

SNOHOMISH COUNTY COUNCIL  
Snohomish County, Washington

MOTION NO. 26-229

APPROVING AND AUTHORIZING THE EXECUTIVE TO EXECUTE THE  
DEPARTMENT OF NATURAL RESOURCES LIDAR COST SHARING AGREEMENT  
AND RELATED INTERGOVERNMENTAL SERVICES AGREEMENTS WITH  
PARTICIPATING CITIES

WHEREAS, Snohomish County has established ambitious urban tree canopy goals, objectives, and policies within the Natural Environment Element of the 2024 Comprehensive Plan; and

WHEREAS, strengthening the County's urban tree canopy is essential to improving environmental health, enhancing climate resilience, supporting stormwater management, and promoting community well-being; and

WHEREAS, the County seeks to develop a comprehensive roadmap for implementing its urban forestry objectives through improved data collection, mapping analysis, stewardship programming, and public participation; and

WHEREAS, acquisition of high-definition LiDAR data will enable accurate tree canopy mapping and support stormwater management efforts on county-owned and county-operated properties; and

WHEREAS, successful implementation of the urban tree canopy goals will be furthered by coordination with DNR and with cities and towns within Snohomish County; and

WHEREAS, the County entered into the Salmon Recovery Through Local Planning Grant Agreement No. 26-63117-011 with the Washington Department of Commerce (Council Motion No. 26-104), which provides funds to the County for the acquisition of LiDAR data; and

WHEREAS, the Washington Department of Natural Resources (DNR) has offered to enter into a cost share agreement with the County to allow the County to receive LiDAR data and mapping services from DNR's contractor, NV5 Geospatial, Inc.; and

WHEREAS, the DNR cost share agreement (Contract No. 93-111079) is attached to this motion as Exhibit A; and

WHEREAS, certain cities in Snohomish County (“Participating Cities”) desire LiDAR data for their jurisdictions and have requested to enter into intergovernmental services agreements with the County so they can acquire that data and pay their share of costs for the LiDAR data; and

WHEREAS, the Participating Cities are Stanwood, Marysville, Arlington, Granite Falls, Mukilteo, Everett, Snohomish, Lake Stevens, Brier, Bothell, and Edmonds; and

WHEREAS, streamlining the approval process for these intergovernmental services agreements would allow the County’s partners to timely access this data; and

WHEREAS, although the terms of each intergovernmental services agreement may vary slightly, a template form for the agreement is attached as Exhibit B to this motion; and

WHEREAS, the DNR cost share agreement includes a provision that allows the County to reduce the scope and cost of the cost share agreement if any Participating City decides not to participate;

NOW, THEREFORE, ON MOTION, the Snohomish County Council approves and authorizes the County Executive to execute the Cost Sharing Agreement with DNR, attached as Exhibit A to this motion, Contract No. 93-111079, in the amount of \$304,606, and funded through the Salmon Recovery Grant and the Snohomish County Council further approves and authorizes the County Executive to execute intergovernmental services agreements in the form provided as Exhibit B attached to this motion with Participating Cities.

PASSED this \_\_\_\_ day of \_\_\_\_\_, 2026.

SNOHOMISH COUNTY COUNCIL  
Snohomish County, Washington

\_\_\_\_\_  
COUNCIL CHAIR

ATTEST:

\_\_\_\_\_  
Deputy Clerk of the Council

# EXHIBIT A



## 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

Cost Share Agreement – DNR #93-111079

- \$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](mailto: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**

NV5G, Inc. will collect NIR Lidar data using a high pulse rate Lidar system to produce a highly accurate, high resolution  $\geq 8$  pulses/m<sup>2</sup> 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 for forest canopy mapping. Data will be collected at a minimum of 40° field of view (+/-20° from nadir), with sufficient overlap among swaths to minimize gaps and laser shadowing.

Lidar Specifications Summary	
Multi-Swath Pulse Density	$\geq 8$ pulses/m <sup>2</sup>
Returns Collected Per Laser	At least 3
Intensity Range	1-65535 (16 bit)
Vertical Accuracy ( $\sigma$ ), slope	$\leq 10$ cm
Horizontal Accuracy ( $\sigma$ )	$\leq 30$ cm

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 ( $\sigma$ ) 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 95<sup>th</sup> 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.

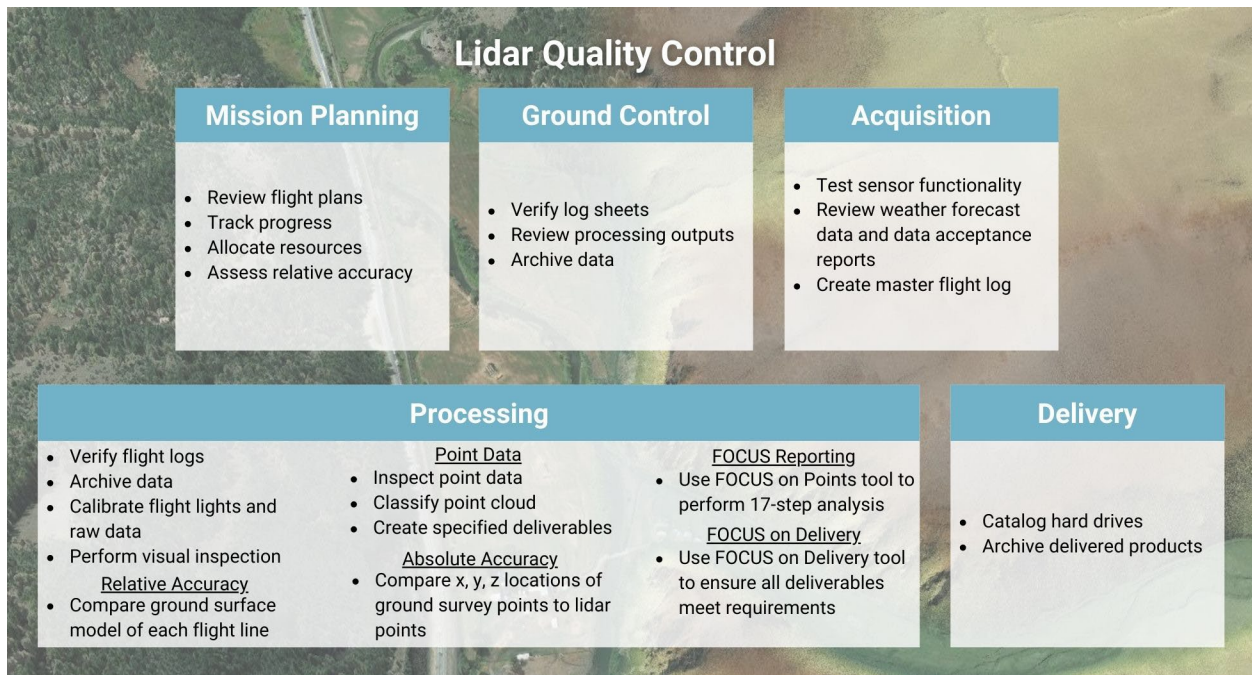


Figure 2. NV5 Geospatial, Inc’s Lidar quality control approach.

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

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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 than 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.

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

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

# EXHIBIT B

## INTERGOVERNMENTAL SERVICES AGREEMENT BETWEEN SNOHOMISH COUNTY AND \_\_\_\_\_ (City/Town) \_\_\_\_\_ FOR THE URBAN TREE CANOPY MAPPING PROJECT

From Execution to July 2027

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This Intergovernmental Services Agreement between Snohomish County and \_\_\_\_\_ (City/Town) \_\_\_\_\_ for Urban Tree Canopy Mapping Project (this “Agreement”), is made and entered into, by and between Snohomish County, a political subdivision of the State of Washington (the “County”), and \_\_\_\_\_ City/Town \_\_\_\_\_, a governmental subdivision of the State of Washington established pursuant to chapter \_\_\_\_\_ RCW (the “City/Town”).

### RECITALS

- A. WHEREAS, Snohomish County has established ambitious urban tree canopy goals, objectives, and policies within the Natural Environment Element of the 2024 Comprehensive Plan; and
- B. WHEREAS, strengthening the County’s urban tree canopy is essential to improving environmental health, enhancing climate resilience, supporting stormwater management, and promoting community well-being; and
- C. WHEREAS, the County seeks to develop a comprehensive roadmap for implementing its urban forestry objectives through improved data collection, mapping analysis, stewardship programming, and public participation; and
- D. WHEREAS, acquisition of high-definition LiDAR data will enable accurate tree canopy mapping and support stormwater management efforts on county-owned and county-operated properties; and
- E. WHEREAS, successful implementation of the urban tree canopy goals will be furthered by coordination with DNR and with cities and towns within Snohomish County; and
- F. WHEREAS, the County entered into the Salmon Recovery Through Local Planning Grant Agreement No. 26-63117-011 with the Washington Department of Commerce (Council Motion No. 26-104), which provides funds to the County for the acquisition of LiDAR data; and
- G. WHEREAS, the Washington Department of Natural Resources (DNR) has offered to enter into a cost share agreement with the County to allow the County to receive LiDAR data and mapping services from DNR’s contractor, NV5 Geospatial, Inc.; and
- H. WHEREAS, certain cities in Snohomish County (“Participating Cities”) desire LiDAR data for their jurisdictions and have requested to enter into intergovernmental services agreements with the County so they can acquire that data and pay their share of costs for the LiDAR data; and
- I. WHEREAS, the City/Town has requested to enter into this Intergovernmental agreement to procure high-definition LiDAR data for the area within the city limits of City/Town; and
- J. NOW, THEREFORE, ON MOTION, the Snohomish County Council approves and authorizes the County Executive to execute the Cost Sharing Agreement with DNR, attached as Exhibit B to this motion, Contract No. 93-111079, in the amount of \$304,606, and funded through the Salmon

Recovery Grant and the Snohomish County Council further approves and authorizes the County Executive to execute intergovernmental services agreements in the form provided with Participating Cities.

## **AGREEMENT**

NOW, THEREFORE, in consideration of the respective agreements set forth below and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the County and the **City/Town** agree as follows:

### **1. PURPOSE OF AGREEMENT**

The purpose of this Agreement is to facilitate the acquisition high-definition aerial data for tree canopy mapping. The County has entered into an agreement with the Washington State Department of Natural Resources (DNR) for LiDAR and imagery collection and geospatial mapping. The City seeks that data for the incorporated area of the City and agrees to pay for the County's provision of that data to the City.

### **2. DURATION OF AGREEMENT**

This Agreement shall remain in full force and effect for one year. The term of this Agreement shall commence upon execution and extend until June 2027 (the "Term"). The County's obligations after December 31, 2026, are contingent upon local legislative appropriation of necessary funds in accordance with applicable laws and the Snohomish County Charter.

### **3. SCOPE OF WORK**

The scope of work is as described in Exhibit A to this Agreement. The County will not be required to perform work for the **City/Town** in excess of work specified in Exhibit B except by mutual agreement to a written amendment to this Agreement.

### **4. PERFORMANCE**

The County agrees to satisfy all aspects of this Agreement in a timely and professional manner. At any time that the County cannot fulfill its responsibilities under this Agreement, the County shall notify the **City/Town** thereof in writing, together with an explanation of why said responsibilities cannot be fulfilled.

### **5. SUBCONTRACTING**

The County has entered into a Cost Sharing Agreement with the Washington Department of Natural Resources for LiDAR and imagery collection and geospatial mapping, as described in Exhibit B to this Agreement.

### **6. ADMINISTRATION OF AGREEMENT**

Each party to this Agreement shall designate an individual who may be designated by title or position to oversee and administer such party's participation in this Agreement. The parties' initial Administrators shall be the following individuals:

County's Initial Administrator:

City Initial Administrator:

Eric Smith, DCNR, OES  
Snohomish County Dept. of Public Works  
3000 Rockefeller Ave, M/S 607  
Everett, WA 98201

## 7. COMPENSATION

The compensation due to the County under this Agreement shall in no event exceed (\$\_\_\_\_\_). The **City/Town** shall have no obligation to pay any invoice from the County that would cause the total payments made to the County under this agreement to exceed \$\_\_\_\_\_.

## 8. INVOICING AND PAYMENT

The County shall submit an invoice to the **City/Town** on delivery of work product. The costs for work completed on the **City/Town's** portion of the project as outlined in the scope of work shall be included on the invoice. The **City/Town** shall pay the invoice within (20) days of receipt. The invoice shall be sent to the following address:

**CITY/TOWN INVOICE INFORMATION  
HERE:**

## 9. AUDIT AND INSPECTION

The **City/Town** shall maintain records pursuant to this Agreement in accordance with generally accepted accounting principles and practices consistently applied. The **City/Town's** records shall be available for inspection and audit by the County, the State Auditor, federal auditors, and any persons duly authorized by the parties. The **City/Town** shall preserve and make such records available to said parties until expiration of six (6) years from the date of final payment under this Agreement.

## 10. ENTIRETY OF AGREEMENT

This Agreement constitutes the entire agreement between the County and the **City/Town** and supersedes all proposals, oral and written, and all other communication between the parties in relation to the subject matter of this Agreement. No other agreement exists between the County and the **City/Town** with regards to the instant subject matter except as expressly set forth in this instrument. Except as otherwise provided herein, no modification of this Agreement shall be effective until placed in writing and executed by both parties.

**11. AGREEMENT ALTERATIONS AND AMENDMENTS**

This Agreement may be altered or amended by mutual agreement of both parties. Such alterations or amendments shall not be binding unless they are in writing and signed by personnel authorized to bind each of the parties.

**12. TERMINATION**

- A. In the event DNR terminates the LiDAR agreement with the County (Exhibit B), the County may, without advance notice and without liability for damages, terminate this Agreement by providing written notice to the City. The termination shall be effective on the date specified in the termination notice. The obligation of the **City/Town** to make final payment shall survive the termination of this Agreement.
- B. Either party may terminate this Agreement at any time on or before July 17, 2026. If this Agreement is so terminated, the parties shall be liable only for performance rendered or costs incurred in accordance with the terms of this Agreement prior to the effective date of termination.

**13. RESPONSIBILITIES OF THE PARTIES**

Each party to this Agreement hereby assumes responsibility for claims and/or damages to persons and/or property resulting from any act or omission on the part of itself, its employees, its officers, and its agents. Neither party assumes any responsibility to the other party for the consequences of any claim, act or omission of any person, agency, firm, or corporation not a party to this Agreement.

**14. RIGHTS AND REMEDIES**

- A. In no event shall any payment by the **City/Town** to the County constitute a waiver by the **City/Town** of any breach of covenant or any default that may exist on the part of the County. The making of any such payment by the **City/Town** while any such breach or default exists shall in no way impair or prejudice any of the **City/Town's** rights and remedies, hereby expressly recognized, to recover payments or portions thereof, to which the County was not entitled under this Agreement, where any payments were made by mistake, or to pursue any other remedy available to the **City/Town** with respect to breach or default of this Agreement.
- B. Performance pursuant to this Agreement may, where appropriate, be offered in satisfaction of an obligation, duty, or responsibility conveyed to the County or the **City/Town** where allowed by law. The **City/Town**, where legally authorized, may delegate any responsibility to the County where contemplated under an Appendix or included in the scope of work.

**15. HOLD HARMLESS**

The **City/Town** agrees to protect, defend and hold harmless the County, its elected and appointed officials, employees and agents, from and against all claims, demands and causes of action of any kind or character, including any cost of defense and attorney's fees, arising out of any actions, errors or omissions of the **City/Town**, its officials, employees and agents in performing this Agreement except for those arising out of the negligence of the County.

**16. RELATIONSHIP TO EXISTING LAWS**

This Agreement is entered into pursuant to and under the authority granted by the laws of the state of Washington and any applicable federal laws. The provisions of this Agreement shall be construed to conform to those laws. In the even to of an inconsistency in the terms of this Agreement, or between its terms and any applicable statute or rule, the inconsistency shall be resolved by giving precedence in the following order:

1. Applicable state and federal statutes and rules;
2. Any provisions of the Grant funding associated with the Agreement;
3. Statement of Work; and
4. Any other provisions of the Agreement, including materials incorporated by reference.

The parties stipulate that any lawsuit regarding this Agreement must be brought in Snohomish County, Washington.

**17. NONASSIGNMENT**

The **County** shall not subcontract, assign or delegate any of the rights, duties or obligations covered by this Agreement without prior express written consent by the **City/Town**.

**18. SEVERABILITY**

If any provision of this Agreement is held invalid, the remainder of this Agreement shall not be affected thereby if such remainder would then continue to serve the purposes and objectives of the Agreement as determined by the County.

**19. MISCELLANEOUS**

- A. No obligation in this Agreement shall limit the **City/Town** in fulfilling its responsibilities otherwise defined by law.
- B. No obligation in this Agreement shall limit the County in fulfilling its responsibilities otherwise defined by law.

IN WITNESS WHEREOF, the County and the **City/Town** have executed this Agreement as of the date of the last party to sign. .

**SNOHOMISH COUNTY:**

**CITY/TOWN:**

By: \_\_\_\_\_  
County Executive

By: \_\_\_\_\_  
Title: \_\_\_\_\_

**Approved as to Form:**

\_\_\_\_\_  
Deputy Prosecuting Attorney

EXHIBIT A  
SCOPE OF WORK AND BUDGET

**Scope of Work**

1. The County will administer the cost sharing agreement with WA DNR, which is attached hereto as Exhibit B.
2. The County will invoice the City and manage payment of the WA DNR contract.
3. The County will oversee validation and verification of work product by DNR's contractor.
4. The County will receive the data from WA DNR and transmit the applicable data to the City.

**Budget**

[to be filled in for each city]

EXHIBIT B  
DNR COST SHARING AGREEMENT



## Cost Share Agreement

DNR Contract No. 93-11107  
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

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Date: \_\_\_\_\_

Date: \_\_\_\_\_





EXHIBIT A – NV5 GEOSPATIAL, INC. PROPOSAL FOR LIDAR COLLECTION, DATED APRIL 15, 2026

**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).

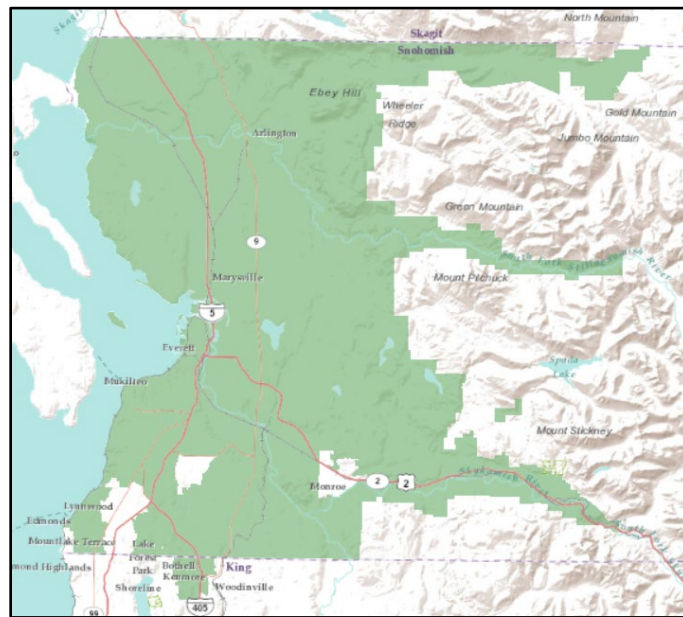


Figure 1: Limits of the Area of Interest (AOI) in green. AOI is approximately 823 square miles (526,720 acres).

**Technical Approach**

**NIR (Topographic) Lidar**

NV5G, Inc. will collect NIR Lidar data using a high pulse rate Lidar system to produce a highly accurate, high resolution  $\geq 8$  pulses/m<sup>2</sup> 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 40° field of view (+/-20° from nadir), with at sufficient overlap among swaths to minimize gaps and laser shadowing.

Lidar Specifications Summary	
Multi-Swath Pulse Density	$\geq 8$ pulses/m <sup>2</sup>
Returns Collected Per Laser	At least 3
Intensity Range	1-65535 (16 bit)
Vertical Accuracy ( $\sigma$ ), slope	$\leq 10$ cm
Horizontal Accuracy ( $\sigma$ )	$\leq 30$ cm

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 ( $\sigma$ ) 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

- RMSEZ  $\leq 10$  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 ( $\sigma$ ) of divergence from ground survey point coordinates. All accuracy statistics (RMSEz, Accuracyz - 1.96  $\sigma$ , skewness/distribution, and percentile deviations) are reported in the Report of Survey.

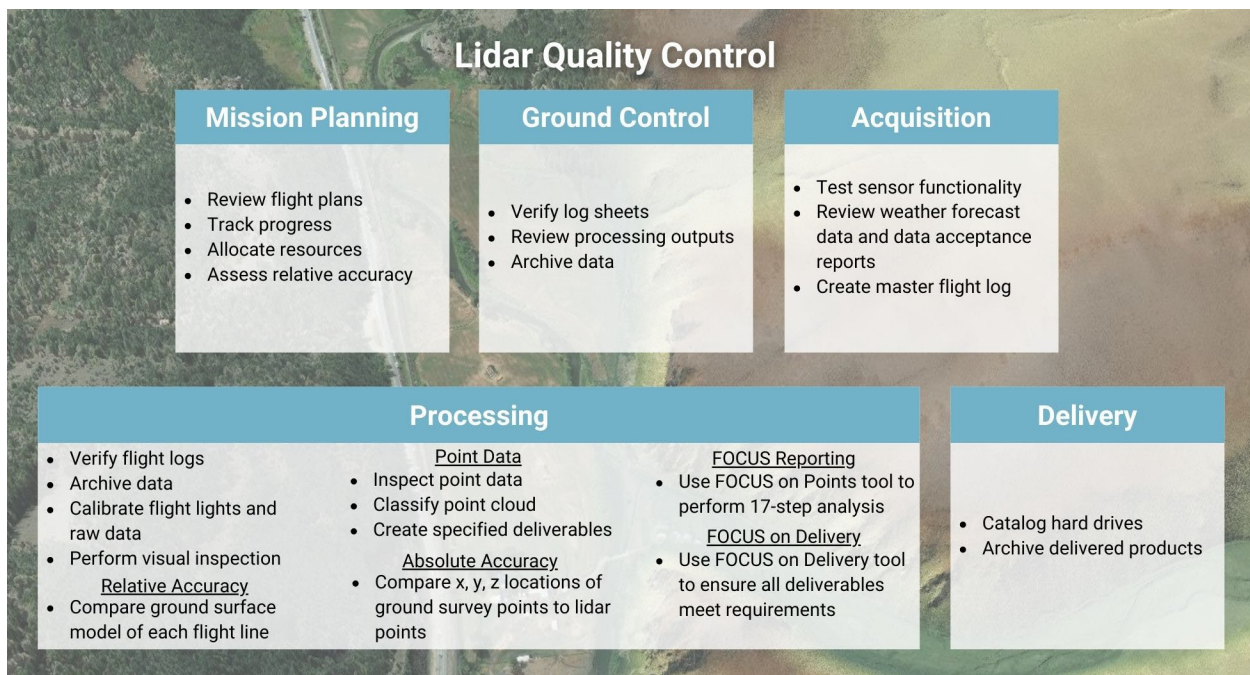


Figure 2. NV5 Geospatial, Inc's Lidar quality control approach.

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

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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 than 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

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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

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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.

<b>Snohomish County and Partners Project Limits (823 square miles)</b>	<b>Cost</b>
<b>Unincorporated County (704.7 square miles)</b>	\$260,739
<b>Stanwood (2.98 square miles)</b>	\$1,103
<b>Marysville (21.06 square miles)</b>	\$7,792
<b>Arlington (9.95 square miles)</b>	\$3,682
<b>Granite Falls (2.22 square miles)</b>	\$821
<b>Mukilteo (6.34 square miles)</b>	\$2,346
<b>Everett (35.53 square miles)</b>	\$13,146
<b>Snohomish (3.98 square miles)</b>	\$1,473
<b>Lake Stevens (11.79 square miles)</b>	\$4,362
<b>Brier (2.19 square miles)</b>	\$810
<b>Bothell (13.60 square miles)</b>	\$5,032
<b>Edmonds (8.92 square miles)</b>	\$3,300
<b>Total Cost</b>	<b>\$304,606</b>