



***Gitanyow Fisheries
Authority***



**Gitanyow Village and Surrounding Area Fish
Habitat Restoration Feasibility Study – 2016/17**



Submitted to: Fisheries and Oceans Canada
200 – 401 Burrard Street
Vancouver, BC V6C 3S4

Prepared by: Mike McCarthy, HBSc.
Gitanyow Fisheries Authority
P.O. Box 397
Kitwanga, BC, V0J 2A0

Date: June 26, 2017

Table of Contents

1.	Introduction and Background	1
2.	Task 1: Reduce the number of stranded fish along Highway 37 North.....	3
2.1	Introduction and Background	3
2.2	Methods for 2016/2017 FHRI	4
2.3	Results for 2016/2017 FHRI.....	6
2.4	Work Plan and Schedule for 2017/2018.....	12
2.5	Cost Estimate	12
2.6	2017/18 Deliverables	12
3.	Task 2: Erosion Control Adjacent to the Kitwanga River Around the Gitanyow Village Perimeter.....	14
3.1	Introduction and Background	14
3.2	Methods for 2016/2017 FHRI	17
3.3	Results for 2016/2017 FHRI.....	18
3.4	Work Plan and Schedule for 2017/2018.....	18
3.5	Cost Estimate for 2017/2018	18
3.6	Deliverables	18
4.	Task 3: Rehabilitation of the Kitwanga River Side-Channel	18
4.1	Introduction and Background	18
4.2	Methods for 2016/2017 FHRI	19
4.3	Results for 2016/2017 FHRI.....	23
4.4	Work Plan and Schedule for 2017/2018.....	25
4.5	Cost Estimate	25
4.6	Deliverables	25
5.	Conclusion and Discussion.....	26
6.	References.....	26

List of Tables

Table 1: Surface flow patterns (Wetted vs. dry) over the 2016/2017 study period for Task 1.	7
Table 2: Groundwater depth, temperature, and dissolve oxygen results for test and refuge pits from February 4 th to April 2 nd , 2017.	8
Table 3: Cost estimate for the ongoing monitoring of Task1: Reduce the number of stranded fish along Hwy 37N during the 2017/2018 fiscal year.	13
Table 4: Surface flow patterns (Wetted vs. dry) over the 2016/2017 study period for Task 3.	24

List of Figures and Photos

Figure 1: Overview map of Gitanyow Village and general area of proposed rehabilitation works (Source: Google Earth 2015).	2
Figure 2: Task 1 Overflow – Annual runoff down Hwy 37N ditch (left); source of overflow over abandoned beaver dam (right) and abandoned beaver dam (lower middle). Photo taken by GFA on May 25 th , 2015.	3
Figure 3: Task 1 Overflow – Example of a refuge pipe measuring 1.5m diameter x 2m length and with slots at regular intervals allowing juvenile fish to enter pipe during low-flow in the side channel (Left; Photo source: DFO) and YSI unit used to monitor temperature and DO in these pipes (right).	5
Figure 4: Photo Series showing examples of wetted channel for Task 1 (top left, right and middle left) and dry channel (middle right and bottom left and right including stranded coho fry). Top left and middle right show inlet in relation to the Kitwanga River in the background.	6
Figure 5: Photo Series showing examples of test and refuge pipes installation on August 30, 2016: pit excavation (top left), test pipe installation (top right), refuge pipe installation (middle left), completed test pipe installation (middle right), and completed refuge pipe installation (bottom).	9
Figure 6: Photo Series showing examples of test and refuge pipe monitoring for groundwater level, temperature and DO in the fall of 2016 (October 31).	10
Figure 7: Photo Series showing examples of test and refuge pipe monitoring for groundwater level, temperature and DO in the winter of 2017 (February 14 th and 17 th). Note the unusually low snow pack in the area.	11
Figure 8: Aerial view of slide along the Gitanyow South Access Road in relation to the Kitwanga River and Gitanyow Village (Source: Google Earth 2015).	15
Figure 9: Failing hillslopes and turbid water flowing through ditch into the Kitwanga River looking north along the Gitanyow South Access Road (Photos taken February 2015).	16
Figure 10: Eroding Kitwanga River bank adjacent to the Gitanyow Totem Pole and Historical Museum site.	16

Figure 11: Stake-out area to measure rate of erosion of the Kitwanga River bank adjacent to the Gitanyow Totem Pole and Historical Museum site. On March 31 st , 2017, stakes were placed 3m from the sloughing bank at 10m intervals.	17
Figure 12: Photo Series showing the naturally scoured deep pool habitat and catch results along the left bank about 50m upstream of the channel outlet.	20
Figure 13: Photo Series showing the natural LWD cluster and catch results located about 110m upstream of the channel outlet.	21
Figure 14: Photo Series showing the naturally scoured deep pool habitat about 10-20m downstream from the side channel inlet.	22
Figure 15: Photo showing the standing cottonwood in center of photo used for LWD Placement material that was adjacent to a pocket of conifers.	22
Figure 15: Photo Series showing the installation of the downstream LWD cluster on October 11, 2016.	24
Figure 16: Photo Series showing the installation of the middle LWD cluster on October 11, 2016.	25

1. INTRODUCTION AND BACKGROUND

During the 2014/15 fiscal year, the Gitanyow Fisheries Authority (GFA) acquired funding from the Fish Habitat Restoration Initiative (FHRI) to carry out an office exercise to identify fisheries problem areas in the general vicinity of Gitanyow Village, then ranked them based on their severity and priority for potential restoration. Gitanyow Village is located along the banks of the Kitwanga River approximately 25km north of Kitwanga BC along Highway 37N (Figure 1). During the 2105/16 FHRI fiscal year, GFA investigated four problem areas to develop fish habitat restoration plans as required. Several plans were implemented in the 2016/17 FHRI fiscal year, which marked the third year for this initiative, and will be described in detail in further sections in this report.

The Kitwanga River is one of the most productive fish bearing streams in the Skeena Watershed. It supports all five species of Pacific salmon and steelhead, several resident salmonid species, along with numerous coarse fish species:

- Sockeye / Kokanee Salmon (*Oncorhynchus nerka*)
- Chinook Salmon (*O. tshawytscha*)
- Pink Salmon (*O. gorbuscha*)
- Chum Salmon (*O. keta*)
- Coho Salmon (*O. kisutch*)
- Steelhead / Rainbow Trout (*O. mykiss*)
- Cutthroat Trout (*O. clarki*)
- Dolly Varden (*Salvelinus malma*)
- Bull Trout (*Salvelinus confluentus*)
- Mountain Whitefish (*Prosopium williamsoni*)
- Pygmy whitefish (*Prosopium coulterii*)

Following consultation between GFA and the Gitanyow Hereditary Chiefs (GHC), four specific problem areas or “tasks” were identified as important and potential candidates for rehabilitation funding under DFO’s FHRI:

- Task 1: Reduce the number of stranded fish along Highway 37 North,
- Task 2: Erosion Control Adjacent to the Kitwanga River Around the Gitanyow Village Perimeter,
- Task 3: Rehabilitation of a Kitwanga River Side-Channel,
- Task 4: Tea Creek Backwater Weir Restoration At Highway37 North Culvert Crossing.

The following sections will summarize the rational for rehabilitation funding, project area, proposed work schedule and cost estimates associated with the next phases of in-stream works for the 2017/18 fiscal year.



Figure 1: Overview map of Gitanyow Village and general area of proposed rehabilitation works
(Source: Google Earth 2015).

2. TASK 1: REDUCE THE NUMBER OF STRANDED FISH ALONG HIGHWAY 37 NORTH

2.1 Introduction and Background

At first visit in 2015, GFA found that the Kitwanga River had changed course since the most recent aerial photography available, which was from 2006 (Google Earth imagery). Since that time and likely during an extreme flood event that occurred region-wide in 2007, the oxbow shown in Figure 1 above (adjacent to Kitwanga River label) is now a seasonally dry channel and the current mainstem alignment has cut directly south through much of the proposed study area that essentially isolated the oxbow. As such, conditions in the study area had no resemblance to the initial planning maps and GFA had to change investigation and restoration strategies to address the Hwy 37N overflow in the ditchline and the number of stranded fish within this ditchline (Figure 2. This chronic overflow site is located between Km 19 and Km 20 along Hwy 37N (about 1km south of the Gitanyow Village South Access Road).



Figure 2: Task 1 Overflow – Annual runoff down Hwy 37N ditch (left); source of overflow over abandoned beaver dam (right) and abandoned beaver dam (lower middle). Photo taken by GFA on May 25th, 2015.

Works completed by GFA during the 2015/16 FHRI resulted in intensive investigation and ground truthing. GFA determined that an abandoned beaver dam along a distinct side channel had caused this Hwy37N ditch overflow during high-water periods. The GFA breached the abandoned beaver dam in the fall of 2015 to track flow that had been cut off from its natural course by the dam. This proved viable as flow into the Hwy 37N ditchline discontinued. Following breaching, this side channel was tracked using a GPS for its entire length of about 800m. This channel offers excellent summer rearing habitat for juvenile salmonids as it contains an abundance of deep pools, instream woody debris, and overstream vegetation cover. Juvenile fish trapping using Gee trap was also carried out in the fall of 2015, which yielded large numbers of coho salmon, and lesser numbers of chinook salmon, Dolly Varden char/bull trout, rainbow/steelhead trout, and rocky mountain whitefish (McCarthy 2016).

Later in the fall of 2015, McElhanney Consulting Services Ltd. (Terrace BC) produced an engineered site plan for an 80m-long channel diversion to prevent any flow from touching the highway at a single point along the reinstated natural channel (presented in a supplemental file entitled “2015-12-23 - Gitanyow Fisheries Improvements Conceptual Design Report”).

GFA returned to this site in March 2016 near winter's end and found the channel was completely dry throughout its length except for a few pockets of shallow pools under ice. The Kitwanga River was under low-flow conditions and the inlet to this channel was suspended by about 20-30cm above the Kitwanga River high water mark at that time. This finding initiated a consultation with DFO, who in turn suggested excavating a series of deep pools along the alignment to create potential low-water habitat. DFO recommended first that GFA install a series of water quality test pipes (4" perforated PVC pipes) and two refuge pipes to justify restoration options.

2.2 Methods for 2016/17 FHRI

Five test pipes and two refuge pipes were installed in a completely dry channel on August 30, 2016 using an excavator and support labour. The 10cm (4") perforated PVC pipes were buried at about 2.5m below the stream bed, while the 1.6m diameter x 2m long refuge pipes were buried about 1.5m below the stream bed (Figure 3). The refuge pipes are designed to allow juvenile salmonids to enter the pipe as water recedes prior to dry periods. These pipes were provided by DFO to GFA on loan for the trial period. During excavation fine sediment material near the

surface was separated from underlying course gravel/cobble material into two piles. Once the pipes were placed in the hole, the excavator used the course material for bottom fill and the remaining fine material for top fill. This would allow improved groundwater flow to percolate through the bottom of the pipes. Following installation, the PVC pipes were capped and the refuge pipes were covered and secured using plywood with a hinged porthole for monitoring access into the pipe in order to prevent people or animals to accidentally fall into the pits.

Water quality monitoring in the pipes involved the collection of groundwater depth, temperature, and dissolved oxygen (DO; mg/L) data regularly during dry channel periods. Temperature and oxygen levels were collected using a YSI Professional Series Model Professional Plus (Figure 3). In addition, water levels within the channel itself (wet vs. dry) were documented at regular intervals during the 2016/17 FHRI season in order to establish a seasonal pattern.



Figure 3: Task 1 Overflow – Example of a refuge pipe measuring 1.5m diameter x 2m length and with slots at regular intervals allowing juvenile fish to enter pipe during low-flow in the side channel (Left; Photo source: DFO) and YSI unit used to monitor temperature and DO in these pipes (right).

2.3 Results for 2016/2017 FHRI

This side channel was largely influenced by the water level of the Kitwanga River at the side channel inlet. The inlet channel bottom is suspended above the Kitwanga River channel bottom due to an accumulation of gravel, cobble and sand, therefore during low-water periods in the Kitwanga River, the channel frequently dried up (Figure 4). This occurred frequently during the summer and winter months of the 2016/17-study period and conversely this channel was flowing during spring and fall freshets or heavy rain events during the late summer (Table 1).



Figure 4: Photo Series showing examples of wetted channel for Task 1 (top left, right and middle left) and dry channel (middle right and bottom left and right including stranded coho fry). Top left and middle right show inlet in relation to the Kitwanga River in the background.

Table 1: Surface flow patterns (Wetted vs. dry) over the 2016/17 study period for Task 1.

Date	Wetted/ Dry	Comments
06-Jun-16	Dry	Very recent and abrupt dry-out post spring freshet, 1,000+ dead coho fry observed in the lower section.
08-Aug-16	Dry	Dry since June 6.
29-Aug-16	Dry	Dry since June 6. Test and refuge pipes installed on this day.
01-Sep-16	Wet	Heavy rainstorm 1-2 days following pipe installation. Flow through side channel was abrupt and at bankfull.
08-Sep-16	Wet/Dry	Kitwanga River subsided following rainstorm, wetted downstream to about 50m upstream of the channel outlet the became subsurface flow.
17-Sep-16	Wet/Dry	Kitwanga River continued to subside following rainstorm; wetted along top half of channel then became subsurface on the lower half.
12-Oct-16	Dry	Completely dry channel soon after September 17.
31-Oct-16	Dry	Dry since Oct 12.
11-Nov-16	Wet	Fully flowing from rainstorm that occurred a few days prior that raised the Kitwanga River water level.
24-Nov-16	Dry	Dry channel after Kitwanga River receded soon after November 11 rainstorm.
04-Feb-17	Dry	Winter dry out since late November.
17-Feb-17	Dry	Winter dry out since late November.
25-Feb-17	Dry	Winter dry out since late November.
05-Mar-17	Dry	Winter dry out since late November.
28-Mar-17	Dry	Winter dry out since late November.
02-Apr-17	Dry	Winter dry out since late November.

Test pipes and refuge pits were installed on August 30, 2016 and monitored during the winter of 2016/2017 for water level, temperature and DO content from groundwater flow. Pipe locations are shown in an attached file to this document in a scaled geo-referenced map in PDF format entitled “Kitwanga_Rehabilitation_2016_2017_Task 1” at 11” x 17” format and at 1:5,000 scale. Photo series of installation is shown in Figure 5 and of monitoring activities in the fall and winter in Figures 6 and 7.

Results were variable and inconclusive for both water levels and DO during 2016/2017 winter monitoring (February 4th and 25th, March 5th, and April 2nd, 2017). A cold weather snap in early December 2016 froze all the 4” test pipes and they remained frozen for the duration of the winter, however readings were obtained On April 2nd, 2017 on a Test Pipe (TP) 4 and 5 in the upper reach of the channel, which had eventually thawed. Water level and DO content inside the refuge pits (RP) varied from nearly dry to a depth from bottom of about 1m, while DO varied from lethal to adequate depending on the RP location, water depth and date of sampling (Table 2; Notes: RP

denotes Refuge Pits and TP denotes Test Pits; TP 3 was deemed immeasurable due to infilling by silt to the top of pipe). DO was more favourable in RP 1 located at the lower end of the channel ranging from above 10 mg/L in February to below 5.4 mg/ L by early April. DO was sub-optimal in RP 2 located about midsection along the channel ranging from above 2.4 to 4.4 mg/L throughout the winter.

Table 2: Groundwater depth, temperature, and dissolve oxygen results for test and refuge pits from February 4th to April 2nd, 2017.

Date	Site	Pipe depth below channel bottom (m)	Groundwater depth (m)	Temp. (Celcius)	DO (mg/L)
04-Feb-17	RP 1	1.10	0.18	0.5	10.30
	RP2	1.15	0.75	0.6	3.51
	TP 1	2.50	Frozen	n/a	n/a
	TP 2	1.78	Frozen	n/a	n/a
	TP 4	1.78	Frozen	n/a	n/a
	TP 5	1.90	Frozen	n/a	n/a
25-Feb-17	RP 1	1.10	0.94	0.4	12.60
	RP2	1.15	0.94	1.4	3.42
	TP 1	2.50	Frozen	n/a	n/a
	TP 2	1.78	Frozen	n/a	n/a
	TP 4	1.78	Frozen	n/a	n/a
	TP 5	1.90	Frozen	n/a	n/a
05-Mar-17	RP 1	1.10	0.14	1.6	6.80
	RP2	1.15	0.48	1.7	2.40
	TP 1	2.50	Frozen	n/a	n/a
	TP 2	1.78	Frozen	n/a	n/a
	TP 4	1.78	Frozen	n/a	n/a
	TP 5	1.90	Frozen	n/a	n/a
02-Apr-17	RP 1	1.10	0.36	0.6	5.35
	RP2	1.15	0.46	1.6	4.40
	TP 1	2.50	Frozen	n/a	n/a
	TP 2	1.78	Frozen	n/a	n/a
	TP 4	1.78	1.27	1.1	2.70
	TP 5	1.90	1.00	0.2	11.70



Figure 5: Photo Series showing examples of test and refuge pipes installation on August 30, 2016: pit excavation (top left), test pipe installation (top right), refuge pipe installation (middle left), completed test pipe installation (middle right), and completed refuge pipe installation (bottom).



Figure 6: Photo Series showing examples of test and refuge pipe monitoring for groundwater level, temperature and DO in the fall of 2016 (October 31).



Figure 7: Photo Series showing examples of test and refuge pipe monitoring for groundwater level, temperature and DO in the winter of 2017 (February 14th and 17th). Note the unusually low snow pack in the area.

2.4 Work Plan and Schedule for 2017/18

For the 2017/18 FHRI fiscal year, GFA plans to conduct monthly monitoring of this side channel for flow regimes and water quality (temperature and DO) starting in April 2017 until March 2018 (12 sessions). In addition, at DFO's advice, GFA will remove all the test pipes and refuge pits during the summer dry-channel period (expected in July/August). An excavator will be used to remove the structures and leave pools at a minimum of 1m in depth at the pipe/pit locations for fish refuge/salvage opportunities. A weir log will be placed at the top of these pools to facilitate pool scouring during flow periods. GFA will attempt fry salvaging in all pools, both natural and constructed, when channel dry-out occurs under another funding source (salvaged fish will be released into the adjacent Kitwanga River mainstem).

2.5 Cost Estimate

The total cost of completing Task 1 for the 2017/18 fiscal year is estimated at \$20,690, which includes contract biologist, GFA labour (GFA Biologist and Field Technicians), excavator rental and low bedding, equipment rental, transportation, reporting and mapping and administration fees (estimated at 7.5%) and is summarized in Table 3. Note that the budget shown in Table 3 is a complete proposed budget for the entire FHRI Gitanyow Village and Surrounding Area Fish Habitat Restoration Feasibility Study for 2017/2018; this budget in Table 3 will be referred to in following sections for Tasks 2 and 3 as three tasks are all inclusive.

2.6 2017/18 Deliverables

A project report will be submitted to all appropriate agencies showing water quality results of water quality for test and refuge pits during the summer dry-out period and prior to removal, along with season flow regimes (wetted vs. dry) within the channel throughout the 2017/18 season.

Table 3: Cost estimate for the ongoing monitoring of Task1: Reduce the number of stranded fish along Hwy 37N during the 2017/18 fiscal year.

Work Phase	Item (Unit)	EC Code	Rate	Qty	Est. Cost
Planning	Contract Biologist (Days)	6	\$600	1	\$600
Task 1, 2, and 3 - Monitoring (Monthly from April 2017 to March 2018).	Contract Biologist (Days)	6	\$600	4	\$2,400
	Technician (hrs)	9	\$45	96	\$4,320
	Pick-up Truck (Days)	11	\$150	12	\$1,800
	Equipment Rental (Days)	7	\$100	12	\$1,200
Subtotal					\$9,720
Test and Refuge Pit Removal	Contract Biologist/ Environmental Monitor (Days)	6	\$600	2	\$1,200
	Technician (hrs)	9	\$45	16	\$720
	Pick-up Truck (Days)	11	\$150	4	\$600
	Excavator Rental (hrs)	6	\$175	10	\$1,750
	Excavator Mob/Demob	6	\$175	8	\$1,400
	Materials (grass seed for erosion and sedimentation control)	7	Lump	1	\$500
	Equipment Rental (Days)	7	\$100	1	\$100
Subtotal					\$6,270
Reporting	Contract Biologist (Days)	6	\$600	2	\$1,200
	GFA Biologist (Hrs)	9	\$60	10	\$600
Drafting	Mapper (Days)	6	\$500	0.5	\$250
Subtotal					\$2,050
Total less Admin.					\$18,640
Admin (7.5%)					\$1,361
Total					\$20,690

3. TASK 2: EROSION CONTROL ADJACENT TO THE KITWANGA RIVER AROUND THE GITANYOW VILLAGE PERIMETER

3.1 Introduction and Background

In 2015, the GFA identified two large-scale erosion and sedimentation issues surrounding the Gitanyow Village that has been ongoing for decades (Figure 8). Firstly, two large slide areas located adjacent to each other along the Gitanyow South Access Road has been eroding and introducing sediment directly into the Kitwanga River since the road was constructed (Figure 9). GFA deemed this issue as outside the scope of FHRI and has been deferred to MOTI for resolution (see McCarthy and Cleveland 2016 for background information including restoration costs prepared by McElhanney Consulting Services Ltd.)

In addition to these slides, significant erosion is ongoing on the Kitwanga River right bank (facing downstream) and is gradually removing land adjacent to the Gitanyow Totem Pole and Historical Museum site and introducing significant amounts of sediment into the river system (Figure 10). The nearest totem pole structures are currently about 30m and the Gitanyow Historical Museum is about 50m away from the river's edge. In the fall of 2015, McElhanney Consulting Services Ltd. estimated the cost of reducing bank erosion behind the Gitanyow Historical Museum/Totem Pole/Cemetery site at about \$550,000 including engineering, construction, and GFA support to armour the riverbank with geotextile and boulder rip-rap (see McCarthy and Cleveland 2016 for background information including restoration costs prepared by McElhanney Consulting Services Ltd.).

No construction works were planned during the 2016/17 fiscal year due to high rehabilitation costs. However GFA carried out a monitoring plan to measure the rate of erosion occurring along the Kitwanga River right bank behind the Gitanyow Totem Pole and Historical Museum. This involved installing a series of survey stakes set perpendicular to the eroding bank section on a grassy area above the eroding area that can be measured on a regular basis.



Figure 8: Aerial view of slide along the Gitanyow South Access Road in relation to the Kitwanga River and Gitanyow Village (Source: Google Earth 2015).



Figure 9: Failing hillslopes and turbid water flowing through ditch into the Kitwanga River looking north along the Gitanyow South Access Road (Photos taken February 2015).



Figure 10: Eroding Kitwanga River bank adjacent to the Gitanyow Totem Pole and Historical Museum site.

3.2 Methods for 2016/17 FHRI

Prior to the 2017 spring freshet (March 31st, 2017), GFA installed wood and metal stakes along the eroding section of the Kitwanga River adjacent to the Gitanyow Totem Pole and Historical Museum. Seven stakes were placed 10 meters apart along the right bank shoreline and set 3 meters from the bank edge (Figure 11). The steep eroding bank measures about 4.5 meters in height from the river high-water mark up the top of the bank and at a slope of about 100%. The wooden stakes were labelled for station number and date of installation. Metal stakes (1/2" diameter rebar x 12" in length) were driven flush to the ground against the wooden stakes. In case the wooden stakes are removed, a metal detector can easily locate the metal stakes along the transect line.



Figure 11: Stake-out area to measure rate of erosion of the Kitwanga River bank adjacent to the Gitanyow Totem Pole and Historical Museum site. On March 31st, 2017, stakes were placed 3m from the sloughing bank at 10m intervals.

3.3 Results for 2016/17 FHRI

Erosion rate will be measured during the 2017/18 FHRI fiscal year. GFA will simply measure the distance from the bank edge to the 3m offset markers on a monthly basis in conjunction with the monthly monitoring of Tasks 1 and 3. GFA expects significant erosion, if measurable, to occur during spring and fall freshets and during heavy rainstorm. A geo-referenced PDF map showing the eroding section (11” x 17” format at 1:5,000 scale) is provided as a separate attachment to this document entitled “Kitwanga_Rehabilitation_2016_2017_Task 2”.

3.4 Work Plan and Schedule for 2017/18

GFA proposes to monitor Task 2 once a month for erosion in conjunction with the monitoring of Tasks 1 and 3 for the entire 2017/2018 FHRI fiscal year.

3.5 Cost Estimate for 2017/18

Table 3 shown above in Task 1 cost estimate section is a complete proposed budget for the entire FHRI Gitanyow Village and Surrounding Area Fish Habitat Restoration Feasibility Study for 2017/2018 and includes monthly monitoring of Tasks 1, 2 and 3 (1 day per month) at an estimated cost of \$20,690.

3.6 Deliverables

An erosion monitoring report will be submitted to all appropriate agencies. Most importantly for this task, the erosion results will be forwarded the Gitanyow Band Council for their review and input.

4. TASK 3: REHABILITATION OF THE KITWANGA RIVER SIDE-CHANNEL

4.1 Introduction and Background

In the spring of 2015, GFA identified possible locations to rehabilitate two Kitwanga River side-channels adjacent to the Hwy 37N just south of the South Access Road junction, however only one was deemed feasible as it appeared to provide year round flow. This channel is located adjacent to the Gitanyow South Access Road/ Hwy 37N junction and enters from the left bank of the Kitwanga River mainstem at about UTM 9U 560210E/6122560N and exits back into the mainstem at about 9U 6122345E/6122350N (about 240m in length).

This side channel provided an excellent opportunity to enhance Kitwanga salmon stocks, particularly coho and chinook, which depend on deep-pool habitat for rearing and overwintering. This side channel was greatly lacking in deep pools due to minimal large woody debris (LWD) content. Only three natural deep pools were associated with this side-channel all of which provide optimal habitat for large numbers of salmonids. In an upstream direction, the first pool was a scoured bend located about 50m upstream of the channel outlet (Figure 12). The second deep pool was associated with a LWD cluster (logs and root wads) located midway through the channel (Figure 13), while another was a scoured pool located about 10m downstream of the inlet (Figure 14). The LWD cluster is the result of one large cottonwood tree that had fallen perpendicular to the channel several years ago acting as a LWD catchment from high Kitwanga River mainstem flow. GFA sampled for fish in the downstream scour pool and under the natural LWD jam mid-reach in late September 2015 and captured significant numbers of coho (about 200 fish in six traps set for 4 hours), along with smaller numbers of chinook, rainbow and cutthroat trout and Dolly Varden/bull trout char (McCarthy and Cleveland 2016).

For the 2016/17 FHRI, GFA received funding to install additional LWD structures during 2016 low-flow conditions to provide fish habitat similar to the only LWD cluster that was currently in place. This side-channel was easily accessed by heavy machinery as Hwy 37N is located within about 50m from the Task 3 project site.

4.2 Methods for 2016/2017 FHRI

Three LWD structures were installed in the side channel on October 11, 2016. An excavator was used to install large-diameter cottonwood logs that were anchored into the stream bank for structural stability. An Engineer from McElhanney Consulting Services Ltd. and a GFA Biologist supervised this project. Prior to construction works, GFA isolated the work area with barrier nets and all fish were salvaged and released into the Kitwanga River mainstem. At that time, most water was flowing subsurface, however some groundwater-fed pools were interspersed within the work area.

A certified faller cut one large cottonwood tree from a densely forested area near the worksite that was used for the two upstream structures (Figure 15; see cottonwood tree in center of photo surrounded by conifers). A large cottonwood that had fallen near the worksite in the recent past was used for the downstream structure. Along with the LWD installation, 1m-deep pools x about

3m in diameter were excavated immediately below the LWD structures with the hope the LWD would maintain these pools in the future. Following installation, the exposed soils from construction activities were seeded with a certified grass mixture for erosion control.

For the 2016/17 FHRI fiscal year, GFA monitored this side channel in conjunction with Task 1 monitoring for seasonal flow regimes (wetted vs. dry) and water quality (temperature and DO) in the constructed pools immediately below the LWD placements when wetted.



Figure 12: Photo Series showing the naturally scoured deep pool habitat and catch results along the left bank about 50m upstream of the channel outlet.



Figure 13: Photo Series showing the natural LWD cluster and catch results located about 110m upstream of the channel outlet.



Figure 14: Photo Series showing the naturally scoured deep pool habitat about 10-20m downstream from the side channel inlet.



Figure 15: Photo showing the standing cottonwood in center of photo used for LWD Placement material that was adjacent to a pocket of conifers.

4.3 Results for 2016/17 FHRI

Three LWD were installed in sections void of deep pools on October 11, 2016. LWD installation locations are shown in an attached file to this document in a scaled geo-referenced PDF map entitled “Kitwanga_Rehabilitation_2016_2017_Task 3” at 11” x 17” format and at 1:5:000 scale. The excavator worked along the left bank of the side channel and the excavator did not need to enter the channel bed at any time.

The lowermost LWD cluster was installed about 80m upstream from the channel outlet (or about 30m downstream of the natural LWD jam) and consisted of a “V” shape configuration pointing downstream (Figure 15; labelled LWD and Deep Pool Placement #1 in attached PDF map). The middle LWD cluster was installed about 145m upstream from the channel outlet and was set at a slight angle pointing downstream (Figure 16; labelled LWD and Deep Pool Placement #2 in attached PDF map). The upstream LWD cluster was installed about 170m upstream from the channel outlet and was set perpendicular to the channel (Figure 17; labelled LWD and Deep Pool Placement #3 in attached PDF map).

Water levels within the channel itself (wet vs. dry) were documented at regular intervals during the 2016/17 FHRI season in order to establish a seasonal pattern (Table 4). Surface flow patterns coincided with high flow conditions in the Kitwanga River, while the channel was dry during Kitwanga River low flow conditions (mid-summer, mid-fall, and all of winter).

Table 4: Surface flow patterns (Wetted vs. dry) over the 2016/17 study period for Task 3.

Date	Wetted/ Dry	Comments
23-Jun-16	Dry	Very recent and abrupt dry-out post spring freshet.
09-Aug-16	Dry	Dry since June 23.
29-Aug-16	Dry	Dry since June 23.
01-Sep-16	Wet	Heavy rainstorm 1-2 days prior; flow through side channel was abrupt and at bankfull.
11-Oct-16	Wet/Dry	Sporadic groundwater-fed pools; mainly dry; LWD structures installed on this day.
16-Oct-16	Wet/Dry	Sporadic groundwater-fed pools; mainly dry.
31-Oct-16	Dry	Dry since Oct 16.
13-Nov-16	Wet	Fully flowing from rainstorm that occurred a few days prior that raised the Kitwanga River water level.
25-Nov-16	Dry	Sporadic groundwater-fed pools; mainly dry. Fry salvage carried out in isolated pools.
15-Jan-17	Dry	Winter dry out since late November.
17-Feb-17	Dry	Winter dry out since late November.
17-Mar-17	Dry	Winter dry out since late November.
17-Apr-17	Dry	Winter dry out since late November.



Figure 15: Photo Series showing the installation of the downstream LWD cluster on October 11, 2016.



Figure 16: Photo Series showing the installation of the middle LWD cluster on October 11, 2016.

4.4 Work Plan and Schedule for 2017/18

For the 2017/2018 FHRI fiscal year, GFA proposes to conduct monthly monitoring of this side channel for flow regimes and water quality (temperature and DO) starting in April 2017 until March 2018 (12 sessions). This will coincide with the monitoring of Tasks 1 and 2. GFA will attempt fry salvaging in all pools, both natural and constructed, when channel dry-out occurs in 2017 under another funding source. Salvaged fish will be released into the adjacent Kitwanga River mainstem.

4.5 Cost Estimate

Table 3 shown above in Task 1 cost estimate section is a complete proposed budget for the entire FHRI Gitanyow Village and Surrounding Area Fish Habitat Restoration Feasibility Study for 2017/2018 and includes monthly monitoring of Tasks 1, 2 and 3 (1 day per month) at an estimated cost of \$20,690.

4.6 Deliverables

A project report will be submitted to all appropriate agencies showing water quality results in constructed pools immediately downstream of the LWD placement during the summer dry-out

period along with seasonal flow regimes (wetted vs. dry) within the channel throughout the 2017/18 season.

5. CONCLUSION AND DISCUSSION

The three projects (Tasks) investigated in this report will benefit the Kitwanga River salmonid populations by reducing the mortality of stranded fry/smolt (Task 1), reducing sedimentation input into the river ecosystem (Task 2), and adding high quality side-channel habitat (Task 3). Due to conflicts with DFO and MOE on the site design by McElhanney Consulting Services Ltd (2015) Task 4, which was the rehabilitation of the Tea Creek/Hwy 37N culvert crossing (McCarthy and Cleveland 2016), was not pursued in 2016/17. Therefore GFA deferred Task 4 back to DFO and MOE. GFA offers support for rehabilitation upon request including environmental monitoring, site isolation and fish salvaging.

The total project costs projected for the 2017/18 fiscal year for Tasks 1,2, and 3 is estimated at \$20,690, which includes monthly monitoring of Tasks 1, 2, and 3, in addition to the removal of test and refuge pipes using an excavator for Task 1 (see Table 3 above).

Given that the Task 1 and 3 side channel projects are only wetted during very high flow in the Kitwanga River mainstem, which draw in large number of salmonids; these two tasks will ideally shift to regular fry salvaging operations as funding permits.

6. REFERENCES

Grieve G.D. and D. Webb. 1999. Kitwanga River Steelhead: Summary of Current Data and Status Review. Biolith Scientific Consultants Ltd. Report prepared for BC Ministry of Environment, Lands and Parks. Skeena Fisheries Report #SK 101.

Reiser D.W. and T.C. Bjornn. 1979. Habitat Requirements of Anadromous Salmonids: Influence of Forest and Rangeland Management on Anadromous Fish Habitat in Western North America. US Department of Agriculture and Forest Service – Pacific Northwest Forest and Range Experimental Station.

McCarthy M. and M.Cleveland. 2016. Gitanyow Village and Surrounding Area Fish Habitat Restoration Feasibility Study – 2015/2016. GFA Report submitted to Fisheries and Oceans Canada.