

# DFA Damage Assessment 2023 Freshet Flooding

Village of Cache Creek



ENGINEERING ■ PLANNING ■ URBAN DESIGN ■ LAND SURVEYING

July 2023

Project No. 310-441

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## Report Submission

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# List of Acronyms

DFA	Disaster Financial Assistance– Provincial Program operating under legal authority of the Emergency Program Act
EMCR	Emergency Management BC – Part of the Ministry of Public Safety and Solicitor General responsible for Emergency Management in BC.
TRUE	TRUE Consulting
WWTP	Wastewater Treatment Plant
MH	Manhole
CB	Catch Basin



# 1.0 Introduction

High spring temperatures in the final days of April and first days of May accelerated freshet and caused Cache Creek to flood a portion of the Village of Cache Creek. Floodwaters passed through the firehall, and erosion started on Highway 97, the abutments on the Todd Road Bridge, and behind bridge abutments on the Trans-Canada-Highway (TCH) Bridge on the South side of the Village. This prompted a state of emergency to be declared on May 2<sup>nd</sup>, 2023. This freshet was followed by extensive rainfall which contributed to high flow rates in Cache Creek and caused high water to be maintained after freshet flows would have normally begun to fall. Floodwaters continued to flow over both private and public property causing extensive damage.



## 2.0 Methodology

The procedure followed for the preparation of this engineer's report consists of the following tasks:

- Review of drawings and GIS mapping
- Completion of site visits
- Determination of recovery costs
- Preparation of summary report using Provincial DFA guidelines and eligibility criteria

Documents and references available for our review included the following:

- Cache Creek composite utility plan
- TRUE 2021 VCC Flood Mitigation Plan
- TRUE 2023 Flood Event Emergency Works – Replacement of River Crossing
- Telford Geotechnical Technical Memorandum – Flood Damage Retaining Wall – 2023

## 3.0 Background information


The Village of Cache Creek is a community of approximately 1000 people and is located at the convergence of Highways 1, 97 and 97C as well as the confluence of Cache Creek into the Bonaparte River. The Village is highly prone to flooding from both Cache Creek and the Bonaparte River. The Cache Creek watercourse has caused flooding impacts in 2015, 2017, 2018, and in 2020. The Bonaparte River has previously experienced significant flood peaks in 1999, 2002, 2011, 2014, 2018, and 2020.

Prior to the Spring 2023 flood, all linear infrastructure and roadways were in good working order.

## 3.1 Damage Assessment

Damage in the Village of Cache Creek experienced during the 2023 flood event is summarized below.

**TABLE 3-1: DAMAGE IN THE VILLAGE OF CACHE CREEK**

<p>1. Critical Watermain Crossing – a section of watermain crossing under the Bonaparte River was compromised during the flooding event and was isolated to prevent contamination and loss of pressure in the system. Temporary HDPE pipe is in place to supply water until a permanent repair can be made. This current temporary solution does not provide adequate fire flow and is highly susceptible to freezing.</p>	
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2. Firehall – Floodwaters from Cache Creek passed through the firehall causing extensive damage. This damage is expected to be covered by insurance.





3. Todd Road Bridge – Access on each side of the wooden deck bridge was eroded from Cache Creek overland flows. This left a significant portion of fire hydrant standpipe exposed with limited thrust restraint as well as an exposed storm manhole.





4. Quartz Road Culvert – rapid high-volume flow in Cache Creek carried significant bedload which eventually plugged and damaged the culvert causing overtopping which subsequently eroded the road structure leaving the current bottom of creek at top of culvert elevation.





5. WWTP Outfall – Beginning in 2020 high volume flow in the Bonaparte River has deposited significant bedload at the location of the wastewater treatment plant outfall. The main river channel has migrated to the east, separating the outfall from the river. Prior to the 2023 flood the outfall was functional, however no longer flowing into a dilution zone in the river. During the 2023 flood the outfall failed completely and wastewater effluent began bubbling to the surface on site. A temporary channel was constructed and is currently being used to convey treated effluent to the Bonaparte River. The last photo shown is a snip showing an area polygon against an ortho photo taken during the flood event to highlight the scale of change in the Bonaparte River.





6. WWTP sediment cleanout – treatment tanks at the WWTP faced significant silt content during flood event flows before the WWTP was completely bypassed. This sediment has settled out reducing the capacity of the aeration tanks and limiting the effectiveness of the treatment plant.



7. Debris Removal – approximately 350 truckloads of silt and gravel were removed from flooded areas in the Village and stockpiled near the local landfill.



8. Firehall Apron- flood waters caused lifting and heaving of concrete slabs in the apron of the firehall.



9. Community Hall Parking – Cache Creek floodwaters caused significant undermining and erosion of storm infrastructure, electrical conduit, parking load structural aggregates and surfacing. A lock-block retaining wall at the south-West corner was also undermined and damaged.







10. Community Hall Rock Pit – Sediment from Cache Creek floodwaters has filled the voids in the rock pit leaving no capacity for storm water. The last photo is taken from ortho imagery taken during the flood event. This rock-pit was attempted to be cleaned by vac-truck but remains unusable.





11. Stage Road Retaining Wall. Cache creek floodwaters undermined the Allan block retaining wall causing settling of a section of the wall and a tension crack to form behind of the wall as was noted in an assessment by Telford Geotechnical Ltd.



	
<p>12. Road Works Repair – Floodwaters and emergency operations caused damage to asphalt that require restoration to existing finished asphalt surface.</p>	

13. Irrigation Systems Failure – many locations throughout the Village of Cache Creek have damaged irrigation lines from Cache Creek flood waters and the debris carried within them. This has left significant portions of the irrigation system inoperable.



14. Sediment and Debris Removal – floodwaters left gravel, silt, and woody debris throughout the Village. The finer material is easily picked up by wind creating hazardous dust.



15. Sanitary Sewer Flushing and Inspection – Significant flows containing a significant amount of sand and gravel from floodwater passed through the sanitary sewer system which deposited sediment and may have caused damage within the system.



16. Hydrovac of Stormwater Systems – all catch basins in the overland flow path are plugged with sediment and can not currently accept any flow.



17. Storm Outfalls– the sediment transport during the flood event caused multiple storm outfalls to be buried.





18. Chipping of Woody debris – large woody debris was deposited in the Village after floodwaters receded.



19. Park Rehabilitation – Floodwaters from Cache Creek eroded grass and soils at Firehall Park. Cariboo Sam's Park pathways experienced erosion and sediment deposits.



	
<p>20. Sidewalk Replacement – Extensive lengths of sidewalk owned by the Village was damaged or completely removed along the Trans-Canada-Highway and Highway 97 from Cache Creek floodwaters and emergency response.</p>	



21. Storage Trailer – The Bonaparte River eroded the rivers edge where a Village storage trailer was located. This caused the trailer to tip into the river, fall apart, and scatter debris along the rivers edge.





22. WWTP Lift station – high sediment concentrations in the wastewater are likely to have caused excessive wear on lift station pumping components with the impeller of particular concern.



23. Collins Road stormwater outfall – overland flow from Cache Creek conveyed on Collins Road caused an outfall to be both filled with sediment and damaged by flows outside of the outfall which cause erosion in the area. A section of chain-link fence was also damaged by the floodwaters.



	
<p>24. Highway bridge damaged watermain – This project refers to the same water crossing damage observed in item 1. The watermain crossing the river was damaged during emergency response. It is likely that the riprap piled on the North bank of the river to protect the bridge abutment caused the damage. The watermain can not be left in its current state.</p>	

25. Bonaparte River Sanitary crossing – rapid moving floodwater exposed sanitary crossing leaving it with no cover below river bottom.



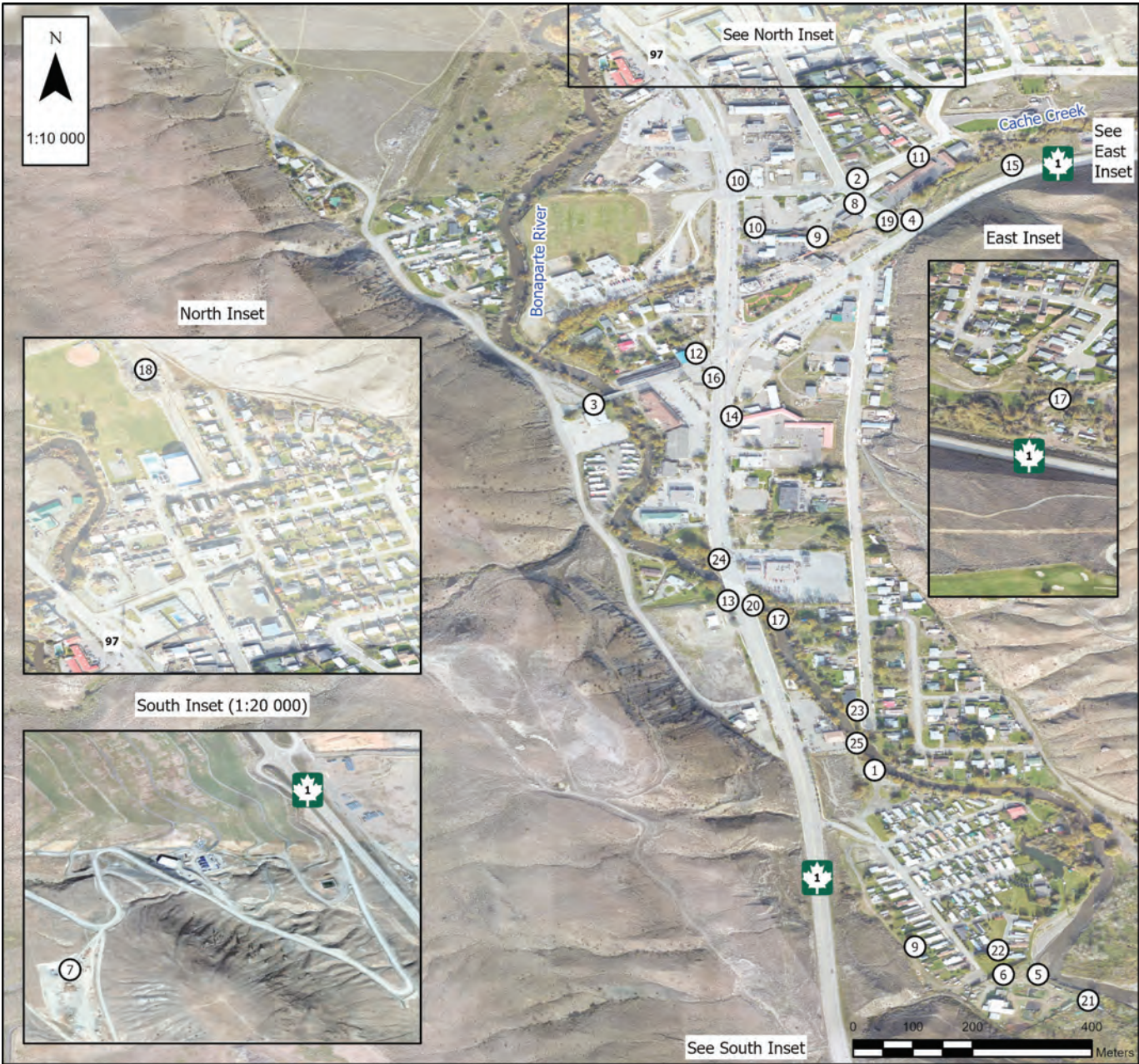


FIGURE 3-1: DAMAGE LOCATIONS

## 4.0 Recovery Plan

A recovery plan for the various locations described previously as well as a description of the repair works proposed at each site and cost estimate to repair is provided in this section. A more detailed breakdown of these costs can be found in Appendix A. In order to proceed with recovery projects as quickly as possible, this report is being submitted with some projects still in the cost estimate phase. These projects are omitted or left blank for the purpose of this submission and will be complete on later submissions of this report.

The estimated costs are considered a Class C estimate (+/- 25 - 40%) as defined in the EGBC Budget Guidelines for Consulting Engineering Services: "An estimate prepared with limited site information and based on probable conditions affecting the project. It represents the summation of all identifiable project elemental costs and is used for program planning, to establish a more specific definition of client needs and to obtain preliminary project approval.

**TABLE 4-1: RECOMMENDED RECOVERY ACTIONS**

RECOMMENDED RECOVERY ACTION	PRELIMINARY RECOVERY COST ESTIMATE	ENHANCEMENTS	ENHANCEMENT COST ESTIMATE	ESTIMATE ELIGIBLE COST	DESCRIPTION
1a. Directional Drill water crossing across Bonaparte River.	\$232,000.00	N/A	N/A	\$232,000.00	This Action is already approved under DFA regulation as Event #2324-01 Project 1 - Watermain. Details can be found in TRUE's 2023 Flood Event Emergency Works – Replacement of River Crossing report which can be found in Appendix B.
1b. Engineering and Project Management for Project 1a. (approved under response)	\$45,000.00	N/A	N/A	\$45,000.00	The cost estimate provided for recovery action 1a was provided in the context of flood response in which engineering and project management would be covered separately. Given that the project is now taking place under the umbrella of recovery this cost will now have to be accounted for here.
2. Firehall Insurance Deductible.	\$50,000.00	N/A	N/A	\$50,000.00	Firehall building repairs are covered by insurance with a \$50,000 deductible to be paid.
3a. Todd Road Bridge Insurance Deductible.	TO BE DETERMINED	N/A	N/A	TO BE DETERMINED	Bridge repairs and asphalt bridge approaches fall under the umbrella of Village insurance.
3b. Repair Road on both sides of Todd Road bridge, Storm MH, and fire hydrant.	\$115,000.00	N/A	N/A	\$115,000.00	Aggregates to fill eroded areas below Todd bridge approaches as well as exposed fire hydrant and storm MH will to be replaced are not covered by insurance and will need to be funded by DFA.
4a. Remove bedload and existing Quartz Road culvert, re-install new crossing.	TO BE DETERMINED	N/A	N/A	TO BE DETERMINED	This is the cost estimate to restore the culvert to pre-flood condition. Remove bedload left from floodwaters and damaged culvert. Reconstruct culvert and road along Quartz Road.
4b. Remove bedload and existing Quartz Road culvert, re-	TO BE DETERMINED	TO BE DETERMINED	TO BE DETERMINED	TO BE DETERMINED	This is the cost estimate to replace the culvert with a bridge crossing. Remove bedload left from

construct road with bridge.					floodwaters and damaged culvert. Construct bridge crossing at Quartz Road.
5a. reroute Bonaparte River to previous location and rebuild outfall	\$1,128,300.00	N/A	N/A	\$1,128,300.00	This is the cost estimate to restore the previous WWTP outfall to pre-flood condition. Due to River migration during the flood this project would involve removing a large amount of material within the river and would require extensive environmental consideration while re-routing the river. Once the previous river path is reestablished a new outfall would be restored in its previous location.
5b. Design and build new WWTP outfall c/w engineered wetland.	TO BE DETERMINED	TO BE DETERMINED	TO BE DETERMINED	TO BE DETERMINED	TO BE DETERMINED
6. Remove sediment from WWTP tanks.	\$7,500.00	N/A	N/A	\$7,500.00	Remove floodwater sediment from WWTP tanks with use of vac-truck to return WWTP to pre-flood levels of effectiveness.
7. Spread material over landfill	\$37,500.00	N/A	N/A	\$37,500.00	Material will be graded and spread out for use as landfill cover in place.
8. Remove and replace firehall apron concrete and base aggregate.	\$43,100.00	N/A	N/A	\$43,100.00	Replacement of firehall apron is essential in providing rapid fire response that matches pre-flood conditions.
9. Remove and replace damaged infrastructure, place aggregates and asphalt at community hall parking lot.	\$328,900.00	N/A	N/A	\$328,900.00	This Project will require the removal of a damaged storm CB, CB lead, MH, Concrete curb, electrical conduit, and replacement of the same items. Removal and reassembly of a portion of the lock-block retaining wall will be required prior to backfilling and paving parking lot.
10. Remove and replace rock pit near community hall.	\$124,300.00	N/A	N/A	\$124,300.00	Entire rock pit will need to be excavated and reconstructed with new clean drain rock material, backfilled and re-paved. This will require a large excavation and for material to be imported from outside of the Village.
11. Repair damaged section of Stage Road retaining wall.	TO BE DETERMINED	TO BE DETERMINED	TO BE DETERMINED	TO BE DETERMINED	Temporary backfill along wall to stabilize it while engaging geotechnical engineer to detail methods of replacement. Assessment report can be found in Appendix C.
12. Repair damaged asphalt sections throughout Village.	\$185,500.00	N/A	N/A	\$185,500.00	Remove material to bottom of subgrade elevation and pave with asphalt to return to pre-flood condition. Damage includes Todd Road west of the highway, a patch on Stage Road, a patch on Collins Road and a Patch at the entrance to Anie's Pizza & Bakery parking lot which was cut during flood response.
13. Replace damaged irrigation lines throughout Village.	\$29,000.00	N/A	N/A	\$29,000.00	Remove and place damaged sections of irrigation lines c/w required appurtenances to restore the irrigation network.

14. Remove debris and sweep Village.	\$62,500.00	N/A	N/A	\$62,500.00	Remove large debris with skid steer and dump truck. Sweep remaining fines to remove dust exposure risk to residents.
15. Flush and inspect sanitary system using CCTV.	\$101,100.00	N/A	\$101,100.00	\$101,100.00	CCTV of the Villages sanitary sewer was completed April 18/19, 2023, and can be used to reference and confirm what damage to sanitary sewer system was directly caused by floodwaters. This cost only represents the investigation and doesn't reflect repairs that may be added after the investigation.
16. Clean out catch basins with Hydro-Vac truck.	\$19,500.00	N/A	N/A	\$19,500.00	Remove material currently plugging catch basins with vac-truck to return them to a pre-flood condition which allows flow to be conveyed.
17. Investigate buried storm outfalls with CCTV.	\$10,400.00	N/A	N/A	\$10,400.00	Use CCTV to determine extent of damage and repairs required. This cost only represents the investigation and doesn't reflect repairs that may be added after the investigation.
18. Chip woody flood debris for disposal.	\$31,300.00	N/A	N/A	\$31,300.00	Use chipper truck to turn large woody debris into a manageable size for disposal.
19. Remove flood debris, regrade path with new gravels and hydroseed grass in damaged parks.	\$22,300.00	N/A	N/A	\$22,300.00	Remove material along park pathway and replace aggregate to recreate a usable, accessible pathway. Hydroseed area where grass was removed during flood.
20. Replace damaged sidewalk sections.	\$90,400.00	N/A	N/A	\$90,400.00	Excavate fines deposited from floodwaters, replace aggregate as required, frame and pour new concrete sidewalk sections.
21. Clean up and dispose of storage trailer and its contents	\$106,300.00	N/A	N/A	\$106,300.00	Dispose of debris pile and debris left along riverbank to landfill. This project will be challenging due to the spread of debris down the river with limited or no access and having to work around water.
22. Clean WWTP lift station using Hydro-Vac truck for inspection.	\$10,000.00	N/A	N/A	\$10,000.00	Use vac-truck to remove material in lift station and inspect pump impeller to determine if replacement is required to return to pre-flood condition. This cost only represents the investigation and doesn't reflect repairs that may be added after the investigation.
23. Clean out and repair outfall, backfill eroded material and repair fencing.	\$11,900.00	N/A	N/A	\$11,900.00	Use vac-truck to remove material from clogged outfall, replace any damaged sections once visual inspection is possible, replace and grade eroded section, seed disturbed earth and repair section of chain link fencing.
24. Decommission compromised water crossing.	\$71,900.00	N/A	N/A	\$71,900.00	On each side of Bonaparte River, Excavate, cut main, install blow-off, and backfill. This project will require adequate traffic control due to its proximity to the highway.
25. Bonaparte River sanitary sewer crossing	TO BE DETERMINED	N/A	N/A	TO BE DETERMINED	TO BE DETERMINED
<b>SUB TOTAL</b>	<b>\$2,863,700.00</b>			<b>\$2,863,700.00</b>	



## 5.0 Enhancements

There are two recovery actions that may include enhancements, these are project 4, Quartz Road culvert and project 5, WWTP outfall.

The Quartz Road culvert enhancement may involve replacing the crossing with a bridge instead of a culvert. This is due to the repeated flooding at this culvert and to the extensive damage sustained by the 2023 flooding.

The WWTP outfall enhancement may involve changing the location and including an engineered wetland. This is due to movement in the river which makes replacing the outfall to the existing location unfeasible.

Additional information is forthcoming in subsequent revisions of this report.

## 6.0 Eligibility

The Village of Cache Creek infrastructure listed in this report was in good working order prior to the Spring 2023 flood event. TRUE considers that all of the damage to the Village infrastructure listed in this report as caused during the Spring 2023 flood event. The recovery plans put in place meet the eligibility criteria of the Provincial DFA guidelines.

## 7.0 Recommendation

As noted in Table 4-1, the total preliminary costs for this report at this time have been estimated at \$2,863,700. for this project with \$232,000. already approved and \$2,631,700. remaining. All of the repairs listed in this report are necessary to restore the Village of Cache Creek to its normal functional condition. Final recoverable costs will be subject to the DFA regulation.

Due to the risk of the temporary HDPE water connections freezing in winter it is recommended that the already approved project 1a proceed in conjunction with project 1b as soon as possible to ensure potable water access for residents of Cache Creek.

Revisions to this document will be prepared as additional information is obtained. Specific revisions will include cost estimates for projects 3a, 4a, 11 and 25.

In addition, options for possible enhancements will be analyzed for projects 4b and 5b.

## 8.0 Closure

This report has been prepared for The Village of Cache Creek for the exclusive use of recovery of expenditures through Emergency Management and Climate Readiness BC for Provincial Disaster Financial Assistance. Any use that other parties may make of this report, or any reliance on or decisions to be made or actions based on it are the responsibility of such third parties. TRUE accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on information provided in this report. This report has been prepared in accordance with generally accepted engineering practices and is based on the information provided and collected at the time of report. No other warranty, expressed or implied, is made.

We trust this report provides the information required at the present time. If you have any questions or comments, please contact us.

# APPENDIX A

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## Cost Calculations



**Village of Cache Creek  
 DFAA Damage Report - Village of Cache Creek  
 Class C Cost Estimate**

ITEM	DESCRIPTION	UNIT	EST. QUANT.	UNIT PRICE	TOTAL PAYMENT
<b>Project 1a - Watermain crossing</b>					
	Traffic Control	LS	1	\$ 5,000.00	\$5,000.00
	Environmental Monitoring	LS	1	\$ 2,000.00	\$2,000.00
	Trench de-watering	LS	1	\$ 10,000.00	\$10,000.00
	Directional drill under river	LS	1	\$ 100,000.00	\$100,000.00
	Extend watermain to drilled crossing	LS	1	\$ 25,000.00	\$25,000.00
	Connection at Highway 1	LS	1	\$ 10,000.00	\$10,000.00
	Design and coordination	LS	1	\$ 15,000.00	\$15,000.00
	Tie-in to existing	ea	4	\$ 10,000.00	\$40,000.00
	Restoration	LS	1	\$ 15,000.00	\$15,000.00
	Mobilization / Demobilization	LS	1	\$ 10,000.00	\$10,000.00
				<b>Subtotal</b>	<b>\$232,000.00</b>
				<b>Total</b>	<b>\$232,000.00</b>
<b>Project 1b - Engineering for 1a</b>					
	Engineering and project management	LS	1	\$45,000.00	\$45,000.00
				<b>Subtotal</b>	<b>\$45,000.00</b>
				<b>Total</b>	<b>\$45,000.00</b>
<b>Project 2 - Firehall</b>					
	Insurance deductible	LS	1	\$50,000.00	\$50,000.00
				<b>Subtotal</b>	<b>\$50,000.00</b>
				<b>Total</b>	<b>\$50,000.00</b>
<b>Project 3a - Todd Road Bridge Insurance deductible (to be completed for future submission)</b>					
	Insurance deductible for bridge and asphalt	LS	1		\$0.00
				<b>Subtotal</b>	<b>\$0.00</b>
				<b>Total</b>	<b>\$0.00</b>
<b>Project 3b - Todd Road Bridge</b>					
	Structural inspections	LS	1	\$25,000.00	\$25,000.00
	Replace storm manhole	ea	1	\$18,750.00	\$18,750.00
	Reaplace Hydrant assembly	LS	1	\$25,000.00	\$25,000.00
	Structural fill to bottom of asphalt	LS	1	\$18,750.00	\$18,750.00
	Reestablish Rip-rap	LS	1	\$12,500.00	\$12,500.00
				<b>Subtotal</b>	<b>\$100,000.00</b>
				<b>Engineering</b>	<b>\$15,000.00</b>
				<b>Total</b>	<b>\$115,000.00</b>
<b>Project 4a - Quartz Road Culvert (to be completed for future submission)</b>					



Supply and transport 75mm minus material	m <sup>2</sup>	500	\$18.00	\$9,000.00
Place and compact 75mm minus material	m <sup>2</sup>	500	\$13.25	\$6,625.00
Supply and transport 19mm minus material	m <sup>2</sup>	500	\$15.00	\$7,500.00
Place and compact 19mm minus material	m <sup>2</sup>	500	\$10.00	\$5,000.00
Supply and transport hot mix asphalt	m <sup>2</sup>	500	\$35.00	\$17,500.00
Place and compact hot mix asphalt	m <sup>2</sup>	500	\$15.00	\$7,500.00
Replace undermined catch basins	ea	1	\$12,500.00	\$12,500.00
Replace undermined manholes	ea	1	\$25,000.00	\$25,000.00
Reset undermined lamp standards	ea	2	\$12,500.00	\$25,000.00
Replace electrical conduit	LS	1	\$18,750.00	\$18,750.00
Rebuild damaged Lock-Block retaining wall	LS	1	\$12,500.00	\$12,500.00
Rip rap along channel	LS	1	\$25,000.00	\$25,000.00
Permitting for working around Cache Creek	LS	1	\$4,000.00	\$4,000.00
Environmental Monitoring	LS	1	\$8,500.00	\$8,500.00
Replace damaged and missing concrete curb	l.m	70	\$312.50	\$21,875.00
			<b>Subtotal</b>	<b>\$285,937.50</b>
			<b>+ Engineering</b>	<b>\$43,000.00</b>
			<b>Total</b>	<b>\$328,900.00</b>

#### Project 10 - Community Hall Rock Pit

Excavation and disposal of materials	m <sup>3</sup>	600	\$62.50	\$37,500.00
backfill rock pit with new clean drain rock as per Village of Cache Creek bylaw	m <sup>3</sup>	600	\$75.00	\$45,000.00
Supply and transport 75mm minus material	m <sup>2</sup>	200	\$18.00	\$3,600.00
Place and compact 75mm minus material	m <sup>2</sup>	200	\$13.25	\$2,650.00
Supply and transport 19mm minus material	m <sup>2</sup>	200	\$15.00	\$3,000.00
Place and compact 19mm minus material	m <sup>2</sup>	200	\$10.00	\$2,000.00
Supply and transport hot mix asphalt	m <sup>2</sup>	200	\$35.00	\$7,000.00
Place and compact hot mix asphalt	m <sup>2</sup>	200	\$15.00	\$3,000.00
Fence	l.m	36	\$125.00	\$4,500.00
			<b>Subtotal</b>	<b>\$108,250.00</b>
			<b>+ Engineering</b>	<b>\$16,000.00</b>
			<b>Total</b>	<b>\$124,300.00</b>

#### Project 11 - Stage Road Retaining Wall (to be completed for future submission)

			<b>Subtotal</b>	<b>\$0.00</b>
			<b>+ Engineering</b>	<b>\$0.00</b>
			<b>Total</b>	<b>\$0.00</b>

#### Project 12 - Emergency Road works Repair

Removal and disposal of broken asphalt	m <sup>2</sup>	650	\$32.50	\$21,125.00
Excavation and disposal of base and sub base	m <sup>2</sup>	650	\$30.00	\$19,500.00
Supply and transport 75mm minus material	m <sup>2</sup>	650	\$18.00	\$11,700.00
Place and compact 75mm minus material	m <sup>2</sup>	650	\$13.25	\$8,612.50
Supply and transport 19mm minus material	m <sup>2</sup>	650	\$15.00	\$9,750.00
Place and compact 19mm minus material	m <sup>2</sup>	650	\$10.00	\$6,500.00
Supply and transport hot mix asphalt	m <sup>2</sup>	650	\$35.00	\$22,750.00
Place and compact hot mix asphalt	m <sup>2</sup>	650	\$15.00	\$9,750.00
Curb gutter and sidewalk	l.m	75	\$687.50	\$51,562.50
			<b>Subtotal</b>	<b>\$161,250.00</b>
			<b>+ Engineering</b>	<b>\$24,200.00</b>
			<b>Total</b>	<b>\$185,500.00</b>



**Project 13 - Irrigation Systems Failure**

Remove and replace damaged irrigation lines throughout the flooded area	LS	1	\$ 25,000.00	\$25,000.00
			<b>Subtotal</b>	<b>\$25,000.00</b>
			<b>+ Engineering</b>	<b>\$4,000.00</b>
			<b>Total</b>	<b>\$29,000.00</b>

**Project 14 - Sediment and Debris Removal**

Sediment removal and disposal at multiple locations throughout village	LS	1	\$62,500.00	\$62,500.00
			<b>Subtotal</b>	<b>\$62,500.00</b>
			<b>Total</b>	<b>\$62,500.00</b>

**Project - 15 Sewer Flushing and Inspection**

Flush and CCTV sanitary sewer network	l.m	12814	\$6.88	\$88,096.25
			<b>Subtotal</b>	<b>\$88,096.25</b>
			<b>+ Engineering</b>	<b>\$13,000.00</b>
			<b>Total</b>	<b>\$101,100.00</b>

**Project 16 - Hydrovac of Stormwater Systems**

hydrovac catch basin and dispose of waste material	ea	26	\$750.00	\$19,500.00
			<b>Subtotal</b>	<b>\$19,500.00</b>
			<b>Total</b>	<b>\$19,500.00</b>

**Project 17 - Outfalls**

CCTV investigation	ea	3	\$3,125.00	\$9,375.00
			<b>Subtotal</b>	<b>\$9,375.00</b>
			<b>+ Engineering</b>	<b>\$1,000.00</b>
			<b>Total</b>	<b>\$10,400.00</b>

**Project 18 - Chipping of Woody Debris**

Chipping of woody debris and stockpile for disposal c/w sweeping of remaining debris on ground	LS	1	\$31,250.00	\$31,250.00
			<b>Subtotal</b>	<b>\$31,250.00</b>
			<b>Total</b>	<b>\$31,300.00</b>

**Project 19 - Park Rehabilitation**

Cariboo Sam park rehabilitaion including walkway gravels and hydro-seeding	m <sup>2</sup>	1280	\$ 12.50	\$16,000.00
Firehall park rehabilitation including hydro-seeding	m <sup>2</sup>	500	\$ 12.50	\$6,250.00
			<b>Subtotal</b>	<b>\$22,250.00</b>
			<b>Total</b>	<b>\$22,300.00</b>

**Project 20 - Sidewalk Replacement**

Traffic Control at Highway 1 and 97	LS	1	\$ 18,750.00	\$18,750.00
Excavate and dispose of flood sediment to subgrade	l.m	50	\$ 25.00	\$1,250.00
Curb gutter and sidewalk including gravels	l.m	85	\$687.50	\$58,437.50
			<b>Subtotal</b>	<b>\$78,437.50</b>
			<b>+ Engineering</b>	<b>\$12,000.00</b>
			<b>Total</b>	<b>\$90,400.00</b>

**Project 21 - Storage Trailer**

Remove and dispose of piled derbis at



## APPENDIX B

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2023 Flood Event Emergency Works – Replacement of  
River Crossing



# 2023 Flood Event Emergency Works – Replacement of River Crossing

Village of Cache Creek

Preliminary Report / Damage Assessment



ENGINEERING ■ PLANNING ■ URBAN DESIGN ■ LAND SURVEYING

May 2023

Project No. 310-173

## Distribution List

# of Hard Copies	PDF Required	Association / Company Name
n/a	Yes	Village of Cache Creek
n/a	Yes	TRUE Consulting
n/a	Yes	EMBC

## Revision Log

Revision #	Revised by	Date	Issue / Revision Description
0		2023-05-24	Draft for Village Review

## Report Submission

Report Prepared By:

Report Reviewed By:





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Jackson Gagnon, EIT  
Project Engineer

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Dave Underwood, P. Eng.  
Project Engineer

R:\Clients\300-399\310\310-173\05 Reports\310-173 River crossing report - 2023-05-23\310-173-Cache Creek-2023 Flood Event Emergency Works-Replacement of River Crossing-R1-2023 05 18.docx

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## APPENDICES

Appendix A – TRUE Flood Mitigation Plan (2021) (bound separately)



# 1.0 Background

High spring temperatures in the last days of April and first days of May accelerated freshet and caused Cache Creek to flood a portion of the Village of Cache Creek. Floodwaters passed through the firehall, and erosion started on Highway 97, the abutments on the Todd Road Bridge, and behind bridge abutments on the Trans-Canada-Highway (TCH) Bridge on the South side of the Village. This prompted a state of emergency to be declared on May 2<sup>nd</sup>, 2023. This freshet was followed by extensive rainfall which contributed to high flow volumes in Cache Creek and caused high water to be maintained after freshet flows would have normally begun to fall. Floodwaters continued to flow over both private and public property causing extensive damage.

The following photos show some of this damage from this flooding event.



**FIGURE 1-1: CACHE CREEK FLOOD WATERS ON HIGHWAY 97 (MAY 03, 2023)**



**FIGURE 1-2: EROSION BEHIND TCH BRIDGE ABUTMENT (MAY 03, 2023)**



**FIGURE 1-3: HIGHWAY 97 EROSION FROM OVERLAND FLOW (MAY 04, 2023)**



## 2.0 Introduction

This report is related to a damaged water main which crosses the Bonaparte River near the TCH bridge mentioned in the background portion of this report. There is only one crossing of the Bonaparte River by the existing water distribution to supply residents south of this section of the Bonaparte, most of whom live in the Sage and Sands mobile home park. With this crossing damaged, temporary measures consisting of overland HDPE piping was installed to regain water supply to impacted properties, however there is currently inadequate fire-flow for residents of the Sage and Sands mobile home park. This crossing was highlighted in the TRUE Flood Mitigation Plan (2021), found in appendix A, as an area of concern in terms of both susceptibility to flood damage and to its lack of looping which makes residents South of the crossing vulnerable to situations similar to the one that has now occurred.

## 3.0 Actions Taken

The area of Cache Creek being discussed is the lower water service pressure zone. This zone is supplied water via water reservoir fed from the village water treatment plant pump station. The lower-pressure zone reservoir was found to be rapidly draining in the early morning hours of May 13<sup>th</sup>, 2023. The village hypothesized that there was a leak in the system and had public works staff search around the village for a possible leak. When a leak could not be confirmed by visual inspection, the Village staff began isolating sections of the water system to try and isolate a leak.

Staff were able to attribute the loss of water to the TCH bridge previously mentioned in this report by isolating the water main at this crossing. To maintain water service to residents south of the crossing, a hydrant-to-hydrant connection was made using firehose to supply limited water supply for basic needs. This connection was later upgraded to a temporary HDPE connection along a pedestrian bridge between Winchester Road and Trans Canada Highway as well as across the Todd Road bridge to create a more robust temporary connection. Although this provides basic water supply for these residents, fire flow requirements are not met by this short-term solution. It is also worth noting that a permanent solution will need to be in place prior to winter as this current short-term solution is highly susceptible to freezing.

## 4.0 Proposed Actions

Based on the information in the section above the following options are considered:

Option 1: Repair the existing system

- This option involves waiting for flows in the Bonaparte River to recede to seasonal lows, building coffer dams and dewatering to keep a safe dry worksite to locate the damage section of water main and repair it if it is found to be accessible.

Option 2: Directional drill at the location parallel to the existing crossing

- This option involves directional drilling under the Bonaparte River parallel to the existing crossing and connecting to the existing main.

Option 3: Direction drill new crossing connecting system to Collins Road

- This option involves directional drilling under the Bonaparte River between Riverside Drive and Collins Road to provide the same level of service that the existing crossing previously provided.

Option 1 will require a significant length of time to monitor flow in the Bonaparte River for safe access to investigate the damage and repair the leak as well as for the work to take place given that the nature of the leak is still uncertain. With the nature of the failure of this main not fully known until excavation works take place, the scope and accessibility of repair is also not certain at this time. Furthermore, it is possible that the damage is located under the river itself, thereby making this approach unfeasible. Option 1 would only be a possible if the water system was found to be damaged at a location that could be accessed. In the TRUE Flood Mitigation Plan (2021) the option of a crossing alongside a raised bridge deck is discussed and is still a recommended long-term option for the village of Cache Creek but is not a viable option given the current elevation of the bridge with respect to future flood events.

Both options 1 and 2 will cause disruptions to the TCH due to the proximity of the Highway and the work zone. Option 2 has the advantage of being able to be advanced prior to the river levels receding, however contains the challenge of being bound by the Highway bridge abutments to the east and private property boundaries to the West, likely causing conflict with the existing pipe crossing and potentially requiring easements on adjacent property.

Option 3 is able to be completed without waiting for the Bonaparte River flow to recede and without causing major traffic impacts to highway traffic during the busy summer months. Option 3 is on property owned by the Village, avoiding requirements for any easements. This option requires special considerations with respect to a sanitary sewer crossing of the river in the vicinity, but this is considered manageable with appropriate project planning.

## 5.0 Cost Summary

Due to the challenges around access and private property boundaries facing option 2, cost estimates and high level sketches are only provided for Options 1 and 3.

It should be noted that Horizontal Directional Drilling (HDD) is considered best practice for river crossings and is also considered to be the most cost-effective option available in this situation.

**TABLE 4-1: COST SUMMARY FOR REPAIRING EXISTING COMPROMISED SECTION – OPTION 1**

Item	Unit	Quantity	Unit Price	Extended Price
Traffic Control on Highway 1 (7 days)	LS	1	\$ 30,000.00	\$ 30,000.00
Environmental Monitoring (5 days)	LS	1	\$ 10,000.00	\$ 10,000.00
Cofferdam	LS	1	\$ 50,000.00	\$ 50,000.00
Site de-watering	LS	1	\$ 50,000.00	\$ 50,000.00
Break investigation	LS	1	\$ 25,000.00	\$ 25,000.00
Design and Coordination	LS	1	\$ 15,000.00	\$ 15,000.00
Repair of water system	LS	1	\$ 25,000.00	\$ 25,000.00
Restoration	LS	1	\$ 15,000.00	\$ 15,000.00
Mobilization / Demobilization	LS	1	\$ 10,000.00	\$ 10,000.00
<b>Subtotal</b>				<b>\$230,000.00</b>
<b>Contingencies (20%)</b>				<b>\$45,000.00</b>
<b>Total</b>				<b>\$275,000.00</b>

**TABLE 4-3: COST SUMMARY FOR CROSSING BONAPARTE RIVER AT COLLINS ROAD - OPTION 3**

Item	Unit	Quantity	Unit Price	Extended Price
Traffic Control	LS	1	\$ 5,000.00	\$ 5,000.00
Environmental Monitoring	LS	1	\$ 2,000.00	\$ 2,000.00
Trench de-watering	LS	1	\$ 10,000.00	\$ 10,000.00
Directional drill under river	LS	1	\$ 100,000.00	\$ 100,000.00
Extend watermain to drilled crossing	LS	1	\$ 25,000.00	\$ 25,000.00
Connection at Highway 1	LS	1	\$ 10,000.00	\$ 10,000.00
Design and coordination	LS	1	\$ 15,000.00	\$ 15,000.00
Tie-in to existing	ea	4	\$ 10,000.00	\$ 40,000.00
Restoration	LS	1	\$ 15,000.00	\$ 15,000.00
Mobilization / Demobilization	LS	1	\$ 10,000.00	\$ 10,000.00
<b>Subtotal</b>				<b>\$232,000.00</b>
<b>Contingencies (20%)</b>				<b>\$45,000.00</b>
<b>Total</b>				<b>\$277,000.00</b>



FIGURE 5-1: OPTION 1 HIGH LEVEL SKETCH



**FIGURE 5-2: OPTION 3 HIGH LEVEL SKETCH**

From this analysis, TRUE recommends proceeding in accordance with Option 3 as we believe it to be the most feasible option to quickly and restore adequate fire flow and clean drinking water supply to the affected residents in the area. This Option represents the lowest risk option recognizing that the break may be in a location that is not accessible and so there is no guarantee

that the Option 1 approach will be successful. This Option also leaves the flexibility to later repair or replace the existing crossing to create system looping which will provide resiliency to the system against future events.

## APPENDIX C

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### 1164 Stage Road Retaining Wall Assessment

## TECHNICAL MEMORANDUM

**CLIENT:** Village of Cache Creek c/o TRUE Consulting      **FILE NO.:** 1164  
**PROJECT:** Flood Damage Retaining Wall                      **DATE:** May 10, 2023  
**ADDRESS:** Stage Road, Cache Creek, BC

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**Purpose:** As requested Telford Geotechnical Ltd. has reviewed the damage to the existing retaining wall on the south side of Stage Road in Cache Creek.

**Observations:** The recent flooding of Cache Creek has caused undermining of the base of the Allan block retaining wall that is currently supporting Stage Road. The approximate location of the wall failure area is shown in red on Figure 1 below.



Figure 1: Wall failure area



We have not been provided with design drawings for the retaining wall, but we would expect that the wall has been reinforced with geogrid due to the block sizes used and the height of the wall. The wall is fairly consistent in height and was measured to be 3.0 m high with a wall batter of around 5 degrees.

A crack approximately 6 m long and 50 to 75 mm wide has developed approximately 0.35 m behind the Allan block wall. The depth of the crack is approximately 0.8 m below the existing ground surface (Figures 1 & 2).

The wall has settled where it was undermined by the flood waters and the upper 3 blocks wall appears to have rotated slightly to a near vertical position (Figures 3 & 4).



Figure 2: Crack above wall (looking southwest)



Figure 3: Crack above wall (looking southeast)



Figure 4: Wall failure (looking northwest)



Figure 5: Wall failure (looking southwest)

**Conclusions:** The recent flooding has undermined the base of the retaining wall along Stage Road and the erosion of the base soils has caused the wall to settle and rotate vertically. Typically walls of this type are reinforced with geogrid every 2<sup>nd</sup> or 3<sup>rd</sup> block (0.4 to 0.6 m in height) and the geogrid extends 70 to 100% of the wall height behind the wall.

**Recommendations:** In the short term, it is recommended to backfill the wall to support it temporarily where it has been undermined with granular fills to a height of 2.0 m above the base of the wall.

It is recommended that a Geotechnical Engineer review the design drawings to assist with re-building of the wall. The re-building of the wall will have to step up laterally from the outer edges of the failure area to allow for a safe working slope.

For:  
Telford Geotechnical Ltd.

Bill Telford, M.Eng., P.Eng.  
Geotechnical Engineer