WASHINGTON STATE DEPARTMENT OF ECOLOGY

Application for a 2015-2017 Floodplains by Design Project Grant

Project Title: Middle Green River Flood, Habitat, and Farmland Enhancement Project
Organization/Jurisdiction Name: King County Department of Natural Resources and Parks
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Legislative District(s): 7 **County:** King **WRIA:** 9 **Congressional District:** 9
Project Location:
Section: 21 **Township:** T21N **Range:** R5E **River Mile:** 34
Latitude: 47.293 **Longitude:** -122.172 **GPS coordinates, if available:** NA
Major Watershed Project is in: Green/Duwamish River Watershed

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1. Short Description of Project

King County (KC) Department of Natural Resources and Parks (KC DNRP) proposes to remove the 1,550-foot-long Porter Levee from its current location adjacent to the Green River, and construct a setback facility next to a county road. The levee, constructed in 1961 and regularly scoured by the river, has a near vertical bank, regularly sloughs rock into the river, and has backfill consisting of sand and gravel. The levee confines the river channel and interferes with habitat-forming processes in the floodplain.

The goals of this project are to:

- Reduce flood risks and impacts by:
  a) Increasing flood conveyance capacity and reconnecting floodplain areas
  b) Improving agricultural drainage on adjacent properties
  c) Protecting a county road from erosion.
- Restore a dynamic mosaic of riverine and floodplain habitats.
- Remove development potential from the flood hazard area.

The major components of this project are to:

- Remove the 1,550-foot-long Porter Levee from its current location adjacent to the Green River.
- Construct a 1,300-foot setback protection facility adjacent to a county road.
- Create fish habitat complexity with logjams, scour pools, forested islands and side channels in the reconnected floodplain on 36 acres of the Porter Natural Area, owned by KC.
- Acquire adjacent farmland development rights by enrolling landowners into the Farmland Preservation Program and remove development potential from flood hazard areas.

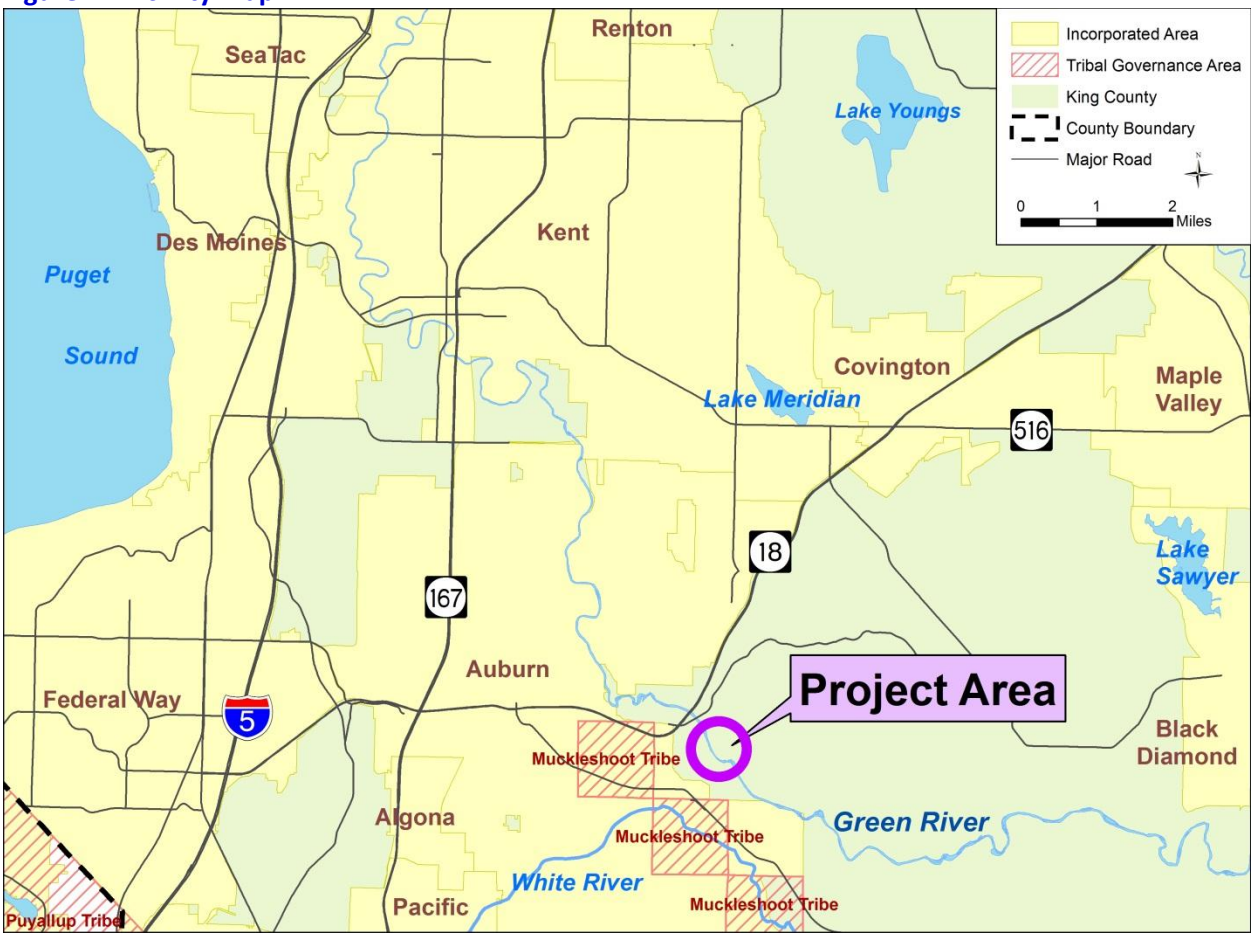
This proposal will likely be a multi-year project in order to complete design, secure permits, construct the project, and obtain agricultural development rights.

2. Flood hazard/risk reduction (*60 points*)

Background

Levees in this reach of the Green River (Figure 1) were constructed to protect farm land mostly in the 1960s. Within a half mile of the Porter site, there are over 300 acres of very productive crop land, three farming-related businesses, and a county road accessing the Green River Valley and over 2,000 additional acres of farmland owned by dozens of landowners. However, few of the levees and revetments that compose the Green River levee system (including Porter) meet current construction standards for flood protection. Existing levees, like Porter, typically have over-steepened banks, sloughing rocks (most Porter Levee rip-rap ranges from 12 – 18 inches in diameter), unconsolidated backfill (sand, gravel), and inadequate rock buttressing at the toe. Flow regulation by Howard Hanson Dam (HHD) limits flows to the two-year (recurrence interval) event compared to flows before the dam was built. This two-year event is at or just above the threshold of bank-full flow, which is often considered to approximate the "channel-forming" flow in alluvial rivers. This flow rate has enough energy to erode the channel bed and banks and move and deposit sediment, leading to continued channel migration where levees are not present, and channel incision where flows are confined. The frequency and duration of flows at this 2-year level have been increased by dam operations. This stresses the levees and increases slumping failures (KC Flood Hazard Management Plan 2006).

Figure 1. Vicinity Map



Because of these design and construction shortcomings, the Green River levee system has not always performed as intended. Seven floods in the last 31 years have caused significant erosion damage to

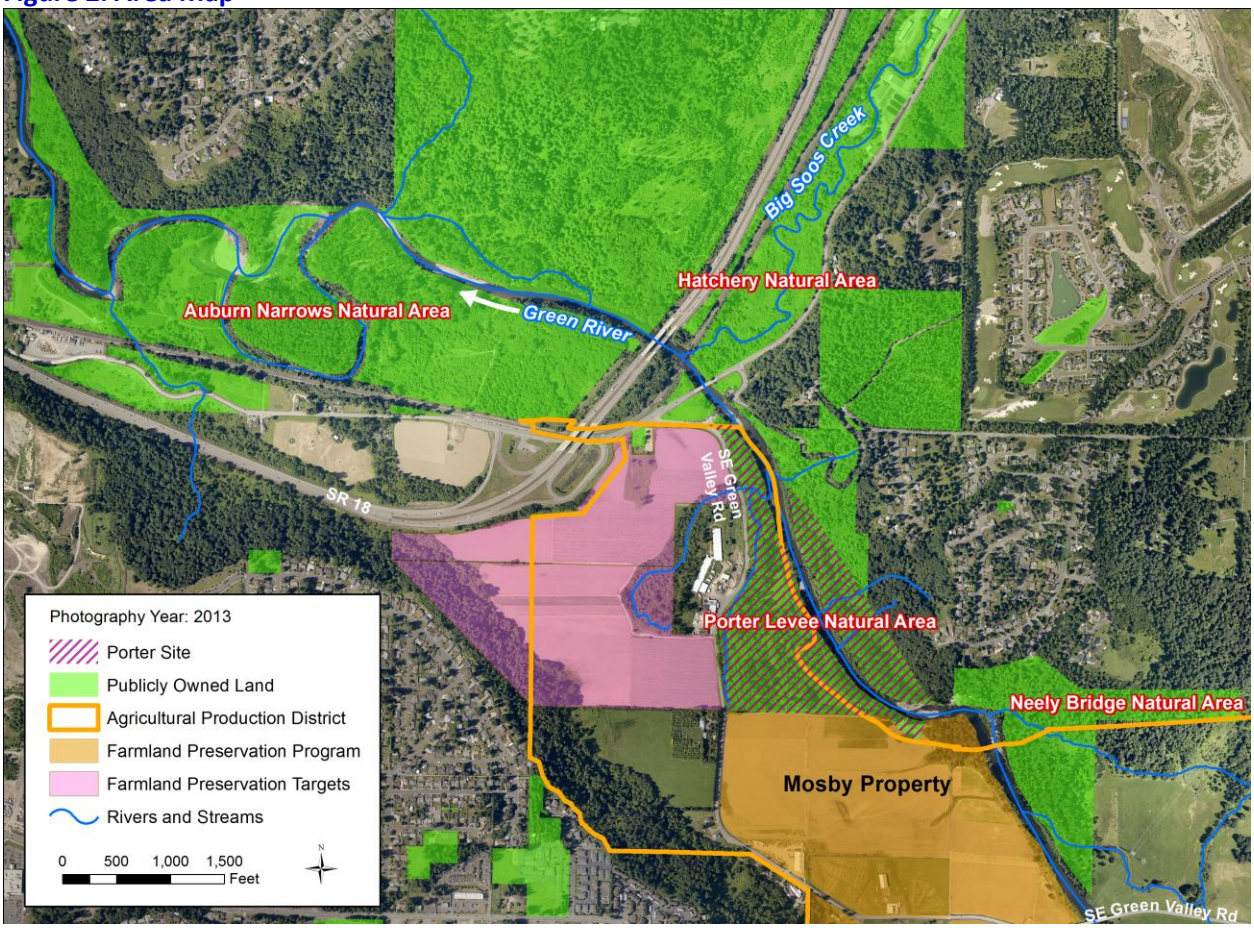
levees throughout the Middle Green River levee system (KC Flood Hazard Management Plan 2006). Porter Levee (built in 1961) was damaged in 1990 and repaired by the U.S. Army Corps of Engineers (USACE) that same year, but was damaged again in 1996 and subsequently abandoned for maintenance. During a single flood in 1990, 150 feet of the Hamakami Levee (RM 36, just upriver of Porter) and 300 feet of levee access road were destroyed, along with two acres of farmland when the river moved laterally about 360 feet along a channel length of a quarter mile. The 1960's-era Lones Levee (RM 38) has also been impacted by channel migration which has severed the levee's access road on several occasions and has eroded 75 feet of the levee itself. Green Valley Road (a KC facility) adjacent to the Porter site closes periodically due to extensive ponding of water over its surface.

The *1993 KC Flood Hazard Reduction Plan* recommended that a number of vulnerable levees and revetments, including Porter, be set back from channel margins (KC Flood Hazard Management Plan 2006). The Porter Levee Natural Area (Porter site) was acquired by KC Department of Natural Resource and Parks in 1999 to facilitate levee removal and the construction of a setback facility, and implement habitat restoration elements.

Flood Hazard Risk Reduction Benefits

Several potential flood risk reduction benefits are expected to result from removing Porter Levee and reconstructing a setback facility adjacent to a county road. Figure 3 depicts the preferred design alternative related to removing the levee, constructing a setback facility, and providing habitat features.

Figure 2. Area Map



Implementation of the Preferred Design Alternative will result in:

- Reduced overtopping of upstream levee and associated surface erosion in farm field: The 1,550-foot Porter Levee will be removed from the edge of the Green River. Design analysis shows the Porter project will lower the mainstem river water surface elevations (WSE) upstream of the Porter site, which will reduce the frequency of overtopping of river water, and the associated soil erosion in the vicinity immediately upstream of the project area. KC will construct a 150-foot levee facility at the southeast portion of the Porter Site (just north of the "Mosby" property shown in Figure 2) that will include toe rock and two deflector jams. This facility will provide enhanced erosion protection to this adjacent landowner. Channel migration will be re-activated within the floodplain. The current single-thread channel is anticipated to be reconfigured by natural river processes over time to re-establish multi-threaded channel morphology in the floodplain terrace. The flow area will be increased by removal of the levee structure, and floodplain storage will be increased in the project reach.
- Increased erosion protection for Green Valley Road (GVR): The Porter project reduces erosion risk to a portion of GVR, a county road which is vital for local businesses and agriculture. The removal of the existing Porter Levee (damaged seven times in last 31 years) and the existing roadside berm adjacent to GVR of unknown origin, with a new 1,300 lineal-foot setback facility built adjacent to the road to current engineering standards should reduce erosion risks to the road. The western boundary of the Porter site abuts GVR. A raised gravel berm of uncertain origin is present along the road in the upstream portions of the site, and is prone to high levels of seepage during flood events, affecting traffic flows on the road and use of the adjoining commercial site. Modest flood containment functions currently provided by this poorly constructed berm will be replaced with a setback facility using current Corps of Engineers structural standards. The setback facility will limit future channel migration. KC will provide 500 linear feet of log clusters between the mainstem river and Green Valley Road to provide additional flow resistance and bank protection that will mitigate the likelihood of a full channel avulsion into the existing side channels and thereby likelihood of the river reaching the Green Valley Road prism.
- Improved farm field drainage (i.e. reduced flood duration): The Porter project will capture runoff from the privately-owned agricultural property (Mosby, see Figure 3) south of the Porter Levee Natural Area and discharge to the south east portion of the Porter site via the installation and connection of an 18-inch culvert. Design analysis shows the levee setback project will result in a decrease in WSE in the main river channel adjacent to Mosby's property by up to one foot but could increase WSE in the floodplain up to 0.10-foot at flows of 9,000 cfs or greater. The proposed drainage improvement would mitigate this potential increase by improving farm field drainage. Currently, water on Mosby's property drains from the northwest corner to a backwater channel that runs south on the Porter site parallel to SE Green Valley Road. The WSE in, and subsequently drainage of, the backwater channel is set by the WSE in the Green River at the downstream confluence. This contributes to slow drainage in the backwater channel. The new culvert will allow direct discharge to the Porter site and will not be controlled by the drainage rate of the backwater channel. KC has initiated discussions with three landowners of 112 acres west of the Porter site that are targeted for enrollment in the KC Farmland Protection Program (FPP), (depicted in pink shading, Figure 2). These landowners are interested in drainage improvements on their properties. Please see question 5c for more information.

This proposal also includes removing development rights on 112 acres of farmland immediately adjacent to and west of the Porter site by enrolling these properties in the KC Farmland Protection Program (Figure 2). Removing development potential in this floodplain area will reduce the potential for future flood

damage to occur. In addition, these properties currently have drainage issues. Working with these landowners to remove through the purchase or transfer of development rights will facilitate discussions on improving drainage infrastructure within the floodplain. All landowners are willing to negotiate the sale or transfer of development rights.

Consistency with Flood Hazard Management Plans

The Porter Levee removal effort (Porter project) is consistent with the *2006 Flood Hazard Management Plan* (KC) which recommends setting back existing flood protection facilities to allow the channel to evolve over the long-term. This requires the pairing of land acquisitions for flood protection facility setbacks with habitat restoration projects. Acquisitions along the middle Green River were informed by the *Last Best Places in the Green River Watershed* (KC 2002). All lands associated with the Porter Project are in public ownership. The *2006 Flood Hazard Management Plan* (KC) recommends acquiring land in the Middle Green Floodplain to: *"…reduce or eliminate: A) risk to public safety if residents are caught unaware of flood conditions or attempt to enter or re-enter flooded areas; B) risk to public safety if fire or rescue personnel are called upon to aid those unable or unwilling to evacuate flooded homes; C) damage to private structures from both flooding and erosion."*

Local Support for Flood Risk Reduction Actions

As part of developing both the *Middle Green River Levee Setback Feasibility Study* (Bowles et al. 2013) and the *Porter Levee Restoration Project – 30% Design Plans* (KC 2013), KC regularly communicated with adjacent landowners and the land custodian (KC Parks Division) of the Porter site. Staff met with adjacent landowner Burr Mosby on eight occasions between 2012 and 2014. Mr. Mosby owns 123 acres of agricultural land immediately adjacent to and south of the Porter site (see Figures 2 and 3). Issues discussed with him pertained to the potential to acquire additional portions of his property, how his lands would be protected from erosion and flooding, current drainage issues on his property, relocating utilities, and ownership boundaries. Mr. Mosby expressed support for this project because he believes it will reduce duration of flooding on his property and the potential for future erosion. If the project is not done, Porter Levee is continuing to degrade, with undercut and sloughing rock armor and will not be able to provide long-term erosion control protection in this reach.

Figure 3. Looking upriver to the southeast, the Porter site in the middle left of the photo; flooded area south of Porter site is private farm (Mosby); road due west of Porter site is Green Valley Road.

Jeff Demeerler owns 15 acres across Green Valley Road from the Porter site to the west; this land is occupied by several agricultural businesses (in lower portion of Figure 3). KC staff met with Mr. Demeerler three times in 2013 and 2014 and has had several phone conversations and multiple e-mail exchanges. KC is interested in acquiring a portion of the Demeerler property to expand the scope of restoration near the Porter site. Mr. Demeerler has expressed support for selling a portion of his property and of the Porter proposal because he wants to minimize the potential of flooding the multiple businesses which operate on his property. He views the construction of a new flood setback facility adjacent to Green Valley Road as an improvement over the current berm. This new facility will meet current federal flood control design standards; the existing levee and berm do not. Three other landowners west of the Porter site have also expressed support for the project; all three are willing to negotiate the sale of development rights to KC, which would permanently preserve agricultural land.

3. Floodplain ecosystem protection or restoration element (*60 points*)

Problem Statement

The construction of Porter Levee to arrest bank erosion simplified the river channel pattern and interfered with the formation of valuable habitat features (e.g. new logjams, scour pools, forested islands, and side channels). It also altered floodplain connectivity, locally confining and increasing in-channel conveyance during flood events (see Figure 4). Hydraulic effects of the Porter Levee also have a strong influence on channel geometry and the characteristics of the streambed.

Figure 4. Porter Levee currently sloughing rock armor into the Green River

Current Conditions

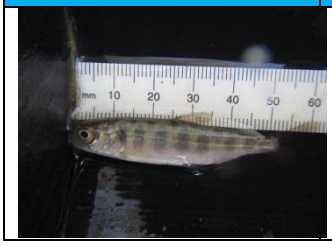
The Project reach lies in a broad valley floor underlain by sandy, silty and gravelly alluvium, bordered by steep valley walls. The project reach has a gentle slope (0.17%) and low sinuosity (1.1). Site conditions are affected by historic agricultural uses, levee construction in 1961, and flow regulation at Howard Hanson Dam, which regulates peak flows to a target of 12,000 cubic feet per second (cfs) and doubles the duration of moderate flows between 2,000 and 10,000 cfs. The river is entrained against the levee and is deep and narrow, flat and straight. In addition to the river, the project site contains four wetlands, and an oxbow pond which are waters of the U.S.

Restoration of the project site began in 1999 when KC acquired the Porter site. In this year, the USACE, in partnership with KC, cut two notches into the levee to provide fish access to a 1.7-acre oxbow pond (Figure 6) which was formed in 1961 when the levee separated the connection to this feature, a remnant river channel. The upstream notch begins flowing at approximately 1,200-1,300 cfs, allowing the pond to provide winter refuge and rearing habitat though it turns stagnant and anoxic in summer. Approximately 10,000 native trees and shrubs have been planted on the property since 2001.

Figure 5. Oxbow pond on Porter site

The Porter site is used by numerous fish species, including five salmonids (Figure 5). Fish surveys from 1999, 2000, and 2013 detected juvenile salmonids thoughout the Porter site. Coho (*Onchorhyncus kisutch*) are most common, but Chinook (*O. tschawytscha*), rainbow trout (*O. mykiss*), and chum salmon (*O. keta*) are also frequently present. Pink salmon (*O. gorbuscha)* inhabit the site in the spring.

Figure 6. Juvenile salmonids captured at Porter site (4-13-14; 2,500 cfs in river)

Chinook	Rainbow trout	Chum	Coho
			

Key Salmon Recovery Problems to be Addressed

In 2005, a NOAA review indicated that the Green River Chinook population (hatchery, natural origin fish) was barely replacing itself; the estimated long-term trend ('68-'02) in abundance was 1.02 in progeny to parent ratio. The short term trend ('90-'02) was similar: 1.05. However, the estimated growth rate of the natural population was 0.67 (assuming that fish spawning in the river have similar success regardless

of whether they were natural or hatchery origin). This was the lowest estimated population growth rate of all stocks in the Puget Sound ESU.

Recent status review suggests a mixed outlook for this Chinook population. The 15-year trend (1995-2009) in natural spawner abundance was 0.95 (0.85-1.06, 95% CI), which is lower than the previously estimated. However, estimates for the growth rate of the natural population are higher than before (0.835 now vs. 0.67 then). The true value is likely between 0.835 and 1.003; the first value assumes hatchery and natural origin are equally fit when spawning in the river and the second value assumes that HORs spawning in the wild produce no offspring. Neither assumption is likely correct. Instead these values bracket the true number. The population growth rate is lower than the target, which is cause for continued concern.

The WRIA 9 Salmon Habitat Plan identifies levees and revetments as one of the primary factors of decline for the Green River Fall Chinook salmon. Other factors in the middle Green River include dams and land use changes. The viability of the Chinook population is related to four indicators: productivity, abundance, diversity, and spatial structure. These indicators help to determine whether the population has a "*negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100-year time frame*" (McElhany et al. 2000).

Project Goals and Objectives

The goal of this project from a fish habitat perspective is to improve the freshwater survival of threatened salmonids (Puget Sound fall Chinook salmon and steelhead trout) by constructing a habitat restoration project that results in a dynamic mosaic of high-quality riverine and floodplain habitats and is self-sustaining over many decades (Figure 7).

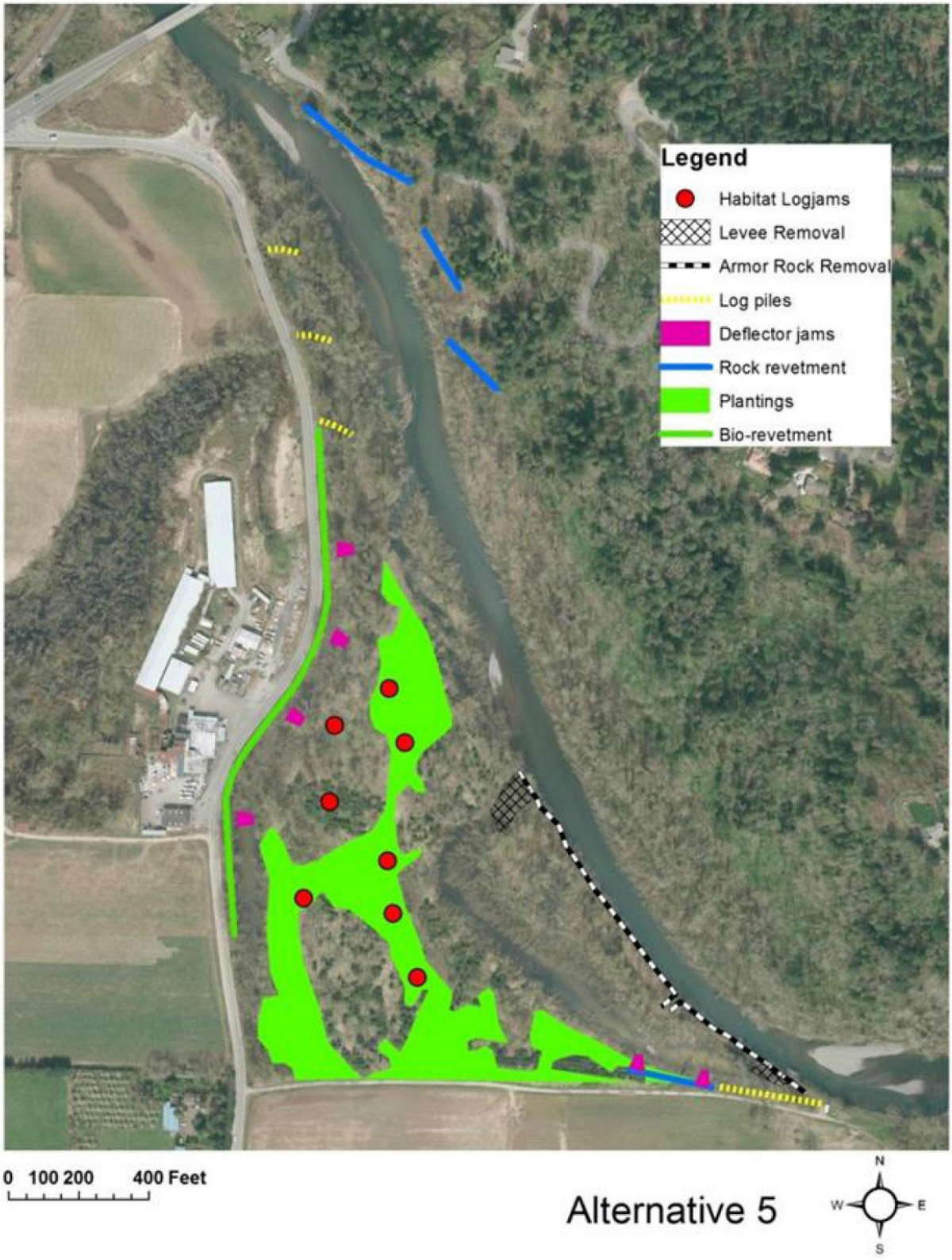
Figure 7. Time series of analogue reach on Green R. illustrating desired outcomes

1970	2002	2005	2012
			
Initial condition; gentle meanders with large radius of curvature, wavelength	30 years later, tight meanders and extensive lateral migration	Cutoff channels and/or avulsions form abandoned features and complex planform	More cutoffs leave remnant features creating complex rearing, refuge habitat

Habitat-related project objectives include removing a 1,550 linear-foot rock levee, installing six floodplain logjams, installing five deflector jams in boundary protection features, and planting 10 acres with trees and shrubs. These actions will promote increased channel migration, wood recruitment and trapping, diversity in the forested floodplain, and increase the quantity/diversity of salmonid habitat.

There are five risk and feasibility-related objectives: maintain existing level of off-site flood and erosion protection; comply with policies, codes, and regulations; limit risks to recreational river users; limit construction impacts; minimize future maintenance needs. A major feature of the project includes constructing a setback levee along Green Valley Road to prevent erosion and to maintain existing levels of flood risk protection.

Figure 8. Preferred Design Alternative



Anticipated Restoration Results

Removing Porter Levee will create 36 acres of a self-sustaining a dynamic mosaic of high-quality riverine and floodplain habitats consisting of:

- Ten acres revegetated with native trees and shrubs
- Six floodplain logjams
- Five deflector jams in boundary protection features

These actions will promote increased channel migration, wood recruitment/trapping, diversity in the forested floodplain, thereby increasing the quantity/diversity of salmonid habitat (see Figure 8).

Figure 9. Expected results of Porter project on Viable Salmonid Population parameters (productivity, abundance, diversity, spatial structure, distribution) – Green R. fall Chinook from Puget S. fall Chinook ESU

Parameter	Indicators	Expect. Result	Mechanism	Long-term viability Implications
Productivity Perfor-mance of fish during life stages	Egg-to-migrant survival; pop. growth rate of natural-origin spawners	Increased survival, natural-origin population growth rate	Reduced scour, improved habitat quality, increased rearing, refuge habitat	Natural-origin spawners will produce sufficient juveniles to grow population over the long-term, withstand unproductive ocean cycles.
Abundance: Number of fish in a population	Abundance of natural origin spawners (target: 1,000-4,200)	Increased abundance of natural origin spawners	>survival rates in fresh-water from >growth rates, reduced mortality during floods	Sufficient #'s of Chinook to be resilient to disturbances, allow for negative feedbacks to stabilize the population size, maintain genetic diversity
Spatial Structure: configure-tion, quality	# of occupied spawning patches as % of total	High complex. in channel; new or expan. spawning	Channel migration causes habitat features to evolve over time	Spatial structure maintained by balance of habitat creation & destruction, natural rates of genetic exchange between pops
Diversity: Genetic, physical, behavioral differences among, within pops.	% river-spawning adults originating from hatchery; % of juv. Chinook that out-migrate as parr	Increased spawning success for river-spawning adults; more prolonged outmigration	Increased egg-fry survival; habitat capacity reduces dispersal pressures, less displacement of parr migrants during floods	Natural patterns of run timing, age, size, egg production, body shape, behavior and genetic diversity still dominate the population. Fish may disperse unimpeded and gene flow continues with little alteration.

This project addresses the WRIA 9 Salmon Habitat Plan which identifies levees and revetments as one of the primary factors of decline for the Green River Fall Chinook salmon. Other factors in the middle Green River include dams and land use changes. The viability of the Chinook population is related to four indicators: productivity, abundance, diversity, and spatial structure.

Sequencing

The Porter project is part of a larger recovery strategy to restore the middle Green River: this restoration site is in close proximity to previously restored reaches downstream in the lower Green River at Fenster (RM 31), Pautzke (RM 32), Auburn Narrows (RM 33) and core spawning areas in the lower mile of Soos Creek which enters the Green River at RM 33. When the Porter site is restored, over 250 acres of floodplain habitat restoration will have occurred in this reach. This construction project is the fourth phase of project development, the first being acquisition, followed by design and permitting.

Implementation of the Porter project is consistent with WRIA 9 Sequencing Guidelines and is the top priority project listed in Guideline 4: "*In the near term (2009-2019), restore habitat and habitat-forming processes in the marine nearshore and in freshwater (Middle Green, and Lower Green). Improving freshwater rearing habitat capacity could reduce density-dependent migration to the lower river and estuary. If so, juvenile densities in the Duwamish River Transition Zone may be lessened or alleviated. Also, it is necessary to maintain productive spawning habitat in the Middle Green River to sustain productivity and spatial structure over the long term. The top priority project is Porter Levee.*"

4. Is project in a Puget Sound Partnership Priority Floodplain? *(5 points)*

Yes, the project site is located in the Duwamish/Green River, which is a PSP Priority Floodplain.

5. Other benefits (*40 points*)

a. Agricultural viability (evidence of agricultural benefits include reductions in flooding (acres), protection from development (acres), improvement of drainage infrastructure (acres), or other capital or non-capital benefits to agricultural productivity).

There are over 300 acres of very productive crop land near the Porter site, along with three businesses related to farming, and a county road accessing the Green River Valley which has over 2,000 acres of farmland. Removing the levee and constructing a setback facility would benefit these agricultural acreages, businesses, landowners, and the associated county road.

A major focus of this proposal is to purchase the development rights of 112 acres of farmland on three properties with active production of commercial row crops (Figure 9). The parcels would be enrolled in the KC Farmland Protection Program (FPP) which would permanently preserve the farming potential of these properties. The farmlands have been cropped for many years. Including these properties in the FPP will result in a block of 275 acres of permanently preserved farmland in this reach. Over 90% of these properties consist of Nooksack silt loam, classified by the USDA Soil Survey as "prime farmland." Annual crop production (vegetables) takes place on these parcels. As such, these properties are a particularly high priority for farmland preservation.

Figure 10. Farmland west of Porter site targeted for development right purchase; photo is looking west

Preserving farming in this area also has strategic growth management benefits since the property is located directly adjacent to the Urban Growth Area boundary and the City of Auburn. A portion of the parcels, approximately 30 acres, is located within the City of Auburn. Placing a conservation easement on these properties will protect the gateway to the middle Green River Agriculture Production District and substantially add to the community separator function that currently is being provided by other properties in the FPP. All three landowners are willing to negotiate for the purchase of development rights on their properties. This is an excellent opportunity to reduce the likelihood of future flooding problems associated with future residential construction in a floodplain.

These agricultural properties also have drainage problems; water ponds on the fields for extensive periods after flood events. KC staff have already talked with these landowners and staff are aware of the need to improve drainage on these parcels. KC has an active Stormwater Services Section (SSS) which provides landowners with design and implementation assistance to improve drainage, and consequently agricultural productivity.

b. Water quality improvement [e.g., through stormwater infrastructure upgrades, treatment of a TMDL or 303(d) issue, reduction in sediment, restoration of wetlands or riparian areas, implementation of related best management practices, etc.].

Redirecting the flow of the Green River from a confined channel through a forested floodplain will allow for the filtering of particulates from the river water, especially in those areas which will have increased retention times. Planting trees and shrubs throughout the site will eventually reduce water temperatures of the multiple watercourses on the Porter site.

c. Public open space and recreation access

This proposal does not emphasize public access on the KC-owned Porter site. However, once the levee is removed, and the river begins to become more dynamic in its flow patterns, the site will likely attract more anglers and people that enjoy recreating in natural areas.

d. Economic development

Implementing this proposal will help maintain the high agricultural productivity in the project area, to the extent that the new culvert and flap-gate improve drainage and therefore growing conditions or reduce crop damage on Mosby's property.

e. Other floodplain values or services of local importance.

This proposal has the potential to be a "win-win-win" for flooding, fish and wildlife, water quality, and farmland. Because this project is located in a KC Comprehensive Plan-designated Agricultural Production District, there have been policy challenges related to implementing projects with extensive habitat and flood benefits. If successfully implemented, this effort can provide a "blueprint" for future projects in similar situations. All anticipated policy and regulatory challenges have been identified and considered, and none are deemed as having the potential to slow the implementation of this project.

6. Cost-effectiveness (*20 points*)

a. Project will be judged on whether the budget is appropriate to the project scope, and designed for project success.

The project budget was based on the year-long process KC staff took to generate a 30% design. This design and cost estimate is appropriate in association with the project's scope. Extensive work went in to prioritizing the design for immediate and long-term project success. Cost-effectiveness of the project was maximized by adherence to explicit design criteria that were specified prior to design and by

iteratively value-engineering the design throughout the development of 30% plans. These two factors contributed to a design that is efficient and effective in the near-term and long-term. The context of a project strongly influences the cost. For example, removing a levee is simple and inexpensive, but restoring a complex, dynamic river in the midst of privately-owned lands and arterial roads and bridges is more difficult and costly. The project budget reflects these constraints and complexities. The following design criteria were established for both near and long-term habitat benefits and for feasibility:

Near-term Habitat Benefit Criteria (occurring within approximately five flood events)

- Channel begins to migrate (visible bank erosion in project site)
- Large wood begins to accumulate (LWD abundance in the project area will increase over baseline, owing to erosion of existing trees, new logjams, trapped wood from upstream)
- Wildlife habitat is enhanced (graded areas will be re-vegetated, >50% of existing clearings will be planted, snagsdowned logs will be installed, blackberry will be reduced)
- Oxbow pond will be converted to mainstem channel containing greater diversity of low-velocity edge habitat for juvenile salmonids, including a mix of backwaters, side channels, banks, bars).

Long-term Habitat Benefit Criteria (a period lasting 30 years or more)

- Channel migrates, avulses, resists entrainment on setback facility; mainstem channel planform will continually evolve, including meander rotation, translation, or extension, and channel avulsions.
- Natural logjams are continually present in the channel.
- Floodplain forest becomes a patchwork of successional stages (a variety of forested landforms is present; young (pioneer to early-successional), older forests.
- More side channel, backwater, edge habitat available for rearing; side channels/backwaters will increase at 'rearing flows'; approximately 1,800 cfs at Auburn.

Feasibility Criteria

- Provide off-site flood, erosion protection for private land, Green Valley Rd., other infrastructure. Setback facility will contain lateral channel migration expected to occur at a 100-year flood event.
- Comply with policies, codes, and regulations (project will comply with zero-rise and comp. storage regulations and comply with KC large wood placement policies.
- Limit risks to recreational users (project area will not pose unacceptable risks to recreational users, as determined by KC Large Wood placement policies).
- Limit construction impacts to what is necessary.
- The maximum amount of placed (angular rock) will be removed from existing levee to prevent the need for future rock removal, and continued adverse impacts.

b. Describe how the project will be continued or maintained after the grant is completed.

After the grant is completed, the project will be monitored and maintained by staff in the KC Monitoring & Maintenance Program for five to ten years. Monitoring will focus on tracking indicators of project performance, relative to the goals and objectives. Maintenance will include site management, weed control, planting survival and replacement. The plan will include necessary inspections to document conditions of concern and responses. Additionally, if needed, adaptive management will be undertaken to ensure project performance. The entire project area is publicly owned by KC. This protection ensures continuity in the management of the site into the future and provides the flexibility needed to implement ongoing monitoring and maintenance, and adaptive management efforts.

KC's plan for providing site stewardship will be based on standards and protocols commonly accepted and followed by resource planners and land managers charged with managing natural areas whose primary

purpose and use is fish and wildlife habitat preservation. Basic site information will be gathered by the KC Capital Improvement Projects Monitoring Program and incorporated into site management activities for both short and longer-term stewardship of the site. Depending on actual needs and costs, funding for stewardship or maintenance could come from a number of different sources, such as surface water management fees or the KC Parks Division. A post-construction update to the site management plan for the Porter Levee Natural Area will be prepared.

c. If project cannot be fully funded, explain how the project could be scaled downward.

If the project cannot be fully funded from this grant source, KC has obtained some match funding and will continue to seek match funding. Scaling the project downward was considered on numerous occasions, but each time it was deemed to be much more expensive that constructing it at one time because of the cost of staging construction equipment multiple times. KC could also not pursue FPP easements at this time.

7. Long-term cost avoidance: (*30 points*)

a. Describe how your project minimizes or eliminates future costs for maintenance, operation, or emergency response. (*15 points*)

The project is designed to create a more dynamic ecologically-functioning floodplain resilient to disturbance and changes in the river. The design is informed by historical sources and a reference site that together characterize the site's potential future state. The design is also based on site-specific technical studies (e.g, geomorphology, hydrology, hydraulic, wood, fish). The long-term functioning of this project is insured by re-establishing the local hydrology and disturbance regime, not on ensuring the as-built condition is maintained. These strategies ensure the project design is compatible with the site, so that we are working with, instead of against, the river. Many features, like floodplain logjams and plantings, would be naturally-occurring under historic conditions and can adjust to changing conditions. Boundary protection features, in contrast, could require more maintenance. Accordingly, they are designed to current standards and should have minimal future maintenance costs. If maintenance is required, existing roads provide good access to each facility in case repair is needed. No operations costs are expected. Emergency response costs are avoided by designing deflector jams to be compatible with river recreation.

KC intends to provide erosion protection along approximately 300 linear feet of the downstream project area (right bank) where the river impinges upon SE Lake Holm Road. The geomorphic assessment carried out for this project indicated the potential for erosive flows negatively impacting Holms Road in response to channel migration on the left bank upstream of this area and then realigning back to the main channel adjacent to Holms Road to pass through the Auburn – Black Diamond Road and SR – 18 bridges.

b. Describe how your project accounts for expected future changes to hydrology, sediment regimes, or water supply resulting from other floodplain management efforts, land use changes, extreme weather events, or other causes. (*15 points*)

The design maximizes the amount of land area appropriated to the river channel. Allowing the channel to re-work a large area increases the likelihood that the site can develop a diverse array of physical characteristics, including topographic complexity, streambed, a riparian forest mosaic, abandoned logjams, wide gradients in soil moisture, shade, and soil texture, as well as overflow channels, springbrooks and hyporheic upwelling. This diverse portfolio of physical and ecological conditions increases the resilience of the site to future alterations in the hydrology, sediment regime, or water supply in sharp contrast to projects that require static channel configurations and stationary flow regimes. KC is planning to collaborate with NOAA, the UW Climate Impacts Group, and other partners to evaluate and quantify climate change impacts that could affect project design and implementation.

8. Demonstration of need and support (*30 points*)

a. Describe how project is consistent with existing floodplain management or habitat recovery plans or is specifically identified through existing plans/work programs. Elements of project may have been developed through more than one planning process. Please identify the planning process used for each major element if not from a common plan. *(15 points*)

How is the project consistent with the intent of existing habitat recovery plans?
The project is identified as MG-17 in the *WRIA 9 Salmon Habitat Plan* (WRIA 9 2005). The project implements two of the Tier 1 Conservation Hypotheses that form the strategic basis of the Habitat Plan:

- MG-1: Protecting and creating/restoring habitat that provides refugia (particularly side channels, off channels, and tributary access), habitat complexity (particularly pools) for salmon over a range of flow conditions and at a variety of locations (e.g., mainstem channel edge, river bends, tributary mouths) will enhance habitat quantity and quality and lead to greater juvenile salmon residence time, greater growth, and higher survival.
- MG-3: Protecting and restoring natural sediment recruitment (particularly spawning gravels) by reconnecting sediment sources to the river will help maintain spawning, adult holding, and juvenile rearing habitat.

The Habitat Plan identifies necessary future conditions for Segment 4 (RM 32-45.3) of the middle Green subwatershed, where the Porter site is located. This project will contribute to meeting these targets from the Habitat Plan. Targets include the following:

- Refugia are established that provide habitat to support both juvenile and adult Chinook
- Sediment recruitment and transport rates approach natural rates to increase productivity of spawning area and to maintain and develop habitat (e.g., pool tail outs, spawning riffles, shallow channel edge) for improving life history productivity;
- Natural rates of channel migration are re-established to create/maintain functioning aquatic habitats that represent ~65% of pre-settlement levels at any given time;
- Natural disturbance events are less restrained to support the creation of new habitats and to recruit sediment and large wood;
- Mainstem, off-channel, tributary habitats are improved to increase juvenile rearing, life stage diversity, and productivity (increase egg-to-fry and fry-to-fingerling survival rates). Habitat targets from Habitat Plan include: braided channels, side channels, shallow channel edges, large wood per km (in logjams), channel-widths per pool (spacing)
- Riparian zone is functioning; effective buffer widths are established to provide shade, bank stabilization, sediment control, organic litter, large wood, nutrients, microclimate.

This project was also identified as a priority project in the:

- *Middle Green River Levee Setback Feasibility Study* (Bowles et al. 2013).
- *Middle Green River Restoration Blueprint* (KC 2006)
- *Green/Duwamish River Ecosystem Restoration Study* (USACE 2000)

Puget Sound Action Agenda
The Porter Project contributes to progress toward the two targets in the Puget Sound Action Agenda:

- Chinook salmon: Supports improvements in wild Chinook abundance by addressing critical factors of decline.
- Floodplains: Restores 35 acres of floodplain area, by improving connectivity with river and forested area, which will lead to improved floodplain functions.

b. Describe which flood control authorities, Tribal Nations, local governments, lead entities, key stakeholders or decision-makers representing floodplain interests located within the river reach or affected by the project have provided letters of support explicitly endorsing the project and its outcomes for their interests. (*15 points*)

Please see letters of support for this proposal.

9. Readiness to proceed, complete proposed phase of project (*25 points)*

Describe how your project is ready to proceed with the scope of work, and your capacity to complete it successfully and maintain it over time, including your project schedule and deliverables.

Readiness

The project site is fully owned by KC. Much of the design work has been completed. A construction easement for access has been secured from the neighbor (Mosby) and a drainage release is being negotiated. A drainage release is necessary because flood models indicate a very small rise in WSE on Mosby's property at flows over 9,000 cfs. Three landowners west of the Porter site are willing to negotiate a sale of development rights under the KC Farmland Preservation Program.

Agency Capacity

KC DNRP has over 25 years of experience in successfully designing, permitting, managing, constructing, monitoring, and maintaining large capital restoration projects related to river, stream, and wetland habitat enhancement. Staff have over 100 years of combined professional experience, and include the following expertise:

- Mason Bowles – Wetland Ecologist (25)
- Carolyn Butchart – Civil Engineer (15)
- Jon Hansen – Ecologist and Project Supervisor (24)
- Todd Hurley – Geomorphologist (16)
- Josh Latterell, Ph.D. Certified Ecologist (10)
- Will Mansfield – Engineering Supervisor (16)
- Fauna Nopp – Landscape Architect and Project Manager (21)

Project Schedule

SCOPE OF WORK TASK:	END DATE
Grant Contracting Completed	September, 2015
Final Design	December, 2016
Purchase of Agricultural Development Rights	March, 2017
Construction Contract Procurement	June, 2017
Drainage Improvements Installed	August, 2017
Implementation (levee removal, setback facility construction)	May, 2018
Close-out	February, 2019

10. Pilot project and leverage opportunities *(25 points)*

a. If applicable, describe how your project could serve as a pilot effort or result in changes or results with broader impacts to the state. *(10 points)*

This proposal offers an excellent opportunity to achieve significant benefit to fish and wildlife habitat, highly productive farmland for crop production near a large urban area, and improved drainage of a 67-acre farm field. Because this project is located in a KC Comprehensive Plan-designated Agricultural

Production District, there have been challenges related to implementing a project with extensive habitat and flood benefits. But this proposal has received early support from various habitat, flood, and agricultural entities. If successfully implemented, it would be a great example for future projects in the county and state to consider under similar situations. KC is planning additional levee removal and setback projects in the Middle Green River sub-basin.

b. If applicable, describe how your project leverages existing investments, such as SRFB, FCZDs, Dike Districts, TMDLs, WWRP, ESRP, NEP, and other funding sources. Evidence of this will be based on the amount and diversity of the leveraged funding sources. *(10 points)*

Puget Sound Acquisition and Restoration Program (PSAR) provided $200,000 to complete a 30% design; KC augmented the design costs with $150,000. The Green River FCZD has provided support and background information to complete the 30% design and assisted in permitting the project. KC recently obtained $300,000 from the Cooperative Watershed Management fund dedicated to the construction of the levee removal project. KC Surface Water Management fees, King Conservation District, and the National Fish and Wildlife Foundation have all provided funding for previous efforts to revegetate the Porter site with native trees and shrubs.

c. If applicable, describe how your project addresses inequity or social justice issue by benefitting underserved communities. *(5 points)*

This project does not address issues of inequity or social justice.

11. Budget (add more tasks as needed)

Task	Amount Requested from Ecology	Other Funding (Min. 20% of Total Cost)	Cost
Task 1: Administration, A & E		**$885,731**	**$885,731**
Task 2: Mobilization		**$451,642**	**$451,642**
Task 3: Construction	**$2,776,315**		**$2,776,315**
Task 4: Habitat Elements	**$572,611**		**$572,611**
Task 5: Ag. Develop. Credits	**$300,000**	**$400,000**	**$700,000**
Total	**$3,648,926**	**$1,737,373**	**$5,386,299**

Narrative and/or Table of other funding sources:

The cost estimates above are based on a recently-completed 30% design. Currently, KC has "in hand" $300,000 in construction match and $400K to purchase agricultural development credits. Additional King County Surface Water Management funding is likely. KC is currently seeking a number of funding opportunities from multiple agencies for the construction of the Porter project and the purchase of agricultural development credits. The availability of these sources to fund the match to this FBD grant will become more apparent in the first half of 2015.

If it's not possible to fully fund this proposal, please describe a *phased* approach that would still significantly advance the effort.

If other sources of funding become available, FBD funding could provide a match to the construction of this project and fund the acquisition of development credits on adjacent agricultural lands.

12. Scope of Work: Please attach a Scope of Work and schedule.

A Scope of Work has been attached; a schedule is under Question 9.

13. Planting Maintenance/Survival:

If project includes plantings, describe how you will ensure plant survival, maintenance.

KC has been actively involved in conducting planting and maintenance experiments to continually improve cost-effectiveness of methods to establish native canopies of trees and shrubs. The results of these studies will be used to design a site-specific strategy for site-preparation, planting strategy, maintenance (i.e., establishment care), and weed control post-project. Examples include:

- Pre-project assessment and treatment of invasive weeds
- Careful handling of any weed-contaminated spoils
- BMPs to avoid/minimize/mitigate soil compaction or other types of degradation by heavy equip.
- Selection of robust plant stock
- Professional plant installation techniques
- Post-project establishment care, potentially including mulch or irrigation, but only as needed.
- Plant replacement during post-project period if necessary, and weed control

Plant performance would focus on achieving robust native woody cover rather than on survival, and would set realistic weed targets for each invasive species. Plants will be actively monitored and maintained for a minimum of five years post project construction.

Certification

I certify to the best of my knowledge that the information provided above is true and correct and that I am legally authorized to sign and submit this information on behalf of the organization applying for this grant.

_____

Signature Date

_____

Printed name and Title

_____

Name of Organization Applying for Grant