



**US Army Corps
of Engineers®**

Portland District

Willamette Basin Review Feasibility Study

APPENDIX H

BiOp Flow Objective Performance of the No Action Alternative and Agency Recommended Plan Under Expected and Peak Demand Conditions

June 2018

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BiOp Flow Objective Performance No Action Alternative and Agency Recommended Plan Under Expected and Peak Demand Conditions

The 2008 NMFS BiOp set minimum flow objectives on the Willamette mainstem at both Albany and Salem and also prescribed minimum flow requirements on tributaries with Corps dams. This appendix describes the minimum flow objectives, provides a brief overview of the analytical methods used to evaluate BiOp flow objectives performance, and provides an evaluation of performance for each of the BiOp mainstem and tributary flow objectives for the Base Year 2020, No Action Alternative in the year 2070, and the Agency Recommended Plan (ARP) in the year 2070.

1 BiOp Minimum Flow Objectives

The BiOp establishes minimum flow objectives on the mainstem Willamette at Salem and Albany, and on tributaries located downstream of Big Cliff, Blue River, Cougar, Dexter, Fall Creek, Foster, and Hills Creek dams.

Minimum flow objectives at Albany and Salem vary depending on the forecasted amount of stored water in the WVP. Appendix B of the “Willamette Project Supplemental Biological Assessment” designates four water year classifications that are used to determine the mainstem Willamette minimum flow objectives for April through October. The four classifications are Abundant, Adequate, Insufficient, and Deficit.

The water year classification is based on the maximum total conservation storage volume of the WVP reservoirs between May 10 and 20 of each year. The storage volume is determined by summing the conservation storage in all the reservoirs (not including the reregulating dams of Big Cliff and Dexter). The maximum conservation storage is 1,590,000 acre-feet, and the total conservation storage associated with each water year type is specified in Table 1.

Table 1: Water Year Types as Defined by Conservation Storage

Water Year Type	Conservation Storage between 10-20 May
Abundant	Greater than 1,480,000 acre-feet
Adequate	From 1,200,000 to 1,480,000 acre-feet
Insufficient	From 900,000 to 1,200,000 acre-feet
Deficit	Less than 900,000 acre-feet

The BiOp specifies two separate flow objectives at Salem: seven-day moving average flow, and instantaneous flow. As the seven-day moving average minimum flow objectives exceed the

instantaneous minimum flow objectives by nearly 25 percent, the seven-day moving average flow objectives were used¹ in analyses of BiOp flow objective performance for Salem.

Table 2 provides the mainstem BiOp flow objectives at Salem and Albany, and tributary BiOp flow objectives are listed in Table 3.

Table 2: Mainstem BiOp Flow Objectives at Salem and Albany (cfs)

Period	Salem Flow Objectives (cfs)			Albany Flow Objectives (cfs)		
	Abundant & Adequate	Insufficient	Deficit	Abundant & Adequate	Insufficient	Deficit
Apr 1-30	* 17,800		* 15,000	--	--	--
May 1-31	* 15,000	Salem flow objectives are linearly interpolated between Adequate and Deficit flow objectives based on 31 May system storage	* 15,000	--	--	--
Jun 1-15	* 13,000		* 11,000	† 4,500	† 4,500	† 4,000
Jun 16-30	* 8,700		* 5,500	† 4,500	† 4,500	† 4,000
Jul 1-31	† 6,000		† 5,000	† 4,500	† 4,500	† 4,000
Aug 1-15	† 6,000		† 5,000	† 5,000	† 4,500	† 4,000
Aug 16-31	† 6,500		† 5,000	† 5,000	† 4,500	† 4,000
Sep 1-30	† 7,000		† 5,000	† 5,000	† 4,500	† 4,000
Oct 1-31	† 7,000		† 5,000	† 5,000	† 4,500	† 4,000

* Seven-day moving average minimum flow

† Instantaneous minimum flow

¹ Seven-day moving average minimum flow objectives for Salem are specified for April 1 through June 30. From July 1 to October 31, instantaneous minimum flow objectives for Salem were used in the analysis.

Table 3: Tributary BiOp Flow Objectives Downstream of WVP Reservoirs (cfs)

Period ²	Big Cliff*	Blue River	Cougar	Dexter*	Fall Creek	Foster	Hills Creek
Apr 1-30	1500	50	300	1200	80	1500	400
May 1-15	1500	50	300	1200	80	1500	400
May 16-31	1500	50	300	1200	80	1100	400
Jun 1-30	1200	50	400	1200	80	1100	400
Jul 1-15	1200	50	300	1200	80	800	400
Jul 16-31	1000	50	300	1200	80	800	400
Aug 1-31	1000	50	300	1200	80	800	400
Sep 1-30	1500	50	300	1200	200	1500	400
Oct 1-15	1500	50	300	1200	200	1500	400
Oct 16-31	1200	50	300	1200	50	1100	400

*= Flow objectives out of Big Cliff and Dexter represent the flows from the storage projects above these re-regulation dams, i.e. Detroit and Lookout Point.

2 ResSim Analyses

The Willamette River Basin was modeled using the Hydrologic Engineering Center (HEC) Reservoir System Simulation Program (ResSim)³ to assess the individual project and system effects of the No Action Alternative and the ARP. ResSim is used to model reservoir systems whose operations are defined by a variety of goals and constraints. The model uses a rule-based description of the operational goals and constraints that reservoir operators must consider when making release decisions. The dam is the root of an outlet hierarchy or “tree” which allows the user to describe the different outlets of the reservoir in as much detail as necessary. ResSim is not an optimization tool and can only be used to simulate rule-based reservoir operations input by the modeler. The model does not run in a forecast mode, it makes decisions based on modeled system status and inflows and given the prescribed rules.

The baseline ResSim model used for this feasibility study is detailed in Appendix C - ResSim Baseline Model Documentation Report. The Baseline Model Documentation Report identifies all of the physical parameter inputs for the thirteen reservoirs in the basin, the routing reach specifications, the inflow time series used, and the operation sets (the rules used in the ResSim model to regulate the thirteen projects) of the existing conditions model of the WVP.

The Base Year 2020 ResSim model mirrors the way the WVP is operated today, with expected demands projected to the 2020 base year. The model includes physical capacity information for all project outlets, special operations at each project during high inflow events, project rule curves, the minimum flow objectives for tributaries and the mainstem, and outflow rates of change (ramping rates) identified in the Willamette BiOps for listed fish. The No Action

² The ten periods correspond to a combined set of analysis periods, which includes all partial months as described in the BiOp. The combined set of periods was used to provide a common time period framework for all tributaries.

³ Additional information on ResSim is available on the U.S. Army Corps of Engineers HEC website: (<http://www.hec.usace.army.mil/>).

Alternative and ARP models also mirror the way the WVP is operated today, with the exception that additional releases are made from WVP reservoirs - diverted for out-of-stream use, and a portion of the diverted out-of-stream water recouped by the system via return flow.

3 WVP Flows Dataset

The flow dataset used for analyses are from the 2010 Level Modified Streamflows, a complete set of flows for the whole Columbia Basin developed jointly by the BPA, the Corps, and Reclamation. The use of this flow dataset for the WBR is documented in Appendix D - Flow Dataset Used for ResSim Analyses, and also in the previously mentioned Baseline Model Documentation Report. This dataset contains historical daily average flows from October 1928 through September 2008, with all years adjusted to the same level of irrigation depletions.

Several rules in the model depend on water year classification. As described above, Insufficient and Deficit water years allow for reduced minimum flow objectives at Salem. The 80 years in the flow data set were classified by water year in order to have a variable minimum flow objective in a downstream rule for Salem and to determine when some of the diversions used in the model (where water is removed from the system) are reduced in the lower water years. For ResSim modeling (upon which all analyses presented in this document are based), the water year type is defined using data from the time period stated above, and no changes are made to the water year classification during the analysis. The 80-year flow data set provides the following counts and frequencies of water types:

- Abundant 44 years (55 percent of the 80 simulated years);
- Adequate 14 years (17 percent of the 80 simulated years);
- Insufficient 11 years (14 percent of the 80 simulated years); and
- Deficit 11 years (14 percent of the 80 simulated years).

4 Performance Evaluation Procedures and Metrics

Performance of the BiOp flow objectives was evaluated for the period April 1 through October 31 in each of the simulated years, which provides 214 simulated days over 80 simulated years – a total of 17,120 simulated days. Four metrics were developed as a means of evaluating flow objective achievement:

1. flow objective achievement on each simulated day;
2. percent of flow objective volume of water met; and
3. percent of flow objective volume of water met on days that the flow objective is not met.

4.2 Flow Objective Achievement on Each Simulated Day

ResSim daily average outflow from each reservoir, and daily average flow at Salem and Albany were compared to the BiOp flow objectives for a simple assessment of whether each flow objective was met on each of the 17,120 simulated days. This simple metric provides a convenient summary of absolute flow objective achievement, though alone, it does not provide sufficient information to convey the degree to which a flow objective was met over the simulation period. For example, the flow objective at Salem is 6,000 cfs on July 4, and on a

simulated July 4 day where the ResSim output average daily flow is 5,999 cfs, the flow objective is not achieved.

4.3 Percent of Flow Objective Volume Met Over Simulation Period

This metric provides a means of evaluating the overall degree to which flow objectives are met over a simulated year by calculating the ratio of the total volume of water provided to the total volume of water specified by the flow objective. While ResSim modeled flows often exceed the flow objectives, this metric was limited to a maximum ratio of 100 percent in order to avoid the problem of excessive flows “averaging out” insufficient flows, which would overstate performance.

4.4 Percent of Flow Objective Volume Met on Missed Days

This metric evaluates the degree to which flow objectives are met for days on which the flow objective is not fully achieved. It represents the ratio of the total volume of water provided over days for which the flow objective was missed to the total volume of water specified by the flow objective over missed flow objective days.

5 Summary of BiOp Flow Objective Comparisons

Tables 4A, 4B, 5A, and 5B below provide summary performance comparisons of the No Action Alternative and the ARP at year 2070 in meeting mainstem and tributary flow objectives. Tables 4A and 4B show the performance comparison under expected demand conditions, and Tables 5A and 5B show the performance under peak demand conditions.

Each table shows percentages for each, with values for the No Action Alternative provided first. For example, in a comparison of the percent of days over which the flow objective is met, performance may be indicated as 97/96, which denotes that No Action Alternative meets flow objectives 97 percent of the days, and the ARP meets flow objectives on 96 percent of the days.

Also included on the table is a graphic indicator of ✓, ↑, or ↓, where:

- ✓ indicates that there is no notable difference between the No Action Alternative and the ARP;
- ↑ indicates a difference of less than two percent between the No Action Alternative and ARP performance with ARP performance superior to the No Action Alternative performance;
- ↓ indicates a difference of less than two percent between the No Action Alternative and ARP performance with No Action Alternative performance superior to ARP performance;
- ↑ indicates a difference of more than two percent between the No Action Alternative and ARP performance with ARP performance superior to the No Action Alternative performance; and
- ↓ indicates a difference of more than two percent between the No Action Alternative and ARP performance with No Action Alternative performance superior to ARP performance.

Following the table, performance in meeting each of the mainstem and tributary flow objectives is provided in detailed tables and charts.

**Table 4A: Flow Objective Performance: No Action Alternative / ARP
Expected Demand Conditions - Mainstem**

	Performance Metric	All Years	Abundant 44 Yrs	Adequate 14 Yrs	Insufficient 11 Yrs	Deficit 11 Yrs
Salem	Pct Days	↑	✓	↑	↑	✓
Mainstem	Flow Objective Met	89/90	98/98	87/88	77/78	71/71
Flow Objective	Pct of Flow Objective	✓	✓	✓	✓	✓
	Volume Met	99/99	+99/+99	99/99	97/97	95/95
Albany	Pct Days	↑	✓	↑	↑	✓
Mainstem	Flow Objective Met	90/91	98/98	88/90	79/81	70/70
Flow Objective	Pct of Flow Objective	✓	✓	✓	✓	✓
	Volume Met	99/99	+99/+99	99/99	96/96	94/94
Willamette Falls	Pct Days	✓	↓	✓	✓	↓
Mainstem	Flow Objective Met	95/95	+99/99	96/96	87/87	83/82
Flow Objective	Pct of Flow Objective	↓	✓	✓	✓	✓
	Volume Met	+99/99	+99/+99	+99/+99	99/99	98/98

✓ - No notable difference between No Action and ARP performance
 ↑ - < 2 % difference – ARP performance superior ↑ > 2% difference – ARP performance superior
 ↓ - < 2 % difference – No Action performance superior ↓ > 2% difference – No Action performance superior

**Table 4B: Flow Objective Performance: No Action Alternative / ARP
Expected Demand Conditions - Tributaries**

	Performance Metric	All Years	Abundant 44 Yrs	Adequate 14 Yrs	Insufficient 11 Yrs	Deficit 11 Yrs
Big Cliff Tributary Flow Objective	Pct Days Flow Objective Met	✓ 97/97	✓ +99/+99	✓ +99/+99	✓ 97/97	↓ 86/85
	Pct of Flow Objective Volume Met	✓ 99/99	✓ +99/+99	✓ +99/+99	✓ 99/99	↓ 95/94
Blue River Tributary Flow Objective	Pct Days Flow Objective Met	✓ +99/+99	✓ 100/100	✓ 100/100	✓ 100/100	↓ 99/98
	Pct of Flow Objective Volume Met	✓ +99/+99	✓ 100/100	✓ 100/100	✓ 100/100	↓ +99/99
Cougar Tributary Flow Objective	Pct Days Flow Objective Met	✓ 98/98	✓ 100/100	↑ 99/+99	✓ 97/97	↓ 89/88
	Pct of Flow Objective Volume Met	✓ 99/99	✓ 100/100	✓ +99/+99	✓ 99/99	✓ 94/94
Dexter Tributary Flow Objective	Pct Days Flow Objective Met	✓ 99/99	✓ 100/100	✓ 100/100	↓ 99/98	↓ 95/93
	Pct of Flow Objective Volume Met	↓ +99/99	✓ 100/100	✓ 100/100	↓ +99/99	↓ 98/97
Fall Creek Tributary Flow Objective	Pct Days Flow Objective Met	↓ 98/97	✓ 99/99	↓ 98/95	↓ 97/94	↓ 95/93
	Pct of Flow Objective Volume Met	↓ 98/97	✓ 99/99	↓ 98/95	↓ 98/95	↓ 94/91
Foster Tributary Flow Objective	Pct Days Flow Objective Met	✓ 92/92	↓ 97/96	↓ 94/93	✓ 83/83	↑ 77/79
	Pct of Flow Objective Volume Met	↓ 97/96	✓ 99/99	↓ 99/98	↓ 94/92	↓ 91/90
Hills Creek Tributary Flow Objective	Pct Days Flow Objective Met	↓ +99/99	✓ 100/100	✓ 100/100	↓ 99/98	↓ 98/95
	Pct of Flow Objective Volume Met	✓ +99/+99	✓ 100/100	✓ 100/100	↓ +99/99	↓ 99/98

✓ - No notable difference between No Action and ARP performance

↑ - < 2 % difference – ARP performance superior

↑ > 2% difference – ARP performance superior

↓ - < 2 % difference – No Action performance superior

↓ > 2% difference – No Action performance superior

Table 5A: Flow Objective Performance: No Action Alternative and ARP Peak Demand Conditions - Mainstem

	Performance Metric	All Years	Abundant 44 Yrs	Adequate 14 Yrs	Insufficient 11 Yrs	Deficit 11 Yrs
Salem	Pct Days Flow Objective Met	✓ 89/89	✓ 98/98	✓ 87/87	✓ 77/77	↓ 71/70
Mainstem Flow Objective	Pct of Flow Objective Volume Met	✓ 99/99	✓ +99/+99	✓ 99/99	✓ 97/97	✓ 95/95
Albany	Pct Days Flow Objective Met	↓ 89/90	✓ 98/98	↑ 87/90	↑ 78/80	✓ 69/69
Mainstem Flow Objective	Pct of Flow Objective Volume Met	✓ 98/98	✓ +99/+99	✓ 99/99	✓ 96/96	↓ 94/93
Willamette Falls	Pct Days Flow Objective Met	↓ 95/94	✓ 99/99	↓ 96/95	↓ 87/86	↓ 83/80
Mainstem Flow Objective	Pct of Flow Objective Volume Met	✓ 99/99	✓ +99/+99	✓ +99/+99	↓ 99/98	↓ 98/97

✓ - No notable difference between No Action and ARP performance
 ↑ - < 2 % difference – ARP performance superior ↑ > 2% difference – ARP performance superior
 ↓ - < 2 % difference – No Action performance superior ↓ > 2% difference – No Action performance superior

Table 5B: Flow Objective Performance: No Action Alternative and ARP Peak Demand Conditions - Tributaries

	Performance Metric	All Years	Abundant 44 Yrs	Adequate 14 Yrs	Insufficient 11 Yrs	Deficit 11 Yrs
Big Cliff Tributary Flow Objective	Pct Days Flow Objective Met	↓ 97/96	✓ +99/+99	✓ +99/+99	↓ 97/95	8↓ 5/80
	Pct of Flow Objective Volume Met	✓ 99/99	✓ +99/+99	✓ +99/+99	↓ 99/98	↓ 94/92
Blue River Tributary Flow Objective	Pct Days Flow Objective Met	✓ +99/+99	✓ 100/100	✓ 100/100	✓ 100/100	↓ 99/97
	Pct of Flow Objective Volume Met	✓ +99/+99	✓ 100/100	✓ 100/100	✓ 100/100	↓ 99/98
Cougar Tributary Flow Objective	Pct Days Flow Objective Met	✓ 98/98	✓ 100/100	↑ 99/+99	✓ 97/97	↓ 89/88
	Pct of Flow Objective Volume Met	✓ 99/99	✓ 100/100	✓ +99/+99	↑ 98/99	↓ 94/93
Dexter Tributary Flow Objective	Pct Days Flow Objective Met	↓ 99/98	✓ 100/100	✓ 100/100	↓ 99/96	↓ 95/90
	Pct of Flow Objective Volume Met	↓ +99/+99	✓ 100/100	✓ 100/100	↓ 99/98	↓ 98/96
Fall Creek Tributary Flow Objective	Pct Days Flow Objective Met	↓ 98/96	✓ 99/99	↓ 97/94	↓ 97/92	↓ 94/91
	Pct of Flow Objective Volume Met	↓ 98/95	✓ 99/99	↓ 96/94	↓ 98/92	↓ 94/88
Foster Tributary Flow Objective	Pct Days Flow Objective Met	↓ 92/90	↓ 97/94	↓ 94/90	✓ 83/83	✓ 77/77
	Pct of Flow Objective Volume Met	↓ 97/95	↓ 99/98	↓ 99/97	↓ 94/90	↓ 90/88
Hills Creek Tributary Flow Objective	Pct Days Flow Objective Met	↓ +99/+99	✓ 100/100	✓ 100/100	↓ 99/97	↓ 98/93
	Pct of Flow Objective Volume Met	↓ +99/+99	✓ 100/100	✓ 100/100	✓ 99/99	↓ 99/97

✓ - No notable difference between No Action and ARP performance

↑ - < 2 % difference – ARP performance superior

↑ > 2% difference – ARP performance superior

↓ - < 2 % difference – No Action performance superior

↓ > 2% difference – No Action performance superior

6 Salem Mainstem Flow Objective Performance

6.1 Salem Mainstem Flow Objective Performance – Expected Diversions

Table 6A provides summary metrics for the modeled Salem mainstem BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp flow objectives are met across the water year types:

- Abundant: no notable difference;
- Adequate: one percent **more** flow objective days met under the ARP;
- Insufficient one percent **more** flow objective days met under the ARP;; and
- Deficit no notable difference.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 6A shows the following differences between the No Action Plan and the ARP for flow objective water volume provided across the water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient no notable difference; and
- Deficit no notable difference.

Table 6A: Salem Mainstem Flow Objective Performance Summary: Expected Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	98	98	98
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	96	96	96
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	88	87	88
Percent of Volume Met Over All Simulated Days	99	99	99
Percent of Volume Met Over Missed Objective Days	93	93	92
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	78	77	78
Percent of Volume Met Over All Simulated Days	97	97	97
Percent of Volume Met Over Missed Objective Days	90	89	89
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	73	71	71
Percent of Volume Met Over All Simulated Days	95	95	95
Percent of Volume Met Over Missed Objective Days	86	86	86

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 6B and Figure 1A provide additional details and a graphic representation of select table data to aid in interpretation.

Table 6B: Salem Mainstem Flow Objective Performance Detail: Expected Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	96	96	96	20	22	22	+ 99	+ 99	+ 99	98	98	98
	May	99	99	99	8	9	9	+ 99	+ 99	+ 99	98	98	99
	Jun 1-15	93	92	93	18	20	18	99	99	99	92	92	91
	Jun 16-30	98	97	99	8	9	8	+ 99	+ 99	+ 99	98	98	99
	Jul	+ 99	+ 99	+ 99	1	2	1	+ 99	+ 99	+ 99	98	98	98
	Aug 1-15	+ 99	+ 99	99	1	1	1	+ 99	+ 99	+ 99	99	+ 99	97
	Aug 16-31	99	99	+ 99	6	4	1	+ 99	+ 99	+ 99	99	97	+ 99
	Sep	99	99	98	5	3	4	+ 99	+ 99	+ 99	96	98	97
	Oct	99	97	98	3	3	3	+ 99	+ 99	+ 99	96	95	97
	SUBTOTAL	98	98	98	34	33	33	+ 99	+ 99	+ 99	96	96	96
Adequate 2996 sim days 14 of 80 years	Apr	78	78	79	13	13	13	99	99	99	93	93	93
	May	70	69	71	14	14	14	98	98	98	93	93	92
	Jun 1-15	60	60	60	8	8	8	96	96	96	89	89	89
	Jun 16-30	95	96	97	5	6	5	+ 99	+ 99	+ 99	98	98	99
	Jul	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 16-31	90	94	97	4	5	2	+ 99	+ 99	+ 99	99	99	98
	Sep	97	93	99	7	7	2	+ 99	+ 99	+ 99	98	98	95
	Oct	97	95	93	1	3	3	+ 99	+ 99	+ 99	92	95	94
	SUBTOTAL	88	87	88	14	14	14	99	99	99	93	93	92
Insufficient 2354 sim days 11 of 80 years	Apr	74	75	76	11	11	11	98	99	98	94	94	94
	May	43	44	44	11	11	11	93	93	93	88	88	88
	Jun 1-15	42	39	44	10	10	10	94	93	94	89	89	89
	Jun 16-30	94	93	96	2	2	2	+ 99	+ 99	+ 99	98	97	99
	Jul	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 1-15	100	100	99			1	100	100	+ 99	N/A	N/A	96
	Aug 16-31	84	79	78	4	4	4	98	97	98	90	88	89
	Sep	88	85	86	4	3	3	99	99	98	91	90	88
	Oct	80	81	79	3	3	3	98	96	95	90	80	77
	SUBTOTAL	78	77	78	11	11	11	97	97	97	90	89	89
Deficit 2354 sim days 11 of 80 years	Apr	69	69	68	11	11	11	96	97	96	89	89	89
	May	38	38	38	11	11	11	90	90	90	84	84	84
	Jun 1-15	44	45	48	11	11	10	93	93	94	88	88	89
	Jun 16-30	100	100	100				100	100	100	N/A	N/A	N/A
	Jul	96	96	99	1	1	1	+ 99	+ 99	+ 99	97	97	98
	Aug 1-15	82	71	73	4	4	4	98	97	98	91	91	94
	Aug 16-31	71	68	74	4	5	4	96	96	97	87	87	89
	Sep	88	82	76	4	5	4	99	98	97	92	89	87
	Oct	76	72	68	5	5	5	96	94	92	82	78	76
	SUBTOTAL	73	71	71	11	11	11	95	95	95	86	86	86

Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Oct = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 1A: Salem BiOp Mainstem Flow Objective Performance: Expected Diversions

■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

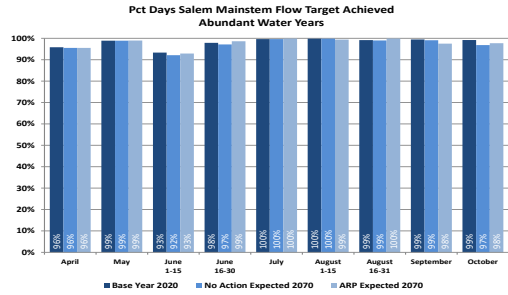
Abundant (n=44)

Adequate (n=14)

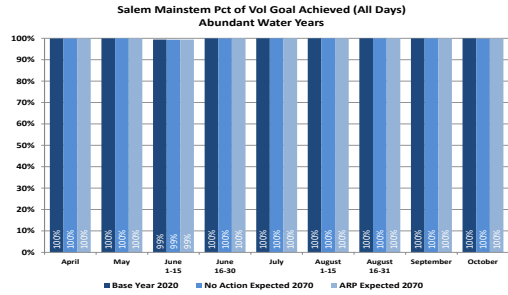
Insufficient (n=11)

Deficit (n=11)

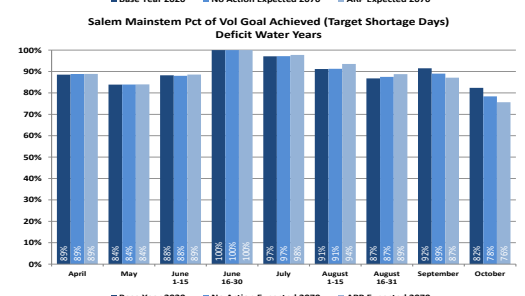
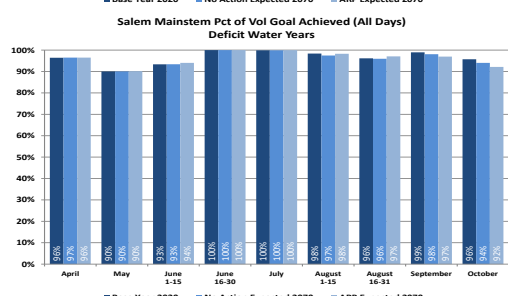
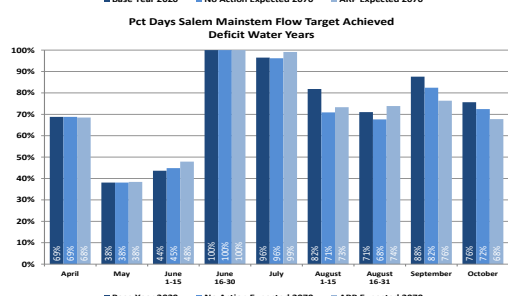
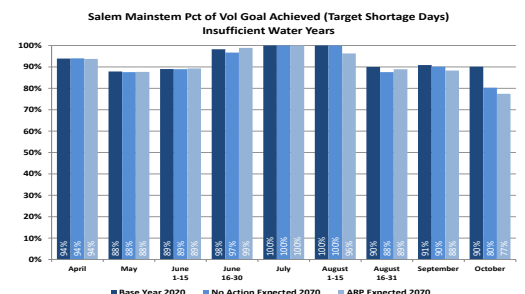
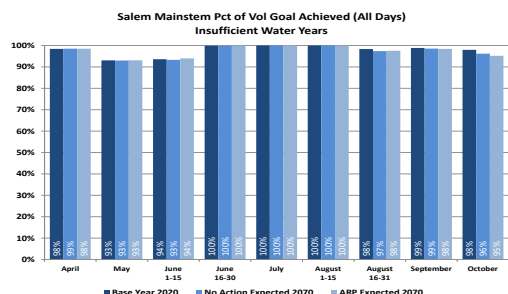
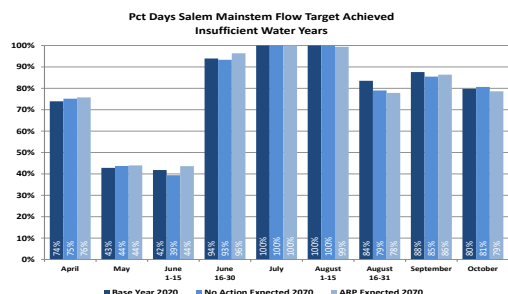
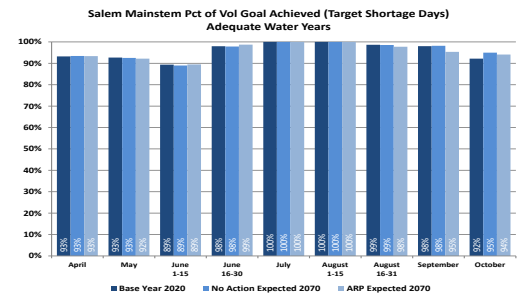
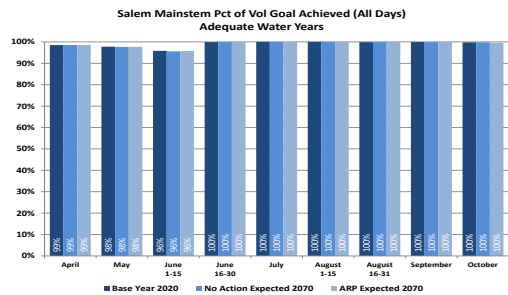
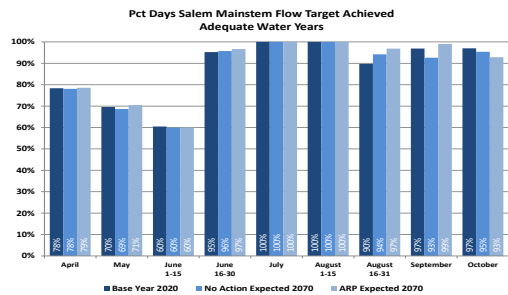
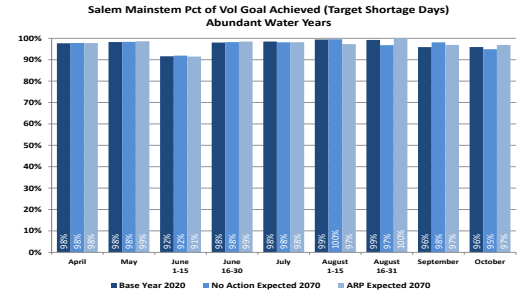
Pct Days Flow Objective Met



Pct Volume Goal Achieved (All Days)



Pct Volume Goal Achieved (Missed Days)



6.2 Salem Mainstem Flow Objective Performance – Peak Diversions

Table 6C provides summary metrics for the modeled Salem mainstem BiOp flow objective performance for Baseline Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp targets are met across the four water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient no notable difference; and
- Deficit one percent **more** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 6C shows the following differences as a percent of target water volume provided for each of the four water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient no notable difference; and
- Deficit no notable difference.

Table 6C: Salem Mainstem Flow Objective Performance Summary: Peak Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	98	98	98
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	96	96	96
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	88	87	87
Percent of Volume Met Over All Simulated Days	99	99	99
Percent of Volume Met Over Missed Objective Days	93	92	92
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	78	77	77
Percent of Volume Met Over All Simulated Days	97	97	97
Percent of Volume Met Over Missed Objective Days	90	89	88
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	73	71	70
Percent of Volume Met Over All Simulated Days	95	95	95
Percent of Volume Met Over Missed Objective Days	86	86	85

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 6D and Figure 1B provide additional details and a graphic representation of select table data to aid in interpretation.

Table 6D: Salem Mainstem Flow Objective Performance Detail: Peak Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	96	96	96	20	22	22	+ 99	+ 99	+ 99	98	98	98
	May	99	99	99	8	9	9	+ 99	+ 99	+ 99	98	99	99
	Jun 1-15	93	92	93	18	20	18	99	99	99	92	92	91
	Jun 16-30	98	97	99	8	9	6	+ 99	+ 99	+ 99	98	99	98
	Jul	+ 99	100	100	1			+ 99	100	100	98	N/A	N/A
	Aug 1-15	+ 99	+ 99	100	1	1		+ 99	+ 99	100	99	99	N/A
	Aug 16-31	99	99	100	6	2		+ 99	+ 99	100	99	98	N/A
	Sep	99	99	98	5	4	3	+ 99	+ 99	+ 99	96	97	96
	Oct	99	97	96	3	3	3	+ 99	+ 99	+ 99	96	95	95
	SUBTOTAL		98	98	98	34	33	31	+ 99	+ 99	+ 99	96	96
Adequate 2996 sim days 14 of 80 years	Apr	78	78	79	13	13	13	99	99	99	93	93	93
	May	70	70	70	14	14	14	98	98	98	93	92	92
	Jun 1-15	60	60	60	8	8	8	96	95	96	89	89	90
	Jun 16-30	95	96	98	5	5	4	+ 99	+ 99	+ 99	98	97	98
	Jul	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 16-31	90	94	98	4	3	2	+ 99	+ 99	+ 99	99	97	99
	Sep	97	91	96	7	6	3	+ 99	+ 99	+ 99	98	98	92
	Oct	97	94	87	1	2	4	+ 99	+ 99	99	92	93	94
	SUBTOTAL		88	87	87	14	14	14	99	99	99	93	92
Insufficient 2354 sim days 11 of 80 years	Apr	74	76	76	11	11	11	98	98	98	94	94	94
	May	43	44	45	11	11	11	93	93	93	88	88	88
	Jun 1-15	42	41	46	10	10	10	94	93	94	89	89	90
	Jun 16-30	94	93	99	2	2	2	+ 99	+ 99	+ 99	98	98	99
	Jul	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 1-15	100	100	98			1	100	100	+ 99	N/A	N/A	92
	Aug 16-31	84	78	78	4	4	3	98	97	98	90	86	90
	Sep	88	85	85	4	3	2	99	98	98	91	90	85
	Oct	80	81	76	3	3	5	98	96	93	90	77	71
	SUBTOTAL		78	77	77	11	11	11	97	97	97	90	89
Deficit 2354 sim days 11 of 80 years	Apr	69	69	68	11	11	11	96	97	96	89	89	89
	May	38	38	38	11	11	11	90	90	90	84	84	84
	Jun 1-15	44	46	50	11	10	9	93	93	94	88	88	89
	Jun 16-30	100	100	100				100	100	100	N/A	N/A	N/A
	Jul	96	96	99	1	1	2	+ 99	+ 99	+ 99	97	97	99
	Aug 1-15	82	68	75	4	4	4	98	97	99	91	91	95
	Aug 16-31	71	65	71	4	5	5	96	96	97	87	88	90
	Sep	88	79	70	4	5	5	99	98	95	92	89	83
	Oct	76	73	67	5	5	5	96	94	91	82	76	72
	SUBTOTAL		73	71	70	11	11	11	95	95	95	86	86

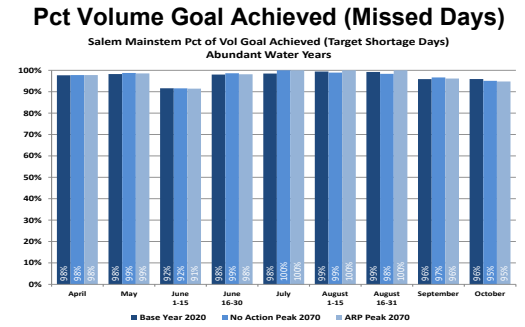
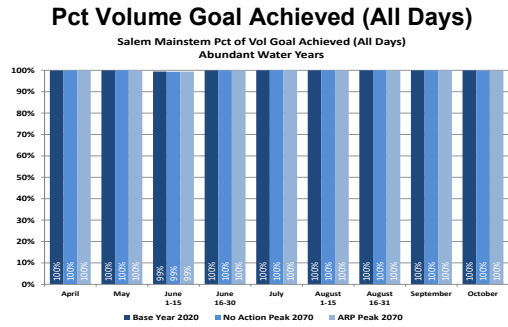
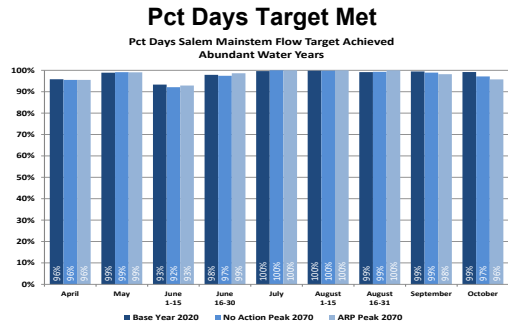
Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Oct = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

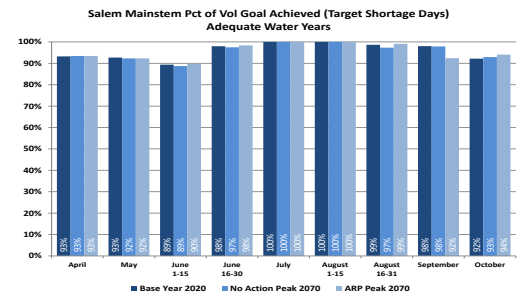
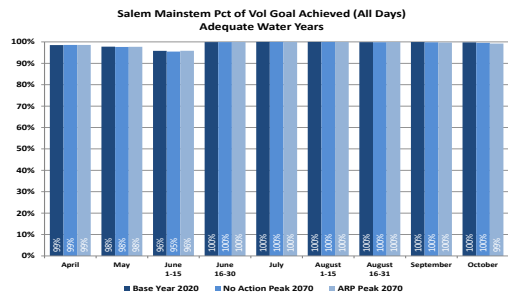
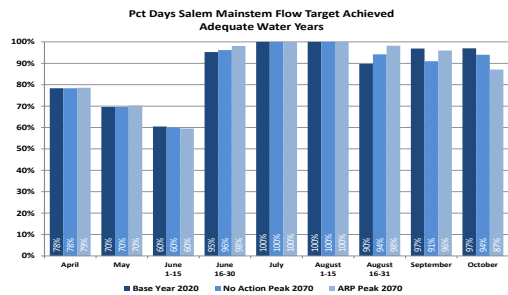
Figure 1B: Salem BiOp Mainstem Flow Objective Performance: Peak Diversions

■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

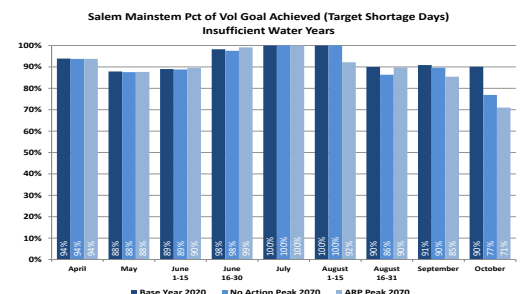
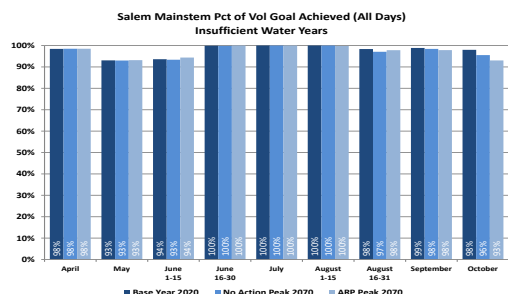
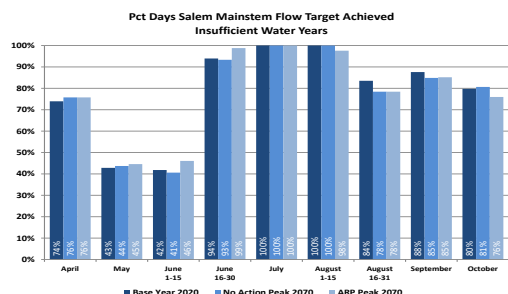
Abundant (n=44)



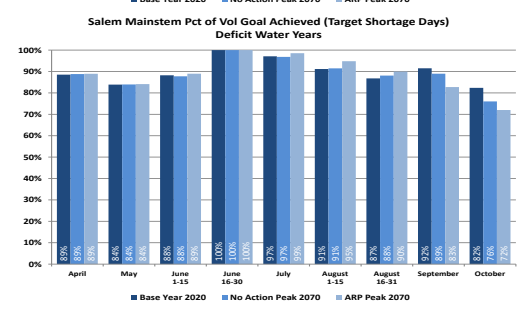
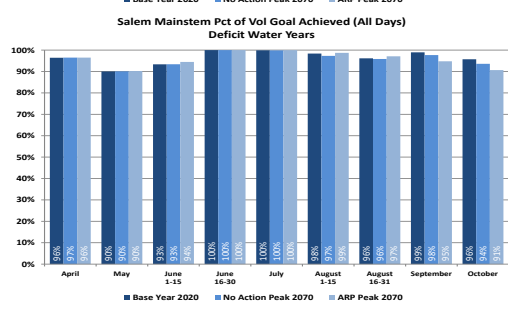
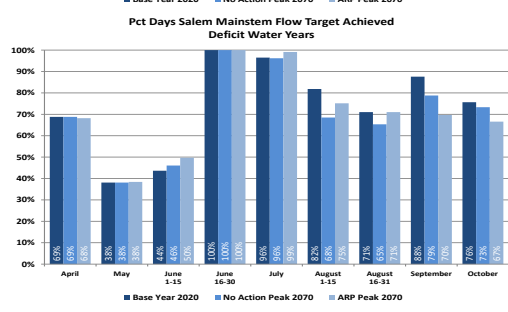
Adequate (n=14)



Insufficient (n=11)



Deficit (n=11)



7 Salem Mainstem Flow Objective at Willamette Falls Performance

7.1 Salem Mainstem Flow Objective Performance at Will Falls – Expected Diversions

Table 7A provides summary metrics for the modeled Salem mainstem BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070 at Willamette Falls. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp flow objectives are met across the water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient: no notable difference; and
- Deficit: one percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 7A shows the following differences between the No Action Plan and the ARP for flow objective water volume provided across the water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient: no notable difference; and
- Deficit: no notable difference.

Table 7A: Salem Mainstem Flow Objective Performance Summary at Will Falls: Expected Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	+ 99	+ 99	99
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	94	94	94
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	96	96	96
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	93	93	93
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	89	87	87
Percent of Volume Met Over All Simulated Days	99	99	99
Percent of Volume Met Over Missed Objective Days	93	92	91
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	86	83	82
Percent of Volume Met Over All Simulated Days	98	98	98
Percent of Volume Met Over Missed Objective Days	89	88	88

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 7B and Figure 2A provide additional details and a graphic representation of select table data to aid in interpretation.

Table 7B: Salem Mainstem Flow Objective Performance at Willamette Falls Detail: Expected Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May	100	100	100				100	100	100	N/A	N/A	N/A
	Jun 1-15	97	97	97	3	4	4	+ 99	+ 99	+ 99	93	92	92
	Jun 16-30	100	100	+ 99			1	100	100	+ 99	N/A	N/A	+ 99
	Jul	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 1-15	100	100	+ 99				100	100	+ 99	N/A	N/A	99
	Aug 16-31	100	+ 99	+ 99		1	2	100	+ 99	+ 99	N/A	+ 99	+ 99
	Sep	+ 99	100	99	2		4	+ 99	100	+ 99	98	N/A	97
	Oct	+ 99	99	99	1	2	1	+ 99	+ 99	+ 99	99	98	98
	SUBTOTAL	+ 99	+ 99	99	4	5	9	+ 99	+ 99	+ 99	94	94	94
Adequate 2996 sim days 14 of 80 years	Apr	99	99	99	1	1	1	+ 99	+ 99	+ 99	93	93	93
	May	92	92	92	4	4	4	99	99	99	91	90	90
	Jun 1-15	73	72	72	6	6	6	99	98	98	95	94	94
	Jun 16-30	100	100	100				100	100	100	N/A	N/A	N/A
	Jul	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 16-31	98	97	96	2	2	3	+ 99	+ 99	+ 99	98	98	97
	Sep	+ 99	98	+ 99	2	3	1	+ 99	+ 99	+ 99	96	98	94
	Oct	98	98	97	1	2	3	+ 99	+ 99	+ 99	95	98	97
	SUBTOTAL	96	96	96	7	8	7	+ 99	+ 99	+ 99	93	93	93
Insufficient 2354 sim days 11 of 80 years	Apr	96	96	96	3	3	3	+ 99	+ 99	+ 99	96	97	97
	May	72	70	69	8	8	8	98	98	98	92	92	92
	Jun 1-15	68	66	69	5	6	5	98	97	97	93	92	92
	Jun 16-30	100	99	100		1		100	+ 99	100	N/A	99	N/A
	Jul	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 1-15	100	100	99			1	100	100	+ 99	N/A	N/A	96
	Aug 16-31	90	81	80	2	3	3	99	98	98	90	89	88
	Sep	92	88	87	3	3	2	99	99	99	93	92	91
	Oct	88	83	80	3	3	3	99	98	97	93	86	83
	SUBTOTAL	89	87	87	8	9	8	99	99	99	93	92	91
Deficit 2354 sim days 11 of 80 years	Apr	93	93	93	1	1	1	99	99	99	88	88	88
	May	67	67	67	7	7	7	96	96	96	88	87	87
	Jun 1-15	74	73	73	4	4	4	98	98	98	91	91	92
	Jun 16-30	100	100	100				100	100	100	N/A	N/A	N/A
	Jul	99	99	99	1	1	1	+ 99	+ 99	+ 99	99	97	99
	Aug 1-15	87	74	74	3	4	4	99	98	99	94	94	95
	Aug 16-31	75	72	73	4	4	4	97	97	97	90	88	90
	Sep	92	86	79	4	4	4	+ 99	99	98	94	92	90
	Oct	82	79	75	4	5	5	97	96	95	86	82	80
	SUBTOTAL	86	83	82	7	7	7	98	98	98	89	88	88

Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Oct = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 2A: Salem BiOp Mainstem Flow Objective Performance at Will Falls: Expected Diversions

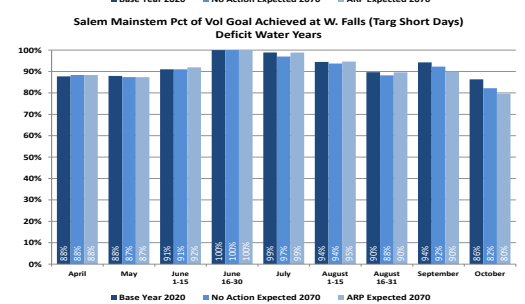
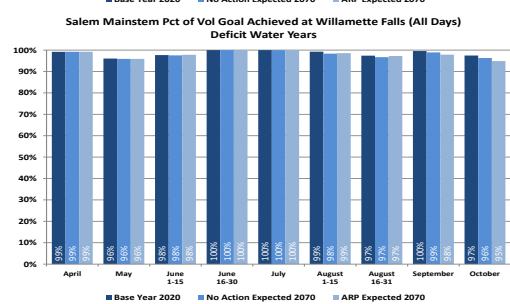
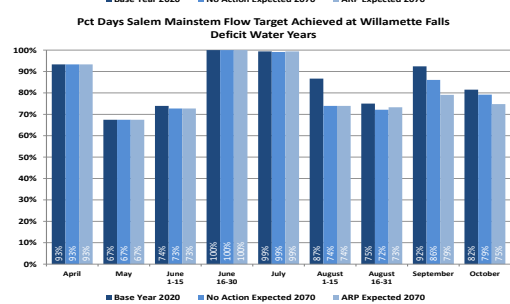
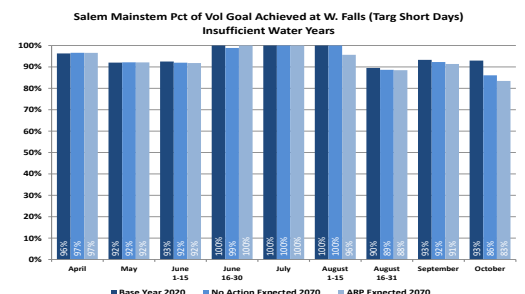
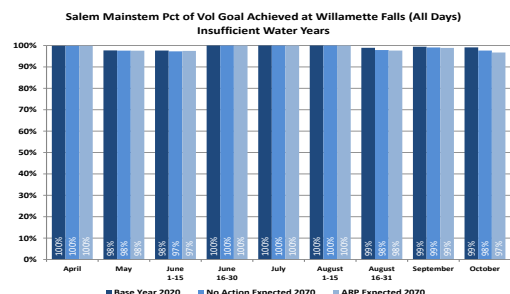
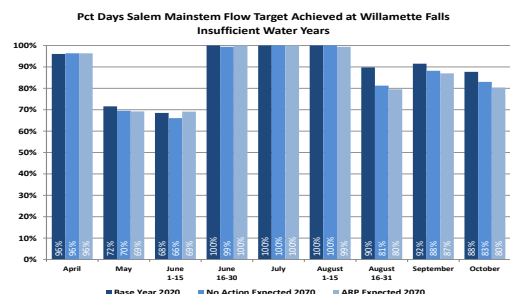
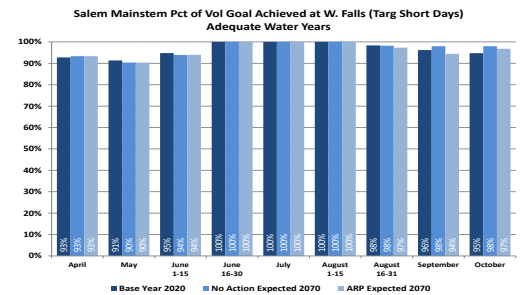
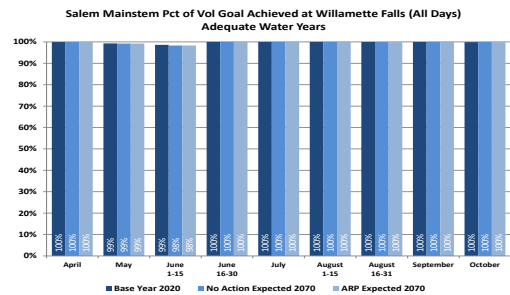
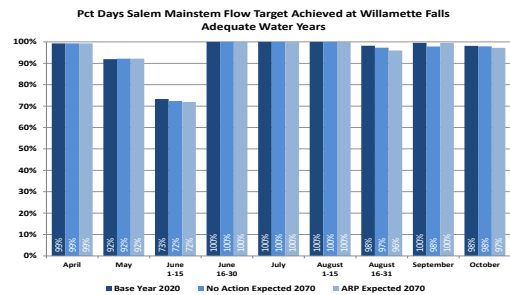
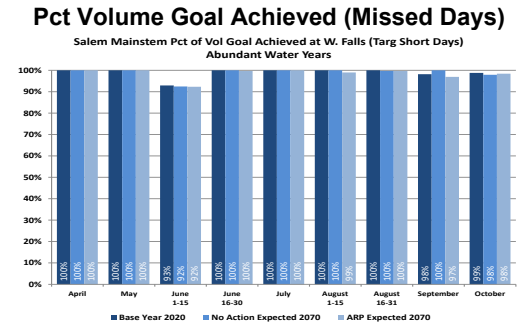
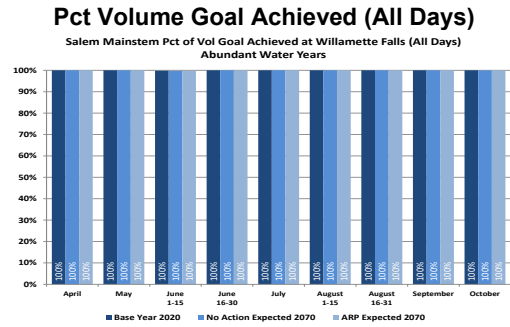
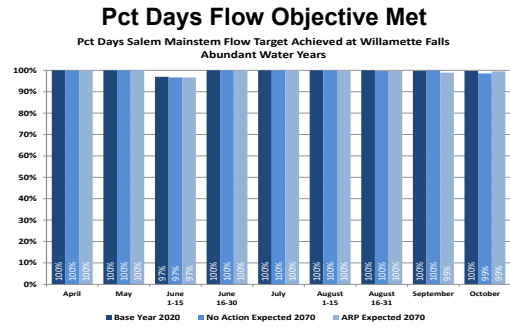
■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

Abundant (n=44)

Adequate (n=14)

Insufficient (n=11)

Deficit (n=11)



7.2 Salem Mainstem Flow Objective Performance at Will Falls – Peak Diversions

Table 7C provides summary metrics for the modeled Salem mainstem BiOp flow objective performance for Baseline Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp targets are met across the four water year types:

- Abundant: no notable difference;
- Adequate: one percent **fewer** flow objective days met under the ARP;
- Insufficient one percent **fewer** flow objective days met under the ARP; and
- Deficit three percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 7C shows the following differences as a percent of target water volume provided for each of the four water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient one percent **less** water provided under the ARP; and
- Deficit one percent **less** water provided under the ARP.

Table 7C: Salem Mainstem Flow Objective Performance Summary at Will Falls: Peak Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	+ 99	99	99
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	94	94	95
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	96	96	95
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	93	93	93
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	89	87	86
Percent of Volume Met Over All Simulated Days	99	99	98
Percent of Volume Met Over Missed Objective Days	93	91	89
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	86	83	80
Percent of Volume Met Over All Simulated Days	98	98	97
Percent of Volume Met Over Missed Objective Days	89	88	87

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 7D and Figure 2B provide additional details and a graphic representation of select table data to aid in interpretation.

Table 7D: Salem Mainstem Flow Objective Performance at Willamette Falls Detail: Peak Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May	100	100	100				100	100	100	N/A	N/A	N/A
	Jun 1-15	97	97	97	3	4	4	+ 99	+ 99	+ 99	93	92	91
	Jun 16-30	100	100	+ 99			1	100	100	+ 99	N/A	N/A	98
	Jul	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 1-15	100	+ 99	+ 99		1	1	100	+ 99	+ 99	N/A	99	97
	Aug 16-31	100	99	98		1	5	100	+ 99	+ 99	N/A	99	99
	Sep	+ 99	99	98	2	3	3	+ 99	+ 99	+ 99	98	99	97
	Oct	+ 99	99	98	1	1	2	+ 99	+ 99	+ 99	99	97	97
	SUBTOTAL	+ 99	99	99	4	5	11	+ 99	+ 99	+ 99	94	94	95
Adequate 2996 sim days 14 of 80 years	Apr	99	99	99	1	1	1	+ 99	+ 99	+ 99	93	93	93
	May	92	92	92	4	4	4	99	99	99	91	90	90
	Jun 1-15	73	72	71	6	6	6	99	98	98	95	93	93
	Jun 16-30	100	100	100				100	100	100	N/A	N/A	N/A
	Jul	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 16-31	98	93	94	2	3	3	+ 99	+ 99	+ 99	98	98	97
	Sep	+ 99	98	97	2	2	3	+ 99	+ 99	+ 99	96	97	91
	Oct	98	97	94	1	2	3	+ 99	+ 99	+ 99	95	95	96
	SUBTOTAL	96	96	95	7	7	7	+ 99	+ 99	+ 99	93	93	93
Insufficient 2354 sim days 11 of 80 years	Apr	96	96	96	3	3	3	+ 99	+ 99	+ 99	96	97	97
	May	72	69	69	8	8	8	98	98	98	92	92	92
	Jun 1-15	68	67	67	5	6	5	98	97	97	93	92	92
	Jun 16-30	100	99	100		1		100	+ 99	100	N/A	99	N/A
	Jul	100	100	100				100	100	100	N/A	N/A	N/A
	Aug 1-15	100	100	98			1	100	100	+ 99	N/A	N/A	88
	Aug 16-31	90	80	77	2	3	3	99	97	97	90	87	88
	Sep	92	88	86	3	3	2	99	99	98	93	91	87
	Oct	88	82	79	3	3	3	99	97	95	93	84	74
	SUBTOTAL	89	87	86	8	9	8	99	99	98	93	91	89
Deficit 2354 sim days 11 of 80 years	Apr	93	93	93	1	1	1	99	99	99	88	88	88
	May	67	67	67	7	7	7	96	96	96	88	87	87
	Jun 1-15	74	73	73	4	4	4	98	98	98	91	91	92
	Jun 16-30	100	100	100				100	100	100	N/A	N/A	N/A
	Jul	99	99	98	1	1	3	+ 99	+ 99	+ 99	99	96	98
	Aug 1-15	87	72	70	3	4	4	99	98	98	94	93	94
	Aug 16-31	75	72	69	4	4	5	97	97	96	90	87	89
	Sep	92	85	72	4	4	5	+ 99	99	96	94	91	85
	Oct	82	78	72	4	5	5	97	96	94	86	81	77
	SUBTOTAL	86	83	80	7	7	7	98	98	97	89	88	87

Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Oct = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 2B: Salem BiOp Mainstem Flow Objective Performance: Peak Diversions

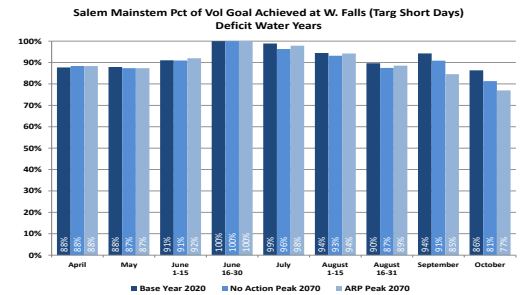
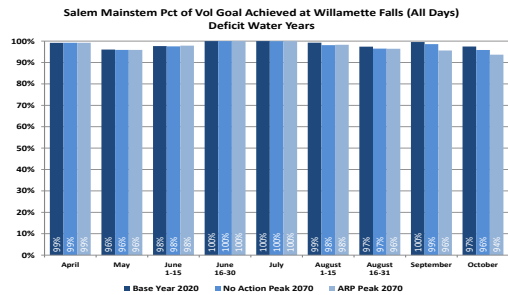
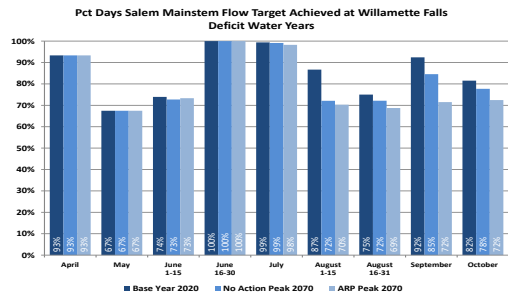
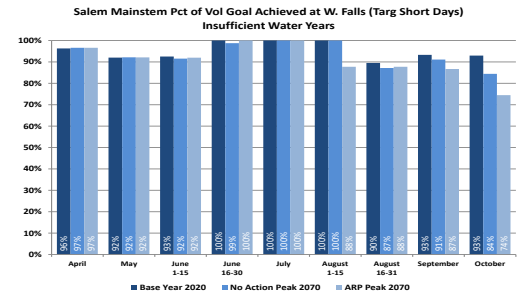
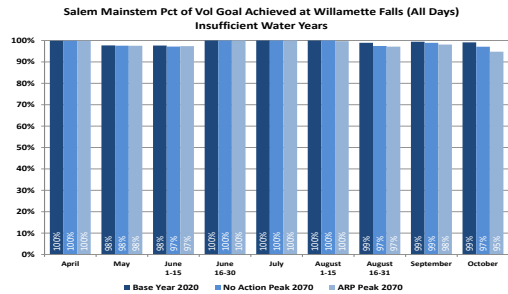
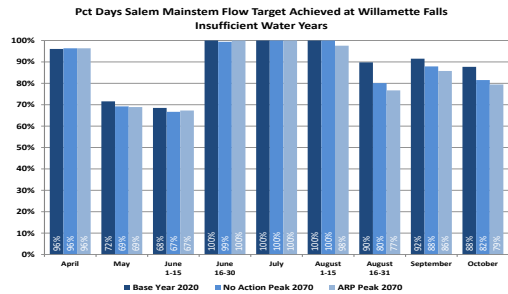
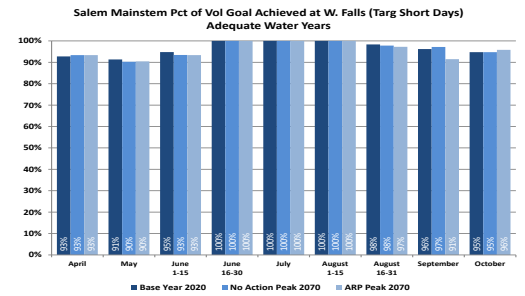
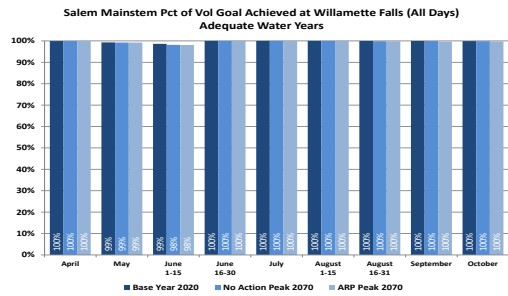
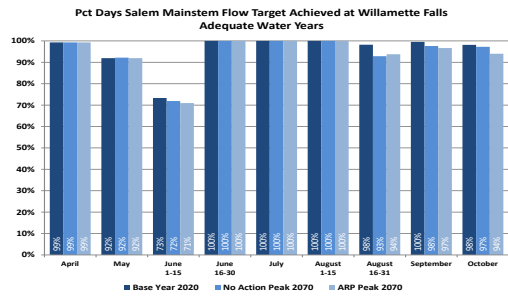
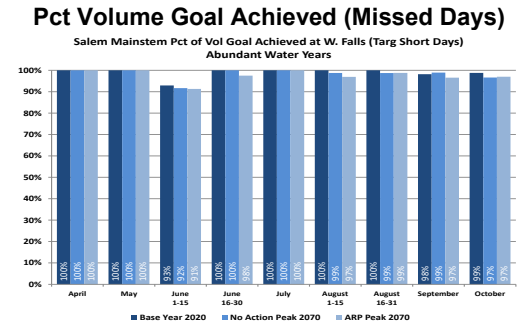
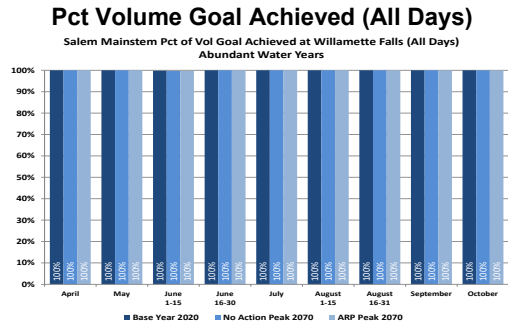
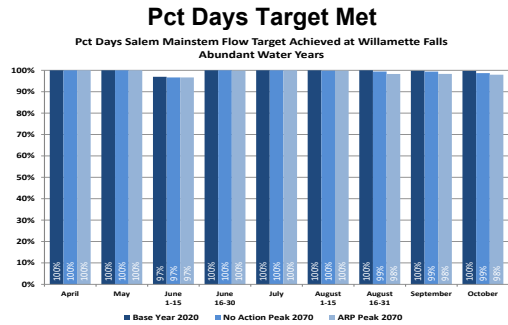
■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

Abundant (n=44)

Adequate (n=14)

Insufficient (n=11)

Deficit (n=11)



8 Albany Mainstem Flow Objective Performance

8.1 Albany Mainstem Flow Objective Performance – Expected Diversions

Table 8A provides summary metrics for the modeled Albany mainstem BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp flow objectives are met across the four water year types:

- Abundant: no notable difference;
- Adequate: two percent **more** flow objective days met under the ARP;
- Insufficient two percent **more** flow objective days met under the ARP; and
- Deficit no notable difference.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 8A shows the following differences between the No Action Plan and the ARP as a percent of flow objective water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient no notable difference; and
- Deficit no notable difference.

Table 8A: Albany Mainstem Flow Objective Performance Summary: Expected Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	97	98	98
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	97	94	95
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	89	88	90
Percent of Volume Met Over All Simulated Days	+ 99	99	99
Percent of Volume Met Over Missed Objective Days	96	94	94
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	78	79	81
Percent of Volume Met Over All Simulated Days	97	96	96
Percent of Volume Met Over Missed Objective Days	87	83	81
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	73	70	70
Percent of Volume Met Over All Simulated Days	95	94	94
Percent of Volume Met Over Missed Objective Days	81	79	79

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 8B and Figure 3A provide additional details and a graphic representation of select table data to aid in interpretation.

Table 8B: Albany Mainstem Flow Objective Performance Detail: Expected Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1, 2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1, 2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr												
	May												
	Jun 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jun 16-30	100	100	100				100	100	100	N/A	N/A	N/A
	Jul	97	99	+ 99	9	7	3	+ 99	+ 99	+ 99	97	99	97
	Aug 1-15	92	94	95	21	17	21	+ 99	+ 99	+ 99	97	96	97
	Aug 16-31	98	98	98	5	5	3	+ 99	+ 99	+ 99	99	97	99
	Sep	97	97	97	8	6	4	+ 99	+ 99	+ 99	96	96	95
	Oct	98	97	97	2	2	2	+ 99	+ 99	+ 99	95	88	91
	SUBTOTAL	97	98	98	28	26	26	+ 99	+ 99	+ 99	97	94	95
Adequate 2996 sim days 14 of 80 years	Apr												
	May												
	Jun 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jun 16-30	100	100	100				100	100	100	N/A	N/A	N/A
	Jul	+ 99	+ 99	100	1	1		+ 99	+ 99	100	+ 99	+ 99	N/A
	Aug 1-15	63	72	80	13	12	7	+ 99	+ 99	+ 99	99	99	99
	Aug 16-31	86	87	92	8	5	6	+ 99	+ 99	+ 99	98	98	98
	Sep	77	73	78	11	11	9	99	99	99	96	95	97
	Oct	93	88	88	3	3	3	99	98	98	85	86	85
	SUBTOTAL	89	88	90	14	14	11	+ 99	99	99	96	94	94
Insufficient 2354 sim days 11 of 80 years	Apr												
	May												
	Jun 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jun 16-30	99	99	100	1	1		+ 99	+ 99	100	+ 99	+ 99	N/A
	Jul	74	80	89	5	6	4	99	99	+ 99	96	97	97
	Aug 1-15	79	85	85	4	4	4	99	99	99	97	95	93
	Aug 16-31	68	65	64	7	7	5	96	94	93	86	82	82
	Sep	65	64	64	6	6	7	93	93	93	80	80	81
	Oct	77	76	77	3	6	4	96	93	92	80	72	68
	SUBTOTAL	78	79	81	9	10	10	97	96	96	87	83	81
Deficit 2354 sim days 11 of 80 years	Apr												
	May												
	Jun 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jun 16-30	100	100	100				100	100	100	N/A	N/A	N/A
	Jul	87	87	88	2	2	5	99	99	+ 99	93	93	96
	Aug 1-15	59	57	55	7	5	5	95	93	95	88	85	88
	Aug 16-31	55	53	55	5	6	5	91	91	92	79	80	83
	Sep	58	52	50	7	7	7	91	89	88	80	78	77
	Oct	62	59	58	6	6	6	91	89	88	77	74	70
	SUBTOTAL	73	70	70	9	7	7	95	94	94	81	79	79

Notes:

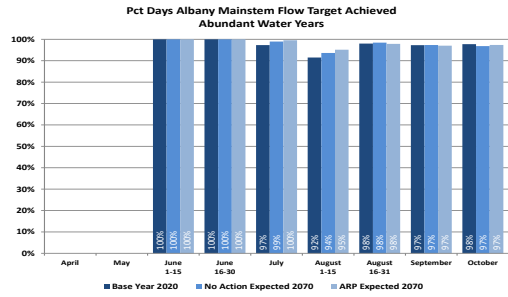
1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Oct = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 3A: Albany Mainstem Flow Objective Performance: Expected Diversions

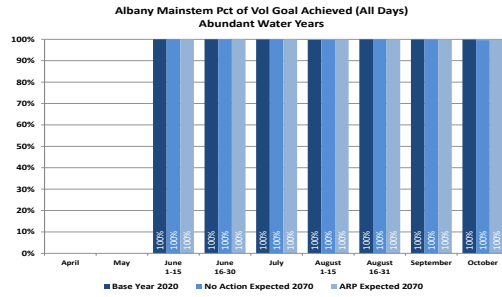
■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

Abundant (n=44)

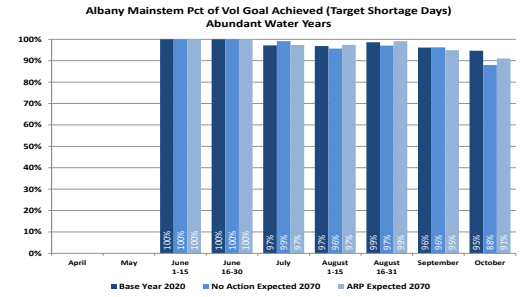
Pct Days Flow Objective Met



Pct Volume Goal Achieved (All Days)

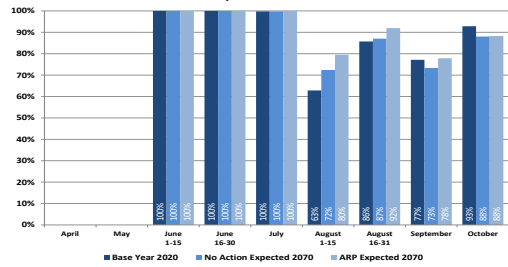


Pct Volume Goal Achieved (Missed Days)

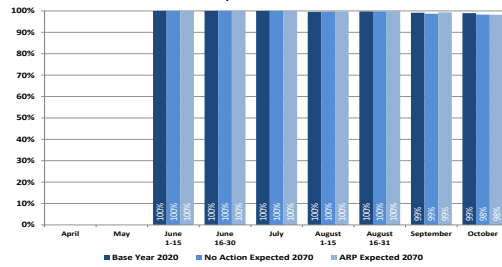


Adequate (n=14)

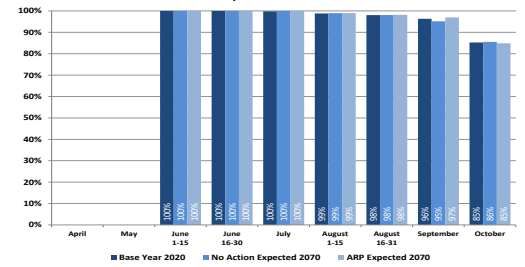
Pct Days Albany Mainstem Flow Target Achieved



Albany Mainstem Pct of Vol Goal Achieved (All Days)

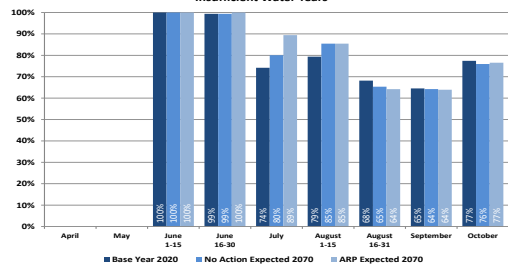


Albany Mainstem Pct of Vol Goal Achieved (Target Shortage Days)

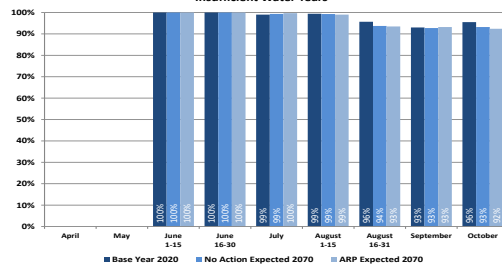


Insufficient (n=11)

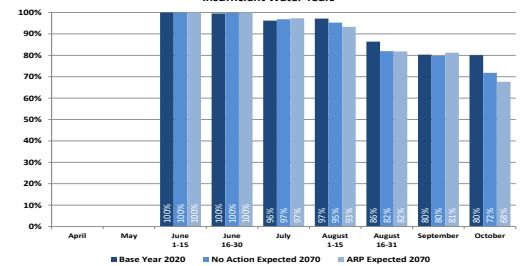
Pct Days Albany Mainstem Flow Target Achieved



Albany Mainstem Pct of Vol Goal Achieved (All Days)

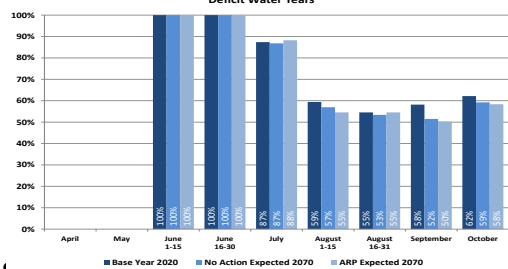


Albany Mainstem Pct of Vol Goal Achieved (Target Shortage Days)

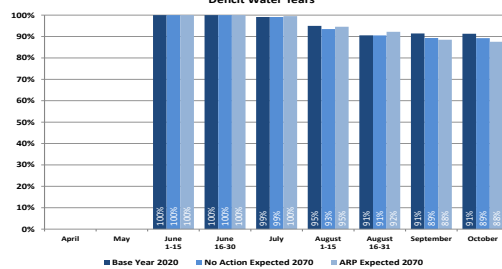


Deficit (n=11)

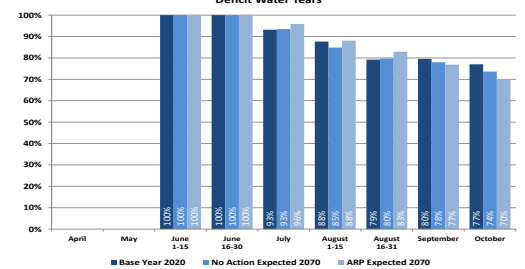
Pct Days Albany Mainstem Flow Target Achieved



Albany Mainstem Pct of Vol Goal Achieved (All Days)



Albany Mainstem Pct of Vol Goal Achieved (Target Shortage Days)



8.2 Albany Mainstem Flow Objective Performance – Peak Diversions

Table 8C provides summary metrics for the modeled Albany mainstem BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp targets are met across the four water year types:

- Abundant: no notable difference;
- Adequate: three percent **more** flow objective days met under the ARP;
- Insufficient two percent **more** flow objective days met under the ARP; and
- Deficit no notable difference.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 8C shows the following differences between the No Action Plan and the ARP as a percent of target water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient no notable difference; and
- Deficit one percent **less** water provided under the ARP.

Table 8C: Albany Mainstem Flow Objective Performance Summary: Peak Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	97	98	98
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	97	95	93
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	89	87	90
Percent of Volume Met Over All Simulated Days	+ 99	99	99
Percent of Volume Met Over Missed Objective Days	96	94	93
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	78	78	80
Percent of Volume Met Over All Simulated Days	97	96	96
Percent of Volume Met Over Missed Objective Days	87	82	78
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	73	69	69
Percent of Volume Met Over All Simulated Days	95	94	93
Percent of Volume Met Over Missed Objective Days	81	79	78

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 8D and Figure 3B provide additional details and a graphic representation of select table data to aid in interpretation.

Table 8D: Albany Mainstem Flow Objective Performance Detail: Peak Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr												
	May												
	Jun 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jun 16-30	100	100	100				100	100	100	N/A	N/A	N/A
	Jul	97	99	100	9	7		+ 99	+ 99	100	97	99	N/A
	Aug 1-15	92	95	97	21	15	13	+ 99	+ 99	+ 99	97	98	99
	Aug 16-31	98	98	+ 99	5	6	1	+ 99	+ 99	+ 99	99	98	99
	Sep	97	96	97	8	7	6	+ 99	+ 99	+ 99	96	95	95
	Oct	98	97	97	2	3	3	+ 99	+ 99	+ 99	95	89	90
	SUBTOTAL	97	98	98	28	25	17	+ 99	+ 99	+ 99	97	95	93
Adequate 2996 sim days 14 of 80 years	Apr												
	May												
	Jun 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jun 16-30	100	100	100				100	100	100	N/A	N/A	N/A
	Jul	+ 99	+ 99	100	1	1		+ 99	+ 99	100	+ 99	+ 99	N/A
	Aug 1-15	63	68	84	13	11	9	+ 99	99	+ 99	99	98	99
	Aug 16-31	86	87	95	8	5	5	+ 99	+ 99	+ 99	98	98	98
	Sep	77	73	79	11	11	10	99	98	99	96	94	95
	Oct	93	87	83	3	4	4	99	98	98	85	84	88
	SUBTOTAL	89	87	90	14	14	13	+ 99	99	99	96	94	93
Insufficient 2354 sim days 11 of 80 years	Apr												
	May												
	Jun 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jun 16-30	99	99	100	1	1		+ 99	+ 99	100	+ 99	+ 99	N/A
	Jul	74	80	92	5	6	2	99	99	+ 99	96	97	97
	Aug 1-15	79	81	79	4	4	5	99	99	98	97	95	89
	Aug 16-31	68	65	63	7	6	5	96	93	93	86	81	82
	Sep	65	64	65	6	6	6	93	93	93	80	79	80
	Oct	77	76	73	3	6	4	96	92	90	80	69	64
	SUBTOTAL	78	78	80	9	10	9	97	96	96	87	82	78
Deficit 2354 sim days 11 of 80 years	Apr												
	May												
	Jun 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jun 16-30	100	100	100				100	100	100	N/A	N/A	N/A
	Jul	87	86	89	2	3	5	99	99	99	93	93	95
	Aug 1-15	59	55	55	7	5	5	95	93	95	88	84	89
	Aug 16-31	55	53	54	5	6	6	91	90	92	79	79	83
	Sep	58	50	46	7	8	8	91	88	86	80	77	75
	Oct	62	57	55	6	7	8	91	89	86	77	74	70
	SUBTOTAL	73	69	69	9	8	8	95	94	93	81	79	78

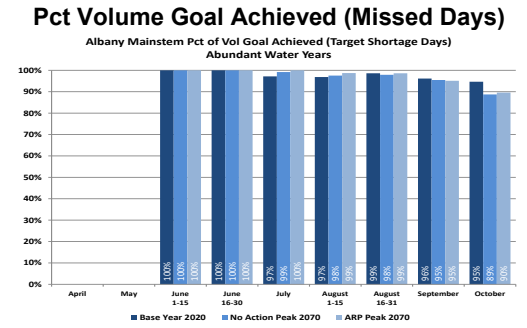
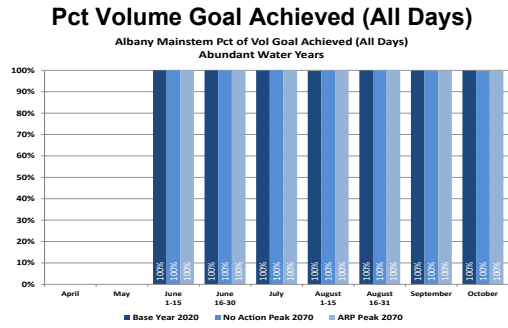
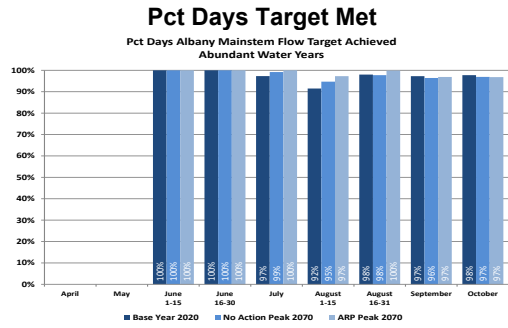
Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Oct = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

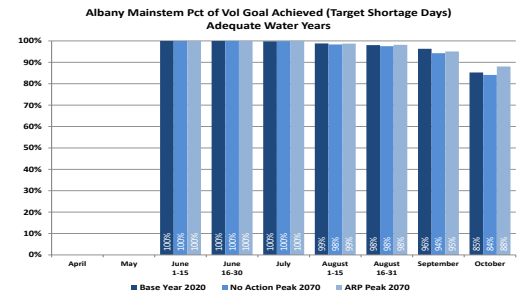
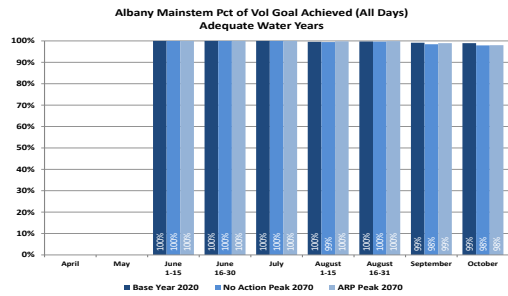
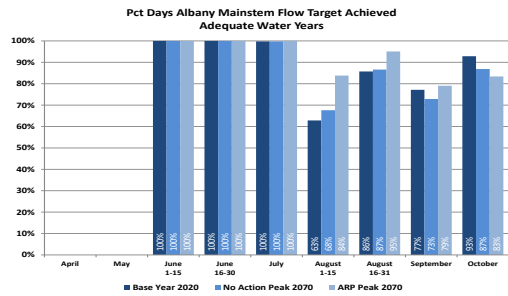
Figure 3B: Albany Mainstem Flow Objective Performance: Peak Diversions

■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

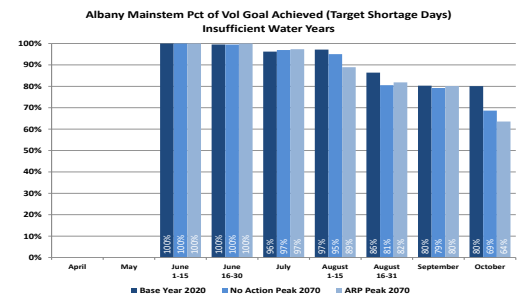
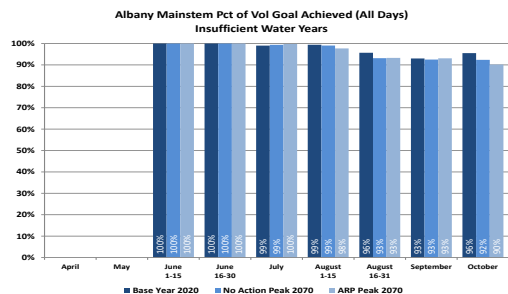
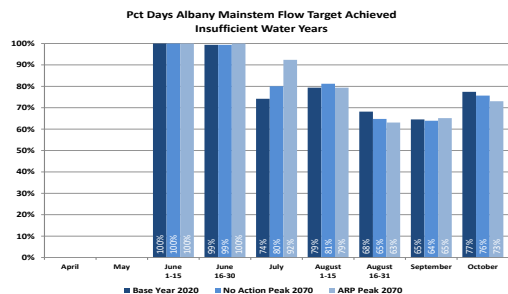
Abundant (n=44)



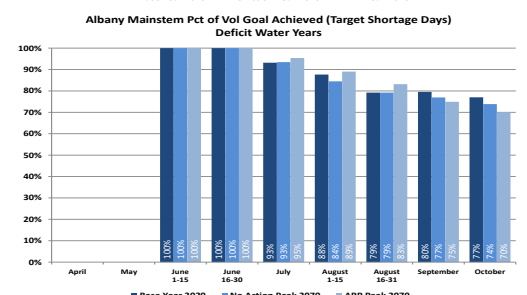
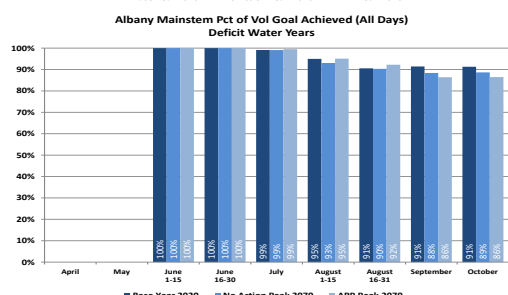
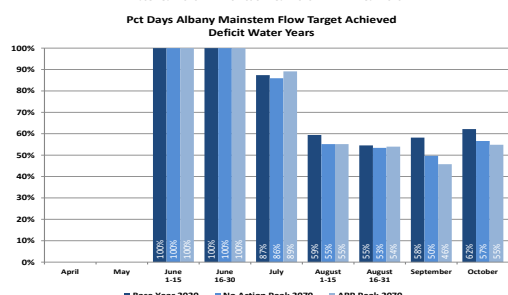
Adequate (n=14)



Insufficient (n=11)



Deficit (n=11)



9 Big Cliff

9.1 Big Cliff Reservoir - Tributary Flow Objective Performance – Expected Diversions

Table 9A provides summary metrics for the modeled Big Cliff Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp flow objectives are met across the four water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient: no notable difference; and
- Deficit: one percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 9A shows the following differences between the No Action Plan and the ARP as a percent of flow objective water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient: no notable difference; and
- Deficit: one percent **less** water provided under the ARP.

Table 9A: Big Cliff Tributary Flow Objective Performance Summary: Expected Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	+ 99	+ 99	+ 99
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	65	66	68
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	+ 99	+ 99	+ 99
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	78	75	71
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	97	97	97
Percent of Volume Met Over All Simulated Days	99	99	99
Percent of Volume Met Over Missed Objective Days	71	68	67
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	88	86	85
Percent of Volume Met Over All Simulated Days	95	95	94
Percent of Volume Met Over Missed Objective Days	66	64	63

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 9B and Figure 4A provide additional details and a graphic representation of select table data to aid in interpretation.

Table 9B: Big Cliff Tributary Flow Objective Performance Detail: Expected Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	98	98	99	27	21	15	99	99	+ 99	65	63	69
	Oct 1-15	99	99	99	8	5	7	+ 99	+ 99	+ 99	65	65	62
	Oct 16-31	+ 99	99	99	3	7	6	+ 99	+ 99	+ 99	64	77	74
	SUBTOTAL	+ 99	+ 99	+ 99	37	32	27	+ 99	+ 99	+ 99	65	66	68
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	99	99	+ 99	5	3	1	+ 99	+ 99	+ 99	78	73	56
	Oct 1-15	99	99	99	3	3	2	+ 99	+ 99	+ 99	77	83	79
	Oct 16-31	99	+ 99	100	3	1		+ 99	+ 99	100	79	51	N/A
	SUBTOTAL	+ 99	+ 99	+ 99	11	7	3	+ 99	+ 99	+ 99	78	75	71
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	91	91	90	1	2	2	98	98	98	80	82	84
	Oct 1-15	90	85	81	2	2	3	98	95	93	80	67	61
	Oct 16-31	91	91	90	1	1	2	95	95	94	40	40	42
	SUBTOTAL	97	97	97	2	3	4	99	99	99	71	68	67
Deficit 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	94	92	91	1	1	1	97	96	96	57	56	55
	Sep	59	55	52	5	5	6	88	87	86	71	71	71
	Oct 1-15	54	42	32	6	8	9	83	77	71	64	59	57
	Oct 16-31	66	66	66	5	5	5	85	85	85	57	56	56
	SUBTOTAL	88	86	85	6	8	9	95	95	94	66	64	63

Notes:

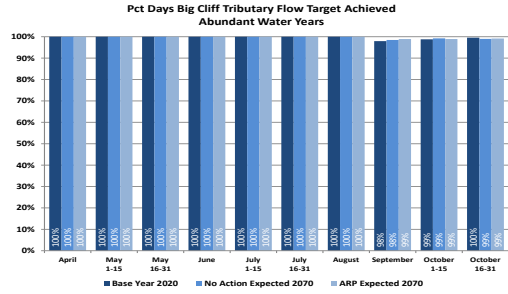
1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 4A: Big Cliff Tributary Flow Objective Performance: Expected Diversions

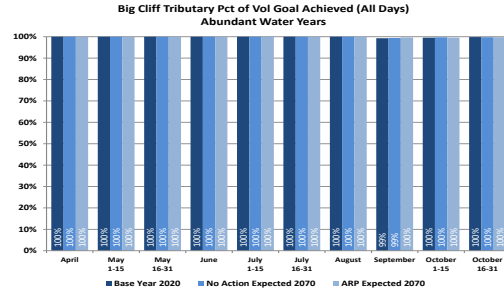
■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

Abundant (n=44)

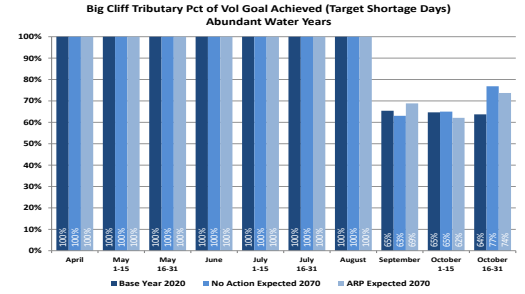
Pct Days Flow Objective Met



Pct Volume Goal Achieved (All Days)

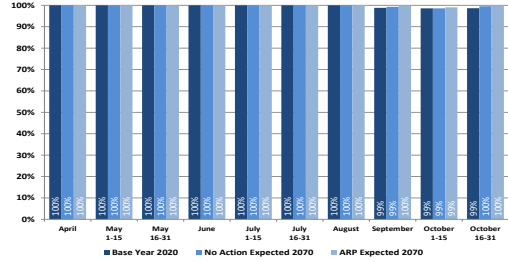


Pct Volume Goal Achieved (Missed Days)

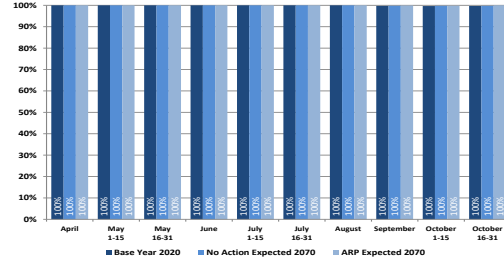


Adequate (n=14)

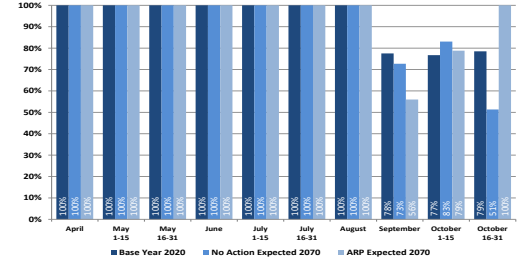
Pct Days Flow Objective Met



Pct Volume Goal Achieved (All Days)

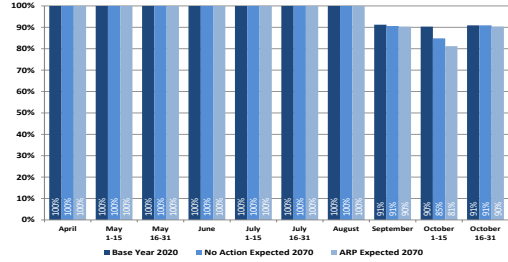


Pct Volume Goal Achieved (Missed Days)

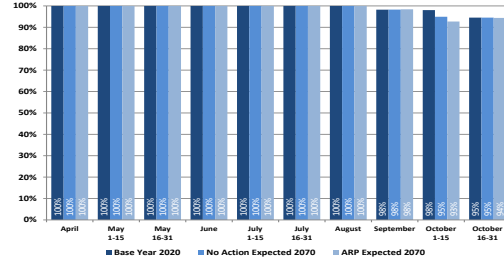


Insufficient (n=11)

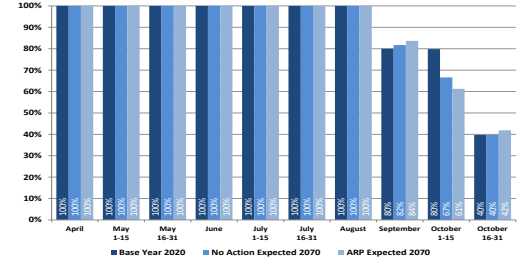
Pct Days Flow Objective Met



Pct Volume Goal Achieved (All Days)

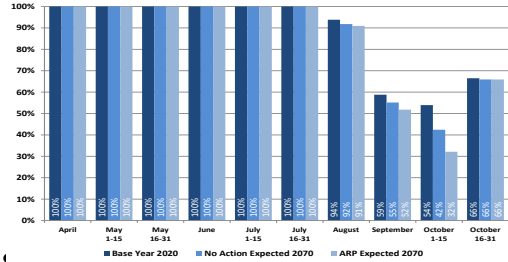


Pct Volume Goal Achieved (Missed Days)

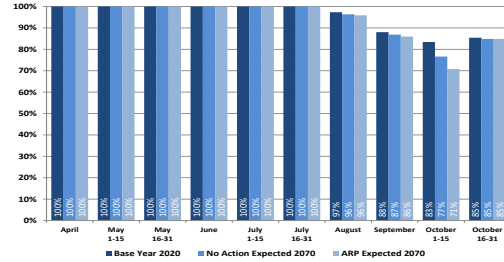


Deficit (n=11)

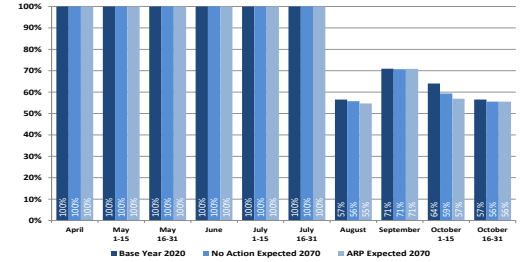
Pct Days Flow Objective Met



Pct Volume Goal Achieved (All Days)



Pct Volume Goal Achieved (Missed Days)



9.2 Big Cliff Reservoir - Tributary Flow Objective Performance – Peak Diversions

Table 9C provides summary metrics for the modeled Big Cliff Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp targets are met across the four water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient two percent **fewer** flow objective days met under the ARP; and
- Deficit five percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 9C shows the following differences between the No Action Plan and the ARP as a percent of target water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient one percent **less** water provided under the ARP; and
- Deficit two percent **less** water provided under the ARP.

Table 9C Big Cliff Tributary Flow Objective Performance Summary Peak Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	+ 99	+ 99	+ 99
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	65	69	70
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	+ 99	+ 99	+ 99
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	78	78	87
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	97	97	95
Percent of Volume Met Over All Simulated Days	99	99	98
Percent of Volume Met Over Missed Objective Days	71	67	66
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	88	85	80
Percent of Volume Met Over All Simulated Days	95	94	92
Percent of Volume Met Over Missed Objective Days	66	63	63

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 9D and Figure 4B provide additional details and a graphic representation of select table data to aid in interpretation.

Table 9D: Big Cliff Tributary Flow Objective Performance Detail: Peak Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	98	99	99	27	15	8	99	+ 99	+ 99	65	70	71
	Oct 1-15	99	99	99	8	9	6	+ 99	+ 99	+ 99	65	66	64
	Oct 16-31	+ 99	99	+ 99	3	6	2	+ 99	+ 99	+ 99	64	67	86
	SUBTOTAL	+ 99	+ 99	+ 99	37	29	16	+ 99	+ 99	+ 99	65	69	70
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	99	+ 99	+ 99	5	1	1	+ 99	+ 99	+ 99	78	76	93
	Oct 1-15	99	99	+ 99	3	2	1	+ 99	+ 99	+ 99	77	68	83
	Oct 16-31	99	99	+ 99	3	2	1	+ 99	+ 99	+ 99	79	93	85
	SUBTOTAL	+ 99	+ 99	+ 99	11	5	3	+ 99	+ 99	+ 99	78	78	87
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	91	90	86	1	3	2	98	98	97	80	82	76
	Oct 1-15	90	82	72	2	2	4	98	93	90	80	63	66
	Oct 16-31	91	90	84	1	2	3	95	94	91	40	41	46
	SUBTOTAL	97	97	95	2	4	4	99	99	98	71	67	66
Deficit 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	97			1	100	100	99	N/A	N/A	60
	Aug	94	91	88	1	1	2	97	96	95	57	55	57
	Sep	59	53	40	5	6	8	88	86	81	71	71	69
	Oct 1-15	54	36	10	6	8	10	83	73	64	64	57	60
	Oct 16-31	66	66	58	5	5	7	85	85	82	57	56	57
	SUBTOTAL	88	85	80	6	8	10	95	94	92	66	63	63

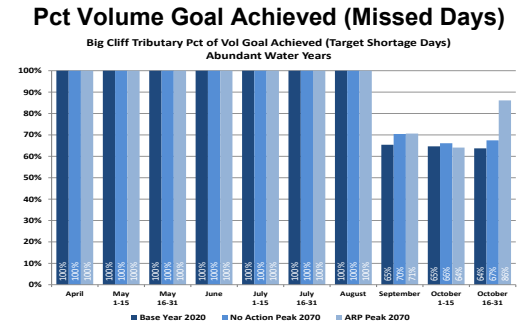
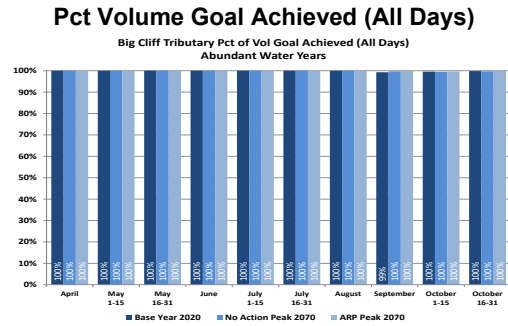
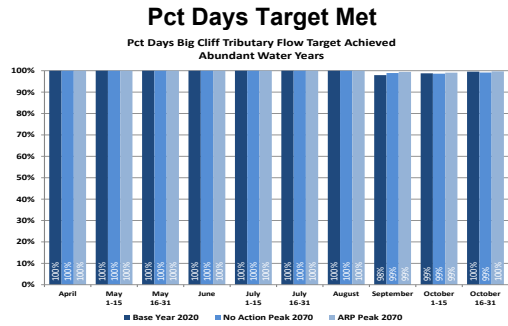
Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

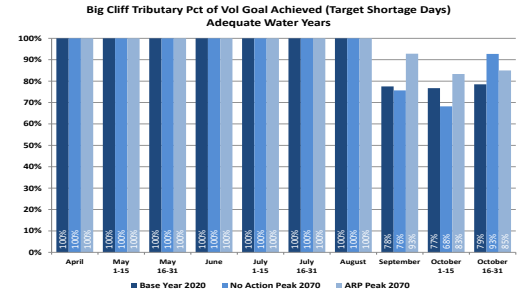
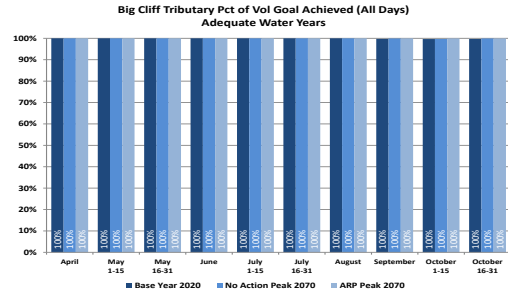
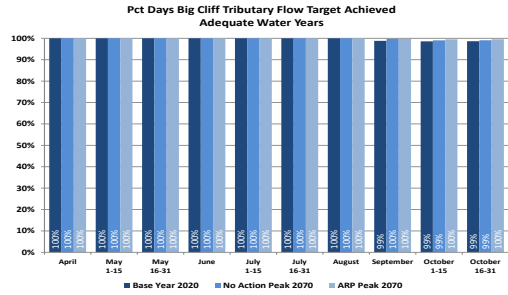
Figure 4B Big Cliff Tributary Flow Objective Performance: Peak Diversions

■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

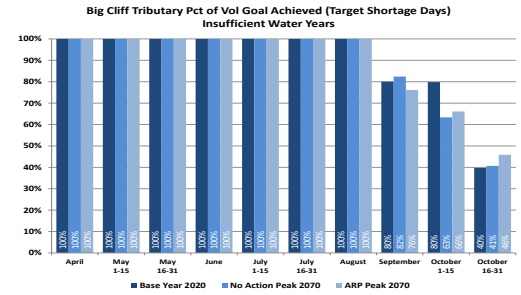
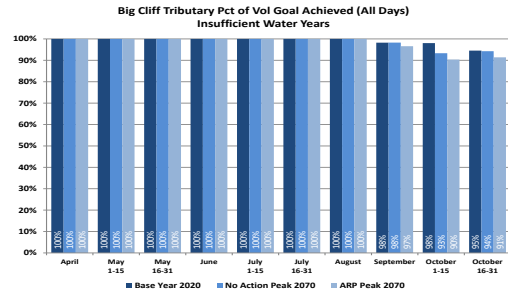
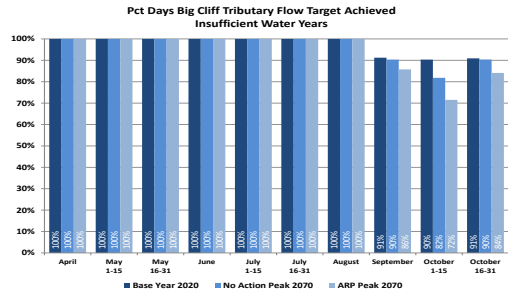
Abundant (n=44)



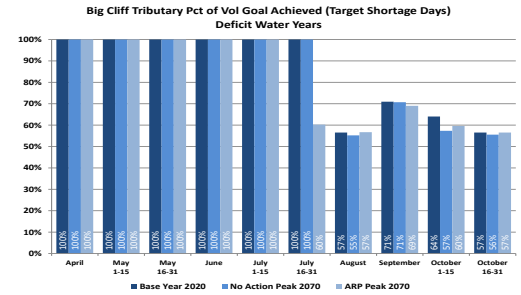
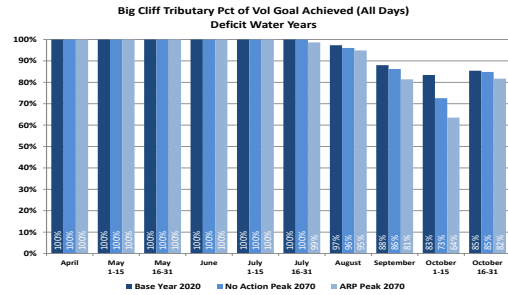
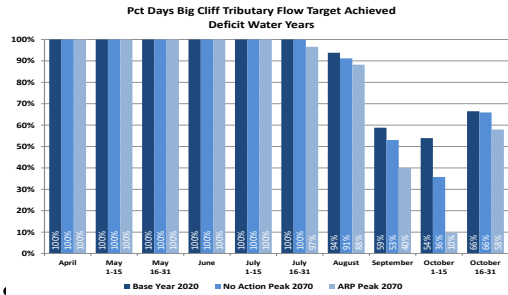
Adequate (n=14)



Insufficient (n=11)



Deficit (n=11)



10 Blue River

10.1 Blue River Reservoir Tributary Flow Objective Performance – Expected Diversions

Table 10A provides summary metrics for the modeled Blue River Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp flow objectives are met across the four water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient: no notable difference; and
- Deficit: one percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 10A shows the following differences between the No Action Plan and the ARP as a percent of flow objective water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient: no notable difference; and
- Deficit: less than one percent **less** water provided under the ARP.

Table 10A: Blue River Tributary Flow Objective Performance Summary: Expected Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	100	99	98
Percent of Volume Met Over All Simulated Days	100	+ 99	99
Percent of Volume Met Over Missed Objective Days	n/a	30	27

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 10B and Figure 5A provide additional details and a graphic representation of select table data to aid in interpretation.

Table 10B: Blue River Tributary Flow Objective Performance Detail: Expected Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Deficit 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	95			1	100	100	96	N/A	N/A	25
	Oct 1-15	100	100	91			1	100	100	93	N/A	N/A	28
	Oct 16-31	100	92	92		1	1	100	94	94	N/A	30	29
	SUBTOTAL	100	99	98		1	1	100	+ 99	99	0	30	27

Notes:

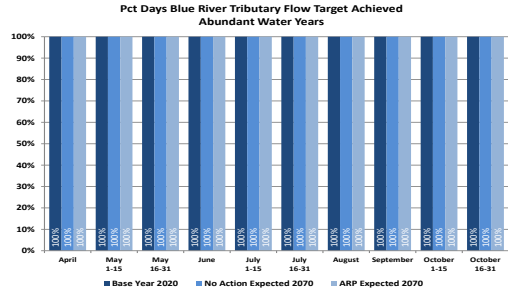
1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 5A: Blue River Tributary Flow Objective Performance: Expected Diversions

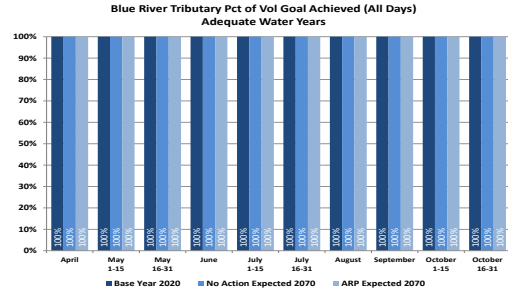
■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

Abundant (n=44)

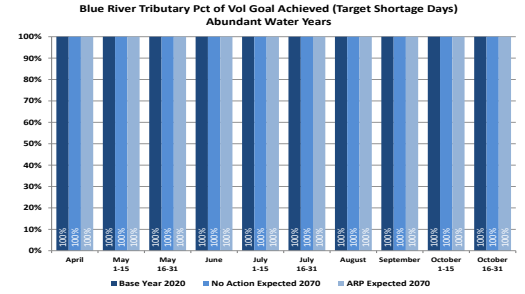
Pct Days Flow Objective Met



Pct Volume Goal Achieved (All Days)

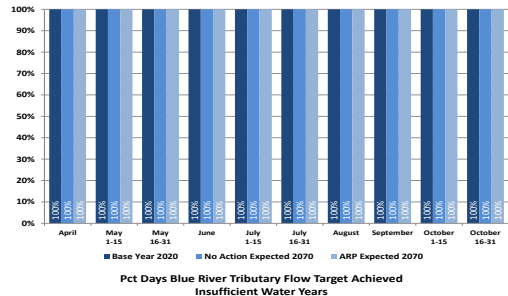


Pct Volume Goal Achieved (Missed Days)

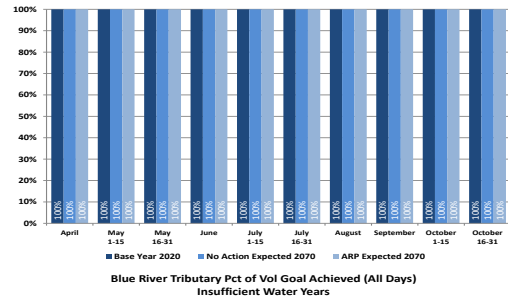


Adequate (n=14)

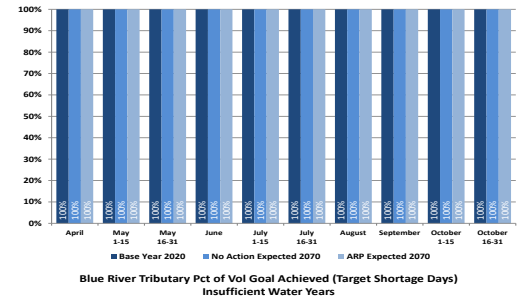
Pct Days Flow Objective Met



Pct Volume Goal Achieved (All Days)

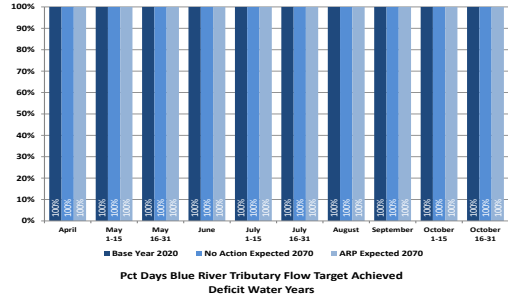


Pct Volume Goal Achieved (Missed Days)

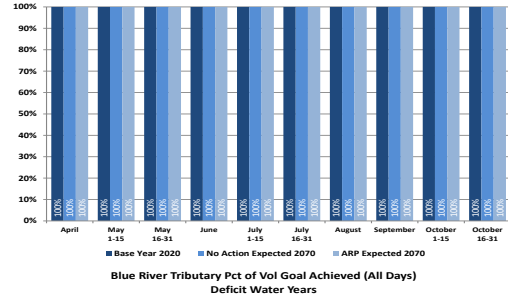


Insufficient (n=11)

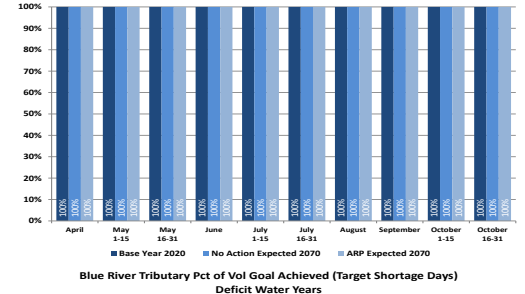
Pct Days Flow Objective Met



Pct Volume Goal Achieved (All Days)

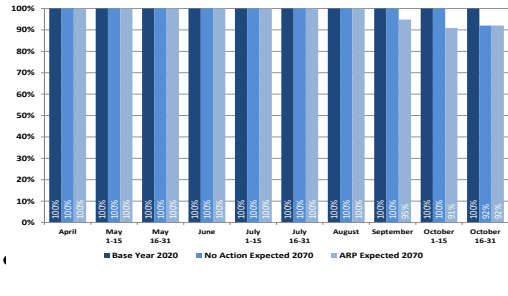


Pct Volume Goal Achieved (Missed Days)

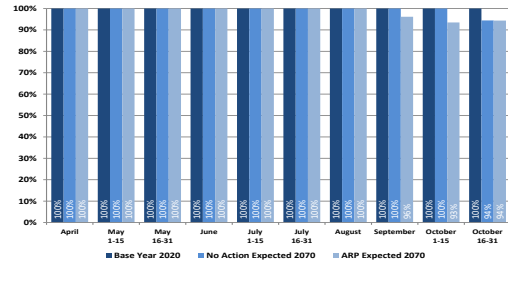


Deficit (n=11)

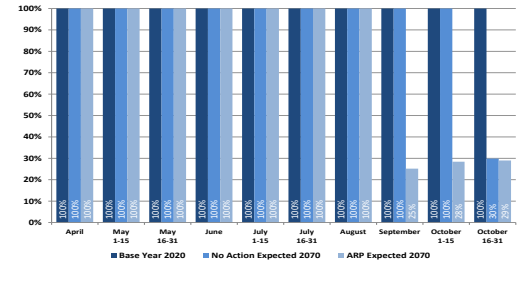
Pct Days Flow Objective Met



Pct Volume Goal Achieved (All Days)



Pct Volume Goal Achieved (Missed Days)



10.2 Blue River Reservoir Tributary Flow Objective Performance – Peak Diversions

Table 10C provides summary metrics for the modeled Blue River Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp targets are met across the four water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient no notable difference; and
- Deficit two percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 10C shows the following differences between the No Action Plan and the ARP as a percent of target water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient no notable difference; and
- Deficit one percent **less** water provided under the ARP.

Table 10C: Blue River Tributary Flow Objective Performance Summary Peak Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	100	99	97
Percent of Volume Met Over All Simulated Days	100	99	98
Percent of Volume Met Over Missed Objective Days	n/a	26	26

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 10D and Figure 5B provide additional details and a graphic representation of select table data to aid in interpretation.

Table 10D: Blue River Tributary Flow Objective Performance Detail: Peak Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Deficit 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	97			1	100	100	98	N/A	N/A	23
	Sep	100	100	92			1	100	100	94	N/A	N/A	25
	Oct 1-15	100	95	91		1	1	100	96	93	N/A	20	28
	Oct 16-31	100	92	92		1	1	100	94	94	N/A	29	29
	SUBTOTAL	100	99	97		1	1	100	99	98	0	26	26

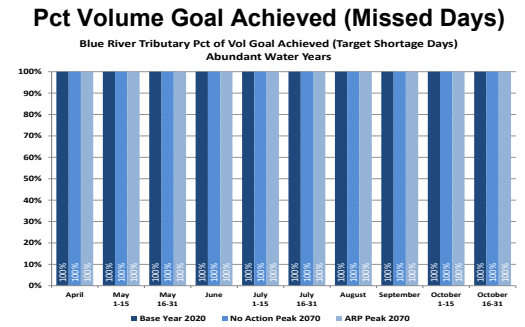
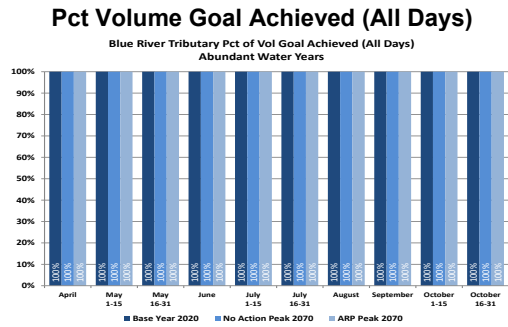
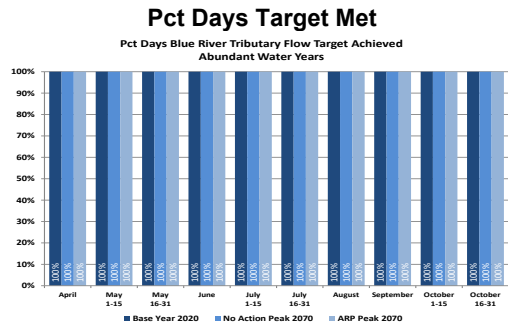
Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

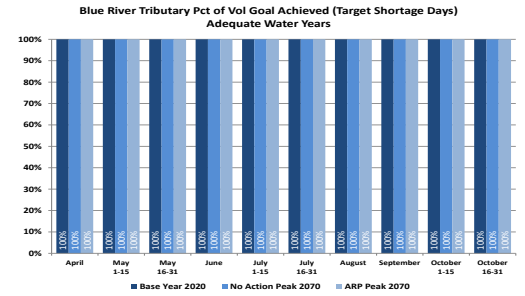
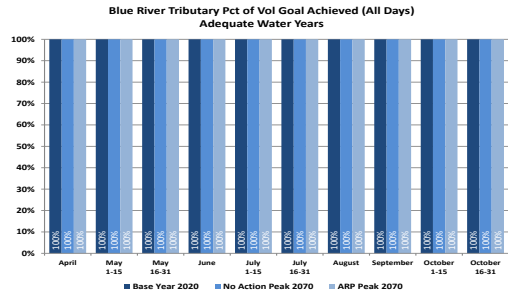
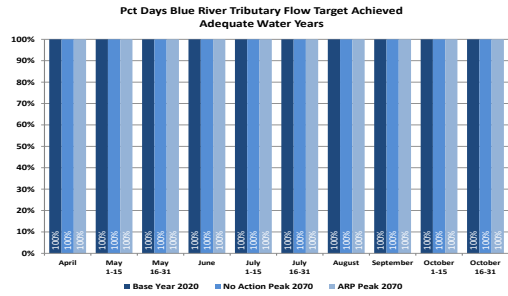
Figure 5B: Blue River BiOp Tributary Flow Objective Performance: Peak Diversions

■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

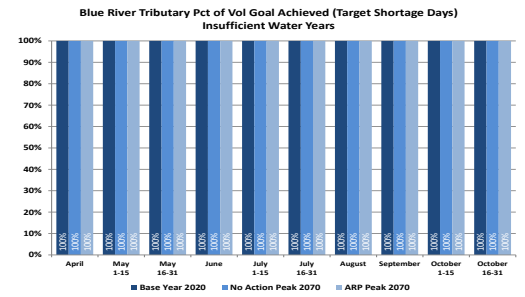
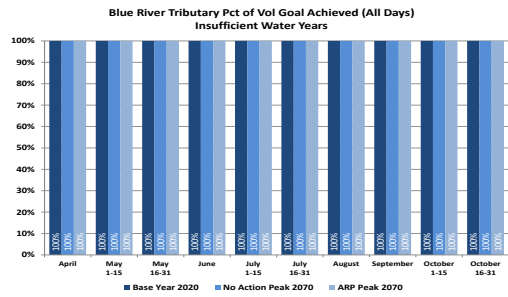
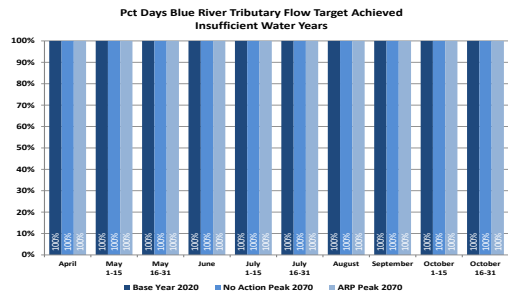
Abundant (n=44)



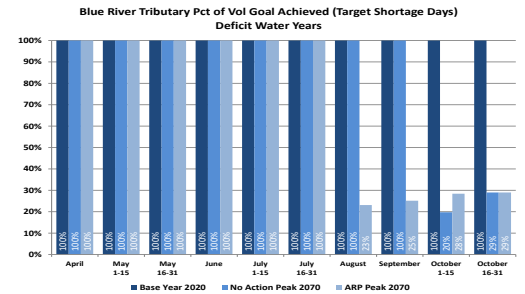
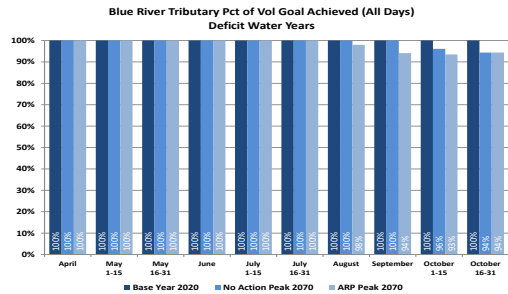
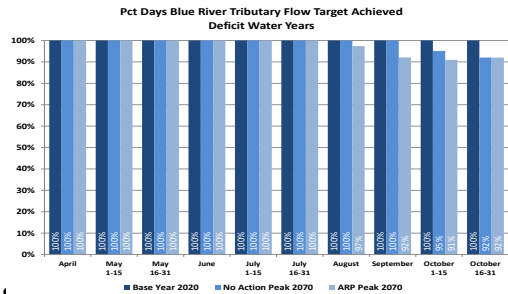
Adequate (n=14)



Insufficient (n=11)



Deficit (n=11)



11 Cougar

11.1 Cougar Reservoir - Tributary Flow Objective Performance – Expected Diversions

Table 11A provides summary metrics for the modeled Cougar Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp flow objectives are met across the four water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient: no notable difference; and
- Deficit: one percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 11A shows the following differences between the No Action Plan and the ARP as a percent of flow objective water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient: no notable difference; and
- Deficit: no notable difference.

Table 11A: Cougar Tributary Flow Objective Performance Summary Expected Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	99	99	+ 99
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	69	71	43
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	97	97	97
Percent of Volume Met Over All Simulated Days	98	99	99
Percent of Volume Met Over Missed Objective Days	52	52	53
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	89	89	88
Percent of Volume Met Over All Simulated Days	94	94	94
Percent of Volume Met Over Missed Objective Days	46	45	45

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 11B and Figure 6A provide additional details and a graphic representation of select table data to aid in interpretation.

Table 11B: Cougar Tributary Flow Objective Performance Detail: Expected Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	98	97	100	1	1		+ 99	+ 99	100	89	90	N/A
	Oct 16-31	94	94	98	2	2	1	98	98	99	63	62	43
	SUBTOTAL	99	99	+ 99	2	2	1	+ 99	+ 99	+ 99	69	71	43
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	97	97	98	1	1	1	98	98	99	38	41	38
	Oct 1-15	83	87	90	3	3	2	91	93	95	49	49	48
	Oct 16-31	77	77	77	3	3	3	90	90	90	57	57	58
	SUBTOTAL	97	97	97	3	3	3	98	99	99	52	52	53
Deficit 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	91	90	89	2	2	2	95	94	94	44	43	42
	Sep	72	70	70	5	5	5	84	83	83	43	41	42
	Oct 1-15	55	55	55	5	5	5	74	74	74	44	44	44
	Oct 16-31	65	65	65	5	5	5	83	83	83	52	52	52
	SUBTOTAL	89	89	88	5	5	5	94	94	94	46	45	45

Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 6A: Cougar Tributary Flow Objective Performance: Expected Diversions

■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

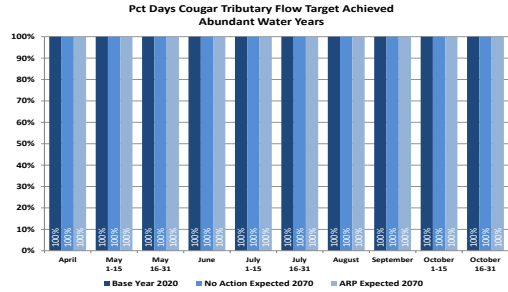
Abundant (n=44)

Adequate (n=14)

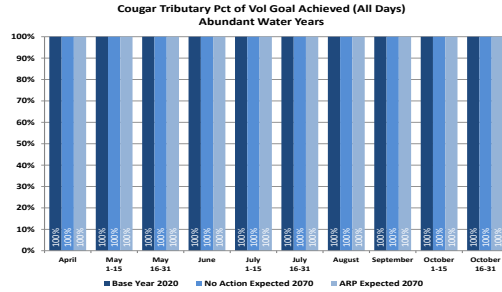
Insufficient (n=11)

Deficit (n=11)

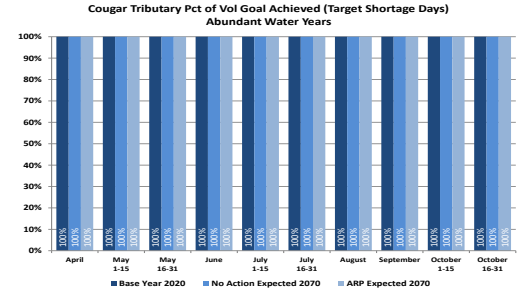
Pct Days Flow Objective Met



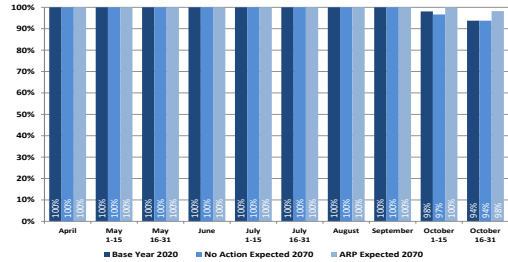
Pct Volume Goal Achieved (All Days)



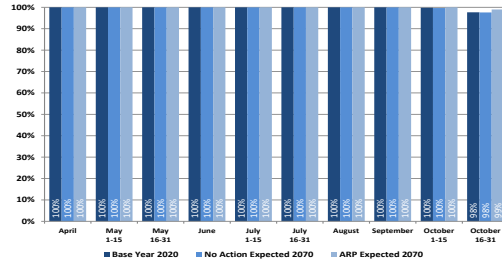
Pct Volume Goal Achieved (Missed Days)



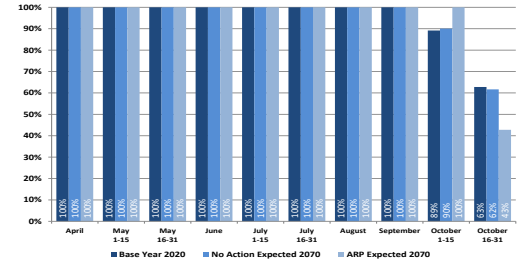
Pct Days Cougar Tributary Flow Target Achieved



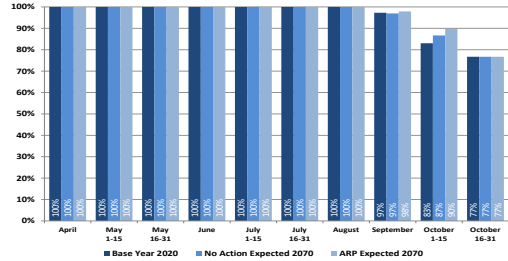
Cougar Tributary Pct of Vol Goal Achieved (All Days)



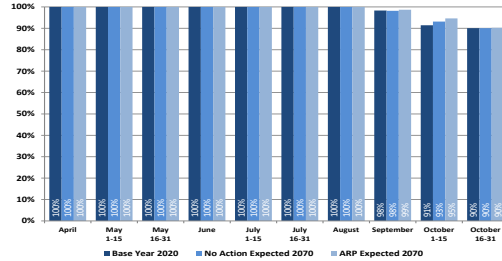
Cougar Tributary Pct of Vol Goal Achieved (Target Shortage Days)



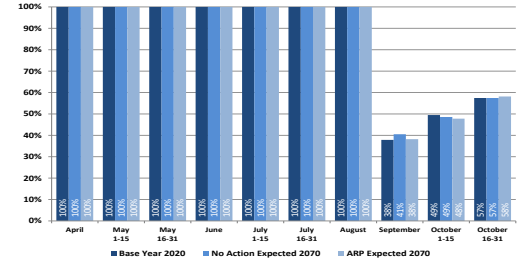
Pct Days Cougar Tributary Flow Target Achieved



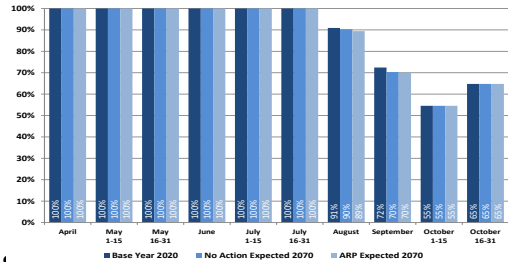
Cougar Tributary Pct of Vol Goal Achieved (All Days)



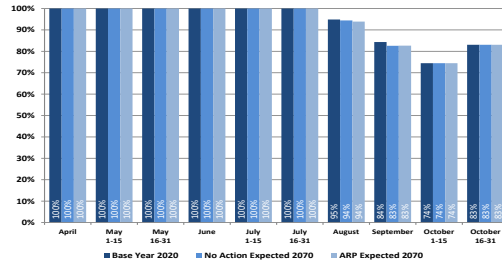
Cougar Tributary Pct of Vol Goal Achieved (Target Shortage Days)



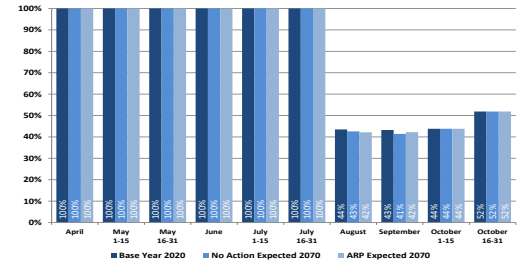
Pct Days Cougar Tributary Flow Target Achieved



Cougar Tributary Pct of Vol Goal Achieved (All Days)



Cougar Tributary Pct of Vol Goal Achieved (Target Shortage Days)



11.2 Cougar Reservoir - Tributary Flow Objective Performance – Peak Diversions

Table 11C provides summary metrics for the modeled Cougar Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp targets are met across the four water year types:

- Abundant: no notable difference;
- Adequate: less than one percent **more** flow objective days met under the ARP;
- Insufficient: no notable difference; and
- Deficit: one percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 11C shows the following differences between the No Action Plan and the ARP as a percent of target water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient: one percent **more** water provided under the ARP; and
- Deficit: one percent **less** water provided under the ARP.

Table 11C: Cougar Tributary Flow Objective Performance Summary: Peak Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	99	99	+ 99
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	+ 99
Percent of Volume Met Over Missed Objective Days	69	68	45
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	97	97	97
Percent of Volume Met Over All Simulated Days	98	98	99
Percent of Volume Met Over Missed Objective Days	52	52	53
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	89	89	88
Percent of Volume Met Over All Simulated Days	94	94	93
Percent of Volume Met Over Missed Objective Days	46	44	45

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 11D and Figure 6B provide additional details and a graphic representation of select table data to aid in interpretation.

Table 11D: Cougar Tributary Flow Objective Performance Detail: Peak Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	98	98	100	1	1		+ 99	+ 99	100	89	89	N/A
	Oct 16-31	94	94	98	2	2	1	98	98	99	63	61	45
	SUBTOTAL	99	99	+ 99	2	2	1	+ 99	+ 99	+ 99	69	68	45
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	97	96	98	1	1	1	98	98	99	38	38	41
	Oct 1-15	83	85	88	3	3	2	91	92	94	49	48	46
	Oct 16-31	77	77	78	3	3	3	90	90	91	57	57	59
	SUBTOTAL	97	97	97	3	3	3	98	98	99	52	52	53
Deficit 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	91	90	89	2	2	2	95	94	93	44	41	42
	Sep	72	70	69	5	5	5	84	83	82	43	41	42
	Oct 1-15	55	55	55	5	5	5	74	74	74	44	44	44
	Oct 16-31	65	65	65	5	5	5	83	83	83	52	52	52
	SUBTOTAL	89	89	88	5	5	5	94	94	93	46	44	45

Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 6B: Cougar Tributary Flow Objective Performance: Peak Diversions

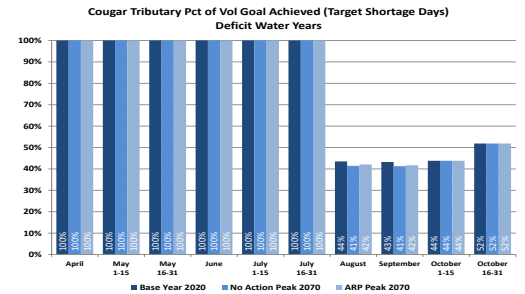
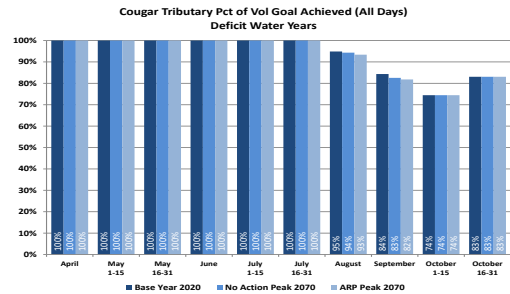
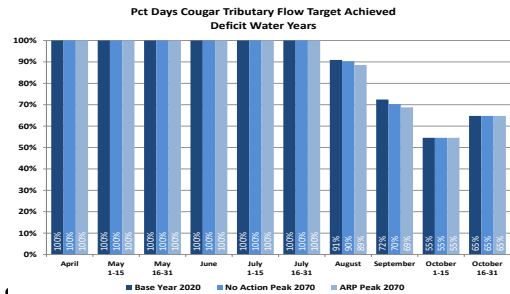
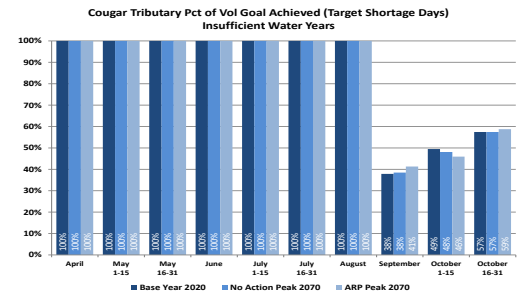
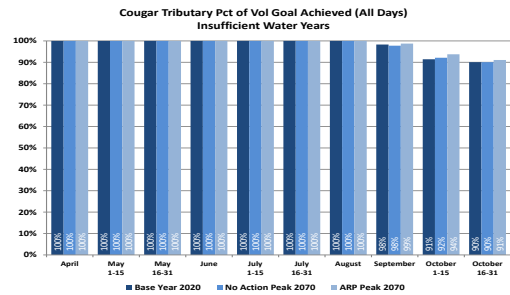
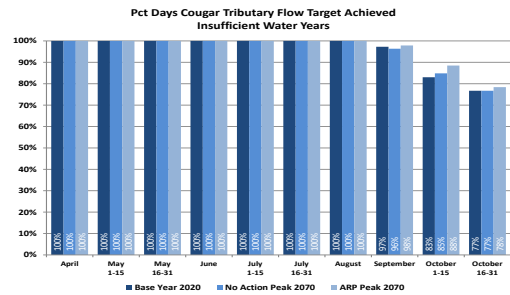
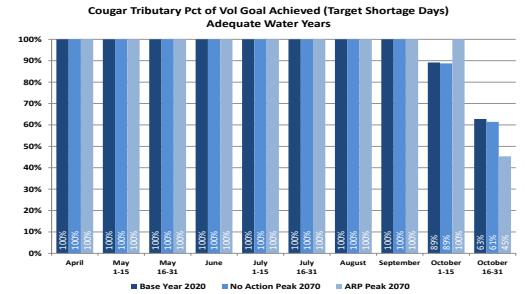
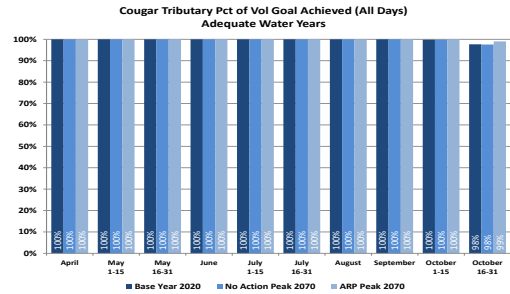
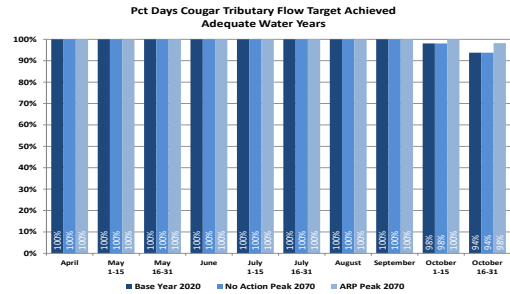
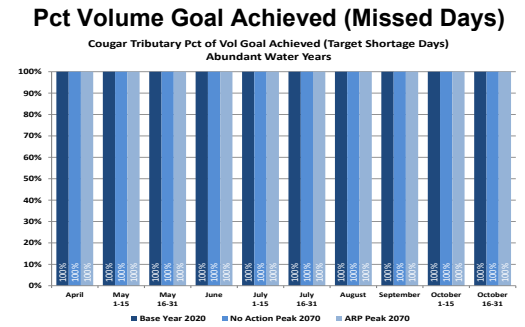
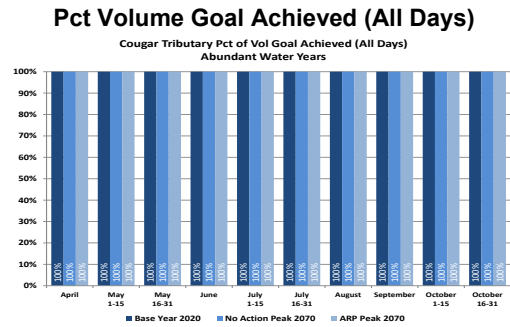
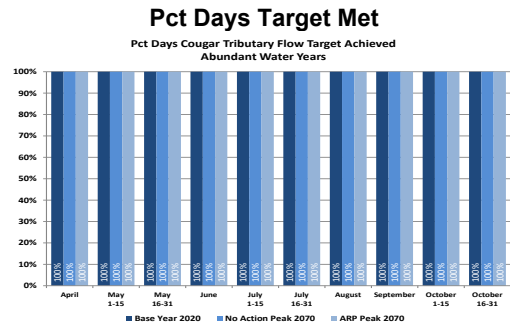
■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

Abundant (n=44)

Adequate (n=14)

Insufficient (n=11)

Deficit (n=11)



12 Dexter

12.1 Dexter Reservoir - Tributary Flow Objective Performance – Expected Diversions

Table 12A provides summary metrics for the modeled Dexter Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp flow objectives are met across the four water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient one percent **fewer** flow objective days met under the ARP; and
- Deficit two percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 12A shows the following differences between the No Action Plan and the ARP as a percent of flow objective water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient no notable difference; and
- Deficit one percent **less** water provided under the ARP.

**Table 12A: Dexter Tributary Flow Objective Performance Summary
Expected Diversions**

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	+ 99	99	98
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	99
Percent of Volume Met Over Missed Objective Days	75	64	54
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	97	95	93
Percent of Volume Met Over All Simulated Days	99	98	97
Percent of Volume Met Over Missed Objective Days	61	59	60

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 12B and Figure 7A provide additional details and a graphic representation of select table data to aid in interpretation.

Table 12B: Dexter Tributary Flow Objective Performance Detail: Expected Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	89			3	100	100	94	N/A	N/A	47
	Oct 16-31	94	82	79	2	3	3	98	94	91	75	64	57
	SUBTOTAL	+ 99	99	98	2	3	3	+ 99	+ 99	99	75	64	54
Deficit 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	+ 99			1	100	100	+ 99	N/A	N/A	84
	Sep	94	89	82	2	2	3	98	96	93	63	65	63
	Oct 1-15	82	76	67	2	3	4	93	90	84	60	57	51
	Oct 16-31	86	80	66	4	4	5	95	91	88	62	56	64
	SUBTOTAL	97	95	93	4	4	5	99	98	97	61	59	60

Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 7A: Dexter Tributary Flow Objective Performance: Expected Diversions

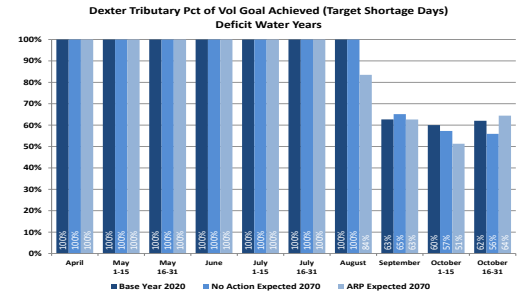
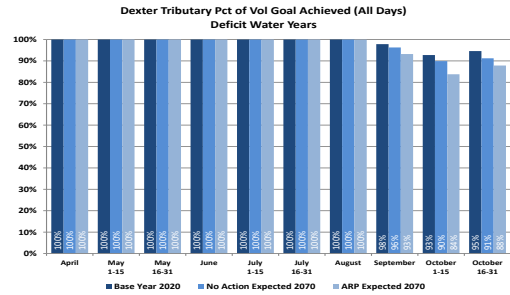
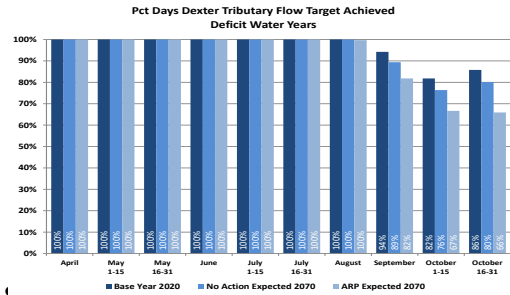
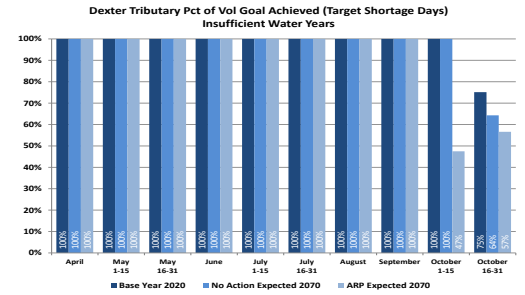
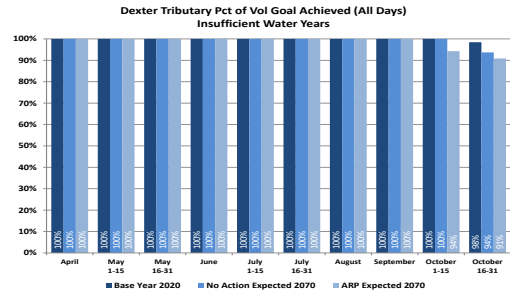
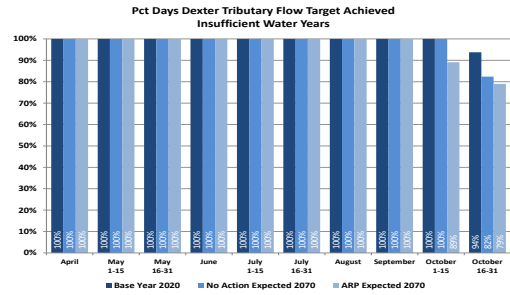
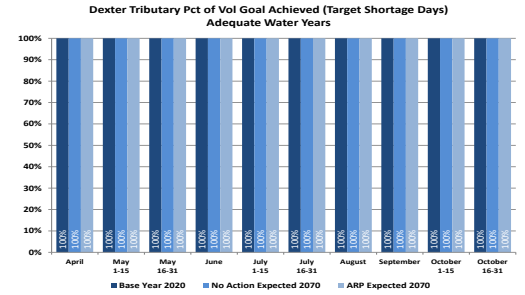
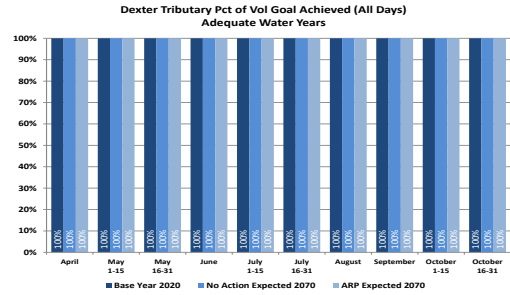
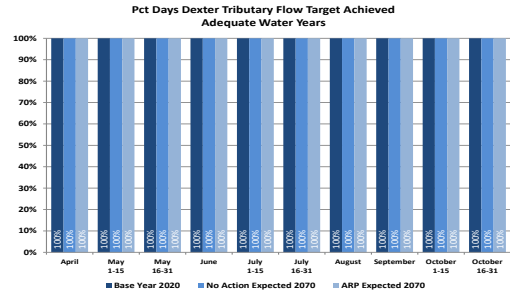
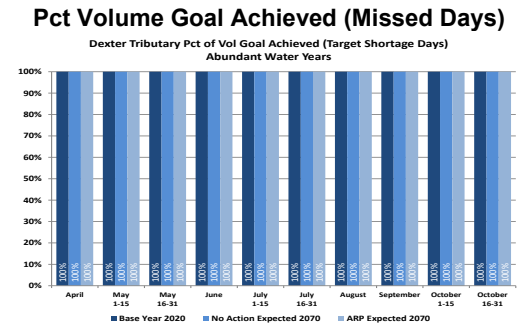
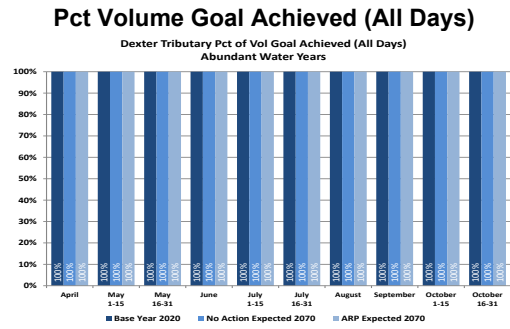
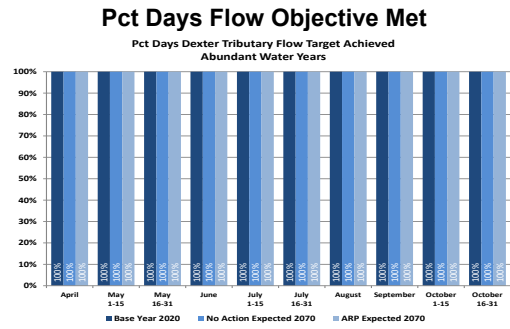
■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

Abundant (n=44)

Adequate (n=14)

Insufficient (n=11)

Deficit (n=11)



12.2 Dexter Reservoir - Tributary Flow Objective Performance – Peak Diversions

Table 12C provides summary metrics for the modeled Dexter Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp targets are met across the four water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient: three percent **fewer** flow objective days met under the ARP; and
- Deficit: five percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 12C shows the following differences between the No Action Plan and the ARP as a percent of target water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient: one percent **less** water provided under the ARP; and
- Deficit: two percent **less** water provided under the ARP.

**Table 12C: Dexter Tributary Flow Objective Performance Summary
Peak Diversions**

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	+ 99	99	96
Percent of Volume Met Over All Simulated Days	+ 99	99	98
Percent of Volume Met Over Missed Objective Days	75	59	54
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	97	95	90
Percent of Volume Met Over All Simulated Days	99	98	96
Percent of Volume Met Over Missed Objective Days	61	58	61

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 12D and Figure 7B provide additional details and a graphic representation of select table data to aid in interpretation.

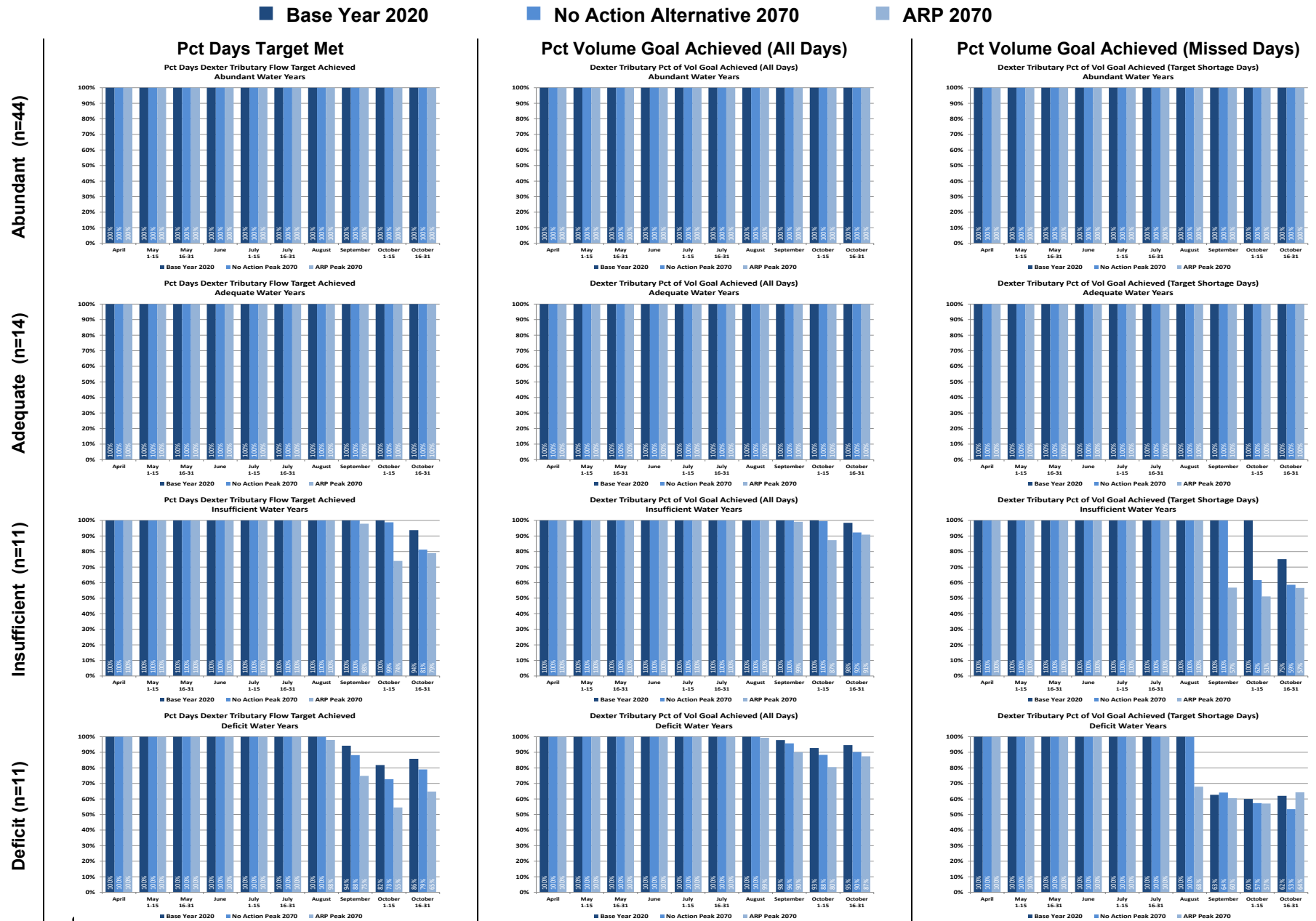
Table 12D: Dexter Tributary Flow Objective Performance Detail: Peak Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	98			2	100	100	99	N/A	N/A	57
	Oct 1-15	100	99	74			2	100	+ 99	87	N/A	62	51
	Oct 16-31	94	81	79	2	3	3	98	92	91	75	59	57
	SUBTOTAL	+ 99	99	96	2	3	3	+ 99	99	98	75	59	54
Deficit 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	98			1	100	100	99	N/A	N/A	68
	Sep	94	88	75	2	2	5	98	96	90	63	64	60
	Oct 1-15	82	73	55	2	4	5	93	88	80	60	57	57
	Oct 16-31	86	79	65	4	4	5	95	90	87	62	53	64
	SUBTOTAL	97	95	90	4	4	5	99	98	96	61	58	61

Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 7B: Dexter BiOp Tributary Flow Objective Performance – Peak Diversions



13 Fall Creek

13.1 Fall Creek Res - Tributary Flow Objective Performance – Expected Diversions

Table 13A provides summary metrics for the modeled Fall Creek Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp flow objectives are met across the four water year types:

- Abundant: no notable difference;
- Adequate: three percent **fewer** flow objective days met under the ARP;
- Insufficient: three percent **fewer** flow objective days met under the ARP; and
- Deficit: two percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 13A shows the following differences between the No Action Plan and the ARP as a percent of flow objective water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: three percent **less** water provided under the ARP;
- Insufficient: three percent **less** water provided under the ARP; and
- Deficit: three percent **less** water provided under the ARP.

Table 13A: Fall Creek Tributary Flow Objective Performance Summary: Expected Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	99	99	99
Percent of Volume Met Over All Simulated Days	99	99	99
Percent of Volume Met Over Missed Objective Days	23	27	34
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	98	98	95
Percent of Volume Met Over All Simulated Days	98	98	95
Percent of Volume Met Over Missed Objective Days	32	37	34
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	99	97	94
Percent of Volume Met Over All Simulated Days	+ 99	98	95
Percent of Volume Met Over Missed Objective Days	39	36	34
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	97	95	93
Percent of Volume Met Over All Simulated Days	96	94	91
Percent of Volume Met Over Missed Objective Days	9	19	17

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 13B and Figure 8A provide additional details and a graphic representation of select table data to aid in interpretation.

Table 13B: Fall Creek Tributary Flow Objective Performance Detail: Expected Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	+ 99	98	98	1	3	2	+ 99	99	99	16	26	37
	Oct 1-15	94	94	95	5	4	3	95	95	97	18	24	28
	Oct 16-31	96	97	95	5	3	6	98	99	97	50	51	47
	SUBTOTAL	99	99	99	7	5	7	99	99	99	23	27	34
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	97			1	100	100	97	N/A	N/A	1
	Sep	100	99	90		1	3	100	99	93	N/A	19	27
	Oct 1-15	84	81	73	3	3	4	88	88	84	26	33	40
	Oct 16-31	90	90	90	3	3	3	97	97	97	69	69	69
	SUBTOTAL	98	98	95	3	3	4	98	98	95	32	37	34
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	98	95		1	2	100	99	97	N/A	48	34
	Oct 1-15	98	90	68	1	2	6	98	92	78	30	18	31
	Oct 16-31	88	73	65	6	6	6	93	87	82	46	53	49
	SUBTOTAL	99	97	94	6	6	7	+ 99	98	95	39	36	34
Deficit 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	98	95	87	2	2	4	98	95	88	5	6	5
	Oct 1-15	78	66	52	4	4	6	80	73	62	8	21	21
	Oct 16-31	80	74	71	4	4	5	83	82	79	17	29	26
	SUBTOTAL	97	95	93	5	5	6	96	94	91	9	19	17

Notes:

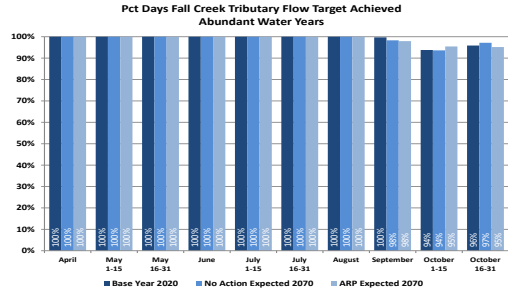
1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 8A: Fall Creek Tributary Flow Objective Performance: Expected Diversions

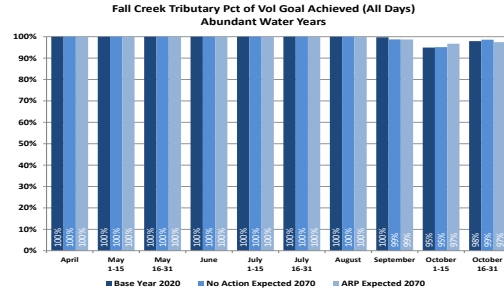
■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

Abundant (n=44)

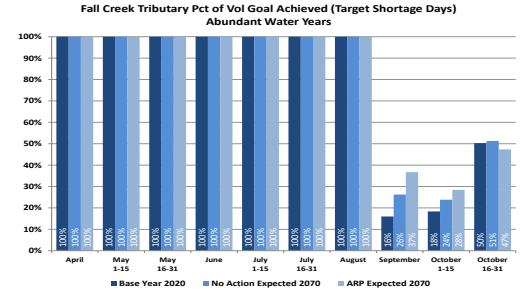
Pct Days Flow Objective Met



Pct Volume Goal Achieved (All Days)

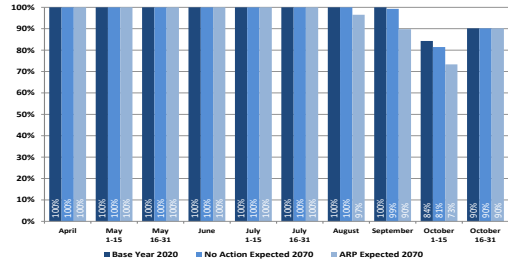


Pct Volume Goal Achieved (Missed Days)

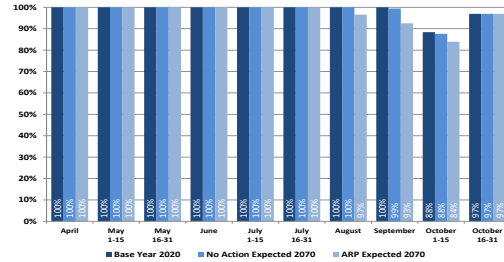


Adequate (n=14)

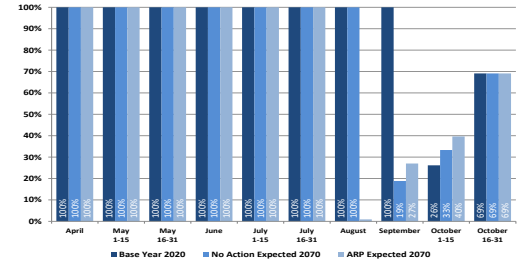
Pct Days Fall Creek Tributary Flow Target Achieved Adequate Water Years



Fall Creek Tributary Pct of Vol Goal Achieved (All Days) Adequate Water Years

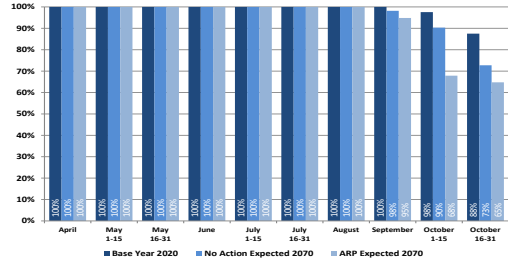


Fall Creek Tributary Pct of Vol Goal Achieved (Target Shortage Days) Adequate Water Years

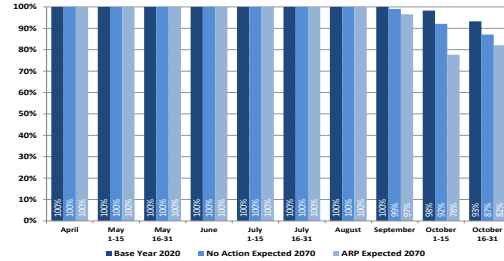


Insufficient (n=11)

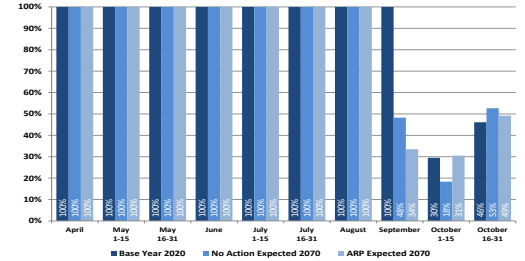
Pct Days Fall Creek Tributary Flow Target Achieved Insufficient Water Years



Fall Creek Tributary Pct of Vol Goal Achieved (All Days) Insufficient Water Years

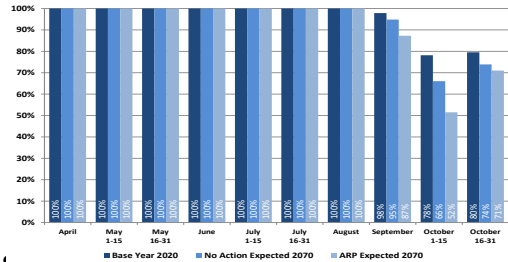


Fall Creek Tributary Pct of Vol Goal Achieved (Target Shortage Days) Insufficient Water Years

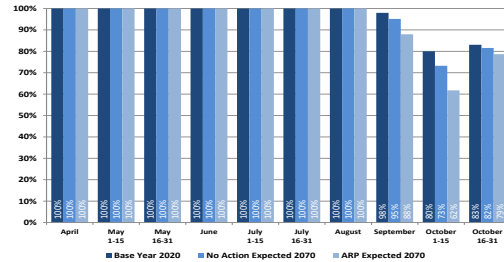


Deficit (n=11)

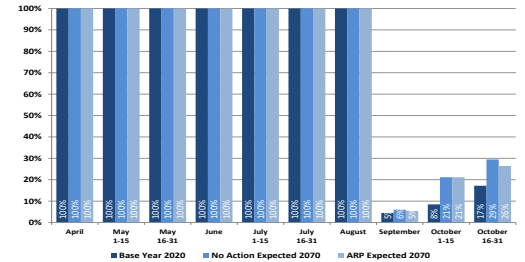
Pct Days Fall Creek Tributary Flow Target Achieved Deficit Water Years



Fall Creek Tributary Pct of Vol Goal Achieved (All Days) Deficit Water Years



Fall Creek Tributary Pct of Vol Goal Achieved (Target Shortage Days) Deficit Water Years



13.2 Fall Creek Reservoir - Tributary Flow Objective Performance – Peak Diversions

Table 13C provides summary metrics for the modeled Fall Creek Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp targets are met across the four water year types:

- Abundant: no notable difference;
- Adequate: three percent **fewer** flow objective days met under the ARP;
- Insufficient: five percent **fewer** flow objective days met under the ARP; and
- Deficit: three percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 13C shows the following differences between the No Action Plan and the ARP as a percent of target water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: two percent **less** water provided under the ARP;
- Insufficient: six percent **less** water provided under the ARP; and
- Deficit: six percent **less** water provided under the ARP.

Table 13C: Fall Creek Tributary Flow Objective Performance Summary Peak Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	99	99	99
Percent of Volume Met Over All Simulated Days	99	99	99
Percent of Volume Met Over Missed Objective Days	23	28	38
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	98	97	94
Percent of Volume Met Over All Simulated Days	98	96	94
Percent of Volume Met Over Missed Objective Days	32	32	37
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	99	97	92
Percent of Volume Met Over All Simulated Days	+ 99	98	92
Percent of Volume Met Over Missed Objective Days	39	34	28
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	97	94	91
Percent of Volume Met Over All Simulated Days	96	94	88
Percent of Volume Met Over Missed Objective Days	9	19	15

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 13D and Figure 8B provide additional details and a graphic representation of select table data to aid in interpretation.

Table 13D: Fall Creek Tributary Flow Objective Performance Detail: Peak Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	+ 99	99	97	1	2	3	+ 99	99	98	16	12	44
	Oct 1-15	94	94	93	5	4	5	95	96	95	18	28	30
	Oct 16-31	96	96	93	5	5	6	98	98	96	50	48	42
	SUBTOTAL	99	99	99	7	6	8	99	99	99	23	28	38
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	98	95		1	1	100	99	95	N/A	57	8
	Sep	100	93	83		1	4	100	94	89	N/A	20	35
	Oct 1-15	84	80	73	3	3	4	88	87	84	26	34	40
	Oct 16-31	90	90	90	3	3	3	97	97	97	69	69	69
	SUBTOTAL	98	97	94	3	3	4	98	96	94	32	32	37
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	98	91		1	4	100	99	93	N/A	41	26
	Oct 1-15	98	89	45	1	2	8	98	91	59	30	18	25
	Oct 16-31	88	70	60	6	6	7	93	86	81	46	53	52
	SUBTOTAL	99	97	92	6	6	8	+ 99	98	92	39	34	28
Deficit 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	98	93	80	2	3	6	98	94	81	5	9	6
	Oct 1-15	78	63	46	4	5	6	80	71	57	8	21	21
	Oct 16-31	80	73	70	4	5	5	83	81	78	17	30	25
	SUBTOTAL	97	94	91	5	6	6	96	94	88	9	19	15

Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 8B: Fall Creek Tributary Flow Objective Performance: Peak Diversions

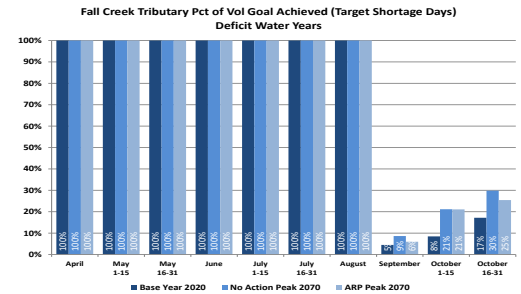
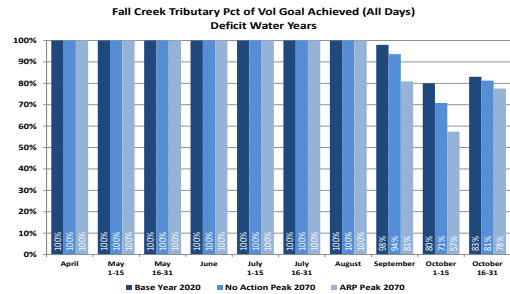
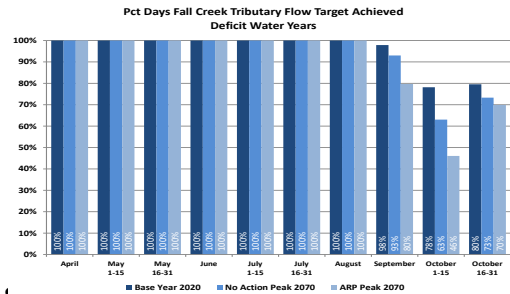
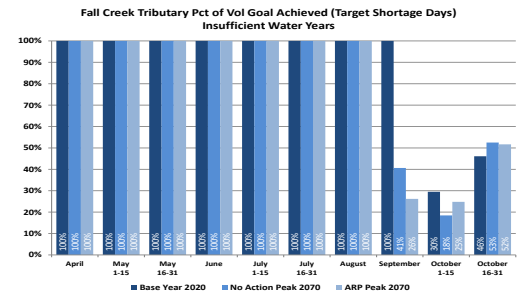
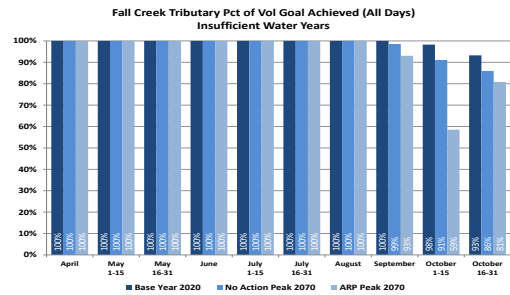
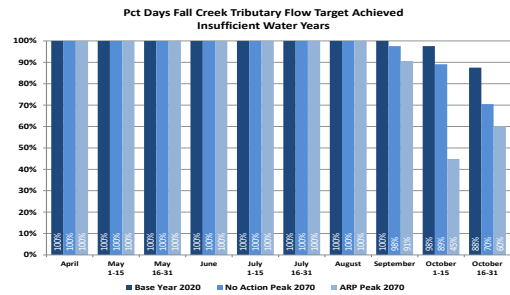
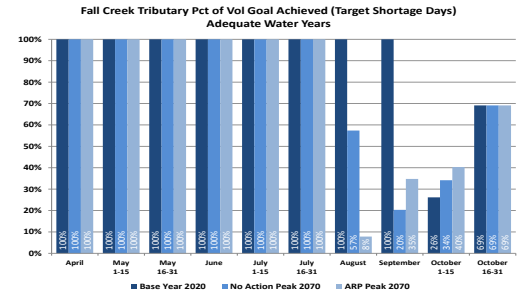
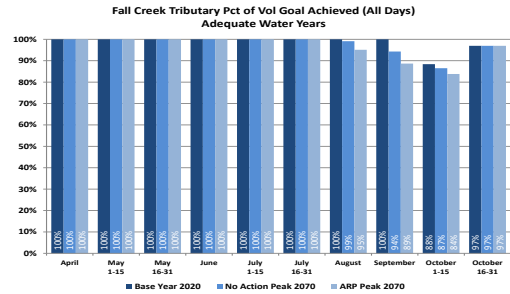
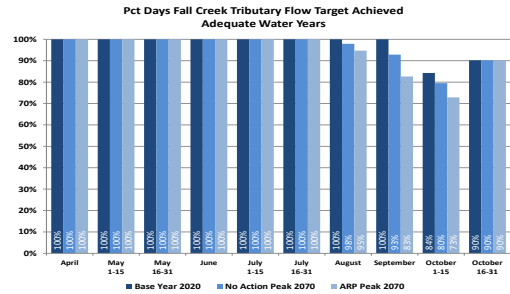
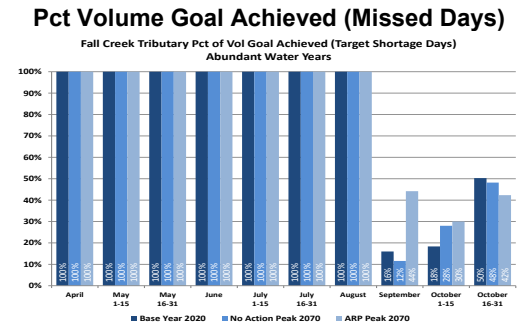
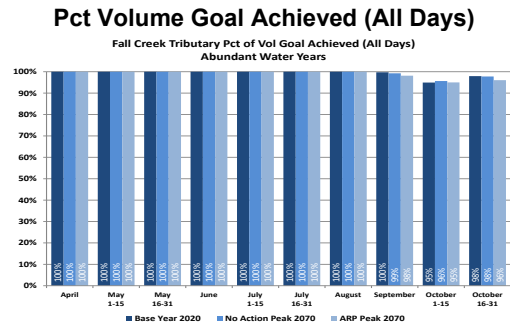
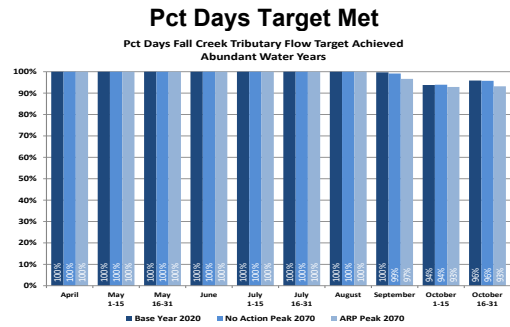
■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

Abundant (n=44)

Adequate (n=14)

Insufficient (n=11)

Deficit (n=11)



14 Foster

14.1 Foster Reservoir - Tributary Flow Objective Performance – Expected Diversions

Table 14A provides summary metrics for the modeled Foster Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp flow objectives are met across the four water year types:

- Abundant: one percent **fewer** flow objective days met under the ARP;
- Adequate: one percent **fewer** flow objective days met under the ARP;
- Insufficient: no notable difference; and
- Deficit: two percent **more** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 14A shows the following differences between the No Action Plan and the ARP as a percent of flow objective water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: one percent **less** water provided under the ARP;
- Insufficient: two percent **less** water provided under the ARP; and
- Deficit: one percent **less** water provided under the ARP.

**Table 14A: Foster Tributary Flow Objective Performance Summary
Expected Diversions**

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	97	97	96
Percent of Volume Met Over All Simulated Days	+ 99	99	99
Percent of Volume Met Over Missed Objective Days	87	84	71
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	93	94	93
Percent of Volume Met Over All Simulated Days	99	99	98
Percent of Volume Met Over Missed Objective Days	86	83	76
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	81	83	83
Percent of Volume Met Over All Simulated Days	94	94	92
Percent of Volume Met Over Missed Objective Days	69	65	55
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	76	77	79
Percent of Volume Met Over All Simulated Days	91	91	90
Percent of Volume Met Over Missed Objective Days	63	61	54

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 14B and Figure 9A provide additional details and a graphic representation of select table data to aid in interpretation.

Table 14B: Foster Tributary Flow Objective Performance Detail: Expected Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	87	87	89	23	23	23	99	99	99	89	89	89
	June	95	96	98	16	15	12	99	+ 99	+ 99	90	88	85
	Jul 1-15	96	97	100	18	13		+ 99	+ 99	100	92	95	N/A
	Jul 16-31	+ 99	+ 99	100	1	1		+ 99	+ 99	100	98	99	N/A
	Aug	+ 99	+ 99	100	2	1		+ 99	+ 99	100	95	98	N/A
	Sep	94	95	93	22	23	17	99	99	98	90	84	64
	Oct 1-15	96	95	85	6	9	14	99	98	94	68	68	61
	Oct 16-31	98	97	92	4	7	11	+ 99	99	98	82	82	80
	SUBTOTAL	97	97	96	37	39	31	+ 99	99	99	87	84	71
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	75	76	79	12	12	12	97	97	97	88	88	87
	June	89	90	94	9	9	9	99	99	99	88	88	86
	Jul 1-15	95	95	100	7	7		+ 99	+ 99	100	92	95	N/A
	Jul 16-31	99	99	100	1	2		+ 99	+ 99	100	98	98	N/A
	Aug	98	100	+ 99	2		1	+ 99	100	+ 99	99	N/A	88
	Sep	89	88	88	10	10	7	99	98	96	92	87	66
	Oct 1-15	90	90	76	2	2	5	96	96	92	60	57	68
	Oct 16-31	98	+ 99	86	1	1	4	+ 99	+ 99	98	80	86	87
	SUBTOTAL	93	94	93	13	13	12	99	99	98	86	83	76
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	99	99	99	1	1	1	+ 99	+ 99	+ 99	90	90	91
	May 16-31	66	71	71	11	11	11	95	95	95	85	83	83
	June	78	85	90	9	9	9	98	98	99	92	90	90
	Jul 1-15	83	92	95	8	6	4	99	99	99	93	87	88
	Jul 16-31	86	90	90	2	2	3	98	98	98	86	83	84
	Aug	89	89	+ 99	4	4	1	99	99	+ 99	94	95	93
	Sep	80	77	72	10	11	9	94	92	85	70	66	46
	Oct 1-15	55	53	43	6	7	8	75	74	67	43	43	42
	Oct 16-31	55	52	47	5	7	7	77	76	73	49	50	48
	SUBTOTAL	81	83	83	11	11	11	94	94	92	69	65	55
Deficit 2354 sim days 11 of 80 years	Apr	+ 99	+ 99	+ 99	1	1	1	+ 99	+ 99	+ 99	51	50	50
	May 1-15	96	96	97	2	2	2	99	99	99	64	64	57
	May 16-31	59	60	64	10	10	10	91	92	92	79	79	77
	June	79	82	88	9	9	8	97	97	98	86	84	81
	Jul 1-15	78	80	89	9	8	4	97	98	99	87	89	90
	Jul 16-31	90	91	99	3	3	2	99	99	+ 99	91	93	87
	Aug	83	86	91	4	3	3	98	98	98	89	88	76
	Sep	56	55	52	9	9	10	79	78	74	53	51	47
	Oct 1-15	48	44	40	8	8	7	70	68	64	43	42	40
	Oct 16-31	61	60	56	8	8	8	83	82	80	57	56	55
	SUBTOTAL	76	77	79	11	11	11	91	91	90	63	61	54

Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 9A: Foster Tributary Flow Objective Performance: Expected Diversions

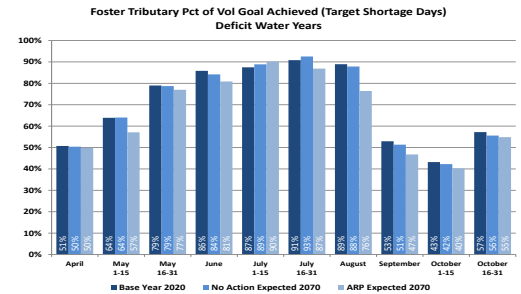
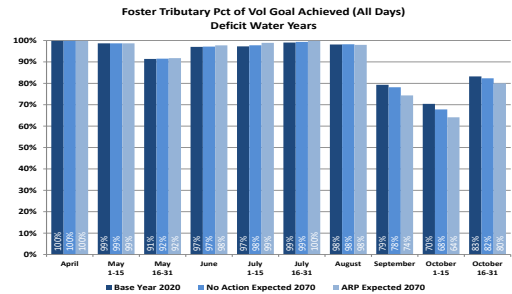
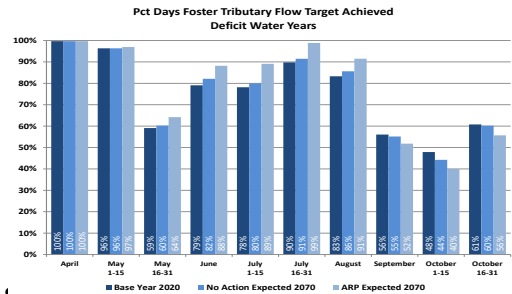
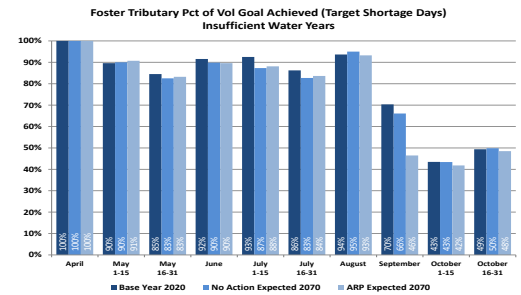
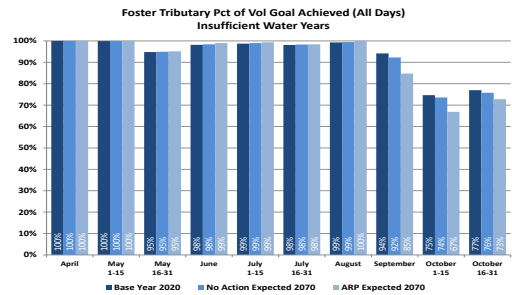
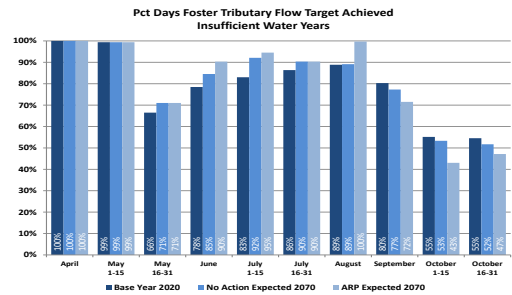
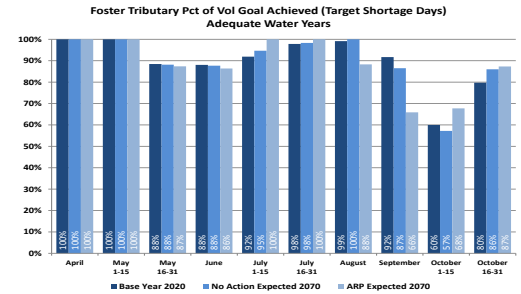
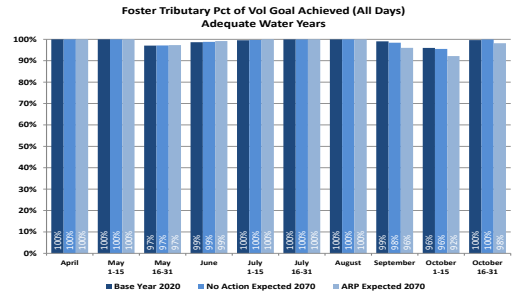
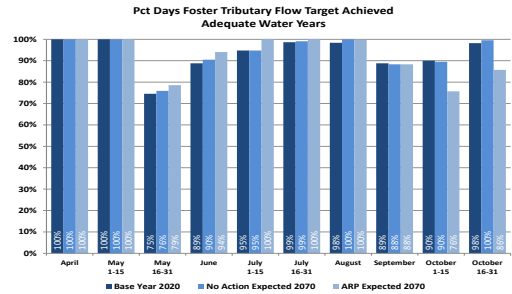
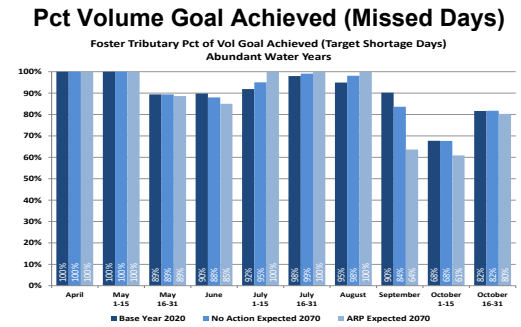
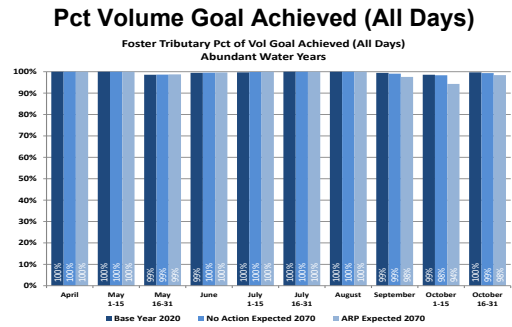
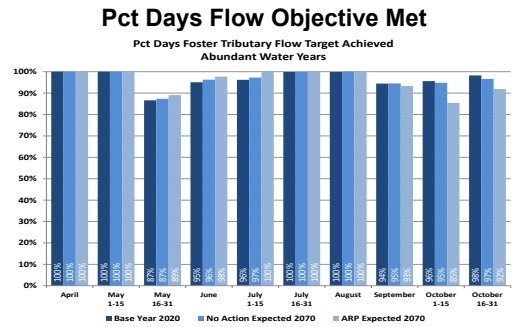
■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

Abundant (n=44)

Adequate (n=14)

Insufficient (n=11)

Deficit (n=11)



14.2 Foster Reservoir - Tributary Flow Objective Performance – Peak Diversions

Table 14C provides summary metrics for the modeled Foster Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp targets are met across the four water year types:

- Abundant: three percent **fewer** flow objective days met under the ARP;
- Adequate: four percent **fewer** flow objective days met under the ARP;
- Insufficient no notable difference; and
- Deficit no notable difference.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 14C shows the following differences between the No Action Plan and the ARP as a percent of target water volume provided for each water year type:

- Abundant: one percent **less** water provided under the ARP;
- Adequate: two percent **less** water provided under the ARP;
- Insufficient four percent **less** water provided under the ARP; and
- Deficit two percent **less** water provided under the ARP.

**Table 14C: Foster Tributary Flow Objective Performance Summary
Peak Diversions**

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	97	97	94
Percent of Volume Met Over All Simulated Days	+ 99	99	98
Percent of Volume Met Over Missed Objective Days	87	83	63
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	93	94	90
Percent of Volume Met Over All Simulated Days	99	99	97
Percent of Volume Met Over Missed Objective Days	86	82	69
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	81	83	83
Percent of Volume Met Over All Simulated Days	94	94	90
Percent of Volume Met Over Missed Objective Days	69	64	49
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	76	77	77
Percent of Volume Met Over All Simulated Days	91	90	88
Percent of Volume Met Over Missed Objective Days	63	60	53

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 14D and Figure 9B provide additional details and a graphic representation of select table data to aid in interpretation.

Table 14D: Foster Tributary Flow Objective Performance Detail: Peak Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	87	88	90	23	23	23	99	99	99	89	89	88
	June	95	96	98	16	15	11	99	+ 99	+ 99	90	88	86
	Jul 1-15	96	98	100	18	10		+ 99	+ 99	100	92	95	N/A
	Jul 16-31	+ 99	+ 99	100	1	1		+ 99	+ 99	100	98	+ 99	N/A
	Aug	+ 99	100	+ 99	2		2	+ 99	100	+ 99	95	N/A	81
	Sep	94	95	88	22	22	18	99	99	94	90	82	52
	Oct 1-15	96	95	69	6	8	25	99	98	87	68	67	59
	Oct 16-31	98	95	87	4	7	15	+ 99	99	97	82	82	78
	SUBTOTAL	97	97	94	37	36	32	+ 99	99	98	87	83	63
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	75	76	79	12	12	12	97	97	97	88	88	88
	June	89	91	96	9	9	6	99	99	99	88	88	84
	Jul 1-15	95	96	100	7	6		+ 99	+ 99	100	92	94	N/A
	Jul 16-31	99	+ 99	100	1	1		+ 99	+ 99	100	98	99	N/A
	Aug	98	100	+ 99	2		1	+ 99	100	+ 99	99	N/A	87
	Sep	89	89	80	10	10	8	99	98	91	92	83	55
	Oct 1-15	90	89	53	2	2	10	96	96	84	60	60	66
	Oct 16-31	98	99	79	1	1	6	+ 99	+ 99	97	80	80	85
	SUBTOTAL	93	94	90	13	13	13	99	99	97	86	82	69
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	99	99	99	1	1	1	+ 99	+ 99	+ 99	90	90	92
	May 16-31	66	71	77	11	11	11	95	95	95	85	83	80
	June	78	85	93	9	9	9	98	98	99	92	90	90
	Jul 1-15	83	92	97	8	6	3	99	99	99	93	87	76
	Jul 16-31	86	90	93	2	2	3	98	98	99	86	83	84
	Aug	89	89	+ 99	4	4	1	99	+ 99	+ 99	94	96	93
	Sep	80	77	59	10	11	10	94	91	77	70	64	44
	Oct 1-15	55	52	39	6	7	8	75	73	63	43	44	39
	Oct 16-31	55	53	48	5	6	7	77	76	72	49	49	46
	SUBTOTAL	81	83	83	11	11	11	94	94	90	69	64	49
Deficit 2354 sim days 11 of 80 years	Apr	+ 99	+ 99	+ 99	1	1	1	+ 99	+ 99	+ 99	51	50	49
	May 1-15	96	96	97	2	2	2	99	99	99	64	64	57
	May 16-31	59	61	65	10	10	10	91	92	92	79	79	77
	June	79	82	88	9	9	8	97	97	98	86	84	81
	Jul 1-15	78	81	95	9	7	3	97	98	+ 99	87	90	94
	Jul 16-31	90	91	99	3	3	1	99	99	+ 99	91	92	75
	Aug	83	86	89	4	2	4	98	98	97	89	88	75
	Sep	56	53	43	9	9	10	79	76	68	53	49	44
	Oct 1-15	48	47	32	8	7	8	70	69	61	43	42	43
	Oct 16-31	61	61	51	8	8	8	83	83	79	57	56	57
	SUBTOTAL	76	77	77	11	11	11	91	90	88	63	60	53

Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 9B: Foster Tributary Flow Objective Performance: Peak Diversions

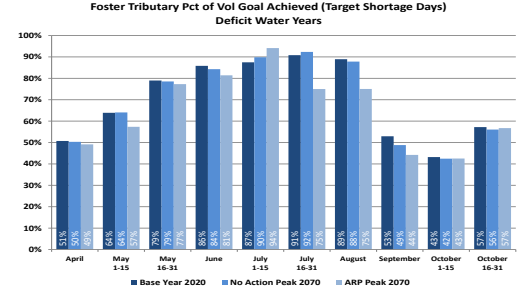
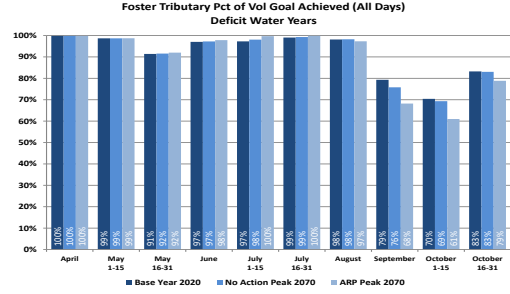
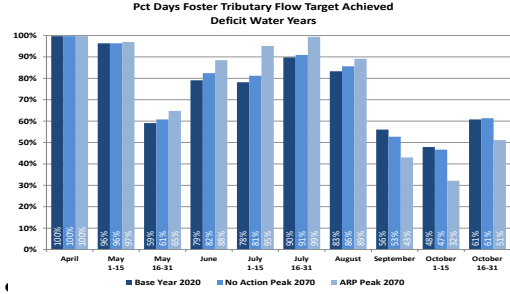
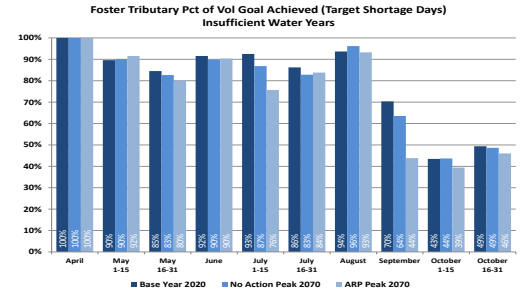
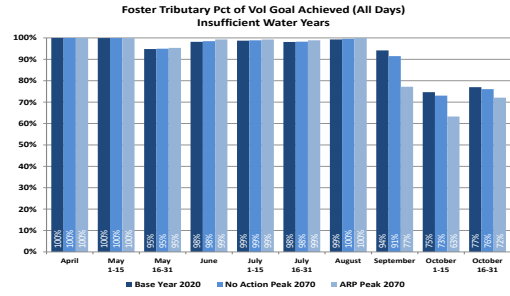
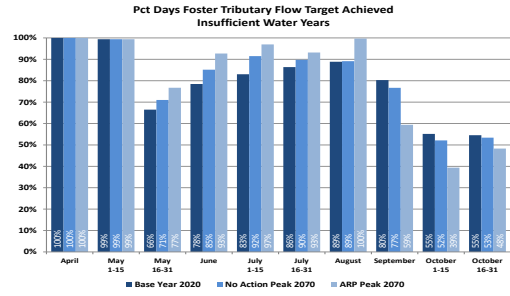
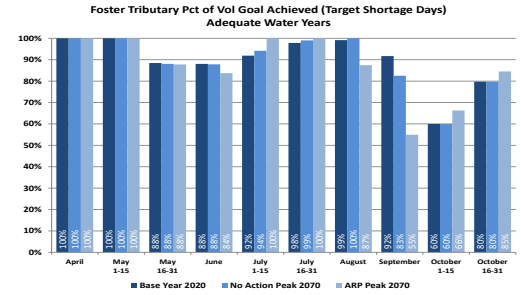
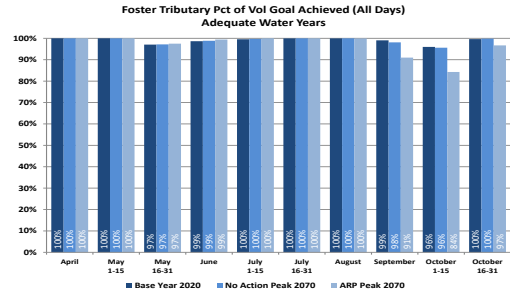
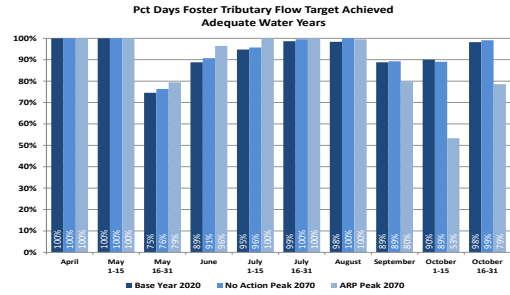
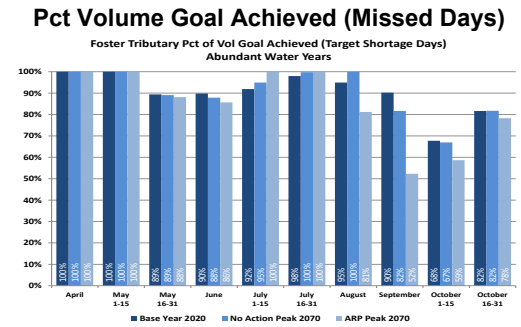
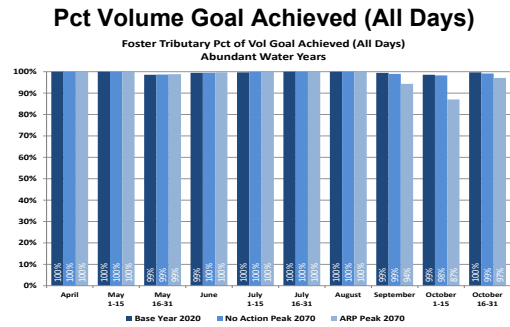
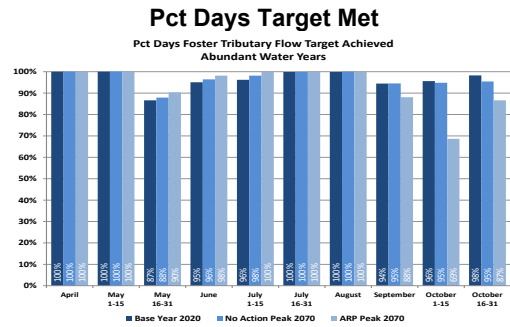
■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

Abundant (n=44)

Adequate (n=14)

Insufficient (n=11)

Deficit (n=11)



15 Hills Creek

15.1 Hills Creek Res - Tributary Flow Objective Performance – Expected Diversions

Table 15A provides summary metrics for the modeled Hills Creek Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp flow objectives are met across the four water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient one percent **fewer** flow objective days met under the ARP; and
- Deficit three percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 15A shows the following differences between the No Action Plan and the ARP as a percent of flow objective water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient less than one percent **less** water provided under the ARP; and
- Deficit one percent **less** water provided under the ARP.

Table 15A: Hills Creek Tributary Flow Objective Performance Summary Expected Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	+ 99	99	98
Percent of Volume Met Over All Simulated Days	+ 99	+ 99	99
Percent of Volume Met Over Missed Objective Days	47	48	55
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	+ 99	98	95
Percent of Volume Met Over All Simulated Days	+ 99	99	98
Percent of Volume Met Over Missed Objective Days	72	64	61

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 15B and Figure 10A provide additional details and a graphic representation of select table data to aid in interpretation.

Table 15B: Hills Creek Tributary Flow Objective Performance Detail: Expected Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴		
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	SUBTOTAL	100	100	100				100	100	100	0	0	0
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	96			1	100	100	98	N/A	N/A	54
	Oct 1-15	100	93	85			1	100	97	93	N/A	50	52
	Oct 16-31	97	97	90	1	1	2	98	98	96	47	46	60
	SUBTOTAL	+ 99	99	98	1	1	2	+ 99	+ 99	99	47	48	55
Deficit 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	June	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A
	Aug	100	100	100				100	100	100	N/A	N/A	N/A
	Sep	100	100	92			4	100	100	97	N/A	N/A	64
	Oct 1-15	100	94	64			2	100	98	85	N/A	64	60
	Oct 16-31	94	82	77	2	4	4	98	94	91	72	64	61
	SUBTOTAL	+ 99	98	95	2	4	4	+ 99	99	98	72	64	61

Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

Figure 10A: Hills Creek Tributary Flow Objective Performance: Expected Diversions

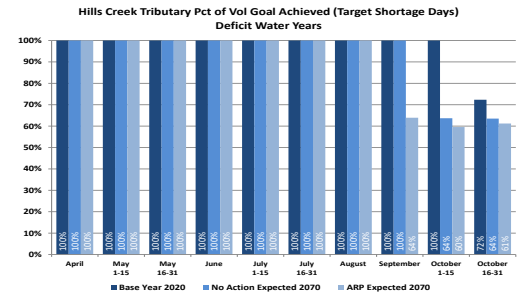
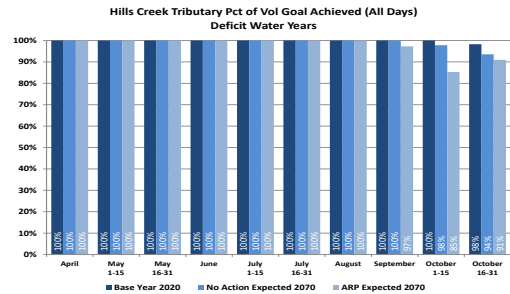
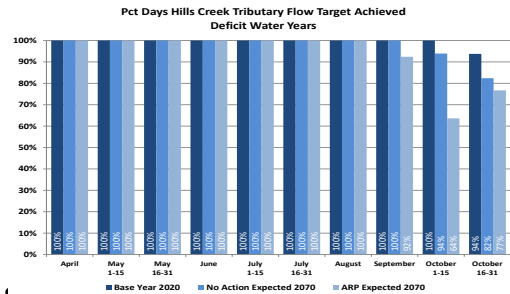
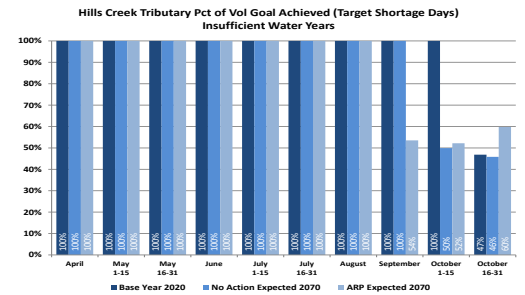
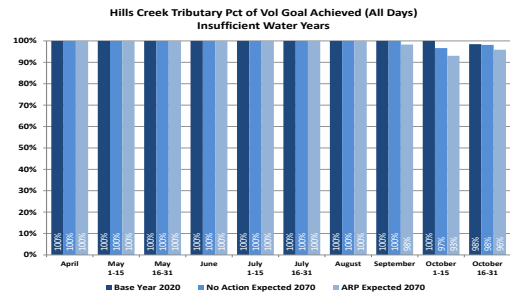
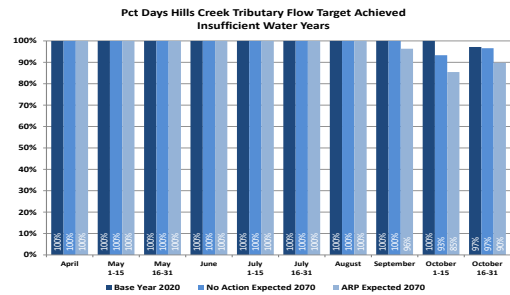
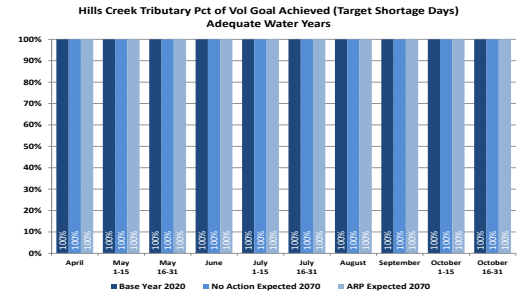
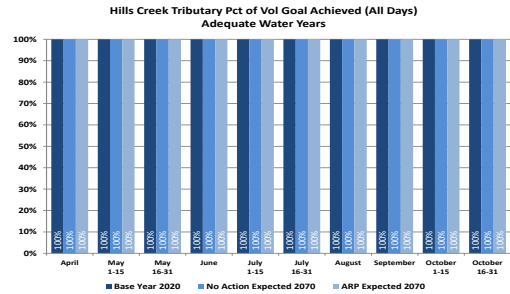
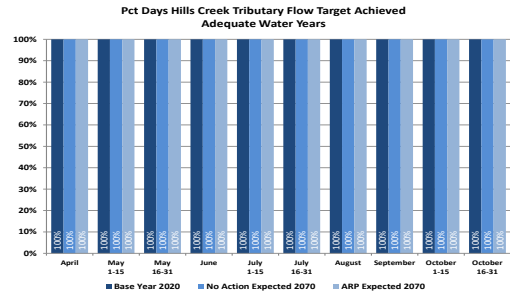
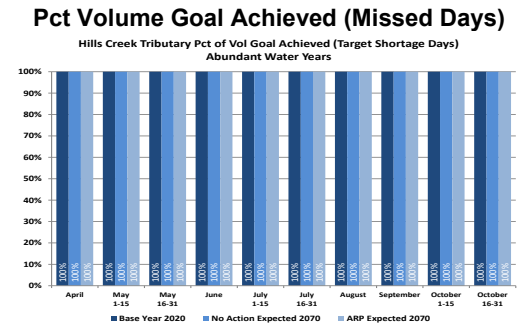
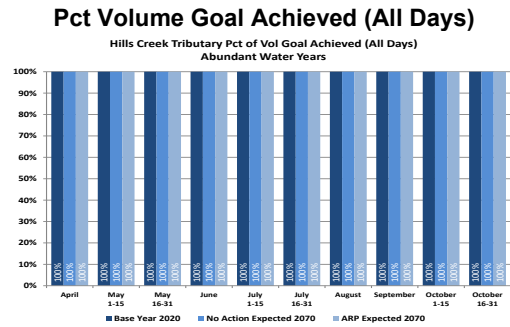
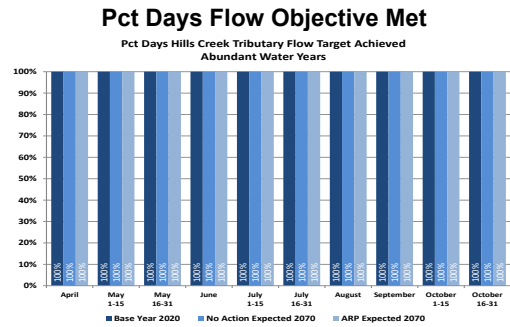
■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

Abundant (n=44)

Adequate (n=14)

Insufficient (n=11)

Deficit (n=11)



15.2 Hills Creek Reservoir - Tributary Flow Objective Performance – Peak Diversions

Table 15C provides summary metrics for the modeled Hills Creek Reservoir Tributary BiOp flow objective performance for Base Year 2020, the No Action Plan in Year 2070, and the ARP in Year 2070. The table shows the following differences between the No Action Plan and the ARP for the percent of days for which BiOp targets are met across the four water year types:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient two percent **fewer** flow objective days met under the ARP; and
- Deficit five percent **fewer** flow objective days met under the ARP.

The percentage of flow objective volume provided over the simulation provides insight on differences in performance, as unmet flow objective days can be triggered by a shortage of as little as one cfs. Table 15C shows the following differences between the No Action Plan and the ARP as a percent of target water volume provided for each water year type:

- Abundant: no notable difference;
- Adequate: no notable difference;
- Insufficient no notable difference; and
- Deficit two percent **less** water provided under the ARP.

Table 15C: Hills Creek Res Tributary Flow Objective Performance Summary Peak Diversions

	Base Year 2020	No Action 2070	ARP 2070
Abundant Years (9,416 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Adequate Years (2,996 simulated days)			
Percent of Simulated Days Flow Objective Met	100	100	100
Percent of Volume Met Over All Simulated Days	100	100	100
Percent of Volume Met Over Missed Objective Days	n/a	n/a	n/a
Insufficient Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	+ 99	99	97
Percent of Volume Met Over All Simulated Days	+ 99	99	99
Percent of Volume Met Over Missed Objective Days	47	54	56
Deficit Years (2,354 simulated days)			
Percent of Simulated Days Flow Objective Met	+ 99	98	93
Percent of Volume Met Over All Simulated Days	+ 99	99	97
Percent of Volume Met Over Missed Objective Days	72	62	61

Note: + 99 indicates a value that exceeds 99.49 percent, which would ordinarily be rounded to 100 percent.

Table 15D and Figure 10B provide additional details and a graphic representation of select table data to aid in interpretation.

Table 15D: Hills Creek Tributary Flow Objective Performance Detail: Peak Diversions

WY Type	Period	Pct Days Flow Objective Met ^{1,2}			No. Years With a Missed Flow Objective Day ³			Pct Volume Goal Achieved (All Days) ^{1,2}			Pct Volume Goal Achieved (Missed Days) ⁴			
		BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	BY 2020	NA 2070	ARP 2070	
Abundant 9416 sim days 44 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A	
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A	
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A	
	June	100	100	100				100	100	100	N/A	N/A	N/A	
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A	
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A	
	Aug	100	100	100				100	100	100	N/A	N/A	N/A	
	Sep	100	100	100				100	100	100	N/A	N/A	N/A	
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A	
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A	
	SUBTOTAL	100	100	100				100	100	100	0	0	0	
Adequate 2996 sim days 14 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A	
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A	
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A	
	June	100	100	100				100	100	100	N/A	N/A	N/A	
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A	
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A	
	Aug	100	100	100				100	100	100	N/A	N/A	N/A	
	Sep	100	100	100				100	100	100	N/A	N/A	N/A	
	Oct 1-15	100	100	100				100	100	100	N/A	N/A	N/A	
	Oct 16-31	100	100	100				100	100	100	N/A	N/A	N/A	
	SUBTOTAL	100	100	100				100	100	100	0	0	0	
Insufficient 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A	
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A	
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A	
	June	100	100	100				100	100	100	N/A	N/A	N/A	
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A	
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A	
	Aug	100	100	100				100	100	100	N/A	N/A	N/A	
	Sep	100	+ 99	92			1	2	100	+ 99	97	N/A	58	56
	Oct 1-15	100	91	82			1	2	100	95	92	N/A	47	54
	Oct 16-31	97	93	90	1	2	2	98	97	96	47	62	60	
	SUBTOTAL	+ 99	99	97	1	2	2	+ 99	99	99	47	54	56	
Deficit 2354 sim days 11 of 80 years	Apr	100	100	100				100	100	100	N/A	N/A	N/A	
	May 1-15	100	100	100				100	100	100	N/A	N/A	N/A	
	May 16-31	100	100	100				100	100	100	N/A	N/A	N/A	
	June	100	100	100				100	100	100	N/A	N/A	N/A	
	Jul 1-15	100	100	100				100	100	100	N/A	N/A	N/A	
	Jul 16-31	100	100	100				100	100	100	N/A	N/A	N/A	
	Aug	100	100	100				100	100	100	N/A	N/A	N/A	
	Sep	100	100	78				100	100	92	N/A	N/A	62	
	Oct 1-15	100	89	64			2	4	100	96	85	N/A	63	60
	Oct 16-31	94	78	77	2	4	4	98	92	91	72	62	61	
	SUBTOTAL	+ 99	98	93	2	4	4	+ 99	99	97	72	62	61	

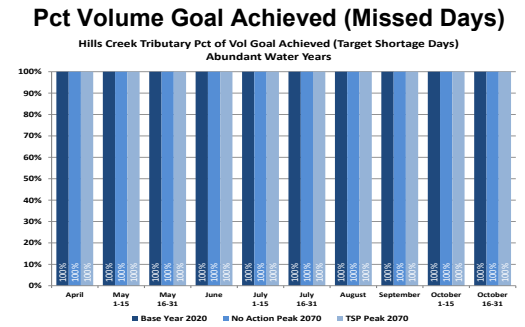
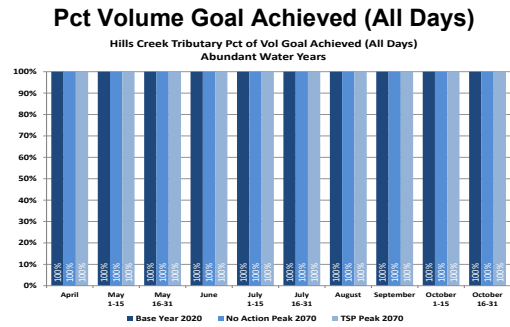
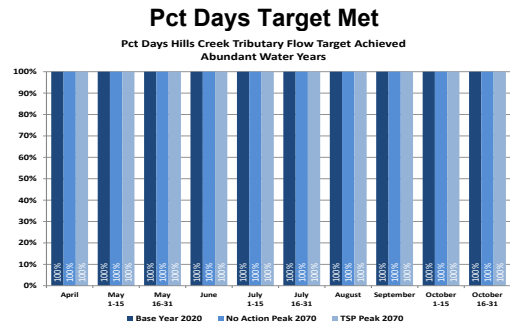
Notes:

1. Values designated as “+ 99” exceed 99.49 percent, which would ordinarily be rounded to 100 percent
2. Subtotals for percentage metrics represent weighted averages based on number of days in each period (e.g., Apr = 30 days, Aug = 31 days, etc.).
3. Subtotals are not calculated as a sum of numbers in the column, as multiple periods may be missed in the same year.
4. Values designated as “N/A” cannot be calculated when “Pct Volume Goal Achieved (All Days)” is equal to 100 percent, as there are no missed days.

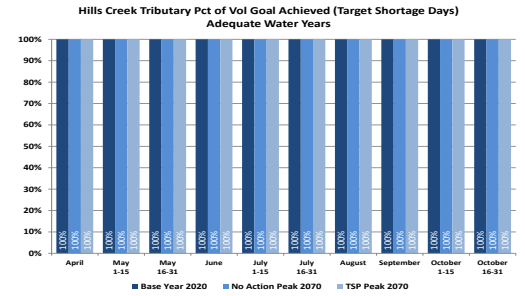
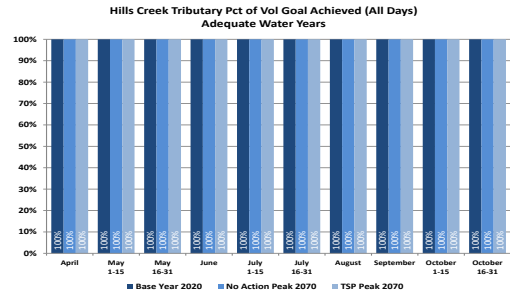
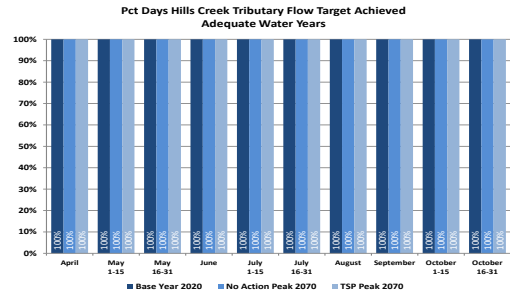
Figure 10B: Hills Creek Tributary Flow Objective Performance: Peak Diversions

■ Base Year 2020 ■ No Action Alternative 2070 ■ ARP 2070

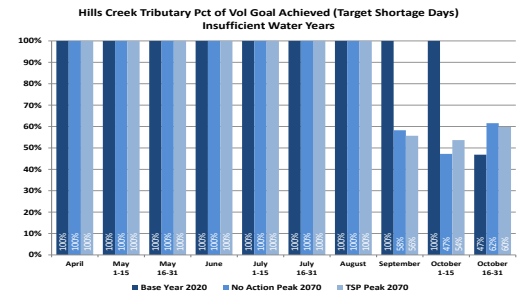
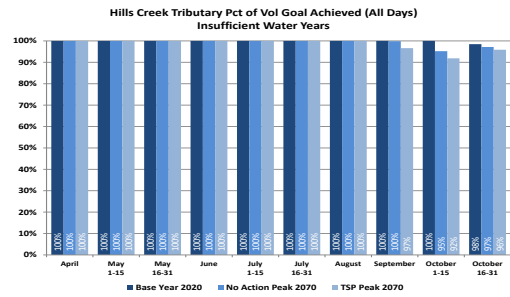
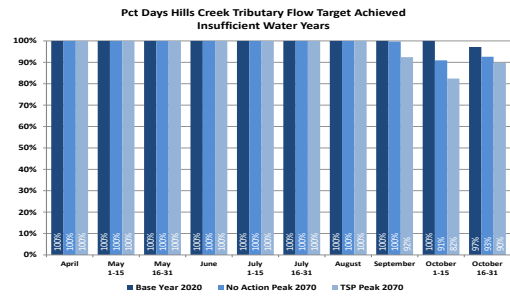
Abundant (n=44)



Adequate (n=14)



Insufficient (n=11)



Deficit (n=11)

