King County

INSTREAM PROJECT DESIGN CHECKLIST

For Design and Construction of Flood and Erosion Protection Facilities and Habitat Restoration Projects that May Include Large Wood Placement or Natural Wood Recruitment

Project Name: Fort Dent Levee Repair Project **Project Manager**: Stella Torres

River/River Mile/Bank: Green River/ River Mile (RM) 11.2/ right bank downstream of Starfire Way bridge

Date: 10/22/2024

Check one or both:

X Project includes placement of large wood elements

X Project may influence the recruitment, mobility and accumulation of natural large wood.

Note: *If the project is comprised of emergency work, then fill out and file this form within 30 days of completion of emergency work.*

I. Project Background and Preliminary Design (30-40 Percent) Information

(Provide general information at a conceptual level)

1. **Describe the overall river management context, strategy and objectives for the river reach. Refer to pertinent plans, policies or documents pertaining to flood hazards, salmon recovery, etc**.

   The project is located at river mile 11.2 in the Lower Green River sub watershed, near the boundary with the Duwamish Estuary sub watershed. Available rearing and high-flow refuge habitat is limited within this sub watershed, with many reaches currently lacking large wood, side channels, sloughs, and slow-water edge habitat. The floodplain is heavily developed, characterized by channelized reaches, hardened banks, and flood control levees. Loss of native riparian vegetation has contributed to elevated instream temperatures and loss of habitat.

   The project area is within a State environmentally designated Urban Conservancy zone, which focuses on protecting and restoring ecological functions of open space, floodplain and other sensitive lands, while allowing for a variety of compatible uses. The Tukwila Shoreline Master Program, dated 2019, provides a list of key ecosystem functions currently lacking within the shorelines of Tukwila, including channel-floodplain interaction; nutrient cycling; and LWM sourcing and complexity. Potential restoration actions associated with these functions include levee setbacks to increase channel-floodplain interactions, restoration of native riparian species to increase bank roughness and shading, removal of invasive species in the riparian zone, and incorporation of LWM into bank stabilization and restoration projects.

   The 2021 WRIA 9 Salmon Habitat Plan includes similar habitat and restoration goals for the Lower Green River including: 1) protect, restore, and enhance channel complexity and slow-water edge habitat; 2) restore and enhance native riparian corridors; 3) add large woody debris back into the system; and 4) reduce implementation of bank armoring.

2. **Describe the goals and objectives of the project and its relative importance to the success of DNRP program goals and mandates. Identify funding source(s) and describe any applicable requirements or constraints.**

   The identified goals and opportunities for this project are as follows: 1) repair, revegetate, and add scour protection to two damage locations within the project reach; 2) improve local aquatic habitat; 3) restore native species to the riparian buffer; 4) enhance recreational value through educational signage, picnic

areas, or river access; 5) replace invasive blackberry with native plantings; and 6) increase shade in the river with new plantings. These goals align with the stated goals of the DNRP of protecting and restoring habitats, ecological functions and aquatic conditions, as well as fostering community-building and healthy living. The project goals also align with the reach goals listed within the 2019 Tukwila Shoreline Master Program and the 2021 WRIA 9 Salmon Habitat Plan, described above.

The proposed project includes several design components intended to meet the goals and objectives of the project, including trail realignment, levee and slope setback, habitat bench creation, rock revetment, incorporation of large woody material (LWM), and site revegetation and restoration. The trail and levee will be set back to the maximum extent practicable to allow for creation of habitat benches and stable setback slopes. Habitat benches will be created at the upstream and downstream ends of the project and will vary in elevation, width, longitudinal slope, and cross slope to maximize habitat variability, diversity, and complexity. Large woody material structures will be incorporated into the habitat benches to increase hydraulic complexity and provide habitat diversity and availability over a range of flows, as well as to provide additional bank roughness. A short rock revetment is proposed at the upstream end of the project to prevent existing upstream bank instabilities from migrating into the proposed project area, and to provide slope stability during the transition from existing to proposed grades. The site will be revegetated using native willows, shrubs, trees and ground cover.

The project is funded by the King County Flood Control District.

3. **Describe the existing (and historic, if relevant) site and reach conditions, including structural features, channel form, and the presence of naturally-deposited large wood. Describe known utilization by salmonids and any important or unique biological or ecological attributes.**

   The project is located along the Fort Dent levee, which is approximately 4,300 feet long and located on the right bank of the Green River in Tukwila, WA between river miles (RMs) 11.02 and 11.84. The levee provides erosion and flood protection for the adjacent Fort Dent Park and the Starfire Sports Complex and is over-steepened and has experienced damage at multiple locations in recent years. The Green River Trail runs along the levee crest at the project location.

   The lower Green River has been heavily influenced by two notable historical events: the permanent diversion of the White River into the Puyallup basin in 1906, and the construction of Howard Hanson dam in 1961. The diversion of the White River reduced the basin area of the Green River above the Black River confluence by approximately 50%, and removed an even larger share of the basin sediment supply. Construction of Howard Hanson Dam for purposes of flood control has greatly reduced the magnitude of large floods, such that the 100-yr discharge is now approximately the same as the 10-yr discharge, around 12,000 cfs; this flow is about equal to the 19th century estimated 2-year flow. The Green River was observed to narrow by approximately 30% between 1906 and 1978 as a result (Dunne and Dietrich, 1978) of these changes. At the same time as the narrowing, a deepening trend has been observed along much of the river. Several feet of incision were noted between 1986 and 2006, mainly above RM 14. Within the immediate project vicinity, long-term trends are not distinguishable from the variability between cross-sections.

   The project reach is channelized, with hardened banks, levees, and infrastructure on either side of the river. The 100-year flood is contained within much of the channel and there was no naturally-deposited large wood observed at the time of the site visit. The riparian zone consists of steeply sloped banks and a narrow corridor at the top of bank adjacent to the trail. Himalayan blackberry is the dominant species vegetating the bank; shade, litterfall and insect fall from the bank is limited. There are a few scattered trees riverward of the trail, including willow species, birch and poplar.

   The Green River in the project site is used as a transition zone for smolts to adjust to saltwater environments. With a bed composition of sand and other fines, this is not a spawning reach. The following species with various designations under county, state, or federal programs were noted to occur in the Green River in the project vicinity: Coho salmon, Cutthroat trout, Steelhead trout, Chum salmon, Chinook salmon, Pink salmon, Sockeye salmon, and bull trout.

4. **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 project site is adjacent to the Green River Trail and Starfire Sports Complex, both of which remain active and heavily utilized throughout the year. The main channel is used for recreational floating in the summertime, but there is no river or boating access at the project area.

5. **If the project includes wood placement, 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.**

   Large woody material structures will be incorporated into the project to increase habitat complexity, diversity and availability over a range of flows, as well as to provide additional bank roughness. Two types of structures are proposed: multi-log LWM structures and toe logs. Logs for both structure types will be approximately 24-inches in diameter and 20 feet long.

   The multi-log LWM structures will consist of two to five logs with rootwads and will be assembled in varying orientations and configurations as shown on the 30% design plans. The varying structure heights and orientations will increase hydraulic complexity. The structures will be placed low down the bank, atop two habitat benches ranging in elevation from 7-11 feet. This placement will ensure the LWM structures interact with the river even during low flow periods, and will keep them saturated to ensure a long life. The LWM structures are also designed to deform and adjust on the riverward side to local scour conditions while preventing long-term channel migration towards the levee and trail.

   Toe logs are also proposed along the toe of slope between the two habitat benches. The logs are oriented with the rootwad facing upstream and are shingled so that the root bole is tucked behind the next upstream log. This orientation minimizes risk to recreational boaters while still providing bank roughness, stability, and habitat benefits. The elevation of the toe logs will be approximately 9-11 feet, ensuring frequent inundation even during low flows.

   The LWM structures and toe logs will be boulder ballasted, with the boulders buried beneath the finished grade and attached to the wood structures with chain. The ballast boulders will be a minimum of 3 tons and will be placed according to the LWM design. Stability calculations were performed to ensure structure stability over a range of hydraulic forces, including buoyancy, lift, drag, and moment forces.

6. **If the project includes wood placement, what is the intended structural, ecological or hydraulic 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 large wood that may be floating in the river?**

   The LWM structures will interact with flow over a wide range of elevations. This will be accomplished through placement at various ground elevations (the habitat benches range in elevation from 7 to 11 feet) and stacking of log members on top of each other. Habitat availability and diversity will be maximized by increasing the duration, frequency, and complexity of how the LWM structures interact with the flow. Keeping the structures inundated for the maximum extent practicable will also prevent the logs from drying out and help extend the longevity of the structures.

   The hydraulic complexity of the project due to the LWM will promote sediment scour, accretion, and sorting due to tidal and river flows. In the long term the floodplain bench is expected to be a depositional environment, allowing continual building of a natural soil profile and native vegetation colonization. This meets the project goals and objectives of improving local aquatic habitat and restoring native species to the riparian buffer.

   The project is not intended to recruit or trap additional large wood transported by the river. This may naturally occur depending on river stage and conditions, but it is not a stated goal of the project.

7. **Is the project likely to affect the recruitment, mobility or accumulation of natural large wood, e.g., by encouraging wood deposition on or near the site or promoting bank erosion that may cause tree toppling? Describe expected site evolution and its potential effects on natural wood dynamics.**

   The proposed project is not anticipated to impact the recruitment or mobility of natural large wood. The proposed project stabilizes the channel banks through slope setbacks and creation of flat, wide habitat benches and are designed to prevent existing upstream bank instabilities from migrating downstream. This will minimize tree loss and recruitment via toppling and protect trees planted as part of site revegetation and restoration. The proposed LWM structures will be boulder ballasted and will not contribute to mobile wood.

The proposed LWM structures may accumulate or rack natural wood members transported downstream by the channel. The risk of racking is minimized by the placement of LWM structures within the habitat benches, away from active channel flow. The width and length of the habitat benches reduce the risk of erosion, scour, or other adverse hydraulic effects if racking of mobile wood does occur on the proposed LWM structures. The hydraulic complexity on the bench due to the LWM will promote sediment scour, accretion, and sorting due to tidal and river flows. In the long term the bench is expected to be a depositional environment, allowing continual building of a natural soil profile and native vegetation colonization.

8. **Describe how public safety considerations have been incorporated into the preliminary project design. For placed wood, address each of the considerations:**

   a. **Type, frequency, and seasonality of recreational use**:
   Recreational boating primarily occurs in the summer months. The summer low-flow, low-tide elevation is 4.5 and the habitat benches and LWM structures are designed from elevations 7 to 12, providing 2.5 feet of vertical separation between boaters and restoration structures at summer low-flow, low-tide conditions.

   During summer low-flow, high-tide conditions the Green River backs up and very low velocities are prevalent (less than 0.5 ft/s along the margins at 500 cfs, a typical summer flow, based on the modeling performed). The low velocities present during high tides in the summer minimize the hazard of the structures to recreational boaters.

   The Green River Trail is at elevation 24 and there is no river or boater access from the project site, minimizing interaction between recreational trail users and the proposed LWM structures.

   b. **Wood location, positioning, and anchoring techniques**:
   As stated in 8a the habitat benches and LWM structures are placed a minimum of 2.5 feet above the summer low-flow elevation to minimize risk and interaction with recreational boaters. The structures are also placed within a graded bench, away from the active channel where hydraulic forces (e.g. flow velocity, stream power) are reduced. The structures are boulder ballasted, but the boulders are buried under the final grade, reducing flow obstructions and obstacles for recreational boaters.

   c. **Maximizing achievement of project goals and objectives while minimizing potential public safety risks**:
   Project goals were able to be accomplished without increasing public safety risk because the trail realignment and levee setback provided sufficient space to set back bank slopes and grade in habitat benches where LWM structures could be installed away from the main channel flow. In fact the trail setback increases public safety by moving the trail further from the riverbank, where slumps are presently occurring within a few feet of the trail.

   d. **Use of established and recognized engineering, geological, and ecological expertise:**
   Licensed civil, hydraulic, and geotechnical engineers performed the hydrologic, hydraulic, geotechnical, scour, and LWM stability assessments. Experienced fluvial geomorphologists and geologists conducted field and channel assessments. Licensed Washington State Professional Engineers developed and reviewed all aspects of the 30% Design Plans.

9. **Has the project been reviewed and approved by a Licensed Professional Civil Engineer? Please list other licensed technical staff who have reviewed and provided input on the design (e.g., 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. Were all reviews and approvals completed?**
   The 30% plans have been reviewed by several Licensed Professional Civil Engineers at NHC (Alex Anderson, Vaughn Collins) as well as King County (Julie Titchbourne, Dan Brubaker). Key input was provided by two licensed geotechnical engineers at Aspect Consulting (Henry Haselton, Mari Otto), who will review the plans in detail at a later date. Jeremy Payne, PE (NHC) is the engineer of record.

10. **Has the project been reviewed and approved 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, to 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? What is the anticipated schedule for completing project milestones (30-40% design, final design, major construction/earthmoving) and for soliciting public input)?

John Klochak, Project Ecologist, approved the design of the wood benches and structures. The project has reached the 30% design milestone. The anticipated project construction date is July 2026.

Stella Torres	10/22/2024
Project Manager	Date
Julie Titchbourne	10/22/2024
Supervising Engineer, Project Supervisor or Unit Manager	Date