

November 15, 2008  
File: 2331-00650-0

Jason Llewellyn  
Director of Planning  
Regional District of Bulkley-Nechako  
37 Third Avenue  
PO Box 820  
Burns Lake, BC V0J 1E0

Ebenezer Flats/Kidd Road Erosion Protection Study - Maintenance Requirements and Identification of Benefiting Properties

Thank you for your letter of October 27, 2008. We are providing the additional information requested in that letter. Upon your review and acceptance of this information we will include it in the final report.

### **Maintenance Works and Inspection Requirements**

The draft report submitted on October 22, 2008 contained a cursory overview of maintenance and inspection requirements for each of the erosion protection options. The discussion in this letter will serve to amplify those requirements and also provide a cost estimate for the options as requested.

The following documents were consulted in the preparation of the maintenance recommendations for the Ebenezer Flats/Kidd Road erosion protection. These documents form the basis of standard practice for dike and erosion protection maintenance and inspection for the Province of British Columbia. Although the erosion protection works will not constitute a dike, the processes of required inspection and maintenance will be similar.

- “Dike Design and Construction Guide – Best Management Practices for British Columbia”, Ministry of Water, Land and Air Protection, July 2003
- “Flood Protection Works Inspection Guide”, Ministry of Environment, Lands and Parks, March 2000
- “Riprap Design and Construction Guide” Ministry of Environment, Lands and Parks, March 2000

## **1.0 Rock Riprap Bank Protection**

### **1.1 Inspection Requirements**

Rock riprap erosion protection will require a minimum of one annual inspection unless there is a flood event. A post-flood inspection should be then also be carried out immediately after the flood waters subside to assess the performance and condition of the erosion protection. The annual inspection should take place during low water to allow visual inspection of the installed rock and bank. Items to look for during the inspection include:

1. Recent high water marks
2. Signs of unauthorized activity (construction, excavation, vandalism)
3. Changes in the river flow pattern, new log jams, new gravel bars, scour holes
4. Evidence of toe scour



5. Signs of weakness in the protective cover, i.e. riprap loss, unusually steep slopes, beaching, scarping
6. Degradation or weathering of riprap material
7. River bed degradation
8. Indications of outflanking at the upstream end of the riprap (river tending to cut new bank material beyond protected area)
9. Rock displacement due to ice, logs etc.
10. Areas where vegetation hampers inspection
11. Signs of beaver/rodent activity
12. Condition of access roads

## 1.2 Maintenance Requirements

Maintenance of the rock riprap erosion protection would involve addressing any problems encountered during the inspections. Generally these would include replacement of rock and minor repair of damaged sections. If more serious problems such as bank or riverbed degradation are found upstream or downstream of the existing riprap section, then modification of the erosion protection could be necessary and additional permits will need to be requested from the Ministry of Environment.

Annual costs of maintenance are usually based on a percentage of capital cost since the actual costs will vary with site conditions. McElhanney recently completed some costing for the City of Prince George and used an average of 5% of capital cost as an estimate of annual maintenance. This was for diking and rock riprap erosion protection similar to the conditions seen on the Bulkley River. The actual annual costs could vary from 3 percent to 15 percent of capital cost depending on the amount of work needed.

The annual maintenance costs include inspections, stockpiling of rock and gravel, heavy equipment and trucking costs, labour, and administration. A Class D estimate of the average annual maintenance costs has been attached to this letter with each component listed separately.

The annual maintenance cost estimates assume that 5 percent of the rock riprap is replaced each year.

## 2.0 Gabion Baskets

### 2.1 Inspection Requirements

Inspection requirements for the gabion baskets will be similar to the requirements for the rock riprap. Special attention will need to be given to the condition of the wire baskets, including any damaged wires, corrosion, missing rock infill or change in shape that would lead to instability of the erosion protection structure.

### 2.2 Maintenance Requirements

Maintenance of the gabion basket protection would be similar in scope to the rock riprap. Although smaller rock is needed for the installation and therefore smaller rock is needed for maintenance, this is offset by the higher labour costs of maintaining gabion baskets. Damaged baskets need to be opened, filled by hand or small equipment, then closed and locked with additional wire.



Average annual maintenance costs for the gabion basket system have been attached to this letter. The estimates assume that 5 percent of the rock infill is replaced each year.

### **3.0 Setback Structure**

#### **3.1 Inspection Requirements**

As stated in the draft report, annual inspection for a setback structure is simplified since access is available on both sides of the structure. If the structure remains buried and there is no slumping or sloughing of the overburden material, it should be safe to assume that the integrity of the rock is unaffected. Also, safety during inspections is less of an issue as the structure is not directly next to the river.

Post-flood inspections are critical for setback structures since their function will have suddenly been tested if enough of the material between the river and the structure has been eroded.

#### **3.2 Maintenance Requirements**

Maintenance requirements for a buried setback structure are initially far less than a riverside structure since there is no erosion potential from the river, even from average annual flows. However, maintenance requirements will increase after a flood event exposes the face of the setback structure to river flows. After a flood, there is likely a need to replace some of the rock in the structure.

### **4.0 Bioengineered Stabilization**

#### **4.1 Inspection Requirements**

Inspection of the bioengineered stabilization option requires more specialized expertise than needed for the other inspections. The inspector must be able to recognize the health of the planted vegetation as well as the other structural items listed in the previous sections. Inexperienced inspectors may assume that vegetation has died and recommend replacement when the plant material is actually healthy but in a normal dormant state. Also, inspection carried out during a typical low-water season may not be the optimal time to assess plant health.

#### **4.2 Maintenance Requirements**

Maintenance of bioengineered structures is more complex due to the requirement to replace vegetation as needed. Also, the time of year of the maintenance will also be important as some plantings are best done during the vegetation's dormant phase. Maintenance of bio-engineered systems is more labour-intensive during the first few years and this has been reflected in the annual cost. However, if vegetation is chosen carefully and is native to the area, the area should eventually stabilize and lower maintenance costs are a possibility.

For purposes of the annual maintenance cost estimate, it was assumed that 10% of the planted area needs to be replaced each year.



## 5.0 Identification of Benefiting Properties

The identification of properties benefiting from erosion protection in specific areas was done on the following basis.

1. Properties which are now directly affected by erosion.
2. Properties that are not directly affected by erosion, but are at risk of damage due to flood flows.

### 5.1 Kidd Road

For the Kidd Road area, one large property encompasses the river bank. This property will be the only one directly affected by erosion on the Bulkley River. Four additional properties will benefit from erosion control works since they will have decreased risk of damage due to flood flows.

These properties are listed below by PID as the civic addresses did not necessarily correspond to separate properties.

#### PID

004192613 (Directly on river bank)  
018611974 (2069 and 2075 Kidd Road)  
012542407  
012542415  
018611982 (2050 and 2080 Kidd Road)

### 5.2 Ebenezer Flats

For the Ebenezer Flats area, the river bank has been subdivided into 15 lots fronting on the Bulkley River. These lots would benefit directly from erosion protection and are listed below from west to east.

#### PID

09167986 (715 Columbia Street)	010556702
006912231 (667 Columbia Street)	012327158
007711107 (635 Columbia Street)	007938870 (335 Columbia Street)
013220004 (593 Columbia Street)	013320122
007264933 (545 Columbia Street)	013320114 (245 Columbia Street)
013219961 (485 Columbia Street)	013211910 (215 Columbia Street)
013219944	013219901
	013219898



The following properties on 22<sup>nd</sup> Avenue would benefit from erosion control works since they will have decreased risk of damage due to flood flows.

004940806 (1815 22 <sup>nd</sup> Avenue)	apparent road r.o.w (2049 22 <sup>nd</sup> Avenue)
009892001 (1845 22 <sup>nd</sup> Avenue)	013220039 (2053 22 <sup>nd</sup> Avenue)
007602243 (1875 22 <sup>nd</sup> Avenue)	013220055 (2085 22 <sup>nd</sup> Avenue)
007921608 (1905 22 <sup>nd</sup> Avenue)	005349621 (2115 22 <sup>nd</sup> Avenue)
004222814 (1935 22 <sup>nd</sup> Avenue)	016942914 (2175 22 <sup>nd</sup> Avenue)
013320050 (1965 22 <sup>nd</sup> Avenue)	008371202 (1854 22 <sup>nd</sup> Avenue)
007576200 (1987 22 <sup>nd</sup> Avenue)	013219839 (2034 22 <sup>nd</sup> Avenue)
007576218 (2005 22 <sup>nd</sup> Avenue)	

## 6.0 Closure

We trust that this letter clarifies and augments the content of the submitted draft report. Please do not hesitate to contact us if you have any questions or comments.

Yours truly,

McElhanney Consulting Services Ltd.



William Cheung, PEng  
Branch Manager

Enclosure

Ebenezer Flats - Annual Maintenance Cost Estimate

Item	Description	Estimated Quantity	Units	Unit Rate	Subtotal
------	-------------	--------------------	-------	-----------	----------

**A Riverside Rock Riprap**

**Ebenezer Flats**

1 Annual Inspection and reporting	16 hrs	\$	200	\$	3,200
2 Rock supply and stockpile	94 m <sup>3</sup>	\$	75	\$	7,050
3 Trucking costs	8 hrs	\$	130	\$	1,040
4 Heavy equipment	24 hrs	\$	185	\$	4,440
5 Supervision	24 hrs	\$	80	\$	1,920
			Subtotal		\$ 17,650

6 Contingency and Administration 25% \$ 4,413

Total **\$ 22,063**

**Kidd Road**

1 Annual Inspection	16 hrs	\$	200	\$	3,200
2 Rock supply and stockpile	118 m <sup>3</sup>	\$	75	\$	8,850
3 Trucking costs	8 hrs	\$	130	\$	1,040
4 Heavy equipment	24 hrs	\$	185	\$	4,440
5 Supervision	24 hrs	\$	80	\$	1,920
			Subtotal		\$ 19,450

6 Contingency and Administration 25% \$ 4,863

Total **\$ 24,313**

Ebenezer Flats - Annual Maintenance Cost Estimate

Item	Description	Estimated Quantity	Units	Unit Rate	Subtotal
------	-------------	--------------------	-------	-----------	----------

**B Gabion Baskets**

**Ebenezer Flats**

1 Annual Inspection and reporting	16 hrs	\$	200	\$	3,200
2 Rock supply and stockpile	55 m <sup>3</sup>	\$	60	\$	3,300
3 Wire material	1 LS	\$	500	\$	500
4 Trucking costs	8 hrs	\$	130	\$	1,040
5 Heavy equipment	24 hrs	\$	185	\$	4,440
6 Labour	24 hrs	\$	100	\$	2,400
7 Supervision	24 hrs	\$	80	\$	1,920
			Subtotal		\$ 16,800

8 Contingency and Administration 25% \$ 4,200

Total **\$ 21,000**

**Kidd Road**

1 Annual Inspection and reporting	16 hrs	\$	200	\$	3,200
2 Rock supply and stockpile	70 m <sup>3</sup>	\$	60	\$	4,200
3 Wire material	1 LS	\$	500	\$	500
4 Trucking costs	8 hrs	\$	130	\$	1,040
5 Heavy equipment	24 hrs	\$	185	\$	4,440
6 Labour	24 hrs	\$	100	\$	2,400
7 Supervision	24 hrs	\$	80	\$	1,920
			Subtotal		\$ 17,700

8 Contingency and Administration 25% \$ 4,425

Total **\$ 22,125**

Ebenezer Flats - Annual Maintenance Cost Estimate

Item	Description	Estimated Quantity	Units	Unit Rate	Subtotal
------	-------------	--------------------	-------	-----------	----------

**C Setback Dike**

**Ebenezer Flats**

1 Annual Inspection and reporting	16 hrs	\$	200	\$	3,200
2 Rock supply and stockpile*	0 m <sup>3</sup>	\$	75	\$	-
3 Trucking costs	0 hrs	\$	130	\$	-
4 Heavy equipment	0 hrs	\$	185	\$	-
5 Supervision	0 hrs	\$	80	\$	-
			Subtotal	\$	3,200
6 Contingency and Administration 25%				\$	800
			Total	\$	<b>4,000</b>

**Kidd Road**

1 Annual Inspection	16 hrs	\$	200	\$	3,200
2 Rock supply and stockpile*	0 m <sup>3</sup>	\$	75	\$	-
3 Trucking costs	0 hrs	\$	130	\$	-
4 Heavy equipment	0 hrs	\$	185	\$	-
5 Supervision	0 hrs	\$	80	\$	-
			Subtotal	\$	3,200
6 Contingency and Administration 25%				\$	800
			Total	\$	<b>4,000</b>

\*in normal "non-flood" year where structure is not exposed to river



Ebenezer Flats - Annual Maintenance Cost Estimate

Item	Description	Estimated Quantity	Units	Unit Rate	Subtotal
------	-------------	--------------------	-------	-----------	----------

**D Bioengineered Stabilization**

**Ebenezer Flats**

1 Annual Inspection and reporting	16 hrs	\$	240	\$	3,840
2 Plant replacement	113 sq.m	\$	25	\$	2,825
3 Log crib repair	16 hrs	\$	100	\$	1,600
4 Heavy equipment	8 hrs	\$	185	\$	1,480
5 Supervision	16 hrs	\$	80	\$	1,280
			Subtotal		\$ 11,025
6 Contingency and Administration 25%					\$ 2,756
			Total		<b>\$ 13,781</b>

**Kidd Road**

1 Annual Inspection and reporting	16 hrs	\$	240	\$	3,840
2 Plant replacement	141 sq.m	\$	25	\$	3,525
3 Log crib repair	16 hrs	\$	100	\$	1,600
4 Heavy equipment	8 hrs	\$	185	\$	1,480
5 Supervision	16 hrs	\$	80	\$	1,280
			Subtotal		\$ 11,725
6 Contingency and Administration 25%					\$ 2,931
			Total		<b>\$ 14,656</b>