

The May Final WSF sets BiOp actions as defined in the table below where highlighted.

Other projects are provided for informational purposes only.

For flood control requirements, see: <http://www.nwd.usace.army.mil/Missions/Water/Columbia/FloodControl>

Forecast Point	Forecast period	Forecast	BiOp Actions to be Determined
Hungry Horse	April – August Provided by Reclamation	January, February, March Final	Sets min. flows at Hungry Horse and Columbia Falls
	May – September Provided by Reclamation	January, February, March Final	Sets VARQ FRM targets
		April Final	Sets VARQ FRM targets and VARQ refill flows
		May, June Final	Sets VARQ refill flows
The Dalles	April – September Provided by NWRFC	March Final	Sets CRWMP adjustments at Grand Coulee
	April – August Provided by NWRFC	April Final	Sets spring flow objective at McNary Dam
		May Final	Sets end of September draft limits at Hungry Horse and Libby
		July Final	Sets end of August draft limit at Grand Coulee
Lower Granite	April – July Provided by NWRFC	April Final	Sets spring flow objective at Lower Granite
		June Final	Sets summer flow objective at Lower Granite
Libby	April – August Provided by Corps Seattle District	December Final	Sets end of December variable draft target
		January, February, March Final	Sets VARQ FRM targets
		April Final	Sets VARQ FRM targets and VARQ refill flows
		May Final	Sets Libby min. sturgeon flow volume and min. bull trout flows for after sturgeon pulse through Sept. Sets VARQ FRM targets and VARQ refill flows
		June Final	VARQ refill flows
Dworshak	April – July Provided by Corps Walla Walla District	January to June Final	Manage for reservoir FRM and refill

May 3, 2016

**Hungry Horse Dam – Official Water Supply Forecast
MAY 2016**

Here are the forecast volumes from the May final forecast for Hungry Horse inflow:

May-Jul: 1164 kaf (74%)

Jan-Jul: 1937 kaf (92%)

Apr-Aug: 1706 (88%)

May-Sep: 1251 (74%)

The minimum flows downstream of Hungry Horse remain:

Columbia Falls: 3500 cfs

Hungry Horse: 900 cfs

Mary Mellema

River and Reservoir Operations
U.S. Bureau of Reclamation
PN Regional Office
Boise, ID 83706

Water Supply Forecast - COLUMBIA - THE DALLES DAM

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COLUMBIA - THE DALLES DAM (TDAO3)

Forecasts for Water Year 2016

Official Forecast

- 10 days QPF: Ensemble: 2016-05-06 Issued: 2016-05-06 Hide Forecast

Forecast Period	Forecasts Are in KAF				30 Year Average (1981-2010)
	90 %	50 %	% Average	10 %	
APR-SEP	86052	91477	99	97293	92704
APR-JUL	75164	78912	99	85183	79855
APR-AUG	81443	85905	98	91737	87532
JAN-SEP	111084	116509	102	122326	114216
JAN-JUL	100197	103944	103	110216	101368
OCT-SEP	126599	132024	101	137840	130518

- 5 days QPF: Ensemble: 2016-05-06 Issued: 2016-05-06 Hide Forecast

APR-SEP	87254	92007	99	98137	92704
APR-JUL	75755	79672	100	86383	79855
APR-AUG	82381	86841	99	92748	87532
JAN-SEP	112286	117039	102	123169	114216
JAN-JUL	100788	104704	103	111415	101368
OCT-SEP	127800	132554	102	138683	130518

- 0 days QPF: Ensemble: 2016-05-06 Issued: 2016-05-06 Hide Forecast

APR-SEP	88145	92586	100	98709	92704
APR-JUL	75830	80547	101	86523	79855
APR-AUG	83406	87580	100	93519	87532
JAN-SEP	113178	117618	103	123741	114216
JAN-JUL	100863	105579	104	111556	101368
OCT-SEP	128692	133133	102	139256	130518

Move the mouse over the desired "Forecast Period" to display a graph.

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CSV (ESP10 / APR-SEP)

Forecast Ensemble

http://www.nwrfc.noaa.gov/chpsesp/ensemble/watersupply/TDAO3W_SQIN.ESPF10.csv

- TDAO3W_SQIN.ESPF0.csv | 2016-05-06
- TDAO3W_SQIN.ESPF10.csv | 2016-05-06
- TDAO3W_SQIN.ESPF5.csv | 2016-05-06

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CSV (ESP10 / APR-SEP)
Forecast Ensemble

- LGDW1W_SQIN.ESPF0.csv|2016-05-06
- LGDW1W_SQIN.ESPF10.csv|2016-05-06
- LGDW1W_SQIN.ESPF5.csv|2016-05-06

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Libby: May Runoff Forecast & Flood Risk Management Calculation

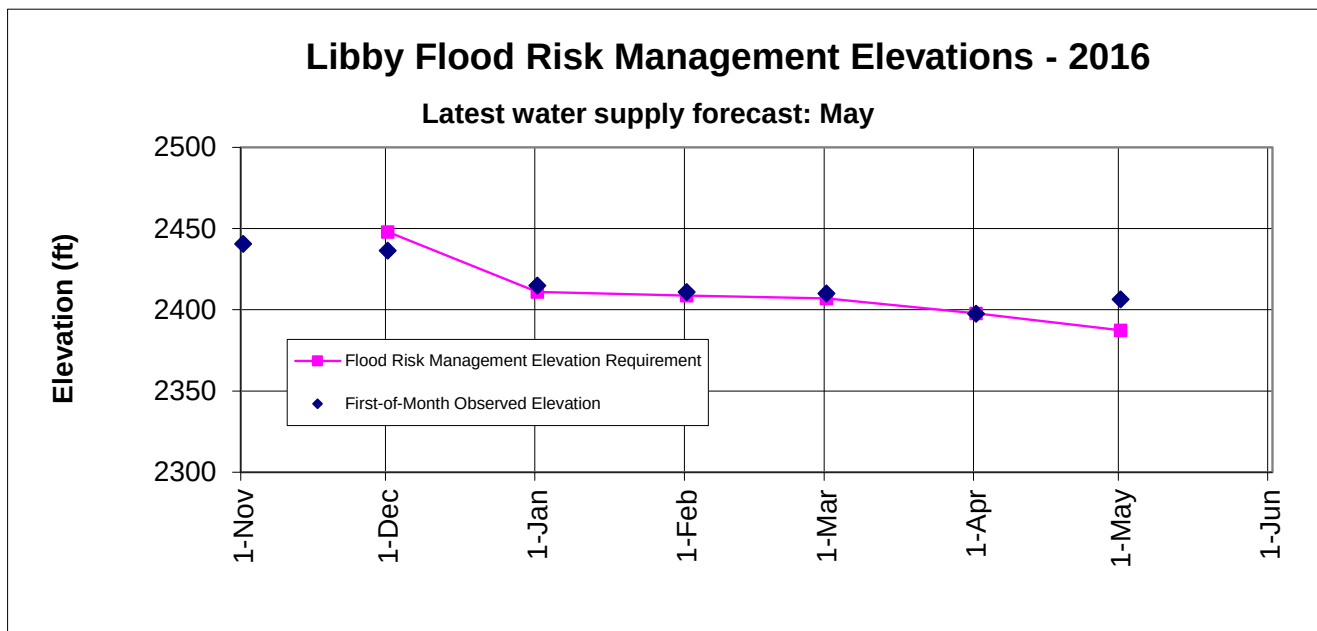
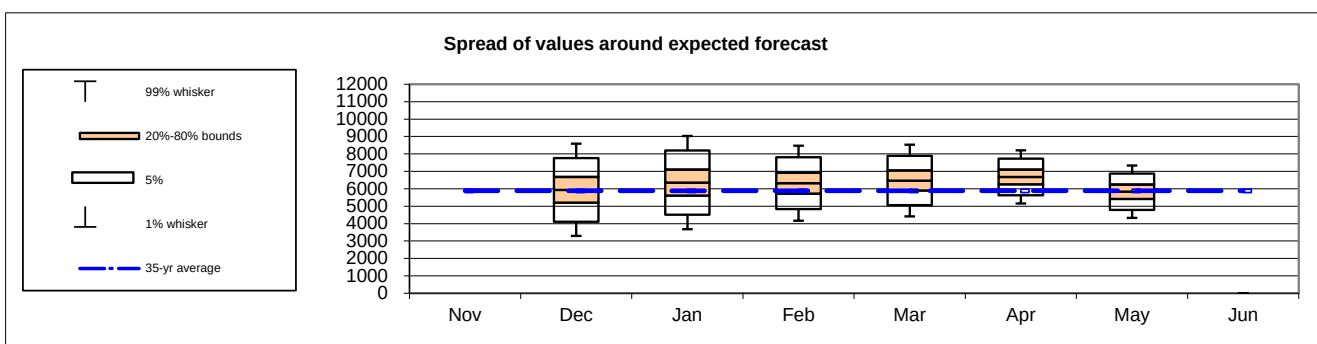
WY 2016

Runoff Forecast and Flood Risk Management			
Most Probable Runoff Volume:	Apr-Aug	5831	KAF
	Apr-Jul	5357	KAF
	May-Jul	4207	KAF

1981-2010 Average	Percent of Average	1929-2008 Average	Percent of Average
5885	99%	6282	93%
5342	100%	5720	94%
4821	87%	5199	81%

Seasonal Flood Risk Management VARQ Flood Risk Management Implemented								
Forecast Date >>	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Apr-Aug Runoff Forecast		5940	6354	6318	6472	6681	5831	
First-of-Month Elev	2440.7	2436.5	2415.0	2411.0	2410.1	2397.6	2406.5	

Date >>	30-Nov	31-Dec	31-Jan	28-Feb	31-Mar	30-Apr	
Flood Risk Management Space	500	2000	2083	2145	2453	2772	
Flood Risk Management Elevation	2448.0	2411.0	2408.7	2407.0	2397.8	2387.4	



Notes:

1. The given forecast is the official Corps of Engineers forecast for Libby. If you have any questions please contact Joel Fenolio (206) 764-6683, Kristy Riley (206) 316-3947, Kevin Shaffer (206) 764-3660, Adam Price (206) 764-3604, or Kristian Mickelson (206) 764-6927.
2. If a prior month's forecast as published in this document is different than what was originally published in the issue month, then the earlier forecast has been adjusted to reflect updated values for precipitation or streamflow.

May forecast for April-August runoff volume 5,831 KAF sets the sturgeon volume at 0.93 MAF (Tier 2 year), followed by bull trout minimum flow of 7 kcfs.

Libby: May Runoff Forecast & Flood Risk Management Calculation

Apr-Aug Runoff Forecast Calculation:						
Variable	Month(s)	Units	Observed Value	Percent of Average	Regression Coefficient	Marginal Runoff (KAF)
			A		B	=A*B
SOI	Σ Jun:Jul					
Eureka RS, MT	Σ Oct:Apr Prcp	inches	8.89	131%	57.5	510.7
West Glacier, MT	Σ Oct:Apr Prcp	inches	19.63	106%	28.0	550.4
Cranbrook A, BC	Σ Oct:Apr Prcp	millimeters	206.90	112%	2.8	579.3
Fernie, BC	Σ Oct:Apr Prcp	millimeters	790.40	104%	0.6	482.1
Hawkins Lake, MT	1-May SWE	inches	20.90	79%	17.3	361.6
Stahl Creek, MT	1-May SWE	inches	34.10	91%	16.7	570.8
East Creek, BC	1-May SWE	millimeters	791.00	86%	0.6	450.9
Moyie Mountain, BC	1-May SWE	millimeters	0.00	0%	0.9	0.0
Sunshine Village, AB	1-May SWE	millimeters	479.00	78%	1.3	603.5
Akamina Pass, AB	1-May SWE	millimeters	73.00	22%	0.6	40.2
South Racehorse Creek, AB	1-May SWE	millimeters	148.00	41%	0.8	122.8
Intercept			1		408.0	408.0
1-May Forecast (KAF)					Σ	4680.4

Data used in Libby Water Supply Forecast

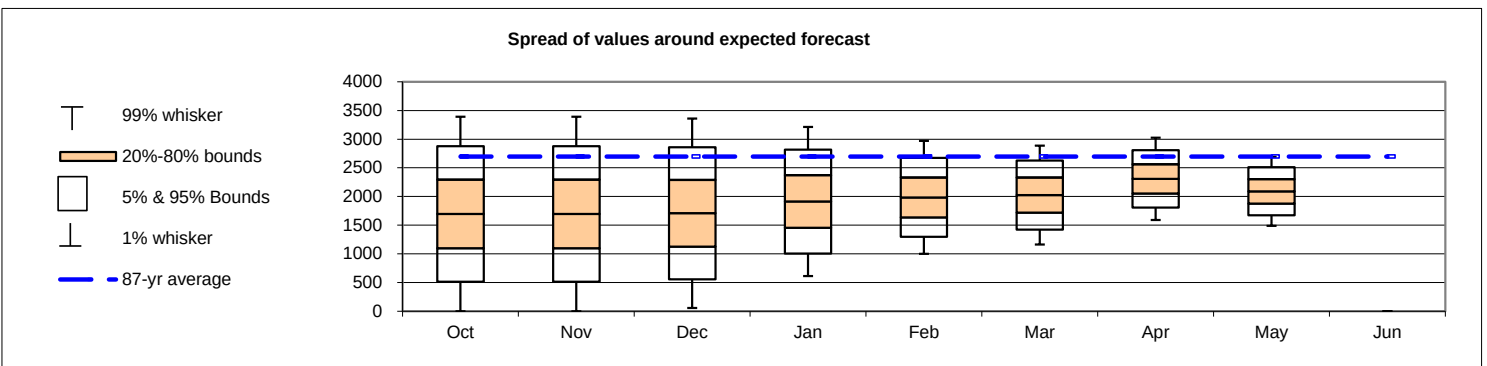
WY 2016

Climate Data				Jun-15	Jul-15				
SOI				-0.60	-1.10				
Precipitation Data	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Units
Eureka RS, MT	1.37	1.73	2.69	1.33	0.59	0.51	0.67		inch
West Glacier, MT	1.93	2.45	4.62	3.07	2.68	3.68	1.20		inch
Cranbrook A, BC	16.60	49.30	50.80	38.00	17.20	29.00	6.00		mm
Fernie, BC	104.00	198.40	172.00	104.00	85.00	112.00	15.00		mm
Snow Water Equiv			1-Jan	1-Feb	1-Mar	1-Apr	1-May	1-Jun	Units
Hawkins Lake, MT				17	23	30	21		inch
Stahl Creek, MT			15	24	32	39	34		inch
East Creek, BC				691	846	1006	791		mm
Moyie Mountain, BC			185	286	353	406	0		mm
Sunshine Village, AB			252	291	414	541	479		mm
Akamina Pass, AB				283	320	464	73		mm
South Racehorse Creek, AB				286	361	429	148		mm
Streamflow			Jan	Feb	Mar	Apr	May	Jun	Units
Libby Inflow Volume			189.4	199.1	294.0	1150.6			KAF
Reservoir Elevation	1-Nov	1-Dec	1-Jan	1-Feb	1-Mar	1-Apr	1-May	1-Jun	Units
Libby FOM Elev	2440.7	2436.5	2415.0	2411.0	2410.1	2397.6	2406.5		feet

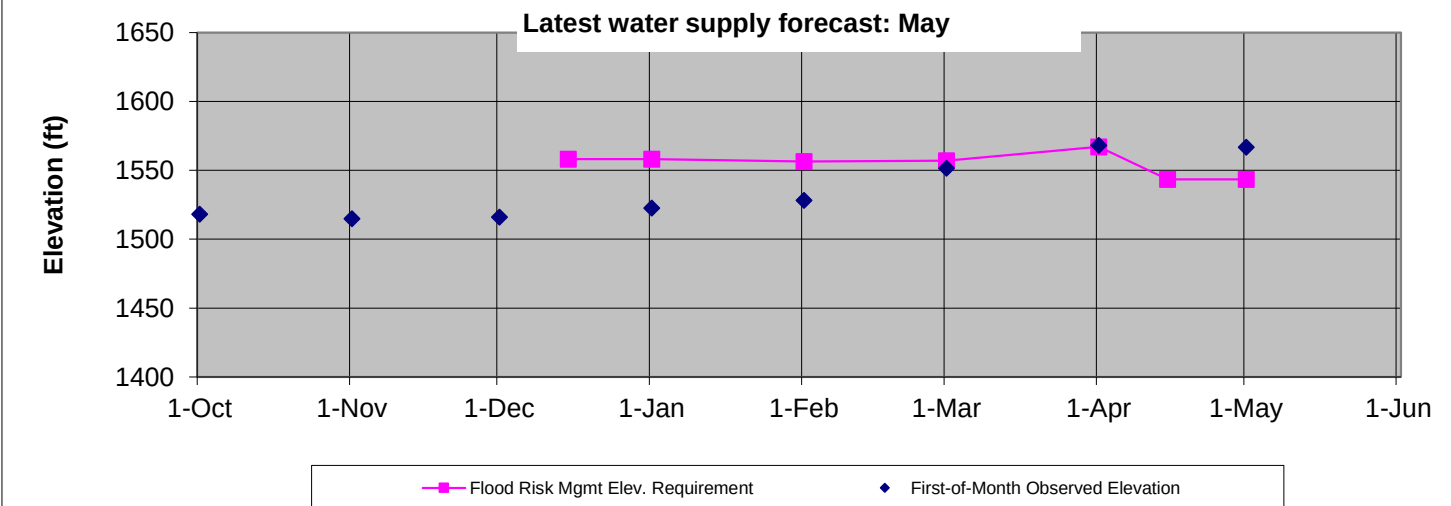
William D. Proctor, P.E.
 Approving Official
 Ch., Hydrologic Engineering and Power Branch
 Northwestern Division

Joel Fenolio, P.E.
 Upper Columbia Senior Water Manager
 Seattle District

Runoff Forecast and Flood Risk Management (FRM)				1981-2010 Average	Percent of 30yr Average	1929-2008 Average	Percent of Average		
Most Probable Runoff Volume		Apr-Jul	2090	KAF	2418	86%	2696	78%	
		May-Jul	1179	KAF	1771	67%	1972	60%	
Seasonal Flood Risk Management (assumes no shift of flood risk management space to Grand Coulee)									
Forecast Date>>	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Apr-Jul Runoff Forecast	1676	1676	1708	1913	1986	2025	2308	2090	
First-of-Month Elev	1518.2	1515.0	1516.1	1522.7	1528.2	1551.6	1568.2	1566.8	
Date >>		15-Dec	31-Dec	31-Jan	29-Feb	31-Mar	15-Apr	30-Apr	31-May
FRM Space	--	700	700	727	718	567	912	912	
FRM Elevation	--	1558.2	1558.2	1556.4	1557.0	1567.1	1543.5	1543.5	



Dworshak Flood Risk Management Elevations - 2016



Dworshak : May Runoff Forecast & Flood Risk Management Calculation

Apr-Jul Runoff Forecast Calculation					
Variable	Month	Observed Value	% of Average	Regression Coefficient	Marginal Runoff (KAF)
		A		B	=A*B
SOI	Sep	-1.60		122.04	-195.3
Hoodoo Basin SWE	1-May	31.7	79%	11.71	371.2
Shanghi Summit SWE	1-May	8.4	61%	14.41	121.0
Lost Lake SWE	1-May	44.4	87%	9.67	429.3
Hemlock SWE	1-May	31.8	80%	11.58	368.2
Intercept		1		84.24	84.2
1-May Forecast (KAF)				Σ	1178.8

Data Station	Sept	Nov	Dec	1-Jan	1-Feb	1-Mar	1-Apr	1-May	1-Jun
Climate (Stdzd SOI)									
September SOI	-1.60								
Precipitation (in)	Oct								
Headquarters, ID	2.80	3.80	6.40	6.30	4.20	6.90	2.50		
Cumulative HQSI Data	2.80	6.60	13.00	19.30	23.50	30.40	32.90		
Snow Water Equiv (First of Month values) (in)									
Elk Butte, ID				14.6	25.8	30.8	38.1		
Cool Creek, ID				17.2	26.5				
Hoodoo Basin, MT				15.1	22.6	29.6	36.7	31.7	0.0
Sherwin, ID				4.6	7.3	5.5	0.7		
Shanghi Summit, ID								8.4	0.0
Lost Lake, ID				19.9	31.7	41.2	52.3	44.4	0.0
Hemlock, ID								31.8	0.0
Crater Meadows Mar						37.9	50.3		
Streamflow (End of Month) (kaf)				Jan	Feb	Mar	Apr	May	Jun
Dworshak Inflow				171	415	631	911	--	--

- Notes:
1. The given forecast is the official Corps of Engineers forecast for Dworshak. If you have any questions please contact Steve Hall (509 527 7550), Wayne Jousma (509-527-7606), or Alfredo Rodriguez (509-527-7532).
 2. Due to updated values for precipitation, snow or streamflow, subsequent forecasts may be different from the forecast published herein.
 3. 15-Dec and 31-Dec Flood Management Space is fixed at 700 KAF.

Approval:

John J. Heitstuman P.E.
Chief Hydrology Section
Walla Walla District USACE

William D. Proctor, P.E.
Ch., Hydrologic Engineering and Power Branch
Columbia Basin Water Management Division

Grand Coulee Dam forecasts are not used for implementation of BiOp actions.
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COLUMBIA - GRAND COULEE DAM (GCDW1)
Forecasts for Water Year 2016

Official Forecast
- 10 days QPF: Ensemble: 2016-05-06 Issued: 2016-05-06 Hide Forecast

Forecast Period	Forecasts Are in KAF				30 Year Average (1981-2010)
	90 %	50 %	% Average	10 %	
APR-SEP	56160	59811	100	64127	60110
APR-JUL	48699	51241	100	55944	51015
APR-AUG	53211	56354	99	60793	56763
JAN-SEP	67294	70944	103	75260	68694
JAN-JUL	59832	62374	105	67077	59599
OCT-SEP	75589	79239	103	83555	76824

- 5 days QPF: Ensemble: 2016-05-06 Issued: 2016-05-06 Hide Forecast

APR-SEP	56973	60453	101	64523	60110
APR-JUL	49187	51536	101	56420	51015
APR-AUG	54012	56763	100	61186	56763
JAN-SEP	68106	71586	104	75656	68694
JAN-JUL	60320	62669	105	67553	59599
OCT-SEP	76401	79881	104	83951	76824

- 0 days QPF: Ensemble: 2016-05-06 Issued: 2016-05-06 Hide Forecast

APR-SEP	56957	60698	101	64834	60110
APR-JUL	49263	52012	102	56440	51015
APR-AUG	53893	57157	101	61558	56763
JAN-SEP	68090	71831	105	75967	68694
JAN-JUL	60396	63146	106	67573	59599
OCT-SEP	76385	80126	104	84262	76824

Move the mouse over the desired "Forecast Period" to display a graph.

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☐ ESP10 ☐ ESP5 ☐ ESP0

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Forecast Ensemble

http://www.nwrfc.noaa.gov/chpsesp/ensemble/watersupply/GCDW1W_SQIN.ESPF10.csv

- GCDW1W_SQIN.ESPF0.csv|2016-05-06
- GCDW1W_SQIN.ESPF10.csv|2016-05-06
- GCDW1W_SQIN.ESPF5.csv|2016-05-06

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PEND OREILLE - ALBENI FALLS DAM (ALFW1)
Forecasts for Water Year 2016

Official Forecast
- 10 days QPF: Ensemble: 2016-05-06 Issued: 2016-05-06 Hide Forecast

Forecast Period	Forecasts Are in KAF				30 Year Average (1981-2010)
	90 %	50 %	% Average	10 %	
APR-SEP	10737	11509	90	12715	12815
APR-JUL	9849	10459	89	11722	11777
APR-AUG	10287	11010	89	12252	12354
JAN-SEP	13693	14465	95	15671	15226
JAN-JUL	12805	13415	95	14678	14189
OCT-SEP	15385	16157	94	17363	17218

- 5 days QPF: Ensemble: 2016-05-06 Issued: 2016-05-06 Hide Forecast

APR-SEP	10795	11652	91	13028	12815
APR-JUL	9865	10637	90	12004	11777
APR-AUG	10324	11155	90	12557	12354
JAN-SEP	13751	14608	96	15984	15226
JAN-JUL	12821	13593	96	14960	14189
OCT-SEP	15443	16300	95	17677	17218

- 0 days QPF: Ensemble: 2016-05-06 Issued: 2016-05-06 Hide Forecast

APR-SEP	10822	11664	91	13088	12815
APR-JUL	9918	10627	90	11979	11777
APR-AUG	10375	11177	90	12615	12354
JAN-SEP	13778	14619	96	16044	15226
JAN-JUL	12874	13583	96	14934	14189
OCT-SEP	15470	16312	95	17736	17218

Move the mouse over the desired "Forecast Period" to display a graph.

Link to image of plot

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☐ ESP10 ☐ ESP5 ☐ ESP0

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Forecast Ensemble

http://www.nwrfc.noaa.gov/chpsesp/ensemble/watersupply/ALFW1IW_SQIN.ESPF10.csv

- ALFW1IW_SQIN.ESPF0.csv|2016-05-06
- ALFW1IW_SQIN.ESPF10.csv|2016-05-06
- ALFW1IW_SQIN.ESPF5.csv|2016-05-06

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