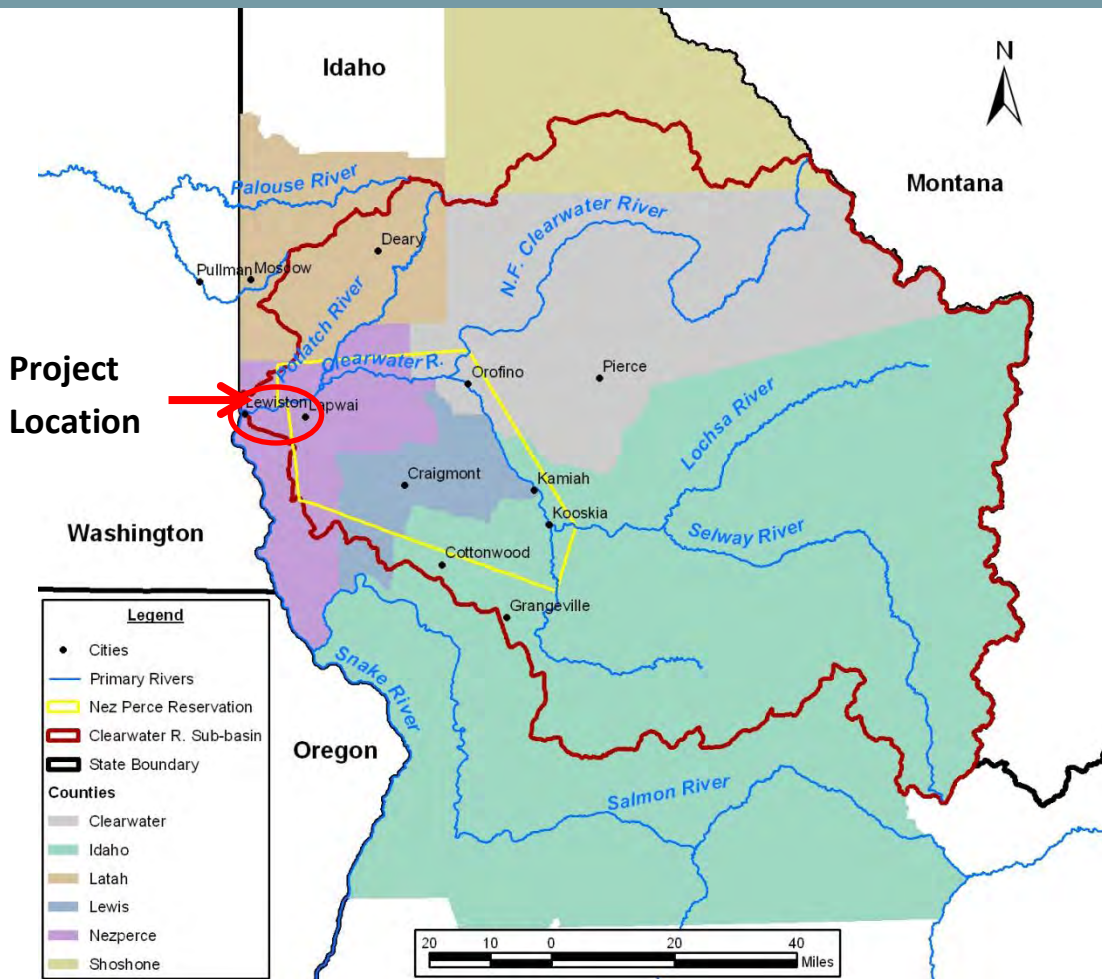


# Nez Perce County Lower River Tributaries Appendix 1 Precipitation-Frequency Estimates for the NWQI Watershed



12-digit HUC's:  
170601030306 (Tammany Creek),  
1706010305 (TenMile Canyon),  
170603061307 (Lindsay Creek),  
1706013061308 (Hidden Canyon),  
170603061308 (unnamed tributary)

Nez Perce Soil and Water  
Conservation District

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USDA Natural Resources Conservation Service  
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## 1. *Precipitation-Frequency*

### *Estimates for the NWQI Watersheds*

For storm event modeling of ungaged watersheds, precipitation amounts, and rainfall distributions are derived from theoretical storms. Precipitation-frequency isopluvials developed by the National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) in the 1970's (Miller, 1973) are the most recent, widely adopted, precipitation-frequency estimates available for the lower Clearwater River basin (and elsewhere in Idaho). Regionally, the NOAA Atlas 2 Isopluvial maps are adopted in the Stormwater Management Manual for Eastern Washington (WADOE, 2019)

and in the NRCS National Engineering Handbook (NRCS, 2013).

The original rainfall maps published by NOAA and the associated report are the primary source of precipitation-frequency estimates used in the hydrologic analysis of the NWQI watershed. The NOAA Atlas 2 includes isopluvial maps that give partial-duration series depths for 6 and 24-hour storm durations for the 2, 5, 10, 25, 50 and 100-year return periods. Spatially distributed grids of the 2-yr 6-hr, 2-yr 24-hr, 100-yr 6-hr, and 100-yr 24-hr precipitation are available from NOAA<sup>1</sup>. The spatially distributed grids for the 2-year 24-hour and 100-year 24-hour precipitation depths are shown in Figure 1 and Figure 2. Area-weighted precipitation depths for the NWQI watersheds were derived from the NOAA grids. The 2-yr 6-hr, 2-

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<http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm>

yr 24-hr, 100-yr 6-hr, and 100-yr 24-hr precipitation depths for the combined NWQI watershed area are 0.82, 1.29, 1.80 and 2.87 inches. As a check, the area-weighted values were compared with estimates from the online precipitation-frequency calculator developed by NOAA-NWS<sup>1</sup> for the centroid of the NWQI watershed. The 2-yr 6-hr, 2-yr 24-hr, 100-yr 6-hr, and 100-yr 24-hr depths obtained from the precipitation-frequency calculator was 0.89, 1.57, 1.91 and 3.17 inches, which agrees with the area-weighted value for this relatively small watershed. Differences are due to the area-weighting of the grid computations.

Precipitation-frequency depths for other durations were computed using regression and nomograph relationships included in the NOAA Atlas 2 report. The equations used to compute the depth grids for the selected durations from the

6-hr and 24-hr values in GIS are summarized in Table 1 for the 2-yr and 100-yr precipitation-frequency. In the expressions "demmm" is the elevation of the grid cell in meters. The resulting grid values are in inches.

$2yr1hr = 0.019 + 0.711 * ("pf\_2yr6hr" * "pf\_2yr6hr" / "pf\_2yr24hr") + 0.001 * ("demmm" * 3.2808 / 100)$
$2yr2hr = 0.250 * "pf\_2yr6hr" + 0.750 * "pf\_2yr1hr"$
$2yr3hr = 0.467 * "pf\_2yr6hr" + 0.533 * "pf\_2yr1hr"$
$2yr12hr = "pf\_2yr6hr" + 0.5 * ("pf\_2yr24hr" - "pf\_2yr6hr")$
$2yr15min = 0.57 * "pf\_2yr1hr"$
$2yr30min = 0.79 * "pf\_2yr1hr"$
$100yr1hr = 0.388 + 0.670 * ("pf\_100yr6hr" * "pf\_100yr6hr" / "pf\_100yr24hr") + 0.001 * ("demmm" * 3.2808 / 100)$
$100yr2hr = 0.250 * "pf\_100yr6hr" + 0.750 * "pf\_100yr1hr"$
$100yr3hr = 0.467 * "pf\_100yr6hr" + 0.533 * "pf\_100yr1hr"$
$100yr12hr = "pf\_100yr6hr" + 0.5 * ("pf\_100yr24hr" - "pf\_100yr6hr")$
$100yr15min = 0.57 * "pf\_100yr1hr"$
$100yr30min = 0.79 * "pf\_100yr1hr"$

**Table 1. NOAA Atlas 2 expressions for durations other than 6-hr and 24-hr.**

NOAA did not produce spatial grids for precipitation frequencies for intermediate return periods. Interpolation of precipitation depths for intermediate return periods directly from the complex and relatively widely spaced isopluvials on the NOAA Atlas 2 introduces subjectivity into the hydrologic analysis

that can be avoided by using a procedure included in the NOAA Atlas 2 report<sup>2</sup>.

Figure 3 shows how precipitation depth for intermediate return periods may be scaled directly from the return period diagram. A straight reference line is drawn between the 2-yr 24-hr (1.3 in) and 100-yr 24-hr (2.9 in) precipitation depths so that intermediate depths can be obtained from the intersection of the reference line and the charted vertical lines for the 5, 10, 25, and 50-year return periods.

Resulting precipitation-frequency depths for the selected return periods for the Tammany Creek watershed are summarized in Table 2. The 35 mi<sup>2</sup> watershed is small compared to the resolution of the NOAA Atlas 2 isopluvial maps, therefore, the precipitation-frequency depth for the entire watershed

is assumed to be constant across the watershed. Depths obtained from the NOAA isopluvial maps are point estimates. In hydrologic modeling, the areal reductions indicated by the curves in Figure 4<sup>3</sup> should be used to reduce the point estimates to represent precipitation over larger areas.

Precipitation depths obtained from the NOAA Atlas 2 isopluvial maps are derived from partial-duration series analysis of extreme precipitation events (Miller, 1973). The partial-duration series may be converted to an annual-maximum series by multiplying the partial-duration series value by a conversion factor given in NOAA Atlas 2. The difference is negligible for return periods greater than about 10 years. The conversion factor for 2-year and 5-year return periods are 0.88 and 0.96.

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<sup>2</sup> Figure 6 in NOAA Atlas 2, Volume IX, p. 6.

<sup>3</sup> Figure 14 in NOAA Atlas2, Volume IX, p.13.

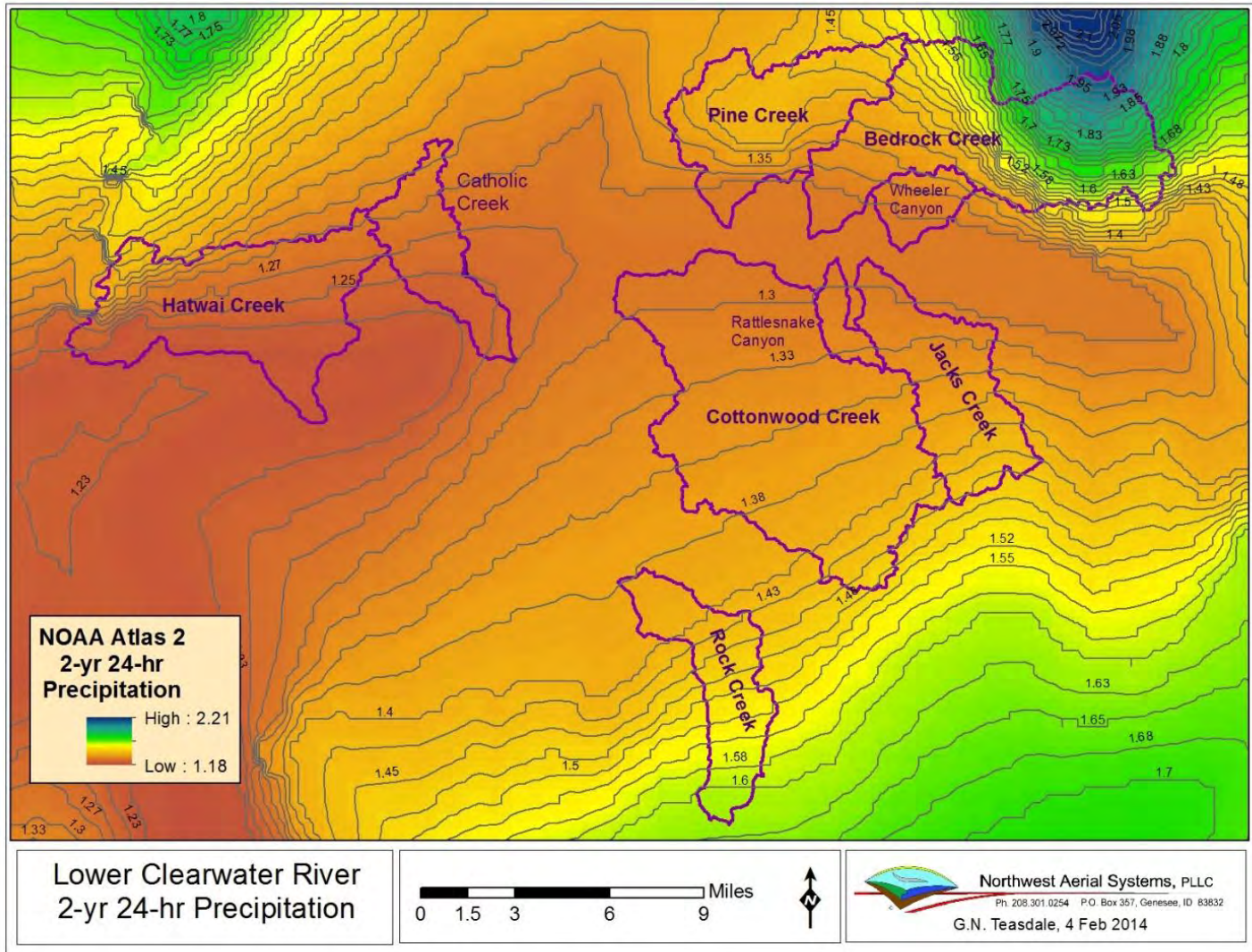


Figure 1. NOAA Atlas 2 2-yr 24-hr grid and isopluvials for the lower Clearwater River basin.

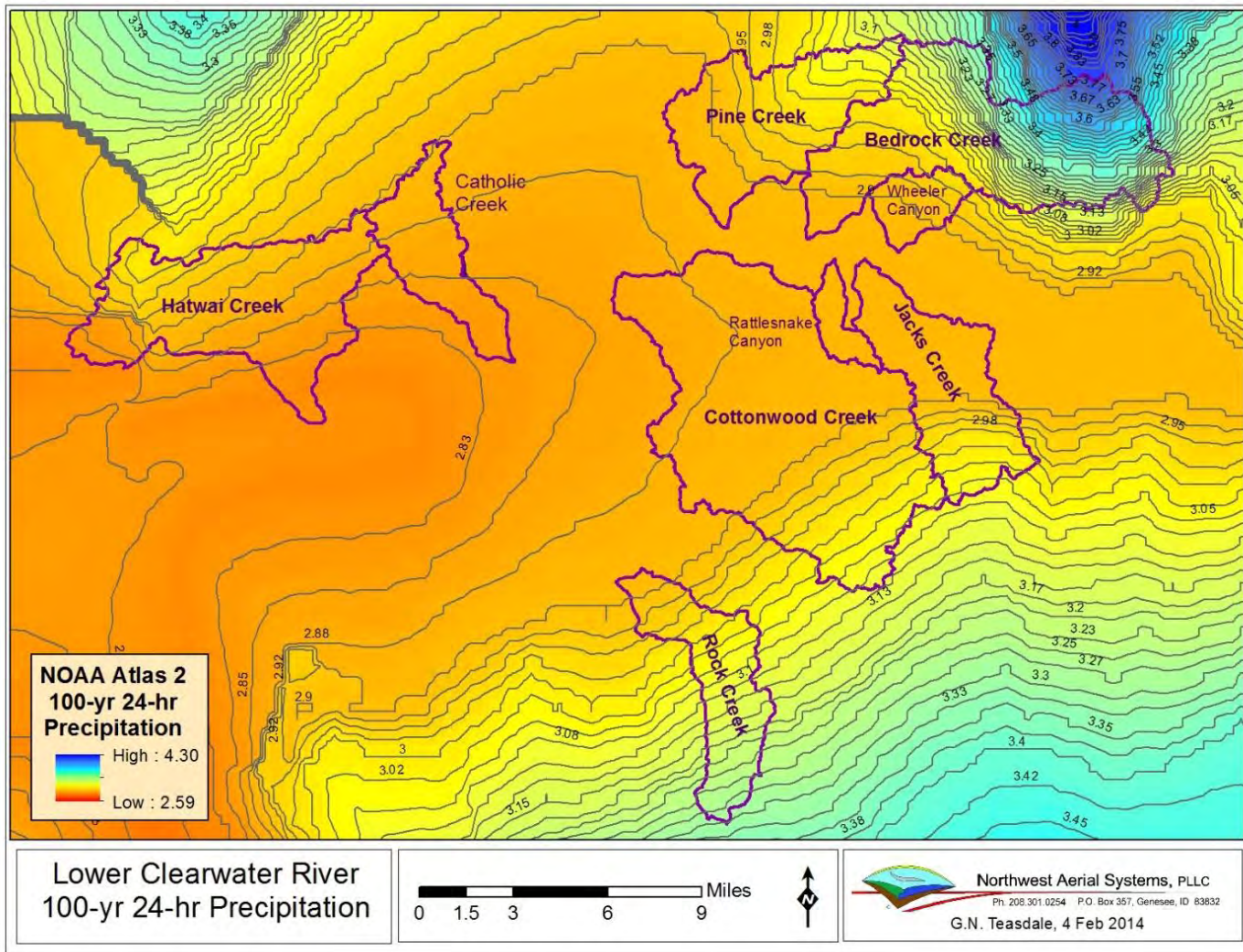


Figure 2. NOAA Atlas 2 100-yr 24-hr grid and isopluvials for the lower Clearwater River basin.

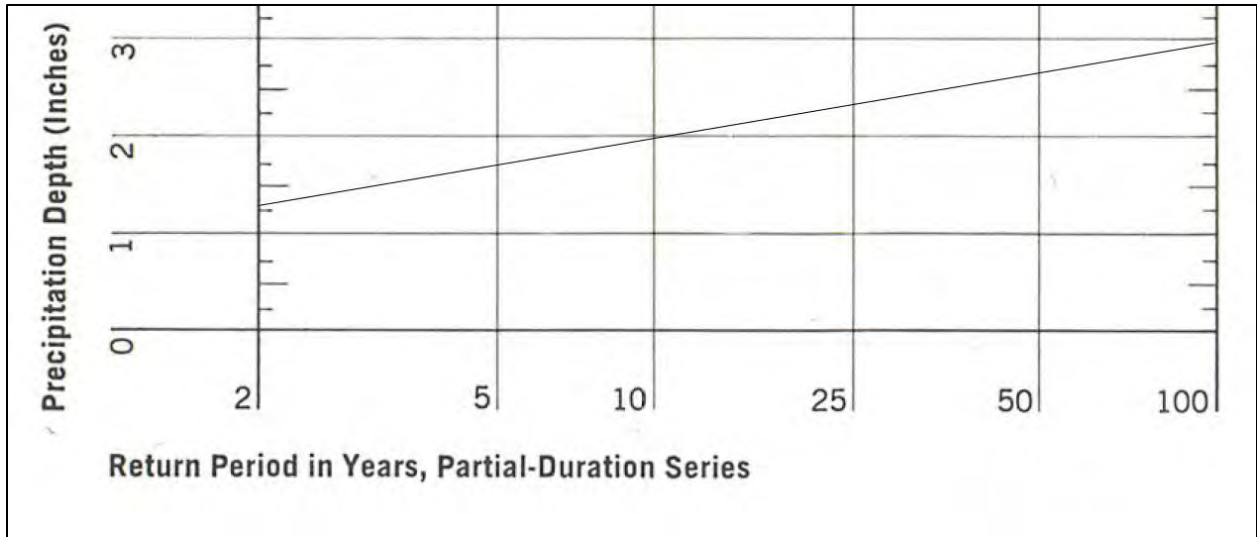


Figure 3. Precipitation depths for intermediate return periods using the NOAA Atlas partial duration-series return period diagram.

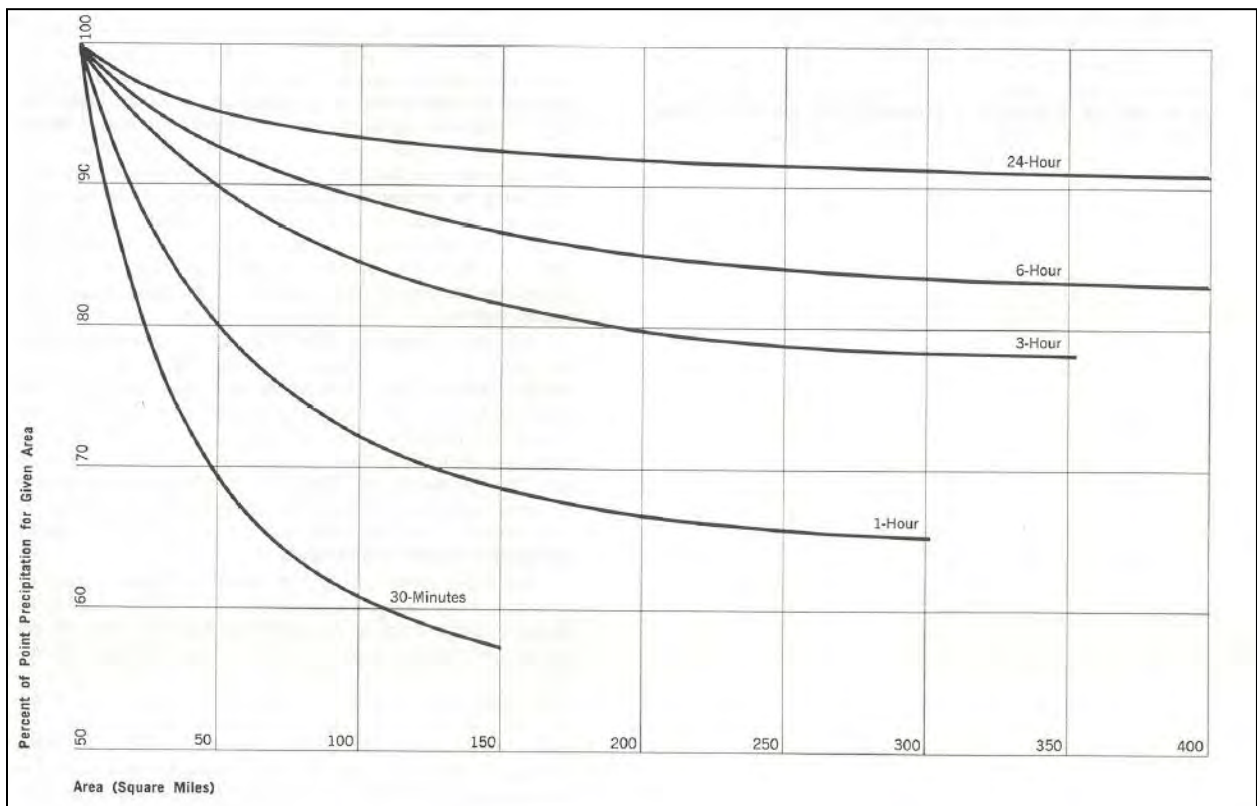


Figure 4. Areal-reduction curves from NOAA Atlas 2.

Precipitation-Frequency Depths for the Tammany Creek Watershed						
Duration	Precipitation Depth by Return Period (inch)					
	Return Period (years)					
	2	5	10	25	50	100
5 min	0.12	0.17	0.21	0.25	0.29	0.34
15 min	0.23	0.34	0.41	0.50	0.58	0.66
1 hr	0.40	0.59	0.71	0.87	1.02	1.16
2 hr	0.50	0.71	0.84	1.01	1.16	1.31
3 hr	0.59	0.81	0.95	1.13	1.29	1.45
6 hr	0.81	1.06	1.22	1.43	1.61	1.79
12 hr	1.06	1.38	1.58	1.85	2.09	2.33
24 hr	1.30	1.69	1.95	2.28	2.58	2.87

**Table 2. 24-hr NOAA Atlas 2 precipitation frequency depths for the Tammany Creek watershed.**

## 2. References

Miller, A. F. (1973). *NOAA Atlas 2, Volume V - Idaho, Precipitation-Frequency Atlas of the Western United States*. Silver Spring, MD: National Oceanic and Atmospheric Administration, National Weather Service.

NRCS. (2013). *National Engineering Handbook Part 630*. Washington DC: U.S. Department of Agriculture, Natural Resources Conservation Service, .

WADOE. (2019). *Stormwater Management Manual for Eastern Washington, Publication No. 18-10-044*. Olympia, WA: Washington State Department of Ecology, Water Quality Program.