King County

INSTREAM PROJECT CHECKLIST

For Construction and Maintenance of Flood and Erosion Protection Facilities and Habitat Restoration Projects that may include large wood elements

Project Name Rainbow Bend Levee Removal and Floodplain Reconnection Project Manager Jon Hansen

River/River Mile/Bank Cedar River/RM 11.2/Right bank Date June 19, 2012

I. Project Background and Preliminary Design (30-40 Percent) Information
(Provide general information at a conceptual level)

1. Describe the goals and objectives of the project and its relative importance to the success of DNRP program goals and mandates. (Note: If the project is comprised of emergency work, then fill out and file this form within 30 days of completion of emergency work.)

The Rainbow Bend Levee Removal and Floodplain Reconnection project will reduce flood hazards and restore riverine processes and floodplain connectivity to approximately 40 acres of public land along the right bank of Cedar River. The project will remove approximately 900 feet of existing levee and allow the river to expand, migrate and form side channels within an entire meander bend just downstream of Cedar Grove Road. Project elements also include grading within the floodplain to reconnect historic side channels, the addition of large wood as floodplain roughening elements and planting native vegetation to restore a more natural floodplain community. Additional protections will also be added where necessary along the opposite (left) bank to ensure public infrastructure and private property is adequately protected. The project has been identified as an important flood hazard reduction project in the 2006 Flood Hazard Management Plan (King County, 2007). The project is also identified as a high priority, Tier 1 habitat restoration project in the Chinook Salmon Conservation Plan for the Lake Washington/Cedar/Sammamish watershed (WRIA 8). The Rainbow Bend project is being designed to be consistent with the goals outlined in those documents as summarized below:

Goal 1: Reduce flood risks to people and infrastructure.

Goal 2: Reduce the need for future facility maintenance and emergency response

Goal 3: Restore floodplain functions and processes that provide for natural development of riverine habitat and aid salmon recovery.

Goal 4: Address impacts of the project on recreational safety.

2. Describe the existing (and historic, if relevant) site and reach conditions, including structural features, channel form, and the presence of naturally-deposited large wood.

The Rainbow Bend project site is just under 40 acres in size and bound on three sides by a large river meander of the Cedar River between River Mile 10.7 and 11.5. The Cedar Grove Road bridge is located at the upstream end of the site and the river flows immediately adjacent to the Cedar River Trail for roughly 1000 feet within this reach. This stretch of the river contains sections of levee (a prism of soil/rock higher than the surrounding area)

and revetment (armored bank at grade) on both banks. The levees and revetments were built in the 1960s and 1970s to minimize flood damage, maintain the current channel alignment and protect the railroad corridor which was later converted to the Cedar River Trail. The Rainbow Bend Levee runs approximately 950 feet along the right bank beginning at the bridge. This levee was constructed to reduce the frequency of flooding in the eastern third of the project site, and is the levee proposed for removal as part of this project.

The armored banks on both sides of the river have historically constricted and concentrated flows, thereby increasing localized scour velocities and heightening the flood risk to public infrastructure. The Rainbow Bend Levee limits storage of floodwaters in the floodplain and deflects high velocity flows directly towards the Cedar River Trail Revetment, which protects significant public infrastructure, including a state highway, an interstate fiber optic cable line, and a regional trail system. Removal of the levee and revetment is expected to allow the channel to expand, form side channels and potentially migrate away from the Cedar River Trail levee. Project Goals 1, 2 and 3 are addressed directly by removing the levee and revetment and allowing flood flows and energy to spread across the floodplain.

Natural wood density in the Cedar River in general and this reach in particular is low relative to reference reaches of other western Washington rivers due to logging and channel confinement activities. The armored banks limit deposition and retention of large wood in the reach. Removal of the levee is expected to increase the opportunities for wood to be deposited and accumulate within the Rainbow Bend Reach. This is consistent with conditions just downstream in the Belmondo Reach located approximately 1/2 mile downstream where large wood is much more abundant. .

3. Describe what is known about adjacent land uses and the type, frequency, and seasonality of recreational uses in the project area. Are there nearby trail corridors, schools or parks? What is the source(s) of your information?

The adjacent properties are predominantly rural residential, but there are mineral extraction uses (M) located to the north and neighborhood businesses (NB) on the south side of Maple Valley Highway. As noted above, the Cedar River Trail and Maple Valley Highway are located south of the site across the river from the Rainbow Bend site.

In 2010, a study of recreation on the Cedar River was conducted to help river managers better understand and address recreational safety concerns in future projects. The study found that floating the Cedar River tends to be a spontaneous activity, largely driven by weather, with limited use when air temperatures are below 70 degrees and drastically increasing on days 80 degree or warmer. The primary access to the river in the project reach is a King County Park's property, Cedar Grove Road Natural Area, on the west side of Cedar Grove Road immediately north of its intersection with Maple Valley Highway (SR 169). The property is popular owing to an informal parking area, an easy, shallow, gravel beach access to the river, it is locatedon public lands, and the fact that there are several publicly-accessible take-out locations downstream - the most popular out of these are locations at City of Renton parks. The access point is immediately across the river from the Rainbow Bend site and a short walk to the Cedar River Regional Trail.

In 2010, the Cedar Grove access was a very popular summer time put-in location for inner-tubers and rafts on the Cedar River, with an estimated 750 river users entering the river at that location. Another 122 users were estimated to have taken out at Cedar Grove after having floated to the site from upstream, while 491 users floated by the site without putting in or taking out there. All told 20% of summer river users engaged with the site by floating by or putting in or taking out there.

Unfortunately, Cedar River floaters are typically poorly prepared for their trips, 98% of those interviewed knew how to swim, but only 14% had access to a life vest, with only half of those with access to vests actually wearing them. At least

26% were visibly drinking alcohol, and only 13% of vessels had an oar or paddle. Although these behaviors are known to increase risk of injury, few serious accidents happened on the Cedar River during summer 2010.

4. Describe the conceptual design of large wood elements of the project, including, if known at this stage in the design, the amount, size, location, orientation, elevation, anchoring techniques, and type of interaction with the river and stream at a range of flows.

No large wood will be placed within the Cedar River itself, but the plan does include placement of large wood within the floodplain and in side channels that will be constructed on-site. The final number of pieces proposed has not yet been determined, but the current estimate of large wood (greater than 20 feet in length and 6inches in diameter) planned for the project is 200 logs. The project also includes smaller pieces of wood that include tree tops, branches and small wood that is referred to as slash on the plans. This wood will typically be placed in front of the larger pieces to help further restrict flow and reduce water velocity. The wood proposed will be used in three distinct areas on-site including: 1) central floodplain in previously developed areas; 2) leading edge of the floodplain within potential channel migration areas; and 3) side channel and backwater areas. Each location has different placement and anchoring approaches based on the desired function, anticipated flow conditions, and potential for recruitment to the river via flood waters, channel migration or side channel formation and evolution. Placement and stability assessments of all the wood planned for the site are based on a combination of two dimensional hydraulic modeling, geomorphic response analysis and professional judgement. The 2-D model provides estimates of depth, velocity and direction of flood flows. These parameters help designers make decisions about placement, orientation and anchoring needs.

Central Floodplain

Large wood placed in the central floodplain area (previously developed portion of the site) will be laced in-between existing trees and live cottonwood poles and oriented in such a way so that the force of the water at flood stage pushes them into existing stands of vegetation. These are likely to become lower velocity areas, thus less likely to become open channel, and more likely to become depositional zones. The cottonwood poles were installed as live cuttings, 2 to 5 inches in diameter with tight spacing (~4 foot centers) to create a dense mass of stems that can reduce overland flow velocity, direct flood waters and help catch and hold debris floating across the floodplain. The tops of the poles extend above the depth of inundation at the 100 year flood event. Since the time of installation, over 90 percent of these poles have sprouted and begun to grow. Given the shallow, relatively slow flows expected within the center of the floodplain, no other form of anchoring is proposed at this time. Additional cottonwood poles may be added in other locations as the design advances if deemed necessary by hydraulic modeling to help further stabilize wood that could potentially float out during high flows. Because no hard fixed anchoring system is proposed, however, wood in this location still has the potential to float out of the site and be recruited to the mainstem over time. If that were to happen, the wood will enter the river as single pieces and not have artificial tethers or anchors that may create additional concerns for recreational users or downstream infrastructure.

Leading Edge Floodplain Potential Channel Migration Zone

The large logs in this portion of the floodplain will be laced in-between existing trees and live cottonwood poles and oriented in such a way so that the force of the water at flood stage pushes them into existing stands of mature trees. Smaller wood (less than 6 inch diameter and less than 20 feet in length) will be racked (piled) in front of these large wood clusters and further slow floodwaters, reduce potential erosive energy and direct overbank flow into natural or constructed channels. Wood in these areas will not initially be in contact with flowing water during typical recreational flows (less than 500 cfs) and in fact will not be inundated or exposed to high velocities prior to the predicted 5 year flood reoccurrence interval (flows greater than 3000 cubic feet per second). While the presence of this wood does have the potential of moderating the rate of channel migration, it also has the potential of being recruited to the river in the future when the channel migrates and trees around them are undermined and fall into the mainstem. Wood recruited in this way will enter the river as single pieces and not have artificial tethers or anchors that may create additional concerns for recreational users or downstream infrastructure. Given the level of recreational use of the Cedar in this reach, regular monitoring of the site will be necessary to assess the need for post project adaptive management.

Side Channel/Backwater Area

Large wood will also be placed in the side channel that will receive some flow well into the summer months. These wood placements are located hundreds of feet off of the main channel and will be partially buried and secured with rock ballast sufficient to hold them in place and resist the forces of buoyancy. Backwater areas are expected to be low energy environments that would not likely present attractive or hazardous flow path for recreational users. While these placements could be encountered by future recreational floaters as conditions change, near term users would likely have to make a concerted effort to access these areas during typical summer recreational flows (200-500 cfs) and even then should have ample opportunity to exit prior to encountering the wood. Conditions are expected to change in these side channel environments over time and in response to high flow events, so post construction monitoring and adaptive management strategies are important components of future site management.

Removal of the levee will initiate channel migration, but the extent and rate of change is dependent upon multiple natural variables including the duration, frequency and magnitude of storm events. Channel migration could be slow, or it could happen quickly with substantial changes in conditions from storm to storm. Newly fallen or recruited wood that could pose a hazard to recreational users could appear quickly and/or without warning and could either lodge on-site or remobilize. Onsite trees may fall into the river and the site may accumulate wood floating into the reach from upstream. Post project monitoring and adaptive management actions will be undertaken, but the character of the reach will change and recreational users will need to take appropriate precautions.

5. What is the intended function of the placed wood? What role does the placed wood have in meeting the project's goals and objectives? Is the project intended to recruit or trap additional woody debris that may be floating in the river?

Large wood will be strategically placed within the floodplain to help direct overbank (flood) flows into pilot channels, moderate bank erosion, and reduce surface erosion in previously developed areas. The wood and associated native plantings are intended to help mimic floodplain roughness that would otherwise be provided by mature native vegetation and downed wood that are typical components of undeveloped floodplain forests. This approach is a method that seeks sustainable solutions by emulating nature's time-tested patterns and strategies. Wood lying on the ground in the floodplain also provides benefits to a variety of terrestrial species including mammals, birds, amphibians and insects, The presence of the wood is expected to help meter change during moderate flow conditions, but will not prevent channel migration or major shifts in river alignment that are driven by large and/or longer duration storms. Placed wood will therefore contribute towards achieving Goal 3: *Restore floodplain functions and processes that provide for natural development of riverine habitat and aid salmon recovery*.

Placed wood will also provide direct benefits to fish that will vary with location and frequency of inundation. Wood placed in backwater areas will improve rearing habitat for salmon nearly year-round. Wood placed along the upstream leading edge, once engaged through channel migration, will likely create substantial, low-velocity rearing areas as well as deep pools for migrating adult salmon.

The armored Rainbow Bend reach is currently a transport reach for wood, allowing most wood that floats in from upstream to move downstream. The reach has a few pieces of wood along the margin of the channel including a large maple along the right bank, but no persistent, large jams or large single logs that restrict recreational use.

If the Rainbow Bend reach responds to levee removal as predicted, it will begin to accumulate wood and at least initially store a large portion of the wood that would otherwise float past the site to the lake or rack up elsewhere downstream. During future flood events, the site will also contribute additional wood as the bank erodes and side channels expand, but this effect is expected to be moderated by the reach trapping greater quantities of wood from upstream reaches. This is consistent with other unconstrained reaches of the river where wider, more complex channel

conditions, connected floodplains and accessible side channels provide ample opportunities for capturing and retaining wood.

6. Describe how public safety considerations have been incorporated into the project design [see section 1.B.2 of Ordinance 16581] and include a description of how the six (6) key steps provided in Public Rule LUD 12-1, Appendix A. (Rule) Section V.2.A. i)-vi) have been addressed.

i) In designing the placement of wood in the project, the project team will gather available information and take into account the expected type, frequency and seasonality of recreational uses as an important element in its overall consideration of impacts to public safety of the proposed project.

The level of recreational use of the project reach is based on the 2010 study of recreational use on the Cedar River (*Cedar River Recreational Study*, King County, 2011). The study focused on summer use and floaters/boaters, but did provide a fair characterization of the types of users the design needs to consider. The study in combination with anecdotal observation from long time river users suggest that there is a wide range of skill and ability among Cedar River users. Please see the response to question 3 above and the study for more detailed information. While the project cannot assure safety for river users, the design does incorporate many elements to avoid, minimize and mitigate potential impacts to this broad range of recreational users while still achieving the other project goals.

ii) Consideration of public safety in the conceptual design will include but not be limited to the following factors: the location, orientation, elevation, and size of the wood placement, the method of anchoring or securing the wood placement, the degree of interaction between flowing water and the placed wood during projected flow regimes, including flows commonly experienced in the recreational seasons, and input received through the public outreach process.

As noted in responses above, the design team has been attentive to potential safety hazards from the beginning of the project design process. These include:

- Placing wood only in the floodplain, not in the river channel;
- Creating open (wood-free) pilot channels to make an easy flow path for water;
- Clustering placed wood outside the pilot channels to encourage flows to concentrate in the channels;
- Planning outreach and education for put-ins and take-outs;
- Developing an adaptive management and stewardship plan forlong term management of the site.

All of the wood placed as part of the project will be within the floodplain and will not be in contact with water users until existing trees and/or placed materials are recruited to the river by channel migration.. Floaters/boaters could access placed wood in the side channel or backwater areas, but velocities are expected to be low at typical recreational flows (<500 cfs) and thereshould be ample opportunity to get out of the water before encountered the placed wood. Please see response to question 4 above for more information regarding placement of wood relative to anticipated flow conditions.

iii) In designing the specific placement of large wood, the design team will seek to maximize achievement of stated project goals and objectives while minimizing potential public safety risks, including risks to recreational users, and will seek to ensure that the procedures and design options affording the greatest safety for river users are of primary consideration in design concerns involving a balancing of important public purposes as it addresses safety issues.

The design team has been mindful of recreational users throughout the design process and incorporated numerous elements into the preliminary design intended to protect public safety and minimize impacts to recreational uses. Consideration of potential hazards has progressed through a series of steps including early identification of risks, data collection to understand specific site conditions that affect those risks, evaluation and assessment using available tools and incorporation of mitigation measures. A site specific, post project adaptive management plan is also being

developed (not yet complete) to outline a series of responses that can be employed to help address recreational safety and site specific hazards that will evolve after the project is complete. The current 30% plan includes a number of specific measures to address potential impacts to recreation including:

Wood Placement

No wood will be placed in the active channel

Placed wood will be setback from the channel edge to accommodate initial channel migration

Some large trees within the channel migration zone will be selective removed (pre-project)

There will be no "permanent" fixed wood structures in the floodplain

- No ELJs or deep piles will be placed
- Logs may be stacked or clustered, but will not be cabled or chained together

Site Management

Warning/Advisory Signs will be posted as site conditions warrant

The boat takeout site will be enhanced

Improvement of portage – trail access via a connector trail

Public outreach and education

Development of a Post Project Site Adaptive Management plan

- Clear roles and responsibilities
- Progressive management strategy driven by future conditions

Post Project Adaptive Management Plan

Removal of the levee will initiate channel migration that in time will cause standing trees and downed wood on site to fall onto the floodplain or even into the river as the bank retreats. The widening channel will also encourage deposition of large wood floating in the river from upstream to be retained within the reach. The position, orientation and relative hazard of these future wood accumulations cannot be addressed through design, but must rely upon adaptive management actions implemented after the site has evolved. King County is commited to post project monitoring and adaptive management actions necessary to address hazards and recreational safety concerns and will work closely with the King County Sheriff to evaluate and respond to emerging conditions. A site specific, post project adaptive management plan is being developed and will be finalized using input received from river safety experts, recreational users and the public.

Basic elements of the plan will include a series of progressive steps that allow for a flexible response to addressing safety concerns using the least intrusive, yet effective means. In relative sequence, these include: education and outreach, monitoring, public notices, web alerts and signs posted along the river to alert users to conditions, temporary and/or seasonal use advisories, temporary or seasonal closure (by order of Sheriff only) and finally modification of wood accumulations where safe portage or passage is not possible during recreational flows. The plan will be consistent with the goals of the project and the draft Natural Wood Policy being developed by allowing natural processes to drive evolution of the site and limiting wood removal/modification to situations where other options will not effectively abate the hazard.

iv) Conceptual project designs will be informed by standard design practices with input from professional designers with expertise in fluvial geomorphology, ecology, river hydraulics and civil engineering with hydraulic analysis expertise.

The design team consists of multidisciplinary team of engineers, ecologists, and geologists with extensive knowledge of northwest rivers and many years of experience designing stream and river restoration projects. The team is supported

by consultants (Tetra Tech and Inter-Fluve) who bring extensive hydraulic modeling expertise as well as practical design experience in rivers throughout the US.

v) All projects that incorporate large wood in rivers and streams will undergo review and approval of engineering plans and analysis from a Licensed Professional Civil Engineer.

The project design is being prepared by the multi-disciplinary team noted above, but overseen, directed and stamped by a licensed professional engineer.

vi) All projects that incorporate large wood with the stated objective of providing ecological benefits will undergo review and approval from a professional ecologist (i.e., persons with an advanced degree in aquatic and/or biological sciences from an accredited university or equivalent level of experience).

The team includes several ecologists meeting those criteria; the senior ecologist on the design team is a fisheries biologist with an advanced degree in Fisheries and twelve years of experience planning, designing, implementing and monitoring stream and river restoration projects. The project plans are also being reviewed by the Unit Manager who has an advanced degree and over twenty years experience in the field of ecological restoration.

7. What is the anticipated schedule for completing project milestones (30-40% design, final design, major construction/earthmoving) and for soliciting public input)?

Distribution of 30% plan for public comment	June 15, 2012
Public review and comment on the 30% plan	June 19-July 20
Completion of 60% plans	August 17 2012
Permit submittal (using 60% plans)	August 31, 2012
SEPA Process	August -September 2012
Final Plan completion	February 2013
Construction	June-August 2013

Project Manager Date

Supervising Engineer, Project Supervisor or Unit Manager Date

II. Pre-Construction Information (70% or 100% design with permits) *These questions relate to the designed and permitted project. Information should include input resulting from permit review process, SEPA, boater safety meetings and any other*

8. Have any answers provided in Section I at the Preliminary Design Phase changed in the interim? If so, provide the new answers and the rationale for the change.

9. The Rule requires project review and approval by a Licensed Professional Civil Engineer. The Engineer will ensure appropriate application of engineering studies and design standards. Describe the design review and approval process for the project, including review by the licensed professional engineer, as well as reviews by other licensed technical staff such as Licensed Geologist and Licensed Engineering Geologist. Specify the Engineer of Record for the design and any

other Licensed Professionals who have sealed their portion of the design plans. Was the review and approval completed?

10. The Rule requires project review and approval by a King County Professional Ecologist (e.g., person with an advanced degree in aquatic and/or biological sciences from an accredited university or equivalent level of experience) if ecological benefits are an intended project objective. The Ecologist will evaluate the consistency of the design with project goals, existing environmental policies and regulations, and expected or known permit conditions. Specify the Reviewing Ecologist for the project. Was this review and approval completed? Please describe steps undertaken by the Ecologist.

11. What regulatory review or permits are required for the project (e.g. HPA, Clearing and Grading permit, COE permits)? List any conditions or requirements included in the permit approvals relevant to placement of large wood in the project.

12. What specific actions or project elements were employed to consider public safety in the final, permit-approved design?

13. Describe how the Public Outreach requirements in Rule Section V.3. have been addressed.?

14. Describe the input received from the public and how, if appropriate, the project team has responded to this input.

15. Describe any additional design modifications or mitigating actions that were or will be taken in response to the public comments.

16. Will further educational or informational materials be made available to the public to heighten awareness of the project (e.g., public meeting, press release, informational website, or temporary or permanent signage posted in the vicinity of the project)? If so, explain.

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Project Manager Date

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Supervising Engineer, Project Supervisor or Unit Manager Date

III. Post-Construction Actions or Project Modifications

17. Have any answers provided in Sections I and II at the Preliminary design and Pre-Construction phases changed in the interim? If so, provide the new answers and the rationale for the change.

18. In accordance with the requirements of Rule Section V.4.,describe post-construction monitoring and inspection activities planned for the project.

19. If post construction monitoring or inspections result in modifications to the project, please describe the action taken and the rationale (See Rule Section V.4.).

Project Manager Date

Supervising Engineer, Project Supervisor or Unit Manager Date