Toby Creek Erosion Protections and Bank Stabilization

Emergency Management, B.C
Funding application – Schedule A

Introduction:

As described in Northern Hydraulic Consultants, 2013 Toby Creek Erosion Protection Design Report, (Dale Muir P. Eng. 2013) "Toby Creek is a slow flowing, meandering channel in its upper reaches and is constricted in its middle sections by several bedrock canyons. The channel cuts through the Columbia River benches in lower sections and becomes wider and more sinuous downstream through its alluvial flats before joining the Columbia River (Carswell, 1993). The Columbia benches are a roughly 100 m+ thick deposit of pot glacial sands and gravels through which the contemporary channel has incised. Continuous active erosion of the bench lands by Toby Creek introduces large volumes of sediments that are subsequently deposited on downstream point and mid-channel bars, which redirect the flow, resulting in extensive local bank erosion."

Over the past decade, the local creek bank erosion potential has been mitigated in selected sections of Toby Creek through a series of bank protection projects addressing erosion events that have had the potential to adversely affect the protective function of the District of Invermere's inland dike, GPS # 87. Protection efforts are focused on protecting the Districts wastewater treatment facilities, Industrial and Residential development and Arterial access on Panorama Drive to adjacent communities all of which are in the Athalmer floodplain.

In December of 2016 and continuing until the present an ice dam on Toby Creek caused a breach in the stream bank, redirecting the entire flow of Toby creek over the flood plain West of the Districts protective Dike #87 and forcing Toby Creek to run along the entire 1.15km length, ultimately discharging through overflow culverts in Panorama Drive and into the Columbia wetlands. The Dike was also breached at a single point and through a series of actions was relieved before significant damage or impact to the Wastewater treatment plant or to the Athalmer development occurred.

This application addresses emergency corrective measures aimed at fortifying the Toby Creek Stream bank to improve protection of the Dike and the Athalmer flood plain.

Scope / Outputs

The following is the scope of works being applied for in order of priority to the District:

1. **Priority 1**: Priority 1 will also include 200m of rip rap armouring of the eddy area next to the bridge (just north of Priority 2 small section), as well as the addition of 30m of rip rap to the bridge support pillars at Panorama Drive.
2. **Priority 2**: Includes 220 lineal meters of creek bank stabilization, rip rap armouring and access upgrades. Also includes a 60 lineal meter stabilization and diversion structure tied into upland flood plain and extending into Toby Chanel 150 m south of Toby Creek Bridge and Panorama Drive. We would also like to install two more 60m diversion structures (rip rap) upstream from the diversion structure in the original application.
3. **Priority 2a**: Includes 540 lineal meters of upland dike protection using and enhancing existing berms which are in place as a result of previous borrow pit excavation, light rip rap armouring and access upgrades.
4. **Priority 3**: Includes 90 lineal meters of armouring along Panorama Drive. We no longer wish to use funding for culvert replacement, because if we secure Priority 2a with armouring, large volumes of the river should not end up flowing through our current culvert like it did during the flood event in winter 2017. However, we do wish to continue with armouring this area with 175m of rip rap. Access upgrades would also include two marshalling areas (gravel fill) on the north (140m3) and south (155m3) end for equipment access and storage.

Figures:

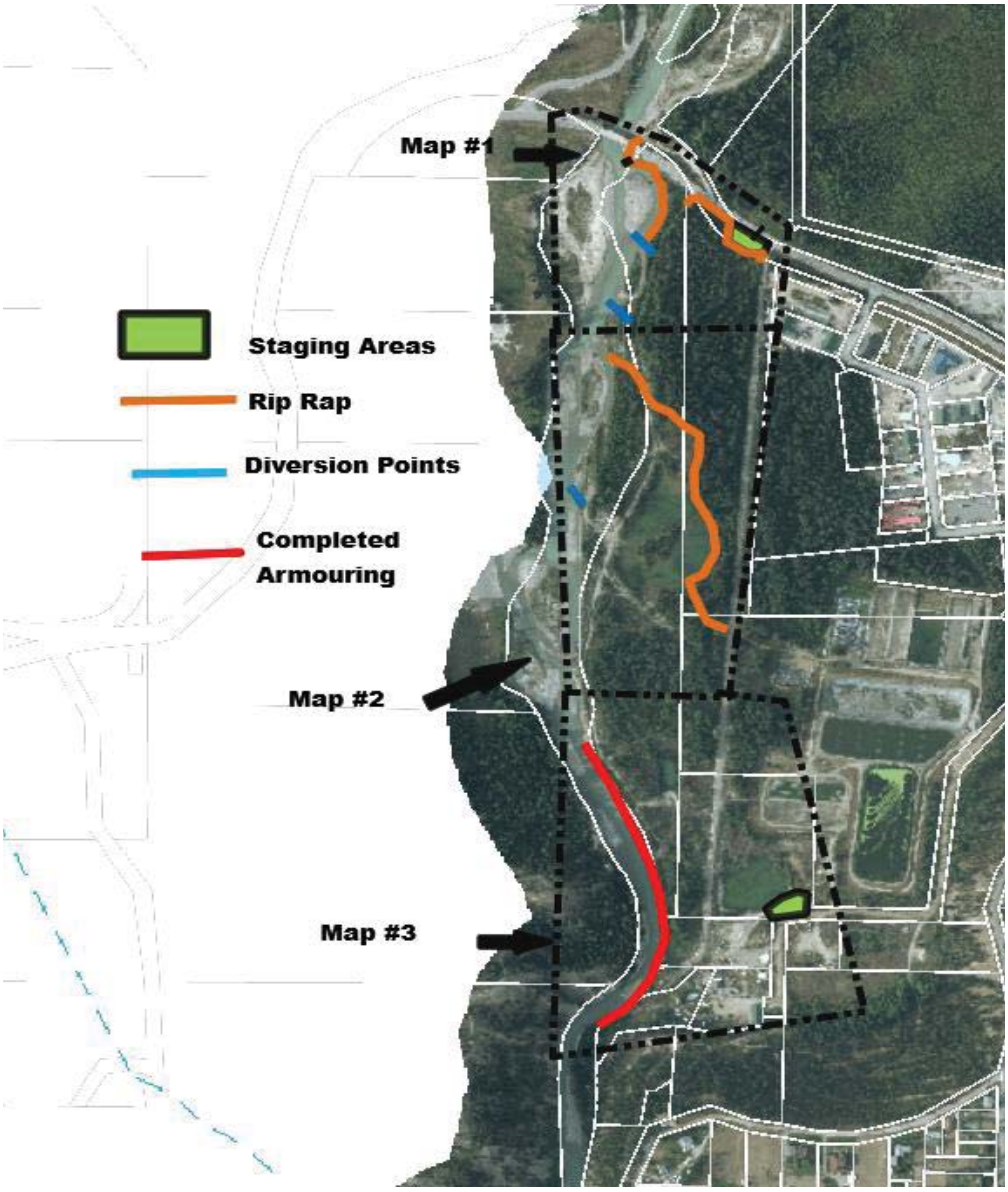

Figure 1. Overview of the work area.

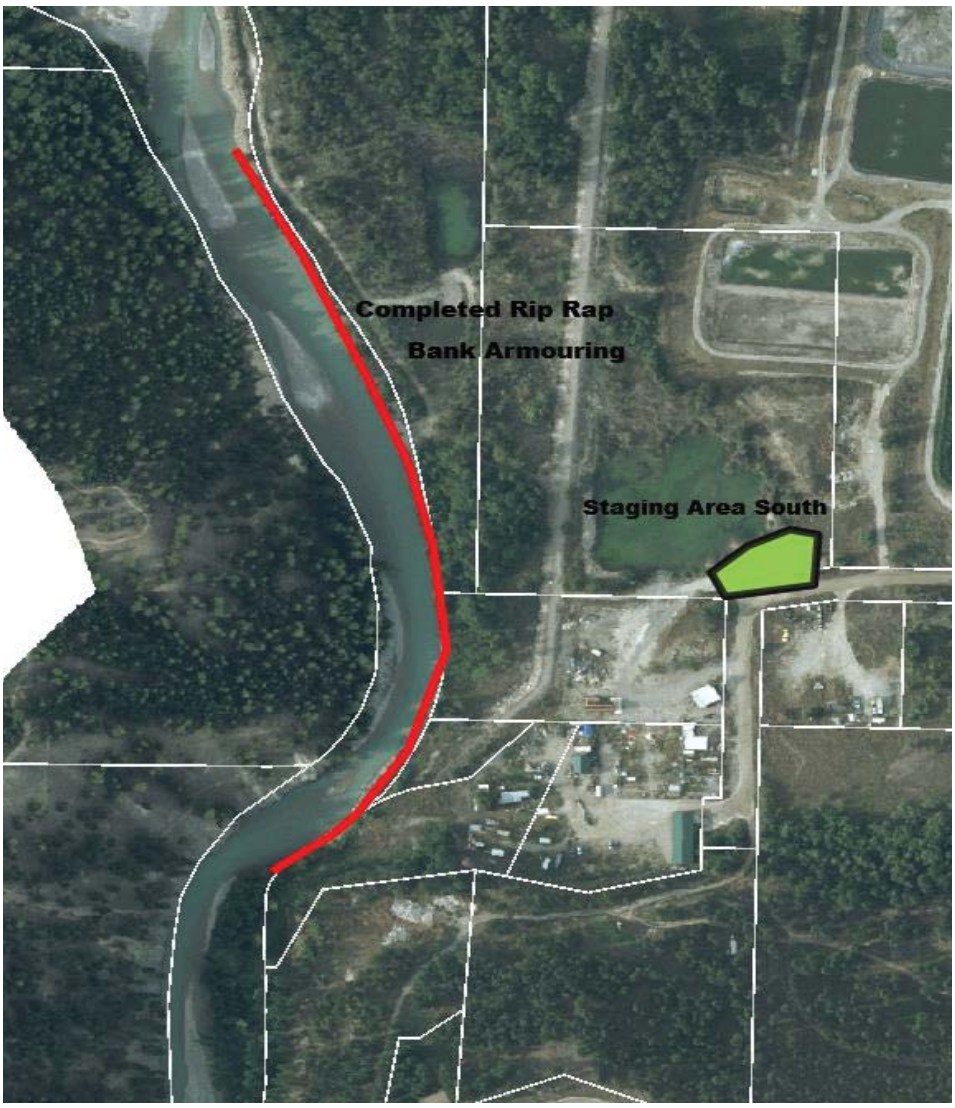

Figure 2. Rip rap armouring already completed and southern marshalling/staging area.

Figure 3. Proposed rip rap armouring in Section 2a, and 3rd (southern) diversion structure

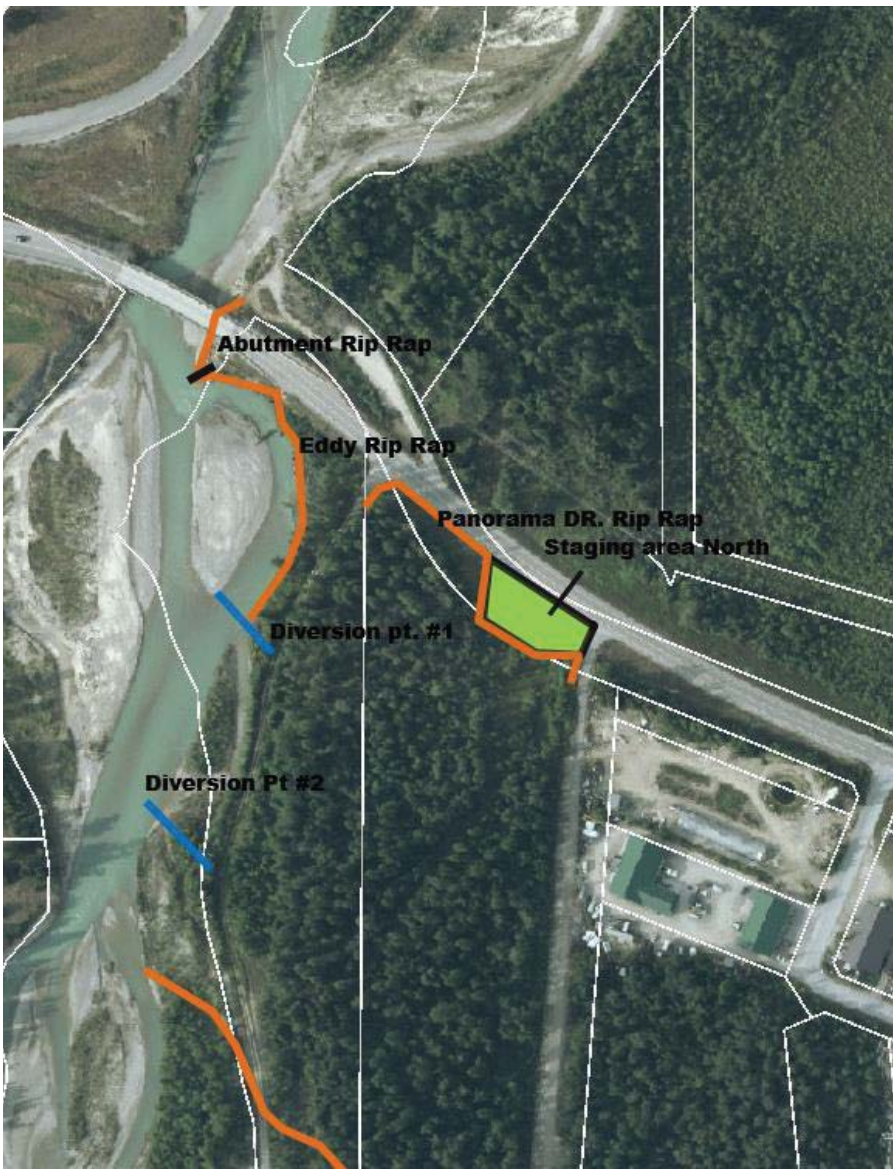

Figure 4. Proposed works at north end including marshalling/staging area, bridge and eddy section rip rap armouring, and two northern diversion structures.

Estimate of cost / Allocation of Funding.

Emergency Management BC allocated $125,000.00 to the District of Invermere to address the emergency remediation needs caused by the December 2016 ice damming of Toby Creek and the resultant Creek bank and Dike #87 erosion and breaches.

These funds were 100% allocated to addressing the emergency management of the ice damming, breaches and flooding rehabilitation not towards the long term protection designs associated with works under Priorities 1, 2, 2A and 3; EMBC allocated $300,000 to these priorities.

The stabilization design is based on engineering design completed for the District of Invermere in 2006 and 2007 by B.C. Rivers Consulting, Toby Creek Erosion Protection Design, January 2007, (Bob Costerton P.Eng.).

Cost quotations are based on the anticipated works required as a result of the 2016 – 2017 ice damming of Toby Creek and the resulting breaches of both the creek bank and dike. Unit cost quotations were requested by the District of Invermere's Public Works in February of 2017.

Contingency 10% is included in this quotation (see next page). Anything over $300,000 will be covered by the District of Invermere.

Activity	Material / Units	Unit Cost	Final Cost
Rip rap materials and installation			**$172,350**
Rip rap materials 685 m total (200m materials provided by DoI)	485 Lm @ 2.0/Lm	$100/m3	$97,000
Rip rap installation 685m total	685 Lm @ 2.0/Lm	$55/m3	$75,350
Eddy area rip rap armouring: Provision of Riprap, Class 450 and trucking.	200 Lm		
Bridge support rip rap armouring: Provision of Riprap, Class 450 and trucking.	30 Lm		
Panorama Drive rip rap armouring: Provision of Riprap, Class 450 and trucking.	175 Lm		
2a (from first application)	100 Lm		
3 in-stream diversion structures: Riprap, Class 450 and trucking for the in-stream diversion structures south of Panorama Bridge.	180 (3x60) Lm		
Marshalling areas north & south			**$53,250**
Gravel installation at north end of road access, 140 m3; Gravel installation at south end of road access, 155 m3.	295 m3	$50/m3	$14,750
Fill underneath gravel marshalling areas 1.4m deep (north only) with earth, including material, transportation and installation costs.	1925 m3	$20/m3	38,500
2A gravel berm and access points			**$74,900**
Gravel berm, 440 Lm at 1.7 m2	748 m3	$50/m3	$37,400
Access points, 2km, 3.0m x 1m gravel, x 75%	450 m3	$50/m3	$22,500
Access points, 1.6km, 2.5m x .1m gravel, x 75%	300 m3	$50/m3	$15,000
Environmental review, applications and monitoring			**$5000**
Total			**$305,500**