# EXHIBIT 12

## SITE CLIMATE ANALYSIS

# Technical Memorandum

**Date:** December 10, 2019

**To:** Matt Haley, NewFields

**From:** Troy Thompson

**Re:** Thacker Pass Climate Analysis

## 1.0 Introduction

Ecological Resource Consultants Inc. (ERC) has evaluated available climate data for Lithium Nevada Corporation's (LNC's) Thacker Pass Project. This site is located in Humboldt County, Nevada and is located at roughly latitude 41.696° N, longitude 118.0206° W at an elevation of approximately 4600 feet above mean sea level (amsl). The evaluation was conducted to refine precipitation and evaporation values that should be used to define climate-related design criteria for mine planning and design.

## 2.0 Climatological Stations

Site and regional data were gathered for this analysis. LNC started recording detailed climatological data at the project site in October of 2011. Site data is collected hourly. Regionally precipitation data is available from the Western Regional Climate Center (WRCC) for the McDermitt Station (COOP No. 264935-1), Orovada 3W Station (COOP No. 262818-1) and the Kings River Valley Station (COOP No. 264236-1). Monthly data was available from the regional sites. The location of each station relative to the site is given in **Figure 1**. McDermitt started collecting data in 1892, Orovada 3W started in 1911 and Kings River Valley started in 1956. Each of the three stations has data gaps and the years of data judged by ERC to be sufficient for inclusion are given in **Table 1**. The table also lists pertinent information about each station.

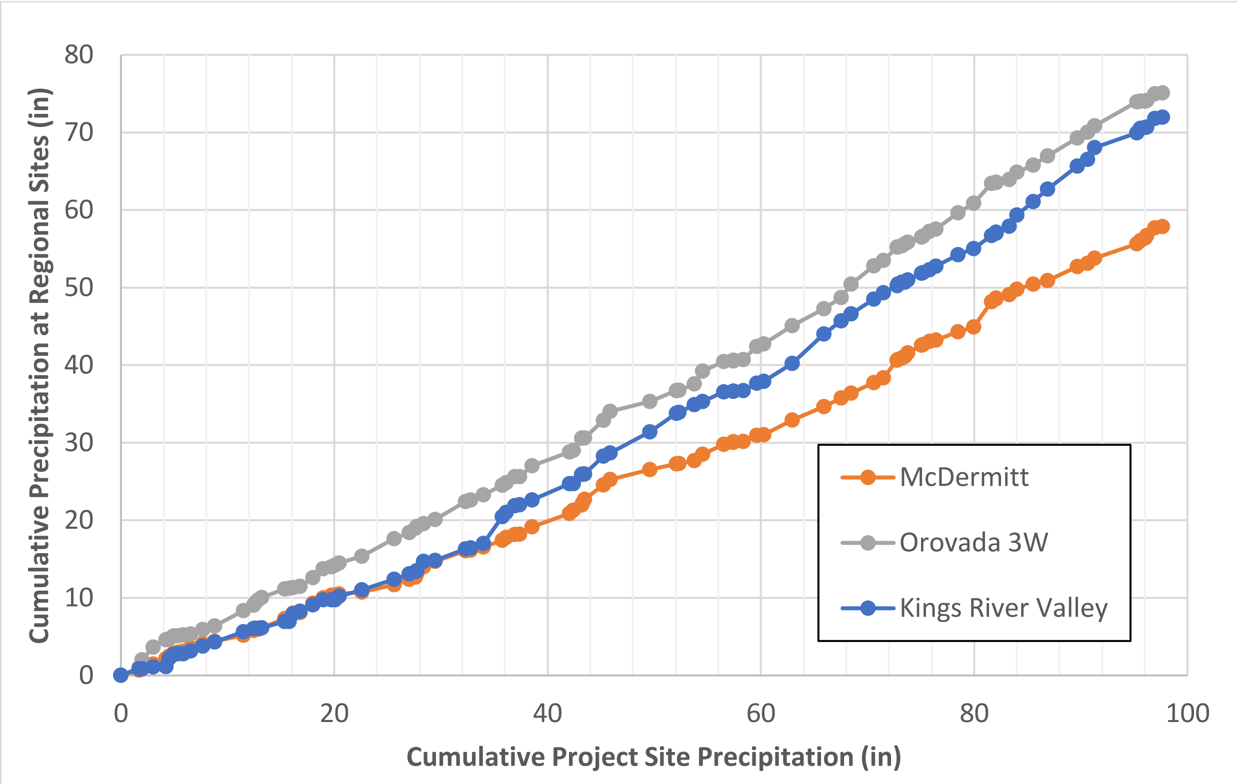
**Figure 1. Station Locations (from Google Earth)**

**Table 1. Meteorological Station Data**

| Site | Distance from Project & Direction | Elevation (ft) | Years Precipitation Data Available | Mean Annual Precipitation over Record (in) | Mean Annual Precip 2012-2018 (in) | Evaporation Data Available |
|---|---|---|---|---|---|---|
| **Site** | NA | 4,600 | 2012-2019 | 12.55 | 12.22 | Yes |
| **McDermitt** | 25 miles NE | 4,500 | 1980-1996, 1998-2019 | 8.19 | 7.20 | No |
| **Orovada 3W** | 14 miles SE | 4,300 | 1912, 1914-1917, 1926-1945, 1947, 1951-1964, 1967-2003, 2006-2019 | 10.62 | 9.28 | No |
| **Kings River Valley** | 12 miles NW | 4,240 | 1957, 1959-1961, 1969-1971, 1981, 1983, 1985-2001, 2012-2019 | 8.88 | 8.73 | No |

Data suggests that precipitation at the site is greater than that observed at regional stations. In order to evaluate how data from the different stations correlate to site precipitation, the overlapping periods of record were compared. Data was first evaluated using double mass curves and monthly precipitation data. Double mass curves plot the cumulative precipitation at sites with the idea that sites with good correlation plot along a line with a consistent slope. For our assessment we plotted the cumulative precipitation at each of the three regional sites versus cumulative precipitation at the project site for the period of January 2012 through October 2019. Results are presented in **Figure 2**.

**Figure 2. Monthly Precipitation Double Mass Curves Comparing Regional Stations to the Site (1/2012 – 10/2019)**

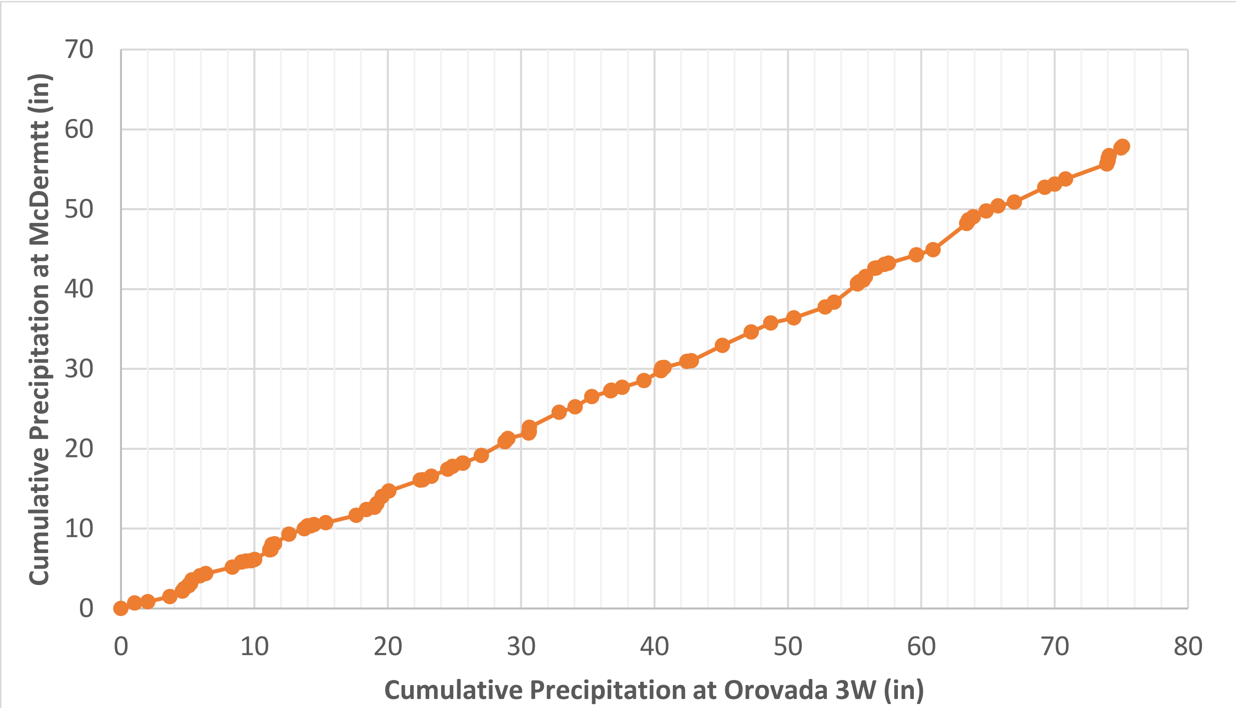



Some observations can be made when considering the double mass curve data

- Until roughly 35 inches on the X axis, which shows project site data, all three lines plotted relatively straight. The cumulative precipitation at the project site reached 35 inches in December of 2014. This suggests that site data from 2012 – 2014 correlated very well with regional data.
- Starting at roughly 35 inches on the X axis the slope of the Kings River Valley line increases. Starting at roughly 42 inches on the X axis the slopes of the McDermitt and the Orovada 3W lines increase. Increases in slopes on this plot indicate a point where the ratio of precipitation at the regional station increases as compared to the project site.
- Data from the McDermitt and Kings River Valley stations are nearly identical from 2012-2014. After this point they diverge suggesting that one or more of these stations does not have consistent data

Given the non-linearity in the graph and the breaks discussed above there is reason to believe that one or more of the data sets could be in question. The similar trends between data from the McDermitt and Orovada 3W in **Figure 2** suggests that there may be consistency between data recorded at these sites. A double mass curve comparing cumulative precipitation at these sites from 2012 through October 2019 was completed with results shown in **Figure 3**.

**Figure 3. Monthly Precipitation Double Mass Curves for McDermitt and Orovada 3W Stations (1/2012 – 10/2019)**




The consistent slope of the line comparing precipitation at McDermitt and Orovada 3W suggests consistency at both sites with Orovada 3W receiving roughly 24% more precipitation than McDermitt. As these two sites were found to produce consistent data and **Figure 2** shows that data from Kings River Valley are not consistent, Kings River Valley data was dropped from our assessment.

ERC then compared the correlation between monthly site data and monthly data at McDermitt and Orovada 3W in order to evaluate which station's data can be more closely related to site data. **Figure 4** shows the correlation between the site and McDermitt and **Figure 5** presents this data for the site and Orovada 3W.

**Figure 4. Correlation of Monthly Precipitation Data for the Site and McDermitt Station (1/2012 – 10/2019)**

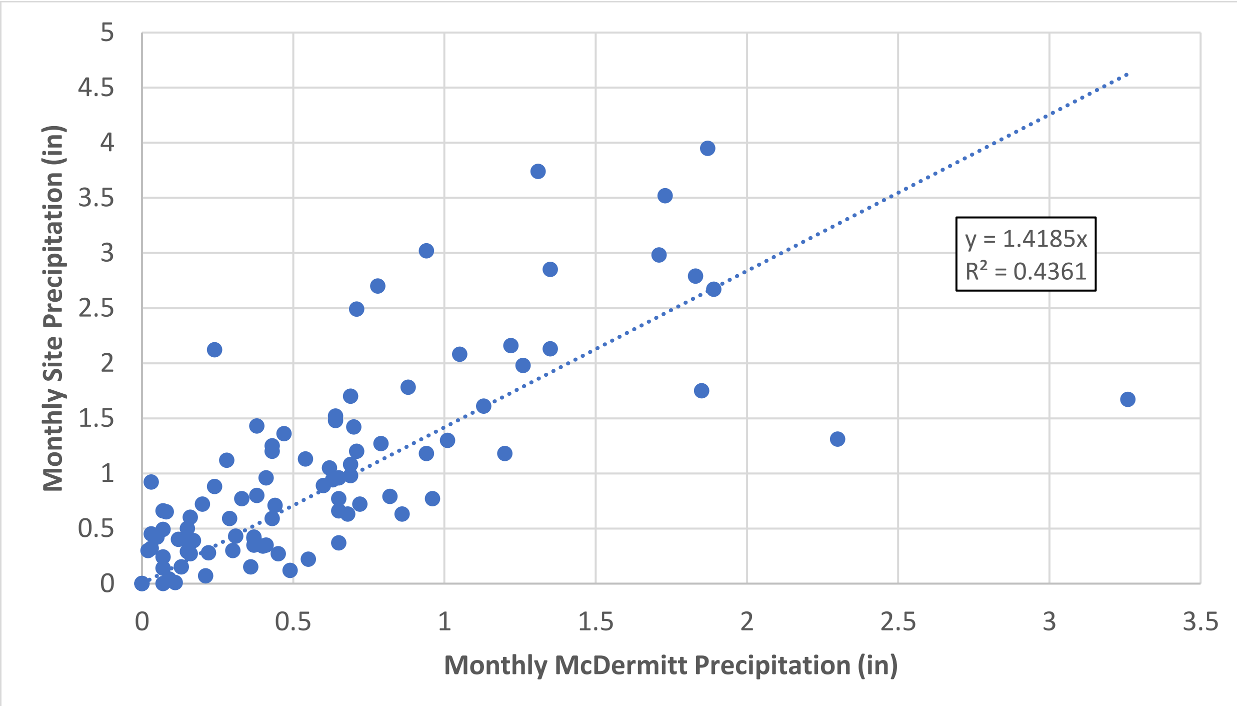
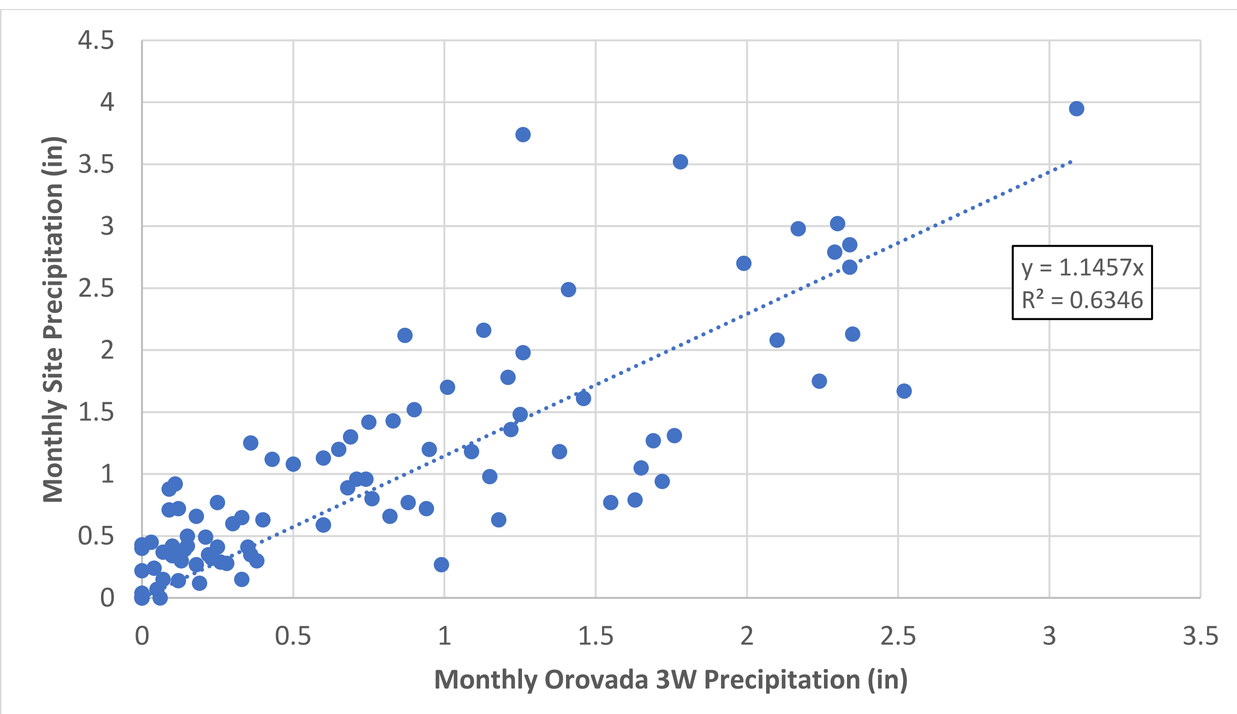



**Figure 5. Correlation of Monthly Precipitation Data for the Site and Orovada 3W Station (1/2012 – 10/2019)**



Given that site data correlates better with Orovada 3W than McDermitt (correlation coefficients of 0.63 vs. 0.44) and average annual precipitation at the site from 2012-2018 (12.22 inches) is more similar to Orovada 3W (9.28 inches) than McDermitt (7.20 inches), Orovada was carried forward in the analysis.

## 3.0 Monthly Site Precipitation Estimates

Monthly estimates of site data were then developed for the full period of record where data is available at the Orovada 3W site. For October 2011 – October 2019 monthly site estimates were taken as actual data recorded at the site. For earlier times, monthly site data was estimated by multiplying the calculated site to Orovada 3W correlation coefficient by the monthly value recorded at Orovada 3W for the years of available data presented in **Table 1**. This produced a synthetic a 91-year precipitation data set for the site. This full data set is provided in **Appendix A**. Monthly statistics for the 91 years of data is provided in **Table 2**.

**Table 2. Statistics for Estimated Site Monthly Precipitation Based on Synthetic 91-Year Record (in)**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mean** | 1.27 | 1.14 | 1.17 | 1.47 | 1.58 | 1.16 | 0.32 | 0.34 | 0.58 | 0.99 | 1.10 | 1.18 | 12.29 |
| **StdDev** | 0.77 | 0.80 | 0.79 | 0.94 | 1.16 | 1.08 | 0.37 | 0.70 | 0.71 | 0.89 | 0.78 | 0.97 | 3.39 |
| **Min** | 0.07 | 0.06 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.80 |
| **Max** | 3.52 | 3.77 | 3.02 | 5.69 | 6.34 | 4.69 | 1.82 | 4.33 | 2.97 | 3.68 | 3.07 | 4.64 | 21.76 |

The long-term mean annual precipitation at the site is estimated to be 12.29 inches, which is very similar to the average of 12.55 obtained from use of site data alone. The range of annual totals at the site is estimated to be 5.80 to 21.76 with an annual standard deviation of 3.39 inches. It is recommended that this data be used for current design calculations. As additional site data is collected, estimates should be updated.

## 4.0 Monthly Runoff Coefficients

For storage and water balance calculations, the portion of precipitation that results in runoff is needed. Runoff as a percentage of monthly precipitation was estimated using the National Resource Conservation Service (NRCS) Curve Number method combined with daily precipitation recorded at the site station. For a given curve number, runoff was estimated by determining the potential maximum retention after runoff ($S_{0.20}$) as provided by the NRCS in the TR-55 report, **Equation 1**. The potential maximum retention was then converted to the 5% retention value ($S_{0.05}$), as detailed by Lim, Engel, Muthukirshnan, and Harbor in the *Effects of Initial Abstraction and Urbanization of Estimated Runoff Using CN Technology*, **Equation 2**. Using this value, the depth of runoff could be obtained by **Equation 3**. These estimated runoff percentages represent the average annual amount of runoff out of the total average annual precipitation for a range of selected curve numbers, as provided in **Table 3.** Note that if estimating runoff from a specific storm event, runoff should be calculated for that event as percentages will be higher for a single event than they are for annual averages.

**Equation 1**

$$S = \frac{1000}{CN} - 10$$

**Equation 2**

$$S_{0.05} = 1.33 {S_{0.20}}^{1.15}$$

**Equation 3**

$$Q = \begin{cases} 0 & \text{for } P \leq 0.05S \\ \frac{(P - 0.05S_{0.05})^2}{P + 0.95S_{0.05}} & \text{for } P > 0.05S \end{cases}$$

**Where:** $S = S_{0.20}$ = Potential maximum retention after runoff

CN = Curve number

$S_{0.05}$ = Converted maximum retention with an assumed 5% storage

P = Precipitation (in)

Q = Runoff depth (in)

This analysis was completed using the 94 months of daily precipitation data from the site. Total daily runoff was compared to total daily precipitation over the full period of record. Runoff as a percentage of precipitation was determined for the full period. Resulting runoff percentages for a range of Curve Numbers from 60 to 95 were calculated and are presented in **Table 3**. The low values in the table are a function of the relatively low daily precipitation accumulations.

**Table 3. Estimated Runoff as a Percentage of Annual Precipitation**

| Curve Number | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 99 |
|---|---|---|---|---|---|---|---|---|
| Average Annual Runoff Percentage | 0.4% | 0.9% | 1.9% | 3.6% | 6.9% | 13.5% | 29.2% | 70.6% |

## 5.0 24-Hour Storm Depths and Distribution

Precipitation frequency estimates for the site were obtained from NOAA Atlas 14 Vol 1 based on the site coordinates for a range of 24-hour storm events. The storm depths were developed from NOAA's point precipitation estimator and resulted in the storm depths presented in **Table 4**.

**Table 4. NOAA Atlas 14 Vol 1 24-Hour Storm Depths for Project Site**

| Recurrence Interval (years) | 2-year | 5-year | 10-year | 25-year | 50-year | 100-year | 200-year | 500-year | 1,000-year |
|---|---|---|---|---|---|---|---|---|---|
| Precipitation Depth (in) | 1.13 | 1.41 | 1.64 | 1.96 | 2.21 | 2.48 | 2.75 | 3.12 | 3.41 |

The distribution of 24-hour storms were evaluated for use in design. To develop a distribution, ERC utilized the intensity, duration and frequency (IDF) data from the NOAA point precipitation website. Examples of the IDF data for the 100-year, 24-hour storm is given in **Table 5**. General point precipitation frequency data recommended for use at the site for other durations and frequencies are provided in **Appendix B**.

**Table 5. NOAA Atlas 14 Vol 1 Precipitation Depths for the 100-year, 24-hour Storm**

| Duration | 5 min | 10 min | 15 min | 30 min | 60 min | 2 hr | 3 hr | 6 hr | 12 hr | 24 hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Precipitation Depth (in) | 0.38 | 0.58 | 0.72 | 0.97 | 1.20 | 1.35 | 1.44 | 1.53 | 2.17 | 2.48 |

## 6.0 Evaporation Data

The project site weather station collects the following data on an hourly basis:

- Precipitation
- Temperature at 2 meters
- Temperature at 10 meters
- Wind speed
- Relative humidity
- Atmospheric pressure
- Solar radiation

This extensive climatological data set allowed ERC to estimate site specific evaporation. Evaporation was calculated following the Penman-Monteith procedure using FAO-56 Method (Zotarelli, 2010). Hourly data was compiled to generate daily data with minimum and maximum temperature and relative humidity defined as the high and low values for each day. Pan evaporation at the site was estimated by taking evapotranspiration (ET) rates determined from the Penman-Monteith method using a short-grass reference crop and multiplying values by 1.2 to convert them to pan evaporation. A summary of site evaporation data calculated from site data using the Penman-Monteith method is provided in **Table 6**. Data suggests that the mean annual site pan evaporation is approximately 71 inches.

**Table 6. Calculated Monthly Site Pan Evaporation**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | | | | | | | | | | 4.34 | 2.10 | 1.86 | |
| 2012 | 2.10 | 2.15 | 4.10 | 5.87 | 9.00 | 11.11 | 13.14 | 11.81 | 8.49 | 5.22 | 2.43 | 1.31 | 76.75 |
| 2013 | 0.94 | 1.97 | 4.46 | 6.13 | 8.13 | 10.91 | 13.82 | 11.47 | 7.38 | 4.15 | 2.62 | 1.27 | 73.24 |
| 2014 | 2.14 | 2.37 | 3.89 | 5.85 | 8.85 | 10.78 | 12.84 | 9.70 | 8.19 | 4.84 | 2.15 | 1.25 | 72.85 |
| 2015 | 1.57 | 2.75 | 4.89 | 6.15 | 7.14 | 11.92 | 11.01 | 11.42 | 7.63 | 4.73 | 1.87 | 1.38 | 72.48 |
| 2016 | 1.04 | 2.30 | 3.50 | 5.98 | 5.10 | 7.95 | 13.25 | 12.21 | 7.81 | 4.19 | 2.31 | 1.07 | 66.70 |
| 2017 | 0.93 | 1.90 | 3.74 | 4.58 | 7.70 | 10.22 | 13.61 | 11.65 | 7.36 | 4.60 | 2.41 | 1.56 | 70.26 |
| 2018 | 1.81 | 2.24 | 3.32 | 5.43 | 7.32 | 10.60 | 13.40 | 11.70 | 8.43 | 4.30 | 2.34 | 1.04 | 71.92 |
| 2019 | 1.26 | 1.35 | 3.05 | 5.15 | 6.00 | 9.40 | 12.03 | 11.27 | 6.55 | 4.28 | | | |
| Minimum | 0.93 | 1.35 | 3.05 | 4.58 | 5.10 | 7.95 | 11.01 | 9.70 | 6.55 | 4.15 | 1.87 | 1.04 | 66.70 |
| Mean | 1.48 | 2.13 | 3.87 | 5.64 | 7.41 | 10.36 | 12.89 | 11.40 | 7.73 | 4.54 | 2.30 | 1.27 | 71.01 |
| Median | 1.42 | 2.20 | 3.82 | 5.86 | 7.51 | 10.69 | 13.20 | 11.56 | 7.72 | 4.34 | 2.32 | 1.29 | 71.92 |
| Maximum | 2.14 | 2.75 | 4.89 | 6.15 | 9.00 | 11.92 | 13.82 | 12.21 | 8.49 | 5.22 | 2.62 | 1.86 | 76.75 |

Monthly pan evaporation estimates at the site were then compared with pan evaporation measurements taken from the Rye Patch Dam site for verification. Pan evaporation data is available at Rye Patch for the months of March through November. Comparisons of the data sets are provided in **Table 7**. The table shows that values calculated from site data compare well with data measured at Rye Patch. It is recommended that values calculated from site data be used for further evaluations.

**Table 7. Monthly Pan Evaporation Comparison**

| Month | Calculated from Site Data Using P-M (in) | Rye Patch Station (in) | Difference (in) |
|---|---|---|---|
| January | 1.48 | NA | NA |
| February | 2.13 | NA | NA |
| March | 3.87 | NA | NA |
| April | 5.64 | NA | NA |
| May | 7.41 | 8.55 | 1.14 |
| June | 10.36 | 9.95 | -0.41 |
| July | 12.89 | 12.80 | -0.09 |
| August | 11.40 | 11.30 | -0.10 |
| September | 7.73 | 8.12 | 0.39 |
| October | 4.54 | 4.90 | 0.36 |
| November | 2.30 | NA | NA |
| December | 1.27 | NA | NA |
| Annual | 71.01 | NA | NA |
| May - Oct | 54.33 | 55.62 | 1.29 |

## 7.0 Summary and Conclusions

Ecological Resource Consultants Inc. completed an evaluation of precipitation and evaporation for design purposes at the Thacker Pass site. Estimates were derived using approximately eight years of daily site precipitation data supplemented with regional climatological data. Long-term annual average precipitation at the site is predicted to be approximately 12.29 inches, which is only slightly less than the average of 12.22 inches recorded over the short period of record at the site station. The range of annual precipitation at the site over a 91-year period of record that is based on data from the Orovada 3W station is estimated to be 5.80 inches to 21.76 inches.

Short-term (24-hour) storms from the 1-year to the 500-year event were defined for the site using NOAA's point precipitation estimator. The 100-year, 24-hour storm was determined to be 2.48 inches. Annual pan evaporation for the site is estimated to be 71.01 inches based on hourly data collected on site.

# References

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# Appendix A

# Synthetic Monthly Project Site Precipitation

## Estimated Site Precipitation Based on Correlation to Orovada 3W

| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1912 | 0.69 | 0.86 | 1.67 | 1.89 | 1.6 | 0.96 | 0.62 | 0.44 | 0.8 | 1.48 | 1.04 | 0.15 | 12.2 |
| 1914 | 2.68 | 0.73 | 0.11 | 2.03 | 0.78 | 4.48 | 0.46 | 0 | 1.32 | 0.47 | 0 | 1.17 | 14.23 |
| 1915 | 0.68 | 2.61 | 1.04 | 2.9 | 2.5 | 0.64 | 0.65 | 0 | 0.49 | 0 | 0.62 | 0.84 | 12.97 |
| 1916 | 1.32 | 1.21 | 0.81 | 0.78 | 1.09 | 0.16 | 0.32 | 0.07 | 0.09 | 2.72 | 0.53 | 0.63 | 9.73 |
| 1917 | 1.03 | 0.66 | 0.45 | 1.08 | 3.73 | 0.5 | 0.08 | 0.34 | 0.38 | 0 | 0.54 | 0.11 | 8.9 |
| 1926 | 1.52 | 1.2 | 0.09 | 2.31 | 1.88 | 0 | 0.1 | 0.02 | 0 | 0.61 | 1.98 | 0.47 | 10.18 |
| 1927 | 1.03 | 2.33 | 1.27 | 1.44 | 1.54 | 1.56 | 0.02 | 0.02 | 0.07 | 1.68 | 2.14 | 0.47 | 13.57 |
| 1928 | 0.74 | 0.65 | 1.89 | 1.16 | 0.06 | 0.45 | 0.03 | 0.05 | 0.13 | 0.48 | 1.34 | 0.93 | 7.91 |
| 1929 | 1.11 | 1.44 | 1.41 | 1.57 | 0.16 | 0.95 | 0 | 0 | 0 | 0.21 | 0 | 0.78 | 7.63 |
| 1930 | 2.49 | 0.94 | 1.01 | 1.02 | 2.84 | 0.92 | 0.09 | 0.19 | 0.58 | 0.76 | 1.63 | 0 | 12.47 |
| 1931 | 0.84 | 1.25 | 0.73 | 0.21 | 0.32 | 1.78 | 0 | 0.05 | 0.21 | 0.31 | 0.95 | 1.84 | 8.49 |
| 1932 | 1.15 | 0.6 | 1.88 | 0.85 | 2.91 | 1.98 | 0.48 | 0.01 | 0.03 | 0.26 | 0.42 | 0.6 | 11.17 |
| 1933 | 1.4 | 0.16 | 0.5 | 0.8 | 1.16 | 0.02 | 0.08 | 0.1 | 0.49 | 1.82 | 0.03 | 0.93 | 7.49 |
| 1934 | 0.96 | 3.77 | 0.86 | 1.62 | 0.85 | 1.6 | 0.01 | 0 | 0.09 | 1.6 | 1.72 | 1.13 | 14.21 |
| 1935 | 1.28 | 1.27 | 1.29 | 5.69 | 2.78 | 0 | 0.05 | 0.01 | 0.01 | 0.96 | 0.85 | 1.81 | 16 |
| 1936 | 1.97 | 1.88 | 0.41 | 0.8 | 1.12 | 1.56 | 0.65 | 0.19 | 0.38 | 0.01 | 0 | 1.17 | 10.14 |
| 1937 | 0.99 | 2.25 | 1.41 | 1.08 | 1.83 | 0.38 | 0.66 | 0 | 0.09 | 0.53 | 1.52 | 1.01 | 11.75 |
| 1938 | 1.55 | 2.96 | 1.82 | 3.68 | 2.46 | 3.41 | 0.32 | 0.21 | 0.44 | 3.48 | 1.17 | 0.26 | 21.76 |
| 1939 | 1.16 | 1.27 | 0.57 | 0.47 | 0.97 | 0.6 | 0.49 | 0.06 | 0.71 | 2.72 | 0.41 | 1.33 | 10.76 |
| 1940 | 2.73 | 1.47 | 1.58 | 0.94 | 0 | 0.36 | 0.23 | 0.06 | 2.97 | 3.52 | 1.63 | 2.11 | 17.6 |
| 1941 | 1.49 | 2 | 1.05 | 2.91 | 2.33 | 2.14 | 1.34 | 1.17 | 0.33 | 1.66 | 1.41 | 1.29 | 19.12 |
| 1942 | 1.87 | 1.04 | 0.38 | 1.79 | 3.07 | 1.49 | 0.02 | 0 | 0.16 | 0.33 | 2.27 | 2.76 | 15.18 |
| 1943 | 1.84 | 0.73 | 0.52 | 1.19 | 1.09 | 1.52 | 0.03 | 0 | 0 | 0.88 | 0.14 | 0.09 | 8.03 |
| 1944 | 1.54 | 2.53 | 0.54 | 2.33 | 1.01 | 4.26 | 0.4 | 0 | 0.52 | 0.45 | 3.07 | 0.84 | 17.49 |
| 1945 | 1.58 | 1.79 | 2.38 | 0.4 | 2.86 | 1.13 | 0.32 | 0.02 | 0.27 | 1.47 | 1.64 | 2.38 | 16.24 |
| 1947 | 0.09 | 0.46 | 0.79 | 1.51 | 2.29 | 1.1 | 0 | 0.13 | 0.03 | 1.49 | 1.02 | 0.6 | 9.51 |
| 1951 | 1.34 | 1.81 | 0.36 | 1.76 | 1.49 | 0.15 | 0 | 0.18 | 0 | 1.56 | 0.53 | 2.34 | 11.52 |
| 1952 | 2.21 | 1.43 | 1.23 | 0.88 | 1.32 | 4.42 | 0.57 | 0 | 2.42 | 0 | 0.99 | 1.07 | 16.54 |
| 1953 | 1.2 | 0.73 | 0.02 | 0.88 | 4.43 | 1.5 | 0 | 0.3 | 0 | 0.22 | 0.58 | 1.04 | 10.9 |
| 1954 | 0.47 | 0.58 | 2.23 | 0.54 | 0.1 | 0.46 | 0 | 0.01 | 0 | 0 | 1.02 | 1.08 | 6.49 |
| 1955 | 1.28 | 0.42 | 0.53 | 1.4 | 1.65 | 0.73 | 0.18 | 0 | 0 | 0.18 | 1.07 | 3.52 | 10.96 |
| 1956 | 3.52 | 1.13 | 0 | 2.13 | 3.35 | 0.33 | 1.18 | 0 | 0.64 | 2.42 | 0.02 | 0.91 | 15.63 |
| 1957 | 1.26 | 1.49 | 2.7 | 2.13 | 6.34 | 0.34 | 0 | 0.02 | 0.34 | 2.36 | 2.15 | 1.6 | 20.73 |
| 1958 | 1.18 | 2.51 | 1.66 | 2.42 | 0.44 | 3.32 | 0 | 0.5 | 0 | 0.31 | 0.48 | 0.48 | 13.3 |

## Estimated Site Precipitation Based on Correlation to Orovada 3W

| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | 1.36 | 1.37 | 0.53 | 0.08 | 1.8 | 1.05 | 0 | 0.39 | 1.27 | 0.46 | 0 | 0.52 | 8.83 |
| 1960 | 0.97 | 1.6 | 1.62 | 0.72 | 1.27 | 0.08 | 1.82 | 0.16 | 0 | 0.54 | 2.8 | 1.44 | 13.02 |
| 1961 | 0.29 | 1 | 2.96 | 0.11 | 0.62 | 0.7 | 1 | 0.44 | 1.44 | 0.62 | 0.65 | 1.15 | 10.98 |
| 1962 | 1.25 | 3 | 1.74 | 0.31 | 1.78 | 0.52 | 0 | 0.16 | 0.11 | 0.81 | 1.47 | 0.1 | 11.25 |
| 1963 | 1.23 | 1.24 | 0.55 | 1.57 | 2.59 | 2.06 | 0 | 0 | 0.42 | 1.01 | 1.66 | 0.39 | 12.72 |
| 1964 | 1.65 | 0.06 | 0.55 | 1.67 | 1.5 | 3.07 | 0.37 | 0.53 | 0 | 1.44 | 1.96 | 4.28 | 17.08 |
| 1967 | 2.45 | 0.19 | 1.23 | 2.33 | 2.33 | 1.16 | 0.32 | 0.17 | 0.39 | 0.56 | 0.84 | 0.01 | 11.98 |
| 1968 | 0.66 | 1.59 | 0.46 | 1.19 | 0.8 | 0.62 | 0 | 2.2 | 0 | 0.61 | 2.77 | 1.6 | 12.5 |
| 1969 | 3.06 | 1.23 | 0.32 | 1.76 | 0 | 1.32 | 0.02 | 0 | 0 | 1.75 | 0.34 | 1.7 | 11.5 |
| 1970 | 3.07 | 0.06 | 0.13 | 1.41 | 1.42 | 4.69 | 0.26 | 0.58 | 0.02 | 0.38 | 2.39 | 1.62 | 16.03 |
| 1971 | 0.55 | 0.32 | 1.82 | 1.33 | 2.59 | 2.53 | 0 | 0 | 1.74 | 0.81 | 1.46 | 1.7 | 14.85 |
| 1972 | 0.93 | 0.7 | 0.95 | 0.4 | 0.11 | 1.5 | 0 | 0 | 0.63 | 1.2 | 2.22 | 0.79 | 9.43 |
| 1973 | 2.26 | 0.72 | 1.67 | 2.33 | 1.11 | 0.37 | 0.05 | 0.46 | 0.81 | 0.4 | 1.82 | 1.59 | 13.59 |
| 1974 | 0.82 | 0.34 | 1.64 | 1.88 | 0 | 0 | 0.87 | 0.36 | 0 | 2.2 | 0.3 | 1.39 | 9.8 |
| 1975 | 1.02 | 1.62 | 2.62 | 0.93 | 0.42 | 1.66 | 0.33 | 1.05 | 0.25 | 3.1 | 0.56 | 0.32 | 13.88 |
| 1976 | 0.6 | 1.64 | 0.38 | 1.49 | 0.34 | 1.7 | 1.5 | 4.33 | 2.38 | 0.32 | 0.24 | 0.06 | 14.98 |
| 1977 | 0.53 | 0.36 | 0.49 | 0.14 | 3.07 | 2.85 | 0.79 | 1.17 | 0.45 | 0 | 1.46 | 1.11 | 12.42 |
| 1978 | 1.75 | 1.32 | 2.06 | 3.01 | 0.69 | 1.23 | 0.15 | 0 | 2.04 | 0.01 | 0.55 | 0.14 | 12.95 |
| 1979 | 1.32 | 1.17 | 2.31 | 1.29 | 0.42 | 0.73 | 0.55 | 1.64 | 0 | 1.65 | 1.05 | 0.73 | 12.86 |
| 1980 | 2.2 | 1.2 | 0.95 | 0.52 | 2.39 | 0.55 | 0.18 | 0.17 | 0.94 | 0.49 | 1.11 | 0.39 | 11.09 |
| 1981 | 0.97 | 0.64 | 1.49 | 0.7 | 2.41 | 0.22 | 0.37 | 0.11 | 0.26 | 1.87 | 2.18 | 1.63 | 12.85 |
| 1982 | 0.49 | 0.44 | 1.68 | 0.57 | 0.24 | 1.96 | 0.64 | 0 | 1.76 | 1.13 | 0.93 | 0.92 | 10.76 |
| 1983 | 1.21 | 1.55 | 2.54 | 3.82 | 1.16 | 1.72 | 0.06 | 0.91 | 0.94 | 0.92 | 1.87 | 4.64 | 21.34 |
| 1984 | 0.23 | 0.6 | 2.04 | 1.95 | 1.27 | 1.39 | 0.24 | 0.68 | 0.23 | 2.52 | 2.73 | 0.26 | 14.14 |
| 1985 | 0.24 | 0.47 | 0.72 | 0.45 | 1.49 | 0.02 | 0.69 | 0.15 | 1.51 | 0.8 | 2.92 | 0.34 | 9.8 |
| 1986 | 0.09 | 3.01 | 0.63 | 1.76 | 1.56 | 1.16 | 0.66 | 0.09 | 1.73 | 0.11 | 0.37 | 0.17 | 11.34 |
| 1987 | 1.15 | 0.52 | 1.82 | 1.21 | 1.6 | 0.57 | 0.4 | 0.74 | 0 | 1.15 | 1.03 | 1.83 | 12.02 |
| 1988 | 1.47 | 0.11 | 0.11 | 1.6 | 0.86 | 1.2 | 0 | 0 | 0.34 | 0 | 2.26 | 1.15 | 9.1 |
| 1989 | 0.07 | 0.27 | 2.78 | 1.49 | 1.56 | 0.03 | 0 | 0.19 | 1.09 | 0.76 | 0.92 | 0.27 | 9.43 |
| 1990 | 0.82 | 0.73 | 0.87 | 1.41 | 1.88 | 0.1 | 0.74 | 0.71 | 0.19 | 0.05 | 0.26 | 0.81 | 8.57 |
| 1991 | 0.16 | 0.17 | 2.35 | 2.69 | 2.82 | 1.7 | 0.05 | 0.09 | 0.61 | 1.29 | 0.53 | 0.73 | 13.19 |
| 1992 | 0.11 | 1.05 | 0.87 | 0.3 | 0.03 | 1.46 | 0.25 | 0 | 0 | 0.52 | 0.34 | 0.87 | 5.8 |
| 1993 | 1.25 | 0.57 | 1.37 | 0.52 | 0.57 | 1.31 | 0.69 | 4.01 | 0 | 0.99 | 0.23 | 1.15 | 12.66 |
| 1994 | 0.14 | 0.42 | 0 | 2.52 | 1.09 | 1.16 | 0 | 0 | 1.32 | 0.53 | 2.64 | 1.28 | 11.1 |

## Estimated Site Precipitation Based on Correlation to Orovada 3W

| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 2.76 | 0.24 | 2.41 | 2.33 | 2.91 | 1.13 | 0.77 | 0 | 0.15 | 0.05 | 0.18 | 1.94 | 14.87 |
| 1996 | 1.64 | 1.13 | 1.4 | 1.17 | 1.28 | 0.89 | 0.1 | 0.18 | 0.47 | 0.86 | 0.74 | 2.03 | 11.89 |
| 1997 | 1.97 | 0.36 | 0.45 | 1.59 | 0.47 | 1.52 | 0.57 | 0.09 | 0.17 | 0.4 | 0.84 | 1.04 | 9.47 |
| 1998 | 1.63 | 2.22 | 2.76 | 2.9 | 3.84 | 1.16 | 0.32 | 0 | 2.8 | 1.9 | 1.11 | 0.11 | 20.75 |
| 1999 | 1.8 | 1.16 | 0.42 | 0.56 | 0.86 | 0.87 | 0 | 0.19 | 0.72 | 0.44 | 0.55 | 0.13 | 7.7 |
| 2000 | 1.91 | 2.68 | 1.34 | 1.9 | 0.93 | 0.07 | 0 | 0.38 | 0.97 | 2.38 | 0.15 | 0.86 | 13.57 |
| 2001 | 0.92 | 0.99 | 0.5 | 1.32 | 0.26 | 0.13 | 0.86 | 0 | 0.41 | 0.06 | 2.02 | 1.56 | 9.03 |
| 2002 | 1.26 | 0.81 | 0.5 | 0.82 | 1.15 | 0.54 | 0.16 | 0.03 | 0.68 | 0.19 | 1.27 | 0.57 | 7.98 |
| 2003 | 0.94 | 0.49 | 0.63 | 1.66 | 2.62 | 0 | 0.29 | 0.79 | 0.38 | 0 | 1.68 | 2.43 | 11.91 |
| 2006 | 1.31 | 0.97 | 0.86 | 3.47 | 1.67 | 0.63 | 0 | 0 | 0.06 | 0.17 | 1.13 | 0.82 | 11.09 |
| 2007 | 0.09 | 1.79 | 0.21 | 1.02 | 0.19 | 0.73 | 0 | 0 | 1.04 | 2.07 | 0.55 | 0.95 | 8.64 |
| 2008 | 0.91 | 0.89 | 0.52 | 0.27 | 1.68 | 0.34 | 0.05 | 0.11 | 0.16 | 0.54 | 1.16 | 1.37 | 8 |
| 2009 | 1.73 | 0.55 | 0.73 | 1.48 | 1.02 | 3.98 | 0.33 | 0.47 | 0.18 | 0.77 | 0.31 | 1.24 | 12.79 |
| 2010 | 1.47 | 0.6 | 1.46 | 2.28 | 2.19 | 0.88 | 0.62 | 0.18 | 0.36 | 3.68 | 0.95 | 3.68 | 18.35 |
| 2011 | 0.25 | 0.74 | 2.35 | 1.7 | 1.72 | 1.16 | 0.27 | 0.02 | 0.02 | 1.16 | 0.61 | 0.04 | 10.04 |
| 2012 | 1.7 | 0.27 | 1.05 | 1.2 | 0.3 | 0.41 | 0.4 | 0.5 | 0.71 | 1.13 | 1.12 | 2.7 | 11.49 |
| 2013 | 0.96 | 0.15 | 0.3 | 0.29 | 2.16 | 0.42 | 0.37 | 0.66 | 1.18 | 0.98 | 0.77 | 0.32 | 8.56 |
| 2014 | 0.41 | 2.12 | 3.02 | 1.42 | 0.59 | 0.12 | 0.63 | 1.08 | 2.85 | 0.49 | 1.2 | 1.78 | 15.71 |
| 2015 | 0.35 | 0.8 | 0.45 | 1.18 | 3.52 | 0.35 | 0.77 | 0.07 | 0.22 | 1.75 | 0.63 | 3.74 | 13.83 |
| 2016 | 2.49 | 0.24 | 1.43 | 0.79 | 1.98 | 0.88 | 0.01 | 0 | 0.92 | 1.27 | 0.65 | 2.67 | 13.33 |
| 2017 | 2.98 | 1.61 | 0.94 | 2.13 | 0.89 | 1.31 | 0.04 | 0.39 | 0.28 | 0.27 | 1.3 | 0.14 | 12.28 |
| 2018 | 0.59 | 0.6 | 2.08 | 1.48 | 1.67 | 0.42 | 0 | 0 | 0 | 1.25 | 0.72 | 1.52 | 10.33 |
| 2019 | 1.36 | 2.79 | 0.96 | 0.66 | 3.95 | 0.34 | 0.43 | 0.15 | 0.77 | 0.72 | | | |
| **Period of Record Statistics** | | | | | | | | | | | | | |
| MEAN | 1.27 | 1.14 | 1.17 | 1.47 | 1.58 | 1.16 | 0.32 | 0.34 | 0.58 | 0.99 | 1.10 | 1.18 | 12.29 |
| S.D. | 0.77 | 0.80 | 0.79 | 0.94 | 1.16 | 1.08 | 0.37 | 0.70 | 0.71 | 0.89 | 0.78 | 0.97 | 3.39 |
| SKEW | 0.65 | 0.99 | 0.56 | 1.35 | 1.09 | 1.59 | 1.54 | 4.13 | 1.74 | 1.14 | 0.67 | 1.41 | 0.74 |
| MAX | 3.52 | 3.77 | 3.02 | 5.69 | 6.34 | 4.69 | 1.82 | 4.33 | 2.97 | 3.68 | 3.07 | 4.64 | 21.76 |
| MIN | 0.07 | 0.06 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.80 |
| YRS | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 90 | 90 | 90 |

# Appendix B

# Point Precipitation Frequency Data for Project Site

**NOAA Atlas 14, Volume 1, Version 5**
**Location name: Orovada, Nevada, USA***
**Latitude: 41.696°, Longitude: -118.0206°**
**Elevation: 4622.8 ft****
* source: ESRI Maps
** source: USGS

## POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

# PF tabular

| PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Duration | Average recurrence interval (years) | | | | | | | | | |
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | 0.092 (0.081-0.108) | 0.117 (0.102-0.138) | 0.161 (0.139-0.188) | 0.200 (0.171-0.233) | 0.260 (0.218-0.306) | 0.316 (0.258-0.376) | 0.381 (0.302-0.459) | 0.456 (0.350-0.557) | 0.578 (0.421-0.723) | 0.690 (0.483-0.882) |
| 10-min | 0.139 (0.123-0.164) | 0.179 (0.156-0.210) | 0.245 (0.212-0.287) | 0.304 (0.260-0.356) | 0.396 (0.332-0.466) | 0.481 (0.393-0.572) | 0.581 (0.461-0.699) | 0.695 (0.534-0.848) | 0.879 (0.641-1.10) | 1.05 (0.736-1.34) |
| 15-min | 0.173 (0.153-0.204) | 0.222 (0.193-0.261) | 0.304 (0.263-0.355) | 0.377 (0.323-0.441) | 0.491 (0.411-0.578) | 0.596 (0.487-0.709) | 0.720 (0.571-0.867) | 0.861 (0.662-1.05) | 1.09 (0.795-1.36) | 1.30 (0.912-1.67) |
| 30-min | 0.233 (0.206-0.274) | 0.298 (0.260-0.351) | 0.409 (0.354-0.479) | 0.508 (0.435-0.594) | 0.661 (0.554-0.778) | 0.803 (0.656-0.955) | 0.970 (0.769-1.17) | 1.16 (0.891-1.42) | 1.47 (1.07-1.84) | 1.75 (1.23-2.24) |
| 60-min | 0.289 (0.255-0.339) | 0.369 (0.322-0.434) | 0.507 (0.438-0.593) | 0.629 (0.538-0.735) | 0.819 (0.686-0.963) | 0.994 (0.812-1.18) | 1.20 (0.952-1.45) | 1.44 (1.10-1.75) | 1.82 (1.33-2.27) | 2.17 (1.52-2.78) |
| 2-hr | 0.377 (0.337-0.428) | 0.475 (0.426-0.540) | 0.628 (0.560-0.711) | 0.760 (0.672-0.859) | 0.964 (0.837-1.10) | 1.14 (0.969-1.31) | 1.35 (1.12-1.56) | 1.59 (1.29-1.87) | 1.98 (1.54-2.38) | 2.33 (1.75-2.87) |
| 3-hr | 0.448 (0.406-0.501) | 0.560 (0.506-0.625) | 0.722 (0.651-0.807) | 0.860 (0.770-0.962) | 1.07 (0.939-1.20) | 1.24 (1.07-1.40) | 1.44 (1.23-1.65) | 1.69 (1.40-1.95) | 2.07 (1.66-2.44) | 2.41 (1.88-2.90) |
| 6-hr | 0.599 (0.545-0.664) | 0.748 (0.678-0.833) | 0.945 (0.857-1.05) | 1.11 (0.999-1.23) | 1.34 (1.19-1.50) | 1.53 (1.35-1.72) | 1.73 (1.50-1.97) | 1.97 (1.68-2.26) | 2.35 (1.95-2.75) | 2.69 (2.18-3.20) |
| 12-hr | 0.760 (0.689-0.843) | 0.956 (0.868-1.06) | 1.21 (1.09-1.34) | 1.42 (1.28-1.57) | 1.70 (1.52-1.89) | 1.93 (1.70-2.16) | 2.17 (1.89-2.44) | 2.42 (2.07-2.75) | 2.77 (2.32-3.21) | 3.09 (2.54-3.63) |
| 24-hr | 0.903 (0.815-1.01) | 1.13 (1.02-1.26) | 1.41 (1.28-1.57) | 1.64 (1.48-1.83) | 1.96 (1.76-2.18) | 2.21 (1.98-2.46) | 2.48 (2.20-2.75) | 2.75 (2.42-3.06) | 3.12 (2.72-3.48) | 3.41 (2.95-3.82) |
| 2-day | 1.10 (0.989-1.22) | 1.37 (1.23-1.52) | 1.69 (1.53-1.88) | 1.96 (1.76-2.17) | 2.32 (2.08-2.57) | 2.59 (2.31-2.87) | 2.88 (2.56-3.18) | 3.17 (2.80-3.51) | 3.56 (3.11-3.95) | 3.87 (3.35-4.31) |
| 3-day | 1.21 (1.09-1.35) | 1.51 (1.36-1.69) | 1.87 (1.69-2.08) | 2.15 (1.94-2.40) | 2.54 (2.28-2.82) | 2.84 (2.54-3.15) | 3.15 (2.80-3.49) | 3.46 (3.06-3.85) | 3.88 (3.39-4.32) | 4.20 (3.64-4.69) |
| 4-day | 1.33 (1.20-1.49) | 1.65 (1.49-1.85) | 2.04 (1.84-2.28) | 2.35 (2.12-2.63) | 2.77 (2.48-3.08) | 3.09 (2.76-3.44) | 3.41 (3.04-3.80) | 3.75 (3.32-4.18) | 4.19 (3.67-4.68) | 4.53 (3.94-5.08) |
| 7-day | 1.59 (1.43-1.77) | 1.98 (1.79-2.21) | 2.45 (2.21-2.73) | 2.81 (2.53-3.13) | 3.30 (2.95-3.66) | 3.66 (3.27-4.07) | 4.04 (3.59-4.49) | 4.41 (3.89-4.92) | 4.90 (4.29-5.49) | 5.28 (4.59-5.93) |
| 10-day | 1.81 (1.62-2.01) | 2.25 (2.03-2.50) | 2.78 (2.50-3.09) | 3.20 (2.86-3.55) | 3.75 (3.35-4.16) | 4.16 (3.71-4.62) | 4.58 (4.06-5.09) | 5.00 (4.41-5.57) | 5.56 (4.86-6.21) | 5.98 (5.19-6.70) |
| 20-day | 2.33 (2.11-2.57) | 2.91 (2.65-3.22) | 3.61 (3.27-3.98) | 4.14 (3.74-4.56) | 4.84 (4.37-5.33) | 5.36 (4.82-5.91) | 5.88 (5.26-6.49) | 6.39 (5.70-7.07) | 7.07 (6.25-7.84) | 7.57 (6.65-8.43) |
| 30-day | 2.83 (2.56-3.13) | 3.54 (3.20-3.91) | 4.39 (3.97-4.85) | 5.05 (4.56-5.58) | 5.93 (5.34-6.56) | 6.60 (5.92-7.29) | 7.28 (6.49-8.05) | 7.96 (7.06-8.82) | 8.85 (7.79-9.86) | 9.53 (8.33-10.7) |
| 45-day | 3.50 (3.16-3.87) | 4.38 (3.96-4.84) | 5.42 (4.91-5.99) | 6.23 (5.62-6.88) | 7.29 (6.55-8.05) | 8.09 (7.25-8.94) | 8.89 (7.93-9.84) | 9.69 (8.60-10.8) | 10.8 (9.45-12.0) | 11.6 (10.1-12.9) |
| 60-day | 4.05 (3.66-4.50) | 5.08 (4.59-5.64) | 6.31 (5.70-7.00) | 7.24 (6.54-8.03) | 8.46 (7.61-9.38) | 9.36 (8.40-10.4) | 10.3 (9.17-11.4) | 11.2 (9.92-12.4) | 12.4 (10.9-13.8) | 13.2 (11.6-14.8) |

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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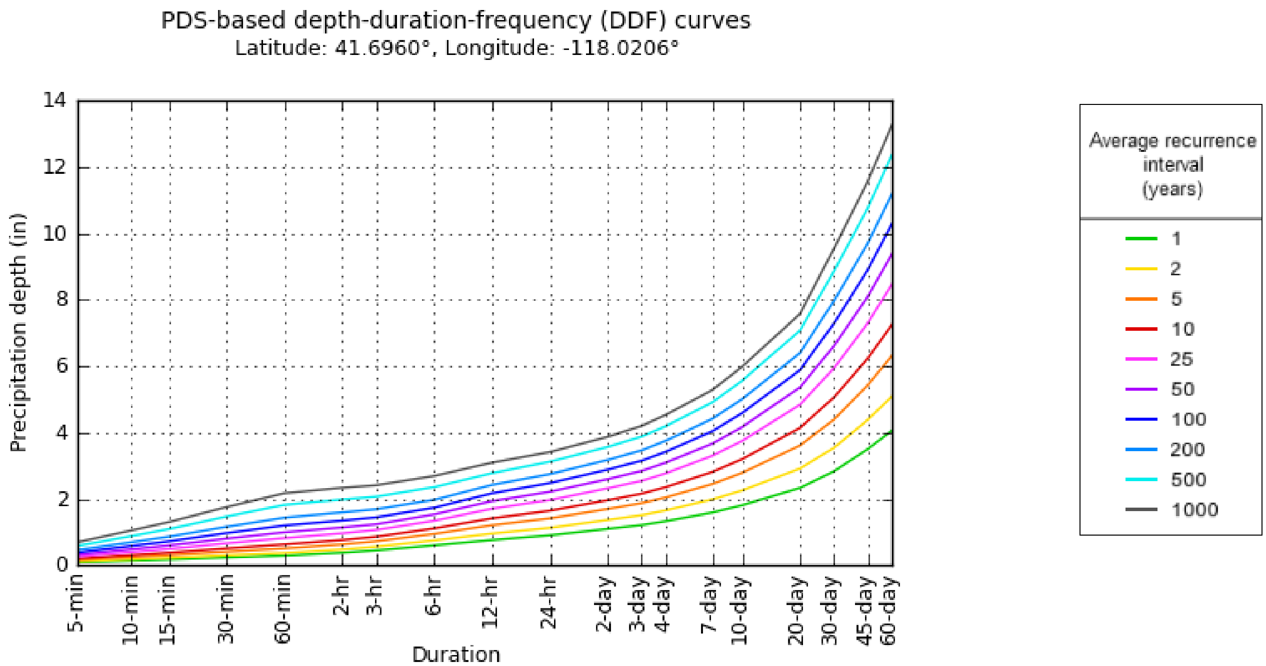
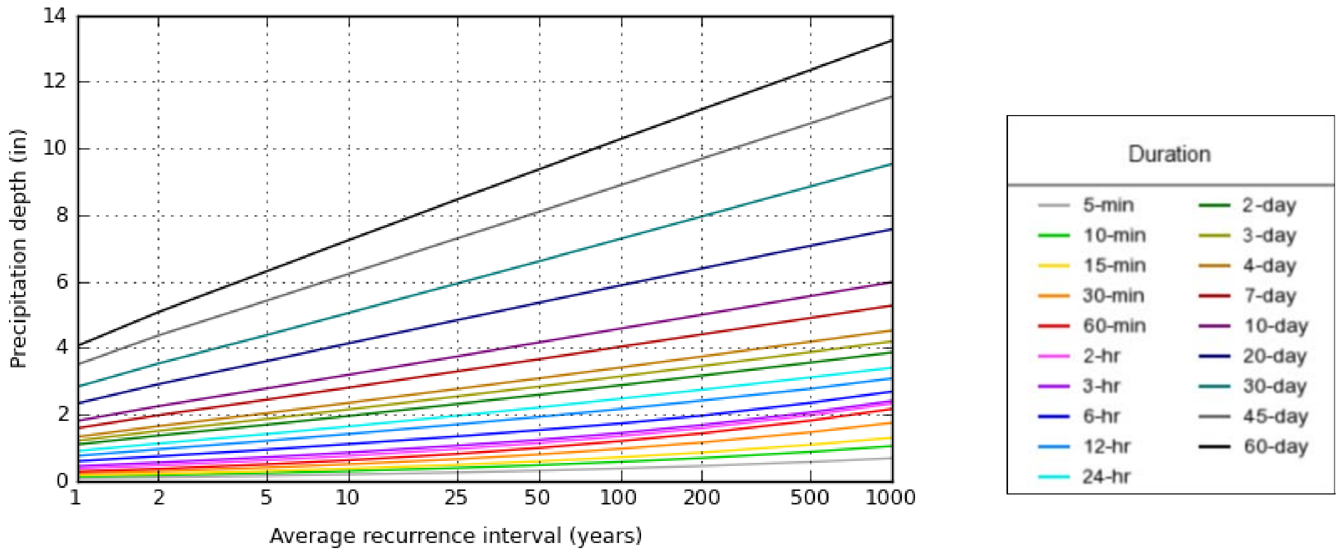
# PF graphical

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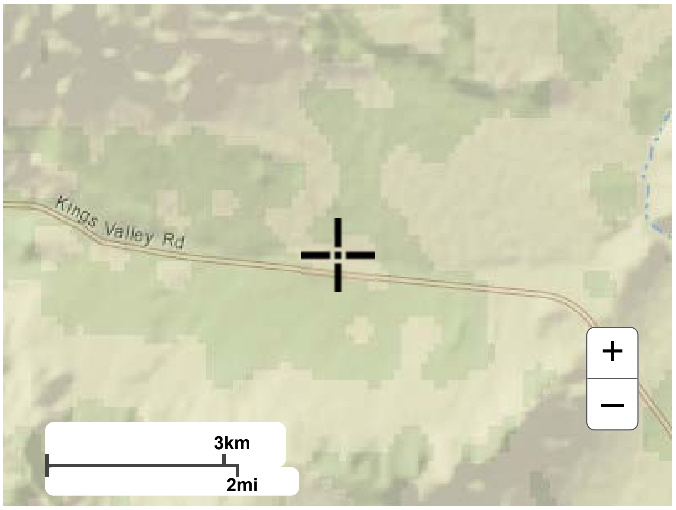
## Maps & aerials

**Small scale terrain**

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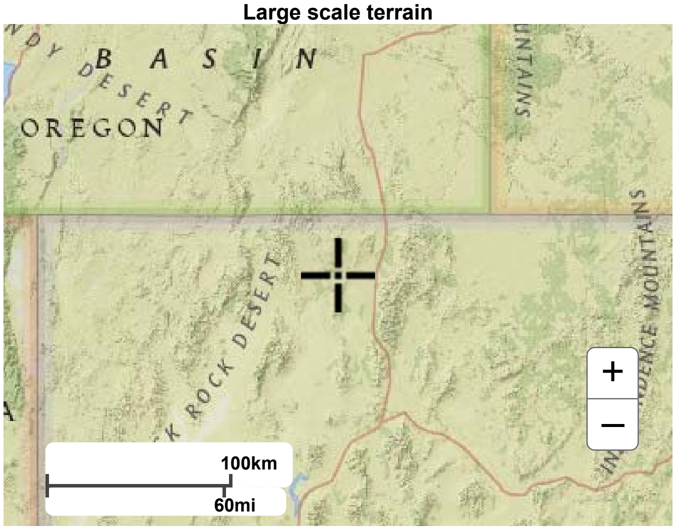
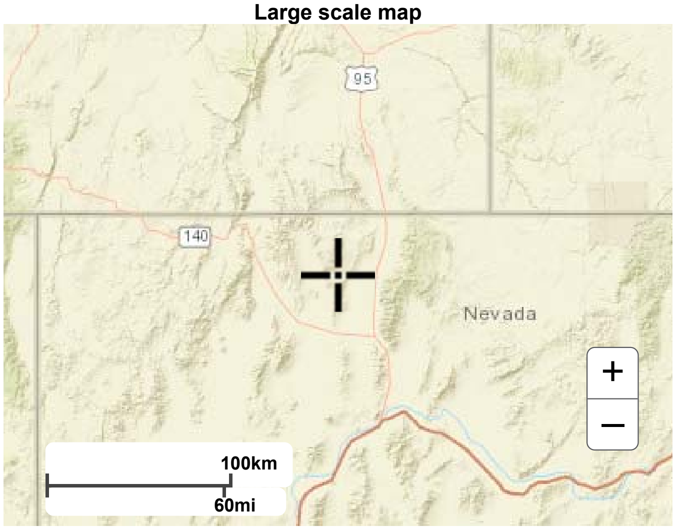
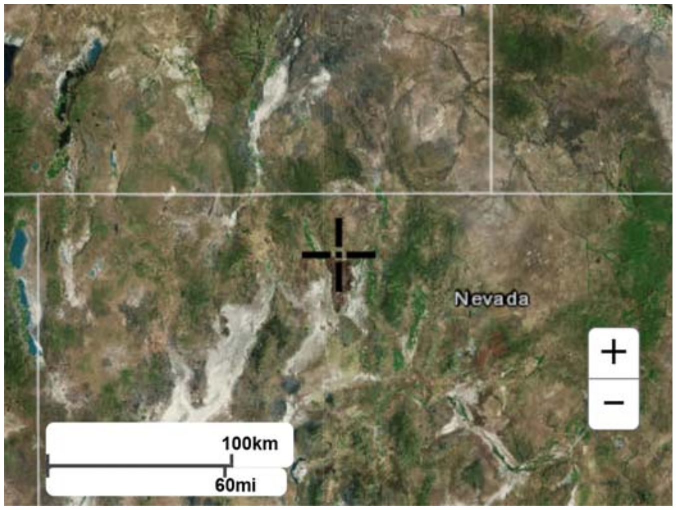



Large scale map




Large scale aerial

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