting successfully. Also, an initial indication is that the modification may deter eagles from adversely affecting nesting loons on platforms in the short-term, but continued monitoring in successive years will be needed to determine if such modification is a long-term 'fix' to eagle harassment at loon nest platform sites.

The importance of the Cedar River Watershed as habitat for common loons takes on added significance when considered in a regional or statewide context, as the three pairs of common loons that typically nest in the municipal watershed have constituted more than one-quarter of the loons nesting in Washington State in many recent years. The production of fledglings from the watershed has, in many years, constituted an even larger fraction of the fledged loons produced in the state, likely as a result of the degree of security within the watershed compared to the high levels of human disturbance to nesting loons on lakes open to the public. As population growth and development pressure from the Seattle/Tacoma metropolitan area continue to diminish the quantity of loon habitat (through housing development around lake and reservoir shorelines) and the quality of habitat (through increasing recreational boat use of lakes and reservoirs, and through sediment input), the availability of undisturbed habitat in the municipal watershed will play an increasingly critical role in maintaining the viability of populations of common loons that nest in the Puget Trough and the western Washington Cascades.

Looking Ahead (Planned 2004 Accomplishments)

Staff will continue to monitor common loon reproductive activity and will deploy experimental nest platforms (as long as monitoring continues to document the efficacy of the program) during 2004 on the Chester Morse Lake/Masonry Pool complex.

Financial Summary

The HCP commits funding of $29,500 for HCP years 1-10 (in 2003 dollars), with an average of $2,950 per year. A total of $4,500 was expended for cost commitments in year 2003.

HCP Program Elements: **Bull Trout Spawning Surveys (N541805)**
Bull Trout Fry/Juvenile Surveys (N541806)
Bull Trout Stream Distribution Surveys (N541809)
Bull Trout Surveys (adult/weir) (N541804)
Bull Trout Redd Inundation Study (N541810)
Bull Trout Stream Telemetry Studies (N541807)
Bull Trout Lake Telemetry Studies (N541808)

HCP Program Category: Watershed Aquatic Monitoring and Research

Contact: Dwayne Paige, Senior Watershed Ecologist, Watershed Management Division

Objectives and Goals

Document the overall distribution of bull trout spawning habitat within the Cedar River Watershed (CRW) and monitor long-term trends in the annual level of spawning activity in "core" spawning habitat as an index of the status of the adfluvial bull trout population in the Chester Morse Lake drainage basin.

Document the basic behavior patterns of bull trout fry (e.g., emergence/outmigration timing), evaluate spring "fry counts" as a potential index of the adfluvial bull trout population and habitat use, and determine the distribution of juvenile rearing habitat within the CRW.

Document the overall extent and distribution of major stream and tributary habitat used by bull trout (all life history stages/forms) within the CRW in order to facilitate development of the most effective management prescriptions for protection and/or enhancement of bull trout habitat under conservation and mitigation strategies of the HCP.

Status of Work (2003)

Bull trout spawning surveys
Numbers of bull trout redds located during recent years have varied widely as a result of natural bull trout behavior, stream flow conditions (i.e., high flows), and staff time available to conduct surveys. During the 2000 season, however, relatively low river flow conditions were ideal for conducting spawning surveys, and additional HCP staff was available to conduct more intensive surveys. A conservative total of 236 redds were observed within the Chester Morse Lake drainage basin, which was more than double the previous high count of 111 redds. In the 2001 season, staff again observed a conservative total of 236 redds within the Chester Morse Lake drainage basin. Based on information from other studies, the number of bull trout redds observed in two consecutive seasons appear to fall well within the range of numbers of redds that would be predicted for a viable, adfluvial bull trout population of this size. Spawning activity was also observed in some side-channel reaches where spawning activity had not previously been documented. Also, the spawning season in 2001 extended into mid-January, approximately four weeks longer than previously documented, and a similar pattern was observed in 2002.

Data collected by Fish and Wildlife Unit staff indicate that the adfluvial bull trout population present in Chester Morse Lake spawned in record numbers in 'core' spawning reaches of major lake tributaries during fall/early winter (September – January) of 2002-03. Despite experiencing near record low flow levels in the Cedar River and other major spawning streams in the watershed, as well as unusually low reservoir levels (i.e., 'drought' conditions) in Chester Morse Lake, bull trout were able to pass potential barriers at the confluence with the lake and find adequate gravel and flow conditions in traditional spawning reaches. The highest previous bull trout redd counts in 'core' spawning reaches prior to this season's survey were 236 redds in both 2000 and 2001. This number was more than doubled in 2002-03 with a count of 504 redds.

2003-04 data collected by biologists indicate that the adfluvial bull trout population present in Chester Morse Lake spawned at a level similar to those documented in HCP years 1-3 (see above). Surveys conducted in 'core' spawning reaches of major lake tributaries during fall/early winter (September – January) of 2003-04 resulted in a total of a total of 258 redds recorded. This total is very similar to the non-drought years of 2000 and 2001 when a total of 236 redds was recorded in each year. Information of this type, collected over the long-term and under a variety of environmental conditions, is necessary to understand habitat requirements of this 'threatened' species and to make informed management decisions in order to protect this 'unique' population of bull trout and its habitat in the municipal watershed. Again, for the fourth year in succession, the number of bull trout redds observed in 2003-04 falls well within the range of numbers of redds that would be predicted for a viable, adfluvial bull trout population of this size.

Staff biologists also invested considerable effort to incorporate pre-HCP redd survey location data into the current database format, perform QA/QC on the data entered, and link the database to the Watershed Management Division GIS system to facilitate long-term trend and statistical analysis, GIS mapping, and the development of other GIS-based materials. These tools will soon be used to evaluate the technique relative to its potential as an index to bull trout population status in the lake, whether it should be modified to be more effective and efficient as a monitoring technique, or whether it should be replaced with other more effective methods in future years. Discussion(s) are planned with the Services to present this information and address associated issues.

Bull trout fry and juvenile surveys

Two experimental techniques have been used to investigate the seasonal timing of bull trout fry behavior and production in the Chester Morse Lake drainage basin. In the early 1990s, fyke nets were deployed at selected locations on the mainstem Cedar and Rex rivers to determine seasonal timing of fry movement and outmigration in mainstem reaches, indicating peak movement levels from mid- to late April. During 2000, 2001, 2002, and 2003 periodic surveys (direct observation) of bull trout fry have also been conducted in selected mainstem and side-channel reaches of the Cedar and Rex rivers, as well as in selected tributary streams (e.g., Boulder, Cabin, Eagle Ridge, and Morse creeks) to document habitat use and general fry behavior, and to identify general trends in the relative number of bull trout fry present in the tributaries of Chester Morse Lake from year to year. This technique is experimental at present and will be evaluated for possible use as an index to monitor annual bull trout fry production under the HCP. The presence of fry was also observed in some side-channel reaches where rearing activity had not previously been documented. Observations of fry in some reaches also indicated earlier dates of emergence and movement in streams than previously documented in this system.

Although a database of fry capture and observational data has been maintained, both prior to and since implementation of the HCP, only basic, within year analyses were meaningful to perform. As data are collected in successive years, however, it becomes more practical to perform more extensive analyses of such data in terms of trends and relevance to variable environmental conditions. As with the spawning survey database (see above) staff biologists also invested considerable effort to incorporate pre-HCP and early HCP fry observation survey data, including locations, into the current database format, perform QA/QC on the data entered, and link the database to the Watershed Management Division GIS system to facilitate long-term trend and statistical analysis, GIS mapping, and the development of other GIS-based materials. These tools will soon be used to evaluate the technique relative to its potential as an index to bull trout population status in the lake, whether it should be modified to be more effective and efficient as a monitoring technique, or whether it should be replaced with other more effective methods in future years. Discussion(s) are planned with the Services to present this information and address associated issues.

Bull trout stream distribution

The Chester Morse Lake bull trout population was conservatively estimated to be approximately 3,100 fish, and general distribution within the lake was documented in 1995 (R2 Resource Consultants, 2001). The full extent of the distribution of bull trout in tributary streams is currently incomplete. The presence of bull trout has, however, been documented in the mainstem of the Cedar River upstream from Chester Morse Lake, 0.7 mile into the North Fork to a natural barrier (falls) and also 0.7 mile into the South Fork to a partial seasonal barrier. The presence of bull trout has also been documented in Eagle Ridge Creek (a rearing area) and in several floodplain channels in the Cedar drainage. In contrast to the rainbow trout distribution within the lake basin, bull trout (or redds) have only been observed in three of the smaller tributaries to the reservoir complex (i.e., Rack Creek, Shotgun Creek, and Damburat Creek (single observation)). Bull trout have not yet been found in certain major tributaries of the Cedar River including Bear Creek, which is accessible and rainbow trout are present. Within the Rex River system, bull trout have been observed upstream in the mainstem as far as the confluence of Lindsay Creek, in Boulder Creek and Cabin Creek (spawning/rearing), and in Morse Creek and Lindsay Creek (rearing only). Observations during 2000-02 (see above) increased the known distribution of spawning and rearing habitat, but limited surveys in a few selected reaches did not extend the overall known range of bull trout within the watershed.

Surveys in several streams during 2002 extended both the known range of bull trout presence and life stage habitat use within the basin. The known presence and distribution of both bull trout spawning and rearing habitat was extended in Rack Creek, a small tributary to Chester Morse Lake. The overall distribution range and specific use of additional rearing habitat was also confirmed in upper Boulder Creek and in a small side-channel of the mainstem Rex River. Surveys in selected reaches of two other major tributary streams (South Fork Cedar and Bear Creek), thought to have substantial habitat suitable for bull trout and previously surveyed, again failed to detect the presence of bull trout.

No fieldwork relative to bull trout distribution was conducted during 2003 because of competing non-HCP workload levels (BPA project construction). The efforts of staff biologists, however, were focused on consolidating bull trout and other fish species information in consistent database format(s) and making the overall fish distribution database more contiguous in order to facilitate future analyses. Such analyses will be used to plan field survey work in 2004 intended to complete the first phase of bull trout distribution surveys in the watershed.

Fish passage to reaches upstream of the lake perimeter forest road (200 Road) was restored at the Shotgun Creek crossing during late summer 2001 by removal of perched culverts and replacement with a pre-cast cement bridge. Installation of this structure provided potential access for both bull trout and rainbow trout from Chester Morse Lake to upstream reaches that had been previously inaccessible for decades. Initial monitoring to detect the presence of fish in newly accessible reaches was conducted during summer/fall of 2002, but no re-colonization of upstream reaches was detected. No monitoring for the presence/absence of fish was conducted in Shotgun Creek during 2003 because of competing non-HCP workload levels (e.g., BPA project construction). A major factor affecting the rate of re-colonization of upstream reaches is the fact that the entire stream reach from the confluence with Chester Morse Lake to the bridge typically exhibits subsurface flow conditions on an annual basis. Upstream reaches, however, typically remain wetted with moderate flow. The especially low flow and/or dry condition during 2002 may have severely constrained the ability of either species to reach the newly accessible habitat. This constraint may delay the re-colonization of upstream reaches for an undetermined period of time. Also, until fish re-establish residency in upstream 'refuge' habitat not affected by annual subsurface flow conditions, the presence and/or absence of fish in downstream reaches will presumably continue to vary widely.

Several aspects of the Chester Morse Lake adfluvial bull trout population are ecologically 'unique', especially its isolation from anadromous influence over a substantial expanse of recent geologic time. As a result, the upper Cedar River Municipal Watershed (CRMW), encompassing critical habitat for this population, has been designated as the 'Chester Morse Lake Core Area' in the first draft of the Puget Sound chapter of the federal Recovery Plan for bull trout, soon to be submitted to the USFWS Regional Office in Portland, OR, for review. Because of the degree and extent of physical isolation of this population, the genetics of the population as a whole is of potential regional and evolutionary significance. In addition, the potential for local populations to have differentiated within the Cedar system also has implications from the perspectives of both reservoir (i.e., water supply) and land management within the watershed.

As one component of 'stream distribution', in order to address the issue of genetic structure and relationship of the Cedar population on both a local and regional basis, Fish and Wildlife Unit staff collected tissue samples from juvenile bull trout in tributaries of Chester Morse Lake (e.g., Rack Creek) and in the Cedar and Rex rivers and their tributaries (e.g., floodplain channels, Boulder Creek, Cabin Creek) during summer 2002. These samples will be analyzed during 2003 in order to develop a clear picture of bull trout genetics within the Cedar system and their potential relationship to other bull trout populations on both regional and evolutionary scales.

Bull trout DNA analysis

Preliminary results of DNA analyses performed in 2003 on bull trout tissue samples collected during 2002 corroborated the findings of a morphometric analysis of a sample of bull trout/Dolly Varden individuals from Chester Morse Lake performed in the early 1990s, which classified the population as 'bull trout' and not Dolly Varden. Additional analyses will be conducted to determine if genetic differences exist between bull trout utilizing different tributaries within the Chester Morse Lake drainage system. Results of this analysis are pending. This work was funded from sources other than HCP cost-commitment funds.

Bull trout redd inundation study

The initial phase of the bull trout redd inundation study (i.e., stream topographic surveys) was initiated in the Cedar and Rex rivers (core spawning habitat) during 2003 to provide information to facilitate better evaluation of the potential risk of redd inundation during spring reservoir refill. Field work for this project phase will be completed in 2004, data will be processed, and work products will be developed to support planning of the second phase of the project (i.e., egg mortality experiments). Preliminary scoping for the egg mortality phase of the project, including a draft experimental design, was also completed during 2003. This phase of the inundation effects project will be initiated in fall of 2004, and monitored through the spawning, incubation, and emergence season in 2005. Current plans call for a second year of data collection in 2005-06.

Also, topographic surveys were completed in 2003 in an 'historic' reach of Boulder Creek immediately upstream of its confluence with the Rex River to support evaluation of this reach as potential spawning habitat for bull trout (out of the inundation zone), if flow were to be restored to the reach (as a additional benefit to the drainage system under HCP stream restoration activities).

Bull trout adult surveys (weir)

A fish weir project was initially proposed as one potential method to obtain physical and behavioral data on the adfluvial bull trout spawning population accessing habitat in the major tributaries of Chester Morse Lake (Cedar and Rex rivers), as well as to efficiently support (e.g., fish capture) other HCP monitoring and research projects, such as lake and stream telemetry and redd inundation studies. At least two factors have recently come to light, that in combination, make it advisable to at least temporarily delay and reevaluate the ecological risks (and logistics) associated with this project. First, observations in some bull trout populations (and other salmonids) have indicated that weirs and/or the capture process may adversely affect aspects of natural bull trout spawning behavior (e.g., upstream and/or downstream position of spawning).

The potential of interference from a weir may be of particular concern in a system, such as this one, where the actual effect of spring inundation (a result of reservoir fill regimes) of bull trout redds remains a question, and relative location of redds within the accessible reaches may be of potential significance to annual reproductive success. Secondly, bull trout redd counts in these systems over the last decade have been highly variable, as influenced by diverse environmental survey conditions (e.g., peak stream flow events) and differing levels of survey effort, as well as the natural variability of bull trout spawning behavior in these dynamic systems. The data collected in the last four years, however, indicate spawning levels consistent with expectations for a population of this size, providing a sufficient basis for making a decision regarding whether or not the weir would be the best approach to use for developing an index for use in monitoring relative change in population size over time. A decision on the status and/or modification of this project is pending.

Looking Ahead (Planned 2004 Accomplishments)

Staff biologists will continue to conduct surveys under each of these three bull trout monitoring projects during 2004-05 with the intent of extending documentation of the overall range of bull trout in the watershed, increasing knowledge relative to timing of bull trout life history stages and behavior, and adding to current information on bull trout habitat use. The second phase of the redd inundation study will be initiated. In addition, monitoring of the potential re-colonization of upstream reaches of Shotgun Creek will be renewed and results of the final genetic analyses will be completed. Also, as mentioned above, the City will try to reach agreement with the USFWS regarding the best approach to developing an index for monitoring bull trout relative population change over time, as was one intent of the weir proposal described above, and modify the project or reapply funds to other HCP bull trout projects in 2004-05. The City plans to scope and design the bull trout redd inundation study in 2003 and to implement initial steps during fall/winter 2003/4. The City will also conduct topographical surveys in core spawning reaches of the Cedar and Rex rivers to better evaluate the potential risk of inundation during spring reservoir refill.

Financial Summary

	Year 3 Cost Commitment (2003 dollars	Year 3 Cost Commitment Expenditures (2003 dollars)	Work accomplished
Bull Trout Spawning Surveys **(N541805)**	$41,300	$39,724	Surveys completed. Cost includes database maintenance/management, and data analysis.
Bull Trout Fry/Juvenile Surveys **(N541806)**	$41,300	$27,165	Surveys completed, continuing evaluation of fry enumeration methods and techniques. Expanded range of known juvenile habitat. Cost includes data maintenance/management, and data analysis.
Bull Trout Stream Distribution Surveys **(N541809)** [1]	$0	$3,655	No field surveys completed in 2003. Cost includes database maintenance/management, and data analysis.
Bull Trout Redd Inundation Study **(N541810)**	$64,900	$47,283	Channel topographic survey phase of project initiated and to be completed in 2004.

Bull Trout Steam Telemetry Studies **(N541807)**	$0	$0	Project deferred to 2005/2006.
Bull Trout Lake Telemetry Studies **(N541808)**	$41,300	$0	Project deferred to 2007.
Bull Trout Surveys (adult, weir) **(N541804)**	$59,000	$0	Continued discussion with USFWS and evaluation regarding appropriate methods and timing. Plan to modify and/or transfer funds to other bull trout project activities in 2004-06.

HCP Program Element: HCP Program Element: Watershed Characterization--Includes Assessment of Expanded Forest Stand Attributes (N541501), Assessment of Expanded Forest Attributes (N541502), Augmentation of Forest Habitat Inventory (N541503), Long-term Forest Habitat Inventory, Old-growth Classification, Field Verification (N541504, N541505), and Forest Habitat Modeling (N541516)
HCP Program Category: Terrestrial Research and Monitoring

Contacts: Amy LaBarge, Senior Forest Ecologist, Dwayne Paige, Senior Watershed Ecologist, and Duncan Munro, IT-Professional, Watershed Management Division

Objectives & Goals

The purpose of the watershed characterization project is to provide information to support the following three major uses of that information under the HCP regarding management of the Cedar River Municipal Watershed (CRW): (1) plan and prioritize habitat restoration projects to meet HCP goals and objectives, (2) track changes in habitats over time, and (3) evaluate alternative approaches for different kinds of restoration projects. This project encompasses the specific HCP commitments listed in the title above, as well as the more general commitments to plan and prioritize restoration activities on a landscape scale. Because existing forest inventory data and remote sensing data that were used to develop the HCP are out-of-date and inaccurate, the funding for the above-listed activities has been combined to provide comprehensive, current and useful information to guide planning and monitoring efforts.

Status of Work (2003)

- Completed the "interim landscape plan" for restoration projects: Mapped locations and categories of restoration projects in the 2 – 5 year time frame, continued to develop models for decision support based on landscape-level information products.

- Watershed Characterization Interdisciplinary Team: This team has completed an options analysis of the available methodologies for characterizing the CRW.

- Established Permanent Sample Plots (PSPs): A total of 19 PSPs were established by staff in the Summer and Fall of 2003 in old-growth forest habitat. An additional 18 were established by staff and consultants in second growth forest in the lower elevations of the CRW during Winter 2003. A total of about 100 (or more) PSPs are planned.

- Established Permanent Sample Reaches (PSRs): PSRs are an adaptation of the PSP concept to serve our characterization needs in the Riparian Zone. A total of 31 PSRs were established at 15 locations by City staff, University of Washington staff, and volunteers in the summer and fall of 2003. As many as about 60 PSRs may be installed at about 30 locations in key riparian habitats.

- Continued to integrate field inventory with remote sensing data: Reworking of existing inventory data to test models of evaluation of stem density and canopy cover from MASTER images (MASTER is a remote sensing data set with a 5-meter pixel resolution ad 50 spectral bands). Continued integration of PSPs as a tool for accuracy assessment of map products developed from MASTER images for upland forest habitats, and integration of PSRs as a tool for verification of map products in riparian zones.

- Documented completeness and quality of existing data that characterize the Cedar River Watershed: Review of 1992 timber cruise data, 1974 Walker Survey data, and all existing data sets that can inform upland forest restoration project site selection and prioritization.

- Assessed expanded forest stand and forest attribute data: Conducted a comprehensive review of 1992-1993 forest inventory stand and attribute data and associated remote sensing data layers. Worked with consultant to analyze forest attribute data. Produced draft report and began evaluating findings. Determined that existing forest data is insufficient to meet upland forest restoration project site selection and prioritization needs.

- Continued acquisition, and analysis of remote sensing data sets: Developed maps of deciduous vs. coniferous vegetation for CRW from MASTER data. Developed maps of vegetation classes for CRW. Tested processing methods for mapping stem density and canopy closure from MASTER and IKONOS images. Received first delivery of King County LiDAR products acquired in 2003 (products include canopy surface, ground surface models, 5' contours, shaded relief images and suites of point used to construct surface models). (LiDAR is data are produced from laser pulse returns from a fixed-wing aircraft.)

- Conducted Forest Habitat Inventory: Forestry consultants cruised approximately 4,000 acres of forest habitat in the lower watershed to provide baseline information for upland forest restoration project planning. This information was also used to assess the effects of the December 3rd windstorm, which felled about 14 million board feet of trees over an area of about 6,000 acres.

Looking Ahead (Planned 2004 Accomplishments)

In 2004, we will continue to work on developing the most cost-effective and useful approach to implementing watershed characterization. We will use existing information and new data that will be acquired in 2004, including both field data and remote sensing data. We will integrate inventories of aquatic, riparian, and upland habitats and integrate field sampling information with remote sensing data for greatest usefulness and the most cost-effective use of the funding available. We will continue to pursue collaborative efforts and external grant funding to "leverage" the funding in the HCP.

Primary activities in 2004 will include:

- Assess plot level data from 1992-1993 timber inventory to determine whether it can be used with new image data and classification.
- Complete development of metadata for map products derived from image analysis.
- Analyze LiDAR data from King County to evaluate precision, accuracy and reliability of prediction of forest habitat conditions.
- Continue to evaluate appropriate forest growth models and species/habitat relationship models (see separate summary)
- Continue implementation of PSPs in second-growth forest (60) and PSRs in riparian forest (31) for long-term monitoring.
- Standardize DADD templates and integrate with ArcCatalog.

Financial Summary

	Year 3 Cost Commitment in 2003 dollars	Year 3 Expenditures	Work accomplished
Assessment of expanded forest stand data [1]	$11,800	$12, 749	Assessment of expanded forest stand data

	Year 3 Cost Commitment in 2003 dollars	Year 3 Expenditures	Work accomplished
Assessment of expanded forest attribute data [1]	$11,800	$7,934	Assessment of expanded forest attribute data
Augmentation of Forest Habitat Inventory [2]	$17,700	$25,604	Design and partial implementation for augmented forest habitat inventory, PSP installation
Long-term Forest Habitat Inventory (Field verification[3] **and old-growth classification**[4]**)**	$28,851	$41,764	Remote sensing image analysis and field data collection, including forest cruising and 19 PSPs in old-growth forest, and preliminary data analysis
Forest Habitat Modeling [5]	$11,063	$9,967	Assessment of forest growth models (including FPS, FVS), analysis of historic forest data, and forest cruising.
Species/Habitat Modeling [6]	$23,600	$19,016	Largely forest habitat inventory, but some modeling work (See separate summary for Species/Habitat Modeling)

1 The HCP commitments are to sample and evaluate in HCP years 1-5, and redesign and sample if needed during years 6-10.

2 Complete sampling within HCP years 1-5, if "assessment" finds incomplete information.

3 Design and field verification to be completed within HCP years 1-5, then sample and monitor through HCP year 50.

4 Design and sample in HCP years 3-8.

5 Evaluate and develop in HCP years 1-8.

6 Evaluate and design in HCP years 1-5; Develop in HCP years 6-10; Maintain through year 50.

HCP Program Element: Species/Habitat Relationship Modeling (contributes to Upland Forest Ecological Thinning, Restoration Thinning, and Restoration Planting,) (N541517)
HCP Program Category: Terrestrial Research and Monitoring

Contact: Bill Richards, Terrestrial Ecologist; Dwayne Paige, Senior Watershed Ecologist, Watershed Management Division

Primary Objective (initial project element)

Utilize Habitat/Dispersal Simulation Modeling as a tool to identify and aid prioritization of specific areas within the landscape of the Cedar River Municipal Watershed (CRMW) where forest restoration projects will be most effective in promoting mid- to late-seral forest connectivity as guided by the conservation strategies of the HCP.

Status of Work (2003)

This project is part of the Watershed Characterization project (see separate summary). In order to provide potential habitat benefits for populations of 28 wildlife species dependent on late-seral forest conditions, one of the goals of the HCP is to facilitate the restoration of late-seral forest characteristics by thinning relatively young and dense second-growth forest. The HCP commits to planning forest restoration on a landscape scale, prioritizing projects for the most potential benefit. This modeling application attempts to identify where ecological and restoration thinning projects will most likely contribute to the connectivity of mid- to late-seral forest habitat.

This project element is being conducted in two phases: 1) habitat modeling, and 2) dispersal simulations. The habitat-modeling phase combines the best available landscape data to define current forest habitat conditions using forest growth models (e.g., FVS, FPS) to predict forest conditions at the end of the 50-year HCP. Ecological and restoration thinning will be simulated in potential stands under current habitat conditions and 'grown' 50 years to produce alternative landscape conditions. The dispersal simulation phase utilizes a spatially explicit model (PATCH) designed to simulate populations of territorial, terrestrial vertebrate species. Comparing dispersal success and dispersal patterns for a range of late-seral dependent wildlife species between alternative landscape conditions will identify forest areas that, when thinned, will contribute most to future forested habitat connectivity. During 2001, we conducted preliminary evaluations of some available models, and preliminary evaluations of data needed for these models.

In 2002, we completed both phases of the modeling process as described above. Completion of this project element has provided the first planning 'tool' that we have developed under the HCP to address landscape-scale prioritization of forest sites in which to plan and implement restoration and ecological thinning to facilitate development of late-seral habitat conditions (e.g., connectivity).

In 2003, we investigated the potential effects of planned ecological thinning projects on wildlife habitat structure at selected low and mid-elevation project sites. We also evaluated several types of remotely sensed data (e.g., MASTER data, LIDAR) as a potential source of stand composition and structural data that would support and improve future wildlife and species distributional data within the watershed. Field data was also collected in lower elevation, second growth stands to be used in modeling exercises and for restoration planning purposes. Further modeling efforts will be conducted when these types of remote sensing data coverages become available and are processed for use with any appropriate and available modeling applications.

Looking Ahead (Planned 2004 Accomplishments)

Staff will continue to investigate the availability and effectiveness of current technology pertinent to development and/or utilization of species/habitat modeling capability to support landscape level

decisions for habitat protection and management under the Conservation and Mitigation Strategies in the HCP during 2003. As our capability to more accurately classify habitat within the watershed improves concurrently with advances in remote sensing technology (e.g., MASTER data, LIDAR), this analysis can be regenerated to refine results, provide a basis for comparison of alternatives, and improve predictive accuracy. Use of more advanced forest growth models that may have become available will also be investigated as a means of improving the accuracy of habitat condition simulations.

Financial Summary

The HCP commits funding of $117,000 for HCP years 1-5 (in 2003 dollars), with an average of $23,400 per year. A total of $24,047 was expended in 2003, for staff time on modeling and remote sensing data to be used for forest characterization, as well as forest habitat sampling by consultants. (Also described in the summary on Watershed Characterization.)

HCP Program Element: Riparian Restoration Project Monitoring (N541506)
HCP Program Category: Terrestrial Research and Monitoring

Contact: Amy LaBarge, Senior Forest Ecologist, Watershed Management Division

Primary Objective (initial project element)

The purpose of this element is to design and conduct a sampling program to monitor riparian forest habitat development and plant species composition changes to track effectiveness and success of riparian restoration projects. This monitoring will include pretreatment baseline information in representative riparian forest sites as well as effectiveness monitoring of selected riparian habitat restoration projects. The application of experimental silvicultural treatments in riparian areas will be monitored in an adaptive management context.

Status of Work (2003)

In 2003, riparian restoration project monitoring occurred on three projects: Webster Creek, Shotgun Creek and Lost Creek. Each of these projects had been planted with conifer seedlings in years prior. City staff conducted all monitoring.

Additionally, permanent sample reaches were established in riparian areas in 15 locations (for a total of 31 linear plots) in order to establish baseline conditions in representative riparian forest sites. Staff and University of Washington personnel implemented this work.

Looking Ahead (Planned 2004 Accomplishments)

Riparian restoration project monitoring will occur on Webster Creek, Shotgun Creek, and Lost Creeks again, as well as on Rock Creek near the 16 Road. Riparian restoration project monitoring will also occur on Taylor Creek, where three small projects were implemented in 2003. Additional permanent sample reaches will be established to generate a more comprehensive database on riparian forest conditions in the watershed.

Financial Summary

The HCP commits funding of $41,300 for HCP years 3-8 (in 2003 dollars), averaging $6,883 annually, with increased funding levels in subsequent years. Approximately $2,216 was spent on riparian restoration project monitoring in this element in 2003. Much of the effectiveness monitoring that occurred and the permanent sample reach installations were funded by other sources, including HCP restoration projects, the University of Washington, a private company, and volunteers.

HCP Program Element: Upland Forest Restoration Project Monitoring (N541507)
HCP Program Category: Terrestrial Research and Monitoring

Contact: Amy LaBarge, Senior Forest Ecologist, Watershed Management Division

Goals and Objectives

The purpose of this element is to design and conduct a sampling program to monitor upland forest habitat development and plant species composition changes to track effectiveness and success of upland forest restoration projects. This monitoring will include pretreatment baseline information in representative forests as well as effectiveness monitoring of selected upland forest habitat restoration projects. The application of experimental silvicultural treatments in upland areas will be monitored in an adaptive management context.

Status of Work (2003)

In 2003, upland forest monitoring occurred on several projects, three of which were covered by this element, including a 10-year re-measurement of the Sugar Bear Substitution variable retention harvest, upland restoration thinning project sites, and upland forest permanent sample plots. City staff conducted all monitoring. In addition, pre-treatment effectiveness monitoring occurred on the 45 Road Forest Restoration Project, but was charged to another element. Forestry consultants also collected forest habitat inventory information in the lower watershed that will serve as a baseline measurement for forest change over time.

Looking Ahead (Planned 2004 Accomplishments)

In 2004, post-treatment effectiveness monitoring will occur at the 45 Road Forest Restoration Project. City staff, including interns will conduct this monitoring.

Financial Summary

The HCP commits funding of $41,300 for HCP years 3-8 (in 2003 dollars), averaging $6,883 annually, with increased funding levels in subsequent years. In 2003, a total of $14,139 was spent for upland forest restoration project monitoring and collection of forest inventory information by consultants. As mentioned above, other monitoring that occurred was funded by other sources.

HCP Program Element: HCP Information Resource Management (includes GIS Data Compatibility) (N541515)
HCP Program Category: Watershed Management

Contact: Tom Van Buren, IT Professional, Watershed Management Division

Goals and Objectives

Developing and maintaining a well-organized and efficient system of accurate databases, integrated and compatible with the Geographical Information System (GIS), is essential to support many HCP commitments within the Cedar River Municipal Watershed (CRW). In addition, as indicated in this section, most of the program elements are interdependent and rely on data and analyses from several tasks in order to be fully functional and effective as management tools. Therefore, it is critical that all databases are designed, maintained, and updated by a procedure that will ensure accuracy and integration of information, including the acquisition and incorporation of pertinent information from outside sources.

The objective of this program is to provide a systematic and efficient means by which data collection formats, incorporation of data into databases, database management, and integration with modeling efforts can be designed and maintained to maximize the system's ability to support HCP-related management activities. In addition, databases should be updated with the most current and best available information whenever possible from both departmental and appropriate external sources. Data management systems are being developed for various kinds of users, from technical specialists to the public.

Status of Work (2003)

- Created production instance of a GIS Oracle database - including roles and privileges to enable all HCP staff to contribute.
- Realigned GIS road layer to agree with the orthophotography base in preparation for road inventory (orthophotography is spatially corrected aerial photography).
- Developed Road Information Management System software prototype.
- Developed database schema for Landscape Information Management System.
- Implemented a data model for hydrologic resources in the CRMW.
- Developed Stream Information Management System software prototype.
- Production of Data Acquisition Description Document for Permanent Sample Plot data collection
- Developed and implemented database schema for culvert inventory database
- Developed interface for input of new culverts and their geographic locations
- Extended the functionality of ShedWeb to facilitate document contribution and retrieval

Looking Ahead (Planned 2004 Accomplishments)

- Complete migration of legacy GIS coverages to Oracle.
- Enhance prototype for flowing information into the Road Inventory Management System (RIMS)
- Extend hydrology data model to incorporate stream inventory measurements and observations.
- Implement database schema for the Landscape Information Management System (LIMS)
- Derive information products from LiDAR and Master data that are required to prioritize restoration activities.
- Participate in requirements gathering and development of a Project Tracking System (PTS) and Science Information System (SIMS)
- Develop a Watershed Information Portal for Key Watershed Assets:

    + Road Information Portlet
    + Riparian and Aquatic Information Portlet
    + Upland Forest Information Portlet
- Develop resources to facilitate map production by staff

Financial Summary

The HCP commits specific funding of $59,000 for HCP years 1-8 (in 2003 dollars), with an average of $7,375 per year. $24,868 was expended in Year 3. In addition, the HCP includes a variety of commitments that have no explicit HCP Cost Commitments but that create a need for linking information management to planning and documenting restoration, monitoring, and research activities. The work described above funded by both cost commitment funds and a variety of other budget sources.

Landsburg Mitigation Background

The anadromous fish conservation strategies are designed to mitigate for the blockage to fish passage created by the Landsburg Diversion Dam. These strategies are designed to complement other regional efforts to protect and restore declining stocks in the Lake Washington Basin. The intent is to implement biologically sound solutions that (1) contribute to the recovery and persistence of healthy, harvestable runs of anadromous fish in the Cedar River and Lake Washington Basin; (2) have a high likelihood of success; and (3) maintain a safe, high quality drinking water supply.

Anadromous salmonids have not entered the protected watershed in nearly a century. The HCP provides passage for all native anadromous salmonids into the protected watershed, significant regionally as refuge habitat in that it is highly protected and in relatively good condition. Included among these native salmonids are chinook and coho salmon, and steelhead trout. The sockeye salmon stock in the Cedar River was introduced from the North Cascades. Because of risks to public health, the City cannot allow passage above the raw water intake of the mass-spawning sockeye salmon. In lieu of passage, the City commits to artificial propagation for sockeye, with extensive monitoring and appropriate adaptive management provisions to reduce or eliminate risks to wild fish. In addition, the City commits to funding habitat protection and/or restoration for anadromous fish in the Cedar River Basin downstream of Landsburg.

Specifically, the City has committed to the following activities:

- Provide funding to protect and restore habitats and populations of anadromous fish currently blocked from entry into the municipal watershed by the Landsburg Diversion Dam
- Construct fish ladders, protective screens on the water intake, and other improvements for the safe passage of chinook, coho, steelhead, and other native fish species over the Landsburg Diversion Dam, providing access to some of the most protected "refuge" habitat in the region
- Prior to construction of fish passage facilities, commit to interim mitigation for chinook, coho and steelhead, which could involve conducting key studies or emergency supplementation, if justified.
- Construct a new sockeye hatchery capable of producing up to 34 million fry, replacing the existing interim hatchery facility at Landsburg
- Continue to operate the interim sockeye hatchery at Landsburg as mitigation until the replacement hatchery is built
- Provide funding for habitat protection and restoration downstream of the Landsburg Diversion Dam for all anadromous fish species
- Develop and implement a comprehensive program of research, monitoring, and adaptive management for salmon and steelhead
- Create the Cedar River Anadromous Fish Committee, comprised of agencies signatory to the Landsburg Mitigation Agreement and other stakeholders, which will advise the City regarding implementation of anadromous fish mitigation

The following pages provide summaries of the individual HCP PROGRAM ELEMENTS under the Landsburg Mitigation program category.

HCP Program Element: Interim mitigation for Coho, Chinook and Steelhead (N663201)
HCP Program Category: Chinook, Coho, Steelhead Mitigation

Contact: Bruce Bachen, Senior Fish Biologist and Paul Faulds, Fish Biologist, Water Management Section

Objectives and Goals

This program has two main objectives: gathering biological information that is critical in designing and managing effective, biologically sound short-term and long-term conservation measures: and, if appropriate, designing and implementing supplementation programs to help preserve one or more of the populations.

Status of Work (2003)

Recolonization above Landsburg Dam
2003 was the first year of a multi-year monitoring project: Investigations and Monitoring of Recolonization by Pacific Salmon of the Cedar River Upstream of the Landsburg Diversion Dam. This project is a collaboration of effort and resources from Seattle Public Utilities (SPU), Northwest Fisheries Science Center (NOAA), Sea Grant and the School of Fisheries and Aquatic Sciences at the University of Washington. The goal of the project is to provide a comprehensive evaluation of spawning adults migrating upstream of Landsburg and the production of juvenile fish from the recolonized Cedar River system.

The project collected data (number, species, timing, length, sex, presence of adipose fin, and genetic samples using non-lethal methods) on anadromous fish as they passed through the fish ladder at the Landsburg Dam. This information will be used to quantify and characterize chinook and coho that are recolonizing the Cedar River above Landsburg and the genetic data will assist in determining relationships of successive generations to earlier colonizing fish. The project also documented chinook and coho spawning distribution upstream of the dam through the use of telemetry equipment and spawning surveys.

Two other elements of the recolonization project were partially completed in 2003. A platform was installed at the outflow of the water intake bypass pipe to accommodate a live trap for the collection and evaluation of juvenile fish migrating downstream and an underwater camera system was integrated with the existing fish counter at the fish ladder to record photographs of fish passing through the counter as they move above Landsburg.

Rainbow trout and steelhead genetics
Washington Department of Fish and Wildlife (WDFW) initiated a multi-year project: Genetic relationships among anadromous and nonanadromous *Oncorhynchus mykiss* in Cedar River and Lake Washington: implications for steelhead recovery planning. The primary goal of the project is to understand the genetic population structure of Cedar River/Lake Washington *O. mykiss* so managers can design and implement strategies that effectively conserve and recover native steelhead and rainbow trout resources. In 2003, WDFW collected tissue samples using non-lethal methods from *O. mykiss* in the Cedar River, Green River, Chester Morse Lake, and Lake Washington. These samples along with samples collected from steelhead in previous years were analyzed.

Adult PIT tag detection at the Ballard Locks
The US Army Corps of Engineers (USACOE) and WDFW funded an evaluation of noise levels at specific weirs within the fish ladder at the Hiram Chittenden Locks as the first phase of a multi-year project that involves the installation of adult PIT Tag readers in the ladder at the Locks. The

primary objective of this work is to gather information from PIT-tagged adult salmon returning to Lake Washington that were tagged as juveniles in 2000 through 2004 in the Cedar River and elsewhere in the Lake Washington basin. This information will be used to evaluate questions associated with juvenile outmigration to gain a better understanding of what proportion of juveniles use the smolt flumes, which can be used to inform estimates of survival. Detection rates decline over time and it is unclear whether this is due to changes in exit pathways at the locks, in lake mortality rates or rates of residualization.

Looking Ahead (Planned 2004 Accomplishments)

Recolonization above Landsburg Dam
In 2004, the main objectives for this project are to evaluate anadromous fish as they pass through the fish ladder at the Landsburg Dam, document spawning distribution, initiate juvenile surveys of resident and Pacific salmon in the mainstem and tributaries; PIT tag resident fishes and juvenile coho; characterize chinook redd habitat from locations mapped in 2003; collect and analyze water and biota for nutrient dynamics during chinook and coho spawning migration, improve the adult trapping capabilities at the ladder, and install a trap at the water intake bypass pipe to evaluate juvenile's migrating downstream in 2005.

Rainbow trout and steelhead genetics
WDFW will issue a preliminary report describing the result of first year sampling. WDFW plans to collect additional genetic samples for this project and will begin a comprehensive genetic evaluation based on using microsatellite DNA markers and maternally inherited mitochondrial DNA. The results of this evaluation are expected in 2005.

Adult PIT tag detection at the Ballard Locks
The installation of the PIT Tag readers in the fish ladder at the Hiram Chittenden Locks should be completed in Spring, 2004 and the project will move into the monitoring phase soon afterwards. The installation and monitoring will be funded in part by SPU, King Conservation District, and USACOE.

Financial Summary

The HCP provides $840,600 (2003 dollars) for this program for HCP years 1-8. The HCP commitment for this program in 2003 (calendar year) was $106,200, the total amount expended on this program was $115,143 and the reported commitment expended was $109,509. The contractor, WDFW operates under a budget that covers the fiscal year July 1 through June 30.

HCP Program Element: Landsburg Fish Passage Improvements (intake screen, fish ladders and downstream passage construction) (C1604)
HCP Program Category: Chinook, Coho, Steelhead Mitigation

Contact: Bill Wells, Project Manager, Field Operations Branch

Objectives and Goals

Construct Fish Passage at Landsburg.

Status of Work (2003)

The project construction was completed on schedule and all facilities were placed into operation by September 2003.

Significant accomplishments:

- Completed new intake fish screen construction and aqueduct tie-ins and placed the new screening facility in service in July 2003.
- Completed facility start-up testing summer 2003
- Took delivery of new live-haul fish tanker for sockeye transport in August 2003.
- Reached construction substantial completion milestone on August 19, 2003, 12 days ahead of schedule.
- Completed fish ladder and sorting/holding facilities construction at the Landsburg Dam in summer 2003. The facility was watered up and placed in service the first week of September 2003.
- First Chinook past upstream of Landsburg Dam on September 19, 2003.
- Held project ribbon cutting ceremony on October 7, 2003.
- Completed all construction contract punch-list items in December 2003.

Looking Ahead (Planned 2004 Accomplishments)

- Receipt of project construction as-built drawings –1st quarter 2004
- Project construction contract final acceptance, and final contractor payment – April 2004

Financial Summary

Landsburg Mitigation – Fish Passage 2003 HCP cost commitment was 3,463,300. Actual expenditures in 2003 were $5,232,189 (inclusive of sales tax, SPU staff costs, and King County permit expenses and imposed construction mitigation). Total project expenditures were $12,633,000. The project cost commitment, in 2003 dollars, is $7,490,830.

HCP Program Element: Operation of Passage Facilities (intake screen, fish ladders and downstream passage construction) (N663501)
HCP Program Category: Chinook, Coho, Steelhead Mitigation

Contact: Rand Little, Senior Fisheries Biologist, Water Management Section

Objectives and Goals

- Allow access for all native fish species in the Cedar River, except sockeye salmon, into the municipal watershed.
- Operate the downstream passage gate and intake screening facilities to safely pass downstream migrating fish while meeting HCP instream flow management requirements and municipal water supply needs.

Status of Work (2003)

All elements of the project, intake screens, downstream passage gate, the fish ladder and associated fish sorting and transport facilities, were placed into operation on schedule in late summer of 2003, just prior to the return of adult salmon. During the spring of 2003, SPU operations staff began working closely with the SPU construction project manager and staff, the project design firm and various contractors and vendors to begin testing facility components and initiate facility operation. Construction of the rock drop structure providing fish passage over the Lake Youngs Aqueduct river crossing approximately 1/3 mile downstream from the Landsburg Dam was completed during the summer of 2002. This structure performed successfully throughout the remaining portion of 2002 and all of 2003.

Just prior to facility start-up and at the request of the Cedar River Anadromous Fish Committee (AFC), SPU staff retrofitted the fish ladder to include chinook and coho trapping facilities. Minimizing the handling of upstream migrating adult fish was a key objective of the project and therefore, the initial ladder design did not include fish trapping facilities. A number of interested parties and members of the AFC expressed an interest in obtaining genetic information from fish as they passed upstream and to track family groups to assess the relative success of early re-colonization efforts. 2003 also marked the first full return of marked Issaquah Hatchery chinook to the Lake Washington Basin. By trapping all upstream migrating chinook, operators are able to assess the relative abundance of naturally produced and hatchery produced adult chinook and coho salmon migrating over Landsburg. SPU staff worked with staff from NOAA Fisheries and WDFW to design and construct trapping facilities in the fish ladder return channel that allow brief, in-water handling of upstream migrating fish while avoiding and minimizing potential impacts. NOAA Fisheries ammended Seattle's Incidental Take Permit to allow capture and handling of upstream migrating fish.

The trapping facilities also help support re-colonization studies being conducted in collaboration with NOAA Fisheries and the University of Washington, School of Fisheries and Aquatic Sciences. Tissues samples were collected from the fins of upstream migrating chinook and coho for genetic analysis. In addition, over half of the migrating coho salmon were radio tagged and tracked as they passed into the habitat upstream of the dam. All chinook and coho were also inspected for the presence of adipose fin clips indicating fish of hatchery origin.

The Fish Ladder and Sorting Facilities were placed into operation on September 16. The first adult chinook salmon passed through the facilities and into the habitat upstream of the Landsburg Dam on September 19. A total of 79 adult chinook and 47 adult coho salmon passed upstream

during the 2003 brood year (see Tables 1 and 2; Figures 1 and 2). Genetic samples were collected from all but two fish passed upstream. The majority of chinook that passed upstream had adipose fin clips indicating that they were of hatchery origin. Of the 79 chinook passed upstream, only 16 were female. Subsequent redd surveys in the river upstream of Landsburg documented a total of 15 chinook redds. All chinook redds were located in the mainstem. Only 4 of the coho passed upstream had adipose fin clips indicating that most coho were naturally produced. A total of 37 coho were radio tagged and tracked as part of a collaborative project with the University of Washington. Most fish appeared to spawn in the mainstem upstream of Landsburg. In addition to coho and chinook, 1001 sockeye salmon entered the facility, were sorted and either transferred to the Interim Landsburg Sockeye Hatchery where they were used for broodstock, or transported back downstream and released into the river.

On January 25, 2004, after nearly a month during which no coho passed upstream, the fish passage facilities were switched to passive migration mode eliminating the need to sort. In the passive migration mode, all upstream migrating fish are allowed to pass upstream through the fish ladder unhindered. Electronic fish counting facilities provide the ability to monitor the number and approximate size of all upstream migrating fish. Although we are still working through some start-up challenges with this equipment, over 150 trout-sized fish have been enumerated passing upstream through the fish counter since late January, 2004. No fish of sufficient size to be considered steelhead have been recorded at the counter.

Looking Ahead (Planned 2004 Accomplishments)

- The fish ladder will continue to be operated in passive migration mode through the late summer. We will attempt to continue to monitor all upstream migrating fish using the electronic fish counting device in the upper fish ladder.
- Fish sorting operations are scheduled to recommence in early September as significant numbers of returning adult salmon begin to arrive in the Landsburg area.
- A number of minor facility improvements, identified during the first year of operations, have been completed. More minor improvements will be completed prior to start-up of the sorting operations in early September to improve fish handling, reduce the risk of fish mortality due to their tendancy to jump out of the holding ponds, and improve operational safety and efficiency.
- SPU will continue to work with State and Tribal fisheries resource co-managers and NOAA Fisheries, the parties to the HCP and the Anadroumous Fish Committee regarding the issue of passing upstream migrating hatchery salmon into the habitat above of the Landsburg Dam.
- SPU will continue to work with NOAA Fisheries and the University of Washington to support ongoing salmon re-colonization studies.

Financial Summary

Construction of the fish passage facilities was accelerated approximately 1 year ahead of the schedule described in the HCP. As a result, the HCP included no operational commitment costs for HCP Year 3. Actual commitment expenditures for HCP Year 3 totaled $91,640.

HCP Program Element: Interim Mitigation for Sockeye Salmon (N663202)
HCP Program Category: Sockeye Mitigation

Contact: Bruce Bachen, Senior Fish Biologist and Paul Faulds, Fish Biologist, Water Management Section

Objectives and Goals

The Washington Department of Fish and Wildlife (WDFW) operates a sockeye broodstock collection facility and hatchery on the Cedar River through an Memorandum of Agreement (MOA) with Seattle Public Utilities (SPU). The interim hatchery program first began operations in 1991and the broodstock collection facility has been in operation since 1993. The hatchery program involves the incubation and release of marked unfed sockeye fry into the Cedar River so they can volitionally outmigrate and rear naturally in Lake Washington. To maintain the program, broodstock are collected at a weir and fish trap located at river mile 6.5. The weir is operated to achieve an egg take goal that is established annually and based on the estimated sockeye return to Lake Washington. Weir operating protocols are developed annually and reviewed by the Anadromous Fish Committee (AFC) with the goal of avoiding adverse impacts to adult chinook salmon. Broodstock are transported to an adult holding facility at Landsburg and spawned when ripe with the goal of having a 1:1 male to female spawning ratio. Weekly targets for gamete collection are based upon the average run timing curve for the Cedar River. Fertilized eggs are then incubated at the hatchery and the resulting emergent fry are released into the river.

Status of Work (2003)

In October 2003, WDFW provided the AFC and SPU with a summary report that detailed the interim hatchery operation for broodyear 2002, which covered the beginning of broodstock collection on September 10, 2002 through the last fry release on April 3, 2003.

In 2003, the interim hatchery released 15,957,000 fry in the Cedar River. This is one of the largest hatchery releases to date. There were four different release locations and the release numbers varied at each site with 4,450,000 at river mile 0.1; 3,270,000 at river mile 1.9; 3,362,000 at river mile 13.5; and 4,875,000 at river mile 22.

The first known losses of hatchery sockeye to IHN virus at the interim sockeye hatchery occurred in early 2003. The outbreak is thought to be associated with the extension of available spawning habitat that resulted from fish passage improvements that allowed sockeye to migrate above the aqueduct crossing located about one quarter mile below the hatchery. The presence of large numbers of naturally spawning sockeye adjacent to the hatchery likely increased the risk of an outbreak in the hatchery. The losses were confined to a relatively small number of incubators and the number of fry that were destroyed amounted to 5.5% of the total number of fry produced that year by the hatchery. The risk of additional IHN losses will continue to be elevated until the replacement hatchery and the associated improvements to the water supply are made. These water supply improvements should be made as soon as possible to lessen this risk of further IHN outbreaks in the interim hatchery; however, permitting such improvements requires the completion of the SEPA process currently underway.

In May 2003, WDFW estimated the sockeye return for Lake Washington would be about 150,000 fish and would support an egg take goal of 17.2 million for the hatchery. The weir was installed in September and the first egg take was on September 22, 2003. Egg collection continued normally until on October 21, 2003 when the weir washed out during unseasonably high flows.

By that time, approximately 9.5 million eggs had been collected. Although WDFW was able to salvage most of the weir, only a portion of the weir could be reinstalled due to high flows. This reduced capture effectiveness and relatively few eggs were collected during the remainder of the run. The final egg take for the year was approximately 10,316,000.

Looking Ahead (Planned 2004 Accomplishments)

Due to delays resulting from the development of a SEIS for the new hatchery, SPU and WDFW are developing a time extension for the MOA that covers the operation of the interim hatchery. It is anticipated the extension will have a termination date of December 31, 2007.

A strong sockeye return is forecasted for 2004, which is expected to be large enough to support sport and tribal fisheries this year.

Financial Summary

The HCP commitment for this program in 2003 (calendar year) was $302,080, the total amount expended on this program was $323,735 and the reported commitment expended was $321,683. The over expenditure was due in part to spending dollars that were carried forward from previous years and no longer paying December invoices in the following year. This difference is expected to be reconciled during 2004. The contractor, WDFW operates under a budget that covers the fiscal year July 1 through June 30.

HCP Program Element: New Sockeye Hatchery - Design and Construction (C100032)
HCP Program Category: Sockeye Mitigation

Contact: Bruce Bachen, Senior Fish Biologist, Water Management Section

Objectives and Goals

The primary goal of this program is to develop an effective, comprehensive, and biologically sound artificial sockeye propagation program consistent with the Cedar River Habitat Conservation Plan. The objectives are to plan, design, permit and construct a sockeye facility to replace the interim sockeye facility that is capable of producing 34 million sockeye fry per year as well as develop the hatchery program documents (biological criteria, operating protocols, adaptive management plan, and capacity analysis).

Status of Work (2003)

Environmental Review
The Cedar River Sockeye Hatchery FEIS and Response to Comments document were released in March, 2003. In April, a citizen filed an appeal regarding the adequacy of the FEIS with the City of Seattle's Hearing Examiner. Activities associated with this appeal required extensive staff time from SPU and the City's Law Department. An addendum to the FEIS was released in August 2003, containing additional information on the project that became available after the FEIS had been released. The 4-day appeal hearing was held in early October. After the hearing, the City and the appellant filed lengthy written briefs summarizing their respective positions for the hearing examiner and the examiner's decision was issued in November. She required SPU to issue a Supplemental EIS, providing additional information including worst case analyses of some potential effects of the hatchery and providing further detail regarding the adaptive management plan. Work was initiated on the Supplemental EIS in late 2003.

Project Design
Engineering design of the hatchery facilities reached 60% in 2003. Using the 60% design drawings, an independent value-engineering study was conducted to identify opportunities to achieve project savings. WDFW and SPU reviewed the drawings and provided comments. The General Contractor/ Construction Manager developed an estimate of construction costs based on the 60% design drawings and provided comments on the design drawings. All comments and value-engineering recommendations were evaluated and used to develop guidance for further design work.

Project Schedule
Due to the delay in the environmental review process, the project timeline has been adjusted to reflect a two year delay. The hatchery is now scheduled to be completed by August, 2007.

Looking Ahead (Planned 2004 Accomplishments)

The Draft Supplemental EIS will likely be ready for review in Fall, 2004. Design will be mostly complete by the end of 2004.

Financial Summary

Total project expenditures amounted to $673,234 in 2003, of which $470,399 was spent on design, program development environmental review services. Total program development and construction costs are currently expected to exceed the HCP commitment level by approximately $2 million. In 2003 $502,612 was expended toward the HCP cost commitment.

HCP Program Element: Broodstock Collection Solutions and Monitoring (C100033)
HCP Program Category: Sockeye Mitigation

Contact: Bruce Bachen, Senior Fish Biologist, Water Management Section

Objectives and Goals

Evaluate alternative broodstock collection methods and sites as options that would allow the hatchery to meet its egg take goals while minimizing adverse impacts on chinook and other salmonids.

Status of Work (2003)

Northwest Hydraulic Consultants (NHC) provided consultation to SPU on the conceptual design of a replacement broodstock collection facility on the Cedar River focusing on stream hydraulics, geomorphology, and the efficiency of facility operations. Dr. John Skalski was hired to evaluate the feasibility of using a broodstock collection weir to sample adult returns in order to determine their origin.

Looking Ahead (Planned 2004 Accomplishments)

Now that method evaluation and site selection studies have been completed, this project will be merged with the overall design effort for the replacement hatchery. Site selection and design activities will continue in 2004. Further evaluation of the I-405 site is planned and the conceptual design will be developed further in 2004 to be prepare for permit submittals.

Financial Summary

The HCP commitment for broodstock collection solutions and monitoring in 2003 was $0 and $7,266 of the commitment was spent on this program category. Cumulative expenditures are less than the total cumulative commitment for this activity. Remaining funds will be spent during the design process, probably in 2004 and 2005.

HCP Program Element: Drinking Water Quality Monitoring, Fish Passage Evaluation (N663504)
HCP Program Category: Passage of Chinook, Coho & Steelhead Above Landsburg Research & Monitoring

Contact: Bruce Bachen, Senior Fish Biologist and Paul Faulds, Fish Biologist, Water Management Section

Objectives and Goals

This study will provide a basis for evaluating the effects of fish passage on the ecosystem above Landsburg Dam as fish passage is restored. There are two main components: (1) collect baseline nutrient data from water samples, fish and riparian biota for two years and, (2) conduct simulation experiments with small artificial channels to evaluate impact of fish carcasses on stream water quality.

This project does not involve the monitoring of drinking water quality, despite what the title implies. However, it will provide data useful in evaluating the possible role of fish passage in any subsequent drinking water quality problems related to the Cedar source. For example, correlation between the problem and nutrient level changes above Landsburg could be evaluated.

The project is a joint effort of SPU and the National Marine Fisheries Service under a memorandum of agreement.

Status of Work (2003)

The baseline nutrient data was collected in 2000 – 2002. Artificial channel experiments were delayed due to difficulty in identifying a suitable water source. Researchers concluded that the best source and site would be at Landsburg Dam. Development of the source was incorporated into fish passage construction at Landsburg. In 2003, a water supply pipe and 6 inch valve was installed at the new intake screen at Landsburg to provide a gravity fed source of screened water for the channel experiments.

Looking Ahead (Planned 2004 Accomplishments)

The artificial channel experiments may begin in 2004.

Financial Summary

HCP reported commitment expenditures in 2003 totaled $9,380 leaving the remaining unspent commitment of $12,567.

HCP Program Element: Fry Marking and Evaluation (N663402)
HCP Program Category: Sockeye Monitoring and Research

Contact: Bruce Bachen, Senior Fish Biologist and Paul Faulds, Fish Biologist, Water Management Section

Objectives and Goals

Since the beginning of the Cedar River sockeye salmon hatchery program, the otoliths of all hatchery-produced sockeye salmon fry have been thermally marked. Marks have been induced on the otoliths of incubating sockeye through brief exposure to chilled water (approximately 4°C). Marks are unambiguous and are easily distinguishable from naturally spawning sockeye. The objective of the program has been to provide a source of marked fish that can be used to evaluate the hatchery program and address fundamental questions about the performance of Cedar River hatchery produced sockeye salmon. This type of information is needed to help manage the ongoing sockeye salmon hatchery program as well as to provide information to help develop the permanent sockeye salmon hatchery facility.

Status of Work (2003)

Washington Department of Fish and Wildlife (WDFW) provided Seattle Public Utilities (SPU) with a summary of the thermal marking for the otoliths of sockeye embryos and alevins at the Landsburg Hatchery for broodyear 2002. This summary documented the 30 different thermal codes that were developed to mark the 15,957,000 fry incubating in 69 vessels at the hatchery. The report also included the incubation release date, release location, and number released by thermal marking pattern.

In October SPU contracted with WDFW for the 2003 marking program. WDFW established a marking plan for the hatchery based on the goals and objectives of the marking program established by the Anadromous Fish Committee (AFC). The main objectives of 2003 marking program were to mark fish for the Short Term Rearing Study resulting in eight marks and mark production fry by release location in the river (lower, middle, and upper) requiring three additional marks. Time of release was also addressed in the final marking strategy. Samples of otoliths were collected from each incubator shortly before each hatchery group was released to verify that the correct marking pattern was actually induced on the otoliths. WDFW also ensured all marking equipment was operational by the middle of November and was maintained throughout the marking period.

Looking Ahead (Planned 2004 Accomplishments)

A summary report that includes the broodyear 2003 marking plan and the results of implementation will be submitted to SPU and the AFC in July of 2004. The report will include a description of the marking patterns used for each release group, how many fish were marked in each group, the start and end date of marking, release location and dates for each mark group. Results of implementation shall describe any deviations from the marking plan, document marks through representative photos of each mark. The draft report will be reviewed and WDFW will produce a final report based on comments by August 2004.

Financial Summary

The HCP provides support for this program for HCP Years 1-8, 24-27 and 42-45. The HCP commitment for this program in 2003 (calendar year) was $23,600, the total amount expended on this program was $17,866 and the reported commitment expended was $17,629. The contractor, WDFW operates under a budget that covers the fiscal year July 1 through June 30.

HCP Program Element: Fry Trapping and Counting (N663403)
HCP Program Category: Sockeye Monitoring and Research

Contact: Bruce Bachen, Senior Fish Biologist and Paul Faulds, Fish Biologist, Water Management Section

Objectives and Goals

This program supports the operation of a downstream migrant trap in the lower Cedar River that is used to develop the data needed to estimate the number of sockeye fry, by origin, that migrate out of the Cedar River each year. Upriver hatchery releases are evaluated to estimate the number of fry that reach the trapping site. On nights that catches of sockeye fry may include hatchery produced fry, otoliths are collected according to the protocols established over the previous seasons. These protocols prescribe the method of sampling each hour's catch over the entire night to insure that regardless of time of capture, each fry captured within a night has an equal probability of being sampled. The Washington State Department of Fish and Wildlife (WDFW) determine the number of nights on which otolith samples are collected. In addition, other biological data such as size and migration timing are collected and recorded to characterize these populations. Since sockeye migration overlaps with chinook migration, trapping data is also used to estimate chinook production as well.

Status of Work (2003)

Funding was provided to WDFW through a two-year agreement to support fry trapping operations on the Cedar River. This agreement provides the full HCP funding commitment for the period. HCP funding is combined with support from other sources to fully fund the activities and analyses associated with the project. Two types of traps have been used; an inclined screen trap, which works best for smaller fry and a screw trap that is more effective at catching larger juveniles. Trapping occurs on the lower Cedar River from January to July each year resulting in estimates of the outmigrant salmonids from the river. This is the only estimate of natural fry production available for the Cedar River.

In May 2003, WDFW provided SPU and the AFC with the draft 2002 Cedar River Sockeye Salmon Fry Production Evaluation. The document provided outmigrant estimates of hatchery and natural origin sockeye in the Cedar River for 2002.

Looking Ahead (Planned 2004 Accomplishments)

A final fry trapping report for 2002 and draft reports for 2003 and 2004 are expected in 2004. Fry trapping work in the Cedar River will continue in 2004.

Financial Summary

The HCP provides support for this program for HCP Years 1-8, 24-27 and 42-45. The HCP commitment for this program in 2003 (calendar year) was $41,300 and the reported commitment expended was $41,377. The contractor, WDFW operates under a budget that covers the fiscal year July 1 through June 30.

HCP Program Element: Short Term Fry Rearing (N663405)
HCP Program Category: Sockeye Monitoring and Research

Contact: Bruce Bachen, Senior Fish Biologist and Paul Faulds, Fish Biologist, Water Management Section

Objectives and Goals

The objective of the project is to learn more about the feasibility and effects of short- term rearing and use this information to guide future hatchery operations.

Status of Work (2003)

Fry incubation and ponding took place at the Cedar River Hatchery at Landsburg, which is operated by the Washington Department of Fish and Wildlife (WDFW). Following incubation and emergence small samples of fry were removed to calculate the KD index and yolk to body weight ratios (to assess stage of development), and individual weights and lengths (to document fry growth during rearing). Reared groups were released after being held and fed to satiation for approximately 10-14 days. Control groups (unfed fry) were comprised of fry that were released the same day they were removed from incubators, consistent with what has been done in the past at the hatchery. Reared and unfed groups of fry were paired together to form four releases. Each release group involved in the experiment received a unique otolith mark to enable future identification and analysis. Each group included roughly 500,000 fry, however the exact number depended on egg takes and the number of otolith marks available. Fry were released near the mouth of the Cedar River at the boat launch ramp adjacent to the Renton Municipal Airport. The rearing study successfully released approximately 4,450,000 fry in 2003, however one fed group (A-22) tested positive for IHN and was euthanized and a control group (A-16) was released before test results showed it to be positive for IHN.

Looking Ahead (Planned 2004 Accomplishments)

The last fry release for the short term rearing study is in 2004 and the work will focus on rearing and releasing fry, taking biological samples of fry, data analysis, and final reporting. The first significant adult returns from the study are expected to begin in 2005.

Financial Summary

The HCP provides support for this program for HCP Years 1-4. The HCP commitment for this program in 2003 (calendar year) was $12,050, the total amount expended was $11,540 and the reported commitment expended was $9,257. The contractor, WDFW operates under a budget that covers the fiscal year July 1 through June 30.

HCP Program Element: Lake Washington Plankton Studies (year-round) (N663406)
HCP Program Category: Sockeye Monitoring and Research

Contact: Bruce Bachen, Senior Fish Biologist and Paul Faulds, Fish Biologist, Water Management Section

Objectives and Goals

At the June 2002 Anadromous Fish Committee (AFC) meeting, members recommended to the Parties to the Landsburg Mitigation Agreement (LMA) that funding for intensive zooplankton monitoring in HCP Year 2 totaling $46,400 be provided instead for juvenile sockeye research. The reason behind this recommendation was that an existing non-HCP U. of Washington research program was providing sufficient data to met the intent of the HCP zooplankton studies.

In 2003 the AFC again recommended that funding for intensive zooplankton monitoring be used instead to support a proposal by Dr. Dave Beauchamp to conduct a fall survey to enumerate and obtain growth information of juvenile sockeye in Lake Washington with funding from the program element Lake Washington Plankton Studies. The Parties to the Landsburg Mitigation Agreement approved these modifications in both 2002 and 2003.

Status of Work (2003)

In 2003, Seattle Public Utilities (SPU) and the AFC received the final report from Dave Beauchamp (UW): Early Feeding Demand and Food Supply of Sockeye Salmon Fry in Lake Washington. This report was funded through the program element: Lake Washington Plankton Studies and examined the early feeding, growth, distribution, and food supply of sockeye salmon fry *Oncorhynchus nerka* in Lake Washington from winter-spring in 2001. Results from this evaluation are included in a manuscript that will be published in 2004 in a peer-reviewed journal. The timing of the evaluation of food supply in 2001 was particularly opportune because the work coincided with the largest number of sockeye fry entering the lake since counts began in 1992. This study generated useful information for the evaluation of potential concerns about food limitations during the early growing period for sockeye fry as they entered Lake Washington. In addition, in-lake survival rate estimates were calculated. SPU and the AFC also received the report: Growth, Distribution, and Abundance of Pelagic Fishes in Lake Washington: Results and Evaluation of Methods. This study evaluated hydroacoustic-midwater trawl survey methods for assessing sockeye presmolt abundance and associated species during the spring and estimated the abundance, growth, and survival of juvenile sockeye and associated pelagic fishes in the fall and spring. Additionally, Dave Beauchamp (UW) was contracted to conduct a fall survey to enumerate and obtain growth information of juvenile sockeye in Lake Washington with funding from this program.

Looking Ahead (Planned 2004 Accomplishments)

In 2004, SPU and the AFC should receive a report on the fall 2003 survey to enumerate and obtain growth information of juvenile sockeye in Lake Washington. Dave Beauchamp (UW) was also contracted to conduct spring juvenile salmon and planktivorous fish surveys to enumerate and obtain growth information for sockeye in Lake Washington. The survey also provides information on the size of other major pelagic planktivores in the lake, longfin smelt and threespine stickleback. Both smelt and sticklebacks potentially influence the temporal availability of zooplankton in the lake, but are also alternative prey for predatory fish and may buffer juvenile salmon species from additional predation losses.

Financial Summary

The HCP provides support for intensive year-round zooplankton surveys for HCP Years 1-4. The HCP commitment for this program in 2003 was $47,200, the total amount expended was $17,201 and the reported commitment expended was $16,097. The remaining dollars will be carried forward for additional work in this program.

HCP Program Element: Adult Survival Distribution, and Homing Studies (N663407)
HCP Program Category: Sockeye Monitoring and Evaluation

Contact: Bruce Bachen, Senior Fish Biologist and Paul Faulds, Fish Biologist, Water Management Section

Objectives and Goals

The purpose of this activity is to collect otoliths from a representative sample of sockeye spawning in the Cedar River. All sockeye released from the Cedar River Hatchery are exposed to temperature changes during incubation that results in chill markings on the otolith bone. When the otolith samples are analyzed, they provide the data to permit evaluation of marked groups originating from the Cedar River Sockeye Hatchery. The specific evaluations are dependent on the marking strategy employed. Some examples of analyses that will be or have been done are to measure fry to adult survival of hatchery-produced fish, determine the proportion of hatchery-origin sockeye in the return, monitor the spawning distribution of hatchery-produced fish in the Cedar River, and to assess straying in Bear Creek.

Data from these studies will be used to evaluate and modify fry release strategies and other appropriate aspects of the supplementation program to improve performance and minimize the risks of deleterious effects on sockeye spawning in the wild.

Status of Work (2003)

WDFW collected otoliths from the carcasses of adult sockeye that spawned and died in the Cedar River from October into 2004. Samples were taken from adult spawners found in the lower, middle, and upper portions of the river. WDFW also received some funding to carry out the second year of a pilot study to examine the consequences of adult fish behavior on carcass recovery rates.

Looking Ahead (Planned 2004 Accomplishments)

Otolith collection should continue in 2004 with additional focus being applied to a better understanding of the results from previous years.

Financial Summary

The HCP provides support for this program for HCP Years 1-8, 24-27 and 42-45. The HCP commitment for this program in 2003 (calendar year) was $47,200, the total amount expended was $53,481 and the reported commitment expended was $52,292. The contractor, WDFW operates under a budget that covers the fiscal year July 1 through June 30.

HCP Program Element: Phenotypic and Genetic Studies (N663408)
HCP Program Category: Sockeye Monitoring and Research

Contact: Bruce Bachen, Senior Fish Biologist and Paul Faulds, Fish Biologist, Water Management Section

Objectives and Goals

In 2002 the Anadromous Fish Committee (AFC) did not identify the need for further genetics work on sockeye populations in Lake Washington since HCP funded genetic research was completed by Ingrid Spies, a graduate student at the University of Washington. At the February 2002 AFC meeting, members recommended to the Parties to the Landsburg Mitigation Agreement (LMA) that funding for phenotypic and molecular genetic studies in HCP Year 2 be used to support a proposal to evaluate the timing and distribution of adult sockeye as they return to Lake Washington and the Cedar River. The project by Dr. Thomas Quinn and Jenny Newell (School of Aquatic and Fishery Sciences, University of Washington) will generate information to better understand sockeye movement, distribution, and lake entry timing in relation to the timing and location of spawning. The information is expected to be useful to fishery managers as they consider how future fisheries should be structured to control effects on other sockeye populations in Lake Washington and to lower the risk of disproportionate impact to a segment of the run to the Cedar River. The need for the research is identified in the draft Adaptive Management Plan for the Cedar River sockeye hatchery. The Parties to the LMA approved the project.

Status of Work (2003)

At the Hiram Chittenden Locks in 2003, the study tagged sockeye with 1,553 disk tags, 261 iButton temperature loggers, and 30 acoustic transmitters. Some interesting and preliminary trends in the data demonstrated: the proportion of males entering the lake increased later in the run, lake entry timing did not seem to be correlated with river entry, sockeye migrating to the Cedar River entered the lake earlier than fish moving to the north end tributaries, recovered iButton tags showed that some fish stayed in the river for over 3 weeks, and the acoustic tags demonstrated that most sockeye stayed below the thermocline in August and most of the detections were in the south end of the lake. Researchers also record the sample date, sex and length and removed a scale sample.

Looking Ahead (Planned 2004 Accomplishments)

The project will enter its second year in 2004 with some minor changes such as, modifications to the trap to increase the trapping efficiency and increasing the number of acoustic tags to 78. Increased numbers of acoustic tags are expected to provide a better understanding about the level of in-lake mortality during maturation, a question that is relevant to the development of estimates of spawning sockeye in the Cedar River. Also, the study will not be using iButton temperature loggers because 2003 proved to be a very warm year and the iButton temperature loggers provided enough data for analysis.

Financial Summary

The HCP commitment for phenotypic and genetic studies in 2002 was $34,800 and no commitment dollars were spent on this program category in 2002. Unexpended 2002 cost commitment and future years' cost commitments were applied to the $82,623 total cost of the

proposal to evaluate the timing and distribution of adult sockeye as they return to Lake Washington and the Cedar River, which is planned for 2003-05.

The HCP cost commitment for this program in 2003 was $35,400, the total amount expended was $29,434 and the reported commitment expended was $29,014.

HCP Program Element: Anadromous Fish Committee
HCP Program Category: Program Management

Contact: Bruce Bachen, Senior Fish Biologist and Paul Faulds, Fish Biologist, Water Management Section

Objectives and Goals

The Anadromous Fish Committee (AFC) provides advice and consultation to the City and the other Parties of the Landsburg Mitigation Agreement (LMA) relating to the implementation of the LMA. The primary objective of the LMA is to implement biologically sound measures that assist in the recovery and persistence of healthy, harvestable runs of sockeye, coho, and chinook salmon and steelhead trout in the Cedar River. The LMA commits the City to long-term measures to help restore anadromous fish runs and mitigate for the blockage at Landsburg Dam. The AFC serves as a forum for coordinating and communicating information on the status, condition, and trends of anadromous fish stocks in the Cedar River and provides guidance with the implementation and oversight of interim and long-term mitigation measures for these stocks.

In 2003, members of the AFC included representatives from: US Fish and Wildlife Service, National Marine Fisheries Service, Washington Department of Fish and Wildlife, City of Seattle, Muckleshoot Indian Tribe, Northwest Marine Trade Association, Puget Sound Anglers-Lake Washington Chapter, Washington Council of Trout Unlimited, and Washington Trout.

Changes in Membership

In 2003, Bill Robinson stepped down from the AFC as a representative of Trout Unlimited and regularly attended subsequent meetings as a member of the public, Hans Berge joined the AFC as the King County representative, Frank Urabeck was appointed as the voting member for Trout Unlimited and stepped down as the representative for the Northwest Marine Trade Association, and Phyllis Meyers became the voting member for NOAA Fisheries. A new non-voting seat was established and Michael Kern with the Long Live the Kings agreed to serve on the AFC.

Status of Work (2003)

The AFC recommended and/or supported the following items:

- Unanimously recommended that the LMA Parties approve funding for a proposal from WDFW for a two-year study on the genetic relationships among anadromous and nonanadromous *Oncorhynchus mykiss* in Cedar River and Lake Washington.
- Unanimously recommended to the LMA Parties to fund a multi-year proposal to study adult sockeye entry timing and distribution in Lake Washington by Tom Quinn and Jenny Newell (UW) with funding that was originally allocated in the HCP for sockeye genetics study.
- Unanimously recommended that the LMA Parties approve funding for proposed work by SPU, NMFS, and the UW to evaluate salmonid recolonization above the Landsburg Dam. The 2003 elements would evaluate anadromous fish passing above the Landsburg Dam, their spawning distribution, and the downstream passage of juveniles through the protective fish screen at the water supply intake.
- Unanimously recommended to the LMA Parties to fund the installation of adult PIT tag readers at the locks. The overall goal of the project is to provide the U.S. Army Corps of Engineers with an adult PIT detection system that will provide 95% detection of

upstream migrating anadromous salmonids using the fish ladder bearing ISO FDX-B PIT tags at Hiram Chittenden Locks.

- Unanimously recommended to the LMA Parties to fund the proposal from Dave Beauchamp (UW) for conducting fall surveys to investigate factors influencing sockeye growth and survival in Lake Washington using uncommitted zooplankton funds from 2003.
- Unanimously recommended to the LMA Parties to fund a proposal from the WDFW to analyze first year genetic samples collected under the *Oncorhynchus mykiss* genetics study and produce a preliminary report.
- Unanimously supported the 2003 weir protocols to protect chinook
- Unanimously supported the 2003 egg take goal of 17.2 million for the Cedar R. hatchery
- Unanimously supported the 2003 thermal marking plan for the interim hatchery including the release strategy
- Unanimously supported funding WDFW carcass collection for adult otolith recoveries

Looking Ahead (Planned 2004 Accomplishments)

In 2004, the AFC will continue to advise SPU on the replacement hatchery including the facilities design and other program elements. The AFC will continue to advise the City on fish passage and interim hatchery operations. A number of proposals under the Interim Mitigation Program for Chinook, Coho, and Steelhead were recommended for funding in 2004. The AFC is also reviewing the 2005 project needs and priorities for the Interim Program for Chinook, Coho, and Steelhead.

Instream Flows Background

The City of Seattle manages the Cedar River water supply to: (1) provide its customers in the region with a high quality, reliable, and adequate supply of drinking water; (2) protect aquatic resources in the Cedar River; and (3) provide a measure of flood protection and electrical power generation compatible with the City's primary water supply mission. The instream flow management strategy commits the City to a binding instream flow regime designed to improve habitat conditions for chinook, coho, sockeye salmon, and steelhead trout in the regulated portion of the Cedar River.

Based on many years of study and analysis of the needs of all life stages for each of the four anadromous species, the flows provide habitat for spawning, incubation, rearing, migration and adult fish holding. The flow regime includes not only minimum instream flow requirements but also adaptive provisions for allocation of supplemental flows above minimums in accordance with real time hydrologic conditions and biological need. Instream flow management is guided by the multi-agency Cedar River Instream Flow Commission (IFC).

It is important to note that, as used in the HCP, the term *minimum flow* does not connote an instream flow that provides only minimum habitat or benefit for fish. Rather, such flows represent commitments to minimum levels of instream flows that the City will allow to occur. These *minimum* flows are designed to provide substantial benefit and habitat for the fish species addressed. As used in the HCP, *supplemental flows* are increases above minimums that are believed to provide even greater benefits during certain times of the year. The combination of minimum and supplemental flows is termed *guaranteed flows.*

In addition to these guaranteed river flows, the HCP instream flow management commitments provide the following measures:

- Limit rates of decrease in river levels (down-ramping) to minimize the risk of stranding fish in shallow areas
- Guaranteed flows in the "bypass reach" between the Masonry Dam and the Cedar Falls Hydroelectric Plant
- Create the Cedar River Instream Flow Commission (IFC), comprised of representatives from federal, state, local and tribal resource agencies, which will assist the City in carrying out its responsibilities for managing the Cedar River for fish and people
- Develop and implement a research and monitoring program (known as "Supplemental Studies") to support SPU and the IFC in the management of water supply and river flows in the Cedar River
- Move the measurement (compliance) point for flows in the lower river from Renton, at the mouth of the Cedar River, to Landsburg to more closely align SPU's responsibilities with its capabilities and authority and to provide more natural flow patterns for aquatic resources in the lower river
- Provide funding for: 1) improvements at the Ballard Locks to increase survival of young fish as they migrate to sea; 2) to protect and restore habitat in the Cedar River Basin downstream of the Landsburg Diversion Dam; 3) to develop water conservation messages for the public related to protecting fish and fish habitat; and 4) to modify hydroelectric facilities at Cedar Falls and Masonry Dam for additional fish protection.
- Evaluate the potential permanent use of "dead storage" in Chester More Lake reservoir (water below the elevation of gravity out-flow) for improved instream flows and water supply

HCP Program Element: Implementation of the Cedar River Instream Flow Agreement and Workings of the Instream Flow Commission
HCP Program Category: Instream Flow Management

Contact: George Schneider, Water Resource Manager; Rand Little, Senior Fisheries Biologist, Water Management Section

Objectives & Goals
The City of Seattle influences river flows in the Cedar River through its water supply and hydroelectric operations within the municipal watershed. Water from the Cedar River is used by about two-thirds of the City's 1.3 million customers in King and Snohomish Counties. The objective of the Instream Flow Agreement of the HCP is to provide highly beneficial conditions for instream resources, while preserving Seattle's water supply and power generation capabilities. We intend to meet this objective, using an extensive, collaboratively developed, scientific information base coupled with an adaptive approach to instream flow management that is supported by continuing research, management flexibility and effective oversight.

Status of Work (2003)
The ***Instream Flow Agreement (IFA)*** established a body to assist the City in carrying out its river management responsibilities. ***The Cedar River Instream Flow Commission (IFC)*** was first convened in July 2000, and has met, on average, every month since then. In HCP Year 3, the IFC participated in real-time stream flow management decisions, guided the development and implementation of supplemental studies and other technical analyses, and monitored compliance with the IFA. Meetings are chaired by SPU (George Schneider, chair; Rand Little, vice-chair) and have been very well attended. Organizational membership is as follows:

NOAA Fisheries – Voting Member
U.S. Fish and Wildlife Service – Voting Member
Washington Department of Fish and Wildlife – Voting Member
Washington Department of Ecology – Voting Member
Muckleshoot Indian Tribe – Voting Member
City of Seattle – Voting Member (representing both Seattle Public Utilities and Seattle City Light)
Corps of Engineers – Non-voting Member
King County – Non-voting Member

The Cedar produced large numbers of juvenile chinook and sockeye in the spring of 2003, indicating good conditions for salmon spawning, incubation and emigration (Table 1 and Figure 2). Although the return of spawning adult steelhead in the spring was again disappointing, all steelhead redds were protected from dewatering with the application of supplemental stream flows. Spring, summer and fall instream flow management efforts were complicated by the need to mitigate the effects of extremely poor snowpack, early snowmelt and an exceptionally warm and dry summer. This was complicated by the need to coordinate all activities with the construction of fish passage facilities at the Landsburg diversion dam, construction and testing of fish and flow protection facilities at the Cedar Falls powerhouse and the construction of new water treatment facilities at Lake Youngs.

Despite the difficult summer conditions, sufficient storage was available to augment stream flows to levels that were significantly higher than estimated natural unregulated flows during much of the early portion of the salmon spawning season in the fall. With the fortunate timely return of the fall rains in late October, we were able to continue to supply supplemental high normal flows throughout the salmon spawning season. Flood storage capacity was maintained at sufficient levels throughout the fall and early winter to moderate the detrimental effects of several large storm events that caused substantial egg mortality in many river systems in the Puget Sound region. Preliminary reports from WDFW indicate

that the 2004 emigration of naturally produced Cedar River sockeye fry may be the largest since the annual counts began in 1992 (Figure 2).

While the early news on juvenile salmon production is encouraging hydrologic conditions began to deteriorate significantly throughout Western Washington during March and April of 2004. While it appears that reservoir storage conditions will be near normal at the start of the summer drawdown season, watershed conditions are unusually dry. Unless conditions change, we are likely to see continued low reservoir inflows and rapid depletion of reservoir storage through the summer months of 2004.

The third ***Annual Compliance Report*** was prepared for the IFC and delivered in March 2004. It demonstrates that SPU was in full compliance with all applicable IFA minimum flow provisions. Four out of the five annual supplemental flows volumes were provided in 2003. With very dry conditions developing in the late spring and early summer, the IFC agreed to forgo allocation of the ***non-firm supplemental summer block*** of water to help better position the system for meeting the needs of returning salmon in the fall. The ***firm supplemental summer block*** of water was fully allocated and was sufficient to provide 100% dewatering protection for all steelhead redds throughout the steelhead incubation period.

During 2003, we experienced 5 distinct events in which downramping provisions were slightly exceeded at Landsburg Dam. Three of these events were directly associated with operations of tainter gates at the Landsburg Dam in support of fish passage facility construction and start-up operations. Two events were the result of inadvertent operational errors (please see page 10 in the attached HCP Year 3 Annual Flow Compliance Report).

The HCP also directs SPU to manage average annual Cedar River diversions in the 98 to 105 mgd range for the first five to ten years of the HCP. ***In calendar year 2003, mean annual diversion was 83 mgd*** ; in calendar year 2002, mean annual diversion was 79 mgd; in 2001, with water use curtailments in effect for the summer, mean annual diversion was 90 mgd; in 2000, mean annual diversion was 93 mgd.

With the passage of anadromous fish above the Landsburg Diversion Dam came new operating requirements below Masonry Dam and the Cedar Falls Powerhouse. A new fish flow valve installed in the Masonry Dam in early 2003 began providing continuos flow of at least 30 cfs in the "canyon reach" (which is below the lower Cedar Falls ending at Cedar Falls Powerhouse) starting in September 2003. Also, new downramping requirements below Masonry Dam and below Cedar Falls Powerhouse were initiated in September 2003. During the 2003 compliance period, we experienced one distinct event in which downramping provisions were exceeded below the Cedar Falls Powerhouse due to inadvertent operational errors (please see page 8 in the attached HCP Year 3 Annual Flow Compliance Report). For additional information, please see following section titled: **Improvements to the Cedar Falls Powerhouse and Masonry Dam.**

Looking ahead: Planned 2004 accomplishments:

The IFC will continue its work in all of the areas that it has been involved with so far. Considerable focus will be on advancing the research and technical study program (see following section). In 2004, the City will try to achieve the goals related to water rights, i.e.; dedication of 100 mgd of the Cedar claim to instream uses, and modification of the water right permit for the dead storage temporary pump plant to reflect the HCP and IFA

Financial Summary:

This is not an HCP cost commitment. Thus there is no financial summary for this activity.

Figure 1 – Cedar River Mean Daily Stream Flow – 2003

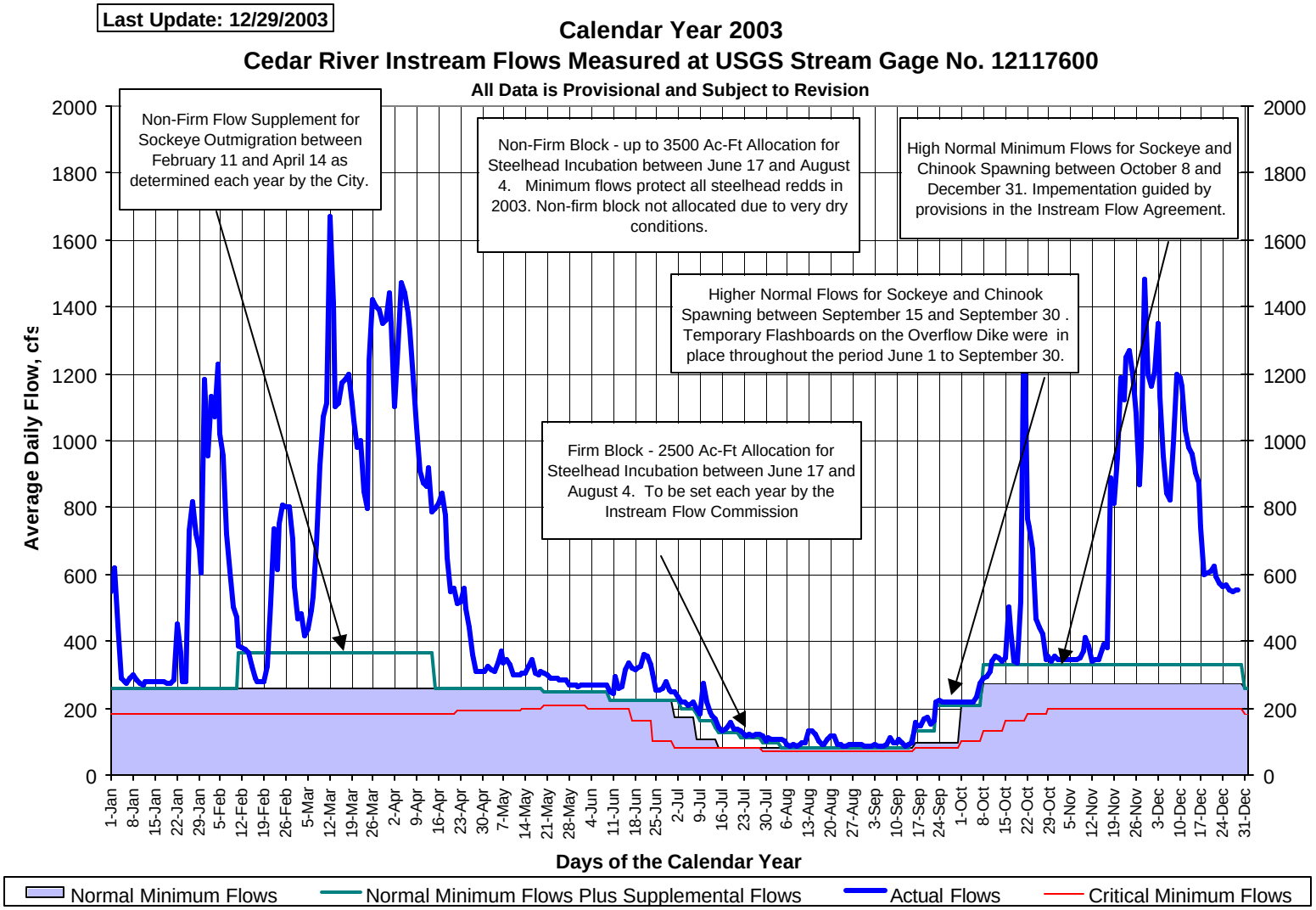
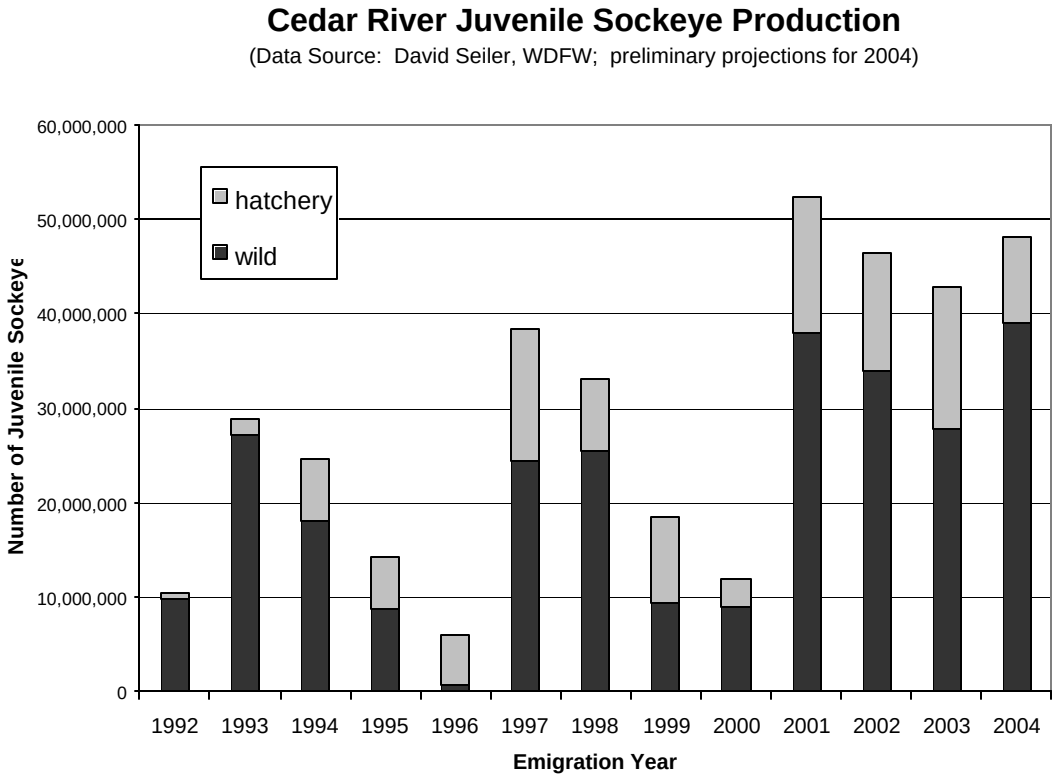


Table 1: Lake Washington Juvenile Chinook Salmon Production

Cedar River Juvenile Chinook Production Source: David Seiler, WDFW (2002, 2003 data preliminary)			
Outmigration Year	Estimated No. of Spawning Females	Estimated No. of Juvenile Emigrants	No. of Juveniles per Spawning Female
1999	173	80,932	468
2000	180	64,723	360
2001	53	32,249	608
2002	395	126,473	320
2003	266	235,397	885

Bear Creek Juvenile Chinook Production Source: David Seiler, WDFW (2002, 2003 data preliminary)			
Outmigration Year	Estimated No. of Spawning Females	Estimated No. of Juvenile Emigrants	No. of Juveniles per Spawning Female
1999	159	15,148	95
2000	293	32,220	110
2001	133	11,157	84
2002	276	22,390	81
2003	N/A	17,313	N/A

Figure 2: Cedar River Sockeye Salmon Fry Production



HCP Program Element: Chinook/Supplemental Biological Studies and Steelhead Redd Monitoring Projects (N663308 & N663309)
HCP Program Category: Instream Flow Monitoring and Research

Contact: Rand Little, Senior Fisheries Biologist; Karl Burton, Fisheries Biologist; Water Management Section

Objectives and Goals

The HCP instream flow management program on the Cedar River attempts to provide certainty for instream resource protection through the implementation of the guaranteed flow regime based on more than 10 years of collaborative study and analysis. The program also provides flexibility to improve and adapt management practices as new information becomes available. The HCP provides this flexibility by placing limits on municipal diversions, providing funding for continued study, and by collaborating with the Cedar River Instream Flow Commission in using new information from a suite of supplemental studies to adapt and improve instream flow management practices in the future.

Soon after its inception in July of 2000, the IFC developed the following objectives for the supplemental studies in support of ongoing efforts to adaptively manage instream flows in the Cedar River:

- Continue to increase our understanding of the relationships between stream flow and habitat conditions in the Cedar River, with an emphasis on chinook salmon and other naturally reproducing salmonids
- Support effective allocation of the "firm" and "non-firm" blocks of water during the summer
- Help guide the allocation of available water above guaranteed levels
- Help address several remaining technical issues that emerged in the later stages of the HCP development

Status of Work (2000-03)

From the objectives above, the IFC developed 9 study topic areas and 19 specific study questions. Through an iterative process, the IFC spent approximately one year refining and prioritizing the study questions and developing preliminary study scopes for each question. The study topics and questions address four major areas of interest:

- Chinook and sockeye spawning and incubation
- Chinook early life history
- The relative effect of stream flow on water temperature
- The relationships between stream flow and natural ecological processes that shape and maintain riparian and in-channel habitat in altered systems.

This work is summarized in a draft document that was finalized in September of 2001 entitled: *Cedar River Instream Flow Management: Biological Research and Monitoring.* This product is considered a living document that will continue to be revised as it is used to guide the implementation of supplemental studies.

A number of high priority instream flow studies have been conducted HCP years 1, 2 and 3. One of the first studies implemented by the IFC was an investigation of temporal and spatial distribution of chinook salmon spawning activity. This work, initially funded with funds from the HCP, has recently received additional funding support from the King Conservation District and the King County Department of Natural Resources. SPU staff has collaborated with staff from WDFW, the Muckleshoot Indian Tribe and the King County Department of Natural Resources to monitor chinook spawning activity, collect, age, sex and size data from carcasses and record interactions with spawning sockeye in 2000, 2001, 2002 and 2003. SPU and its research partners were successful in obtaining grants from the King Conservation District in 2001 and 2002 and from the King County Department of Natural Resources for work conducted in 2003. These grants covered nearly all costs incurred by SPU during the 2001, 2002 and 2003 chinook spawning study and thus reduced the required amount of Cedar HCP funding. Annual project reports are available for 2000, 2001, 2002 and 2003.

Since 1999, WDFW has conducted a major sampling effort to estimate the number of juvenile chinook emigrating from the Cedar River each year. This project continued in 2003 with funds from King County and the Landsburg Mitigation component of the Cedar River HCP. Information from this project is considered very useful in addressing several instream flow supplemental study questions. This information is perhaps of most immediate interest in addressing one of the top priority questions identified by the IFC: "Are the numbers of recently emerged chinook fry that migrate out of the Cedar River [as opposed to remaining to rear in the river] correlated with stream flow?" The IFC has identified the continued collection of chinook emigration data by WDFW as a key element in addressing this question. Supplemental study funding may be allocated to investigate potential relationships between stream flow and chinook early life history in the Cedar using past WDFW data.. WDFW has also conducted annual enumeration of sockeye fry emigrants from the Cedar River since 1992. The IFC has identified this effort as another high priority information source for instream flow management. If future funding from current sources becomes unavailable, the IFC will consider funding these fry enumeration programs with funding from the HCP instream flow supplemental studies program.

The IFA provides for "firm" and "non-firm" volumes of water to supplement minimum flows during the steelhead incubation period. In order to support decision making regarding this water, SPU, in collaboration with the Washington Department of Fish and Wildlife (WDFW), continued annual steelhead spawning and incubation studies as provided in Section E. 5. of the Instream Flow Agreement. In 2000, 2001, 2002, and 2003 this monitoring program was used by the IFC to allocate the supplemental blocks of summer water in a manner that ensured all steelhead redds in the Cedar River were protected from dewatering. Final reports are available for the results of studies conducted in 2000, 2001, 2002 and 2003.

At the direction of the IFC, SPU entered into an agreement with the U. S. Fish and Wildlife service to conduct juvenile chinook rearing habitat electivity studies on the mainstem Cedar River during the spring of 2002. This study will supplement previous collaborative IFIM, PHABSIM analyses conducted on the Cedar during the late 1980s. Due to relatively high flows during the spring of 2002, and the need for additional information, further field work was conducted in the spring of 2003 and 2004. We expect a draft report on the juvenile chinook habitat electivity studies to be submitted to the IFC in late 2004. We anticipate that this work will help guide the second phase of the study; assessment of the effects of stream flow on juvenile chinook rearing habitat availability.

In 2002, the IFC initiated the first phase of a interesting and challenging effort to explore the relationships between stream flow and natural ecological processes that shape and maintain riparian and in-channel habitat in altered systems. The first step in this process will be to compare a wide range of hydrologic characteristics exhibited by a natural, unregulated flow regime in the Cedar with those exhibited by the present regulated regime. During extensive discussions in 2002, it became clear that developing robust "natural" and "regulated" flow data sets for this exercise will be a significant effort. After much discussion and work, the IFC agreed to contract independent expertise to help guide the development of synthetic "natural" and "regulated" flow data sets. This work was commissioned in early 2003 and a final report providing recommendations on appropriate technical approaches to compiling the data sets was submitted to the IFC in late 2003. SPU is currently developing a draft work plan for compiling the flow data sets. The plan is expected to be submitted to the IFC in the near future with work scheduled to commence later this year.

Looking Ahead (Planned 2004 Accomplishments)

Steelhead spawning and incubation and chinook spawning studies will continue in 2004. SPU, in collaboration with WDFW and King County, has submitted another grant proposal to the King Conservation District to fund chinook spawning surveys in 2004. As mentioned above, WDFW will continue to enumerate emigrating juvenile chinook and the IFC may ask WDFW to begin analyzing past data to investigate potential links between stream flow and early life history characteristics. Juvenile chinook rearing habitat electivity studies are scheduled to be completed in 2004; juvenile chinook habitat availability studies are expected to be initiated in the spring of 2005. The IFC will be working with SPU staff and independent hydrologic consultants as needed to generate "unregulated" and "regulated" flow data sets for the Cedar River. Once these data sets have been created, we will explore differences in the hydrologic characteristics between the two in an effort to better understand the ecological effects of the differences in "natural" and 'regulated" flows in stream channels that have been subject to a high degree of physical alteration.

Several technical/engineering studies to be overseen by the IFC will commence in 2003. These are discussed under the following program element.

Financial Summary

The Year 2 cost commitment for Chinook Studies was $223,020 for Chinook Studies, and $35,400 for Steelhead Redd Monitoring. The actual cost commitment expenditures in HCP Year 3 for the two projects combined totaled $154,537. Successful efforts to secure grant funding for the chinook spawning studies, a delay in a portion of the juvenile chinook rearing studies and a very small return of adult steelhead in 2003 resulted in expenditures below anticipated budget levels.

HCP Program Element: Streamflow Gaging and Technical/Engineering Studies
HCP Program Category: Instream Flow Monitoring and Research

Contact: George Schneider, Water Resources Manager and Alan Chinn, Senior Civil Engineer, Water Management Section

Objectives and Goals

To effectively perform water management responsibilities as well as monitor compliance with conditions of the Instream Flow Agreement, Seattle participates in a ***cooperative stream gaging program*** with the USGS. The IFA requires the maintenance of certain existing stream gages and the installation and maintenance of some new gages. The ***Accretion Flow Study***, a component of the instream flow research and monitoring program that will likely require installation of temporary stream gages, is intended to validate certain hydrologic assumptions that were used in the development of the instream flow regime. The objective of the ***Switching Criteria Study*** is to develop criteria that would be used by the IFC to help decide the appropriateness of moving from a normal to a critical instream flow regime, and to decide between high-normal and low-normal flow regimes in the fall.

Status of Work (2003)

Streamflow Gaging

Existing gages to monitor compliance with elevations and flow and downramping rate requirements were maintained continuously throughout this reporting period.

Accretion Flow Study

The Instream Flow Commission (IFC) and other key participants met at several monthly IFC meetings to discuss the need for the Accretion Flow Study and to design a study plan to carry out continuously over the next 10 years or so. In general, the study will:

- specify the precise inflow assumptions to be evaluated,
- establish and implement a long-term monitoring protocol,
- establish analytical objectives; identify any apparent long-term differences from the assumptions, and
- perform additional investigations and analyses to identify causes of any differences from the assumptions.

An initial level of accretion flow monitoring has already been started. In the lower Cedar River, Seattle maintains three existing stream gages through its cooperative stream gaging program with the USGS. These stream gages continuously record mean daily streamflow data in the Cedar River just upstream of the Landsburg dam (USGS Stream Gage No. 12117500 at river mile 23.4), immediately downstream of Landsburg dam (USGS Stream Gage No. 12117600 at river mile 20.4) and at a location in Renton near the mouth of the river (USGS Stream Gage No. 12119000 at river mile 1.6). Seattle also continuously monitors and records average daily water diversions made at the Landsburg Facilities (river mile 21.9). In addition, Seattle operates and maintains an existing weather station at Landsburg. The data collected at these existing monitoring stations are providing useful information to help characterize the accretion flow patterns in the lower Cedar River. The data will be continuously collected over the study period for analysis purposes.

Figure 1 below is an example of a draft conceptual monitoring and tracking graph that was prepared and regularly updated for the IFC during 2003 using the provisional real-time streamflow data collected at USGS Stream Gage No. 12117600 and USGS Stream Gage No. 12119000.

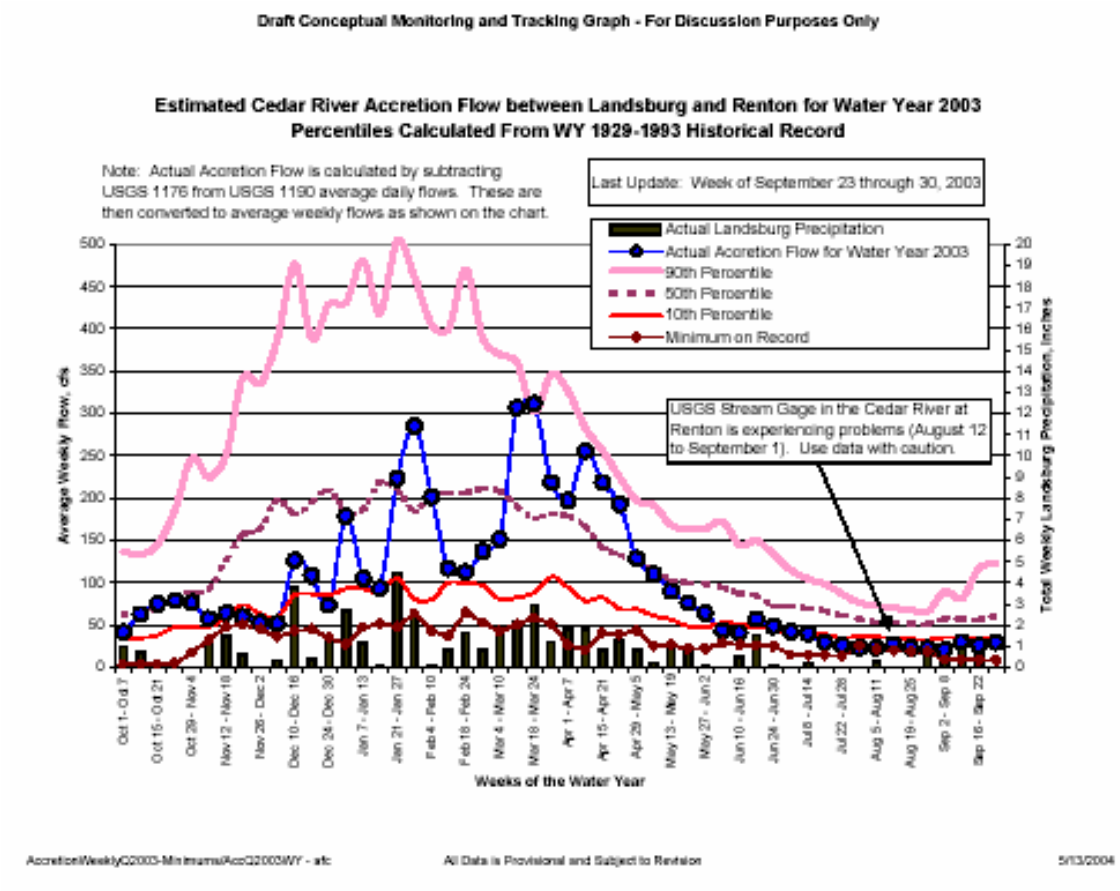


Figure 1. Draft conceptual monitoring and tracking graph for estimating lower Cedar River accretion flow between Landsburg and Renton.

To provide additional field data to help meet other specified study needs and objectives that might be established by the IFC during the study design phase, HCP cost commitments allow for up to three additional temporary stream gages to be strategically installed in the Lower Cedar River between Landsburg dam and Renton. In 2003, the IFC expressed their desire to possibly involve the USGS on various potential phases of this accretion flow study. The USGS was contacted and they indicated that they have researchers who are interested and available to work on this project.

Looking Ahead (Planned 2004 Accomplishments)

The IFC will continue to work on developing a detailed 10-year Accretion Flow Study plan to implement within the resources available. The Switching Criteria Study is expected to begin in 2004. Existing gages will be operated and maintained continuously throughout 2004 to monitor compliance with elevations and flow and downramping rate requirements.

Financial Summary

During HCP Year 3, Seattle Public Utilities and Seattle City Light made cost commitment expenditures for three stream gages. For the existing stream gage above the Cedar Falls Powerhouse, the existing stream gage below the Cedar Falls Powerhouse and the existing stream gage below Landsburg, the City spent $53,195 for gage operations and maintenance to monitoring instream flow and downramping requirements.

For the following activities, there were no cost commitment expenditures made: (see Financial Monitoring Report Comments column for details)

- Temporary Gages in Lower River
- New gage at Renton
- Switching Criteria Study

A total of $1761 was expended toward the HCP cost commitment for the Accretion Flow Study.

HCP Program Element: Cedar Permanent Dead Storage Project Evaluation (C100052 – C 100057)
HCP Program Category: Instream Flow Monitoring and Research

Contact: Daniel Basketfield, Sr. Water Resources Engineer, Water Management Section; Dwayne Paige, Senior Watershed Ecologist, Watershed Management Division

Objectives and Goals

Water stored below the existing outlet of Chester Morse Lake is known as "dead storage". Currently, this significant amount of water can be accessed only by operating the Morse Lake Temporary Pumping Plants, and is permitted only during water shortage emergencies and under other very limited situations. In the context of the Cedar River Instream Flow Agreement, Seattle Public Utilities (SPU) has committed to evaluate use of dead storage to provide additional water for both instream uses and municipal and industrial water supply.

The reservoir currently supports healthy populations of fish and wildlife, including bull trout, which have been listed as threatened under the Endangered Species Act, and approximately one quarter of the breeding loon population in Washington State. Increased frequency and/or deeper reservoir drawdown may prevent bull trout upstream spawning migrations and impair loon nesting during some years. Project elements would include environmental studies, engineering and water rights evaluations, cost estimates, yield analyses, negotiations over instream flow augmentation, and other studies. The environmental impact and mitigation study would include literature search and model effects of increased reservoir drawdown on fish, wildlife, and wetland vegetation over a three-year period. If lower than usual drawdown occurs during the study period, effects on biota would be directly observed.

Status of Work (2003)

In early 2002, at the recommendation of the IFC, The Parties to the IFA approved the ***first amendment to the IFA.*** The amendment extended by five years the overall schedule for completion of the full suite of dead storage-related studies. It was agreed that certain aspects of the environmental evaluation that were proposed should proceed at the original schedule. These relate to impacts of reservoir drawdown on resident species and plant communities. These studies are relevant even without the development of permanent dead storage since low reservoir conditions may occur whenever there is a period of severe drought.

The fall and early winter drought of 2002 provided unusual opportunity to observe relatively low Chester Morse Lake elevations. Aerial photos were taken at levels as low as 1538 feet. Significantly, it was observed that the steeply sloped portions of the delta fans, thought to be a potential bull trout migration barrier at reservoir levels as high as 1540 feet, did not present a passage problem at the minimum reservoir level that was reached, around 1537.5 feet.

Looking ahead: Planned 2004 accomplishments:

The approved amendment to the IFA, noted above, calls for commencement of scoping for five environmental components of the Cedar Permanent Dead Storage Project. These components are:

- Dead Storage Study Engineering Assessment;
- Delta Fans Geomorphologic Investigations and Modeling;
- Bull Trout Passage Assistance Plan;

- Pygmy Whitefish/Rainbow Trout Studies;
- Delta Plant Community Monitoring; and,
- Assessment of Common Loon Nesting Habitat

This work will be initiated this year.

In a related project, SPU will be looking into the reliability of the existing temporary pumping plant system at Chester Morse Lake. Experience during last year's drought, when the plants were mobilized but not actually used, showed that some improvements to the existing system may be warranted. The work to evaluate such improvements could also be used to assess some aspects of a permanent dead storage project, so these efforts will be closely coordinated.

If it is determined during the scoping processes that consultants and/or other professional services are required to conduct all or part of these investigations, procedures for hiring such project support can also be initiated during 2003.

Financial Summary:
The recently approved amendment to the IFA delayed the start of cost commitments on this project.

Expenditures toward HCP cost commitments in 2003 were as follows:

Engineering, Water Quality and Economic Studies (C100052)	$4162
Bull Trout Passage Assistance Plan (C100053)	$ 632
Common Loon Nesting Habitat Study (C100056)	$ 84
Bull Trout Spawning Impedance Study (C100057)	$8618

HCP Program Element: Improvements to the Cedar Falls Powerhouse and Masonry Dam
HCP Program Category: Instream Flow Management

Contact: Liz Ablow, Senior Fisheries Biologist; Pat Steele, Project Manager, Seattle City Light

Objectives and Goals

As part of the City of Seattle's HCP, Seattle City Light has been making changes at the Masonry Dam and the Cedar Falls Powerhouse to improve fish habitat within the Seattle's municipal watershed. These are important components of the HCP, as downstream improvements at Landsburg has allowed migrating anadromous salmonids access to this reach of the Cedar River for the first time in nearly 100 years.

Status of Work (2003)

1) Cedar Falls Tailrace Barrier

A tailrace barrier was installed at the Cedar Falls Powerhouse in 2002 to prevent injury to adult salmon and steelhead when anadromous fish passage occurred in 2003 above Landsburg. HCP year-3 accomplishments include:

- Initial tailrace barrier testing of flow characteristics during normal discharge and during flow events were implemented.
- Alterations to tailrace barrier were made, including installation of baffles to dissipate energy during flow events.
- Successful follow up testing occurred after tailrace barrier modifications were made.
- Monitoring of tailrace barrier continues.

2) Cedar Falls Flow Modification

Modification to the dam are required to provide a continuous minimum river flow of 30 cfs in the canyon reach (between lower Cedar Falls and the Powerhouse) and to improve the control system for downramping. These changes include the installation of a new low-level valve in Masonry Dam. HCP year-3 accomplishments include:

- Completed installation of fish flow valve in Masonry Dam.
- Implemented remote control of Masonry dam valves that control flow downstream, control points include the Cedar Fall Powerhouse and the System Control Center located in Seattle.

3) Cedar Fall Emergency Bypass Improvements

This Project will install mechanical devices and electronic controls on the bypass valves in the powerhouse to maintain and regulate flow in the event of a load rejection or load reduction. This will protect against stranding of fish and dewatering of redds as a result of such events. HCP Year 3 accomplishments include:

- Active testing was completed
- Continued monitoring of equipment occurred
- Additional fine-tuning and minor adjustments of the automatic coordination continues

4) Installation of USGS gage

Installation of a new USGS gage upstream of the Cedar Falls Powerhouse is required to monitor the flow for compliance purposes once fish passage above Landsburg occurs. Accomplishments in HCP Year 3 include:

- Rating curve is continuing to be expanded.

Looking Ahead (Planned 2004 Accomplishments)

Most of the project construction was completed in 2002 and 2003. In Masonry Dam the installation and calibration of a flow meter is planned for early 2004. Remote control of the fish flow valve will be activated. Also, the development and installation of an automatic downramp capability for the Howell-Bunger valve in Masonry Dam is planned for 2004.

In the Cedar Falls Powerhouse improvements of the operator interface to the control system are planned. This will improve the operators' ability to more easily respond to events that could cause flow disruptions in the river. For both the Cedar Falls Powerhouse and the Masonry Dam monitoring and fine-tuning of the new equipment will continue.

Financial Summary

The cost commitments for the Emergency Bypass project totaled $385,000; expenditures for the Emergency Bypass project totaled $870,618 in 2003, which combined with previous expenditure totals $2,640,272 (91% of life-to-date expenditures). This is substantially higher then the financial commitment because a decision was made to develop a more reliable emergency bypass system than what was called for in the agreement. For the tailrace barrier, expenditures were originally planned to occur in HCP Year 3 but the project was accelerated to ensure that it would be completed prior to fish passage at Landsburg planned for early fall 2003. The cost commitments for the tailrace barrier totaled $275,000; actual expenditures for HCP year-3 equaled $477,858, which combined with previous expenditure totals $ 1,851,574 (94% of life-to-date expenditures). See Program Element Summary for Streamflow Gaging and Technical/Engineering Studies for financial information on the new stream gage above the Cedar Falls Powerhouse.

HCP Program Element: Conservation Messages for Fish
HCP Program Category: Instream Flow Management

Contact: Rich Gustav, Resource Conservation Division

Objectives and Goals

The goal of HCP marketing efforts is to educate consumers about the importance of their personal water use to our region's salmon habitat. Teaching our customers to use less water enables us to keep more water in the river for fish. Such conservation efforts are being carried out under SPU's 1% Water Conservation Program.

The goal of the 1% Percent Program is to reduce personal and business water consumption one percent every year over a 10-year period with the end result being an overall reduction in water use of ten percent. Such conservation efforts could save approximately 18 million gallons of drinking water per day. Such an amount is the equivalent demand of 130,000 new households or the projected population growth in King County over the next ten years. Keeping water demands lower reduces the demands on water supply by reducing the need for diverting water from in-stream flows. Conserving water is a critical part of our commitment to wise management of natural resources.

Status of Work (2003)

There were a number of public outreach vehicles for distributing salmon related messages. The table below describes the vehicles and messages.

Product	***Type of Promotion***	***General Message***	***Target Audience***	***Size of Distribution***	***Cost***
Bert The Salmon Cartoon	TV Ad	If you use too much water there won't be enough for Bert and his friends. You can save water by turning it off while brushing your teeth, taking shorter showers and watering your lawn only in the early morning or evening.	Families and kids.	280,000 Shown on KOMO TV, KCPQ and WB 22	$25,000
Issaquah Salmon Days Booth	Event promotion	Conserving water is important to our water supply and fish.	Regional Saving Water Partnership customers	250,000 visitors	$2,000
Water Busters Game	On-line interactive game	A race against the clock to help Bert the Salmon and his friends find all the ways to save water in the home so there is more water available for fish: http://www.savingwater.org/waterbusters/	Families and kids	Available to everyone with internet access.	$40,000
Water Supply	Online Interactive map	Educates our customers about where their water	Families and school aged	Online to all regional	$17,000 Develop-

Interactive Map	of our regional water supply.	comes from and how it reaches their homes. This map shows the relationship between fish and drinking water: http://www.savingwater.org/waterconnection/default.htm	children, ages 8 - 13	customers	ment
Water Supply Poster	Printed map of our regional water supply.	Educates our customers on where their water comes from and how it reaches their homes. This map shows the relationship between fish and drinking water	Families and school aged children, ages 8 - 13	2,000 posters	$7,000 Develop-ment and printing
Natural Yard Care	New overview booklet for home owners	Leaving grass clippings, careful watering, using less soluble fertilizers and avoiding herbicides makes the lawn healthier, a safer place for kids and pets, and causes less impact on local bodies of water and salmon.	Residential yard owners in Seattle and purveyor water districts	23,725	$7,300
Why Conserve?	Fact Sheet	People need to conserve water because resources are finite and salmon and other creatures also depend on this water for their survival	Home owners and anyone who pays a water bill	2,000	$600
The "Naturals" brochure series	Printed in-depth guides covering environmentally friendly yard care.	"Smart Watering," "Healthy Soil," "Natural Lawn," "Right Plant," "Compost at Home" and "Natural Pest," all help to educate serious gardeners about landscape practices that reduce water use and eliminate the need for chemicals that can run off and effect our streams and salmon runs.	Hotlines, nurseries, purveyors, The Northwest Flower and Garden Show, and other partners such as King County.	20,855	$9,384
				TOTAL	$108,284

Looking Ahead to 2004

An outreach and educational conservation practices campaign is currently underway for 2004 that targets residential high peak-use water customers by appealing to their desires for beautiful gardens. A second major effort is Northwest Natural Yard Days, which has grown into a two month event promoting natural yard care practices that keep pesticides and other chemicals out of creeks and streams. The event is a partnership with King County and area lawn and yard care retailers. Another major outreach effort involves a newly produced and soon to air Bert the Salmon television ad. The ad will be part of an annual youth-oriented television educational campaign.

HCP Program Category: Instream Flows
HCP Program Element: Locks Improvements - Smolt Passage Improvements and Freshwater Conservation (C100014, C100013)

Contact: Melinda Jones, Strategic Advisor
Resource Planning Division

Goals and Objectives

One of the objectives of the instream flow management component of the HCP is to help support measures that will contribute to improving downstream migration conditions for juvenile salmonids at the Hiram M. Chittenden Locks. The Smolt Passage Improvements project commits funding for smolt passage improvements at the Locks in co-sponsorship with King County and the Muckleshoot Indian Tribe. The Freshwater Conservation project commits funding for a feasibility study and implementation of cost-effective long-term water efficiency improvements at the Locks, with the aim of providing improved fish passage conditions.

Status of Work (2003)

The City continued to provide partial funding and sponsorship, through the joint Corps/City/County Lake Washington Ecosystem Restoration General Investigation Study, for on-going work related to the following: PIT and microacoustic tag field studies to help determine smolt survival by migratory route segment, and other technical field research focused on juvenile salmon migration and habitat upstream and downstream of and through the Locks; regular monitoring and periodic refinement of the operation of the four smolt flumes at the Locks spillway dam; and analyses of approaches for water quantity and water quality modeling.

Looking Ahead (Planned 2004 Accomplishments)

Field work to be completed in 2004 will include a second Smolt Flume Observer Calibration Study and a second Relative Smolt Flume Efficiency Study. Completion of the joint General Investigation Study has been delayed by Federal funding cuts, and may not occur until 2006 or 2008.

Financial Summary

There is no HCP commitment for funding in HCP year 3. Modest expenditures were planned for 2003 and beyond to help support work described above; $15,783 was spent in 2003 for Smolt Passage Improvements and $8,019 was spent in 2003 for Freshwater Conservation.

HCP Program Element: Cedar River Downstream Habitat Protection and Restoration Program (C100015 and C100036)
HCP Program Category: Landsburg Mitigation and Instream Flow Management

Contact: Cyndy Holtz, HCP Program Manager, Resource Planning Division

Objectives and Goals

Protection and restoration of salmonids and their habitat is vital to successful long-term recovery in the Lake Washington Basin. The goal of this program is to protect and restore fish habitat in the lower Cedar River downstream of the City's ownership boundary. Projects will be designed in a manner that will benefit any or all anadromous salmonid species, especially chinook salmon, and enhance natural ecological processes that shape and maintain riparian and aquatic habitat.

Status of Work (2003)

Working closely with King County Cedar Legacy program staff (Department of Natural Resources), a draft legal agreement has been developed between the City of Seattle and King County. The agreement provides the mechanism for the City and County to cost-share equally in the acquisition of habitat lands on the lower Cedar River. A total of 124 individual parcels have been included on an acquisitions priority list, which will guide King County Resource Land Acquisitions staff in carrying out acquisition transactions. The agreement provides that the City will purchase a conservation easement from the County for half the total sale and acquisition costs, which will secure the City's interest in preservation of the land for habitat conservation purposes. The agreement commits the City to contribute $3 million to joint acquisitions with King County. The HCP total commitment under this program is $5.8 million. If this collaborative endeavor proves successful, the contract could be expanded to utilize remaining program funds available. A retroactivity clause has been included in the agreement, which will allow the City to reimburse King County for one-half the cost of acquisition of 11 parcels that the County acquired during the two years that negotiations were occurring with the City. The HCP contribution for these 11 parcels is $500,000.

During 2002 the SPU and King County Cedar River Legacy program staff also collaborated on a jointly-sponsored grant proposal to the U.S. Fish and Wildlife Service under the Cooperative Endangered Species Conservation Fund program. The City and County were awarded $1.5 million of the $3 million total funding requested. This grant award will supplement City and County funds dedicated for this program. The City and County submitted a second funding proposal for the 2004 funding cycle for an additional $1.5 million. Results should be announced this fall.

Looking Ahead (Planned 2004 Accomplishments)

During 2004 the legal agreement and related conservation easement drafts will be finalized and approved by legislative actions of both the City of Seattle and King County Councils. King County acquisitions staff will step-up acquisitions efforts after the City and County legislatures approve the agreement.

Financial Summary

The extended length of time to develop the legal agreement between King County and the City of Seattle deferred expenditures until the third and fourth quarters of 2004. Unexpended HCP Year

2 and 3 cost commitment funds will be expended during 2004 through 2006. The HCP provides funding for this program in two areas: Instream Flows ($3.86 million) and Landsburg Mitigation ($1.93 million). The funds expended toward the HCP cost commitment was $18,392.

HCP YEAR 2 FINANCIAL MONITORING REPORT
(as of year-end 2002)

			50 Year Project Totals		HCP Year 3				
Item #	Project Manager	Project Description	Cost Commitment *(in 2003 $)*	Life-to-Date Cost Commitment Expenditures	Cost Commitment *(in 2003 $)*	Cost Commitment Expenditures	Cost Commitment Over(+) or Under (-) Expenditures	Performance Commitments *(with $ as stated in HCP, in 1996 $)*	Comments
WATERSHED MANAGEMENT									
Watershed Road Improvement and Decommissioning (cost category 1)									
1	Anderson, C	Watershed Road Decommissioning	$5,875,000	$1,040,220	$295,000	$297,319	$2,319	Average 10 miles of road decommissioned per year over 20 years. Fund $250,000 per year for the first 20 years, based on cost of $25,000 per mile for deconstruction.	5.1 miles of road abandoned in 2003.
2	Anderson, C	Watershed Road Improvements	$8,520,000	$1,047,332	$413,000	$413,000	$0	Road repair and improvements, culvert replacement, fish passable stream-crossing structures, slope stabilization, construct new roads to reduce sediment loading to river and streams. Fund $1,750,000 over the first 5 years, based on cost of $2,000 per mile for stabilization and repair, and $600 for each additional installed cross drain. Average annual cost commitment in Years 1-5 is	12.5 miles of roads improved, including culvert installations, road surfacing, ditching and slope stabilization with soil nailing.
3	Anderson, C	Watershed Road Maintenance	$3,846,880	$252,006	$110,450	$82,198	-$28,252	Provide an increased level of maintenance over levels previous to HCP implementation specifically for reducing sediment loading to streams. Fund $468,000 over the first 5 years. Average annual cost commitment in Years 1-5 is $102,960.	Performed maintenance on 42 miles of roads that have potential to impact aquatic system.
		SUBTOTALS	**$18,241,880**	**$2,339,558**	**$818,450**	**$792,517**	**-$25,933**		
Stream and Riparian Restoration (cost category 1)									
4	Beedle, D	LWD Replacement in Streams	$1,149,250	$32,307	$14,750	$22,712	$7,962	Fund $100,000 over the first 8 years, based on estimated cost of $20,000 per project. Average annual cost commitment in Years 1-8 is $13,750.	Developed a system to identify and prioritize aquatic restoration sites and a watershed specific instream habitat inventory system. Completed two LWD projects on Rock Creek.
5	Beedle, D	Bank Stabilization	$890,110	$36,974	$23,310	$25,174	$1,864	Stabilize approximately 200 feet of stream bank per year averaged over the first 8 years. Fund $158,000 over the first 8 years, based on cost of $10,000 per 100 linear feet of stream bank. Average annual cost commitment in Years 1-8 is $21,730.	Developed a system to identify and prioritize aquatic restoration sites and a watershed specific instream habitat inventory system. Removed poorly designed or failed stream drainage structures and redesigned channel for long-term stability for 100 linear feet of stream during road abandonment projects.
6	Beedle, D	Bank Revegetation	$249,500	$36,617	$7,820	$32,301	$24,481	Revegetate approximately 330 linear feet of stream bank per year averaged over the first 8 years. Fund $53,000 over the first 8 years, based on cost of $2,000 per 100 linear feet of stream bank. Average annual cost commitment in Years 1-8 is $7,290.	Planted stream crossings in past road abandonment project areas. Approximately 1950 linear feet were planted with 721 native trees and shrubs.
7	LaBarge, A	Riparian Conifer Underplanting	$249,530	$26,387	$7,380	$12,257	$4,877	Reestablish conifers in riparian and streamside areas for approximately 20 acres per year averaged over the first 8 years. Fund $50,000 over the first 8 years, based on cost of $300 per acre planted. Average annual cost commitment in Years 1-8 is $6,880.	Completed two planting projects on mainstem of Taylor Creek. Approximately 500 linear feet of riparian areas was improved by these projects.
8	LaBarge, A	Riparian Restoration Thinning	$211,840	$24,242	$6,640	$12,209	$5,569	Perform thinning on approximately 18 acres per year averaged over the first 8 years. Fund $45,000 over the first 8 years, based on cost of $316 per acre thinned. Average annual cost commitment in Years 1-8 is $6,190.	Completed Selleck thinning project and 11 acres on unnamed creek in lower watershed. Thinned three acres of dense grand fir along mainstem of Taylor Creek, and seven acres in upper watershed in conjunction with restoration thinning work.
9	Spencer, M	Stream Crossing Projects for Passage of Peak Flows	$1,001,440	$51,647	$18,440	$16,957	-$1,483	Implement approximately 12 stream crossing projects to improve flow patterns per year averaged over the first 8 years. Fund $125,000 over the first 8 years, based on cost of $1,250 per culvert. Average annual cost commitment in Years 1-8 is $17,190.	Completed stream 18 stream crossings, designed to convey 100-year peak flow.
10	Spencer, M	Stream Crossing Projects for Fish Passage	$1,427,600	$605,640	$141,600	$134,214	-$7,386	Implement approximately 4 stream crossing projects to reestablish fish passage per year averaged over the first 8 years. Fund $960,000 over the first 8 years, based on cost of $20,000 to $36,000 per culvert or structural improvement. Average annual cost commitment in Years 1-8 is $132,000.	Removed fish barrier on tributary to Williams Creek at 13 Road. Purchased crossing structure for a Carey Creek project to be constructed in 2004.
		SUBTOTAL	**$5,179,270**	**$813,814**	**$219,940**	**$255,824**	**$35,884**		
Upland Reserve Forest Restoration (cost category 1)									

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11	LaBarge, A	Upland Restoration Thinning	$3,071,430	$671,183	$238,070	$194,732	-$43,338	Conduct restoration thinning on approximately 800 acres per year averaged over the first 8 years. Fund $1,614,000 over the first 8 years, based on cost of $250 per acre thinned. Average annual cost commitment in Years 1-8 is $221,930.	Restoration thinned 1200 acres, primarily in upper watershed.
12	LaBarge, A	Upland Ecological Thinning	$1,176,870	$83,939	$36,880	$14,475	-$22,405	Conduct ecological thinning on approximately 500 acres per year averaged over the first 8 years. Fund $250,000 over the first 8 years, based on a cost of $500 per acre thinned. Average annual cost commitment in Years 1-8 is $34,380.	Completed first ecological thinning project (45 Road Forest Restoration Project) over 157 acres.
13	LaBarge, A	Upland Restoration Planting	$353,070	$19,227	$11,060	$19,227	$8,167	Conduct restoration planting on approximately 31 acres per year averaged over the first 8 years. Fund $75,000 over the first 8 years, based on cost of $300 per acre planted. Average annual cost commitment in Years 1-8 is	Planted 64 acres with diverse conifer and shrub species as part of 45 Road Forest Restoration Project.
		SUBTOTALS	**$4,601,370**	**$774,349**	**$286,010**	**$228,434**	**-$57,576**		
		WATERSHED MANAGEMENT TOTALS	**$28,022,520**	**$3,927,721**	**$1,324,400**	**$1,276,775**	**-$47,625**		
LANDSBURG MITIGATION									
Chinook, Coho and Steelhead Mitigation (cost category 3)									
14	Bachen, B	Interim Chinook, Coho and Steelhead Mitigation	$840,600	$128,159	$106,200	$109,509	$3,309	Between Years 1 and 8, accomplish the following: i) fund the implementation of life history, genetic, demographic and/or ecological studies to fill critical information gaps; ii) implement emergency supplemental production programs designed to help sustain and rebuild populations; and/or iii) other measures deemed appropriate by Parties. Parties agree on form of interim mitigation within two years of initiating discussion (discussion period began 3/29/01).	Work focused on beginning evaluation of spawning adults migrating upstream of the Landsburg Diversion Dam and the production of juvenile fish from the recolonized Cedar River; studying the genetic relationships among rainbow and steelhead trout to conserve and recover native trout species in the Cedar River; and gathering information from PIT-tagged adult salmon returning to Lake Washington.
15	Wells, B	Landsburg Fish Passage *(see note at end)*	$7,476,700	$11,524,062	$3,463,300	$5,232,189	$1,768,889	Complete construction of Fish Passage facilities by the end of Year 3.	Project construction was completed on schedule and all facilities were operational by September 2003.
16	Little, R	Operation of Passage Facilities	$2,773,000	$91,640	$0	$91,640	$91,640	Provide up to $50,000 per year during term of LMA to operate and maintain fish passage facilities.	First adult chinook passed through facilities into upstream habitat on Sept. 19. A total of 79 adult chinook and 47 adult coho salmon passed upstream during 2003 brood year. Operations included genetic sampling of fish prior to passage upstream.
		SUBTOTALS	**$11,090,300**	**$11,743,861**	**$3,569,500**	**$5,433,338**	**$1,863,838**		
Sockeye Mitigation (cost category 4)									
17	Bachen, B	Interim Sockeye Mitigation	$1,192,960	$760,302	$302,080	$321,683	$19,603	Operate existing interim hatchery at Landsburg.	In 2003 the interim hatchery released 15,957,000 fry, one of the largest hatchery releases to date. First known losses to IHN virus occurred early in 2003; losses were confined to small number of incubators. Estimated sockeye returns for 2003 are 150,000.
18	Bachen, B	New Sockeye Hatchery - Design & Construction	$9,015,520	$1,212,841	$376,420	$502,612	$126,192	Initiate design of replacement hatchery in Year 1. Parties agree in Year 3 as to design, capacity, operating guidelines, and adaptive management program. Hatchery facilities will be operational by Sept. 1 Year 5.	Final Environmental Impact Statement was released in March and appealed in April to City Hearing Examiner. Hearing was held in October. Hearing Examiner remanded EIS back to City for further analysis of environmental impacts and development of a Supplemental EIS, scheduled to be available for public review in Fall, 2004.
19	Bachen, B	Operation of Replacement Hatchery	$16,284,000	$0	$0	$0	$0	Provide up to $300,000 per year to operate and maintain the facilities for the term of the LMA. Commitment begins in HCP Year 5.	Commitment begins in Year 5. Completion of hatchery construction scheduled for 2007.
20	Bachen, B	Supplementation Guidelines	$35,200	$11,198	$0	$0	$0	The Parties, in consultation with the AFC, shall develop guidelines to govern the design, construction, operation and monitoring phases of the sockeye fry production program.	Guidelines completed in 2001.

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21	Bachen, B	Broodstock Collection Solutions	$226,000	$110,495	$7,266	$7,266	$0	In Years 1 through 3, develop and evaluate measures to improve sockeye broodstock collection practices.	Work was performed on conceptual design of a replacement broodstock collection facility focusing on stream hydraulics, geomorphology, and efficiency of facility operations. Remaining funds will be used for design of facilities.
		SUBTOTALS	**$26,753,680**	**$2,094,836**	**$685,766**	**$831,561**	**$145,795**		
Downstream Habitat (cost category 4)									
22	Holtz, C	Downstream Habitat - all species	$1,929,700	$17,022	$173,460	$5,330	$0	Provide up to $1,637,000 in HCP Years 2 through 5 to acquire, restore, and/or protect habitat for any or all anadromous fish, especially chinook salmon, in the lower Cedar River outside the City's current property ownership boundary. HCP required implementation schedule is between Years 2 and 5.	Negotiations with King County on a collaborative, cost-sharing land-acquisition agreement. An agreement is expected to be reached in Summer 2004.
		SUBTOTALS	**$1,929,700**	**$17,022**	**$173,460**	**$5,330**	**$0**		
		LANDSBURG MITIGATION TOTALS	**$39,773,680**	**$13,855,719**	**$4,428,726**	**$6,270,229**	**$2,009,633**		
INSTREAM FLOWS									
Powerhouse Improvements (cost category 2)									
23	Steele, P	Emergency Bypass	$385,000	$3,698,009	$0	$870,618	$870,618	Install new equipment to provide bypass flows around its hydroelectric turbines during most emergency plant shutdowns to protect against stranding of fish and dewatering of redds as a result of such events.	Active testing was completed, and equipment monitoring and additional fine-tuning and minor adjustments of the automatic coordination occurred in 2003.
24	Steele, P	Tailrace Rack	$295,000	$2,366,119	$295,000	$477,858	$182,858	Upon construction of fish ladder, install a tailrace rack at the Cedar Falls Powerhouse to protect fish from injury or mortality.	Initial tailrace barrier testing of flow characteristics during normal discharge and flow events was implemented; alterations to tailrace barrier were made, including installation of baffles to dissipate energy during flow events; successful followup testing occurred after tailrace barrier modifications were made; and monitoring of the tailrace barrier continued.
		SUBTOTALS	**$680,000**	**$6,064,128**	**$295,000**	**$1,348,476**	**$1,053,476**		
Ballard Locks Improvements (cost category 2)									
25	Jones, M	Smolt Passage Improvements	$687,500	$579,598	$0	$15,783	$15,783	Commit up to $625,000 for smolt passage improvements at the Chittenden Locks in co-sponsorship with King County and the Muckleshoot Tribe.	City continued to provide partial funding and sponsorship, through the joint Corps/City/County GI Study, for work related to monitoring and refinement of smolt flumes at the Locks, technical field research on juvenile salmon migration and habitat through the Locks, and analyses of approaches for water quantity and water quality modeling.
26	Jones, M	Freshwater Conservation	$1,455,000	$200,545	$0	$8,019	$8,019	Commit to local sponsorship, up to $1,250,000, for the purposes of funding a feasibility study and implementation of long-term water efficiency improvements at the Chittenden Locks.	See comments above under Smolt Passage Improvements.
		SUBTOTALS	**$2,142,500**	**$780,143**	**$0**	**$23,802**	**$23,802**		

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Conservation Messages for Fish (cost category 2)									
27	Gustav, R	Conservation Messages for Fish	$1,767,000	$320,535	$35,400	$108,284	$72,884	Publish or broadcast water conservation messages every summer that emphasize the importance of water conservation to protect fish habitat each year of the HCP.	Several salmon related water conservation public outreach messages, including TV ads, event promotion, booklets, brochures, and on-line games and maps were developed and distributed in Year 3. Costs exceeded the commitment amount because work was included within SPU's larger One Percent Conservation program.
		SUBTOTALS	**$1,767,000**	**$320,535**	**$35,400**	**$108,284**	**$72,884**		
Downstream Fish Habitat (cost category 2)									
28	Holtz, C	Downstream Habitat Protection and Restoration (Instream Flow)	$3,520,000	$72,415	$1,180,000	$13,062	$0	Provide up to $3,000,000 to protect and restore aquatic riparian and floodplain habitat in the lower Cedar River downstream of the municipal watershed.	Negotiations with King County on a collaborative, cost-sharing land-acquisition agreement. An agreement is expected to be reached in Summer 2004. HCP required timeline is between Years 2 and 4.
29	Beedle, D	Walsh Lake Restoration	$313,200	$0	$0	$0	$0	Provide up to $270,000 for restoration of the Walsh Lake system and connecting areas within the municipal watershed (to be matched by King County).	Completed some consultant work in 2002 on fatal flaw analysis for potential re-diversion project.
		SUBTOTALS	**$3,833,200**	**$72,415**	**$1,180,000**	**$13,062**	**$0**		
		INSTREAM FLOWS TOTALS	**$8,422,700**	**$7,237,221**	**$1,510,400**	**$1,493,624**	**$1,150,162**		
RESEARCH AND MONITORING									
Instream Flow Monitoring and Research (cost category 6)									
30	Chinn, A	Existing Stream Gage at Cedar Falls	$290,460	$27,945	$0	$27,945	$27,945	Measure downramping rates immediately below the powerhouse using existing gage at river mile 33.2.	Commitment begins in Year 6, but costs started once fish passage above Landsburg occurred. Gage operations and maintenance to monitor instream flow and downramping requirements is ongoing.
31	Chinn, A	Existing Stream Gages Below Landsburg	$644,370	$37,501	$12,910	$13,295	$385	Monitor flows and downramping rates with the existing gage at USGS station located below Landsburg at River Mile 20.4.	Gage operations and maintenance to monitor instream flow and downramping requirements is ongoing.
32	Ablow, L	New Stream Gage Above Powerhouse	$619,500	$108,429	$0	$11,955	$11,955	Establish a new USGS stream gage near river mile 33.7 just upstream of the Cedar Falls hydroelectric facility tailrace to monitor compliance with the City's commitment to provide minimum rearing flows of 30 cfs for anadromous fish in the bypass reach between Lower Cedar Falls and the powerhouse once fish passage facilities are complete.	Gage operations and maintenance to monitor instream flow and downramping requirements is ongoing, and rating curve continues to be expanded.
33	Chinn, A	New Gage at Renton	$140,200	$0	$10,740	$0	-$10,740	For the purpose of accretion flow monitoring study, monitor flows at existing stream gage at river mile 1.6. If a more suitable location is found near existing gage site, fund installation and temporary operation of a new USGS stream gage.	Installation of new gage will be timed with Accretion Flow Study.
34	Chinn, A	Temporary Gages in Lower River (2)	$150,800	$0	$11,800	$0	-$11,800	Monitor flow at up to two additional locations between Renton and Landsburg for a temporary period as part of the accretion flow study to help monitor accretion flows between Landsburg and Renton. Monitoring will begin when accretion flow study is initiated and will terminate when study is completed by or before Year 13.	Installation of new gages will be timed with Accretion Flow Study.
35	Chinn, A	Switching Criteria Study	$231,000	$0	$59,000	$0	-$59,000	Provide up to $200,000 to sponsor a collaborative analysis of alternatives to switching criteria. It is the intent of the Parties to complete the study, and develop and implement revised criteria no later than the end of Year 4.	The Switching Criteria Study is expected to begin in 2004.

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36	Little, R	Steelhead Redd Monitoring	$280,200	$105,260	$35,400	$20,781	-$14,619	Sponsor annual monitoring of steelhead redds for a period of time until prospective flow guidelines and objectives can be established. Monitor steelhead redds for up to eight spawning seasons beginning in Year 1. Total costs of study will not exceed $240,000.	SPU, in collaboration with WDFW continued annual steelhead spawning and incubation studies as provided in Section E.5. Of the Instream Flow Agreement. Final reports are available for results from 2000-2003 studies.
37	Little, R	Chinook Studies	$1,155,580	$365,786	$223,020	$133,756	-$89,264	Provide up to $1,000,000 to support further study of the effects of certain aspects of instream flow management on anadromous salmonids with special emphasis on additional information about chinook and other salmonids originating from the Cedar River. Funding will be available over a period of up to 9 years.	Work on high priority study topics identified by IFC continued in Year 3. Info. from fall chinook and spring steelhead spawning surveys was used by IFC in allocating supplemental available water to protect all chinook and steelhead redds from dewatering. Juveline salmon migration monitoring results indicate very robust production of juvenile chinook and sockeye from the Cedar River in 2003.
38	Chinn, A	Accretion Flow Study	$471,200	$1,761	$47,200	$1,761	-$45,439	Sponsor a long-term monitoring study to develop a better understanding of inflow patterns throughout the lower river. The study will begin no later than the end of Year 3 and will continue for not less than 10 years. Total costs will not exceed $400,000.	Began discussions and initial development of study plan for 10-year program that is expected to require installation of temporary and possible permanent stream gages. USGS may participate in some phases of this program.
		SUBTOTALS	**$3,983,310**	**$646,682**	**$400,070**	**$209,493**	**-$190,577**		
Chinook, Coho and Steelhead Monitoring and Research (cost category 7)									
39	Bachen, B	Counts at Landsburg Fish Ladders	$129,800	$0	$0	$0	$0	Provide up to a total of $110,000 during the first 12 years after completion of upstream fish passage facilities to monitor adult fish passage and better understand run timing, rate of passage, and rate of recolonization. Commitment begins in Year 4.	Commitment begins in Year 4.
40	Bachen, B	Landsburg Intake Screen Evaluation	$17,700	$0	$0	$0	$0	Provide up to $15,000 to perform hydraulic analyses to refine flow characteristics of the screens to demonstrate conformity with hydraulic parameters established during design of passage facility. Commitment begins in Year 4.	To be conducted in 2004.
41	Donner, R	Drinking Water Quality Monitoring	$136,000	$64,213	$9,380	$9,380	$0	Provide up to $10,000 per year for up to 6 years to implement water quality sampling program to monitor the effects of coho and chinook salmon spawning carcasses on drinking water quality. Provide $60,000 in Year 1 to help fund collaborative studies with NMFS regarding recolonization of habitat within the municipal watershed by anadromous fish.	A gravity fed source of screened water for channel experiments was incorporated into fish passage construction at Landsburg; artificial channel experiments may begin in 2004.
		SUBTOTALS	**$283,500**	**$64,213**	**$9,380**	**$9,380**	**$0**		
Sockeye Monitoring and Research (cost category 8)									
42	Bachen, B	Fry Condition at Release	$108,560	$0	$0	$0	$0	Provide $92,000 total, $2,000 annually, Years 5-50 to study physiological, developmental and morphological similarity between artificial and naturally produced fry.	Commitment begins in Year 5.
43	Bachen, B	Fry Marking and Evaluation	$375,600	$58,954	$23,600	$17,629	-$5,971	Provide $320,000 total, $20,000 annually, Years 1-8, 24-27, 42-45 to study fry to adult survival, spawning distribution.	WDFW issued summary of thermal marking for otoliths of sockeye embryos and alevins for Landsburg Hatchery, documenting 30 thermal codes developed to mark fry at the hatchery for broodyear 2002. Contracted with WDFW for 2003 marking program using goals of program established by the AFC. Performance goals were met at lower cost than commitment amount.
44	Bachen, B	Fry Trapping and Counting	$657,300	$122,066	$41,300	$41,377	$77	Provide $560,000 total, $35,000 annually, Years 1-8, 24-27, 42-45 to study outmigration timing and comparative fry to adult survival for naturally and artificially produced fry.	Provided funding to WDFW to support fry trapping operations on the Cedar River. WDFW provided the draft 2002 Cedar River Sockeye Salmon Fry Production Evaluation in May, 2003. The report provides outmigrant estimates of hatchery and natural origin sockeye in the Cedar River for 2002.
45	Bachen, B	Fish Health	$731,600	$0	$0	$0	$0	Provide $620,000 total; $20,000 annually, Years 5-12, 24--27, 42-45; and $10,000 annually, Years 13-23, 28-41, 46-50; to study risks associated with IHN.	Commitment begins in Year 5.

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46	Bachen, B	Short-term Fry Rearing	$73,700	$61,298	$11,800	$9,257	-$2,543	Provide $65,000 total; $35,000 Year 1; $10,000 annually Years 2-4, to study similarity to naturally produced fry, fry to adult survival.	Research was conducted on fry at the Landsburg Hatchery to learn more about the feasibility and effects of short term rearing. Performance goals were met at lower
47	Bachen, B	Lake Washington Plankton Studies (year-round)	$562,400	$105,017	$47,200	$16,097	-$31,103	Provide $536,000 total; $40,000 annually Years 1-4, 24-27, 42-56; $7,000 annually Years 5-12; to study plankton abundance, distribution periodicity and effects on fry outmigration timing and in-lake carrying capacity.	Final reports completed on 1) Early Feeding Demand and Food Supply of Sockeye Salmon Fry in Lake Washington, and 2) Growth, Distribution and Abundance of Pelagic Fishes in Lake Washington: Results and Evaluation Methods. Contracted with UW for fall survey to enumerate and obtain growth info on juvenile sockeye in Lake Washington. Alternative funding has allowed the HCP funding to be used for (1) juvenile surveys in L. Washington to assess survival and growth and (2) maintaining surveys over a longer period of time into the future than was originally planned.
48	Bachen, B	Lake Plankton Studies (spring)	$66,080	$0	$0	$0	$0	Implement a real time spring plankton monitoring program to determine the most appropriate time to release supplemental fry each spring. $7,000 per year in Years 5-12.	Commitment begins in Year 5.
49	Bachen, B	Adult Survival, Distribution, Homing Studies	$940,000	$140,211	$47,200	$52,292	$5,092	Provide $800,000 total; $40,000 annually Years 1-12, 28-31, 46-49; to study fry to adult survival, spawning distribution.	Otolith were collected from adult sockeye carcasses in 2003. WDFW received funding to carry out 2nd year of pilot study to examine consequences of adult fish behavior on carcass recovery rates.
50	Bachen, B	Phenotypic and Genetic Studies of Adults	$563,400	$65,280	$35,400	$29,014	-$6,386	Provide $480,000 total; $30,000 annually; Years 1-4, 9-12, 28-31, 46-49 to characterize and monitor changes in phenotypic and molecular genetic traits in Lake Washington sockeye populations in the Cedar River and north Lake Washington tributaries.	Evaluation of timing and distribution of adult sockeye as they return to Lake Washington and the Cedar River began in 2003. Sockeye at the Hiram Chittenden Locks fish ladder were trapped and tagged with disk tags, iButton temperature loggers and acoustic transmitters. The project will continue in 2004. Remaining funds will be used to support this project in 2005.
		SUBTOTALS	**$4,078,640**	**$552,826**	**$206,500**	**$165,666**	**-$40,834**		
Watershed Aquatic Monitoring and Research (cost category 5)									
51	Beedle, D	Two-Year Experimental Stream Monitoring	$0	$0	$0	$0	$0	Monitoring completed in 1997.	Monitoring completed in 1997.
52	Beedle, D	Long-Term Stream Monitoring	$541,620	$0	$0	$0	$0	Provide $459,000 over the term of the HCP, up to $50,000 per year to conduct monitoring stream temperature, channel stability, BIBI study.	Commitment begins in Year 4.
53	Beedle, D	Aquatic Restoration Monitoring	$1,032,500	$0	$0	$0	$0	Provide up to $25,000 per year in Years 4-6, and up to $50,000 per year in Years 7-16, 18, 20, 25, 30, 40 to monitor the success of specific projects implemented through the conservation strategies for the aquatic and riparian ecosystem in the HCP.	Commitment begins in Year 4.
54	Paige, D	Bull Trout - Adult Surveys (weir)	$408,000	$11,374	$59,000	$0	-$59,000	Conduct adult surveys at the weir and live-box trap counts in Years 1 through 4.	Continued discussions with USFWS exploring possible use of funds for other bull trout projects.
55	Paige, D	Bull Trout - Adult Surveys (spawning)	$326,900	$95,535	$41,300	$39,724	-$1,576	Conduct spawning surveys in Years 1 through 8.	504 redds were surveyed in 2002-03, more than double the highest previous survey count.
56	Paige, D	Bull Trout - Fry/Juvenile Surveys	$326,900	$51,267	$41,300	$27,165	-$14,135	Conduct juvenile/fry surveys in Years 1 through 8.	Surveys completed, continuing evaluation of fry enumeration methods and techniques.
57	Paige, D	Bull Trout - Stream Telemetry Studies	$140,400	$0	$0	$0	$0	Initiate a 2-year stream telemetry study within Years 2 to 7.	Will begin work in 2005.
58	Paige, D	Bull Trout - Lake Telemetry Studies	$82,600	$0	$41,300	$0	-$41,300	Initiate lake telemetry studies within years 2 to 7.	Will begin work in 2007.
59	Paige, D	Bull trout - Stream Distribution	$69,840	$12,310	$0	$3,655	$3,655	Conduct distribution surveys up to 5 times between Years 1 and 20.	No field work conducted in 2003. Costs include database maintenance/management and data analysis
60	Paige, D	Bull Trout - Redd Inundation Study	$128,700	$56,395	$64,900	$47,283	-$17,617	Conduct bull trout redd inundation and egg mortality study in one or more years during Years 1 through 9, up to $60,000 per year.	Channel topographic survey phase of project initiated and to be completed in 2004.
61	Paige, D	Common Loon Monitoring	$147,250	$10,150	$2,950	$4,500	$1,550	Conduct common loon monitoring on an annual basis throughout the term of the HCP. Average annual cost commitment in Years 1-10 is $2750.	Three artificial nest platforms were deployed in spring. Monitoring documented first successful nest in last three years in watershed. Conducted platform modification experiment.

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		SUBTOTALS	**$3,204,710**	**$237,031**	**$250,750**	**$122,327**	**-$128,423**		
Watershed Terrestrial Monitoring and Research (cost category 5)									
62	LaBarge, A	Assessment of Expanded Forest Stand Data	$87,500	$21,082	$11,800	$12,749	$949	Prepare preliminary design and conduct evaluation in Years 1 through 5.	Assessment of expanded forest stand conducted.
63	LaBarge, A	Assessment of Expanded Forest Attribute Data	$87,500	$16,522	$11,800	$7,934	-$3,866	Design and conduct evaluation of preliminary sampling effort in Years 1 through 5.	Assessment of expanded forest attribute data conducted.
64	LaBarge, A	Augmentation of Forest Habitat Inventory	$87,000	$35,938	$17,700	$25,604	$7,904	Design and conduct sampling program to augment existing forest and habitat inventory data for the watershed in Years 1 through 5.	Design and partial implementation of augmented forest habitat inventory conducted.
65	LaBarge, A Paige, D	Long-Term Forest Habitat Inventory (including old-growth classification and field verification)	$618,020	$66,926	$28,760	$41,764	$13,004	Design program during Years 1-5.	Conducted remote sensing image analysis and field data collection.
66	LaBarge, A	Habitat Restoration - Riparian Forest Development	$395,300	$2,216	$6,880	$2,216	-$4,664	Design and initiate program during Years 3 through 8.	Monitored Webster, Shotgun, and Lost Creek riparian underplanting projects. Installed Permanent Sample Reaches in representative riparian forests.
67	LaBarge, A	Habitat Restoration - Upland Forest Development	$395,300	$14,139	$6,880	$15,183	$8,303	Design and initiate program during Years 3 through 8.	Monitored three HCP projects, including 10-year re-measurement of Sugar Bear Substitution variable retention harvest, upland restoration thinning sites, and upland forest permanent sample plots.
68	Paige, D	Marbled Murrelet - Survey, Old Growth	$88,500	$0	$29,500	$0	-$29,500	Conduct baseline surveys during Years 3 through 8.	Delayed from starting in 2003 as originally planned until 2005 for budget reasons, but still consistent with the timing requirements of HCP.
69	Paige, D	Marbled Murrelet - Baseline Survey, Second Growth	$177,000	$0	$0	$0	$0	Develop and implement sampling plan and conduct field surveys to evaluate habitat potential, and subsequently develop and implement a prioritized sampling plan to document occupancy during HCP years 5 through 8.	Commitment begins in Year 5.
70	Paige, D	Marbled Murrelet - Long Term Surveys	$118,000	$0	$0	$0	$0	Conduct surveys during Years 25 through 28.	Commitment begins in Year 25.
71	Paige, D	Marbled Murrelet - Experimental Habitat Study	$218,300	$0	$0	$0	$0	Development and initiation in Years 7 through 10.	Commitment begins in Year 7.
72	Paige, D	Spotted Owl - Baseline Survey	$88,500	$0	$29,500	$0	-$29,500	Conduct survey during Years 3 through 10.	Delayed from starting in 2003 as originally planned until 2005 for budget reasons, but still consistent with the timing requirements of HCP.
73	Paige, D	Spotted Owl - Site Center Survey	$88,500	$0	$0	$0	$0	Conduct survey in Year intervals 11-20, 21-30 and 31-50.	Commitment begins in Year 11.
74	Paige, D	Optional Species/Habitat Surveys	$177,000	$0	$0	$0	$0	Conduct research in Year intervals 9-20, 21-35 and 36-48.	Commitment begins in Year 9.
75	VanBuren, T	Data/GIS Compatibility	$176,380	$38,998	$7,380	$24,868	$17,488	Integrate data collection formats to make them compatible with watershed GIS systems and provide for mapping and analysis capability in Years 1 through 8.	Created production instance of GIS Oracle database; realigned GIS road layer to agree with orthophotography base; developed Road Information Management System software prototyp; developed database schema for Landscape Information Management System; implemented data model for hydrologic resources in CRMW.
76	Paige, D	Forest Habitat Modeling	$87,560	$18,633	$11,060	$9,667	-$1,393	Design modeling in Years 1 through 8.	Assessed forest growth models, and conducted analysis of historic forest data and forest cruising.
77	Richards, B	Species-Habitat Relations Modeling	$204,500	$49,405	$23,600	$24,047	$447	Evaluate and design modeling in Years 1 through 5.	Investigated potential effects of planned ecological thinning projects on wildlife habitat structure. Evaluated remotely sensed data as potential source of stand composition and structural data.
		SUBTOTALS	**$3,094,860**	**$263,859**	**$184,860**	**$164,032**	**-$20,828**		

HCP YEAR 2 FINANCIAL MONITORING REPORT
(as of year-end 2002)

			50 Year Project Totals		HCP Year 3				
Item #	Project Manager	Project Description	Cost Commitment *(in 2003 $)*	Life-to-Date Cost Commitment Expenditures	Cost Commitment *(in 2003 $)*	Cost Commitment Expenditures	Cost Commitment Over(+) or Under (-) Expenditures	Performance Commitments *(with $ as stated in HCP, in 1996 $)*	Comments
Cedar Permanent Dead Storage Evaluation (cost category 6)									
78	Schneider, G	Engineering, Water Quality, & Economic Studies	$812,000	$4,162	$165,200	$4,162	-$161,038	Conduct engineering studies to address design options, siting, water quality, geology and hydrology, yield analysis, costs and economics, constructibility, reliability, and other factors for development of permanent non-emergency access to water stored below Morse Lake. Commence not later than end of HCP Year 5 and take 10 Years to complete (per IFA amendment), and will not exceed $700,000.	No studies were performed in Year 2; schedule for this work revised per first amendment to the IFA.
79	Paige, D	Bull Trout - Spawning Impedance (Passage Assistance Plan)	$75,400	$632	$15,340	$632	-$14,708	Conduct environmental studies to address potential effects of permanent non-emergency access to water stored below Morse Lake on resident fish and wildlife populations and wetlands. Commence not later than end of HCP Year 5 and take 10 Years to complete. Total costs will not exceed $745,000.	Work scheduled to begin in 2005.
80	Basketfield, D	Bull Trout - Spawning Impedance (Delta Modeling)	$334,950	$0	$85,550	$0	-$85,550	See Performance Commitment for Item #79 above.	Work scheduled to begin in 2004.
81	Paige, D	Pygmy Whitefish/Rainbow Trout Studies	$330,400	$0	$165,200	$0	-$165,200	See Performance Commitment for Item #79 above.	Work scheduled to begin in 2006.
82	Paige, D	Delta Plant Community Monitoring	$93,600	$0	$0	$0	$0	See Performance Commitment for Item #79 above.	Work scheduled to begin in 2004.
83	Paige, D	Common Loon Nesting Habitat Monitoring	$35,400	$84	$0	$84	$84	See Performance Commitment for Item #79 above.	Work scheduled to begin in 2006.
		SUBTOTALS	**$1,681,750**	**$4,878**	**$431,290**	**$4,878**	**-$426,412**		
		RESEARCH AND MONITORING TOTALS	**$16,326,770**	**$1,769,489**	**$1,482,850**	**$675,776**	**-$807,074**		
		HCP GRAND TOTALS	**$92,545,670**	**$26,790,150**	**$8,746,376**	**$9,716,404**	**$2,305,096**		

Note for Item #15: Construction of Intake Screens, Construction of Fish Ladders, Construction of Downstream Passage, and Contingency Fund for Fish Passage Facilities are combined into one project, Landsburg Fish Passage.

Cost Commitment Category	Year 3 Cost Commitment	HCP Year 3 Actual
1. Watershed Management	**$1,324,400**	**$1,276,775**
2. Instream Flow Management	**$1,510,400**	**$1,493,624**
3. Mitigation for Chinook, Coho & Steelhead	**$3,569,500**	**$5,433,338**
4. Mitigation for Sockeye	**$859,226**	**$836,891**
5. Watershed Research & Monitoring	**$435,610**	**$286,359**
6. Instream Flow Research & Monitoring	**$831,360**	**$214,371**
7. Chinook, Coho & Steelhead Research & Monitoring	**$9,380**	**$9,380**
8. Sockeye Research & Monitoring	**$206,500**	**$165,666**
TOTALS	**$8,746,376**	**$9,716,404**

APPENDIX A

ANNUAL COMPLIANCE REPORT
INSTREAM FLOW AGREEMENT
for the
CEDAR RIVER

March 2004

Cedar River immediately above Landsburg Dam (photo by Laura Kelly)

ANNUAL COMPLIANCE REPORT

INSTREAM FLOW AGREEMENT

for the

CEDAR RIVER

March 2004

SEATTLE PUBLIC UTILITIES and SEATTLE CITY LIGHT

HCP YEAR 3

JANUARY 1 through DECEMBER 31, 2003

The City of Seattle influences river flows in the Cedar River through its water supply and hydroelectric operations within the municipal watershed. Water from the Cedar River is used by about two-thirds of the City's 1.3 million customers in King and Snohomish Counties. The objective of the Instream Flow Agreement of the HCP is to provide highly beneficial conditions for instream resources, while preserving Seattle's water supply and power generation capabilities.

The Instream Flow Agreement (IFA), a key element of the Cedar River Watershed Habitat Conservation Plan (HCP) established an inter-agency body to assist the City in carrying out its river management responsibilities. The Cedar River Instream Flow Commission (IFC) was first convened in July 2000, and has met, on average, every month since then. Meetings are chaired by SPU and have been very well attended.

In HCP Year 3, the region experienced severe weather and hydrologic conditions. The year began with the extreme fall/winter drought still unabated, and continued with a poor snowpack accumulation and one of the driest summers ever recorded in Seattle. Through it all, the IFC members participated in real-time stream flow management decisions and monitored compliance with the IFA, while still guiding the development and implementation of complex supplemental studies and other technical analyses. **The efforts of the IFC members are herein recognized for their vital role in achieving the successes in 2003.** Organizational membership and representation is as follows:

- National Marine Fisheries Service – Voting Member (Tom Sibley)
- U.S. Fish and Wildlife Service – Voting Member (Tim Romanski)
- Washington Department of Fish and Wildlife – Voting Member (Gary Engman)
- Washington Department of Ecology – Voting Member (Steve Hirshey)
- Muckleshoot Indian Tribe – Voting Member (Holly Coccoli, Eric Warner, Carla Carlson)
- City of Seattle – Voting Member (representing both Seattle Public Utilities and Seattle City Light) (Liz Ablow, Karl Burton, Alan Chinn, Tom Johanson, Rand Little, George Schneider)
- Corps of Engineers – Non-voting Member (Lynn Melder)
- King County – Non-voting Member (Kelly Whiting)

In addition, it is recognized that it takes many people in an organization to translate good intentions into successful operations. Providing beneficial conditions for fish and other instream resources in the Cedar River is a 24-hour – 365-day a year responsibility. **Special thanks go to staff from:**

- Cedar Falls Headworks (Seattle City Light)
- Water Supply and Treatment Section (Landsburg Operators and Control Center)
- Operations Transition Section
- Watershed Management Division
- Water Management Section

CEDAR RIVER

ANNUAL FLOW COMPLIANCE REPORT

City of Seattle

HCP Year 3

January 1 through December 31, 2003

Seattle Public Utilities and Seattle City Light, for the City of Seattle, present this report to the Cedar River Instream Flow Oversight Commission ("Commission") as documentation of compliance with flow requirements established in the 2000 Instream Flow Agreement (IFA) for the Cedar River. The IFA is part of the City's Cedar River Watershed Habitat Conservation Plan (HCP). Section D.3(a) of the IFA stipulates that an annual compliance report be submitted to the Commission. This annual report covers the period January 1, 2003 through December 31, 2003.

Throughout this report, direct excerpts from the IFA are presented within quotation marks.

Flow compliance is measured at several locations throughout the Cedar River Watershed including:

USGS Gaging Station 12115000 – Cedar River near Cedar Falls, Washington (*this gage located at River Mile (RM) 43.5 measures unregulated inflows to Morse Lake*).

USGS Gaging Station 12115900 – Chester Morse Lake at Cedar Falls, Washington (*this gage located at the Overflow Dike at RM 37.2 measures water surface elevation of Chester Morse Lake*).

USGS Gaging Station 12116400 – Cedar River at Powerplant at Cedar Falls (*this gage located at RM 33.7 immediately upstream of the Cedar Falls Powerhouse measures regulated streamflow downstream of Masonry Dam. Note: Date of installation Oct. 1, 2001*).

USGS Gaging Station 12116500 – Cedar River at Cedar Falls, Washington (*this gage located at RM 33.2 immediately below the Cedar Falls Powerhouse measures regulated streamflow downstream of the Cedar Falls Powerhouse*).

Seattle Public Utilities Diversion - *the volume of water (millions of gallons per day) diverted for municipal use is monitored at the Landsburg Diversion Dam.*

USGS Gaging Station 12117600 – Cedar River below Diversion near Landsburg, Washington (*this gage, located at RM 20.4 measures regulated streamflow downstream of Landsburg Diversion Dam*).

I. INSTREAM FLOWS BELOW LANDSBURG DIVERSION DAM

In accordance with IFA Section B.1.a, the instream flows "consist of two types of commitments by the City. The minimum instream flows or volumes, as described in Sub-sections B.2., B.4., B.6., B.7., and B.8" of the IFA "represent requirements of the City and are referred to as "firm" flows or volumes". "Additional flows or volumes provided to supplement minimum flows, as described in sub-sections B.3. and B.5." of the IFA "represent goals of the City and are referred to as 'non-firm' flows or volumes".

A. Minimum Instream Flows below Landsburg Diversion Dam

Compliance with minimum flow requirements is assessed at one monitoring location within the Cedar River Watershed: USGS Gage 12117600 - Cedar River below Diversion near Landsburg

Requirements

Required minimum flows are shown below for USGS Gage 12117600 and are specified in Sec. B.2.c. of the Instream Flow Agreement.

Compliance

During the reporting period, the project was in compliance with the Instream Flow Agreement for the minimum flow at USGS Gage 12117600. Provisional mean daily flows for the reporting period are shown in Table 1 and graphed in Figure 1. The agreed on operational 2003 minimum instream flow schedule with firm and non-firm flows are shown in Table 2 and graphed in Figure 1.

B. "Non-Firm" Flow Supplement in late Winter and Early Spring for Sockeye Outmigration

"Between February 11 and April 14, the City will, as a goal, expect to supplement the normal minimum instream flows listed in sub-section B.2.c. by 105 cfs at least 70% of the time throughout said period in any year in which normal flows are in effect throughout said period."

Compliance

The City met and exceeded the goal this year by providing more than 105 cfs for supplemental flow 90.5% of the time.

C. "Firm Block" of Water in Early Summer to Supplement Normal Minimum Flows for Steelhead Incubation

"Between June 17 and August 4, in addition to the normal minimum flows listed in subsection B.2.c., the City shall provide such supplemental flow volumes as the Commission may direct, provided that the total volume of such supplemental flows shall not exceed 2500 acre feet of water, and that other procedures and conditions in this sub-section B.4. are met." The agreed on operational 2003 minimum instream flow schedule with firm and non-firm flows are shown in Table 2 and graphed in Figure 1.

Compliance

The City provided supplemental flow volumes as the Commission directed. See Table 1 and Figure 1.

D. "Non-Firm Block" of Water in Early Summer to Supplement Normal Minimum Flows for Steelhead Incubation

"Between June 17 and August 4, in addition to the normal minimum flows listed in sub-section B.2.c, and the "firm block" described in sub-section B.4, the City will, as a goal and under the conditions set forth in sub-section B.5, expect to further supplement normal minimum flows by 3500 acre feet of "non-firm" water in 63% of all years." The agreed on operational 2003 minimum instream flow schedule with firm and non-firm flows are shown in Table 2 and graphed in Figure 1.

Compliance

The current conditions were very dry and fairly severe for unregulated inflows and the City indicated that they would likely decline to accept any recommendations to allocate the non-firm block unless there were very compelling reasons to do so. The Commission voted on July 2 not to allocate the non-firm block. See Table 1 and Figure 1.

For long-term tracking purposes, this goal has been met in 2 years out of 4 (50%). The IFA set 63% as an expectation.

E. Higher Normal and Critical Minimum Flows in September for Sockeye and Chinook Spawning

"In any year in which the temporary flashboards, as they presently exist in the City's Overflow Dike or may hereafter be reconstructed, are in place throughout the period of June 1 through September 30, the normal minimum flows listed in sub-section B.2.c. shall be increased by the amount of 38 cfs between September 15 and 22, and by the amount of 115 cfs between September 23 and 30, and the critical minimum flows shall be increased by the amount of 10 cfs through the period between September 1 and 15."

Compliance

Temporary flashboards were in place throughout the period June 1 through September 30, 2003 and the City provided the additional flows. See Table 1 and Figure 1.

F. Two-Part Normal Minimum Flow Regime in the fall for Sockeye and Chinook Spawning

"Between October 8 and December 31, the City shall provide either high-normal minimum flows of 330 cfs or low-normal minimum flows of 275 cfs, except when flows are reduced to critical minimum flows under the terms of sub-section B.8. More specifically, the City, beginning on October 8, will meet the high-normal and low-

normal flow regimes with the following long-term average frequencies assuming that the critical minimum flow regime will be in effect at a long-term average frequency of one of ten years:"

1. "The City will follow the high-normal minimum flow regime in six of ten years, provided that it may switch down to low-normal in one of those years when actual or forecasted water availability conditions worsen significantly from those projected and understood at the time of the decision to provide high-normal minimum flows."

2. "The City may follow the low-normal minimum flows in three of ten years, provided that it will switch up to high-normal at such time after October 8 if the City determines that improving conditions allow, or when criteria for high-normal are met, whichever comes first."

Compliance

With early October dry conditions, hydrologic switching criteria remained below the levels prescribed for high normal. From October 8 through October 10, the City provided flows that were at or above low normal levels. The City provided high-normal minimum flows exceeding 330 cfs from October 11 through December 31,2003, during the expected peak of the sockeye and chinook spawning season. See Table 1 and Figure 1.

For long term tracking purposes, the following table compares expected with actual performance (expressed as percentage of all years).

Week Period	Actual 2003	Expected High %	Expected Low %	Actual 00-03 High %	Actual 00-03 Low %
Oct 8 - Oct 14	Low	60	30	75	25
Oct 15 - Oct 21	High	60	30	100	0
Oct 22 - Oct 28	High	60	30	75	25
Oct 29 - Nov 4	High	50	40	75	25
Nov 5 - Nov 11	High	55	35	75	25
Nov 12 - Nov 18	High	65	25	75	25
Nov 19 - Nov 25	High	65	25	75	25
Nov 26 - Dec 2	High	70	20	75	25
Dec 3 - Dec 9	High	75	15	75	25
Dec 10 - Dec 16	High	75	15	75	25
Dec 17 - Dec 23	High	80	10	75	25
Dec 24 - Dec 31	High	80	10	75	25

G. Reductions to Critical Minimum Flows

Sub-section B.8 of the IFA "describes the circumstances under which the Parties agree that the City may switch to the minimum flow levels indicated in the column headed "Critical Flows" in the table which appears in sub-section B.2.c., until such time as those criteria may be modified pursuant to section E.4."

Compliance

Although alert level switching criteria were triggered, the City did not switch to the critical flow levels at any time during the reporting period. See Table 1 and Figure 1.

II. OTHER OPERATING AND FACILITY IMPROVEMENTS

A. Instream Flows Above Landsburg Diversion Dam

"After construction of a fish ladder at Landsburg Diversion Dam and subsequent upstream passage of selected species of anadromous fish, the City will provide a minimum flow of 30 cfs on a continuous basis to protect rearing habitat in the Cedar River "Canyon Reach," measured by a new USGS stream gage installed on October 1, 2001, near river mile 33.7 and funded by the City."

Compliance

Fish ladder was completed and operational September 1, 2003. The first anadromous fish passed above Landsburg Diversion Dam on September 19, 2003, which marks the date the City will provide a minimum flow of 30 cfs on a continuous basis in the Cedar River "Canyon Reach."

During the reporting period, the project was in compliance with the Instream Flow Agreement for the minimum flow at USGS Gage 12116400. Provisional mean daily flows for the reporting period are shown in Table 10 and hourly flows are graphed in Figure 4.

B. Downramping Below City Facilities

1. Downramping Below Masonry Dam

a. General

(1) The downramping rates and procedures set forth in this sub-section C.2.a will become effective not later than the end of HCP Year 4 (2004) and will apply to operations at Masonry Dam when flows are less than 80 cfs.

"Adopted ramping rates, criteria and procedures will become effective only after construction of a fish ladder at Landsburg Dam and upstream passage of anadromous fish."

(2) The measuring point for downramping rates at the Masonry Dam will be the USGS gage number 12116400 located below the Dam at river

mile 33.7. For compliance purposes, specific ramping rate values set forth in this sub-section C.2.a will be calculated from provisional real time data and gage error, as determined by USGS, shall be factored into the ramping rate calculation.

(3) The downramping rates and prescriptions set forth in this sub-section C.2.a will not apply when flows exceed 80 cfs

b. Downramping During Normal Operations

(1) Between February 1 and October 31, on an interim basis the maximum downramping flow rate will be two inches per hour. Once the new equipment is in place, the City will undergo downramp testing. The Commission will adopt final ramping criteria once testing is complete, no later than HCP year 4.
(2) Between November 1 and January 31, the maximum downramping flow rate will be two inches per hour.

Compliance

The current year is HCP Year 3 (2003). Fish passage above Landsburg on September 19, 2003 marks when the City will implement the new interim downramping guidelines in the Cedar River "Canyon Reach." There were no significant downramping events for year 2003 subsequent to fish passage above Landsburg. Two events occurred a day prior to passage, and they are shown in Figures 5 and the following table in this section.

Below Masonry Dam: Events exceeding the maximum downramping flow rate of two inch per hour and less than 80 cfs between from September 19 through December 31, 2003.

Date	Hour	Rate per Hour	cfs	Description
9-18	14:00	-5.4"	43	Occurred a day prior to fish passage at Landsburg. The Howell Bunger valve (low level flow) automated system failed when the valve went from 20% to close after a downramping test was successfully completed.
9-18	15:00	-2.5"	25	Same closure as above.

2. Downramping Below Cedar Falls Powerhouse

a. General
(1) The downramping rates and procedures set forth in this sub-section C.2.b will become effective not later than the end of HCP Year 4 (2004) and will apply to operations at Cedar Falls Powerhouse when flows are less than 300 cfs.

"Adopted ramping rates, criteria and procedures will become effective only after construction of a fish ladder at Landsburg Dam and upstream passage of anadromous fish."

(2) The measuring point for downramping rates at the Cedar Falls Powerhouse will be the existing USGS gage number 12116500 located ½ mile below the Powerhouse at river mile 33.2. For compliance purposes, specific ramping rate values set forth in this sub-section C.2.b will be calculated from provisional real time data and gage error, as determined by USGS, shall be factored into the ramping rate calculation.

(3) The downramping rates and prescriptions set forth in this sub-section C.2.b will not apply when flows exceed 300 cfs

b. Downramping During Normal Operations

(1) Between February 1 and June 15, the maximum downramping flow rate will be two inches per hour with no daylight downramping (defined as one hour before sunrise until one hour after sunset).

(2) Between June 16 and October 31, the maximum downramping flow rate will be one inch per hour.

(3) Between November 1 and January 31, the maximum downramping flow rate will be two inches per hour.

c. Downramping during full system shutdown

(1) Based on past experience, full system shutdown at flows less than 300 cfs can be expected to occur one to two times per year due to low flow conditions or for scheduled and unscheduled maintenance or construction projects.

(2) When the lone unit is shutdown the wicket gates close at a prescribed speed (a condition of the machine safety mechanisms), which results in a sudden drop in flow, averaging a total of 25 cfs per occurrence.

d. Swapping load during daytime downramping restrictions

(1) During daytime downramping restrictions there may be a need to swap loads between generators. In most circumstances it is seamless and would not show up as a change in stage. However, there are situations in moving water from one machine to the other, due to the normal shutdown sequence, that can cause a sudden drop followed by an increase, or vice-versa. These are typically short duration occurrences.

e. Extended shutdowns during the February to June 15 time frame.

(1) The City will notify the IFC ahead of time of the circumstances that will require an extended shutdown and discuss the need for leniency on daytime downramping.

Compliance

The current year is HCP Year 3 (2003). Fish passage above Landsburg on September 19, 2003 marks when the City will implement the new interim downramping guidelines in the Cedar below Cedar Falls Powerhouse. There was one significant downramping event for year 2003 as shown in Figures 6 & 7 and the following table in this section.

Below Cedar Falls Powerhouse: Events exceeding the maximum downramping flow rate of one-inch per hour and less than 300 cfs from September 19 through October 31, 2003.

Date	Hour	Rate per Hour	cfs	Description
10-31	9:00	-1.4"	116	Operator error resulted in downramp exceedance.

No downramps exceeded the maximum downramping flow rate of two-inch per hour and less than 300 cfs between November 1 and December 31, 2003.

3. Downramping Below Landsburg Dam

a. "General

(1) The downramping rates and procedures set forth in this sub-section C.2.c will become effective not later than the end of HCP Year 2" (2002) "and will apply to operations at Landsburg Diversion Dam when flows are less than 850 cfs.

(2) The measuring point for downramping rates at the Landsburg Diversion Dam will be the existing USGS gage number 12117600 located below the Dam at river mile 20.4. Not later than the end of HCP Year 2, the City will install equipment to monitor this gage on a "real time" basis. For compliance purposes, specific ramping rate values set forth in this sub-section C.2.c will be calculated from provisional real time data and gage error, as determined by USGS, shall be factored into the ramping rate calculation.

(3) The downramping rates and prescriptions set forth in this sub-section C.2.c will not apply when flows exceed 850 cfs.

b. Downramping During Normal Operation

(1) Between February 1 and October 31, the maximum downramping flow rate will be one inch per hour.

(2) Between November 1 and January 31, the maximum downramping flow rate will be two inches per hour.

(3) The tainter gates will be down and closed during normal operation.

c. During Startup Following Full System Shutdown

(1) Based on past experience, full system shutdown at flows less than 850 cfs can be expected to occur one to two times per year for scheduled and unscheduled maintenance, and at least once per year for forebay cleaning. Shutdowns for construction may also occur depending on the nature of the construction project."

(2) "To minimize risk of cavitation and mechanical damage of equipment at Landsburg Diversion Dam, initial downramping following full system shutdown will be at a maximum of 60 cfs per hour.

(3) Not later than the end of HCP Year 2 and as part of the City's current evaluation of forebay cleaning procedures with WDFW, the City will propose downramping rates and procedures for operation of the tainter gate. After consideration of the City's proposal, the Commission will adopt final ramping criteria, but such criteria must be capable of implementation with existing equipment (for example, the City must have the mechanical ability to ramp at the recommended rate)."

With the accelerated schedule for completion of the fish passage facilities, use of tainter gates to drain the forebay will be very limited. Draining and refilling of the forebay will be accomplished primarily through the operation of the newly installed, vertically hinged, tip-out gate in bay #2 of the Landsburg Dam. SPU proposed and the Commission agreed that downramping provisions associated with forebay draining and refilling would be developed after installation and testing of the new tip-out gate.

Compliance

Current year is HCP Year 3 (2003) and the downramping limits were in effect during this period. There were five significant downramping events for year 2003; they are shown in Figures 2 and 3, Tables 9 (1-3) and the following tables (see next page).

Below Landsburg: Events exceeding the maximum downramping flow rate of one inch per hour and less than 850 cfs between February 1 and October 31, 2003:

Date	Hour	Rate Per Hour	cfs	Comments
May 2	20:00	-1.20”	278	(1) Stop Log Installation
October 17	16:00	-1.20”	354	(3) Max. was 39cfs (non-violation)
October 22	5:00	-1.08”	802	(1) Tainter gate operation
October 28	20:00	-1.20”	354	
October 31	11:00	-1.32”	358	(2), Malfunction

(1) Tainter gate operation – Lowering of the forebay for Landsburg forebay cleaning and construction of fish passage facilities is accomplished by opening tainter gates and the subsequent closure of the gates can drop flows at rates in excess of the requirements because the control of the gate closures is crude and inaccurate with a minimum gate closure of 3 inches. The lower the flow volume at the time of operation, the more difficult it is to perform the operation without exceeding downramping requirements because it takes less volume to drop one inch at lower flows than it would at comparatively higher flows.

(2) Downstream passage gate flow mode malfunction.

(3) Following full system shutdown.

Below Landsburg: Events exceeding the maximum downramping flow rate of two inches per hour and less than 850 cfs between January 1 - 31, 2003 and November 1 through December 31, 2003:

Date	Hour	Rate Per Hour	cfs	Comments
November 17	13:00	-2.28”	321	

C. Municipal Water Use

The HCP provides that “ The City …is dedicated to managing water diversions from the Cedar for the next 5 to 10 years in the same range that water diversions have been for the last five years (98-105 mgd on an annual average basis).”

Compliance

The City was in compliance with the provision in 2003. Actual average annual water diversion in 2003 was 82 mgd. (See Table 6.)

III. MEASUREMENT AND REPORTING

Annual reports are provided to the Commission to evaluate the City's compliance with the terms of the Instream Flow Agreement. "The reports will also include tables of precipitation levels, reservoir in-flow, reservoir out-flow, and Chester Morse Lake levels and usage." These flow and elevation records are described below.

A. USGS Gage 12117600, Cedar River below Diversion nr Landsburg
Data provided in Table 1 and shown in Figure 1.

B. USGS Gaging Station 12116500 – Cedar River at Cedar Falls
Data provided in Table 3

C. USGS Gaging Station 12116400 – Cedar River at Powerplant at Cedar Falls
Data provided in table 10

D. USGS Gaging Station 12115900 – Chester Morse Lake at Cedar Falls
Data provided in Table 4

E. USGS Gaging Station 12115000 – Cedar River near Cedar Falls
Data provided in Table 5

F. SPU Landsburg Tunnel Flow (MG) – Cedar River Landsburg Diversion
Data provided in Table 6

G. SPU Landsburg Weather Station – Precipitation 24 hour Total (inches)
Data provided in Table 7

H. SPU Masonry Weather Station – Precipitation 24 hour Total (inches)
Data provided in Table 8

I. USGS Gage 12117600, Cedar River below Diversion nr Landsburg
Downramping flow data in one-hour increments in Table 9 (1-3)

Figure 1

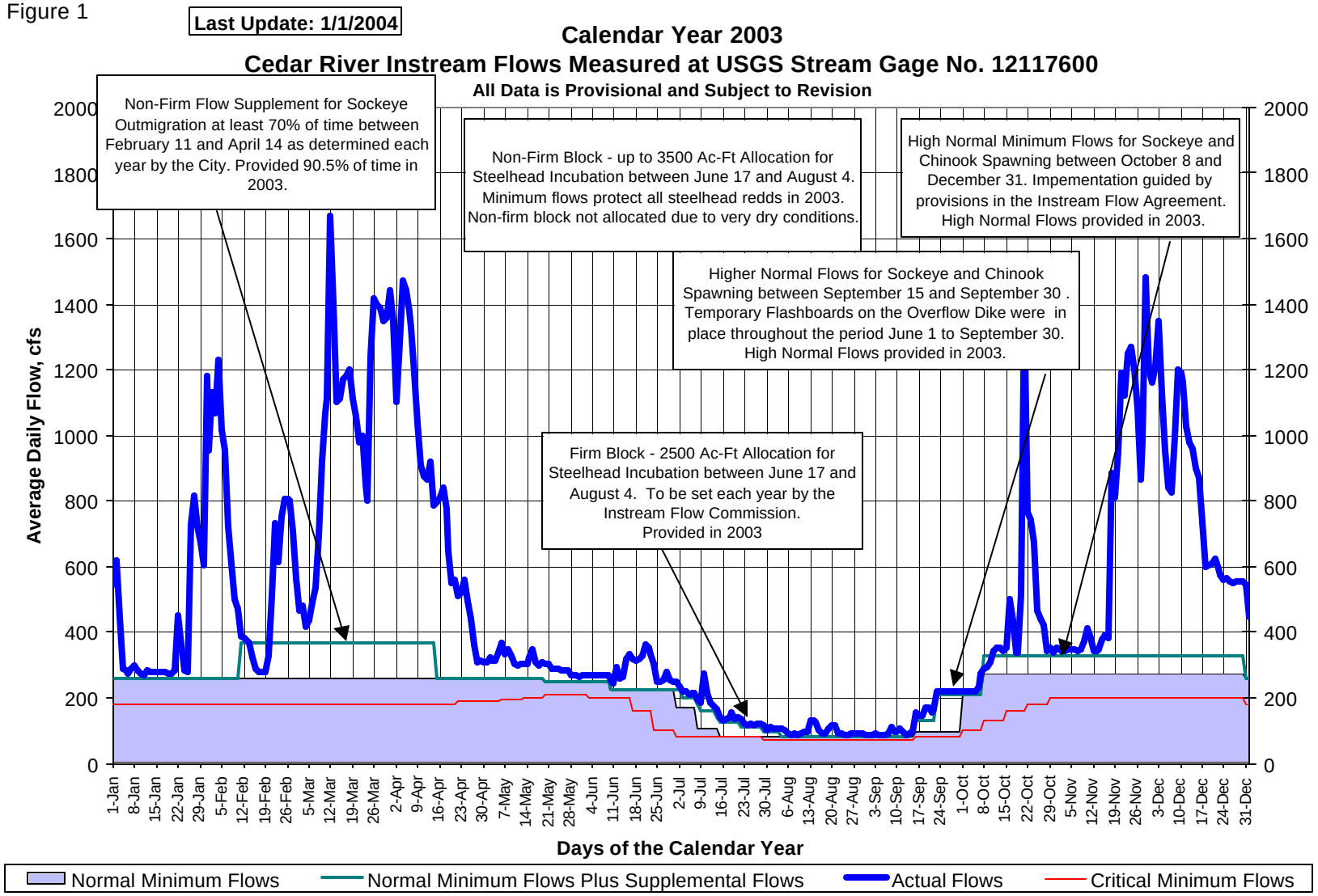
Last Update: 1/1/2004
Calendar Year 2003
Cedar River Instream Flows Measured at USGS Stream Gage No. 12117600
All Data is Provisional and Subject to Revision
Non-Firm Flow Supplement for Sockeye Outmigration at least 70% of time between February 11 and April 14 as determined each year by the City. Provided 90.5% of time in 2003.
Non-Firm Block - up to 3500 Ac-Ft Allocation for Steelhead Incubation between June 17 and August 4. Minimum flows protect all steelhead redds in 2003. Non-firm block not allocated due to very dry conditions.
High Normal Minimum Flows for Sockeye and Chinook Spawning between October 8 and December 31. Impementation guided by provisions in the Instream Flow Agreement. High Normal Flows provided in 2003.
Higher Normal Flows for Sockeye and Chinook Spawning between September 15 and September 30 . Temporary Flashboards on the Overflow Dike were in place throughout the period June 1 to September 30. High Normal Flows provided in 2003.
Firm Block - 2500 Ac-Ft Allocation for Steelhead Incubation between June 17 and August 4. To be set each year by the Instream Flow Commission. Provided in 2003
Average Daily Flow, cfs
0
200
400
600
800
1000
1200
1400
1600
1800
2000
1-Jan
8-Jan
15-Jan
22-Jan
29-Jan
5-Feb
12-Feb
19-Feb
26-Feb
5-Mar
12-Mar
19-Mar
26-Mar
2-Apr
9-Apr
16-Apr
23-Apr
30-Apr
7-May
14-May
21-May
28-May
4-Jun
11-Jun
18-Jun
25-Jun
2-Jul
9-Jul
16-Jul
23-Jul
30-Jul
6-Aug
13-Aug
20-Aug
27-Aug
3-Sep
10-Sep
17-Sep
24-Sep
1-Oct
8-Oct
15-Oct
22-Oct
29-Oct
5-Nov
12-Nov
19-Nov
26-Nov
3-Dec
10-Dec
17-Dec
24-Dec
31-Dec
Days of the Calendar Year
Normal Minimum Flows
Normal Minimum Flows Plus Supplemental Flows
Actual Flows
Critical Minimum Flows

Figure 2

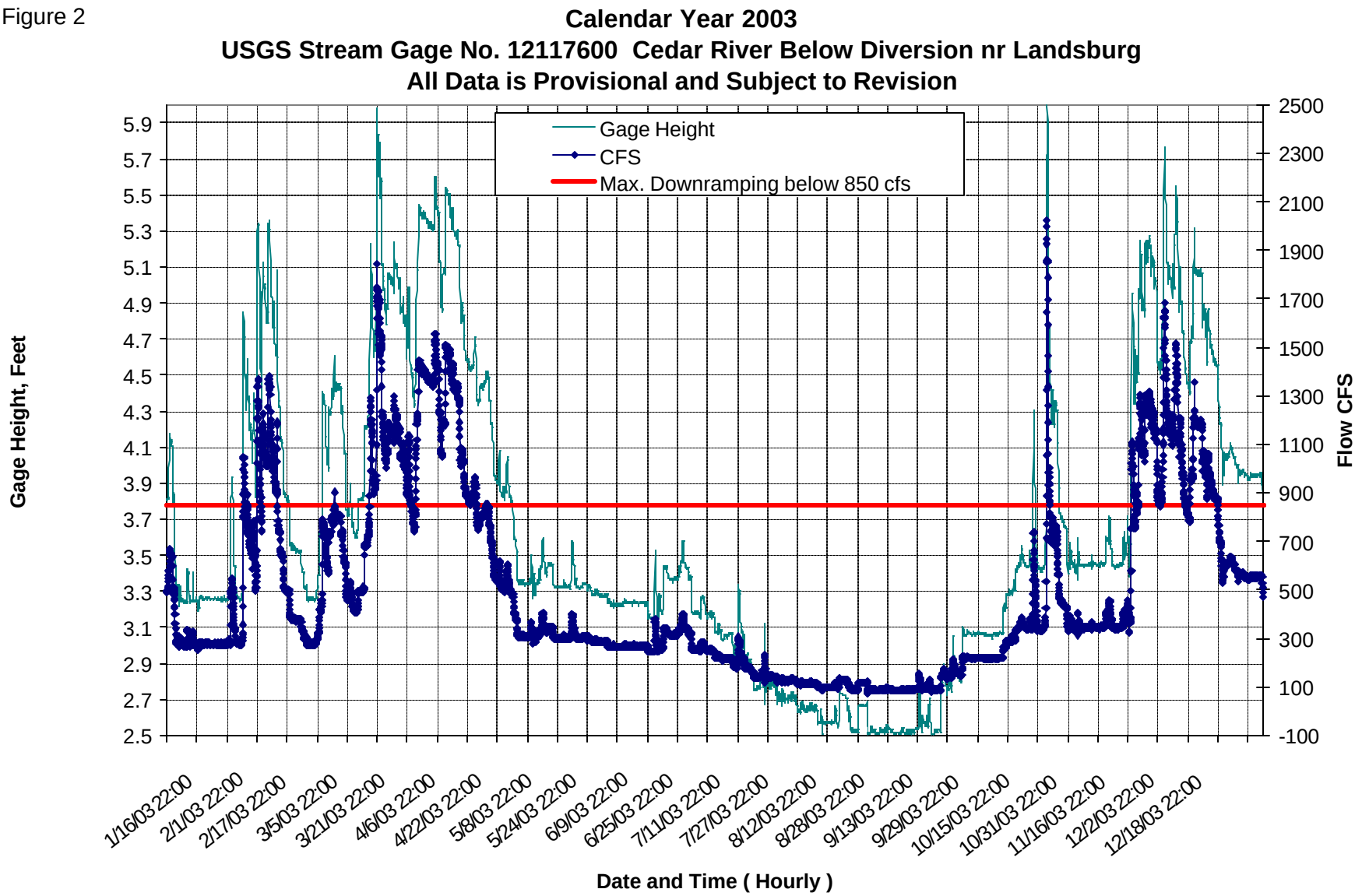
Calendar Year 2003
USGS Stream Gage No. 12117600 Cedar River Below Diversion nr Landsburg
All Data is Provisional and Subject to Revision
Gage Height
CFS
Max. Downramping below 850 cfs
Gage Height, Feet
Flow CFS
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
4.3
4.1
3.9
3.7
3.5
3.3
3.1
2.9
2.7
2.5
2500
2300
2100
1900
1700
1500
1300
1100
900
700
500
300
100
-100
1/16/03 22:00
2/1/03 22:00
2/17/03 22:00
3/5/03 22:00
3/21/03 22:00
4/6/03 22:00
4/22/03 22:00
5/8/03 22:00
5/24/03 22:00
6/9/03 22:00
6/25/03 22:00
7/11/03 22:00
7/27/03 22:00
8/12/03 22:00
8/28/03 22:00
9/13/03 22:00
9/29/03 22:00
10/15/03 22:00
10/31/03 22:00
11/16/03 22:00
12/2/03 22:00
12/18/03 22:00
Date and Time (Hourly)

Figure 3

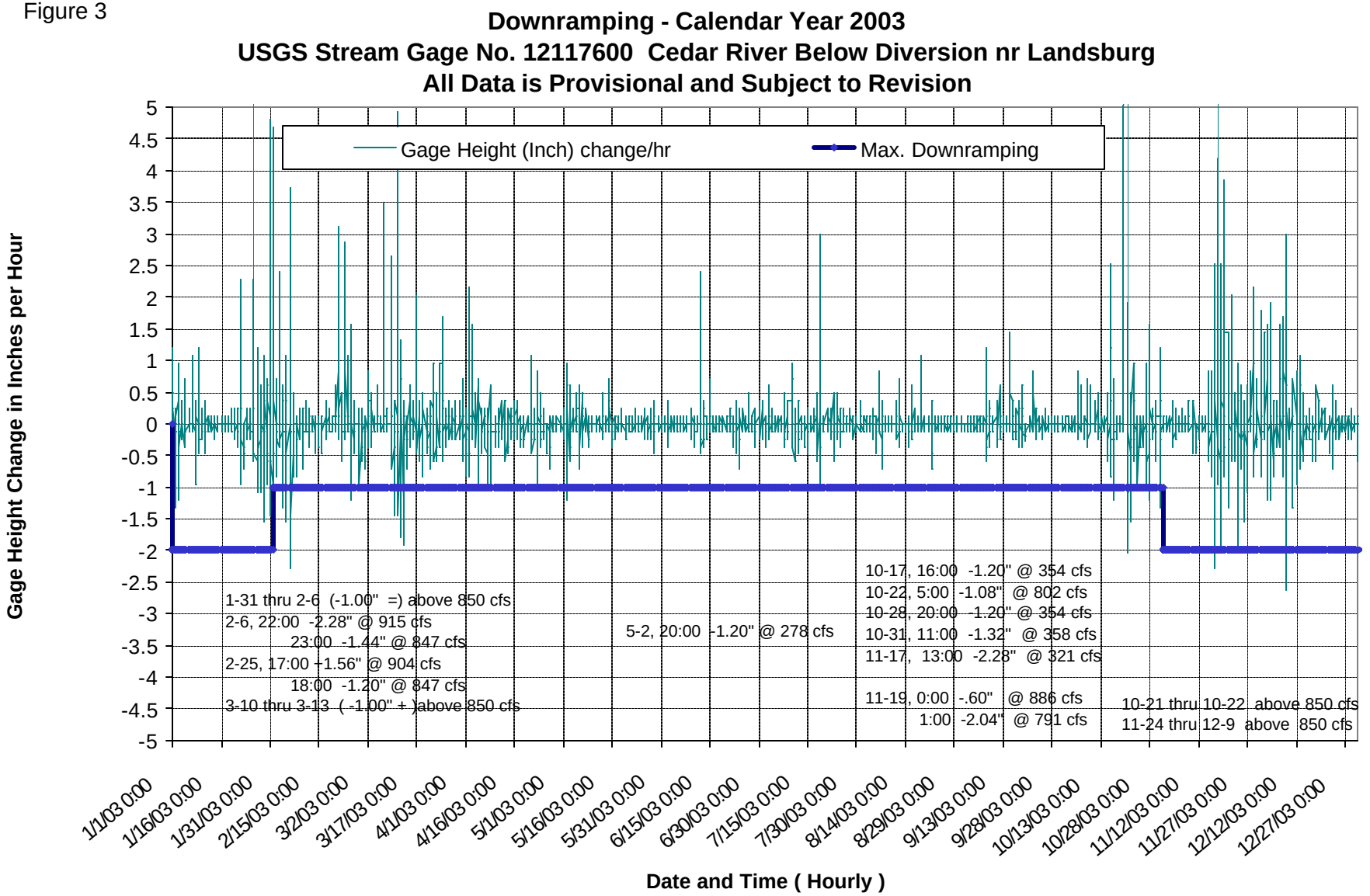
Downramping - Calendar Year 2003
USGS Stream Gage No. 12117600 Cedar River Below Diversion nr Landsburg
All Data is Provisional and Subject to Revision
Gage Height (Inch) change/hr
Max. Downramping
Gage Height Change in Inches per Hour
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
1-31 thru 2-6 (-1.00" =) above 850 cfs
2-6, 22:00 -2.28" @ 915 cfs
23:00 -1.44" @ 847 cfs
2-25, 17:00 +1.56" @ 904 cfs
18:00 -1.20" @ 847 cfs
3-10 thru 3-13 (-1.00" +)above 850 cfs
5-2, 20:00 -1.20" @ 278 cfs
10-17, 16:00 -1.20" @ 354 cfs
10-22, 5:00 -1.08" @ 802 cfs
10-28, 20:00 -1.20" @ 354 cfs
10-31, 11:00 -1.32" @ 358 cfs
11-17, 13:00 -2.28" @ 321 cfs
11-19, 0:00 -.60" @ 886 cfs
1:00 -2.04" @ 791 cfs
10-21 thru 10-22 above 850 cfs
11-24 thru 12-9 above 850 cfs
1/1/03 0:00
1/16/03 0:00
1/31/03 0:00
2/15/03 0:00
3/2/03 0:00
3/17/03 0:00
4/1/03 0:00
4/16/03 0:00
5/1/03 0:00
5/16/03 0:00
5/31/03 0:00
6/15/03 0:00
6/30/03 0:00
7/15/03 0:00
7/30/03 0:00
8/14/03 0:00
8/29/03 0:00
9/13/03 0:00
9/28/03 0:00
10/13/03 0:00
10/28/03 0:00
11/12/03 0:00
11/27/03 0:00
12/12/03 0:00
12/27/03 0:00
Date and Time (Hourly)

Figure 4

Calendar Year 2003
USGS Stream Gage No. 12116400 Cedar River at Powerplant at Cedar Falls
All Data is Provisional and Subject to Revision

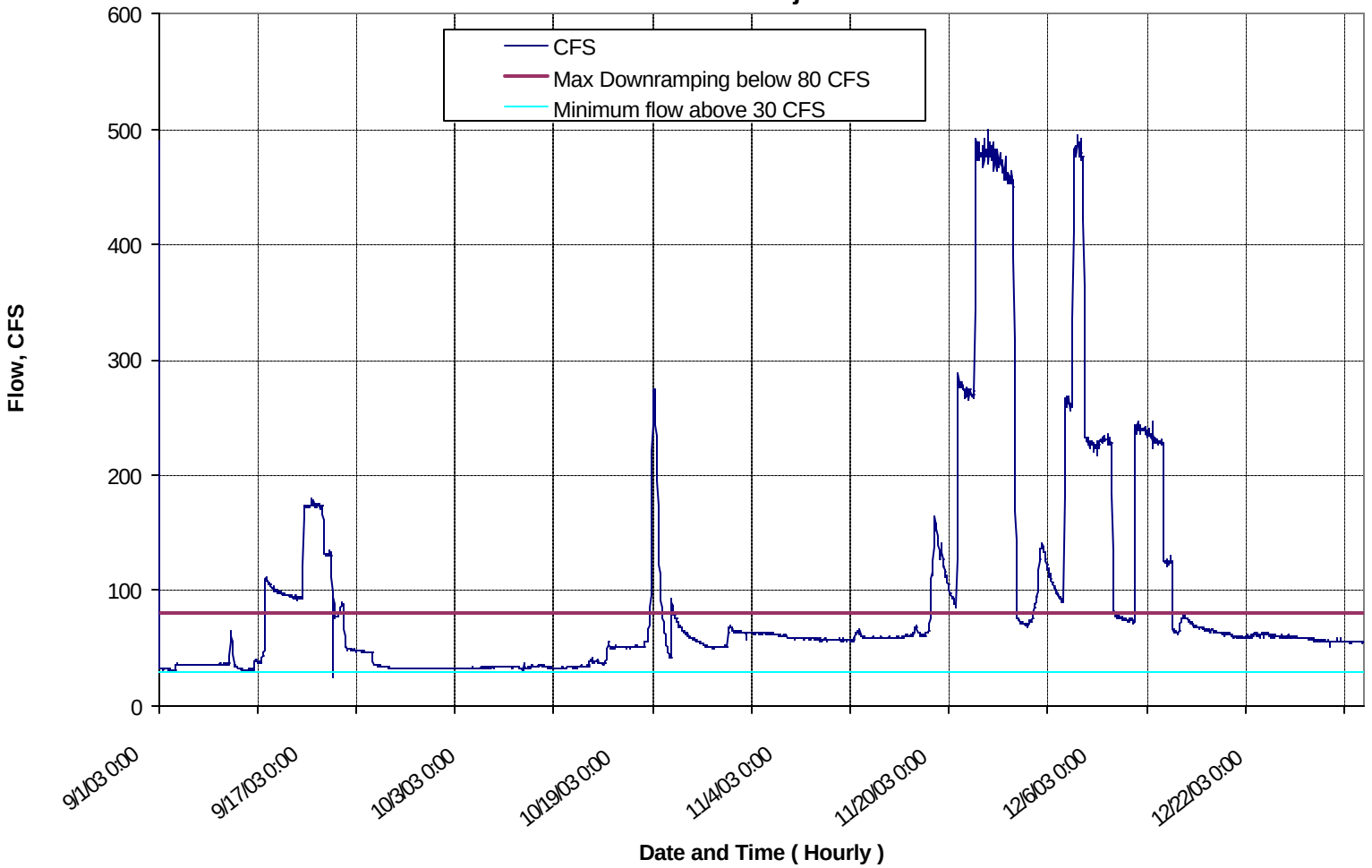

Figure 5

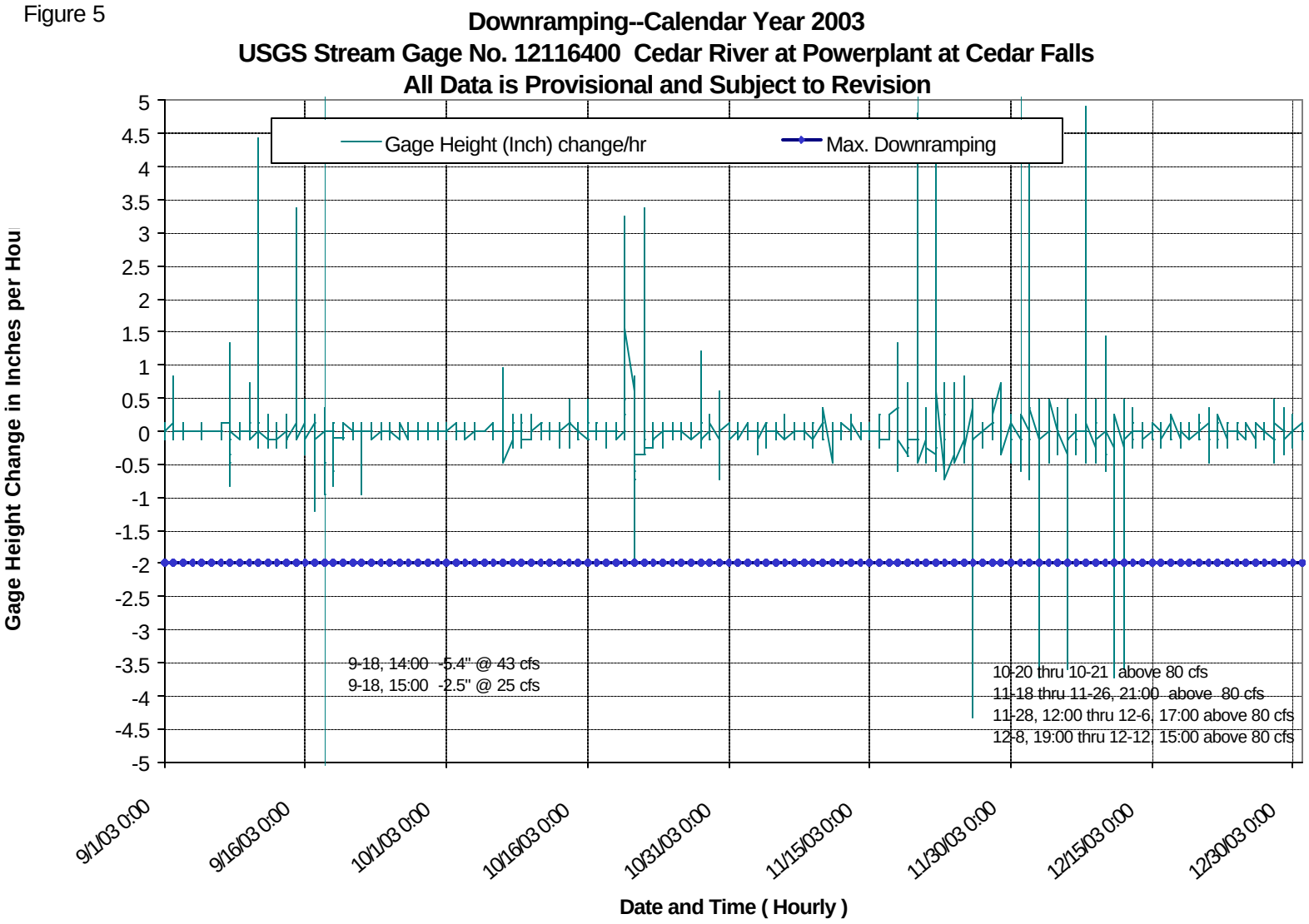
Downramping--Calendar Year 2003
USGS Stream Gage No. 12116400 Cedar River at Powerplant at Cedar Falls
All Data is Provisional and Subject to Revision
Gage Height (Inch) change/hr
Max. Downramping
Gage Height Change in Inches per Hou
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
9-18, 14:00 -5.4" @ 43 cfs
9-18, 15:00 -2.5" @ 25 cfs
10-20 thru 10-21 above 80 cfs
11-18 thru 11-26, 21:00 above 80 cfs
11-28, 12:00 thru 12-6, 17:00 above 80 cfs
12-8, 19:00 thru 12-12, 15:00 above 80 cfs
9/1/03 0:00
9/16/03 0:00
10/1/03 0:00
10/16/03 0:00
10/31/03 0:00
11/15/03 0:00
11/30/03 0:00
12/15/03 0:00
12/30/03 0:00
Date and Time (Hourly)

Figure 6

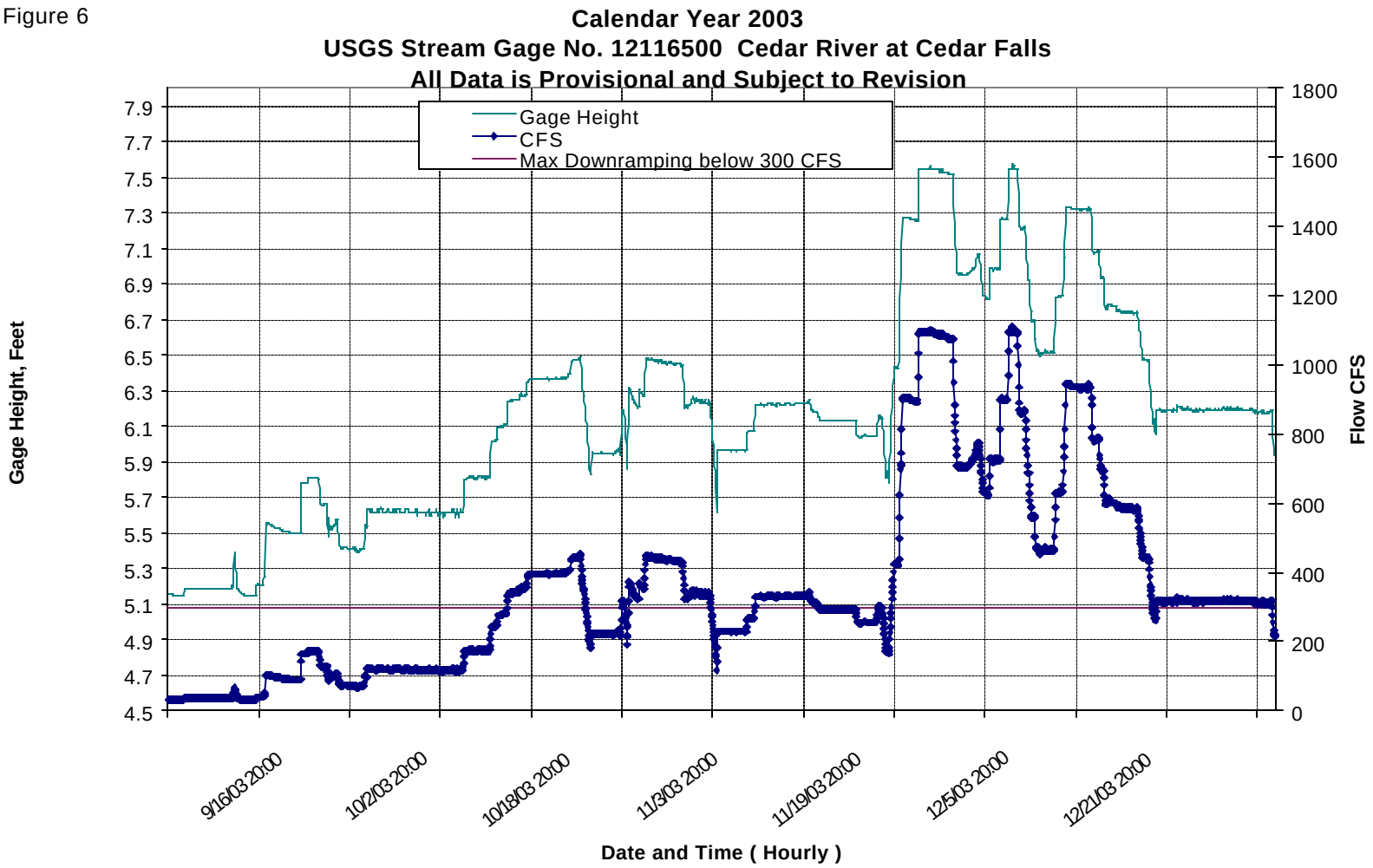
Calendar Year 2003
USGS Stream Gage No. 12116500 Cedar River at Cedar Falls
All Data is Provisional and Subject to Revision
Gage Height
CFS
Max Downramping below 300 CFS
Gage Height, Feet
Flow CFS
7.9
7.7
7.5
7.3
7.1
6.9
6.7
6.5
6.3
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
1800
1600
1400
1200
1000
800
600
400
200
0
9/16/03 20:00
10/2/03 20:00
10/18/03 20:00
11/3/03 20:00
11/19/03 20:00
12/5/03 20:00
12/21/03 20:00
Date and Time (Hourly)

Figure 7

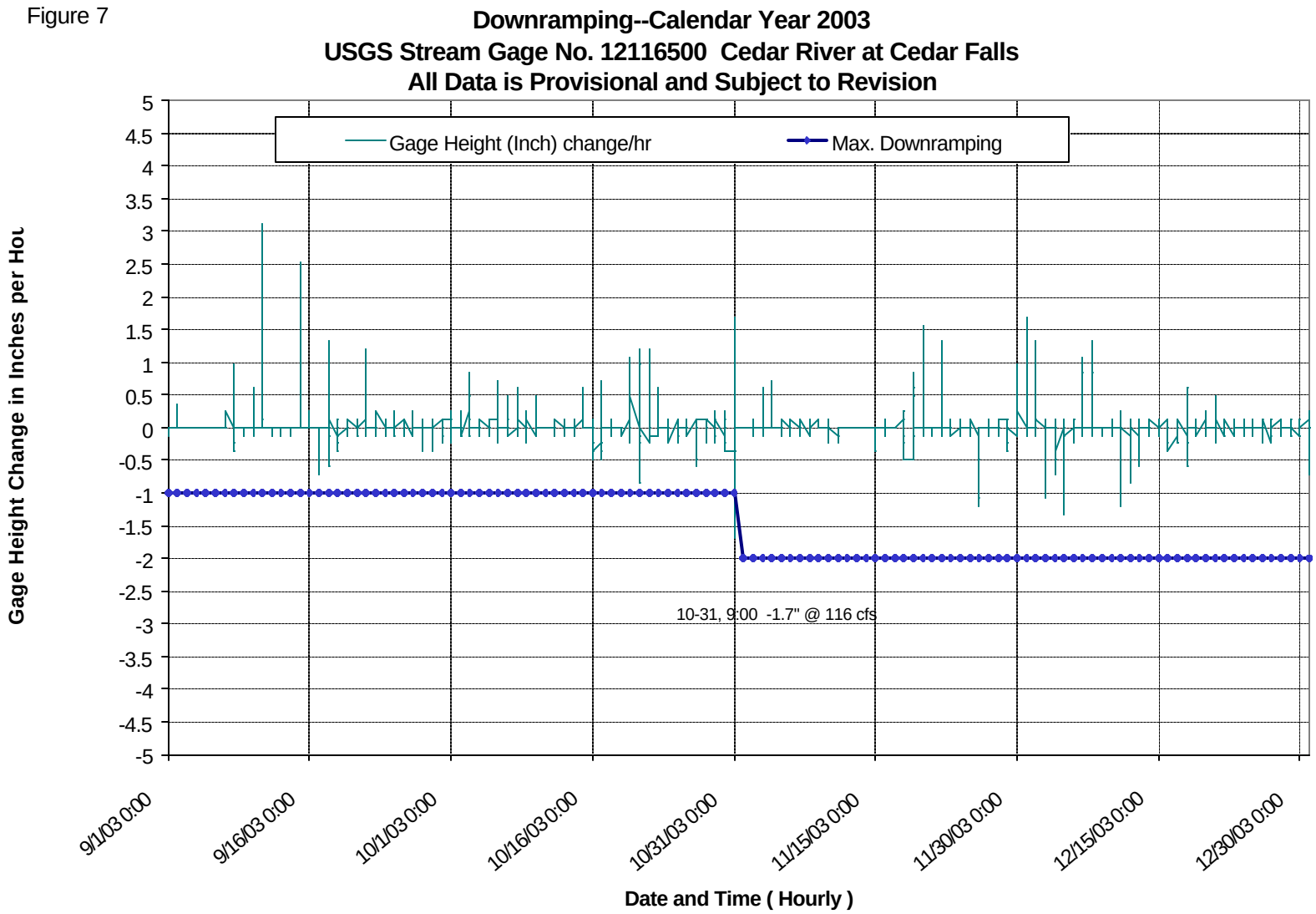
Downramping--Calendar Year 2003
USGS Stream Gage No. 12116500 Cedar River at Cedar Falls
All Data is Provisional and Subject to Revision
Gage Height (Inch) change/hr
Max. Downramping
Gage Height Change in Inches per Hou
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
10-31, 9:00 -1.7" @ 116 cfs
9/1/03 0:00
9/16/03 0:00
10/1/03 0:00
10/16/03 0:00
10/31/03 0:00
11/15/03 0:00
11/30/03 0:00
12/15/03 0:00
12/30/03 0:00
Date and Time (Hourly)

Table 1

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - WASHINGTON STATE NWIS

PROVISIONAL REAL-TIME

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NR LANDSBURG, WA STREAM SOURCE AGENCY USGS

LATITUDE 472247 LONGITUDE 1215856 DRAINAGE AREA 124 DATUM 490 STATE 53 COUNTY 033

PROVISIONAL DATA FROM DCP SUBJECT TO REVISION

DISCHARGE, CUBIC FEET PER SECOND, CALENDER YEAR JANUARY 2003 TO DECEMBER 2003

DAILY MEAN VALUES

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	547	954	565	1350	309	267	250	104	88	218	346	1160
2	617	1130	466	1100	322	270	233	105	88	217	344	1210
3	444	1070	481	1280	313	269	220	108	89	220	345	1350
4	289	1230	415	1470	311	270	218	105	88	219	347	1130
5	281	1020	437	1440	336	270	210	99	86	220	346	953
6	273	954	493	1380	368	269	212	92	88	234	346	841
7	289	723	535	1330	335	269	216	88	90	275	345	824
8	299	608	692	1190	347	269	197	90	112	290	349	995
9	284	502	921	1040	328	270	183	88	98	294	372	1200
10	275	471	1070	908	301	247	276	89	98	307	412	1190
11	269	386	1110	875	300	244	216	96	105	342	384	1160
12	281	380	1670	864	301	292	186	95	97	355	342	1030
13	278	376	1410	918	304	258	177	133	87	351	344	979
14	280	366	1100	785	302	266	166	131	90	342	346	961
15	278	322	1110	797	325	316	141	123	95	351	376	901
16	278	290	1170	811	346	333	132	101	157	501	393	873
17	277	278	1180	841	306	317	136	90	145	437	382	739
18	277	278	1200	775	299	314	140	90	145	338	886	597
19	276	280	1110	647	307	319	155	106	168	337	812	603
20	276	326	1060	548	304	326	135	118	172	516	951	609
21	283	512	981	560	301	362	139	117	154	1400	1190	625
22	451	734	1000	510	289	353	134	92	163	765	1120	596
23	363	615	849	519	289	331	122	91	218	740	1250	572
24	281	753	799	559	290	303	118	88	221	675	1270	561
25	278	806	1240	496	285	251	119	88	220	466	1200	566
26	729	804	1420	440	285	251	117	90	219	440	1080	553
27	818	803	1400	360	283	256	119	90	220	420	867	550
28	722	707	1390	309	271	278	122	91	220	345	979	555
29	674		1350	311	268	253	114	90	220	354	1480	554
30	605		1360	307	267	250	103	89	218	340	1200	555
31	1180		1440		266		109	87		353		546
TOTAL	12752	17678	31424	24720	9458	8543	5115	3064	4259	12662	20404	25538
MEAN	411	631	1014	824	305	285	165	99	142	408	680	824
MAX	1180	1230	1670	1470	368	362	276	133	221	1400	1480	1350
MIN	269	278	415	307	266	244	103	87	86	217	342	546
AC-FT	25293	35064	62329	49031	18760	16945	10145	6077	8448	25115	40471	50654

Table 2

OPERATIONAL MINIMUM INSTREAM FLOW SCHEDULE WITH FIRM AND NON-FIRM FLOWS

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NR LANDSBURG, WA

LATITUDE 472247 LONGITUDE 1215856 DRAINAGE AREA 124 DATUM 490 STATE 53 COUNTY 033

DISCHARGE, CUBIC FEET PER SECOND, CALENDER YEAR JANUARY 2003 TO DECEMBER 2003

DAILY MEAN VALUES

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	260	260	365	365	260	250	225	95	80	210	330	330
2	260	260	365	365	260	250	225	95	80	210	330	330
3	260	260	365	365	260	250	200	95	80	210	330	330
4	260	260	365	365	260	250	200	80	80	210	330	330
5	260	260	365	365	260	250	200	80	80	210	330	330
6	260	260	365	365	260	250	200	80	80	210	330	330
7	260	260	365	365	260	250	200	80	80	210	330	330
8	260	260	365	365	260	250	180	80	80	330	330	330
9	260	260	365	365	260	250	160	80	80	330	330	330
10	260	260	365	365	260	225	160	80	80	330	330	330
11	260	365	365	365	260	225	160	80	80	330	330	330
12	260	365	365	365	260	225	160	80	80	330	330	330
13	260	365	365	365	260	225	160	80	80	330	330	330
14	260	365	365	365	260	225	140	80	80	330	330	330
15	260	365	365	260	260	225	125	80	118	330	330	330
16	260	365	365	260	260	225	125	80	133	330	330	330
17	260	365	365	260	260	225	125	80	133	330	330	330
18	260	365	365	260	260	225	125	80	133	330	330	330
19	260	365	365	260	260	225	125	80	133	330	330	330
20	260	365	365	260	250	225	125	80	133	330	330	330
21	260	365	365	260	250	225	125	80	133	330	330	330
22	260	365	365	260	250	225	110	80	133	330	330	330
23	260	365	365	260	250	225	110	80	210	330	330	330
24	260	365	365	260	250	225	110	80	210	330	330	330
25	260	365	365	260	250	225	110	80	210	330	330	330
26	260	365	365	260	250	225	110	80	210	330	330	330
27	260	365	365	260	250	225	110	80	210	330	330	330
28	260	365	365	260	250	225	110	80	210	330	330	330
29	260		365	260	250	225	95	80	210	330	330	330
30	260		365	260	250	225	95	80	210	330	330	330
31	260		365		250		95	80		330		260
TOTAL	8060	9170	11315	9270	7940	6975	4500	2525	3849	9390	9900	10160
MEAN	260	328	365	309	256	233	145	81	128	303	330	328
MAX	260	365	365	365	260	250	225	95	210	330	330	330
MIN	260	260	365	260	250	225	95	80	80	210	330	260
AC-FT	15987	18188	22443	18387	15749	13835	8926	5008	7634	18625	19636	20152

Table 3

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - WASHINGTON STATE NWIS 2/2/2004
STATION NUMBER 12116500 CEDAR RIVER AT CEDAR FALLS, WASH. STREAM SOURCE AGENCY USGS
LATITUDE 472502 LONGITUDE 1214727 DRAINAGE AREA 84.20 DATUM 902.1 STATE 53 COUNTY 033
PROVISIONAL DATA FROM THE DCP SUBJECT TO REVISION
DISCHARGE, CUBIC FEET PER SECOND, CALENDER YEAR JANUARY 2003 TO DECEMBER 2003
DAILY MEAN VALUES

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	400	337	436	785	50	144	261	76	32	117	229	789
2	355	628	340	587	76	146	257	73	32	118	229	997
3	159	724	286	817	76	145	257	75	36	142	240	1020
4	54	897	253	1000	77	144	256	78	36	174	292	765
5	59	864	292	999	79	144	254	88	36	176	330	512
6	50	814	338	995	81	144	254	84	36	212	331	464
7	67	614	402	997	78	143	253	83	36	269	331	520
8	102	514	527	881	63	143	199	83	43	321	331	727
9	142	444	542	754	30	144	36	82	31	346	334	939
10	170	406	550	644	30	152	20	81	34	373	331	936
11	185	335	663	634	30	164	31	52	60	396	304	892
12	187	267	816	633	45	229	121	8.3	99	397	292	749
13	187	219	614	627	127	148	168	7.6	94	397	292	610
14	186	164	507	513	125	100	168	7.2	91	399	292	595
15	178	122	629	507	119	53	168	7.1	119	431	284	587
16	176	104	696	498	53	43	168	6.9	171	395	256	577
17	174	103	835	473	30	32	165	6.6	157	223	256	458
18	173	102	1010	372	30	31	138	6.3	114	223	274	323
19	175	102	926	256	92	31	80	6.2	96	222	260	315
20	201	118	832	176	87	32	80	6	73	236	597	316
21	226	225	623	182	78	34	80	11	71	298	902	321
22	258	293	326	122	74	35	76	25	86	339	974	317
23	245	330	218	78	72	34	66	30	119	403	1100	316
24	215	503	300	59	74	32	65	29	121	444	1090	317
25	214	612	748	34	73	56	65	28	119	438	1080	317
26	260	696	887	33	72	152	66	28	120	434	938	320
27	261	681	880	31	74	217	66	27	119	407	705	319
28	269	575	879	32	79	258	70	29	118	334	721	318
29	276	---	874	34	116	220	80	33	118	340	705	316
30	274	---	876	30	146	233	77	33	117	317	681	311
31	165	---	896	---	146	---	76	33	---	206	---	284
TOTAL	6043	11793	19001	13783	2382	3583	4121	1223.2	2534	9527	14981	16547
MEAN	195	421	613	459	77	119	133	39	84	307	499	534
MAX	400	897	1010	1000	146	258	261	88	171	444	1100	1020
MIN	50	102	218	30	30	31	20	6	31	117	229	284
AC-FT	11990	23390	37690	27340	4720	7110	8170	2430	5030	18900	29710	32820

Table 4

SEATTLE PUBLIC UTILITIES

Daily Readings Approximately 7am

STATION NUMBER 12115900 CHESTER MORSE LAKE AT CEDAR FALLS, WASH.

LATITUDE 472434 LONGITUDE 1214322 DRAINAGE AREA 78.4 sq mi

PROVISIONAL DATA SUBJECT TO REVISION

RESERVOIR ELEVATION SURFACE WATER (FEET), CALENDER YEAR JANUARY 2003 TO DECEMBER 2003

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	1540.03	1560.32	1557.40	1560.10	1557.50	1561.55	1557.30	1550.30	1549.75	1548.91	1547.41	1552.00
2	1539.52	1561.12	1557.25	1560.15	1557.70	1561.52	1556.96	1550.22	1549.75	1548.77	1547.25	1551.90
3	1539.61	1561.42	1557.15	1560.00	1557.87	1561.44	1556.58	1550.20	1549.77	1548.63	1546.97	1551.49
4	1540.03	1561.11	1556.90	1559.50	1558.08	1561.36	1556.23	1550.15	1549.74	1548.41	1546.71	
5	1541.30	1560.62	1556.80	1558.90	1558.35	1561.23	1555.80	1550.10	1549.66	1548.20	1546.40	1551.05
6	1542.15	1560.10	1556.55	1558.22	1558.67	1561.19	1555.48	1550.10	1549.64	1548.00	1546.06	1551.10
7	1542.65	1559.50	1556.34	1557.52	1558.72	1561.00	1555.16	1550.09	1549.56	1547.70	1545.63	1551.00
8	1543.30	1559.10	1555.97	1556.85	1558.83	1561.00	1554.98	1550.18	1549.71	1547.50	1545.18	1550.75
9	1543.77	1558.80	1555.55	1556.43	1558.95	1560.90	1554.78	1550.07	1549.82	1547.15	1544.80	1550.25
10	1544.17	1558.52	1555.90	1556.05	1559.00	1560.75	1554.50	1550.00	1549.79	1546.75	1544.40	1549.67
11	1544.24	1558.16	1556.57	1555.80	1559.15	1560.60	1554.50	1550.00	1549.87	1546.55	1544.75	1548.99
12	1544.35	1557.90	1558.05	1555.50	1559.30	1560.40	1554.50	1550.00	1550.10	1546.30	1545.70	1548.89
13	1544.65	1557.65	1560.03	1555.34	1559.42	1560.15	1554.09	1550.00	1550.12	1546.30	1545.97	1548.30
14	1544.85	1557.50	1561.22	1555.29	1559.48	1560.00	1553.85	1549.99	1550.12	1546.10	1545.97	1548.05
15	1545.09	1557.40	1561.76	1555.25	1559.61	1559.85	1553.53	1549.95	1550.05	1545.90	1545.89	1547.70
16	1545.28	1557.32	1561.85	1555.15	1559.72	1559.75	1553.27	1549.96	1549.90	1545.50	1545.81	1547.27
17	1545.40	1557.28	1561.75	1555.00	1559.96	1559.60	1552.97	1549.95	1550.02	1546.30	1546.10	1547.00
18	1545.50	1557.22	1561.30	1554.90	1560.02	1559.50	1552.65	1549.92	1549.87	1546.41	1547.65	1546.80
19	1545.50	1557.10	1560.68	1555.10	1560.08	1559.38	1552.43	1549.85	1549.83	1546.30	1552.43	1546.58
20	1545.50	1557.14	1560.10	1555.20	1560.07	1559.31	1552.22	1549.83	1550.02	1546.15	1553.82	1546.50
21	1545.50	1557.50	1559.77	1555.31	1560.12	1559.32	1552.03	1549.85	1549.90	1548.50	1553.83	1546.35
22	1545.47	1558.70	1560.22	1555.46	1560.17	1559.30	1551.82	1549.85	1549.85	1550.15	1553.30	1546.50
23	1545.93	1559.52	1561.50	1555.67	1560.25	1559.20	1551.63	1549.81	1549.78	1550.38	1552.54	1546.29
24	1546.30	1559.67	1562.25	1555.90	1560.45	1559.10	1551.40	1550.00	1550.01	1550.25	1551.86	1546.15
25	1546.88	1559.48	1562.40	1556.20	1560.77	1559.00	1551.21	1549.75	1549.68	1549.97	1551.33	1546.01
26	1547.90	1559.02	1562.20	1556.50	1560.98	1558.87	1551.01	1549.75	1549.53	1549.50	1550.69	1545.87
27	1551.28	1558.60	1561.84	1556.72	1561.12	1558.63	1550.86	1549.75	1549.46	1549.00	1550.18	1545.70
28	1552.25	1557.95	1561.35	1556.97	1561.26	1558.30	1550.67	1549.74	1549.38	1548.30	1549.72	1545.50
29	1552.25		1560.83	1557.14	1561.42	1557.95	1550.55	1549.75	1549.18	1548.15	1550.62	1545.25
30	1553.28		1560.30	1557.32	1561.50	1557.60	1550.45	1549.75	1549.09	1547.93	1551.80	1545.02
31	1556.10		1560.00		1561.53		1550.35	1549.75	0.00	1547.65		
MEAN	1545.48	1558.78	1559.41	1556.65	1559.68	1559.93	1553.35	1549.96	1499.77	1547.79	1548.36	1548.07
MAX	1556.10	1561.42	1562.40	1560.15	1561.53	1561.55	1557.30	1550.30	1550.12	1550.38	1553.83	1552.00
MIN	1539.52	1557.10	1555.55	1554.90	1557.50	1557.60	1550.35	1549.74	0.00	1545.50	1544.40	1545.02

Table 5

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - WASHINGTON STATE NWIS 2/2/2004
STATION NUMBER 12115000 CEDAR RIVER NEAR CEDAR FALLS, WASH. STREAM SOURCE AGENCY USGS
LATITUDE 472213 LONGITUDE 1213726 DRAINAGE AREA 40.70 DATUM 1560.00 STATE 53 COUNTY 033
PROVISIONAL DATA FROM THE DCP SUBJECT TO REVISION
DISCHARGE, CUBIC FEET PER SECOND, CALENDER YEAR JANUARY 2003 TO DECEMBER 2003
DAILY MEAN VALUES

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	85	1500	167	574	264	294	70	31	23	28	175	503
2	164	832	159	453	289	262	67	31	23	27	159	403
3	229	621	155	383	304	241	64	31	22	27	144	371
4	354	474	143	326	298	231	61	30	22	27	131	309
5	479	382	152	291	302	243	60	30	22	27	120	326
6	329	317	157	272	284	253	58	30	21	26	112	344
7	256	273	150	255	254	247	56	30	22	29	105	300
8	212	240	138	256	232	226	55	30	51	35	98	267
9	183	214	226	272	220	197	53	29	36	54	93	237
10	161	196	399	270	216	169	51	29	31	73	126	215
11	148	178	707	275	234	152	49	29	63	70	737	195
12	173	164	1230	290	260	143	48	29	71	162	478	187
13	163	153	1270	349	273	135	53	28	41	226	343	214
14	164	144	807	360	291	126	50	27	34	146	269	204
15	150	138	637	332	309	115	47	27	32	120	229	188
16	139	139	551	310	276	109	45	27	44	432	250	177
17	130	142	462	308	250	106	44	27	53	366	442	174
18	122	134	388	291	220	104	42	27	41	240	2270	161
19	115	129	332	266	200	100	40	26	49	189	1300	155
20	109	197	313	252	193	109	39	26	50	416	706	157
21	114	570	371	263	205	133	39	25	43	1240	484	168
22	132	712	831	268	231	115	38	25	39	591	370	158
23	188	472	731	264	298	107	37	25	37	396	311	153
24	223	343	560	304	455	98	36	24	35	290	280	153
25	281	275	503	285	442	93	35	24	33	231	253	154
26	1340	235	447	272	347	89	35	24	32	193	236	145
27	1130	204	392	262	327	86	34	24	31	167	211	136
28	758	186	338	251	401	81	34	24	30	205	317	130
29	620		304	255	379	77	33	24	29	272	1150	122
30	1170		322	259	358	74	32	23	28	220	712	117
31	3090		593	---	335	---	32	23	---	193	---	113
TOTAL	12911	9564	13935	9068	8947	4515	1437	839	1088	6718	12611	6636
MEAN	416	342	450	302	289	151	46	27	36	217	420	214
MAX	3090	1500	1270	574	455	294	70	31	71	1240	2270	503
MIN	85	129	138	251	193	74	32	23	21	26	93	113
AC-FT	25610	18970	27640	17990	17750	8960	2850	1660	2160	13330	25010	13160
CFSM	10.2	8.39	11	7.43	7.09	3.7	1.14	0.66	0.89	5.32	10.3	5.26
IN.	11.8	8.74	12.74	8.29	8.18	4.13	1.31	0.77	0.99	6.14	11.53	6.07

Table 6

SEATTLE PUBLIC UTILITIES

LANDSBURG TUNNEL - FLOW VOL 24HR TOT - MG

YEAR 2003

from IWRMS 1-13-04

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	53.2	0	112.6	0	87.9	115	168.8	124.7	96.6	48.4	59.7	43.4
2	50.7	28	95.2	0	86.6	115.4	180.7	120.8	91.8	48	56.7	74.5
3	46.9	33.3	78.7	0	95.5	112.8	181.6	119.7	95	61.3	62.6	80
4	87.4	103.9	79.6	0	98.1	111.2	190.1	123.3	94.1	75.6	92.3	2.2
5	67.7	16.8	79.9	48.6	88.2	108.8	181.9	134.4	94.1	76.1	109.1	49.7
6	39.2	151.3	77.9	94.7	78.7	107.5	183.2	136.1	92.4	85.9	110	51.6
7	9.1	128.7	79.8	143	74.5	106	182.1	134.2	91.1	93.4	107.4	52
8	35.9	155.9	79.3	171.7	55.7	104.2	157.1	132.1	101.7	125.5	107.7	66.4
9	52.4	158.8	34.5	171	55.6	106.8	71.3	131.5	89.3	140.7	81.3	83.7
10	71.2	158.1	86.6	170.4	60.2	128.9	12.2	131.2	92.9	144.8	89.1	85.3
11	81.7	144.3	62.3	170.7	55.5	132.6	56.6	113.2	124.7	140.8	92.9	84.9
12	103	98.6	0	170.3	66.2	134.8	123.1	83	136.8	145.1	91.7	85.3
13	91.4	68	0	169.5	105.5	110.6	151	71	136.8	147.2	85	83.1
14	89	44.3	0	160.2	107.5	79	160.4	73.4	119.8	145.9	85.1	86.1
15	72	43.7	0	120.6	73.4	78.9	174.3	79.1	123.2	181	55.6	85.3
16	69.5	60.3	0	107	50.1	0	172	90.2	141.3	49.1	55.7	86.2
17	65	56.2	85.8	80.3	56.6	0	169.6	91.4	134.7	28.6	67.6	83.9
18	60.8	52.1	152.6	65.6	51.3	0	138.5	90.3	104	47.6	0	66.9
19	61.4	48.5	160	65.7	78.1	0	118.5	73.9	91.3	43.9	0	48.6
20	75.2	48	139.4	54.3	78.2	0	118	72.8	77.7	28.5	0	49.4
21	103.5	26.3	99.6	47.1	77.8	0	116.1	76.8	77	0	59.7	48.1
22	33.2	26.8	11.5	31.5	77.5	0	119.4	97.8	58.7	0	74.1	49.3
23	130.3	43.1	0	0	69.9	0	117.7	97.8	54.5	0	82.6	55.5
24	142.5	43.2	0	0	72.2	40	114.8	97.5	52.2	72.8	104.6	61.3
25	146.9	87.1	0	0	74.5	56.2	115.3	97.1	52.3	147.9	130.5	59
26	9	124.3	0	41.3	69.8	107.1	114.4	96.5	51.6	144.6	114.3	60.8
27	0	116.2	0	86.6	71.8	137.4	113.3	95.5	49.8	126	84.7	57.2
28	0	117.4	0	93.1	79.3	149.2	115	93.7	48	134.4	54.3	52.5
29	15.7		0	88.6	103.5	146	125.8	96.6	48.9	137.5	0	47.2
30	108		0	80	120.6	153.8	121.5	96.9	48.8	112	0	42.6
31	0		0		117.9		120.6	94.4		45		45.2
TOTAL	1971.8	2183.2	1515.3	2431.8	2438.2	2442.2	4184.9	3166.9	2671.1	2777.6	2114.3	1927.2
MEAN	63.6	78.0	48.9	81.1	78.7	81.4	135.0	102.2	89.0	89.6	70.5	62.2
MAX	146.9	158.8	160	171.7	120.6	153.8	190.1	136.1	141.3	181	130.5	86.2
MIN	0	0	0	0	50.1	0	12.2	71	48	0	0	2.2

Average CY 2003 81.71

Table 7

SEATTLE PUBLIC UTILITIES
LANDSBURG WEATHER STATION - PRECIP 24HR TOT
YEAR 2003

(inches)

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.88	0.04	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.20
2	0.68	0.18	0.55	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.50
3	0.09	0.27	0.00	0.25	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.15
4	0.78	0.00	0.00	0.09	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.29
5	0.00	0.00	0.06	0.51	0.35	0.00	0.00	0.09	0.00	0.02	0.00	0.85
6	0.00	0.00	0.18	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.22
7	0.00	0.00	0.06	0.59	0.05	0.00	0.00	0.00	0.27	0.02	0.00	0.08
8	0.00	0.02	0.24	0.26	0.00	0.00	0.00	0.00	0.53	0.28	0.00	0.25
9	0.00	0.06	1.04	0.10	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00
10	0.00	0.00	0.22	0.05	0.00	0.10	0.00	0.16	0.29	0.03	0.35	0.34
11	0.35	0.00	0.63	0.15	0.00	0.00	0.00	0.03	0.63	0.17	0.00	0.21
12	0.42	0.00	1.08	0.29	0.00	0.00	0.00	0.00	0.03	0.48	0.00	0.42
13	0.40	0.00	0.10	0.92	0.00	0.37	0.21	0.00	0.00	0.00	0.02	0.72
14	0.00	0.00	0.02	0.01	0.03	0.00	0.01	0.00	0.01	0.01	0.02	0.14
15	0.00	0.14	0.04	0.00	0.62	0.00	0.00	0.00	0.00	0.36	0.28	0.00
16	0.00	0.48	0.21	0.18	0.15	0.00	0.00	0.00	0.53	0.86	0.42	0.08
17	0.00	0.17	0.11	0.42	0.17	0.00	0.00	0.00	0.01	0.16	0.70	0.00
18	0.03	0.02	0.16	0.01	0.00	0.09	0.00	0.00	0.03	0.00	1.10	0.00
19	0.00	0.23	0.21	0.00	0.00	0.04	0.00	0.00	0.60	0.18	1.31	0.11
20	0.00	0.38	0.51	0.00	0.13	0.06	0.00	0.00	0.00	5.50	0.52	0.24
21	0.89	0.65	0.95	0.20	0.22	1.02	0.00	0.00	0.00	1.36	0.13	0.02
22	0.98	0.34	0.92	0.15	0.01	0.22	0.00	0.00	0.00	0.42	0.08	0.00
23	0.14	0.00	0.15	0.30	0.43	0.11	0.00	0.00	0.00	0.00	0.37	0.03
24	0.47	0.00	0.05	0.63	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.31
25	0.45	0.00	0.45	0.01	0.05	0.00	0.00	0.00	0.00	0.00	0.18	0.00
26	1.05	0.00	0.08	0.18	0.03	0.00	0.00	0.65	0.00	0.00	0.02	0.08
27	0.50	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.16
28	0.03	0.27	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.16	1.28	0.00
29	0.62		0.02	0.02	0.00	0.00	0.00	0.00	0.02	0.10	0.52	0.00
30	0.79		0.17	0.00	0.10	0.04	0.00	0.00	0.00	0.00	0.00	1.30
31	0.63		0.21		0.00		0.00	0.00		0.00		0.00
TOTAL	10.18	3.25	8.69	5.71	2.95	2.05	0.22	0.93	2.95	10.48	7.35	6.70
MEAN	0.33	0.12	0.28	0.19	0.10	0.07	0.01	0.03	0.10	0.34	0.25	0.22
MAX	1.05	0.65	1.08	0.92	0.62	1.02	0.21	0.65	0.63	5.50	1.31	1.30
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 8

SEATTLE PUBLIC UTILITIES
MASONRY WEATHER STATION - PRECIP 24HR TOT
YEAR 2003

(inches)

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	1.72	0.16	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.10
2	0.47	0.75	0.85	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02
3	0.33	0.04	0.02	0.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.99	0.00	0.31	0.24	1.02	0.00	0.00	0.00	0.00	0.00	0.00	1.07
5	0.00	0.00	0.04	0.75	0.40	0.00	0.00	0.05	0.00	0.00	0.00	1.16
6	0.00	0.00	0.55	0.06	0.00	0.00	0.00	0.00	0.19	0.36	0.00	0.00
7	0.00	0.00	0.46	0.74	0.06	0.00	0.07	0.00	2.90	0.00	0.00	0.20
8	0.00	0.00	0.85	0.56	0.00	0.00	0.00	0.00	0.20	0.89	0.00	0.10
9	0.00	0.00	1.25	0.00	0.00	0.00	0.00	0.00	0.14	0.88	0.00	0.00
10	0.00	0.00	0.76	0.27	0.00	0.05	0.00	0.00	0.76	0.13	1.71	0.00
11	1.12	0.00	1.23	0.11	0.02	0.00	0.00	0.68	1.20	0.62	0.00	0.35
12	0.35	0.00	1.25	0.75	0.00	0.00	0.28	0.00	0.00	0.45	0.00	0.81
13	0.46	0.08	0.12	0.26	0.00	0.42	0.02	0.00	0.00	0.05	0.00	1.60
14	0.00	0.00	0.06	0.06	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.10
15	0.00	0.43	0.10	0.12	0.41	0.00	0.00	0.13	0.10	1.20	0.82	0.00
16	0.00	0.63	0.31	0.53	0.76	0.00	0.00	0.00	1.25	1.27	0.83	0.24
17	0.00	0.17	0.09	0.61	0.15	0.00	0.00	0.00	0.00	0.00	2.53	0.01
18	0.00	0.05	0.12	0.00	0.00	0.24	0.00	0.00	0.60	0.21	2.91	0.00
19	0.00	0.97	0.15	0.00	0.00	0.45	0.00	0.00	0.54	0.68	0.19	0.28
20	0.11	1.09	1.45	0.04	0.30	1.04	0.00	0.00	0.00	5.91	0.38	0.00
21	1.05	1.35	2.26	0.16	0.00	0.68	0.00	0.00	0.00	0.10	0.05	0.00
22	1.22	0.24	0.39	0.04	0.00	0.18	0.00	0.00	0.00	0.69	0.00	0.00
23	0.44	0.00	0.74	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.25
24	0.39	0.00	0.46	0.31	0.15	0.00	0.00	0.00	0.00	0.00	0.66	0.48
25	1.96	0.00	0.41	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.13
26	0.88	0.00	0.25	0.03	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.17
27	0.79	0.10	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.76	0.44
28	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72	2.05	0.13
29	1.45		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.05	0.00
30	2.28		1.61	0.00	0.14	0.04	0.00	0.00	0.00	0.00	0.00	0.35
31	0.82		0.30		0.00		0.00	0.00		0.00		0.12
TOTAL	16.83	6.31	16.57	7.37	3.93	3.1	0.368	0.86	7.88	14.56	14.15	9.11
MEAN	0.5	0.2	0.5	0.2	0.1	0.1	0.0	0.0	0.3	0.5	0.5	0.3
MAX	2.28	1.35	2.26	0.76	1.02	1.04	0.28	0.68	2.9	5.91	2.91	1.6
MIN	0	0	0	0	0	0	0	0	0	0	0	0

Table 9

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Discharge FROM DCP, in cfs COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA FEBRUARY 06, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	939	933	933	927	933	921	921	915	909	904	915	909
	904	892	898	898	1080	1180	1190	1130	1030	915	847	824

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Gage height FROM DCP, in feet COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA FEBRUARY 06, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	4.67	4.66	4.66	4.65	4.66	4.64	4.64	4.63	4.62	4.61	4.63	4.62
	4.61	4.59	4.60	4.60	4.91	5.06	5.08	4.98	4.82	**4.63**	**4.51**	4.47

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Discharge FROM DCP, in cfs COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA FEBRUARY 25, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	791	786	780	786	786	786	780	780	786	780	770	786
	780	775	775	830	904	847	841	835	847	841	841	830

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Gage height FROM DCP, in feet COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA FEBRUARY 25, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	4.41	4.40	4.39	4.40	4.40	4.40	4.39	4.39	4.40	4.39	4.37	4.40
	4.39	4.38	4.38	4.48	**4.61**	**4.51**	4.50	4.49	4.51	4.50	4.50	4.48

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Discharge FROM DCP, in cfs COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA MAY 02, 2003 Pacific Daylight Time SUBJECT TO REVISION

(96)	310	310	310	310	310	310	325	343	362	366	366	351
	339	336	332	325	328	328	314	278	306	321	328	310

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:59 By johanson
Gage height FROM DCP, in feet COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA MAY 02, 2003 Pacific Daylight Time SUBJECT TO REVISION

(96)	3.35	3.35	3.35	3.35	3.35	3.35	3.39	3.44	3.49	3.50	3.50	3.46
	3.43	3.42	3.41	3.39	3.40	3.40	**3.36**	**3.26**	3.34	3.38	3.40	3.35

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Discharge FROM DCP, in cfs COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA OCTOBER 17, 2003 Pacific Daylight Time SUBJECT TO REVISION

(96)	558	544	535	522	517	499	490	477	473	464	447	439
	430	414	394	355	332	355	358	374	366	358	355	351

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Gage height FROM DCP, in feet COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA OCTOBER 17, 2003 Pacific Daylight Time SUBJECT TO REVISION

(96)	3.95	3.92	3.90	3.87	3.86	3.82	3.80	3.77	3.76	3.74	3.70	3.68
	3.66	3.62	**3.57**	**3.47**	3.41	3.47	3.48	3.52	3.50	3.48	3.47	3.46

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Discharge FROM DCP, in cfs COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA OCTOBER 22, 2003 Pacific Daylight Time SUBJECT TO REVISION

(96)	863	886	869	852	802	819	808	797	775	775	743	738
	748	722	717	696	701	696	696	701	696	701	711	753

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Gage height FROM DCP, in feet COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA OCTOBER 22, 2003 Pacific Daylight Time SUBJECT TO REVISION

(96)	4.54 T	4.58	4.55	**4.52**	**4.43**	4.46	4.44	4.42	4.38	4.38	4.32	4.31
	4.33	4.28	4.27	4.23	4.24	4.23	4.23	4.24	4.23	4.24	4.26	4.34

NOTE: SYMBOLS USED ABOVE HAVE THE FOLLOWING MEANINGS --
T = THIS VALUE EXCEEDS THE "STANDARD DIFFERENCE" THRESHOLD

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Discharge FROM DCP, in cfs COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA OCTOBER 28, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	328	328	343	351	343	336	336	336	343	343	339	343
	343	339	339	336	336	343	394	355	355	370	378	378

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Gage height FROM DCP, in feet COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA OCTOBER 28, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	3.40	3.40	3.44	3.46	3.44	3.42	3.42	3.42	3.44	3.44	3.43	3.44
	3.44	3.43	3.43	3.42	3.42	3.44	**3.57 T**	**3.47**	3.47	3.51	3.53	3.53

NOTE: SYMBOLS USED ABOVE HAVE THE FOLLOWING MEANINGS --
T = THIS VALUE EXCEEDS THE "STANDARD DIFFERENCE" THRESHOLD

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES
STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Discharge FROM DCP, in cfs COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA OCTOBER 31, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	343	351	347	343	332	343	355	366	406	402	358	332
	314	321	343	370	374	366	358	358	351	347	343	343

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES
STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Gage height FROM DCP, in feet COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA OCTOBER 31, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	3.44	3.46	3.45	3.44	3.41	3.44	3.47	3.50	3.60	**3.59**	**3.48**	3.41
	3.36	3.38	3.44	3.51	3.52	3.50	3.48	3.48	3.46	3.45	3.44	3.44

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES
STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Discharge FROM DCP, in cfs COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA NOVEMBER 17, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	410	414	410	394	398	394	394	394	370	374	374	394
	321	328	410	382	370	362	366	366	370	374	386	378

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES
STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:25 By johanson
Gage height FROM DCP, in feet COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA NOVEMBER 17, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	3.61	3.62	3.61	3.57	3.58	3.57	3.57	3.57	3.51	3.52	3.52	**3.57**
	3.38 T	3.40	3.61	3.54	3.51	3.49	3.50	3.50	3.51	3.52	3.55	3.53

NOTE: SYMBOLS USED ABOVE HAVE THE FOLLOWING MEANINGS --
T = THIS VALUE EXCEEDS THE "STANDARD DIFFERENCE" THRESHOLD

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES
STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:59 By johanson
Discharge FROM DCP, in cfs COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA NOVEMBER 18, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	390	390	426	495	577	753	1020	998	1070	1100	1060	1040
	1060	1100	1110	1110	1090	1060	1010	980	933	933	915	886

PROVISIONAL DATA NOVEMBER 19, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	791	797	786	753	764	780	898	921	909	858	813	786
	759	753	759	770	786	830	813	819	819	824	841	852

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124 CONTRIBUTING DRAINAGE AREA DATUM 490 NGVD29
Date Processed: 2004-02-10 14:59 By johanson
Gage height FROM DCP, in feet COMPUTED UNIT VALUES (INSTANTANEOUS)

	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
(# VALUES)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400

PROVISIONAL DATA NOVEMBER 18, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	3.56	3.56	3.65	3.81	3.99	4.34	4.81 T	4.77	4.89	4.94	4.87	4.84
	4.87	4.93	4.95	4.95	4.92	4.87	4.79	4.74	4.66	4.66	4.63	**4.58**

PROVISIONAL DATA NOVEMBER 19, 2003 Pacific Standard Time SUBJECT TO REVISION

(96)	**4.41**	4.42	4.40	4.34	4.36	4.39	4.60	4.64	4.62	4.53	4.45	4.40
	4.35	4.34	4.35	4.37	4.40	4.48	4.45	4.46	4.46	4.47	4.50	4.52

NOTE: SYMBOLS USED ABOVE HAVE THE FOLLOWING MEANINGS --
T = THIS VALUE EXCEEDS THE "STANDARD DIFFERENCE" THRESHOLD

Table 10

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - WASHINGTON STATE NWIS 2/2/2004
STATION NUMBER 12116400 CEDAR RIVER AT POWERPLANT AT CEDAR FALLS, WASH. SOURCE AGENCY USGS
LATITUDE 472508 LONGITUDE 1214649 NAD27 DRAINAGE AREA CONTRIBUTING DRAINAGE AREA DATUM 940 NGVD29
PROVISIONAL DATA FROM THE DCP SUBJECT TO REVISION
DISCHARGE, CUBIC FEET PER SECOND, CALENDER YEAR JANUARY 2003 TO DECEMBER 2003
DAILY MEAN VALUES

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	398	343	141	157	28	32	26	14	32	33	62	156
2	351	636	68	65	28	33	26	14	33	33	61	370
3	153	728	56	197	28	33	25	14	36	33	60	391
4	51	864	37	384	28	33	25	13	36	34	59	226
5	56	847	36	379	29	33	24	14	36	34	58	230
6	47	771	35	377	31	34	23	13	36	34	58	160
7	66	621	106	375	28	34	22	12	36	33	57	76
8	101	523	233	254	28	33	22	12	42	34	57	112
9	142	448	248	210	28	33	21	11	32	35	57	239
10	169	401	257	52	27	33	21	11	34	33	61	233
11	182	311	377	50	27	33	24	11	62	33	60	195
12	186	250	562	48	28	33	125	10	103	34	59	99
13	186	199	470	49	29	33	171	9.6	98	34	59	73
14	184	161	225	46	29	33	170	9	94	37	59	72
15	176	120	127	94	28	32	169	8.3	125	38	60	67
16	174	103	120	38	28	31	168	7.9	175	47	64	65
17	173	102	279	38	29	31	167	7.4	159	51	63	63
18	171	101	441	37	29	30	138	6.9	105	51	130	61
19	173	101	350	36	29	30	81	6.5	78	52	119	60
20	199	106	315	34	29	30	80	6	48	90	134	61
21	224	225	102	33	30	33	80	5.4	47	173	276	62
22	253	293	91	32	30	33	55	4.8	43	59	354	61
23	240	330	82	31	31	32	17	4.5	35	73	478	60
24	210	395	70	34	32	30	16	4	33	62	477	60
25	210	330	130	33	32	29	16	4.3	33	56	466	59
26	256	419	263	31	32	29	15	4.5	33	52	311	58
27	257	396	262	30	31	28	15	3.4	33	51	72	57
28	266	284	259	29	32	28	16	11	32	59	83	56
29	271	---	258	28	32	27	20	34	32	64	129	56
30	265	---	256	28	32	27	16	34	33	63	106	55
31	157	---	267	---	32	---	15	33	---	63	---	55
TOTAL	5947	10408	6523	3229	914	943	1809	353.5	1754	1578	4149	3648
MEAN	192	372	210	108	29	31	58	11	58	51	138	118
MAX	398	864	562	384	32	34	171	34	175	173	478	391
MIN	47	101	35	28	27	27	15	3.4	32	33	57	55