

**CLACKAMAS RIVER PROJECT
TOTAL MAXIMUM DAILY LOAD
IMPLEMENTATION PLAN**

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Appendix 1 - Request to Modify Settlement Agreement Proposed License

Appendix 2 – Draft Lower Clackamas River Coarse Sediment Management Plan

1.0 INTRODUCTION

1.1 Purpose

The Oregon Department of Environmental Quality (ODEQ) has set Total Maximum Daily Loads (TMDLs) for the Willamette Basin, which includes the Clackamas River. TMDLs limit the total amount of specific pollutants that may be discharged to a given waterway. Under Oregon law, TMDLs must include a Water Quality Management Plan (WQMP) that identifies how the TMDLs will be implemented. The WQMP for the Willamette Basin TMDL provides that ODEQ will require a temperature management plan be developed by Portland General Electric Company (PGE) as part of the water quality certification for the Clackamas River Hydroelectric Project (the Project) (FERC No. 2195).

This *Total Maximum Daily Load Implementation Plan* (TIP) describes strategies that will be employed by PGE to address the thermal load allocation for the Clackamas Project established by the Willamette Basin TMDL. The Project is located in Clackamas County, Oregon, in the Clackamas River Basin. This TIP is a companion document to (i) the Water Quality Management and Monitoring Plan (WQMMP) included in PGE's final application for 401 certification (Final 401 Application; PGE 2008) and (ii) the Settlement Agreement filed with FERC on March 29, 2006 (PGE 2006a).

This TIP provides information regarding State water quality goals and standards, the application of those goals and standards to the Project, measures designed to attain compliance, monitoring strategies, and reporting of monitoring results. In combination with information contained in the WQMMP, the Final 401 Application (PGE 2008), and the Settlement Agreement (PGE 2006a), PGE believes that this TIP provides the Oregon Department of Environmental Quality (ODEQ) with reasonable assurance that the Project will comply with the requirements of the Willamette Basin TMDL.

1.2 Legal Background

A Total Maximum Daily Load (TMDL) defines the amount of a pollutant that can be present in a water body without causing water quality criteria to be exceeded. In September 2006, ODEQ issued, and EPA approved, final Total Daily Maximum Loads for the Willamette Basin. The TMDLs address water pollution from temperature, bacteria, and mercury throughout the Willamette Basin. The TMDL assigned PGE's Clackamas Project a Load Allocation of 0.15°C for temperature in the lower reach of the Clackamas River below River Mill Dam. PGE was not assigned any load allocations for bacteria or mercury and is not required to take action for those TMDLs. This TIP describes the actions that PGE will take to address its thermal load allocation in the lower Clackamas River.

PGE originally applied for a 401 certification for the Clackamas Project in August 2004; the final application was filed in June 2008. As required by the TMDL Water Quality Management Plan (Chapter 14 of the Willamette Basin TMDL), ORS chapter 468B, and OAR 340-042-0080, ODEQ has required PGE to develop a temperature TMDL implementation plan, because the

Project, as described in the June 2008 401 application, will not meet temperature standards in the lower Clackamas River in the near term. The requirements for this implementation plan are specified in OAR 340-042-0080. As relevant here, PGE's temperature TMDL implementation plan must:

- Identify the management strategies PGE will use to achieve its load allocations;
- Provide a timeline for implementing these management strategies, and a schedule for completing measurable milestones;
- Provide for performance monitoring and periodic review and revision of the implementation plan; and
- Provide evidence of compliance with applicable land use requirements.

Sections 2 to 4 of this TIP describe the management strategies that PGE will employ to achieve its load allocations, and provide the information specified in OAR 340-042-0080.

1.3 Project Setting and Water Quality Information

The Clackamas River flows northwest and drains an area of more than 940 mi², emptying into the Willamette River near Gladstone, Oregon. The Project consists of the Oak Grove Development and the three mainstem developments: North Fork Dam, the Faraday Development, and River Mill Dam. The three mainstem developments are located in sequence on the Clackamas River between river mile (RM) 22.3 and RM 29.2. Water released from North Fork Dam is diverted by the Faraday Diversion Dam into Faraday Lake, except during high flows when flow exceeds the capacity of the Faraday Powerhouse, and a portion of total flow passes over the Faraday Diversion Dam and through the Faraday Diversion Reach. PGE currently supplies a year-round minimum flow of 180 cfs to the Faraday Diversion Reach. Water from Faraday Lake is released via the Faraday Powerhouse into Estacada Lake, which is formed by River Mill Dam. Water released from River Mill Dam flows into the lower Clackamas River. A complete description of the Project is available in the Final License Application to the Federal Energy Regulatory Commission (FERC), dated August 2004 (PGE 2004).

As part of FERC relicensing, PGE conducted comprehensive water quality studies in, adjacent to, and downstream of the Project in 2000 and 2001. Thermaloggers were deployed at riverine and reservoir sites, and temperature profiles were measured in reservoirs. Descriptions of temperature and water quality sampling results are contained in the June 2008 401 Application, Doughty (2004a, 2004b), and EES Consulting (2004).

As discussed in the June 2008 401 Application, a predictive model (CE-QUAL-W2) of the Clackamas River system was developed to evaluate existing water quality conditions, to understand the physical processes controlling temperature and water quality, and to be used as a predictive tool for quantitative assessment of the impact of future Project operations on water quality (Battelle 2005). In addition, the model was used to compute natural thermal potential

(NTP), i.e., temperatures in the absence of the Project under existing hydrologic and meteorological conditions.

1.4 Procedural Background

On August 26, 2004, PGE filed an application for a new FERC license for the Clackamas Project. PGE filed an application for water quality certification with ODEQ on August 18, 2004. Beginning in April 2004, PGE and 25 other parties (collectively, the SWG), including ODEQ, participated in settlement negotiations to resolve issues associated with the relicensing of the Project. These negotiations were successful, and in June 2005 the SWG reached agreement in principle (AIP) on the terms and conditions under which the Project should be relicensed. Because the AIP superseded the August 2004, application, PGE withdrew that application and in June 2005 filed a revised application that reflected the terms and conditions of the AIP.

The SWG continued to negotiate the details of elements outlined in the AIP, and in March 2006, successfully concluded the negotiations. PGE then filed a comprehensive relicensing Settlement Agreement with FERC. The Settlement Agreement resolved all issues raised by all parties to the proceeding, with the exception of water temperature in the Clackamas River below River Mill Dam. PGE withdrew its June 2005 application for water quality certification on May 2, 2006, and on December 29, 2006, filed a revised application that reflected the terms and conditions of the final Settlement Agreement.

PGE continued to work with a water quality subgroup of the SWG (the “Water Quality Group”) during 2007 to resolve outstanding water quality issues related to the impact of the Project on temperature in the Clackamas River below River Mill Dam. On November 13, 2007, PGE withdrew the December 2006 401 application. PGE continued to meet with the Water Quality Group after withdrawing the December 2006 application, and in May 2008 reached agreement with the Water Quality Group and with ODEQ on the components of a revised application for water quality certification. On June 20, 2008, PGE filed a revised application incorporating the terms and conditions of that agreement.

1.5 Summary of TMDL Implementation Measures

As part of the Settlement Agreement, PGE developed a suite of protection, mitigation, and enhancement measures (PMEs) to be implemented when the new FERC license is issued, along with some interim measures to be implemented during the period between the filing of the Settlement Agreement and issuance of the new license. The PMEs include changes to Project operations, improved fish passage and protection measures, and enhancements of aquatic habitat. These measures are described in Section 10.2 of the June 2008 401 application.

During preparation of that application, PGE also identified other measures that it proposes to implement to address its thermal load allocation in the Clackamas River below River Mill Dam. These measures are described in Section 10.3 of the June 2008 401 application and discussed in Sections 2 through 4 of this TIP. PGE believes that these measures will provide ODEQ with reasonable assurance that PGE will meet its thermal load allocation downstream of the Project.

Specifically, PGE will implement the following measures pursuant to address its TMDL thermal allocation: 1) gravel augmentation in the Clackamas River downstream of River Mill Dam; 2) shading of tributaries to the lower Clackamas River; 3) creation of two additional side-channel habitat enhancement projects in the Clackamas River downstream of River Mill Dam; and 4) seasonal drawdown or channelization of Faraday Lake. The remainder of this TIP discusses the first three measures. The modification to Faraday Lake will be implemented through a revision to Proposed License Article 14, which was part of the Settlement Agreement. PGE filed that modification with FERC on July 21, 2008; it is attached to the TIP as Appendix 1.

Various management activities that will be conducted pursuant to this WQMMP, or pursuant to the terms and conditions of the new FERC license, may require PGE to conduct instream work. As discussed below, PGE will obtain any permits that may be required, such as a U.S. Army Corps of Engineers 404 permit, prior to conducting such activities.

1.6 Compliance with Land Use Requirements

In association with the August 2004 401 application, PGE filed a Land Use Compatibility Statement (LUCS) with Clackamas County. Clackamas County determined that the actions proposed in that 401 Application complied with all applicable local land use requirements and indicated that no additional land use applications would be required for water quality improvements.

In connection with its review of PGE's June 2008 401 application, ODEQ required PGE to seek a determination from Clackamas County that the measures included in this TIP that had not been included in the August 2004 401 application would be consistent with local comprehensive plans. Accordingly, on September 12, 2008, PGE filed a revised LUCS with Clackamas County that addressed these specific measures. On October 7, 2008, Clackamas County determined that these measures also complied with all applicable land use requirements. Clackamas County reaffirmed its earlier determination that no additional land use applications would be required for water quality improvements.

2.0 GRAVEL AUGMENTATION BELOW RIVER MILL DAM

2.1 Summary

A set of dam-induced geomorphic changes resulting from sediment supply changes has been documented in the Clackamas River below River Mill Dam (Wampler, 2004). Geomorphic changes downstream of the dam include increases in surface grain-size, a reduction in side channel area, reductions in coarse sediment bar storage, an increase in bedrock exposure, and a lowering of water surface elevations.

A gravel augmentation program can begin to reverse these observed geomorphic changes below River Mill Dam by restoring a portion of the historic coarse sediment supply that has been

trapped behind River Mill and North Fork dams. Physical channel changes resulting from coarse sediment augmentation will also provide biological benefits in the form of increased spawning and rearing habitat for salmonids.

In addition, gravel augmentation is expected to increase the coarse sediment storage and water surface elevations in side channels in the lower Clackamas River. Coarse sediment deposition in the channel will result in higher water surface elevations for a given river discharge. This will increase the amount of side channel habitat during low flow periods, which in turn will benefit temperature as described below.

Gravel augmentation – and gravel retention – in a river channel with low concentrations of alluvial sediment has the potential to result in reduced maximum water temperatures (Grant et al. 2006). Gravel augmentation can increase hyporheic exchange, which promotes mixing of waters of different ages and temperatures, thereby having the potential to reduce maximum water temperatures. Field work and numeric modeling undertaken by the USDA Pacific Northwest Research Station and Oregon State University to assess the possible impacts of gravel augmentation on temperature in the lower Clackamas River indicates that maximum temperatures in the lower Clackamas River will be reduced by the coarse sediment augmentation program to be implemented by PGE following issuance of the new FERC license (Burkholder et al 2008).

2.2 Management Strategies

The Settlement Agreement establishes the basic framework for gravel augmentation in the Clackamas River below River Mill Dam. It includes the following proposed license article (PLA) for the new FERC license:

ARTICLE 46 - Gravel Augmentation Below River Mill Dam

Within six months of license issuance, the Licensee shall, after consultation with the Fish Committee, file with the Commission, for approval, a detailed gravel augmentation plan consistent with Section IX and Appendix F of the Fish Passage and Protection Plan, below River Mill Dam. The Gravel Augmentation Plan will provide for (i) two years of baseline data collection and sediment transport modeling, (ii) completion of permitting and construction of necessary facilities within five years of license issuance, (iii) five years of initial augmentation, (iv) annual evaluation throughout the first five years of augmentation, (v) continued annual augmentation, as modified, in consultation with the Fish Committee, based on the first five years of augmentation, and (vi) the evaluation and modification, in consultation with the Fish Committee, of the Gravel Augmentation Plan every five years thereafter. Upon Commission approval, the Licensee shall implement the plan.

The following description of the Gravel Augmentation Plan is drawn from the Fish Passage and Protection Plan (FPPP) included in the March 2006 Settlement Agreement. As provided by PLA 46, these proposed actions are subject to consultation with the Fish Committee and ultimate review and approval by FERC. Therefore, they are also subject to modification resulting from that consultation and approval process. DEQ has reserved its authorities regarding any

modifications to plans approved by DEQ for 401 or TMDL purposes. The measures related to adaptive management of the gravel augmentation program including consultation, monitoring and evaluation are described in Section 2.4.

The Gravel Augmentation Plan for the lower Clackamas River calls for incremental coarse sediment introduction below River Mill Dam. A volume of 8,000 yd³ will be introduced 850 feet downstream of River Mill Dam on the right bank. Coarse sediment will be placed during low flow (July-September) in a geomorphically favorable location where recruitment by the river will occur during moderate flows (> 10,000 cfs). The full range of grain sizes will be used to allow the river to hydraulically sort gravel in the channel; washing or sorting of augmentation material is not planned (Wampler, 2005).

This coarse sediment introduction will continue until coarse sediment sources on PGE property defined and permitted for this gravel mining operation are no longer accessible, or it is determined that augmentation is no longer warranted.

Winter replenishment at the introduction site may occur up to three times per year depending on high flow recruitment, but the overall annual volume will be limited to a maximum of 20,000 yd³ for the first five years of augmentation. As discussed in Section 2.4, the annual rate of coarse sediment introduction will be reevaluated periodically.

2.3 Timeline

A timeline outlining the major milestones for Gravel Augmentation Plan was developed as part of the March 2006 Settlement Agreement. The timeline is subject to modification resulting from the consultation process with the Fish Committee and ultimate approval by FERC. DEQ has reserved its authorities regarding any modifications to plans approved by DEQ for 401 or TMDL purposes. Where the timeline designates a “year” in establishing a milestone, it is referring to the full year after license issuance. For example, a designation of “Year 5” is designating a milestone to be met by the end of the “fifth” full year of the license term.

Year 2: Completion of two years of baseline data collection and sediment transport modeling.

Year 4: Completion of construction planning, engineering, and permitting activities. (See Permitting Section below for details).

Year 5: Completion of sediment extraction (mining) facility and transportation infrastructure to deliver materials to the river bank.

Year 6: Completion of first year of gravel augmentation. The proposed river bank site for the gravel placement would be loaded once in this first year of augmentation. The preliminary survey of the site suggests that approximately 8,000 yd³ of material could be placed on that site at one time and that is the targeted volume of material for the first year.

Years 7 – 10: Completion of the second – fifth years of gravel augmentation. The site could be replenished up to three times per year after high flow events have eroded the deposit. The total replenishment will be capped at a maximum augmentation volume of 20,000 yd³ per year.

Year 10: Monitoring results will be compiled and analyzed. Coarse sediment introduction rates and caps will be adjusted to achieve the intended beneficial channel morphology changes. Monitoring frequency and methods will also be evaluated to determine which measures are providing the most useful data.

Permitting: Permitting to implement this gravel augmentation program will have its own set of milestones, which are presented below. State and Federal permits may be required for both the coarse sediment extraction (mining) and the coarse sediment placement within the Clackamas River. The final determination of which mining permits will be required of PGE will take place after an application has been made to the Oregon Department of Geology and Mineral Industries (DOGAMI). Clackamas County may consider the site exempt from County jurisdiction based on DOGAMI's final determination.

Placement of coarse sediment in the Clackamas River will require a Fill and Removal Permit from the Department of State Lands (DSL) and from the Army Corps of Engineers (ACOE). Both DSL and ACOE coordinate their permit process with other state and federal agencies. Coordinating agencies include ODEQ; Oregon Department of Fish and Wildlife; U.S. Fish and Wildlife; and National Marine Fisheries Service (NMFS). Any 401 certification required in connection with the ACOE permit will be handled in accordance with Section 6.3.4 of the Settlement Agreement.

Year 3: Develop the supporting materials (mining plan, site reclamation plan) for the mining permit application permit and submit application to DOGAMI.

Year 4: Develop and submit the joint application for DSL and ACOE for the Fill and Removal Permit.

2.4 Performance Monitoring/Periodic Review and Revision

The Gravel Augmentation Plan for the lower Clackamas River calls for incremental coarse sediment introduction below River Mill Dam. Monitoring will attempt to document trends in erosion and deposition, which will influence yearly modifications to gravel augmentation volumes.

Consultation with the Fish Committee

The Fish Committee, which includes ODEQ, will be consulted during the development of the Gravel Augmentation Plan for the lower Clackamas River, as described below. All consultation time periods and dispute resolution procedures will be as provided in the Settlement Agreement and proposed license articles, unless otherwise specified, or changed by FERC.

Year 1 (6 months after license issuance): PGE will develop and, after consultation with the Fish Committee and approval by DEQ, file with FERC a detailed plan and schedule for the implementation of the Gravel Augmentation Plan below River Mill Dam. The requirements of the plan are specified in PLA 46, which is quoted above.

Year 2 through program termination (or end-of-license term): PGE will conduct activities pursuant to the Gravel Augmentation Plan with continued involvement of the Fish Committee through an annual work planning and reporting process. Study results will be reported annually to the Fish Committee. PGE may develop major modifications to the methodology in consultation with the Fish Committee. Upon approval by DEQ and FERC, PGE will implement such modifications.

Year 10: After the first five years of augmentation and monitoring have been completed, the Fish Committee may recommend that PGE extend the initial 5-year monitoring period if flows were too low to permit complete assessment of the augmentation plan.

Year 10 (or following years): Based on results of the studies, PGE will, as necessary and after consultation with the Fish Committee, file plans with FERC for modifying or discontinuing the Gravel Augmentation Plan. Upon DEQ and FERC approval, PGE will implement the plans.

Specific Consultation Points

Year 1: PGE will consult with the Fish Committee on the baseline data collection plan for areas downstream of the augmentation site. PGE will also consult with the Fish Committee on sediment transport model selection and application.

Year 2: Continued consultation on baseline data collection and sediment transport modeling as outlined for Year 1.

Year 3: PGE will review results and conclusions of baseline data collection and sediment transport modeling with the Fish Committee. PGE will consult with the Fish Committee on the initial coarse sediment augmentation volume and timing of initial sediment introduction; the possible impact of gravel augmentation on the stilling well for the USGS Estacada gage, and the location and design of proposed extraction and transport infrastructure.

Year 4: Continued consultation on construction planning, engineering, and permitting as outlined above for Year 3.

Year 5: PGE will update the Fish Committee on progress of construction of the extraction and transport infrastructure.

Year 6: Following the initial sediment placement at the augmentation location, PGE will consult with the Fish Committee while reviewing the cross section and survey data of depositional areas after first year's winter flows have distributed coarse sediment, and

other key monitoring results. In consultation with the Fish Committee, PGE will determine frequency, volume, and timing of subsequent course sediment addition.

Years 7 – 10: PGE will consult with the Fish Committee in an annual review of key monitoring results and refinement of augmentation and monitoring approaches, if warranted. PGE will consult with the Fish Committee to confirm whether hydrologic conditions are representative of typical conditions, and to develop a process for determining if changes to augmentation should be made based on hydrologic conditions.

Year 10: PGE will review 5-year monitoring results with the Fish Committee in a report which will provide a comparison of post-augmentation results to baseline data, a validation of sediment transport model predictions and additional modeling if initial modeling results appear grossly inaccurate, establish an annual sediment augmentation rates and caps, frequency of sediment introductions as a function of flow, and the amount of erosion during a single high-flow event that will trigger addition of material. The consultation with the Fish Committee will consider monitoring and evaluation approaches for the remainder of the license period, possibly including a longer regular interval between Fish Committee review and feedback, or periodic review triggered by a pre-defined high-flow event.

Years 15 -- 45 (5-Year reporting through End of License): PGE's report of 5-year monitoring results and comparison of post-augmentation results to baseline data will be prepared in consultation with the Fish Committee.

Reporting

As described in Section 5, PGE will submit an annual report to DEQ containing a description of its efforts to implement the gravel augmentation plan during the prior year.

2.5 Compliance with Land Use Requirements

Clackamas County Planning Department has responsibility for determining floodplain compliance for all activities in the County. As noted in Section 1.6, on October 7, 2008, Clackamas County issued a land use compatibility statement for the measures described in this TIP, including the gravel augmentation program. Clackamas County may also require that fill within the river does not result in a net rise of flood levels of more than one foot. Computer modeling used to predict sediment transport may provide the necessary floodplain alteration documentation to demonstrate "no net rise."

3.0 TRIBUTARY SHADING

Riparian shading is a means by which PGE can offset excess heat load on the lower Clackamas River. Streamside trees shade the stream and its riparian area, resulting in lower in-stream temperatures as less sunlight reaches the water to warm it. Shading can be accomplished by the preservation of existing mature forests that are otherwise at risk from logging or development

or by planting trees along streams. PGE proposes to employ both approaches in the lower Clackamas River watershed.

Preserving shade and augmenting it by planting trees will provide ancillary benefits beyond temperature reduction, such as reducing sediment reaching the water as woody vegetation slows flood flows through above-ground structure and holds existing soil in place. Streamside trees provide habitat for the macro invertebrates that provide important food for juvenile salmonids. As trees mature and large woody debris accumulates in the stream and side channels, providing habitat for juvenile salmonids and increases channel complexity.

3.1 Summary

During discussions with the Water Quality Group, PGE agreed to implement a program of shading along tributaries to the lower Clackamas River. As described in Section 9.3.5 of the June 2008 401 Application, this program will lead to the shading of 30 miles of tributaries, with a concomitant reduction of heat loading to those tributaries and the lower Clackamas River.

In addition to this riparian shading program, PGE will be protecting the mature riparian forest along nearly one mile of Eagle Creek, a major tributary of the lower Clackamas River. This forest was acquired by PGE in October 2002. PGE will protect these lands in perpetuity either by itself or by transferring title to this land to a governmental entity or non-governmental organization that can assume the obligation to assure the permanent protection of the land for habitat restoration purposes.

3.2 Management Strategies

PGE will undertake a riparian shading program in the Clackamas River basin downstream of River Mill Dam, which will result in 30 streamside miles of newly planted riparian forest, completed at a rate of about 5 miles per year. Trees will be maintained (weeded, fed, watered) for three years (the year of planting and two additional years). As a result, this program will entail six years of active planting and maintenance, with two additional years being used for the maintenance program. The program will also include an outreach program designed to provide information to participants and to people interested in participating in the shading program.

Clackamas River Basin Council

PGE proposes to contract with the Clackamas River Basin Council (CRBC) to implement the tributary planting program. The CRBC is a local voluntary watershed council, founded in 1997, with representatives elected from 21 diverse member groups in the basin. The CRBC meets monthly as a consensus-based forum to foster partnerships for clean water, healthy streams, and abundant fisheries in the watershed. The purpose of the CRBC is to protect and improve water quality and fish and wildlife habitat, and support the quality of life for those who live, work, and recreate in the Clackamas River basin.

The CRBC's extensive experience in riparian planting and its established relationships with landowners will be a valuable asset. Since its inception in 1997, the CRBC has been active in

tree planting in the Clackamas River watershed. The CRBC has planted hundreds of thousands of trees and shrubs on private and public lands in the basin and has existing relationships with nurseries and landowners that will allow for tree planting programs to expand dramatically in the future. Streamside tree planting is intended to provide a variety of benefits to the stream, principally solar interception through shading but also inputs of organic material in the form of leaves, needles, limbs and trunks, which form the basis of the aquatic food chain in the tributaries and help maintain channel structure.

As the licensee for the Clackamas Project, PGE remains ultimately responsible for the implementation of the tributary shading program of the TIP. Therefore, PGE will actively monitor CRBC's performance throughout the timeline described below to provide assurance that the shading targets will be met. Should CRBC be unable to implement the shading program as described here, PGE will find additional contracting partners, replace CRBC, or assume direct responsibility for the program, as appropriate.

Shading Plan

The plan focuses on the significant tributaries in the Clackamas Basin downstream of River Mill Dam. The rural watersheds, including Eagle Creek, Deep Creek, and Clear Creek, will be the primary target. Mainstem Clackamas River property owners with opportunities for planting will be included in this program. Smaller but still important urban/urbanizing watersheds include Rock Creek, Richardson Creek, Noyer Creek, Sieben Creek, and Cow Creek. These smaller watersheds will be considered after the primary watersheds have been targeted.

Plantings will occur largely on the private property of streamside landowners. Landowner participation in the program will be voluntary and will not require conservation easements from landowners to participate in the program. CRBC's experience in the Clackamas basin suggests that a much higher rate of participation by landowners is achieved if their property rights are not legally constrained. Experience shows that most landowners in the basin do not disturb streamside plantings, because they recognize the benefits of having a healthy riparian reserve on their properties. However, as discussed below, the shading program will require some more limited type of agreement to permit access to private property during the first three years of the program, to allow for planting and two years of follow-up monitoring.

A 50-foot buffer will be planted. This buffer, along one side of a stream, would amount to approximately six acres of planting per mile. 12 native tree species, appropriately selected for the local site being replanted are proposed for this program, with additional species added as appropriate:

Likely Tree Species for Planting Program

Alnus rubra	Red alder
Crataegus douglasii	Douglas hawthorn
Fraxinus latifolia	Oregon ash
Malus fusca	Western crabapple
Thuja plicata	Western red cedar
Cornus stolonifera	Red-osier dogwood

Acer macrophyllum	Big Leaf Maple
Populus trichocarpa	Black Cottonwood
Tsuga heterophylla	Western Hemlock
Salix lucida	Pacific willow
Pseudotsuga menziesii	Douglas fir
Rhamnus purshiana	Cascara

Shade Program Outreach

The public outreach component of the tributary shading program will have two main elements. First, it will be used to solicit landowner participation in the program. Then, it will be used to provide information and support to participants, while at the same time continuing to solicit participation.

Working through the CRBC, PGE will take a number of steps to solicit landowner participation in the streamside shading program. The CRBC has a number of ongoing programs that involve outreach to streamside landowners that take into account an appeal to both public and private interests. Based on this experience, streamside landowners will be contacted by multiple methods: through the mail, through follow-up phone calls, and through neighbor referrals. For each landowner responding positively to mail or follow-up contacts, CRBC will conduct a field visit and site evaluation.

The planting program undertaken by PGE will be focused on higher priority areas that lack significant shade (0 to 40 percent existing shade). Landowners with property in these shade zones will be contacted and offered tree planting services. The arrangement that the CRBC offers to streamside landowners is simple: a mix of native species of trees will be planted for landowners in priority shade areas at no cost to them. The CRBC will provide the tree stock and the planting staff and will clear the area of invasive weeds prior to planting. In return, the landowners will allow the CRBC access to their property for site clearance, plant installation, and subsequent monitoring and maintenance. Landowners will be educated on the care and maintenance of the plantings.

Selection of streamside tax lots will be assisted by the use of GIS data (RLIS Taxlot Layer). This provides a list of streamside landowners and a map of property ownership along the streams and their tributaries. This becomes the outreach campaign map, which CRBC keeps updated to indicate who has been contacted, enrolled or referred.

PGE proposes to expand the services currently provided by the CRBC to increase the support both for participants in the shading program and for landowners interested in becoming participants or protecting the shading existing on their properties. These expanded services will include the production and distribution of brochures on maintaining the planted trees, based on the requirements of the specific species planted, as well as brochures on the control of invasive species that compete with new plantings. The outreach services will also include one annual workshop for each of the six years that planting will take place. These workshops will discuss the care of shade plantings and will be open to all landowners participating in the shading

program, as well as those interested in participating or in preserving existing shade trees on their properties.

Priorities for the Planting Program

PGE has established a general priority scheme to guide where planting takes place first and most intensively in this planting program. The targeting of streamside property will include these considerations, but could be altered after consultation with the Fish Committee: property with 0-40 percent existing shade, property that is located at the confluence of tributaries (because these are mixing zones that are often important fish holding or rearing locations), property that is part of a long contiguous frontage where multiple land ownerships can be planted, property where gaps in otherwise continuous riparian canopy can be filled, and property that is located along river sections where concentrations of spawning and rearing salmonids have been identified.

3.3 Timeline

The timeline for implementing the shading program is separated into start-up tasks, planting tasks, and maintenance tasks.

Start-Up Tasks

2010 - Negotiate contract between CRBC and PGE covering terms and conditions for the 30 mile planting program. Make initial contacts with nurseries willing to grow tree stock for this program, draft land owner agreements, and design the database management system that will track landowner involvement in the planting program. Pilot plantings may be implemented by the CRBC in 2010, 2011, and 2012, to evaluate nursery stock and planting techniques. The plantings will be monitored and the results reported back to PGE. PGE will consult with DEQ and the Fish Committee about the design of the planting program.

2011 – The following tasks will be undertaken in 2011.

Contract with nurseries. Initial contacts will lead to contracts for seed germination for some species and seedlings of others to be grown out for this program. Multiple suppliers will probably be required and they may be required to use locally adapted seed stock for this program.

Develop marketing materials. Various letters will be developed that will target streamside landowners in priority areas and include, where appropriate, references to successful CRBC plantings in that watershed. Information specific to the subbasin will be included in the landowner outreach letters when practical. A brochure describing the effects and importance of streamside planting will also be developed.

Implement the data base management system of streamside landowners. This database, designed in 2010, will include contact information and information about the location of the streamside property. The data base will be designed track all interactions with landowners that are contacted for the planting program and will be used extensively in the reporting on progress in meeting the goals of this program.

2012 – The following tasks will be undertaken in 2012.

Develop landowner agreements. Agreements for landowners will be developed which will contain elements confirming access to land for planting, monitoring, and weed control.

Develop media outreach plan. The CRBC will coordinate with PGE to contact local and regional news outlets to promote the story of the planting program generally, and specific planting events, and providing media with updates about the progress being made on the ground.

Outreach to landowners. Marketing materials including a general brochure on the CRBC, the planting program, and ways residents can become involved will be communicated to the first landowners selected as candidates. The first landowners will be signed up this year, in anticipation of the 2013 planting season. A follow up in person will be made to a sample of the landowners contacted, including non-respondents to understand why they are not interested in the shade tree program.

Stocking of supplies – A storage facility to base this program will be developed. Necessary equipment including shovels, weed whackers, brush mowers and other planting and invasive clearing supplies will be purchased. Vehicles and watering tank will be acquired.

Contract for first staffing needs - The bulk of the planting will be done by Americorps interns, or similar workers, who will be contracted to the CRBC. These interns will be hired toward the end of the preparation period (2012), in time for the first planting in the wet season following signing of contracts. Some site preparation and invasive plant removal for the 2013 planting season will be started at late in 2012 by these workers.

Planting Tasks

2013 – 2018 – With a target of 5 miles of shading completed each year, a six year planting program is contemplated. Setbacks or better marketing penetration might extend or reduce the number of years needed to complete this work. Annual goals and strategies will evolve as experience is gained with this program. The following tasks will be completed each year during the yearly planting phase of this program.

Site visits and planting plans. Site visits to discuss planting plans with the landowner will be the first step after landowners express interest in the program. A planting plan is prepared for each of these locations and agreed upon with the landowner. The planting plan will include invasive species control strategies as well as proposing trees in appropriate landscape locations.

Schedule plantings. Prepare schedule for work that meets participant landowner's needs, organize and schedule field work for efficient use of staff, follow up with any neighbors of participants that express an interest in the program.

Clearing of invasive plants. Most riparian landholdings that are to be planted will need to be cleared of invasive plants first. While some landowners may have already cleared streamside areas, many will require a full effort by the CRBC field crew to control blackberry, knotweed, canary grass and other invasive species.

Delivery/pick up of plants. The actual transfer of the vegetation from nursery to staging area and to the locations where they are to be planted will be coordinated to maximize the health of the plantings and efficient use of the program staff.

Complete Initial plantings. Most of the year's planting will occur during the dormant period to maximize survival. However, some species and some sites can be successfully planted during the growing season.

Maintenance Tasks

2013 – 2020 – The following tasks will be undertaken in 2013 – 2020. One additional task will be completed only in 2013. Any pilot plantings done by the CRBC between 2010 and 2012 that meet the conditions for inclusion in this program will be monitored and evaluated. If plant survival and plant densities meet the conditions listed below, they will be counted toward the goals of this program and reported in the 2013 annual report.

Monitoring & maintaining plantings - The planted sites will be revisited starting with the year they are planted and at least once each year during the two years following planting. 2013, the first year of planting, will also be the first year of monitoring and maintenance. On these monitoring visits, plantings will be cleared of any encroaching invasive vegetation, fed and watered as appropriate, and an inventory of the health/survival of the plantings will be documented to help monitor success of the program.

Replanting - If during one of the maintenance trips to the planted site, the survival rate of the new plantings has fallen below 80%, there will be a follow-up replanting with additional tree stock back to the original planting density. It is possible that the species being planted will be changed to adjust for the mortality effects observed. Each planted site will be replanted up to two additional times corresponding to the two years where the site is monitored after the planting year. In the first year of planting, there will be no follow-up replanting.

Outreach to landowners (recruiting new participants). Marketing materials will continue to be sent out each year to provide the additional participants needed for the program. Areas in the basin that have had preliminary plantings done by CRBC will be retargeted with marketing outreach, as appropriate, to communicate to non-participants about the early program success and determine if they would now like to participate. A continually refined marketing effort building on experience to date will be undertaken and will include letters, telephone contacts, personal contacts, community events, and a website to reach out to landowners to recruit them to participate in the tree planting program.

Contracting for additional plants - Select species and quantities for the following year's planting will be based on experiences to date and projected landowner involvement for the following year. Most species will require at least a 2 year grow out; some plants will be grown by the nursery from germinated seeds, and some will be acquired by the nursery as seedlings and grown on the nursery for several years. The contracting with wholesale nurseries for additional stock to be delivered before the next year's planting schedule will be scaled back and eventually terminate as the planting program goal of 30 miles is reached.

3.4 Performance Monitoring/Periodic Review and Revision

Yearly reporting - Each year PGE will report on the progress of the shade program. This annual report to DEQ (with copies to the Fish Committee) will document the status of the program and could include using GIS mapping of the planted areas. The report will document the number of miles planted and the number of landowners enrolled. It will also include the location of each landowner in the shade program, the streamside miles associated with each property planted, the number of acres planted, and the number of trees planted by species during the year. The annual report will also include a summary of the program's progress to date and of the maintenance activities and replanting efforts that were undertaken during the year. To the extent that replanting occurred during the year, the annual report will provide the same information for areas replanted as for initial plantings, as described above. The annual report will also report these measures on a "program-to-date" basis.

Consultation – PGE will consult with the Fish Committee on implementation of this program. The Fish Committee will be given an opportunity to review marketing materials and outreach strategies. An annual meeting will be established where the yearly report is presented and potential modifications to the program can be discussed. At the request of the Fish Committee, additional meetings can be scheduled as issues arise. The Fish Committee will have an opportunity to meet with PGE and the CRBC starting in Year 1 and continuing through completion of the shade program.

If the shading program is not achieving the mileage targets established here, PGE will meet with the Fish Committee and DEQ to identify additional approaches to achieve those targets.

3.5 Compliance with Land Use Requirements

As noted in Section 1.6, on October 7, 2008, Clackamas County issued a land use compatibility statement for the measures described in this TIP, including the tributary shading program.

4.0 HABITAT PROJECTS

4.1 Summary

In 2004 PGE constructed a 0.5-mile-long groundwater side channel downstream of Barton Bridge, at RM 12.0 (Parsons side-channel project). The channel was designed and constructed to create additional cold water summer rearing habitat for juvenile Coho, Chinook, and steelhead. The project created approximately 1600 m² of new cool water summer habitat. Field studies in 2006 showed that average temperatures in the new channel are 2 to 4 °C cooler than mixed mainstem temperatures, and that these conditions provide ideal summer rearing temperatures and thermal refugia from mainstem river temperatures. Fish densities were shown to be higher in the side channel than in the mainstem.

During discussions with the Water Quality Group, PGE agreed to implement two additional habitat enhancement projects along the lower Clackamas River. As described in Section 9.3.5 of

the June 2008 401 Application, these projects are planned to be located at McIver Park and Eagle Creek and are expected to provide a significant amount of cold water summer rearing habitat for juvenile Coho, Chinook, and steelhead. These side channel improvements are expected to provide substantial benefits to juvenile salmonids, thereby increasing salmonid production and promoting beneficial uses designated for the lower river.

4.2 Management Strategies

Project identification focused on opportunities to restore or create side channel habitat in the Clackamas River floodplain that would provide juvenile rearing habitats for Chinook, steelhead and Coho. While side channel habitat was the primary focus of this effort, tributary and large wood habitat potential was also examined and considered. The objective of this effort was to identify, prioritize and recommend sites to implement habitat restoration work along the Clackamas River and in tributaries within a ¼ mile of their confluence with the Clackamas. The evaluation reach started at Carver Park and ended below River Mill Dam. Ten sites were identified as having potential for restoration of juvenile rearing and backwater habitat.

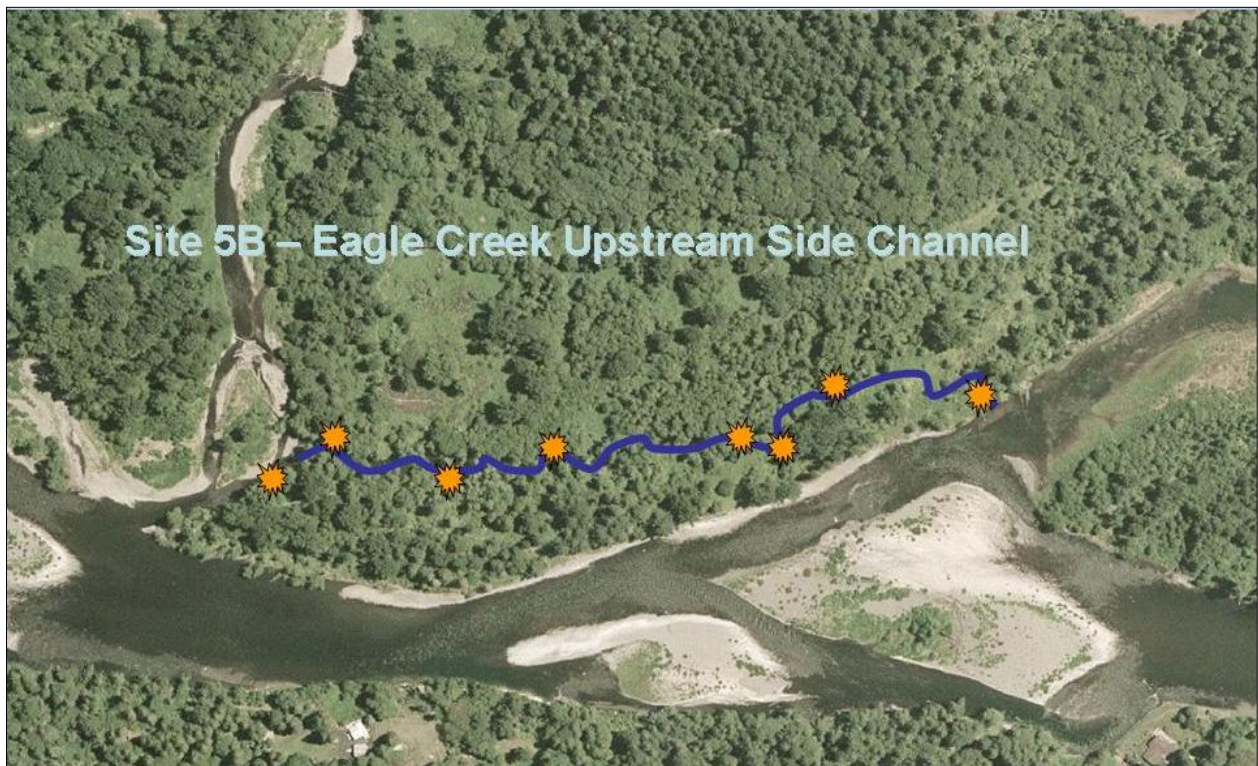
Of the ten sites reviewed, two showed the most promise based on the following criteria: site access, suitable substrate, potential side channels near the river channel elevation, suitable gradient between potential side channel inlet and outlets, suitability of each site to develop large wood cover habitat, and public ownership (which provided a reasonable assurance that permission to work at the site would be granted). As a result of this effort the Eagle Creek and McIver Park side channel project sites were chosen as projects to be implemented under this TIP.

- **Eagle Creek Project**

Existing Conditions – The proposed project follows the alignment of an old side channel of the Clackamas River. The upstream 1000 feet of the existing channel is currently isolated from river flows by a high river bank, while the downstream 500 feet of the channel empties into Eagle Creek and is backwatered by this system. The upstream reach is composed of a narrow, incised channel, while the downstream reach is currently a long pool. There is some woody debris in the pool, recruited from the adjacent forest. A small surface stream intersects the side channel near the upper end of the backwatered reach, and hyporheic flow is also evident along the deeper parts of the channel. The entire channel alignment winds through a mature forest. It is difficult to determine substrate type due to a well-established vegetative mat, but exposed areas indicate it is likely gravel and cobble.

Enhancement Potential – The enhancement of the existing channel to create a new summer low flow channel will provide habitat specifically designed to maximize juvenile steelhead and Chinook productivity. The gradient will allow for the creation of the optimum ratio of pool/riffle habitat; and the conceptual design includes the placement of large woody debris and boulders, resulting in increased habitat complexity. The proposed woody debris will provide physical refuge from predators and competitors, as well as creating a low velocity refuge during flood events. The log jams will dissipate peak flow energy, and result in the continued evolution of scour pools during high water events. The jams will also serve to influence the retention of

gravels moving through the system. Altering the grade, increasing summer flow, and adding riffle habitat to the currently backwatered reach of the channel will increase the density of rearing juvenile fish the system can support. The mature riparian habitat along the channel will provide a recruitment source of additional woody debris over time, and offer shade and a rich source of food for juvenile fish.



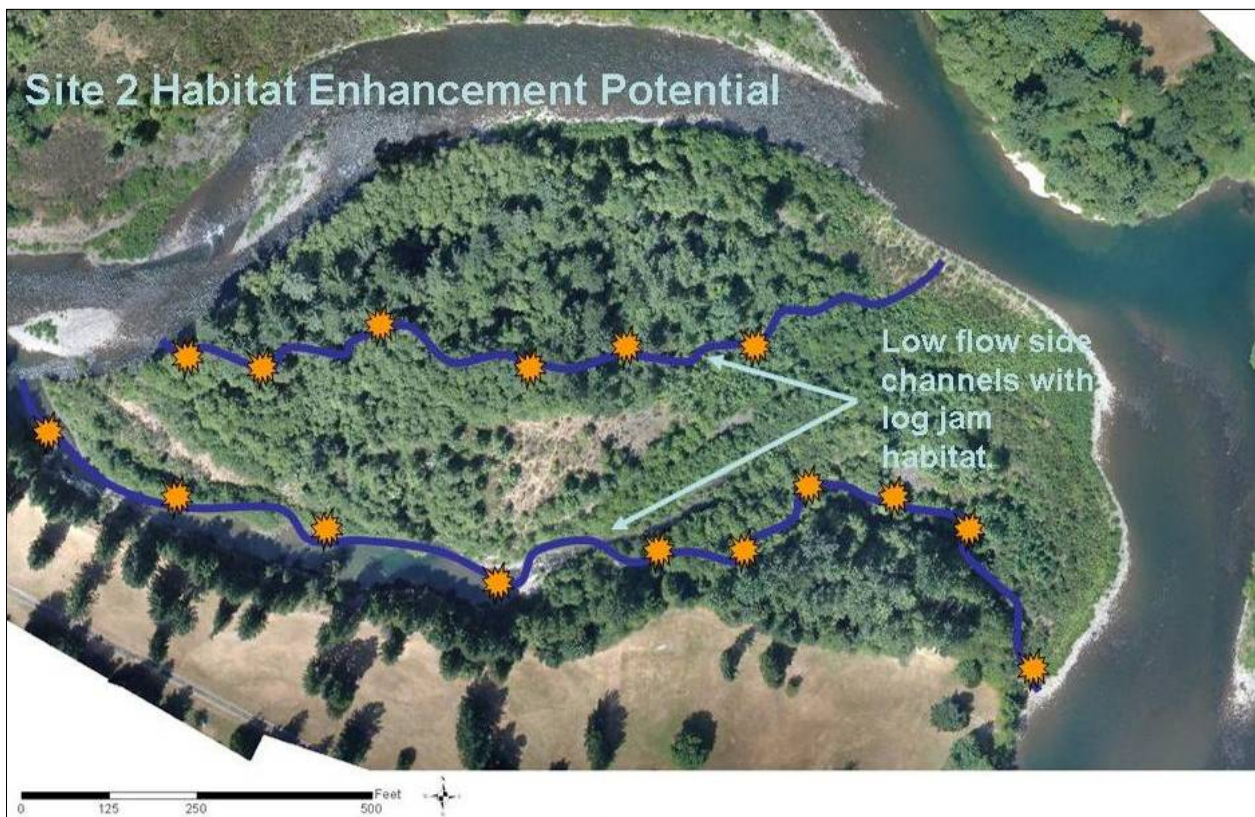
Project Description – The project upstream of Eagle Creek imports logs and trees to create log jam habitat within a created low flow side channel excavated into an old abandoned Clackamas River channel. The lower 500 feet of the existing channel is backwatered during low flow discharge. The upper 1000 feet reach of the channel is dry during average winter flows. The upper 1000 feet will be excavated and graded to allow low flow rearing habitat with approximate channel top widths of 15 feet. The existing channel width in the lower 500 feet is similar to the old Clackamas channel that created it. This part of the channel will be filled to create a top width of approximately 30 feet, reducing its existing width by approximately 20 feet.

Two forms of wood habitat will be created within the side channel. The first form will create cover habitat similar to fallen trees within pools and riffles. The second form will be composed of large log jams emulating the deposition of large trees during flood events.

- **McIver Park Project**

Existing Conditions – The proposed McIver Park project involves the enhancement of two existing high flow side channels of the Clackamas River. The North Side Channel winds primarily through a mature alder forest, with a substantial portion of the reach adjacent to an area composed of a mature fir forest. This is a flood channel, formed by high flow events. There are numerous pools on the channel alignment, and hyporheic flow is evident. Individual trees have fallen across the channel, but no large wood jams are present. The base substrate is cobble, but some of the bank material is fine soil.

The upper half of the South Side Channel is composed of an open, cobble based flood channel, indicating recent scouring flows. The channel alignment is along the historic mudstone bank of the Clackamas. The lower half of the South Side Channel still exhibits characteristics of the mainstem Clackamas River, with deep pool habitat and scoured mudstone shelves. This reach is backwatered. There is an additional flood channel entering this channel from the north, and substantial hyporheic flow is present. On the south bank of the proposed channel alignment the existing riparian vegetation is mature, while the north bank is composed primarily of scrub willow.



Enhancement Potential – The enhancement of these existing channels by creating two new low flow channels will provide habitat specifically designed to maximize juvenile steelhead and Chinook productivity. The gradient will allow for the creation of the optimum ratio of pool/riffle habitat, and the conceptual design includes the placement of large woody debris and boulders, resulting in increased habitat complexity. The proposed woody debris will provide physical

refuge from predators and competitors, as well as providing a low velocity refuge during flood events. The log jams will dissipate peak flow energy, and result in the continued evolution of scour pools. The jams will also serve to influence the retention of gravels moving through the system. Altering the grade, increasing summer flow, and adding riffle habitat to the currently backwatered reach of the south channel will increase the density of rearing juvenile fish the system can support. The mature riparian habitat along both channels will provide a recruitment source of additional woody debris over time, and also will offer shade and a rich source of food for juvenile fish.

Project Description – The McIver Park project proposes to create two low flow side channels with large wood cover habitat. There will be a north and south side channel.

All of the North Channel and the upstream half of the south channel will be graded to allow low flow rearing habitat with approximate channel top widths of 15 feet. The lower half of the south channel, currently 80 feet wide, will be filled to a top width of approximately 30 feet to take advantage of existing pool volume and deeper residual pool depths. This segment of channel will slowly fill and narrow further to resemble upstream top widths of 15 feet as river transported sediment is delivered to the site. The speed at which this occurs will be dependent on the sediment influx following gravel augmentation and final design grade to be determined.

Two forms of wood habitat will be created within both side channels. The first will create cover habitat in riffles and pools. The second will be composed of large log jams. The larger log jams are intended to maintain habitat value and collect mobile wood debris if a greater percentage of flow enters the side channels in the years following construction.

4.3 Timeline

The following implementation schedule outlines the tasks required to move the Eagle Creek and McIver Projects forward to construction. It also includes the tasks associated with the long-term monitoring program, described in Section 4.4, to ensure that the positive effects of the Parson, McIver, and Eagle Creek habitat improvement projects will continue.

The tasks within each year are not necessarily sequential but their completion within the assigned year is necessary to move each project forward. Due to the limited in-water construction work window (July – September) in the Clackamas River, this schedule is time sensitive.

2011

- Determine if the Eagle Creek and McIver Park project sites are still in the same condition as when they were proposed. If the geomorphic setting is not similar to the original proposal, identify changes to the proposal that would yield a project of similar scope and habitat enhancement. As discussed below, if changes to original proposal will not meet mitigation habitat criteria, identify alternative project in another location.
- Determine order in which projects will be implemented.

- Identify, accumulate and stock materials such as large wood and boulders for placement in habitat projects.
- Obtain landowner permission and easements necessary to undertake and complete the projects in the order identified above.
- In consultation with the Fish Committee, begin time sensitive data collection necessary to design the Eagle Creek and McIver Park projects. Establish permanent bench marks so future topographic data can be tied to monitoring data and design construction staking.
- Complete topographic survey for Project 1.
- Contact permitting agencies and interested parties to begin preparatory work for the permitting process for the Eagle Creek and McIver Park projects. Agencies contacted would include ODEQ; DSL; the Army Corps of Engineers; and NOAA Fisheries, for consultation pursuant to the Endangered Species Act (ESA).

2012

- In consultation with the Fish Committee, complete data collection and designs for Project 1.
- Hold a field review for permitting agencies at the Project 1 site.
- Complete and file permit applications for Project 1.
 - DSL Permit.
 - Biological Assessment for NOAA Fisheries.
 - Complete NOAA consultation.
 - Clackamas County Permit.
 - Wetland Delineation.
 - SWPPP – Storm water pollution prevention plan.
- Continue to monitor and collect design data for Project 2.
- Complete topographic survey for Project 2.

2013

- Receive permits to construct Project 1.
- Complete construction contracting for Project 1.
- Construct Project 1 (July – September).

- In consultation with the Fish Committee, complete design work for Project 2.
- Hold a field review for permit agencies at the Project 2 site.
- Complete and file permit applications for Project. It is anticipated that the same permits and consultations will be required for Project 2 as for Project 1.

2014

- Receive permits to construct Project 2.
- Complete an as-built survey of Project 1.
- Complete construction contracting for Project 2.
- Construct Project 2.

2015

- Conduct post construction monitoring walk through for Project 1.
- Complete as-built survey for Project 2.

2016

- Conduct post construction monitoring walk through for Project 2.
- Carry out annual inspection of Project 1 as described in Section 4.4.

2017 – 2025

- Continue annual project inspections as described in Section 4.4.
- Evaluate the need for release of funds to maintain projects following each annual monitoring inspection as described in Section 4.4.

2019, 2014, 2019 and 2024

- Carry out 5-year post construction detailed monitoring for Project 1 as described in Section 4.4.
- Evaluate the need for release of funds to maintain Project 1 following each 5-year monitoring report as described in Section 4.4.

2010, 2015, 2020, and 2025

- Carry out 5-year post construction detailed monitoring for Project 2 as described in Section 4.4.
- Evaluate the need for release of funds to maintain Project 2 following each 5-year monitoring report as described in Section 4.4.

As noted previously, in 2011, PGE will determine if the Eagle Creek and McIver Park project sites have changed in ways that make either project infeasible. If either project is no longer feasible, PGE will consult with the Fish Committee to identify a replacement project. This evaluation will consider, but will not be limited to, the original list of projects that was surveyed during the selection of the Eagle Creek and McIver Park projects. Once a replacement project has been identified, a revised timeline for implementation of that project will be developed.

The feasibility of a replacement project will be determined in part based on its estimated cost, judged against the estimated total cost of the Eagle Creek and McIver Park projects, as developed by PGE in consultation with the Fish Committee. If no replacement project can be identified that meets this test, any funds remaining between the estimate developed with the Fish Committee and the cost of the project that is undertaken will be set aside for PGE for further measures to be developed with DEQ pursuant to this TIP.

4.4 Performance Monitoring/Periodic Review and Revision

PGE will undertake a long-term monitoring program to ensure that the positive effects of the Parson, McIver, and Eagle Creek habitat improvement projects will continue. This program will have three components: annual inspection of habitat restoration projects; periodic evaluations of the quality and quantity of salmonids habitat in the projects; and potential modifications to those projects. PGE will consult with the Fish Committee on implementation of this long-term monitoring program. As discussed below, this consultation will include review of annual inspections and periodic evaluation results and discussion of potential modifications to the projects.

Annual inspections of the habitat restoration projects.

Beginning the second year after construction, PGE will conduct an annual “walk through” inspection of the side channel projects. (During the first year after construction, the contractor will complete “as-built surveys” of the project.). These annual inspections will include photographs and other appropriate observations to note if flows are continuing to travel through the projects as designed. This information will be made available to the Fish Committee. During the annual inspections, simple modifications that can be made with hand tools (*e.g.* shovel, picks) and do not require any additional permits or agency consultations will be made to attempt to keep flows moving through the project.

Annual inspections will continue through year 20 of each project, or until the project has been so altered by hydrologic events (flooding, channel migration) that it is no longer critical to do inspections. The annual inspections will be replaced every five years by a more comprehensive survey of the available aquatic habitat at each restoration project.

Five-year evaluation of the habitat restoration projects.

Five-year evaluations will be used to evaluate the quality and quantity of salmonid habitat in the habitat projects. Such evaluations could include documenting log jams, flow velocities, channel depths, and observations about substrate and proximity to cover. Measurements will be of a similar quality and detail as the information collected by PGE for the Salmon Life Cycle Model of the Clackamas River (Cramer 2008). Monitoring will entail re-measuring and re-evaluating the amount of designed habitat within each constructed side channel consistent with the biological objectives defined for the construction of the project.

The five-year evaluations will be done four times for each project, or until the project has been so altered by hydrologic events (such as flooding or channel migration) that it is no longer useful to do these evaluations, whichever comes first. The five-year evaluations will result in a report to the Fish Committee documenting the square meters of habitat with preferred juvenile salmonid characteristics (depth, substrate, velocity, and proximity to cover).

Potential modifications to habitat restoration projects.

As a result of assessments of side channel performance based on annual “walk through” inspections and the five year monitoring evaluation reports, Fish Committee members may request that PGE design moderate maintenance activities that would help restore functionality of the constructed side channel habitat projects. Such activities refer to potential modifications beyond any minor, hand-tool modifications described above. PGE will implement these maintenance activities after consultation with the Fish Committee and approval by DEQ. The total budget for these activities is \$600,000, which includes the costs of design, permitting, and construction of the proposed modifications. PGE will implement these measures within 12 months of the decision to modify the habitat project.

These funds will be available to maintain the two habitat projects until the 22nd year after the habitat projects were constructed. This would allow the fourth and final 5-year evaluation of the habitat projects to contribute to this decision. This funding commitment will escalate in accordance with the terms of PLA 5 in the Settlement Agreement. If the cost of proposed modifications is estimated to exceed the remaining available funds, PGE will consult with the Fish Committee before PGE and DEQ determine whether to proceed with the modifications in their proposed form.

Reporting

As described in Section 5, PGE will submit an annual report to DEQ containing a description of its efforts to implement the habitat projects during the prior year.

4.5 Compliance with Land Use Requirements

As noted in Section 1.6, on October 7, 2008, Clackamas County issued a land use compatibility statement for the measures described in this TIP, including the proposed habitat enhancement project at Eagle Creek and McIver Park.

5.0 REPORTING

PGE will prepare and submit to DEQ an annual report of its progress implementing the TIP. This report will contain a description of its efforts to implement each of the elements of the TIP described above, including the modification of Faraday Lake. Progress reports from consultants will be attached as appendices to the annual report.

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TMDL IMPLEMENTATION PLAN - APPENDIX 1

Request to Modify Settlement Agreement Proposed License

UNITED STATES OF AMERICA

Before the

FEDERAL ENERGY REGULATORY COMMISSION

Portland General Electric)
Company) **Project No. 2195**
)

Request to Modify Settlement Agreement Proposed License Article 14

Portland General Electric Company ("PGE") is the Applicant for a new license for Project No. 2195, the Clackamas River Hydroelectric Project. On March 29, 2006, PGE filed a Settlement Agreement with the Commission. It was signed by PGE and 32 other parties and resolved all issues associated with the relicensing of the project, other than the issue of temperature in the Clackamas River below River Mill Dam. The issue of temperature in the lower Clackamas River must be resolved before the Oregon Department of Environmental Quality ("ODEQ") can issue a water quality certification for the Project. Since March 2006, PGE has been working with ODEQ and other settlement parties in order to resolve the issue of temperature in the lower Clackamas River. On June 20, 2008, PGE filed a revised application for water quality certification that proposes a resolution of this issue.

The Settlement Agreement included proposed license articles ("PLAs") to be included in a new license; PLA 14 regulated the operation of Faraday Lake. PGE's revised water quality certification application necessitates a modification of PLA 14 as filed with the Commission.

Accordingly, PGE respectfully requests that the Commission modify Proposed License Article 14, as described below, to be consistent with PGE's application for water quality certification. To the best of PGE's knowledge, no party to the Settlement Agreement opposes this request.

Background

On August 26, 2004, PGE filed an application for a new license for the Clackamas Project. As required by Commission rules, PGE had, on August 18, 2004, filed an application for water quality certification with ODEQ.

Beginning in April 2004, PGE and 32 other parties (collectively, the "Settlement Working Group" or "SWG"), including ODEQ, participated in active settlement negotiations intended to resolve all outstanding issues associated with the relicensing of the Project. These negotiations were successful (except with respect to temperature below the Project), and in June 2005 the SWG reached agreement in principle ("AIP") on the terms and conditions under which the Project should be relicensed. Because the AIP superseded the August 18, 2004, application for water quality certification, PGE withdrew the August 2004 application and in June 2005 filed a revised application that reflected the terms and conditions of the AIP reached by the SWG.

The SWG continued to negotiate the details of elements outlined in the AIP, and in March 2006, the SWG successfully concluded the negotiations. PGE filed a comprehensive relicensing Settlement Agreement with FERC. As noted, the Settlement Agreement included proposed license articles. PLA 14 governed operation of Faraday Lake, providing, in its entirety: "The Licensee shall operate Faraday Lake between a minimum elevation of 510.2 ft., msl, and a maximum elevation of 522.0 ft."

After PGE filed the Settlement Agreement on March 29, 2006, the Commission issued a Draft Environmental Impact Statement, followed by a Final Environmental Impact Statement ("FEIS") in December 2006. The FEIS recommended adoption of substantially all of the provisions of the Settlement Agreement, including specifically the provisions governing Project Operations.

As noted, the Settlement Agreement had resolved all issues raised by all parties to the proceeding, with the exception of water temperature in the Clackamas River below River Mill Dam. To reflect the terms of the Settlement Agreement and address the issue of temperature below the Project, PGE withdrew its June 2005 application for water quality certification on May 2, 2006, and filed a revised application on December 29, 2006.

Further water quality modeling and research indicated, however, that PGE's December 2006 401 application would not resolve all temperature issues below the Project. Therefore, PGE continued to work with the SWG throughout 2007 to try to resolve outstanding water quality issues related to the impact of the Project on temperature in the Clackamas River below River Mill Dam. These discussions led to revisions of the December 2006 application and a decision that PGE would re-file its application. Accordingly, on November 13, 2007, PGE withdrew the December 2006 application. On December 13, 2007, FERC granted PGE an extension of time, to June 30, 2008, to re-file the water quality certification application with ODEQ.

In May 2008, PGE concluded its discussions with the SWG and with ODEQ on the components of a revised application for water quality certification. PGE filed that application with ODEQ on June 20, 2008.

Based on extensive water quality modeling, the June 2008 application proposed a number of measures to address the issue of temperature in the Clackamas River below River Mill Dam. One of these measures would modify the operation of Faraday Lake in order to reduce the amount of warming that occurs in Faraday Lake during July, August, and September. Implementation of this measure necessitates modification of PLA 14, as described below.

Proposed Modification to PLA 14

PGE has determined that by drawing down or channelizing Faraday Lake, it is possible to reduce the amount of warming that occurs in Faraday Lake, thereby reducing temperatures in the lower Clackamas River. However, PGE has not yet been able to determine which approach is more cost effective. Therefore, PGE proposes to file a plan with the Commission and ODEQ, within six months of license issuance, to implement either a seasonal drawdown or a channelization of Faraday Lake that would produce a comparable temperature reduction at the Faraday tailrace.

This proposal is based on the extensive water quality modeling that PGE conducted during the past five years, using the CE-QUAL-W2 model. That modeling shows that although modeled temperatures in the River Mill tailrace will comply with relevant ODEQ criteria throughout the year, after implementation of the measures contained in the Settlement Agreement, applicable water quality standards will be exceeded at Eagle Creek, approximately eight miles downstream. Based on model results, temperatures at Eagle Creek would have exceeded ODEQ criteria during 101 and 118 days in 2000 and 2001, respectively. This location represents the Project's point of maximum impact in temperature, which is the point at which compliance with the ODEQ standard is measured. As a result, it is the focus of the temperature

improvement measures that PGE investigated during the preparation of the June 2008 ODEQ application.¹

In the December 2006 application, PGE investigated physically reconfiguring Faraday Lake to allow water to flow through Faraday Lake with minimal temperature gain. Its analysis showed that a temperature reduction of approximately 0.65 °C could be achieved at the Faraday powerhouse tailrace by channelizing and drawing Faraday Lake down to minimize the warming of the water as it flowed through Faraday Lake. Subsequent analysis determined, however, that this approach to channelization was not cost effective, and that the drawdown would cause a significant loss of generation.

During the preparation of the June 2008 application, PGE investigated the possibility that a similar result could be achieved by drawing Faraday Lake down, effectively creating a rapidly flowing channel that limited temperature gains between the intake tunnel and forebay. PGE analyzed two alternatives - a 9-foot drawdown and a 13-foot draw down. The 13-foot drawdown, in particular, showed significant temperature reductions in the Faraday tailrace, compared to existing conditions, though temperature improvements in the lower river are reduced following passage of the water released from Faraday Lake through Lake Estacada. The 13-foot drawdown reduces temperatures by approximately 0.5 °C at the Faraday tailrace and by approximately 0.18 °C at Eagle Creek. While this alternative would not require construction to be implemented, it would entail both a loss of generation and a loss of ancillary service

1

This heating of the lower river is due to a phase shift induced by the uniform temperatures of water discharged from River Mill Dam resulting from warming and reduced diurnal variation associated with the reservoirs. See page 159 of the June 2008 Application, a copy of which was filed with the Commission on June 24, 2008.

capability while Faraday Lake is drawn down. For the 13-foot drawdown, this loss totals approximately \$5 million over the term of the license. By contrast, channelization of Faraday Lake would involve construction costs but would not result in a loss of generation.

PGE's further analyses showed that reconfiguring Faraday Lake to create a 125-ft-wide channel leading to the powerhouse would create a temperature reduction comparable to that produced by a 13-ft drawdown. As noted, drawdowns could be accomplished without significant capital expenditures, but would result in significant loss of seasonal generating capacity, which would be avoided by channelizing Faraday Lake. At this time, PGE does not have sufficient detailed engineering information and design analyses to determine which approach would be more cost effective.

Accordingly, PGE proposes to achieve the 0.18 °C temperature reduction modeled for a 13-ft drawdown either through reliance on seasonal drawdowns, or by channelizing Faraday Lake. To do this, it will be necessary to modify the provisions of the Settlement Agreement (PLA 14) governing the operation of Faraday Lake. To accomplish this, PLA 14 should be modified as follows:

Article 14. Faraday Lake and Powerhouse

- (a) Except as provided in paragraph (b), the Licensee shall operate Faraday Lake between a minimum elevation of 510.2 ft., msl, and a maximum elevation of 522.0 ft.
- (b) Within six months of license issuance, the Licensee, after consultation with the Fish Committee and approval by the Oregon Department of Environmental Quality, shall file a plan and schedule for Commission approval to achieve a temperature reduction of approximately 0.5°C during the period July 1 to September 30 at the Faraday powerhouse tailrace by implementing either (1) a seasonal drawdown of approximately 13 feet in Faraday Lake, or (2) a channelization of Faraday Lake. The

plan shall include an implementation schedule. If the plan provides that a drawdown should be implemented, it shall also include a monitoring plan and a schedule to file an evaluation report with the Commission within 24 months of Commission approval of the plan, and address whether the drawdown causes downstream turbidity problems, threatens the stability of the Faraday Lake embankments, or causes unacceptable operational problems at the Faraday powerhouse. Upon Commission approval, the Licensee shall implement the plan. The Commission reserves the right to require that the actual implementation of the drawdown regime be modified based on the results of the evaluation report.

With this proposed modification, PLA 14 will be consistent with PGE's proposal to ODEQ in the June 2008 application to implement either a seasonal drawdown or channelization of Faraday Lake, and will provide the Commission with the approval authority and continuing oversight to ensure that implementation of either approach is consistent with Commission requirements and design standards.

Consultation with Settlement Parties

As noted above, PGE has been discussing possible ways to address the issue of temperature in the lower Clackamas River since it filed the Settlement Agreement in March 2006. All parties to the Settlement Agreement are aware of the filing of this request for modification of PLA 14. To the best of PGE's knowledge, no party opposes this request.

Conclusion

For the foregoing reasons, Portland General Electric Company respectfully requests that the Commission modify Proposed License Article 14, included in Exhibit A to the Settlement Agreement filed by PGE on March 29, 2006, in the manner described above so that it will be consistent with the application for water quality certification filed with ODEQ on June 20, 2008.

Respectfully submitted,

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TMDL IMPLEMENTATION PLAN - APPENDIX 2

**DRAFT
Lower Clackamas River
Coarse Sediment Management Plan**

**Submitted by Peter Wampler
Submitted to the Settlement Working Group
(Fish & Aquatics Subgroup)
February 8, 2005**

Key Provisions of the Coarse Sediment Management Plan

- The broad goal of the proposed coarse sediment management plan is to begin reversing observed geomorphic changes below River Mill Dam by restoring a portion of the historic coarse sediment supply that has been trapped behind River Mill and North Fork dams.
- Plan implementation is scheduled to proceed as follows:
 - Year 1 and 2 (First two full years of license) - Baseline data collection and numerical modeling.
 - Year 3 and 4 – Construction planning, engineering, and permitting.
 - Year 5 – Construction of sediment extraction and transport infrastructure.
 - Year 6 – Initial sediment placement at the augmentation location.
 - Year 6 to 10 – Annual sediment augmentation; and downstream monitoring of erosion and deposition.
 - Year 10 - Monitoring results will be compiled and analyzed. Coarse sediment introduction rates and caps will be adjusted to achieve the intended beneficial channel morphology changes, and monitoring frequency and methods will also be evaluated to determine which measures are providing the most useful data.
- The coarse sediment management plan for the lower Clackamas River calls for incremental coarse sediment introduction below River Mill Dam. A volume of 8,000 yd³ will be introduced 850 feet downstream of River Mill Dam on the right bank. Coarse sediment will be placed during low flow (July-September) in a geomorphically favorable location where recruitment by the river will occur during moderate flows (> 10,000 cfs).
- The average annual rate of coarse sediment introduction is anticipated to be approximately 8,000 yd³/year for the life of the license, until coarse sediment sources on PGE property are exhausted, or it is determined that augmentation is no longer warranted. Winter replenishment at the introduction site may occur up to three times per year depending on high flow recruitment, but the overall annual volume will be limited to a maximum of 20,000 yd³. Annual replenishment rates and caps will be reevaluated after five years of augmentation.
- The full range of grain sizes will be used to allow the river to hydraulically sort gravel in the channel; washing or sorting of augmentation material is not planned.

INTRODUCTION

River Mill Dam on the lower Clackamas River was completed in 1911 to provide hydroelectric power to the burgeoning city of Portland, Oregon. Hydrologic changes from the dam are minimal; however, a set of dam-induced geomorphic changes resulting from sediment supply changes have been documented (Wampler, 2004). Channel incision immediately below the dam is minor due to the presence of erosion-resistant bedrock. However, regularly spaced bedrock pools up to 10 m deep, eroded into bedrock for 3 km below the dam, and may be related to sediment supply reduction and channel degradation below the dam.

Other geomorphic changes below the dam include: 1) increase in surface grain-size; 2) reduction in side channel area; 3) reductions in coarse sediment bar storage; 4) increase in bedrock exposure; and 5) lowering of water surface elevations.

Substantial improvements to the physical channel characteristics below River Mill Dam may be possible without complete replacement of historic coarse sediment supply. Floodplain development, which has occurred within the context of the current sediment transport regime, could be impacted by large scale coarse sediment augmentation due to flood height changes, lateral erosion, and increased channel dynamism. Therefore, we recommend that the volume of coarse sediment introduced annually should fall between the long term historic coarse sediment supply and the current sediment transport regime.

OBJECTIVES OF THE PROPOSED AUGMENTATION PROGRAM

The goal of the proposed coarse sediment management plan is to begin reversing observed geomorphic changes below River Mill Dam by restoring a portion of the historic coarse sediment supply that has been trapped behind River Mill and North Fork dams (Table 1). Physical channel changes resulting from coarse sediment augmentation would also provide potential biological benefits in the form of increased spawning and rearing habitat for salmonids. Less predictable changes to water quality, water temperature, and improved invertebrate production may occur as a result of increased coarse sediment storage and exchange between groundwater (hyporheic flow) and surface water.

Table 1. Approximate reservoir trap data and transport data below River Mill Dam (Washington Infrastructure Services Inc., 2001; McBain and Trush, 2002; Wampler, 2004).

	yd ³	m ³
River Mill Dam (51 years)	5,080,404	3,884,248
River Mill Dam Bedload ^a	1,524,121	1,165,274
Annual volume of coarse bedload trapped	29,900	22,800
North Fork Dam (42 years)	10,443,100	7,984,323
North Fork Dam Bedload ^a	3,132,930	2,395,297
Annual volume of coarse bedload trapped	74,600	57,000
Combined (93 years)	15,523,504	11,868,570
Combined Bedload ^a	4,657,051	3,560,571
Annual volume of coarse bedload trapped	50,100	38,300
Maximum bedload transport based on GIS analysis (1938-2003)^b	402,083	307,414
Annual bedload transport out of the 2-mile reach below River Mill Dam	6,200	4,700

^aBedload defined as > sand-size (assumed 30% of total sediment trapped).

^bsee Wampler (2004) for details on this estimate

The fundamental questions surrounding coarse sediment augmentation are:

- How much coarse sediment should be added to achieve measurable geomorphic changes?
- What type of coarse sediment should be added and what range of grain sizes?
- How often should coarse sediment be added to achieve desired geomorphic changes?
- Where and when should coarse sediment be introduced to achieve the maximum benefits?
- What regulatory constraints will be imposed on the timing, size, type of coarse sediment, and total volumes of coarse sediment added?

PROPOSED ACTION

The timeline for implementation of the coarse sediment plan will begin after the license has been granted. Initial sediment introduction will take place after planning, permitting, and construction (Figure 2).

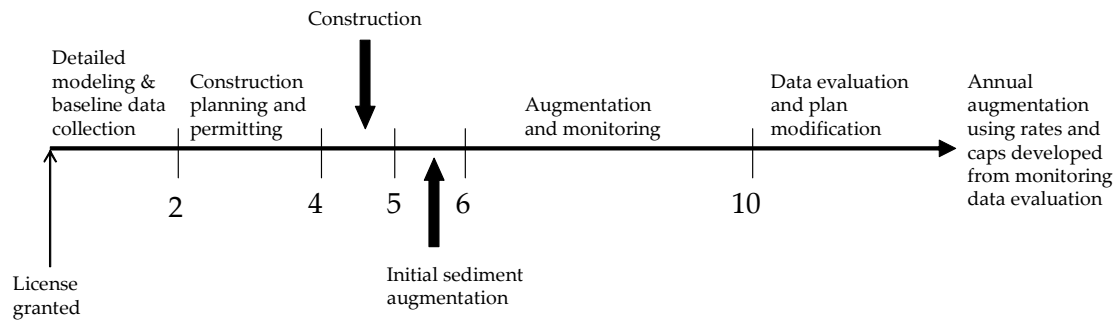


Figure 2. Implementation timeline for the coarse sediment management plan.

In the first full year of gravel augmentation, a volume of 8,000 yd³ will be introduced 850 feet downstream of River Mill Dam on the right bank. The location needs to be close to both River Mill Dam and sediment resources to allow efficient access. The size and precise location of the introduction site may be adjusted to accommodate hydraulic conditions. Course sediment will be extracted from PGE property on the right bank and transported to the augmentation location by truck or conveyor. Coarse sediment will be placed in a lateral bar on the right bank up to five feet thick during low flow (August-September) at a location where recruitment by the river will occur during moderate flows (> 10,000 cfs).

The average annual rate of coarse sediment introduction is anticipated to be about 8,000 yd³/year for the life of the license, until course sediment sources on PGE property are exhausted, or it is determined that augmentation is no longer warranted. PGE will dedicate the vast majority of the gravel supply located on its property adjacent to the augmentation site for this purpose. Any other use of this gravel that exceeds 600 yd³/yr will need to be approved by the Fish Committee. The Fish Committee will evaluate these requests for coarse sediment based on the amount of available material and the average annual volume of material being added to the river through this augmentation program.

During the second full year of augmentation, the portion of the original 8,000 yd³ eroded will be replenished during low flow (August-September). If most or all of the augmentation material is eroded early in the water year (November-January), winter-time replenishment will be implemented. Replacement of the 8,000 yd³ bar will occur up to three times following high flow events, with the maximum volume added during any year limited to 20,000 yd³.

After the first five full years of augmentation, annual rates and caps will be evaluated and adjusted to achieve the desired beneficial changes. For example, 1) the cap for annual introduction may be increased by as much as 25% (25,000 yd³); 2) the number of times in a given winter that sediment is added may be increased to five; and 3) the amount of erosion in a single erosive event that would trigger adding augmentation material will be 25-75%. Hydrologic events over the first five years will be analyzed to establish if flow conditions are average, wetter than normal, or dryer than "normal," and this information will be reflected in Fish Committee recommendations regarding alteration of augmentation volumes and/or augmentation schedule.

Downstream monitoring and numerical modeling will help determine whether this augmentation strategy is supplying sufficient volume of coarse sediment to achieve management objectives. Natural coarse sediment dispersion, erosion, and deposition will occur as coarse sediment is transported downstream from the introduction location. Monitoring will attempt to document trends in erosion and deposition, which will influence yearly modifications to gravel augmentation volumes.

Hydraulic/sediment transport modeling

Computer models such as the one developed by Yantao Cui are a combination of two distinct numerical models. The hydraulic model calculates hydraulic conditions (e.g., water surface elevations, shear stress) across a range of flow conditions, and the sediment transport model predicts coarse sediment transport rates, aggradation (bed raising), and degradation (bed lowering) based on those hydraulic conditions. The predicted sediment transport rates are based on the ability of the water to move sediment, and assume that sediment supply is not limiting.

All numerical models are built upon assumptions and input data which limit the accuracy of the models. One of the limiting factors of the sediment transport portion of the model is that all the sediment transport relations are developed for a specific set of empirical sediment transport data, and assume that sediment supply is not limiting.

In a coupled one-dimensional sediment transport and routing model, results should be interpreted from a reach-average perspective because complicated features in a natural

river, such as pool-riffle sequences and deep pools are not accurately modeled by a 1-D hydraulic and sediment transport model.

The model will predict reach-average sediment aggradation and degradation over a series of flow events. In addition, the model can be used to compare different combinations of sediment-size and input volume for various water year discharge scenarios (e.g., wet and dry years), which will help develop preferred gravel augmentation scenarios and save money over the long-term. The output of the one-dimensional model is aggradation and degradation thickness over the entire channel width at measured cross sections. The model will also provide valuable sediment routing data and predict areas of long-term aggradation at risk of elevated water surface elevations.

A one-dimensional sediment transport model will not accurately predict specific locations where sediment will deposit (aggrade) or erode (degrade). For example, the model might be able to predict that there will be aggradation in the reach between river mile 22.5 and 22.7, but it will not predict whether a gravel bar will form in front of Dog Creek. The hydraulic conditions are simply too complex to achieve this level of model accuracy.

Location, Method, and Timing of Coarse Sediment Introduction

The coarse sediment augmentation location was selected to be as near to the dam as possible to achieve the maximum potential benefit to the affected reach. The augmentation site is also near land owned by PGE with abundant coarse sediment resources, is readily accessed from PGE property, is compatible with conveyor delivery, and is near existing PGE infrastructure. Additional locations were considered, but the bench on the right bank, 850 ft downstream of River Mill Dam, provided the best combination of access, simplicity, and proximity to the base of River Mill Dam.

The USGS stilling well for the Estacada gage is located across from the augmentation location. Resolution of concerns regarding this gage and possible relocation will need to be addressed prior to plan implementation.

Several coarse sediment placement methods are possible at the augmentation location. Direct coarse sediment placement using trucks and loaders, although feasible, may not be a preferred method due to cost, in-water working restrictions, and the necessity of building and maintaining access roads near the river. A permanent conveyor system with a removable extension near the river could provide flexibility, lower cost, and minimal in-water work.

Coarse Sediment Augmentation Rates and Grain-Size

Steep channel slopes and flow restriction within narrow canyon walls below River Mill Dam result in high bedload transport capacity during large floods. Therefore, we have adopted a coarse sediment augmentation strategy that allows the river to recruit coarse sediment placed within the bankfull channel rather than a more complicated placement to create specific habitat features (e.g., spawning riffles). Recruitment and downstream transport by the river will create bars, reduce particle size, and form the desired habitat features.

Coarse sediment augmentation that mimics a natural lateral bar is proposed so that coarse sediment is mobilized from the introduction site during moderate to large flows and the augmentation site maintains a relatively natural look. Topography and water surface elevation data collected prior to introduction will help define the frequency of inundation for the augmentation location. It is anticipated that gravel mobilization from the augmentation site will occur several times per winter. Flows in excess of 10,000 cfs occur, on average, seven times per winter based on long-term historic records at the USGS Estacada gage.

We anticipate that most or all of the coarse sediment placed in the first full year of augmentation will be eroded during the first winter after augmentation. If all the coarse sediment is removed over the winter, and downstream monitoring suggests additional coarse sediment is needed, augmentation will be done up to three times during subsequent winters up to a maximum yearly volume of 20,000 yd³ (Figure 4).

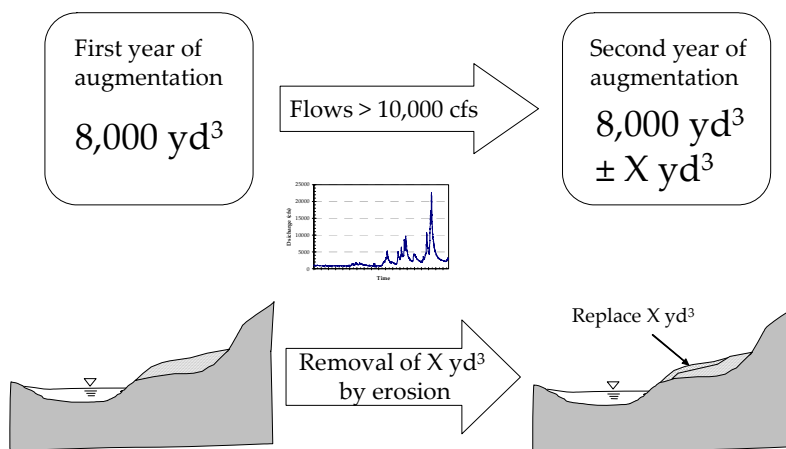


Figure 4. Conceptual diagram showing coarse sediment introduction.

Annual coarse sediment replenishment will place up to 8,000 yd³ each year prior to winter floods (July-September), and replenish the site up to three times following

selected high flow events. Winter replenishment from year to year may vary considerably; drier years may require no additional coarse sediment augmentation, while wetter years may require more than 8,000 yd³. Therefore, we recommend that coarse sediment augmentation during any given year be flexible, but capped to a maximum augmentation volume of 20,000 yd³/yr and three gravel introductions.

Monitoring of channel response downstream and numerical modeling will guide annual adjustments to targeted coarse sediment augmentation rates. At the end of the first five full years of augmentation, monitoring results will be analyzed and coarse sediment introduction rates and caps will be reconsidered to better achieve the intended beneficial channel morphology changes. The frequency and methods used for monitoring will also be evaluated at this time to determine which measures are providing the most useful data. The frequency of evaluations after the first full five years augmentation will be based on the rate of geomorphic changes occurring.

Permitting and Environmental Compliance

Two activities associated with the proposed coarse sediment management plan may require permitting by state and federal agencies: 1) coarse sediment extraction; and 2) coarse sediment placement within the Clackamas River.

Coarse sediment (sand and gravel) extraction in Oregon is regulated by the Oregon Department of Geology and Mineral Industries (DOGAMI) Mined Land Reclamation Program. Preliminary discussions with DOGAMI suggest that mining near the River Mill Dam location on PGE land would qualify for a Total Exemption from mine permitting because: 1) the coarse sediment will not be mined for commercial purposes; and 2) it will not be transported off PGE property except by the river. A final determination of exemption status will be provided once application has been made to DOGAMI. Land-use authority for coarse sediment extraction will need to be obtained from Clackamas County. The county may consider the site exempt from county jurisdiction if it is exempt from DOGAMI rules. Extraction permitting is likely to take 1-3 months if an exemption is granted and 3-16 months if a full mining permit is required.

Placement of coarse sediment below River Mill Dam within the bed and banks of the Clackamas River will require a Fill and Removal Permit from the Division of State Lands (DSL) and from the Army Corps of Engineers (ACOE). Both DSL and ACOE coordinate their permit process with other state and federal agencies. Coordinating agencies include: Oregon Department of Environmental Quality (DEQ); Oregon Department of Fish and Wildlife; U.S. Fish and Wildlife; National Marine Fisheries

Service (NMFS) and others. Coordinating agencies provide comments and recommendations about the proposed activity.

Since the lower Clackamas River has been designated essential salmon habitat, any fill in excess of one cubic yard of rock requires a permit. Typically, a fill and removal permit requires extensive review and consultation prior to issuance and may take several months to obtain. An individual permit may be required by ACOE due to the scale of the project. Individual permits are site specific and require a 30-day public comment period in addition to the more time-consuming internal review and outside coordination with other agencies. A scenic waterway consultation will be required with Oregon State Parks for modifications within the waterway. This may influence the infrastructure used to transport and store the augmentation gravel.

A special permit from DSL, intended for fisheries enhancement projects, may be appropriate for this project. If augmentation is to occur in the winter months, a variance (obtained from the District Biologist) to the in-water work period may be necessary from the Oregon Department of Fish and Wildlife (ODFW).

Since there is some potential to change flood heights as a result of coarse sediment augmentation, it may be necessary to demonstrate that the activity is in compliance with the Federal Emergency Management Agency's (FEMA's) floodplain ordinance. Clackamas County enforces this ordinance. The volumes of material proposed are not likely to raise 100-year flood heights by more than one foot. Numerical models developed for initial design could be used to predict flood heights under different course sediment introduction scenarios.

Permit requirements imposed to mine or place the sediment may influence the economics and permitting of the plan. This would include requirements to wash gravel, restrictions on infrastructure, visual impacts, or in-water work restrictions.

Supplemental Permitting Information

Specific permits, estimated timelines, and key issues for each permitting authority are provided to clarify and provide additional details regarding the permitting of Lower Clackamas River Coarse Sediment Management.

Oregon Department of Environmental Quality (DEQ)

Permitting Authority: Section 401 of the Clean Water Act.

Timeline: It is anticipated that 401 certification will be obtained as part of the FERC relicensing documents. This project would not fit into the standard storm water or

point source discharge classifications.

Key Issues: Obtaining a 401 certification will hinge on the way that sediment added to the river is regulated and whether DEQ will allow some turbidity to occur as a part of the restoration of a more natural sediment regime.

Oregon Department of Geology and Mineral Industries (DOGAMI)

Permitting Authority: Oregon Revised Statutes (ORS) section 570, Mining Laws

Timeline: Total Exemption (30-60 days); Operating Permit (3-12 months)

Key Issues: Mining sediment resources near the River Mill Dam location, on PGE land would likely qualify for a Total Exemption from mine permitting because: 1) the coarse sediment will not be mined for commercial purposes; and 2) it will not be transported off PGE property except by the river. However, the expense and degree of difficulty permitting mining of augmentation resources will depend on this determination. If the mining does not qualify for an exemption, a full operating permit will be required by DOGAMI.

Oregon Division of State Lands (ODSL)

Permitting Authority: ORS 541.605-695 requires that permits be obtained from the Division of State Lands prior to any fill and removal of material from the bed or banks of any stream.

Timeline: State law requires DSL to determine whether an application for a joint removal-fill permit is complete within 30 days of receipt and to issue a decision within 90 days of the completeness determination. The applicant may request a deadline extension.

Key Issues: Sediment placed in the river is considered fill and will likely require compliance with Oregon Fill and Removal law. The Clackamas River from below River Mill Dam to Carver is designated as a Scenic Waterway (ORS 390.805-390.925) and specifies that all fills and removals in State Scenic Waterways require a permit from the DSL.

Army Corps of Engineers

Permitting Authority: 404 certification; fill and removal in waters of the U.S.

Timeline: 90-120 days

Key Issues: Many projects that require a DSL removal-fill permit also will require a federal permit from the U.S. Army Corps of Engineers. The DSL and the Corps use a joint permit application form. This allows the Corps to address any concerns voiced by the DSL, but the joint permit is actually granted by the Corps.

Oregon Parks and Recreation Department (OPRD)

Permitting Authority: Scenic Waterway compliance coordination with DSL

Timeline: OPRD has authority to make recommendations to DSL regarding Scenic Waterway compliance.

Key Issues: The only outstanding issue is the visual impact and temporary disturbance that the sediment introduction site will cause below the dam. Since the site is located near the dam may not be as controversial as if it were located in an undisturbed area.

Clackamas County Planning Department

Permitting Authority: Floodplain compliance; Department of Land Conservation and Development (DLCD) land use compatibility.

Timeline: The county has 90 days to provide a Land use compatibility statement. If Clackamas County requires a change in land use zoning or a Conditional Use Permit (CUP) the permitting processes could take 6 months to 2 years.

Key Issues: Clackamas County will be asked to provide a land use compatibility statement by DOGAMI which verifies that mining of sediment resources is compatible with county Land use zoning. Clackamas County may also require that fill within the river does not result in a net rise of flood levels of more than one foot. Computer modeling used to predict sediment transport may provide the necessary floodplain alteration documentation to demonstrate “no net rise”.

Oregon Department of Fish and Wildlife

Permitting Authority: Although the ODFW does not issue permits directly they do have authority to work with other agencies to address the restoration of native stocks of salmon and trout to historic levels of abundance, pursuant to ORS 496.435.

Timeline: There is no defined time limit for a decision from ODFW since they serve an advisory role. Typically, other coordinating agencies do not hold up a permit process for ODFW comment.

Key Issues: The main issue related to the ODFW is the in-water work period and whether sediment addition could take place outside this window for fish enhancement purposes.

National Marine Fisheries Service (NMFS)

Permitting Authority: Endangered Species Act

Timeline: The timeline for this approval is tied to the Biological Opinion regarding the hydro license project impacts.

Key Issues: The most important issue surrounding endangered species is the incidental take of a protected species in the process of placing gravel at the introduction location. The current plan calls for placing material on the channel margin rather than into the river, therefore the chance of incidental take is minimal. The other issue that may arise is the alterations to habitat for protected species. Since the goal of the project is to improve habitat for these species this issue should be resolved by coordination of the plan with NMFS during the process.

United States Fish & Wildlife Service (USFWS)

Permitting Authority: Endangered Species Act

Timeline: The timeline for this approval is tied to the Biological Opinion regarding the hydro license project impacts.

Key Issues: The most likely species to merit consultation with the USFWS is the Bald Eagle. Potential risks of disturbed nesting, could require alternations in scheduling the gravel extraction or transport to the river. At a minimum documenting any bald eagle nesting sites in the area will be required.

DESIGN METHODS

Detailed baseline topography of the augmentation site is needed prior to coarse sediment introduction. Topographic data will be collected by standard surveying methods using a combination of global positioning system (GPS) and total station surveying methods. Bathymetry data will be collected using single beam sonar or an acoustic Doppler profiler coupled with a GPS for horizontal position.

Grain-size analysis of coarse sediment augmentation sources will be performed to determine the grain size distribution of augmentation resources. This will include a

bulk sample from the proposed extraction area to determine the precise grain-size distribution.

In order to evaluate the potential benefits of different augmentation scenarios, we recommend that a coupled sediment transport and one-dimensional hydraulic model be applied to predict sediment dispersion and reach-scale aggradation and degradation. Natural sediment pulses, introduced by landslides, have been successfully simulated by this method (Cui et al., 2003). Model predictions could be evaluated by monitoring of the channel after coarse sediment introduction has started to both validate the modeling and refine the parameters used in the model. Real-time bedload sampling, during 2-3 high flow events, is also needed as a way to calibrate the numerical sediment transport model. Numerical modeling and baseline data collection will occur during the first two full years of the license.

HYPOTHESIZED BENEFICIAL CHANNEL MORPHOLOGY CHANGES

Injection of coarse sediment is hypothesized to result in the following beneficial changes to the reach between River Mill Dam (RM 23.3) and two miles downstream (RM 21.2):

1. Increase in bedload transport rate. Introducing coarse sediment will increase the bedload transport rate during bed-mobilizing flows. Mobile bedload will be available to reform channel bed forms and geomorphic features such as bars and riffles.
2. Decrease in surface and subsurface grain size. Many areas that are presently armored will likely be covered with a layer of coarse sediment with a smaller average grain size than presently exists. Newly formed bars will have a surface and subsurface grain size which is more comparable to pre-dam conditions. There should be an increase in bar and channel area with D_{50} between 10 mm and 128 mm, which should increase the area available for salmonid spawning, reduce superimposition of redds, and increase egg-to-emergence success.
3. Decrease in area of exposed bedrock and increase of bar area. Channel margin and in-channel areas of exposed bedrock will be repopulated with coarse sediment. As sediment transport increases during peak flow events, many bedrock shelves and armored channel sections will be covered with coarse sediment deposits.
4. Increase in hyporheic flow, potential temperature moderation, and increase the amount of intergravel flow in this river reach.
5. Increase in coarse sediment storage and water surface elevations (WSE) in side channels. Coarse sediment deposition in the channel will result in higher water

surface elevations for a given river discharge. This will increase the amount of side channel habitat during low flow periods. Coarse sediment will be available for complex bedforms.

MONITORING METHODS

Channel morphology changes will be measured once each summer for the first five years following coarse sediment introduction and possibly less frequently in subsequent years, depending on monitoring results. Proposed monitoring methods are outlined below:

1. Coarse sediment augmentation volumes and dispersal patterns will be determined by repeat ground survey of the augmentation site, as well as repeat surveys of the channel topography and bathymetry downstream. An accounting of total volume added to the augmentation site each year will be derived either from ground survey or by recording the rate of replenishment by truck or conveyor methods.
2. If safe and feasible, bedload transport will be estimated by direct measurement during 2-3 high flow events with boat-mounted bedload sampling equipment. Acoustic bedload measurements will be made at the same time boat-based measurements are being done. Once acoustic methods have been calibrated to measured bedload transport, acoustic methods may be used to provide a means of estimating bedload during higher flows when direct bedload sampling is not feasible. Bedload measurement and acoustic measurements taken after coarse sediment augmentation can be used to quantify bedload transport changes resulting from coarse sediment introduction.
3. Ten to 20 Wolman Pebble Counts and subsurface grain-size sample sites will be selected for the augmentation reach. Sample sites will be selected to incorporate diverse flow and geomorphic settings (bar heads, mid-bar, bar tails, in-channel, and side channels) where changes are expected to occur due to coarse sediment augmentation. Sample sites will be accurately surveyed so that they can be resampled in consecutive years to determine temporal grain-size trends. A photographic record of 1 square meter sites will be taken each year to document changes. In-channel grain size will be determined by collecting 6-10 freeze core samples from riffles. Freeze core sample locations will be surveyed so that sample locations can be relocated to provide temporal changes of in-channel

grain-size following coarse sediment replenishment.

4. Ground-based topographic surveying and boat-based bathymetry measurements for the augmentation reach will be used to evaluate coarse sediment storage changes and aggradation and incision trends in the 3 km reach below River Mill Dam. Below the 3 km reach, more widely spaced cross sections will be used to evaluate channel geometry changes and channel migration rates. Bar deposition in the vicinity of the Dog Creek confluence will be included as one of the index reaches monitored. Topographic and bathymetric data will be collected prior to coarse sediment injection and annually for the first five years following injection. Ground-based monitoring will be supplemented with aerial photography as warranted.
5. Twelve to 20 Onset temperature probes will be installed to monitor temperature changes in the reach below River Mill Dam. Probes will be placed in several geomorphic settings to monitor the effect of coarse sediment storage changes on river temperatures.
6. Water surface elevations at several key side channel habitat areas will be recorded using electronic stage height recorders so that WSE trends can be correlated with coarse sediment introduction volumes.
7. Permanent ground photo locations will be established to document visual changes in the channel morphology.
8. In order to measure changes to the available spawning area, steelhead, spring Chinook, and fall Chinook redds will be mapped in the augmentation reach before and after coarse sediment introduction. Fish populations are influenced by many factors unrelated to gravel presence or absence. Therefore, physical measures of geomorphic change rather than the degree of utilization of augmentation gravel for spawning will be used to evaluate the success of the augmentation plan. If possible, pre-augmentation baseline data will be collected to determine which species to monitor. Spring-run Chinook may be the easiest species to monitor, since they spawn during the low-flow period when redd mapping could be more readily accomplished.

Supplemental Baseline Data Collection

The numbers referred to in this section are the same used in the Draft Lower Clackamas River Coarse Sediment Management Plan.

1, 4 – Volumetric analysis using 3D surveying of the channel and channel margins rather than cross-sections is recommended. For this size reach it is feasible to complete ground surveying with sufficient details with 2 weeks or less of field work. More time and effort will be spent each year surveying areas of change. The 3D survey data will be used with a Geographic Information System (GIS) to calculate volumetric change from year to year and quantify sediment storage changes.

3 – Each subsurface sample will be sieved in a lab to determine the grain size distribution. Freeze cores will be subdivided into 10 cm depth increments to obtain a vertical distribution of grain size.

5 – In order to characterize the modern temperature regime under current conditions, temperature and water quality monitoring within the channel and in selected gravel bars is needed. Prior to deciding upon exact temperature recording stations and a sampling strategy to capture the exchange between alluvial groundwater storage and the river, it would be useful to undertake a reconnaissance level study. This goal of a reconnaissance study would be to determine the optimal areas for sampling and capturing the inherent thermal variability of the river system in the affected reach. The reconnaissance level study should take place as soon as possible so that baseline data can begin to be collected.

7 – One meter squares will be photographed at numerous locations to allow for digital measurements of surface grain size. The locations of the one meter squares will be surveyed so that they can be relocated and photographed.

References

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