

**MIDDLE FORK OF THE WHITE RIVER, MAIYUK, KLOOKUH, AND WINDERMERE  
CREEKS – ROUTINE MONITORING NEAR CANAL FLATS, BRITISH COLUMBIA**

Prepared for:

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Prepared by:

**Applied Aquatic Research Ltd.**  
Calgary, Alberta

March 2001  
File: AAR00-4

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## EXECUTIVE SUMMARY

Applied Aquatic Research Ltd. (AAR) was retained by Slocan Forest Products Ltd. (SFP) to assess the Interior Reforestation Co. (IR) Routine Monitoring Report (IR 1999) and complete routine (Level 1) monitoring for restoration prescriptions within the Middle Fork of the White River (Middle Fork) and Maiyuk, Klookuh, and Windermere Creek watersheds. Restoration prescriptions were developed in the subject watersheds based on completion of Overview Fish Habitat Assessment Procedures (FHAP), Level 1 FHAP's, and/or Level 2 FHAP's according to Resources Inventory Committee (RIC) standards. Restoration prescriptions were constructed during August of 1998 in the Middle Fork, Klookuh and Windermere Creek watersheds. Additional restoration prescriptions were constructed in August 1999 in the Maiyuk and Windermere Creek watersheds.

Objectives of the review undertaken by AAR staff were to:

- Identify maintenance priorities for restoration works implemented on behalf of SFP in the subject watersheds;
- Complete routine monitoring on structures not completed by IR in the fall of 1999; and
- Provide recommendations for additional maintenance for existing structures in the above watersheds.

A total of five structures were examined in the Klookuh Creek Watershed. Minor maintenance (re-seeding, removing frayed cables) is recommended at sites KK-01 and KK-05. The site on Maiyuk Creek (MY-01) also requires minor maintenance, which includes removal of loose cable ends, attachment of loose cable. Similarly two sites on the Middle Fork (MF-02, MF-05) have loose cables that should be tightened and/or re-attached. Site MF-06 was not completely restored and additional restoration works are required at this site. One site in the Windermere Creek requires structural maintenance that includes the placement of additional riprap-sized stone. Additional work in the Windermere Creek Watershed includes monitoring/replacing vegetation growth in the spring of 2001. The recommendations provided in this report should be reviewed in the field with MoELP staff prior to undertaking additional works.

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## 1.0 INTRODUCTION

Applied Aquatic Research Limited (AAR) was retained by Slocan Forest Products Ltd. (SFP) to review monitoring recommendations developed by Interior Reforestation Co. Ltd. (IR) in the fall of 1999 for the Middle Fork of the White River (Middle Fork) and Maiyuk, Klookuh, and Windermere creeks. In addition, AAR was to assess maintenance requirements for stream restoration prescriptions in the above watersheds.

Watersheds within the study area support regionally important sport fisheries. Adfluvial bull trout are found within the White River Watershed including the Middle Fork and Maiyuk Creek (Baxter 1997; Oliver 1998). Bull trout are found in Windermere Creek; however, their distribution is limited to the lower portion of the watershed (AGRA 1998a). A concrete dam on Windermere Creek 1 km upstream from Highway 93/95 is a barrier to fish passage further upstream. The Middle Fork and Klookuh, Maiyuk, and Windermere creeks also support resident populations of westslope cutthroat trout (*Oncorhynchus clarki*). Adult kokanee (*O. nerka*) spawn in the lower portion of Windermere Creek, from the concrete barrier on the Scandia property, downstream to the mouth.

### 1.1 Study Area

The Middle Fork, Maiyuk and Klookuh creeks are tributaries to the White River, which in turn, flows into the Kootenay River. The Middle Fork originates in the Front Range of the Rocky Mountains, while Maiyuk and Klookuh creeks originate in the Park Range of the Rockies. The White River Watershed is mapped on 1:50,000 NTS maps 082J/03 and 082J/06 (Figure 1). Access to restoration sites MF-01 to MF-05 (Middle Fork) and KK01-05 (Klookuh Creek) is along the Middle Fork-White River Forest Service Road (FSR), between kilometer 54 and kilometer 61. The restoration site on Maiyuk Creek (MY-01) is reached using the "Branch A" Road at kilometer 1. Restoration prescriptions in the watershed are all located on Crown land (Province of British Columbia).

Windermere Creek originates in the Stanford Range of the Rockies, and flows west toward the community of Windermere, where it empties into Windermere Lake. The Windermere Creek Watershed is mapped on 1:50,000 NTS maps 082J/05 and 082J/12 (Figure 2). The Dell Road provides access to restoration prescription sites on Windermere Creek in the community of Windermere, Highway 93/95 near the Windermere Creek crossing, and from the Westroc Mines road (accessed from the Windermere Loop Road). Restoration sites in the Windermere Creek Watershed are found both on Crown land (Province of British Columbia) and on private land.

### 1.2 Background

Restoration prescriptions developed by Baxter *et. al.*, 1997 were constructed in the summer of 1998 for the Middle Fork (Oliver, 1998). Restoration prescriptions were developed for Klookuh



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Creek by the Ministry of Environment, Lands and Parks (MELP) in Nelson, and constructed in August 1998. Additional restoration prescriptions were developed for Maiyuk Creek by IR and constructed by G.G. Oliver and Associates (Oliver, 1999). Restoration Prescriptions for the Windermere Creek Watershed were developed by AGRA Earth & Environmental Limited (AEE) in 1997, and constructed in 1998 (AEE1998b, c) and 1999 (AEE 1999a, b).

Restoration prescriptions were developed in the subject watersheds based on completion of Overview Fish Habitat Assessment Procedures (FHAP), Level 1 FHAP's, and/or Level 2 FHAP's according to Resources Inventory Committee (RIC) standards. Restoration prescriptions were constructed during August of 1998 in the Middle Fork, Klookuh and Windermere Creek watersheds. Additional restoration prescriptions were constructed in August 1999 in the Maiyuk and Windermere Creek watersheds. Interior Reforestation Co. (IR) completed Level 1 routine monitoring in the fall of 1999 (reported by Wright 2000) for the following restoration sites:

- Middle Fork: MF-01, MF-02, MF-03, MF-04, and MF-05;
- Klookuh Creek – KK-01, KK-02, KK-03, KK-04, and KK-05;
- Maiyuk Creek: MY-01; and
- Windermere Creek: P-2B, P-3A, P-9C, P11-D, P12-A, P15-A, P15-B; and P17-A.

SFP requested that AAR review monitoring recommendations for the above prescription sites to assign priority to required maintenance measures, because initial recommendations for maintenance were higher than available funding for this fiscal year (2000/2001). Additional monitoring was also completed at the following sites on Windermere Creek and the Middle Fork:

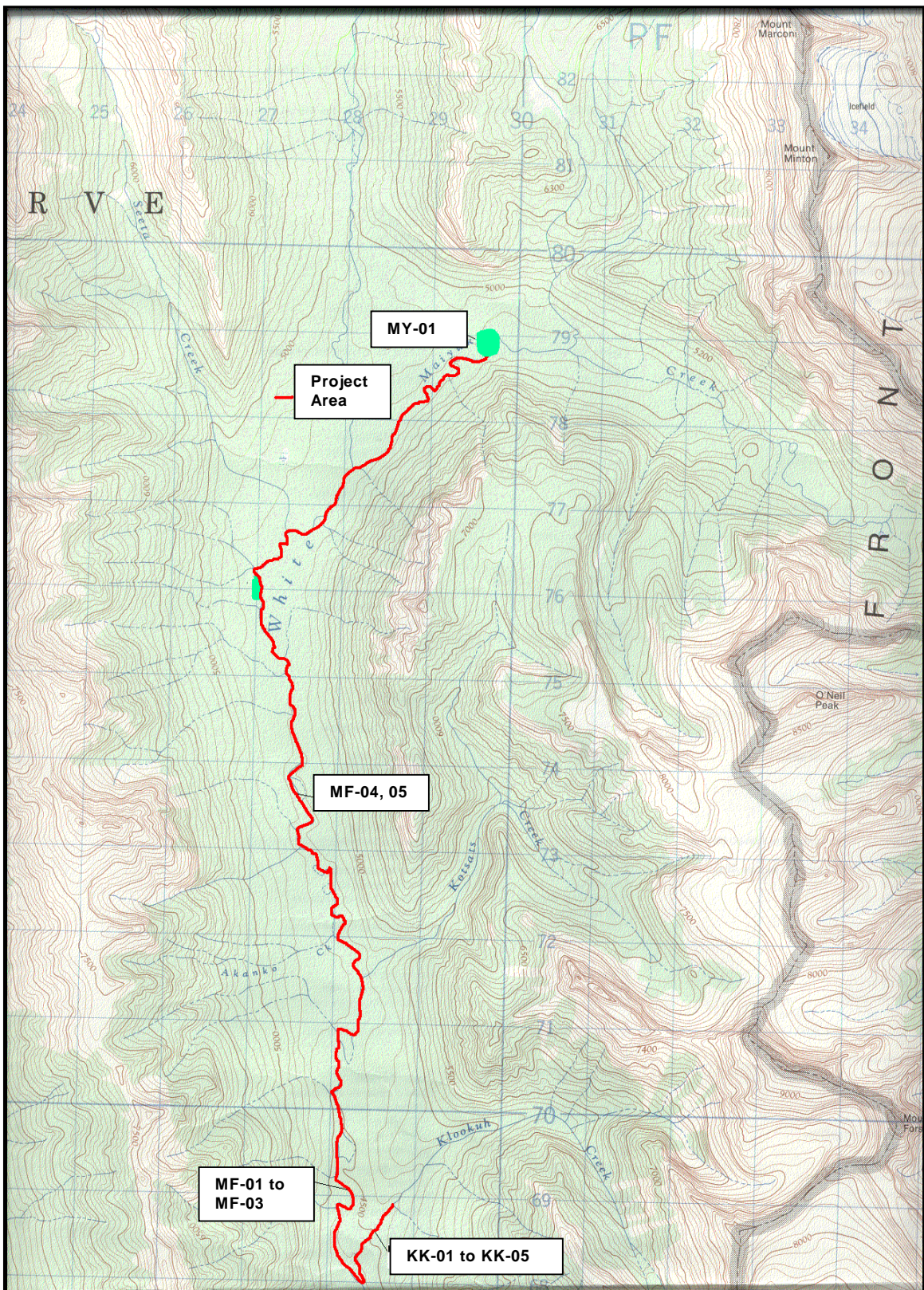
- P11-A, P11-B, P11-C, P12-B, and P12-C
- And MF-06 (steep bank, tree revetment).

Maintenance work at sites identified in the various watersheds would be completed in this fiscal year (2000/2001) and next fiscal year (2002/2003) as funding permits through the Watershed Restoration Program (WRP) and Forest Renewal BC (FRBC).

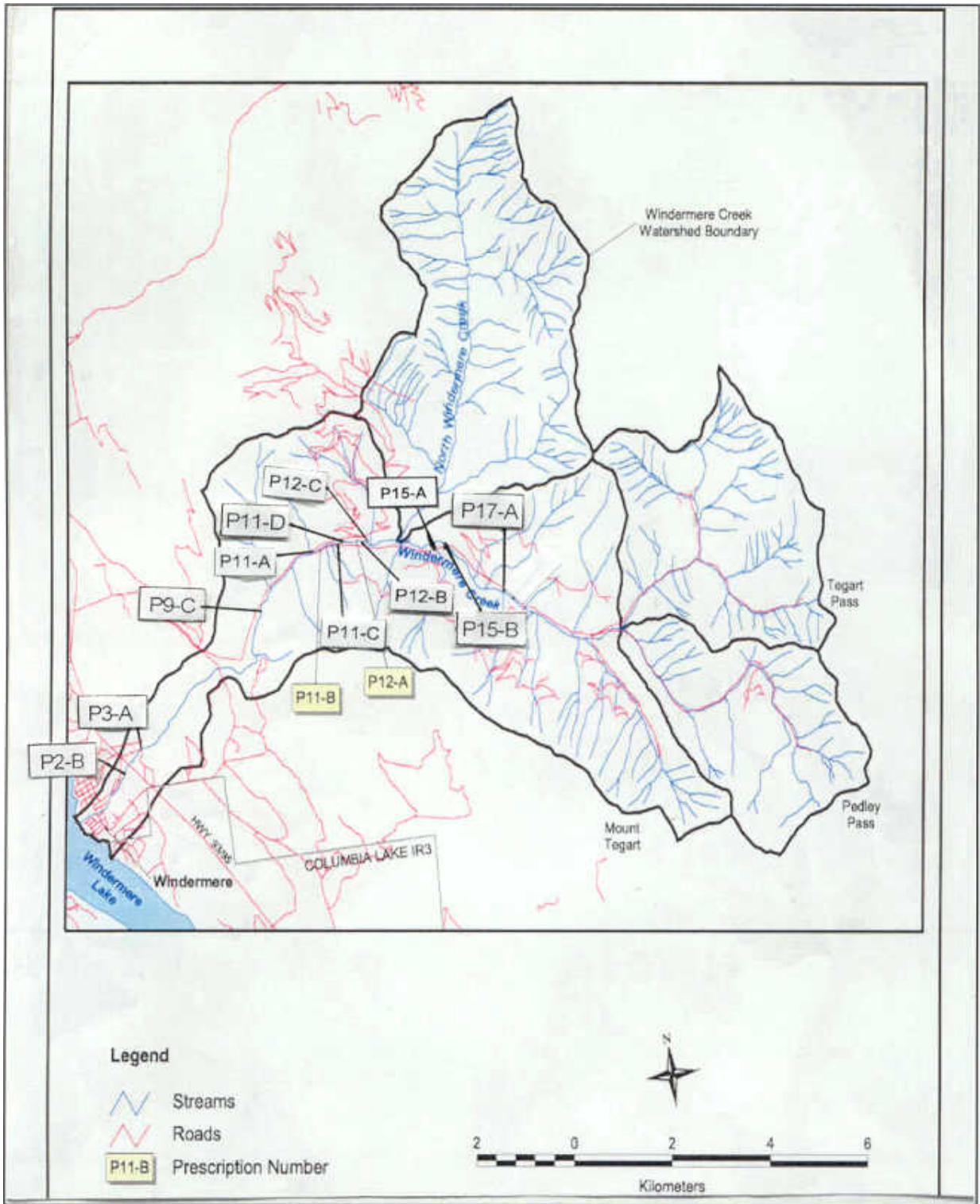
### **1.3 Objectives**

Objectives of the review undertaken by AAR staff were to:

- Identify maintenance priorities for restoration works implemented on behalf of SFP in the subject watersheds;
- Complete routine monitoring on structures not completed by IR in the fall of 1999; and
- Provide recommendations for additional maintenance for existing structures in the above watersheds.



**Figure 1**  
**Location of Monitoring Sites for Restoration Prescriptions in the**  
**Middle Fork of the White River Watershed (NTS)**



**Figure 2**  
**Location of the Windermere Creek Watershed**  
 (Source: AGRA Earth & Environmental Limited 1999b)

**Figure 2**  
**Location of the Windermere Creek Watershed**

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## 2.0 METHODS

Before completion of field surveys, AAR staff reviewed existing reports prepared in support of the completed restoration prescriptions (Baxter 1997, Oliver 1998 and 1999, AEE 1998a, b, c, 1999a and b). The routine monitoring report prepared by Wright (2000) was used as a starting point to review present maintenance requirements. Referencing of prescription sites follows that identified by Wright (2000) for consistency. Following review of existing information and reports, Jon Bisset (AAR, RP. Bio) and Jim King (SFP) completed a field survey of the restoration prescriptions on July 22, 2000. Mr. Bisset completed field surveys in the Windermere Creek watershed in early June.

Photographs documenting riverine habitat were taken at each of the sites identified in section 1.1, with the exception of the Windermere Creek Watershed. Prescriptions had not changed significantly since the report by Wright (2000). As described in the Standards Agreement (SA) additional photos were therefore not required. The reader is referred to previous reports (Wright 2000, AEE 1998a, b, c, 1999a, and b) to review photos from the Windermere Creek Watershed. The site visit and discussions with SFP and MELP staff were used to develop maintenance recommendations for each of the sites. Because of the short time frame for prescription development and limited budget, prescription and reporting procedures have been simplified. Detailed site descriptions were provided in previous background reports, and are not repeated here. The results of the site visit(s) and discussions are presented in this report. All streambank references (left bank, right bank) are identified based on a downstream view of the channel according to existing Channel Assessment Procedure (CAP) standards. The recommendations presented in the following section have been developed according to current RIC WRP standards and procedures.

## 3.0 RESULTS

### KLOOKUH CREEK

All station references indicated for restoration sites on Klookuh Creek are referenced from the FSR and bridge crossing. The station measurements are oriented downstream from the bridge crossing. The prescriptions constructed in Klookuh are atypical structures in comparison to those currently being constructed (i.e. triangular logjams, single and multiple LWD structures). Ballasting calculations are not appropriate for these types of structures and have not been used (D'Aoust and Millar 1999).

#### **Site KK-01, Station 0+075**

##### **Description and Recommended Maintenance**

The prescription constructed at this site was a tree revetment. Representative photographs are provided in Plates 1 and 2. The pool next to this site is 49 cm deep. The previous monitoring report identified that riprap used did not meet the design specification; however, the structure

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has experienced a second freshet and remains stable. No structural maintenance is required at this time. Recommended maintenance at this site includes removal of the erosion control mat and addition of native grass seed mix to establish vegetative cover.

**Site KK-02, Station 0+108**

**Description and Recommended Maintenance**

Representative photographs are provided in Plate 3. The pool next to this prescription site was 45 cm deep during the field visit, and its depth has increased slightly compared to that recorded previously. It may take a larger flow event (i.e. 1-in-5 or 1-in-10 year) to change pool depth at this site significantly, because of the large substrates present. No additional maintenance is required at this site.

**Site KK-03, Station 0+131**

**Description and Recommended Maintenance**

The sediment wedge reported by Wright (2000) has not increased in size. Representative photographs are provided in Plates 4, 5 and 6. Pool depth downstream of the structure was 40 cm. No new barriers have formed, and the placement of the LWD structure has not compromised bank integrity. No maintenance is presently required at this site.

**Site KK-04, Station 0+162**

**Description and Recommended Maintenance**

The restoration prescription constructed at this site was a tree revetment to stabilize an eroding bank. Representative photographs are provided in Plates 7 and 8. As described in the previous report (Wright 2000) no maintenance is presently required. The footer logs at the base of the tree revetment and root wad will minimize the risk of the structure being undermined.

**Site KK-05, Station 0+187**

**Description and Recommended Maintenance**

The prescription at this location consisted of a combination of bank revetment, slope re-contouring and LWD placement. Representative photographs are provided in Plates 9 and 10. The pool adjacent to the restoration prescription was 36 cm deep along the left bank. Some larches have been planted along the top of bank. No additional riprap is required along the toe of the slope. Recommended maintenance at this site includes planting of willows along the toe of the slope- note there is abundant source material on site.

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## **MAYUIK CREEK**

### **Site MY-01, Station 0+000**

#### **Description and Recommended Maintenance**

The restoration prescription at this site consists of a bankside logjam and tree revetment approximately 35 m long constructed in August 1999. (Plates 11 to 22). The upstream end of structure is well protected with lots of rock at its upstream end. There is a section of cable at the upstream end of the site that has about 8" of play and needs to be tightened. The footer logs throughout the length of the structure average 60 cm in diameter. There is a loose log 5 m long with its stump attached under an overhanging spruce that is also under ballasted (Plate 12). The log should be cabled in series with the existing rock and adjacent structures. Also, some cables have frayed ends that should be cut off and braided neatly. There is some evidence of slumping along the top of bank in the middle of the structure, and a fracture line has formed. It is anticipated that this material will slump onto woody debris at the rear of the logjam, and a stable angle of repose will form at the bank's edge. The area slumping should be monitored and planted with willows once the bank has stabilized.

Overall the physical and biological objectives appear to be met fully, and the structure is rated well. The pool at the downstream end of the structure is 1.5 to 2.0 m deep and provides excellent cover for resident adult salmonids. The structure is situated appropriately and well keyed to the bank. The structural components are keyed to the footer logs in series, which is important in maintaining the integrity of the entire structure. The structure has only experienced one freshet event; however, none of the components appear to have shifted. Maintenance required includes removing frayed cable ends and attaching one loose cable, which are considered relatively minor.

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## **MIDDLE FORK of the WHITE RIVER**

As noted by Wright (2000), some of the structures in the Middle Fork may be under ballasted based on factors of safety of 1.5 to 2.0. It should be noted that deadman techniques (railway ties) used at each of the sites below are not accounted for in the ballasting calculations. In addition, ballasting calculations are based on single and multiple (2-3 log) structures; however, in each of the prescriptions, logs and ballast components are all connected together in series. It is difficult to account for this component in the ballast calculations. However this also provides added strength to the overall structure. The deadman techniques and cabling in series may compensate somewhat for the ballasting requirements. Each of the structures has experienced two freshet events, with little sign of movement.

### **Site MF-01, Station 0+000, Reach 5**

#### **Description and Recommended Maintenance**

Representative photographs are provided in Plates 23 to 26. The restoration prescription at this site was a lateral triangular logjam. The structure is stable and has not shifted. Rock >1.5 m has been used for ballast. No maintenance is required at this site.

### **Site MF-02, Station 0+086, Reach 5**

#### **Description and Recommended Maintenance**

The restoration prescription at this site was a lateral triangular logjam (Plates 27 and 28). There is a loose log (no cables attached) on the upstream side of the structure, which should be attached. There are several loose cables (Jim holding cable end – Plate 29), which should be tightened or removed. Components of the structure may porpoise during freshet and weaken cables. The amount of slack/play in the cables should be monitored.

### **Site MF-03, Station 0+173, Reach 5**

#### **Description and Recommended Maintenance**

The restoration prescription constructed at this site was a triangular logjam (Plates 30 and 31). There are loose cables in the structure, although it may be difficult to tighten them given their location. Components of the structure are connected in series, which reduces the risk of an individual component swinging free because of a loose cable. Cables may tighten as the structure settles over time, and should be monitored occasionally (every 2-3 years). No additional maintenance is required.

### **Site MF-04, Station 0+000, Reach 7**

#### **Description and Recommended Maintenance**

A lateral logjam was constructed at this site (Plates 32 and 33). All components appear to be attached and connected (poor site conditions may have restricted visibility during completion of the fall 1999 monitoring). There is a log extending into the stream which previous reports recommended for removal; however, the log is providing instream cover and does not appear to be affecting the integrity of the structure. The log extending downstream should be left intact. No additional maintenance is required.

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**Site MF-05, Station 0+220, Reach 7****Description and Recommended Maintenance**

The restoration prescription at this site is a lateral triangular logjam (Plates 34 and 35). Maintenance requirements at this site include tightening loose cables and attaching loose components. No additional ballast needs to be added at this time.

**Site MF-06, Station 0+220, Reach 7****Description and Recommended Maintenance**

The restoration prescription initially proposed at this site consisted of a tree revetment at the toe of the slope, along with woody debris placed on the slope face. The initial design for the restoration prescription was modified because of safety concerns for hoe operation at the top of the slope (Oliver 1999). The logjam initially proposed was not constructed, and was replaced with boulders placed at the toe of the slope to dissipate energy (Plates 46 to 50). The hill slope was planted with immature shrubs to establish rooted vegetation. The upper section of the slope was re-contoured to a more stable angle (Oliver 1999, Plate 14).

Maintenance requirements at this site include monitoring of vegetation and replanting as required. The steepness of the slope and soil composition makes it difficult to effectively stabilize the slope without extensive disturbance along the slope. This approach would also be extremely costly, and may not be cost effective. The logjam and deflector constructed upstream of this site appear to have reduced the near bank velocity somewhat, relieving some of the erosive forces at the toe of the slope. A collection trench at the top of the slope should be excavated in combination with the placement of live fascines along the top of the slope. This would redirect surface drainage away from the slope and may reduce surface erosion on the hill face. Efforts to re-establish vegetative cover (conifer plantings, bioengineering) should also continue.



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## WINDERMERE CREEK

### 1998 Restoration Sites

#### Site P2-B, Reach 2, Station 815

##### Description and Recommended Maintenance

The restoration prescription at this site was a combination of debris removal and LWD placement along the bank. Recommended maintenance at this site includes removal of loose/excess cable. No additional maintenance is required.

#### Site P3-A, Reach 3, Station 150

##### Description and Recommended Maintenance

The restoration prescription at this site was a series of two V-log weirs. Some undermining of the lower V-log weir structure on the south side has occurred; however, the structural integrity remains sound. The channel is continuing to adjust. Although no additional maintenance is required, the channel should be monitored to see if continued down-cutting occurs which might threaten structure integrity. The channel should start to aggrade naturally once a stable dynamic equilibrium is reached. If maintenance is required, the placement of fill is **not recommended**. Once a stable channel profile is reached, the V-log weir can be lowered to the correct invert of the channel.

#### Site P9-C, Reach 9, Station 700-710

##### Description and Recommended Maintenance

The restoration prescription at this site consisted of a tree revetment. Scouring at the toe of the bank has resulted in slumping along the upper banks. Although gaps are present in the existing structure, rootwads remain stable and intact. The following maintenance recommendations are provided:

1. The existing concrete barriers should be moved to the side, and the top surface of the road should be excavated back, to the level of the existing logs and rootwads;
2. The existing footer logs and rootwads should be left in place, undisturbed. Large rip-rap should be placed on top of the logs and rootwads, to fill in gaps created by the washout, to a depth of 600 mm;
3. A layer of large washed (clear) bedding gravel 300 mm thick should be placed ovetop of the large rip-rap;
4. Native material removed in step 1 can be placed on top of the bedding gravel, and the slope graded to 2:1;
5. A layer of topsoil should be placed on top of the slope, and seeded with a native seed mix; and
6. Willow and dogwood cuttings should be planted along the slope in the spring of 2001. Survival of the grass seed mix and cuttings should be monitored, and replaced as required.

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**Site P11-D, Reach 11, Station 960-980****Description and Recommended Maintenance**

The restoration prescription at this site consisted of a tree revetment and riprap at the upstream end of the structure. The thalweg moves away from the bank at the downstream end of the structure, and slumping at the downstream end is not considered significant. The integrity of the structure is not presently at risk. No maintenance is required.

**Site P12-A, Reach 12, Station 0-100****Description and Recommended Maintenance**

The restoration prescription constructed here was a series of large boulders placed along the toe of the eroding bank (August 1998), for 100 m. Additional boulder clusters were placed at the toe of the slope, for an additional 70 m upstream, in August of 1999 by AEE (AEE 1999c). Dogwood and willow cuttings were also planted in the spring of 1999 by SFP staff. The slope is stabilizing and the channel has shifted away from the toe of the slope. No maintenance is required at this time. The cuttings (dogwood and willow) should be monitored for survival, and supplemented as required.

**Site P15-B, Reach 15, Station 180****Description and Recommended Maintenance**

The prescription at this site consisted of a collection drain and culvert to redirect flows from the roadside ditch into Windermere Creek. The drain and culvert are in good condition, and no maintenance is required at this site.

**Site P17-A, Reach 17, Station 490-520****Description and Recommended Maintenance**

The prescription constructed at this site was a log wall terrace along the base of the eroding slope. Vegetation has become established on the slope and the structure remains as constructed. No maintenance is required at this site.

**1999 Restoration Sites**

Restoration prescriptions were constructed at the following sites in August 1999 and have only experienced one bankfull event. Routine monitoring should be completed at sites constructed in 1999 following several bankfull (channel forming) flows. The structures as completed appear to be stable and functioning well.

**Site P11-A, Reach 11, Station 45****Description and Recommended Maintenance**

The restoration prescription at this site consisted of removal of a debris jam and re-orientation of LWD, which was completed in August 1999. The new channel and thalweg continue to adjust and downcutting may occur following future freshet events. The channel and adjacent banks appear stable at present. No maintenance is required at this time. Vegetation growth and survival should be monitored as part of other activities, and additional seeding and planting considered as opportunities arise.

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**Site P11-B, Reach 11, Station 340-360****Description and Recommended Maintenance**

The restoration prescription at this site consisted of the removal of a debris jam and reorientation of LWD, which was completed in August 1999. As indicated for the previous prescription, no maintenance is required at this time. Monitoring requirements are similar to those indicated for the previous site.

**Site P11-C, Reach 11, Station 850****Description and Recommended Maintenance**

The restoration prescription at this site is a V-log weir and sediment pond, which was constructed in August 1999. The V-log weir appears stable and the pond is collecting sediment. Aquatic vegetation has become established in the outlet channel. No maintenance is required at this structure. The depth of sediment in the pond should be monitored, and sediment removed during the August instream window as required. Westroc Mines were partners in completing this structure and are aware of the maintenance requirements. An access point for maintenance was constructed on the downstream side of this structure.

**Site P12-B, Reach 12, Station 170-230****Description and Recommended Maintenance**

The restoration prescription at this site is a tree revetment, which was constructed in August 1999. The adjacent bank was also re-contoured to a more stable slope. The structure and bank are stable with little evidence of movement. A series of pools and pockets are forming along the front face of the structure, which will provide added instream cover. No maintenance is required at this site. If SFP is planning additional spring plantings in the Windermere Creek Watershed, this site should also be considered.

**Site P12-C, Reach 12, Station 270-300****Description and Recommended Maintenance**

The restoration prescription at this site is a tree revetment that was constructed in August 1999. Marginal pools are forming along the front face of the structure, which will provide added instream cover for adult fish. The structure is stable and does not appear to have moved or shifted. No maintenance is required at this time.

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## **4.0 RECOMMENDATIONS**

The proposed maintenance requirements, cost estimates and schedule are provided in Table 1. The bioengineering component of maintenance activities was completed by Slocan staff in both the Windermere Creek and Middle Fork of the White River watersheds in the year 2000. Bioengineering works were completed in the Windermere Creek Watershed from May 16-19, 2000. Bioengineering activities were completed in the Middle Fork of the White River Watershed between October 23 and October 26, 2000. A description of the bioengineering activities is provided in Appendix B.

**Table 1**  
**Proposed Maintenance Works and Construction Schedule for the White River**  
**and Windermere Creek Watersheds**

<b>Watershed</b>	<b>Prescription Site Number</b>	<b>Maintenance Requirements</b>	<b>Construction Period</b>	<b>Personnel, Equipment Requirements</b>	<b>Estimated Cost<sup>1</sup> for Restoration Works</b>
<i>Klookuh Creek</i>	KK-01	Remove terra mat, add native seed mix to slope surface;	Completed October 2000	3 person crew (Slocan)	\$1,079 <sup>2</sup>
	KK-02, 03, 04	No maintenance required;		None	
	KK-05	Plant additional willows; no structural maintenance required	Completed October 2000	3 person crew (Slocan)	
<i>Maiyuk Creek</i>	MY-01	Remove frayed cable ends, attach loose cable	Fall 2000, spring 2001	2 person crew	\$1,500
<i>Middle Fork</i>	MF-01, MF-03, MF-04	No maintenance required;		None	
	MF-02, MF-05	Attach/tighten loose cables	Fall 2000, spring 2001	2 person crew	
	MF-06	Construct a drainage collection trench, place fascines, plant conifers, bioengineering	Summer 2000	Excavator, professional supervision, 1 crew member, 2 days	\$3,000
<i>Windermere Creek – 1998 structures</i>	P2-B, P3-A, P11-D, P12-A, P15-A, P15-B, P17-A	No maintenance required		None	0
	P9-C	Maintenance required to stabilize structure and prevent further slumping	Summer 2001	Excavator, riprap, construction supervision (biologist/engineer)	\$3,000
<i>Windermere Creek – 1999 structures</i>	P11-A, P11-B, P11-C, P12-B, P12-C	No maintenance required. Continue monitoring vegetation growth, supplement plantings as required.	Spring/fall 2001-2002 as funding permits	2 person crew, 1 day	\$1,000
Construction Supervision, Report Preparation			Construction Supervision, Report preparation (Biologist/Engineer)	\$ 3,000	

- Notes:
1. Cost Estimates are rough estimates based on costs for works previously constructed, and are provided for budget purposes only. Detailed cost estimates will be required prior to initiation of restoration works.
  2. Cost provided for works completed in fall 2000.

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## 5.0 REFERENCES

- AGRA Earth & Environmental Limited. 1998a. Windermere Creek Channel Condition and Prescription Assessment and Level 1 Fish Habitat Assessment. Prepared for Slocan Forest Products Ltd. *Radium Division*. Prepared by AGRA Earth & Environmental Limited, Calgary. 54pp. + app.
- AGRA Earth & Environmental Limited. 1998b. Detailed Design of Fish Habitat Rehabilitation and Stream Channel Restoration Prescriptions. Prepared for Slocan Forest Products Ltd. – *Radium Division*. Prepared by AGRA Earth & Environmental Limited, Calgary, Alberta. 8pp. + app.
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- Baxter, J.S., K.F. Sigurdson and G.G. Oliver. 1998. Level 1 Fish Habitat Assessment within the upper White River (Middle Fork) Watershed. Prepared for Slocan Forest Products Ltd. – *Radium Division*. Prepared by Interior Reforestation Co. Ltd. 57pp. + app.
- D’Aoust, S.G. and R.G. Millar. 1999. Large Woody Debris Fish Habitat Structure Performance and Ballasting Requirements. Province of British Columbia, Ministry of Environment, Lands and Parks and Ministry of Forests. Watershed Restoration Management Report No. 8: 119 pp.
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- Slaney, P.A. and D. Zaldokas (eds.). 1997. Fish Habitat Rehabilitation Procedures. Watershed Restoration Technical Circular No. 9. Watershed Restoration Program, Ministry of Environment, Lands and Parks, and Ministry of Forests. 281pp. + app.
- Wright, J. and L. Amos. 2000. 1999 Watershed Restoration Program Monitoring for the Middle Fork of the White River and Windermere Creek Watersheds. Prepared for Slocan Forest Products Ltd.-*Radium Division*. Prepared by Interior Reforestation Co. Ltd. 17pp. + app.

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**APPENDIX A**  
**PHOTO PLATES**





Plate 1 View downstream at Site KK-001, Klookuh Creek. Jim King as scale (July 22, 2000).



Plate 2 View downstream at site KK-01, Klookuh Creek. Jim King as scale (July 22, 2000).



Plate 3 View across stream channel at tree revetment; site KK-02, Klookuh Creek (July 22, 2000). Jim King as scale



Plate 4 View downstream at tree revetment; site KK-03, Klookuh Creek (July 22, 2000).



Plate 5 View across channel from right bank (looking downstream); site KK-03, Klookuh Creek (July 22, 2000). Flagging tape as scale.



Plate 6 View downstream at site KK-03, Klookuh Creek (July 22, 2000).



Plate 7 View across channel at site KK-04, Klookuh Creek (July 22, 2000). Jim King as scale.



Plate 8 View across and downstream at tree revetment; site KK-04, Klookuh Creek (July 22, 2000).



Plate 9 View upstream at site KK-05, Klookuh Creek (July 22, 2000). Tree revetment is located in left of photo (right downstream bank).



Plate 10 View across and downstream at pool formation; site KK-05, Klookuh Creek (July 22, 2000).



Plate 11 View downstream at lower end of structure MY-01, Mayuik Creek (July 22, 2000).



Plate 12 View upstream from lower end of site MY-01, Mayuik Creek (July 22, 2000). Note fracture line along top-of-bank and associated slumping.



Plate 13 View upstream from lower end of site MY-01, Mayuik Creek (July 22, 2000).



Plate 14 View upstream from lower end of structure; site MY-01, Mayuik Creek (July 22, 2000). Jim King as scale.



Plate 15 View upstream along lower section of structure; site MY-01, Mayuik Creek (July 22, 2000).



Plate 16 View upstream along upper section of structure; site MY-01, Mayuik Creek (July 22, 2000).





Plate 17 View downstream from upper end of structure; site MY-01, Mayuik Creek (July 22, 2000). Jim King as scale.



Plate 18 View of boulders used for ballast, upstream end of structure. Site MY-01, Mayuik Creek (July 22, 2000).



Plate 19 View of typical fence post anchoring used throughout structure, site MY-01, Mayuik Creek (July 22, 2000).



Plate 20 View upstream along upper end of structure; site MY-01, Mayuik Creek (July 22, 2000). Note eddy area in right of photo. The eddy should provide good adult rearing habitat.



Plate 21 View of typical rebar pin used to secure spruce logs, site MY-01, Mayuik Creek (July 22, 2000).



Plate 22 View of channel upstream from structure; site MY-01, Mayuik Creek (July 22, 2000). Jim King as scale.



Plate 23 View upstream at triangular logjam; site MF-01, Middle Fork of the White River (July 22, 2000).



Plate 24 View downstream at triangular logjam; site MF-01, Middle Fork of the White River (July 22, 2000).



Plate 25 View downstream of sediment wedge formed at tip of triangular logjam; site MF-01, Middle Fork of the White River (July 22, 2000).



Plate 26 View toward centre of channel showing ballast rock, triangular logjam MF-01, Middle Fork of the White River (July 22, 2000).



Plate 27 View upstream at triangular logjam; site MF-02, Middle Fork of the White River (July 22, 2000).



Plate 28 View downstream at triangular log jam, site MF-02, Middle Fork of the White River (July 22, 2000)



Plate 29 Jim King holding loose cable end at triangular log jam, site MF-02, Middle Fork of the White River (July 22, 2000).



Plate 30 View upstream at triangular log jam, site MF-03, Middle Fork of the White River (July 22, 2000)



Plate 31 View downstream at triangular logjam; site MF-03, Middle Fork of the White River (July 22, 2000).



Plate 32 View upstream at triangular logjam; site MF-04, Middle Fork of the White River (July 22, 2000).





Plate 33 View downstream at triangular logjam; site MF-04, Middle Fork of the White River (July 22, 2000).



Plate 34 View across triangular log jam, site MF-05, Middle Fork of the White River (July 22, 2000)



Plate 35 View downstream at triangular log jam, site MF-05, Middle Fork of the White River k (July 22, 2000)



Plate 36 Live stakes planted along bank, Maiyuk Creek (October 23-26, 2000). Note white tops of stakes.



Plate 37 Live stakes planted along bank, Maiyuk Creek (October 23-26, 2000). Note white tops of stakes.



Plate 38 Live stakes planted along bank slope, Middle Fork of the White River (October 23-26, 2000). Note white tops of stakes.



Plate 39 Live stakes planted along bank, Middle Fork of the White River (October 23-26, 2000). Note white tops of stakes.



Plate 40 Live stakes planted along bank, Klookuh Creek (October 23-26, 2000). Note white tops of stakes.



Plate 41 Live stakes planted along bank, Klookuh Creek (October 23-26, 2000). Note white tops of stakes.



Plate 42 Live stakes planted along bank, Klookuh Creek (October 23-26, 2000). Note white tops of stakes.



Plate 43 Live stakes planted along bank, Klookuh Creek (October 23-26, 2000). Note white tops of stakes.



Plate 44 Live stakes planted along bank, Klookuh Creek (October 23-26, 2000). Note white tops of stakes.



Plate 45 Live stakes planted along bank, Klookuh Creek (October 23-26, 2000). Note white tops of stakes.



Plate 46 View upstream from top of steep bank, MF-06, Middle Fork of the White River (July 22, 2000).



Plate 47 View downstream from upstream end; site MF-06, Middle Fork of the White River (July 22, 2000). Jim as scale.



Plate 48 View downstream from upstream end; site MF-06, Middle Fork of the White River (July 22, 2000). Jim as scale.





Plate 49 View downstream from upstream end; site MF-06, Middle Fork of the White River (July 22, 2000). Jim as scale.

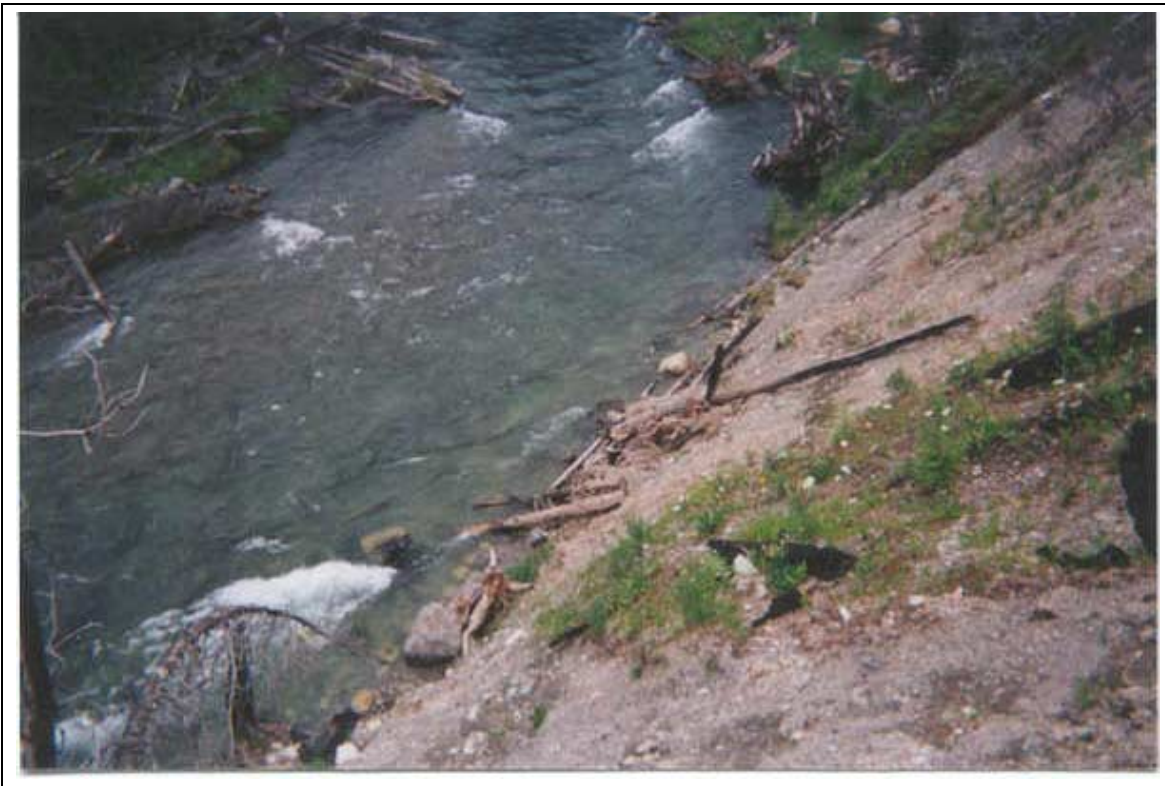


Plate 50 View upstream from top-of-bank, site MF-06, Middle Fork of the White River (July 22, 2000).

## APPENDIX B

### Summary of Bioengineering Works completed in the Middle Fork of the White River and Windermere Creek Watersheds

Bioengineering works were completed at several sites in the Middle Fork of the White River and Windermere Creek Watersheds during the period from October 23 – 26, 2000 according to guidelines provided by MoELP. Cuttings were obtained locally on October 23, 2000. The lower 60 percent of the cuttings (cut ends) were placed in tubs of water in preparation for planting between October 24 and 26, 2000. Cuttings ranged in length from 50-60 cm in length.

Prior to insertion of cuttings into the ground, a pilot hole was made using a piece of 16mm diameter rebar approximately 1m in length, driven into the ground with a small sledge hammer or an axe. Cuttings were then pushed into the ground by hand, leaving approximately 8-12cm exposed above ground. The top (exposed) 3-4cm was treated with a mixture of white latex paint and water (50:50 ratio). Cuttings consisted of a mixture of willow and red osier dogwood (75% willow, 25% dogwood). The site locations, number of cuttings, and photo plates are summarized in Table 2.

**Table 2**  
**Summary of Bioengineering Activities in the Middle Fork of the White River and**  
**Windermere Creek Watersheds– Year 2000**  
**(Source: Jim King, Slocan Forest Products)**

Site Number	Location	Number of Cuttings		Photo Plate
		Willow	Dogwood	
<b>Windermere Creek</b>				
P2B	The Dell	30	17	
P9C	Boy scout Camp	284		
P11D	1998 Roadside	30		
P12A	Blue Lake	181		
P17A	56 Board, sill log	50		
P15B	Culvert	40	20	
P15A	Bridge	60	20	
P12C	Berm	288		
P12B	Far Bank	80		
P11C	Sediment Pond	50		
	<b>Total:</b>	<b>1093</b>	<b>57</b>	
<b>Middle Fork – White River</b>				
Site 1	Maiyuk (99)	125		36, 37
Site 2	2 structures	0		
Site 3	Steep Bank (99), Branch A	137		38, 39
Site 4	3 structures	90		
Site 5	Klookuh Creek	85		40, 41, 42, 43, 44, 45, 46
	<b>Total:</b>	<b>437</b>		

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**APPENDIX C**

**Form 1 Restoration Works Summary**

### Form 1. Restoration Works Summary

Stream	Distance	ID #	Structure Type	Performance Objectives															As-Constructed Data			Comments										
				Physical										Biological					Material Quantities & Stream Plan View	Typical Structure X/S & Plan View	Detailed River Survey Drawings											
				Pool	Riffle	Substrate	Cover	Off-Channel Habitat	Fish Access	Nutrient	High Flow	Low Flow	Overall Rating	Erosion Control	Species	Life Stage	Overwinter	Rearing					Spawning	Incubation	Overall Rating							
Klookuh Creek	0+075	KK-01	Re-grade Bank, Rootwads, coir mat														WCT	All														
Klookuh Creek	0+108	KK-02	LWD /Revetment														WCT	All														
Klookuh Creek	0+131	KK-03	Logjam Removal														WCT	All														
Klookuh Creek	0+162	KK-04	Tree Revetment														WCT	All														
Klookuh Creek	0+187	KK-05	Debris removal														WCT	All														
Maiyuk Creek	0+000	MY-01	spurs/traverses														WCT	All														
Middle Fork White River	0+00, Reach 5	MF-01	Triangular log jam														BT, WCT	All														Detailed descriptions provided in Level 2 FHAP; Structure planform typical;
Middle Fork White River	0+086, Reach 5	MF-02	Triangular log jam														BT, WCT	All														Detailed descriptions provided in Level 2 FHAP; Structure planform typical;
Middle Fork White River	0+173, Reach 5	MF-03	Triangular log jam														BT, WCT	All														Detailed descriptions provided in Level 2 FHAP; Structure planform typical;
Middle Fork White River	0+00, Reach 7	MF-04	Triangular log jam														BT, WCT	All														Detailed descriptions provided in Level 2 FHAP; Structure planform typical;
Middle Fork White River	0+220, Reach 7	MF-05	Triangular log jam														BT, WCT	All														Detailed descriptions provided in Level 2 FHAP; Structure planform typical;
Middle Fork White River		MF-06	Stabilize Steep slope																													Detailed descriptions provided in Level 2 FHAP; Significant modifications from original prescription;
Windermere Creek	Stn 815, Reach 2	P2-B	Debris Removal/LWD placement														WCT, BT, KO, EB	All, All, Ad. All														Plan view and cross sections provided in AGRA prescriptions
Windermere Creek	Stn. 150, Reach 3	P3-A	V-log weirs														WCT, KO, BT	All, Ad. All														Plan view and cross sections provided in AGRA prescriptions
Windermere Creek	Stn. 700-710, Reach 9	P9-C	Tree Revetment														WCT	All														Plan view and cross sections provided in AGRA prescriptions

Form 1. Restoration Works Summary

Stream	Distance	ID #	Structure Type	Performance Objectives													As-Constructed Data			Comments												
				Physical										Biological			Material Quantities & Stream Plan View	Typical Structure X/S & Plan View	Detailed River Survey Drawings													
				Pool	Riffle	Substrate	Cover	Off-Channel Habitat	Fish Access	Nutrient	High Flow	Low Flow	Overall Rating	Erosion Control	Species	Life Stage					Overwinter	Rearing	Spawning	Incubation	Overall Rating							
Windermere Creek	Stn. 0-100, Reach 12	P12-A	Boulder clusters																			WCT	All									Plan view and cross sections provided in AGRA prescriptions
Windermere Creek		P15-A	Culvert removal																			WCT	All									Plan view and cross sections provided in AGRA prescriptions
Windermere Creek	Stn. 180, Reach 15	P15-B	Diversion culvert																			WCT	All									Plan view and cross sections provided in AGRA prescriptions
Windermere Creek	Stn. 490-520, Reach 17	P17-A	Log wall																			WCT	All									Plan view and cross sections provided in AGRA prescriptions
Windermere Creek	Stn. 45, Reach 11	P11-A	Debris removal																			WCT	All									Plan view and cross sections provided in AGRA prescriptions 1999
Windermere Creek	Stn. 340-360, Reach 11	P11-B	Debris removal																			WCT	All									Plan view and cross sections provided in AGRA prescriptions 1999
Windermere Creek	Stn. 850, Reach 11	P11-C	V-log weir/sediment pond																			WCT	All									Plan view and cross sections provided in AGRA prescriptions 1999
Windermere Creek	Stn. 170-230, Reach 12	P12-B	Tree Revetment																			WCT	All									Plan view and cross sections provided in AGRA prescriptions 1999
Windermere Creek	Stn. 270-300, Reach 12	P12-C	Tree Revetment																			WCT	All									Plan view and cross sections provided in AGRA prescriptions 1999

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**APPENDIX D**

**Form 2 Routine Monitoring (Level 1)**

**Form 2. Routine Monitoring (Level 1)**

Stream	Distance	ID #	Structure Type	Performance Objectives																	Comments				
				Physical							Biological														
				Pool	Riffle	Substrate	Cover	Off-Channel Habitat	Fish Access	Nutrients	High Flow	Low Flow	Overall Rating	Species	Life Stage	Overwinter	Rearing	Spawning	Incubation	Overall Rating		Structural Condition	Structural Stability	Maintenance Recommendation	
Klookuh Creek	0+075	KK-01	Re-grade Bank, Rootwads, coir mat								3	2	WCT	All					2	3	3	4	Structure remains stable following second freshet; No maintenance required at this time		
Klookuh Creek	0+108	KK-02	LWD /Revetment	3			3				4	3	WCT	All			3	3		3	4	4	4	Pool depth has increased slightly; no maintenance required	
Klookuh Creek	0+131	KK-03	Logjam Removal						4		4	4	WCT	All			2	4		4	4	4	3	No maintenance required	
Klookuh Creek	0+162	KK-04	Tree Revetment	2			2				3	2	WCT	All			2	2		2	4	3	3	No maintenance required	
Klookuh Creek	0+187	KK-05	Debris removal								3	3	WCT	All			2	2		2	3	4	3	Additional willows were planted in the fall 2000	
Maiyuk Creek	0+000	MY-01	spurs/traverses				4				4	4	WCT	All						4	4	3	3	Minor maintenance includes removing loose/frayed cable ends and attaching one loose cable	
Middle Fork White River	0+00, Reach 5	MF-01	Triangular log jam	3			4				4		BT, WCT	All			4			3	3	4	3	No maintenance required	
Middle Fork White River	0+086, Reach 5	MF-02	Triangular log jam	3			4				4		BT, WCT	All			4			3	4	3	3	No maintenance required, monitor slack/play in cables, tighten as required	
Middle Fork White River	0+173, Reach 5	MF-03	Triangular log jam	3			4				4		BT, WCT	All			4			4	4	3	3	No maintenance required	
Middle Fork White River	0+00, Reach 7	MF-04	Triangular log jam	2		3	3				3		BT, WCT	All			3			3	4	4	3	No maintenance required	
Middle Fork White River	0+220, Reach 7	MF-05	Triangular log jam	2		3	3				3		BT, WCT	All			4	3		3	3	3	2	Minor maintenance to attach/tighten loose cables, loose components; no additional ballast required at this time	
Middle Fork White River		MF-06	Stabilize steep slope			3					2	2	2	BT, WCT	All			2			2	2	2	2	Maintenance required - redirect surface flows using trench/fascines, continue conifer planting/bioengineering
Windermere Creek	Stn 815, Reach 2	P2-B	Debris Removal/LWD placement			3	4		4				4	WCT, BT, KO, EB	All, All, Ad. All			4			4	3	3	3	No maintenance required
Windermere Creek	Stn. 150, Reach 3	P3-A	V-log weirs	4					4				4	WCT, KO, BT	All, Ad. All			4			4	4	3	3	Monitor degradation around V-log weir; see report text
Windermere Creek	Stn. 700-710, Reach 9	P9-C	Tree Revetment			3	3				3		3	WCT	All			3			3	2	3	2	Maintenance required. See report text - replace/add additional cobble and boulder to fill voids and stabilize structure
Windermere Creek	Stn. 960-980, Reach 11	P11-D	Tree Revetment				3				3		3	WCT	All			3			3	3	3	3	No maintenance required
Windermere Creek	Stn. 0-100, Reach 12	P12-A	Boulder clusters				2				3		3	WCT	All			3			3	3	3	3	No maintenance required; complete routine monitoring;

**Form 2. Routine Monitoring (Level 1)**

Stream	Distance	ID #	Structure Type	Performance Objectives																	Comments			
				Physical							Biological							Structural Condition	Structural Stability	Maintenance Recommendation				
				Pool	Riffle	Substrate	Cover	Off-Channel Habitat	Fish Access	Nutrients	High Flow	Low Flow	Overall Rating	Species	Life Stage	Overwinter	Rearing					Spawning	Incubation	Overall Rating
Windermere Creek		P15-A	Culvert removal			3			4					4	WCT	All	4				3	3	3	No maintenance required
Windermere Creek	Stn, 180, Reach 15	P15-B	Diversion culvert			3						4	4	WCT	All					4	4	4	4	No maintenance required
Windermere Creek	Stn. 490-520, Reach 17	P17-A	Log wall			3				3			4	WCT	All		3			3	4	3	4	No maintenance required
Windermere Creek	Stn. 45, Reach 11	P11-A	Debris removal		4	4			4	4	4	4	4	WCT	All			4		4	4	4	4	Monitor vegetation growth; no maintenance required
Windermere Creek	Stn. 340-360, Reach 11	P11-B	Debris removal		4	4			4	4	4	4	4	WCT	All			3		4	4	4	4	Monitor vegetation growth; no maintenance required
Windermere Creek	Stn. 850, Reach 11	P11-C	V-log weir/sediment pond			3							3	WCT	All					3	3	3	3	Maintenance consists of removing sediment as it accumulates in the pond (Westroc is coordinating this)
Windermere Creek	Stn. 170-230, Reach 12	P12-B	Tree Revetment	3			3			4	4	4	4	WCT	All					4	4	4	4	No maintenance required;
Windermere Creek	Stn. 270-300, Reach 12	P12-C	Tree Revetment	3			3			4	4	4	4	WCT	All					4	4	4	4	No maintenance required



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**APPENDIX E**  
**Field Notes**

Revised - 18/01 July 22/00

Maynik CK (P71)

Photo 15 - looking at far upstream log & root wad (2003) check to see if ballasted structure - good location - upstream end is well protected - Lots of back - Good location - Upper cable needs tightening & log

Footer Log 60 cm (mid point) Splice top dia avg 23 cm

Photo 14 looking upstream at structure

13 typical Rebar Pin

12 Footer Log

11 View of typical fence post anchoring

top end of logs with root wads. - 10 upstream end of second footer log and join between first & second footer logs

FIELD

Maynik P73

July 22/00

Stump (wad) under anchoring is loose, under ballasted. There are existing rock - additional cables in series to secure it. May be pop pin & flip over & drag rock down stream

Some cables 3-4 have frayed ends - could be cut with torch

- Good location for structure, - 10 additional debris accumable spots

- Photo 7 - Pocket

Photo 6 View upstream of floating wad & log

- Everything is keyed in to footer logs in series - Good Gorry

FIELD

May 21 07 02

(2)

Dug Rock size .8 - 1m<sup>3</sup> July 22/00

Joint sp look like structure has moved or shifted

Photo 9 Jans Pocket (inside)

Photo 8 View downstream from quarter way down

Lots of rocks, moss, & bushes  
edges - provide lots of cover

May 21 07 04

July 22/00

Mid section

1 m. long tail on cable should be cut

3 m downstream from

cable ± 3" loose

tough to tighten

- Lots of ballast

2.5m from 5

Rebar pin needs to be bent over

- From habitat viewpoint,

Jon gives "A" rating

Pool at back eddy

3/4 of way downstream

is 1.5 - 2 m deep

- Excellent cover

Photo 5, 4, 3 - looking upstream from downstream end

2 Fractures & slumping/downstr.

- evidence of slumping

PA. 1 B

July 25/00

RF-06 1779

us debris catcher / bank stabilization.  
 - debris catcher - structure is  
 in excellent condition.  
 - very large rock used for ballast.

R2 F 15 view dls  
 - all key components appear  
 solid & anchored in place;  
 - Poured cable ends need  
 to be cut;

- the way has shifted away from  
 toe of log, steep, eroding bank;  
 - some evidence of deposition along  
 bank;

- pool starting to form @ aft  
 end of structure; 25 on days.  
 - good habitat, monitor  
 APP rising.  
 logs piling in size form -  
 48 cm x 48 cm x 50 cm.

Manique Co PA (5)

July 27/00

Days objectives - A/B  
 and Y stable - B - some minor  
 mainline Top of structure (to be  
 less w/ marks)

- space @ dls end of structure  
 could be filled / tied in...

Roll 1 F1 - leave spaces -  
 fill 4 tie in.

⑦

Middle Fork MF-05 July 22/10

Slope: 10%  
R3 - F 20 - loose soil @ base of steep slope;

10% (or less) covered on the end of structure;

R3 F 12, F 18 - poles by not placed, Tom holding cable ends;

- by floating availability of structures - tighten cable end.

- cut - loose/loose cable ends;

Prescription modified slightly

- Some soil vegetation attached on slope;

Recommend 15: - collection

drain system along top of slope to collect surface drainage;

- use for water / cutting;

- select concrete on slope face.

Page 3.

Middle Fork

July 22/10

MF-04. Δ logan  
R3 F 16 - view of  
R3 F 17 - view of

- Del. depth appears to have increased from Jeff's survey; may need additional sketches to reach desired depth.

- Some cables need to be tightened (Notes) - another boulder needs to be attached to 1 base cable.

- While this structure may be under belayed, there is no chance of movement / slide.

- do not need to cut and piece returning from structure

- Jeff's connectivity may in fact provide some additional cable / 20 sections.

- Structures tied together in series; in components connected at a unit; will need to sand bag rail after;

No maintenance required

FIELD

904

- 25

July 22, 100

similar to MF-01, which structure may be under ballast, wire units is tied together which may compensate for ballast;

no additional ballast required at this time;

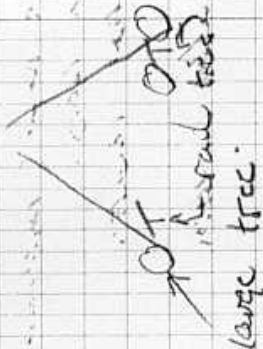
- there are several loose cables which should be tightened, a section of loose cable also needs to be anchored to a boulder (presently not anchored).

structure does not appear to have moved; under what may be considered for by disband/railway ties and that structure is well tied together.

page 5 - Middle Fork

July 22, 100

MF-01 - A log jam  
R3F9 - view up S.  
R3F8 - view dls



- structure does not look like it has moved; tied together in series, all cables tight!  
- lot of buried rock under structure.  
- no movement required.

- some of the better rock may have been hidden during JES's assessment;

located under structure, difficult to measure/include in calculations.

FIELD

Middle Fork Page 6

July 21/00

MF-02 D log jam.

R3 F4-view d/s

R3 F3-view u/s.

F2 Tom's pocket.

- good pool formation / unbroken  
cover at Jett? indicators.

- some loose cable recess  
play; no maint. required, but  
monitor loose cables / excess

play - may be difficult to tighten

- cables may tighten up,  
structure tied together well  
in series; remove any loose cable  
ends;

MF-03 D log jam.

R3 F2 - view d/s.

R3 F1 - view u/s.

R2 F17, 18, 19 - panoramic view

u/s.

As above;

monitor / tighten loose cables  
as required / where possible

- pool forming @ outer end of  
structure; pool habitat

Kloodah Creek - page 1 July 22/00

①

site KK-05 - bank measuring/recontouring  
 - low survival of planted willows,  
 - PE indicated in Jess's report,  
 bioengineering components have had low survival,  
 - structure is stable does not appear to have eroded/undermined;  
 - riprap/armouring does not appear to be causing additional erosion further downstream;

RK 1, F27; View across @ KK-05;  
 Roll 1, F26; View across @ KK-05;

Recommendations: - Plant additional willows @ the top of slope; some larch has been replanted already; there is abundant source material.  
 - don't need to re-armour or add additional riprap;  
 R (F25 - View of pool 36cm deep on LB);  
 Roll 3, Frames 147 - Panorama facing d/s.

Kloodah Creek - page 4 July 22/00

KK-01. Repair bank, place cut mat, revegetate;

Roll 2, Frames 11, 12 - View ups at structure; structure is stable; rock footings remain in place; vegetation; cuttings have had limited survival.  
 pool depth adjacent to structure is 49cm;

Recommendations;

As indicated by IR, cut mat should be removed, bank should be re-seeded, bioengineering cuttings should be replaced;

Canisters could also be planted along the top of bank.



Knox Creek - page 2

July 22, 00

KK-04 - Tree Retention

Roll 1, Frame 23 - View of site KK-04  
Roll 1, Frame 22

- As described - monitor retained
- structure is stable, little erosion around structure - does not appear to have been undermined
- evolution of the channel should not result in severe undermining, but this should provide additional B&I habitat & improve overhead cover.

Roll 2, F9 - View of tree retention.

- No maintenance required.

Site KK-03 - Logjam removal

Roll 2 F4 - View w/ls & sediment wedge; pool depth 0.5 - 1m  
Roll 1 F 21 - View w/ls note floating logs; Roll 1 F 20 - view across structure

Knox Creek - page 3

July 22, 00

Site KK-09

Roll 2, Frame 8 - View across structure

Roll 2, Frame 9 - View down stream at structure

- d/s bank referred to in I/R report appears stable; no further erosion;
- sediment wedge com. d/s does not appear to be having a detrimental effect;

Site KK-02, LWD Retention.

Roll 2, Frame 40;

- note pod adjacent to structure is 45cm

Pool depth has increased slightly from fall 99 assessment by 1R.

Structurally, the LWD Retention remains very stable. Structure / Cover ratings remain as A/B; No maintenance required.

FIELD

Windermere Creek - P 8 July 12, 10

P12-C.

Similar to P12B; several pods forming in amongst reeds, providing good cover.

- structure and bank appear stable; vegetation becoming established on slope;

- no maintenance required - monitor vegetation growth and survival.

Windermere Creek - P 9c July 12, 10

Site P12-B - debris removal / KWT placement.

- structure is stable, vegetation well established;

- logs on bank face called back to headman logs; - underments were built & intended to provide holding areas for migrating adults; - remove loose / exposed cables.

Site P-3A - series of 2 U-leg walls

- structures are stable, banks are well vegetated, good removal of cuttings. Some underments at lower U-leg which structure channel is still adjusting following debris removal. may start to upgrade and

FIELD

page 2 - Windsor

July 23/00

deposit on NW side of  
WSP. wires are functioning  
well to improve fish passage  
through site;

- No maintenance required,  
monitor lower weir for  
additional scouring / underpinning

Site P.Q.C. Tree Retention / removal.

- loose cables were not attached  
to boulders, but were in fact  
cabled to downstream logs; cables  
are a secondary matter for  
this structure.

- structure was designed  
to reduce bank erosion and  
promote downcutting. There was  
limited cover at this location.  
The rootwads have resulted in  
increased erosion / downcutting

Page 3 - Windsor

July 23/00

which has exposed additional  
CWS & SWD;

- The structure has been  
undermined and the bedding  
gravel washed out, resulting  
in holes / voids on the bank side  
of the structure;

Maintenance Reg'd;

- placement of large tymp  
on top of existing box / footings -  
place additional bedding gravel -  
filter cloth on top of  
tymp;

- add native material (topsoil)  
and plant additional willow;  
cover with surface cover -  
native seed mix.

P11-D. Tree Retention

- some stumping @ dk end  
of structure; thalweg risk

FIELD

Page 4 - Windsor  
Structure @ top end.  
No stumping is not affecting  
structure stability or increasing  
sediment loss;  
no maintenance required.

- headcut logs are tied into  
downstream logs and buried into  
bank; the logs were also connected  
to the road.

site P12-A.

- The boulders have not been  
displaced by high flows,  
but were in fact placed  
(connected to) to their  
current position; additional  
boulders were placed in  
1999. This section was  
2-100 m of featureless riffle;  
the channel has moved away  
from the toe of the slope, and  
the slope is starting to

Page 5 - Windsor  
July 23/06  
Reach on stable slope; vegetation  
is becoming established.  
Additional cuttings placed in  
the spring appear to be surviving.

- No maintenance required.

P. 15-A - culvert removal

- No maintenance req'd.

P. 15-B - Collection Drain Culvert

- Reach proven to be stable;  
Culvert/drain is working effectively  
to collect - spring discharge  
and redirect flows directly  
to creek;

- Vegetation becoming established  
on banks -

No maintenance required; monitor  
vegetation cover / survival

FIELD

Page 6 - Windermere

P17-A - Log wall terrace

- The log wall appears stable & has not moved. The slope is becoming well vegetated and is stable. No maintenance required.

1999 sites:

P17-D Debris removal (reorientation) - channel has stabilized and is depositing on the right bank (looking d/s).

- creek bank is stable; vegetation starting to establish. Could use some additional plantings / cuttings.

- d/s habitat starting to form with stream banks, low; no maintenance required.

Page 7 - Windermere

P11-B - Debris Removal (repositioning)

- similar to P11-A; channel form becoming stable; no maintenance required - monitor vegetation growth / survival;

P11-C. V-log weir / sediment trap.

- structure is sound / has not moved;

- banks becoming vegetated; vegetation established in outlet channel; No maintenance other than regular sediment removal.

P12-B - Tree Recruitment.

- structure stable, no evidence of movement;
- vegetation becoming established;
- monitor following subsequent

FIELD