

Measuring Plains Snow Water Equivalent and Depth

Missouri Basin Water Management Division and Omaha District Method

U.S. Army Corps of Engineers
Northwestern Division - Omaha
1616 Capitol Avenue, Suite 365
Omaha, NE 68102

<http://www.nwd-mr.usace.army.mil/rcc/snowsurvey/snowsurvey.html>

INSTRUCTIONS FOR SNOW SAMPLERS

(Updated December 7, 2015)

A. GENERAL – The success of a sampling survey depends upon obtaining a representative sample of local snow cover to measure. Do not select drifts or areas blown clear, but locate the 5 points of the sample in an “average” location.

Observations should be recorded on the form titled, Cooperative Missouri Basin Plains Snow Survey, found at the “Data Sheet” link on the website. This form will be referred to as “data sheet” in this document.

B. SNOW SURVEY EQUIPMENT

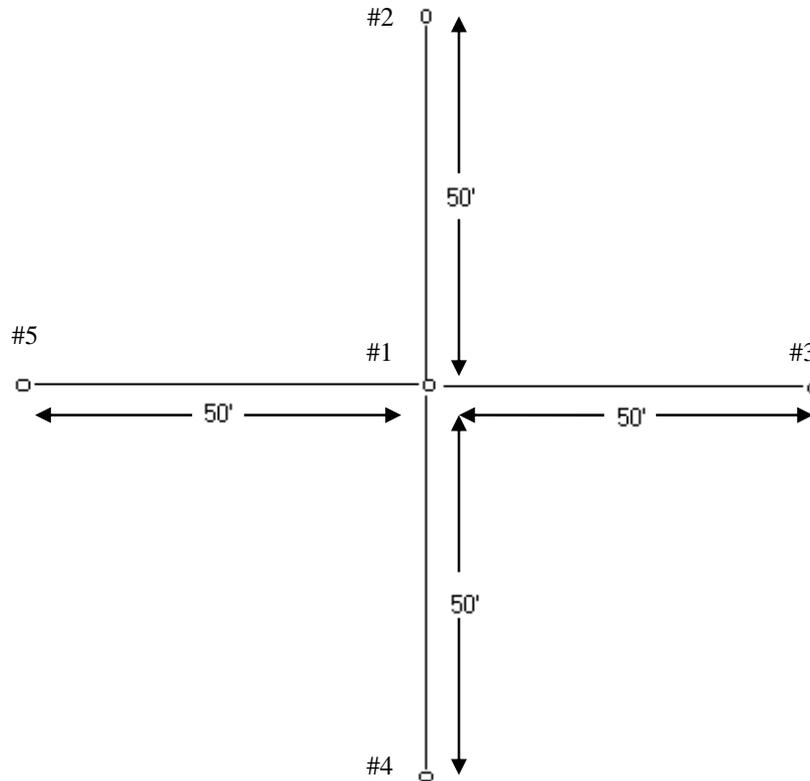
1. Standard 3-inch outside diameter, 2 7/8th-inch inside diameter snow tube
2. PVC tube (tamper)
3. Electronic scale
4. Bucket with handle (approx 2 ½ gallon plastic or metal)
5. Data sheet
6. Pen or pencil
7. Calculator

Optional Equipment

8. *Flat shovel*
9. *Folding rule*
10. *Pick (for glare ice and frost depth)*
11. *Handheld GPS device*

C. SNOW COURSE LAYOUT

A typical 5 sampling point snow course layout is shown in the figure below. Five samples should be taken in the shape of a cross, with exterior samples 50 feet from the center sample.



D. SAMPLING TECHNIQUE

1. Select a site at the snow course location. Ideally, the site should be in a flat field. A field with stubble that has snow cover representative of the surrounding country is best. The site should be at least $\frac{1}{4}$ mile from any upwind obstruction (windbreaks, barns etc.) Note any landmarks near the site for future reference.
2. Prepare a sketch showing the location of the survey site to roads and other landmarks on the back of the data sheet. Record the latitude and longitude of the location on the data sheet.
3. Record estimated snow cover, drifting and soil moisture observations on the data sheet.
4. Measure the tare weight of the empty bucket using the handheld scale and record it as the Bucket Tare Weight in the ⁴Total Weight of Snow Calculation block of the data sheet.

Note about the Electronic Scale: If the scale measures weight in pounds-ounces (lbs-oz) convert it to pounds in decimal format. This is done by dividing the ounces by 16 and adding to the number of pounds. (1 pound = 16 ounces)

*Example: If 6 lbs and 10 oz are measured with the scale, convert to pounds only:
 $10 \text{ oz}/16 \text{ oz}=0.625$ $6 \text{ lbs and } 10\text{oz} = 6.625 \text{ lbs}$*

5. *Optional Step.* If you are using a using 2 7/8th-inch inside diameter snow tube the ⁵Conversion Factor is provided on the data sheet. Calculate a new conversion factor only if NOT using 2 7/8th-inch inside diameter snow tube. Measure the inside diameter of the snow tube and enter it in the ⁵Conversion Factor Calculation block on the data sheet. Compute the Area of Tube and the ⁵Conversion Factor.
6. To make a snow water equivalent measurement:
 - a. At each location, insert the snow tube firmly into the snow. Force the tube down until it contacts the soil or ice cover.
 - b. Measure the ¹Snow Depth in inches using markings on the snow tube or the folding ruler and record it on the data sheet.
 - c. Pack the snow in the tube with the PVC tamper. Carefully remove the tube. If the snow is granular, slide the flat shovel under the tube to capture the contents and prevent the snow from falling out.
 - d. Hold the tube near the bucket, remove stray dirt and grass, then dump the snow and ice into the bucket using the PVC tamper to clear the tube. Note the thickness of any significant (>1”) ice layers.
 - e. Measure the thickness of any ice remaining on the ground, estimate the density as a percent, and record it in the Ground Ice Layer box on the data sheet.
 - f. Repeat the procedure at each of the remaining points.
 - g. After the five samples have been emptied into the bucket, weigh the accumulated weight of the snow in the bucket and record it as the Weight of Accumulated Samples in Bucket in the ⁴Total Weight of Snow Calculation block on the data sheet.
7. *Optional Step.* Frost observations.
 - a. Drive the pick axe into a cleared area of the ground near the sample location. Repeat this three times.
 - b. Estimate the depth of pick axe penetration and frost depth at the sample location and record these observations on the data sheet.
8. Calculate the ³Snow Water Equivalent (SWE) in the data sheet
 - a. Compute the ⁴Total Weight of Snow by subtracting the Bucket Tare Weight from the Weight of Accumulated Samples in Bucket.
 - b. In the ³Snow Water Equivalent Calculation block, convert the total weight of snow to ³Snow Water Equivalent by dividing by the ⁵Conversion Factor.
9. Compute the Total Water Equivalent in the data sheet
 - a. Compute the ²Ice Water Equivalent for each sampling point. Compute an average ²Ice Water Equivalent of the five sampling points.

- b. Add the average ²Ice Water Equivalent and ³Snow Water Equivalent in the Total Water Equivalent Calculation block.

10. Compute the Average ¹Snow Depth in the data sheet

E. RECORD OF MEASUREMENTS

1. Record the measurement location number, average ¹Snow Depth in inches, and the ³Snow Water Equivalent in inches for the specified measurement date on the summary sheet on page 6 of this document.

2. Email the location, date, snow depth, and snow water equivalent of the most recent measurement immediately to the U.S. Army Corps of Engineers Northwestern Division, Missouri River Basin Water Management in Omaha, NE at:

Missouri.Water.Management@nwd02.usace.army.mil.

3. Scan the data sheet and email it or the results to the address above or fax it to 402-996-3898.

Snow Survey
ACTIVITY HAZARDS ANALYSIS
Hydrologic Engineering Branch

ACTIVITY: Snow Survey

ANALYZED BY/DATE: Kevin Stamm, 01/26/11

REVIEWED BY/DATE:

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Snow Survey	<ol style="list-style-type: none"> 1. Injury to the worker 2. Sharp edges on equipment. 3. Auto accidents. 4. Frostbite or other cold weather related illnesses. 5. Vehicle breakdown. 6. Threat of severe or hazardous weather. 	<ol style="list-style-type: none"> 1. When driving onto private property, if the owner or their animals appear hostile, leave at once. 2. Do not read a map and drive at the same time. 3. Dress for cold winter weather and be alert to signs of frostbite. 4. Wear gloves to protect your hands from sharp edges on the equipment. Handle equipment carefully. 5. Have a winter survival kit in the car. 6. Observe winter driving conditions. 7. Do not venture down unplowed roads in isolated areas. 8. Remain aware of potential severe and hazardous weather. Obtain updated weather forecasts from local weather sources.
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ol style="list-style-type: none"> 1. Vehicle 2. Snow Tube 3. Scale 4. Ruler 5. GPS 6. Maps of local area 	<ol style="list-style-type: none"> 1. Make sure vehicle is running well before departing. 2. Check ground clearance before driving through snowdrifts. 3. Verify map is of recent origin. 	On the job training by an experienced employee.

