# HISTORICAL SNOW WATER EQUIVALENT AND TEMPERATURE DATA FOR OVERSNOW VEHICLE TRAVEL AREAS IN GRAND TETON AND YELLOWSTONE NATIONAL PARKS

Final Report
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To
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NOTE: There was an extensive amount of data assembled for this analysis that could not be included in this report. There was daily data for all of the stations for all of the years (some 517 station-years) covering 1949 through 2005 water year melt-out or period of record for stations not starting in 1949. This includes maximum temperature, minimum temperature, average temperature, precipitation, snow depth, SWE, and snow density. There are also monthly summaries of average maximum, average minimum and average temperatures in degree C and F, and monthly precipitation in mm and inches. Annual summaries of coldest temperature, day of coldest temperature, day snow starts to accumulate, maximum SWE, day of maximum SWE, day snow melts, day of 1 inch SWE, day of 1.5 inches SWE and day of 2 inches SWE. (For the Yellowstone Park station, there is also the day of 0.5 inches SWE). This data is available on a CD from the authors or from Michael J. Yochim, Ph.D. at P.O. Box 168, Yellowstone National Park, WY 82190.

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# EXECUTIVE SUMMARY

The objective of this report is to quantify the historic snow water equivalent and temperatures for stations in Grand Teton and Yellowstone National Parks, compare snow water equivalent with opening and closing dates of oversnow vehicle travel, and provide estimated opening and closing dates that would have been possible over the historic period of record.

Snowpack and climate data have been collected at many locations in Grand Teton and Yellowstone National Parks. Measurements of climatic variables have been taken since the late 1800's at Mammoth. Other stations were started in the early 1900's up to the late 1970's. Snow courses have been measured since the mid 1930's and SNOTEL (SNOw survey TELemetry) stations were generally started in the early 1980's. Four telemetered weather stations were installed in the upper Snake River drainage in the early 1990's.

Daily data from these stations have been analyzed for their period of record to determine the coldest temperature for each winter, when the snowpack starts to accumulate, maximum snow water equivalent (SWE) and date of maximum SWE, date snowpack melts, and various threshold values of SWE needed to sustain oversnow vehicle travel. Monthly average maximum, minimum, and average temperature and monthly precipitation have been summarized and are available on the data CD (see page 3).

There is considerable variability in how the snowpack develops and melts over the span of many years. In order to establish realistic opening and closing dates for use of oversnow vehicles on park roads, it is important to understand this variability. Using historical snow and climate measurements at locations along these travel routes can provide an insight to this variability and to the dates that OSV travel would have been possible over this historic record.

Recently, the criteria for opening the roads to the public for over snow vehicle (OSV) travel has been to open them on the Wednesday before the weekend before Christmas, usually around December 15 (thereafter, the targeted opening date). Closure typically occurred no later than the first Monday in March for the Mammoth to Norris, Norris to Madison, and Norris to Canyon roads (hereafter, generally considered to be March 4). The National Park Service closes the remaining roads on the second Monday in March (hereafter, March 11).

By comparing historical opening dates with SWE on those dates, about 25mm or 1 inch of SWE (about 250 – 300 mm or 10-12 inches accumulated snow depth) was needed for administrative OSV travel and 1.5 inches SWE was needed to open the roads to the public. This amounts to about 380 – 460 mm or 15 to 18 inches of cumulative snowfall needed for opening to the public. The threshold levels at Mammoth are less than for other areas as the point for starting oversnow travel is at higher elevation than the Mammoth (Yellowstone Park) weather station. Historically, administrative travel south

from Mammoth to Norris has occurred when the SWE at Mammoth reached about 12 mm or one-half inch SWE and public travel was permitted when SWE reached about 25 mm or one inch SWE.

Some areas of the park road system accumulate less snow than others and are more critical to opening the park roads to OSV's. For example, snowpack at Madison Junction dictates when the road can be opened between West Yellowstone and Old Faithful and West Yellowstone, Norris Junction and Canyon. Snow accumulation at Old Faithful and Lake dictate when traffic can be permitted from the South Entrance to those areas. The freeze-up of Yellowstone Lake determines when Mary Bay becomes safe for visitor travel (although the NPS often opens it before freeze-up, in part because relatively few visitors travel this route). Mammoth must have adequate snowpack to access the interior of the park from the North Entrance via Norris Junction. Moran 5 WNW at Jackson Dam and Glade Creek are critical in determining when OSV's can use local roads in Grand Teton National Park and the road from Flagg Ranch into Idaho via Grassy Lake.

Using SWE data and estimated road openings from 1949-2005, it appears that roads would have been opened to the public about 7 days after they were opened to administrative travel for the West Yellowstone-Old Faithful-Lake-Canyon-Norris-West Yellowstone loop (hereafter the "Lower Loop and West Entrance Road"). In 8 of the 57 years, roads would not have been open to administrative travel by December 15. In 16 years out of 57, public access would have been delayed until after the current opening date of December 15.

Spring closure dates closely match the date at which snowpack becomes isothermal (same temperature throughout the snowpack), which is the beginning of spring melt. Road closures due to snowmelt in the spring would have occurred earlier than March 4 in about 7 of those 57 years. Madison Junction is again a critical point for snowmobile travel on the Lower Loop and West Entrance Road; snowmelt starts there about 18 days before it begins at West Yellowstone.

For the road between East Entrance and Lake, Yellowstone Lake needs to be frozen before snow starts to accumulate in the Mary Bay area (Pers. Comm. M. Yochim). This is typically about a month after there is adequate snow on other portions of the road based on the SWE accumulation at the Lake Yellowstone station. Based on SWE and estimated road openings from 1949-2005, administrative travel would have been possible by December 15 on 55 of the past 57 years. Public travel would have been possible by December 15 on 50 of the past 57 years. For the past 57 years, snowmelt has always started after March 11.

The Mammoth to Norris section would have been open to administrative travel on 34 of the 57 years (based on 12 mm SWE at Mammoth) by December 15 while only 14 out of 57 years would have been open to public travel by December 15 (based on 25 mm SWE at Mammoth). Melt would close the roads before March 4 in 24 of the 57 years.

Access from the South Entrance (Snake River Station) to Grant Village would have been open to administrative travel by December 15 in all but 3 years over the past 57 years based on criteria shown above. Public access would have been possible in 49 of the past 57 years by December 15. Melt would have closed the roads by March 4 in only one of the past 57 years.

At Madison Junction, there is neither a weather station or snow course. However, winter maximum and minimum daily temperatures and daily snow depths and snowfall have been recorded for the majority of days between the time the snow starts to accumulate and when it melts. SWE was estimated on the first of the month using snow depths from Madison Junction and densities from West Yellowstone, Old Faithful and Norris Basin snow courses. Daily data were extrapolated using daily SWE from the West Yellowstone snow pillow (a device that measures snow water equivalent by measuring the weight of accumulated snow). Norris Basin has only a snow course. The daily SWE for the Norris Basin location was estimated using the Canyon snow pillow data to estimate the SWE distribution between the monthly measurements.

Mid-winter melt can be a problem for maintaining snow on the roadways. Days between December 15 and March 1 when daily minimum temperatures remained at or above $0^0$ C or $32^0$ F and whether or not precipitation was observed, were analyzed for all sites. Some mid-winter melt occurs almost every year. In over one-half of the cases, rain was recorded. The events were fairly well distributed across the period indicating that warm minimum temperatures with or without rain can occur at most anytime during the winter. Lower elevation sites, such as Mammoth, have more frequent occurrences of mid-winter melt and rain-on-snow events than do higher elevations sites.

## INTRODUCTION

Snowpack conditions can be quite variable over any period of record. In order to better understand when roads could have been open and closed to ORV's, the historic record of SWE was compared to criteria based on recent years of opening and closing dates. This report uses the SWE at measured sites along traveled corridors to estimate the opening and closing dates that would have occurred over the past 57 years (1949-2005) for most travel routes.

Snowpack and climate data have been collected at many locations in Grand Teton and Yellowstone National Parks. Measurements of climatic variables have been taken by the NPS, NWS and US Army since the late 1800's at Mammoth. Other stations were started in the early 1900's up to the late 1970's. Snow courses have been measured by the NRCS and NPS since the mid 1930's and most SNOTEL stations were started in the early 1980's. The U. S. Bureau of Reclamation installed four telemetered weather stations in the upper Snake River drainage in 1990 and 1991.

Snow water equivalent has been estimated for climatological stations using daily temperatures, precipitation and snow depth (Farnes et al., 1999 and Farnes et al., 2000). Daily data from these stations have been analyzed for their period of record to determine

the coldest temperature each winter, when the snowpack starts to accumulate, maximum SWE and date of maximum SWE, date snowpack melts, and various threshold values of SWE needed to sustain oversnow vehicle travel. Monthly average maximum, minimum, and average temperature and monthly precipitation have been summarized but the data are too extensive to be included in this report and are available on the data CD (see page 3).

There is considerable variability in how the snowpack develops and melts over the span of many years. In order to establish realistic opening and closing dates for use of oversnow vehicles on park roads, it is important to understand this variability. Generally, there is more variation from north to south than from west to east. Using historical snow and climate measurements at locations along these travel routes can provide an insight to this variability and historic climatic conditions.

This report provides long term data that should be useful in understanding historic patterns of snow accumulation and the variability over time. This information should provide the criteria for determining opening and closing dates of park roads to oversnow vehicles and historic variability of the snow accumulation at various locations in the two parks.

## METHODOLOGY

Snowpack and climate data have been collected at many locations in Grand Teton and Yellowstone National Parks. Stations near areas open to oversnow vehicle travel are shown in Table 1. Figure 1 shows these locations on a map. At climatological stations (Lake Yellowstone, Old Faithful, and Yellowstone Park often referred to as Mammoth) it was necessary to estimate missing records and to estimate the SWE using temperature, precipitation and snow depth. This procedure was described in detail in Farnes et al., 1999 and Farnes et al., 2000. Briefly, the SWE starts to accumulate when snow depth is first reported. SWE equals the accumulated precipitation prior to any melt. Melt was assumed to occur when the average daily temperature (Tavg) was above $0^0$ C or $32^0$ F. Melt rates were calculated from SNOTEL sites in the area and used to melt the accumulated SWE. Snow density was limited to a maximum of 45 percent and SWE was zero when snow depth was reported as zero. Sometimes, it was necessary to adjust melt rates to meet these criteria, usually related to readings of snow depth when melt depressions are present around the snow stake. The under-catch of winter precipitation in precipitation gages seems to balance sublimation losses from the snowpack so that the calculated SWE approximates that which would be measured with a snow sampler or snow sensor.

**Table 1.** Stations and period of record analyzed for determining opening and closing dates of oversnow vehicle travel in Grand Teton and Yellowstone National Parks.

| Station Name | Station Number | Station Type** | Period of Record Used | UTME | UTMN | Elev. m |
|---|---|---|---|---|---|---|
| Base Camp | WY10F02S | SNOTEL | 1989-2005 | 544497 | 4865389 | 2143 |
| Canyon | WY10E03S | SNOTEL | 1981-2005 | 538720 | 4951901 | 2420 |
| Glade Creek | WY10E13S | USBR | 1991-2005 | 521077 | 4882983 | 2146 |
| Grassy Lake | WY10E15S | SNOTEL | 1989-2005 | 514311 | 4886204 | 2214 |
| Huckleberry Divide | WY10E14S | USBR | 1991-2005 | 524990 | 4877042 | 2225 |
| Jackson Dam | WY10F04S | USBR | 1991-2005 | 533397 | 4856068 | 2057 |
| Lake Camp | WY10E04 | SC | 1936-2005 | 547302 | 4933730 | 2371 |
| Lake Yellowstone | WY5345 | CLIM | 1949-2005 | 548046 | 4933276 | 2368 |
| Lewis Lake Divide | WY10E09S | SNOTEL | 1984-2005 | 526653 | 4895097 | 2396 |
| Madison Junction | WY10E50 | WRS | 1983-2005 | 511135 | 4943768 | 2085 |
| Moran 5WNW | WY6440 | CLIM | 1949-2005 | 533038 | 4856038 | 2072 |
| Norris Basin | WY10E19 | SC | 1981-2005 | 523973 | 4953243 | 2280 |
| Old Faithful | WY6845 | CLIM | 1979-2005 | 513303 | 4922635 | 2243 |
| Old Faithful | WY10E18 | SC | 1975-2005 | 514129 | 4922356 | 2256 |
| Snake River Station | WY10E12S | SNOTEL | 1949-2005 | 526465 | 4886766 | 2109 |
| Sylvan Lake | WY10E06S | SNOTEL | 1984-2005 | 567179 | 4925288 | 2566 |
| Sylvan Road | WY10E20S | SNOTEL | 1990-2005 | 576501 | 4925452 | 2170 |
| Thumb Divide | WY10E07S | SNOTEL | 1988-2005 | 533685 | 4912994 | 2432 |
| West Yellowstone | MT11E07S | SNOTEL | 1949-2005 | 492710 | 4945001 | 2042 |
| Yellowstone Park* | WY9905 | CLIM | 1949-2005 | 523897 | 4980429 | 1899 |

* Also referred to as Mammoth. **SNOTEL indicates NRCS Snow Survey Telemetry site, USBR indicates U. S. Bureau of Reclamation telemetry site, CLIM indicates NWS climatological station, WRS is winter recreation station, and SC indicates NRCS snow course.

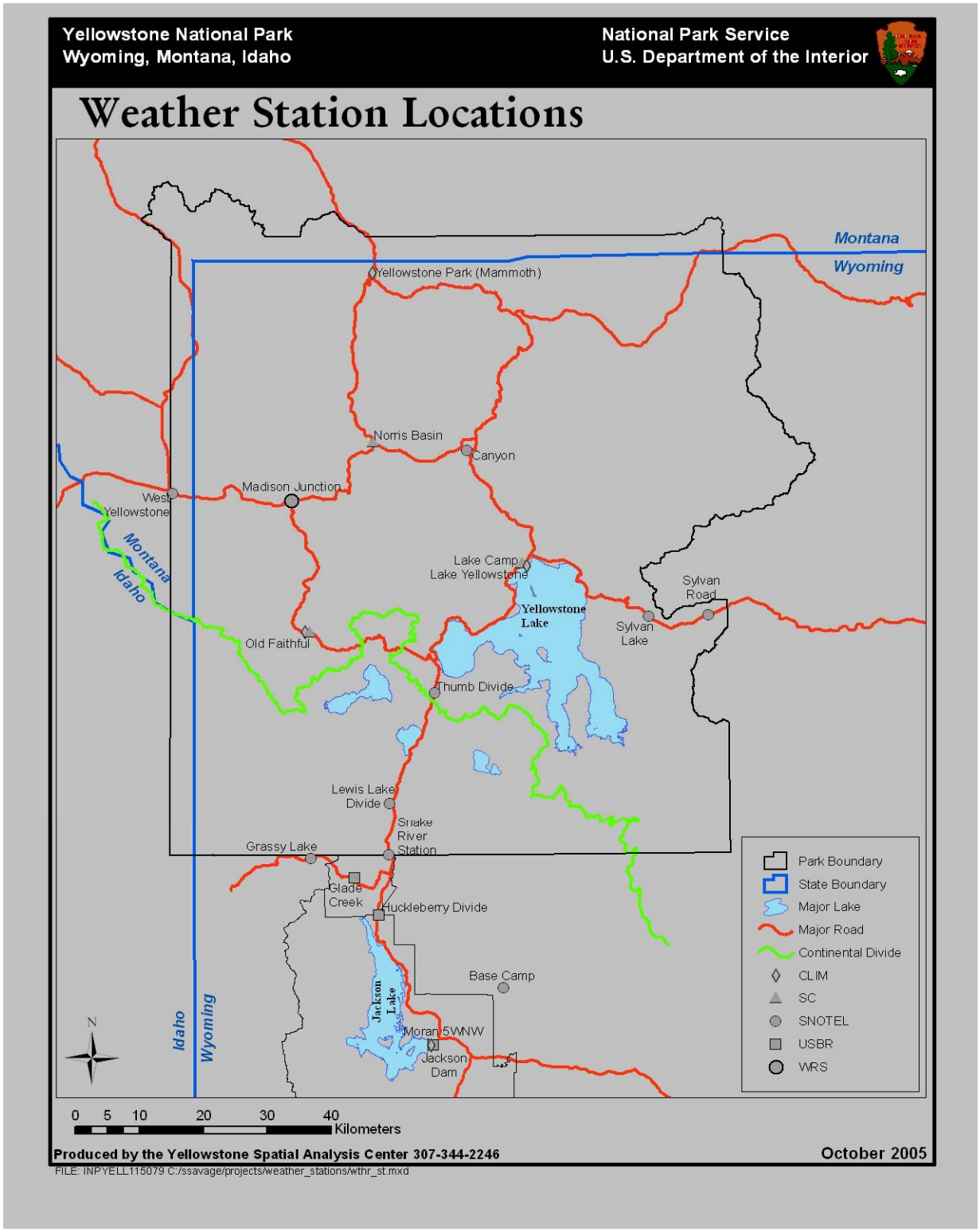


**Figure 1.** Map showing locations of data sites used for analysis of snow water equivalent, precipitation and temperature for oversnow vehicle use in Grand Teton and Yellowstone National Parks.

At Norris Basin, the snow course is only read on the first of January, February, March, April, and May. The snow depth, SWE, and density are measured. There is a fair correlation between SWE at Norris Basin and Canyon ($R^2 = .70$). The daily values for the snow pillow at the Canyon SNOTEL site were used to estimate the daily SWE for Norris Basin between the first of the month measurements since it is the only site with similar SWE that has daily data and is nearest to Norris Basin.

At Madison Junction, the snow depth, new snowfall, maximum and minimum temperatures are recorded for most days between the beginning of snow accumulation and the beginning of melt-off. SWE was estimated for the first of the month using density at West Yellowstone, Old Faithful and Norris Basin and the snow depth at Madison Junction. Daily values of the SWE for the snow pillow at West Yellowstone were used to estimate the daily SWE for Madison Junction between the first of the month SWE estimates. Records were available for 1975, 1979 and every year since 1983.

At Lake and Old Faithful there are snow courses, where snow depth and SWE are measured five times during the winter, and climatological stations, where temperature, precipitation and snow depth are observed daily. For this study, data from the climatological stations were used in the analysis because they provide daily estimates of SWE. The snow course at Lake is named Lake Camp and the climatological station is named Lake Yellowstone. At Old Faithful, both the snow course and climatological station are named Old Faithful.

At West Yellowstone, electronic records of climatic data started in the 1949 water year (October 1 through September 30). SWE was estimated using climatic data from 1949-March 1996. The climatic station was then moved 9 miles north of West Yellowstone and is now officially named West Yellowstone 9 NNW. Correlations between the West Yellowstone SNOTEL and West Yellowstone 9 NNW climatic site for both temperature and precipitation using the period from 1999 through 2004 were used to estimate the daily temperature and precipitation for the West Yellowstone station from April 1996 through September 1998 based on observations at the West Yellowstone 9 NNW site. Records from October 1, 1999 through the present were from the SNOTEL station. From 1967 through September 1998, there was a 6-foot diameter snow pillow with an on-site recorder at West Yellowstone (data was recorded on charts that were processed manually to obtain daily SWE). In October 1999, a SNOTEL site was installed at West Yellowstone and the 6-foot pillow replaced with a standard 10-foot snow pillow. The NRCS estimated the SWE for the West Yellowstone site from 1967 through 1998 using the correlation between the 6-foot and 10-foot snow pillows. Temperature, SWE and precipitation have been transmitted daily since October 1, 1999.

From park records, historic opening dates were compared to sites having the lowest SWE on those dates. Administrative travel using oversnow vehicles generally began when SWE reached about 25 mm or one inch. Public access was generally authorized when SWE reached about 40 mm or 1.5 inches of SWE. There have been some years when earlier openings were possible but were delayed until a couple of weeks before Christmas for administrative purposes.

Closing dates correlated better with the start of melt than with the amount of SWE. When melt begins, south and west facing slopes melt faster than snow on the level or snow shaded by trees or snow on north- or east-facing slopes. During the early part of the melt sequence, the snowpack starts becoming isothermal (all same temperature of $0^0$ C or $32^0$ F) and the snowpack becomes "rotten". In these conditions, oversnow vehicles sink into the snow pack. Sometimes sinking is uneven and it is difficult to keep vehicles from tipping or getting stuck. In many cases, road plowing began at about the same time, when the snowpack became isothermal. The melt-off was assumed to start on the day after the maximum SWE was reached for the season.

Mid-winter melting can also occur in the upper part of the snowpack for short periods of time, and may occur with or without rainfall. The snowpack generally re-stabilizes soon after cold temperatures return. Daily records were analyzed for all sites to determine the days between December 15 and March 1 when snow was present where minimum temperatures were $0^0$ C ($32^0$ F) or above and whether or not precipitation occurred that day. During these periods, over snow travel may need to be suspended until cooler temperatures return and the snowpack "sets up" or becomes firm again. It was assumed that if precipitation occurred when temperatures were above freezing, it was in the form of rain even though precipitation may fall as snow when temperatures are a little above freezing.

Daily SWE, temperature and precipitation for earlier years were calculated in previous studies (Farnes et al. 1999 and 2000, Farnes and Hansen 2002 and 2003, Farnes 2005). Records for all of the stations used in this report were updated through the snow melt-out in 2005.

## RESULTS

Snowpack at Madison Junction is the most critical for oversnow vehicle travel on the Lower Loop and West Entrance roads. The five–year moving average of days with 40 mm or 1.5 inches SWE (the amount necessary for public access) for Madison Junction is shown in Figure 2 and annual dates are shown in Appendix 1. The shorter record for Madison Junction can be compared with the longer record of West Yellowstone in Figure 3 to obtain an idea of the long term trends. On March 1, the average SWE at Madison Junction is about 66 percent of that of the West Yellowstone site.

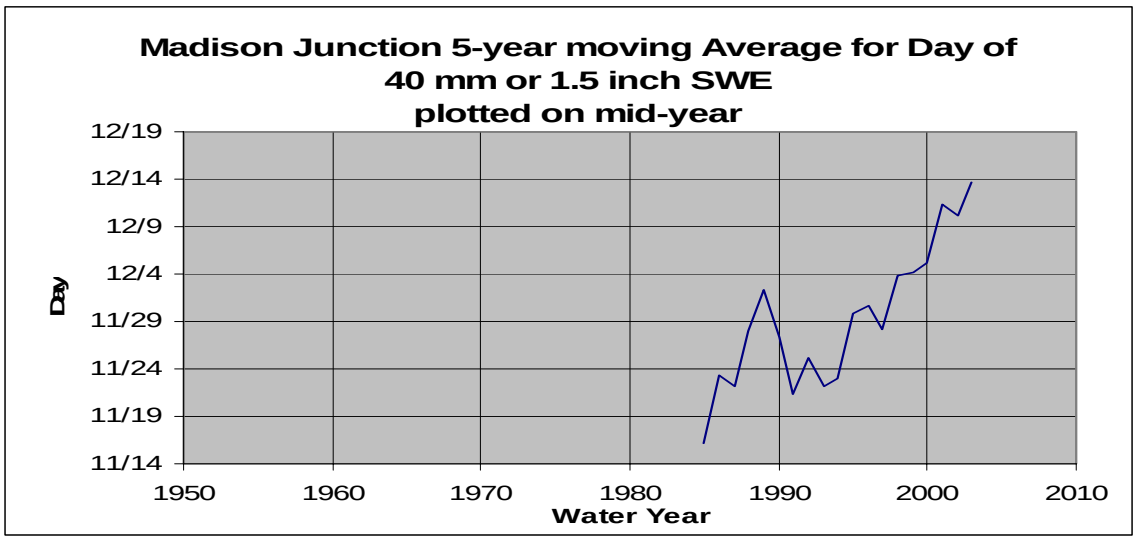


**Figure 2**. Five-year moving average of the day when Madison Junction has accumulated 40 mm or 1.5 inches of snow water equivalent needed for public OSV travel.

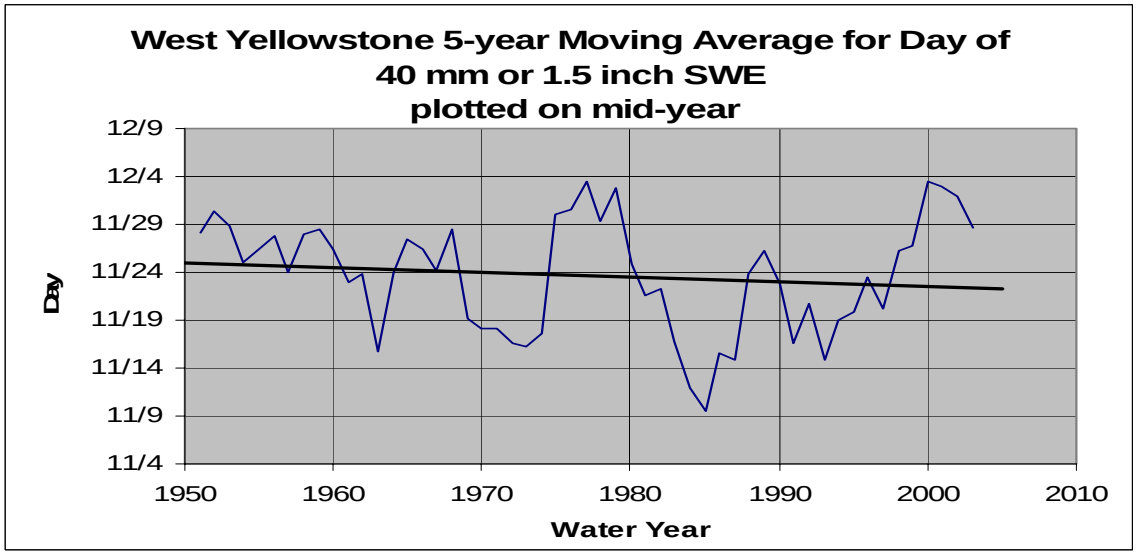


**Figure 3**. Five-year moving average and trend line of the day when West Yellowstone has accumulated 40 mm or 1.5 inches of snow water equivalent needed for public OSV travel.

SWE at the Yellowstone Park (Mammoth) station is critical for the public to use OSV travel from the Mammoth Hot Springs parking area to Norris Junction. Less SWE is required at the Mammoth station to open roads to OSV travel since the weather station is at a lower elevation than the starting area (about 130 meters or 430 feet). Figure 4 shows the five-year moving average and trend line of estimated opening dates for the Mammoth to Norris Junction road to OSV travel. Annual dates are shown in Appendix 2.

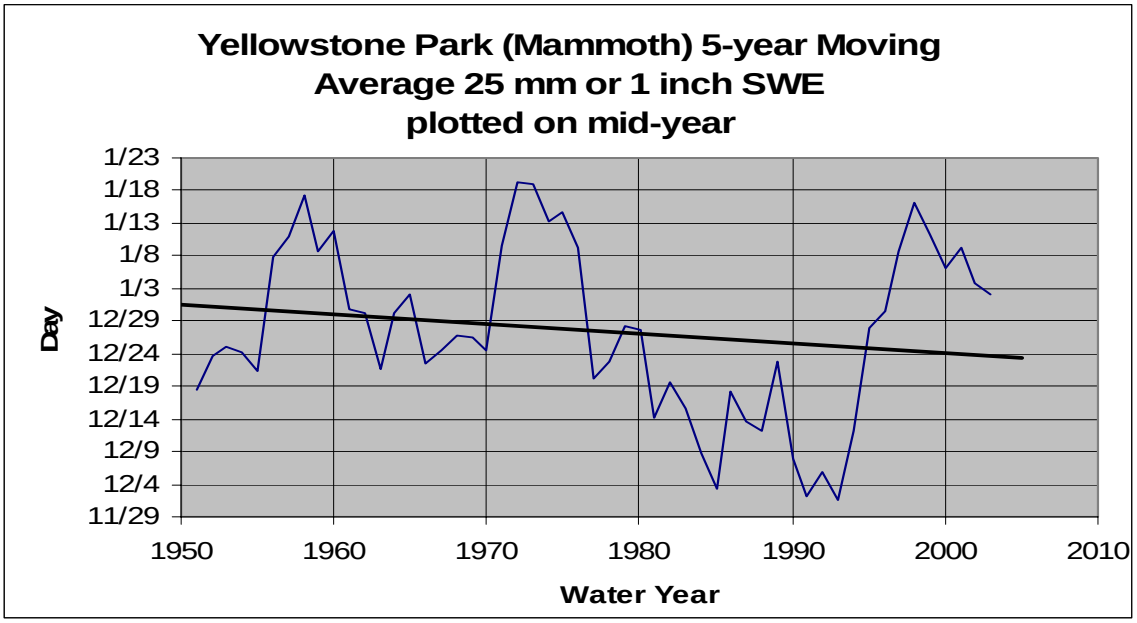


**Figure 4**. Five-year moving average and trend line of the day when Yellowstone Park (Mammoth) has accumulated 25 mm or 1 inch of snow water equivalent needed for public OSV travel.

Yellowstone Lake must be frozen before enough snow accumulates in the Mary Bay area to allow for public oversnow travel in that area, although enough snow has accumulated on the remainder of the East Entrance road by that date. Because few visitors travel this route, it is sometimes opened earlier than the freezing date of Yellowstone Lake when there is less snow at Mary Bay than desired. The safest time for public travel is after Yellowstone Lake has frozen. Figure 5 shows the five-year moving average and trend line of dates that Yellowstone Lake freezes. Annual dates are shown in Appendix 3.

The five-year moving averages of dates when other long-term or critical stations reach 40 mm or 1.5 inches SWE are shown in Figures 6 through 9. Stations with shorter records can be compared nearby stations having over 50 years of record to obtain the relationship of trends over a longer period than the shorter record station data might suggest.

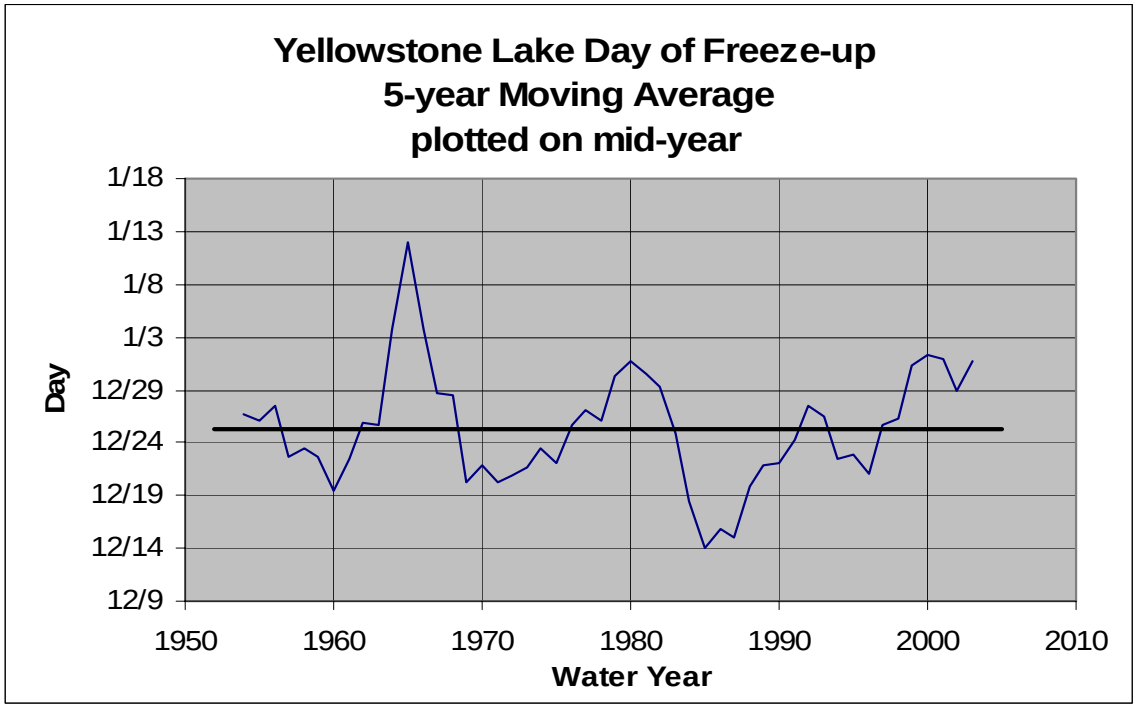


**Figure 5**. Five-year moving average and trend line of the day when Yellowstone Lake has frozen over.

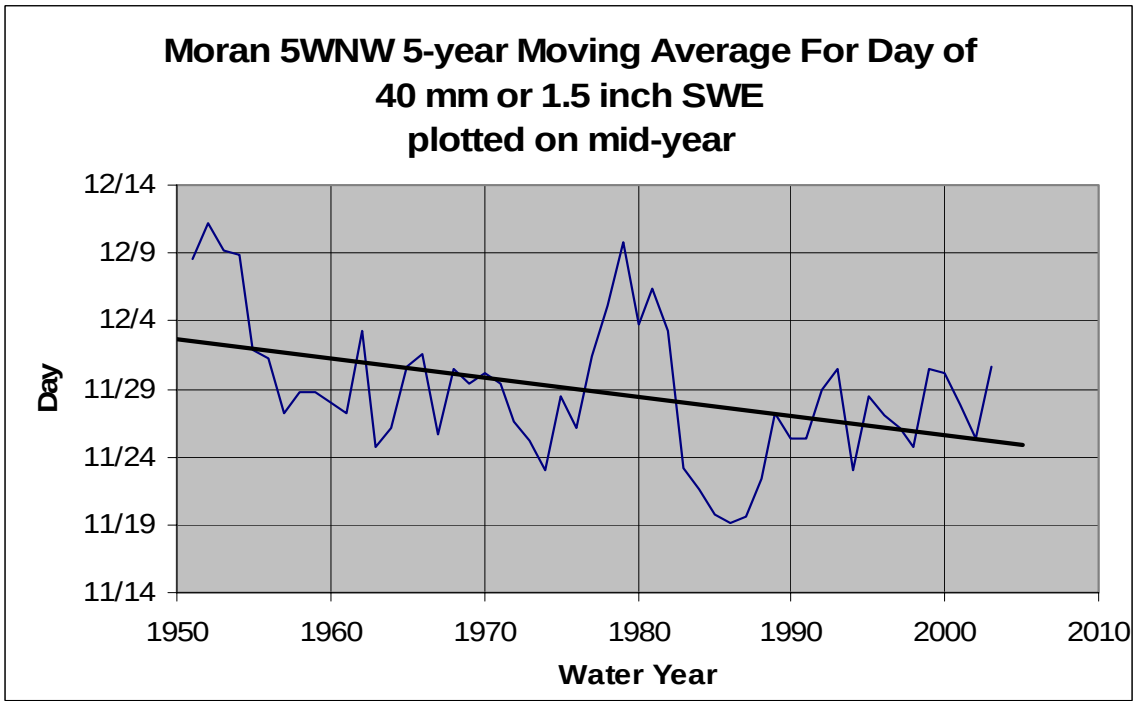


**Figure 6**. Five-year moving average and trend line of the day when Moran 5 WNW has accumulated 40 mm or 1.5 inches of snow water equivalent.

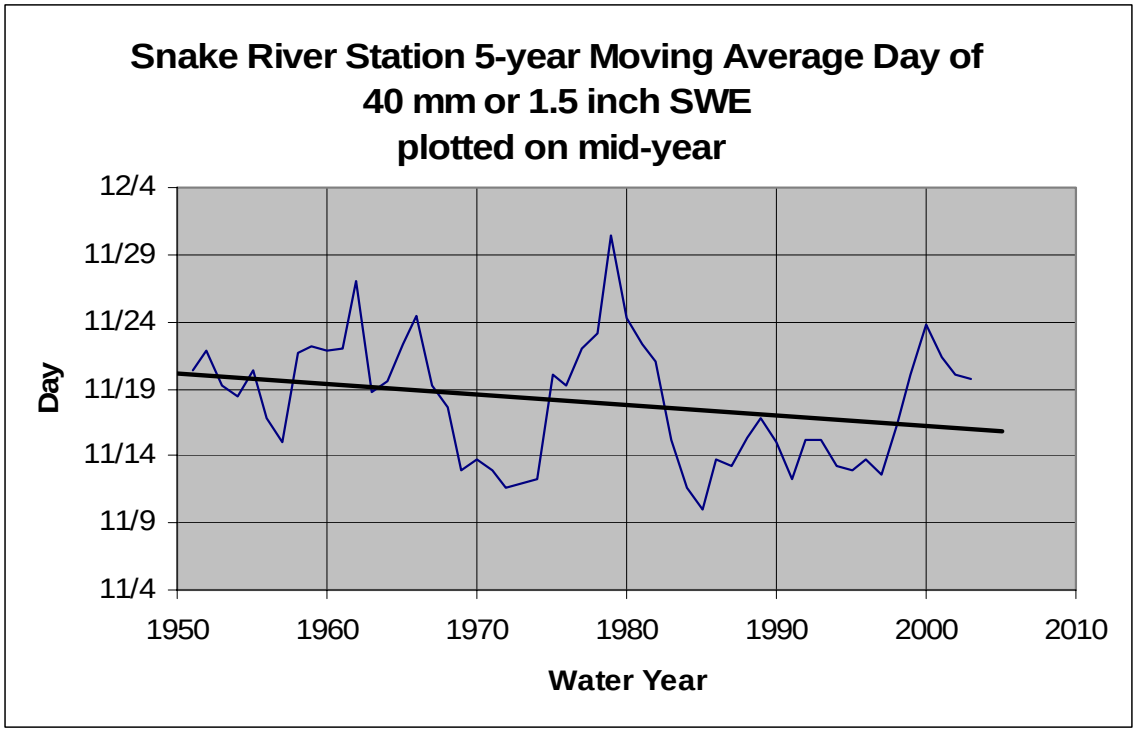


**Figure 7**. Five-year moving average and trend line of the day when Snake River Station has accumulated 40 mm or 1.5 inches of snow water equivalent needed for public OSV travel.

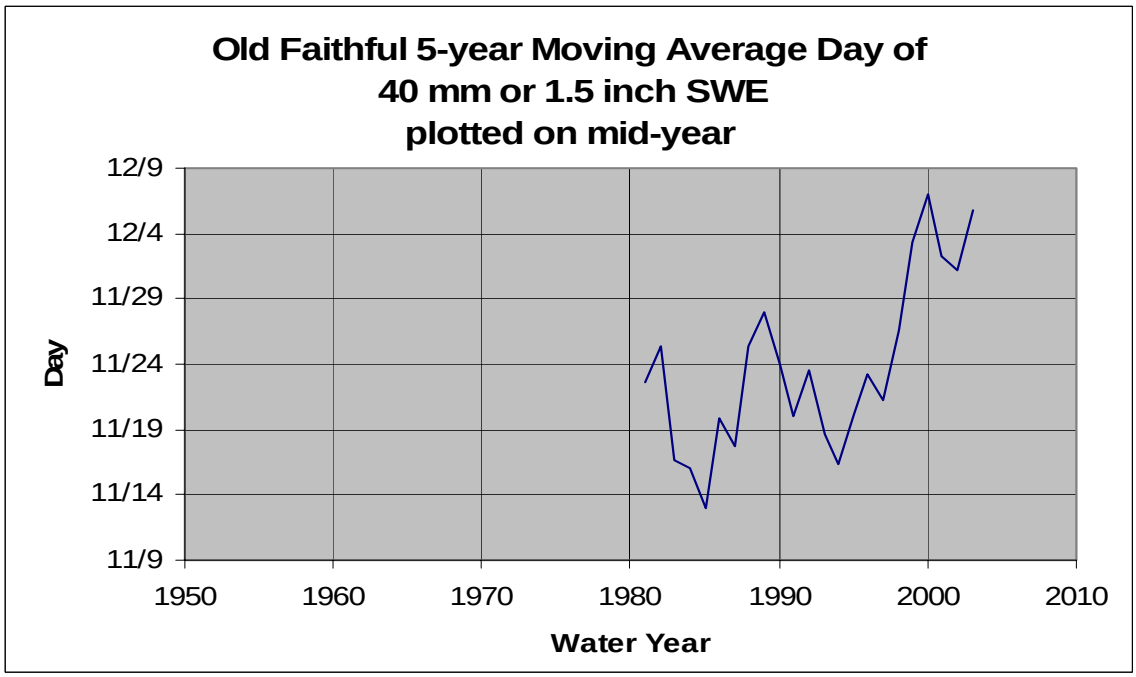


**Figure 8**. Five-year moving average of the day when Old Faithful has accumulated 40 mm or 1.5 inches of snow water equivalent needed for public OSV use. This record can be compared to West Yellowstone (Figure 3) to obtain a better idea of the long term trends than can be obtained from just this shorter record.

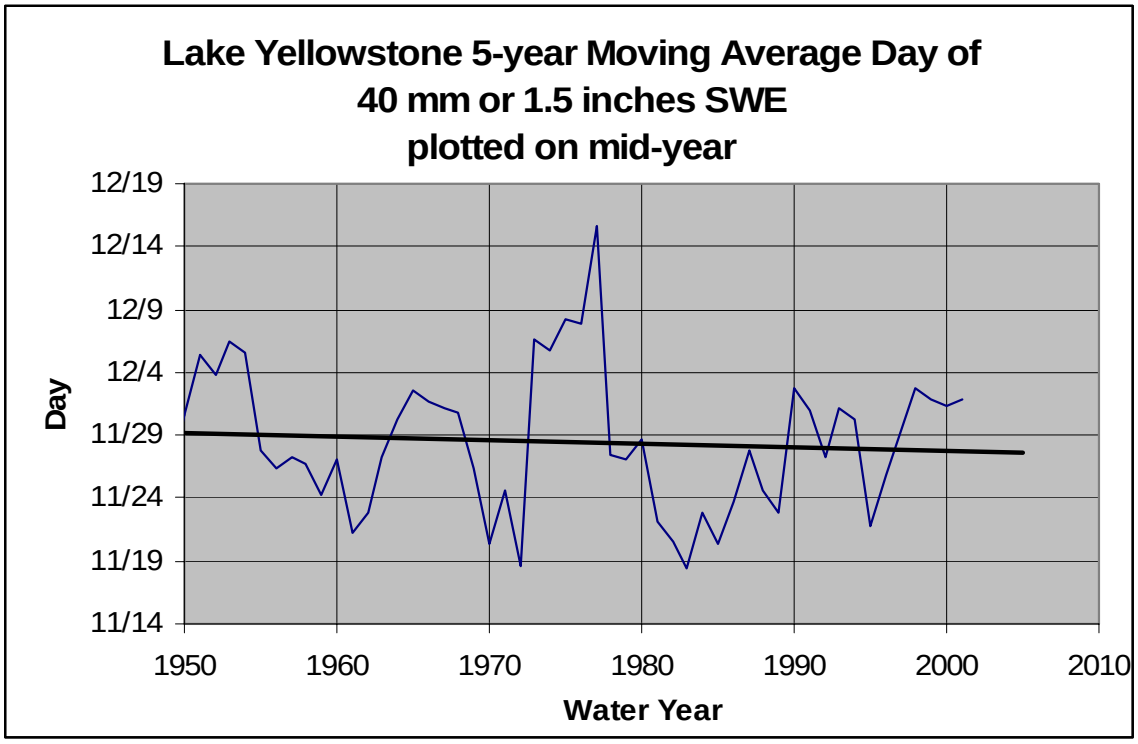


**Figure 9**. Five-year moving average and trend line of the day when Lake Yellowstone has accumulated 40 mm or 1.5 inches of snow water equivalent needed for public OSV travel.

Estimated dates of opening and closing of roads to both administrative and public oversnow vehicle access due to the snowpack at Madison Junction are shown in Appendix 1. These are projected dates as actual historic dates varied depending on many conditions including administrative needs. During periods of marginal snowpack at Madison Junction, it may still be possible to have access to Old Faithful and Lake and Canyon through the South Entrance. Appendix 2 shows projected (not actual historical) opening and closing dates of the Mammoth Hot Springs to Norris Junction road based on Yellowstone Park (Mammoth) records. Appendix 3 shows opening and closing dates of the road between East Entrance to Lake based on the freezing of Yellowstone Lake and Lake Yellowstone data. Appendix 4 shows opening and closing dates for starting area in Grand Teton National Park near Jackson Dam based on records from Moran 5NNW climatic station. The last record would pertain only to the Continental Divide Snowmobile Trail from Moran to Flagg Ranch.

There are thermal areas and wind scour areas along the road system that reduce snowpack on the roadway. These are localized areas that need to be addressed separately and are not considered in the analysis for this report.

A summary of cold temperatures and snow water equivalent and days is shown in Table 2 for the 1971-2000 base period.

**Table 2.** Averages for 1971-2000 base period for coldest temperature, day of coldest temperature, day snow starts to accumulate, maximum daily SWE, day of maximum SWE, day the accumulated snowpack melts out, day snowpack reaches 25mm or one inch SWE, and day snowpack reaches 40 mm or one and one-half inches SWE.

| Station Name | Cold $^0$C | Cold $^0$F | Day Cold | Day Snow Starts | Max. SWE mm | Max. SWE Inch | Day of Max. | Day Snow Ends | Day 25 mm or 1 in. SWE | Day 40 mm or 1.5 in. SWE |
|---|---|---|---|---|---|---|---|---|---|---|
| Base Camp | -31 | -23 | 1/09 | 10/28 | 490 | 19.3 | 4/03 | 5/23 | 11/10 | 11/15 |
| Canyon | -37 | -34 | 1/26 | 10/24 | 378 | 14.9 | 4/11 | 5/26 | 11/06 | 11/15 |
| Glade Creek | -38 | -36 | 1/23 | 10/30 | 592 | 23.3 | 4/07 | 5/21 | 11/08 | 11/13 |
| Grassy Lake | -33 | -28 | 1/15 | 10/18 | 940 | 37.0 | 4/14 | 6/07 | 10/30 | 11/03 |
| Huckleberry Divide | -33 | -27 | 1/14 | 10/30 | 589 | 23.2 | 4/11 | 5/22 | 11/05 | 11/10 |
| Jackson Dam | -34 | -30 | 1/25 | 10/28 | 371 | 14.6 | 4/02 | 5/11 | 11/11 | 11/15 |
| Lake Yellowstone | -37 | -35 | 1/24 | 11/03 | 229 | 9.0 | 4/09 | 5/14 | 11/18 | 11/27 |
| Lewis Lake Divide | -29 | -21 | 1/19 | 10/26 | 942 | 37.1 | 4/17 | 6/11 | 10/31 | 11/04 |
| Madison Junction | -38 | -36 | 1/09 | 11/04 | 203 | 8.0 | 3/15 | 4/24 | 11/23 | 11/29 |
| Moran 5WNW | -35 | -30 | 1/22 | 11/12 | 296 | 11.7 | 3/22 | 5/01 | 11/22 | 11/26 |
| Norris Basin | * | * | * | 10/24 | 345 | 13.6 | 4/08 | 5/15 | 11/09 | 11/17 |
| Old Faithful | -38 | -37 | 1/03 | 11/04 | 292 | 11.5 | 3/29 | 5/07 | 11/18 | 11/24 |
| Snake River Station | -36 | -33 | 1/06 | 11/01 | 491 | 19.3 | 4/05 | 5/16 | 11/10 | 11/16 |
| Sylvan Lake | -34 | -30 | 12/25 | 10/16 | 622 | 24.5 | 4/25 | 6/10 | 10/20 | 10/28 |
| Sylvan Road | -34 | -29 | 1/02 | 10/28 | 356 | 14.0 | 4/09 | 5/16 | 11/08 | 11/14 |
| Thumb Divide | -37 | -34 | 1/18 | 10/27 | 488 | 19.2 | 4/18 | 5/25 | 11/05 | 11/11 |
| West Yellowstone | -39 | -38 | 1/09 | 10/30 | 346 | 13.6 | 4/02 | 5/08 | 11/16 | 11/21 |
| Yellowstone Park | -29 | -21 | 1/06 | 12/06 | 51 | 2.0 | 2/23 | 3/11 | 12/13[1] | 1/09[2] |

Cold indicates coldest temperature for the winter

* No temperature observations at Norris Basin

[1] Not enough snow to reach threshold in 3 years, average of remaining years

[2] Not enough snow to reach threshold in 5 years, average of remaining years

Occasionally, warm minimum temperatures and/or rain have occurred during the winter season. This causes part of the snowpack to become isothermal or "rotten" similar to spring melt. Days when Tmin stays above $0^0$ C or $32^0$ F between December 15 and March 1 when there was snowpack present has been determined for all stations analyzed in this report. Results are shown in Table 3.

Stations with shorter records were compared to those with longer records to obtain a realistic probability for the previous 57 years. Using data from 1949-2005, it appears that the Lower Loop and West Entrance roads would have opened to the public about 7 days after they opened to administrative travel. In 8 of the past 57 years, roads would not have been open to administrative travel by December 15. In 16 years out of 57, public access would need to have been delayed until after December 15. Closures due to snowmelt in the spring would have occurred earlier than March 4 in about 7 of those 57 years. Madison Junction has the earliest start of melt-off of any point on the Lower Loop-West Entrance road system. Melt there begins an average of 18 days before it begins at West Yellowstone.

Precipitation trends indicate that the winter precipitation has been decreasing in this area and winter temperatures have been increasing (Farnes 2005). If these trends

continue, they could affect the opening and closing dates for oversnow vehicle travel in Grand Teton and Yellowstone National Parks.

**Table 3**. Number of events for period of record where Tmin was above $0^0$ C or $32^0$ F, whether there was rain associated with the event, and distribution of events by half-month periods.

| | | | | | | Events by half-month periods | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Years Record | Events (Days) | No. with Rain | No. W/O Rain | % with Rain | 12/15-12/31 | 1/1-1/15 | 1/16-1/31 | 2/1-2/15 | 2/16-3/1 |
| Base Camp | 17 | 4 | 2 | 2 | 50 | | 3 | | | 1 |
| Canyon | 25 | 2 | 1 | 1 | 50 | | 1 | 1 | | |
| Glade Creek | 15 | 11 | 10 | 1 | 90 | 1 | 4 | 2 | 2 | 2 |
| Grassy Lake | 17 | 3 | 1 | 2 | 33 | | 1 | | 1 | |
| Huckleberry Divide | 15 | 4 | 3 | 1 | 75 | 2 | 1 | | 1 | |
| Jackson Dam | 15 | 6 | 5 | 1 | 83 | | 1 | 1 | 1 | 3 |
| Lake Yellowstone | 57 | 5 | 4 | 1 | 80 | | 2 | | 1 | 2 |
| Lewis Lake Divide | 22 | 11 | 8 | 3 | 73 | | 2 | 1 | 2 | 7 |
| Madison Junction | 23 | 4 | 1 | 3 | 25 | | 1 | | 2 | 1 |
| Moran 5WNW | 57 | 48 | 43 | 5 | 90 | 6 | 8 | 10 | 12 | 12 |
| Old Faithful | 27 | 5 | 2 | 3 | 40 | | 1 | | 1 | 3 |
| Snake River Station | 57 | 23 | 21 | 2 | 91 | 3 | 8 | 4 | 3 | 5 |
| Sylvan Lake | 22 | 1 | 0 | 1 | 0 | | | | | 1 |
| Sylvan Road | 16 | 7 | 6 | 1 | 86 | | 2 | | 4 | 1 |
| Thumb Divide | 18 | 3 | 2 | 1 | 66 | | 1 | 1 | 1 | |
| West Yellowstone | 57 | 21 | 12 | 9 | 57 | 1 | 6 | 5 | 2 | 7 |
| Yellowstone Park (Mammoth) | 57 | 96 | 45 | 51 | 47 | 9 | 19 | 20 | 24 | 24 |
| Sum of all stations | 517 | 254 | 166 | 88 | 65 | 22 | 61 | 45 | 57 | 69 |
| Percent | | | | | | 9 | 24 | 18 | 22 | 27 |
| Sum w/o Mammoth | 460 | 158 | 121 | 37 | 77 | 13 | 42 | 25 | 33 | 45 |
| Percent | | | | | | 8 | 27 | 16 | 21 | 28 |

## DISCUSSION

Feasible opening and closing dates for use of oversnow vehicles in Grand Teton and Yellowstone National Parks depends on the accumulated snowpack. Opening and closing dates may also be affected by NPS staffing levels, spring plowing, and administrative decisions. Low snow years with inadequate snow for oversnow vehicle travel by mid-December, prompt the question of whether the roads should be plowed to provide access by wheeled vehicles or whether the limited snow on them should be preserved until more snow falls. Neither of these alternatives comes without associated problems. Plowing roads means that it may take longer for adequate snow accumulation to arrive while leaving less than adequate amounts of snow on the roads makes travel by OSV difficult, impossible or somewhat unsafe.

All SNOTEL sites are on telemetry and they can be accessed via the web at (www.nrcs.usda.gov/snow). These stations can provide an insight into current snowpack accumulations. Jackson Dam site is on the U. S. Bureau of Reclamation's web site at www.usbr.gov/pn/hydromet/webhydracread.html and is indicative of snow accumulations at the Moran 5 WNW station and Jackson Lake Junction.

The West Yellowstone SNOTEL could be used as an indicator of when the Lower Loop-West Entrance road could be opened. Relationship between West Yellowstone SNOTEL and Madison Junction indicates that about 40 mm or 1.5 inches SWE at West is comparable to 25 mm or 1 inch at Madison Junction which represents the snow needed for opening roads to administrative oversnow vehicle travel. About 60 mm or 2.3 inches of SWE at West Yellowstone is comparable to 40 mm or 1.5 inches at Madison Junction and represents the approximate amount of SWE needed to open the Lower Loop-West Entrance road to public oversnow vehicle travel. The Resource Division at Lake Ranger Station monitors the freezing of Yellowstone Lake and could provide this information to determine when the road between East Entrance and Lake could be opened. Finally, increases in SWE and changes in temperature at the Sylvan Lake SNOTEL might be used to assess avalanche danger in the Sylvan Pass area. Winter storms usually travel from the west to east or southwest to northeast and are influenced by the jet stream. Generally, there is more variability in the park snowpack from north to south than from east to west.

## RECOMMENDATIONS

The NPS should consider installing an automated station at Madison Junction to obtain temperature, precipitation, and SWE electronically. This site is the most critical location in the Lower loop-West Entrance road system. Generally, when there is adequate snow at Madison Junction, there is adequate snow all around the loop (except for thermal areas and wind scour areas). Also, data from this location would be important for wildlife studies as it is in a critical wintering area and travel corridor for migrating elk and bison.

Consideration needs to be given to using the snow water equivalent model developed at Colorado State University for Yellowstone National Park and the Snake River Drainage above Jackson, Wyoming with the assistance from the authors of this report. The Snake River model is operational and can provide estimated daily SWE on 30 m pixels. The Yellowstone model has been developed to provide daily SWE on 100 m pixels but does need to be validated for lower elevations of the Madison River Drainage and the Northern Range. Data input to these models uses the daily data from the same stations used in this report and additional stations outside this study area.

These models would provide valuable information to all resource managers in both parks, not just to those involved with oversnow vehicle use. The NPS should be the lead agency that runs and updates these models and distributes the data to its staff, other agencies and the public.

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# APPENDICES

**Appendix 1**. Estimated opening and closing dates of oversnow vehicle access for the Lower loop-West Entrance road system based on Madison Junction data.

| Water Year | Opening Day for Admin Travel[1] | Opening Day for Public Travel[2] | Closing Day for All Travel[3] | Remarks |
|---|---|---|---|---|
| | | | | |
| 1983 | 11/19 | 11/16 | 3/12 | |
| 1984 | 11/23 | 11/26 | 3/10 | |
| 1985 | 10/29 | 11/02 | 3/04 | |
| 1986 | 11/08 | 11/16 | 4/02 | |
| 1987 | 11/11 | 11/21 | 3/06 | |
| 1988 | 12/10 | 12/22 | 4/06 | |
| 1989 | 11/17 | 11/20 | 4/05 | |
| 1990 | 11/26 | 12/01 | 3/19 | |
| 1991 | 11/21 | 12/08 | 2/03 | |
| 1992 | 10/25 | 10/27 | 3/04 | |
| 1993 | 11/08 | 11/22 | 3/16 | |
| 1994 | 12/05 | 12/09 | 3/01 | |
| 1995 | 11/12 | 11/16 | 2/18 | |
| 1996 | 12/11 | 12/12 | 4/02 | |
| 1997 | 11/21 | 11/30 | 3/20 | |
| 1998 | 11/25 | 11/26 | 3/12 | |
| 1999 | 11/23 | 11/27 | 3/15 | |
| 2000 | 12/07 | 12/14 | 3/03 | |
| 2001 | 12/06 | 12/14 | 3/04 | |
| 2002 | 12/02 | 12/05 | 3/20 | |
| 2003 | 12/10 | 12/27 | 3/09 | |
| 2004 | 11/14 | 11/21 | 3/12 | |
| 2005 | 12/08 | 12/31 | 2/22 | |
| | | | | |
| 71-00 Avg | 11/22 | 11/29 | 3/11 | |

[1] Based on 25 mm or 1 inch SWE
[2] Based on 40 mm SWE or 1.5 inches SWE
[3] Based on day of maximum SWE

**Appendix 2**. Estimated opening and closing dates of oversnow vehicle access for the Mammoth to Norris Junction based on Yellowstone Park (Mammoth) data.

| Water Year | Opening Day for Admin Travel[1] | Opening Day for Public Travel[2] | Closing Day for All Travel[3] | Remarks |
|---|---|---|---|---|
| 1949 | 11/15 | 11/24 | 3/17 | |
| 1950 | 12/19 | 12/24 | 2/04 | |
| 1951 | 12/01 | 1/04 | 3/19 | |
| 1952 | 12/13 | 12/19 | 3/27 | |
| 1953 | 12/03 | 12/20 | 1/10 | |
| 1954 | 12/09 | 12/20 | 3/06 | |
| 1955 | 12/07 | 12/31 | 3/28 | |
| 1956 | 12/26 | 12/31 | 3/16 | |
| 1957 | 11/17 | 12/05 | 3/15 | |
| 1958 | 3/09 | 3/17 | 3/31 | |
| 1959 | 12/12 | 1/05 | 3/15 | |
| 1960 | 1/06 | 1/31 | 3/18 | |
| 1961 | 11/15 | 11/18 | 3/12 | |
| 1962 | 11/21 | 12/21 | 3/06 | |
| 1963 | 12/20 | 1/16 | 1/31 | |
| 1964 | 12/09 | 1/02 | 3/28 | |
| 1965 | 12/04 | 12/19 | 3/28 | |
| 1966 | 12/27 | 12/31 | 3/08 | |
| 1967 | 12/31 | 1/05 | 3/16 | |
| 1968 | 11/19 | 11/24 | 2/17 | |
| 1969 | 12/28 | 1/11 | 3/12 | |
| 1970 | 12/22 | 12/31 | 2/05 | |
| 1971 | 12/18 | 12/29 | 3/09 | |
| 1972 | 12/07 | 12/26 | 2/12 | |
| 1973 | 12/04 | 2/12 | 2/26 | |
| 1974 | 2/01 | 3/01 | 3/16 | |
| 1975 | 12/15 | 12/30 | 3/01 | |
| 1976 | 11/27 | 12/01 | 3/30 | |
| 1977 | 12/01 | 1/02 | 3/02 | |
| 1978 | 12/16 | 1/15 | 3/04 | |
| 1979 | 11/13 | 11/21 | 3/05 | |
| 1980 | 1/09 | 1/12 | 2/27 | |
| 1981 | -- | -- | 2/13 | Maximum SWE was 0.4 inches |
| 1982 | 12/17 | 12/31 | 2/14 | |
| 1983 | 11/09 | 11/22 | 2/18 | |

Starting area is about 130 m or 430 feet elevation higher than weather station.

[1] Based on 12 mm or 0.5 inch SWE

[2] Based on 25 mm SWE or 1 inch SWE

[3] Based on day of maximum SWE

**Appendix 2 (Cont.).** Estimated opening and closing dates of oversnow vehicle access for the Mammoth to Norris Junction based on Yellowstone Park (Mammoth) data.

| Water Year | Opening Day for Admin Travel[1] | Opening Day for Public Travel[2] | Closing Day for All Travel[3] | Remarks |
|---|---|---|---|---|
| 1984 | 11/25 | 12/12 | 3/01 | |
| 1985 | 12/24 | 12/28 | 3/14 | |
| 1986 | 11/09 | 11/11 | 1/19 | |
| 1987 | -- | -- | 3/10 | Maximum SWE was 0.4 inches |
| 1988 | 12/17 | 1/21 | 2/26 | |
| 1989 | 11/22 | 11/24 | 2/24 | |
| 1990 | 12/15 | 12/22 | 3/02 | |
| 1991 | 12/28 | -- | 2/09 | Maximum SWE was 0.9 inches |
| 1992 | 10/23 | 10/24 | 11/08 | Melted out early – some accumulated later |
| 1993 | 12/09 | 12/30 | 3/05 | |
| 1994 | 11/23 | 12/09 | 2/28 | |
| 1995 | 11/26 | 12/04 | 2/18 | |
| 1996 | 1/10 | 1/24 | 3/08 | |
| 1997 | 1/08 | 1/10 | 3/10 | |
| 1998 | 1/10 | 1/12 | 3/12 | |
| 1999 | 1/18 | 1/24 | 3/13 | |
| 2000 | 12/20 | 1/11 | 2/07 | |
| 2001 | 12/10 | 12/30 | 3/05 | |
| 2002 | 11/29 | 12/15 | 3/22 | |
| 2003 | 1/05 | 1/28 | 3/09 | |
| 2004 | 11/17 | 12/28 | 3/08 | |
| 2005 | 1/01 | 1/02 | 2/25 | |
| | | | | |
| 71-00 Avg | 12/12 | 12/13 | 2/23 | |

Starting area is about 130 m or 430 feet elevation higher than weather station.

[1] Based on 12 mm or 0.5 inch SWE

[2] Based on 25 mm SWE or 1 inch SWE

[3] Based on day of maximum SWE

**Appendix 3.** Estimated opening and closing dates of oversnow vehicle access for the road between East Entrance and Lake Junction based on Lake Yellowstone data and day Yellowstone Lake freezes over.

| Water Year | Lake Yellowstone [1] | Lake Yellowstone [2] | Opening-Day Yellowstone Lake is Frozen [3] | Closing Day for All Travel[4] | Remarks |
|---|---|---|---|---|---|
| 1949 | 11/15 | 11/20 | N/R | 4/11 | |
| 1950 | 11/28 | 12/09 | N/R | 4/14 | |
| 1951 | 11/18 | 11/22 | N/R | 3/30 | |
| 1952 | 10/20 | 10/24 | 12/26 | 4/06 | |
| 1953 | 12/08 | 12/20 | 12/25 | 4/20 | |
| 1954 | 12/17 | 12/19 | 1/11 | 4/16 | |
| 1955 | 12/13 | 1/02 | N/R | 4/25 | |
| 1956 | 11/10 | 11/14 | 12/14 | 4/10 | |
| 1957 | 11/01 | 11/06 | 12/23 | 4/20 | |
| 1958 | 12/02 | 12/16 | 12/31 | 4/15 | |
| 1959 | 11/10 | 11/10 | N/R | 3/31 | |
| 1960 | 11/25 | 12/26 | 12/18 | 3/22 | Opening 12/26 |
| 1961 | 11/12 | 11/18 | 12/11 | 3/12 | |
| 1962 | 10/28 | 11/04 | 12/10 | 4/07 | |
| 1963 | 11/23 | 12/03 | 1/12 | 4/12 | |
| 1964 | 11/16 | 11/24 | 1/08 | 3/31 | |
| 1965 | 11/26 | 11/27 | N/R | 4/20 | |
| 1966 | 11/24 | 11/26 | 1/16 | 3/28 | |
| 1967 | 11/11 | 11/26 | N/R | 4/27 | |
| 1968 | 11/30 | 12/18 | 12/15 | 3/27 | Opening 12/18 |
| 1969 | 11/25 | 12/06 | 12/21 | 4/08 | |
| 1970 | 12/21 | 11/22 | 12/28 | 5/02 | |
| 1971 | 11/20 | 11/24 | 12/14 | 4/14 | |
| 1972 | 11/01 | 11/24 | 12/28 | 3/05 | |
| 1973 | 11/15 | 11/26 | 12/10 | 5/03 | |
| 1974 | 11/03 | 11/06 | 12/24 | 4/08 | |
| 1975 | 12/15 | 12/13 | 1/01 | 5/09 | |
| 1976 | 10/22 | 10/25 | N/R | 4/06 | |
| 1977 | 1/04 | 2/22 | N/R | 4/03 | |
| 1978 | 11/14 | 11/22 | 12/21 | 3/22 | |
| 1979 | 11/10 | 11/18 | 12/28 | 4/15 | |
| 1980 | 11/25 | 12/11 | 12/29 | 4/14 | |
| 1981 | 12/01 | 12/03 | 1/12 | 4/14 | |

[1] Based on 25 mm SWE or 1 inch SWE
[2] Based on 40 mm SWE or 1.5 inch SWE
[3] Based on NPS Resource Staff Records
[4] Based on day of maximum SWE
N/R - No Record

**Appendix 3 (Cont).** Opening and closing dates of oversnow vehicle access for the road between East Entrance and Lake Junction based on Lake Yellowstone data and day Yellowstone Lake freezes over.

| Water Year | Lake Yellowstone [1] | Lake Yellowstone [2] | Opening-Day Yellowstone Lake is Frozen [3] | Closing Day for All Travel[4] | Remarks |
|---|---|---|---|---|---|
| 1982 | 11/19 | 11/23 | 1/07 | 4/23 | |
| 1983 | 11/13 | 11/20 | 12/15 | 4/20 | |
| 1984 | 11/20 | 11/26 | 12/22 | 4/15 | |
| 1985 | 10/28 | 11/9 | 12/06 | 4/01 | |
| 1986 | 11/17 | 11/25 | 12/11 | 3/21 | |
| 1987 | 11/10 | 11/12 | 12/16 | 4/04 | |
| 1988 | 12/07 | 12/12 | 12/24 | 4/11 | |
| 1989 | 11/14 | 11/14 | 12/18 | 4/05 | |
| 1990 | 11/14 | 11/26 | 12/30 | 3/31 | |
| 1991 | 12/02 | 12/15 | 12/21 | 5/06 | |
| 1992 | 10/24 | 10/27 | 12/17 | 4/01 | |
| 1993 | 11/19 | 12/03 | 1/04 | 5/02 | |
| 1994 | 12/12 | 1/03 | 12/27 | 4/16 | Opening 1/03 |
| 1995 | 11/18 | 11/17 | 12/25 | 4/04 | |
| 1996 | 11/12 | 11/26 | 12/01 | 4/01 | |
| 1997 | 11/14 | 11/16 | 12/19 | 4/13 | |
| 1998 | 11/18 | 11/28 | 12/26 | 4/21 | |
| 1999 | 11/20 | 11/22 | 1/26 | 3/20 | |
| 2000 | 11/27 | 12/07 | 12/28 | 4/05 | |
| 2001 | 12/11 | 12/15 | 12/27 | 4/17 | |
| 2002 | 12/01 | 12/02 | 12/24 | 3/22 | |
| 2003 | 11/11 | 11/23 | 12/24 | 4/09 | |
| 2004 | 11/12 | 11/20 | 1/11 | 3/18 | |
| 2005 | 11/28 | 12/09 | 1/11 | 4/22 | |
| | | | | | |
| 71-00 Avg | 11/18 | 11/27 | 12/24 | 4/09 | |

[1] Based on 25 mm SWE or 1 inch SWE
[2] Based on 40 mm SWE or 1.5 inch SWE
[3] Based on NPS Resource Staff Records
[4] Based on day of maximum SWE
N/R - No Record

**Appendix 4.** Estimated opening and closing dates of oversnow vehicle access at Jackson Lake Junction based on Moran 5 WNW data.

| Water Year | Opening Day for Admin Travel[1] | Opening Day for Public Travel[2] | Closing Day for All Travel[3] | Remarks |
|---|---|---|---|---|
| 1949 | 11/17 | 11/23 | 3/14 | |
| 1950 | 12/24 | 1/09 | 3/30 | |
| 1951 | 11/18 | 11/20 | 3/30 | |
| 1952 | 11/21 | 12/10 | 4/15 | |
| 1953 | 12/08 | 12/10 | 4/15 | |
| 1954 | 11/26 | 12/06 | 4/13 | |
| 1955 | 12/13 | 12/30 | 3/28 | |
| 1956 | 11/14 | 11/18 | 3/22 | |
| 1957 | 10/30 | 11/05 | 4/08 | |
| 1958 | 11/28 | 12/07 | 3/28 | |
| 1959 | 11/14 | 11/16 | 3/31 | |
| 1960 | 1/05 | 1/07 | 3/22 | |
| 1961 | 11/15 | 11/18 | 3/13 | |
| 1962 | 10/29 | 11/01 | 4/12 | |
| 1963 | 11/27 | 12/03 | 3/19 | |
| 1964 | 12/09 | 12/16 | 3/31 | |
| 1965 | 11/25 | 11/26 | 3/30 | |
| 1966 | 11/23 | 11/25 | 3/27 | |
| 1967 | 11/11 | 11/23 | 3/08 | |
| 1968 | 11/30 | 12/08 | 3/23 | |
| 1969 | 11/14 | 11/16 | 3/30 | |
| 1970 | 12/12 | 12/20 | 4/04 | |
| 1971 | 11/12 | 11/20 | 3/29 | |
| 1972 | 11/26 | 11/27 | 3/05 | |
| 1973 | 12/03 | 12/04 | 4/09 | |
| 1974 | 11/10 | 11/02 | 3/14 | |
| 1975 | 12/05 | 12/13 | 4/19 | |
| 1976 | 10/26 | 11/09 | 4/04 | |
| 1977 | 12/09 | 12/24 | 4/06 | |
| 1978 | 11/22 | 11/23 | 3/05 | |
| 1979 | 11/22 | 11/28 | 3/05 | |
| 1980 | 12/03 | 1/01 | 4/13 | |
| 1981 | 11/30 | 12/02 | 3/22 | |
| 1982 | 11/24 | 11/24 | 4/10 | |

[1] Based on 25 mm SWE or 1 inch SWE
[2] Based on 40 mm SWE or 1.5 inch SWE
[3] Based on day of maximum SWE

**Appendix 4 (Cont).** Estimated opening and closing dates of oversnow vehicle access at Jackson Lake Junction based on Moran 5 WNW data.

| Water Year | Opening Day for Admin Travel[1] | Opening Day for Public Travel[2] | Closing Day for All Travel[3] | Remarks |
|---|---|---|---|---|
| 1983 | 11/29 | 12/06 | 4/09 | |
| 1984 | 11/08 | 11/12 | 3/12 | |
| 1985 | 11/08 | 11/12 | 3/31 | |
| 1986 | 11/13 | 11/24 | 3/20 | |
| 1987 | 11/10 | 11/15 | 3/05 | |
| 1988 | 12/02 | 12/03 | 4/05 | |
| 1989 | 11/14 | 11/14 | 4/04 | |
| 1990 | 11/26 | 11/26 | 3/08 | |
| 1991 | 11/13 | 11/19 | 3/30 | |
| 1992 | 11/05 | 11/09 | 3/25 | |
| 1993 | 11/12 | 12/01 | 3/22 | |
| 1994 | 12/01 | 12/02 | 3/17 | |
| 1995 | 11/05 | 11/07 | 3/31 | |
| 1996 | 11/08 | 11/11 | 3/31 | |
| 1997 | 11/04 | 11/07 | 4/14 | |
| 1998 | 11/18 | 11/19 | 3/19 | |
| 1999 | 11/08 | 11/18 | 4/07 | |
| 2000 | 11/26 | 11/27 | 4/02 | |
| 2001 | 11/27 | 11/30 | 3/21 | |
| 2002 | 11/30 | 12/02 | 3/30 | |
| 2003 | 11/09 | 11/09 | 3/30 | |
| 2004 | 11/11 | 11/13 | 3/14 | |
| 2005 | 10/21 | 10/23 | 4/01 | |
| | | | | |
| 71-00 Avg | 11/11 | 11/15 | 4/01 | |

[1] Based on 25 mm SWE or 1 inch SWE
[2] Based on 40 mm SWE or 1.5 inch SWE
[3] Based on day of maximum SWE

**Appendix 5.** Estimated opening and closing dates of oversnow vehicle access for the road between South Entrance and Lake Area and Old Faithful over Thumb Divide based on Snake River Station, Lake Yellowstone or Old Faithful data.

| Water Year | Opening Day for Admin Travel[1] to Lake | Opening Day for Admin Travel[1] to Old F | Opening Day for Public Travel[2] To Lake | Opening Day for Public Travel[2] to Old F | Closing Day for All Travel[3] To Lake | Closing Day for All Travel[3] to Old F | Remarks |
|---|---|---|---|---|---|---|---|
| 1949 | 11/15 | | 11/20 | | 4/06 | | |
| 1950 | 12/10 | | 12/16 | | 3/30 | | |
| 1951 | 11/18 | | 11/22 | | 3/30 | | |
| 1952 | 10/20 | | 10/24 | | 4/05 | | |
| 1953 | 12/08 | | 12/20 | | 3/06 | | |
| 1954 | 12/17 | | 12/19 | | 4/02 | | |
| 1955 | 12/13 | | 1/02 | | 4/13 | | |
| 1956 | 11/10 | | 11/14 | | 3/19 | | |
| 1957 | 11/01 | | 11/06 | | 3/28 | | |
| 1958 | 12/02 | | 12/16 | | 4/14 | | |
| 1959 | 11/13 | | 11/14 | | 3/31 | | |
| 1960 | 12/25 | | 1/05 | | 3/22 | | |
| 1961 | 11/12 | | 11/18 | | 3/12 | | |
| 1962 | 10/28 | | 11/04 | | 4/07 | | |
| 1963 | 11/23 | | 12/03 | | 3/19 | | |
| 1964 | 12/06 | | 12/09 | | 3/31 | | |
| 1965 | 11/26 | | 11/27 | | 3/30 | | |
| 1966 | 11/24 | | 11/26 | | 3/28 | | |
| 1967 | 11/11 | | 11/26 | | 3/08 | | |
| 1968 | 11/30 | | 12/18 | | 3/27 | | |
| 1969 | 11/25 | | 12/06 | | 3/30 | | |
| 1970 | 12/21 | | 11/22 | | 5/01 | | |
| 1971 | 11/20 | | 11/24 | | 4/06 | | |
| 1972 | 11/15 | | 11/24 | | 3/05 | | |
| 1973 | 11/15 | | 11/26 | | 4/22 | | |
| 1974 | 11/05 | | 11/06 | | 4/08 | | |
| 1975 | 12/15 | | 12/13 | | 4/19 | | |
| 1976 | 10/22 | | 10/26 | | 4/05 | | |
| 1977 | 1/04 | | 2/22 | | 4/03 | | |
| 1978 | 11/16 | | 11/22 | | 3/22 | | |
| 1979 | 11/12 | 11/12 | 11/20 | 11/20 | 4/14 | 4/14 | |
| 1980 | 11/25 | 11/24 | 12/11 | 12/11 | 4/14 | 4/13 | |
| 1981 | 12/01 | 11/13 | 12/03 | 12/01 | 4/09 | 4/09 | |
| 1982 | 11/22 | 11/25 | 11/23 | 12/01 | 4/22 | 4/10 | |

[1] Based on 25 mm SWE or 1 inch SWE

[2] Based on 40 mm SWE or 1.5 inch SWE

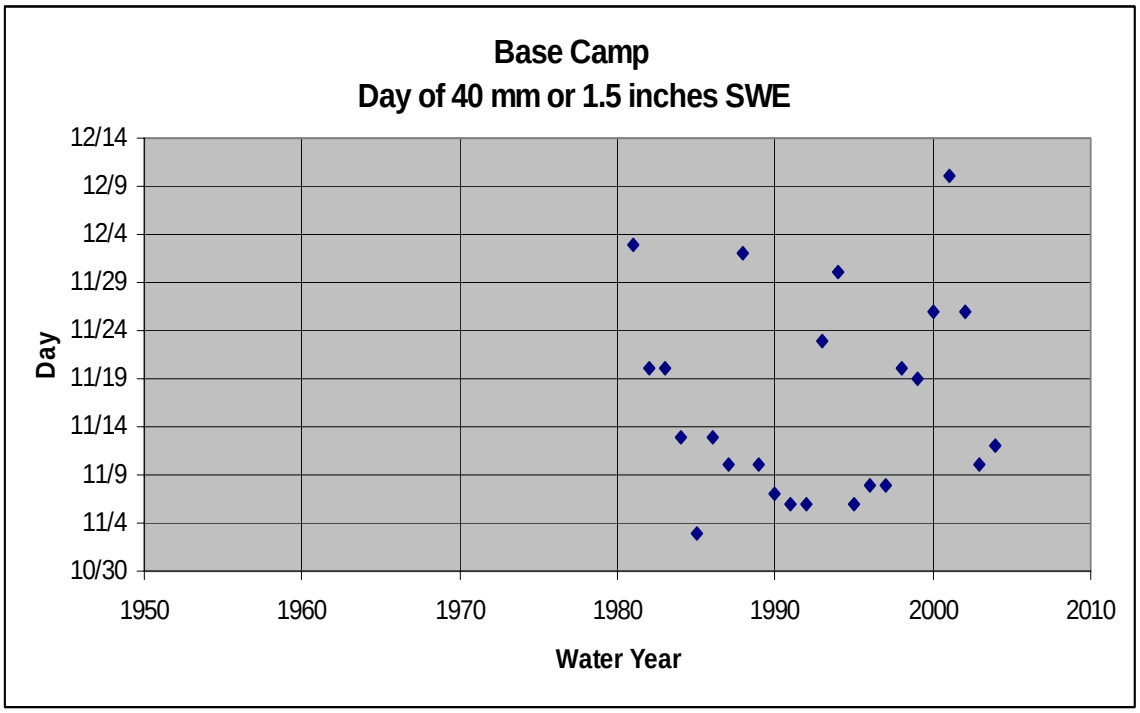
[3] Based on day of maximum SWE

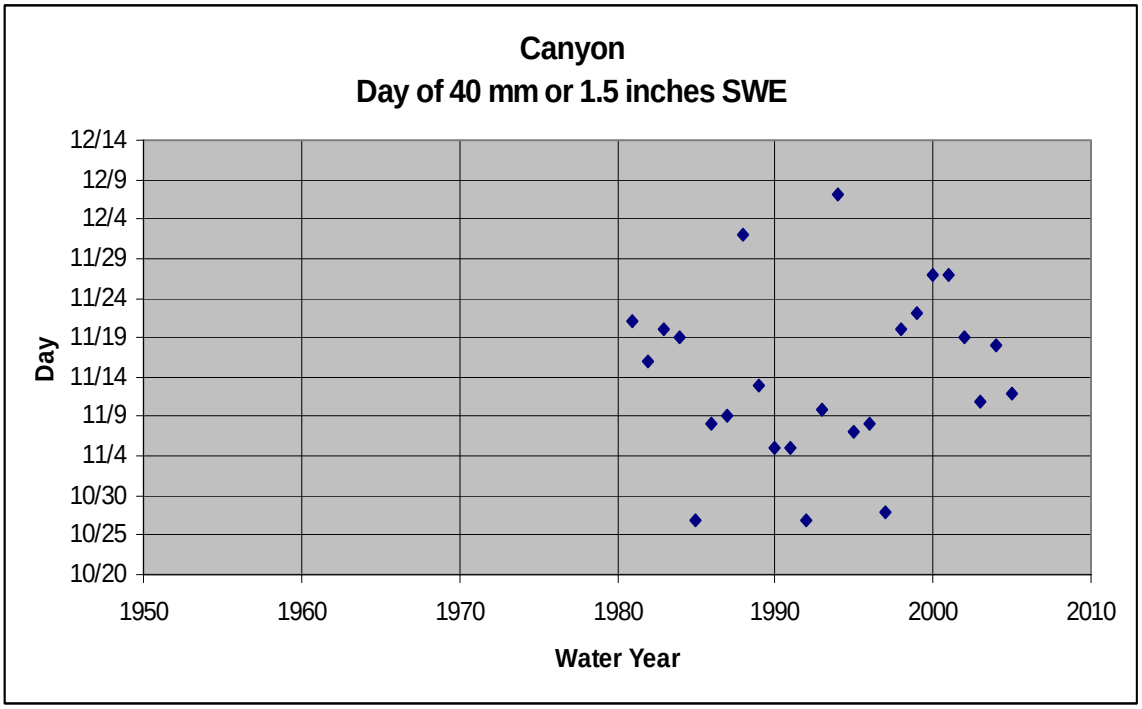
**Appendix 5 (Cont).** Estimated opening and closing dates of oversnow vehicle access for the road between South Entrance and Lake Area and Old Faithful over Thumb Divide based on Snake River Station, Lake Yellowstone or Old Faithful data.

| Water Year | Opening Day for Admin Travel[1] to Lake | Opening Day for Admin Travel[1] to Old F | Opening Day for Public Travel[2] To Lake | Opening Day for Public Travel[2] to Old F | Closing Day for All Travel[3] To Lake | Closing Day for All Travel[3] to Old F | Remarks |
|---|---|---|---|---|---|---|---|
| 1983 | 11/13 | 11/13 | 11/20 | 11/19 | 4/17 | 4/09 | |
| 1984 | 11/20 | 11/17 | 11/26 | 11/24 | 4/14 | 3/19 | |
| 1985 | 10/28 | 10/27 | 11/09 | 10/28 | 3/31 | 3/31 | |
| 1986 | 11/17 | 11/10 | 11/25 | 11/13 | 3/21 | 3/22 | |
| 1987 | 11/10 | 11/10 | 11/15 | 11/16 | 4/04 | 4/03 | |
| 1988 | 12/07 | 12/10 | 12/12 | 12/23 | 4/06 | 3/19 | |
| 1989 | 11/14 | 11/13 | 11/14 | 11/14 | 4/05 | 3/06 | |
| 1990 | 11/14 | 11/26 | 11/26 | 12/05 | 3/29 | 3/10 | |
| 1991 | 12/02 | 11/21 | 12/15 | 11/22 | 4/01 | 3/31 | |
| 1992 | 11/05 | 11/05 | 11/06 | 11/06 | 3/24 | 3/01 | |
| 1993 | 11/19 | 11/30 | 12/03 | 12/03 | 3/23 | 3/17 | |
| 1994 | 12/12 | 12/01 | 1/03 | 12/02 | 3/29 | 3/01 | |
| 1995 | 11/08 | 11/07 | 11/17 | 11/10 | 3/30 | 3/30 | |
| 1996 | 11/12 | 11/09 | 11/26 | 11/11 | 4/01 | 4/01 | |
| 1997 | 11/14 | 11/14 | 11/16 | 11/15 | 4/08 | 3/16 | |
| 1998 | 11/20 | 11/27 | 11/28 | 12/18 | 4/19 | 4/19 | |
| 1999 | 11/20 | 11/19 | 11/22 | 11/22 | 3/20 | 4/07 | |
| 2000 | 11/27 | 11/26 | 12/07 | 12/07 | 4/02 | 3/27 | |
| 2001 | 12/11 | 12/10 | 12/15 | 12/15 | 4/16 | 3/20 | |
| 2002 | 12/01 | 12/02 | 12/02 | 12/03 | 3/22 | 3/22 | |
| 2003 | 11/11 | 11/09 | 11/23 | 11/24 | 3/12 | 3/12 | |
| 2004 | 11/12 | 11/11 | 11/20 | 11/17 | 3/18 | 3/16 | |
| 2005 | 11/28 | 12/09 | 12/09 | 12/30 | 4/07 | 4/06 | |
| | | | | | | | |
| 71-00 Avg | 11/19 | 11/19 | 11/28 | 11/27 | 4/04 | 3/27 | |

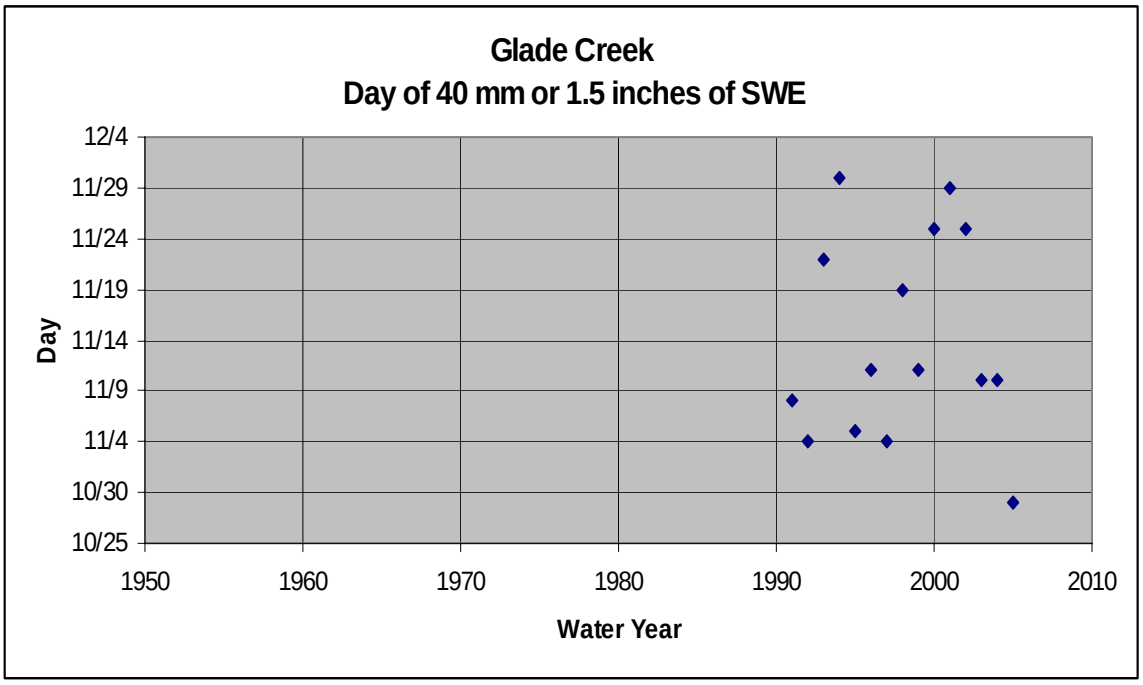
[1] Based on 25 mm SWE or 1 inch SWE
[2] Based on 40 mm SWE or 1.5 inch SWE
[3] Based on day of maximum SWE

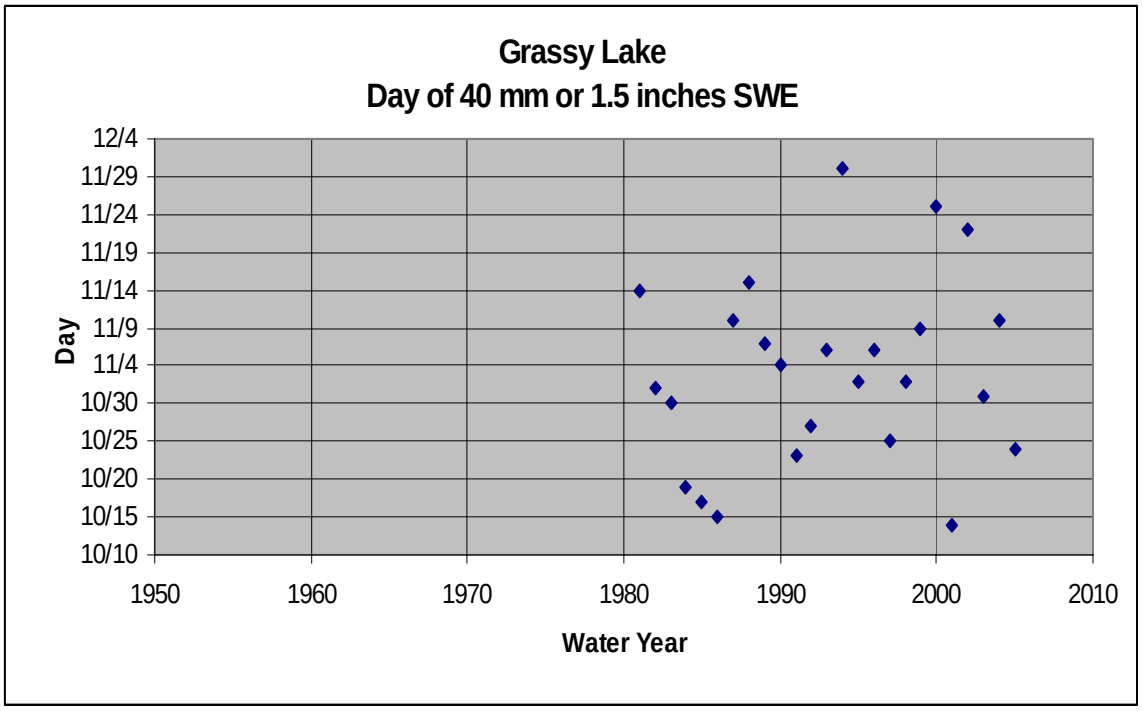
**Appendix 6.** Graphs of day that the snowpack has accumulated 40 mm or 1.5 inches of SWE for non-critical sites in the Grand Teton and Yellowstone National Parks area.



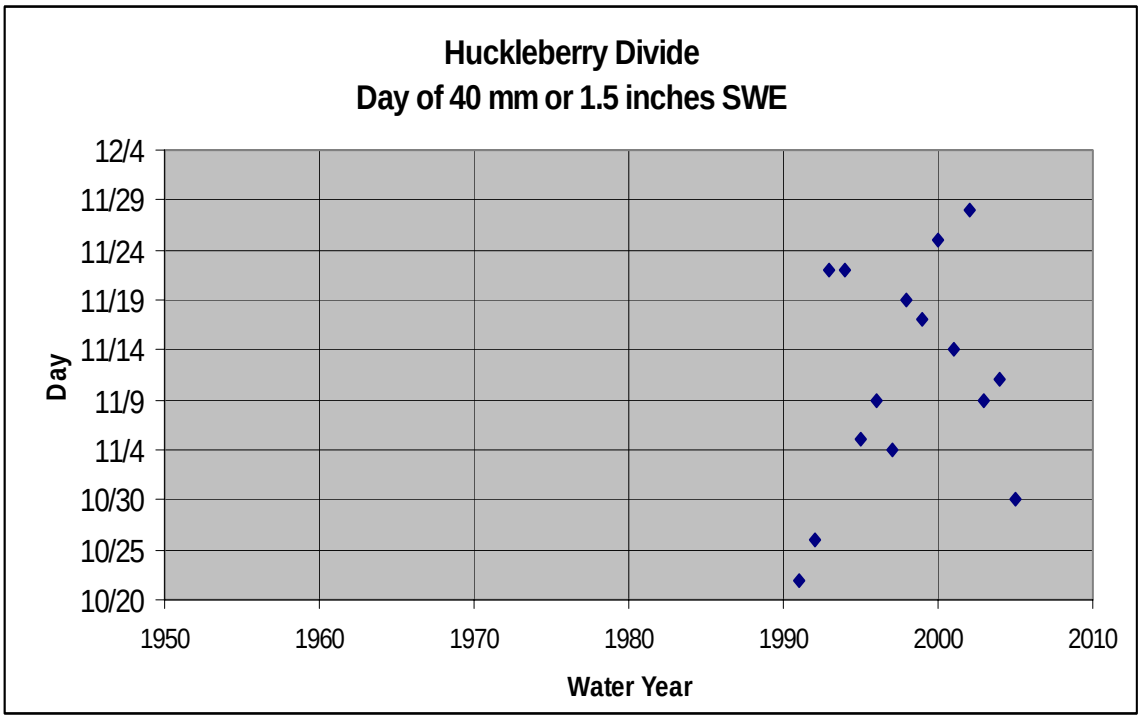



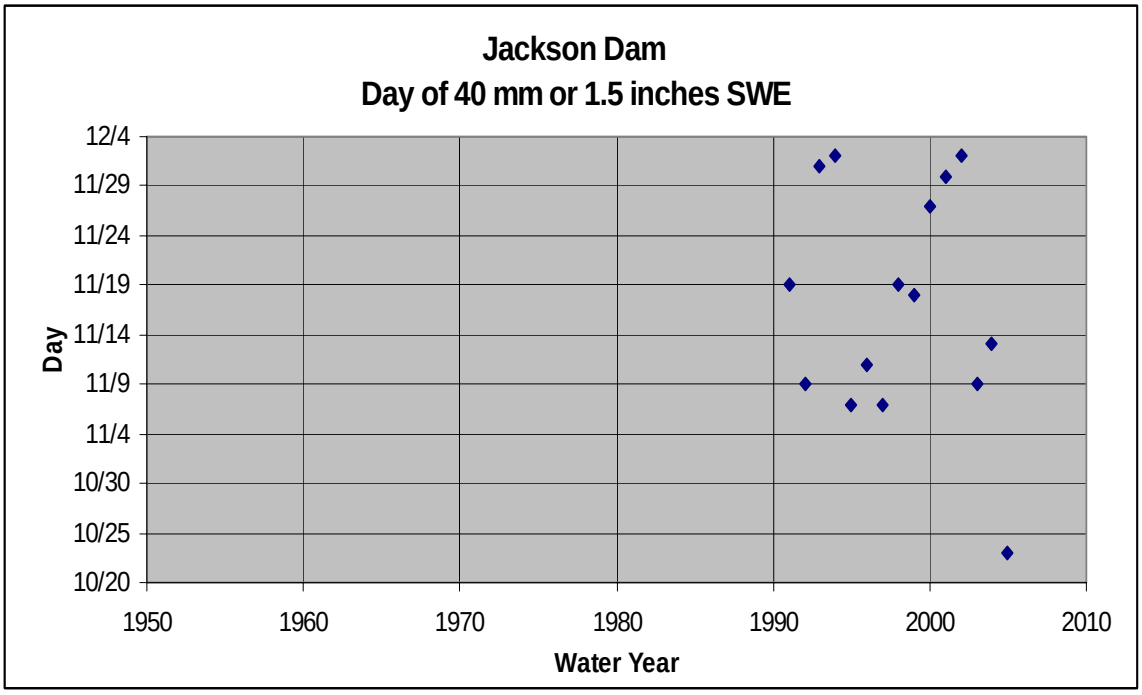
**Appendix 6 (Cont).** Graphs of day that the snowpack has accumulated 40 mm or 1.5 inches of SWE for non-critical sites in the Grand Teton and Yellowstone National Parks area.



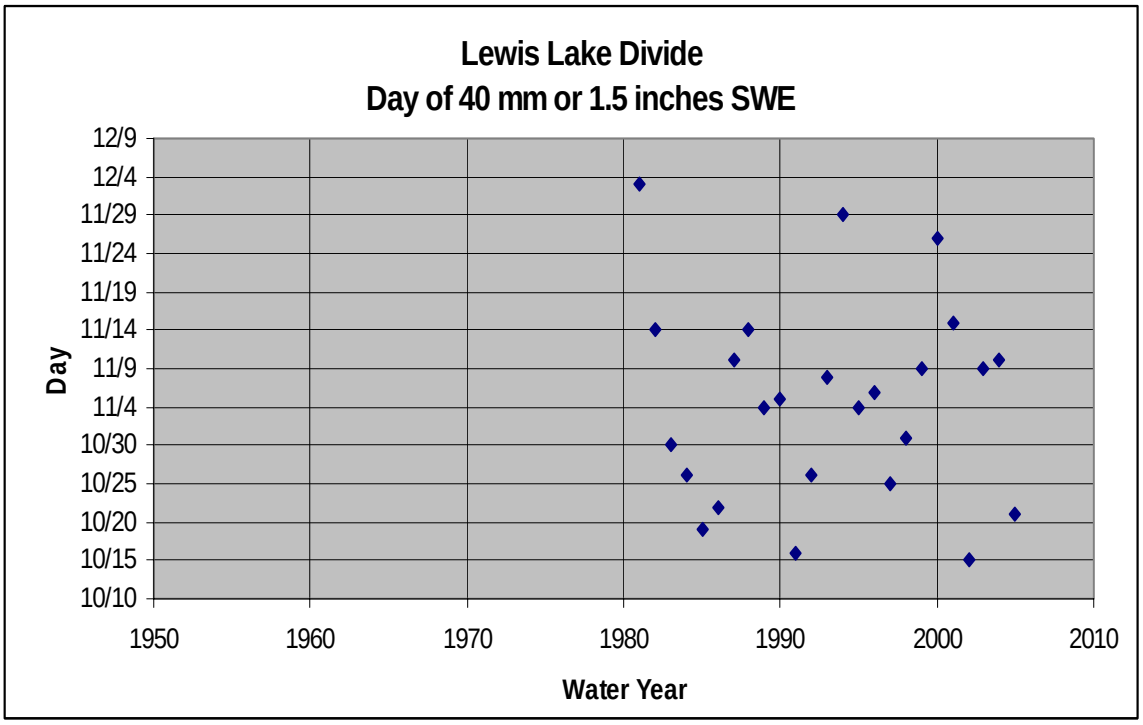



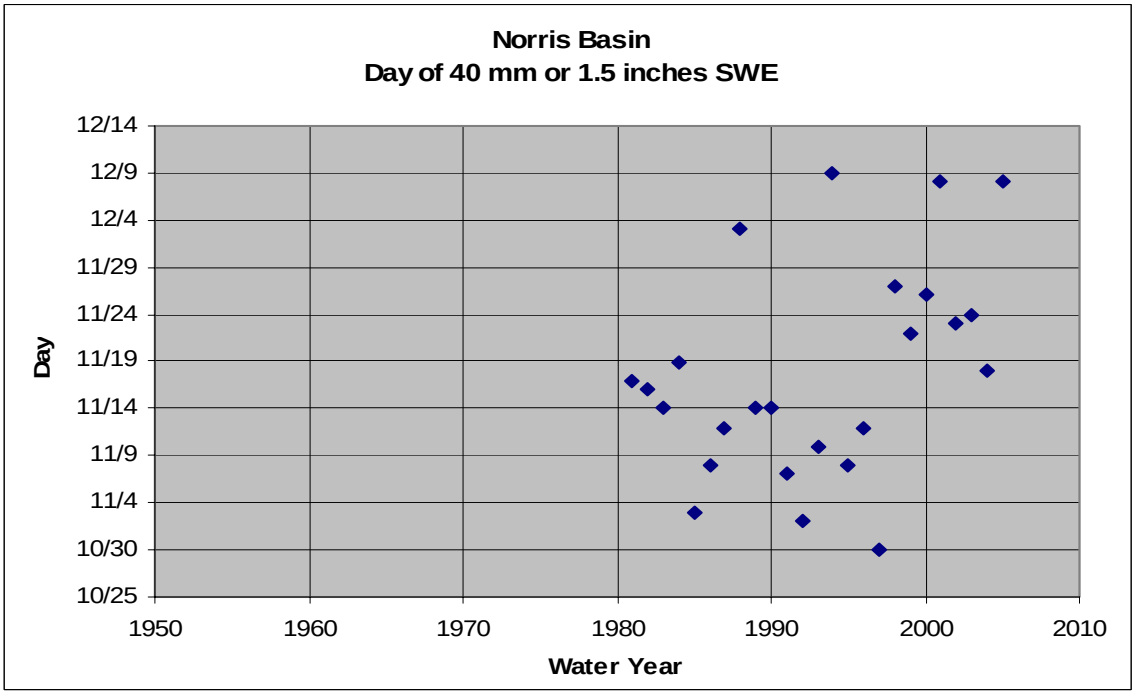
**Appendix 6 (Cont).** Graphs of day that the snowpack has accumulated 40 mm or 1.5 inches of SWE for non-critical sites in the Grand Teton and Yellowstone National Parks area.



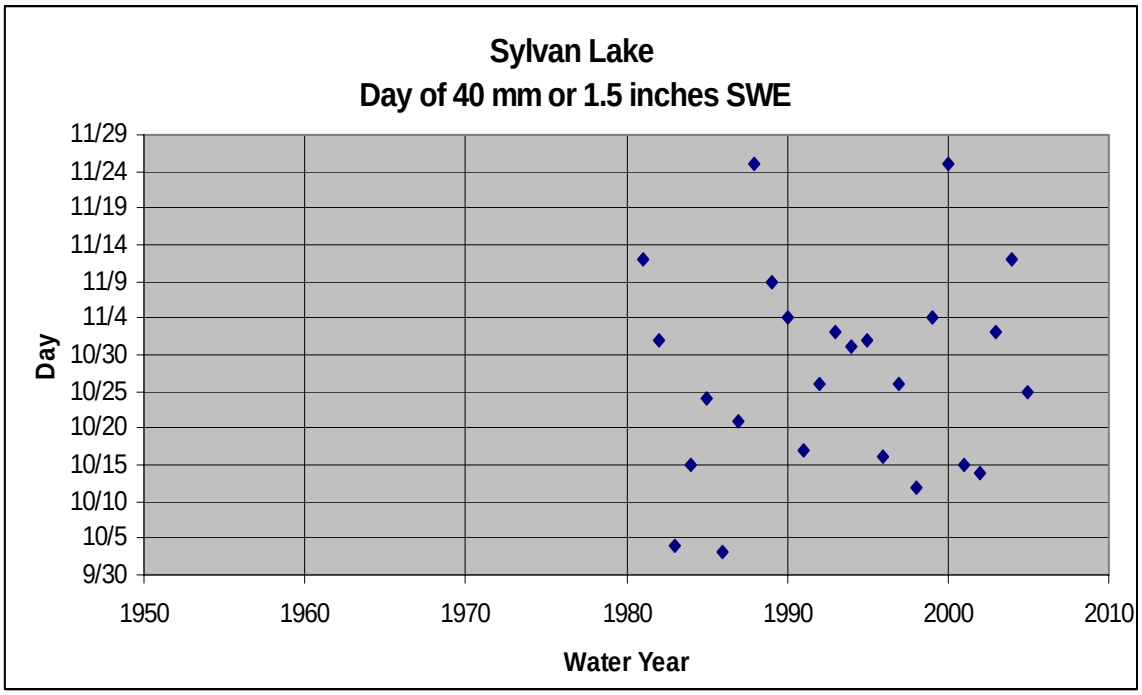



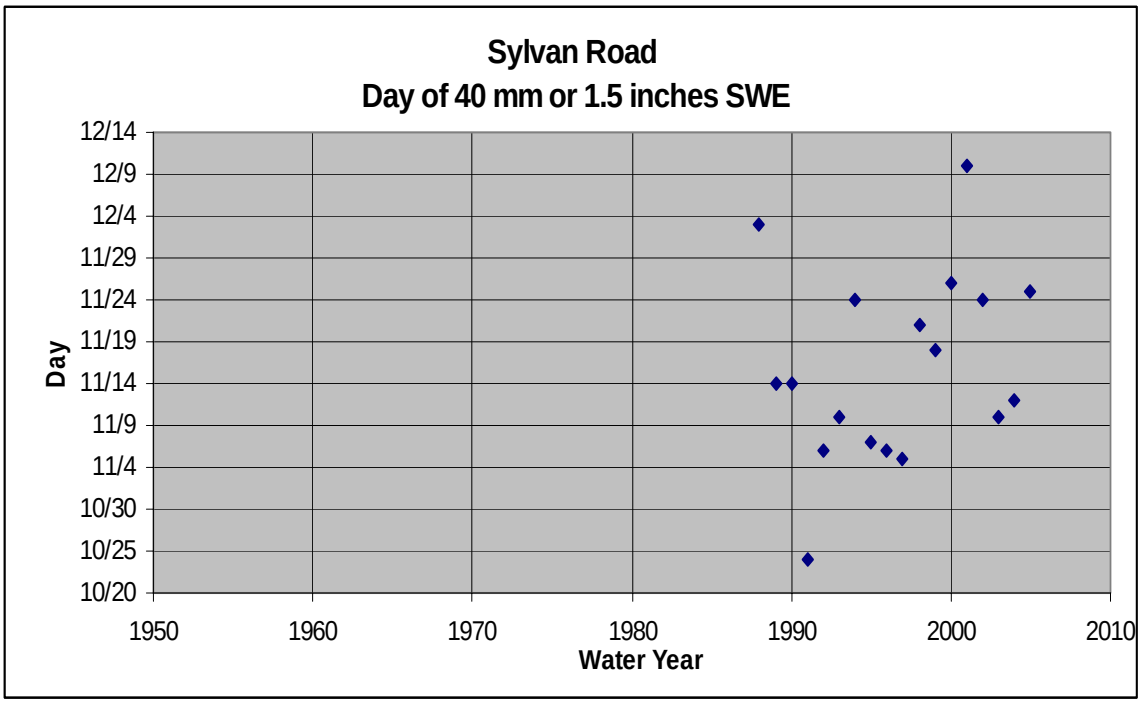
**Appendix 6 (Cont).** Graphs of day that the snowpack has accumulated 40 mm or 1.5 inches of SWE for non-critical sites in the Grand Teton and Yellowstone National Parks area.



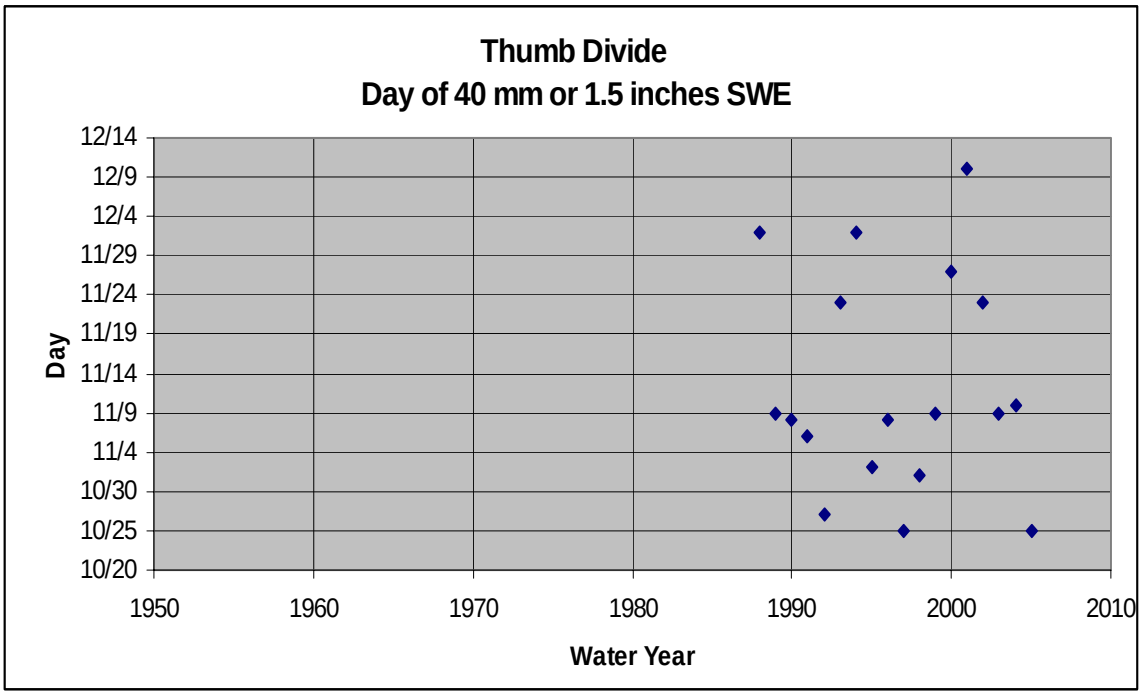



**Appendix 6 (Cont).** Graphs of day that the snowpack has accumulated 40 mm or 1.5 inches of SWE for non-critical sites in the Grand Teton and Yellowstone National Parks area.



**Appendix 6 (Cont).** Graphs of day that the snowpack has accumulated 40 mm or 1.5 inches of SWE for non-critical sites in the Grand Teton and Yellowstone National Parks area.



**Appendix 7.** Annual dates and values for temperatures and SWE for individual stations used in this study.

Site Name: Base Camp

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1981 | | | | 11/3 | 221 | 8.7 | 4/14 | 5/2 |
| 1982 | | | | 10/4 | 754 | 29.7 | 4/17 | 6/4 |
| 1983 | | | | 10/30 | 455 | 17.9 | 4/17 | 5/25 |
| 1984 | | | | 11/8 | 414 | 16.3 | 4/15 | 5/28 |
| 1985 | | | | 10/13 | 409 | 16.1 | 3/29 | 5/10 |
| 1986 | | | | 11/8 | 599 | 23.6 | 3/16 | 5/30 |
| 1987 | | | | 10/29 | 295 | 11.6 | 4/5 | 4/26 |
| 1988 | | | | 11/12 | 391 | 15.4 | 4/12 | 5/13 |
| 1989 | -30 | -22 | 2/8* | 11/3 | 592 | 23.3 | 4/17 | 5/22 |
| 1990 | -30 | -22 | 2/16 | 10/28 | 368 | 14.5 | 3/31 | 5/6 |
| 1991 | -37 | -35 | 12/23 | 10/15 | 312 | 12.3 | 4/4 | 5/21 |
| 1992 | -28 | -18 | 12/2 | 10/27 | 251 | 9.9 | 3/10 | 4/22 |
| 1993 | -30 | -22 | 2/18 | 10/31 | 399 | 15.7 | 3/22 | 5/22 |
| 1994 | -28 | -18 | 2/1* | 11/17 | 318 | 12.5 | 3/30 | 5/4 |
| 1995 | -30 | -22 | 1/3* | 11/1 | 549 | 21.6 | 3/31 | 5/30 |
| 1996 | -33 | -27 | 2/4* | 11/5 | 635 | 25.0 | 4/1 | 6/3 |
| 1997 | -30 | -22 | 12/18 | 10/19 | 777 | 30.6 | 4/15 | 6/1 |
| 1998 | -26 | -15 | 12/12 | 10/9 | 417 | 16.4 | 3/30 | 5/20 |
| 1999 | -32 | -25 | 12/22 | 11/7 | 615 | 24.2 | 4/7 | 5/29 |
| 2000 | -26 | -14 | 1/31 | 11/18 | 450 | 17.7 | 3/23 | 5/2 |
| 2001 | -28 | -18 | 2/10 | 10/12 | 221 | 8.7 | 3/21 | 5/1 |
| 2002 | -31 | -23 | 2/27 | 11/18 | 361 | 14.2 | 3/29 | 5/14 |
| 2003 | -32 | -26 | 2/25 | 10/24 | 531 | 20.9 | 3/31 | 5/18 |
| 2004 | -26 | -14 | 1/7 | 11/4 | 452 | 17.8 | 3/10 | 5/2 |
| 2005 | -29 | -20 | 12/24 | 10/19 | 325 | 12.8 | 4/6 | 5/9 |
| 1971-2000 Average | -31 | -23 | 1/9 | 10/28 | 490 | 19.3 | 4/3 | 5/23 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence.

Site Name: Canyon

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1981 | -38 | -36 | 2/11 | 11/8 | 203 | 8.0 | 4/13 | 5/19 |
| 1982 | -39 | -38 | 2/7* | 10/13 | 574 | 22.6 | 4/21 | 6/23 |
| 1983 | -32 | -26 | 2/6 | 10/19 | 310 | 12.2 | 4/20 | 6/8 |
| 1984 | -38 | -37 | 1/19 | 10/11 | 254 | 10.0 | 4/13 | 5/31 |
| 1985 | -42 | -44 | 2/3* | 10/13 | 325 | 12.8 | 4/7 | 5/16 |
| 1986 | -30 | -22 | 2/12 | 10/7 | 373 | 14.7 | 3/19 | 6/2 |
| 1987 | -27 | -17 | 1/21* | 11/2 | 185 | 7.3 | 4/14 | 4/30 |
| 1988 | -34 | -30 | 1/25 | 11/13 | 300 | 11.8 | 4/11 | 5/19 |
| 1989 | -33 | -27 | 2/7 | 11/2 | 493 | 19.4 | 4/10 | 5/21 |
| 1990 | -36 | -33 | 2/16 | 10/26 | 307 | 12.1 | 3/30 | 5/16 |
| 1991 | -40 | -40 | 12/22 | 10/17 | 373 | 14.7 | 5/13 | 6/3 |
| 1992 | -34 | -29 | 12/1 | 10/23 | 307 | 12.1 | 3/30 | 5/7 |
| 1993 | -35 | -31 | 12/5 | 10/30 | 414 | 16.3 | 4/27 | 5/26 |
| 1994 | -32 | -26 | 11/26* | 11/23 | 290 | 11.4 | 4/11 | 5/11 |
| 1995 | -35 | -31 | 2/12* | 10/28 | 432 | 17.0 | 4/4 | 6/5 |
| 1996 | -40 | -40 | 2/3 | 10/4 | 549 | 21.6 | 4/6 | 6/8 |
| 1997 | -32 | -26 | 1/7 | 10/16 | 602 | 23.7 | 4/3 | 6/2 |
| 1998 | -31 | -24 | 12/26 | 10/11 | 340 | 13.4 | 4/19 | 5/22 |
| 1999 | -42 | -44 | 12/22 | 11/3 | 485 | 19.1 | 4/16 | 6/4 |
| 2000 | -31 | -23 | 1/31 | 10/29 | 345 | 13.6 | 4/4 | 5/24 |
| 2001 | -37 | -35 | 2/9 | 10/31 | 277 | 10.9 | 4/22 | 5/16 |
| 2002 | -37 | -35 | 2/27 | 10/12 | 340 | 13.4 | 4/25 | 5/29 |
| 2003 | -41 | -42 | 2/25 | 10/1 | 363 | 14.3 | 4/9 | 5/29 |
| 2004 | -34 | -29 | 1/6 | 10/30 | 290 | 11.4 | 3/17 | 5/7 |
| 2005 | -32 | -26 | 12/24 | 10/19 | 246 | 9.7 | 4/5 | 5/18 |
| 1971-2000 Average | -37 | -34 | 1/26 | 10/24 | 378 | 14.9 | 4/11 | 5/26 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence.

Site Name: Glade Creek

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1991 | -39 | -38 | 1/29 | 10/14 | 485 | 19.1 | 4/19 | 5/27 |
| 1992 | -33 | -28 | 12/1* | 10/21 | 328 | 12.9 | 3/21 | 4/28 |
| 1993 | -37 | -34 | 2/17 | 11/1 | 538 | 21.2 | 3/22 | 5/25 |
| 1994 | -35 | -31 | 1/31* | 10/19 | 391 | 15.4 | 4/4 | 5/7 |
| 1995 | -38 | -36 | 1/1 | 10/28 | 645 | 25.4 | 4/4 | 5/31 |
| 1996 | -42 | -43 | 2/2 | 11/5 | 711 | 28.0 | 4/5 | 6/1 |
| 1997 | -35 | -31 | 12/17 | 10/18 | 909 | 35.8 | 4/16 | 5/28 |
| 1998 | -32 | -25 | 3/8 | 10/23 | 556 | 21.9 | 4/18 | 5/26 |
| 1999 | -38 | -37 | 12/23 | 11/5 | 787 | 31.0 | 3/29 | 6/4 |
| 2000 | -33 | -28 | 1/30 | 10/28 | 503 | 19.8 | 4/4 | 5/15 |
| 2001 | -37 | -34 | 2/8 | 11/3 | 318 | 12.5 | 4/15 | 5/7 |
| 2002 | -39 | -39 | 2/26 | 11/21 | 478 | 18.8 | 3/29 | 5/17 |
| 2003 | -39 | -38 | 2/24 | 10/22 | 472 | 18.6 | 4/5 | 5/15 |
| 2004 | -34 | -29 | 2/12 | 10/28 | 566 | 22.3 | 3/15 | 5/3 |
| 2005 | -36 | -33 | 12/23 | 10/18 | 361 | 14.2 | 3/27 | 5/6 |
| 1971-2000 Average | -38 | -36 | 1/23 | 10/30 | 592 | 23.3 | 4/7 | 5/21 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence.

Site Name: Grassy Lake

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1981 | | | | 11/10 | 660 | 26.0 | 4/11 | 5/30 |
| 1982 | | | | 10/27 | 1463 | 57.6 | 4/25 | 6/30 |
| 1983 | | | | 9/27 | 1082 | 42.6 | 5/20 | 6/21 |
| 1984 | | | | 11/5 | 935 | 36.8 | 5/11 | 6/25 |
| 1985 | | | | 10/12 | 798 | 31.4 | 4/2 | 5/28 |
| 1986 | | | | 10/7 | 1064 | 41.9 | 3/23 | 6/14 |
| 1987 | | | | 10/31 | 472 | 18.6 | 4/6 | 5/6 |
| 1988 | | | | 11/1 | 724 | 28.5 | 4/6 | 5/26 |
| 1989 | -33 | -27 | 2/8 | 11/3 | 1074 | 42.3 | 4/8 | 6/8 |
| 1990 | -33 | -27 | 2/16 | 10/25 | 706 | 27.8 | 3/31 | 6/5 |
| 1991 | -39 | -38 | 12/22 | 10/15 | 813 | 32.0 | 4/18 | 6/9 |
| 1992 | -30 | -22 | 12/2 | 10/23 | 579 | 22.8 | 3/28 | 5/13 |
| 1993 | -30 | -22 | 2/18 | 10/29 | 968 | 38.1 | 4/26 | 6/13 |
| 1994 | -31 | -24 | 11/26* | 10/29 | 671 | 26.4 | 4/12 | 5/20 |
| 1995 | -30 | -22 | 1/2* | 10/25 | 998 | 39.3 | 5/2 | 6/16 |
| 1996 | -34 | -29 | 2/2* | 10/4 | 1001 | 39.4 | 4/7 | 6/12 |
| 1997 | -30 | -22 | 12/18 | 10/17 | 1247 | 49.1 | 4/17 | 6/11 |
| 1998 | -28 | -18 | 3/9* | 10/24 | 843 | 33.2 | 4/20 | 6/15 |
| 1999 | -34 | -30 | 12/24* | 10/28 | 1120 | 44.1 | 4/17 | 6/20 |
| 2000 | -28 | -18 | 1/30 | 11/18 | 826 | 32.5 | 4/4 | 5/30 |
| 2001 | -33 | -27 | 2/9 | 10/11 | 599 | 23.6 | 4/16 | 5/19 |
| 2002 | -36 | -32 | 2/27 | 10/10 | 747 | 29.4 | 3/29 | 6/5 |
| 2003 | -31 | -24 | 2/26 | 10/23 | 826 | 32.5 | 4/15 | 6/3 |
| 2004 | -31 | -24 | 1/6 | 10/28 | 897 | 35.3 | 3/22 | 6/2 |
| 2005 | -32 | -26 | 12/24 | 10/19 | 655 | 25.8 | 4/12 | 5/26 |
| 1971-2000 Average | -33 | -28 | 1/15 | 10/18 | 940 | 37.0 | 4/14 | 6/7 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence

Site Name: Huckleberry Divide

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1991 | -36 | -33 | 12/23* | 10/14 | 485 | 19.1 | 4/18 | 5/26 |
| 1992 | -30 | -22 | 11/30 | 10/25 | 307 | 12.1 | 3/27 | 4/28 |
| 1993 | -31 | -24 | 2/17 | 11/1 | 457 | 18.0 | 4/20 | 5/26 |
| 1994 | -32 | -25 | 11/25 | 10/26 | 371 | 14.6 | 4/8 | 5/8 |
| 1995 | -31 | -24 | 1/3* | 10/28 | 533 | 21.0 | 3/31 | 5/31 |
| 1996 | -36 | -32 | 2/2 | 11/5 | 648 | 25.5 | 4/24 | 6/3 |
| 1997 | -31 | -23 | 12/17 | 10/19 | 777 | 30.6 | 4/20 | 5/28 |
| 1998 | -27 | -16 | 3/8 | 10/23 | 538 | 21.2 | 4/19 | 5/25 |
| 1999 | -33 | -28 | 12/21 | 11/5 | 638 | 25.1 | 4/7 | 6/3 |
| 2000 | -28 | -18 | 1/29 | 10/28 | 465 | 18.3 | 3/31 | 5/15 |
| 2001 | -31 | -24 | 2/8 | 10/10 | 338 | 13.3 | 4/16 | 5/10 |
| 2002 | -33 | -28 | 2/26 | 11/21 | 394 | 15.5 | 3/26 | 5/18 |
| 2003 | -37 | -34 | 2/24 | 10/22 | 498 | 19.6 | 3/30 | 5/21 |
| 2004 | -28 | -19 | 1/5 | 11/1 | 490 | 19.3 | 3/8 | 5/7 |
| 2005 | -31 | -24 | 12/23 | 10/21 | 345 | 13.6 | 4/6 | 5/14 |
| 1971-2000 Average | -33 | -27 | 1/14 | 10/30 | 589 | 23.2 | 4/11 | 5/22 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence

Site Name: Jackson Dam

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1991 | -38 | -36 | 12/23* | 11/1 | 279 | 11.0 | 3/30 | 5/6 |
| 1992 | -42 | -43 | 2/4 | 10/26 | 236 | 9.3 | 3/25 | 4/15 |
| 1993 | -31 | -23 | 2/17 | 10/30 | 356 | 14.0 | 3/22 | 5/14 |
| 1994 | -31 | -23 | 2/12 | 11/20 | 229 | 9.0 | 3/17 | 4/27 |
| 1995 | -34 | -29 | 1/4 | 11/1 | 351 | 13.8 | 3/31 | 5/9 |
| 1996 | -39 | -38 | 2/3 | 11/5 | 386 | 15.2 | 3/31 | 5/13 |
| 1997 | -33 | -28 | 2/8 | 10/16 | 450 | 17.7 | 4/14 | 5/12 |
| 1998 | -29 | -20 | 2/28 | 11/7 | 373 | 14.7 | 3/19 | 5/5 |
| 1999 | -31 | -24 | 1/30* | 11/6 | 541 | 21.3 | 4/7 | 5/15 |
| 2000 | -31 | -23 | 1/31* | 11/20 | 414 | 16.3 | 4/2 | 4/24 |
| 2001 | -32 | -25 | 2/9 | 10/10 | 183 | 7.2 | 3/21 | 4/26 |
| 2002 | -33 | -27 | 2/26* | 11/22 | 277 | 10.9 | 3/30 | 4/30 |
| 2003 | -36 | -33 | 2/24 | 10/22 | 297 | 11.7 | 3/30 | 4/27 |
| 2004 | -30 | -22 | 1/6 | 10/30 | 307 | 12.1 | 3/14 | 4/18 |
| 2005 | -31 | -24 | 2/16 | 10/18 | 292 | 11.5 | 4/1 | 5/6 |
| 1971-2000 Average | -34 | -30 | 1/25 | 10/28 | 371 | 14.6 | 4/2 | 5/11 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence.

Site Name: Lake Yellowstone

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1949 | -41 | -41 | 2/13 | 11/3 | 302 | 11.9 | 4/11 | 5/16 |
| 1950 | -38 | -37 | 2/3 | 11/9 | 295 | 11.6 | 4/14 | 5/30 |
| 1951 | -45 | -49 | 1/29 | 11/7 | 213 | 8.4 | 3/30 | 5/16 |
| 1952 | -36 | -33 | 2/24 | 10/15 | 269 | 10.6 | 4/6 | 5/12 |
| 1953 | -36 | -33 | 2/20 | 11/15 | 206 | 8.1 | 4/20 | 5/16 |
| 1954 | -34 | -30 | 3/3 | 11/22 | 211 | 8.3 | 4/16 | 5/11 |
| 1955 | -37 | -35 | 3/5* | 11/27 | 175 | 6.9 | 4/25 | 5/14 |
| 1956 | -43 | -46 | 2/1 | 10/29 | 399 | 15.7 | 4/10 | 5/17 |
| 1957 | -41 | -42 | 1/27 | 10/26 | 201 | 7.9 | 4/20 | 5/10 |
| 1958 | -33 | -28 | 1/20 | 11/13 | 198 | 7.8 | 4/15 | 5/11 |
| 1959 | -37 | -34 | 1/21* | 11/4 | 221 | 8.7 | 3/31 | 5/13 |
| 1960 | -38 | -36 | 2/1 | 11/4 | 130 | 5.1 | 3/22 | 5/11 |
| 1961 | -38 | -37 | 1/27 | 11/1 | 173 | 6.8 | 3/12 | 5/13 |
| 1962 | -44 | -47 | 1/10 | 10/22 | 310 | 12.2 | 4/7 | 5/16 |
| 1963 | -46 | -50 | 1/12 | 11/15 | 147 | 5.8 | 4/12 | 5/15 |
| 1964 | -35 | -31 | 2/25 | 11/4 | 175 | 6.9 | 3/31 | 5/16 |
| 1965 | -42 | -44 | 2/11 | 11/10 | 312 | 12.3 | 4/20 | 5/27 |
| 1966 | -36 | -33 | 3/4 | 11/10 | 173 | 6.8 | 3/28 | 5/8 |
| 1967 | -34 | -29 | 3/7 | 11/6 | 279 | 11.0 | 4/27 | 5/24 |
| 1968 | -33 | -28 | 12/14 | 11/19 | 163 | 6.4 | 3/27 | 5/3 |
| 1969 | -38 | -36 | 12/31 | 10/31 | 246 | 9.7 | 4/8 | 5/9 |
| 1970 | -38 | -37 | 1/5 | 11/8 | 226 | 8.9 | 5/2 | 5/25 |
| 1971 | -38 | -37 | 1/4 | 11/9 | 348 | 13.7 | 4/14 | 5/26 |
| 1972 | -41 | -42 | 2/2 | 10/27 | 236 | 9.3 | 3/5 | 5/16 |
| 1973 | -39 | -39 | 1/4 | 10/24 | 152 | 6.0 | 5/3 | 5/16 |
| 1974 | -40 | -40 | 1/2 | 10/31 | 274 | 10.8 | 4/8 | 5/25 |
| 1975 | -41 | -42 | 1/12 | 11/13 | 236 | 9.3 | 5/9 | 6/1 |
| 1976 | -38 | -36 | 2/6 | 10/22 | 328 | 12.9 | 4/6 | 5/15 |
| 1977 | -37 | -35 | 1/9 | 12/7 | 76 | 3.0 | 4/3 | 4/13 |
| 1978 | -38 | -37 | 1/2 | 10/29 | 305 | 12.0 | 3/22 | 5/9 |
| 1979 | -41 | -42 | 1/1* | 11/9 | 244 | 9.6 | 4/15 | 5/23 |
| 1980 | -40 | -40 | 1/29* | 10/29 | 251 | 9.9 | 4/14 | 5/12 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence.
SWE estimated from precipitation, snow depth and temperature at climatological station.

Site Name: Lake Yellowstone (Cont)

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1981 | -41 | -42 | 2/10 | 11/10 | 155 | 6.1 | 4/14 | 4/29 |
| 1982 | -42 | -44 | 2/5 | 11/15 | 312 | 12.3 | 4/23 | 5/23 |
| 1983 | -34 | -30 | 2/5 | 10/28 | 241 | 9.5 | 4/20 | 5/31 |
| 1984 | -43 | -46 | 1/18 | 11/8 | 145 | 5.7 | 4/15 | 5/21 |
| 1985 | -46 | -50 | 2/2* | 10/14 | 157 | 6.2 | 4/1 | 5/1 |
| 1986 | -32 | -26 | 2/11 | 11/5 | 335 | 13.2 | 3/21 | 5/26 |
| 1987 | -29 | -21 | 11/10 | 10/30 | 183 | 7.2 | 4/4 | 4/25 |
| 1988 | -37 | -35 | 1/19 | 11/13 | 165 | 6.5 | 4/11 | 4/22 |
| 1989 | -39 | -38 | 3/4 | 11/4 | 262 | 10.3 | 4/5 | 5/17 |
| 1990 | -36 | -32 | 2/15 | 10/28 | 150 | 5.9 | 3/31 | 4/23 |
| 1991 | -42 | -43 | 12/22 | 11/15 | 168 | 6.6 | 5/6 | 5/23 |
| 1992 | -33 | -28 | 1/15 | 10/23 | 170 | 6.7 | 4/1 | 4/29 |
| 1993 | -33 | -28 | 2/28* | 10/30 | 188 | 7.4 | 5/2 | 5/21 |
| 1994 | -33 | -28 | 2/12 | 11/19 | 160 | 6.3 | 4/16 | 5/6 |
| 1995 | -36 | -32 | 2/11* | 11/2 | 246 | 9.7 | 4/4 | 5/29 |
| 1996 | -41 | -41 | 2/3* | 11/6 | 272 | 10.7 | 4/1 | 5/30 |
| 1997 | -34 | -29 | 2/8* | 10/19 | 376 | 14.8 | 4/13 | 5/21 |
| 1998 | -27 | -17 | 3/8 | 10/24 | 185 | 7.3 | 4/21 | 5/9 |
| 1999 | -37 | -34 | 12/21 | 11/3 | 272 | 10.7 | 3/20 | 5/26 |
| 2000 | -30 | -22 | 1/31* | 11/21 | 269 | 10.6 | 4/5 | 5/2 |
| 2001 | -35 | -31 | 2/8 | 11/5 | 175 | 6.9 | 4/17 | 5/9 |
| 2002 | -35 | -31 | 2/26 | 11/18 | 191 | 7.5 | 3/22 | 5/11 |
| 2003 | -39 | -39 | 2/24 | 10/23 | 193 | 7.6 | 4/9 | 5/19 |
| 2004 | -32 | -26 | 1/6 | 10/30 | 216 | 8.5 | 3/18 | 5/2 |
| 2005 | -33 | -27 | 2/16 | 10/18 | 203 | 8.0 | 4/22 | 5/7 |
| 1971-2000 Average | -37 | -35 | 1/24 | 11/3 | 229 | 9.0 | 4/9 | 5/14 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence
SWE estimated from precipitation, snow depth and temperature at climatological station.

Site Name: Lewis Lake Divide

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1981 | | | | 11/30 | 523 | 20.6 | 4/13 | 6/4 |
| 1982 | | | | 10/27 | 1560 | 61.4 | 4/22 | 7/9 |
| 1983 | | | | 10/26 | 988 | 38.9 | 4/17 | 6/25 |
| 1984 | -34 | -29 | 12/24 | 10/11 | 833 | 32.8 | 5/8 | 6/26 |
| 1985 | -32 | -26 | 2/5* | 10/13 | 828 | 32.6 | 4/2 | 6/8 |
| 1986 | -27 | -16 | 2/12* | 10/8 | 1209 | 47.6 | 3/28 | 6/23 |
| 1987 | -25 | -13 | 1/10 | 10/31 | 465 | 18.3 | 4/15 | 5/8 |
| 1988 | -28 | -19 | 1/20 | 11/14 | 752 | 29.6 | 4/9 | 6/2 |
| 1989 | -31 | -23 | 2/7 | 11/3 | 1171 | 46.1 | 4/6 | 6/11 |
| 1990 | -26 | -14 | 2/16 | 10/25 | 704 | 27.7 | 3/31 | 6/10 |
| 1991 | -37 | -34 | 12/22 | 10/11 | 787 | 31.0 | 5/11 | 6/13 |
| 1992 | -24 | -12 | 1/16* | 10/23 | 648 | 25.5 | 4/12 | 5/18 |
| 1993 | -28 | -18 | 2/17 | 10/31 | 876 | 34.5 | 5/8 | 6/14 |
| 1994 | -29 | -20 | 11/26 | 11/21 | 592 | 23.3 | 4/10 | 5/21 |
| 1995 | -29 | -21 | 1/2 | 10/15 | 1087 | 42.8 | 4/13 | 6/24 |
| 1996 | -33 | -27 | 2/3 | 10/4 | 1252 | 49.3 | 4/29 | 6/21 |
| 1997 | -27 | -16 | 1/13* | 10/19 | 1415 | 55.7 | 4/15 | 6/18 |
| 1998 | -24 | -11 | 12/26 | 10/24 | 846 | 33.3 | 4/20 | 6/16 |
| 1999 | -32 | -25 | 12/22 | 10/29 | 1064 | 41.9 | 4/13 | 6/23 |
| 2000 | -23 | -10 | 1/31 | 11/21 | 678 | 26.7 | 4/4 | 5/29 |
| 2001 | -29 | -21 | 2/9 | 10/12 | 485 | 19.1 | 4/24 | 5/18 |
| 2002 | -27 | -16 | 2/27* | 10/12 | 805 | 31.7 | 4/23 | 6/11 |
| 2003 | -33 | -27 | 2/25 | 10/23 | 876 | 34.5 | 4/19 | 6/5 |
| 2004 | -25 | -13 | 2/13 | 10/28 | 767 | 30.2 | 3/18 | 6/5 |
| 2005 | -27 | -16 | 12/24 | 10/18 | 625 | 24.6 | 4/9 | 5/27 |
| 1971-2000 Average | -29 | -21 | 1/19 | 10/26 | 942 | 37.1 | 4/17 | 6/11 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence

Site Name: Madison Junction

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1975 | -38 | -36 | 1/12 | 11/18 | 272 | 10.7 | 4/23 | 5/16 |
| 1976 | | | | | | | | |
| 1977 | | | | | | | | |
| 1978 | | | | | | | | |
| 1979 | -42 | -43 | 1/2 | 10/31 | 274 | 10.8 | 3/18 | 5/16 |
| 1980 | | | | | | | | |
| 1981 | | | | | | | | |
| 1982 | | | | | | | | |
| 1983 | -34 | -30 | 11/23 | 10/27 | 180 | 7.1 | 3/12 | 5/4 |
| 1984 | -42 | -44 | 1/18 | 11/8 | 137 | 5.4 | 3/10 | 5/4 |
| 1985 | -43 | -45 | 2/4 | 10/24 | 163 | 6.4 | 3/4 | 4/14 |
| 1986 | -37 | -34 | 12/11 | 11/5 | 173 | 6.8 | 4/2 | 5/4 |
| 1987 | -38 | -36 | 1/16 | 11/6 | 91 | 3.6 | 3/6 | 4/15 |
| 1988 | -40 | -40 | 1/19 | 11/13 | 102 | 4.0 | 4/6 | 4/17 |
| 1989 | -41 | -42 | 2/3 | 11/10 | 267 | 10.5 | 4/5 | 5/5 |
| 1990 | -38 | -36 | 2/15 | 10/28 | 127 | 5.0 | 3/19 | 4/6 |
| 1991 | -43 | -45 | 12/12* | 10/6 | 109 | 4.3 | 2/3 | 4/23 |
| 1992 | -34 | -29 | 11/30 | 10/23 | 155 | 6.1 | 3/4 | 3/30 |
| 1993 | -37 | -35 | 12/4 | 10/31 | 257 | 10.1 | 3/16 | 4/28 |
| 1994 | -34 | -30 | 2/1 | 11/23 | 150 | 5.9 | 3/1 | 4/12 |
| 1995 | -37 | -34 | 1/4 | 11/1 | 231 | 9.1 | 2/18 | 4/22 |
| 1996 | -41 | -41 | 2/2 | 11/26 | 254 | 10.0 | 4/2 | 4/28 |
| 1997 | -32 | -26 | 2/8* | 10/19 | 361 | 14.2 | 3/20 | 5/4 |
| 1998 | -32 | -25 | 12/11 | 11/19 | 188 | 7.4 | 3/12 | 4/22 |
| 1999 | -40 | -40 | 12/21 | 11/8 | 246 | 9.7 | 3/15 | 4/29 |
| 2000 | -30 | -22 | 1/31* | 11/20 | 140 | 5.5 | 3/3 | 4/14 |
| 2001 | -36 | -32 | 2/8 | 11/5 | 97 | 3.8 | 3/4 | 4/6 |
| 2002 | -36 | -33 | 2/26 | 11/21 | 188 | 7.4 | 3/20 | 4/13 |
| 2003 | -38 | -36 | 2/24 | 10/30 | 180 | 7.1 | 3/9 | 4/13 |
| 2004 | -35 | -31 | 1/6 | 11/4 | 229 | 9.0 | 3/12 | 4/1 |
| 2005 | -33 | -28 | 12/23 | 11/25 | 107 | 4.2 | 2/22 | 4/14 |
| 1971-2000 Average | -38 | -36 | 1/9 | 11/4 | 203 | 8.0 | 3/15 | 4/24 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence
Monthly SWE estimated from snow depth at climatological station and density at adjacent snow courses and distributed to daily SWE using West Yellowstone.

Site Name: Moran 5WNW

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1949 | -43 | -45 | 12/22 | 11/3 | 234 | 9.2 | 3/14 | 4/26 |
| 1950 | -43 | -45 | 2/3 | 12/10 | 236 | 9.3 | 3/30 | 5/13 |
| 1951 | -46 | -50 | 2/1 | 11/11 | 251 | 9.9 | 3/30 | 4/30 |
| 1952 | -37 | -35 | 1/3* | 11/12 | 234 | 9.2 | 4/15 | 4/30 |
| 1953 | -39 | -39 | 2/20 | 11/15 | 262 | 10.3 | 4/15 | 5/1 |
| 1954 | -36 | -32 | 3/3 | 11/22 | 226 | 8.9 | 4/13 | 4/28 |
| 1955 | -38 | -36 | 1/7 | 11/27 | 213 | 8.4 | 3/28 | 5/4 |
| 1956 | -43 | -46 | 2/1 | 10/28 | 460 | 18.1 | 3/22 | 5/5 |
| 1957 | -36 | -32 | 1/27 | 10/23 | 328 | 12.9 | 4/8 | 5/7 |
| 1958 | -33 | -27 | 1/1 | 11/13 | 272 | 10.7 | 3/28 | 5/6 |
| 1959 | -33 | -28 | 1/21 | 11/11 | 279 | 11.0 | 3/31 | 4/30 |
| 1960 | -36 | -32 | 1/20* | 12/3 | 213 | 8.4 | 3/22 | 4/26 |
| 1961 | -37 | -34 | 1/27 | 11/8 | 198 | 7.8 | 3/13 | 4/29 |
| 1962 | -41 | -41 | 1/22 | 10/22 | 404 | 15.9 | 4/12 | 4/27 |
| 1963 | -42 | -44 | 1/12 | 11/15 | 188 | 7.4 | 3/19 | 5/3 |
| 1964 | -33 | -28 | 1/14 | 11/21 | 259 | 10.2 | 3/31 | 5/10 |
| 1965 | -36 | -32 | 3/25 | 11/11 | 442 | 17.4 | 3/30 | 5/1 |
| 1966 | -33 | -27 | 3/5 | 11/10 | 218 | 8.6 | 3/27 | 4/30 |
| 1967 | -29 | -20 | 2/20* | 11/7 | 246 | 9.7 | 3/8 | 5/16 |
| 1968 | -31 | -24 | 1/12 | 11/22 | 236 | 9.3 | 3/23 | 5/3 |
| 1969 | -34 | -30 | 12/31 | 11/8 | 328 | 12.9 | 3/30 | 4/30 |
| 1970 | -34 | -30 | 1/6 | 11/16 | 295 | 11.6 | 4/4 | 5/19 |
| 1971 | -36 | -33 | 1/5* | 11/7 | 452 | 17.8 | 3/29 | 5/12 |
| 1972 | -38 | -36 | 1/4 | 11/14 | 391 | 15.4 | 3/5 | 5/9 |
| 1973 | -36 | -32 | 12/11* | 11/15 | 206 | 8.1 | 4/9 | 5/7 |
| 1974 | -37 | -34 | 1/2 | 11/1 | 371 | 14.6 | 3/14 | 5/7 |
| 1975 | -34 | -30 | 1/12 | 11/18 | 345 | 13.6 | 4/19 | 5/28 |
| 1976 | -32 | -26 | 2/6 | 10/25 | 419 | 16.5 | 4/4 | 5/14 |
| 1977 | -35 | -31 | 1/9 | 11/26 | 130 | 5.1 | 4/6 | 4/18 |
| 1978 | -38 | -36 | 1/2 | 11/15 | 437 | 17.2 | 3/5 | 5/12 |
| 1979 | -43 | -45 | 12/31 | 11/10 | 307 | 12.1 | 3/5 | 5/6 |
| 1980 | -36 | -33 | 1/28 | 11/4 | 236 | 9.3 | 4/13 | 4/29 |
| 1981 | -32 | -26 | 2/10 | 11/10 | 145 | 5.7 | 3/22 | 4/19 |
| 1982 | -42 | -43 | 2/5 | 11/22 | 457 | 18.0 | 4/10 | 5/15 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence
SWE estimated from precipitation, snow depth and temperature at climatological station.

Site Name: Moran 5WNW (Cont)

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1983 | -32 | -26 | 2/6* | 11/19 | 236 | 9.3 | 4/9 | 5/9 |
| 1984 | -38 | -36 | 1/18 | 11/7 | 292 | 11.5 | 3/12 | 5/17 |
| 1985 | -40 | -40 | 1/31 | 11/2 | 287 | 11.3 | 3/31 | 4/30 |
| 1986 | -31 | -23 | 2/8* | 11/8 | 371 | 14.6 | 3/20 | 4/24 |
| 1987 | -33 | -27 | 1/20* | 10/31 | 180 | 7.1 | 3/5 | 4/17 |
| 1988 | -34 | -30 | 1/19 | 11/17 | 229 | 9.0 | 4/5 | 4/18 |
| 1989 | -34 | -30 | 2/7 | 11/11 | 338 | 13.3 | 4/4 | 5/1 |
| 1990 | -32 | -26 | 2/19 | 11/24 | 203 | 8.0 | 3/8 | 4/15 |
| 1991 | -38 | -36 | 12/23* | 11/20 | 145 | 5.7 | 3/17 | 4/25 |
| 1992 | -29 | -20 | 1/21* | 10/26 | 185 | 7.3 | 3/1 | 4/9 |
| 1993 | -33 | -28 | 2/17 | 11/22 | 269 | 10.6 | 3/17 | 5/1 |
| 1994 | -31 | -24 | 2/12 | 11/22 | 208 | 8.2 | 2/26 | 4/20 |
| 1995 | -34 | -30 | 1/4* | 11/12 | 292 | 11.5 | 3/30 | 5/5 |
| 1996 | -37 | -35 | 2/3 | 11/5 | 297 | 11.7 | 3/20 | 5/10 |
| 1997 | -32 | -25 | 2/8 | 11/25 | 470 | 18.5 | 3/9 | 5/5 |
| 1998 | -29 | -20 | 2/28 | 11/17 | 305 | 12.0 | 3/21 | 4/28 |
| 1999 | -32 | -25 | 12/23* | 11/18 | 381 | 15.0 | 3/20 | 5/2 |
| 2000 | -32 | -25 | 1/31* | 11/20 | 295 | 11.6 | 3/25 | 4/14 |
| 2001 | -33 | -28 | 2/9 | 11/9 | 157 | 6.2 | 3/19 | 4/16 |
| 2002 | -35 | -31 | 2/26* | 11/22 | 264 | 10.4 | 3/29 | 4/14 |
| 2003 | -38 | -37 | 2/24 | 11/8 | 264 | 10.4 | 3/10 | 4/15 |
| 2004 | -33 | -27 | 1/6 | 11/9 | 269 | 10.6 | 3/15 | 4/3 |
| 2005 | -34 | -30 | 2/16 | 11/24 | 165 | 6.5 | 4/7 | 4/17 |
| 1971-2000 Average | -35 | -30 | 1/22 | 11/12 | 296 | 11.7 | 3/22 | 5/1 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence
SWE estimated from precipitation, snow depth and temperature at climatological station.

Site Name: Norris Basin

| Water Year | Coldest Temp Winter $^0C$ | Coldest Temp Winter $^0F$ | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1981 | | | | 11/8 | 234 | 9.2 | 4/13 | 5/1 |
| 1982 | | | | 10/26 | 498 | 19.6 | 4/22 | 5/26 |
| 1983 | | | | 10/19 | 284 | 11.2 | 4/20 | 5/30 |
| 1984 | | | | 10/12 | 236 | 9.3 | 4/13 | 5/18 |
| 1985 | | | | 10/13 | 323 | 12.7 | 4/7 | 5/8 |
| 1986 | | | | 10/7 | 351 | 13.8 | 3/19 | 5/26 |
| 1987 | | | | 11/2 | 191 | 7.5 | 4/6 | 4/27 |
| 1988 | | | | 11/13 | 277 | 10.9 | 4/19 | 5/13 |
| 1989 | | | | 11/2 | 414 | 16.3 | 4/10 | 5/9 |
| 1990 | | | | 10/26 | 249 | 9.8 | 3/30 | 4/20 |
| 1991 | | | | 10/17 | 221 | 8.7 | 5/5 | 5/22 |
| 1992 | | | | 10/23 | 201 | 7.9 | 3/1 | 4/26 |
| 1993 | | | | 10/30 | 348 | 13.7 | 3/21 | 5/16 |
| 1994 | | | | 11/23 | 251 | 9.9 | 4/11 | 5/2 |
| 1995 | | | | 11/1 | 366 | 14.4 | 4/4 | 5/21 |
| 1996 | | | | 10/4 | 483 | 19.0 | 4/16 | 5/29 |
| 1997 | | | | 10/16 | 460 | 18.1 | 4/3 | 5/17 |
| 1998 | | | | 10/11 | 366 | 14.4 | 4/19 | 5/9 |
| 1999 | | | | 11/3 | 351 | 13.8 | 4/16 | 5/23 |
| 2000 | | | | 11/21 | 358 | 14.1 | 3/5 | 4/30 |
| 2001 | | | | 10/31 | 201 | 7.9 | 4/23 | 5/10 |
| 2002 | | | | 10/12 | 274 | 10.8 | 3/26 | 5/13 |
| 2003 | | | | 10/12 | 246 | 9.7 | 4/5 | 5/20 |
| 2004 | | | | 10/30 | 262 | 10.3 | 3/15 | 4/17 |
| 2005 | | | | 10/19 | 231 | 9.1 | 4/11 | 5/6 |
| 1971-2000 Average | | | | 10/24 | 345 | 13.6 | 4/8 | 5/15 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence
No temperature data at this site
Monthly SWE distributed to daily SWE using Canyon.

Site Name: Old Faithful

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1979 | -44 | -47 | 12/30 | 11/9 | 333 | 13.1 | 4/14 | 5/20 |
| 1980 | -42 | -43 | 1/29 | 10/29 | 335 | 13.2 | 4/13 | 5/9 |
| 1981 | -45 | -49 | 2/11 | 11/8 | 257 | 10.1 | 4/11 | 5/2 |
| 1982 | -42 | -43 | 2/6* | 11/15 | 452 | 17.8 | 4/10 | 5/23 |
| 1983 | -33 | -28 | 12/28 | 10/27 | 307 | 12.1 | 4/9 | 5/21 |
| 1984 | -43 | -46 | 12/22 | 11/11 | 170 | 6.7 | 3/19 | 5/19 |
| 1985 | -42 | -43 | 2/4* | 10/17 | 277 | 10.9 | 4/1 | 5/13 |
| 1986 | -36 | -33 | 12/11 | 11/5 | 310 | 12.2 | 3/23 | 5/28 |
| 1987 | -36 | -32 | 11/10 | 10/13 | 170 | 6.7 | 4/3 | 4/22 |
| 1988 | -38 | -36 | 1/20* | 11/23 | 152 | 6.0 | 3/19 | 4/21 |
| 1989 | -38 | -36 | 2/6 | 11/8 | 269 | 10.6 | 3/6 | 5/1 |
| 1990 | -38 | -36 | 2/15 | 10/28 | 224 | 8.8 | 3/10 | 5/4 |
| 1991 | -43 | -46 | 12/22* | 11/5 | 203 | 8.0 | 3/31 | 5/17 |
| 1992 | -35 | -31 | 11/30 | 10/23 | 208 | 8.2 | 3/1 | 4/14 |
| 1993 | -38 | -36 | 12/4 | 11/2 | 274 | 10.8 | 3/17 | 5/12 |
| 1994 | -36 | -32 | 11/25 | 11/19 | 216 | 8.5 | 3/1 | 4/21 |
| 1995 | -35 | -31 | 1/3 | 11/1 | 376 | 14.8 | 4/3 | 5/16 |
| 1996 | -42 | -44 | 2/2 | 11/6 | 340 | 13.4 | 4/1 | 5/11 |
| 1997 | -37 | -35 | 12/17 | 10/24 | 546 | 21.5 | 3/16 | 5/9 |
| 1998 | -32 | -26 | 12/26* | 11/18 | 180 | 7.1 | 4/19 | 4/30 |
| 1999 | -43 | -45 | 12/22* | 11/6 | 373 | 14.7 | 4/17 | 5/8 |
| 2000 | -31 | -23 | 1/29 | 11/20 | 213 | 8.4 | 3/27 | 4/16 |
| 2001 | -37 | -35 | 2/8 | 11/9 | 102 | 4.0 | 3/20 | 4/19 |
| 2002 | -37 | -34 | 2/26 | 11/21 | 175 | 6.9 | 3/22 | 4/24 |
| 2003 | -41 | -42 | 2/24 | 10/23 | 208 | 8.2 | 3/30 | 4/16 |
| 2004 | -35 | -31 | 1/6 | 10/29 | 277 | 10.9 | 3/16 | 4/4 |
| 2005 | -34 | -30 | 12/23 | 11/19 | 211 | 8.3 | 4/6 | 4/25 |
| 1971-2000 Average | -38 | -37 | 1/3 | 11/4 | 292 | 11.5 | 3/29 | 5/7 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence
SWE estimated from precipitation, snow depth and temperature at climatological station.

Site Name: Snake River Station

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1949 | -39 | -38 | 2/3 | 11/5 | 579 | 22.8 | 4/6 | 5/10 |
| 1950 | -44 | -48 | 2/3 | 11/23 | 531 | 20.9 | 3/30 | 5/25 |
| 1951 | -42 | -43 | 2/1 | 11/1 | 465 | 18.3 | 3/30 | 5/10 |
| 1952 | -34 | -29 | 1/3 | 10/15 | 531 | 20.9 | 4/5 | 5/13 |
| 1953 | -35 | -31 | 12/25 | 11/13 | 472 | 18.6 | 3/6 | 5/12 |
| 1954 | -31 | -24 | 3/3 | 11/22 | 523 | 20.6 | 4/2 | 5/10 |
| 1955 | -38 | -36 | 3/5 | 11/16 | 417 | 16.4 | 4/13 | 5/15 |
| 1956 | -39 | -39 | 2/1 | 10/28 | 671 | 26.4 | 3/19 | 5/18 |
| 1957 | -36 | -32 | 1/18 | 10/23 | 505 | 19.9 | 3/28 | 5/11 |
| 1958 | -34 | -30 | 1/1 | 11/11 | 445 | 17.5 | 4/14 | 5/6 |
| 1959 | -35 | -31 | 1/21 | 11/10 | 450 | 17.7 | 3/31 | 4/30 |
| 1960 | -37 | -35 | 1/20* | 11/15 | 330 | 13.0 | 3/22 | 4/26 |
| 1961 | -38 | -37 | 1/27 | 11/8 | 417 | 16.4 | 3/14 | 4/29 |
| 1962 | -42 | -44 | 1/22 | 10/22 | 533 | 21.0 | 4/10 | 4/27 |
| 1963 | -44 | -47 | 1/12 | 11/15 | 330 | 13.0 | 3/19 | 5/3 |
| 1964 | -35 | -31 | 1/14 | 11/5 | 457 | 18.0 | 3/31 | 5/10 |
| 1965 | -37 | -35 | 3/25 | 11/11 | 551 | 21.7 | 3/30 | 5/1 |
| 1966 | -34 | -30 | 3/5 | 11/10 | 389 | 15.3 | 3/29 | 4/30 |
| 1967 | -31 | -23 | 2/20* | 11/7 | 399 | 15.7 | 3/8 | 5/16 |
| 1968 | -33 | -27 | 1/12 | 11/22 | 450 | 17.7 | 3/27 | 5/3 |
| 1969 | -36 | -33 | 12/31 | 11/8 | 462 | 18.2 | 3/30 | 5/6 |
| 1970 | -35 | -31 | 1/5 | 11/9 | 516 | 20.3 | 5/1 | 5/28 |
| 1971 | -38 | -37 | 1/4 | 10/23 | 615 | 24.2 | 4/6 | 5/24 |
| 1972 | -38 | -37 | 1/4 | 10/27 | 566 | 22.3 | 3/10 | 5/18 |
| 1973 | -39 | -38 | 12/10 | 10/26 | 391 | 15.4 | 4/22 | 5/19 |
| 1974 | -39 | -39 | 1/3 | 10/31 | 559 | 22.0 | 4/9 | 5/29 |
| 1975 | -36 | -33 | 1/12 | 11/1 | 572 | 22.5 | 4/19 | 6/6 |
| 1976 | -33 | -28 | 2/21 | 10/22 | 640 | 25.2 | 4/5 | 5/22 |
| 1977 | -33 | -27 | 11/28* | 11/26 | 213 | 8.4 | 4/4 | 4/25 |
| 1978 | -38 | -37 | 1/2 | 10/30 | 655 | 25.8 | 3/25 | 5/23 |
| 1979 | -43 | -46 | 12/31 | 11/9 | 541 | 21.3 | 4/14 | 5/20 |
| 1980 | -38 | -37 | 1/28 | 11/4 | 480 | 18.9 | 4/14 | 5/7 |
| 1981 | -37 | -35 | 2/11* | 11/10 | 335 | 13.2 | 4/9 | 4/30 |
| 1982 | -42 | -44 | 2/5 | 11/16 | 729 | 28.7 | 4/22 | 6/2 |
| 1983 | -34 | -29 | 2/7* | 10/27 | 490 | 19.3 | 4/17 | 5/29 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence

Site Name: Snake River Station (Cont)

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1984 | -41 | -41 | 1/18 | 11/8 | 399 | 15.7 | 4/14 | 5/23 |
| 1985 | -42 | -43 | 1/31 | 10/13 | 518 | 20.4 | 3/31 | 5/9 |
| 1986 | -32 | -26 | 12/11 | 11/8 | 635 | 25.0 | 3/22 | 5/26 |
| 1987 | -33 | -28 | 1/10 | 11/6 | 213 | 8.4 | 4/4 | 4/24 |
| 1988 | -35 | -31 | 1/4 | 11/13 | 434 | 17.1 | 4/6 | 5/12 |
| 1989 | -39 | -39 | 2/7 | 11/4 | 551 | 21.7 | 4/5 | 5/27 |
| 1990 | -31 | -24 | 2/20* | 10/28 | 391 | 15.4 | 3/29 | 4/23 |
| 1991 | -41 | -42 | 12/23 | 10/17 | 394 | 15.5 | 4/1 | 5/24 |
| 1992 | -31 | -24 | 12/2 | 10/23 | 310 | 12.2 | 3/24 | 4/27 |
| 1993 | -34 | -29 | 12/5 | 10/29 | 465 | 18.3 | 3/23 | 5/19 |
| 1994 | -32 | -26 | 2/1 | 11/19 | 345 | 13.6 | 3/29 | 5/6 |
| 1995 | -36 | -33 | 1/5 | 10/27 | 521 | 20.5 | 3/30 | 5/22 |
| 1996 | -42 | -44 | 1/2 | 11/1 | 541 | 21.3 | 4/6 | 5/29 |
| 1997 | -35 | -31 | 12/18 | 10/17 | 744 | 29.3 | 4/8 | 5/21 |
| 1998 | -28 | -18 | 3/9* | 10/24 | 460 | 18.1 | 4/19 | 5/19 |
| 1999 | -35 | -31 | 12/24 | 11/3 | 582 | 22.9 | 4/7 | 5/27 |
| 2000 | -32 | -25 | 2/1* | 11/21 | 439 | 17.3 | 4/2 | 5/2 |
| 2001 | -32 | -26 | 2/10 | 11/2 | 284 | 11.2 | 4/16 | 5/5 |
| 2002 | -36 | -33 | 2/27 | 11/7 | 424 | 16.7 | 3/30 | 5/12 |
| 2003 | -35 | -31 | 2/26 | 10/23 | 406 | 16.0 | 3/12 | 5/16 |
| 2004 | -33 | -28 | 1/6 | 10/30 | 455 | 17.9 | 3/20 | 5/2 |
| 2005 | -35 | -31 | 12/24 | 10/19 | 312 | 12.3 | 4/7 | 5/3 |
| 1971-2000 Average | -36 | -33 | 1/6 | 11/1 | 491 | 19.3 | 4/5 | 5/16 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence

Site Name: Sylvan Lake

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1981 | | | | 10/19 | 366 | 14.4 | 4/16 | 6/8 |
| 1982 | | | | 10/11 | 866 | 34.1 | 4/27 | 6/30 |
| 1983 | | | | 9/28 | 676 | 26.6 | 5/25 | 6/23 |
| 1984 | -44 | -47 | 12/24 | 10/10 | 643 | 25.3 | 5/12 | 6/26 |
| 1985 | -42 | -44 | 2/2 | 10/14 | 569 | 22.4 | 4/9 | 5/28 |
| 1986 | -36 | -33 | 2/9 | 9/25 | 871 | 34.3 | 5/16 | 6/17 |
| 1987 | -33 | -27 | 3/30 | 9/19 | 411 | 16.2 | 4/14 | 5/10 |
| 1988 | -35 | -31 | 12/25 | 11/14 | 373 | 14.7 | 5/9 | 5/28 |
| 1989 | -35 | -31 | 2/7 | 11/2 | 699 | 27.5 | 4/18 | 6/13 |
| 1990 | -32 | -26 | 2/16 | 10/26 | 475 | 18.7 | 4/30 | 6/18 |
| 1991 | -38 | -36 | 12/23 | 10/11 | 699 | 27.5 | 5/13 | 6/16 |
| 1992 | -30 | -22 | 11/3 | 10/23 | 485 | 19.1 | 4/24 | 5/24 |
| 1993 | -31 | -24 | 12/5 | 10/5 | 655 | 25.8 | 5/8 | 6/19 |
| 1994 | -31 | -24 | 11/26 | 10/14 | 470 | 18.5 | 4/14 | 5/25 |
| 1995 | -31 | -24 | 2/12 | 10/15 | 792 | 31.2 | 5/3 | 6/28 |
| 1996 | -28 | -18 | 2/4 | 10/5 | 714 | 28.1 | 4/27 | 6/28 |
| 1997 | -29 | -20 | 2/24 | 10/16 | 836 | 32.9 | 4/17 | 6/8 |
| 1998 | -27 | -17 | 12/12 | 10/7 | 500 | 19.7 | 4/21 | 6/13 |
| 1999 | -35 | -31 | 12/22 | 10/28 | 716 | 28.2 | 4/25 | 6/24 |
| 2000 | -25 | -13 | 1/30 | 11/18 | 500 | 19.7 | 4/4 | 6/4 |
| 2001 | -32 | -25 | 2/9 | 10/12 | 442 | 17.4 | 4/22 | 5/24 |
| 2002 | -33 | -27 | 2/27 | 10/10 | 536 | 21.1 | 4/23 | 6/6 |
| 2003 | -35 | -31 | 2/25 | 9/30 | 607 | 23.9 | 5/13 | 6/9 |
| 2004 | -27 | -17 | 1/6 | 10/30 | 391 | 15.4 | 3/19 | 5/9 |
| 2005 | -33 | -28 | 12/24 | 10/19 | 391 | 15.4 | 4/13 | 5/26 |
| 1971-2000 Average | -34 | -30 | 12/25 | 10/16 | 622 | 24.5 | 4/25 | 6/10 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence

Site Name: Sylvan Road

| Water Year | Coldest Temp Winter $^0C$ | Coldest Temp Winter $^0F$ | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1988 | | | | 11/13 | 239 | 9.4 | 4/6 | 5/12 |
| 1989 | | | | 11/7 | 427 | 16.8 | 4/6 | 5/15 |
| 1990 | -31 | -24 | 2/16 | 10/29 | 290 | 11.4 | 4/1 | 5/11 |
| 1991 | -40 | -40 | 12/22 | 10/14 | 368 | 14.5 | 4/20 | 5/24 |
| 1992 | -29 | -20 | 12/1 | 10/23 | 239 | 9.4 | 4/12 | 5/2 |
| 1993 | -31 | -24 | 12/5 | 11/2 | 264 | 10.4 | 4/21 | 5/15 |
| 1994 | -30 | -22 | 11/26* | 10/29 | 305 | 12.0 | 4/14 | 5/9 |
| 1995 | -30 | -22 | 2/12* | 10/22 | 358 | 14.1 | 4/10 | 5/23 |
| 1996 | -36 | -33 | 2/3 | 10/22 | 505 | 19.9 | 4/6 | 6/2 |
| 1997 | -33 | -27 | 1/13 | 10/15 | 538 | 21.2 | 4/14 | 5/20 |
| 1998 | -26 | -15 | 12/26 | 10/24 | 269 | 10.6 | 4/1 | 5/10 |
| 1999 | -33 | -27 | 12/21 | 10/29 | 442 | 17.4 | 4/17 | 5/25 |
| 2000 | -25 | -13 | 1/30 | 11/19 | 340 | 13.4 | 4/4 | 5/6 |
| 2001 | -31 | -24 | 2/9 | 11/4 | 264 | 10.4 | 4/17 | 5/9 |
| 2002 | -32 | -25 | 2/27 | 10/12 | 274 | 10.8 | 3/31 | 5/19 |
| 2003 | -37 | -35 | 2/25 | 10/13 | 368 | 14.5 | 4/8 | 5/21 |
| 2004 | -28 | -19 | 1/6 | 10/30 | 257 | 10.1 | 3/20 | 4/28 |
| 2005 | -29 | -20 | 12/24 | 10/24 | 231 | 9.1 | 4/7 | 5/7 |
| 1971-2000 Average | -34 | -29 | 1/2 | 10/28 | 356 | 14.0 | 4/9 | 5/16 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence

Site Name: Thumb Divide

| Water Year | Coldest Temp Winter $^0C$ | Coldest Temp Winter $^0F$ | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1988 | -34 | -29 | 1/21 | 11/3 | 356 | 14.0 | 4/10 | 5/22 |
| 1989 | -37 | -35 | 2/7 | 11/3 | 516 | 20.3 | 4/6 | 5/24 |
| 1990 | -37 | -35 | 2/16 | 10/25 | 290 | 11.4 | 4/3 | 5/19 |
| 1991 | -40 | -40 | 12/22 | 10/6 | 424 | 16.7 | 5/13 | 6/4 |
| 1992 | -31 | -24 | 1/16 | 10/23 | 274 | 10.8 | 4/12 | 5/6 |
| 1993 | -34 | -29 | 2/18 | 10/30 | 462 | 18.2 | 5/1 | 5/26 |
| 1994 | -32 | -26 | 2/1 | 11/19 | 323 | 12.7 | 4/13 | 5/10 |
| 1995 | -36 | -33 | 1/2 | 10/15 | 559 | 22.0 | 5/3 | 6/5 |
| 1996 | -41 | -42 | 2/3 | 10/3 | 663 | 26.1 | 4/6 | 6/8 |
| 1997 | -33 | -27 | 1/7 | 10/16 | 836 | 32.9 | 4/15 | 6/2 |
| 1998 | -30 | -22 | 3/9 | 10/24 | 460 | 18.1 | 4/21 | 5/26 |
| 1999 | -38 | -37 | 12/22 | 10/31 | 620 | 24.4 | 4/12 | 6/6 |
| 2000 | -32 | -26 | 1/31 | 11/21 | 373 | 14.7 | 4/4 | 5/16 |
| 2001 | -36 | -33 | 2/9 | 11/5 | 226 | 8.9 | 4/16 | 5/6 |
| 2002 | -38 | -37 | 2/27 | 10/12 | 404 | 15.9 | 4/23 | 5/25 |
| 2003 | -41 | -41 | 2/25 | 10/23 | 419 | 16.5 | 4/9 | 5/24 |
| 2004 | -32 | -25 | 2/13 | 10/31 | 439 | 17.3 | 3/18 | 5/7 |
| 2005 | -32 | -26 | 2/17 | 10/19 | 373 | 14.7 | 4/12 | 5/19 |
| 1971-2000 Average | -37 | -34 | 1/18 | 10/27 | 488 | 19.2 | 4/18 | 5/25 |

* More than one date. One shown is latest in season. Date of maximum SWE is for latest date of occurrence

Site Name: West Yellowstone

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1949 | -41 | -42 | 2/13* | 11/2 | 178 | 7.0 | 3/17 | 5/3 |
| 1950 | -41 | -41 | 2/3 | 12/9 | 183 | 7.2 | 3/30 | 5/13 |
| 1951 | -48 | -55 | 1/29 | 11/11 | 244 | 9.6 | 3/30 | 4/29 |
| 1952 | -36 | -33 | 2/24 | 10/21 | 363 | 14.3 | 4/2 | 5/2 |
| 1953 | -38 | -36 | 11/26 | 11/12 | 254 | 10.0 | 4/16 | 5/5 |
| 1954 | -33 | -28 | 3/3 | 11/17 | 206 | 8.1 | 4/2 | 5/4 |
| 1955 | -42 | -43 | 3/5 | 12/3 | 218 | 8.6 | 4/12 | 5/8 |
| 1956 | -47 | -52 | 2/1 | 10/26 | 422 | 16.6 | 3/21 | 5/1 |
| 1957 | -48 | -54 | 1/27 | 10/24 | 371 | 14.6 | 4/8 | 5/7 |
| 1958 | -33 | -28 | 1/20 | 11/11 | 201 | 7.9 | 4/1 | 5/4 |
| 1959 | -42 | -44 | 1/3 | 11/3 | 236 | 9.3 | 3/31 | 4/28 |
| 1960 | -41 | -42 | 2/1 | 11/12 | 142 | 5.6 | 3/18 | 4/9 |
| 1961 | -42 | -43 | 1/27 | 11/1 | 231 | 9.1 | 4/1 | 5/1 |
| 1962 | -48 | -55 | 1/10 | 10/21 | 373 | 14.7 | 3/24 | 5/2 |
| 1963 | -51 | -60 | 1/12 | 11/14 | 185 | 7.3 | 4/11 | 5/5 |
| 1964 | -38 | -36 | 1/14 | 11/15 | 246 | 9.7 | 3/30 | 5/12 |
| 1965 | -47 | -52 | 12/17 | 11/10 | 371 | 14.6 | 3/30 | 5/11 |
| 1966 | -37 | -35 | 3/4 | 11/23 | 206 | 8.1 | 3/25 | 4/19 |
| 1967 | -33 | -27 | 12/9 | 11/6 | 559 | 22.0 | 4/12 | 5/22 |
| 1968 | -37 | -35 | 12/14 | 11/18 | 320 | 12.6 | 3/27 | 5/10 |
| 1969 | -38 | -36 | 12/31 | 11/3 | 475 | 18.7 | 4/3 | 5/10 |
| 1970 | -41 | -41 | 1/5 | 11/16 | 358 | 14.1 | 5/1 | 5/22 |
| 1971 | -40 | -40 | 1/3 | 10/15 | 554 | 21.8 | 4/3 | 5/21 |
| 1972 | -39 | -39 | 1/4 | 10/16 | 419 | 16.5 | 3/6 | 5/13 |
| 1973 | -44 | -48 | 12/10 | 11/7 | 284 | 11.2 | 4/22 | 5/15 |
| 1974 | -38 | -37 | 1/2 | 10/24 | 505 | 19.9 | 4/10 | 5/16 |
| 1975 | -36 | -33 | 1/12 | 11/8 | 391 | 15.4 | 4/23 | 5/27 |
| 1976 | -37 | -35 | 2/6 | 11/8 | 472 | 18.6 | 4/3 | 5/18 |
| 1977 | -37 | -35 | 1/9 | 11/28 | 132 | 5.2 | 4/5 | 4/24 |
| 1978 | -38 | -37 | 1/2 | 10/30 | 378 | 14.9 | 3/23 | 5/11 |
| 1979 | -46 | -50 | 12/30 | 10/31 | 394 | 15.5 | 4/3 | 5/17 |
| 1980 | -43 | -46 | 1/28 | 11/4 | 335 | 13.2 | 4/15 | 5/1 |
| 1981 | -42 | -44 | 2/10 | 10/24 | 203 | 8.0 | 4/11 | 4/26 |
| 1982 | -45 | -49 | 2/15 | 11/4 | 475 | 18.7 | 4/23 | 5/26 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence

Site Name: West Yellowstone (Cont)

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1983 | -34 | -30 | 12/28* | 10/18 | 409 | 16.1 | 3/28 | 5/25 |
| 1984 | -44 | -48 | 12/24 | 11/11 | 312 | 12.3 | 4/15 | 5/29 |
| 1985 | -43 | -45 | 2/4 | 10/19 | 391 | 15.4 | 4/7 | 5/8 |
| 1986 | -35 | -31 | 2/11* | 10/7 | 417 | 16.4 | 3/8 | 5/5 |
| 1987 | -37 | -35 | 1/16 | 11/5 | 211 | 8.3 | 4/3 | 4/20 |
| 1988 | -37 | -35 | 1/19 | 11/13 | 224 | 8.8 | 4/6 | 4/22 |
| 1989 | -38 | -36 | 2/5 | 11/10 | 452 | 17.8 | 4/5 | 5/10 |
| 1990 | -37 | -35 | 2/15 | 11/23 | 218 | 8.6 | 3/26 | 4/19 |
| 1991 | -43 | -46 | 12/21 | 10/6 | 221 | 8.7 | 3/27 | 5/12 |
| 1992 | -34 | -30 | 11/30* | 10/23 | 246 | 9.7 | 3/3 | 4/21 |
| 1993 | -38 | -36 | 12/4 | 10/1 | 399 | 15.7 | 3/23 | 5/10 |
| 1994 | -35 | -31 | 11/25 | 11/23 | 231 | 9.1 | 4/11 | 5/1 |
| 1995 | -39 | -38 | 1/3 | 11/1 | 419 | 16.5 | 4/3 | 5/16 |
| 1996 | -47 | -53 | 2/2 | 10/21 | 295 | 11.6 | 4/4 | 5/7 |
| 1997 | -34 | -30 | 1/12 | 10/19 | 485 | 19.1 | 3/20 | 5/8 |
| 1998 | -31 | -23 | 12/11 | 10/29 | 246 | 9.7 | 4/2 | 5/1 |
| 1999 | -43 | -46 | 12/22 | 11/2 | 409 | 16.1 | 4/12 | 5/18 |
| 2000 | -32 | -26 | 2/1 | 11/25 | 259 | 10.2 | 4/2 | 4/23 |
| 2001 | -38 | -36 | 2/19 | 11/13 | 150 | 5.9 | 4/15 | 4/29 |
| 2002 | -38 | -37 | 2/27 | 11/21 | 267 | 10.5 | 4/4 | 5/6 |
| 2003 | -42 | -43 | 2/25 | 10/31 | 211 | 8.3 | 3/10 | 4/20 |
| 2004 | -39 | -39 | 1/6 | 11/3 | 307 | 12.1 | 3/12 | 4/14 |
| 2005 | -36 | -32 | 12/24 | 10/24 | 254 | 10.0 | 4/7 | 4/27 |
| 1971-2000 Average | -39 | -38 | 1/9 | 10/30 | 346 | 13.6 | 4/2 | 5/8 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence

Site Name: Yellowstone Park (Mammoth)

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1949 | -34 | -30 | 1/10 | 11/15 | 165 | 6.5 | 3/17 | 4/11 |
| 1950 | -31 | -24 | 1/3 | 12/9 | 86 | 3.4 | 2/4 | 4/7 |
| 1951 | -38 | -36 | 1/29 | 11/8 | 76 | 3.0 | 3/19 | 4/4 |
| 1952 | -28 | -19 | 1/22 | 11/14 | 140 | 5.5 | 3/27 | 4/14 |
| 1953 | -26 | -15 | 11/26 | 11/15 | 46 | 1.8 | 1/10 | 1/13 |
| 1954 | -28 | -18 | 1/20 | 12/1 | 102 | 4.0 | 3/6 | 4/11 |
| 1955 | -29 | -21 | 2/19 | 12/5 | 94 | 3.7 | 3/28 | 4/29 |
| 1956 | -33 | -27 | 2/16* | 11/22 | 89 | 3.5 | 3/16 | 3/26 |
| 1957 | -32 | -25 | 1/27* | 10/26 | 91 | 3.6 | 3/15 | 3/31 |
| 1958 | -22 | -7 | 11/21 | 2/27 | 36 | 1.4 | 3/31 | 4/6 |
| 1959 | -34 | -29 | 1/3 | 11/25 | 74 | 2.9 | 3/15 | 4/12 |
| 1960 | -33 | -27 | 11/13 | 11/12 | 51 | 2.0 | 3/18 | 3/27 |
| 1961 | -27 | -17 | 1/27 | 11/7 | 48 | 1.9 | 3/12 | 3/17 |
| 1962 | -34 | -30 | 1/9 | 11/11 | 124 | 4.9 | 3/6 | 4/18 |
| 1963 | -38 | -36 | 1/12 | 11/28 | 56 | 2.2 | 1/31 | 2/1 |
| 1964 | -25 | -13 | 12/11 | 11/20 | 89 | 3.5 | 3/28 | 4/5 |
| 1965 | -37 | -34 | 12/17 | 11/26 | 145 | 5.7 | 3/28 | 4/9 |
| 1966 | -29 | -20 | 1/20 | 12/21 | 66 | 2.6 | 3/8 | 3/16 |
| 1967 | -26 | -15 | 3/7 | 12/21 | 102 | 4.0 | 3/16 | 4/2 |
| 1968 | -28 | -18 | 1/2* | 11/19 | 178 | 7.0 | 2/17 | 3/21 |
| 1969 | -27 | -16 | 1/24* | 11/25 | 127 | 5.0 | 3/12 | 3/28 |
| 1970 | -29 | -21 | 1/5 | 12/22 | 51 | 2.0 | 2/5 | 4/11 |
| 1971 | -28 | -18 | 1/4 | 12/9 | 89 | 3.5 | 3/9 | 3/23 |
| 1972 | -32 | -25 | 1/27* | 12/5 | 137 | 5.4 | 2/12 | 2/1 |
| 1973 | -33 | -27 | 12/5 | 11/26 | 28 | 1.1 | 2/26 | 3/19 |
| 1974 | -28 | -18 | 1/9* | 1/18 | 79 | 3.1 | 3/16 | 3/27 |
| 1975 | -28 | -18 | 1/12 | 11/28 | 66 | 2.6 | 3/1 | 4/23 |
| 1976 | -27 | -17 | 2/6 | 11/17 | 76 | 3.0 | 3/30 | 4/8 |
| 1977 | -26 | -14 | 1/9 | 11/28 | 38 | 1.5 | 3/2 | 3/10 |
| 1978 | -28 | -19 | 11/20 | 12/6 | 89 | 3.5 | 3/4 | 3/31 |
| 1979 | -35 | -31 | 12/29 | 11/11 | 163 | 6.4 | 3/5 | 4/13 |
| 1980 | -33 | -28 | 1/28 | 1/2 | 46 | 1.8 | 2/27 | 4/12 |
| 1981 | -34 | -29 | 2/11* | 2/1 | 10 | 0.4 | 2/13 | 2/14 |
| 1982 | -33 | -27 | 2/4 | 12/14 | 84 | 3.3 | 2/14 | 2/28 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence
SWE estimated from precipitation, snow depth and temperature at climatological station.

Site Name: Yellowstone Park (Mammoth) (Cont)

| Water Year | Coldest Temp Winter $^0$C | Coldest Temp Winter $^0$F | Day Coldest Temp | Day Snow Starts | Max SWE mm | Max SWE inches | Day Max SWE | Day Snow Melts |
|---|---|---|---|---|---|---|---|---|
| 1983 | -22 | -8 | 12/28 | 11/7 | 56 | 2.2 | 2/18 | 3/12 |
| 1984 | -34 | -29 | 12/24 | 11/13 | 41 | 1.6 | 3/1 | 3/21 |
| 1985 | -32 | -25 | 2/4 | 11/23 | 71 | 2.8 | 3/14 | 4/2 |
| 1986 | -27 | -16 | 2/11 | 11/8 | 64 | 2.5 | 1/19 | 3/1 |
| 1987 | -27 | -16 | 1/16 | 3/8 | 10 | 0.4 | 3/10 | 3/17 |
| 1988 | -26 | -15 | 1/20* | 12/8 | 36 | 1.4 | 2/26 | 3/9 |
| 1989 | -37 | -35 | 2/4* | 11/14 | 86 | 3.4 | 2/24 | 3/12 |
| 1990 | -27 | -17 | 2/15 | 11/25 | 48 | 1.9 | 3/2 | 3/19 |
| 1991 | -37 | -35 | 12/22 | 12/12 | 23 | 0.9 | 2/9 | 2/10 |
| 1992 | -24 | -11 | 11/2 | 10/23 | 51 | 2.0 | 11/8 | 11/13 |
| 1993 | -27 | -16 | 2/17* | 12/2 | 84 | 3.3 | 3/5 | 3/24 |
| 1994 | -27 | -17 | 11/25 | 11/23 | 66 | 2.6 | 2/28 | 3/7 |
| 1995 | -26 | -15 | 2/13* | 11/2 | 53 | 2.1 | 2/18 | 2/25 |
| 1996 | -34 | -30 | 2/2 | 1/1 | 61 | 2.4 | 3/8 | 3/16 |
| 1997 | -34 | -30 | 1/12 | 12/14 | 48 | 1.9 | 3/10 | 3/18 |
| 1998 | -23 | -9 | 1/11 | 11/26 | 43 | 1.7 | 3/12 | 3/23 |
| 1999 | -32 | -26 | 12/21 | 1/1 | 64 | 2.5 | 3/13 | 3/22 |
| 2000 | -19 | -3 | 1/30 | 12/13 | 46 | 1.8 | 2/7 | 3/3 |
| 2001 | -28 | -18 | 2/9* | 11/5 | 36 | 1.4 | 3/5 | 3/9 |
| 2002 | -26 | -15 | 2/27* | 11/25 | 64 | 2.5 | 3/22 | 4/1 |
| 2003 | -31 | -24 | 2/24 | 11/23 | 46 | 1.8 | 3/9 | 3/13 |
| 2004 | -31 | -23 | 1/6* | 12/8 | 58 | 2.3 | 3/8 | 3/14 |
| 2005 | -24 | -11 | 12/23 | 12/30 | 51 | 2.0 | 2/25 | 3/9 |
| 1971-2000 Average | -29 | -21 | 1/6 | 12/6 | 51 | 2.0 | 2/23 | 3/11 |

* More than one date. One shown is latest in season.
Date of maximum SWE is for latest date of occurrence
SWE estimated from precipitation, snow depth and temperature at climatological station.