NORTH DAKOTA
ATMOSPHERIC RESOURCE BOARD

A DIVISION OF THE NORTH DAKOTA STATE WATER COMMISSION

DATE: September 21, 2015 SITE ID # -

TO: COOPERATIVE PRECIPITATION OBSERVERS

FROM: DANIEL BROTHERS, ENVIRONMENTAL SCIENTIST

SUBJECT: SNOW REPORTING PROCEDURES

I would like to take this opportunity to thank you for volunteering your time to report snow for the Atmospheric Resource Board Cooperative Observer Network (ARBCON). We greatly appreciate your participation! The information you collect will not only be used by the ARB, but also by the National Weather Service (NWS), State Water Commission (SWC), and several other organizations. Accurate reporting of rain, hail, and snow events will help us maintain one of the best precipitation data networks in the nation.

The following instructions will help maintain uniformity in reporting. **Please take a few minutes to read through all the instructions**. **Please keep this memo so that you may refer to it throughout the coming season.**

INSTRUCTIONS

In your packet, there should be six white reporting cards, one for each month, beginning with **October and running through March**. If you signed up for Internet reporting during the growing season you will continue reporting via the Internet for the snow reporting season and will not receive any reporting cards. These cards are postage-paid, so no stamps are required. If rates change, or if postage is missing, mail the card anyway. **We'll pay any postage due**.

In addition, you are supplied with a four-inch diameter rain gauge to make the daily measurements. These gauges are fairly resilient, but do crack, break, or become unreadable after extended use for any number of reasons. Please contact us as quickly as possible at **1-800-654-5981** if you need a new gauge. If you do not receive a gauge by October 1 please contact us using the "800" number. Internet accounts have been set up for every observer, so if you want to try Internet reporting, you can do so at any time. Internet reporting instructions are located on pages 5 and 6 of this letter.

900 EAST BOULEVARD AVENUE, DEPT 770, BISMARCK, NORTH DAKOTA 58505-0850
(701) 328-2788 • FAX (701) 328-4749 • TDD (701) 328-2750 • http://www.swc.nd.gov/arb/

1. MONTH. Enter the month (and year, if you wish) on the card. When you begin a new month, mail the completed card for the previous month. Once received, your reports are entered into our database and a map is generated from the data. All the maps generated are on the ARB website for your viewing at www.swc.nd.gov/arb.

2. TIME OF OBSERVATION. Read your gauge each morning, as near to 8:00 a.m. as it is convenient for you. [Note: Typically, the reading taken will include rain/snow that fell the previous day. This is expected and accounted for]. **Please enter each reading on the day it was made**.

   If it is raining/snowing when you make your morning observation, record the amount of precipitation received and empty the gauge. Any precipitation received after your 8:00 a.m. daily reading each morning will be recorded the next morning.

3. READING THE GAUGE. Rain is funneled into the inner cylinder and the total should be read from the scale on the side of the cylinder. If rain exceeds one inch, it will overflow into the larger cylinder. If this occurs, empty the inner cylinder and use the funnel to empty water from the large outer cylinder into the inner cylinder. Repeat as necessary until all the water is measured, remembering to report each inch that is emptied from the inner cylinder. Record the total amount of water in the "W" column of the reporting card.

   If no water is in your gauge at your daily reading, report 0; otherwise, report the exact amount of water in the rain gauge. Record a "T" for Trace when there is less than one one-hundredth of an inch of rainfall.

   MISSING DATA. If you miss a reading, please enter "M" for each day missed. If there is water in the gauge after a missed reading, please disregard the amount and dispose of it as you won't be sure on which day it fell. Please record an "M" on the days missed. **Do not report cumulative amounts here.** They should be reported as remarks.

4. **SNOW WATER EQUIVALENT.** The new four-inch diameter gauges are more suitable for measuring snow than the Tru-Check gauges. If snow is expected in your area, remove the funnel and inner cylinder, leaving only the larger outer cylinder outside. The amount of water in the snowfall is actually more useful to many of our data's users than the snowfall itself. To measure the water content of the snowfall, bring the gauge inside and allow the snow to melt. Then measure the water using the funnel and inner cylinder as you would for rainfall. **Do Not heat the snow on the stove or in a microwave**; **some of the water will evaporate, resulting in an inaccurate reading**. If you need to accelerate the melting process, you can add a known amount of hot (but not boiling) water to the snow.

Measure the hot water in the inner cylinder before adding it to the snow, and then subtract out the same amount from the total water measured in the gauge. **Note: Refer to the DAILY SNOWFALL section below for measuring snow with high winds.**

SNOWPACK. Information about the water content in the snowpack is extremely useful for forecasting spring flooding. Measuring the snowpack should be done on the last day of each month and entered in the box in the lower left corner of the reporting card. Internet reporters can do this as often as they wish. If possible, a snowpack measurement on the 15th of each month, called in to the ARB or emailed, would be very helpful. To measure snowpack water content, pick an area of relatively flat ground out in the open that is free of drifting due to the wind. Place the outer cylinder of the gauge upside down into the snow and remove the volume of snow contained within the gauge. A flat object such as a clipboard can be helpful in preventing the snow from falling out as you lift the gauge with the snow. Bring the snow inside and measure the water content according to the instructions immediately above.

DAILY SNOWFALL. Measure new snowfall on a flat area (previously snow free), such as a deck, picnic table, or ideally a snowboard. Try to avoid areas of drifting during high winds. Measure the depth of new snow with a ruler and gather a sample with your gauge as described in the "**SNOWPACK**" section above. Although not required, a "snowboard" is a popular and useful way to measure new snow depth. This is a flat piece of wood (approx 16in X 16in) painted white and placed in your yard. Measure the snow accumulated on the board, clear the board of snow, and place it on top of the new snow so it is ready for the next measurement. Be sure to mark the board's location with a flag, pole, or other marker so you can find it after it snows. The snowboard is also useful if there is a particularly heavy snow that fills the gauge completely.

ADDITIONAL INFORMATION. If you have access to the Internet and would like additional information on reporting snowfall data there are two sources that may be useful. The NWS has a training video that shows snow measuring techniques at
http://madis-data.noaa.gov/snow_video.html.
Also, the Community Collaborative Rain, Hail, & Snow Network (CoCoRaHS) has some useful information at
http://www.cocorahs.org/Content.aspx?page=measuresnow.

5. HAIL. If hail falls at your location, refer to the yellow card you received in the spring, and put the hail report in the Remarks section. **Please report time in either 24-hour clock format (1 p.m. = 1300, 11 p.m. = 2300) or, if it is more convenient specify a.m. or p.m.** Any extra information (remarks) about the hail events, are most helpful and aids the study of North Dakota's climate.

6. LOCATION OF RAIN GAUGE. **Please do not use any gauge other than the four-inch gauge that the ARB has provided. Your location and Site ID appear at the top of the mailing label**. **For example**, the numbers "16310430 Your Name 58" would indicate the location of your gauge and ID. The numbers correspond as follows, 163 indicates the township, 104 indicates the range, 30 indicates the section, and 58 would indicate your Site ID. Please notify us **if the numbers on your label are incorrect**. If you must move your rain gauge, please notify us as soon as possible of the new location. A new Site ID number will likely then be issued if the township, range, or section has changed. *Please make sure that the township, range, and section shown on the mailing label are correct.* ***IT IS EXTREMELY IMPORTANT.*** *The numbers are the method used in plotting your precipitation on the map. If it is wrong, your reports won't correspond to the correct location.*

7. SITING OF YOUR RAIN GAUGE. The best site for your four-inch gauge is on a post at least 50 feet from the nearest building or tree. The top of the gauge should be at least three feet above the ground. Other areas may be acceptable; please refer to the pamphlet enclosed with the gauge.

8. PERSONAL PRECIPITATION RECORDING. A separate sheet is enclosed for you to record rain and snowfall and keep for your own reference.

9. ADDING THE MONTHLY TOTAL. Please add the monthly total and enter it in the location shown. **If there were any missing days, just put an "M" for the monthly total**. This saves time in the processing of the cards and makes the data accessible faster.

INTERNET REPORTING

An account has been created for each observer on the ARB website at **www.swc.nd.gov/precip.phtml**. You can access your account and report precipitation at any time. If you signed up for Internet reporting, you did not receive reporting cards. If you didn't sign up for Internet reporting, but you would like to try it out, an account is already set up for you and you can try it at any time.

1. LOG IN. Once you reach the login page at the above website you will need to enter your Site ID and password. Your Site ID is the number located at the top of Page 1 of this letter. The first time you log in your password will be your Site ID number followed by your five-digit zip code with no spaces in between. For example, if your Site ID is 65 and your zip code is 58505, then your password would be 6558505. After these have been entered you can either hit enter or click on the **Log In** button. If you reported on the Internet last year, your password has **not** been reset to the default password for your Site ID. Please call the

ARB if you need to find out your password. If your session lasts several minutes your session may "time out" in which case you will be returned to the log in page and have to log in again. All the data you have already entered should appear in the appropriate locations if it was previously saved.

2. CHANGING YOUR PASSWORD. If you would like to change your password to something that would be easier to remember you can click on the **Change Password** button located next to the **Logout** button after you log in. You will be prompted to enter your old password, which is the one you used to log in. You will then need to enter a new password and verify that new password by typing it again. Your new password can be any combination of letters, numbers, and symbols provided that it is a minimum of **four** characters and a maximum of **twenty** characters. The password is also case sensitive so be aware of capital and lowercase letters when you enter your new password. After you have entered your new password click on the **Change** button and you will be returned to the precipitation reporting page. If your password was changed successfully a dialog box saying *Password successfully changed* will appear.

3. REPORTING WATER/RAIN. Once you have logged in you should come to a page that is set up similar to the reporting cards. Your name should appear at the top next to the **Month**. Use the drop down menu for selecting the month for which you are reporting, followed by the year. In the upper right corner next to your name is a number that should correspond to your Site ID. To report rainfall first make sure the month selected is correct and then simply put the amount of rain next to the corresponding day of the month to the nearest hundredth of an inch. For example, ½ inch of rain would be reported as 0.50. As you enter precipitation the total for the month should automatically update. **Please enter 0 for any day that no precipitation is received**. Otherwise, the day will be reported as missing. Any pertinent remarks such as high wind, excessive flooding, or tornadoes can be entered in the *Add Remarks* section at the bottom of the page. When all the information is entered, check to make sure it is accurate and click the **Save** button. Once the data has been saved it cannot be changed except by ARB staff. All previously entered information will appear when you log in.

4. REPORTING SNOWFALL. Report Snowfall the same way you would report Water/Rain, except in the Snow column.

5. REMARKS. To enter remarks scroll down to the **Observer Remarks** section. Make sure the month selected is accurate and Click on the **Add** button next to **Observer Remarks.** Then enter the day the

remark pertains to and the remark. When all the information is entered, check to make sure it is accurate and click the **Save** button. Once the data has been saved it cannot be changed except by ARB staff.

6. REPORTING HAIL. To report any hail information scroll down to the **Hail Reports** section. Make sure the month selected is accurate and Click on the **Add** button next to **Hail Reports**. You will then have to enter the day of the month in which the event took place, the time the event started and stopped including am or pm, the size of the hail, and the amount of damage received in the appropriate spaces on the page. Any additional remarks on the hail event can be entered in the remarks section as explained above. When all the information is entered, check to make sure it is accurate and click the **Save** button. Once the data has been saved it cannot be changed except by ARB staff.

7. REPORTING SNOWPACK WATER CONTENT. To report snow water equivalent information scroll down to the **Snow Pack Water Equivalent** section. Make sure the month selected is accurate and Click on the **Add** button next to **Snow Pack Water Equivalent**. You will then have to enter the day of the month and time of the observation, and the water content of the snowpack. Remember, this is the water content, not the snow depth. The snow depth may be entered in the remarks section as explained above. Please make sure the information is accurate and the click the **Save** button.

8. LOG OUT. When you have finished entering your information click on the **Logout** button and you will return to the log in page. If any information, such as your name or Site ID, are incorrect or you encounter difficulties in logging in or reporting data please contact the ARB as soon as possible by phone at **1-800-654-5981** or by e-mail at **dabrothers@nd.gov**.

Please follow all of the reporting guidelines in this memo to maintain the accuracy of the data collected. If you have any questions or problems, feel free to call us at the ARB's toll-free number, **1-800-654-5981**. Again, please note that this "800" number is different from the NWS toll-free numbers. Thank you for your help!

THE
ATMOSPHERIC RESERVOIR
Examining the Atmosphere and Atmospheric Resource Management

Measuring Snow

By Daniel Brothers

Snow measurements in North Dakota are important, but getting accurate data can be difficult. The snow rarely settles nicely to the ground, creating an even layer that's easily measured. Usually the snow is accompanied by windy conditions, creating large drifts in some areas while leaving others almost bare. Where do you measure the snow when it's blowing all over the place? What if the snow is melting as it hits the ground, or starts melting shortly after the storm, when the sun comes out? What if it's mixed with rain or sleet?

Most people are interested in the amount of new snow that fell in a storm. While there are some more exotic snow gauges and systems used for research, most daily snow measurements are made with a good old-fashioned ruler or yard stick. In order to keep the new snow separate from the older snowpack that was already on the ground, observers are encouraged to use a snow board. A snow board is just a regular plywood board, painted white to help prevent heat absorption, placed on the ground in an area away from obstructions and not prone to drifting. The board is usually about 16" x 16", but can be larger. An observer will use their ruler to measure the depth of snow on the board. If the snow did not settle evenly on the board they measure a few different spots on the board and use an average of the depths as their report for the new snowfall. After taking the measurement, the board is cleared of snow and placed on top of the snowpack so it is ready for the next snow event. The snow board should be marked with a pole or flag so it can be found after the next snowfall. A picnic table, deck, or other flat surface away from obstructions and drifting can also be used if it was previously free of snow and the snow accumulated on its surface is representative of the snow that fell.

Another aspect of snow measurement important for organizations such as the National Weather Service (NWS) is the water content of the snow that fell. This can be important in forecasting runoff from spring snow melt that can lead to flooding. The ratio of water to snow depth can vary considerably from one storm to the next, so it is important to measure the water equivalent each time new snow falls. Observers in precipitation networks for the NWS, Atmospheric Resource Board (ARB), and the Community Colaborative Rain, Hail & Snow Network (CoCoRaHS) use a 4-inch diameter rain gauge for measuring both rain and snow. When new snow falls it is collected in the gauge (without it's funnel or smaller inner cylinder). The snow that collects in the gauge is melted and poured carefully into the smaller cylinder for measuring. Observers can add warm (but not boiling) water to the snow to aid in melting, but that warm water must be subtracted from the total to get an accurate measurement.

In windy conditions it is better to use the gauge to collect a sample from the snow board for melting, since the gauge may not have collected a representative amount of snow. To do this, an observer places the gauge upside down on the snow board and carefully collects the amount of snow inside the gauge's circumference.

Measuring the depth and water content of the total snowpack is also very helpful. Observers find any area where the ground is relatively level and free of drifting to measure the snowpack. Some observers will find a good spot and stake a pole with the measurements marked into the ground so they can just read it each time. If an observer is bringing their yard stick out with them, they must be sure to measure through all layers of snow and ice. Measuring the water content is done by taking a core sample with the 4-inch gauge, much like getting a sample of daily snowfall off a snowboard. Since the snow rarely settles in a uniform pattern, it is often a good idea to take a few samples from different areas and average the depths to get a proper measurement. If some of the ground is covered and some is bare, measure the area with snow and average it with the percent of bare ground. For example, if the covered areas have two inches of snow but 50 percent of the ground is bare, an observer would report an average snow depth of one inch. In those instances it is also recommended to leave a remark with the percentage of snow cover.

The Atmospheric Resource Board operates a volunteer network known as ARBCON in North Dakota. More observers are always appreciated to help with rain and/or snow reporting. If you would like to volunteer please contact the ARB at 1-800-654-5981 or via email at *dabrothers@nd.gov*.

Atmospheric Resource Board
North Dakota State Water Commission
900 East Boulevard, Bismarck, ND 58505
(701) 328-2788 • http://swc.nd.gov

ND Weather Modification Association
PO Box 2599, Bismarck, ND 58502
(701) 223-4232

RAIN/SNOWFALL RECORDING

Date	October		November		December		January		February		March	
	W	S	W	S	W	S	W	S	W	S	W	S
1												
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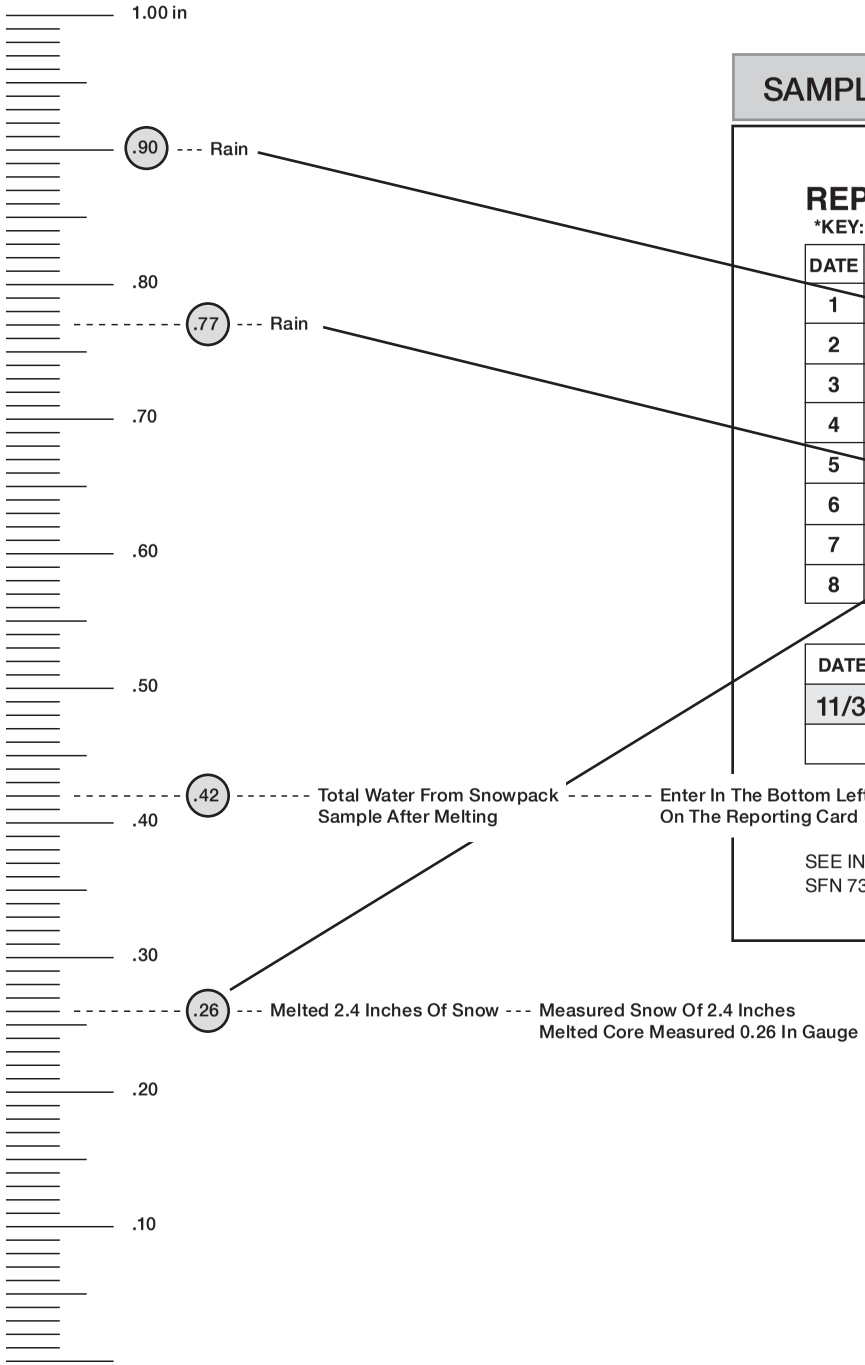
SNOWGAUGE READING



SAMPLE OF SNOW REPORTING CARD

REPORTING CARD

MONTH: November

*KEY: W= Rain/Water S= Snow

DATE	W*	S*	DATE	W*	S*	DATE	W*	S*	DATE	W*	S*
1	0.90	0	9	0	0	17	0	0	25	0	0
2	0	0	10	0	0	18	0	0	26	0.02	0.4
3	0	0	11	0	0	19	0	0	27	0	0
4	0	0	12	0	0	20	0.16	0	28	0	0
5	0.77	0	13	0	0	21	0	0	29	0	0
6	0	0	14	0	0	22	0	0	30	0	0
7	0	0	15	0.32	8.5	23	0	0	31	0	0
8	0.26	2.4	16	0	0	24	0	0	TOTAL	2.43	11.3

WATER IN SNOWPACK

DATE	TIME	TOTAL WATER
11/31	8:00 AM	0.42

REMARKS:

Snowpack depth on 11/31 was 8 inches.

SEE INSTRUCTION CARD FOR COMPLETE INFORMATION ON HOW TO FILL OUT THIS REPORTING CARD.
SFN 7350-2 3/2011

Total Snowpack Depth At End Of The Month Was 8 Inches. Melted Sample In Gauge Measured 0.42. Not The Sum Of Daily Measurements.

Total Water

Total Of Daily Snow Measurements