

# 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  
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### INSTRUCTIONS FOR SNOW SAMPLERS

(Updated December 3, 2012)

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.

#### B. SNOW SURVEY EQUIPMENT

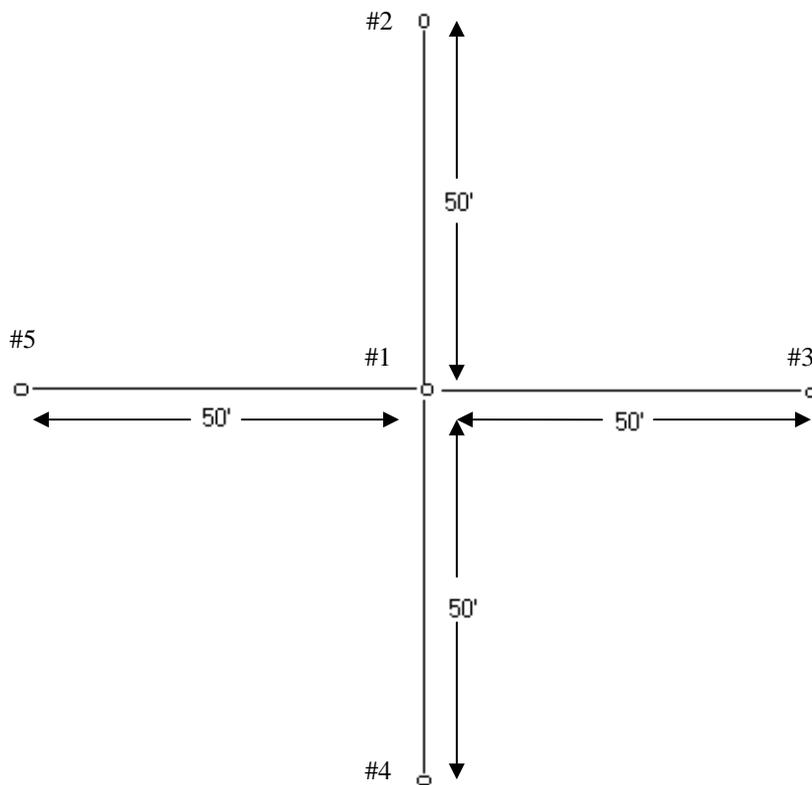
1. Standard 3-inch outside diameter, 2 7/8<sup>th</sup>-inch inside diameter snow tube
2. PVC tube (tamper)
3. Electronic scale
4. Bucket with handle (approx 2 ½ gallon plastic or metal)
5. Snow survey data sheet
6. Pen or pencil
7. Calculator

#### *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 form, if no sketch was provided. 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 in as the Bucket Tare Weight in the <sup>4</sup>Total Weight of Snow Calculation block.

**Note About the Electronic Scale:** If the scale measures weight in pounds-ounces (lbs-oz) convert it to pounds in decimal format using the attached Pound-Ounce to Pound-Decimal Conversion Table on page 5 of these instructions. You may also divided the ounces by 16 oz/lb and add to the number of lbs.

*Example: If 6 lbs. and 10 oz. are measured with the scale, convert to pounds only. Select the number of pounds (6 lbs.) across the top of the table and the number of ounces (10 oz) in the first column of the table. The number where the column and row meet in the table (6.625 lbs in this example) is the number to enter on the datasheet.*

5. *Optional Step.* Perform only if the conversion factor is **NOT** listed on the datasheet. Measure the inside diameter of the snow tube and enter it in the <sup>5</sup>Conversion Factor Calculation block on the data sheet. Compute the Area of Tube and the <sup>5</sup>Conversion 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 snow 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. Compute the ground-ice water equivalent.
  - g. Repeat the procedure at each of the remaining points.
  - h. After the five samples have been emptied into the bucket, weigh the accumulated weight of the snow in the bucket and record it in the <sup>4</sup>Total 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 Snow Water Equivalent (SWE)
  - a. Compute the <sup>4</sup>Total Weight of Snow by subtracting the bucket tare weight.
  - b. In the <sup>3</sup>Snow Water Equivalent Calculation block, convert the total weight of snow to <sup>3</sup>Snow Water Equivalent (SWE) by dividing by the computed conversion factor.
9. Compute the Total Water Equivalent.
  - a. Compute the average ice water equivalent from each sampling point.
  - b. Add the average <sup>2</sup>Ice Water Equivalent and <sup>3</sup>Snow Water Equivalent in the Total Water Equivalent Calculation block.

## E. RECORD OF MEASUREMENTS

1. Record the measurement location number, snow depth in inches, and the snow water equivalent in inches for the specified measurement date on the summary sheet.
2. Email the 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](mailto:Missouri.Water.Management@nwd02.usace.army.mil).

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

