WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES

Cost Share Agreement

DNR Contract No. 93-111079

Snohomish County Contract No. 2026 DNR-OES Cost Share Agreement 05062026

In accordance with Chapter 39.34 RCW, Washington State Department of Natural Resources (DNR) and Snohomish County agree to a Cost Share Agreement, hereafter, "Agreement" for Lidar and imagery collection and geospatial mapping ("Lidar services").

DNR contracted with NV5 Geospatial, Inc. (DNR Contract #93-102831) for remote sensing services, including collection of Lidar data, processing, quality assurance (QA) / quality control (QC), and delivering Lidar and derivative products, and other remote sensing data for natural resource mapping. DNR #93-102831 allows other state agencies, local and tribal governments, and private companies access to this contract through specific Work Orders. Snohomish County is entering into this Agreement with DNR for a specific Work Order that provides Snohomish County with Lidar services.

DNR and Snohomish County:

1. Snohomish County wishes to acquire certified Lidar data and derivatives for 823 square miles of area through DNR's contract with NV5 Geospatial, Inc.

2. Per the Agreement, DNR will act as the agent for this purchase.

3. This Agreement covers services for the collection, processing, and delivery of Lidar data and derivative products provided by a specific work order between DNR and NV5 Geospatial, Inc. which is outlined in the attached Exhibit A – NV5 Geospatial, Inc. proposal, titled Snohomish County Leaf-on Lidar Mapping Services, Washington, dated April 15, 2026.

4. The total cost expected from Snohomish County will not exceed Three Hundred Four Thousand Six Hundred Six Dollars ($304,606) which reflects the following costs:

    - $260,739 for Snohomish County for unincorporated areas – 704.7 Square Miles
    - $1,103 for the City of Stanwood – 2.9 Square Miles
    - $7,792 for the City of Marysville -21.06 Square Miles
    - $3,682 for the City of Arlington – 9.95 Square Miles
    - $821 for the City of Granite Falls – 2.22 Square Miles
    - $2,346 for the City of Mukilteo – 6.34 Square Miles
    - $13,146 for the City of Everett – 35.53 Square Miles
    - $1,473 for the City of Snohomish – 3.98 Square Miles
    - $4,362 for the City of Lake Stevens – 11.79 Square Miles
    - $810 for the City of Brier – 2.19 Square Miles

- $5,032 for the City of Bothell – 13.60 Square Miles
- $3,300 for the City of Edmonds – 8.92 Square Miles

5. No later than July 17, 2026, Snohomish County may notify DNR of a reduction in the scope and cost of this Agreement due to one or more cities identified in Section 4 opting out of participation. This notification must be delivered via email to Abigail Gleason, Abigail.Gleason@dnr.wa.gov 360-902-1560. Snohomish County and DNR agree that the geographic scope and cost of this Agreement will be reduced by the dollar amount and square mileage listed in Section 4 associated with any city identified as no longer participating. Any modification to this Agreement must be made in writing by an amendment and executed by both parties.

6. The period of performance for this agreement is July 17, 2026, or the date of execution, whichever is later, to January 31, 2027.

7. DNR shall submit two invoices for Snohomish County's share of the services, the first after successful collection and submission of a collection status report, and the second after delivery and acceptance of the data and deliverables by DNR. Payment for the approved good/services will be made by check, warrant or account transfer within 30 days of receipt of the invoice. Upon expiration of the Agreement, invoice shall be paid, if received within 30 days after the expiration date. However, invoices for all work done within a fiscal year must be submitted within 30 days after the end of the fiscal year.

8. This Agreement may be revoked at any time in writing by either party, provided, however, Snohomish County agrees to pay for any services rendered under this Agreement prior to termination.

Accepted for: Snohomish County	Accepted for: Washington State Department of Natural Resources
_____	_____
Date: _____	Date: _____

RE: Snohomish County Leaf-on Lidar Mapping Services, Washington

NV5 Geospatial, Inc. appreciates the opportunity to present Washington State Department of Natural Resources (DNR) and project partners with a quote and brief Statement of Work for geospatial mapping services over a substantial area of Snohomish County. The following provides an overview of services, including product deliverables and timeline. All specifications and deliverables follow those outlined in the NV5G, Inc. proposal response to the Lidar Request for Proposal (RFP) No. 22-03 issued by DNR (WGS RFP).

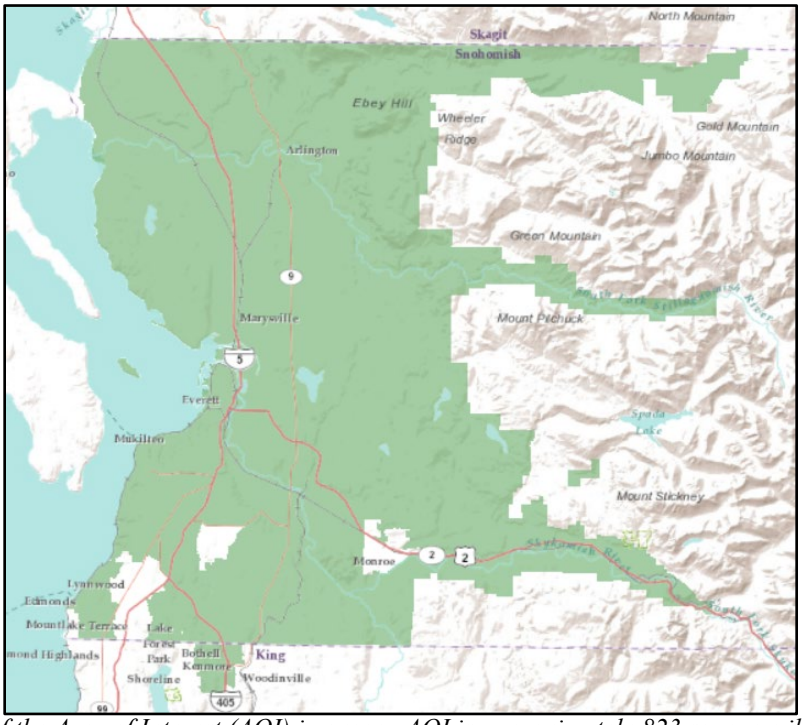

Figure 1: Limits of the Area of Interest (AOI) in green. AOI is approximately 823 square miles (526,720 acres).

Technical Approach

NIR (Topographic) Lidar

Lidar Specifications Summary	
Multi-Swath Pulse Density	**≥ 8 pulses/m²**
Returns Collected Per Laser	**At least 3**
Intensity Range	**1-65535 (16 bit)**
Vertical Accuracy (σ), *slope*	**≤ 10 cm**
Horizontal Accuracy (σ)	**≤ 30 cm**

NV5G, Inc. will collect NIR Lidar data using a high pulse rate Lidar system to produce a highly accurate, high resolution ≥ 8 pulses/m2 Lidar dataset with no gaps and ample buffers (at least 100m) around project boundaries. This state-of-the-art sensor is ideal for yielding a high density, multi-return Lidar point cloud suitable forest canopy mapping. Data will be collected at a minimum of 40º field of view (+/-20º from nadir), with at sufficient overlap among swaths to minimize gaps and laser shadowing.

The Lidar system records up to four range measurements (returns) per pulse (first, second, third, and last). All overlapping flight lines will be flown in opposing directions to maximize detection of swath-to-swath inconsistencies and used to resolve system misalignments. Using a combination of automated and manual techniques that are tailored to the particular land cover and terrain of the study area, Lidar processing will

include kinematic corrections, calculation of laser point position, relative accuracy testing and calibrations, classification of ground and non-ground points, assessments of statistical absolute accuracy, and creation of ground surface models.

Survey Control

NV5G, Inc., survey team will perform the ground survey work. Depending on acquisition logistics (configuration of sites, access, schedule, and weather), the NV5G, Inc. team will use one or more appropriate methods to enable geo-spatial correction of aircraft positional coordinate data. These include conventional base supported ('BS') survey control, TerraPos Precise Point Positioning ('PPP'), or Trimble CenterPoint Post-Processed Real-Time Extended ('PP-RTX'). To verify Lidar point calibration and enable accuracy assessment, the NV5G, Inc. field crew will collect ground check points (GCPs) using GPS-based real-time kinematic (RTK) survey techniques. For an RTK survey, the NV5G, Inc. ground crew uses a roving unit to receive radio-relayed corrected positional coordinates for all ground points from a GPS base unit set up over a survey control monument. The roving unit records precise location measurements with an error (σ) of $\leq$3 cm relative to the base control. The NV5G, Inc. team will distribute a suitable number of hard, bare earth ground check points (GCPs) on level slope throughout project areas, as feasible given road access and GPS conditions.

NV5G, Inc. will collect checkpoints for the Non-vegetated Vertical Accuracy/Vegetated Vertical Accuracy (NVA/VVA) calculations. All checkpoints for VVA will fall within the DEM footprint. All ground survey operations will be conducted under the supervision of a Washington State Professional Licensed Surveyor who will also certify the accuracy of control monument locations. The techniques for establishing all ground check points will be outlined in the Report of Survey, including the identity, locations, and position residuals of all GCPs used to evaluate survey accuracy. The following vertical accuracies will be met or exceeded:

Area	NVA Count	VVA Count	Checkpoints
(823 square miles/526,720 acres)	50+	30+	20

- $RMSE_Z \leq 10$ cm (non-vegetated Swath, DEM)
- NVA $\leq$ 19.6 cm 95% Confidence Level (Swath, DEM)
- VVA $\leq$ 30 cm 95th Percentile (DEM)

Processing

Generally, Lidar processing tasks include GPS control computations, kinematic corrections, calculation of laser point position, calibration for optimal relative and absolute accuracy, classification of ground and non-ground points, and creation of ground/DSM models. Bare earth classification is accomplished using an automated ground modeling process with visual QA/QC inspection to identify any misclassifications. NV5G, Inc. will employ Lidar ground model parameters appropriate for the project land cover and terrain based on past experience. All methodology and subsequent data products will comply with the most recent U.S. Geological Survey (USGS) Lidar Base Specifications.

The bare earth Digital Elevation Model (DEM) will be hydro-flattened to ensure all water bodies are cartographically acceptable and that streams are at or below surrounding terrain. The Riffe Lake edge of water will be defined by the water level at the time of the fall collection. NV5G, Inc. hydroflattening

methods use a combination of automated feature edge detection and traditional LiDARgrammetric techniques. The 3-D hydro-line will be used for reclassifying ground points within the wetted area or channel to 'water.' Ponds and lakes > 2 acres in size will be hydroflattened at a single elevation with the entire water surface edge at or below the immediate surrounding terrain. Long impoundments whose elevations drop moving downstream will be treated as a river. For rivers > 30 m (100') in average width, hydro-lines will follow the direction of flow (gradient to follow the immediate surrounding terrain) and will be flat and level from bank to bank and at or below immediately surrounding terrain. Streams will break at road crossings, but road fills will not be removed from the DEM. Bridges will be delineated and removed from the DEM. Variations in water surface elevation from tidal variations will not be removed. However, a pseudo-line (no elevation values) will be generated along the tidal shoreline to depict a best estimate of the water's edge at time of collection.

QA/QC of Lidar and Derived Products

During both the planning and processing phases, all personnel involved operate under the guidance of the quality manual which follows principles of the QMS. In addition to outlining responsibilities, accountability, and reporting requirements throughout the life of a project, the Project Execution Plan outlines quality control checks for each phase of execution including detailed QC procedures.

Accuracy Analysis and Reporting: Absolute accuracy assessments will compare the x, y, z locations of known ground survey points (not clustered) to the triangulated ground surface generated from the Lidar points. Accuracies are described as the mean and standard deviation (sigma~s) of divergence from ground survey point coordinates. All accuracy statistics (RMSEz, Accuracyz - 1.96 s, skewness/distribution, and percentile deviations) are reported in the Report of Survey.

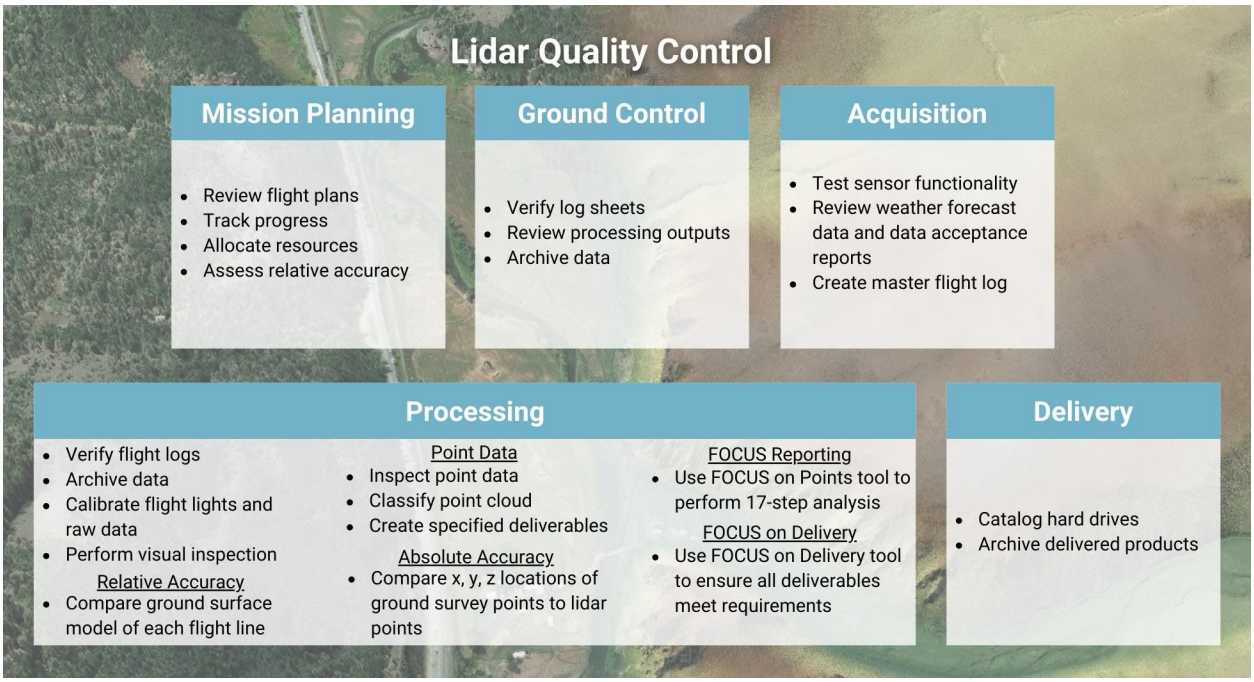

Figure 2. NV5 Geospatial, Inc's Lidar quality control approach.

NV5 Geospatial, Inc. staff play an important role in the quality control system, and we empower employees to take ownership of project quality by training all NG5G Inc. team members to participate in quality checks. Each employee is given a clear understanding of the quality expectations for the processes they participate in, allowing them to rapidly identify any potential problems and resolve them with minimal impact to the project schedule.

Metadata and Reports

NV5 Geospatial, Inc. will generate Federal Geographic Data Committee (FGDC)-compliant metadata for all geospatial data products at the project level for each product. These files will be analyzed to confirm accurate data generation and naming. Each dataset produced will include a metadata document in compliance with the FGDC Content Standards for Digital Geospatial Metadata. NV5 Geospatial, Inc. will describe the production process, the project specifications, and a variety of other factors that led to the generation of a digital deliverable. Once a metadata template has been compiled for a geospatial product, and all data quality tests have been completed successfully, the metadata will be evaluated for compliance with FGDC standards. The NV5 Geospatial, Inc. team checks the compliance of metadata records using various FGDC recognized and proprietary tools.

Deliverables

All geospatial data products will be delivered in Washington State Plane South, North American Datum of 1983 NAD83 High Accuracy Reference Network (HARN), North American Vertical Datum of 1988 NAVD88 (Geoid 12b), US Survey Feet. All Lidar products will follow the most current version of USGS Lidar Based Specification Deliverables.

Classified Point Cloud

- Fully compliant LAS v1.4, Point Record Format 6, 7, 8, 9, or 10 including "File Source ID."
- Proper use of the LAS (Laser) withheld and overlap bits is required. Outlier, blunders, geometrically unreliable points near the extreme edge of the swath, and any other points the data producer deems unusable are to be identified using the withheld bit flag, as defined in LAS specification version 1.4-R13 (ASPRS, 2011).Use of the overlap bit flag is intended to identify overage points, which are described as those points within a given swath that would be excluded when constructing a coverage with a uniform depth of swaths at any location within the project.
- Georeferenced information included in LAS header Open Geospatial Consortium (OGC) Well-Known Text (WKT).
- GPS times are to be recorded as Adjusted GPS Time, at a precision sufficient to allow unique timestamps for each return. In compliance with LAS specification requirements, the encoding tag in the LAS header must be properly set.
- Tiled delivery, without overlap
- Classification Scheme (minimum):
  - Class 1 – Processed, but unclassified
  - Class 2 – Bare-earth ground
  - Class 7 – Low Noise (low, manually identified, if necessary)
  - Class 9 — Water
  - Class 17 — Bridge Decks
  - Class 18 – High Noise (high, manually identified, if necessary)
  - Class 20 — Ignored Ground (Break line Proximity)
  - Class 21 – Snow (where reliably identified)
  - Class 22 – Temporal Exclusion (typically non-favored data in intertidal zones)

  Class 1 will be used for feature points that are not in Classes 2, 7, 8, 9, 10, 17 or 18. These typically represent returns from man-made structures, vegetation etc.

  Class 7 will be used for artifacts that do not represent the ground, manmade structures or vegetation. Typically, these are extraneous points that are below the surface not representing any true feature.

  Class 18 will be used for artifacts that do not represent the ground, manmade structures or vegetation.

Typically, these are extraneous points that are well above the surface not representing any true feature. No points will be deleted from the LAS file.

Hydro-flattened Bare Earth Surface (Raster DEM)

- Cell Size no greater than 1.5 U.S. Survey Feet for QL1, and no less than the design Aggregate Nominal Pulse Spacing (ANPS).
- Delivered in industry-standard, GIS-compatible, 32-bit floating point raster format in GeoTiff Format.
- Georeferenced information will be included in raster file
- Tiled delivery, without overlap or gaps
- Tiles will be suitable for creating seamless data mosaics
- DEM tiles will show no edge artifacts or mismatch
- Void areas (i.e., areas outside the project boundary but within the tiling scheme) will be coded using a unique "NODATA" value. This value will be identified in the appropriate location within the file header.
- A report on the assessed absolute vertical accuracy (NVA and VVA) of the bare-earth surface in accordance with the guidelines set forth in the "Positional Accuracy Standards for Digital Geospatial Data" (American Society for Photogrammetry and Remote Sensing (ASPRS), 2014). Absolute vertical accuracy requirements using the ASPRS methodology for the bare-earth DEM are listed in "Absolute vertical accuracy for digital elevation models, Quality Level 0–Quality Level 3" (table 5).
- Depressions (sinks), natural or man-made, are not to be filled (as in hydro-conditioning and hydro-enforcement).
- Water Bodies (ponds and lakes), wide streams and rivers ("double-line"), and other non-tidal water bodies as defined in Section III are to be hydro-flattened within the DEM.
- Bridges (as defined in the USGS Lidar Base Specification V2.0) will be removed from the DEM. Roads or other travel ways over culverts will remain intact in the surface.
- The bare earth surface below a bridge will be a continuous logical interpolation of the apparent non-hydrographic terrain lateral to the bridge deck. Where abutments are clearly visible, the bare earth interpolation will begin at the junction of the bridge deck and approach structure. Where this junction is not clear, NV5G, Inc. will use their best judgment to delineate the separation of below-bridge terrain from elevated bridge surface.
- No geometric change will be made to the originally computed Lidar points. Bare-earth Lidar points that are near break lines will be classified as Ignored Ground (class value equal to 10) and will be excluded from the DEM generation process. This process prevents unnatural surface artifacts from being created between mass points and break line vertices. The proximity threshold for reclassification as Ignored Ground is at the discretion of the data producer, but in general will not exceed the ANPS.
- Streams, rivers, and water bodies meeting the criteria for hydro-flattening will be monotonically continuous where bridge decks have been removed.
- Any break lines used to enforce a logical terrain surface below a bridge will be considered a required deliverable.

Digital Surface Model (DSM) product will have same resolution, format and tiling specifications as the Raster DEM.

Break Lines:

- Break lines for all hydro-flattened areas will be delivered, regardless of technique used for hydro-flattening the DEM.
- Break lines will be delivered in Esri file geodatabase formats, as PolylineZ and PolygonZ feature classes, as appropriate to the type of feature represented and the methodology used by the data producer.
- Break lines will be developed to the limit of the buffered project boundary area.

- Break lines will be delivered in the same coordinate reference system and units (horizontal and vertical) as the Lidar point delivery.
- Break line delivery may be in a single layer or in tiles, at the discretion of the data producer.
- In the case of tiled deliveries, all features will edge-match exactly across tile boundaries in both the horizontal (x, y) and vertical (z) spatial dimensions.
- Delivered data will be sufficient for the USGS to effectively re-create the delivered DEMs using the Lidar points and break lines without substantial editing.

Intensity Image

- 1.5 U.S. Survey Feet cell size
- Intensities 16-bit, linear rescaled
- Image 8-bit, 256 color gray scale and GeoTIFF format
- Images will be tiled to match the Classified LAS and DEMs.

Delivery Diagram: A final project-wide delivery diagram is required for QL1 projects over 1,000 square miles. At the completion of acquisition NV5G, Inc. will supply a diagram delineating the delivery blocks.

Metadata: Task Order requirements will be met and generally include:

- Ancillary products used to support processing of the Lidar dataset will be delivered.
- Collection Report detailing mission planning and flight logs. Additionally, a flight index will be delivered as an Esri file geodatabase. Flight index will contain flight line ID, acquisition date, start time and end time for each flight line.
- Georeferenced, polygonal extents detailing actual coverage of each of the Lidar swaths will be delivered as defined in the referenced Version 1.3 specification. Esri geodatabase is required.
- Survey Report detailing the collection of control and reference points used for calibration and QA/QC.
- Processing Report detailing calibration, classification, and product generation procedures including methodology used.
- QA/QC Reports (detailing the analysis, accuracy assessment and validation of:
  - The point data (absolute, within swath, and between swath)
  - The bare-earth surface (absolute)
  - All other optional deliverables, if appropriate
- Control points and check points: All control and check points used to calibrate, control, process, and validate the Lidar point data or any derivative products are to be delivered.
- Geo-referenced, digital spatial representation of the precise extents of each delivered dataset. This should reflect the extents of the actual Lidar source or derived product data, exclusive of Triangular Irregular Network (TIN) artifacts or raster NODATA areas. A union of tile boundaries or minimum bounding rectangle is not acceptable. Esri Polygon shapefile is preferred.
- Product metadata FGDC compliant, XML format metadata). One file for each:
  - Tiled deliverable product group (classified point data, bare-earth DEMs, etc.) Product group metadata should contain contents unique and specific to that product group, a renamed copy of the project level metadata is not sufficient. Metadata files for individual tiles are not required.

Note that the NGP version 1.3 of the Lidar Base Specification, has a modified XML metadata template to reflect other updates in the specification, careful review is advised.

Project Report: NV5G, Inc. will deliver a production report which details:

- A record of field work procedures.
- Data derivation and adjustments.
- Quality control procedures and results.
- Any problems encountered, and solutions used in resolving such problems.

- Statistical report summarizing the results of the airborne GPS adjustment and the overall accuracy of the adjusted Inertial Measurement Unit (IMU) data.
- Production report will be Microsoft Word, Adobe PDF format or another compatible digital format.

Acquisition Reports: NV5G, Inc. will provide regular progress updates to the technical point of contact throughout the data acquisition process.

- Update frequency will be based upon the collection period, but no less that once a week.
- Reports will be delivered as shapefiles which represent the geographic extent of the acquired data.
- Updates will commence at acquisition onset and will continue until acquisition is complete

Projection Information

- Washington State Plane South, NAD83 (HARN), NAVD88 (Geoid 12b), US Survey Feet

Tiling Scheme

DNR Format: All geospatial products will be delivered in a 4500 x 4500-foot tiling scheme unless otherwise specified. Esri grids and shapefiles will have complete and correct associated projection files. Tiled products will be edge matched, without gaps or overlap.

Vectors

- Survey boundary, shapefile format
- Tile layout, shapefile format

Reporting

- Final Project Report including: Methods, Results, Survey and Accuracy Assessments
- FGDC-CSDGM compliant Metadata

Schedule & Timeline

NV5G, Inc. will work with DNR and project partners to coordinate data collection to coincide with optimal weather conditions and as best meets the needs of the project. Collection will occur during leaf on conditions in mid-June to July 2026. Lidar products will be delivered 90 business days from the date of successful acquisition and receipt of survey.

Cost Estimate

Costs are provided below for the study area portrayed in Figure 1 above, assuming timeline and deliverables listed above. Changes in the size and/or shape of the area of interest as well as changes to the products below will result in modifications to the cost structure. Costs include mobilization, acquisition, survey, processing to products and reporting.

Snohomish County and Partners Project Limits (823 square miles)	Cost
Unincorporated County (704.7 square miles)	$260,739
Stanwood (2.98 square miles)	$1,103
Marysville (21.06 square miles)	$7,792
Arlington (9.95 square miles)	$3,682

Granite Falls (2.22 square miles)	$821
Mukilteo (6.34 square miles)	$2,346
Everett (35.53 square miles)	$13,146
Snohomish (3.98 square miles)	$1,473
Lake Stevens (11.79 square miles)	$4,362
Brier (2.19 square miles)	$810
Bothell (13.60 square miles)	$5,032
Edmonds (8.92 square miles)	$3,300
Total Cost	**$304,606**