La Nina Events Lead to More Robust Flow Distributions for Small Streams in Thurston County, WA: A Statistical Study of Water Years 2008, 2009, 2010, 2011 and 2012

By

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THURSTON COUNTY
WASHINGTON
SINCE 1852

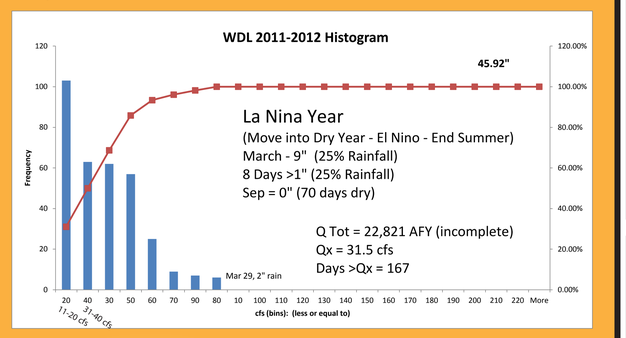
The Computed Record: How Streams Respond to Rainfall Distributions

Woodland Creek Stats - Flow Frequencies

FLOW FREQUENCY HISTOGRAMS FOR WDL1.0

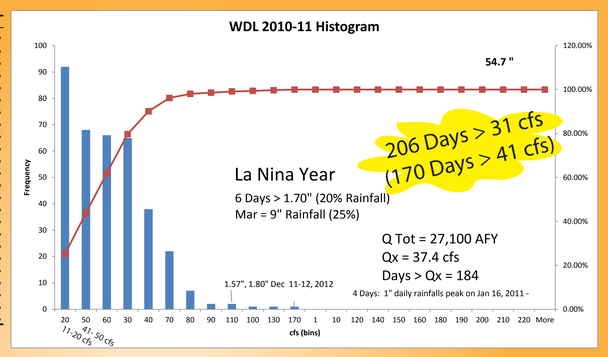
WDL1.0 2011-12 — Frequency = # of Days

cfs	1	Frequency	Cumulative %	1	Frequency	Cumulative %
	10	0	0.00%	20	103	31.02%
11-20 cfs	20	103	31.02%	40	63	50.00%
21-30 cfs	30	62	49.70%	30	62	68.67%
	40	63	68.67%	50	57	85.84%
	50	57	85.84%	60	25	93.37%
	60	25	93.37%	70	9	96.08%
	70	9	96.08%	90	7	98.19%
	80	6	97.89%	80	6	100.00%
	90	7	100.00%	10	0	100.00%
	100	0	100.00%	100	0	100.00%
	110	0	100.00%	110	0	100.00%
	120	0	100.00%	120	0	100.00%
	130	0	100.00%	130	0	100.00%
	140	0	100.00%	140	0	100.00%
	150	0	100.00%	150	0	100.00%
	160	0	100.00%	160	0	100.00%
	170	0	100.00%	170	0	100.00%
	180	0	100.00%	180	0	100.00%
	190	0	100.00%	190	0	100.00%
	200	0	100.00%	200	0	100.00%
	210	0	100.00%	210	0	100.00%
	220	0	100.00%	220	0	100.00%
More		0	100.00%	More	0	100.00%



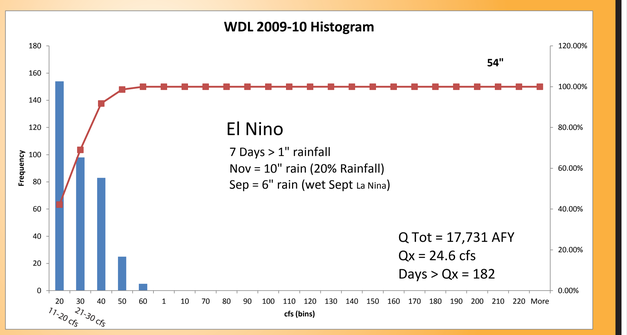
WDL 2010-2011 — Frequency = # of Days

cfs	Bin	Frequency	Cumulative %	Bin	Frequency	Cumulative %
	1	0	0.00%	20	92	25.21%
	10	0	0.00%	50	68	43.84%
11-20 cfs	20	92	25.21%	60	66	61.92%
21-30 cfs	30	65	43.01%	30	65	79.73%
	40	38	53.42%	40	38	90.14%
	50	68	72.05%	70	22	96.16%
	60	66	90.14%	80	7	98.08%
	70	22	96.16%	90	2	98.63%
	80	7	98.08%	110	2	99.18%
	90	2	98.63%	100	1	99.45%
	100	1	98.90%	130	1	99.73%
	110	2	99.45%	170	1	100.00%
	120	0	99.45%	1	0	100.00%
	130	1	99.73%	10	0	100.00%
	140	0	99.73%	120	0	100.00%
	150	0	99.73%	140	0	100.00%
	160	0	99.73%	150	0	100.00%
	170	1	100.00%	160	0	100.00%
	180	0	100.00%	180	0	100.00%
	190	0	100.00%	190	0	100.00%
	200	0	100.00%	200	0	100.00%
	210	0	100.00%	210	0	100.00%
	220	0	100.00%	220	0	100.00%
More		0	100.00%	More	0	100.00%



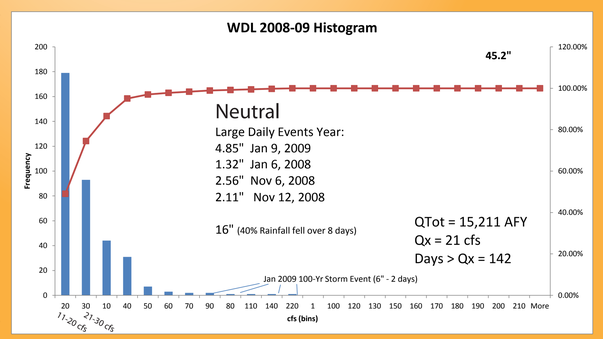
WDL 2009-2010 — Frequency = # of Days

cfs	Bin	Frequency	Cumulative %	Bin	Frequency	Cumulative %
	1	0	0.00%	20	154	42.19%
	10	0	0.00%	30	98	69.04%
	20	154	42.19%	40	83	91.78%
	30	98	69.04%	50	25	98.63%
	40	83	91.78%	60	5	100.00%
	50	25	98.63%	1	0	100.00%
	60	5	100.00%	10	0	100.00%
	70	0	100.00%	70	0	100.00%
	80	0	100.00%	80	0	100.00%
	90	0	100.00%	90	0	100.00%
	100	0	100.00%	100	0	100.00%
	110	0	100.00%	110	0	100.00%
	120	0	100.00%	120	0	100.00%
	130	0	100.00%	130	0	100.00%
	140	0	100.00%	140	0	100.00%
	150	0	100.00%	150	0	100.00%
	160	0	100.00%	160	0	100.00%
	170	0	100.00%	170	0	100.00%
	180	0	100.00%	180	0	100.00%
	190	0	100.00%	190	0	100.00%
	200	0	100.00%	200	0	100.00%
	210	0	100.00%	210	0	100.00%
	220	0	100.00%	220	0	100.00%
More		0	100.00%	More	0	100.00%



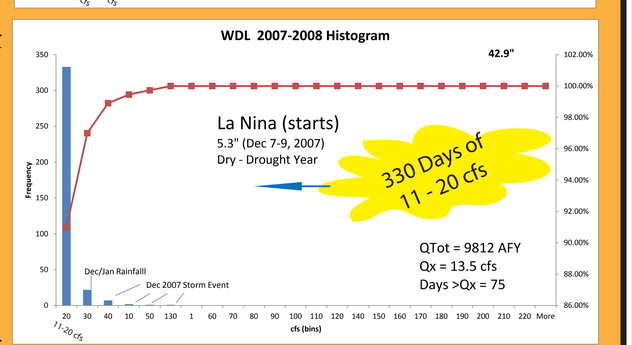
WDL 2008-2009 — Frequency = # of Days

cfs	Bin	Frequency	Cumulative %	Bin	Frequency	Cumulative %
	1	0	0.00%	20	179	49.04%
	10	44	12.05%	30	93	74.52%
11-20 cfs	20	179	61.10%	10	44	86.58%
21-30 cfs	30	93	86.58%	40	31	95.07%
	40	31	95.07%	50	7	96.99%
	50	7	96.99%	60	3	97.81%
	60	3	97.81%	70	2	98.36%
	70	2	98.36%	90	2	98.90%
	80	1	98.63%	80	1	99.18%
	90	2	99.18%	110	1	99.45%
	100	0	99.18%	140	1	99.73%
	110	1	99.45%	220	1	100.00%
	120	0	99.45%	1	0	100.00%
	130	0	99.45%	100	0	100.00%
	140	1	99.73%	120	0	100.00%
	150	0	99.73%	130	0	100.00%
	160	0	99.73%	150	0	100.00%
	170	0	99.73%	160	0	100.00%
	180	0	99.73%	170	0	100.00%
	190	0	99.73%	180	0	100.00%
	200	0	99.73%	190	0	100.00%
	210	0	99.73%	200	0	100.00%
	220	1	100.00%	210	0	100.00%
More		0	100.00%	More	0	100.00%

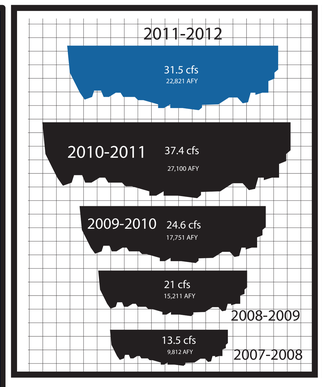


WDL 2007-2008 — Frequency = # of Days

cfs	Bin	Frequency	Cumulative %	Bin	Frequency	Cumulative %
	1	0	0.00%	20	333	90.98%
	10	2	0.55%	30	22	96.99%
11-20 cfs	20	333	91.53%	40	7	98.91%
21-30 cfs	30	22	97.54%	10	2	99.45%
	40	7	99.45%	50	1	99.73%
	50	1	99.73%	130	1	100.00%
	60	0	99.73%	1	0	100.00%
	70	0	99.73%	60	0	100.00%
	80	0	99.73%	70	0	100.00%
	90	0	99.73%	80	0	100.00%
	100	0	99.73%	90	0	100.00%
	110	0	99.73%	100	0	100.00%
	120	0	99.73%	110	0	100.00%
	130	1	100.00%	120	0	100.00%
	140	0	100.00%	140	0	100.00%
	150	0	100.00%	150	0	100.00%
	160	0	100.00%	160	0	100.00%
	170	0	100.00%	170	0	100.00%
	180	0	100.00%	180	0	100.00%
	190	0	100.00%	190	0	100.00%
	200	0	100.00%	200	0	100.00%
	210	0	100.00%	210	0	100.00%
	220	0	100.00%	220	0	100.00%
More		0	100.00%	More	0	100.00%



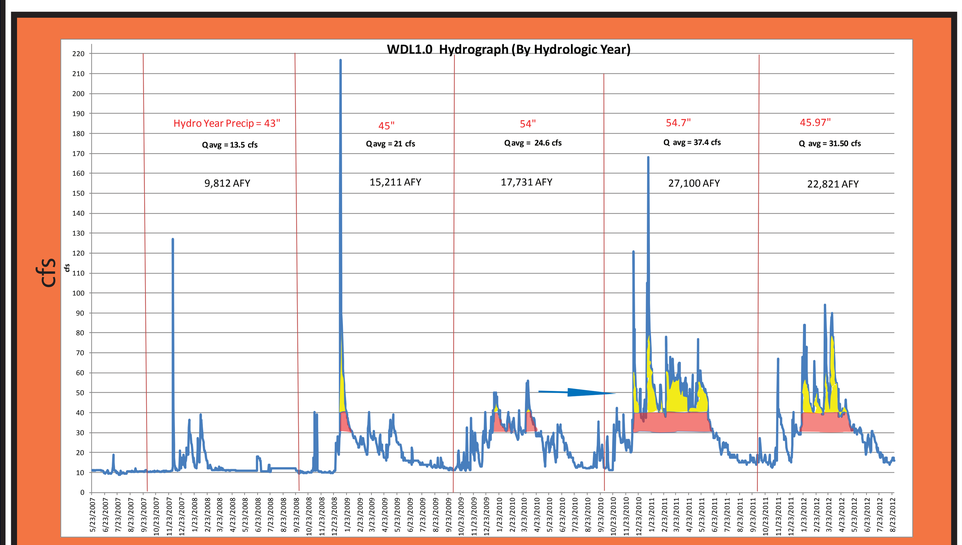
Discharge (Q- cfs)

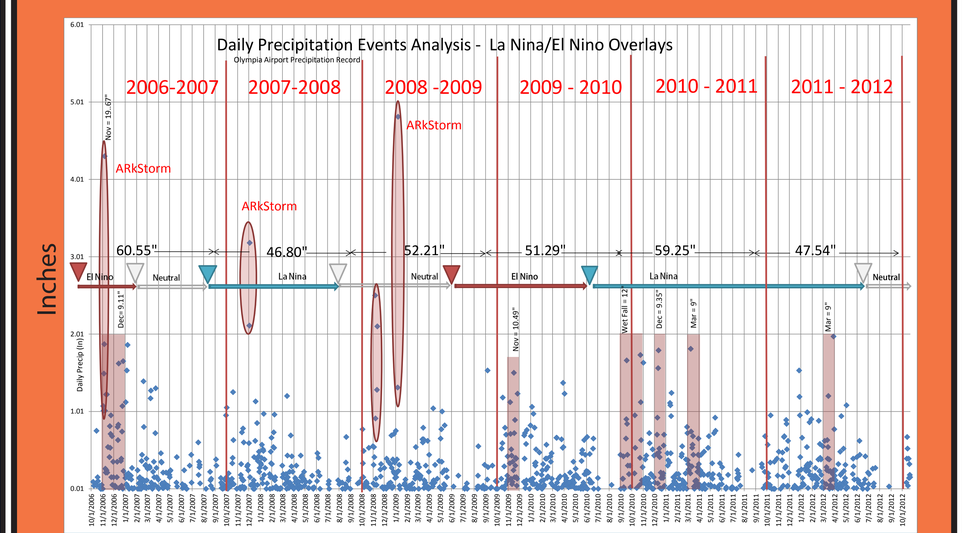


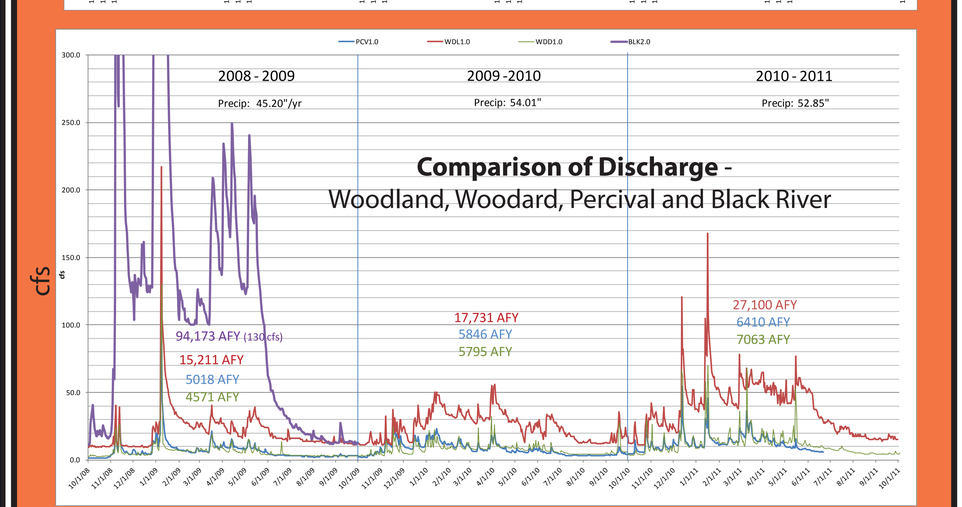
The Hydrologic Story:

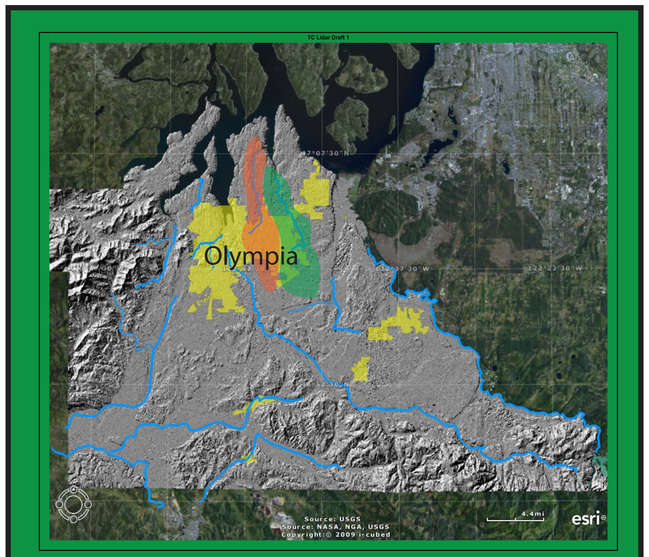
AR = Atmospheric River

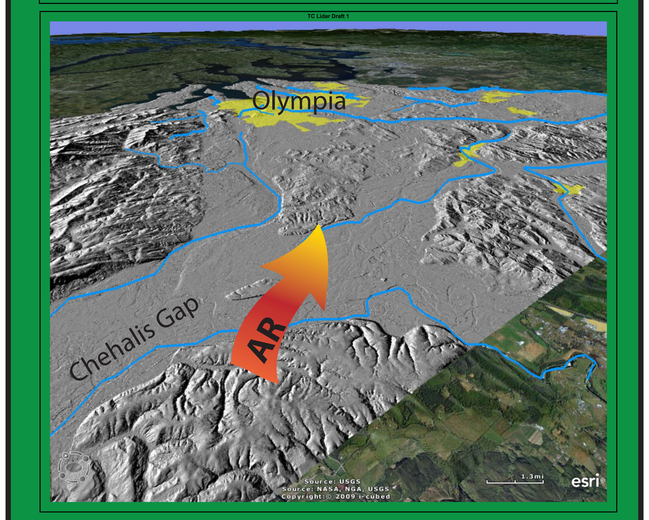
Stream flow (Q) distributions have become more *robust* and *varied* in the last 5 years in Woodland, Woodard and Percival Creeks due to a persistent La Nina Event. However, El Nino's act like 'drier' years-- if one subtracts the large daily rain events that run off the landscape. Meteorologist term these, "Atmospheric Rivers" (also referred to as "Pineapple Express Events"). Note that during the last 3 years there were no daily events above 2 inches. Now, examine the El Nino years. Will this November, December or January bring us another large daily rain event? What do you think? To deepen the story - are the ARkStorm events headed upward? We found an R-correlation of .99 that tells us that out of 19,000 daily events since 1948 the top ten fell in the last decade - each increasing with time.

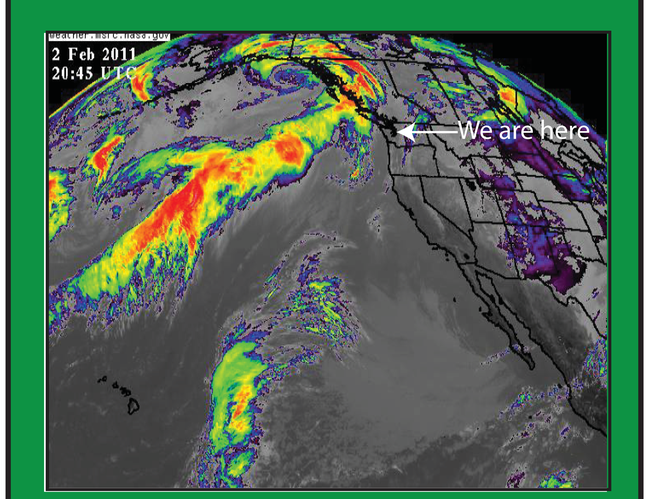












Thurston County collects close to 1 million pieces of hydrologic, ground water and precipitation data each year. Discharge is computed for stream gaging stations. Our efforts allow us to track climate trends, prepare for emergencies and conduct 3D modeling for prediction. Please visit the Thurston County - Water Resources Program Website for more information or to download a copy of this publication at: www.co.thurston.wa.us/monitoring

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