CLIMATE AND PRECIPITATION of Hood River County by Hugh McMahan

Water resources cannot be discussed or evaluated without an assessment and inventory of the input: the precipitation that falls on Hood River County. The amount and kind of precipitation are dictated by the interrelationship of the county’s unique topography, location, and climate.

LOCATION AND TOPOGRAPHY

Hood River County is nestled between the Cascade Range to the west, the Columbia River and Gorge to the north, and Surveyors Ridge, Fir Mountain and Hood River Mountain to the east. The mighty Mount Hood and its flanks define the southern border of the County. There is a dramatic range of elevation in the County - from about 75’ at the Columbia River to the north all the way to the summit of Mount Hood at 11,240’ in the south. In addition to this great topographical variation, the County also reflects the biodiversity fostered by both its climate and topography: the fir-hemlock forests on the west and the fir-ponderosa pine-oak forests on the east.

Running from the summit of Mount Hood at 11,240’ roughly north-south between these land forms is the Hood River Valley. The Heights of the lower Hood River Valley are at about 500’ elevation, Odell at about 700’, and the diminutive middle valley in the saddle between Middle Mountain and Fir Mountain, is at about 1600’. The upper valley at its lowest, northern end is at about 1400’ elevation and farther south in Parkdale about 1740’ and on up to the Cooper Spur Inn at 3400’. The Mount Hood Meadows parking lot is about 5320’. To the east, the County is bordered by Hood River Mountain, Fir Mountain and Surveyors Ridge with elevations up to 3840’ at Bald Butte and 6525’ at Lookout Mountain. On the western side of the County lies the Cascade Crest with Red Hill at 4920’, Blue Ridge at 3780’ and Waucoma Ridge with Mount Defiance at 4960’. These land masses were formed by the volcanic activity of Mount Hood and the action of the Hood River. The West Fork of the Hood River drains the northeast side of Mount Hood (Ladd and Glisan Glaciers) and flows north and east. The East Fork of the Hood River drains the eastern flank of the mountain (Newton Clark Glacier) and flows north through the upper valley to join its Middle Fork (which drains the Eliot, Coe and Langille Glaciers) to form the Hood River proper. After flowing several miles, the Hood River joins its West Fork at Dee and Punchbowl Falls and then continues around the west flank of Middle Mountain to basically bisect the lower valley until it reaches the Columbia River.

CLIMATE

Oregon was divided into seven climatic zones by NOAA’s National Climatic Data Center. Hood River County is in Oregon Climate Zone 6 (North Central Oregon), however this zone is predominantly the semi-arid climate to our east. (The NWS’s Climate Forecast Zones, however, are more fine tuned: Hood River County is covered in the North Oregon Cascade Foothills Zone and the Western Columbia River Gorge Zone. The EPA places the county in its East Cascades Ecoregion.) The County could easily be a
part of Climate Zone 4 (Northern Cascades) or a separate zone all by itself because it is a battle zone between the Continental/arctic weather of Climate Zone 6 and the temperate maritime weather of Climate Zones 4 (Northern Cascades) and 2 (Willamette Valley). Because of the prevailing westerly winds, Zones 4 and 2 are both in turn a continuation of the weather of Climate Zone 1 (Oregon Coast) and of course, the jet stream and the Pacific Ocean: We are under the constant influence of the moisture laden maritime air coming on the jet stream from the Pacific up and over the Cascades and up the Gorge. Most of the moisture falls on the west flank of the Cascades, however, most of what is left falls on Hood River County. Occasionally, we experience tropical air masses coming in from the south. The seasonal winds ripping through the gorge alternately from the east in winter, and then from the west in spring and summer greatly influence the weather and recreation in the Valley, and especially the city of Hood River and the Gorge. In winter, these winds will create significant microclimates between Hood River and Portland with resulting rain or freezing rain or snow and sleet making Gorge travel some of the most treacherous anywhere. The arctic, east winds come down the Gorge and/or over the ridges into the Valley but they can also head south out of the Gorge and come up the Valley and be experienced in the upper Valley as north winds. In the spring and summer the west Gorge winds delight the windsurfers.

The County’s climate is generally described as mild, however there are wide variations. Healthy precipitation, combined with wonderful soils, makes it ideal for agriculture. The focus of this report is water resources, but a brief comment about temperatures is appropriate when discussing the Valley’s climate. At the MCAREC (Mid-Columbia Agricultural Research and Extension Center) station off Tucker Road on the Heights, between 1928 and 2005, the average annual maximum temperature was 61°. The average annual minimum temperature was 40°. The average high temperature in July and August was 81° and the average low in January was 28°. Up in Parkdale, from 1981 to 2005, the average annual maximum temperature was 60° and the average annual low was 37°. The average high temperature in July and August was interestingly the same as down on the Heights, also about 81° and, likewise, the average low in January was 28°.

The climate also presents yearly and ongoing challenges to the agricultural community of the County with constant worry about freezes at the susceptible times of the growing season, and over droughts. Droughts, of course, impact the irrigation districts’ abilities to deliver water to their orchardists. Global climate change is impacting our water supplies affecting not only the form and the amount falling from the sky, but the frequency of delivery and the amount available from its storage facilities on the mountain (the shrinking glaciers) in the ground (the springs) and on the ground (the yearly snowpack). Regardless of the debate over the cause of climate change, we will need to be prepared for variations and extremes, not only in the water supplies themselves, but from increasing frequency of rain-on-snow floods and debris flows coming down the mountain destroying infrastructure, causing millions of dollars of damage and impacting the availability and delivery of our water supplies. As the glaciers have shrunk, particularly in this last decade, glacial moraines previously stabilized by the presence of the glacial ice are vulnerable to being saturated with water, sloughing off, and resulting in large debris flows of mud, rock, and ice careening down the mountain. There have been debris flows on the mountain for centuries, however, their frequency is increasing...
dramatically. USFS geologist, Tom DeRoo, has said that from 1960 to 1995 there were one or two debris flows of record and since 1995, there has been one almost every other year.

Memorable Climatic Events of Hood River County (1):
*1862* - Columbia River frozen until mid-March. Accumulated snowfall at the river was over 13 feet.

*Dec. 1884* – On Dec. 13th gale force east winds hit the Gorge and it snowed for 3 weeks. Snow depth in downtown Hood River was over 9 feet. A west bound train was buried by an avalanche east of Wyeth at a place now called Starvation Creek because of the effort it took to get food to the stranded passengers and crew.

**1887** – Rain-on-snow flood on Neal Creek. Sawmill destroyed.

**Jan. 1919** – Columbia River froze solid, temperatures down to 27 degrees below zero were recorded and most of the apple trees did not survive. This was the beginning of the ascendancy of pears in the Hood River Valley.

**Nov. 1921** – Thirty to forty foot drifts covered the road and railroad tracks at Viento.

**Winter 1930** – Thirty below zero temperatures and 11 feet of snow at Red Hill.

**Winter 1937** – Twelve below zero and the Columbia River froze bank-to-bank.

**Jan. 1950** – Snowstorm during the second week of January dumped 64.4” of snow on Hood River and 8 to 10 feet fell in Parkdale over the month.

**Dec. 22, 1964** – Flood: The weekend before Christmas 30” snow fell followed by warm rain. At Tucker Bridge: 20.60’ stage, 33,000 c.f.s. This is the number one historical flood crest of the Hood River.

**Jan. 1970** - “Silver Thaw” in Dee turns orchards to “icy garbage piles.” Gov. McCall declares Hood River County a state disaster area.


**1977** – Drought Year and Flood: lowest water year with 47% of average runoff. However, the 4th historic flood crest on the Hood River occurred on Dec. 13th at 15.59’ at Tucker Bridge.

**Jan. 1980** – Snowstorm dumped 47” of snow in 2 days

**Dec. 1980** – Christmas Day Flood: The 5th highest flood of record with a crest of 14.74’ at Tucker Bridge. Rainfall had been heavy and the temperature had reached 60 degrees. About 9PM in the evening a sudden flood on Pollalie Creek created a debris flow that swept a camper at the Pollalie Creek Campground to his death, dammed the East Fork for a short period of time, blew out, and tore downstream. Four bridges were torn out, over 5 miles of Highway #35 was damaged or wiped out, and 600’ of the 14” main line of the Crystal Springs Water District ripped out.

**Feb. 20, 1982** – Flood: Seventh highest flood of record on the Hood River with crest of 14.05’.

**Feb. 23, 1986** – Flood: The 8th highest flood of record on the Hood River with crest of 13.70’.

**Sept. 13, 1994** – Lowest daily flow on the Hood River at Tucker Bridge: 144 c.f.s.

**Feb. 7 and 8, 1996** Flood – “Once-in-a-generation flood.” 5.5” of rain fell over two days creating mud flows which closed I-84 in several places as well as Highway #35. The number two historical crest of the Hood River was Feb. 7 at 17.11’ and the number three historical crest was 16.03’ on Feb. 8th. The 4” main of Crystal Springs at Neal
Creek was washed out and the spring box was contaminated thus initiating chlorination. The East Fork Irrigation District sustained significant infrastructure damage.


*Nov. 25, 1999* – Flood: The 10th highest flood of record on the Hood River crested at 13.29’ at Tucker Bridge.

*Sept. 2000* Flood – On September 30, 3-4” of warm rain fell and melted portions of the White and Newton Clark glaciers. Water and hundreds of cubic yards of rock and mud descended down the White River and Newton Creek. A group of 10 hunters at the Robinhood Campground barely escaped. The campground was destroyed and has never reopened. Twenty miles of Highway #35 was closed.

*2001* – Drought Year.

*March 2005* – Almost a drought year: Flow at Tucker Bridge on 3/23/05 was 407 c.f.s.; mean for this date is 1360 c.f.s. Rain came and on 3/28/05 flow improved to 2190 c.f.s.

*Nov. 2006* – Debris Flow: The granddaddy of them all since the valley was settled – so far - was from the Elliot Glacier and the Newton Clark Glacier. This monster did multi-millions of dollars of damage: It took out sections of Highway #35 in three places, several key structures of the Middle Fork Irrigation District shutting down their hydroelectric generating plants, wiped out the Red Hill Road Bridge, damaged Toll Bridge Road, invaded and undercut the spring box of the Ice Fountain Water District, suspended 300 yards of track of the Mount Hood Railroad in mid-air, ripped away critical infrastructure of the Farmers Irrigation District and shut down their hydroelectric plants, and, lastly, created a huge new river delta in the Columbia. Needless to say, the threat of water related natural disasters is omnipresent and the economic impact is huge.

In the absence of a statistical analysis of climate data and/or specific climate modeling and forecasting for Hood River County, the mountain’s shrinking glaciers and the above chronology of the County’s major climate events strongly suggests a warming trend: the Columbia River has not frozen since 1937, droughts are becoming more frequent, and winter precipitation is increasingly falling more as rain than snow. Snowfall records at the MCAREC station are available back to 1927 (79 years). In that period of time there have only been two years when no snowfall occurred: the winter of 2002-2003 and the winter of 2004-2005. This trend is supported by historical precipitation data as well. See Table 1 below.

**PRECIPITATION:**

Precipitation occurs when water droplets or ice crystals making up a cloud become large enough and heavy enough to fall to earth under the influence of gravity. Precipitation includes rain, snow, hail, freezing rain and sleet.

Precipitation is measured in various ways, but most commonly with a rain gauge. This is the classic 8” cylinder, which has been used for over 100 years, or a 4” cylinder with a funnel on top. The funnel fills a smaller, graduated (markers to indicate the amount of rain in inches and tenths of an inch) cylinder within the larger one. Overflow can occur from the small cylinder into the large one if necessary. When snow is forecast, the funnel is removed and the snow is collected in the larger cylinder. When the storm is over, the
depth is measured and the snow melted and the amount of water measured (Snow Water Equivalent or SWE). In some cases, the station operator will take a core of the snowfall or snowpack and weigh it or melt it to obtain the SWE. There are “tipping bucket” rain gauges which measure the rainfall automatically, although these are less accurate. These are used most commonly in the remote unmanned stations and the data sent by telemetry to a central location. Most unmanned weather stations cannot measure snowfall, however, some are dedicated snow monitoring stations and use a “snow pillow” to measure snowfall. This is a hydraulic weighing platform which can be used to automatically calculate the SWE. There are, as of this writing, two such stations in Hood River County, one on Red Hill and one on Green Point.

Hood River County is unique and fortunate - the greatest percentage of the precipitation that falls in the county, stays in the county and travels through it making it available for irrigation, domestic water supplies and hydroelectric generation. In addition to our northern boundary, the Columbia River, the other major waterway is the Hood River. In the county’s northwest corner, it’s Herman Creek and Eagle Creek. Our county soils for the most part are very permeable and suited for agriculture and storing water. Nine out of ten of the county’s domestic water supplies come from springs flowing from underground aquifers. It is some of the purest water in the world. Additionally, much of the county’s precipitation is stored for our future use in the above mentioned, unfortunately shrinking, glaciers on the north and east sides of the mountain. The glacial melt water feeds our streams and underground aquifers.

In general, precipitation falling in Hood River County is tied closely to elevation: higher elevations receive higher amounts of precipitation, however, the amount of precipitation decreases from west to east. See Figure 2, although it should be noted that the source of the data used to produce this map is not noted in the source document. Given the current and historical lack of remote weather stations, particularly on the Cascade Crest and on the mountains along the County’s eastern border, some of these precipitation lines may be extrapolated. There are anecdotal figures from the popular literature regarding rainfall in Hood River County, most of which are reasonable: Cascade Locks, elevation approximately 100’, on the western edge of the County and the Cascade Crest, receives around 77” of precipitation a year. The Hood River Valley itself receives between about 30” to 45” a year. There is a “ridge above Lost Lake” (Butcher Knife Ridge, 3900’?) The former lookout on Lost Lake Butte, 4400’?) that purportedly receives 130” of precipitation a year. Data from a dedicated weather snow station (Red Hill, 4410’) indicates a snowpack of 130” would be within the normal range. The summit of Mount Hood at 11,240’ receives over 150” of water a year, most of it in the form of snow. The Dalles, just 16 miles east of Hood River and in the “rain shadow” of the Cascades, receives only 15” a year. See Table 1 for a sampling of actual precipitation data. Hood River County is fortunate again in that its precipitation records were started in 1884!
**Figure 2. Hood River County Mean Annual Precipitation 1971-2000**

**TABLE 1: A Sampling of Hood River County Precipitation Data**

<table>
<thead>
<tr>
<th>Location</th>
<th>Elev.</th>
<th>Time Period</th>
<th>A.A.P.</th>
<th>Minimum</th>
<th>Maximum</th>
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</thead>
<tbody>
<tr>
<td>MCAREC</td>
<td>510’</td>
<td>1884-2009</td>
<td>31”</td>
<td>16”</td>
<td>54”</td>
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<tr>
<td>Parkdale</td>
<td>1700’</td>
<td>1912-1969</td>
<td>43”</td>
<td>24”</td>
<td>62”</td>
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<tr>
<td>Parkdale</td>
<td>1942’</td>
<td>1969-1981</td>
<td>38”</td>
<td>22”</td>
<td>47”</td>
</tr>
<tr>
<td>Parkdale</td>
<td>1520’</td>
<td>1981-2009</td>
<td>32”</td>
<td>22”</td>
<td>44”</td>
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</tbody>
</table>

**Average Annual Snowfall (A.A.S.)**

<table>
<thead>
<tr>
<th>Location</th>
<th>Elev.</th>
<th>Time Period</th>
<th>A.A.S.</th>
<th>Minimum</th>
<th>Maximum</th>
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</thead>
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<tr>
<td>MCAREC</td>
<td>510’</td>
<td>1927-2006</td>
<td>32”</td>
<td>0</td>
<td>100”</td>
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<tr>
<td>Parkdale</td>
<td>1700’</td>
<td>1911-1969</td>
<td>96”</td>
<td>20”</td>
<td>222”</td>
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<tr>
<td>Parkdale</td>
<td>1942’</td>
<td>1969-1981</td>
<td>82”</td>
<td>17”</td>
<td>141”</td>
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<tr>
<td>Parkdale</td>
<td>1520’</td>
<td>1981-2009</td>
<td>55”</td>
<td>12”</td>
<td>117”</td>
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**Date of Maximal Snowpack Depth**

<table>
<thead>
<tr>
<th>Location</th>
<th>Elev.</th>
<th>Date</th>
<th>Depth</th>
<th>Date</th>
<th>Depth</th>
<th>Date</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Point</td>
<td>3310’</td>
<td>3-3-07</td>
<td>63”</td>
<td>2-3-08</td>
<td>104”</td>
<td>3-17-09</td>
<td>69”</td>
</tr>
</tbody>
</table>
Hood River County is probably the most “wired for weather” county in the state with 35 active weather-related stations scattered about the County. These stations change over time, some being phased out by obsolescence or cannibalized to keep other stations going and new stations with newer technology added. Some stations, such as Parkdale COOP station, have changed location multiple times. Many of the stations send their data to multiple agencies and organizations so the data is shared in a cooperative manner. However, this does not necessarily translate to easy data access via websites. Access can be problematic on some websites, especially for historic data. The best source for historical data is the Western Regional Climate Center (www.wrcc.dri.edu/CLIMATEDATA.html).

There are 25 stations dedicated to agriculture and they are spread throughout the Valley. They monitor parameters important to agriculture: temperature, relative humidity, dew point, barometric pressure, wind speed, direction and peak gusts, evaporation, leaf wetness, and solar radiation, etc. Precipitation is measured with a non-heated tipping bucket which is designed to measure rainfall. Snowfall is only measured incidentally, and only if ambient conditions cause it to melt. Not all stations measure all parameters. These ag stations are sponsored and/or funded by various government agencies. The Agrimet system has 4 stations and is under the aegis of the Department of Interior/Bureau of Reclamation. The Integrated Fruit Production Network is a consortium of multiple organizations, affiliates and sponsors. They maintain 21 stations with 12 in the lower Valley and 9 in the upper Valley.

There are currently three stations in the RAWS (Remote Automated Weather Stations) network. These stations are used by land management agencies such as the BLM, Forest Service, Fish and Wildlife, and BIA to monitor air quality and rate fire danger. These stations are located at Cascade Locks, Middle Mountain, and the newest at Blue Ridge. They monitor temperature, dew point, relative humidity, wind chill, wind direction, wind speed and gusts, fuel temperature, fuel moisture, solar radiation, solar percent possible, hourly, daily, and total precipitation. Not every station records all parameters and they cannot measure snowfall.

Snowfall and snowpack are currently measured at 6 stations in the County. The MCAREC and Parkdale NWS COOP stations measure snowfall and calculate the SWE and this data becomes part of their precipitation record. There is a station at Mount Hood Meadows at 5250’ elevation that measures the snowpack and snowfall. (A sister station is located at Timberline.) They are under the auspices of NOAA and the Forest Service and the data analysis is handled by a volunteer organization, the Northwest Weather and Avalanche Center. The USDA’s Natural Resources Conservation Service “SNOTEL” program has two stations in Hood River County, one on Red Hill at 4410’ and one on Green Point at 3310’. A third station may be established at Cloud Cap in the future. These stations give a running tally of the SWE, snow depth, year-to-date precipitation,
current temperature, and the last 24 hours maximum, minimum and average temperatures.

Currently there is one CoCoRaHS station in the upper valley near the town of Mount Hood. CoCoRaHS (Community Collaborative Rain, Hail and Snow Network) is based in Fort Collins, CO, at Colorado State University and has volunteers in all 50 states who daily record all precipitation including snowfall and SWE.

Appendix F2 is a list of weather stations in the valley, their affiliations and website addresses, where applicable.

References:

(1) Sources: Articles from the Hood River News and The Oregonian; Hood River Watershed Assessment, 1999; Aakki-Daakki, 1994, Pat Krussow, Editor; Legacy, 1995, Susan Crowley, Editor; Hood River Valley, by J. Cook and P. Marbach, 2003; and personal communications.

(2) From “Climate of Hood River County” prepared by George Taylor, State Climatologist, Cadee Hale and Sarah Joos, publication assistants. www.ocs.orst.edu/county.climate/…files/Hood%River.htm

(3) Western Regional Climate Center and MCAREC data

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