

**WHATCOM COUNTY CONTRACT
INFORMATION SHEET**

Whatcom County Contract No.

201812026-1

Originating Department:	Public Works
Division/Program: (i.e. Dept. Division and Program)	River & Flood (9075)/Flood Hazard Reduction (907550)
Contract or Grant Administrator:	Paula Harris
Contractor's / Agency Name:	BGC Engineering Inc

Is this a New Contract? If not, is this an Amendment or Renewal to an Existing Contract? Yes No
 Yes No If Amendment or Renewal, (per WCC 3.08.100 (a)) Original Contract #: 201812026

Does contract require Council Approval? Yes No If No, include WCC: _____
 Already approved? Council Approved Date: _____
 (Exclusions see: Whatcom County Codes 3.06.010, 3.08.090 and 3.08.100)

Is this a grant agreement?
 Yes No If yes, grantor agency contract number(s): _____ CFDA#: _____

Is this contract grant funded?
 Yes No If yes, Whatcom County grant contract number(s): _____

Is this contract the result of a RFP or Bid process? Contract
 Yes No If yes, RFP and Bid number(s): 18-40 Cost Center: 718007

Is this agreement excluded from E-Verify? No Yes If no, include Attachment D Contractor Declaration form.

If YES, indicate exclusion(s) below:

- Professional services agreement for certified/licensed professional.
- Contract work is for less than \$100,000.
- Contract work is for less than 120 days.
- Interlocal Agreement (between Governments).
- Contract for Commercial off the shelf items (COTS).
- Work related subcontract less than \$25,000.
- Public Works - Local Agency/Federally Funded FHWA.

Contract Amount:(sum of original contract amount and any prior amendments):
 \$ 39,525
 This Amendment Amount:
 \$ 163,300
 Total Amended Amount:
 \$ 202,825

Council approval required for; all property leases, contracts or bid awards **exceeding \$40,000**, and professional service contract amendments that have an increase greater than \$10,000 or 10% of contract amount, whichever is greater, **except when:**

1. Exercising an option contained in a contract previously approved by the council.
2. Contract is for design, construction, r-o-w acquisition, prof. services, or other capital costs approved by council in a capital budget appropriation ordinance.
3. Bid or award is for supplies.
4. Equipment is included in Exhibit "B" of the Budget Ordinance
5. Contract is for manufacturer's technical support and hardware maintenance of electronic systems and/or technical support and software maintenance from the developer of proprietary software currently used by Whatcom County.

Summary of Scope: This amendment to the Contract for Services with BGC Engineering Inc. will include Phase 2 tasks as follows: hydrogeomorphic hazards characterization for developing a frequency and magnitude relationship for debris floods, habitat characterization, risk assessment, conceptual alternatives development, conceptual alternatives analysis including hydraulic modeling, selection of a preferred alternative, community outreach, and reporting. The alternatives analysis will involve identifying and weighing conceptual design alternatives for restoring the alluvial fan and providing structural protection measures for adjacent landowners and the community of Glacier. Community engagement will occur throughout the project.

Term of Contract: _____ Expiration Date: December 31, 2020

Contract Routing:	1. Prepared by: <u>Deb Johnson</u>	Date: <u>7/22/19</u>
	2. Attorney signoff: <u>Christopher Quinn</u>	Date: <u>7/22/2019</u>
	3. AS Finance reviewed: <u>M Caldwell</u>	Date: <u>7/23/19</u>
	4. IT reviewed (if IT related): _____	Date: _____
	5. Contractor signed: _____	Date: <u>7-24-19</u>
	6. Submitted to Exec.: _____	Date: <u>7-29-19</u>
	7. Council approved (if necessary): _____	Date: <u>8.7.19</u>
	8. Executive signed: _____	Date: <u>8.8.19</u>
	9. Original to Council: _____	Date: <u>8-9-19</u>

AMENDMENT NO. 1
TO
CONTRACT FOR SERVICES BETWEEN WHATCOM COUNTY FLOOD CONTROL ZONE DISTRICT AND
BGC ENGINEERING INC.

THIS AMENDMENT is to the Contract between Whatcom County Flood Control Zone District, hereinafter referred to as the "County", and BGC Engineering Inc., a consulting company hereinafter referred to as the "Contractor", dated December 19, 2018, and designated "Whatcom County Contract No. 201812026". In consideration of the mutual benefits to be derived, the parties agree to the following:

WITNESSETH

WHEREAS, the County has entered into an agreement with the Contractor dated December 19, 2018, to perform tasks under Phase 1 of the Glacier-Gallup Creeks Alluvial Fan Restoration Project;

WHEREAS, Phase 1 tasks included review of background information, a site visit of both drainage basins to better define the scope of tasks needed to characterize the frequency and magnitude of debris floods, community outreach, and reporting; and

WHEREAS, completion of Phase 1 tasks was needed to develop a scope of work for Phase 2 tasks; and

WHEREAS, Phase 2 tasks proposed for this amendment include a hydrogeomorphic hazards characterization for developing a frequency and magnitude relationship for debris floods, habitat characterization, risk assessment, conceptual alternatives development, conceptual alternatives analysis including hydraulic modeling, selection of a preferred alternative, community outreach, and reporting; and

WHEREAS, the Contractor has delivered quality products and has been responsive thus far to the County's needs; and

WHEREAS, the County has requested that the Contractor perform tasks under Phase 2 of the Glacier-Gallup Creeks Alluvial Fan Restoration Project; and

NOW, THEREFORE, County and Contractor agree to modify the Agreement as follows:

1. SCOPE OF SERVICES

The scope of services is amended to include the Phase 2 Scope of Services described in Exhibit A-1, attached hereto and incorporated herein by reference.

2. PERFORMANCE

As consideration for the services provided by the Contractor, the County agrees to compensate the Contractor for Phase 2 services rendered under this amendment at a sum not to exceed \$163,300 DOLLARS based on the cost breakdown detailed in Exhibit B-1, attached hereto and incorporated herein by reference. The revised contract amount is \$202,825.

3. TIME SCHEDULE

The duration of this Agreement shall be extended through December 31, 2020.

This Amendment shall be made part of W.C. Contract No. 201812026 by and between Whatcom County Flood Control Zone District and BGC Engineering Inc. Unless specifically stated herein, all other terms and conditions of the original agreement shall remain in full force and effect.

IN WITNESS WHEREOF, Whatcom County and BGC Engineering Inc. have executed this Amendment on the date and year below written.

DATED this 24 day of July, 2019.


CONTRACTOR INFORMATION:

BGC Engineering Inc.
Suite 500 – 980 Howe Street
Vancouver, BC V6Z 0C8

Contact Name: Hamish Weatherly
Contact Phone: (604) 684-5900
Contact FAX: (604) 684-5909
Contact Email: hweatherly@bgcengineering.ca

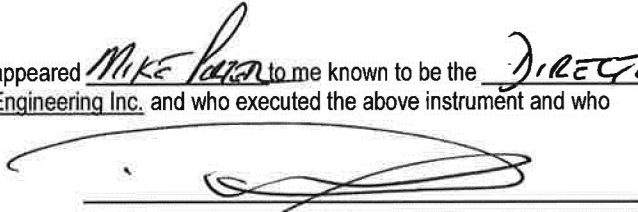
CONTRACTOR:

BGC Engineering Inc.


~~Steve Hedberg, M.Sc., P.Eng., P. Geo, President & CEO, Principal Geological Engineer~~
MICHAEL PORTER, DIRECTOR

PROVINCE OF BRITISH COLUMBIA)

On this 24 day of July, 2019, before me personally appeared MIKE PORTER to me known to be the DIRECTOR of the BGC Engineering Inc. and who executed the above instrument and who acknowledged to me the act of signing and sealing thereof.



NOTARY PUBLIC in and for the Province of British Columbia,

MICHAEL GELDERT printed name,
residing at VANCOUVER.
My commission expires N/A.

MICHAEL GELDERT
Barrister & Solicitor
Geldert Law Corporation
3101A - 930 Seymour Street
Vancouver, B.C. V6B 1B4
Tel.: 778.330.7775 Fax: 778.330.7774

Exhibit A-1 Scope of Work

The Glacier-Gallup Creeks alluvial fan restoration project will involve the following steps:

1. Inform the community about the project and seek input.
2. Assess flood and debris flow/debris flood hazards and risks.
3. Assess and map existing habitat conditions and work with the Salmon Recovery Staff Team (SRST) to define habitat restoration objective metrics for evaluating project benefits to habitat recovery.
4. Identify and evaluate potential levee configurations to reduce flood hazards and restore habitat forming processes.
5. Share the results with the community and listen to community feedback.
6. Select preferred levee configuration and habitat enhancements in coordination with the community and WSDOT.
7. Design, permit, and construct the project, working with the community to minimize disruption.



To meet the project objectives, the following tasks have been identified:

- the development of a frequency-magnitude (F-M) relationship for hydrogeomorphic hazards on Glacier and Gallup creeks
- quantification of sediment transport and bank erosion rates during major flood events
- evaluation of existing fish habitat limiting factors and alternatives to improve habitat
- examination of the effects of eliminating or modifying levees and/or constructing new ones
- semi-quantitative risk assessment
- development and formal option analyses of various potential risk reduction strategies.

BGC Engineering Inc. (BGC) is the prime contractor for the project and Cardno is an approved subcontractor to BGC hereinafter referred to as the BGC/Cardno team.

When BGC was initially retained in November 2018, it was difficult to estimate the level of effort required to complete the above tasks, particularly the characterization of hydrogeomorphic hazards. Some of this uncertainty was related to the 2019 WSDOT study that had yet to be published. At the time, it was unclear how much geomorphic, hydrologic and hydraulic analysis would be included in the WSDOT assessment.

Therefore, the BGC/Cardno team proposed a phased approach to the study. Phase 1 focused on a review of existing information, a site visit, community outreach, reporting, and a proposed scope of work and cost estimate to complete the alternatives analysis for the Glacier-Gallup creeks alluvial fan restoration project (i.e., Phase 2), as described below.

Phase 2 Work

The proposed scope of work for Phase 2 has been divided into the following tasks.

Task 2.1 – Project Management

The BGC/Cardno team will coordinate with Whatcom County and WSDOT throughout the project. This task covers all aspects of the project administration including communication with Whatcom County on project progress, invoicing, scheduling and coordination with other organizations including WSDOT, the community of Glacier, salmon recovery partners and adjacent landowners.

Task 2.2 – Geohazard Characterization

One of the objectives of the project is to develop an F-M relationship for hydrogeomorphic hazards on Glacier and Gallup creeks, which in turn will be used to better inform the risk assessment, and the development and option analyses of appropriate risk reduction strategies. Through discussions with Whatcom County, it has been decided that the F-M relationship will consider return periods up to 500 years (annual probability of 1:500, or 0.002, or 0.2%). Furthermore, it was decided that syn- and non-eruptive lahars² be excluded from the analysis.

Development of an F-M relation for both Glacier Creek and Gallup Creek requires an estimate of both sediment volume and peak discharge (i.e., magnitude) for return periods up to 500 years (i.e., frequency). The information reviewed to date by the BGC/Cardno team presents some, but not all of this information. No estimate has been made of the total volumes of sediment being mobilized by a flood or debris flood. Therefore, development of such F-M relations will build upon previous work by WSDOT and others. Previous work, which will be adopted for the F-M work, includes:

- A DEM comparison of 2007 and 2013/2015 LiDAR data by WSDOT (February 2019).
- The historic channel planform of Glacier Creek has been mapped in detail by Herrera (2009) using air photographs from 1938, 1955, 1964, 1976, 1984, 1994, 2003 and 2006.
- Peak flows for return periods up to 500 years have been estimated by WSDOT for both existing and climate change conditions.

² These are debris flows of volcanic origin, either associated with an eruption (syn-eruptive) or without (non-eruptive)

Additional analyses to be completed by BGC include:

- A number of deep-seated landslides are located in the Glacier Creek watershed. While none of these landslides appear to be moving at high rates (> several inches per year), rapid movement of these landforms could result in a significant blockage of the creek. Therefore, BGC will use available LiDAR data to conduct a change detection analysis with the intent of evaluating whether any of the landslides are active. BGC staff (Lato, Anderson, and Porter, 2019) recently used this methodology to quantify the activity of the Oso landslide in Washington State.
- The potential height of blockages at the inlet to the gorge will be evaluated by BGC using an interpreted landslide mechanism and DAN 3D landslide modelling. BGC will examine the local geology from existing maps and estimate the likely failure mechanisms from the team's combined knowledge and experience. BGC does not propose any drilling and complex landslide stability analyses as this would be a very costly (hundreds of thousands of dollars) project. Instead, a sensitivity analysis approach will be favored in which different configurations are contemplated.
- The resulting dam outbreak hydrograph will be simulated using a probabilistic approach coupled with empirical equations. The resulting outbreak flood will be routed downstream using FLO-2D, a two-dimensional (2D) hydraulic model. It is expected that the outbreak flood peak flow will exceed that of the 500-year return period flood flow. If it does not, then the latter will dominate the hazard. BGC will likely choose a mean annual flood as the baseflow condition for hydraulic modeling of outbreak floods.
- Dendrogeomorphology is the science of using tree rings to date debris floods, which can cause growth reductions, form so-called "traumatic resin tissue" (TRD) and scar trees due to direct impact or aggradation. During the initial site visit, none of the trees along Glacier Creek or Gallup Creek were identified as being suitable for dendrochronology – either because of their young age (historic logging has removed much of the mature riparian forest) or lack of obvious scars. However, there are several trees on the Glacier Creek fan that were identified as potential targets for further investigation.
- A review of information provided by residents, which is to be summarized by NHC and provided to BGC.

Together these data will be used by BGC to develop F-M relationships for floods and debris floods on Glacier and Gallup creeks. A qualitative assessment of potential effects of wildfires on F-M estimates will also be provided.

Having established F-M relations, debris floods of various return periods will be numerically modeled to assess their impact to infrastructure flanking the creeks and on their respective alluvial fans. WSDOT have developed a 2D hydraulic model of the reach using SRH-2D for both existing and proposed conditions. It is proposed that this existing SRH-2D model would be used by the BGC/Cardno team, but the model would be extended to include sediment transport. SRH-2D has the capability of morphodynamic modelling and the user can choose between three different sediment transport formulae: Parker (1990), Wilcock and Crowe (2003), and Meyer-Peter and Müller (1948). Of interest is the impact of the existing bridge structures on sediment transport rates and overall channel morphology.

The morphodynamic modelling will not inform on potential bank erosion, which forms a critical component of the hazard assessment. Except for academic research, existing morphodynamic models are generally incapable of modelling both bank erosion and sediment transport, particularly in dynamic gravel-bed rivers such as Glacier Creek. Therefore, BGC will use a BGC- proprietary methodology that calibrates bank erosion by known events and predicts bank erosion probabilistically for the spectrum of return period floods and debris floods assessed.

The bank erosion assessment will also consider the recent damage sustained to the left bank levee in late November 2018 (Figure 1-1). Whatcom County has requested that the BGC/Cardno team evaluate whether there are any short-term remedial actions that should be completed at this location and assist the County in developing an emergency response plan.

Task 2.3 – Habitat Characterization

Identifying salmon habitat restoration project needs and opportunities within the context of salmonid recovery planning and priorities in WRIA 1 is one of the “integrated” objectives of this project. An initial meeting of Cardno (Sky Miller and Peter Drobney) and members of the WRIA 1 SRST was held in Bellingham on June 24, 2019 to identify available sources of salmon habitat and fish use data and other data sources that support integrated fish/flood planning. Those attending provided initial guidance, based on their familiarity of the project area, on key salmonid species and life-stages that use the streams and the habitat functions in both Glacier Creek and Gallup Creek to consider as a starting point from which to define specific habitat objectives, metrics for evaluating project benefits to recovery, and project alternatives to be developed. It was recognized in the meeting that the geomorphology of the two creeks differs and that different interim and long-term restoration strategies might be developed for each fan and the intersection of the fans with the North Fork Nooksack River floodplain.

It is anticipated that development of project habitat objectives, metrics, and alternatives will be facilitated by input from the SRST at key points in the process. The following are the anticipated elements of this task:

- Cardno will map existing stream and riparian habitat conditions on the alluvial fan areas of both Glacier and Gallup Creeks with a more limited evaluation of the adjacent North Fork Nooksack River floodplain side channels most likely to provide habitat benefits if Gallup or Glacier Creeks were to reoccupy them.
- Cardno will work with Whatcom County Public Works (WCPW) staff to develop an initial set of salmon habitat project objectives, restoration strategies, and associated habitat metrics that conform to WRIA 1 recovery planning guidelines. This “strawdog” will be presented to the SRST in a meeting in Bellingham to receive feedback, revise as necessary, and confirm the approach is generally supported by SRST members.
- Cardno will develop up to four conceptual habitat alternatives for the combined fans area. The alternatives will be presented in a SRST meeting to receive feedback from the members. The alternatives will then be more fully developed, analyzed, and a preferred alternative identified as part of the overarching integrated flood risk reduction and salmon habitat restoration project (Tasks 2.6 and 2.8).
- Cardno will present habitat project alternatives at the first of two community meetings to be scheduled with presentation being tailored to specific meeting objectives (Task 2.7).

- Cardno will present the preferred habitat project alternative at the second community meeting (Task 2.7).
- Appropriate visual aids will be developed in support of the SRST and community meetings.

Task 2.4 – Risk Assessment Existing Conditions

A risk assessment involves estimating the likelihood that a hazard occurs, impacts elements at risk, and causes particular types and severities of consequences. Vulnerability estimation involves estimating the likelihood of consequences, given that a hazard occurs and impacts elements at risk. The key difference between vulnerability and risk estimation is that vulnerability estimates assume impact, whereas risk additionally provides estimates of the likelihood of impact. Risk can be assessed quantitatively through a series of relatively complex input parameters, qualitatively largely by judging relative risk levels, and semi-quantitatively. In the latter approach, the input parameters of geohazard likelihood, vulnerabilities and consequences are estimated via several quantitative methods, and then combined in a matrix to determine risk.

For this project, the BGC/Cardno team will use a semi-quantitative risk assessment as it provides a sound basis for consistent comparison of multiple geohazards simultaneously and can be effectively communicated to all stakeholders. BGC has used this approach successfully numerous times in the past, especially to compare a variety of hazards and risks, not all of which are readily quantifiable. Consequences to be evaluated could include some or all of the following risks: safety, economic, environmental (aquatic/terrestrial), and intangibles (e.g., loss of cultural values) depending on the needs of Whatcom County and the Glacier community.

Task 2.5 – Hazard and Risk Assessment Report

The BGC/Cardno team will provide a draft report that documents the geohazard and habitat characterization and risk assessment. Once feedback on that report has been provided, conceptual risk reduction alternatives will be developed.

Task 2.6 – Conceptual Risk Reduction and Habitat Restoration Alternatives Development

Based on the results of the interim report, the BGC/Cardno team will develop several risk reduction and habitat restoration alternatives in consultation with Whatcom County and WSDOT. A total of four alternatives have been budgeted for, along with a meeting to discuss the strategies. For each alternative:

- a. The hydraulic/morphodynamic model will be run for the first identified alternative. Changes in hydraulic output between existing and proposed conditions will be used to evaluate the relative effectiveness of the proposed designs at meeting the project goals and addressing the ecological concerns for this reach. Alternatives will be evaluated for peak flow events and for a representative 'fish flow' suitable for target spawning/rearing conditions.
- b. Estimate risk via risk matrix to all elements at risk. Clearly demonstrate any benefits for elements at risk and any benefits to salmon habitat.
- c. Change mitigation alternatives type and/or location, dimensions. Repeat risk assessment.

WSDOT's plan to span the channel migration zone of Glacier Creek creates the opportunity to remove existing levees and set back new levees that, if chosen as the preferred alternative, will re-

create 28 acres of floodplain and multiple channel salmon habitat. Also, engineered log jams could be strategically placed to create pool habitat for resting salmon adults and spawning habitat. Such log jams may also promote flow splits and assist in restoring natural alluvial fan processes. Cardo staff will evaluate alternatives including these items and provide evaluation of the habitat benefits versus costs.

Results of the conceptual risk reduction alternatives development will be documented in a report.

Task 2.7 – Community Outreach

Prior to finalization of the hazard and risk report and conceptual risk reduction strategies, a meeting will be held in Glacier to share the findings with the community and obtain input prior to preparation of the final reports.

At the conclusion of the study (i.e., after Task 2.8), a second meeting will also be held to present the selected alternative, answer questions, and provide information to the community about what to expect as the project design, permitting, and construction advances.

Task 2.8 – Conceptual Alternatives Analysis

The final task is the conceptual alternatives analysis, which informs the preferred risk reduction strategy. The general option analysis approach that is being proposed follows the Kepner Tregoe Method, also known as the KT-Method, developed by Charles Kepner and Benjamin Tregoe (Kepner & Tregoe, 1965). The KT-Method is a problem analysis model in which the “problem” is disconnected from the “decision”.

The KT-Method uses three terms: problem, task, and approach (Figure 3-1). A situation analysis is used to identify the specific tasks and problems for the project. Examples of these terms applied to this project are given as follows:

- **Problem:** The existing Glacier Creek Levee and Gallup Creek push-up berms restrict channel migration and negatively affect fish habitat.
- **Task:** Generate and evaluate potential alternatives for levee removal and levee setback that reduce flood and debris flood risk to adjacent landowners and improve salmon habitat.
- **Approach:** Objectively analyse each conceivable alternative separately and in conjunction to arrive at a logical and defensible outcome.

Through the situation analysis process, insight into the necessity, priority and urgency of the various tasks is gained. This insight generates clarity amongst the participants/stakeholders on what needs to be done and when, and the outcome is an action list. By thoroughly evaluating the problem in advance, the solutions which are developed address the real, rather than the perceived problem. Engaging stakeholders in the process provides for a well-rounded view of the problem, creates a common understanding of the situation, and can allow for early stakeholder buy-in. Importantly, the method invites a consensual solution.

BGC has recently been tasked with running and facilitating a KT analysis for a complex diking issue at Port Coquitlam, which led to a mutually agreeable outcome amongst three parties with substantially differing outlooks and motivations. The KT method will be used to evaluate the conceptual alternatives.

Cardno has used the Habitat Equivalency Assessment methodology to quantify habitat degradation or improvement. The regulatory agencies, WSDOT and other Whatcom County stakeholders are familiar with this methodology and as such it will be used to evaluate the conceptual alternatives for habitat.

It is important to note that while the BGC/Cardno team provide technical input to the KT analysis, none of the team members will form part of that group that grades the various options to avoid technical bias. Whatcom County will determine the stakeholders to participate in the KT workshop.

For costing purposes, a 2-day workshop for the KT analysis is proposed with one team member each from BGC and Cardno attending (i.e., the two meetings shown on Figure 3-1 are condensed into a 2-day workshop, as the options report is completed by the BGC/Cardno team in Task 2.6).

It is assumed that facilitation of the workshop will be provided by Ms. Cynthia Carlstad of NHC and that NHC will provide a summary report that documents the results of the workshop.

Decision Analysis Framework

(after Kepner and Tregoe 1965)

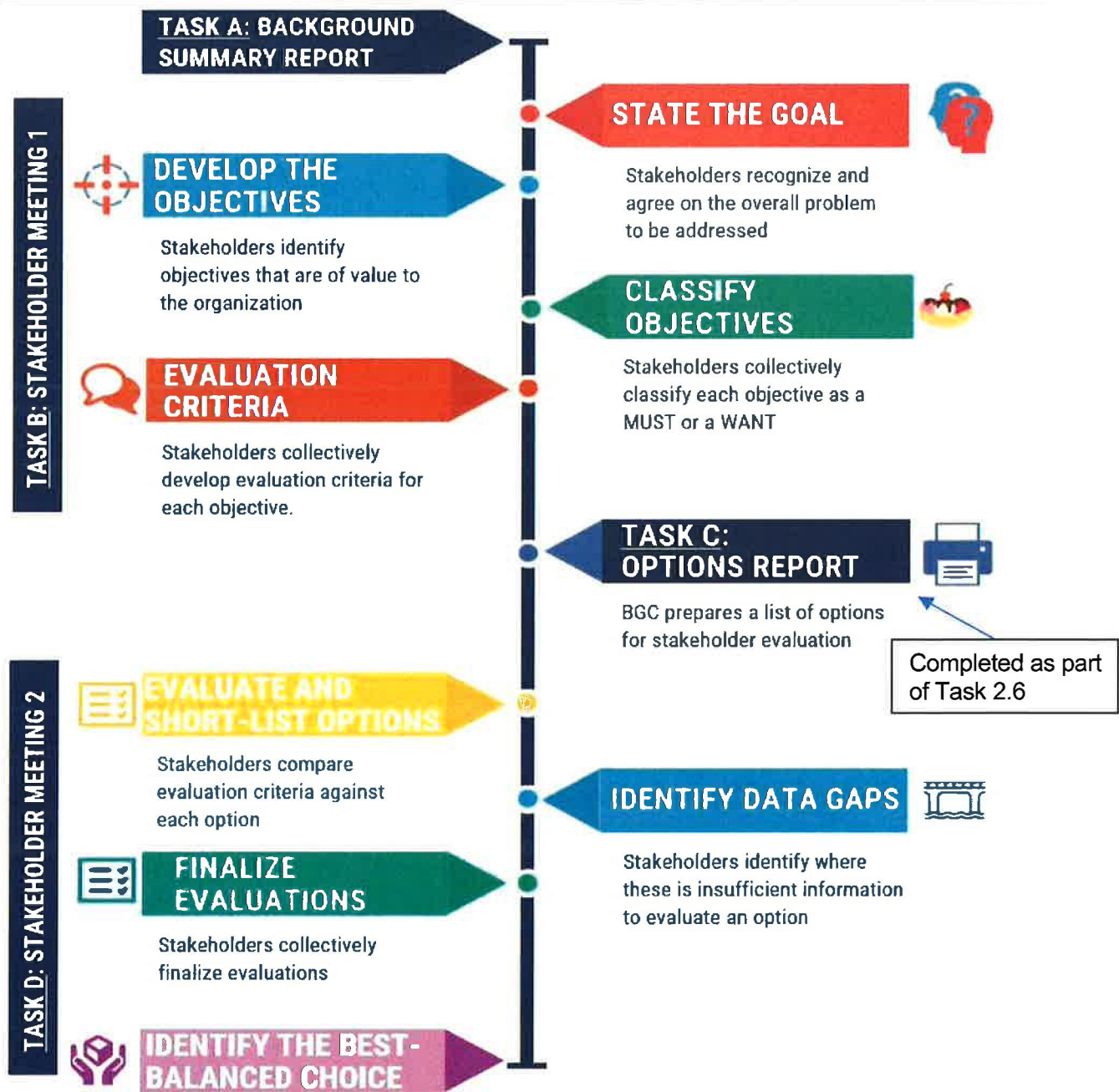


Figure 3-1. Decision analysis framework summary.

Exhibit B-1 Compensation

As consideration for the services provided pursuant to Exhibit A-1, Scope of Work, the County agrees to compensate the Contractor according to the hourly rates provided in the Rate Schedule provided below. Other reasonable expenses incurred in the course of performing the duties herein shall be reimbursed. Mileage is to be reimbursed at the current IRS rate; lodging and per diem will be reimbursed at a rate not to exceed the GSA rate for the location at which services are provided. Other expenditures such as printing, postage and telephone charges shall be reimbursed at actual cost.

The Contractor will invoice monthly. Invoices will include hours worked by employee by day together with tasks accomplished. Requests for reimbursement of expenses must be accompanied by copies of paid invoices itemizing costs incurred. Costs of alcoholic beverages are not eligible for reimbursement. Compensation shall not exceed the amended contract amount of \$202,825. Any work performed prior to the effective date of this contract or continuing after the completion date of the same unless otherwise agreed upon in writing, will be at the Contractor's expense.

BGC Engineering Inc.
2019 Billing Rates (USD)

Classification	Rate
Geomatics I	\$90
Geomatics II	\$110
Geomatics III	\$120
Junior I	\$110
Junior II	\$125
Intermediate I	\$130
Intermediate II	\$145
Senior I	\$165
Senior II	\$190
Principal I	\$215
Principal II	\$255

BGC Engineering Inc. and Cardno (as sub-contractor to BGC)
Amendment No. 1 Cost Estimate

Description	BGC					Cardno				Estimated Total Hours	Estimated Fees	Estimated Expenses	Estimated Task Total
	H. Weatherly - Principal I	M. Jakob - Principal II	J. Whittal - Int II	Junior II Eng/Geo	Geomatics II	S. Miller - Senior Consultant	Peter Drobney, Fish Biologist	F. Asikhodapasand - Senior Engineer	W.J. Smith - Staff Scientist				
2018/2019 Chargeout rates (USD)	\$ 215	\$ 255	\$ 145	\$ 125	\$ 110	\$ 220	\$ 140	\$ 130	\$ 130				
Task 2.1 - Project Management	30	24				12		6		72	\$ 15,990	\$ -	\$ 15,990
Task 2.2 - Geohazard Characterization	24	40	40	120	24					248	\$ 38,800	\$ 190	\$ 38,990
Task 2.3 - Fish Habitat Characterization						6	24	12		42	\$ 6,240	\$ -	\$ 6,240
Task 2.4 - Risk Assessment	4	8		16		4	8			40	\$ 6,900	\$ -	\$ 6,900
Task 2.5 - Hazard and Risk Assessment Report	24	40		80	16	12	24		8	204	\$ 34,160	\$ -	\$ 34,160
Task 2.6 - Risk Reduction and Habitat Restoration Alternatives Development	24	24		40	12	24	24	40		188	\$ 31,440	\$ -	\$ 31,440
Task 2.7- Community Outreach (x2) and SRST (x2) Meetings	4	20				24	16	8		72	\$ 14,520	\$ 1,000	\$ 15,520
Task 2.8 - Conceptual Alternatives Analysis	4	24		8		20	4	4		64	\$ 13,460	\$ 600	\$ 14,060
TOTAL HOURS	114	180	40	264	52	102	100	70	8	930			
TOTAL FEES (\$)	\$ 24,610	\$ 46,900	\$ 6,800	\$ 33,000	\$ 5,720	\$ 22,440	\$ 14,000	\$ 9,100	\$ 1,040		\$ 161,510	\$ 1,790	\$ 163,300



RECEIVED

JUL 29 2019

JACK LOUWS
COUNTY EXECUTIVE

MEMORANDUM

TO: The Honorable Jack Louws, Whatcom County Executive for the Whatcom County Flood Control Zone District Board of Supervisors

THROUGH: Jon Hutchings, Public Works Director *JH*

FROM: Paula J. Harris, P.E., River and Flood Manager *AH*
Gary Stoyka, Natural Resources Program Manager *ESW*

RE: BGC Engineering Inc. Contract for Services for Glacier-Gallup Creeks Alluvial Fan Restoration Feasibility and Alternatives Analysis – Amendment No. 1

DATE: July 22, 2019

Enclosed are two (2) originals of an amendment for Services between Whatcom County Flood Control Zone District (FCZD) and BGC Engineering Inc. for your review and signature.

▪ Background and Purpose

The Washington Department of Transportation (WSDOT) constructed an approximately 1,700 foot long levee on the west bank of Glacier Creek in the 1960s to prevent channel migration and overflows into Gallup Creek, and resulting damage to SR 542. Constriction of Glacier Creek by the SR 542 bridge and the Glacier Creek Levee has exacerbated aggradation upstream of SR 542, severely degraded fish habitat, and increased risk to USFS structures along the east bank of Glacier Creek.

WSDOT is planning to replace the two bridges with a much longer bridge spanning both creeks and the channel migration zone between them, currently proposed for construction in 2026. WSDOT requested assistance from Whatcom County Flood Control Zone District (WCFCZD) to evaluate options for removing or partially removing the left bank Glacier Creek Levee and replacing it with a setback levee(s) along the left bank of Gallup Creek to protect the community of Glacier.

BGC Engineering Inc. was retained in December 2018 to perform a risk assessment for the alluvial fan and an analysis of alternatives to mitigate the risk. Phase 1 tasks included review of background information including technical analyses by WSDOT, a site visit of both drainage basins to better define the scope of tasks needed to characterize the frequency and magnitude of debris floods, community outreach, and reporting.

Phase 2 tasks proposed for this amendment include a hydrogeomorphic hazards characterization for developing a frequency and magnitude relationship for debris floods, habitat characterization, risk assessment, conceptual alternatives development, conceptual alternatives analysis including hydraulic modeling, selection of a preferred alternative, community outreach, and reporting. Phase 2 tasks will occur through December 2020.

▪ **Funding Amount and Source**

The proposed amendment for Phase 2 of the Glacier-Gallup Creeks Alluvial Fan Restoration Feasibility and Alternatives Analysis is \$163,300 for a total contract amount of \$202,825. The 2019 FCZD budget has adequate expenditure authority for this contract amendment.

Please contact Paula Harris at extension 6285, if you have any questions or concerns regarding the terms of this agreement.

Encl.