

## CHAPTER 4. RESTORATION ACTION PLAN

In order to actually implement the strategic approach described above in Chapter 3, this chapter presents programmatic and site-specific project recommendations to restore the Sammamish River Corridor to a much better functioning ecosystem that has suitable conditions and habitats for a variety of fish and wildlife species. The strategic approach identified the most critical elements necessary to achieve the goals of a healthy migratory corridor for fish and wildlife, in addition to contributing to the overall recovery of salmon in the greater Lake Washington watershed. Those critical elements are embodied as the first six programmatic action alternatives identified below and comprise the “*core*” recommendations for this Action Plan. These recommendations *must* be implemented in order to address the most critical problems in the corridor. Implementation of many of these recommendations will likely require participation of several jurisdictions in the corridor. Additional “*non-core*” programmatic recommendations along with site-specific project recommendations are then presented that will further implement the strategic approach and rectify several sources of degradation in the corridor to achieve an overall well-connected corridor with key habitats for both fish and wildlife. A summary of the programmatic recommendations is presented in Table 6.

The site-specific actions are prioritized according to their ability to both implement the key strategies and address lower priority problems in the Corridor. A prioritized list of recommendations is shown in Tables 7 and 8 at the end of this chapter. Implementation of the recommended Action Plan will dramatically improve the habitat values, water quality conditions, and character of the Sammamish River Corridor and allow it to maintain these functions over the long term.

### PROGRAMMATIC RECOMMENDATIONS.

<b>Table 6. Summary of Core and Non-Core Programmatic Recommendations</b>	
<b>Programmatic Recommendation</b>	<b>Designation</b>
<b>P1.</b> Restore riparian areas throughout the entire Sammamish River Corridor	<b>Core</b>
<b>P2.</b> Create and enhance pools in the river channel	<b>Core</b>
<b>P3.</b> Protect and improve buffers along the river, tributaries and wetlands	<b>Core</b>
<b>P4.</b> Explore engineered solutions to cool the river upstream of Bear Creek (Reach 6)	<b>Core</b>
<b>P5.</b> Increase water conservation in the Sammamish Watershed (Particularly the Bear Creek Basin)	<b>Core</b>
<b>P6.</b> Acquisition of existing high-value habitats or areas with high likelihood of restoration success	<b>Core</b>
<b>P7.</b> Reduce unauthorized water withdrawals	<b>Core</b>
<b>P8.</b> Construct demonstration reclaimed water production facility	Non-Core
<b>P9.</b> Tightline stormwater above landslide hazards and steep slopes	Non-Core
<b>P10.</b> Education and incentive program for landowners along the Corridor	Non-Core

## **P1. Core Recommendation: Restore Riparian Areas Throughout The Entire Sammamish River Corridor.**

This is the most important alternative to address temperature problems and provide significant habitat improvements for salmon and wildlife. This alternative includes bank sloping to create shallow water habitat; removal of non-native invasive plant species; and riparian revegetation with native trees, shrubs and herbaceous species. This alternative will be primarily focused on areas that are currently publicly owned, which is approximately 70% of the length of the corridor on both banks, and an additional 20% on the right bank only.

The width of public ownership available for buffer restoration (above OHWM) varies from approximately 25 feet to over 100 feet (7.5 to 30 m). However, a minimum average width of 100 feet (30 m) is recommended for revegetation to provide a variety of buffer functions. Wherever wider buffers can be achieved, they should be in order to provide a more fully functional buffer. This large-scale project cannot be accomplished within a single year (or even two or three years) and will need to be phased over several years, perhaps over a ten-year schedule. It may be most feasible to implement riparian revegetation as trail modifications or maintenance occurs (particularly where it may be opportune to move the trail somewhat further from the river or as the equestrian trail is constructed on the west bank), or in conjunction with larger floodplain projects to minimize mobilization costs. High-priority locations to begin riparian restoration for each reach are identified in the site-specific recommendations section later in this chapter.

The Sammamish River Trail will continue to be located somewhere within the restored riparian buffer. Other activities such as the placement of stormwater detention or percolation ponds should generally not occur within the buffer because they would reduce shading and cause a "break" in the corridor (any large scale facility). However, in areas where streams or ditches enter the river via culverts and other structures, it would be beneficial to daylight the stream or create a wetland at the mouth of the ditch which will both improve fish passage and create wetland habitat.

These publicly owned lands provide a unique opportunity to create wildlife habitat features along with riparian restoration. Specific elements should include placement of aquatic and terrestrial LWD<sup>16</sup>, grading to create microtopographic features<sup>17</sup>, revegetation with native fruiting shrubs, and inclusion of snags for cavity nesting and foraging bird species.

The placement of LWD along the shoreline may not provide significant salmon habitat benefits, at least for chinook salmon, based on Jeanes and Hilgert (2001) work (refer to Figures 13 and 14). However, LWD should be used experimentally in this large-scale riparian restoration to determine what functions it may provide and whether LWD is more useful in some reaches than others. This experimental LWD study is described further in Chapter 5.

## **P2. Core Recommendation: Create and Enhance Pools in the River Channel.**

Adult salmon frequently migrate through the river during the warmest period of the year (i.e., late summer and early fall). In order to conserve energy, avoid predators (i.e., birds, mammals and humans), avoid warm water and hold until temperature conditions improve<sup>18</sup>, adult salmon typically use pools for refuge during their upstream migration to reach spawning areas. Currently, only two areas in the entire river actually meet

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<sup>16</sup> LWD in uplands or wetlands provides cover and wintering habitat for native amphibians and reptiles.

<sup>17</sup> Microtopographic relief provides wintering habitat for native amphibians and reptiles during high water periods.

<sup>18</sup> Water temperatures fluctuate daily, but depending on air temperatures may remain elevated for several days at a time.

TFW criteria for depth and cover to be classified as a pool. An additional 27 somewhat deeper than average channel depth areas were identified during field tracking of adult chinook in 1998 and 1999. This small number of pools, and the large distance between them, means that a limited number of salmon can use the pools at any particular time forcing some fish into warmer waters outside of the pools, and fish must sometimes migrate up to a mile between pools. Historically, prior to dredging, it appears that pools were located approximately every 100 to 200 feet (30 to 60 m) in the river (USACE 1962). Pools should be created within the channel profile, and when possible, should be located to take advantage of cool water from tributaries and groundwater inflows. Further, these pools should be designed either with engineered features (i.e. log jams) or placed in specific locations (outside of meander bends or adjacent to bridge piers) that will provide natural scour over time to prevent sediment deposition. Cool water sources include all of the major and most of the minor tributaries, plus groundwater sources.

Pool creation should also include cover features such as LWD or overhanging vegetation. Depth is another form of cover (obscures visual observation of fish). LWD may help sustain pools over time by creating scour. Overhanging vegetation can be provided by constructing pools in connection with riparian restoration efforts described above in recommendation P1 or as part of riparian restoration at specific sites chosen for pool creation. Pools are usually not naturally formed adjacent to shallow bank zones, so bank sloping may not be necessary at pool locations.

This large-scale project should be implemented over several years because, even with more detailed design work and monitoring, it cannot be assumed that all pools will persist and function over time. A few pools in several locations should be initially constructed, focused in the upper river where temperature refuge is most critically needed. These constructed pools should then be monitored for temperature stratification, sediment deposition or scour, and fish use over one to three years. Subsequently, adaptive management should be applied in the design of additional pools depending on the information gained from monitoring.

### **P3. Core Recommendation: Protect and Improve Buffers Along the River, Tributaries, and Wetlands.**

The cities and King County should use their sensitive area protection authority (under the Shoreline Management Act and Growth Management Act) to protect and improve the quality and size of buffers to the Sammamish River, its tributaries and their associated wetlands, consistent with the rights of private property owners. Where existing development or lot sizes has reduced the potential size of buffers, emphasis should be placed on improving the quality of degraded riparian areas through incentives, such as tax reduction programs and conservation easements, as well as conditions placed on future development. To the extent possible, improvements should promote the riparian restoration strategy described in Chapter 3. Literature reviews of riparian buffer functions (R2 Resource Consultants 2001; Wenger 1999) recommend minimum 100-foot buffers to provide multiple functions (e.g., sediment retention, pollutant retention, shading, wildlife habitat). Wider buffers are better, particularly on salmon bearing streams, or where adjoining land uses create a moderate to high risk of environmental risk (pollutant spills, etc.). In the Sammamish River Corridor, wider buffers should be sought for significant habitat nodes, such as tributary mouths, to promote shade and possible localized reductions in air temperatures that could help cool the river. All perennial streams should have 100-foot buffer recommendations and intermittent streams should have 50-foot buffers to prevent degradation from erosion or pollutants.

### **P4. Core Recommendation: Explore Engineered Solutions to Cool the River Upstream of Bear Creek (Reach 6).**

Reach 6 of the river has the most severe temperature problems because of the very warm surface water outflow from Lake Sammamish. Riparian revegetation will have minimal effect on temperature in this reach or in Reach 5. While there may be potential for increased groundwater recharge in Marymoor Park, it would not likely significantly influence the temperature of warm surface water outflow from the lake. We recommend that King County and the Corps immediately undertake a feasibility study of both hypolimnetic

withdrawal and cooling tower technology, and possibly construct a demonstration project. More detailed evaluation of these technologies will allow comparison of costs, potential environmental impacts, and potential benefits. Benefits should not only be quantified in terms of temperature, but also into predicted biological effects to better translate temperature reductions into benefits to fish. Other solutions may be developed during these studies that could prove more effective.

**P5. Core Recommendation: Increase Water Conservation in the Sammamish Watershed (particularly the Bear Creek Basin).**

Improved water conservation in the Sammamish Watershed could help increase and maintain summer base flow conditions and reduce summer water temperature in the Sammamish River. Reduction of either groundwater or surface water withdrawals (or both) could be effective. Conservation efforts that lead to reduced groundwater withdrawal in the Bear Creek basin are particularly important, since the Bear Creek confluence is in the vicinity of where the river experiences its warmest temperatures. The model results described in detail in Appendix B suggest that an increase of approximately 5 cfs in Bear Creek summer flow could significantly reduce thermal stress for salmon in the mainstem river—particularly in Reach 5 immediately downstream of Bear Creek's confluence with the river. The City of Redmond; the water districts of Olympic View, Northeast Sammamish and Union Hill; and the Sahalee and Bear Creek golf courses withdraw the largest volume of water from the Bear Creek basin. King County Parks withdraws water for Marymoor Park and other parks along the mainstem. Modern water supply systems have highly efficient transport of water, however, some water purveyors may find that reduction of leaks in their piping system conserves significant quantities of water. Implementation of a conservation-based rate structure could further increase conservation of water for some utilities. Some utilities already have implemented a conservation-based rate structure and have realized some significant reductions in water use. It is recommended that athletic fields be converted to an alternate type of turf (i.e. “sports turf”) that either does not require irrigation or significantly reduced irrigation. Little Bear, North and Swamp Creeks appear to contribute more flow to the river during low-flow periods than occurred historically (WRIA-8 Technical Subcommittee 2001) as a result of importation of water from outside the basin. However, it is still of critical importance to protect and maintain low flow conditions in these basins because runoff of irrigation water is not nearly as beneficial (and often at higher temperatures) as the natural inflow of groundwater and surface water. Groundwater withdrawals in the valley floor may reduce groundwater inflows or small tributary flows which may also be important for cool water refuges.

**P6. Core Recommendation: Acquisition of Existing High-Value Habitats or Areas with High Likelihood of Restoration Success.**

In many cases, riparian restoration and other habitat restoration projects in the Sammamish River Corridor will be limited to publicly owned lands because of other land use priorities for private landowners. In order to maximize restoration potential within the corridor, existing high quality habitats or other areas with a high potential for restoration success should be acquired by public entities to ensure they will be protected or restored. In many areas, publicly owned lands along the river are very narrow and this limits the area available for riparian restoration recommended in recommendation P1. Acquisition of a wider easement or fee title should be investigated in these areas (particularly in Reaches 4 and 5) to ensure a minimum 100-foot (30 m) buffer can be established along most of the river. A few vacant parcels exist along the river, such as the former meander across the river from Willows Run Golf Course, and currently face development pressure. These areas have good potential for restoration success and should be acquired to provide future wetland restoration or groundwater recharge sites. Another high quality area is the Cold Creek headwater area (tributary to Bear Creek) that provides a year-round source of cool water and helps maintain cool temperatures in Bear Creek. A large parcel along Bear Creek near the Evans Creek confluence is an ideal location for floodplain and riparian restoration that could also provide significant shading benefits. This parcel is being evaluated for its potential as a mitigation bank. However, whether restoration is

accomplished for mitigation purposes or as part of this plan, this should be a high priority for acquisition. It is very critical that these areas do not experience further habitat degradation while restoration projects are being implemented and maturing.

### **P7. Core Recommendation: Reduce Unauthorized Water Withdrawals.**

Based on field observations (by King County staff and other agencies), there appear to be a significant number of unauthorized water withdrawals that likely have an adverse effect on base flow and temperature in the Sammamish River and its tributaries. These include:

- Withdrawals covered by state water right permits, but which are currently un-metered and may exceed their authorized withdrawal volumes.
- Un-permitted withdrawals for which potentially invalid claims have been filed.
- Un-permitted withdrawals for which no claims have been filed.
- Wells that are exempt from requirements for water rights because they withdraw less than 5,000 gallons-per-day, but which may be in violation of other requirements listed below.

The most significant of these un-authorized withdrawals for the river's ecology are those in direct hydraulic continuity with either the river or Bear Creek (the latter for reasons discussed in Recommendation P5). Ecology is taking steps to ensure water right holders install flowmeters (particularly for the largest water withdrawals in the Greater Lake Washington watershed by the end of 2002). Ecology will require meter-monitoring reports to ensure users do not exceed authorized volumes. The sooner that these data are available, the sooner the efficacy and urgency of using reclaimed water to augment or replace existing water withdrawals can be evaluated. We encourage Ecology to prioritize the Sammamish Valley and Bear Creek for metering.

Because legal adjudication of water right claims could take many years, we do not recommend it as a priority at this time. Highest priority, however, should be placed on enforcement against illegal withdrawals. If base flow continues to be a significant problem after metering and enforcement have occurred, then adjudication of claims should be undertaken.

Unauthorized withdrawals identified (or suspected) by state or local field personnel should be reported to Ecology as quickly as possible. Exempt wells cannot be used for commercial nurseries or other non-domestic purposes, or to irrigate more than a total of 1/2-acre across the one or more homes they may serve. Current surface withdrawals should be reviewed both for water rights and for appropriate fish screens. Ecology has jurisdiction over water rights and we do not recommend that other local governments attempt to exert jurisdiction over water rights..

### **P8. Construct Demonstration Reclaimed Water Production Facility.**

By 2004, King County plans to construct a pilot reclaimed water production facility in the Sammamish Valley, which would treat wastewater to Class A standards for non-potable uses. It would serve as a demonstration project for potential expanded use of reclaimed water in the valley and elsewhere in the region. The highest initial priority for the facility would be to replace current surface and groundwater withdrawals from wells believed to be in hydraulic continuity with the river. In the future, reclaimed water could potentially be used to augment groundwater flow to the river if supported by studies discussed in Chapter 5. Based on the model results discussed in Appendix B, a combination of strategies using reclaimed water (including replacement of existing withdrawals and large-scale augmentation of groundwater flow) could potentially reduce thermal stress on salmon in the Sammamish River. King County's initial demonstration facility is expected to produce approximately 3 million gallons per day (about 4.5 cfs in river flow, assuming complete hydraulic continuity between the withdrawals it would replace and the river). It

should be designed for future expansion, since the potential uses and demand for reclaimed water in the Sammamish River Corridor are likely far greater than simply replacing existing withdrawals.

### **P9. Tightline Stormwater Above Landslide Hazards and Steep Slopes.**

Large new developments that drain to landslide hazard areas or steep slopes should be required to discharge stormwater into tightlines to provide conveyance beyond the hazard area and to minimize discharge of fine sediments into the Sammamish River and its tributaries. This requirement could be waived if stormwater is discharged to stable drainages, such as road ditches or constructed stormwater conveyance systems. It could also be waived for small residential developments that have less than 10,000 square feet of new impervious surface area and can effectively disperse flows.

### **P10. Education and Incentive Program for Property Owners Along the Sammamish River Corridor.**

Toxicity has been observed in water samples collected from the Sammamish River (King County unpublished data, 2000-2001). It is suspected that pesticides may be the cause of the observed toxicity; however, agricultural users are only one potential source of pesticides. There are a variety of other land uses in the basin that can result in pesticide runoff (i.e., residential use and golf courses). This recommendation would develop an education and, as feasible, an incentive program to reduce pesticide and herbicide use and associated runoff. Methods to reduce runoff include stream and wetland buffers, created wetlands for water quality enhancement, and improved irrigation practices (avoid flood irrigation and excessive sprinkler watering). Discharge of potential contaminants can also be decreased by reduced application of pesticides/herbicides and use of organic or biological (predator insects, etc.) alternatives. This program should be targeted at farmers and commercial, industrial, and residential landowners. The incentive approach could include reduced-cost organic/biological alternatives; reduced-cost native plants for buffer plantings; reduced-cost drip irrigation equipment or irrigation timers/meters, etc. A variety of Best Management Practices may also be suitable to reduce runoff and reduce pesticide/herbicide use (such as spot application of chemicals rather than large-scale application). Replacement of existing golf course or athletic fields with "sports turf" could also minimize pesticide and fertilizer use

The Core programmatic recommendations presented above **must** be implemented to achieve a functioning river corridor and implement the overall strategic approach. Non-core programmatic recommendations are of lower priority because implementation requires significantly more study or time for implementation, or they address less critical problems. However, this does not mean to suggest that non-core ecological integrity of the corridor will be missed and degradation will continue to occur. The next section describes more localized projects that can be implemented by single jurisdictions or otherwise relatively quickly.

## **SITE-SPECIFIC HABITAT RECOMMENDATIONS, BY REACH**

The following section provides a description of specific locations to implement the programmatic recommendations of riparian restoration and pool creation are described for each reach.. Additionally, numbered site-specific project recommendations are included, by reach.

### **Reach 1**

#### ***Riparian Restoration in Reach 1 as Part of P1***

Several opportunistic locations (either publicly owned or known landowner willingness) exist for riparian restoration in this reach, including Inglewood Golf Course, WDFW boat ramp at Juanita Bridge, Kenmore Park, and the lower half of Wayne Golf Course. However, none of these sites are designated as "high priority" because shading has a greater cumulative temperature benefits when implemented first in the upper

half of the river. Riparian restoration in this reach will however, significantly improve wildlife habitat, provide a shallow water migration corridor for juvenile salmon and contribute LWD over the long term. Riparian restoration in this reach should be considered medium priority and implemented as funds are available.

### ***Pool Locations in Reach 1 as Part of P2***

Currently, only two somewhat deeper areas exist in this reach. This reach is dominated by backwater from Lake Washington, so thermal refuge may not be as important for migrating salmon because the water column is stratified in this area (i.e., cooler water at the bottom). However, sufficient cover is important for migrating adult salmon. Additionally, the small tributaries that enter this reach may provide a source of cool water for pools if created. The mouths of these small tributaries are moderate priorities for pool creation (at approximately RMs 1.0 and 1.8). Additional lower priority pools could be constructed to provide more frequent holding areas for adult salmon, potentially on the outside of meander bends at approximately RMs 1.5, 1.9, and 2.0. Medium and low priority pools should only be constructed after those identified as high priority have been constructed and subsequently monitored for at least two years to determine if they persist (don't fill in with sediment), provide cooler water habitat, and are actually used by adult or juvenile salmon.

### ***Other Project Recommendations for Reach 1***

- 1-1. *Sammamish River Mouth Wetland Restoration.* Historically, this area was a vast wetland. Currently, only a minimal area of wetland remains and is highly disturbed. The mouth of the Sammamish River could serve as an important rearing and refuge habitat for juvenile salmon as they enter Lake Washington, particularly for sockeye fry, which have been observed using shallow water and wetland habitat adjacent to the Cedar River mouth. This project would include restoration on King County property, including the island at the mouth of the river. This area is primarily wetland, with a small riparian area. It will first be necessary to remove non-native species (i.e. Himalayan blackberries, purple loosestrife) and revegetate the riparian area up to a 100-foot width with native shrubs and trees, especially including willow, alder, cedar and spruce. Emergent and shrub wetland species that could be planted in the wetland area and toe of slope include species such as *Spirea douglasii*, *Scirpus acutus*, and *Carex aquatilis*. A mixed LWD and small woody debris jam should be placed on the upstream end of the island. This project should be monitored extensively for fish use, particularly for use of the woody debris jam to determine if it provides habitat for native or non-native fish.
- 1-2. *LakePointe Property Riparian and Aquatic Restoration.* The LakePointe project is a proposal for a mixed-use development to be built on approximately 45 acres (18 hectares) on Lake Washington at the Sammamish River mouth (right bank). The project contemplates including approximately 650,000 square feet of commercial space and 1,200 residential units. King County approved the Master Plan and Shoreline Permit for the project just prior to the City of Kenmore's incorporation. Upon incorporation, jurisdiction over the project transferred from King County to the City. In August 2001, a consent decree was signed with the State Ecology resolving site clean-up issues for the hydrocarbons and other pollutants present on the site. Preliminary plans were developed to restore and enhance habitat along the Sammamish River and Lake Washington shorelines as part of the Commercial Site Development and Shoreline Permits issued by King County. Detailed plans will be developed as part of the site's construction permit applications and reviewed by the City of Kenmore for consistency with the previously issued permits. While not required as part of the previously issued permits, it is desirable that this shoreline restoration be consistent with this report's recommendations for other riparian restoration projects. Some of the desired restoration elements are: decrease bank slope on the Sammamish River shoreline to 3:1 or less; revegetate a minimum 100 foot wide (30m) riparian area on the river bank with native trees and shrubs, especially including willow, alder, cedar and spruce; place gravel substrate at the toe of the slope on the Lake Washington shoreline to provide shallow water habitat; and provide a shallow-water, emergent wetland area along the toe of slope on the Sammamish River shoreline (emergent species to include *Scirpus acutus*, *Carex obnupta*, etc.)

- 1-3. *Swamp Creek Regional Park Wetland and Stream Restoration.* Currently, King County is developing plans for restoration of a portion of Swamp Creek and its floodplain downstream of 175<sup>th</sup> Street. Historically Swamp Creek had a large wetland area within its floodplain. Similar to the Sammamish River, it also likely contained a significant quantity of LWD that created pools, provided overhead cover for fish, and caused meandering of the creek channel. Currently, the creek is confined to a narrow, and relatively straight channel. Wetlands are present in the floodplain, but are not well connected to the creek and fill has been placed in many areas. Restoration element recommendations include: removal of fill material; removal of non-native vegetation (e.g., reed canary grass, Himalayan blackberries); re-meander Swamp Creek across its floodplain; excavate connections and create a diversity of wetland elevations in the floodplain; revegetate the entire site with native trees, shrubs and emergent species; place LWD in jams in the lower creek. Educational trails and signage would provide a good recreational element. It is further recommended that the adjacent parcel to the east that is also undeveloped be acquired and included in the overall plan.
- 1-4. *Wetland and Riparian Restoration at Wildcliff Shores Property Across River from Swamp Creek.* Directly across the river from the Swamp Creek confluence is a large, relatively undeveloped area, currently in private ownership. This area is also of flat topography and much of the site is wetland. It was formerly farmed, and is currently minimally vegetated with native trees and shrubs and appears to have been recently used for unofficial recreation (trails, biking, etc.). This project would include removal of non-native plant species; excavation to seasonally connect the wetlands to the Sammamish River; sloping of banks; revegetation of the parcel with native trees and shrubs; and placement of terrestrial LWD and snags for wildlife habitat.

## **Reach 2**

### ***Riparian Restoration in Reach 2 as Part of P1***

Several opportunistic locations (either publicly owned or known landowner willingness) exist for riparian restoration in this reach, including Blyth Park and King County trail land. Multipurpose projects at the side channel at 102<sup>nd</sup> Ave and at I-405 are discussed below. None of these locations are classified as "high priority" because shading has greater cumulative temperature benefits when implemented first in the upper half of the river, however, increased vegetation will provide other significant benefits to the corridor and should be considered medium priority. Riparian restoration at the mouth of North Creek should be considered a high priority to provide enhanced habitat at an important tributary junction and connect restored habitat upstream on North Creek to the Sammamish River.

### ***Pools in Reach 2 as Part of P2***

This reach has a greater frequency of deeper areas per mile than all other reaches. However, it still contains only six such areas. This reach receives significant groundwater flow from Norway Hill that could potentially be utilized to create cool water refuge pools. No specific locations are yet identified, but the groundwater seep area extends from approximately RM 3 to 4.5. Four small tributaries also enter this reach at approximately RMs 2.6 (Wayne Golf Course), 3.4, 4.2, and 4.3. These cool water pools should all be considered high priority, because of the known groundwater seeps and tributaries. As a pilot project, it would be beneficial to construct a couple of pools in this reach and then monitor temperature, sediment deposition and other factors before constructing additional pools throughout this reach.

### ***Other Project Recommendations for Reach 2***

- 2-1. *Improve Tributary 0068 Confluence and Upstream Reaches.* Tributary 0068 enters the river through the Wayne Golf Course. It is a fairly extensive system arising on Norway Hill, which includes tributaries 0067 and 0066, and likely has extensive groundwater inputs. This system should be both protected and enhanced by restoring a riparian area and allowing the channel to meander and a natural



delta to form at the mouth if enough coarse sediment is coming out of the system. It is unknown if there are any fish passage barriers, however, this should be investigated (see Chapter 5). Other restoration elements include removal of non-native vegetation and placement of LWD in the creek channel<sup>19</sup>. This tributary may provide a significant migration corridor for wildlife from the forested uplands down to the river.

- 2-2. *Wetland Restoration on Right Bank in Bothell*. Two undeveloped parcels located on the right bank downstream of the 102<sup>nd</sup> Avenue bridge were previously classified as wetland (NWI 1982). A portion of both properties could be restored to seasonally inundated wetlands with small channels connecting them to the river. Restoration elements could include removal of non-native vegetation; creation of wetlands and channels; riparian and wetland revegetation with native trees, shrubs and emergents; placement of LWD in wetlands, channels and river shoreline; and placement of snags and upland topographic features for enhancement of wildlife habitat.
- 2-3. *Side Channel Restoration Near 102<sup>nd</sup> Avenue*. This property is owned by King County and remnants of former wetlands and channel meanders exist both upstream and downstream of the 102<sup>nd</sup> Avenue bridge on the left bank. In conjunction with riparian restoration, a side channel could be restored in this area, along with seasonally inundated wetlands. Restoration elements could include removal of non-native vegetation; removal of fill material; excavation of connections to the side channel and wetlands; riparian and wetland revegetation with native trees, shrubs and emergents; and placement of LWD in side channel, wetlands, and river shoreline. Constraints on restoration will be the bridge abutments.
- 2-4. *Investigate Restoration Opportunities at Minor Tributaries (Tribes 0057A, 0069)*. The small tributaries entering this reach should be investigated for habitat preservation and enhancement opportunities. Some restoration has already been done at Horse Creek (0057), but additional measures may be warranted to create a cool-water refuge. There may also be fish passage barriers in these tributaries.

### Reach 3

#### *Riparian Restoration in Reach 3 as Part of P1*

Riparian restoration adjacent to and downstream of the Little Bear Creek confluence should be considered a very high priority. Little Bear Creek is a significant cool water source for the river, which should be maintained with shading along the Sammamish River downstream of the confluence. The right bank of the corridor in this reach is owned by King County, and should also be considered high priority because there is currently very little riparian vegetation in this reach.

#### *Pools in Reach 3 as Part of P2*

This reach has five deeper areas that are widely spaced apart (up to a mile between some areas). These areas are associated with bridge piers or the outside of meander bends. Several small tributaries enter this reach and would be prime locations for pools, including at approximately RMs 4.7, 4.9, 6.3, 6.9, 7.0, and 7.4. The Little Bear and Gold Creek confluences should be considered the highest priority for pool creation in this reach. A particularly long stretch without pools exists between RMs 6.1 and 7.1, and the Gold Creek confluence is within this area. There may also be opportunities in this reach to use existing groundwater wells that are no longer in use as a source of cool water that could be diverted into a created pool.

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<sup>19</sup> For this project and several other site-specific projects, we recommend the placement of LWD in the tributary streams where it should function to provide cover and form pools. This is in contrast to the recommendations for the mainstem Sammamish River, which propose to place LWD only experimentally because evidence suggests that it does not function the same way in the larger river as in the small tributaries.

### *Other Project Recommendations for Reach 3*

- 3-1. *Restore Wetlands and Riparian Area Adjacent to I-405/Highway 522 Interchange.* Land on the right bank owned by the Washington State Department of Transportation (WSDOT) adjacent to the I-405/Highway 522 interchange could be restored. The King County trail parallels this bank. Currently, the bank slope is steep and rarely overtops; the riparian area is limited. Restoration elements could include creation of wetlands and small channels to connect the wetlands to North Creek and the Sammamish River; removal of non-native vegetation; and revegetation of riparian and wetland areas with native trees, shrubs and emergent species. Revegetation will be constrained by the highway bridges that will shade the site, but shade-tolerant shrubs and herbs could be planted in these areas. Another constraint will be the need to prevent undermining of any bridge structures and requirements for highway maintenance access roads.
- 3-2. *Side Channel and Wetland Restoration on East Bank.* There are remnants of a former river meander and wetland area near Gold Creek that could be restored; and portions of the site could be used as a demonstration nursery for wetland plants in order to provide agricultural income for the property owner. If the property can be acquired for restoration, features could include removal of non-native vegetation; creation of a side channel and wetlands; revegetation of riparian and wetland areas with native trees, shrubs and emergent plants; and placement of terrestrial LWD and microtopographic variation for wildlife habitat. .
- 3-3. *Investigate Restoration Opportunities at Minor Tributaries (Gold, Woodin and Derby Creeks).* Three small tributaries, Gold, Woodin, and Derby Creeks, enter the River on the right bank, upstream of Little Bear Creek. The very lower reaches of both Gold and Woodin Creeks have been restored by King County (primarily for fish passage), but there may be additional opportunity for both habitat preservation and enhancement, particularly within Gold Creek Park. There may be additional fish passage barriers that need removal in these systems. All of these tributaries contribute cool water to the river during much of the year; this function should be maintained.

## **Reach 4**

### ***Riparian Restoration in Reach 4 as Part of P1***

This reach has virtually no existing native riparian vegetation, other than the few small areas that have recently been restored. However, both sides of the river are owned by King County. Of high priority in this reach would be riparian restoration in areas adjacent to existing or proposed creation of pools, such as upstream and downstream of 124<sup>th</sup> Street and along the stretch between Tributary 0101 and 0098 (RM 10 - 10.5). There are several wider areas (Sammamish River Regional Park) in this reach where riparian restoration could extend beyond 100 feet; these areas should be high priority for restoration. Additionally, this reach would be ideal to experiment with placement of LWD and small woody debris along the shallow banks and monitoring to determine if fish are using such habitat features in this reach.

### ***Pools in Reach 4 as Part of P2***

A two-mile long stretch with only two deeper areas exists between 145<sup>th</sup> and 116<sup>th</sup> Streets (deeper areas are only a foot or so deeper than the main channel). A limited number of small tributaries enter this reach; however two of them may provide a source of cool water at approximately RM 8 and 9. Additionally, pools should be created further upstream at the mouths of Tributaries 0101 and 0098. There may be a potential to utilize existing groundwater wells currently not in use as a source of cool water that could be diverted to created pools. Additionally, this reach would be ideal to experiment with using LWD to create and maintain scour pools.

#### *Other Project Recommendations for Reach 4*

- 4-1. *Restore Small Meanders in Reach 4.* Reach 4 is the most straightened reach of the river and as such does not naturally form pools and other habitat features. If it is feasible and compatible with the Farmland Preservation Program (FPP), restoration of small meanders should be considered in this reach (similar to the scale of the meanders within Redmond's RiverWalk). This project could be done in conjunction with recommendations P1 and P2, to restore riparian vegetation and pools to Reach 4 where they are critically needed. These small meanders will not significantly increase river length and may allow for natural maintenance of pools, and also create a diversity of velocities in the reach.
- 4-2. *Minor Tributary Restoration.* A habitat survey of the lower 1,650 feet (500 m) of Tributaries 0095 and 0101 was conducted in 1999 (Jeanes and Hilgert 1999). Tributary 0095 flows in an agricultural ditch and has a perched culvert during low to moderate flow conditions. Tributary 0101 has moderate canopy cover and some medium sized LWD. All of the small tributaries in Reach 4 could contribute cool water to the river, which is very important in this reach where significant heating occurs. Restoration of the riparian areas would help maintain cooler temperatures; placement of LWD would provide additional aquatic habitat diversity. On the tributaries with impassable culverts, the culverts should be replaced with a culvert at an appropriate elevation or an open channel. Mitigation is planned for the lower end of Tributary 0095 as part of a King County Roads project, however, additional restoration measures should also be investigated.
- 4-3. *Wetland and Side Channel Restoration on Right Bank Across from Willows Run Golf Course.* A large parcel(s) (about 80 acres) exists on the right bank across from Willows Run Golf Course. This parcel may be slated for development in the near future. It is the site of former channel meander and may still contain wetlands. It is recommended that a side channel and floodplain wetland habitat be restored to at least a portion of the site. Restoration elements could include removal of non-native vegetation, excavation of side channel and wetlands, revegetation of riparian and wetland areas with native trees, shrubs and emergent plants, and placement of LWD in restored or created side channel, wetlands and at river confluences. A significant constraint on this site is the location of the King County sewer line under the trail, which will make construction of an open channel for reconnection more difficult; a culvert connection may be the best option.
- 4-4. *Riparian and Wetland Restoration in Willows Run Golf Course.* This project was not included in recommendation P1 because it is unknown if the landowner is willing to provide restoration features; however, it is a significant opportunity for riparian restoration, with additional wetland opportunities. There is also the potential to connect some of the ponds/wetlands in the Golf Course to the river channel for groundwater recharge and potential juvenile salmon rearing, although water quality and pesticide/herbicide use by the golf course should be investigated first. These areas could provide fish habitat if they were emergent wetlands rather than ponds, which can experience high temperatures. Currently the golf course has minimal trees or shrubs, but more could be planted in several areas without decreasing playing surface.

## **Reach 5**

### ***Riparian Restoration in Reach 5 as Part of P1***

This reach, within the City of Redmond, has already had several riparian restoration projects constructed as part of RiverWalk. There may be opportunities to widen the riparian area in RiverWalk areas. The City of Redmond should continue to complete their RiverWalk plans as a high priority because riparian restoration in these upper reaches likely provides the most cumulative benefit to the river for shading. We also recommend reducing use of boulders and LWD in future sections as there is limited information on their benefit. In addition, this would provide an opportunity to compare sections with LWD and/or boulders to areas without. A particularly important section to restore is adjacent to and downstream of Bear Creek. This

should be implemented as a high priority regardless of whether the lower Bear Creek project is implemented in the near future (see below).

### ***Pools in Reach 5 as Part of P2***

There are several deeper areas within this reach; however, this is the second most critical reach to provide cool water refuges (after Reach 6). The existing deeper areas should be enhanced by further excavation and provision of cover (they are currently too shallow to be considered pools under the TFW criteria). Also, as the highest priority in this reach, a pool should be created or enhanced (there is an existing deeper area here) at the mouth of Bear Creek with an LWD jam or similar feature to reduce mixing of water and promote scour.

- 5-1 *Minor Tributaries Restoration.* Some restoration has already occurred on Peters Creek and Tributary 0102 to provide fish passage and increase riparian revegetation. Tributary 0104 would benefit from similar restoration, particularly fish passage improvements.
- 5-2 *Lower Bear Creek Floodplain and Channel Restoration.* The Corps of Engineers and the City of Redmond have developed final designs for remeandering lower Bear Creek with pools and riffles and other aquatic habitat features, floodplain wetlands and extensive riparian revegetation. This project is highly recommended and will provide improved habitat in lower Bear Creek, as well as provide groundwater recharge and help maintain or reduce temperature in Bear Creek. An additional feature that should be added (P2) is to place an LWD jam on the upstream side of the outlet to the river and create a large holding pool. LWD in this instance will be primarily used to reduce immediate mixing of the cooler Bear Creek water with river water and provide scour for a cold-water refuge pool for fish in the upper river. This project will also provide a wildlife corridor to the restored habitat upstream (WSDOT project).

## **Reach 6**

### ***Riparian Restoration in Reach 6 as Part of P1***

A number of riparian restoration projects have been implemented in this reach; however it should still be considered a very high priority to complete riparian restoration throughout this corridor between Lake Sammamish and Bear Creek, and because riparian restoration in the upper reaches likely provides the most cumulative benefit to the river. Riparian restoration adjacent to existing pools and areas proposed for pool creation would be the highest priority. The use of LWD may be the most beneficial in this reach because it has a higher gradient than the other reaches .

### ***Pools in Reach 6 as Part of P2***

There are only two deeper areas or pools in this reach, and they are critically important due to the elevated temperatures in this reach. This reach should be considered the highest priority for enhancement and pool creation, particularly at small tributary outlets, at the meander bend downstream of the transition zone, and just downstream of the weir. Additional pools should also be created downstream of the Marymoor Park entrance road on the outside of the large meander bend. There is no apparent benefit to providing pools upstream of the weir.

- 6-1. *Restore Transition Zone.* The transition zone downstream of the weir eliminated a left meander of the river, but remnants of the meander still remain on the left bank as wetlands. Restoration of the left meander as either the main channel or a seasonal channel with wetlands is recommended. Restoration elements could include excavation of new channel, pools, and wetlands; removal of non-native vegetation; placement of gravel substrate in the new channel; and revegetation of riparian and wetland areas with native trees, shrubs, and emergent plants.

## PRIORITIZATION OF RECOMMENDED ACTIONS

The programmatic alternatives described in the first part of this chapter are already ranked according to whether they are “core” or “non-core” recommendations. The “core” recommendations significantly contribute to achieving the goal of restoring the Sammamish River Corridor and addressing the critical elevated water temperature and migration problems for salmon and are numerically listed in order of priority. The “core” projects will immediately begin to address the elevated water temperature issue in the system by protecting existing cool water sources, and beginning to restore the riparian area and increasing shading. They will also provide specific aquatic habitat features of value to migrating juvenile and adult salmon and investigate potential solutions to the primary cause of elevated water temperature (i.e., outflow from Lake Sammamish). Recommendations P8 through P10 are considered “non-core” recommendations that will address more difficult and long-term issues associated with possible replacement of water withdrawals with reclaimed water, sediment inputs and education/incentives for landowners. However, they will not immediately provide benefits that address the critical problems.

The site-specific alternatives are further rated below in Table 7 by listing whether they address either the most critical problems and other factors of declined in the watershed such as fish passage, water quality problems (other than temperature), water quantity and base flow issues, habitat complexity, and wildlife habitat features. The rating is qualitative and is intended to only demonstrate a relative scale of benefit.

<b>Recommendation</b>	<b>Water Temperature</b>	<b>Fish Barriers</b>	<b>Water Quality (not temperature)</b>	<b>Water Quantity</b>	<b>Habitat Complexity</b>	<b>Wildlife Habitat</b>
<b>1-1.</b> Sammamish River Mouth Wetlands					X	X
<b>1-2.</b> LakePointe Property			X		X	
<b>1-3.</b> Swamp Creek Park	X		X	X	X	X
<b>1-4.</b> WildCliff Shores				X	X	X
<b>2-1.</b> Tributary 0068	X	X			X	
<b>2-2.</b> Right Bank in Bothell					X	X
<b>2-3.</b> Side Channel at 102nd Avenue					X	X
<b>3-1.</b> I-405/522 Wetlands				X	X	X
<b>3-2.</b> Side Channel/ Wetland Near Gold Creek				X	X	X
<b>3-3.</b> Minor Tribs, Reach 3	X	X			X	
<b>4-1.</b> Small Meanders in Reach 4					X	
<b>4-2.</b> Minor Tribs, Reach 4	X	X			X	
<b>4-3.</b> Wetlands Across from Willows Run				X	X	X
<b>4-4.</b> Willows Run	X				X	X
<b>5-1.</b> Minor Tribs, Reach 5	X	X			X	
<b>5-2.</b> Lower Bear Creek	X		X	X	X	X
<b>6-1.</b> Transition Zone	X				X	X

The site-specific projects are ranked below by three categories high, medium, and low priority, based on the number of factors they address (Table 7). A relative scale of cost is also provided for each recommendation, based on construction costs of similar types of projects in the basin (the cost estimate provided here does not include real estate or operation and maintenance [O&M] costs). The reader should not consider these estimates to be more accurate than a preliminary conceptual cost. Low cost is less than \$100,000; medium cost is \$100,000 to \$1 million; high cost is \$1 million to \$5 million; and very high cost is more than \$5 million.

### High Priority Site-Specific Recommendations

- |     |  |                  |
|-----|--|------------------|
| 1-3 | Swamp Creek Regional Park Wetland and Stream Restoration | <i>High Cost</i> |
| 5-2 | Lower Bear Creek Floodplain and Channel Restoration      | <i>High Cost</i> |

These two projects contribute significantly to implementation of key strategies in this plan and further address several other limiting factors in the corridor. These two projects will significantly enhance the lower end and confluence area of two major tributaries, providing cool water refuge, and significantly benefit fish and wildlife migration corridors.

### Medium Priority Site-Specific Recommendations

- |     |  |                    |
|-----|--|--------------------|
| 1-4 | Wildcliff Shores Wetland and Riparian Restoration          | <i>Medium Cost</i> |
| 2-1 | Tributary 0068 Confluence and Upstream Reaches             | <i>Medium Cost</i> |
| 3-1 | I-405/Hwy 522 Interchange Wetland and Riparian Restoration | <i>Medium Cost</i> |
| 3-2 | Side Channel/Wetland Restoration Near Gold Creek           | <i>Medium Cost</i> |
| 3-3 | Minor Tributaries, Reach 3                                 | <i>Medium Cost</i> |
| 4-2 | Minor Tributaries, Reach 4                                 | <i>Medium Cost</i> |
| 4-3 | Wetland Restoration Across from Willows Run                | <i>High Cost</i>   |
| 4-4 | Willows Run Riparian and Wetland Restoration               | <i>Low Cost</i>    |
| 5-1 | Minor Tributaries, Reach 5                                 | <i>Medium Cost</i> |
| 6-1 | Transition Zone Channel and Riparian Restoration           | <i>High Cost</i>   |

These projects primarily are floodplain wetland or minor tributary enhancements (which includes riparian restoration and removal of fish passage barriers). These projects should be considered important for creating the well-connected river corridor and providing key locations for wildlife habitat. They make minor contributions to the implementation of the key strategies in this plan and provide other important features.

### Low Priority Site-Specific Recommendations

- |     |  |                             |
|-----|--|-----------------------------|
| 1-1 | Sammamish River Mouth Wetlands                         | <i>Low Cost</i>             |
| 1-2 | LakePointe Property Riparian and Shoreline Restoration | <i>Low Cost (to public)</i> |
| 2-2 | Right Bank Wetland and Riparian Restoration in Bothell | <i>Medium Cost</i>          |
| 2-3 | Side Channel at 102 <sup>nd</sup> Avenue               | <i>Medium Cost</i>          |
| 4-1 | Small Meanders in Reach 4                              | <i>Medium Cost</i>          |

These projects provide minimal contributions to the key strategies in this plan and also only address one or two limiting factors. They do contribute to formation of a well-connected corridor. These projects may be

lower priorities for implementation under this Action Plan, but in the case of the LakePointe project, will be required for regulatory purposes. Further, the wetlands at the mouth of the river are important for wildlife habitat and may provide fish habitat. Restoration at this site can be achieved for very low cost and so should be opportunistically implemented if funds are available.

**PLAN IMPLEMENTATION**

Potential lead implementing agencies for each of the recommendations are identified in the following Tables 8 and 9. The relative scale of cost is reiterated here for future planning purposes. The “core” recommended actions are primarily large-scale, thus requiring significant funds and a long-term commitment to implementation.

<b>Table 8. Core and High-Priority Recommendations</b>		
<b>Core Recommendations</b>	<b>Potential Lead Implementing Agency</b>	<b>Relative Scale of Cost</b>
<b>P1.</b> Restore Riparian Areas Throughout The Entire River Corridor	King County/Corps/Cities	Very High (\$5-6 mil)
<b>P2.</b> Create and Enhance Pools in the River Channel	King County/Corps/Cities	Very High (\$5-6 mil)
<b>P3.</b> Protect and Improve Buffers Along the River, Tributaries and Wetlands	King County/Cities	Low (primarily regulatory)
<b>P4.</b> Explore Engineered Solutions to Cool the River Upstream of Bear Creek (Reach 6)	Corps/King County	High (\$1 mil for studies + demo project)
<b>P5.</b> Increased Water Conservation in the Sammamish Watershed	Ecology/Utilities/Water rights holders	Medium (\$500K- \$1 mil for incentives, etc.)
<b>P6.</b> Acquisition of Existing High-Value Habitats or Areas With High Likelihood of Restoration Success	King County/Cities	High (\$10 mil at least)
<b>P7.</b> Reduce Unauthorized Water Withdrawals	Ecology	Medium (primarily enforcement)
<b>High Priority Site-Specific Recommendations</b>		
<b>1-3.</b> Swamp Creek Regional Park Wetland and Stream Restoration	King County/Corps	High (\$5 mil)
<b>5-2.</b> Lower Bear Creek Floodplain and Channel Restoration	Corps/City of Redmond	High (\$4 mil)

Implementation of these core and high priority projects would cost an estimated \$33 million shared between federal, state and local governments over ten years of implementation (not including real estate costs or O&M).

<b>Table 9. Non-Core and Medium to Low Priority Recommendations</b>		
<b>Non-Core Recommendations</b>	<b>Potential Lead Implementing Agency</b>	<b>Relative Scale of Cost</b>
<b>P8.</b> Construct Demonstration Reclaimed Water Production Facility	King County	Very High (\$10 mil+ <i>already planning for other reasons</i> )
<b>P9.</b> Tightline Stormwater Above Landslide Hazards and Steep Slopes	King County/Cities	Low (regulatory)
<b>P10.</b> Education and Incentive Program for Property Owners Along the Sammamish River Corridor	King County/Cities	Medium (\$150K/yr)
<b>Medium Priority Site-Specific Recommendations</b>		
<b>1-4.</b> Wildcliff Shores Wetland and Riparian Restoration	City of Kenmore/private landowner(s)	Medium (\$200K public)
<b>2-1.</b> Tributary 0068 Confluence and Upstream Reaches	City of Bothell	Medium (\$300K)
<b>3-1.</b> 405/Hwy 522 Interchange Wetland and Riparian Restoration	WSDOT/City of Bothell	Medium (\$300-500K)
<b>3-2.</b> Side Channel/Wetland Restoration Near Gold Creek	King County	Medium (\$500K)
<b>3-3.</b> Minor Tributaries, Reach 3	City of Woodinville	Medium (\$500K)
<b>4-2.</b> Minor Tributaries, Reach 4	City of Redmond	Medium (\$500K)
<b>4-3.</b> Wetland Restoration Across from Willows Run	City of Redmond	High (\$1 mil)
<b>4-4.</b> Willows Run Riparian and Wetland Restoration	City of Redmond/Golf course	Low (\$100K public)
<b>5-1.</b> Minor Tributaries, Reach 5	City of Redmond	Medium (\$500K)
<b>6-1.</b> Transition Zone Channel and Riparian Restoration	King County/Corps	High (\$2 mil)
<b>Low Priority Site-Specific Recommendations</b>		
<b>1-1.</b> Sammamish River Mouth Wetlands	King County	Low (\$100K)
<b>1-2.</b> LakePointe Property Riparian and Shoreline Restoration	Private Developer	Low (<\$50K public)
<b>2-2.</b> Right Bank Wetland and Riparian Restoration in Bothell	City of Bothell	Medium (\$250K)
<b>2-3.</b> Side Channel at 102 <sup>nd</sup> Avenue	King County	Medium (\$300-500K)
<b>4-1.</b> Small Meanders in Reach 4	King County	High (\$1 mil+)



Implementation of the “non-core” and medium and low priority projects would cost approximately \$20 million. However, the most expensive project, the demonstration facility for reclaimed water (P8) is already being pursued by King County as part of their wastewater management planning. The other projects entail approximately \$10 million.

Implementation of *all* of the above recommendations and the research and monitoring recommendations described below in Chapter 5 would result in a dramatically changed Sammamish River Corridor. Of particular interest to the citizens of the greater Lake Washington watershed will be how this Action Plan will contribute to the recovery of salmon species. Implementation of the above recommendations will significantly contribute to reversing the trend that has caused the corridor to not function properly for salmonids. Water temperature would be reduced throughout the river, although temperatures could still occasionally exceed 64° F (17° C)<sup>20</sup> the stress on salmon species will be dramatically reduced. Runoff of fine sediment and other pollutants would likely be reduced as a result of riparian improvements and regulatory actions. Salmon would be able to freely migrate upstream and downstream to all available spawning and rearing areas as passage barriers are removed. The riparian corridor would provide shade, small and large woody debris to the river, overhanging cover, buffering of surface water runoff, and significantly enhanced wildlife habitat and migration corridors. Pools would be frequent and provide thermal refuge and cover for juvenile and adult salmon. There would be a diversity of aquatic habitat types including pools, riffles, glides, and shallow water bank habitat, with significant cover in the form of LWD, small woody debris, and overhanging vegetation. Remaining floodplain wetlands would seasonally flood and provide groundwater recharge and significant areas of wildlife habitat. The tributaries would be protected and provide high quality spawning and rearing habitats and migration corridors for wildlife. Recreational and educational opportunities would be significantly enhanced and more diverse. The corridor would provide significant ecological functioning and provide the surrounding communities with a healthy and beautiful recreational feature. (See Figures 15 to 21 for with-restoration view of the reaches.)

Implementation of the core and high priority actions is necessary to address the most severe problems in the corridor. Implementing only these actions will reduce water temperature throughout the river, and provide riparian and aquatic habitat benefits. The tributaries would be protected and some would be enhanced. However, a cohesive and well-connected corridor would be lacking, and opportunities would likely be missed to restore wetland habitat and remove fish passage barriers. The Corridor would provide a healthy migration corridor for salmon, and to a lesser extent wildlife, but its functioning would not have been maximized and continued degradation could occur. However, the corridor would be significantly improved.

Overall, it is expected that full implementation of the programmatic and site-specific actions will cost approximately \$53 million over the next 10 years (not including real estate costs or O&M).

## **IMPLEMENTATION AND PERMITTING ISSUES**

The recommendations identified in this Action Plan are conceptual in nature. Further design work will be necessary to implement any of these proposed actions. Additional information necessary for design work includes detailed topographic survey information, location of utilities and other constraints, acquisition of real estate interests, hydraulic modeling, floodplain and flood control effects, and permitting.

All restoration actions will require some measure of environmental documentation and permitting. All projects will need to comply with the State Environmental Policy Act (SEPA) and projects with a federal connection will need to comply with the National Environmental Policy Act (NEPA). Projects that occur

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<sup>20</sup> 64 F (17 C) was considered in the temperature model (Appendix B) to be the point at which salmon experience significant stress. and NMFS considers temperatures above this to be not properly functioning for salmon migration and rearing (NMFS, 1996).

below the ordinary high water mark (OHWM) will need to comply with Sections 404 and 401 of the Clean Water Act (CWA). Any construction activity over 5 acres in size will need to comply with stormwater regulations under the National Pollutant Discharge Elimination System (NPDES). Actions that modify a waterbody or its banks may need a Hydraulic Project Approval (HPA). All construction actions will need to comply with local (city and/or county) grading and erosion control rules. Expedited permits are available for both Section 404 and the HPA for some restoration activities. The expedited HPA process allows a waiver of local grading permits for qualifying projects. All projects with a federal connection will require consultation under ESA. All projects must also include an appropriate level of cultural resource investigation to ensure that historic or archaeological sites are not damaged or destroyed. There are several known archaeological sites within Marymoor Park and there are likely to be other sites in the corridor.

The Corps of Engineers may undertake a number of these projects with their Lake Washington Basin Ecosystem Restoration Study. Programmatic environmental documents will be prepared for those projects.

Table 10 identifies the permits and compliance requirements that may be applicable to the recommended projects.

<b>Table 10. Potential Permitting Requirements for Recommended Restoration Actions</b>	
NEPA	Prepare programmatic or individual EAs or EISs
National Historic Preservation Act	Investigate site for potential historic or cultural features and coordinate with State Historic Preservation Officer and tribes
Clean Water Act	Section 404 permit, Section 401 Water Quality Certification, NPDES construction stormwater, NPDES if point source discharge
Endangered Species Act	Consult as required for federal nexus, ensure no “take” for non-federal projects
Coastal Zone Management Act	Ensure consistency
Executive Orders 11988 (Floodplain Mgmt) and 11990 (Protection of Wetlands)	Ensure consistency with Executive Orders for federal projects
Fish and Wildlife Coordination Act	For Corps projects, must consult with the US Fish & Wildlife Service
State Environmental Policy Act	Prepare appropriate programmatic or individual documents (EIS, EA, or checklist)
Washington Hydraulic Code	HPA
City or County Development and Land Use Regulations and Sensitive Area Ordinances	Grading Permits, Substantial Development Permits, Erosion Control Plans