3.6 MIDDLE GREEN RIVER TRIBUTARIES

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PHYSICAL DESCRIPTION

SUBBASIN

This section includes the following tributary streams to the mainstem Green River upstream of the confluence of Soos Creek (RM 33.65) and downstream from the confluence with Newaukum Creek (RM 40.7):

- Burns Creek (09.0105);
- Crisp Creek (09.0113) (locally referred to as Keta Creek);
- O'Grady Creek (09.0107); and
- Nine other locally named or unnamed tributaries (09.0100 through 09.0110).

These streams are grouped together because of their similar drainage basin size, geomorphic characteristics, flows, geographic location and salmonid resource utilization.

STREAM COURSE AND MORPHOLOGY

Burns Creek (a right-bank tributary to the Green River) has its origins from a spring. It drains much of the east valley floor in this reach and enters the Green River at the upstream end of the Loans Levee (RM 38.0). Burns Creek is fed by three tributaries, all located along the north valley wall. The upstream tributary has its origins as a wall-based spring, while the two downstream tributaries flow from steep-sided ravines. Once Burn Creek enters the valley floor, it flows through old river channels before joining the mainstem Green River.

Crisp Creek enters the Green River at RM 40.1 as a right bank tributary. It drains an area of approximately 5.0 square miles and is approximately 3.0 miles long. The creek has its origins from several groundwater sources and springs (including Keta Creek Springs) which augment the flow of Crisp Creek. The origins of Crisp Creek appear to be a 20-acre, relatively pristine bog at approximately 600 feet in elevation. Crisp Creek moves across a natural plateau before it drops steeply over the topographic break that discerns the plateau from the valley walls of the Green River. The stream becomes slower with a lower gradient when it reaches the alluvial valley floor and then travels roughly parallel to the Green River before entering it. Two lakes important to surface water flow (Horseshoe and Keevies) are located within the subbasin. The Keta Creek Hatchery (one of two Muckleshoot Indian Tribe (MIT) hatcheries) and two adjacent former WDFW rearing ponds are located at approximately RM 1.05 of Crisp Creek.

The mainstem of O'Grady Creek originates from wetlands and is approximately 2.4 RM long, with a single wall-based tributary that contributes an additional mile (total of 3.4 RM). O'Grady Creek (09.0107) joins the Green River through an oxbow (side channel) along the left bank at approximately RM 39. The O'Grady Creek subbasin and drainage basin area includes 1.3 square miles. The creek is best characterized when it is divided into three distinctive reaches or sections:

- An upper headwater reach (approximately 1 mile long) with a low gradient that meanders through plateau farmland;
- A middle reach (approximately 0.8 miles long) that descends from the plateau through a high-gradient, steep-walled ravine to the Green River valley floor; and
- A lower reach (approximately 0.5 mile long) that comprises the alluvial fan.

O'Grady Creek subbasin is impacted by the Osceola Mudflow, a natural geologic feature that originated from a past eruption of Mt. Rainier and is the dominant geologic feature of the plateau. The mudflow deposited a large area of unsorted clay sediments which created a flat, riverine topography combined with significant numbers of depressions. These depressions formed the wetlands and are similar to the features of the Newaukum Creek subbasin (see Hydromodification—Off Channel Habitat, below).

Stream course and morphology information on the several small tributaries mentioned above (09.0098 through 09.0106) was not located or made available during the course of this report.

SALMONID USE

More than 10 miles of stream length of the combined Middle Green River tributaries are accessible to anadromous salmonids.

The known freshwater distribution of anadromous salmonids is depicted in the report Appendix. Chinook, sockeye, coho, pink and chum salmon (along with winter steelhead adults) have been observed spawning in these tributaries (WDFW Spawning Ground Survey database). Burns and Crisp Creeks provide spawning and rearing habitat for coho, chinook, chum and winter steelhead. Coho and chum salmon adults and juveniles utilize O'Grady Creek.

Resident and anadromous cutthroats have been observed throughout the these streams and lakes. Crisp Creek also serves as the water supply for the MIT Keta Creek Hatchery and rearing ponds.

The lower reaches of the primarily smaller, wall-based streams (09.0098 through 09.0106) are utilized for spawning by coho and chum, and rearing by chinook, coho, chum, and winter steelhead.

FACTORS OF DECLINE

FISH PASSAGE

King County is currently conducting a comprehensive investigation of culvert and bridge crossings of county roads in the Green River basin. It is expected that this investigation will produce a database identifying barriers or constrictors of stream channels on King County Roads.

That survey should be completed in late 2000 or early 2001 and does not include city or private roads.

The known barriers to anadromous salmonids are shown in the report Appendix.

CRISP CREEK

The Keta Creek Hatchery (one of two Muckleshoot Indian Tribe (MIT) hatcheries) and two adjacent former WDFW rearing ponds are located at approximately RM 1.05 Crisp Creek. A dam at the facility ponds water upstream and also creates an anadromous barrier. The hatchery rears and releases at both on and off-station locations chum, coho, chinook salmon. Winter steelhead are reared at this facility and released off-station.

O'GRADY CREEK

Within O'Grady Creek there are no known passage barriers for salmonid juveniles in the reach downstream of the culvert and upstream of the confluence.

However, O'Grady Creek chronically overflows its banks during fall and winter at a point about 1,000 feet upstream from the confluence with the Green River. This causes much of the stream to flow in a shallow, sheet-like manner across the remnant pasture. In the past, adult chum and coho and juvenile salmonids have been stranded as the creek drops back into its banks. This reach is currently the recipient of a King County restoration project to construct a more stable channel.

Boehm (1999) noted that during seasonal low-flow periods there was insufficient flow across the alluvial fan for adult salmonids to access O'Grady Creek in the most recent four years (1995-1999). He also noted that "…strandings have occurred...", but no species were identified.

RIPARIAN CONDITION

CRISP CREEK

The upper reaches of Crisp Creek contain deciduous trees, primarily red alder and black cottonwood, with some conifers where the stream traverses through commercial timberlands. There is a sparse, mixed coniferous and deciduous stand of second-growth trees along Crisp Creek just upstream of the Auburn-Black Diamond Road. Downstream of the commercial timberlands, the stream gradient flattens and the riparian area becomes wider and larger with mostly deciduous trees growing from the top of the stream bank to the stream. Downstream of the MIT Keta Creek Hatchery, Crisp Creek flows past several farms and houses and has little functioning riparian habitat (primarily willows), until just prior to its confluence with the Green River. The riparian habitat at the confluence of Crisp Creek and the mainstem Green River is comprised primarily of large cottonwood trees (Kerwin 2000).

O'GRADY CREEK

Native vegetation riparian buffers are lacking within the upper plateau reaches of the O'Grady Creek subbasin. There are sections of willow (*Salix sp*.), ninebark (*Physocarpus capitus*), vine maple (*Acer circinatum*), black cottonwood (*Populus trichocarpa),* and scattered stands of Sitka spruce (*Picea sitchensis*), and western red cedar (*Thuja plicata*).

Historic logging practices harvested the old-growth forest within the ravine in the early 1900s. The riparian zone throughout most of this reach is vegetated with second-growth deciduous forest and shrubs. Boehm (1999) found the mid-section riparian buffer of O'Grady [0–450 meters (0-1320 feet)] to be dominated by willow, red-osier dogwood, red alder and black cottonwood saplings. The overstory vegetation pattern of the upper section of his study area, (2,600-5,600 feet below the ravine above the culvert) was dominated by red alder, big leaf maple, black cottonwood, and bitter cherry (*Prunus emarginata*). There were a few sections of coniferous overstory in the study area and the upper reaches of the wall-based tributary included western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterphylla*), sitka spruce (*Picea sitchensis*), and Douglas fir (*Pseudotsuga menziesii*). Additional upland plants found in the shrub layer include red elderberry (*Sambucus racemosa*), beaked hazelnut (*Corylus cornuta*), and indian plum (*Oemleria cerasiformis*). Sword fern, bleeding heart (*Dicentra formosa*), Pacific waterleaf (*Hydrophyllum tenuipes*), and trillium (*Trillium ovatum*) were the dominant plants found in the understory. In the moist upland areas, and in wet areas, piggy-back plant (*Tolmiea menziesii*), Scouler's corydalis (*Corydalis scouleri*), false lily-of-the-valley (*Maianthemum dilatatum*), current (*Ribes bracteosum*), and salmonberry were all present. Scouler's corydalis, skunk cabbage, water parsley (*Oenanthe sarmentosa*), horsetail, reed canary grass, and scattered cattails (*Typha latifolia*) were identified in sections of the wetland and overflow area adjacent to O'Grady Creek approximately 828 feet-1159 feet downstream of the culvert.

In the lower stream reach, adjacent to the mainstem Green River, there is no development adjacent to the stream buffer other than past clearing and a remnant pasture within the alluvial fan downstream of the access road culvert. Boehm (1999) examined three study reaches in the lower portion of O'Grady Creek, including the wall-based tributary in that area. He found that a riparian coniferous forest overstory was lacking in the stream buffer from the outlet with the Green River side channel upstream 993 meters (3,287 feet). He did note the presence of "patches" of conifers in the upstream reaches of both streams. In the study areas examined by Boehm (1999), the riparian vegetation was is dominated by a young, hardwood forest consisting of young red alder (*Alnus rubra*), larger and older individual black cottonwood *(Populus trichocarpa*) and occasional big-leaf maple (*Acer macrophyllum*). There was also a shrub layer is dominated by willow (*Salix spp*.), red-osier dogwood (*Cornus stolonifera*), vine maple (*Acer circinatum*), Himalayan blackberry (*Rubus discolor*), snowberry (*Symphoricarpos alba*), and salmonberry (*Rubus spectabilis*). There was a sparse herbaceous layer in the wet depressions/small wetlands adjacent to the stream consisting of skunk cabbage (*Lysichitum americanum*), giant horsetail (*Equisetum telmatiea*), reed canarygrass (*Phalaris arundinacea*), and lady fern (*Athyrium filix-femina*).

LARGE WOODY DEBRIS

There have not been any quantitative surveys of LWD abundance in the creeks in this reach. An active program to remove LWD from the Burns, Crisp and O'Grady Creek systems over the past 150 years, combined with the loss of the historic coniferous riparian buffer and associated potential recruitment of large trees/key pieces of wood with rootwads, have impacted stream process formation and morphology, and ultimately salmonid species production and composition.

Crisp Creek

While no quantitative counts of large woody debris were found, there is a limited amount of large, functional woody debris in the channel to buffer changes in sediment and water flow (Malcom 2000).

O'Grady Creek

Within the reach of O'Grady Creek examined by Boehm (1999), there was an almost complete lack of both small and large woody debris (LWD) within both the active channel and the floodway. However there were some areas with lateral and side channel LWD accumulation. Winter high flow events have evidently placed most of the LWD as debris dams, lateral logs or bridges. Most of the debris accumulations were upstream of the access road culvert within the ravine. For the purpose of his study, Boehm defined LWD as being in excess of 10 inches in diameter and 10 feet) long. Using this definition, he found 17 pieces of wood within the study reach of O'Grady Creek that qualified as LWD, and about 3 pieces for the wall-based tributary. Calculating this on a piece-per-distance basis, there are 1.7 pieces/100 meters and 1.4 pieces/100 meters respectively.

Boehm (1999) also examined pool quality formed according to the methodology presented by Platts et al. (1987). This protocol assigns each pool a score ranging from 1 to 5. A pool with a value of 1 has little habitat value for salmonids while a rating of 5 would have superior habitat value for salmonids. In the study area, the average pool quality index (PQI) rating was 2, with an average maximum and residual depth of 0.54 meters (1.8 feet) and 0.41 meters (1.4 feet), respectively. LWD or an LWD/ boulder matrix combination were the responsible pool-forming features.

Therefore, the lack of LWD is a limiting factor in the production of anadromous salmonids in the O'Grady.

HYDROLOGY

CRISP CREEK

At present, increases in peak flows caused by precipitation do not appear to substantially adversely impact Crisp Creek. However, this scenario could easily change if the stream receives more overland flow as a result of increased impervious surfaces and loss of forest cover. This change in hydrology will cause higher and more frequent stormflow peaks and could cause channel instability.

Crisp Creek's existing mean annual flow is fairly low. Based on King County stream flow gage 40D, mean annual flow for the period of water year 1995 through 2000, is approximately 8.8 cfs. The mean annual 1-day minima stream flow is about 2.5 cfs with the lowest stream flow occurring in 1995 (Burkey 2000). If too much water were to be withdrawn or groundwater recharge were to be interrupted, it is likely that the stream could go dry during seasonal low flow periods.

O'GRADY CREEK

The O'Grady system responds quickly to rainfall from seasonal storm events that move through the watershed, generating high-peaked flash flows. Increases in impervious surface areas due to urbanization in combination with changes in historic land use practices (i.e., conversion of coniferous forests to pasture land) and the impermeable Osceola mudflow that covers most of the upper watershed the Enumclaw plateau have collectively created this hydrologic sensitivity and poor hydrologic. The natural impervious layer of the Enumclaw plateau and the lack of LWD in the O'Grady Creek system has created high-velocity conditions with high bedload mobility (see Riparian Condition—Large Woody Debris; and Sediment Condition0).

Peak flows coincide with the winter storm season of November through March. Based on 4 years of data from King County stream gage number 40C (water years 1992 – 1995 inclusive), the annual maxima mean daily flow is just under half of the annual maxima daily maximum. The mean annual flow rate for O'Grady Creek for those 4 years is approximately 1.5 cfs. The annual 1-day minimum flow ranges from 0 - 0.4 cfs. However at low flow, the gaging records may not accurately measure stream flow (Burkey 2000).

The transport of sediments and movement within the lower reaches of the O'Grady Creek system is also high (see Sediment Condition).

Water Rights

The tributaries to the Green River have been closed to additional surface water withdrawals since 1980 (Chapter 173-509 WAC). However, potable water wells that produce less than 5,000 gallons per day do not require a water right. It is not known how many of these wells are present in the subbasin, nor their cumulative impacts on groundwater discharge and stream baseflow to these creek systems.

SEDIMENT CONDITION

Substrate conditions of the creeks within this subbasin have not been thoroughly investigated.

BURNS CREEK

Burns Creek is impacted by sediments originating from landslides in one of its tributaries, locally known as Doll Creek. Doll Creek originates on the plateau approximately 240 feet above the Green River valley. The landslides are located in a section of the creek locally referred to as the Bell Ravine. The Bell Ravine is a young geologic process that is formed by the creek cutting down through softer sediments on its way to the Green River valley floor. Landslides in Bell Ravine are a part of a natural process, but may be exacerbated by historic and current land use practices.

Landslides are present in aerial photographs taken of Doll Creek in 1936 and 1985. However, they are not believed to have caused the sedimentation problems in Burns Creek (Perkins 1999).

During the winters of 1990 and 1995-96, sustained, intense rainstorms caused large landslides that reactivated sediment fans (in 1990) and led to sediment deposition in Burns Creek. Perkins (1999) indicates between 1985 and 1999, between 12,000 and 34,000 cubic yards of sand and gravel probably entered Doll Creek. Between 4,000 to 8,000 cubic yards were deposited in the alluvial fan at the confluence of Doll and Burns creeks.

Perkins (1999) examined sediments in the lower reaches of Burns Creek downstream of the confluence with Doll Creek. This area has an average stream gradient of 0.2 percent (Perkins 1999). She found this reach to be comprised of either sands or silts up to three feet thick. These sediments have reduced pool depths and buried salmonid spawning gravels. Coho and chum salmon continue to spawn in this reach, but their reproductive success is thought to be marginal.

This sediment buildup has largely been responsible for local flooding. The response by local property owners has been to conduct a maintenance dredging program once or twice each year since 1996. However, the landslides are believed to be a natural process and not directly the result of land use activities (Perkins 1999). Typically, permits have allowed up to 49 cubic yards of sediments to be removed during each maintenance dredging. This dredging is supposed to be in the vicinity of residential driveways, but dredge spoils are present on both banks from approximately 250 feet downstream of private property along Burns Creek. During 1997, King County also removed sediments from Burns Creek stream channel below the confluence with Doll Creek in an effort to minimize flooding of the S.E. Green Valley Road.

Williams (1975) noted the presence of only “patchy” gravels in Burns Creek and either gravels were absent or covered at that time.

CRISP CREEK

Crisp Creek is similar to Burns Creek in that the lower reaches are heavily silted and significantly altered where they pass through agricultural lands (primarily pastureland). The creek has its origins from a wetland northwest of Keevies Lake. The hydrology of the creek is dominated by groundwater and baseflow is the main component of the annual hydrograph (MIT, 1993).

The upper reaches of Crisp Creek are relatively stable and capable of accommodating winter stream flows, in part due to limited urban and residential development and the low channel gradient. However, immediately above the MIT Keta Creek Hatchery, Crisp Creek flows through a confined area that is surrounded by unstable landforms. These landforms are a source of fine sediment and landslides when disturbed (MIT, 1994). Crisp Creek has the potential to become degraded through aggradation and erosion processes due to peak flows.

O’GRADY CREEK

Excessive scour and deposition has been documented by Bill Priest (Bill Priest 1999 as contained in Boehm 1999). The intensity of scour and sediment movement is severely a limiting factor for salmonid production in the O’Grady Creek system. This would be adversely impacting the survival rate of cutthroat, coho and chum eggs during incubation and coho and steelhead during rearing.

Boehm (1999) found that winter flood-flows were responsible for substantial sediment loading and bed movement within the study reach of O'Grady Creek. Within the reach examined, he found that substrates were moderately imbedded within a fine-grain matrix. The area poorest in spawning gravels was the 1,225 feet – 2,259 feet reach of channel with a lower stream gradient and a sand dominated substrate. The wall-based tributary had a substrate with less sand present and was dominated by large gravel (25 mm to 100 mm) (40%), cobble (100mm-256mm) (30%), small gravel (20%) (<25mm), and sand (10%). There are also a few cobbles present within the stream channel.

WATER QUALITY

Burns, Crisp and O'Grady creeks are all classified as a Class A waters (WAC 173-201A).

Burns and O'Grady Creeks currently meet all numeric water quality standards for all monitored chemical constituents, including fecal coliforms, water temperature and dissolved oxygen.

Crisp Creek currently meets all numeric water quality standards for a variety of chemical constituents, including water temperature and dissolved oxygen. However, like many other streams in the Green River basin, Crisp Creek does not currently meet water quality standards for fecal coliform, and appears on the Environmental Protection Agency 1998 303(d) list (WSDOE 2000) for exceeding the upper criteria in samples collected between 1991 and 1997.

Water quality information on several other tributary streams in this reach was not available.

Water quality in Burns, Crisp and O'Grady Creeks is not believed to be a limiting factor at this time.

LAND USE

BURNS CREEK

Aerial photographs from 1936 of the Burns Creek subbasin show an immature forest, probably the result of logging activities in the early part of the 20th century. Numerous old landslide bowls are also present in these photographs. These landslides may be the result of reduced root strength of immature trees and/or more winter storms with high and intense precipitation patterns.

CRISP CREEK

The historic old-growth forest around Crisp Creek was also logged sometime near the beginning of the 20th Century. There are some remnant old-growth Sitka spruce and Western red cedar trees widely scattered throughout the subbasin.

Currently, approximately 69 percent of the watershed upstream of approximately RM 11 is managed for commercial timber production (Malcom 2000). Beginning in 1991, commercial logging activities harvested the majority of the second-growth timber on the commercial forest land tracts. Within the Crisp Creek drainage area there are at least six concentrated areas of residential development with densities of 1 house per acre or less. The remaining land use is considered rural residential with lot sizes of 1 to 10 acre. The residential sites vary in vegetative conditions from clear-cut to pastureland to small private woodlots with a single residential house.

O'GRADY CREEK

O'Grady Creek has experienced significant and substantial changes since historic times (prior to 1860). Virtually all of the original pre-settlement wetland forests of Sitka spruce and western red cedar, and upland forests within the subbasin have been logged (in some cases twice) and then cleared. Following clearing, land use on the plateau was dominated by hay and straw production, and dairy farms (King Co. Basin Recon. 1990). Currently, the subbasin is predominantly rural in character, but under increasing pressures to convert to new single-family residences on smaller parcels, and a breakup of the large-acreage pasture into "hobby" farms. Currently, there are several large horse stables and horse breeding farms on the plateau.

NON-NATIVE SPECIES

ANIMALS

No information on non-native fish species was located during the course of this investigation.

PLANTS

Reed canarygrass (*Phalaris arundinacea*) is abundant throughout this subbasin. Himalayan blackberry (*Rubus discolor)* is present in O'Grady Creek subbasin.

HYDROMODIFICATION

O'GRADY CREEK

In 1984, a land owner channelized the lower 600 meters (1980 feet) of O'Grady Creek. This removed all of the meanders (and LWD) from the historic channel to force stream flows into the newly excavated and straightened channel. This lower section has experienced the greatest habitat damage from property owners. This damage limits natural production of salmonids.

Local channelization is extensive in the lower reaches of Burns and Crisp Creeks where they traverse across the valley floor through agricultural lands.

SOUTH FORK BURNS CREEK

The South Fork of Burns Creek has its origins in a wetland that historically received flow from Crisp Creek during floods. Prior to the construction and operation of Howard Hanson Dam in 1962, the South Fork of Burns Creek also received flood waters from the mainstem Green River. These flood waters are believed to have flushed the fine sediments from the South Fork of Burns Creek, leaving behind spawning gravels that were capable of supporting spawning salmon.

After the dam was constructed in 1962, flood flows from the mainstem Green River no longer occurred in the upper reaches of Burns Creek. Williams (1975) noted that in the previous 15 years, stream habitat degradation had occurred due to "…heavy silting, extensive aquatic weed growths, and reduced flows." He attributed the observed siltation problems to land use practices and illegal hydraulic projects of that time period.

In addition to the flow changes believed to be caused by the building and operations of Howard Hanson Dam, changes in mainstem Green River channel location is also thought to contribute to increased siltation of this area in Burns Creek. A comparison of aerial photographs between 1936 and 1958 indicates that the Green River abandoned a meander bend upstream of Burns Creek during this time period. As a result, this channel migration moved the mainstem river away from Burns Creek, and contributed to a reduction of flood flows from the mainstem Green River into Burns Creek.

OFF CHANNEL HABITAT

Crisp Creek

The upper portion of the Crisp Creek has numerous adjacent wetlands that mostly remain connected to the stream.

O'Grady Creek

There are still large wetlands present in the upper reaches of this subbasin. The largest include O'Grady Creek No. 85b, 94b, 5 (51 acres), and O'Grady Creek No. 88b (King Co. Wetlands Inventory 1990). However, most of the plateau wetlands have either been cleared, ditched, filled and/or are extensively grazed by livestock.

FLOODPLAIN CONNECTIVITY

As previously mentioned, O'Grady Creek originates from a group of wetlands and then descend westerly into a series of ditched streams that coalesce at the eastern edge of the Osceola flow area before entering a steep-walled, high-gradient ravine. The grazed wetlands are often inundated with water during the winter. This is evidence of highly compacted soils and poor permeability that is a characteristic of the Osceola mudflow. The poor permeability of the Osceola flow area and the compacted soil caused by extensive grazing generates a combination of conditions that favor a severe rapid runoff pattern during rain and rain-on-snow storm events.

KEY FINDINGS AND IDENTIFIED HABITAT-LIMITING FACTORS

- There is a general lack of habitat information for this subbasin.
- The subbasin is undergoing a rapid conversion from forest and rural to a more urbanized environment.
- The riparian buffer in this subbasin is insufficient and is limiting natural salmonid production.
- There is a lack of LWD throughout the streams in this subbasin.

- Summer low flows limit available rearing production for species of salmonids that require over-summer residency.

- High winter flows limit the reproductive success of coho and chum salmon because of scour and bedload movement and coho and steelhead because of lack of refugia.

- Channelization of the lower reach of O'Grady Creek has eliminated stream channel complexity and limits natural production of salmonids.

- Sediments in the lower reaches of Burns, Crisp, and O'Grady creeks are believed to be limiting the success of egg incubation of anadromous salmonids in this reach.

DATA GAPS

- Information on several small tributaries (09.0098 through 09.0108) was not located or made available during the course of this investigation.

- Baseline habitat information is lacking for all or portions of the creeks in this reach.

- The impact level of non-native and invasive aquatic plants on naturally producing salmonids is not well understood..

- Use and importance of these streams as overwintering refuge habitat for juvenile salmonids from high mainstem flows is not fully known.

- The amount and type of LWD is not known. .

- The amount of loss of streambed channel and complexity after channel relocation is not known.

- The quality of the sediments in the lower reaches of Burns, Crisp, and O'Grady creeks are not fully known .

EARLY ACTION RECOMMENDATIONS

- Conduct baseline habitat inventory surveys

- Comprehensive barrier surveys need to be initiated in this subbasin.

- Comprehensive base line riparian habitat and bank condition surveys should be initiated.

- An inventory of LWD should be initiated.

- Historic channel location information needed.