Western Copper Corporation

# Project Proposal

## Carmacks Copper Project
## Yukon Territory

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## Appendix D4

## Williams Creek Site Hydrology Update
## Memorandum CCL-CC6
## (January 2006)

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# FINAL DRAFT Memorandum CCL-CC6

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**From:** Clearwater Consultants Ltd. - Peter S. McCreath P.Eng. (pmccreath@shaw.ca)

**Subject:** Carmacks Copper Project – Williams Creek Site Hydrology Update

## 1. Introduction

This memorandum presents an update to the Williams Creek area site hydrology using site and regional data available up to 2005. Previous summaries of the estimated site hydrology were presented in Clearwater Consultants Ltd. Memoranda CCL-CC2 (March 12, 1998) and CCL-CC2A (April 23, 1998). The purpose of the update presented herein is to present revised hydrological design parameters that will be applied to the updated water balance analysis for the Carmacks Copper Project using all the available site hydrology data and concurrent regional data. The hydrology update includes precipitation, evaporation and streamflow distributions.



## 2. Available Data

Since the 1998 hydrology studies, additional data have been collected at the Williams Creek site (station elevation 850 m). The station is operated by Yukon Government Water Resources. The data includes temperatures, solar radiation, wind speed and direction, snowpack surveys, and rainfall. The rainfall data were collected using a tipping bucket during non-freezing months: no winter snowfall data have been collected. Data are available up to September 2005. Regional data were used in the update from the following stations:

- Pelly River Ranch at elevation 454 m: temperatures, precipitation, rainfall, snowfall and lake evaporation
- Pelly Farm at elevation 472 m: snow surveys
- Carmacks at elevation 525 m: temperatures, precipitation, rainfall, snowfall
- Whitehorse at elevation 703 m: solar radiation, pan evaporation

Regional streamflow data were evaluated from the following stations:

| Station Number | Station Name | Catchment Area ($km^2$) | Average Catchment Elevation (m) |
|---|---|---|---|
| 08AA009 | Giltana Creek near the mouth | 194 | 1200 |
| 09AG001 | Big Salmon River near Carmacks | 6,760 | 1300 |
| 09AG003 | South Big Salmon River below Livingstone Ck. | 515 | 1430 |
| 09AH001 | Yukon River at Carmacks | 81,800 | |
| 09AH003 | Big Creek near the mouth | 1,750 | 1070 |
| 09AH004 | Nordenskiold River below Rowlinson Creek | 6,370 | 1090 |
| 09BC005 | Tay River near the mouth | 3,810 | 1160 |

## 3. Rainfall, Snowfall and Total Precipitation

All parties involved in design and review of the Carmacks Copper project have previously agreed that annual precipitation increases with increasing elevation. It has also been agreed that annual rainfall as a percent of annual total precipitation decreases with increasing elevation, that is to say that higher elevations experience proportionally more snowfall than do lower elevations. Orographic factors (the rate of change per 100 m elevation increase) will be different for rainfall and for snowfall.

The results presented following are based on comparison of the 29 months of concurrent precipitation data collected at Williams Creek and at Pelly River Ranch from 1995 to 2004, 11 years of concurrent snowsurvey data (1995 to 2005) at Williams Creek and at Pelly Farm, and the long-term precipitation data available for Pelly River Ranch from 1955 to 2004. The assumptions and results are believed to be conservative and appropriate for design applications for the Carmacks Copper Project.

### 3.1 Rainfall

There are 29 months of concurrent rainfall data at Williams Creek and at Pelly River Ranch as shown on Table CC6-1 in Appendix 1. Over this period average total monthly rainfall at Williams Creek was 3.73% higher than at Pelly River Ranch. Based on the station elevations this translates to an orographic factor for rainfall of 1.0373 or a 0.941% increase per 100 m elevation increase.

Tables CC6-2, -3 and -4 in Appendix 1 summarize precipitation, rainfall and snowfall data for Pelly River Ranch. Over the long term (1955 to 2004) annual rainfall has averaged 189.4 mm at Pelly River Ranch, therefore, the estimated average annual rainfall at Williams Creek is (189.4 x 1.0373) 196.5 mm.



### 3.2 Snowfall

Table CC6-6 summarizes snowsurvey data collected at Williams Creek (1995 to 2005) and Pelly Farm (1986 to 2005). The estimation of annual average snowfall at Williams Creek is summarized following:

| | Williams Creek | | Pelly River | | |
|---|---|---|---|---|---|
| | 1995-2004 | Long-Term | 1995-2004 | 1986-2004 | Long-Term |
| Average Maximum Snowpack (mm water) | 89.0 | 99.6 (B) | 71.1 | 80.4 | 79.6 (A) |
| Total Snowfall (mm) (Oct-Apr) | n/a | 141.6 (C) | 110.7 | 114.4 | 113.2 |
| Annual Snowfall (mm) (Jan-Dec) | n/a | 141.9 (D) | 108.5 | 115.6 | 113.7 |

where,

A = Pelly Long-Term Average Maximum Snowpack =
(Pelly 1986-04 Max Snowpack) x [(Pelly LT Total Snowfall) / (Pelly 1986-2004 Total Snowfall)]

B = Williams Creek Long-Term Average Maximum Snowpack =
(Pelly LT Average Maximum Snowpack) x [1995-2004 Avg. Max Snowpack (WC / Pelly) ]

C = Williams Creek Total Snowfall (October to April) =
[(Pelly LT Total Snowfall)/(Pelly LT Avg. Max Snowpack)] x (Williams Ck LT Avg. Max Snowpack)

D = Williams Creek Long-Term Total Average Annual Snowfall (January to December) =
[(Pelly Snowfall Jan to Dec)/Pelly Snowfall Oct to Apr)] x Williams Ck Total Snowfall (Oct to April)

Based on the above, annual snowfall at Williams Creek is estimated to be about 24.8% higher than at Pelly River. Based on the station elevations this translates to an orographic factor for snowfall of 1.2480 or a 6.26% increase per 100 m elevation increase.

### 3.3 Total Precipitation

Based on the analyses above, the total annual average precipitation at Williams Creek is estimated to be 338.4 mm comprised of 196.5 mm rainfall (58.1%) and 141.9 mm snowfall (41.9%). The following shows comparative values of total precipitation, rainfall and snowfall for Pelly River Ranch and for Williams Creek and the associated orographic factors:

| Item | Pelly River | Williams Creek | % per 100 m | Factor |
|---|---|---|---|---|
| Total Annual Precipitation | 303.1 mm | 338.4 mm | 2.94% | 1.1165 |
| Annual Rainfall | 189.4 mm | 196.5 mm | 0.941% | 1.0373 |
| Annual Snowfall | 113.7 mm | 141.9 mm | 6.26% | 1.2480 |



### 3.4 Wet and Dry Year Precipitation

Frequency analyses were carried out on Pelly River Ranch total annual precipitation (47 complete years of data from 1955 to 2004) and the results are shown on Table CC6-7. Based on the orographic factors for rainfall and snowfall developed above, the Table also shows updated estimated annual rainfall and snowfall for extreme wet and dry years for the Williams Creek site for a range of return periods from a 20 year dry year up to a 500 year return period wet year. Values shown on Table CC6-7 are the expected values (best estimates) for each return period: lower and upper bounds for each estimate are within +/-5% to +/-9% of the values shown.

An evaluation of Pelly River Ranch precipitation data corrected for the effects of precipitation undercatch by Environment Canada suggests that annual average total precipitation could be about 5% higher with the increase due to increased rainfall (i.e. more undercatch correction on rainfall data). Corrections each year varied from less than 3% to about 9%. Frequency analyses on the corrected precipitation database yielded values from 3% to 5% higher than the results using the uncorrected database. This difference is not significant and is within the lower to upper bound range calculated for the results using the uncorrected database.

### 3.5 Wet Periods – One Day, One Month to 12 Month Duration

Total precipitation for wet periods for one day and from one month to 12 months duration were estimated based on the analyses above and assuming the following:

- One day wet periods will have an orographic factor of 1.30 times Pelly River Ranch (Table CC6-1B)
- One month wet periods will have an orographic factor of 1.15 times Pelly River Ranch based on the available common monthly rainfall data (Table CC6-1B);
- Orographic factors for wet periods with durations of 2, 3 and 4 months were estimated by interpolation as shown on Table CC6-8.

- The annual rainfall orographic factor of 1.0373 will apply to five month duration wet periods extending from the start of May through to the end of September. This period is responsible for about 94% of the total annual rainfall recorded at Pelly Ranch;
- The snowfall orographic factor (1.2480) will apply to wet periods of six to seven months duration extending from the start of October through to the end of the following April;
- Wet periods starting in October and lasting more than seven months will be comprised of both snowfall and rainfall; therefore, the orographic factor will be less than the snowfall factor (1.2480) but more than the annual precipitation factor (1.1165). For wet periods of 8, 9, 10 and 11 months duration, the orographic factor was estimated by interpolation as shown on Table CC6-8;

Table CC6-8 summarizes orographic factors for rainfall, snowfall and total precipitation for a range of wet period durations and types. Based on the above, updated estimates of extreme wet and dry year and wet period precipitation depths were prepared. The results for the Williams Creek site are presented in Table CC6-7 (Wet and Dry Year Precipitation, Rainfall and Snowfall) and Table CC6-9 (Wet Period Precipitation – One Day and One to Twelve Month Duration).

Table CC6-10 presents updated estimated average monthly precipitation conditions for the Williams Creek Site. Figures CC6-1 and CC6-2 show average monthly rainfall, snowfall and total precipitation for Pelly River Ranch and for Williams Creek, respectively.



### 3.6 Snowmelt

Based on the Williams Creek snowsurvey data from 1995 to 2005, the maximum annual snowpack has been measured on April 1 eight times out of 11 years. On average about 50% of the snowpack has been depleted during each of April and May. For design purposes the following is recommended:

- For average conditions the snowmelt will be distributed 50% in April and 50% in May
- For the design of maximum storage volumes in the events pond, 100% of the snowpack will be assumed to melt in May. The total snowmelt could occur over a period of about two weeks.

## 4. Evapotranspiration and Lake Evaporation

Lake evaporation and land evapotranspiration (including transpiration from vegetation) were estimated using the computer model WREVAP, which was developed by Environment Canada's National Hydrology Research Institute (NHRI, 1985). WREVAP is a semi-empirical, semi-physical model that estimates evaporation from meteorological data (humidity, air temperature and sunshine duration). The model uses different routines to estimate lake evaporation and land evapotranspiration. Estimates were prepared for Whitehorse Airport (elevation 703 m), Mayo Airport (elevation 504 m), and Williams Creek (elevation 850 m). Table CC6-11 summarizes the calculated values of lake evaporation and evapotranspiration. Monthly values are shown on Figures CC6-3 and CC6-4.

Annual calculated total lake evaporation ranges from 467 mm/year at Mayo to 528 mm/year at Williams Creek. Values calculated for Williams Creek and for Whitehorse are very similar. During the typical open water season from May through September, calculated lake evaporation was 440 mm at Whitehorse and at Williams Creek, about 83% of the annual total. Pan evaporation data have been collected by Environment Canada for Pelly Ranch and for Whitehorse Airport. Table CC6-11 also shows lake evaporation calculated from the pan evaporation data assuming a typical pan coefficient of

0.7. Lake evaporation calculated from the pan evaporation data from May to September was 480 mm at Whitehorse, approximately 10% higher than calculated using the WREVAP program.

For application to the Carmacks Copper Project water balance it is recommended that lake (open water) evaporation losses be based on the values calculated for Williams Creek using the WREVAP program. For conservatism in design the following is recommended:

- For the evaluation of maximum design solution storage volumes a "low" estimate of open water season (May to September) annual lake evaporation of 400 mm corresponding to 10% less than the WREVAP calculated value.
- For average operating conditions and the evaluation of make-up water requirements an annual open water season lake evaporation of 440 mm.

Annual calculated areal evapotranspiration ranges from about 180 mm/year at Williams Creek to 220 mm/year at Mayo with about 80% of the total occurring from May through September. At Williams Creek annual areal evapotranspiration is equal to about 34% of annual lake evaporation. Actual evapotranspiration losses of 180 mm/year are recommended for application to the Carmacks Copper site water balance.



## 5. Temperatures and Solar Radiation

Table CC6-12 summarizes measured temperature data at the Williams Creek site. Figure CC6-5 compares the site data to long-term average temperature data reported for Carmacks. Overall, the Williams Creek site appears warmer than Carmacks: average annual temperatures of -0.6$^{o}$C and -3.0$^{o}$C, respectively.

Table CC6-13 summarizes measured global solar radiation at Williams Creek. Monthly average values are generally slightly less than reported for Whitehorse Airport.

## 6. Monthly Streamflow Distributions and Mean Annual Runoff

The monthly distribution of streamflows in the receiving waters downstream of the Williams Creek site is required in order to estimate potential impacts due to off-site flows from treatment plant and/or settling pond releases. Limited site area streamflow data are available and were reported in previous studies ("Baseline Data Compilation Report" prepared by Access Mining Consultants Ltd., January 1998). A regional evaluation of streamflow data was undertaken to estimate the seasonal distribution of flows within the Williams Creek catchment area. Table CC6-14 summarizes the regional streamflow data evaluated.

Figure CC6-6 shows the monthly distribution of streamflows as a percent of mean annual runoff for the regional streamflow stations. The legend on the Figure provides three characteristics of the catchments associated with the runoff distributions: drainage area; catchment median elevation; and mean annual runoff. Median elevation appears to be a reasonably good predictor of the shape of a stream's average monthly hydrograph. Low elevation catchments generally experience earlier peaks than high elevation catchments and winter baseflows tends to increase with increasing median elevation.

Based on the regional data, Table CC6-15 and Figure CC6-6 show the recommended monthly streamflow distribution for Williams Creek catchment areas up to about 90 km$^2$ and the average monthly distribution of flow in the Yukon River downstream of Williams Creek. These monthly distributions of flows will be used in the overall site water balance analysis.

Mean annual runoff within the Williams Creek catchment was estimated as follows:

- Comparisons of measured Williams Creek flows (1992 to 1994 data) and concurrent flows in Big Creek (IEE Addendum #2, Report on Preliminary Design, May 1995, Tables 2.12 to 2.15) indicated a mean annual runoff depth of 56 mm for Williams Creek;
- For an estimated mean annual precipitation of 338 mm (Table CC6-7), annual areal evapotranspiration of 177 mm (Table CC6-11), and estimated winter sublimation loss of about 20 mm, the calculated mean annual runoff for the catchment would be about 141 mm.
- For water quality modeling purposes it is recommended that a mean annual runoff (MAR) of 100 mm is appropriate for Williams Creek based on the average of the above two values.

Mean annual runoff for the Yukon River downstream of Williams Creek (estimated 83,700 $km^2$ area) was assumed to be about 290 mm, the same as the average recorded for the streamflow gauging station 09AH001 "Yukon River at Carmacks" (81,800 $km^2$) from 1951 to 1995.

## 7. Conclusions

The estimated hydrologic characteristics of the Williams Creek site area have been updated using all the available site and regional data. The updated site hydrology parameter values will be applied to the site water balance analysis of the project. Table CC6-16 summarizes and compares hydrological parameters estimated in previous studies with the results of the present study.



The following conclusions are made:

1) 29 months of concurrent rainfall data are available between Williams Creek and Pelly River Ranch from 1995 to 2005
2) The updated estimated annual average precipitation at the Williams Creek site is 338 mm comprised of 196.5 mm rainfall (58.1%) and 141.9 mm snowfall (41.9%).
3) The results of updated frequency analyses for annual precipitation and one day and one to twelve month duration wet periods are shown on Tables CC6-7 and CC6-9, respectively.
4) Average monthly rainfall, snowfall and total precipitation depths for the Williams Creek site area are shown on Table CC6-10 and Figure CC6-2.
5) For average conditions the annual snowmelt will be assumed to be equally distributed between April and May. For design storage determination 100% of the snowmelt will be assumed to occur in May.
6) Annual average potential lake evaporation for Williams Creek is estimated to be 528 mm with about 83% of the lake evaporation (440 mm) occurring during the open water season from May to September. A 10% lower value (475 mm/year, 400 mm from May to September) is recommended as a conservative design parameter to evaluate maximum design solution storage volumes.
7) Annual average areal evapotranspiration for Williams Creek is estimated to be about 180 mm equal to 34% of lake evaporation with about 80% of the total occurring from May to September.
8) The Williams Creek site appears slightly warmer than Carmacks based on the limited available data.
9) Global solar radiation at Williams Creek is slightly less than reported for Whitehorse Airport.

10) Monthly streamflow distributions recommended for the Williams Creek catchment area and for the Yukon River downstream of Williams Creek are shown on Figure CC6-6 and Table CC6-15.

11) Mean annual runoff depth for Williams Creek is estimated to be 100 mm with 290 mm mean annual runoff depth for the Yukon River downstream of Williams Creek.

**CLEARWATER CONSULTANTS LTD.**

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# APPENDIX 1

## Williams Creek Site Hydrology Update

## Tables

## Table CC6-1A - Monthly Rainfall (mm) - Concurrent Data at Williams Creek & Pelly River Ranch

**Williams Creek (elevation 850 m)**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | | | 3.3 | 19.5 | | | | | 25.0 | 8.5 | | | |
| 1996 | | | | 5.9 | 16.0 | 12.0 | 91.0 | 79.9 | 10.3 | | | | |
| 1997 | | | | | 60.3 | 45.9 | 102.4 | 14.6 | 23 | | | | |
| 1998 | | | | 1.9 | 5.4 | 39.1 | 28.3 | 19.2 | 16 | 4.7 | | | |
| 1999 | | | | | 15.1 | 54.3 | 38.6 | 35.9 | | | | | |
| 2000 | | | | | | | | | | | | | |
| 2001 | | | | | | | | | | | | | |
| 2002 | | | | | | | | | | | | | |
| 2003 | | | | | 14.6 | 64.6 | 67.7 | | | | | | |
| 2004 | | | | | | | | | | | | | |
| 2005 | | | | 1.6 | 14.7 | 63.9 | 83.5 | 42.6 | 19.8 | | | | |
| Average - All Data | | | 3.3 | 7.2 | 21.0 | 46.6 | 68.6 | 38.4 | 18.8 | 6.6 | | | 210.6 |
| **Average - Common with Pelly** | | | **3.3** | **9.1** | **22.3** | **43.2** | **65.6** | **37.4** | **18.6** | **6.6** | | | **206.0** |

Note: Precipitation measured by tipping bucket rain gauge.

**Pelly River Ranch (elevation 454 m)**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | | | 0.4 | 0.2 | | | | | 10.6 | 14.6 | | | |
| 1996 | | | | 7.6 | 3.4 | 27.9 | 67.2 | 58.2 | 33.6 | | | | |
| 1997 | | | | | 86.0 | 56.6 | 80.6 | 36.0 | 29.4 | | | | |
| 1998 | | | | 0.0 | 6.4 | 40.6 | 19.4 | 21.4 | 25.8 | 3.0 | | | |
| 1999 | | | | | 19.8 | 62.8 | 28.2 | 57.2 | | | | | |
| 2000 | | | | | | | | | | | | | |
| 2001 | | | | | | | | | | | | | |
| 2002 | | | | | | | | | | | | | |
| 2003 | | | | | 12.6 | 29.6 | 52.6 | | | | | | |
| 2004 | | | | | | | | | | | | | |
| 2005 | | | | | | | | | | | | | |
| **Average - Common with WC** | | | **0.4** | **2.6** | **25.6** | **43.5** | **49.6** | **43.2** | **24.9** | **8.8** | | | **198.6** |
| Avg - All Data | 0.0 | 0.0 | 0.2 | 3.6 | 22.4 | 36.4 | 53.7 | 38.3 | 25.5 | 7.2 | 0.4 | 0.1 | 187.8 |

Calculation of Rainfall Orographic Factor based on 29 common months of data

Total Rainfall at Williams Creek = 206.0 mm

Total Rainfall at Pelly River Ranch = 198.6 mm

Orographic Factor per 100 m elevation = [(WC Rainfall / Pelly Rainfall) - 1 ] / [(WC Elev - Pelly Elev)/100]

= [ (206.0 / 198.6) -1 ] / [(850-454)/100] = 0.00941 or 0.941% per 100 m elevation increase

## Table CC6-1B - Comparison of Maximum Daily and Maximum One Month Rainfalls

| | Maximum One Day mm | | | Maximum One Month mm | | |
|---|---|---|---|---|---|---|
| **Year** | WC | PRR | WC/PRR | WC | PRR | WC/PRR |
| 1995 | | | | 25.0 | 14.6 | 1.712 |
| 1996 | 28.8 | 19.8 | 1.45 | 91.0 | 67.2 | 1.354 |
| 1997 | 22.9 | 26.4 | 0.87 | 102.4 | 86.0 | 1.191 |
| 1998 | 16.8 | 7.1 | 2.37 | 39.1 | 40.6 | 0.963 |
| 1999 | 17.6 | 23.4 | 0.75 | 54.3 | 62.8 | 0.865 |
| 2000 | | | | | | |
| 2001 | | | | | | |
| 2002 | | | | | | |
| 2003 | 29.0 | 11.6 | 2.50 | 67.7 | 52.6 | 1.287 |
| 2004 | | | | | | |
| 2005 | 19.7 | | | | | |
| **Averages** | 23.0 | 17.7 | **1.30** | 70.9 | 61.8 | **1.15** |

Averages based on common days / months of data

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## Table CC6-2 - PELLY RIVER RANCH Total Precipitation (mm)

Station 2100880 Lat 62o 49' N
Elevation 454 m Long 137o 22' W

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1951 | | | | | | | | | | | | 48.3 | |
| 1952 | 48.3 | 5.1 | 6.4 | 2.5 | 6.6 | | | | | | | | |
| 1954 | | | | | | 6.1 | 40.6 | 17.8 | 23.4 | 2.5 | 18.8 | 32.8 | |
| 1955 | 22.4 | 5.3 | 8.1 | 0.1 | 7.1 | 43.2 | 14.0 | 86.1 | 10.7 | 4.8 | 26.4 | 23.6 | 251.8 |
| 1956 | 12.7 | 11.7 | | 6.9 | 40.1 | 45.0 | 48.3 | 40.9 | 2.8 | 37.1 | 33.0 | 18.0 | |
| 1957 | 14.7 | 23.9 | 13.7 | 7.9 | 15.2 | 12.7 | 34.8 | 19.6 | 19.8 | 2.3 | 33.3 | 20.8 | 218.7 |
| 1958 | 20.8 | 16.3 | 1.3 | 3.0 | 14.2 | 33.5 | 62.0 | 67.1 | 17.0 | 45.2 | 35.1 | 12.4 | 327.9 |
| 1959 | 10.2 | 21.1 | 24.4 | 10.7 | 19.3 | 46.7 | 29.0 | 37.6 | 25.1 | 6.4 | 20.1 | 14.5 | 265.1 |
| 1960 | 11.2 | 15.2 | 12.7 | 5.1 | 18.5 | 26.4 | 117.9 | 36.6 | 28.4 | 8.4 | 24.1 | 17.8 | 322.3 |
| 1961 | 13.5 | 10.9 | 11.2 | 6.6 | 23.4 | 45.0 | 44.5 | 25.9 | 18.3 | 41.9 | 24.4 | 29.2 | 294.8 |
| 1962 | 25.4 | 17.3 | 4.1 | 24.9 | 16.3 | 55.9 | 35.6 | 39.4 | 13.0 | 6.4 | 15.0 | 37.8 | 291.1 |
| 1963 | 47.8 | 7.4 | 10.7 | 10.9 | | 47.5 | 58.7 | 18.5 | 35.1 | 27.2 | 14.7 | 47.5 | |
| 1964 | 24.1 | 19.1 | 16.5 | 16.0 | 26.2 | 53.6 | 88.1 | 30.7 | 21.1 | 19.8 | 19.1 | 20.1 | 354.4 |
| 1965 | 12.2 | 9.9 | 5.1 | 3.6 | 14.0 | 30.0 | 41.9 | 17.5 | 40.4 | 42.4 | 17.8 | 24.9 | 259.7 |
| 1966 | 7.6 | 26.2 | 6.6 | 10.2 | 5.8 | 28.2 | 7.1 | 20.3 | 16.0 | 35.3 | 61.0 | 10.4 | 234.7 |
| 1967 | 37.6 | 26.7 | 31.2 | 14.2 | 16.5 | 46.2 | 65.0 | 56.4 | 28.4 | 13.0 | 16.3 | 18.5 | 370.0 |
| 1968 | 30.7 | 12.2 | 19.8 | 15.7 | 25.1 | 21.3 | 29.7 | 25.7 | 59.7 | 14.2 | 27.4 | 10.7 | 292.2 |
| 1969 | 11.7 | 3.6 | 14.5 | 11.9 | 30.5 | 3.3 | 81.5 | 12.2 | 22.9 | 7.9 | 25.7 | 14.5 | 240.2 |
| 1970 | 8.4 | 16.0 | 2.0 | 7.6 | 48.8 | 24.4 | 5.3 | 42.7 | 50.3 | 35.3 | 25.7 | 35.3 | 301.8 |
| 1971 | 4.6 | 6.6 | 7.9 | 4.8 | 7.4 | 11.7 | 24.1 | 45.0 | 22.1 | 28.4 | 28.4 | 40.4 | 231.4 |
| 1972 | 23.1 | 13.7 | 7.9 | 12.7 | 14.7 | 70.9 | 47.2 | 23.1 | 23.4 | 54.1 | 20.1 | 12.2 | 323.1 |
| 1973 | 25.1 | 12.4 | 17.8 | 30.5 | 5.1 | 50.8 | 47.5 | 54.1 | 8.6 | 17.3 | 22.6 | 34.3 | 326.1 |
| 1974 | 4.6 | 37.3 | 9.7 | 19.1 | 7.4 | 14.7 | 65.8 | 31.8 | 8.6 | 27.9 | 14.0 | 30.5 | 271.4 |
| 1975 | 20.3 | 4.6 | 0.3 | 18.3 | 13.7 | 16.5 | 71.6 | 29.0 | 32.3 | 20.8 | 15.7 | 12.2 | 255.3 |
| 1976 | 30.5 | 14.0 | 26.9 | 10.7 | 42.9 | 37.3 | 46.7 | 19.3 | 14.5 | 15.2 | 24.1 | 13.7 | 295.8 |
| 1977 | 31.1 | 4.1 | 16.8 | 25.0 | 24.2 | 44.8 | 30.3 | 18.3 | 14.9 | 18.1 | 21.7 | 11.7 | 261.0 |
| 1978 | 10.8 | 3.3 | 3.4 | 12.9 | 17.8 | 33.4 | 100.0 | 46.7 | 23.8 | 24.7 | 23.7 | 26.9 | 327.4 |
| 1979 | 23.8 | 19.5 | 20.9 | 4.6 | 29.5 | 47.7 | 54.1 | 10.2 | 33.5 | 4.0 | 18.9 | 17.6 | 284.3 |
| 1980 | 24.3 | 11.5 | 2.8 | 3.2 | 9.2 | 24.8 | 44.4 | 33.0 | 53.4 | 17.6 | 21.5 | 1.8 | 247.5 |
| 1981 | 5.4 | 27.0 | 4.3 | 11.0 | 13.2 | 33.3 | 87.9 | 43.6 | 52.9 | 43.0 | 41.5 | 6.0 | 369.1 |
| 1982 | 11.3 | 13.1 | 6.4 | 13.9 | 33.7 | 13.3 | 62.7 | 22.4 | 31.7 | 25.4 | 22.0 | 13.2 | 269.1 |
| 1983 | 30.1 | 27.2 | 3.3 | 5.8 | 29.0 | 50.3 | 53.8 | 82.2 | 26.0 | 20.6 | 6.6 | 11.3 | 346.2 |
| 1984 | 24.1 | 23.6 | 8.2 | 8.5 | 33.5 | 27.0 | 44.6 | 48.7 | 25.0 | 14.4 | 14.7 | 28.9 | 301.2 |
| 1985 | 27.6 | 17.0 | 5.6 | 8.9 | 20.5 | 69.8 | 88.4 | 48.8 | 28.5 | 23.1 | 17.2 | 10.9 | 366.3 |
| 1986 | 27.7 | 4.7 | 16.9 | 5.8 | 30.0 | 47.4 | 73.0 | 44.5 | 8.0 | 9.0 | 20.9 | 14.5 | 302.4 |
| 1987 | 11.7 | 25.7 | 8.3 | 9.2 | 22.3 | 26.6 | 53.4 | 34.6 | 43.1 | 42.9 | 32.4 | 25.2 | 335.4 |
| 1988 | 12.4 | 14.8 | 13.9 | 4.1 | 23.8 | 26.2 | 68.8 | 28.6 | 9.8 | 26.6 | 22.0 | 21.3 | 272.3 |
| 1989 | 14.0 | 6.0 | 5.6 | 0.2 | 32.6 | 49.1 | 13.1 | 20.4 | 23.8 | 18.6 | 35.9 | 12.0 | 231.3 |
| 1990 | 11.6 | 21.9 | 6.8 | 1.6 | 48.4 | 57.0 | 13.0 | 41.0 | 45.0 | 34.0 | 23.2 | 40.0 | 343.5 |
| 1991 | 16.6 | 23.8 | 9.9 | 4.0 | 25.1 | 30.0 | 47.8 | 34.7 | 43.0 | 23.4 | 40.1 | 30.0 | 328.4 |
| 1992 | 32.0 | 11.2 | 16.0 | 46.6 | 28.2 | 32.2 | 44.3 | 47.4 | 56.4 | 39.2 | 31.0 | 19.4 | 403.9 |
| 1993 | 24.9 | 6.8 | 34.4 | 8.8 | 18.4 | 16.8 | 61.9 | 40.0 | 20.8 | 28.1 | 34.8 | 7.0 | 302.7 |
| 1994 | 24.6 | 4.8 | 15.9 | 7.7 | 37.8 | 53.6 | 36.2 | 8.6 | 21.6 | 27.4 | 27.4 | 3.6 | 269.2 |
| 1995 | 5.8 | 12.4 | 4.6 | 0.2 | 16.8 | 31.8 | 84.4 | 78.2 | 10.6 | 22.9 | 15.8 | 22.4 | 305.9 |
| 1996 | 12.8 | 16.6 | 9.9 | 16.6 | 3.4 | 27.9 | 67.2 | 58.2 | 33.6 | 32.8 | 6.2 | 24.4 | 309.6 |
| 1997 | 7.6 | 17.0 | 18.4 | 12.6 | 86.0 | 56.6 | 80.6 | 36.0 | 29.4 | 24.0 | 24.7 | 18.2 | 411.1 |
| 1998 | 12.6 | 1.8 | 2.8 | 2.4 | 6.4 | 40.6 | 19.4 | 21.4 | 30.6 | 12.1 | 14.0 | 22.8 | 186.9 |
| 1999 | 21.2 | 21.0 | 8.2 | 12.4 | 19.8 | 63.0 | 28.2 | 57.2 | 35.2 | 38.4 | 33.9 | 31.8 | 370.3 |
| 2000 | 33.2 | 7.4 | 9.6 | 12.4 | 32.6 | 45.7 | 93.8 | 78.6 | 84.4 | 15.6 | 26.4 | 13.8 | 453.5 |
| 2001 | 16.0 | 7.0 | 5.6 | 12.6 | 12.3 | 47.8 | 99.4 | 36.4 | 23.0 | 22.0 | 23.2 | 12.4 | 317.7 |
| 2002 | 22.2 | 14.8 | 3.8 | 12.2 | 26.9 | 23.4 | 74.8 | 74.6 | 9.0 | 13.6 | 18.0 | 27.8 | 321.1 |
| 2003 | 8.7 | 13.4 | 15.2 | 3.0 | 16.0 | 29.6 | 52.6 | 26.8 | 20.4 | 9.8 | 50.6 | 34.0 | 280.1 |
| 2004 | 48.7 | 36.5 | 26.9 | 3.9 | 19.2 | | | | | | | | |
| 2005 | | | | | | | | | | | | | |
| # years | 51 | 51 | 50 | 51 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 51 | 47 |
| Mean | 20.0 | 14.7 | 11.3 | 10.3 | 22.7 | 36.4 | 53.7 | 38.4 | 27.6 | 22.9 | 24.6 | 21.4 | 303.1 |
| Max. | 48.7 | 37.3 | 34.4 | 46.6 | 86.0 | 70.9 | 117.9 | 86.1 | 84.4 | 54.1 | 61.0 | 48.3 | 453.5 |
| Min. | 4.6 | 1.8 | 0.3 | 0.1 | 3.4 | 3.3 | 5.3 | 8.6 | 2.8 | 2.3 | 6.2 | 1.8 | 186.9 |
| Std. Dev | 11.13 | 8.50 | 7.95 | 8.34 | 14.42 | 16.18 | 26.22 | 19.35 | 15.85 | 12.74 | 10.08 | 10.98 | 53.34 |
| | | | | | | | | | | | | Sum of Average Months = | 303.9 |
| | | | | | | | | | | | | Average of Complete Years = | 303.1 |

January 13, 2006

## Table CC6-3 - PELLY RIVER RANCH Total Rainfall (mm)

Station 2100880 Lat 62o 49' N
Elevation 454 m Long 137o 22' W

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1951 | | | | | | | | | | | | 0.0 | |
| 1952 | 0.0 | 0.0 | 0.0 | 0.0 | 6.6 | | | | | | | | |
| 1954 | | | | | | 6.1 | 40.6 | 17.8 | 19.3 | 2.5 | 0.0 | 5.1 | |
| 1955 | 0.0 | 0.0 | 0.0 | 0.0 | 7.1 | 43.2 | 14.0 | 86.1 | 10.4 | 1.5 | 0.0 | 0.0 | 162.3 |
| 1956 | 0.0 | 0.0 | | 0.0 | 40.1 | 45.0 | 48.3 | 40.9 | 2.5 | 16.0 | 0.0 | 0.0 | |
| 1957 | 0.0 | 0.0 | 0.0 | 7.6 | 15.2 | 12.7 | 34.8 | 19.6 | 13.5 | 0.1 | 2.5 | 0.0 | 106.0 |
| 1958 | 0.0 | 0.0 | 0.0 | 0.0 | 14.2 | 33.5 | 62.0 | 67.1 | 12.7 | 4.6 | 0.0 | 0.0 | 194.1 |
| 1959 | 0.0 | 0.0 | 0.0 | 0.1 | 18.8 | 46.7 | 29.0 | 37.6 | 25.1 | 0.0 | 0.0 | 0.0 | 157.3 |
| 1960 | 0.0 | 0.0 | 0.0 | 2.3 | 18.5 | 26.4 | 117.9 | 36.6 | 28.4 | 7.4 | 0.3 | 0.0 | 237.8 |
| 1961 | 0.0 | 0.0 | 0.0 | 0.0 | 23.4 | 45.0 | 44.5 | 25.9 | 18.3 | 12.4 | 0.0 | 0.0 | 169.5 |
| 1962 | 0.0 | 0.0 | 0.0 | 20.8 | 16.3 | 55.9 | 35.6 | 39.4 | 13.0 | 5.1 | 0.0 | 0.0 | 186.1 |
| 1963 | 0.0 | 0.0 | 0.0 | 5.1 | | 47.5 | 58.7 | 18.5 | 35.1 | 14.5 | 0.0 | 0.0 | |
| 1964 | 0.0 | 0.0 | 0.0 | 0.0 | 19.8 | 53.6 | 88.1 | 30.7 | 21.1 | 4.6 | 0.0 | 0.0 | 217.9 |
| 1965 | 0.0 | 0.0 | 0.0 | 0.3 | 14.0 | 30.0 | 41.9 | 17.5 | 40.4 | 10.4 | 0.0 | 0.0 | 154.5 |
| 1966 | 0.0 | 0.0 | 0.0 | 10.2 | 5.8 | 28.2 | 7.1 | 20.3 | 16.0 | 8.6 | 0.0 | 0.0 | 96.2 |
| 1967 | 0.0 | 0.0 | 0.0 | 1.3 | 16.5 | 46.2 | 65.0 | 56.4 | 28.4 | 8.6 | 1.3 | 0.0 | 223.7 |
| 1968 | 0.0 | 0.0 | 2.5 | 5.1 | 25.1 | 21.3 | 29.7 | 25.7 | 50.8 | 0.0 | 0.0 | 0.0 | 160.2 |
| 1969 | 0.0 | 0.0 | 0.0 | 0.8 | 30.5 | 3.3 | 81.5 | 12.2 | 22.9 | 1.5 | 0.0 | 0.0 | 152.7 |
| 1970 | 0.0 | 0.0 | 0.0 | 1.0 | 47.5 | 24.4 | 5.3 | 42.7 | 41.7 | 11.9 | 2.5 | 0.0 | 177.0 |
| 1971 | 0.0 | 0.0 | 0.0 | 1.0 | 7.4 | 11.7 | 24.1 | 45.0 | 22.1 | 4.1 | 0.0 | 0.0 | 115.4 |
| 1972 | 0.0 | 0.0 | 0.0 | 0.0 | 13.0 | 70.9 | 47.2 | 23.1 | 17.3 | 2.8 | 0.0 | 0.0 | 174.3 |
| 1973 | 0.0 | 0.0 | 0.0 | 22.4 | 5.1 | 50.8 | 47.5 | 54.1 | 8.6 | 1.5 | 0.0 | 0.0 | 190.0 |
| 1974 | 0.0 | 0.0 | 0.0 | 0.8 | 6.4 | 14.7 | 65.8 | 31.8 | 8.6 | 12.7 | 0.1 | 0.0 | 140.9 |
| 1975 | 0.0 | 0.0 | 0.0 | 7.4 | 13.7 | 16.5 | 71.6 | 29.0 | 32.3 | 3.3 | 0.0 | 0.1 | 173.9 |
| 1976 | 0.0 | 0.0 | 0.0 | 0.1 | 42.9 | 37.3 | 46.7 | 19.3 | 14.5 | 2.3 | 2.0 | 0.0 | 165.1 |
| 1977 | 0.0 | 0.3 | 0.0 | 1.8 | 24.2 | 44.8 | 30.3 | 18.3 | 14.9 | 16.8 | 0.0 | 0.0 | 151.4 |
| 1978 | 0.0 | 0.0 | 0.0 | 4.0 | 17.8 | 33.4 | 100.0 | 46.7 | 23.8 | 0.5 | 0.0 | 0.0 | 226.2 |
| 1979 | 0.0 | 0.0 | 2.5 | 0.0 | 29.5 | 47.7 | 54.1 | 10.2 | 33.5 | 2.2 | 10.0 | 0.0 | 189.7 |
| 1980 | 0.0 | 0.0 | 0.0 | 3.2 | 9.2 | 24.8 | 44.4 | 33.0 | 49.9 | 11.2 | 0.0 | 0.0 | 175.7 |
| 1981 | 0.0 | 0.0 | 0.8 | 7.6 | 13.2 | 33.3 | 87.9 | 43.6 | 50.9 | 31.4 | 0.0 | 0.0 | 268.7 |
| 1982 | 0.0 | 0.1 | 0.0 | 0.0 | 33.7 | 13.3 | 62.7 | 22.4 | 31.7 | 2.3 | 0.0 | 0.0 | 166.2 |
| 1983 | 0.0 | 0.0 | 0.0 | 4.8 | 29.0 | 50.3 | 53.8 | 82.2 | 23.7 | 9.8 | 0.0 | 0.0 | 253.6 |
| 1984 | 0.0 | 0.0 | 0.0 | 3.4 | 33.5 | 27.0 | 44.6 | 47.7 | 25.0 | 8.7 | 0.0 | 0.0 | 189.9 |
| 1985 | 0.0 | 0.0 | 0.0 | 0.0 | 20.5 | 69.8 | 88.4 | 48.8 | 28.5 | 2.4 | 0.0 | 0.1 | 258.5 |
| 1986 | 0.0 | 0.0 | 0.0 | 0.1 | 30.0 | 47.4 | 73.0 | 44.5 | 8.0 | 9.0 | 0.0 | 0.1 | 212.1 |
| 1987 | 0.0 | 0.0 | 2.0 | 2.0 | 17.9 | 26.6 | 53.4 | 34.6 | 43.1 | 33.4 | 0.0 | 0.0 | 213.0 |
| 1988 | 0.0 | 0.0 | 0.0 | 2.9 | 23.8 | 26.2 | 68.8 | 28.6 | 9.6 | 0.0 | 0.0 | 0.0 | 159.9 |
| 1989 | 0.0 | 0.0 | 0.0 | 0.2 | 32.6 | 49.1 | 13.1 | 20.4 | 21.0 | 2.8 | 0.0 | 0.0 | 139.2 |
| 1990 | 0.0 | 0.0 | 0.1 | 0.6 | 48.4 | 57.0 | 13.0 | 41.0 | 45.0 | 12.4 | 0.0 | 0.0 | 217.5 |
| 1991 | 0.0 | 0.0 | 0.0 | 0.0 | 25.1 | 30.0 | 47.8 | 34.7 | 43.0 | 14.6 | 0.0 | 0.0 | 195.2 |
| 1992 | 0.0 | 0.0 | 0.8 | 18.0 | 24.4 | 32.2 | 44.3 | 47.4 | 34.2 | 2.6 | 0.0 | 0.0 | 203.9 |
| 1993 | 0.0 | 0.0 | 0.0 | 7.8 | 18.4 | 16.8 | 61.9 | 40.0 | 18.8 | 14.2 | 0.0 | 0.0 | 177.9 |
| 1994 | 0.0 | 0.0 | 0.1 | 1.4 | 37.8 | 53.6 | 36.2 | 8.6 | 21.6 | 7.4 | 0.1 | 0.0 | 166.8 |
| 1995 | 0.0 | 0.0 | 0.4 | 0.2 | 16.8 | 31.8 | 84.4 | 78.2 | 10.6 | 14.6 | 0.0 | 0.0 | 237.0 |
| 1996 | 0.0 | 0.0 | 0.0 | 7.6 | 3.4 | 27.9 | 67.2 | 58.2 | 33.6 | 0.0 | 0.0 | 0.0 | 197.9 |
| 1997 | 0.0 | 0.0 | 0.0 | 5.8 | 86.0 | 56.6 | 80.6 | 36.0 | 29.4 | 0.0 | 0.0 | 0.0 | 294.4 |
| 1998 | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | 40.6 | 19.4 | 21.4 | 25.8 | 3.0 | 0.0 | 0.0 | 116.6 |
| 1999 | 0.0 | 0.0 | 0.0 | 5.4 | 19.8 | 62.8 | 28.2 | 57.2 | 25.2 | 6.6 | 0.0 | 0.0 | 205.2 |
| 2000 | 0.0 | 0.0 | 0.0 | 7.0 | 32.6 | 45.7 | 93.8 | 78.6 | 77.6 | 0.4 | 0.0 | 0.0 | 335.7 |
| 2001 | 0.0 | 0.0 | 0.0 | 9.4 | 12.3 | 47.8 | 99.4 | 36.4 | 23.0 | 5.4 | 0.0 | 0.0 | 233.7 |
| 2002 | 0.0 | 0.0 | 0.0 | 8.2 | 26.9 | 23.4 | 74.8 | 74.6 | 9.0 | 9.6 | 0.0 | 0.0 | 226.5 |
| 2003 | 0.0 | 0.0 | 0.0 | 0.0 | 12.6 | 29.6 | 52.6 | 26.8 | 10.4 | 0.8 | 0.0 | 0.0 | 132.8 |
| 2004 | 0.0 | 0.0 | 0.0 | 0.8 | 19.2 | | | | | | | | |
| 2005 | | | | | | | | | | | | | |
| # years | 51 | 51 | 50 | 51 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 51 | 47 |
| Mean | 0.0 | 0.0 | 0.2 | 3.7 | 22.3 | 36.4 | 53.7 | 38.3 | 25.5 | 7.2 | 0.4 | 0.1 | 189.4 |
| Max. | 0.0 | 0.3 | 2.5 | 22.4 | 86.0 | 70.9 | 117.9 | 86.1 | 77.6 | 33.4 | 10.0 | 5.1 | 335.7 |
| Min. | 0.0 | 0.0 | 0.0 | 0.0 | 3.4 | 3.3 | 5.3 | 8.6 | 2.5 | 0.0 | 0.0 | 0.0 | 96.2 |
| Std. Dev | 0.00 | 0.04 | 0.58 | 5.22 | 14.45 | 16.17 | 26.22 | 19.34 | 14.42 | 7.27 | 1.51 | 0.71 | 48.08 |
| | | | | | | | | | | | | Sum of Average Months = | 187.7 |
| | | | | | | | | | | | | Average of Complete Years = | 189.4 |

January 13, 2006

## Table CC6-4 - PELLY RIVER RANCH Total Snowfall (mm)

Station 2100880 62o 49' N
Elevation 454 m 137o 22' W

(Note - Calculation of Total Precipitation (Table CC5-2) assumes constant 10% density for snowfall)

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1951 | | | | | | | | | | | | 48.3 | |
| 1952 | 48.3 | 5.1 | 6.4 | 2.5 | 0.0 | | | | | | | | |
| 1954 | | | | | | 0.0 | 0.0 | 0.0 | 4.1 | 0.0 | 18.8 | 27.7 | |
| 1955 | 22.4 | 5.3 | 8.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.3 | 3.3 | 26.4 | 23.6 | 89.6 |
| 1956 | 12.7 | 11.7 | | 6.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.3 | 21.8 | 33.0 | 18.0 | |
| 1957 | 14.7 | 23.9 | 13.7 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 6.4 | 2.3 | 30.7 | 20.8 | 112.9 |
| 1958 | 20.8 | 16.3 | 1.3 | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.3 | 40.6 | 35.1 | 12.4 | 133.8 |
| 1959 | 10.2 | 21.1 | 24.4 | 10.7 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | 20.1 | 14.5 | 107.9 |
| 1960 | 11.2 | 15.2 | 12.7 | 2.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 23.9 | 17.8 | 84.6 |
| 1961 | 13.5 | 10.9 | 11.2 | 6.6 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 29.5 | 24.4 | 29.2 | 125.4 |
| 1962 | 25.4 | 17.3 | 4.1 | 4.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 15.0 | 37.8 | 105.0 |
| 1963 | 47.8 | 7.4 | 10.7 | 5.8 | | 0.0 | 0.0 | 0.0 | 0.0 | 12.7 | 14.7 | 47.5 | |
| 1964 | 24.1 | 19.1 | 16.5 | 16.0 | 6.4 | 0.0 | 0.0 | 0.0 | 0.0 | 15.2 | 19.1 | 20.1 | 136.5 |
| 1965 | 12.2 | 9.9 | 5.1 | 3.3 | | 0.0 | 0.0 | 0.0 | 0.1 | 32.0 | 17.8 | 24.9 | |
| 1966 | 7.6 | 26.2 | 6.6 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.7 | 61.0 | 10.4 | |
| 1967 | 37.6 | 26.7 | 31.2 | 13.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 4.3 | 15.0 | 18.5 | 146.4 |
| 1968 | 30.7 | 12.2 | 17.3 | 10.7 | 0.0 | 0.0 | 0.0 | 0.0 | 8.9 | 14.2 | 27.4 | 10.7 | 132.1 |
| 1969 | 11.7 | 3.6 | 14.5 | 11.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | 25.7 | 14.5 | 87.6 |
| 1970 | 8.4 | 16.0 | 2.0 | 6.6 | 1.3 | 0.0 | 0.0 | 0.0 | 8.6 | 23.4 | 23.1 | 35.3 | 124.7 |
| 1971 | 4.6 | 6.6 | 7.9 | 3.8 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 24.4 | 28.4 | 40.4 | 116.3 |
| 1972 | 23.1 | 13.7 | 7.9 | 12.7 | 1.8 | 0.0 | 0.0 | 0.0 | 6.1 | 51.3 | 20.1 | 12.2 | 148.9 |
| 1973 | 25.1 | 12.4 | 17.8 | 8.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.7 | 22.6 | 34.3 | 136.0 |
| 1974 | 4.6 | 37.3 | 9.7 | 18.3 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.2 | 14.0 | 30.5 | 130.6 |
| 1975 | 20.3 | 4.6 | 0.3 | 10.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 17.5 | 15.7 | 12.2 | 81.5 |
| 1976 | 30.5 | 14.0 | 26.9 | 10.7 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 13.0 | 22.1 | 13.7 | 131.0 |
| 1977 | 31.1 | 3.8 | 16.8 | 23.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 21.7 | 11.7 | 109.6 |
| 1978 | 10.8 | 3.3 | 3.4 | 8.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.2 | 23.7 | 26.9 | 101.2 |
| 1979 | 23.8 | 19.5 | 18.4 | 4.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 8.9 | 17.6 | 94.6 |
| 1980 | 24.3 | 11.5 | 2.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.5 | 6.4 | 21.5 | 1.8 | 71.8 |
| 1981 | 5.4 | 27.0 | 3.5 | 3.4 | 0.1 | 0.0 | 0.0 | 0.0 | 2.0 | 11.6 | 41.5 | 6.0 | 100.5 |
| 1982 | 11.3 | 13.1 | 6.4 | 13.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 23.1 | 22.0 | 13.2 | 103.1 |
| 1983 | 30.1 | 27.2 | 3.3 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.3 | 10.8 | 6.6 | 11.3 | 92.6 |
| 1984 | 24.1 | 23.6 | 8.2 | 5.1 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 5.7 | 14.7 | 28.9 | 111.3 |
| 1985 | 27.6 | 17.0 | 5.6 | 8.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.7 | 17.2 | 10.9 | 107.9 |
| 1986 | 27.7 | 4.7 | 16.9 | 5.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 20.9 | 14.5 | 90.7 |
| 1987 | 11.7 | 25.7 | 6.3 | 7.2 | 4.4 | 0.0 | 0.0 | 0.0 | 0.0 | 9.5 | 32.4 | 25.2 | 122.4 |
| 1988 | 12.4 | 14.8 | 13.9 | 1.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 26.6 | 22.0 | 21.3 | 112.4 |
| 1989 | 14.0 | 6.0 | 5.6 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 2.8 | 15.8 | 35.9 | 12.0 | 92.2 |
| 1990 | 11.6 | 21.9 | 6.8 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | 23.2 | 40.0 | 126.1 |
| 1991 | 16.6 | 23.8 | 9.9 | 4.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8.8 | 40.1 | 30.0 | 133.2 |
| 1992 | 32.0 | 11.2 | 15.2 | 28.6 | 3.8 | 0.0 | 0.0 | 0.0 | 22.2 | 36.6 | 31.0 | 19.4 | 200.0 |
| 1993 | 24.9 | 6.8 | 34.4 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 13.9 | 34.8 | 7.0 | 124.8 |
| 1994 | 24.6 | 4.8 | 15.9 | 6.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.0 | 27.4 | 3.6 | 102.6 |
| 1995 | 5.8 | 12.4 | 4.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8.3 | 15.8 | 22.4 | 68.9 |
| 1996 | 12.8 | 16.6 | 9.9 | 9.0 | 0.0 | 0.0 | 0.0 | 0.0 | TR | 32.8 | 6.2 | 24.4 | 111.7 |
| 1997 | 7.6 | 17.0 | 18.4 | 6.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.0 | 24.7 | 18.2 | 116.7 |
| 1998 | 12.6 | 1.8 | 2.8 | 2.4 | 0.0 | 0.0 | 0.0 | 0.0 | 4.8 | 9.1 | 14.0 | 22.8 | 70.3 |
| 1999 | 21.2 | 21.0 | 8.2 | 7.0 | 0.0 | 0.2 | 0.0 | 0.0 | 10.0 | 31.8 | 33.9 | 31.8 | 165.1 |
| 2000 | 33.2 | 7.4 | 9.6 | 5.4 | 0.0 | 0.0 | 0.0 | 0.0 | 6.8 | 15.2 | 26.4 | 13.8 | 117.8 |
| 2001 | 16.0 | 7.0 | 5.6 | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 16.6 | 23.2 | 12.4 | 84.0 |
| 2002 | 22.2 | 14.8 | 3.8 | 4.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.0 | 18.0 | 27.8 | 94.6 |
| 2003 | 8.7 | 13.4 | 15.2 | 3.0 | 3.4 | 0.0 | 0.0 | 0.0 | 10.0 | 9.0 | 50.6 | 34.0 | 147.3 |
| 2004 | 48.7 | 36.5 | 26.9 | 3.1 | 0.0 | | | | | | | | |
| # years | 51 | 51 | 50 | 50 | 49 | 50 | 50 | 50 | 49 | 50 | 50 | 51 | 45 |
| Mean | 20.0 | 14.7 | 11.1 | 6.7 | 0.5 | 0.0 | 0.0 | 0.0 | 2.2 | 15.8 | 24.2 | 21.3 | 113.4 |
| Max. | 48.7 | 37.3 | 34.4 | 28.6 | 6.4 | 0.2 | 0.0 | 1.0 | 22.2 | 51.3 | 61.0 | 48.3 | 200.0 |
| Min. | 4.6 | 1.8 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 | 1.8 | 68.9 |
| Std. Dev | 11.13 | 8.51 | 7.88 | 5.92 | 1.30 | 0.03 | 0.00 | 0.14 | 4.17 | 11.60 | 10.28 | 10.89 | 25.88 |
| | | | | | | | | | | | | Sum of Average Months = | 116.4 |
| | | | | | | | | | | | | Average of Complete Years = | 113.4 |

January 13, 2006

## Table CC6-5 - PELLY RIVER RANCH Wet Period Precipitation

(May through September = Rainfall, Winter October through April = Snowfall)

| | Maximum One Months | | | | | | Maximum Two Month Periods | | | | | Maximum Three Months | | | | Winter Precipitation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | May | June | July | Aug | Sept | MAX | M/J | J/J | J/A | A/S | MAX | M/J/J | J/J/A | J/A/S | MAX | 6-mo. O - M | 7-mo. O - A | 8-mo. O - May |
| 1951 | | | | | | | | | | | | | | | | | | |
| 1952 | 6.6 | | | | | | | | | | | | | | | | | |
| 1954 | | 6.1 | 40.6 | 17.8 | 23.4 | 40.6 | | 46.7 | 58.4 | 41.2 | 58.4 | | 64.5 | 81.8 | 81.8 | | | |
| 1955 | 7.1 | 43.2 | 14.0 | 86.1 | 10.7 | 86.1 | 50.3 | 57.2 | 100.1 | 96.8 | 100.1 | 64.3 | 143.3 | 110.8 | 143.3 | 89.9 | 90.0 | 97.1 |
| 1956 | 40.1 | 45.0 | 48.3 | 40.9 | 2.8 | 48.3 | 85.1 | 93.3 | 89.2 | 43.7 | 93.3 | 133.4 | 134.2 | 92.0 | 134.2 | | | |
| 1957 | 15.2 | 12.7 | 34.8 | 19.6 | 19.8 | 34.8 | 27.9 | 47.5 | 54.4 | 39.4 | 54.4 | 62.7 | 67.1 | 74.2 | 74.2 | 140.4 | 148.3 | 163.5 |
| 1958 | 14.2 | 33.5 | 62.0 | 67.1 | 17.0 | 67.1 | 47.7 | 95.5 | 129.1 | 84.1 | 129.1 | 109.7 | 162.6 | 146.1 | 162.6 | 94.8 | 97.8 | 112.0 |
| 1959 | 19.3 | 46.7 | 29.0 | 37.6 | 25.1 | 46.7 | 66.0 | 75.7 | 66.6 | 62.7 | 75.7 | 95.0 | 113.3 | 91.7 | 113.3 | 148.4 | 159.1 | 178.4 |
| 1960 | 18.5 | 26.4 | 117.9 | 36.6 | 28.4 | 117.9 | 44.9 | 144.3 | 154.5 | 65.0 | 154.5 | 162.8 | 180.9 | 182.9 | 182.9 | 80.1 | 85.2 | 103.7 |
| 1961 | 23.4 | 45.0 | 44.5 | 25.9 | 18.3 | 45.0 | 68.4 | 89.5 | 70.4 | 44.2 | 89.5 | 112.9 | 115.4 | 88.7 | 115.4 | 85.9 | 92.5 | 115.9 |
| 1962 | 16.3 | 55.9 | 35.6 | 39.4 | 13.0 | 55.9 | 72.2 | 91.5 | 75.0 | 52.4 | 91.5 | 107.8 | 130.9 | 88.0 | 130.9 | 142.3 | 167.2 | 183.5 |
| 1963 | | 47.5 | 58.7 | 18.5 | 35.1 | 58.7 | | 106.2 | 77.2 | 53.6 | 106.2 | | 124.7 | 112.3 | 124.7 | 125.1 | 136.0 | |
| 1964 | 26.2 | 53.6 | 88.1 | 30.7 | 21.1 | 88.1 | 79.8 | 141.7 | 118.8 | 51.8 | 141.7 | 167.9 | 172.4 | 139.9 | 172.4 | 149.1 | 165.1 | 191.3 |
| 1965 | 14.0 | 30.0 | 41.9 | 17.5 | 40.4 | 41.9 | 44.0 | 71.9 | 59.4 | 57.9 | 71.9 | 85.9 | 89.4 | 99.8 | 99.8 | 86.2 | 89.8 | 103.8 |
| 1966 | 5.8 | 28.2 | 7.1 | 20.3 | 16.0 | 28.2 | 34.0 | 35.3 | 27.4 | 36.3 | 36.3 | 41.1 | 55.6 | 43.4 | 55.6 | 125.5 | 135.7 | 141.5 |
| 1967 | 16.5 | 46.2 | 65.0 | 56.4 | 28.4 | 65.0 | 62.7 | 111.2 | 121.4 | 84.8 | 121.4 | 127.7 | 167.6 | 149.8 | 167.6 | 202.2 | 216.4 | 232.9 |
| 1968 | 25.1 | 21.3 | 29.7 | 25.7 | 59.7 | 59.7 | 46.4 | 51.0 | 55.4 | 85.4 | 85.4 | 76.1 | 76.7 | 115.1 | 115.1 | 110.5 | 126.2 | 151.3 |
| 1969 | 30.5 | 3.3 | 81.5 | 12.2 | 22.9 | 81.5 | 33.8 | 84.8 | 93.7 | 35.1 | 93.7 | 115.3 | 97.0 | 116.6 | 116.6 | 82.1 | 94.0 | 124.5 |
| 1970 | 48.8 | 24.4 | 5.3 | 42.7 | 50.3 | 50.3 | 73.2 | 29.7 | 48.0 | 93.0 | 93.0 | 78.5 | 72.4 | 98.3 | 98.3 | 74.5 | 82.1 | 130.9 |
| 1971 | 7.4 | 11.7 | 24.1 | 45.0 | 22.1 | 45.0 | 19.1 | 35.8 | 69.1 | 67.1 | 69.1 | 43.2 | 80.8 | 91.2 | 91.2 | 115.4 | 120.2 | 127.6 |
| 1972 | 14.7 | 70.9 | 47.2 | 23.1 | 23.4 | 70.9 | 85.6 | 118.1 | 70.3 | 46.5 | 118.1 | 132.8 | 141.2 | 93.7 | 141.2 | 141.9 | 154.6 | 169.3 |
| 1973 | 5.1 | 50.8 | 47.5 | 54.1 | 8.6 | 54.1 | 55.9 | 98.3 | 101.6 | 62.7 | 101.6 | 103.4 | 152.4 | 110.2 | 152.4 | 141.7 | 172.2 | 177.3 |
| 1974 | 7.4 | 14.7 | 65.8 | 31.8 | 8.6 | 65.8 | 22.1 | 80.5 | 97.6 | 40.4 | 97.6 | 87.9 | 112.3 | 106.2 | 112.3 | 125.8 | 144.9 | 152.3 |
| 1975 | 13.7 | 16.5 | 71.6 | 29.0 | 32.3 | 71.6 | 30.2 | 88.1 | 100.6 | 61.3 | 100.6 | 101.8 | 117.1 | 132.9 | 132.9 | 97.6 | 115.9 | 129.6 |
| 1976 | 42.9 | 37.3 | 46.7 | 19.3 | 14.5 | 46.7 | 80.2 | 84.0 | 66.0 | 33.8 | 84.0 | 126.9 | 103.3 | 80.5 | 126.9 | 120.1 | 130.8 | 173.7 |
| 1977 | 24.2 | 44.8 | 30.3 | 18.3 | 14.9 | 44.8 | 69.0 | 75.1 | 48.6 | 33.2 | 75.1 | 99.3 | 93.4 | 63.5 | 99.3 | 105.0 | 130.0 | 154.2 |
| 1978 | 17.8 | 33.4 | 100.0 | 46.7 | 23.8 | 100.0 | 51.2 | 133.4 | 146.7 | 70.5 | 146.7 | 151.2 | 180.1 | 170.5 | 180.1 | 69.0 | 81.9 | 99.7 |
| 1979 | 29.5 | 47.7 | 54.1 | 10.2 | 33.5 | 54.1 | 77.2 | 101.8 | 64.3 | 43.7 | 101.8 | 131.3 | 112.0 | 97.8 | 131.3 | 139.5 | 144.1 | 173.6 |
| 1980 | 9.2 | 24.8 | 44.4 | 33.0 | 53.4 | 53.4 | 34.0 | 69.2 | 77.4 | 86.4 | 86.4 | 78.4 | 102.2 | 130.8 | 130.8 | 79.1 | 82.3 | 91.5 |
| 1981 | 13.2 | 33.3 | 87.9 | 43.6 | 52.9 | 87.9 | 46.5 | 121.2 | 131.5 | 96.5 | 131.5 | 134.4 | 164.8 | 184.4 | 184.4 | 77.6 | 88.6 | 101.8 |
| 1982 | 33.7 | 13.3 | 62.7 | 22.4 | 31.7 | 62.7 | 47.0 | 76.0 | 85.1 | 54.1 | 85.1 | 109.7 | 98.4 | 116.8 | 116.8 | 121.3 | 135.2 | 168.9 |
| 1983 | 29.0 | 50.3 | 53.8 | 82.2 | 26.0 | 82.2 | 79.3 | 104.1 | 136.0 | 108.2 | 136.0 | 133.1 | 186.3 | 162.0 | 186.3 | 121.2 | 127.0 | 156.0 |
| 1984 | 33.5 | 27.0 | 44.6 | 48.7 | 25.0 | 48.7 | 60.5 | 71.6 | 93.3 | 73.7 | 93.3 | 105.1 | 120.3 | 118.3 | 120.3 | 94.4 | 102.9 | 136.4 |
| 1985 | 20.5 | 69.8 | 88.4 | 48.8 | 28.5 | 88.4 | 90.3 | 158.2 | 137.2 | 77.3 | 158.2 | 178.7 | 207.0 | 165.7 | 207.0 | 108.2 | 117.1 | 137.6 |
| 1986 | 30.0 | 47.4 | 73.0 | 44.5 | 8.0 | 73.0 | 77.4 | 120.4 | 117.5 | 52.5 | 120.4 | 150.4 | 164.9 | 125.5 | 164.9 | 100.5 | 106.3 | 136.3 |
| 1987 | 22.3 | 26.6 | 53.4 | 34.6 | 43.1 | 53.4 | 48.9 | 80.0 | 88.0 | 77.7 | 88.0 | 102.3 | 114.6 | 131.1 | 131.1 | 90.1 | 99.3 | 121.6 |
| 1988 | 23.8 | 26.2 | 68.8 | 28.6 | 9.8 | 68.8 | 50.0 | 95.0 | 97.4 | 38.4 | 97.4 | 118.8 | 123.6 | 107.2 | 123.6 | 141.6 | 145.7 | 169.5 |
| 1989 | 32.6 | 49.1 | 13.1 | 20.4 | 23.8 | 49.1 | 81.7 | 62.2 | 33.5 | 44.2 | 81.7 | 94.8 | 82.6 | 57.3 | 94.8 | 95.5 | 95.7 | 128.3 |
| 1990 | 48.4 | 57.0 | 13.0 | 41.0 | 45.0 | 57.0 | 105.4 | 70.0 | 54.0 | 86.0 | 105.4 | 118.4 | 111.0 | 99.0 | 118.4 | 106.8 | 108.4 | 156.8 |
| 1991 | 25.1 | 30.0 | 47.8 | 34.7 | 43.0 | 47.8 | 55.1 | 77.8 | 82.5 | 77.7 | 82.5 | 102.9 | 112.5 | 125.5 | 125.5 | 147.5 | 151.5 | 176.6 |
| 1992 | 28.2 | 32.2 | 44.3 | 47.4 | 56.4 | 56.4 | 60.4 | 76.5 | 91.7 | 103.8 | 103.8 | 104.7 | 123.9 | 148.1 | 148.1 | 152.7 | 199.3 | 227.5 |
| 1993 | 18.4 | 16.8 | 61.9 | 40.0 | 20.8 | 61.9 | 35.2 | 78.7 | 101.9 | 60.8 | 101.9 | 97.1 | 118.7 | 122.7 | 122.7 | 155.7 | 164.5 | 182.9 |
| 1994 | 37.8 | 53.6 | 36.2 | 8.6 | 21.6 | 53.6 | 91.4 | 89.8 | 44.8 | 30.2 | 91.4 | 127.6 | 98.4 | 66.4 | 127.6 | 115.2 | 122.9 | 160.7 |
| 1995 | 16.8 | 31.8 | 84.4 | 78.2 | 10.6 | 84.4 | 48.6 | 116.2 | 162.6 | 88.8 | 162.6 | 133.0 | 194.4 | 173.2 | 194.4 | 81.2 | 81.4 | 98.2 |
| 1996 | 3.4 | 27.9 | 67.2 | 58.2 | 33.6 | 67.2 | 31.3 | 95.1 | 125.4 | 91.8 | 125.4 | 98.5 | 153.3 | 159.0 | 159.0 | 100.4 | 117.0 | 120.4 |
| 1997 | 86.0 | 56.6 | 80.6 | 36.0 | 29.4 | 86.0 | 142.6 | 137.2 | 116.6 | 65.4 | 142.6 | 223.2 | 173.2 | 146.0 | 223.2 | 106.4 | 119.0 | 205.0 |
| 1998 | 6.4 | 40.6 | 19.4 | 21.4 | 30.6 | 40.6 | 47.0 | 60.0 | 40.8 | 52.0 | 60.0 | 66.4 | 81.4 | 71.4 | 81.4 | 84.1 | 86.5 | 92.9 |
| 1999 | 19.8 | 63.0 | 28.2 | 57.2 | 35.2 | 63.0 | 82.8 | 91.2 | 85.4 | 92.4 | 92.4 | 111.0 | 148.4 | 120.6 | 148.4 | 99.3 | 111.7 | 131.5 |
| 2000 | 32.6 | 45.7 | 93.8 | 78.6 | 84.4 | 93.8 | 78.3 | 139.5 | 172.4 | 163.0 | 172.4 | 172.1 | 218.1 | 256.8 | 256.8 | 154.3 | 166.7 | 199.3 |
| 2001 | 12.3 | 47.8 | 99.4 | 36.4 | 23.0 | 99.4 | 60.1 | 147.2 | 135.8 | 59.4 | 147.2 | 159.5 | 183.6 | 158.8 | 183.6 | 84.4 | 97.0 | 109.3 |
| 2002 | 26.9 | 23.4 | 74.8 | 74.6 | 9.0 | 74.8 | 50.3 | 98.2 | 149.4 | 83.6 | 149.4 | 125.1 | 172.8 | 158.4 | 172.8 | 98.4 | 110.6 | 137.5 |
| 2003 | 16.0 | 29.6 | 52.6 | 26.8 | 20.4 | 52.6 | 45.6 | 82.2 | 79.4 | 47.2 | 82.2 | 98.2 | 109.0 | 99.8 | 109.0 | 96.7 | 99.7 | 115.7 |
| 2004 | 19.2 | | | | | | | | | | | | | | | 206.5 | 210.4 | 229.6 |
| 2005 | | | | | | | | | | | | | | | | | | |
| # years | 50 | 50 | 50 | 50 | 50 | 50 | 48 | 50 | 50 | 50 | 50 | 48 | 50 | 50 | 50 | 49 | 49 | 48 |
| Average | 22.7 | 36.4 | 53.7 | 38.4 | 27.6 | 63.5 | 59.9 | 90.1 | 92.1 | 66.0 | 103.8 | 113.8 | 128.5 | 119.7 | 137.7 | 114.5 | 125.0 | 147.5 |
| Max. | 86.0 | 70.9 | 117.9 | 86.1 | 84.4 | 117.9 | 142.6 | 158.2 | 172.4 | 163.0 | 172.4 | 223.2 | 218.1 | 256.8 | 256.8 | 206.5 | 216.4 | 232.9 |
| Min. | 3.4 | 3.3 | 5.3 | 8.6 | 2.8 | 28.2 | 19.1 | 29.7 | 27.4 | 30.2 | 36.3 | 41.1 | 55.6 | 43.4 | 55.6 | 69.0 | 81.4 | 91.5 |
| Std. Dev | 14.42 | 16.18 | 26.22 | 19.35 | 15.85 | 19.11 | 23.70 | 30.36 | 35.60 | 25.42 | 30.37 | 35.14 | 40.02 | 39.32 | 39.63 | 31.06 | 34.37 | 37.21 |
| # Max. | 1 | 11 | 28 | 6 | 4 | 44 | 4 | 16 | 24 | 6 | 44 | 7 | 25 | 18 | 50 | | | |

## Table CC6-6 - Snowsurvey Data - Williams Creek & Pelly Farm

(Snow Water Equlivalents in mm water)

**PELLY FARM (09CD-SC03)**

| Year | Feb-01 | Mar-01 | Apr-01 | May-01 | May-15 |
|---|---|---|---|---|---|
| 1986 | | 74 | **84** | 70 | 0 |
| 1987 | | **73** | 56 | 0 | 0 |
| 1988 | | 88 | **89** | 0 | 0 |
| 1989 | | 76 | **77** | 0 | 0 |
| 1990 | | **105** | 89 | 0 | 0 |
| 1991 | | 113 | **116** | 0 | 0 |
| 1992 | | 95 | **97** | 31 | 0 |
| 1993 | | 95 | **113** | 15 | 0 |
| 1994 | | **62** | 60 | 0 | 0 |
| 1995 | | 52 | **52** | 0 | 0 |
| 1996 | | 50 | **73** | 0 | |
| 1997 | | | **77** | 9 | |
| 1998 | | **59** | 56 | 0 | |
| 1999 | | 54 | **61** | 0 | 0 |
| 2000 | | 78 | **82** | 38 | |
| 2001 | | 58 | **70** | 0 | |
| 2002 | | 58 | **67** | 55 | |
| 2003 | | 42 | **48** | 5 | |
| 2004 | | **122** | 112 | 42 | |
| 2005 | | **71** | 56 | 0 | |
| Avg. | | 75.0 | **76.8** | 13.3 | 0.0 |
| Max. | | 122 | 116 | 70 | 0 |
| Min. | | 42 | 48 | 0 | 0 |
| No. of Maximums | | 6 | 14 | 0 | 0 |

| **Average Maximum Snowpack** | | |
|---|---|---|
| | 1995 to 2004 | **71.1** |
| | 1986 to 2004 | **80.4** |

**WILLIAMS CREEK #09AH-SC04**

| Year | Feb-01 | Mar-01 | Apr-01 | May-01 | May-15 |
|---|---|---|---|---|---|
| 1995 | | 55 | **78** | 20 | |
| 1996 | | 79 | **88** | 17 | |
| 1997 | | 84 | **93** | 59 | |
| 1998 | | 80 | **92** | 0 | |
| 1999 | | 73 | **91** | 36 | 0 |
| 2000 | | 76 | 82 | **84** | |
| 2001 | | **99** | **99** | 72 | |
| 2002 | | 78 | **84** | 31 | |
| 2003 | | **44** | 43 | 11 | |
| 2004 | | 108 | **137** | 124 | |
| 2005 | | **79** | 78 | 0 | |
| Avg. | | 77.7 | **87.7** | 41.3 | |
| Max. | | 108 | 137 | 124 | |
| Min. | | 44 | 43 | 0 | |
| No. of Maximums | | 3 | 8 | 1 | |

| **Average Maximum Snowpack** | | |
|---|---|---|
| | 1995 to 2004 | **89.0** |

## Table CC6-7 - Wet & Dry Year Precipitation, Rainfall and Snowfall - Williams Creek Site

| Return Period (years) | Annual Percent Probability | Pelly Ranch Total Precipitation (Elev. 454 m) Note 1 | Williams Creek Total Precipitation (Elev. 850 m) Note 2 | Williams Creek Rainfall Note 3 | Williams Creek Snowfall Note 3 |
|---|---|---|---|---|---|
| 20 (Dry) | 95.0% | 222 | 248 | 144 | 104 |
| 5 (Dry) | 80.0% | 258 | 288 | 167 | 121 |
| Average | 50.0% | 303 | 338 | 196 | 142 |
| 5 (Wet) | 20.0% | 346 | 386 | 224 | 162 |
| 10 (Wet) | 10.0% | 373 | 416 | 242 | 175 |
| 20 (Wet) | 5.0% | 397 | 443 | 257 | 186 |
| 50 (Wet) | 2.0% | 424 | 473 | 275 | 199 |
| 100 (Wet) | 1.0% | 444 | 496 | 288 | 208 |
| 200 (Wet) | 0.5% | 462 | 516 | 299 | 217 |
| 500 (Wet) | 0.2% | 486 | 543 | 315 | 228 |

**NOTES**

1) Frequency analysis results from 3 parameter log normal distribution for Pelly Ranch 1955 to 2004
Mean Annual Total Precipitation = 303 mm (62% Rainfall, 38% Snowfall)
Standard Deviation = 53.34 mm
Coefficient of Variation = 0.176

2) Williams Creek total annual precipitation estimated assuming 2.9% increase per 100 m elevation increase between Pelly River Ranch and Williams Creek, equal to a factor of 1.1165 times the precipitation at Pelly River Ranch.

3) Rainfall and Snowfall for extreme years above estimated assuming Rainfall = 58% of Total Precipitation and Snowfall = 42% of Annual Total Precipitation.

## Table CC6-8 - Summary of Wet Period Orographic Factors

| Wet Period Starts | Wet Period Ends | Wet Period Duration | Type of Precipitation | Orographic Factor | |
|---|---|---|---|---|---|
| October 1 | March 31 | 6 months | Snowfall only | 1.2480 | |
| | April 30 | 7 | Snowfall only | 1.2480 | |
| | May 31 | 8 | Snow and Rain | 1.22 | * |
| | June 30 | 9 | Snow and Rain | 1.19 | * |
| | July 31 | 10 | Snow and Rain | 1.16 | * |
| | August 31 | 11 | Snow and Rain | 1.13 | * |
| | September 30 | 12 | Snow and Rain | 1.1165 | |
| Any Day May to September | | One Day | Rainfall only | 1.30 | (see Table CC5-1B) |
| May 1 | May 31 | 1 month | Rainfall only | 1.15 | |
| | June 30 | 2 | Rainfall only | 1.12 | * |
| | July 31 | 3 | Rainfall only | 1.09 | * |
| | August 31 | 4 | Rainfall only | 1.07 | * |
| | September 30 | 5 | Rainfall only | 1.0375 | (see Table CC5-1A) |

Notes 1) Value for Pelly Ranch *times* Orogrpahic Factor *equals* value for Williams Creek
2) * values are interpolated

## Table CC6-9 - Wet Period Precipitation - One Day and One to Twelve Month Duration

### Table CC6-9A - Pelly River Ranch

| | | | Wet Periods Starting on May 1 | | | | | Wet Periods Starting October 1 | | | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Return Period (years) | Annual Percent Probability | One Day | 1 -Month Rainfall | 2 -Month Rainfall | 3 -Month Rainfall | 4 -Month Rainfall | 5 -Month Rainfall | 6 -Month Snowfall | 7 -Month Snowfall | 8 -Month Precipitation | 12 -Month Precipitation |
| 20 (Dry) | 95.0% | 9.0 | 37 | 58 | 80 | 99 | 112 | 76 | 83 | 92 | 222 |
| 5 (Dry) | 80.0% | 12.7 | 47 | 78 | 104 | 125 | 142 | 88 | 85 | 116 | 258 |
| Average | 50.0% | 17.6 | 63 | 104 | 138 | 163 | 181 | 115 | 125 | 147 | 299 |
| 5 (Wet) | 20.0% | 24.1 | 78 | 128 | 169 | 198 | 218 | 137 | 150 | 176 | 346 |
| 10 (Wet) | 10.0% | 28.3 | 89 | 144 | 190 | 221 | 242 | 157 | 176 | 199 | 373 |
| 20 (Wet) | 5.0% | 32.2 | 99 | 157 | 209 | 241 | 262 | 178 | 199 | 220 | 397 |
| 50 (Wet) | 2.0% | 37.2 | 113 | 173 | 231 | 267 | 287 | 207 | 227 | 247 | 424 |
| 100 (Wet) | 1.0% | 40.9 | 122 | 185 | 247 | 284 | 304 | 229 | 248 | 267 | 444 |
| 200 (Wet) | 0.5% | 44.6 | 132 | 195 | 262 | 302 | 321 | 252 | 270 | 287 | 462 |
| 500 (Wet) | 0.2% | 49.5 | 145 | 209 | 282 | 324 | 342 | 285 | 300 | 314 | 486 |

### Table CC6-9B - Williams Creek Site

| | | | Wet Periods Starting on May 1 | | | | | Wet Periods Starting October 1 | | | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Return Period (years) | Annual Percent Probability | One Day | 1 -Month Rainfall | 2 -Month Rainfall | 3 -Month Rainfall | 4 -Month Rainfall | 5 -Month Rainfall | 6 -Month Snowfall | 7 -Month Snowfall | 8 -Month Precipitation | 12 -Month Precipitation |
| Orographic Factor | | **1.30** | **1.15** | **1.12** | **1.09** | **1.07** | **1.0375** | **1.248** | **1.248** | **1.22** | **1.1165** |
| 20 (Dry) | 95.0% | 11.7 | 42.6 | 65.0 | 87.2 | 106 | 116 | 94.8 | 103.6 | 112 | 248 |
| 5 (Dry) | 80.0% | 16.5 | 54.1 | 87.4 | 113 | 134 | 147 | 110 | 106 | 142 | 288 |
| Average | 50.0% | 22.9 | 72.5 | 116 | 150 | 174 | 188 | 144 | 156 | 179 | 334 |
| 5 (Wet) | 20.0% | 31.3 | 89.7 | 143 | 184 | 212 | 226 | 171 | 187 | 215 | 386 |
| 10 (Wet) | 10.0% | 36.8 | 102 | 161 | 207 | 236 | 251 | 196 | 220 | 243 | 416 |
| 20 (Wet) | 5.0% | 41.9 | 114 | 176 | 228 | 258 | 272 | 222 | 248 | 268 | 443 |
| 50 (Wet) | 2.0% | 48.4 | 130 | 194 | 252 | 286 | 298 | 258 | 283 | 301 | 473 |
| 100 (Wet) | 1.0% | 53.2 | 140 | 207 | 269 | 304 | 315 | 286 | 310 | 326 | 496 |
| 200 (Wet) | 0.5% | 58.0 | 152 | 218 | 286 | 323 | 333 | 314 | 337 | 350 | 516 |
| 500 (Wet) | 0.2% | 64.4 | 167 | 234 | 307 | 347 | 355 | 356 | 374 | 383 | 543 |

Notes 1) Orographic Factors (see Table CC6-8) *times* Pelly River values *equals* Williams Creek values
2) Snowmelt for 6 to 8 month duration wet periods will allow for 20 mm sublimation loss from the snowpack

## Table CC6-10 - Average Monthly Precipitation Conditions - Williams Creek Site

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pelly River Ranch at Elevation 454 m** | | | | | | | | | | | | | |
| Average Conditions - Monthly Depths - mm | | | | | | | | | | | | | |
| Average Rainfall | 0.0 | 0.0 | 0.2 | 3.5 | 22.6 | 36.3 | 53.5 | 38.1 | 27.6 | 7.1 | 0.4 | 0.1 | 189.4 |
| Average Snowfall | 20.0 | 14.7 | 11.1 | 6.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.8 | 24.2 | 21.2 | 113.7 |
| Average Precipitation | 20.0 | 14.7 | 11.3 | 10.2 | 22.6 | 36.3 | 53.5 | 38.1 | 27.6 | 22.9 | 24.6 | 21.3 | 303.1 |
| Percent per month of Total Annual Precipitation | | | | | | | | | | | | | |
| Average Rainfall | 0.0% | 0.0% | 0.1% | 1.2% | 7.5% | 12.0% | 17.6% | 12.6% | 9.1% | 2.3% | 0.1% | 0.0% | 62.5% |
| Average Snowfall | 6.6% | 4.9% | 3.7% | 2.2% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.2% | 8.0% | 7.0% | 37.5% |
| Total Precipitation | 6.6% | 4.9% | 3.7% | 3.4% | 7.5% | 12.0% | 17.6% | 12.6% | 9.1% | 7.6% | 8.1% | 7.0% | 100.0% |
| **Williams Creek Site at Elevation 850 m** | | | | | | | | | | | | | |
| Percent per month of Total Annual Precipitation | | | | | | | | | | | | | |
| Average Rainfall | 0.0% | 0.0% | 0.0% | 1.2% | 7.1% | 11.7% | 16.9% | 12.2% | 9.0% | 0.0% | 0.0% | 0.0% | 58.1% |
| Average Snowfall | 6.4% | 4.8% | 4.0% | 3.6% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 8.3% | 7.9% | 6.9% | 41.9% |
| Total Precipitation | 6.9% | 5.3% | 4.2% | 7.6% | 3.6% | 11.2% | 16.4% | 11.7% | 8.4% | 8.9% | 8.4% | 7.4% | 100.0% |
| Average Conditions - Monthly Depths - mm | | | | | | | | | | | | | |
| Average Rainfall | 0.0 | 0.0 | 0.0 | 4.1 | 24.0 | 39.6 | 57.2 | 41.3 | 30.5 | 0.0 | 0.0 | 0.0 | 196.5 |
| Average Snowfall | 21.7 | 16.2 | 13.5 | 12.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 28.1 | 26.7 | 23.3 | 141.9 |
| Total Precipitation | 21.7 | 16.2 | 13.5 | 16.2 | 24.0 | 39.6 | 57.2 | 41.3 | 30.5 | 28.1 | 26.7 | 23.3 | 338.4 |

**NOTES**

1) Williams Creek % per month for rainfall, snowfall and total precipitation estimated assuming annual rainfall = 58.1% and annual snowfall = 41.9% of total annual precipitation.

**Table CC6-11 - Average Areal Evapotranspiration and Lake Evaporation**

| Month | Average Monthly Areal Evapotranspiration (mm) | | |
|---|---|---|---|
| | Williams Creek | Whitehorse A | Mayo A |
| Jan | 0 | 0 | 0 |
| Feb | 0 | 0 | 0 |
| Mar | 16.7 | 12.8 | 0 |
| Apr | 16.5 | 24 | 19.3 |
| May | 27.0 | 35.1 | 33.2 |
| Jun | 40.5 | 45.2 | 49.9 |
| Jul | 38.3 | 44.5 | 55.9 |
| Aug | 18.4 | 23.9 | 38.7 |
| Sep | 15.3 | 15.3 | 17.3 |
| Oct | 4.6 | 8.1 | 6 |
| Nov | 0 | 0 | 0 |
| Dec | 0 | 0 | 0 |
| Annual Total | 177.3 | 208.9 | 220.3 |
| May-Sept | 139.5 | 164.0 | 195.0 |
| Elevation (m) | 850 | 703 | 504 |

| | Average Monthly Lake Evaporation (mm) | | | | |
|---|---|---|---|---|---|
| Month | Williams Creek (WREVAP) | Whitehorse A (WREVAP) | Mayo A (WREVAP) | Whitehorse A (adjusted Class A pan) | Pelly Ranch (adjusted Class A pan) |
| Jan | 0 | 0 | 0 | | |
| Feb | 0 | 0 | 0 | | |
| Mar | 21.6 | 15.3 | 0 | | |
| Apr | 61.6 | 58.4 | 47.8 | | |
| May | 99.7 | 97.3 | 90.6 | 104.3 | 107.6 |
| Jun | 119.4 | 118.7 | 110.5 | 124.8 | 120.3 |
| Jul | 110.7 | 113.1 | 108.4 | 109.9 | 108.0 |
| Aug | 76.5 | 81.2 | 77.9 | 96.0 | 79.8 |
| Sep | 34 | 34.1 | 26.2 | 47.7 | 37.2 |
| Oct | 4.1 | 10.3 | 5.7 | | |
| Nov | 0 | 0 | 0 | | |
| Dec | 0 | 0 | 0 | | |
| Annual Total | 527.6 | 528.4 | 467.1 | 482.7 | 452.9 |
| May-Sept | 440.3 | 444.4 | 413.6 | 482.7 | 452.9 |
| Elevation (m) | 850 | 703 | 504 | 703 | 454 |

Notes
1) Areal evapotranspiration and average monthly lake evaporation estimated using WREVAP program
2) Class A pan evaporations adjusted by Environment Canada using 0.7 pan coefficient

## Table CC6-12 - Monthly Average Temperatures at Williams Creek ($^{o}$C)

| Year | Element | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1994 | Daily Maximum | | | | | | | | | | 2.0 | -12.9 | -13.0 |
| | Daily Mean | | | | | | | | | | -0.7 | -15.9 | -16.4 |
| | Daily Minimum | | | | | | | | | | -3.3 | -18.8 | -19.7 |
| 1995 | Daily Maximum | -12.9 | -8.9 | -6.6 | 9.2 | 15.8 | 19.6 | 18.9 | 15.8 | 15.1 | 1.2 | -10.2 | |
| | Daily Mean | -15.3 | -11.9 | -10.4 | 4.4 | 10.7 | 14.9 | 14.8 | 11.6 | 10.7 | -1.1 | -12.5 | |
| | Daily Minimum | -17.7 | -14.6 | -13.9 | -0.2 | 5.8 | 10.0 | 11.0 | 8.2 | 7.0 | -3.0 | -14.7 | |
| 1996 | Daily Maximum | | | | 5.5 | 10.8 | 17.2 | 19.3 | 14.6 | 8.9 | -5.4 | | |
| | Daily Mean | | | | 1.1 | 6.9 | 12.7 | 14.8 | 10.5 | 5.2 | -7.7 | | |
| | Daily Minimum | | | | -3.1 | 2.8 | 8.3 | 10.8 | 7.1 | 1.7 | -9.8 | | |
| 1997 | Daily Maximum | -18.3 | -5.1 | -8.0 | 6.4 | 11.8 | 17.1 | 19.8 | 17.6 | 12.1 | -3.6 | | |
| | Daily Mean | -21.6 | -7.5 | -11.4 | 2.0 | 7.6 | 13.2 | 15.5 | 13.7 | 8.4 | -5.9 | | |
| | Daily Minimum | -24.6 | -9.7 | -15.3 | -2.8 | 3.1 | 9.1 | 11.4 | 9.5 | 4.8 | -8.4 | | |
| 1998 | Daily Maximum | -19.3 | -4.7 | -2.1 | 7.1 | 15.0 | 18.9 | 20.3 | 16.8 | 10.3 | 0.8 | -10.1 | -10.8 |
| | Daily Mean | -21.5 | -7.9 | -6.2 | 2.8 | 10.2 | 14.6 | 15.9 | 12.2 | 6.4 | -1.8 | -12.2 | -13.7 |
| | Daily Minimum | -23.3 | -10.8 | -10.2 | -1.2 | 5.3 | 10.6 | 11.6 | 7.7 | 3.1 | -4.0 | -14.1 | -16.6 |
| 1999 | Daily Maximum | -18.1 | -14.7 | -2.0 | 4.8 | 10.0 | 19.2 | 19.6 | 18.8 | | | | |
| | Daily Mean | -21.2 | -17.8 | -6.2 | 0.7 | 5.9 | 14.6 | 15.2 | 14.2 | | | | |
| | Daily Minimum | -24.0 | -20.4 | -9.8 | -3.0 | 2.1 | 10.4 | 11.0 | 10.2 | | | | |
| 2000 | Daily Maximum | | | | | | | | | | | -5.4 | -12.9 |
| | Daily Mean | | | | | | | | | | | -7.6 | -15.7 |
| | Daily Minimum | | | | | | | | | | | -9.4 | -18.5 |
| 2001 | Daily Maximum | -3.6 | | | | | | | | | | | |
| | Daily Mean | -6.6 | | | | | | | | | | | |
| | Daily Minimum | -9.4 | | | | | | | | | | | |
| 2002 | Daily Maximum | -10.5 | -8.5 | -7.2 | | | | | | | | | |
| | Daily Mean | -12.9 | -11.7 | -10.6 | | | | | | | | | |
| | Daily Minimum | -15.2 | -14.6 | -14.1 | | | | | | | | | |
| 2003 | Daily Maximum | | | | | 11.1 | 16.1 | | | | | | |
| | Daily Mean | | | | | 6.8 | 12.1 | | | | | | |
| | Daily Minimum | | | | | 2.6 | 8.2 | | | | | | |
| 2004 | Daily Maximum | -17.0 | -1.7 | -2.1 | | | | | | 7.2 | | | |
| | Daily Mean | -20.9 | -4.9 | -6.3 | | | | | | 3.5 | | | |
| | Daily Minimum | -23.6 | -8.1 | -9.9 | | | | | | 0.3 | | | |
| 2005 | Daily Maximum | | -9.6 | 1.7 | 7.2 | 15.3 | 17.6 | | | | | | |
| | Daily Mean | | -12.8 | -2.3 | 3.0 | 10.8 | 13.2 | | | | | | |
| | Daily Minimum | | -15.7 | -5.9 | -1.1 | 6.1 | 8.9 | | | | | | |
| **Average** | Daily Maximum | -14.2 | -7.6 | -3.8 | 6.7 | 12.8 | 17.9 | 19.6 | 16.7 | 10.7 | -1.0 | -9.7 | -12.3 |
| | Daily Mean | -17.1 | -10.7 | -7.6 | 2.3 | 8.4 | 13.6 | 15.2 | 12.4 | 6.9 | -3.4 | -12.1 | -15.3 |
| | Daily Minimum | -19.7 | -13.4 | -11.3 | -1.9 | 4.0 | 9.3 | 11.2 | 8.5 | 3.4 | -5.7 | -14.2 | -18.3 |
| **Carmacks** | Daily Maximum | -20.3 | -11.0 | -1.1 | 8.1 | 15.0 | 20.8 | 22.3 | 20.1 | 13.4 | 3.0 | -9.8 | -17.3 |
| | Daily Mean | -25.7 | -17.9 | -10.2 | 0.5 | 7.5 | 13.4 | 15.3 | 12.9 | 6.8 | -1.8 | -14.0 | -22.4 |
| | Daily Minimum | -31.3 | -25.0 | -19.1 | -7.0 | 0.1 | 5.9 | 8.3 | 5.6 | 0.4 | -6.4 | -18.2 | -27.5 |
| **Pelly Ranch** | Daily Maximum | -22.2 | -14 | -2 | 8 | 15.4 | 20.9 | 22.6 | 20 | 12.9 | 1.8 | -11.7 | -19.2 |
| | Daily Mean | -27.5 | -21.1 | -11.2 | 0.5 | 8 | 13.4 | 15.5 | 12.7 | 6.5 | -2.7 | -16.1 | -24.4 |
| | Daily Minimum | -32.8 | -28.1 | -20.3 | -7 | 0.6 | 5.9 | 8.3 | 5.5 | 0 | -7.2 | -20.5 | -29.6 |

## Table CC6-13 - Monthly Average Global Solar Radiation at Williams Creek (MJ/m$^2$/d)

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1994 | | | | | | | | | | 3.7 | 1.2 | 0.4 |
| 1995 | 0.6 | 3.3 | 8.6 | 17.2 | 19.2 | 21.0 | 15.0 | 13.4 | 9.3 | 3.3 | 1.2 | |
| 1996 | | | | 15.9 | 19.0 | 21.5 | 17.8 | 13.4 | 9.4 | 2.4 | | |
| 1997 | 0.3 | 2.2 | 8.7 | 15.8 | 18.7 | 19.9 | 17.4 | 14.7 | 9.9 | 3.7 | 1.5 | |
| 1998 | 0.2 | 3.1 | 9.9 | 15.9 | 20.5 | 20.2 | 19.5 | 14.8 | 8.6 | 3.8 | 0.5 | 0.2 |
| 1999 | 0.1 | 0.9 | 9.7 | 14.4 | 18.7 | 20.0 | 19.2 | 14.2 | | | | |
| 2000 | | | | | | | | | | | 0.4 | 0.2 |
| 2001 | 0.9 | | | | | | | | | | | |
| 2002 | 0.5 | 2.1 | 10.1 | | | | | | | | | 0.1 |
| 2003 | | | | | 19.3 | 20.2 | 17.9 | | | | | |
| 2004 | 0.2 | 2.5 | 7.7 | | | | | | 9.0 | | | |
| 2005 | | 2.3 | 9.4 | 16.2 | 20.3 | 20.8 | | | | | | |
| **Average** | **0.4** | **2.3** | **9.1** | **15.9** | **19.4** | **20.5** | **17.8** | **14.1** | **9.2** | **3.4** | **1.0** | **0.2** |

**Monthly Averages for Whitehorse**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | **1.3** | **4.0** | **9.2** | **15.7** | **19.6** | **21.0** | **18.8** | **15.0** | **9.0** | **4.4** | **1.6** | **0.7** |

## Table CC6-14 - Regional WSC Streamflow Stations

| Station Number | Station Name | Catchment Area (km2) | Average Catchment Elevation (m) |
|---|---|---|---|
| 08AA009 | Giltana Creek near the mouth | 194 | 1200 |
| 09AG003 | South Big Salmon River below Livingstone Ck. | 515 | 1430 |
| 09AH003 | Big Creek near the mouth | 1,750 | 1070 |
| 09BC005 | Tay River near the mouth | 3,810 | 1160 |
| 09AH004 | Nordenskiold River below Rowlinson Creek | 6,370 | 1090 |
| 09AG001 | Big Salmon River near Carmacks | 6,760 | 1300 |
| 09AH001 | Yukon River at Carmacks | 81,800 | |
| Williams Creek | | up to 87.8 km2 | |

## Table CC6-15 - Regional Streamflow Data & Monthly Distributions

| Station Number | Station Name | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year | MAR (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Monthly Average Streamflow (m3/s)** | | | | | | | | | | | | | | | |
| 08AA009 | Giltana Creek | 0.097 | 0.077 | 0.076 | 0.187 | 1.94 | 1.59 | 0.700 | 0.626 | 0.653 | 0.493 | 0.278 | 0.165 | 0.577 | 94 |
| 09AG003 | South Big Salmon River | 0.691 | 0.472 | 0.393 | 0.549 | 4.88 | 13.3 | 9.33 | 5.96 | 5.64 | 3.70 | 1.78 | 1.06 | 4.02 | 246 |
| 09AH003 | Big Creek | 0.306 | 0.178 | 0.152 | 1.83 | 25.0 | 17.6 | 18.9 | 13.8 | 10.6 | 3.98 | 1.29 | 0.588 | 8.01 | 144 |
| 09BC005 | Tay River | 5.37 | 4.32 | 3.98 | 8.23 | 66.8 | 71.0 | 47.9 | 33.5 | 46.7 | 23.5 | 11.0 | 7.84 | 27.5 | 227 |
| 09AH004 | Nordenskiold River | 3.83 | 3.25 | 3.09 | 6.93 | 41.1 | 31.2 | 21.3 | 19.1 | 19.7 | 13.0 | 7.47 | 5.07 | 14.6 | 72 |
| 09AG001 | Big Salmon River | 20.9 | 18.4 | 16.9 | 17.8 | 75.6 | 205.7 | 142.6 | 94.8 | 85.5 | 64.5 | 37.9 | 26.4 | 67.6 | 316 |
| 09AH001 | Yukon River at Carmacks | 310 | 284 | 262 | 268 | 592 | 1560 | 1620 | 1290 | 1120 | 923 | 551 | 364 | 756 | 291 |
| **Monthly Percent of Annual Discharge** | | | | | | | | | | | | | | | |
| 08AA009 | Giltana Creek | 1.4% | 1.0% | 1.1% | 2.7% | 28.6% | 22.6% | 10.3% | 9.2% | 9.3% | 7.3% | 4.0% | 2.4% | 100.0% | |
| 09AG003 | South Big Salmon River | 1.5% | 0.9% | 0.8% | 1.1% | 10.4% | 27.3% | 19.9% | 12.7% | 11.6% | 7.9% | 3.7% | 2.3% | 100.0% | |
| 09AH003 | Big Creek | 0.3% | 0.2% | 0.2% | 1.9% | 26.8% | 18.3% | 20.2% | 14.8% | 11.0% | 4.3% | 1.3% | 0.6% | 100.0% | |
| 09BC005 | Tay River | 1.6% | 1.2% | 1.2% | 2.4% | 20.5% | 21.1% | 14.7% | 10.3% | 13.9% | 7.2% | 3.3% | 2.4% | 100.0% | |
| 09AH004 | Nordenskiold River | 2.2% | 1.7% | 1.8% | 3.9% | 23.8% | 17.5% | 12.3% | 11.1% | 11.0% | 7.5% | 4.2% | 2.9% | 100.0% | |
| 09AG001 | Big Salmon River | 2.6% | 2.1% | 2.1% | 2.2% | 9.5% | 25.1% | 18.0% | 11.9% | 10.4% | 8.1% | 4.6% | 3.3% | 100.0% | |
| 09AH001 | **Yukon River at Carmacks** | 3.4% | 2.9% | 2.9% | 2.9% | 6.6% | 16.8% | 18.0% | 14.3% | 12.0% | 10.2% | 5.9% | 4.0% | 100.0% | |
| **Recommended for Williams Creek** | | 1.2% | 0.6% | 0.7% | 5.0% | 25.9% | 18.7% | 12.8% | 11.3% | 11.2% | 7.2% | 3.4% | 2.0% | 100.0% | |

**Notes**

1) MAR = Mean Annual Runoff depth (mm)
2) Catchment area for Yukon River at Williams Creek is estimated to be 83,700 km2. The flow distribution for Yukon River at Carmacks is assumed applicable to the Yukon River at Williams Creek. Flow rates/volumes could be increased by the ratio of the catchment areas (approx. 2.3%).
3) Estimated MAR for the Williams Creek catchment is 100 mm.
4) Distribution recommended for WIlliams Creek is based on the Nordenskiold River distribution.
5) Estimated MAR for Yukon River downstream of Williams Creek is 290 mm.

**Table CC6-16 - Carmacks Copper Project - Comparison of Hydrology Studies**

| | Previous Values Knight Piesold | Previous Proposed Values - Clearwater Consultants Ltd. | | |
|---|---|---|---|---|
| **Item or Issue** | **KP Report # 1785/1, April 23/97** | **Memo CCL-CC2, March 12, 1998** | **Memo CCL-CC2A, April 23, 1998** | **Current Proposed Values (Clearwater Memo CCL-CC5), Jan. 13, 2006** |
| **1) Orographic Factor** (Williams Creek 850 m v. Regional Data) | Total Precipitation increases at **8% per 100 m**, also applied to Rainfall and Snowfall | Total Precipitation **3.2%/100m**, Annual Rainfall = **58%** and Annual Snowfall = **42%** of annual total precipitation | Total Precipitation **6.1%/100m**, Annual Rainfall = **55%** and Annual Snowfall = **45%** of annual total precipitation | Total Precipitation **2.94%/100m**, Annual Rainfall = **58%** and Annual Snowfall = **42%** of annual total precipitation |
| **2) Annual Total Precipitation, Rainfall, Snowfall** | - used average of Pelly Ranch and Carmacks precipitation increased 8%/100m. Average Precipitation = **375 mm**, Average Rainfall = 233 mm, Average Snowfall = 143 mm. | - used Pelly River Ranch precipitation increased as above. Average Precipitation = **338 mm**, Average Rainfall = 195 mm, Average Snowfall = 143 mm. | - used Pelly River Ranch precipitation increased as above. Average Precipitation = **372 mm**, Average Rainfall = 205 mm, Average Snowfall = 167 mm. | - used Pelly River Ranch precipitation increased as above. Average W.C. Precipitation = **338 mm**, Average Rainfall = 196 mm, Average Snowfall = 142 mm. |
| **3) Wet & Dry Year Precipitation** | - used assumed normal distribution with assumed coefficient of variation of 0.20 based on Carmacks data. | - used frequency analysis of Pelly River Ranch data, GEV distribution, increased to Williams Creek site using factors in (1) above. | - used frequency analysis of Pelly River Ranch data, GEV distribution, increased to Williams Creek site using factors in (1) above. | - used frequency analysis of Pelly River Ranch data, 3 parameter log normal distribution, increased to Williams Creek site using factors in (1) above. |
| | Results - 20 year Dry = 252 mm, 10 year Wet = 471 mm, 100 year Wet = 549 mm. | Results - 20 year Dry = 252 mm, 10 year Wet = 416 mm, 100 year Wet = 491 mm. | Results - 20 year Dry = 278 mm, 10 year Wet = 458 mm, 100 year Wet = 541 mm. | Results - 20 year Dry = 248 mm, 10 year Wet = 416 mm, 100 year Wet = 496 mm. |
| **4) Wet Periods** | 100 year wet year = **550 mm** | 100 year wet year = **491 mm** | 100 year wet year = **541 mm** | 100 year wet year = **496 mm** |
| | 100 year April (snowmelt) = **286 mm** | 100 yr (Oct - April 7 month wet period), snowmelt in April = **263 mm** | 100 yr (Oct - April 7 month wet period), snowmelt in April = **311 mm** | 100 yr (Oct - April 7 month wet period), snowmelt runoff in April = **290 mm** |
| | 100 year April + May, total runoff in (April + May) = **386 mm** | 100 year (Oct - May 8 month wet period), total runoff in (April + May) = **284 mm** | 100 year (Oct - May 8 month wet period), total runoff in (April + May) = **325 mm** | 100 year (Oct - May 8 month wet period), total runoff in (April + May) = **306 mm** |
| | - average snowmelt (April) plus 100 year wet May, total April + May runoff = **261 mm** | - average snowmelt (April) plus 100 year wet One Month in May, total April + May runoff = **290 mm** | - average snowmelt (April) plus 100 year wet One Month in May, total April + May runoff = **316 mm** | - average snowmelt (April) plus 100 year wet One Month in May, total April + May runoff = **276 mm** |
| | 100 year (April + May + June), total runoff in (April + May + June) = **450 mm** | 100 year (Oct - May 8 month wet period) + avg. June, total runoff in (April+May+June) = **322 mm** | 100 year (Oct - May 8 month wet period) + avg. June, total runoff in (April+May+June) = **367 mm** | 100 year (Oct - May 8 month wet period) + avg. June, total runoff in (April+May+June) = **346 mm** |
| | | - average snowmelt (April) plus 100 year wet Two Months in May/June, total April+May+June runoff = **360 mm** | - average snowmelt (April) plus 100 year wet Two Months in May/June, total April+May+June runoff = **390 mm** | - average snowmelt (April) plus 100 year wet Two Months in May/June, total April+May+June runoff = **343 mm** |
| **5) Snowmelt Runoff Distribution** | - assumed snowmelt distributed 70% in April, 30% in May. | - propose 100% snowmelt in April for design storage, 70/30% split for average conditions. Will check 100% snowmelt in May. | - propose 100% snowmelt in April for design storage, 70/30% split for average conditions. Will check 100% snowmelt in May. | - propose 100% snowmelt in May for design storage, 50/50% split for average conditions. |
| **6) Annual Evaporation** | - used 400 mm per year lake evaporation | - propose 400 mm/year for design storage, 520 mm/year to determine make-up water, 460 mm/year for average conditions. | - propose 400 mm/year for design storage, 520 mm/year to determine make-up water, 460 mm/year for average conditions. | - propose 400 mm/year (open water season) for design storage, 440 mm/year to determine make-up water and for average conditions. |

# APPENDIX 2

## Williams Creek Site Hydrology Update

## Figures



Figure CC6-1 – Pelly River Ranch Average Monthly Precipitation

Figure CC6-2 – Williams Creek Average Monthly Precipitation

Figure CC6-3 – Estimated Monthly Evapotranspiration

Figure CC6-4 – Estimated Monthly Lake Evaporation

Figure CC6-5A – Williams Creek & Carmacks Monthly Temperatures

Figure CC6-5B – Williams Creek & Pelly Ranch Monthly Temperatures

Figure CC6-6 – Monthly Flow Distributions

**Figure CC6-1 - Pelly River Ranch Average Monthly Precipitation**

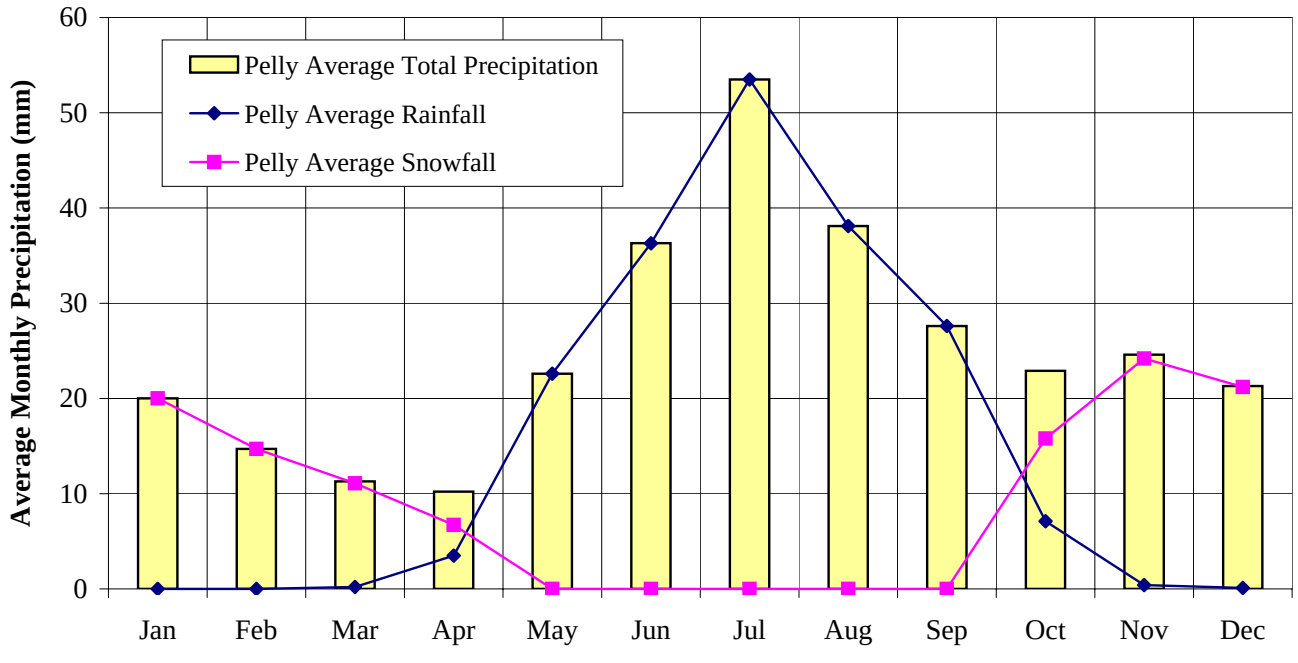


**Figure CC6-2 - Williams CreekAverage Monthly Precipitation**

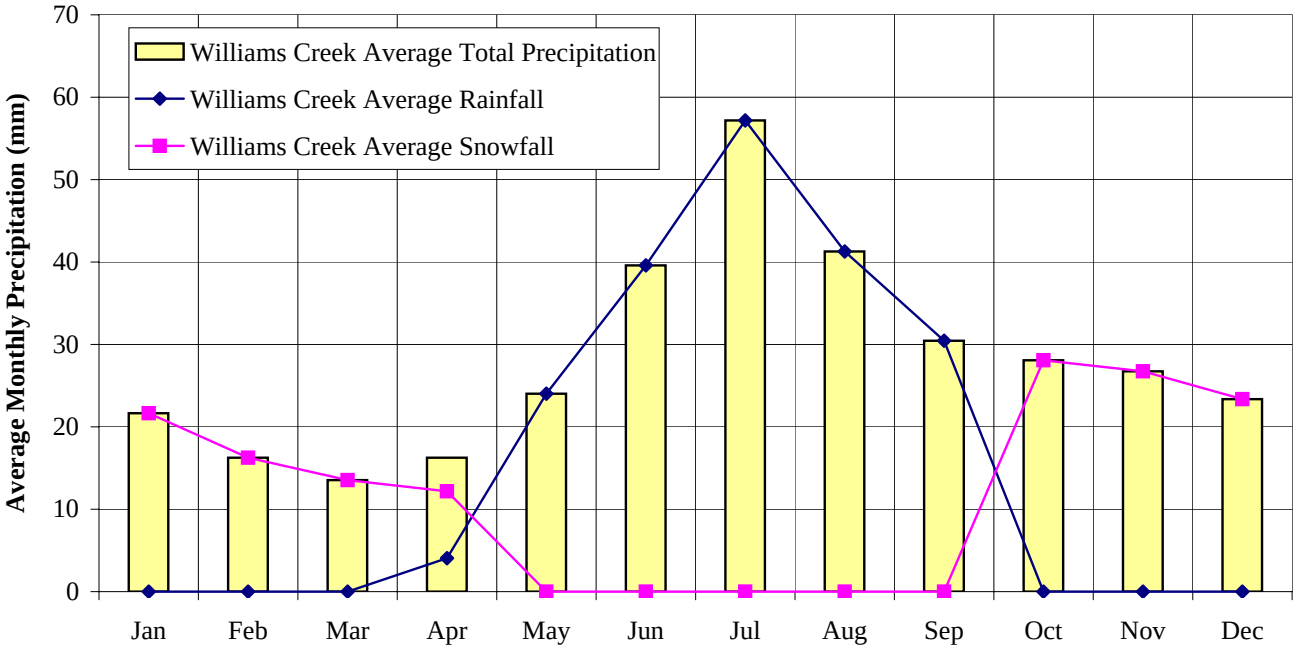

**Figure CC6-3 - Estimated Monthly Evapotranspiration**

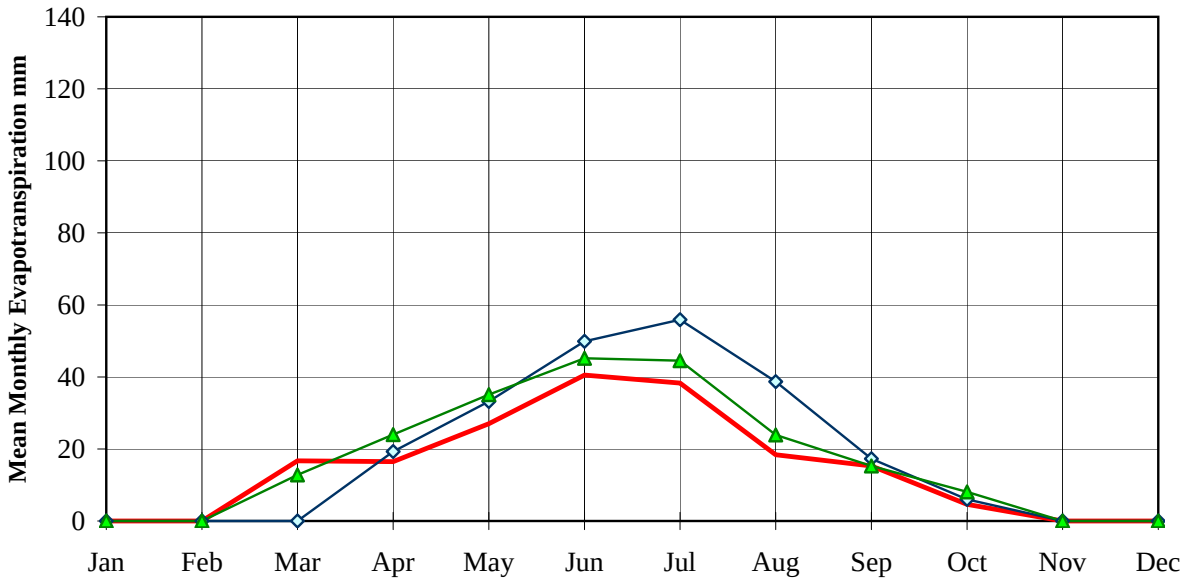


**Figure CC6-4 - Estimated Monthly Lake Evaporation**

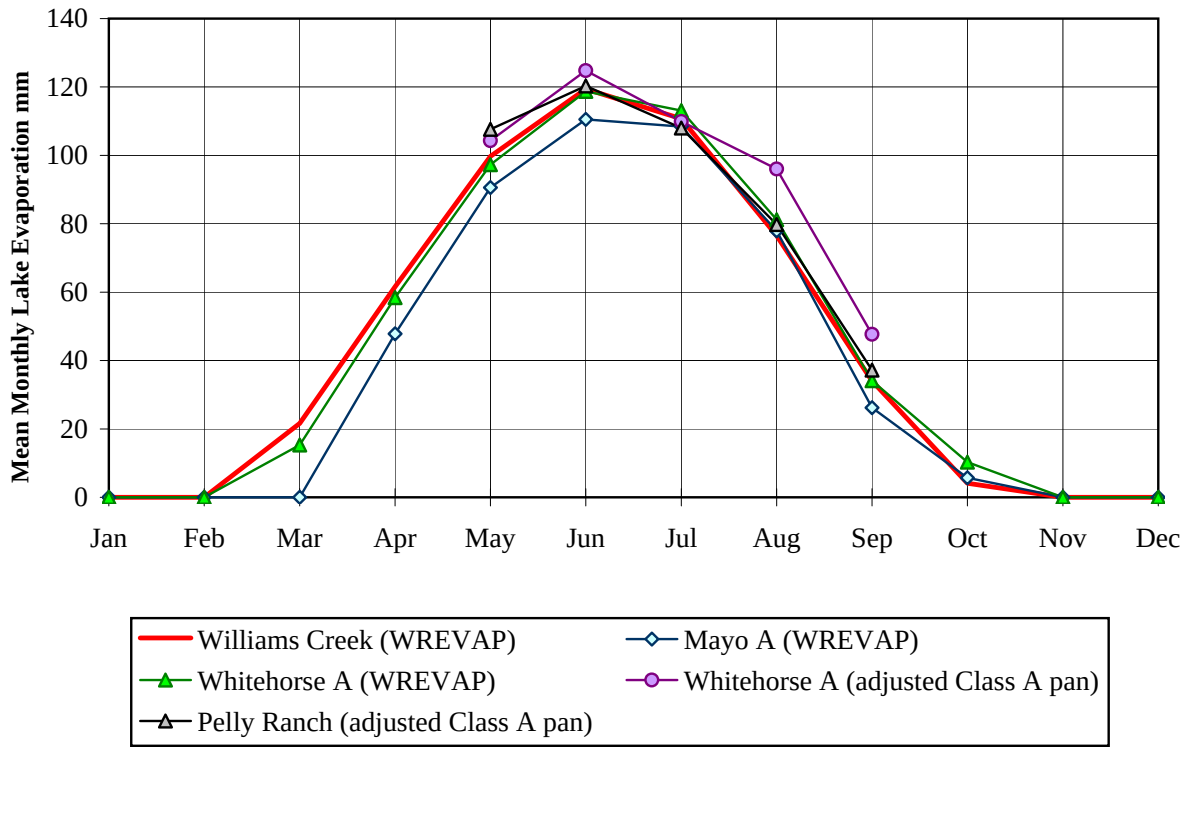

**Figure CC6-5A - Williams Creek & Carmacks Monthly Temperatures**

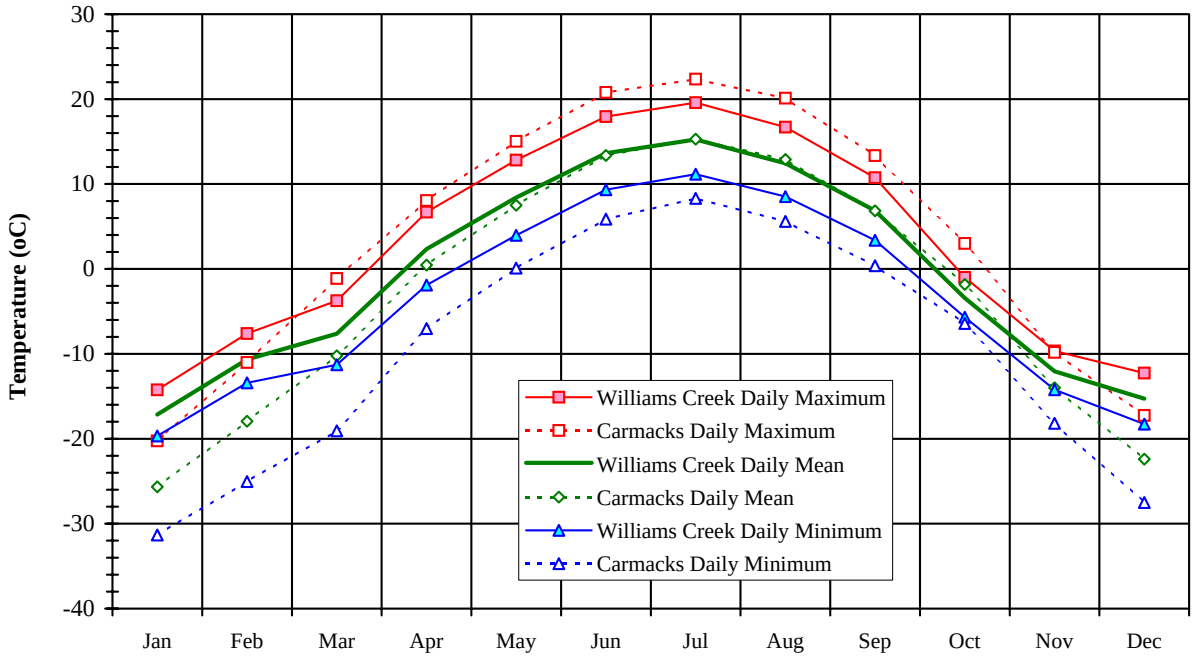


**Figure CC6 - 5B - Williams Creek & Pelly Ranch Monthly Temperatures**

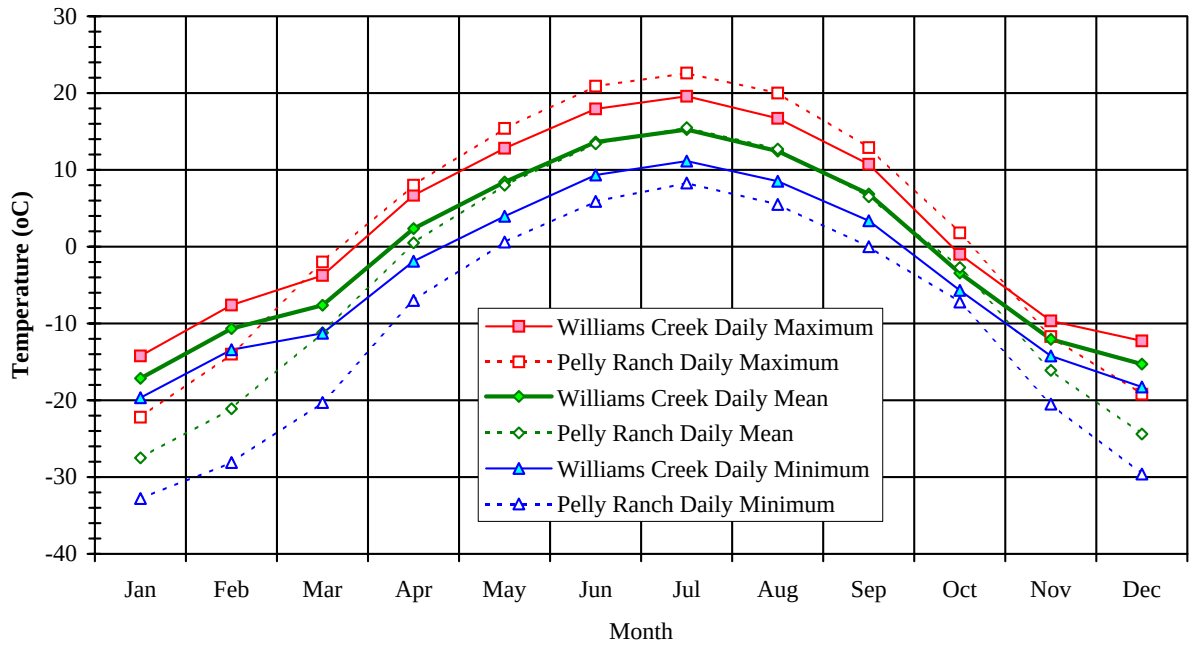

**Figure CC6-6 Monthly Flow Distributions**