Large Scale Photography for the Dogrib Fire

Prepared for:

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Project Scope

In November 2002, the Foothills Model Forest contracted Timberline Forest Inventory Consultants Ltd. to photograph selected stream reaches within the Dogrib Fire, near Sundre, AB. The objectives of the project were to attain complete stereo coverage of selected stream reaches in order to:

1. Track the recruitment of large woody debris to the stream channel and riparian area;
2. measure channel morphology, including stream width; and
3. create a permanent reference from the photographs that may be closely duplicated at a future time using similar photographic techniques in order to measure changes in large woody debris abundance and channel morphology.

Field work Observations and Recommendations for Future LSP Large Woody Debris Surveys *(written March 2004)*

Time of Year for Photography- Photo aquistion was completed in the fall 2002. Although summer months provide the largest window of opportunity for acceptable sun angles for acquiring aerial photographs, having leaf off conditions for photo interpretation is preferred in this case. Minimal snow cover can create a good contrast between the large woody debris and the ground. The risk is the possibility of missing smaller pieces that get covered by the snow. In steeper sided gullies oriented east west can create excessive unwanted shadow conditions that can be somewhat mitigated if the photographs are acquired under bright, high overcast conditions.

Photo Scale- The level of detail changes dramatically with large scale photography. The Dogrib Fire Study was flown at approximately 180m (1:1800 photo scale), which was selected as the mission scale to ensure that the riparian area was captured. This objective was met at a sacrifice to the detail of the photographs. The accuracy of some attributes were at a lower confidence level than desired. Recommendations to photograph streams at the largest scale is desired

At the time of aerial photo acquisition, the stand dynamics plots were not a consideration for this project. For future projects to capture 10 x 10 samples on both the upland and within the riparian zone it is recommended a separate set of photo stereo pairs be taken for each stand dynamics plot, and that the flying height be reduced (increasing the photo scale) to 50m (1:500 scale). The photo coverage at this scale is approximately 20m x 26m. This is a typical scale that forestry projects are flown at for silviculture surveys to achieve very high resolution photographs where forest health attributes such as spruce leader weevil damage can be collected.

Aerial Photography Acquisition- The aerial photograph acquisition went very smooth. The Foothills Model Forest supplied the navigator who was prepared on which site locations were to be targeted and the stream reach criteria to be met. Complete photo coverage of the target reaches was attained.

Photo Interpretation Observations and Recommendations for Future LSP Large Woody Debris Surveys

Large Scale Photography Background - The 70mm cameras used for the stream photography each have a reseau plate with 25 cross-shaped index marks, each being exactly 10mm apart in the X and Y axes (see fig. 1 top). The crosshairs are captured on film during each exposure. When viewing on the stereocomparator, 50 crosshairs are viewed (see fig 1 bottom).

Fig 1.
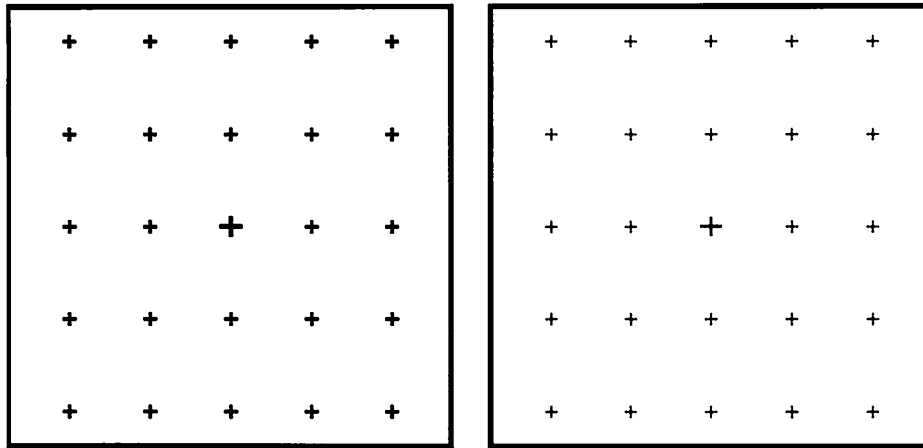
Camera 1   Camera 2
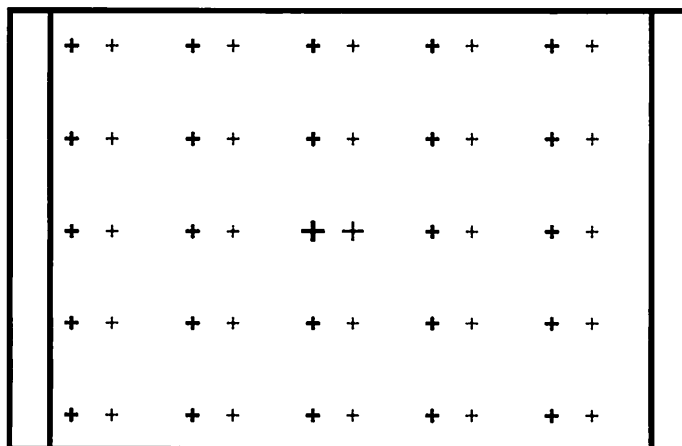
View of Images through the Ross Stereocomparitor

Proposed and Accepted Changes for Coarse Woody Debris Line Transects -Photo Interpretation Methodology Ammendment – The original sampling method used was to measure all large woody debris that lies within the riparian zone over 100 percent coverage of one photo. While this method gives the most statistical representation for the photo, it is time consuming and may not represent the entire stream reach. At a photo scale of 1: 1800, one photo will capture approximately 100 m stream coverage. During flight data collection, a minimum of 400 m of each reach was photographed. To utilize the photos collected and sample over a greater stream length, it was proposed to change the sampling methodology from 100 percent coverage over one photo stereo pair, to completing line transects across the stream reach over several photo stereo pairs.

This provides an opportunity for an unbiased start and end of a line transect. Other photo interpretation projects use the crosshairs for unbiased plot centers. The distance between each of the crosshairs is measurable. Since each photo has its own unique scale, the distances between the crosshairs will vary by photo pair. This presents two sampling options:

1.   Use two crosshairs as start and finish points of the line transect, measuring all large woody debris that falls along the transect as done in most traditional ground surveys.

2.   Use one cross as the start of the transect and have a pre-determined transect length and measure all large woody debris that falls along the transect as done in most traditional ground surveys.

For photo interpretation purposes option 1 would be the preferred method for a number of reasons. The start and end points are defined and eliminates measuring to determine the end of the transect. There is also more flexibility to project requirements. For example, capturing the full floodplain zone (both sides of the stream). By using the crosshairs we can randomly select a start point that lies outside the riparian zone, run the transect through the floodplain and finish the transect at the first crosshair on the other side of the riparian zone. This method will ensure that we collect all necessary data, but still have an unbiased transect starting point and transect length.

Sample Selection Criteria

> 1.   The number of transects completed would be budget driven. It is proposed that a minimum of five transects per reach be sampled until all reaches are completed. Return to sampled photos and add more transects if economically feasible.
> 2.   Select a photo to be sampled using a random number generator. See below for the suggested criteria to select a suitable photo.
> 3.   Select a transect using a random number generator. See below for the suggested criteria on what makes a suitable transect.

Note: To date there have been two photos completed for each stream with three transects on each photo.

Photo Sampling Criteria

1. Photo must be clear and measurable. Reasons for omitting the photo include:
   - poor photo quality;
   - transect data can not be collected due to the stream / photo location (stream is offset too far from the photo center so that a complete transect can not be measured);
   - too many shadows to interpret large woody debris;
   - too much snow;
   - riparian area not interpretable.

2. Complete transect must fall within disturbance area.

Transect Line Selection Criteria

The following methods will be used to determine the start of the large woody debris transect:

1. Looking at the center of the photo, determine the stream orientation and select the direction of the transect that will best place the transect perpendicular to the stream (see fig. 3)
2. Using a random number generator, pick the transect number to be interpreted (1, 2,or 3). If the first transect selected cannot be measured because the crosshairs are not visible, then go to its alternate (1a, 2a or 3a). If this selected transect is not measurable, then go to the random number generator and move to the next random transect and follow the same elimination process. If all transects are not interpretable than the photo is to be dropped and another sample is randomly selected.
3. Transect length will be determined based on the width of the floodplain. The transect will always start at the top of the photo and proceed down. The start point will be the first crosshair that lies outside the floodplain. Measurements will be taken on all pieces from the start, through the floodplain, and to the first crosshair that lies outside the floodplain.
4. Crosshair numbering has been designed so the line transects can be reviewed at future dates (See fig. 4). The database will have fields to locate the start and end of each transect.

Fig. 3
Proposed Line Transects for Large Woody Debris with East West Stream Orientation

	Floodplain Edge	+	Left Stereopair Image Crosshair
	Stream Edge	+	Right Stereopair Image Crosshair
	Transect Possibility	□	One 70mm Stereopair

Proposed Line Transects for Large Woody Debris with Northeast Southwest Stream Orientation
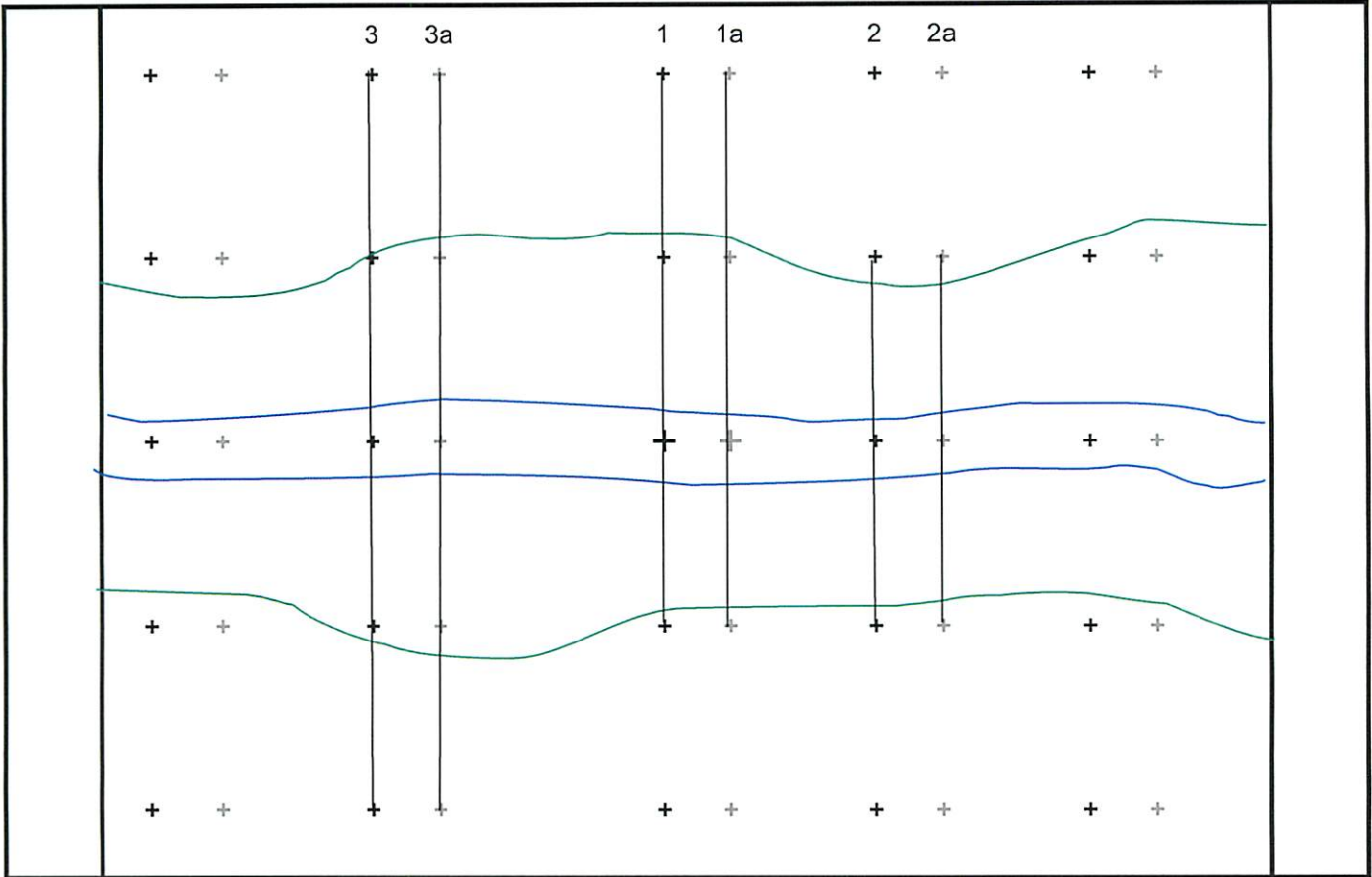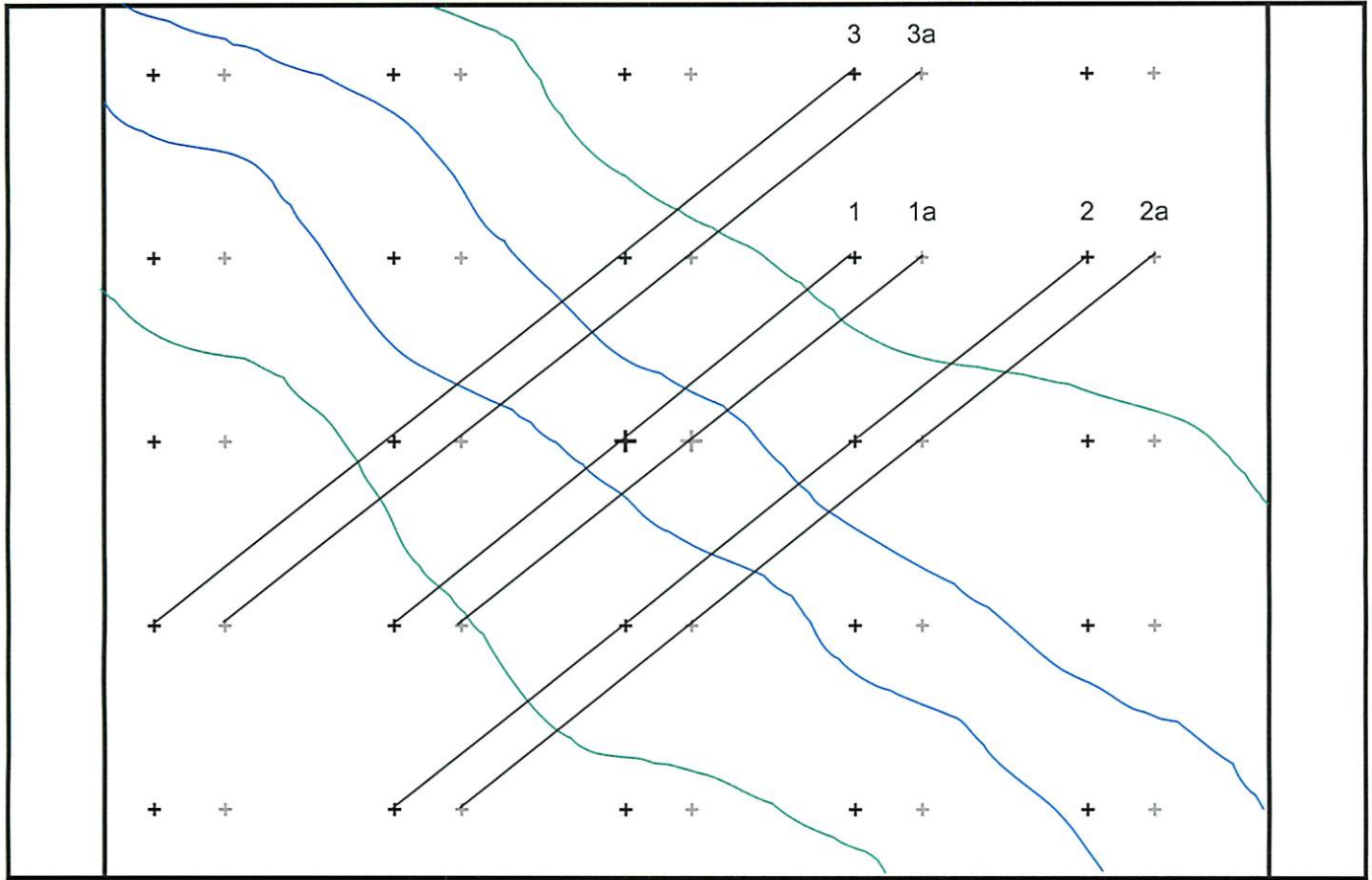
‒‒‒	Floodplain Edge	
‒‒‒	Stream Edge	
‒‒‒	Transect Possibility	
+	Left Stereopair Image Crosshair	
+	Right Stereopair Image Crosshair	
☐	One 70mm Stereopair	

Proposed Line Transects for Large Woody Debris with Northwest Southeast Stream Orientation

Symbol	Legend
—— (green)	Floodplain Edge
—— (blue)	Stream Edge
—— (black)	Transect Possibility
+	Left Stereopair Image Crosshair
+	Right Stereopair Image Crosshair
☐	One 70mm Stereopair

Fig.4

1	1a	2	2a	3	3a	4	4a	5	5a
+	+	+	+	+	+	+	+	+	+
6	6a	7	7a	8	8a	9	9a	10	10a
+	+	+	+	+	+	+	+	+	+
11	11a	12	12a	13	13a	14	14a	15	15a
+	+	+	+	+	+	+	+	+	+
16	16a	17	17a	18	18a	19	19a	20	20a
+	+	+	+	+	+	+	+	+	+
21	21a	22	22a	23	23a	24	24a	25	25a
+	+	+	+	+	+	+	+	+	+

Floodplain Volume Estimates

Remaining standing timber estimates within the floodplain have been estimated by overlaying 5.64m radius (0.01ha) circle templates in random locations on top of the 70mm photo. Multiple templates have been created to reflect the different photo scales. Stem counts are recorded in the database. An average height of the standing trees within the plot are also measured and a height – diameter curve is used to for diameter estimates.

Database Descriptions – Pieces Table

Reach Number – Indicates the Reach Number.

Photo Number - Indicates the Photo Number.

Survey – (Floodplain, Transect, or Instream) – *Floodplain* selection is labeled for photos where 100 percent of the CWD was measured within the floodplain. This was done for the first eight photos and then methodology amendments were made because of time constraints and project goals. *Transect* selection are labeled for photos where CWD transects were measured. In addition to the CWD transect all pieces located within the stream channel were measured. All CWD pieces that lie outside the transect but within the stream channel have been identified as *Instream.*

Transect – For each of the photos 3 transects were completed. The transect measurements always started at top of the photo and ran towards the bottom. The first transect selected contained the photo center crosshair – identified as crosshair number 13 or its alternate 13A if the transect is not suitable (see fig 4). The stream orientation influenced the CWD transect bearing as shown in fig. 3. The second transect will run through crosshair number 14 or its alternate 14A. And the third transect will pass through crosshair number 12 or its alternate 12A.

Transect Total Length – The transect length from the POC (Point of Commencement) to the POT (Point of Termination).

POC to Strm Bnk 1 – The transect length from the POC to the closest stream bank.

Strm Width – The length of the transect that falls within the stream channel.

POC to Strm Bnk 2 – The transect length from the POC to the furthest streambank.

Piece Loc in Strm – The transect length from the POC to a CWD piece within the stream.

Sample Length – The transect length between the two uplands.

Floodplain to POT – The Transect length from floodplain 2 to the POT.

Transect Start – The crosshair identification number where the transect begins.

Transect Stop – The crosshair identification number where the transect ends.

Distance to Stream – The closest distance from the stump to the stream.

Chainage – The cumulative distance from the reference point to the stump piece (100 % photo coverage samples only).

Distance to Floodplain - shortest distance from stump to edge of floodplain, if tree does not reach to stream (m).

OriginZone - Zone of stump. Linked to Zones LUT, must be 3, 4, or 5 (3 indicates within bankfull channel, includes 1 and 2), 4 = within floodplain, 5 = upland.

Orientation - Orientation of piece. Linked to orientation LUT.

Decay Class - Decay class, linked to Decay LUT.

Species – Tree Species.

Rootwad – Rootwad LUT. Defined as a Log, Rootwad or Log/Rootwad.

Log Jam – Is the tree part of a log jam? Y/N

Zone Number - Location of the piece. Defined as the Upland, Floodplain, or Stream channel. Upland and floodplain are also split up to which side of the stream the piece is located on.

Zone Length – The length of the piece within the zone number.

Diameter – Measured diameters, designed to put into 10 cm classes. These measurements were completed for the 100% coverage photos only. Remaining diameters were calculated by Foothills Model Forest.

Database Descriptions – Locations Table

Scale – Photo scale.

Stream Widths – Each photo has 5 stream width measurements.

Floodplain Widths – Each photo has 5 floodplain measurements.

P1, P2, P3 counts – Each photo has 3 5.64m radius plots (0.01ha) counting the remaining standing trees within the floodplain.

P1, P2, P3 hts – Each plot has a representative height of the remaining standing trees.

P1, P2, P3 diameters – Using height – diameter relationship tables diameters were assigned to the average tree

Foothills Flight Logs

File: 02-11-29.006
Date: 02-11-29 Time: 11:13:16

Roll ID: 3
Flight Plan: 1

Front Camera: 1183-
Back Camera: 1188-
Operator: DLL
Remarks: 1

Film Type: AVI200
Exposure: 3.5- 250
Navigator: SCOTT

Auto Sample: 8-01	Offset:	+2.5	Residual:	-22.6	Auto Sample: 8-17	Offset:	+10.4	Residual:	+4.1

Auto Sample: 8-01   Offset: +2.5   Residual: -22.6
Altitude: Low: 179.2   High: 181.9
GPS Age: 0.0 sec.   51.7226491 N   115.3041027 W

Auto Sample: 8-17   Offset: +10.4   Residual: +4.1
Altitude: Low: 150.9   High: 158.2
GPS Age: 0.0 sec.   51.7223790 N   115.3087465 W

Auto Sample: 8-02   Offset: -2.0   Residual: +3.1
Altitude: Low: 183.1   High: 185.9
GPS Age: 0.3 sec.   51.7226098 N   115.3043138 W

Auto Sample: 8-18   Offset: +11.2   Residual: +5.3
Altitude: Low: 149.0   High: 150.9
GPS Age: 0.3 sec.   51.7224007 N   115.3090072 W

Auto Sample: 8-03   Offset: -1.4   Residual: +11.4
Altitude: Low: 186.4   High: 191.1
GPS Age: 0.5 sec.   51.7225720 N   115.3045269 W

Auto Sample: 8-19   Offset: +12.3   Residual: +0.6
Altitude: Low: 144.5   High: 148.5
GPS Age: 0.5 sec.   51.7224174 N   115.3092612 W

Auto Sample: 8-04   Offset: +0.9   Residual: +9.8
Altitude: Low: 189.9   High: 193.9
GPS Age: -0.2 sec.   51.7225103 N   115.3048803 W

Auto Sample: 25-1   Offset: +16.0   Residual: -6.1
Altitude: Low: 206.6   High: 214.6
GPS Age: 0.2 sec.   51.7268592 N   115.3021606 W

Auto Sample: 8-05   Offset: +2.8   Residual: +13.4
Altitude: Low: 193.8   High: 194.9
GPS Age: 0.0 sec.   51.7224692 N   115.3051293 W

Auto Sample: 25-2   Offset: +14.8   Residual: +13.2
Altitude: Low: 199.8   High: 207.1
GPS Age: 0.5 sec.   51.7270499 N   115.3022507 W

Auto Sample: 8-06   Offset: +5.5   Residual: +7.3
Altitude: Low: 193.1   High: 194.1
GPS Age: 0.3 sec.   51.7224305 N   115.3053830 W

Auto Sample: 25-3   Offset: +17.4   Residual: +4.3
Altitude: Low: 195.9   High: 204.3
GPS Age: -0.3 sec.   51.7273144 N   115.3024116 W

Auto Sample: 8-07   Offset: +7.0   Residual: +4.6
Altitude: Low: 192.6   High: 193.8
GPS Age: 0.5 sec.   51.7223931 N   115.3056345 W

Auto Sample: 25-4   Offset: +18.3   Residual: +10.2
Altitude: Low: 184.6   High: 196.8
GPS Age: 0.0 sec.   51.7274788 N   115.3025435 W

Auto Sample: 8-08   Offset: +7.9   Residual: +6.4
Altitude: Low: 187.8   High: 193.1
GPS Age: -0.2 sec.   51.7223403 N   115.3060095 W

Auto Sample: 25-5   Offset: +20.3   Residual: +6.5
Altitude: Low: 180.4   High: 184.6
GPS Age: 0.2 sec.   51.7276360 N   115.3026894 W

Auto Sample: 8-09   Offset: +9.2   Residual: +6.0
Altitude: Low: 186.3   High: 187.6
GPS Age: 0.0 sec.   51.7223102 N   115.3062677 W

Auto Sample: 25-6   Offset: +21.6   Residual: -1.3
Altitude: Low: 178.7   High: 180.1
GPS Age: 0.5 sec.   51.7277879 N   115.3028478 W

Auto Sample: 8-10   Offset: +10.4   Residual: +2.1
Altitude: Low: 182.4   High: 186.2
GPS Age: 0.3 sec.   51.7222829 N   115.3065371 W

Auto Sample: 25-7   Offset: +21.3   Residual: -1.4
Altitude: Low: 175.6   High: 177.9
GPS Age: -0.3 sec.   51.7280232 N   115.3030891 W

Auto Sample: 8-11   Offset: +10.8   Residual: -0.8
Altitude: Low: 178.2   High: 180.7
GPS Age: 0.5 sec.   51.7222601 N   115.3068175 W

Auto Sample: 25-8   Offset: +21.1   Residual: -4.9
Altitude: Low: 174.7   High: 175.8
GPS Age: 0.0 sec.   51.7281851 N   115.3032520 W

Auto Sample: 8-12   Offset: +10.6   Residual: +0.1
Altitude: Low: 175.9   High: 177.9
GPS Age: -0.2 sec.   51.7222506 N   115.3072566 W

Auto Sample: 25-9   Offset: +20.1   Residual: -1.6
Altitude: Low: 173.9   High: 174.6
GPS Age: 0.2 sec.   51.7283531 N   115.3034295 W

Auto Sample: 8-13   Offset: +10.7   Residual: +0.7
Altitude: Low: 171.9   High: 175.8
GPS Age: 0.0 sec.   51.7222526 N   115.3075425 W

Auto Sample: 25-10   Offset: +19.8   Residual: -2.0
Altitude: Low: 172.8   High: 173.6
GPS Age: 0.5 sec.   51.7285250 N   115.3036242 W

Auto Sample: 8-14   Offset: +10.8   Residual: -1.5
Altitude: Low: 167.6   High: 171.2
GPS Age: 0.3 sec.   51.7222661 N   115.3078190 W

Auto Sample: 25-11   Offset: +19.4   Residual: -2.3
Altitude: Low: 171.0   High: 172.7
GPS Age: -0.3 sec.   51.7288021 N   115.3039359 W

Auto Sample: 8-15   Offset: +10.5   Residual: +1.2
Altitude: Low: 163.7   High: 167.6
GPS Age: 0.5 sec.   51.7222936 N   115.3080879 W

Auto Sample: 25-12   Offset: +18.9   Residual: -3.0
Altitude: Low: 167.4   High: 170.5
GPS Age: 0.0 sec.   51.7290027 N   115.3041483 W

Auto Sample: 8-16   Offset: +10.8   Residual: -2.0
Altitude: Low: 157.1   High: 163.7
GPS Age: -0.2 sec.   51.7223465 N   115.3084826 W

Auto Sample: 25-13   Offset: +18.3   Residual: +3.0
Altitude: Low: 165.1   High: 166.7
GPS Age: 0.2 sec.   51.7292087 N   115.3043589 W

```
Auto Sample: 25-14 Offset:      +18.9  Residual:     +0.8   Auto Sample: 21-10 Offset:      +13.6  Residual:     -2.0
Altitude:          Low:      165.5  High:       166.0   Altitude:          Low:      180.2  High:       183.6
GPS Age:  0.5 sec.        51.7294046 N       115.3045588 W   GPS Age: -0.4 sec.        51.7196554 N       115.2723040 W

Auto Sample: 25-15 Offset:      +19.0  Residual:     -3.6   Auto Sample: 21-11 Offset:      +13.2  Residual:     -3.8
Altitude:          Low:      165.4  High:       166.4   Altitude:          Low:      181.1  High:       183.5
GPS Age: -0.3 sec.        51.7296853 N       115.3048373 W   GPS Age: -0.1 sec.        51.7195189 N       115.2722421 W

Auto Sample: 25-16 Offset:      +18.3  Residual:     -3.4   Auto Sample: 21-12 Offset:      +12.4  Residual:     -0.4
Altitude:          Low:      164.1  High:       165.4   Altitude:          Low:      179.8  High:       181.3
GPS Age:  0.0 sec.        51.7298698 N       115.3050132 W   GPS Age:  0.1 sec.        51.7193819 N       115.2721889 W

Auto Sample: 25-17 Offset:      +17.6  Residual:     +3.4   Auto Sample: 21-13 Offset:      +12.4  Residual:     -1.0
Altitude:          Low:      161.4  High:       163.7   Altitude:          Low:      177.0  High:       179.8
GPS Age:  0.2 sec.        51.7300528 N       115.3051877 W   GPS Age:  0.4 sec.        51.7192420 N       115.2721450 W

Auto Sample: 25-18 Offset:      +18.3  Residual:     +0.7   Auto Sample: 21-14 Offset:      +12.2  Residual:    +17.6
Altitude:          Low:      161.1  High:       161.5   Altitude:          Low:      174.6  High:       176.4
GPS Age:  0.5 sec.        51.7302269 N       115.3053593 W   GPS Age: -0.4 sec.        51.7190273 N       115.2721155 W

Auto Sample: 25-19 Offset:      +18.4  Residual:     -4.8   Auto Sample: 21-15 Offset:      +15.7  Residual:     -1.2
Altitude:          Low:      161.1  High:       161.8   Altitude:          Low:      172.5  High:       174.4
GPS Age: -0.3 sec.        51.7304644 N       115.3056126 W   GPS Age: -0.1 sec.        51.7188828 N       115.2721086 W

Auto Sample: 25-20 Offset:      +17.5  Residual:     +0.6   Auto Sample: 21-16 Offset:      +15.5  Residual:     +9.3
Altitude:          Low:      161.7  High:       162.8   Altitude:          Low:      172.4  High:       173.4
GPS Age:  0.0 sec.        51.7306186 N       115.3057755 W   GPS Age:  0.1 sec.        51.7187395 N       115.2721181 W

Auto Sample: 25-21 Offset:      +17.6  Residual:     +1.8
Altitude:          Low:      147.6  High:       165.3
GPS Age:  0.2 sec.        51.7307726 N       115.3059329 W

Auto Sample: 25-22 Offset:      +18.0  Residual:     +5.3
Altitude:          Low:      163.7  High:       167.4
GPS Age:  0.5 sec.        51.7309234 N       115.3060900 W

Auto Sample: 21-1  Offset:      +16.9  Residual:     -2.3
Altitude:          Low:      169.1  High:       172.6
GPS Age:  0.4 sec.        51.7211289 N       115.2731402 W

Auto Sample: 21-2  Offset:      +16.4  Residual:     +0.2
Altitude:          Low:      171.6  High:       172.6
GPS Age: -0.4 sec.        51.7209333 N       115.2730534 W

Auto Sample: 21-3  Offset:      +16.5  Residual:     -4.4
Altitude:          Low:      171.7  High:       173.9
GPS Age: -0.1 sec.        51.7208010 N       115.2729827 W

Auto Sample: 21-4  Offset:      +15.6  Residual:     +0.9
Altitude:          Low:      171.6  High:       172.2
GPS Age:  0.1 sec.        51.7206709 N       115.2729029 W

Auto Sample: 21-5  Offset:      +15.8  Residual:     +0.9
Altitude:          Low:      172.4  High:       173.7
GPS Age:  0.4 sec.        51.7205393 N       115.2728156 W

Auto Sample: 21-6  Offset:      +16.0  Residual:     -4.3
Altitude:          Low:      173.3  High:       174.5
GPS Age: -0.4 sec.        51.7203320 N       115.2726886 W

Auto Sample: 21-7  Offset:      +15.1  Residual:     -4.9
Altitude:          Low:      174.4  High:       177.5
GPS Age: -0.1 sec.        51.7201793 N       115.2726070 W

Auto Sample: 21-8  Offset:      +14.1  Residual:     +0.4
Altitude:          Low:      177.5  High:       179.3
GPS Age:  0.1 sec.        51.7200245 N       115.2725183 W

Auto Sample: 21-9  Offset:      +14.2  Residual:     -3.0
Altitude:          Low:      179.0  High:       182.1
GPS Age:  0.4 sec.        51.7198697 N       115.2724245 W
```

File: 02-11-29.007
Date: 02-11-29 Time: 12:08:15

'ront Camera: 1183-
Jack Camera: 1188-
Operator: DLL
Remarks: 1

Roll ID: 3 CONT
Flight Plan: 1

Film Type: AVI200
Exposure: 3.5- 250
Navigator: SCOTT

Auto Sample: 24-1	Offset:	+17.1	Residual:	-5.4	Auto Sample: 24-17	Offset:	+10.8	Residual:	+7.9
Altitude:	Low:	177.9	High:	180.3	Altitude:	Low:	163.6	High:	164.4
GPS Age: 0.0 sec.	51.7277929 N		115.2775009 W		GPS Age: 0.0 sec.	51.7250922 N		115.2755977 W

Auto Sample: 24-1 Offset: +17.1 Residual: -5.4   Auto Sample: 24-17 Offset: +10.8 Residual: +7.9
Altitude: Low: 177.9 High: 180.3   Altitude: Low: 163.6 High: 164.4
GPS Age: 0.0 sec.   51.7277929 N   115.2775009 W   GPS Age: 0.0 sec.   51.7250922 N   115.2755977 W

Auto Sample: 24-2 Offset: +14.4 Residual: -1.3   Auto Sample: 24-18 Offset: +12.4 Residual: +1.7
Altitude: Low: 180.3 High: 181.6   Altitude: Low: 163.1 High: 163.9
GPS Age: 0.3 sec.   51.7276603 N   115.2773826 W   GPS Age: 0.3 sec.   51.7249587 N   115.2754360 W

Auto Sample: 24-3 Offset: +14.0 Residual: +0.2   Auto Sample: 24-19 Offset: +12.7 Residual: +7.4
Altitude: Low: 180.7 High: 181.6   Altitude: Low: 164.1 High: 166.9
GPS Age: 0.5 sec.   51.7275223 N   115.2772646 W   GPS Age: 0.5 sec.   51.7248278 N   115.2752794 W

Auto Sample: 24-4 Offset: +14.0 Residual: -6.6   Auto Sample: 24-20 Offset: +14.2 Residual: +3.1
Altitude: Low: 180.7 High: 182.3   Altitude: Low: 167.8 High: 168.6
GPS Age: -0.2 sec.   51.7273125 N   115.2770887 W   GPS Age: -0.2 sec.   51.7246325 N   115.2750602 W

Auto Sample: 24-5 Offset: +12.7 Residual: -4.8   Auto Sample: 24-21 Offset: +14.8 Residual: +2.0
Altitude: Low: 180.2 High: 182.3   Altitude: Low: 168.6 High: 170.5
GPS Age: 0.0 sec.   51.7271672 N   115.2769755 W   GPS Age: 0.0 sec.   51.7244984 N   115.2749196 W

Auto Sample: 24-6 Offset: +11.8 Residual: -4.6   Auto Sample: 24-22 Offset: +15.2 Residual: +8.0
Altitude: Low: 179.7 High: 181.5   Altitude: Low: 170.4 High: 171.0
GPS Age: 0.3 sec.   51.7270174 N   115.2768643 W   GPS Age: 0.3 sec.   51.7243608 N   115.2747776 W

Auto Sample: 24-7 Offset: +10.8 Residual: -1.6   Auto Sample: 24-23 Offset: +16.8 Residual: +1.0
Altitude: Low: 179.3 High: 180.0   Altitude: Low: 170.8 High: 171.1
GPS Age: 0.5 sec.   51.7268644 N   115.2767584 W   GPS Age: 0.5 sec.   51.7242274 N   115.2746337 W

Auto Sample: 24-8 Offset: +10.5 Residual: +0.6   Auto Sample: 24-24 Offset: +17.0 Residual: +1.3
Altitude: Low: 177.9 High: 179.3   Altitude: Low: 170.4 High: 171.0
GPS Age: -0.2 sec.   51.7266339 N   115.2766305 W   GPS Age: -0.2 sec.   51.7240300 N   115.2744333 W

Auto Sample: 24-9 Offset: +10.6 Residual: +0.2   Auto Sample: 11-1 Offset: +18.4 Residual: -11.7
Altitude: Low: 178.3 High: 178.5   Altitude: Low: 197.2 High: 198.6
GPS Age: 0.0 sec.   51.7264836 N   115.2765573 W   GPS Age: -0.1 sec.   51.7360251 N   115.2534602 W

Auto Sample: 24-10 Offset: +10.7 Residual: -2.4   Auto Sample: 11-2 Offset: +16.0 Residual: -9.6
Altitude: Low: 176.5 High: 178.3   Altitude: Low: 196.9 High: 198.3
GPS Age: 0.3 sec.   51.7263364 N   115.2765001 W   GPS Age: 0.1 sec.   51.7358538 N   115.2534804 W

Auto Sample: 24-11 Offset: +10.2 Residual: +1.6   Auto Sample: 11-3 Offset: +14.1 Residual: -5.3
Altitude: Low: 175.2 High: 176.8   Altitude: Low: 195.9 High: 196.9
GPS Age: 0.5 sec.   51.7261838 N   115.2764388 W   GPS Age: 0.4 sec.   51.7356863 N   115.2534618 W

Auto Sample: 24-12 Offset: +10.5 Residual: +1.8   Auto Sample: 11-4 Offset: +13.1 Residual: -3.7
Altitude: Low: 173.4 High: 175.5   Altitude: Low: 194.4 High: 195.5
GPS Age: -0.2 sec.   51.7259470 N   115.2763204 W   GPS Age: -0.4 sec.   51.7354133 N   115.2533943 W

Auto Sample: 24-13 Offset: +10.9 Residual: -1.2   Auto Sample: 11-5 Offset: +12.3 Residual: -1.0
Altitude: Low: 171.5 High: 173.3   Altitude: Low: 191.7 High: 193.9
GPS Age: 0.0 sec.   51.7257848 N   115.2762247 W   GPS Age: -0.1 sec.   51.7352134 N   115.2533266 W

Auto Sample: 24-14 Offset: +10.6 Residual: +1.0   Auto Sample: 11-6 Offset: +12.1 Residual: -2.2
Altitude: Low: 169.0 High: 171.1   Altitude: Low: 189.9 High: 191.6
GPS Age: 0.3 sec.   51.7256248 N   115.2761132 W   GPS Age: 0.1 sec.   51.7350013 N   115.2532383 W

Auto Sample: 24-15 Offset: +10.9 Residual: -0.9   Auto Sample: 11-7 Offset: +11.7 Residual: -0.5
Altitude: Low: 165.8 High: 168.9   Altitude: Low: 189.3 High: 190.5
GPS Age: 0.5 sec.   51.7254661 N   115.2759841 W   GPS Age: 0.4 sec.   51.7347913 N   115.2531276 W

Auto Sample: 24-16 Offset: +10.7 Residual: +0.6   Auto Sample: 11-8 Offset: +11.6 Residual: -1.1
Altitude: Low: 164.4 High: 165.3   Altitude: Low: 187.3 High: 187.9
GPS Age: -0.2 sec.   51.7252360 N   115.2757575 W   GPS Age: -0.4 sec.   51.7345016 N   115.2529486 W

```
Auto Sample: 11-9  Offset:     +11.3  Residual:    +0.1
Altitude:          Low:        187.0  High:       187.6
GPS Age: -0.1 sec.      51.7343228 N     115.2528203 W

Auto Sample: 11-10 Offset:     +11.4  Residual:    -1.4
Altitude:          Low:        186.4  High:       187.6
GPS Age:  0.1 sec.      51.7341444 N     115.2526845 W

Auto Sample: 11-11 Offset:     +11.1  Residual:    -0.9
Altitude:          Low:        185.1  High:       186.0
GPS Age:  0.4 sec.      51.7339709 N     115.2525377 W

Auto Sample: 11-12 Offset:     +10.9  Residual:    -0.2
Altitude:          Low:        184.3  High:       184.8
GPS Age: -0.4 sec.      51.7337028 N     115.2523054 W

Auto Sample: 11-13 Offset:     +10.9  Residual:    +0.3
Altitude:          Low:        184.3  High:       184.6
GPS Age: -0.1 sec.      51.7335223 N     115.2521417 W

Auto Sample: 11-14 Offset:     +10.9  Residual:    -0.5
Altitude:          Low:        183.9  High:       184.4
GPS Age:  0.1 sec.      51.7333409 N     115.2519641 W

Auto Sample: 11-15 Offset:     +10.8  Residual:    -5.1
Altitude:          Low:        182.8  High:       183.9
GPS Age:  0.4 sec.      51.7331524 N     115.2517728 W

Auto Sample: 11-16 Offset:      +9.8  Residual:    -0.3
Altitude:          Low:        181.7  High:       182.3
GPS Age: -0.4 sec.      51.7328598 N     115.2514700 W

Auto Sample: 11-17 Offset:      +9.7  Residual:    -1.6
Altitude:          Low:        179.6  High:       181.9
GPS Age: -0.1 sec.      51.7326692 N     115.2512726 W

Auto Sample: 11-18 Offset:      +9.4  Residual:    -3.8
Altitude:          Low:        178.9  High:       179.4
GPS Age:  0.1 sec.      51.7324917 N     115.2510876 W

Auto Sample: 11-19 Offset:      +8.7  Residual:    -2.3
Altitude:          Low:        178.0  High:       178.7
GPS Age:  0.4 sec.      51.7323242 N     115.2509130 W

Auto Sample: 11-20 Offset:      +8.2  Residual:    -5.3
Altitude:          Low:        176.8  High:       177.5
GPS Age: -0.4 sec.      51.7320740 N     115.2506717 W

Auto Sample: 11-21 Offset:      +7.1  Residual:    -2.0
Altitude:          Low:        175.8  High:       176.3
GPS Age: -0.1 sec.      51.7318991 N     115.2505242 W

Auto Sample: 11-22 Offset:      +6.7  Residual:    -2.3
Altitude:          Low:        171.9  High:       175.0
GPS Age:  0.1 sec.      51.7317129 N     115.2503822 W
```

File: 02-11-29.008
Date: 02-11-29 Time: 12:26:52

Front Camera: 1183-
Back Camera: 1188-
Operator: DLL
Remarks: 1

Roll ID: 4
Flight Plan: 1

Film Type: AVI200
Exposure: 3.5- 250
Navigator: SCOTT

```
Auto Sample: 12-1  Offset:    +19.4  Residual:     -5.4   Auto Sample: 12-17 Offset:     +7.1  Residual:     -1.9
Altitude:          Low:       176.3  High:        177.3   Altitude:          Low:       165.1  High:        181.2
GPS Age:  0.0 sec.      51.7400181 N      115.2255924 W   GPS Age:  0.0 sec.      51.7380466 N      115.2279441 W

Auto Sample: 12-2  Offset:    +18.3  Residual:    -10.4   Auto Sample: 12-18 Offset:     +6.8  Residual:     -0.2
Altitude:          Low:       173.8  High:        176.6   Altitude:          Low:       165.1  High:        181.2
GPS Age:  0.3 sec.      51.7399182 N      115.2257315 W   GPS Age:  0.3 sec.      51.7379330 N      115.2280329 W

Auto Sample: 12-3  Offset:    +16.3  Residual:     -9.2   Auto Sample: 12-19 Offset:     +6.7  Residual:     -1.7
Altitude:          Low:       161.9  High:        172.4   Altitude:          Low:       165.8  High:        179.7
GPS Age:  0.5 sec.      51.7398119 N      115.2258757 W   GPS Age:  0.5 sec.      51.7378187 N      115.2281225 W

Auto Sample: 12-4  Offset:    +14.4  Residual:     -7.6   Auto Sample: 12-20 Offset:     +6.4  Residual:     +4.0
Altitude:          Low:       165.6  High:        170.2   Altitude:          Low:       165.8  High:        179.7
GPS Age: -0.2 sec.      51.7396374 N      115.2261009 W   GPS Age: -0.2 sec.      51.7376287 N      115.2282366 W

Auto Sample: 12-5  Offset:    +12.9  Residual:     -9.8   Auto Sample: 22-1  Offset:     +9.4  Residual:     +2.3
Altitude:          Low:       164.9  High:        166.8   Altitude:          Low:       169.9  High:        172.0
GPS Age:  0.0 sec.      51.7395224 N      115.2262602 W   GPS Age:  0.0 sec.      51.7642278 N      115.2223821 W

Auto Sample: 12-6  Offset:    +10.9  Residual:     -4.5   Auto Sample: 22-2  Offset:     +9.9  Residual:     -4.2
Altitude:          Low:       162.1  High:        168.3   Altitude:          Low:       167.6  High:        169.2
GPS Age:  0.3 sec.      51.7394136 N      115.2264155 W   GPS Age:  0.2 sec.      51.7640801 N      115.2224098 W

Auto Sample: 12-7  Offset:    +10.0  Residual:     -4.9   Auto Sample: 22-3  Offset:     +9.1  Residual:     -0.4
Altitude:          Low:       162.1  High:        168.3   Altitude:          Low:       165.1  High:        167.2
GPS Age:  0.5 sec.      51.7393044 N      115.2265620 W   GPS Age:  0.5 sec.      51.7639236 N      115.2224483 W

Auto Sample: 12-8  Offset:     +9.1  Residual:     -3.9   Auto Sample: 22-4  Offset:     +9.0  Residual:     -3.6
Altitude:          Low:       162.8  High:        168.3   Altitude:          Low:       164.8  High:        165.4
GPS Age: -0.2 sec.      51.7391299 N      115.2267618 W   GPS Age: -0.3 sec.      51.7636746 N      115.2225002 W

Auto Sample: 12-9  Offset:     +8.3  Residual:     -4.7   Auto Sample: 22-5  Offset:     +8.3  Residual:     +1.6
Altitude:          Low:       163.4  High:        166.2   Altitude:          Low:       165.0  High:        165.8
GPS Age:  0.0 sec.      51.7390059 N      115.2268803 W   GPS Age:  0.0 sec.      51.7635075 N      115.2225315 W

Auto Sample: 12-10 Offset:     +7.3  Residual:     -0.5   Auto Sample: 22-6  Offset:     +8.6  Residual:     -0.2
Altitude:          Low:       151.6  High:        164.2   Altitude:          Low:       165.2  High:        166.0
GPS Age:  0.3 sec.      51.7388848 N      115.2269992 W   GPS Age:  0.2 sec.      51.7633434 N      115.2225437 W

Auto Sample: 12-11 Offset:     +7.2  Residual:     -4.9   Auto Sample: 22-7  Offset:     +8.6  Residual:     -0.6
Altitude:          Low:       140.7  High:        162.9   Altitude:          Low:       165.4  High:        166.2
GPS Age:  0.5 sec.      51.7387738 N      115.2271250 W   GPS Age:  0.5 sec.      51.7631833 N      115.2225321 W

Auto Sample: 12-12 Offset:     +6.3  Residual:     +2.8   Auto Sample: 22-8  Offset:     +8.4  Residual:     +2.3
Altitude:          Low:       147.9  High:        165.3   Altitude:          Low:       164.7  High:        165.2
GPS Age: -0.2 sec.      51.7386206 N      115.2273203 W   GPS Age: -0.3 sec.      51.7629583 N      115.2224746 W

Auto Sample: 12-13  Offset:    +6.8  Residual:          Auto Sample: 22-9  Offset:     +8.9  Residual:     +4.2
  2.4                                                     Altitude:          Low:       164.7  High:        165.2
Altitude:          Low:       163.8  High:        169.9   GPS Age:  0.0 sec.      51.7628168 N      115.2224157 W
GPS Age:  0.0 sec.      51.7385227 N      115.2274518 W

                                                          Auto Sample: 22-10 Offset:     +9.7  Residual:     +5.9
Auto Sample: 12-14 Offset:     +7.3  Residual:     -0.7   Altitude:          Low:       164.5  High:        165.1
Altitude:          Low:       158.4  High:        173.3   GPS Age:  0.2 sec.      51.7626841 N      115.2223407 W
GPS Age:  0.3 sec.      51.7384219 N      115.2275759 W
                                                          Auto Sample: 22-11 Offset:    +10.9  Residual:     +2.6
Auto Sample: 12-15 Offset:     +7.2  Residual:     -0.1   Altitude:          Low:       164.9  High:        165.9
Altitude:          Low:       175.4  High:        178.8   GPS Age:  0.5 sec.      51.7625597 N      115.2222570 W
GPS Age:  0.5 sec.      51.7383162 N      115.2276931 W
                                                          Auto Sample: 22-12 Offset:    +11.4  Residual:     +5.3
Auto Sample: 12-16 Offset:     +7.2  Residual:     +0.0   Altitude:          Low:       166.2  High:        166.5
Altitude:          Low:       164.5  High:        180.2   GPS Age: -0.3 sec.      51.7623771 N      115.2221192 W
GPS Age: -0.2 sec.      51.7381557 N      115.2278481 W
```

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Auto Sample: 22-13 Offset:     +12.5  Residual:     +2.4 | Auto Sample: 2-06  Offset:     +10.4  Residual:     -2.1
Altitude:          Low:      167.0  High:      167.9 | Altitude:          Low:      178.9  High:      184.1
GPS Age:  0.0 sec.      51.7622510 N      115.2220234 W | GPS Age:  0.5 sec.      51.7661231 N      115.1979811 W

Auto Sample: 22-14 Offset:     +12.9  Residual:     +3.5 | Auto Sample: 2-07  Offset:     +10.0  Residual:     +1.5
Altitude:          Low:      168.1  High:      169.5 | Altitude:          Low:      174.3  High:      178.3
GPS Age:  0.2 sec.      51.7621158 N      115.2219256 W | GPS Age: -0.3 sec.      51.7659609 N      115.1976281 W

Auto Sample: 22-15 Offset:     +13.6  Residual:     -1.8 | Auto Sample: 2-08  Offset:     +10.3  Residual:     -1.5
Altitude:          Low:      170.0  High:      171.9 | Altitude:          Low:      170.8  High:      173.4
GPS Age:  0.5 sec.      51.7619764 N      115.2218272 W | GPS Age:  0.0 sec.      51.7658403 N      115.1973961 W

Auto Sample: 22-16 Offset:     +13.3  Residual:     +2.0 | Auto Sample: 2-09  Offset:     +10.0  Residual:     -3.8
Altitude:          Low:      171.2  High:      173.4 | Altitude:          Low:      168.1  High:      170.1
GPS Age: -0.3 sec.      51.7617650 N      115.2216734 W | GPS Age:  0.2 sec.      51.7657102 N      115.1971597 W

Auto Sample: 22-17 Offset:     +13.7  Residual:     +0.7 | Auto Sample: 2-10  Offset:      +9.3  Residual:     -0.1
Altitude:          Low:      173.4  High:      177.6 | Altitude:          Low:      168.9  High:      169.8
GPS Age:  0.0 sec.      51.7616139 N      115.2215692 W | GPS Age:  0.5 sec.      51.7655775 N      115.1969144 W

Auto Sample: 22-18 Offset:     +13.8  Residual:     +0.4 | Auto Sample: 2-11  Offset:      +9.2  Residual:     +0.0
Altitude:          Low:      178.3  High:      180.8 | Altitude:          Low:      169.0  High:      169.8
GPS Age:  0.2 sec.      51.7614564 N      115.2214594 W | GPS Age: -0.3 sec.      51.7653647 N      115.1965636 W

Auto Sample: 22-19 Offset:     +13.9  Residual:     +0.3 | Auto Sample: 2-12  Offset:      +9.2  Residual:    +13.9
Altitude:          Low:      180.7  High:      181.9 | Altitude:          Low:      169.3  High:      169.7
GPS Age:  0.5 sec.      51.7612977 N      115.2213548 W | GPS Age:  0.0 sec.      51.7652057 N      115.1963392 W

Auto Sample: 22-20 Offset:     +14.0  Residual:     +1.0 | Auto Sample: 2-13  Offset:     +12.0  Residual:    +12.4
Altitude:          Low:      181.2  High:      183.0 | Altitude:          Low:      167.3  High:      169.3
GPS Age: -0.3 sec.      51.7610659 N      115.2212081 W | GPS Age:  0.2 sec.      51.7650320 N      115.1961185 W

Auto Sample: 22-21 Offset:     +14.2  Residual:     -0.5 | Auto Sample: 2-14  Offset:     +14.5  Residual:    +12.9
Altitude:          Low:      182.8  High:      183.2 | Altitude:          Low:      165.0  High:      166.5
GPS Age:  0.0 sec.      51.7609042 N      115.2211077 W | GPS Age:  0.5 sec.      51.7648551 N      115.1958953 W

Auto Sample: 22-22 Offset:     +14.1  Residual:     -0.7 | Auto Sample: 2-15  Offset:     +17.1  Residual:     +7.1
Altitude:          Low:      183.2  High:      184.9 | Altitude:          Low:      164.0  High:      164.9
GPS Age:  0.2 sec.      51.7607368 N      115.2210031 W | GPS Age: -0.3 sec.      51.7646066 N      115.1955952 W

Auto Sample: 22-23 Offset:     +13.9  Residual:     +0.7 | Auto Sample: 2-16  Offset:     +18.5  Residual:    +11.3
Altitude:          Low:      184.7  High:      185.9 | Altitude:          Low:      161.3  High:      164.0
GPS Age:  0.5 sec.      51.7605636 N      115.2209031 W | GPS Age:  0.0 sec.      51.7644571 N      115.1954298 W

Auto Sample: 22-24 Offset:     +14.1  Residual:     +1.0 | Auto Sample: 2-17  Offset:     +20.8  Residual:     +9.9
Altitude:          Low:      185.4  High:      185.8 | Altitude:          Low:      158.9  High:      160.3
GPS Age: -0.3 sec.      51.7602944 N      115.2207543 W | GPS Age:  0.2 sec.      51.7643157 N      115.1952919 W

Auto Sample: 22-25 Offset:     +14.3  Residual:     +2.5 | Auto Sample: 2-18  Offset:     +22.7  Residual:     +9.0
Altitude:          Low:      185.7  High:      187.1 | Altitude:          Low:      156.9  High:      158.3
GPS Age:  0.0 sec.      51.7601048 N      115.2206735 W | GPS Age:  0.5 sec.      51.7641783 N      115.1951725 W

Auto Sample: 2-01  Offset:     +14.6  Residual:     -3.3 | Auto Sample: 2-19  Offset:     +24.5  Residual:     +0.0
Altitude:          Low:      208.8  High:      213.4 | Altitude:          Low:      155.5  High:      156.6
GPS Age:  0.2 sec.      51.7665513 N      115.1994761 W | GPS Age: -0.3 sec.      51.7639746 N      115.1950036 W

Auto Sample: 2-02  Offset:     +13.9  Residual:     -5.6 | Auto Sample: 2-20  Offset:     +24.6  Residual:     +0.4
Altitude:          Low:      203.3  High:      208.6 | Altitude:          Low:      154.4  High:      155.2
GPS Age:  0.5 sec.      51.7664808 N      115.1991812 W | GPS Age:  0.0 sec.      51.7638286 N      115.1949097 W

Auto Sample: 2-03  Offset:     +12.8  Residual:     -5.8 | Auto Sample: 2-21  Offset:     +24.6  Residual:     -3.0
Altitude:          Low:      195.0  High:      202.3 | Altitude:          Low:      153.6  High:      154.2
GPS Age: -0.3 sec.      51.7663755 N      115.1987589 W | GPS Age:  0.2 sec.      51.7636740 N      115.1948158 W

Auto Sample: 2-04  Offset:     +11.7  Residual:     -2.6 | Auto Sample: 2-22  Offset:     +24.0  Residual:     -8.0
Altitude:          Low:      189.5  High:      195.9 | Altitude:          Low:      152.3  High:      153.2
GPS Age:  0.0 sec.      51.7662999 N      115.1984893 W | GPS Age:  0.5 sec.      51.7635098 N      115.1947170 W

Auto Sample: 2-05  Offset:     +11.1  Residual:     -3.4 | Auto Sample: 2-23  Offset:     +22.4  Residual:     -6.5
Altitude:          Low:      184.1  High:      189.5 | Altitude:          Low:      151.9  High:      152.7
GPS Age:  0.2 sec.      51.7662173 N      115.1982293 W | GPS Age: -0.3 sec.      51.7632511 N      115.1945541 W
```

```
Auto Sample: 3-01  Offset:     +18.7  Residual:     -4.1   Auto Sample: 3-19  Offset:      +7.6  Residual:     -0.3
Altitude:           Low:       183.2  High:        184.4   Altitude:           Low:       182.9  High:        183.8
GPS Age:  0.3 sec.       51.7024858 N       115.2909604 W  GPS Age:  0.2 sec.       51.7018906 N       115.2907294 W

Auto Sample: 3-02  Offset:     +17.9  Residual:     -4.0   Auto Sample: 3-20  Offset:      +7.5  Residual:     +1.9
Altitude:           Low:       184.0  High:        184.5   Altitude:           Low:       180.5  High:        182.7
GPS Age: -0.4 sec.       51.7023404 N       115.2907321 W  GPS Age:  0.5 sec.       51.7017864 N       115.2905217 W

Auto Sample: 3-03  Offset:     +17.1  Residual:     -4.7   Auto Sample: 3-21  Offset:      +7.9  Residual:     +1.0
Altitude:           Low:       183.5  High:        184.6   Altitude:           Low:       177.4  High:        180.1
GPS Age: -0.2 sec.       51.7022288 N       115.2905455 W  GPS Age: -0.3 sec.       51.7016405 N       115.2902159 W

Auto Sample: 3-04  Offset:     +16.1  Residual:     -6.2   Auto Sample: 3-22  Offset:      +8.1  Residual:     +0.2
Altitude:           Low:       182.3  High:        184.6   Altitude:           Low:       174.6  High:        176.7
GPS Age:  0.1 sec.       51.7021094 N       115.2903463 W  GPS Age:  0.0 sec.       51.7015421 N       115.2900025 W

Auto Sample: 3-05  Offset:     +14.9  Residual:     -3.5   Auto Sample: 3-23  Offset:      +8.1  Residual:     +4.8
Altitude:           Low:       182.2  High:        182.9   Altitude:           Low:       173.1  High:        173.8
GPS Age:  0.3 sec.       51.7019852 N       115.2901357 W  GPS Age:  0.2 sec.       51.7014385 N       115.2897800 W

Auto Sample: 3-06  Offset:     +14.2  Residual:     -1.9   Auto Sample: 3-24  Offset:      +9.1  Residual:     +2.3
Altitude:           Low:       182.9  High:        184.9   Altitude:           Low:       171.8  High:        173.1
GPS Age: -0.4 sec.       51.7017922 N       115.2898069 W  GPS Age:  0.5 sec.       51.7013267 N       115.2895499 W

Auto Sample: 3-07  Offset:     +13.8  Residual:     -4.8   Auto Sample: 3-25  Offset:      +9.5  Residual:     +0.1
Altitude:           Low:       184.6  High:        185.4   Altitude:           Low:       172.0  High:        173.7
GPS Age: -0.2 sec.       51.7016733 N       115.2895815 W  GPS Age: -0.3 sec.       51.7011321 N       115.2891921 W

Auto Sample: 3-08  Offset:     +12.9  Residual:     -4.2   Auto Sample: 3-26  Offset:      +9.5  Residual:     +0.1
Altitude:           Low:       185.4  High:        185.7   Altitude:           Low:       174.3  High:        176.6
GPS Age:  0.1 sec.       51.7015576 N       115.2893572 W  GPS Age:  0.0 sec.       51.7009889 N       115.2889419 W

Auto Sample: 3-09  Offset:     +12.0  Residual:     -4.7   Auto Sample: 3-27  Offset:      +9.6  Residual:     +2.4
Altitude:           Low:       185.4  High:        186.3   Altitude:           Low:       176.9  High:        181.5
GPS Age:  0.3 sec.       51.7014416 N       115.2891299 W  GPS Age:  0.2 sec.       51.7008413 N       115.2886797 W

Auto Sample: 3-10  Offset:     +11.1  Residual:     -2.0   Auto Sample: 3-28  Offset:     +10.0  Residual:     +2.3
Altitude:           Low:       184.0  High:        185.2   Altitude:           Low:       181.8  High:        182.3
GPS Age: -0.4 sec.       51.7012605 N       115.2887849 W  GPS Age:  0.5 sec.       51.7006888 N       115.2884075 W

Auto Sample: 3-11  Offset:     +10.7  Residual:     -4.2   Auto Sample: 3-29  Offset:     +10.5  Residual:     +5.4
Altitude:           Low:       182.3  High:        184.1   Altitude:           Low:       179.6  High:        183.7
GPS Age: -0.2 sec.       51.7011396 N       115.2885470 W  GPS Age: -0.3 sec.       51.7004531 N       115.2879756 W

Auto Sample: 3-12  Offset:      +9.8  Residual:     +1.0   Auto Sample: 4-01  Offset:     +11.6  Residual:     +1.1
Altitude:           Low:       179.7  High:        181.8   Altitude:           Low:       159.4  High:        161.1
GPS Age:  0.1 sec.       51.7010258 N       115.2883018 W  GPS Age: -0.3 sec.       51.7044617 N       115.3060763 W

Auto Sample: 3-13  Offset:     +10.1  Residual:     -5.1   Auto Sample: 4-02  Offset:     +11.8  Residual:     +0.5
Altitude:           Low:       176.9  High:        179.6   Altitude:           Low:       161.5  High:        163.4
GPS Age:  0.3 sec.       51.7009164 N       115.2880530 W  GPS Age:  0.0 sec.       51.7045428 N       115.3058569 W

Auto Sample: 3-14  Offset:      +9.0  Residual:     -4.2   Auto Sample: 4-03  Offset:     +11.9  Residual:     +2.4
Altitude:           Low:       175.2  High:        177.1   Altitude:           Low:       164.0  High:        167.6
GPS Age: -0.4 sec.       51.7007507 N       115.2876831 W  GPS Age:  0.2 sec.       51.7046238 N       115.3056395 W

Auto Sample: 3-15  Offset:      +8.2  Residual:     +3.2   Auto Sample: 4-04  Offset:     +12.4  Residual:     +6.1
Altitude:           Low:       186.1  High:        187.4   Altitude:           Low:       168.3  High:        172.5
GPS Age:  0.2 sec.       51.7024315 N       115.2916450 W  GPS Age:  0.5 sec.       51.7047060 N       115.3054170 W

Auto Sample: 3-16  Offset:      +8.8  Residual:     +0.2   Auto Sample: 4-05  Offset:     +13.6  Residual:     +3.3
Altitude:           Low:       184.5  High:        185.6   Altitude:           Low:       172.9  High:        176.6
GPS Age:  0.5 sec.       51.7023143 N       115.2914701 W  GPS Age: -0.3 sec.       51.7048282 N       115.3050591 W

Auto Sample: 3-17  Offset:      +8.9  Residual:     -1.7   Auto Sample: 4-06  Offset:     +14.2  Residual:     +0.5
Altitude:           Low:       183.4  High:        184.3   Altitude:           Low:       176.6  High:        180.5
GPS Age: -0.3 sec.       51.7021307 N       115.2911691 W  GPS Age:  0.0 sec.       51.7049109 N       115.3048033 W

Auto Sample: 3-18  Offset:      +8.5  Residual:     -4.8   Auto Sample: 4-07  Offset:     +14.3  Residual:     +1.0
Altitude:           Low:       183.0  High:        184.4   Altitude:           Low:       180.4  High:        185.1
GPS Age:  0.0 sec.       51.7020065 N       115.2909476 W  GPS Age:  0.2 sec.       51.7049903 N       115.3045374 W
```

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Auto Sample: 4-08  Offset:      +14.5  Residual:     -0.3
Altitude:          Low:         184.4  High:        186.9
GPS Age:  0.5 sec.      51.7050606 N      115.3042694 W

Auto Sample: 4-09  Offset:      +14.5  Residual:     +2.4
Altitude:          Low:         178.5  High:        184.4
GPS Age: -0.3 sec.      51.7051376 N      115.3038721 W

Auto Sample: 4-10  Offset:      +15.0  Residual:     -1.0
Altitude:          Low:         176.2  High:        178.0
GPS Age:  0.0 sec.      51.7051739 N      115.3036044 W

Auto Sample: 4-11  Offset:      +14.8  Residual:     +0.9
Altitude:          Low:         175.9  High:        176.8
GPS Age:  0.2 sec.      51.7052010 N      115.3033250 W

Auto Sample: 4-12  Offset:      +14.9  Residual:     +1.5
Altitude:          Low:         175.9  High:        176.3
GPS Age:  0.5 sec.      51.7052232 N      115.3030274 W
```

```
File: 02-11-29.003                            Roll ID:        1
Date: 02-11-29 Time: 10:10:55                 Flight Plan:  1

Front Camera: 1183-                           Film Type:    AVI200
Back Camera:  1188-                           Exposure:     3.5- 250
Operator:     DLL                             Navigator:    SCOTT
Remarks:      17
```

<table>
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Auto Sample: 17-1 Offset: +0.0 Residual: +33.1
Altitude: Low: 189.1 High: 189.8
GPS Age: -0.4 sec.   51.6718307 N   115.3856581 W

Auto Sample: 17-2 Offset: +33.1 Residual: +6.4
Altitude: Low: 187.4 High: 188.3
GPS Age: -0.2 sec.   51.6716996 N   115.3856272 W

Auto Sample: 17-3 Offset: +36.3 Residual: +4.1
Altitude: Low: 186.5 High: 187.4
GPS Age: 0.1 sec.   51.6715652 N   115.3855715 W

Auto Sample: 17-4 Offset: +37.6 Residual: +8.7
Altitude: Low: 186.9 High: 187.4
GPS Age: 0.4 sec.   51.6714247 N   115.3854898 W

Auto Sample: 17-5 Offset: +39.8 Residual: +9.2
Altitude: Low: 186.1 High: 186.7
GPS Age: -0.4 sec.   51.6711941 N   115.3853553 W

Auto Sample: 17-6 Offset: +41.6 Residual: -16.2
Altitude: Low: 186.2 High: 188.1
GPS Age: -0.2 sec.   51.6710260 N   115.3852953 W

Auto Sample: 17-7 Offset: +38.4 Residual: +9.5
Altitude: Low: 188.2 High: 189.4
GPS Age: 0.1 sec.   51.6708534 N   115.3852637 W

Auto Sample: 17-8 Offset: +40.3 Residual: +21.5
Altitude: Low: 189.8 High: 191.6
GPS Age: 0.4 sec.   51.6706834 N   115.3852656 W

Auto Sample: 17-9 Offset: +44.6 Residual: +11.7
Altitude: Low: 189.8 High: 191.5
GPS Age: -0.4 sec.   51.6704356 N   115.3852923 W

Auto Sample: 17-10 Offset: +46.9 Residual: +7.9
Altitude: Low: 187.5 High: 190.1
GPS Age: -0.2 sec.   51.6702716 N   115.3853165 W

Auto Sample: 17-11 Offset: +48.5 Residual: +2.5
Altitude: Low: 183.5 High: 187.5
GPS Age: 0.1 sec.   51.6701070 N   115.3853372 W

Auto Sample: 17-12 Offset: +49.0 Residual: -6.2
Altitude: Low: 182.4 High: 184.3
GPS Age: 0.4 sec.   51.6699390 N   115.3853414 W

Auto Sample: 17-13 Offset: +47.7 Residual: -3.6
Altitude: Low: 182.5 High: 183.1
GPS Age: -0.4 sec.   51.6696817 N   115.3853328 W

Auto Sample: 17-14 Offset: +47.0 Residual: -10.0
Altitude: Low: 175.8 High: 181.2
GPS Age: -0.2 sec.   51.6695040 N   115.3853037 W

Auto Sample: 17-15 Offset: +45.0 Residual: -3.5
Altitude: Low: 175.0 High: 175.8
GPS Age: 0.1 sec.   51.6693205 N   115.3852595 W

Auto Sample: 17-16 Offset: +44.3 Residual: -12.2
Altitude: Low: 174.6 High: 177.9
GPS Age: 0.4 sec.   51.6691319 N   115.3852018 W

Auto Sample: 17-17 Offset: +41.9 Residual: -4.0
Altitude: Low: 177.2 High: 179.0
GPS Age: -0.4 sec.   51.6688437 N   115.3851020 W

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Auto Sample: 17-18 Offset: +41.1 Residual: -9.7
Altitude: Low: 180.0 High: 184.5
GPS Age: -0.2 sec.   51.6686452 N   115.3850379 W

Auto Sample: 17-19 Offset: +39.1 Residual: -6.9
Altitude: Low: 184.2 High: 187.6
GPS Age: 0.1 sec.   51.6684417 N   115.3849740 W

Auto Sample: 17-20 Offset: +37.8 Residual: -14.3
Altitude: Low: 186.4 High: 189.5
GPS Age: 0.4 sec.   51.6682427 N   115.3849138 W

Auto Sample: 17-21 Offset: +34.9 Residual: -12.5
Altitude: Low: 189.2 High: 190.0
GPS Age: -0.5 sec.   51.6679501 N   115.3848302 W

Auto Sample: 17-22 Offset: +32.4 Residual: -7.2
Altitude: Low: 189.1 High: 190.5
GPS Age: -0.2 sec.   51.6677596 N   115.3847811 W

Auto Sample: 17-23 Offset: +30.9 Residual: -5.4
Altitude: Low: 187.3 High: 188.4
GPS Age: 0.1 sec.   51.6675695 N   115.3847307 W

Auto Sample: 17-24 Offset: +29.9 Residual: -4.3
Altitude: Low: 185.6 High: 187.6
GPS Age: 0.4 sec.   51.6673789 N   115.3846753 W

Auto Sample: 17-25 Offset: +29.0 Residual: -10.7
Altitude: Low: 183.9 High: 186.3
GPS Age: -0.5 sec.   51.6670900 N   115.3845942 W

Auto Sample: 17-26 Offset: +26.9 Residual: +2.8
Altitude: Low: 183.5 High: 184.0
GPS Age: -0.2 sec.   51.6668961 N   115.3845538 W

Auto Sample: 17-27 Offset: +27.4 Residual: -2.2
Altitude: Low: 183.2 High: 183.9
GPS Age: 0.1 sec.   51.6666995 N   115.3845316 W

Auto Sample: 17-28 Offset: +27.0 Residual: +2.8
Altitude: Low: 182.3 High: 183.2
GPS Age: 0.4 sec.   51.6665041 N   115.3845160 W

Auto Sample: 17-29 Offset: +27.6 Residual: -3.2
Altitude: Low: 181.7 High: 182.9
GPS Age: -0.4 sec.   51.6662219 N   115.3844769 W

Auto Sample: 17-30 Offset: +26.9 Residual: -1.9
Altitude: Low: 180.8 High: 181.4
GPS Age: -0.2 sec.   51.6660402 N   115.3844316 W

Auto Sample: 17-31 Offset: +26.5 Residual: -10.3
Altitude: Low: 179.7 High: 180.9
GPS Age: 0.1 sec.   51.6658641 N   115.3843675 W

Auto Sample: 17-32 Offset: +24.5 Residual: +26.0
Altitude: Low: 178.7 High: 179.5
GPS Age: 0.4 sec.   51.6656923 N   115.3842846 W

Auto Sample: 17-33 Offset: +29.7 Residual: +2.6
Altitude: Low: 178.2 High: 178.9
GPS Age: -0.4 sec.   51.6654333 N   115.3841330 W

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Auto Sample: 1-01	Offset: +29.8	Residual: +0.6	Auto Sample: 1-18	Offset: +21.3	Residual: +5.2
Altitude:	Low: 187.0	High: 188.4	Altitude:	Low: 170.4	High: 170.9
GPS Age: 0.2 sec.	51.6758518 N	115.3717769 W	GPS Age: 0.5 sec.	51.6742171 N	115.3672531 W
Auto Sample: 1-02	Offset: +29.9	Residual: -59.6	Auto Sample: 1-19	Offset: +22.4	Residual: +6.0
Altitude:	Low: 183.8	High: 187.0	Altitude:	Low: 170.2	High: 171.1
GPS Age: 0.5 sec.	51.6757843 N	115.3714972 W	GPS Age: -0.3 sec.	51.6741097 N	115.3669330 W
Auto Sample: 1-03	Offset: +0.0	Residual: -12.0	Auto Sample: 1-20	Offset: +23.6	Residual: +3.5
Altitude:	Low: 181.0	High: 182.9	Altitude:	Low: 170.9	High: 171.4
GPS Age: -0.3 sec.	51.6757029 N	115.3710633 W	GPS Age: 0.0 sec.	51.6740370 N	115.3667131 W
Auto Sample: 1-04	Offset: -12.0	Residual: +29.9	Auto Sample: 1-21	Offset: +24.3	Residual: +0.2
Altitude:	Low: 178.8	High: 180.2	Altitude:	Low: 171.1	High: 171.9
GPS Age: 0.0 sec.	51.6756565 N	115.3707649 W	GPS Age: 0.2 sec.	51.6739610 N	115.3664853 W
Auto Sample: 1-05	Offset: +3.0	Residual: -1.3	Auto Sample: 1-22	Offset: +24.3	Residual: +1.3
Altitude:	Low: 174.1	High: 178.6	Altitude:	Low: 170.5	High: 171.7
GPS Age: 0.2 sec.	51.6756113 N	115.3704586 W	GPS Age: 0.5 sec.	51.6738786 N	115.3662539 W
Auto Sample: 1-06	Offset: +2.6	Residual: +12.2	Auto Sample: 1-23	Offset: +24.6	Residual: +1.8
Altitude:	Low: 168.4	High: 174.2	Altitude:	Low: 169.3	High: 170.3
GPS Age: 0.5 sec.	51.6755567 N	115.3701358 W	GPS Age: -0.3 sec.	51.6737421 N	115.3658892 W
Auto Sample: 1-07	Offset: +5.6	Residual: +8.4	Auto Sample: 1-24	Offset: +24.9	Residual: +3.9
Altitude:	Low: 168.0	High: 174.0	Altitude:	Low: 168.1	High: 170.3
GPS Age: -0.3 sec.	51.6754447 N	115.3696780 W	GPS Age: 0.0 sec.	51.6736403 N	115.3656256 W
Auto Sample: 1-08	Offset: +7.3	Residual: +11.6	Auto Sample: 1-25	Offset: +25.7	Residual: +0.4
Altitude:	Low: 174.6	High: 176.2	Altitude:	Low: 168.0	High: 172.9
GPS Age: 0.0 sec.	51.6753463 N	115.3694006 W	GPS Age: 0.2 sec.	51.6735294 N	115.3653503 W
Auto Sample: 1-09	Offset: +9.6	Residual: +8.4	Auto Sample: 1-26	Offset: +25.8	Residual: +4.8
Altitude: -	Low: 173.7	High: 174.3	Altitude:	Low: 172.6	High: 173.7
GPS Age: 0.2 sec.	51.6752301 N	115.3691471 W	GPS Age: 0.5 sec.	51.6734085 N	115.3650739 W
Auto Sample: 1-10	Offset: +11.3	Residual: -9.0	Auto Sample: 1-27	Offset: +26.7	Residual: -2.0
Altitude:	Low: 173.2	High: 178.1	Altitude:	Low: 174.5	High: 177.3
GPS Age: 0.5 sec.	51.6751103 N	115.3689188 W	GPS Age: -0.3 sec.	51.6732101 N	115.3646339 W
Auto Sample: 1-11	Offset: +9.5	Residual: +6.1	Auto Sample: 1-28	Offset: +26.3	Residual: +2.0
Altitude:	Low: 176.8	High: 178.8	Altitude:	Low: 177.3	High: 181.2
GPS Age: -0.3 sec.	51.6749564 N	115.3686521 W	GPS Age: 0.0 sec.	51.6730783 N	115.3643190 W
Auto Sample: 1-12	Offset: +10.7	Residual: +5.1	Auto Sample: 1-29	Offset: +26.7	Residual: -1.0
Altitude:	Low: 173.5	High: 176.8	Altitude:	Low: 184.1	High: 188.4
GPS Age: 0.0 sec.	51.6748476 N	115.3684935 W	GPS Age: 0.2 sec.	51.6729718 N	115.3639894 W
Auto Sample: 1-13	Offset: +11.7	Residual: +15.4	Auto Sample: 1-30	Offset: +26.6	Residual: +2.2
Altitude:	Low: 172.7	High: 173.2	Altitude:	Low: 188.2	High: 190.2
GPS Age: 0.2 sec.	51.6747303 N	115.3683243 W	GPS Age: 0.5 sec.	51.6728875 N	115.3636537 W
Auto Sample: 1-14	Offset: +14.8	Residual: +8.5	Auto Sample: 1-31	Offset: +27.0	Residual: +14.1
Altitude:	Low: 172.1	High: 172.4	Altitude:	Low: 189.4	High: 192.3
GPS Age: 0.5 sec.	51.6746150 N	115.3681447 W	GPS Age: -0.3 sec.	51.6727773 N	115.3631806 W
Auto Sample: 1-15	Offset: +16.5	Residual: +7.4	Auto Sample: 1-32	Offset: +29.8	Residual: +18.7
Altitude:	Low: 171.8	High: 172.0	Altitude:	Low: 191.1	High: 192.1
GPS Age: -0.3 sec.	51.6744589 N	115.3678764 W	GPS Age: 0.0 sec.	51.6727087 N	115.3628889 W
Auto Sample: 1-16	Offset: +18.0	Residual: +4.2	Auto Sample: 1-33	Offset: +33.6	Residual: +10.4
Altitude:	Low: 171.9	High: 172.8	Altitude:	Low: 188.7	High: 191.3
GPS Age: 0.0 sec.	51.6743659 N	115.3676741 W	GPS Age: 0.2 sec.	51.6726501 N	115.3626384 W
Auto Sample: 1-17	Offset: +18.8	Residual: +12.6	Auto Sample: 6-01	Offset: +35.6	Residual: +3.5
Altitude:	Low: 170.8	High: 172.9	Altitude:	Low: 186.8	High: 189.7
GPS Age: 0.2 sec.	51.6742879 N	115.3674652 W	GPS Age: 0.0 sec.	51.6879498 N	115.3636654 W

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Auto Sample: 6-02  Offset:     +36.3  Residual:     +1.8   Auto Sample: 6-20  Offset:     +42.6  Residual:     -5.4
Altitude:          Low:        184.6  High:        185.8   Altitude:          Low:        189.7  High:        193.4
GPS Age:  0.2 sec.       51.6878354 N       115.3637035 W   GPS Age: -0.3 sec.       51.6850989 N       115.3616583 W

Auto Sample: 6-03  Offset:     +36.7  Residual:     +2.0   Auto Sample: 6-21  Offset:     +41.5  Residual:     -3.6
Altitude:          Low:        179.6  High:        183.5   Altitude:          Low:        182.0  High:        193.3
GPS Age:  0.5 sec.       51.6877150 N       115.3637513 W   GPS Age:  0.0 sec.       51.6849582 N       115.3615138 W

Auto Sample: 6-04  Offset:     +37.1  Residual:     +7.1   Auto Sample: 6-22  Offset:     +40.8  Residual:     -4.4
Altitude:          Low:        171.6  High:        180.2   Altitude:          Low:        167.6  High:        184.6
GPS Age: -0.3 sec.       51.6875064 N       115.3638368 W   GPS Age:  0.2 sec.       51.6848174 N       115.3613813 W

Auto Sample: 6-05  Offset:     +38.5  Residual:     +0.2   Auto Sample: 6-23  Offset:     +39.9  Residual:     -3.7
Altitude:          Low:        171.1  High:        176.1   Altitude:          Low:        167.6  High:        170.3
GPS Age:  0.0 sec.       51.6873549 N       115.3638937 W   GPS Age:  0.5 sec.       51.6846798 N       115.3612478 W

Auto Sample: 6-06  Offset:     +38.6  Residual:     +0.9   Auto Sample: 6-24  Offset:     +39.2  Residual:     -6.8
Altitude:          Low:        171.1  High:        174.5   Altitude:          Low:        170.0  High:        175.4
GPS Age:  0.2 sec.       51.6871960 N       115.3639516 W   GPS Age: -0.3 sec.       51.6844743 N       115.3610339 W

Auto Sample: 6-07  Offset:     +38.7  Residual:     +0.8   Auto Sample: 6-25  Offset:     +37.8  Residual:    -13.4
Altitude:          Low:        174.4  High:        183.7   Altitude:          Low:        174.9  High:        179.4
GPS Age:  0.5 sec.       51.6870201 N       115.3640030 W   GPS Age:  0.0 sec.       51.6843399 N       115.3608760 W

Auto Sample: 6-08  Offset:     +38.9  Residual:     -0.3   Auto Sample: 6-26  Offset:     +35.1  Residual:     -7.8
Altitude:          Low:        178.9  High:        186.4   Altitude:          Low:        179.8  High:        187.7
GPS Age: -0.3 sec.       51.6867226 N       115.3640267 W   GPS Age:  0.2 sec.       51.6842025 N       115.3607088 W

Auto Sample: 6-09  Offset:     +38.8  Residual:     +4.0   Auto Sample: 6-27  Offset:     +33.6  Residual:    -13.7
Altitude:          Low:        180.9  High:        194.6   Altitude:          Low:        186.9  High:        187.8
GPS Age:  0.0 sec.       51.6865209 N       115.3639603 W   GPS Age:  0.5 sec.       51.6840593 N       115.3605326 W

Auto Sample: 6-10  Offset:     +39.6  Residual:     +2.8   Auto Sample: 6-28  Offset:     +30.8  Residual:     -6.1
Altitude:          Low:        192.3  High:        199.7   Altitude:          Low:        185.2  High:        187.0
GPS Age:  0.2 sec.       51.6863447 N       115.3638233 W   GPS Age: -0.3 sec.       51.6838476 N       115.3602649 W

Auto Sample: 6-11  Offset:     +40.2  Residual:     +3.4   Auto Sample: 6-29  Offset:     +29.6  Residual:     -2.1
Altitude:          Low:        200.2  High:        201.8   Altitude:          Low:        185.6  High:        185.8
GPS Age:  0.5 sec.       51.6862055 N       115.3636695 W   GPS Age:  0.0 sec.       51.6837157 N       115.3600950 W

Auto Sample: 6-12  Offset:     +40.9  Residual:     -0.6   Auto Sample: 6-30  Offset:     +29.2  Residual:     +9.5
Altitude:          Low:        200.5  High:        201.8   Altitude:          Low:        183.8  High:        185.6
GPS Age: -0.3 sec.       51.6860475 N       115.3634333 W   GPS Age:  0.2 sec.       51.6835873 N       115.3599415 W

Auto Sample: 6-13  Offset:     +40.8  Residual:     +0.2   Auto Sample: 6-31  Offset:     +31.1  Residual:     -3.4
Altitude:          Low:        196.3  High:        199.5   Altitude:          Low:        182.1  High:        184.6
GPS Age:  0.0 sec.       51.6859487 N       115.3632654 W   GPS Age:  0.5 sec.       51.6834516 N       115.3598208 W

Auto Sample: 6-14  Offset:     +40.8  Residual:     +3.4   Auto Sample: 6-32  Offset:     +30.4  Residual:     -2.6
Altitude:          Low:        196.7  High:        199.2   Altitude:          Low:        178.4  High:        181.7
GPS Age:  0.2 sec.       51.6858431 N       115.3630826 W   GPS Age: -0.3 sec.       51.6832241 N       115.3597000 W

Auto Sample: 6-15  Offset:     +41.5  Residual:     -4.5   Auto Sample: 6-33  Offset:     +29.9  Residual:     -4.2
Altitude:          Low:        196.9  High:        198.8   Altitude:          Low:        176.2  High:        180.0
GPS Age:  0.5 sec.       51.6857387 N       115.3628817 W   GPS Age:  0.0 sec.       51.6830647 N       115.3596442 W

Auto Sample: 6-16  Offset:     +40.6  Residual:     +4.6   Auto Sample: 6-34  Offset:     +29.1  Residual:     +3.7
Altitude:          Low:        181.2  High:        196.9   Altitude:          Low:        166.6  High:        176.1
GPS Age: -0.3 sec.       51.6856004 N       115.3625431 W   GPS Age:  0.2 sec.       51.6829057 N       115.3595955 W

Auto Sample: 6-17  Offset:     +41.5  Residual:    +12.4   Auto Sample: 6-35  Offset:     +29.8  Residual:     -7.5
Altitude:          Low:        173.8  High:        180.6   Altitude:          Low:        164.0  High:        166.1
GPS Age:  0.0 sec.       51.6855089 N       115.3623132 W   GPS Age:  0.5 sec.       51.6827464 N       115.3595429 W

Auto Sample: 6-18  Offset:     +44.0  Residual:     -4.3   Auto Sample: 6-36  Offset:     +28.3  Residual:     -4.7
Altitude:          Low:        181.6  High:        185.5   Altitude:          Low:        164.0  High:        168.0
GPS Age:  0.2 sec.       51.6854111 N       115.3620967 W   GPS Age: -0.3 sec.       51.6824980 N       115.3594367 W

Auto Sample: 6-19  Offset:     +43.1  Residual:     -2.7   Auto Sample: 6-37  Offset:     +27.4  Residual:     -3.0
Altitude:          Low:        184.7  High:        189.1   Altitude:          Low:        167.0  High:        175.9
GPS Age:  0.5 sec.       51.6852981 N       115.3619050 W   GPS Age:  0.0 sec.       51.6823225 N       115.3593418 W
```

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Auto Sample: 6-38  Offset:     +26.8  Residual:     -5.1
Altitude:           Low:       174.9  High:        176.6
GPS Age:  0.2 sec.       51.6821399 N      115.3592369 W
```

```
Auto Sample: 7-01  Offset:    +25.8  Residual:   +12.3 | Auto Sample: 15-1  Offset:    +27.3  Residual:    +2.9
Altitude:          Low:       198.2  High:       200.4 | Altitude:          Low:       219.9  High:       237.0
GPS Age:  0.3 sec.      51.6822631 N     115.3592770 W | GPS Age: -0.4 sec.      51.6869540 N     115.3631045 W

Auto Sample: 7-02  Offset:    +28.3  Residual:    +9.6 | Auto Sample: 15-2  Offset:    +27.9  Residual:    -6.4
Altitude:          Low:       192.8  High:       199.0 | Altitude:          Low:       233.1  High:       238.7
GPS Age:  0.5 sec.      51.6823078 N     115.3594770 W | GPS Age: -0.1 sec.      51.6871628 N     115.3632291 W

Auto Sample: 7-03  Offset:    +30.2  Residual:   +22.0 | Auto Sample: 15-3  Offset:    +26.6  Residual:    +1.4
Altitude:          Low:       182.7  High:       191.8 | Altitude:          Low:       229.7  High:       236.7
GPS Age: -0.3 sec.      51.6823714 N     115.3598007 W | GPS Age:  0.1 sec.      51.6873744 N     115.3633469 W

Auto Sample: 7-04  Offset:    +34.6  Residual:   +10.2 | Auto Sample: 15-4  Offset:    +26.9  Residual:    -5.6
Altitude:          Low:       180.9  High:       184.6 | Altitude:          Low:       223.6  High:       229.7
GPS Age:  0.1 sec.      51.6824115 N     115.3600516 W | GPS Age:  0.5 sec.      51.6875878 N     115.3634650 W

Auto Sample: 7-05  Offset:    +36.6  Residual:    +6.9 | Auto Sample: 15-5  Offset:    +25.8  Residual:    -7.2
Altitude:          Low:       180.4  High:       184.0 | Altitude:          Low:       216.2  High:       225.5
GPS Age:  0.2 sec.      51.6824504 N     115.3603268 W | GPS Age: -0.4 sec.      51.6879142 N     115.3636497 W

Auto Sample: 7-06  Offset:    +38.0  Residual:    -1.2 | Auto Sample: 15-6  Offset:    +24.3  Residual:    -1.6
Altitude:          Low:       179.4  High:       182.3 | Altitude:          Low:       208.2  High:       221.8
GPS Age: -0.5 sec.      51.6825136 N     115.3607665 W | GPS Age: -0.1 sec.      51.6881406 N     115.3637847 W

Auto Sample: 7-07  Offset:    +37.8  Residual:    +0.7 | Auto Sample: 15-7  Offset:    +24.0  Residual:    -2.6
Altitude:          Low:       178.6  High:       179.6 | Altitude:          Low:       201.3  High:       207.5
GPS Age: -0.3 sec.      51.6825677 N     115.3610772 W | GPS Age:  0.1 sec.      51.6883713 N     115.3639295 W

Auto Sample: 7-08  Offset:    +37.9  Residual:    -3.0 | Auto Sample: 15-8  Offset:    +23.5  Residual:    -6.3
Altitude:          Low:       176.4  High:       180.2 | Altitude:          Low:       196.7  High:       201.0
GPS Age:  0.0 sec.      51.6826293 N     115.3614005 W | GPS Age:  0.4 sec.      51.6885938 N     115.3640780 W

Auto Sample: 7-09  Offset:    +37.3  Residual:    -8.7 | Auto Sample: 15-9  Offset:    +22.2  Residual:    -5.4
Altitude:          Low:       173.5  High:       176.6 | Altitude:          Low:       190.8  High:       196.7
GPS Age:  0.3 sec.      51.6826998 N     115.3617389 W | GPS Age: -0.4 sec.      51.6889153 N     115.3642897 W

Auto Sample: 7-10  Offset:    +35.6  Residual:    -8.7 | Auto Sample: 15-10 Offset:    +21.2  Residual:    -6.5
Altitude:          Low:       175.7  High:       177.4 | Altitude:          Low:       187.1  High:       187.9
GPS Age:  0.5 sec.      51.6827754 N     115.3620998 W | GPS Age: -0.1 sec.      51.6891299 N     115.3644471 W

Auto Sample: 7-11  Offset:    +33.8  Residual:    -5.7 | Auto Sample: 15-11 Offset:    +19.8  Residual:    -3.8
Altitude:          Low:       175.3  High:       176.4 | Altitude:          Low:       187.4  High:       188.7
GPS Age: -0.3 sec.      51.6828853 N     115.3626422 W | GPS Age:  0.2 sec.      51.6893360 N     115.3646304 W

Auto Sample: 7-12  Offset:    +32.7  Residual:    -6.0 | Auto Sample: 15-12 Offset:    +19.1  Residual:    -5.0
Altitude:          Low:       175.1  High:       176.1 | Altitude:          Low:       188.2  High:       192.1
GPS Age:  0.1 sec.      51.6829549 N     115.3629830 W | GPS Age:  0.4 sec.      51.6895334 N     115.3648331 W

Auto Sample: 7-13  Offset:    +31.5  Residual:    -4.2 | Auto Sample: 15-13 Offset:    +18.1  Residual:    -6.8
Altitude:          Low:       170.7  High:       174.2 | Altitude:          Low:       183.9  High:       190.7
GPS Age:  0.3 sec.      51.6830236 N     115.3633071 W | GPS Age: -0.4 sec.      51.6898126 N     115.3651826 W

Auto Sample: 7-14  Offset:    +30.6  Residual:    -4.2 | Auto Sample: 15-14 Offset:    +16.7  Residual:    -1.9
Altitude:          Low:       170.3  High:       170.5 | Altitude:          Low:       187.3  High:       188.9
GPS Age: -0.4 sec.      51.6831277 N     115.3637889 W | GPS Age: -0.1 sec.      51.6899982 N     115.3654325 W

Auto Sample: 7-15  Offset:    +29.8  Residual:    -5.1
Altitude:          Low:       169.9  High:       170.5
GPS Age: -0.2 sec.      51.6831944 N     115.3641200 W

Auto Sample: 7-16  Offset:    +28.8  Residual:    -2.3
Altitude:          Low:       168.0  High:       170.3
GPS Age:  0.1 sec.      51.6832468 N     115.3644597 W
```

Auto Sample: 26-01 Offset: +20.0 Residual: -0.3
Altitude: Low: 213.3 High: 215.7
GPS Age: -0.4 sec.   51.7054882 N   115.3023174 W

Auto Sample: 26-02 Offset: +19.8 Residual: -1.5
Altitude: Low: 212.1 High: 214.0
GPS Age: -0.2 sec.   51.7056345 N   115.3024702 W

Auto Sample: 26-03 Offset: +19.3 Residual: -2.5
Altitude: Low: 207.6 High: 211.8
GPS Age: 0.1 sec.   51.7057790 N   115.3026411 W

Auto Sample: 26-04 Offset: +18.7 Residual: +18.0
Altitude: Low: 204.7 High: 207.3
GPS Age: 0.3 sec.   51.7059295 N   115.3028242 W

Auto Sample: 26-05 Offset: +22.3 Residual: +12.2
Altitude: Low: 199.3 High: 203.9
GPS Age: -0.4 sec.   51.7061791 N   115.3030932 W

Auto Sample: 26-06 Offset: +24.7 Residual: +16.0
Altitude: Low: 196.2 High: 198.4
GPS Age: -0.2 sec.   51.7063539 N   115.3032695 W

Auto Sample: 26-07 Offset: +27.9 Residual: +6.3
Altitude: Low: 192.6 High: 195.6
GPS Age: 0.1 sec.   51.7065243 N   115.3034471 W

Auto Sample: 26-08 Offset: +29.2 Residual: +13.2
Altitude: Low: 189.3 High: 192.2
GPS Age: 0.3 sec.   51.7066809 N   115.3036308 W

Auto Sample: 26-09 Offset: +31.8 Residual: +13.2
Altitude: Low: 185.5 High: 189.3
GPS Age: -0.4 sec.   51.7069049 N   115.3039063 W

Auto Sample: 26-10 Offset: +34.5 Residual: +2.7
Altitude: Low: 185.0 High: 186.0
GPS Age: -0.2 sec.   51.7070578 N   115.3040933 W

Auto Sample: 26-11 Offset: +35.0 Residual: +5.2
Altitude: Low: 184.0 High: 185.1
GPS Age: 0.1 sec.   51.7072178 N   115.3042759 W

Auto Sample: 26-12 Offset: +36.0 Residual: -6.3
Altitude: Low: 182.6 High: 184.5
GPS Age: 0.3 sec.   51.7073834 N   115.3044564 W

Auto Sample: 26-13 Offset: +34.8 Residual: -5.3
Altitude: Low: 182.1 High: 183.5
GPS Age: -0.4 sec.   51.7076420 N   115.3047334 W

Auto Sample: 26-14 Offset: +33.7 Residual: -4.3
Altitude: Low: 181.9 High: 182.5
GPS Age: -0.2 sec.   51.7078191 N   115.3049314 W

Auto Sample: 26-15 Offset: +32.9 Residual: -4.9
Altitude: Low: 181.8 High: 184.2
GPS Age: 0.1 sec.   51.7079932 N   115.3051348 W

Auto Sample: 26-16 Offset: +31.9 Residual: -8.9
Altitude: Low: 183.7 High: 184.7
GPS Age: 0.3 sec.   51.7081519 N   115.3053313 W

Auto Sample: 13-1 Offset: +26.8 Residual: -11.7
Altitude: Low: 175.6 High: 178.9
GPS Age: 0.4 sec.   51.7042939 N   115.3015021 W

Auto Sample: 13-2 Offset: +24.4 Residual: -9.3
Altitude: Low: 181.6 High: 187.1
GPS Age: -0.3 sec.   51.7044309 N   115.3012469 W

Auto Sample: 13-3 Offset: +22.5 Residual: -8.4
Altitude: Low: 184.4 High: 186.4
GPS Age: -0.1 sec.   51.7045243 N   115.3010520 W

Auto Sample: 13-4 Offset: +20.9 Residual: -4.0
Altitude: Low: 184.6 High: 185.6
GPS Age: 0.2 sec.   51.7046233 N   115.3008449 W

Auto Sample: 13-5 Offset: +20.1 Residual: -1.5
Altitude: Low: 185.6 High: 186.0
GPS Age: 0.4 sec.   51.7047288 N   115.3006314 W

Auto Sample: 13-6 Offset: +19.8 Residual: -3.6
Altitude: Low: 183.7 High: 186.0
GPS Age: -0.3 sec.   51.7048960 N   115.3003171 W

Auto Sample: 13-7 Offset: +19.0 Residual: +19.6
Altitude: Low: 179.6 High: 182.4
GPS Age: -0.1 sec.   51.7050186 N   115.3001161 W

Auto Sample: 13-8 Offset: +23.0 Residual: +20.6
Altitude: Low: 181.1 High: 183.0
GPS Age: 0.2 sec.   51.7051490 N   115.2999209 W

Auto Sample: 13-9 Offset: +27.1 Residual: +12.9
Altitude: Low: 182.4 High: 185.3
GPS Age: 0.4 sec.   51.7052887 N   115.2997372 W

Auto Sample: 13-10 Offset: +29.7 Residual: +9.0
Altitude: Low: 183.1 High: 186.3
GPS Age: -0.3 sec.   51.7055106 N   115.2994687 W

Auto Sample: 13-11 Offset: +31.5 Residual: +2.5
Altitude: Low: 180.2 High: 183.1
GPS Age: -0.1 sec.   51.7056621 N   115.2992931 W

Auto Sample: 13-12 Offset: +32.0 Residual: +8.0
Altitude: Low: 176.6 High: 179.4
GPS Age: 0.2 sec.   51.7058091 N   115.2991311 W

Auto Sample: 13-13 Offset: +33.6 Residual: +0.9
Altitude: Low: 172.8 High: 176.4
GPS Age: 0.4 sec.   51.7059600 N   115.2989687 W

Auto Sample: 13-14 Offset: +33.7 Residual: -10.3
Altitude: Low: 167.3 High: 171.6
GPS Age: -0.3 sec.   51.7062048 N   115.2987269 W

Auto Sample: 13-15 Offset: +31.7 Residual: -9.7
Altitude: Low: 165.2 High: 166.9
GPS Age: -0.1 sec.   51.7063805 N   115.2985633 W

Auto Sample: 13-16 Offset: +29.7 Residual: -8.1
Altitude: Low: 162.7 High: 164.2
GPS Age: 0.2 sec.   51.7065559 N   115.2984041 W

Auto Sample: 13-17 Offset: +28.1 Residual: -5.2
Altitude: Low: 163.3 High: 165.3
GPS Age: 0.4 sec.   51.7067204 N   115.2982569 W

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Auto Sample: 13-18 Offset:      +27.1  Residual:      -6.9  | Auto Sample: 18-15 Offset:      +14.7  Residual:      +0.5
Altitude:           Low:        165.9  High:         169.1  | Altitude:           Low:        170.0  High:         170.9
GPS Age: -0.3 sec.        51.7069551 N      115.2980556 W   | GPS Age:  0.1 sec.        51.7216267 N      115.2939238 W

Auto Sample: 13-19 Offset:      +25.7  Residual:      -7.5  | Auto Sample: 18-16 Offset:      +14.7  Residual:      -2.2
Altitude:           Low:        169.5  High:         172.6  | Altitude:           Low:        170.6  High:         175.7
GPS Age: -0.1 sec.        51.7071098 N      115.2979167 W   | GPS Age:  0.4 sec.        51.7215374 N      115.2935587 W

Auto Sample: 13-20 Offset:      +24.2  Residual:      -7.4  | Auto Sample: 5-01  Offset:       +5.5  Residual:     -44.5
Altitude:           Low:        172.9  High:         174.5  | Altitude:           Low:        173.0  High:         174.6
GPS Age:  0.2 sec.        51.7072693 N      115.2977695 W   | GPS Age: -0.3 sec.        51.7225789 N      115.2989565 W

Auto Sample: 13-21 Offset:      +22.7  Residual:      -2.8  | Auto Sample: 5-02  Offset:       -3.4  Residual:     -23.4
Altitude:           Low:        175.1  High:         176.2  | Altitude:           Low:        174.4  High:         177.2
GPS Age:  0.4 sec.        51.7074359 N      115.2976298 W   | GPS Age: -0.1 sec.        51.7227304 N      115.2990863 W

Auto Sample: 18-1  Offset:      +20.8  Residual:     -12.4  | Auto Sample: 5-03  Offset:       -8.1  Residual:     -26.7
Altitude:           Low:        195.8  High:         200.0  | Altitude:           Low:        174.6  High:         179.3
GPS Age: -0.4 sec.        51.7213139 N      115.2989669 W   | GPS Age:  0.2 sec.        51.7228852 N      115.2992289 W

Auto Sample: 18-2  Offset:      +18.3  Residual:     -19.4  | Auto Sample: 5-04  Offset:      -13.4  Residual:     -14.7
Altitude:           Low:        192.5  High:         194.9  | Altitude:           Low:        162.9  High:         182.0
GPS Age: -0.1 sec.        51.7214064 N      115.2986907 W   | GPS Age:  0.4 sec.        51.7230478 N      115.2993798 W

Auto Sample: 18-3  Offset:      +14.4  Residual:      -7.6  | Auto Sample: 5-05  Offset:      -16.3  Residual:      -3.2
Altitude:           Low:        190.5  High:         192.0  | Altitude:           Low:        183.2  High:         184.2
GPS Age:  0.1 sec.        51.7215005 N      115.2984120 W   | GPS Age: -0.3 sec.        51.7233085 N      115.2996143 W

Auto Sample: 18-4  Offset:      +12.9  Residual:      +0.9  | Auto Sample: 5-06  Offset:      -17.0  Residual:      +6.4
Altitude:           Low:        189.3  High:         190.2  | Altitude:           Low:        183.6  High:         185.5
GPS Age:  0.4 sec.        51.7215948 N      115.2981216 W   | GPS Age: -0.1 sec.        51.7234961 N      115.2997845 W

Auto Sample: 18-5  Offset:      +13.1  Residual:      -3.8  | Auto Sample: 5-07  Offset:      -15.7  Residual:      +7.4
Altitude:           Low:        187.3  High:         188.8  | Altitude:           Low:        184.9  High:         186.2
GPS Age: -0.4 sec.        51.7217198 N      115.2976518 W   | GPS Age:  0.2 sec.        51.7236912 N      115.2999667 W

Auto Sample: 18-6  Offset:      +12.3  Residual:      -5.1  | Auto Sample: 5-08  Offset:      -14.2  Residual:      +4.3
Altitude:           Low:        185.5  High:         187.0  | Altitude:           Low:        185.5  High:         187.4
GPS Age: -0.1 sec.        51.7217988 N      115.2973269 W   | GPS Age:  0.4 sec.        51.7238935 N      115.3001511 W

Auto Sample: 18-7  Offset:      +11.3  Residual:     -12.8  | Auto Sample: 5-09  Offset:      -13.3  Residual:      +6.5
Altitude:           Low:        184.4  High:         185.1  | Altitude:           Low:        185.3  High:         187.4
GPS Age:  0.1 sec.        51.7218775 N      115.2969937 W   | GPS Age: -0.3 sec.        51.7241787 N      115.3004046 W

Auto Sample: 18-8  Offset:       +8.7  Residual:      +3.9  | Auto Sample: 5-10  Offset:      -12.0  Residual:     +14.1
Altitude:           Low:        184.4  High:         186.8  | Altitude:           Low:        181.7  High:         185.3
GPS Age:  0.4 sec.        51.7219425 N      115.2966544 W   | GPS Age: -0.1 sec.        51.7243621 N      115.3005682 W

Auto Sample: 18-9  Offset:       +9.5  Residual:      +5.9  | Auto Sample: 5-11  Offset:       -9.2  Residual:     +27.8
Altitude:           Low:        185.1  High:         186.6  | Altitude:           Low:        180.1  High:         181.7
GPS Age: -0.4 sec.        51.7219771 N      115.2961313 W   | GPS Age:  0.2 sec.        51.7245412 N      115.3007273 W

Auto Sample: 18-10 Offset:      +10.7  Residual:      +6.7  | Auto Sample: 5-12  Offset:       -3.7  Residual:     +13.5
Altitude:           Low:        183.7  High:         184.5  | Altitude:           Low:        173.8  High:         179.1
GPS Age: -0.1 sec.        51.7219525 N      115.2957758 W   | GPS Age:  0.4 sec.        51.7247097 N      115.3008807 W

Auto Sample: 18-11 Offset:      +12.0  Residual:      +7.9  | Auto Sample: 5-13  Offset:       -1.0  Residual:     +11.1
Altitude:           Low:        181.5  High:         182.9  | Altitude:           Low:        173.8  High:         175.7
GPS Age:  0.1 sec.        51.7219238 N      115.2954442 W   | GPS Age: -0.3 sec.        51.7249617 N      115.3011013 W

Auto Sample: 18-12 Offset:      +13.6  Residual:      +5.8  | Auto Sample: 5-14  Offset:       +1.2  Residual:     +10.6
Altitude:           Low:        180.2  High:         181.2  | Altitude:           Low:        170.6  High:         173.5
GPS Age:  0.4 sec.        51.7218750 N      115.2951098 W   | GPS Age: -0.1 sec.        51.7251384 N      115.3012314 W

Auto Sample: 18-13 Offset:      +14.7  Residual:      +2.8  | Auto Sample: 5-15  Offset:       +3.4  Residual:      +3.9
Altitude:           Low:        176.8  High:         179.8  | Altitude:           Low:        169.4  High:         170.8
GPS Age: -0.4 sec.        51.7217811 N      115.2946104 W   | GPS Age:  0.2 sec.        51.7253192 N      115.3013536 W

Auto Sample: 18-14 Offset:      +15.3  Residual:      -3.3  | Auto Sample: 5-16  Offset:       +4.2  Residual:      +8.3
Altitude:           Low:        171.6  High:         175.4  | Altitude:           Low:        164.7  High:         169.4
GPS Age: -0.1 sec.        51.7217069 N      115.2942712 W   | GPS Age:  0.4 sec.        51.7255030 N      115.3014697 W
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Auto Sample: 5-17   Offset:      +5.8   Residual:      +8.3
 Altitude:           Low:        163.7   High:         165.1
GPS Age: -0.3 sec.         51.7257837 N       115.3016257 W
```