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LETTS
ENVIRONMENTAL
CONSULTANTS LTD.

**FINAL ENVIRONMENTAL MONITORING REPORT**

November 13, 2015

Dewdney Area Improvement District
C/O Larry Wiens
PO Box 3005
Mission, BC, V2V 4J3

Attention: Larry Wiens
Re: Changes in and about Hatzic Slough - Sand Recovery Station Construction and Dredging
File #: A2006265

SUMMARY

Letts Environmental Consultants Ltd. are pleased to submit this final Environmental Monitoring report involving the construction of eleven sand recovery stations (SRS) and subsequent dredging works at 9 of the eleven stations within Hatzic Slough in Mission, BC.

All Stations were originally designed to have three levels of lock blocks with the top row being level with the top of bank. Stations B to F were constructed as planned, however, stations G through L were constructed two lock blocks high due to water seeping into the excavation. Dredging works were carried out from all stations except for H and I.

All works were completed by Mission Contracting and monitored full time by Letts Environmental Consultants Ltd. All works were done in compliance with the conditions set forth in the Approval (2006265), dated August 20, 2015. Replanting is to be completed by March 31, 2016.

One significant barrier to progress was the lack of a complete survey prior to works beginning. Station F was relocated due to the presence of a wetland. Station I required a further application to the Ministry of Forests, Lands and Natural Resource Operations (MoFLNRO) for approval as a ditch was discovered to extend further north than previously identified and would be impacted by works.

A complete post-work survey has now been provided and can be used to establish stockpile locations for future dredging. Following this survey, replanting can occur, taking into account the area of land impacted by the works and future dredging plans. Habitat planting plans have been revised and are included.

COMMENTS

Sand Recovery Stations

Each SRS was constructed as per the design plans with the exception of Stations G-L. Fencing was present along the top of the bank for Stations G-L and was removed for construction.

Seepage into the excavated areas was pumped into an area where no sediment or sediment-laden water could enter Hatzic Slough. If sediment was noted in water anywhere near to the channel, the pump was turned off and measures implemented to mitigate the risk of sediment-laden water entering the watercourse. On one occasion, during construction of SRS K, a small volume of sediment-laden water did enter Hatzic Slough. Work was stopped and erosion and sediment control measures were implemented to address the issue.

A 9.0m long by 650mm dia corrugated steel culvert was installed between Stations K and L to allow for farm field run-off into the creek. Two 12 inch corrugated steel culverts were also installed behind Station I to allow flows to continue through a constructed ditch adjacent to the station. The lack of a formal survey also resulted in some confusion and delays as works were briefly halted while the locations of stations G-L were clarified.

Vegetation

Prior to any works commencing, Station locations were staked and flagged. Trees requiring removal were measured and identified and the stations were cleared and grubbed prior to construction. All areas involving invasive species (Japanese knotweed – *Fallopia japonica* and Police helmet – *Impatiens glandulifera*) were identified. Invasive species were disposed of according to regulation, with Japanese knotweed (*F. japonica*) at Stations B and D taken to Meadow Landscaping, an approved disposal facility.

A total of 119 trees were removed. Each tree was measured and the diameter at breast height (dbh) was calculated. Trees were replaced following the Ministry of Environment (MoE) tree replacement standards. A total of 265 trees and approximately 148 shrubs will be planted as replacements.

Access Roads

Access roads to all stations were upgraded with 3" minus or ¾" clear crush several times during the course of the works.

Continuous flows of water were noted flowing across the access road to Stations G through L. This area had to be upgraded multiple times to reduce the generation of fines that had a risk of entering Hatzic Slough and sediments being tracked out on to Dale Road.

Dredging and Stockpiles

Following construction of each SRS, sand was dredged from the creek using a long-reach excavator positioned on the SRS platform. When work was approved and continued beyond the fisheries window (September 15th), fish fences were installed within Hatzic Slough downstream of where dredging occurred to prevent fish from entering the work zone. Turbidity measurements were taken throughout the day when dredging using a LaMotte 2020we

Turbidimeter, and was ongoing (Table 2). When turbidity readings exceeded the 8 NTU limit, dredging was stopped until levels returned to normal.

The amounts of organic material, fines, and type of sand dredged varied considerably between stations and even across a single station. This required flexibility as the unique conditions at each station would determine the speed at which dredging could occur, while remaining within the requirements of the approval. Generally, dredging was halted every six buckets for a break of 30 secs to a few minutes to allow sediment to settle.

The long-reach excavator bucket contained holes, which allowed some water and material to drain from the bucket before loading or being placed on a stockpile. This resulted in the deposition of sand along the swing radius of the machine, which will cause damage to riparian vegetation in future. Dredging was completed on October 6th 2015.

Stockpile locations on the east bank of the creek were inhibited due to blueberry production on crown land. Stations H and I were not dredged as no appropriate stockpile location could be identified.

Endangered Species

A vegetated island at Station G was conserved from dredging. This was identified as an important habitat for amphibians, confirmed by the presence of a Western toad (*Bufo boreas*), which is a species of conservation concern in BC. The western toad is found on Schedule 1 of the Species At Risk Act (SARA), considered special concern by Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and endangered by the World Conservation Union (IUCN).

The largest threats to the western toad are stocking of fish where fish were not present in the past, as they usually carry diseases that transmit to the amphibians, and habitat loss. Habitat loss is especially an issue in the Greater Vancouver and Victoria areas where 75% of wetlands have been destroyed. Habitat requirements are varied for the toad, however, they prefer areas of slow moving water and wetlands.

Site Clean-up

Clean-up activities and remaining erosion and sediment control (E&SC) requirements were addressed on October 19th and 20th. Silt fences were repaired or replaced at every station, exposed clay-based soils were covered with straw, and garbage and organic debris was collected and transported off site. Remaining stockpiles were either moved (Station J on to farmer's land), reduced in size (Station E), or tidied up with a silt fence installed along the toe of the pile (Station L). A flap gate was installed at the outflow of the culvert between Stations K and L and the outflow was lined with clean rock.

All stations are to be rehabilitated by replanting of native vegetation and as per the included planting plan. Within the 16m reach of the excavator, small native shrubs will be planted including salmonberry (*Rubus spectabilis*), willows (*Salix* spp.) and hardhack (*Spiraea douglasii*). The landowner's fence that was removed for works can be replaced however should be aligned along property boundaries and not top of banks.

Table 1: Construction Activities

Date	Weather	Station	Construction Activities	Environmental Measures
31-Aug	Rain	C-F	Measured and flagged trees for removal at SRS C-F. Trees at SRS E and F removed. Re-staked F further downstream as it was discovered it was located in a wetland area. A culvert is to be installed between E and F to allow the wetland to flow beneath the access road. An inactive robin's nest was found at SRS D.	Culvert installation required at wet and between E and F. Robin's nest relocated to an undisturbed area nearby, as per regulation.
1-Sep	Rain	F	Construction of SRS F. Darryl (geotech) engineer on site. Discrepancy noted in number of lock blocks in plans. SRS F will be six lock blocks wide but all other stations will have five. Excavation of the station and one row of lock blocks in place by the end of the day. Culvert installed under the roadway between Stations E and F.	Roadway required sweeping as road had somewhat degraded under the weight of the haul trucks and track out of sediment occurred. Installed a silt fence along the creek side of the stockpiled materials from excavation.
2-Sep	Overcast	F	Excavation had filled with water overnight and required dewatering. Remaining two rows constructed. Road is deep and muddy in places, therefore built it up with 3" minus. Station constructed as per plan.	Roadway swept at the end of the day.
		E	Grubbed and removed native vegetation and invasive plants (policeman's helmet).	
3-Sep	Overcast	F	SRS F completed.	Straw spread on exposed soils.
		E	Station E constructed closer to the top of the bank and lots of water seepage. Geotechnical engineer advised to not dig to the target depth as indicated on the plan. Station constructed three lock blocks high as per plan.	Larger pump and generator used to pump water into adjacent woodland.
		D	Clearing of trees occurred. Areas of Japanese knotweed identified prior and left untouched during clearing.	Operator made aware of risks of spreading knotweed.
4-Sep	Clear	D	Grubbing and removal of trees, native and invasive vegetation and contaminated soils from D.	Knotweed and soil hauled to Meadow Landscaping. Tracks of excavator cleared of knotweed.
4-Sep		E	Construction of Station E complete.	Exposed soils were seeded and covered with a thick layer of straw and a silt fence installed along the toe of the bank.

8-Sep	Light rain	D	Station D constructed as per design. Soil required for backfilling as contaminated soils had been removed off site during clearing.	
9-Sep	Clear	C	Station C constructed as per design.	
		G-L	Review of Station locations on the opposite bank.	SRS J & I are located within a ditch that holds significant amounts of water. J is moved south to avoid ditch. Station I location undecided due to ditch.
10-Sep	Clear	C and D	Fill in & build up bank on D with sand left from C.	Exposed soils were seeded and covered with a thick layer of straw and a silt fence installed along the toe of the bank.
		Access to G-L	Water flows across access road adjacent to Dale Road, from a leaking water main. Culvert damaged and not functioning. Sediment-laden water noted when vehicles drive through.	Recommended filter cloth and 3" clear crush, or a steel plate so that trucks can drive over. Crush added.
		K	Trees measured, cleared and grubbed. Works were halted until locations of stations along the east bank could be determined based on environmental constraints.	
11-Sep	Clear	G-L	All station locations identified with the exception of Station I. Station I requires review from the Ministry.	
11-Sep		K	Excavation works commence and geotechnical engineer on-site. Excavation revealed that the water table is high and the stations could not reach the depth. The engineer advised they are to be 2 lock blocks high instead of 3. Station construction is completed the same day.	Water pumped from the excavation was contributing to sediment-laden water into the creek. The pump was shut off. The pump end was wrapped in filter cloth and check dams were installed. Additional pump length was added to the hose and the water was contained within the blueberry fields. Silt fence was installed along the toe of the bank.
		J	Station J is cleared and grubbed.	

14-Sep	Overcast	J	Construction of Station J commences. Station constructed 2 lock blocks high instead of three due to high water table.	Water is pumped behind dam in the blueberry field but breach occurs. Sediment-laden water enters channel. Pump is off but there was lots of water behind check dams. Filter cloth and check dams added to outflow. Water quality improves after a few minutes.
		F	Dredging commences. A 250GLC Brandt long reach excavator onsite. Turbidity is carefully monitored and operator is stopped when levels are above 8 NTUs. Once the creek is clear, dredging commences. No materials stockpiled at F.	Machine is free of leaks and is clean. Spill kit and fire extinguisher are in the back of the machine.
15-Sep	Rain	E and F	Dredging commenced at Station F and moved to E in the afternoon.	Stockpiling at Station E. Silt fence installed along the creek side of the stockpile. Ditch eels were salvaged from material removed.
		G, H	Fence removed, trees measured and clearing commenced.	
16-Sep	Overcast	E	Dredging continued following extension of works approval (September 29, 2015).	Fish fence in place while dredging.
		J-K	Upgrading road and improving ESC measures.	Silt fence in place alongside ditch and in front of station K and outflow.
17-Sep	Overcast	H	Construction of Station H commences. Station constructed 2 lock blocks high instead of three due to high water table. Meeting onsite to discuss location of Station I.	Added ~75m of hose to the pump and extended across the blueberry field. The end was covered in filter cloth and water was filtered through vegetation.
18-Sep	Overcast	D	Dredging of Station D in the morning and then moved to Station C. Materials were temporarily stockpiled between haul trucks.	Fish fence in place downstream.
		G	Construction of Station G commences. Station constructed 2 lock blocks high instead of three due to high water table.	Exposed soils were seeded and covered with a thick layer of straw and a silt fence installed along the toe of the bank.
21-Sep	Clear	C	Dredging of Station C.	Fish fence in place downstream.

		B	Measuring of trees and vegetation removal. Japanese knotweed at the top of the bank is removed and disposed of in a separate load.	Knotweed is disposed of at Meadow Landscaping (an approved facility).
22-Sep	Clear	B	Station B constructed as per design. No water seepage into excavation, therefore, no pumping required.	Silt fence installed along the toe of the bank.
23-Sep	Clear	L	9m long 650mm culvert installed between K-L. Small swale at inflow end. Trees measured, fence removed, shrubs & vegetation cleared. Construction of Station L commences. Station constructed 2 lock blocks high instead of 3. Backfilling of the station not completed.	Culvert installed in the dry. Some trees cleared beyond approved work zone. Measured for replanting.
24-Sep	Overcast	L	Station L is backfilled. And completed	
		B	Dredging of Station B commences.	Fish fence in place downstream.
25-Sep	Light rain	I	Larry, Bruce, & Gary on site to meet with Krista (MoFLNRO) about Station I location. It is approved pending some paperwork.	
		B	Dredging of station B continues.	Fish fence in place downstream. Large chum salmon seen upstream of B.
28-Sep	Clear	G	Dredging of Station G commences. Small stockpile on the road.	Fish fence in place. Vegetated island must be left in place upstream.
		I	Location of Station I staked and trees for removal are measured.	
29-Sep	Clear	I	The site is cleared and grubbed. Construction of Station I commences. Station constructed 2 lock blocks high instead of three due to high water table. Two 12" corrugated steel culverts are installed within ditch adjacent to the station. No ESC measures implemented.	Culverts installed in the dry.
30-Sep	Clear	G	Dredging at Station G continues. Temporarily stockpiling on the road.	Fish fence in place downstream.
		I	Clean up of Station I.	Load brush and seed exposed soils and cover with a thick layer of straw.
		Access to G-L	Lots of sediment generated when water main is leaking across road. Previous ESC measures (silt fence, clear crush) no longer adequate.	Request gravel or plate to raise trucks above water. Hay bales placed to filter water temporarily.

1-Oct	Clear	L	Dredging of Station L commences. No adequate space for stockpiling in designated location. Small stockpile on the downstream side of L and sand placed up blueberry rows	Fish fence in place downstream. Sediments draining from road will soon enter creek through culvert. Sand berms in place to filter water.
		Access to G-L	Gravel delivered to entrance.	
2-Oct	Clear	K and L	Dredging commenced at L and moved to K. Removed one ~20cm alder tree from K as in way of long-reach.	Fish fence in place downstream. 2 filter cloth/silt fence structures in place to filter sediments before water reaches culvert.
5-Oct	Clear	K and J	Dredging continues at Station K and moves to Station J. Road built up with load of gravel. Small stockpile on road.	Fish fence in place downstream.
6-Oct	Clear	J	Dredging of SRS J completed at the end of the day, small stockpile left on road. No room for stockpiled materials.	Fish fence in place. ESC measures improved by monitor - additional filter cloth in place at culvert entrance.
7-Oct	Rain		Dredging of Station H and I cancelled, the job is complete. No one onsite.	Silt fences need repairing/replacing, some exposed soils need covering, cleaning temporary swale between J-L, stockpile at L removed or sil: fence on wetland side.
19-Oct	Cloudy		Installation of flap gate on to culvert between stations K and L. Some access road improvements were done using 2 loads of 3" minus. Clean-up operations included repairing and replacing silt fences as required, laying straw on exposed clay-based soils, and moving or securing stockpiles with silt fencing.	All measures above have been addressed.
20-Oct	Cloudy		Final clean-up operations included cutting up remaining logs into 4 foot lengths and transporting to First Nations land, removal of garbage, and a final walk through with Monitor.	

CONCLUSIONS

All works were completed by Mission Contracting and monitored full time by Letts Environmental Consultants Ltd. All works were carried out in compliance with the conditions set forth in the Approval (2006265), dated August 20, 2015.

Sand Recovery Stations

Five out of eleven stations were constructed as per design (SRS B-F), and the remaining six stations (G-L) followed design except for having only two levels of lock blocks. The locations of the Stations had changed slightly during construction and the changes are reflected in the most recent legal survey.

The sand recovery stations have been placed on average approximately 1.0 – 2.0m back from the top of the bank. During dredging works, the excavator has the capability of travelling 'beyond' the SRS pad and past the lock blocks to gain reach as no barrier is present. The SRS were designed to stabilize the bank of the creek so the excavator could work from the pad.

Vegetation

Rehabilitation is required following the included Revised Replanting Plan. Shrubs species initially proposed have been revised to include salmonberry (*Rubus spectabilis*) and hardhack (*Spiraea douglasii*). Additionally, willows (*Salix* spp). will be planted within the limits of the SRS.

Replanting should occur within the spring window and must be completed by March 31, 2016. To ensure survival of plants through the summer months, a watering plan should be implemented. Replanting will be monitored for 3 years following completion and must result in 100% tree survival and 85% shrubs survival. Post completion monitoring reports will require submission to Krista Englund at MoFLNRO.

Access Roads

At the access road to Stations G-L along the eastern bank of Hatzic Slough, water is flowing due to a leaking water main. There is no evidence of a culvert here, or it may be damaged, resulting in water flowing over the access road. The movement of various vehicles across this entrance during construction generated fines that may eventually enter Hatzic Slough. In addition, the water causes road degradation and sediment to be carried out on to Dale Road. Attention is needed prior to further activity in future. The culvert (if present) requires repair or replacement. If no culvert is found through the access, then one should be installed for a long-term solution.

Endangered Species

Species at Risk were identified onsite. A western toad was seen within Hatzic Slough just north of Station G near the vegetated island that was conserved from dredging. Habitat opportunities are present in the form of four wetlands nearby to this site and should be protected. SARA does not require protection of wetlands on private property; two of the four wetlands in this case. However, the two wetlands located near Station L are on Crown land and therefore will be protected.

Dredging and Stockpiles

Dredging did result in fines and sediments being released from the watercourse bed but this was controlled by an environmental monitor, with work being halted for short periods to prevent a continuous flush of sediments down. This was important to minimize environmental stress for fish and other organisms downstream of dredging.

Stockpile locations along the eastern bank of Hatzic Slough are constrained by farming activities (blueberry production), Hatzic Slough and access roads. Stockpiling space is limited and dredging could not occur from SRS H and I. Farming activities are currently occurring on crown land which creates conflict for the storage of dredged sand.

Holes in the excavator bucket resulted in some sand and water escaping the bucket while it was moved across the station into a dump truck or on to a stock pile. While it is necessary to allow some drainage, the sand covers a swath of vegetation approximately 2m wide and 7m long, adjacent to the station. Conducting dredging annually will result in permanent destruction of this vegetation and finding an alternate method is recommended. If an alternate method for dredging is adopted, such as vacuuming by means of a vac-truck, then exposed soils within the 16m radius should be rehabilitated with low growing fruit bearing shrubs.

During dredging, the operators extend as far as possible to try and reach as much sand as possible. This leads to the machine sitting on top of and periodically beyond the lock blocks instead of resting behind the lock blocks on the pad of the station. Movement within the lock blocks is evident, but any long-term structural damage as a result of this is unknown.

RECOMMENDATIONS

- 1) A visual barrier should be constructed on each SRS to limit the excavator from traveling beyond the blocks. This will help ensure the top of bank zone is protected from erosion and sloughing.
- 2) Replanting, as per the included plan, is required and should be completed during the spring window. A watering plan should be implemented for the summer months.
- 3) Japanese knotweed is a voracious growing invasive plant. Despite best efforts to remove it, it is already re-growing at Station D and it is likely that it will return to Station B. An Invasive Species Management Plan is required.
- 4) The volume of water flowing across the surface of the access road (on the east side) leading from Dale Road should be addressed. It should be determined if a culvert is present under the road and if so, whether it requires maintenance or upsizing.
- 5) The roadways to SRSs will require maintenance. Maintenance and/or upgrading to all access roads must not prevent the flow and or drainage of surface water from internal farm lands.
- 6) The flap-gate at the outflow end of the culvert between stations K and L will need regular maintenance checks to ensure functionality, particularly following high water events.
- 7) The landowner's original fence was located along the top of the bank and on crown land. The fence can be replaced, provided it follows the private land boundary and does not encroach on crown land.
- 8) The wetlands identified along the banks of Hatzic Slough require protection as habitat for the western toad (*Bufo boreas*) that is protected under Schedule 1 of the Species At Risk Act.

- 9) The recently provided as-built survey must be used to *establish* stockpile locations for dredging in future years and to identify crown land boundaries.
- 10) An alternate method involving the dredging of material in Hatzic Slough is recommended to reduce the impact of sand along the bank and may include vacuum trucks.
- 11) Dredging is a sensitive process in which there can be extremely negative effects downstream if not done in a careful manner. Any future dredging works are to be monitored full-time.
- 12) Conflict is identified between the SRS and farming activities on the east side. A solution is required to be able to stockpile sand adjacent to the blueberry fields. Until a solution can be reached, all sand removed from Stations G, H and I should be hauled off-site.