Grave Creek Demonstration Project Area Riparian Revegetation and Vane Maintenance As-built Report

Task Order #0906

Prepared for:

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Introduction

This report describes work that was completed between August and October 2009 as part of implementing the *Grave Creek Demonstration Phase Riparian Revegetation Plan* (revegetation plan, Geum Environmental Consulting, Inc. 2008). Work described in this report was contracted through Kootenai River Network (Task Order #0906). A riparian revegetation plan for the Demonstration Phase was completed in December 2008 and final design was completed in August 2009, both under contract with Kootenai River Network, Inc. This report describes the locations and quantities of treatments implemented and provides recommendations for integrating effectiveness monitoring of these treatments into overall project monitoring.

Treatments

The following treatments were completed under task order #0906:

- Slope Revegetation: Coir Log Fascine
- Slope Revegetation: Planting and Seeding
- Floodplain Treatment: Microtopography
- Floodplain Treatment: Planting and Seeding
- Weed Control
- Log Cross Vane Maintenance
- Road Improvement
- Seeding Fill Disposal Areas

These treatments are described in detail in the revegetation plan. Treatments were further refined during a final design site visit in July 2009. Changes based on final design are described in a memo dated August 18, 2009. Treatments were completed between August and October 2009. A summary of treatment quantities are provided in Table 1. The following sections provide details on each treatment. Figures 1 and 2 show treatment locations.

Table 1. Summary of treatments implemented in Summer and Fall 2009 under Task Order #0906.

Treatment	Description/Quantity Installed	Date Completed
Slope Revegetation: Coir Log Fascine	-80 feet of 16-inch high density coir logs installed along the toe of the upper 1/3 of the terrace slope	10/14/09
Slope Revegetation: Planting and Seeding	-8, 16-gallon Drummond willow and 16, one-gallon, and four, 2-gallon shrubs installed along the toe of the upper 1/3 of the terrace slope	10/14/09
Floodplain Treatment: Microtopography	-400 cubic yards of floodplain material removed and transported downstream for use in vane maintenance or to other disposal locations outside of the floodplain -5 floodplain swales constructed and large woody debris placed in swales	8/31/09
Floodplain Treatment: Planting and Seeding	-17, 16-gallon Drummond willow installed in floodplain swales -Placement of coarse woody debris around planted willows -0.5 acres of floodplain area seeded	10/14/09
Weed Control	-1.9 acres of knapweed and houndstongue removed through hand-pulling	8/17/09
Log Cross Vane Maintenance	-Maintenance of one log cross vane	8/31/09
Road Improvement	-Minor modifications to the road above terrace slope to direct run-off towards areas that would not cause erosion of the slope -7 coir wattles installed to slow overland flow between the road and terrace slope	9/2/09 and 10/14/09
Seeding and Mulching Fill Disposal Areas	-0.25 acres of placed fill seeded per permit requirements -No mulch was placed on fill surfaces	10/14/09

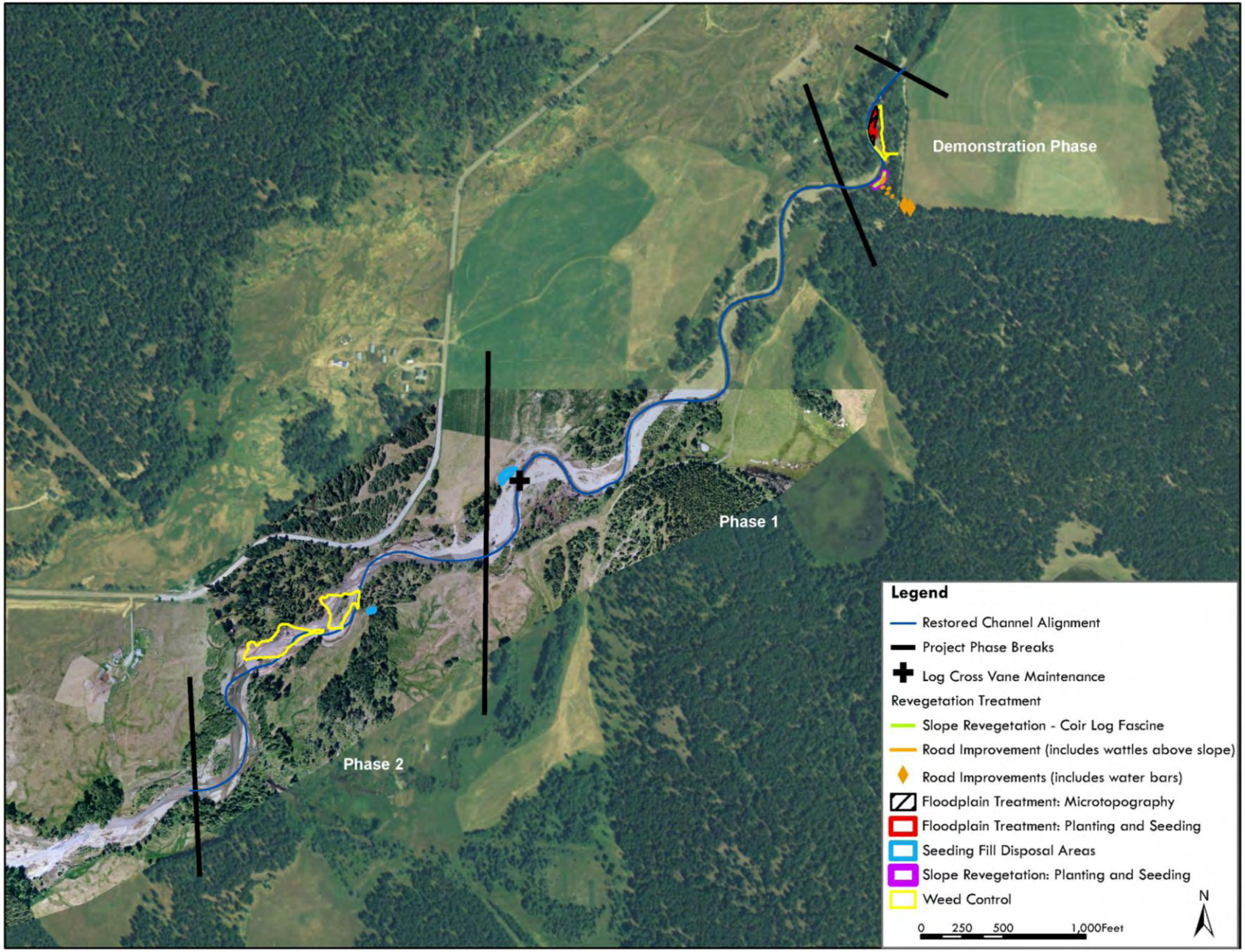

Figure 1. Overview of Grave Creek Restoration project area showing locations of work completed under Task Order #0906.

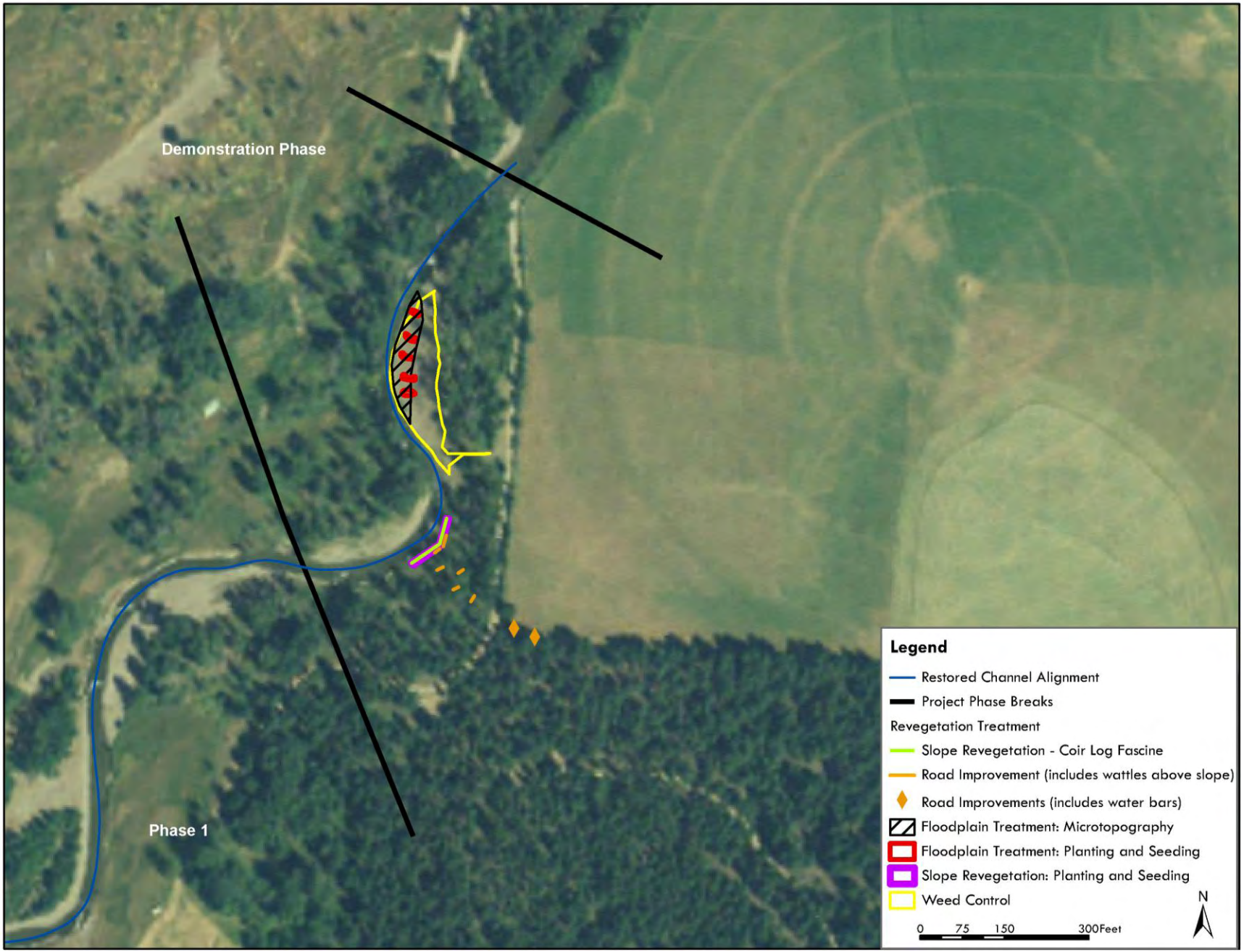

Figure 2. Aerial photograph of Demonstration Phase showing locations of treatments implemented in Summer and Fall 2009 under Task Order #0906.

Slope Revegetation: Coir Log Fascine and Planting and Seeding

As described in the revegetation plan, a steep terrace slope is present in the Demonstration Phase reach. The streambank in front of this slope was reconstructed in 2006 using large woody debris bank stabilization structures combined with vegetated soil lifts. These treatments are effectively directing flows away from the slope and providing dense woody vegetation along the bank line. During the August final design site visit, little to no vegetation was observed on the bench and slope behind the soil lifts of the upper 1/3 of this slope and the erosion on the face of the slope had increased. To best address the potential risks of continued erosion of this slope from overbank flows, the following materials were installed at the interface of the terrace slope toe and bankfull bench located immediately behind the soil lifts:

- 8 sixteen inch diameter high density coir logs
- 8 sixteen gallon Drummond willow
- 8 tall one gallon Wood's rose
- 8 tall one gallon chokecherry
- 4 two gallon snowberry
- 5 pounds native seed

A trench was excavated to a depth of approximately eight inches (half the diameter of the 16-inch coir logs). The coir logs were placed in the trench, back-filled with material from the slope and staked into place using 1-inch x 2-inch x 24-inch wooden stakes and coir twine. Sixteen-gallon plants were installed between the coir logs and one- and two- gallon shrubs were installed between the coir logs and the bottom edge of the slope. The bench between the coir logs and vegetated soil lifts was seeded with a native seed mix (species are listed in Table 2).

Table 2. Seed mix used for stabilization along toe of slope.

Scientific Name	Common Name
Agropyron riparium	Streambank wheatgrass
Elymus trachycaulus	Slender wheatgrass
Achillea millefolium	Common yarrow
Epilobium angustifolium	Fireweed

Figure 3. Photographs of revegetation of the terrace slope using 16-inch high density coir logs, 16-gallon willows, and one and two-gallon shrubs. This treatment was focused on the interface of the terrace slope and bankfull bench. Photograph on the left shows the bench prior to treatment. Photograph on the right shows the bench after treatment.

Floodplain Treatment: Microtopography and Planting and Seeding

As described in the revegetation plan, the primary limiting factor to revegetation identified in the Demonstration Phase reach was a lack of connectivity between the floodplain and channel in the upstream portion the reach. To address this limiting factor, approximately 400 cubic yards of floodplain material (mainly sand, gravel and cobble) was removed from the floodplain to lower the floodplain surface and re-establish connectivity with the channel. The floodplain surface was lowered between 1 and 3 feet. The remaining floodplain surface was re-shaped by constructing five floodplain swales (Figure 4). These swales provide lower elevation microsites where planted shrubs can grow in a wetter, more protected location and other vegetation can establish naturally from seed. Swale dimensions range from between ten and twenty feet long and five and ten feet wide. Swales are two to three feet deep at their deepest point. To create additional microsites where plants can become established, large wood was partially buried within the swales during construction. Large container plants (16 gallon Drummond willow) were installed in each swale (Figure 5). Coarse wood was scattered within and around swales on the floodplain surface after containerized shrubs were installed. Each swale was seeded with the seed mix listed in Table 3. A total of 20 pounds of seed were applied to the floodplain and swales.

Figure 4. Photographs of Demonstration Phase floodplain surface before (left photograph) and after (right photograph) removal of 400 cubic yards of material, construction of floodplain swales, and placement of woody debris and 16-gallon willows in swales.

Figure 5. Photographs of a constructed floodplain swale planted with 16 gallon Drummond willow. Large woody debris was partially buried into the floodplain during swale construction, and coarse woody debris was placed around planted shrubs to create microsites.

Table 3. Seed mix used in the constructed floodplain swales and in other microtopography features on the floodplain surface.

Scientific Name	Common Name
Cornus sericea	Redosier dogwood
Betula occidentalis	Water birch
Carex stipata	Sawbeak sedge
Carex utriculata	Beaked sedge
Juncus ensifolius	Daggerleaf rush
Deschampsia cespitosa	Tufted hairgrass
Glyceria grandis	American mannagrass
Poa palustris	Fowl bluegrass
Prunus virginiana	Chokecherry
Juncus balticus	Baltic rush
Betula occidentalis	Water birch
Agropyron riparium	Streambank wheatgrass
Elymus trachycaulus	Slender wheatgrass

Weed Control

Another limiting factor identified for the Demonstration Phase floodplain in the revegetation plan was the increasing density of noxious weeds and other invasive species on floodplain surfaces. The flat, uniform floodplain surfaces constructed during channel restoration resulted in a dense cover of spotted knapweed and other noxious weeds. To address this limiting factor, weeds were pulled by hand prior to removal of floodplain material to reduce the canopy cover and potential spread of weeds by seed. Weeds were hand-pulled by a Montana Conservation Corps (MCC) crew on August 17, and 18, 2009 (Figure 6). A total of 0.4 acres of knapweed and houndstongue were hand-pulled in the Demonstration Phase (Figure 2).

In addition to the Demonstration Phase floodplain, weeds were also removed by hand-pulling from two other floodplain surfaces in the project area (Figure 1). These areas are the same locations where weeds were hand-pulled in August 2008. A total of 1.5 acres of floodplain surfaces were treated. All weeds removed were placed in a location outside of the floodplain and buried with material removed from the Demonstration Phase floodplain (Figure 7).

Figure 6. Photograph of Montana Conservation Corps (MCC) crews hand pulling knapweed on the Demonstration Phase floodplain surface.

Figure 7. Photograph of weed disposal area. Fill removed from the floodplain in the Demonstration Phase was used to expand the road grade and bury weeds.

Log Cross Vane Maintenance

In addition to work completed in the Demonstration Phase, described above, maintenance work was completed on one log vane structure located in Phase 2 (Figure 1). As a result of flows scouring the cobble placed over the arm of the structure in 2004, the riffle downstream of this structure down-cut leaving a drop over the vane throat in excess of two feet (Figure 8). This drop may have prevented upstream passage of juvenile fish. To address this issue, a boulder grade control structure was installed at the glide/top of riffle transition downstream of the vane. This reduced the total drop over the log vane throat at base flow to less than 0.5 feet. Cobble needed for the vane repair work was generated during re-shaping of the floodplain surface in the Demonstration Phase reach. Vane maintenance was completed by River Design Group on August 31 2009.

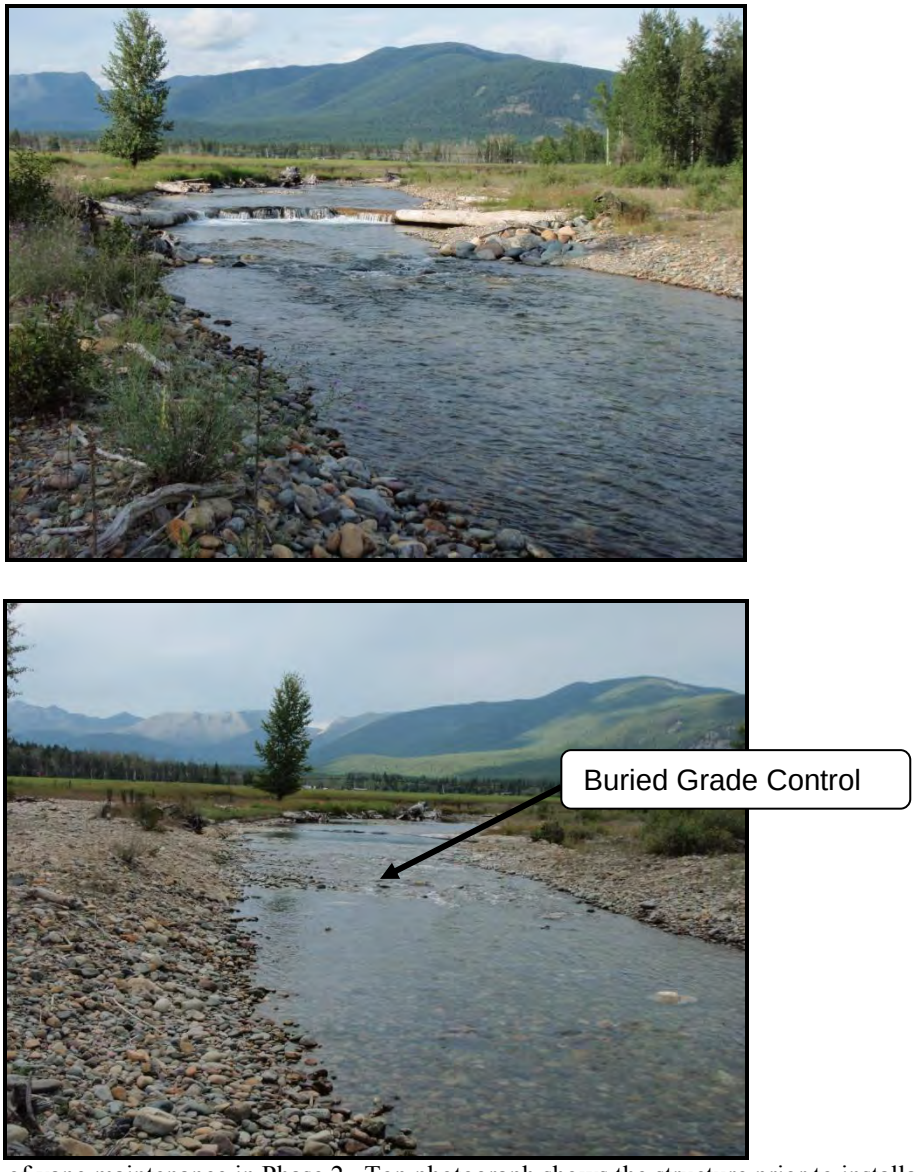

Figure 8. Photographs of vane maintenance in Phase 2. Top photograph shows the structure prior to installation of the boulder grade control. Photograph on the bottom shows the structure after installation of the boulder grade control which reduced the drop over the structure from 2 feet to approximately 0.5 feet.

Road Repair

Run-off from the road above the Demonstration Phase slope was identified as the cause of deep rills observed in the terrace slope during the August 2009 final design site visit. For slope revegetation and stabilization to be successful, it was necessary to address this source of erosion. Two treatments were implemented to reduce the velocity of overland run-off: 1) two water bars were constructed on the upper portion of the road to slow run-off and route water so it is dispersed into existing vegetated areas before reaching the terrace above the slope (Figure 1); and 2) coir wattles were installed in a staggered pattern perpendicular to the path of overland flow between the road and the terrace slope (Figures 1 and 9). Seven coir wattles were partially buried and staked in a similar manner as the coir logs at the toe of the slope. The top of the slope and any disturbed ground were seeded with the seed mix shown in Table 1.

Figure 9. Photograph showing the concentrated route of road run-off leading to the top of the terrace slope in the Demonstration Phase. Coir wattles were installed in a staggered pattern to reduce the velocity of overland flows, shorten the effective slope length, and prevent further erosion of the slope.

Seeding of Fill Disposal Areas

Two locations were designated for placement of the fill removed from the Demonstration Phase reach floodplain (Figures 1 and 7). Per permit requirements, these areas were to be seeded and mulch applied to the surfaces. The drier native seed mix (Table 1) was applied to these areas. No mulch was applied. Small woody debris and duff were spread over these surfaces, but not at a density or thickness to function as mulch.

Maintenance, Monitoring & Adaptive Management

Revegetation treatments installed in the Demonstration Phase represent the fourth phase of riparian revegetation implemented as part of the Grave Creek Riparian Revegetation project. Other phases were implemented in 2005, 2006 and 2008. Treatments implemented in 2006 included construction of vegetated soil lifts in the Demonstration Phase. In February 2008, Geum Environmental prepared a *Grave Creek Riparian Revegetation and Monitoring Plan*. The purpose of this plan was to describe how treatments focus on addressing specific limiting factors and how to integrate monitoring into determining treatment effectiveness through use of an adaptive management framework. The effectiveness monitoring and adaptive management program described in this plan was implemented in 2008 and 2009. Data collected in 2008 and 2009 were used to develop and finalize the treatments used in the Demonstration Phase in 2009. The results of 2008 and 2009 monitoring and how these data were used to determine treatment effectiveness and determine additional revegetation treatments are described in the *Grave Creek Riparian Revegetation 2008 As-built and 2009 Monitoring Report* prepared by Geum in August 2009.

The treatments implemented in the Demonstration Phase in 2009 should be integrated into the on-going effectiveness monitoring and adaptive management program. For this purpose, the following tables provide recommendations for potential maintenance needs (Table 4) and effectiveness monitoring needs (Table 5). Table 14 in the August 2009 report provides an adaptive management decision making framework for the Grave Creek Riparian Revegetation project. Any effectiveness monitoring observations or data collected for treatments implemented in the Demonstration Phase should be integrated into this table.

Table 4. Potential maintenance needs for 2009 Demonstration Phase riparian revegetation treatments.

Treatment	Potential Maintenance Needs
Slope Revegetation: Coir Log Fascine	No maintenance anticipated
Slope Revegetation: Planting and Seeding	Supplemental irrigation Supplemental seeding
Floodplain Treatment: Microtopography	No maintenance anticipated
Floodplain Treatment: Planting & Seeding	Supplemental irrigation Supplemental seeding
Weed Control	Implement integrated weed management plan
Log Cross Vane Maintenance	No maintenance anticipated
Road Improvement	Re-secure loose or undercut wattles Supplemental seeding
Seeding of Fill Disposal Areas	Supplemental irrigation Supplemental seeding

Table 5. Effectiveness monitoring recommendations for 2009 Demonstration Phase treatments.

Treatment	Treatments Implemented Fall 2009	2010 Effectiveness Monitoring Recommendations
Slope Revegetation: Coir Log Fascine	-80 feet of 16-inch high density coir logs installed along the toe of the upper 1/3 of the terrace slope	-Monitor sediment scour and deposition at toe of slope and assess maintenance needs
Slope Revegetation: Planting and Seeding	-8, 16-gallon Drummond willow and 20, one gallon shrubs installed along the toe of the upper 1/3 of the terrace slope	-Monitor survival of shrubs, establishment of seed on bench and assess maintenance needs
Floodplain Treatment: Microtopography	-400 cubic yards of floodplain material removed and transported downstream for use in vane maintenance or to other disposal locations outside of the floodplain -5 floodplain swales constructed and large woody debris placed in swales	-Monitor swale conditions including: hydrology, scour and deposition, and natural recruitment of native and weedy species -Observe channel adjustments
Floodplain Treatment: Planting & Seeding	-17, 16 gallon Drummond willow installed in floodplain swales -Placement of coarse woody debris around planted willows -0.5 acres of floodplain area seeded using a diverse native seed mix	-Monitor willow survival, germination of seeded species and assess maintenance needs
Weed Control	-1.9 acres of knapweed and houndstongue removed through hand-pulling	-Monitor for weedy species regeneration and assess maintenance needs
Log Cross Vane Maintenance	-Maintenance of one log cross vane	-Observe changes to drop over log vane.
Road Improvement	-Minor modifications to the road adjacent to terrace slope to direct run-off towards areas that would not affect the terrace slope -7 coir wattles installed to slow overland flow between the road and terrace slope	-Observe erosion on face of slope, integrity of wattles and water bars and assess maintenance needs
Seeding of Fill Disposal Areas	-0.25 acres of placed fill seeded per permit requirements -No mulch was placed on fill surfaces	-Observe germination of seeded species (canopy cover), colonization by noxious weeds and assess potential maintenance needs