# Appendix C

# WRIA 27 Restoration Opportunities

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## Table C-1. Key to Programmatic Restoration Measures

| Measure ID | Description |
|---|---|
| **Water Quality** | |
| WQ-1 | Protect water quality. |
| WQ-2 | Implement best management practices for use of pesticides and fertilizers. |
| WQ-3 | Use construction best management practices to minimize runoff. |
| WQ-4 | Restrict livestock access to streams. |
| WQ-5 | Remove and/or replace failing septic systems. |
| WQ-6 | Identify and reduce sources of contaminants in soils and water. |
| WQ-7 | Maintain adequate summer flows to control high temperature. |
| WQ-8 | Reduce excessive fine sediments. |
| WQ-9 | Improve water quality (dissolved oxygen, bacteria, temperature). |
| WQ-10 | Decommission or repair logging roads to prevent erosion. |
| WQ-11 | Use timber harvest best management practices to reduce erosion. |
| WQ-12 | Control agricultural runoff. |
| WQ-13 | Educate shoreline property owners on best management practices to minimize impacts to water quality. |
| **Fish Habitat** | |
| F-1 | Protect remaining off-channel habitat. |
| F-2 | Create additional side channel habitat. |
| F-3 | Restore off-channel rearing habitat. |
| F-4 | Remove barriers to fish passage. |
| F-5 | Remove or repair failing culverts. |
| F-6 | Supplement large woody debris. |
| F-7 | Enhance spawning gravel. |
| F-8 | Recreate stream meanders. |
| F-9 | Improve stream channel shading. |
| **Hydrology** | |
| H-1 | Restore stream connectivity to off-channel and floodplain habitats. |
| H-2 | Remove, lower, or set back dikes and levees. |
| H-3 | Provide for adequate in-stream flows through management of water withdrawals. |
| H-4 | Address water withdrawal polices for lakes. |
| H-5 | Acquire diked properties. |
| H-6 | Protect remaining floodplains. |
| H-7 | Restore natural hydrology and movement of sediment. |
| **Riparian** | |
| R-1 | Protect intact riparian areas. |
| R-2 | Acquire riparian properties. |
| R-3 | Enhance riparian vegetation. |
| R-4 | Restore riparian forest. |
| R-5 | Increase native conifer component of riparian vegetation. |
| R-6 | Fence livestock away from riparian areas. |
| R-7 | Restore riparian buffers impacted by agricultural practices. |
| R-8 | Restore topsoil in riparian buffers impacted by fill, compaction, agricultural practices, or other uses. |
| R-9 | Educate and provide incentives to landowners to restore riparian conditions. |

| Measure ID | Description |
|---|---|
| **Stormwater** | |
| SW-1 | Retrofit stormwater facilities to meet performance standards. |
| SW-2 | Implement stormwater best management practices. |
| SW-3 | Improve urban stormwater infrastructure to provide flow treatment. |
| SW-4 | Use groundwater recharge and infiltration techniques as part of stormwater management strategy. |
| **Non-native Species** | |
| NN-1 | Take aggressive measures to prevent the introduction of non-native invasive plant and animal species. |
| NN-2 | Control invasive riparian vegetation. |
| NN-3 | Use weed management and education to control invasive plant species. |
| **Wetlands** | |
| W-1 | Protect wetland habitat. |
| W-2 | Enhance and restore degraded wetland habitats. |

### Timeline Definitions:

**Short-term** (approximately 1-5 years) restoration projects include those that could be implemented by local landowners and volunteers and that would benefit the areas that are most in need. Short-term restoration efforts include habitat restoration and enhancement efforts in publicly owned areas. These projects could be implemented in the near term, depending on grant cycles and coordination with volunteer and community organizations.

**Long-term** (more than 5 years) restoration projects could be those that require coordination with other jurisdictions or that cover larger land areas. These projects may be more difficult to implement and would likely require additional planning and permitting.

| LOWER COLUMBIA RIVER | WRIA 27 | Lower Columbia River Floodplain |
|---|---|---|

**Impairments:**

- Installation of levees that reduced floodplain width, channel migration and disconnected associated wetlands.
- Removal of sediment to maintain deep channels.
- Reduced variability of flow and delivery of sediments due to hydropower dams.
- Channelization, dredging, jetties, removal of wetlands, and isolation of wetlands from the former floodplain.
- Non-native and invasive species.
- Listed industrial facilities and contaminated sites.
- Degraded water quality.

**Programmatic Restoration Opportunities:**

- F-2, WQ-6, WQ-7, W-2, H-2, H-5, R-3 (see Table C~~5~~-1)
- Restore floodplain connectivity and connections between channels, sloughs, lakes, and mainstem.
- Protect rearing and spawning habitat.

**Information Sources and Organizations:**

- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm
- Lower Columbia River Estuary Partnership web site: http://www.lcrep.org/restoration-projects-0
- Columbia River Estuary Study Task Force (CREST), web site: http://www.columbiaestuary.org/projects.html

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed |
|---|---|---|---|
| | See other Lower Columbia River Restoration table, WRIA 28 (Appendix D) | | |

| MUD LAKE | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Conversion of forests to residential uses.
- Increased magnitude, duration and frequency of peak flows and reduced summer base flows caused by increases in impervious surfaces.
- Discharge of turbid waters (e.g., gravel mining operations) affecting water quality.
- Invasive aquatic species.

**Programmatic Restoration Opportunities:**

- NN-3, W-1 (see Table C-1)
- Acquire properties to improve vegetative buffer and increase habitat diversity.
- Protect wetland habitat to minimize sedimentation and improve water quality.
- Preserve habitat for waterfowl and wildlife.

**Information Sources and Organizations:**

- Washington Wildlife and Recreation Commission, web site: http://wildliferecreation.org/
- Clark County Legacy Lands at: http://www.clark.wa.gov/legacylands/index.html

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All | County is acquiring 340 acres of property on Mud Lake using WWRP grant and Conservation Futures funding. | High | Habitat connectivity | Short term |

| LANCASTER LAKE | WRIA 27 | Lower Columbia River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Altered connections to the Lower Columbia River, therefore reduction in periodic flooding of floodplain.
- Invasive plants and invasive non-native fish (i.e., carp).
- Loss of riparian forest and native plant diversity through agricultural use.

**Programmatic Restoration Opportunities:**

- NN-3, W-1 (see Table C-1)
- A 500-acre wetland mitigation bank is proposed north of and partially including Lancaster Lake, extending from the east bank of the North Fork Lewis River to the BNSF railroad tracks.
- Protect wetland habitat to minimize sedimentation and improve water quality.

**Information Sources and Organizations:**

- Joint Public Notice, Proposal for a Wetland Mitigation Bank, Clark County Mitigation Partners LLC, March 23, 2007.
- Friends of the Ridgefield National Wildlife Refuge, source of volunteers, web site: http://www.ridgefieldfriends.org/index.php
- National Wildlife Refuges, web site: http://www.fws.gov/ridgefieldrefuges/complex/
- Ridgefield National Wildlife Final Comprehensive Conservation Plan (USFWS, Sept. 2010): http://www.fws.gov/ridgefieldrefuges/ridgefield/

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All | Lake currently in good stewardship under private ownership. However, long-term preservation of lake shoreline habitat through easement or purchase by USFWS Ridgefield NWR would be consistent with goals of the Conservation Plan | Medium | Habitat | Long term |

| HATHAWAY LAKE (or Fowler Lake) | WRIA 27 | Lower Columbia River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Altered connections to the Lower Columbia River, therefore reduction in periodic flooding of floodplain.
- Invasive plants and invasive non-native fish (i.e, carp).
- Conversion of forest to railroad tracks and roads.
- Loss of riparian forest and native plant diversity

**Programmatic Restoration Opportunities:**

- NN-3, W-1 (see Table C-1)
- Protect wetland habitat to minimize sedimentation and improve water quality.
- Acquire properties adjacent to Hathaway Lake to protect waterfowl habitat and increase habitat diversity.

**Information Sources and Organizations:**

- Friends of the Ridgefield National Wildlife Refuge, source of volunteers, web site: http://www.ridgefieldfriends.org/index.php
- National Wildlife Refuges, web site: http://www.fws.gov/ridgefieldrefuges/complex/
- Ridgefield National Wildlife Final Comprehensive Conservation Plan and EA (USFWS, Sept. 2010): http://www.fws.gov/ridgefieldrefuges/ridgefield/

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All | Restore riparian floodplain forests to increase habitat complexity | High | Habitat | Short term |
| All | Remove tour roads on south side of lake to enhance and improve habitat for dusky Canada geese. | High | Habitat | Long term |

| GEE CREEK | WRIA 27 | Lower Columbia River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Floodplains and channel migration zones confined by development.
- Channel alterations, bridge stream crossings, culverts and fish passage barriers.
- Bank erosion caused by livestock access and grazing.
- Lack of large woody debris.
- Degraded riparian habitat conditions due to invasive vegetation.
- Private dams and associated ponds along the mainstem and tributary reaches.
- Increased magnitude, duration and frequency of peak flows and reduced summer base flows caused by increases in impervious surfaces.
- Drainage ditches in fields and along roadways
- Contaminants from agriculture, livestock, stormwater runoff impair water quality.

**Programmatic Restoration Opportunities:**

- R-3, R-4, R-6, R-8, NN-2, WQ-4, WQ-13, F-4 F-6, W-1, SW-4 (see Table C1)
- Prevent riparian degradation through education and acquisition.
- Remove or stabilize small dams.

**Information Sources and Organizations:**

- Clark County Monitoring Documents web page: http://www.clark.wa.gov/water-resources/documents-monitoring.html#volmon.
- Clark County Public Works Clean Water Program. 2007 Stormwater Needs Assessment Program Upper Gee Creek / Lower Gee Creek / Cathlapotle Subwatershed Needs Assessment Report. http://www.clark.wa.gov/water-resources/documents/SNAP/GeeCreekSNAPfinal.pdf.
- Gee Creek Watershed Restoration Project web page: http://clark.wsu.edu/natural/geeCreek.html
- Gee Creek Watershed Restoration Background Report (Cornelius 2006).

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| Lower watershed | • Acquire wetlands west of NW 51st Avenue and north of NW 289th Street. | High | Protect stream flow and hydrology | Long term |
| Upper watershed | • Reforest the floodplain and riparian corridor upstream of I-5. | Medium | LWD, habitat, instream fish habitat | Short term |
| Lower watershed | • Preserve intact forest areas between Royle Road and I-5. | High | Protect stream flow and hydrology | Long term |
| Various | • Upgrade stormwater facilities and outfalls at numerous locations noted in 2007 Stormwater Needs Assessment Program report. | High | Hydrology | Long term |
| Various | • Control invasive vegetation at numerous locations noted in 2007 Stormwater Needs Assessment Program report. | High | Habitat | Short term |
| | • Conduct further analysis of fish passage barriers and replace culverts as needed at numerous locations noted in 2007 Stormwater Needs Assessment Program report. | Medium | Habitat for salmonids | Long term |
| | • Assess and replace fish passage barriers at Union Pacific railroad crossing near mouth of Gee Creek. | High | Habitat for salmonids | Long term |
| | • Assess and replace fish passage barriers between Main Street and Royle Road. | High | Habitat for salmonids | Long term |

| NORTH FORK LEWIS RIVER | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Hydropower system impacts on channels, floodplains, flow, sediment transport, and LWD transport.
- Lower seven miles of river is diked primarily to protect agricultural uses.
- Lower seven to 15 miles of river are armored to protect residential, agricultural and transportation uses.
- Diking and channelization have reduced connection to floodplains and off channel habitat.
- Increase in impervious area.
- Bank armoring, levees, dredging, and gravel extraction.
- Cleared riparian areas.
- Limited availability of large woody debris.
- Leaking underground storage tanks.
- Impaired water quality.

**Programmatic Restoration Opportunities:**

- H-1 (lower river), H-3, H-6, H-7, R-5, R-8, F-1, F-2, F-3, F-6, WQ-10, NN-2 (see Table C-1)
- Continue to support LCFRB and LCREP in ongoing restoration activities
- Address agricultural and rural/suburban development impacts to floodplains and riparian areas for the middle reaches.
- Use land use controls to protect habitat and watershed processes for the middle reaches.

**Information Sources and Organizations:**

- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.
- Lower Columbia River Estuary Partnership site: http://maps.lcrep.org/program/habitat_restoration
- R2 Resource Consultants. 2004. Kalama, Washougal and Lewis River Habitat Assessments - Chapter 3: The North Fork Lewis River Basin.
- Inter-fluve, Inc. et al. 2009. Lewis River – Eagle Island Project Identification and Design.
- Inter-fluve Inc. et al. 2008. Lewis River Large Woody Debris Assessment.
- Clark County 2010 Stream Health Report web page: http://www.clark.wa.gov/water-resources/stream.html.
- G. Wade. 2000. Salmon and Steelhead Habitat Limiting Factors - WRIA 27. http://www.scc.wa.gov/index.php/291-WRIA-27-Lewis-Watershed/View-category.html
- PacifiCorp. 2008. Lewis River Wildlife Habitat Management Plan.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| LEW_RV_01 | • A 500-acre wetland mitigation bank is proposed along the North Fork Lewis River, north of the confluence with Gee Creek, which provides an opportunity to restore degraded pasture to floodplain wetlands, and restore habitat connectivity between the wildlife refuge, the rivers, and surrounding agricultural fields. | High | Habitat, LWD | Long term |
| LEW_RV_01 | • Restore tidal slough and floodplain forest habitats at the confluence of the Lewis and Columbia Rivers. | High | Habitat, Hydrology | Long term |
| LEWI_RV_02, LEWI_RV_03 | • Preserve and restore floodplain habitats at RM 2 to 3 and RM 13 to 15. | High | Habitat, Hydrology | Long term |
| Reach 1 | • Complete high priority projects identified in the Lewis River – Eagle Island Project Identification and Design Report including enhancement of: existing side channel habitat, channel dynamics, LWD, riparian habitat, and existing backwater habitat. | High | Habitat, Hydrology | Short term |
| All Reaches | • Add LWD in the lower main channel and side channels; several locations for LWD placement are identified up to RM 18.6. | High | LWD | Long term |
| All Reaches | • Add large wood to existing armored banks during future maintenance or repair activities from mouth to RM 15. | Medium | LWD | Long term |
| LEWI_RV_02 | • Limit intensive recreational use of stream channel during adult salmonid holding and spawning periods, between Woodland and Merwin Dam. | Medium/High | | Long term |

| LAKE MERWIN | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Impoundment of the Lewis River upstream of Merwin Dam.
- Hydroelectric dam and facilities.
- Fish passage barriers.
- Impaired water quality.

**Programmatic Restoration Opportunities:**

- Encourage PacifiCorp Energy with implementation of the Lewis River Wildlife Habitat Management Plan.
- Coordinate with PacifiCorp as they reintroduce anadromous fish upstream of the dams.
- Work with PacifiCorp as they administer their Lewis River Aquatics Fund, to support projects to enhance and improve wetlands, riparian, and riverine habitats in support of salmonid recovery.

**Information Sources and Organizations:**

- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.
- PacifiCorp: http://www.pacificorp.com/index.html

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| MERW_LK_01 and 02 | Protect existing riparian forest | High | LWD, Habitat | Long term |

| YALE RESERVOIR | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Impoundment of the North Fork Lewis River behind Yale Dam.
- Hydroelectric dam and facilities.
- Blocks natural fish passage.
- Water quality affected by impoundment.

**Programmatic Restoration Opportunities:**

- NN-2, R-3 (see Table C-1)
- Encourage PacifiCorp Energy with implementation of the Lewis River Wildlife Habitat Management Plan.
- Coordinate with PacifiCorp as they reintroduce anadromous fish upstream of the dams.
- Work with PacifiCorp as they administer their Lewis River Aquatics Fund, to support projects to enhance and improve wetlands, riparian, and riverine habitats in support of salmonid recovery.
- Recent preservation of forested shoreline for elk habitat (http://lewisriver.com/valley/01-11-elk.pdf).

**Information Sources and Organizations:**

- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.
- PacifiCorp: http://www.pacificorp.com/index.html
- Lewis River Valley Information web page: http://lewisriver.com/valley/

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| YALE_LK_01 | • Work with PacifiCorp to reduce total dissolved gas at outlet. | High | Water quality | Short term |

| HORSESHOE LAKE | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- High nutrient levels causing excessive algal growth.
- Invasive aquatic plants including Eurasian milfoil.
- Poor water quality due to lack of water flow and urban runoff.
- Interstate 5 disconnects Horseshoe Lake from the Lewis River floodplain.
- Excess sedimentation in the lake from residential development.
- Shoreline erosion from boat wakes and/or development.

**Programmatic Restoration Opportunities:**

- WQ-13, R-3, R-8, NN-2, W-1 (see Table C-1)
- Educate landowners on lawn maintenance practices to reduce nutrient input.

**Information Sources and Organizations:**

- Lewis River valley web site: http://lewisriver.com/horseshoe.html
- City of Woodland Parks, web site: http://www.ci.woodland.wa.us/Dept/ParksRec/citypar ks.htm
- Ecology Water Quality Assessment and Lake Restoration program, web site: http://www.ecy.wa.gov/programs/eap/lakes/wq/lk_ma n.html

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All | City of Woodland planted trees in March 2010. Coordinate with Woodland to continue planting native trees in the riparian zone. | High | LWD, Shade and Habitat | Short term |

| UNNAMED LAKE 1 | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Increased runoff caused by increases in impervious surfaces.
- Runoff from adjacent highways, I-5 and NW Pacific Highway.
- Lack of riparian forest vegetation.

**Programmatic Restoration Opportunities:**

- NN-2, R-3, SW-1, SW-2, SW-3, SW-4 (see Table C-1)
- Work with private property owner to restore riparian areas.

**Information Sources and Organizations:**

- None available.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All | Restore riparian areas with planting of native trees | Medium | Habitat, LWD, Water Quality | Short term |
| All | Use best management practices in agriculture. | Medium | Water Quality | Long term |

| CEDAR CREEK | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Deforestation has resulted in erosion.
- Lack of large woody debris.
- Poor substrate conditions between headwaters and Pup Creek.
- Rural residential and agricultural uses have impacted riparian areas and floodplains.
- Confined floodplains.
- Streambank instability and degraded riparian buffers, especially between Pup Creek and Chelatchie Creek (RM 11.2) due to logging, grazing, residential development.

**Programmatic Restoration Opportunities:**

- H-3, R-3, R-5, R-8, W-2, F-2, F-3, F-5, F-6, WQ-4, WQ-5, WQ-10, SW-1, SW-2, SW-3, SW-4, NN-2 (see Table C-1)
- Preserve and enhance Cedar Creek spawning habitats.

**Information Sources and Organizations:**

- R2 Resource Consultants, Inc. 2004. Kalama, Washougal and Lewis River Habitat Assessments - Chapter 3: The North Fork Lewis River Basin.
- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.
- Friends of the East Fork Lewis River web page: http://www.eastforklewisriver.org/river-restoration.html.
- Fish First web page: http://www.fishfirst.org.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| CEDA_CR_01 | • Restore riparian habitats | High | Habitat | Long term |
| CEDA_CR_02 | • Survey for and control invasive weeds and maintain riparian plantings (i.e., Cedar Creek Wildlife Area). | High | Habitat | Short term |

| PUP CREEK | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Conversion of forests to agriculture, residential development and roads.
- Degraded in-stream habitats and processes due to residential development and forestry activities.

**Programmatic Restoration Opportunities:**

- Educate and provide incentives to landowners to restore riparian conditions.
- Use of agricultural BMP's to protect water quality.

**Information Sources and Organizations:**

- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All | Work with landowners to restore riparian vegetation | Medium | LWD, shade, habitat | Long term |

| CHELATCHIE CREEK | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Oversupply of fine sediments.
- Disruption of sediment supply to the stream by roads and riparian degradation.
- Lack of large woody debris.
- Streambank erosion and degradation due to livestock access.

**Programmatic Restoration Opportunities:**

- H-3, WQ-8, R-3, R-5, R-6, SW-1, SW-2, SW-3, SW-4, NN-2, F-6, W-1, W-2 (see Table C-1)

**Information Sources and Organizations:**

- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.
- R2 Resource Consultants, Inc. 2004. Kalama, Washougal and Lewis River Habitat Assessments - Chapter 3: The North Fork Lewis River Basin.
- The Conservation Registry, web: http://www.conservationregistry.org/projects/3200
- Fish First: http://www.fishfirst.org/projects.htm

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| Lower watershed | • Protect and enhance wetland complexes in the lower two miles to provide overwintering and rearing habitat for coho salmon. | High | Hydrology, Habitat | Long term |
| All | • Restoration of riparian areas and fencing to limit livestock access along 2,400 feet of Chelatchie Creek. A joint project by NRCS, Clark Conservation District, Fish First and a private landowner. http://www.conservationregistry.org/projects/3200 | High | Habitat, LWD | Short term |

| UNNAMED TRIBUTARY TO CHELATCHIE CREEK | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Disruption of sediment supply to the stream by roads and riparian degradation.
- Lack of large woody debris.
- Streambank erosion and degradation due to livestock access.

**Programmatic Restoration Opportunities:**

- R-3, R-5, R-6, NN-2, F-6, SW-4, H-3 (see Table C-1)

**Information Sources and Organizations:**

- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.
- R2 Resource Consultants, Inc. 2004. Kalama, Washougal and Lewis River Habitat Assessments - Chapter 3: The North Fork Lewis River Basin.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| UCHE_CK_01 | Protection of associated wetlands in the upper watershed | High | Habitat, Hydrology, Protection of stream baseflow | Long term |

| CANYON CREEK | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Removal of timber in the upper watershed affecting runoff and water quality downstream.
- Lack of riparian vegetation.
- Elevated stream temperatures
- Landslides and bank instability due to increased surface water flows

**Programmatic Restoration Opportunities:**

- R-1, R-4, F-9, NN-2 (see Table C-1)
- Protect potential bull trout spawning areas by restoring riparian areas and controlling erosion/sedimentation.

**Information Sources and Organizations:**

- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.
- Clark County 2010 Stream Health Report web page: http://www.clark.wa.gov/water-resources/stream.html.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All reaches | Protect riparian areas and restore riparian forests | High | LWD, water quality improvement | Long term |
| CANY_CR_02 | Restore riparian forest and trees in upper watershed | Medium | LWD, water quality improvement | Long term |

| FLY CREEK | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Removal of trees in the upper watershed.
- Lack of riparian vegetation.
- Elevated stream temperatures

**Programmatic Restoration Opportunities:**

- WQ-10, R-4, F-5, NN-2 (see Table C-1).

**Information Sources and Organizations:**

- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.
- Clark County Stream Health Report 2010

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| FLY_CR_01 | Restore riparian forest by tree planting within 200 feet of OHWM | Medium | LWD, water quality and temperature improvement | Long term |

| SIOUXON CREEK | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Removal of forest in the upper watershed.
- Inundation due to dam creating Yale Reservoir
- Dams are barrier to natural fish passage.

**Programmatic Restoration Opportunities:**

- WQ-10, R-4, F-5, NN-2 (see Table C-1)

**Information Sources and Organizations:**

- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.
- Clark County 2010 Stream Health Report web page: http://www.clark.wa.gov/water-resources/stream.html.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| SIOU_CR_01 | Protect forested riparian zones | High | LWD, Habitat | Long term |

| NORTH SIOUXON CREEK | WRIA 27 | North Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Removal of forest in the upper watershed.
- Inundation due to dam creating Yale Reservoir
- Dam is fish passage barrier

**Programmatic Restoration Opportunities:**

- WQ-10, R-4, F-5, NN-2 (see Table C-1)

**Information Sources and Organizations:**

- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.
- Clark County Stream Health Report 2010

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All | Work with landowners to revegetate riparian areas | Medium | LWD, shade, habitat | Long term |

| EAST FORK LEWIS RIVER | WRIA 27 | East Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Deforestation has reduced quality of riparian habitat.
- Wildfires have removed forested cover and increased sediment loading.
- Decline in LWD inputs to stream channel and floodplain.
- Agricultural ditching and runoff.
- Livestock access to stream causing streambank erosion.
- Bank armoring, levees, bridges, floodplain fill resulting in channel confinement and loss of processes that allow meanders to form.
- Predation on native salmonids by non-native warm water fish species in lower sections of river.
- Invasive vegetation in aquatic and riparian areas.
- Gravel mining has contributed to loss of floodplain function and channel instability.
- Failing culverts in tributaries to the river.
- Degraded water quality – TMDL under development for fecal coliform and temperature.

**Programmatic Restoration Opportunities:**

- H-1, H-2, H-3, H-7, WQ-1, WQ-4, WQ-5, WQ-9, WQ-10, WQ-12, R-4, R-6, NN-2, F-3, F-5, F-6, SW-1, SW-2, SW-3, SW-4, W-2 (see Table C-1)
- Protect intact middle and upper stream reaches.
- Monitor water temperatures and groundwater connectivity to support off-channel enhancement projects.

**Information Sources and Organizations:**

- East Fork Lewis Working Group. 2009. Lower East Fork Lewis River Habitat Restoration Plan.
- Friends of the East Fork Lewis River web page: http://www.eastforklewisriver.org/
- Clark County 2010 Stream Health Report web page: http://www.clark.wa.gov/water-resources/stream.html.
- Clark County Stormwater Needs Assessment Program (SNAP) reports: http://www.co.clark.wa.us/water-resources/documents.
- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.
- G. Wade. 2000. Salmon and Steelhead Habitat Limiting Factors - WRIA 27. http://www.scc.wa.gov/index.php/291-WRIA-27-Lewis-Watershed/View-category.html
- Ecology. 2010. Water Quality Improvement Projects (TMDLs) – Clark County projects. Available: http://www.ecy.wa.gov/programs/wq/tmdl/overview.html . Accessed February 2010.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| EFLE_RV_03 | • Numerous restoration opportunities are identified on County and private properties near Lewisville Regional Park and Lewis River Ranch, including off-channel and side channel enhancement, streambank and in-channel enhancement, streambank stabilization, and riparian restoration. | High | Hydrology, in-stream habitat, LWD | Short term (public properties)<br><br>Long term (private properties) |
| EFLE_RV_03 | • Side channel enhancement, levee removal, off-channel restoration, in-channel and streambank enhancement at and near Daybreak Regional Park. | High | Hydrology, in-stream habitat, LWD | Short term |
| EFLE_RV_03 | • Evaluate risk of channel avulsion into Daybreak Pits located in floodplain at RM 7.3 to 9.5; assess impact of existing levees; explore options to restore habitat. | High | Hydrology | Long term |
| EFLE_RV_03 | • Off-channel restoration at mouth of Manley Creek. | High | Habitat | Long term |
| EFLE_RV_03 | • Streambank restoration and in-channel habitat enhancement at power line crossing. | High | Habitat | Long term |
| EFLE_RV_03 | • Remove riprap near airstrip, enhance in-channel and off-channel habitat, revegetate riparian area. | Medium | Habitat | Long term |
| EFLE_RV_02 | • Revegetate riparian zone between Mason Creek and Ridgefield Pits. | Medium | Habitat, LWD | Short term |
| EFLE_RV_02 | • Remove or set back levee on County owned Schaeffer property (RM 5). | High | Channel migration, hydrology | Long term |
| EFLE_RV_01 | • Remove or set back levees on County owned property in La Center Bottoms (RM 3.2 to 4.4). | High | Channel migration, hydrology | Long term |
| EFLE_RV_01 | • Riparian reforestation and wetland creation on Dyer Creek within East Fork Lewis River Greenway. | High | Habitat, Surface water and stream baseflow | Short term |
| Various | • Upgrade stormwater facilities and outfalls at numerous locations noted in SNAP reports. | Medium | Surface water and stream baseflow | Long term |
| Various | • Control invasive vegetation at numerous locations noted in SNAP reports. | Medium | Habitat, LWD | Short term |

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| Various | • Work with landowners to apply agricultural BMPs at numerous locations noted in SNAP reports. | High | Water quality | Long term |
| Various | • Conduct further analysis of fish passage barriers and replace culverts as needed at numerous locations noted in SNAP reports. | High | Habitat for Salmonids | Long term |

| LOCKWOOD CREEK | WRIA 27 | East Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Conversion of forests to residential development and high road density.
- Increased magnitude, duration and frequency of peak flows and reduced summer base flows caused by increases in impervious surfaces.
- Lack of floodplain connectivity.
- Lack of functioning pieces of large woody debris.
- Impaired water quality including elevated water temperatures and sediment levels.
- Potential fish passage barriers at road crossings.

**Programmatic Restoration Opportunities:**

- WQ-1, WQ-5, WQ-8, H-2, H-3, F-4, F-6, R-3, R-5, R-8, NN-2, W-1, W-2, SW-4 (see Table C-1)

**Information Sources and Organizations:**

- Clark County Clean Water Program. 2007 Stormwater Needs Assessment Program Lockwood Creek Subwatershed Needs Assessment Report. http://www.clark.wa.gov/water-resources/documents/SNAP/LockwoodSNAPfinal.pdf.
- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.
- Clark Public Utilities, monitoring web page: http://www.clarkpublicutilities.com/ourenvironment/streamTeam/monitoring

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| Upper watershed | Complete riparian restoration project north of Lockwood Creek Road. | Medium | Habitat | Short term |

| MASON CREEK | WRIA 27 | East Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Conversion of forests to residential development and high road density.
- Degraded watershed conditions.
- Channel stability falls within a "zone of uncertain stability".
- Impaired water quality (elevated temperature and fecal coliform).
- Channel simplification and incision, historic channel realignment for agricultural uses.
- Lack of woody cover in riparian zones.
- Invasive plant species.
- Fish passage barriers at road crossings.

**Programmatic Restoration Opportunities:**

- H-2, F-4, F-5, R-3, WQ-1, WQ-9, WQ-13, W-1, W-2, SW-4 (see Table C-1)
- Educate and provide incentives to landowners to restore riparian conditions, reduce nutrient inputs.
- Remove ponds in headwater tributaries.

**Information Sources and Organizations:**

- Clark County Public Works Clean Water Program. 2007 Stormwater Needs Assessment Program Mason Creek Subwatershed Needs Assessment Report. http://www.clark.wa.gov/water-resources/documents/SNAP/MasonCreekSNAPfinal.pdf.
- East Fork Lewis Working Group. 2009. Lower East Fork Lewis River Habitat Restoration Plan.
- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| MASON_CK-01 | • Enhance channel structure and habitat, revegetate riparian areas along lower Mason Creek. | Medium | LWD, shade, in-channel habitat | Long term |
| MASON_CK-01 | • Enhance channel structure and habitat near Anderson Road crossing (RM 3.2 to 3.6). | Medium | in-channel habitat | Long term |

| ROCK CREEK (LOWER) | WRIA 27 | East Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Lack of riparian vegetation causes streambank instability and erosion.
- Limited floodplain connectivity.
- Impaired stream function (hydroperiod) caused by water diversions.
- Failing culverts and fish passage barriers.
- Invasive vegetation in riparian areas.
- Streambank armoring and incised channels.
- Poor pool quantity and substrate.
- Lack of large woody debris.
- Impaired water quality.
- Agricultural runoff and livestock access to stream.

**Programmatic Restoration Opportunities:**

- H-3, WQ-2, WQ-4, WQ-5, WQ-12, R-4, R-5, R-8, F-3, F-4, F-5, F-6, NN-2, W-1, W-2, SW-1, SW-4 (see Table C-1)
- Control reed canarygrass and Himalayan blackberry.
- Educate and provide incentives to landowners to restore riparian and stream channel habitat; reduce nutrient inputs.
- Investigate and potentially remove small dams.

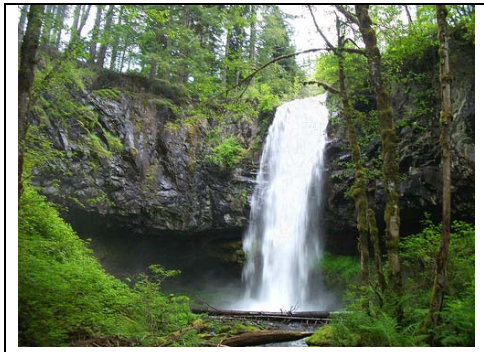
**Information Sources and Organizations:**

- Clark County Public Works Clean Water Program. 2009. 2008 Stormwater Needs Assessment Program - Rock Creek (North)/East Fork Lewis River (RM 15.75) Subwatershed Needs Assessment Report.
- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| | • | | | |
| Various | • Upgrade stormwater facilities and outfalls at numerous locations noted in 2008 Stormwater Needs Assessment Program report. | High | Water quality | Long term |
| Various | • Control invasive vegetation at numerous locations noted in 2008 Stormwater Needs Assessment Program report. | High | Habitat | Short term |

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| Various | • Work with landowners to apply agricultural BMPs at numerous locations noted in 2008 Stormwater Needs Assessment Program report. | High | Water quality | Short term |
| ROC1_01 | • Reforest riparian areas immediately downstream from Rock Creek Road bridge. | Medium | Habitat, shade, LWD | Long term |
| ROC1_01 | • Reforest riparian areas in upper reaches within DNR land and near Farger Lake. | Medium | Habitat, shade, LWD | Long term |

| BIG TREE CREEK | WRIA 27 | East Fork Lewis River Tributaries & Lakes |
|---|---|---|



**Impairments:**

- Sub-basin is heavily logged and surface water runoff has increased in the watershed.
- Conversion of forests to impervious surfaces.
- Impaired water quality.

**Programmatic Restoration Opportunities:**

- WQ-1, WQ-10, F-5, R-4, W-1, W-2, SW-4 (see Table ~~5~~C-1)

**Information Sources and Organizations:**

- Clark County Public Works Clean Water Program. 2008 Stormwater Needs Assessment Program- Big Tree Creek/East Fork Lewis River (RM 26.30)/King Creek Subwatershed Needs Assessment Report. http://www.co.clark.wa.us/water-resources/documents/SNAP/2008/BigTreeSNAPreport.pdf
- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed |
|---|---|---|---|
| Lower reaches | ~~No site-specific opportunities~~Work with private landowners to re-vegetate riparian areas. | Moderate | LWD, shade, habitat |

| YACOLT CREEK | WRIA 27 | East Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Conversion of forests to impervious surfaces; especially high road density.
- Impaired water quality.
- Loss of riparian forest to logging, agriculture, and residential use.
- Invasive vegetation in riparian areas.
- Lack of large woody debris.

**Programmatic Restoration Opportunities:**

- NN-2, R-4, WQ-1, WQ-5, SW-4, F-9, W-1, W-2 (see Table C-1)
- Coordinate stormwater management activities with the Town of Yacolt

**Information Sources and Organizations:**

- Clark County Public Works Clean Water Program. 2009. 2008 Stormwater Needs Assessment Program – Yacolt Creek/East Fork Lewis River (RM 21.40) Subwatershed Needs Assessment Report. April 2009.
- Cramer, S.P. & Associates, Inc. (January 2005). Chapter 4: East Fork Lewis River Basin – Habitat Assessment, report prepared for the Lower Columbia Fish Recovery Board under contract to Clark County Water Resources.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All reaches | Restore riparian forest zones | Medium | Habitat, LWD | Long term |

| KING CREEK | WRIA 27 | East Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Impaired substrate.
- Lack of large woody debris due to timber harvest.
- Impaired water quality.
- Riparian zones lack forest cover.

**Programmatic Restoration Opportunities:**

- R-3, R-5, R-8, F-5, F-6, W-1, WQ-10 (see Table C-1)
- Prevent riparian degradation through education and acquisition.
- Undertake selective clearing and replant riparian areas with native trees, particularly conifers.

**Information Sources and Organizations:**

- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All | • Restore vegetative canopy in logged areas to improve shading of pool and braided channel habitats and reduce the potential for erosion. | High | LWD, shade, habitat | Long term |

| COPPER CREEK | WRIA 27 | East Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Timber harvest in upper watershed has affected stream flow and erosion.

**Programmatic Restoration Opportunities:**

- R-3, R-5, R-8, WQ-1, WQ-10, F-5, F-6, W-1 (see Table C-1)
- Prevent riparian degradation through education and acquisition.
- Undertake selective clearing and replant riparian areas with native trees, particularly conifers.

**Information Sources and Organizations:**

- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All reaches | • Install LWD to increase the formation of pools and offset time required for conifers planted along streambanks to be mature. | High | Habitat, LWD | Long term |

| ROCK CREEK (UPPER) | WRIA 27 | East Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Logging road crossings and culverts.
- "Poor" or "not properly functioning" pool quantity, due largely to the topography and stream gradient.
- "Not properly functioning" LWD.
- Impaired water quality

**Programmatic Restoration Opportunities:**

- WQ-1, WQ-10, R-3, R-5, R-8, F-5, F-6, W-1, W-2, SW-4 (see Table C-1)
- Undertake selective clearing and replant riparian areas with native trees, particularly conifers.
- Prevent riparian degradation through education and acquisition.

**Information Sources and Organizations:**

- Clark County Public Works Clean Water Program. 2008 Stormwater Needs Assessment Program-Cedar Creek (East Fork)/Lower Rock Creek (South)/Upper Rock Creek (South) Subwatershed Needs Report. http://www.co.clark.wa.us/water-resources/documents/SNAP/2008/CedarEFSNAPreport.pdf.
- Lower Columbia Fish Recovery Board web page: http://www.lcfrb.gen.wa.us/default1.htm.

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All reaches | • Install LWD to increase the formation of pools and offset time required for conifers planted along streambanks to be mature. | High | Habitat, LWD | Long term |
| ROC3_CR_01 and 02 | • Revegetate riparian areas along the lower reaches that have been impacted by residential development and downstream of the Dole Valley Road crossing. | High | Habitat, LWD | Short term |

| CEDAR CREEK (EAST FORK LEWIS RIVER TRIBUTARY) | WRIA 27 | East Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Logging road crossings and culverts.
- High water temperatures and summer low flow issues
- Lack of LWD and in-stream habitat

**Programmatic Restoration Opportunities:**

- R-3, R-5, R-8, WQ-1, WQ-10, F-5, F-6, SW-4, W-1, W-2 (see Table C-1)
- Undertake selective clearing and replant riparian areas with native trees, particularly conifers.
- Acquire riparian areas and preserve habitat.

**Information Sources and Organizations:**

- Clark County Public Works Clean Water Program. 2008 Stormwater Needs Assessment Program-Cedar Creek (East Fork)/Lower Rock Creek /Upper Rock Creek (South) Subwatershed Needs Report. http://www.co.clark.wa.us/water-resources/documents/SNAP/2008/CedarEFSNAPreport.pdf.
- Friends of East Fork Lewis River, web site: http://www.eastforklewisriver.org/river-restoration.html

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All reaches | • Install LWD to increase the formation of pools and offset time required for conifers planted along streambanks to be mature. | High | Habitat, LWD | Long term |

| COYOTE CREEK | WRIA 27 | East Fork Lewis River Tributaries & Lakes |
|---|---|---|

**Impairments:**

- Logging road crossings and culverts.
- Timber harvest in the upper watershed affects stream flow and water quality.

**Programmatic Restoration Opportunities:**

- R-3, R-5, R-8, WQ-1, WQ-10, F-5, F-6, W-1, W-2, SW-4 (see Table C-1)
- Undertake selective clearing and replant riparian areas with native trees, particularly conifers.
- Prevent riparian degradation through education and acquisition.

**Information Sources and Organizations:**

- None identified

| Reach or Location | Site-Specific Restoration Opportunities | Relative Priority of Actions | Ecosystem Functions Addressed | Timeline |
|---|---|---|---|---|
| All reaches | • Install LWD to increase the formation of pools and offset time required for conifers planted along streambanks to be mature. | High | Habitat, LWD | Long term |