C-6 STATISTICAL WATER QUALITY IMPACT ANALYSIS

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Tables

Introduction

Changes in timing and location of diversions have the potential to affect water quality conditions in the Delta. The water quality impacts and benefits analysis focuses on salinity (reported as electrical conductivity and chloride concentration) as an indicator of Delta water quality because salinity is the Delta water quality constituent most likely to be affected by shifts in the timing and location of pumping in the Delta. Salinity is also the constituent for which the most monitoring data and calibrated Delta modeling tools exist.

To assess the potential water quality impacts and benefits of the project alternatives, the results of CalSim II studies were input into the DSM2 water quality model for the Delta, and estimated Delta salinity concentrations were compared between each project alternative study and the relevant without project conditions under the existing or future level of development. Water quality analysis for these project alternatives was performed for the 16-year period from 1975 – 1991.

It is important to note that not all of the differences in simulated salinity are necessarily due to changes in operations under the project alternatives. Model artifacts as discussed in Section 4.2.2 and project operations both contribute to potential water quality impacts. In order to determine if the changes in water quality posed potentially significant impacts, several statistical tests were used (Zar, 1999).

D1641 Water Quality Standards

Compliance with the D1641 water quality standards was assessed at the standard compliance locations in each of the model runs (without project and four alternatives). The compliance locations included Emmaton, Jersey Point, Brandt Bridge, Old River near Middle River, Old River near Tracy Bridge, and Old River at Rock Slough. The standards for each station are listed below in **Table C6-1.**

TABLE C6-1:
SUMMARY OF WATER QUALITY STANDARDS FOR SELECT LOCATIONS IN THE DELTA

Compliance Location	Description	Value
Sac River @ Emmaton	14 day running average of mean EC during the spring and summer months depending on water year type	0.45-2.78 (mmhos/cm) depending on water year type and time of year
San Joaquin River @ Jersey Pt	14 day running average of mean EC during the spring and summer months depending on water year type	.45 -2.20 (mmhos/cm) depending on water year type and time of year
San Joaquin River @ Brandt Bridge	Maximum 30 day running average of mean daily EC	Apr – Aug 0.7 (mmhos/cm) Sep – Mar 1.0 (mmhos/cm)
Old River near Middle River	Maximum 30 day running average of mean daily EC	Apr – Aug 0.7 (mmhos/cm) Sep – Mar 1.0 (mmhos/cm)
Old River @ Tracy Bridge	Maximum 30 day running average of mean daily EC	Apr – Aug 0.7 (mmhos/cm) Sep – Mar 1.0 (mmhos/cm)
Old River @ Rock Slough	Maximum mean daily Cl	250 Cl

Potential standards violations were found in all model runs, including the existing and future without project runs. In reality, water system operators manage the system so that water quality standard violations are avoided. However, a recognized issue in using CalSim II inputs to DSM2 is that the estimation of Delta water quality is approached differently by the two models. This sometimes leads to a condition in which the CalSim II model estimates the amount of outflow required to avoid causing a Delta water quality violation, but the subsequent DSM2 estimate of Delta salinity shows that the standard was exceeded. This model mismatch is responsible for water quality standard violations in the existing condition model run but also contributes to the number of violations under the project alternatives.

If the project alternative operations caused a significant impact to water quality standards, the frequency of standards violations in the without project case and alternatives would be significantly different. Specifically, if project operations caused a water quality impact, the frequency of violations for that project would be significantly greater than the frequency of violations for the without project operation. The occurrence of standards violations under the without project conditions were compared to the occurrence under the various alternative conditions. A contingency table (χ^2) was used to determine if the occurrence of standards violations under the project alternatives were significantly different (more or less frequent) than the occurrence under the without project condition. The χ^2 was calculated using the Yates correction for continuity. The following example demonstrates the calculation used (**Table C6-2**).

TABLE C6-2:
EXAMPLE OF 2-BY-2 CONTINGENCY TABLE

	Days With Violation	Days Without Violation	Total
Without Project	a	b	a+b
Alternative	c	d	c+d
Total	a+c	b+d	a+b+c+d = N

$$\chi^2 = \frac{N(ad - bc - \frac{N}{2})^2}{(a+b)(c+d)(b+d)(a+c)}$$

The p-values were calculated using the EXCEL function CHIDIST for one degree of freedom. At the 95% confidence interval, a significant result is a calculated p-value less than 0.05. If there was a significant difference between the without project violations and alternatives, it was assumed that the changes in operations cause a significant impact to water quality. **Table C6-3** through **Table C6-6** present the contingency tables and the results for each alternative.

The only instance of a statistically significant difference between the without project runs and alternative runs was at Rock Slough. The frequency of violations was significantly less than the without project runs for Alternatives 1, 2 and 3 assuming the moderate fisheries restrictions and future level of development. Additionally there were significantly fewer violations for Alternative 3 assuming severe fishery restrictions and future level of development. In all other locations and scenarios there were no significant differences between the frequency of water standards

violations in the without project and alternatives conditions. Therefore, we conclude that there were no significant impacts.

Protection of Beneficial Uses

In addition to assessing project compliance with enforceable water quality standards, water quality changes were analyzed elsewhere in the Delta to ensure that the project alternatives did not affect beneficial uses. Unlike the standards violation analysis described above, the analysis of potential impacts to beneficial uses involved a direct comparison of water quality in the without project conditions and water quality with each of the project alternatives. Small differences, described in more detail below, were eliminated from further consideration and water quality changes that could be large enough to cause a change in beneficial use were further investigated. Changes in water quality were analyzed at existing and planned Delta drinking water intakes: Jones Pumping Plant, Clifton Court Forebay, Barker Slough, Cache Slough, San Joaquin River at Antioch and San Joaquin River at Empire Tract.

A sizeable increase in salinity was defined as a salinity difference between a project alternative and the without project condition greater than 5% and greater than 5 mg/l Cl. A sizeable decrease in salinity was defined as a salinity difference between a project alternative and the without project condition that is less than -5% and greater than -5 mg/l Cl.

Sizeable changes at the City of Antioch intake were defined separately because an operational threshold is established at that location, and effects on the beneficial use could be caused by changing the amount of time that Antioch's source water salinity is below that threshold. When chloride concentration is greater than 250 mg/L, the City of Antioch uses water from other sources. If the existing or future without project monthly average chloride concentration was modeled as less than 250 mg/L and operations under a project alternative increased the concentration to 250 mg/L Cl or more, the month was flagged as a sizeable increase in salinity. Conversely, if chloride concentration was modeled as greater than 250 mg/L in the existing or future without project run and was lowered below 250 mg/L Cl under a project alternative, the month was a sizeable salinity decrease.

If there was no statistically significant difference in the number of increases compared to decreases, then the changes found in the alternatives runs were attributed to threshold sensitivity and it was assumed that there would be no significant impact to beneficial uses. If there was a statistically significant difference, then it was assumed that project operations have to potential impact beneficial uses and was investigated further.

A one-tailed binomial test was used to determine if the likelihood of water quality degradation was significantly greater than the likelihood of a water quality improvement for a given alternative. The p-values were calculated using the EXCEL function BINOMDIST which required the following input: the number of improvements, total number of improvements plus degradations, an expected probability of 0.5, and a flag to indicate the functional form ("false" returns the probability mass function). At the 95% confidence interval, a significant result is a

calculated p-value less than 0.05. **Table C6-7** through **Table C6-10** present the data used and the results.

The only time a significant difference was found was for Alternative 3 at Barker Slough assuming moderate fisheries restrictions and existing levels of development. The number of degradations was 10 compared to zero improvements. Further investigation indicated that the number of sizeable salinity increases was influenced by an event lasting several consecutive months where changes not related to Alternative 3 caused the changes in salinity. It was concluded that this estimated difference in Barker Slough water quality does not reflect an impact that would be caused by the Alternative 3 operations. Based on this analysis we conclude that for Alternatives 1, 2, 3 and 4 there are no significant impacts due to changes in project operations.

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TABLE C6-3: CHI-SQUARED AND P-VALUES FOR WATER QUALITY STANDARDS VIOLATIONS IN ALTERNATIVE 1 AND WITHOUT PROJECT CONDITIONS

	Emmaton				Jersey Point				Brandt Bridge				Old River near Middle River				Old River near Tracy Bridge				Old River at Rock Slough			
	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value
2030 Level of Development; Moderate Fishery Restrictions																								
Future Without Project	247	5597			327	5517			554	5290			472	5372			503	5341			442	5402		
Alternative 1	243	5601	0.019	0.890	340	5504	0.229	0.632	555	5289	0.000	1.000	473	5371	0.000	1.000	507	5337	0.010	0.921	335	5509	15.491	8.29E-05
2005 Level of Development; Moderate Fishery Restrictions																								
Existing Condition	184	5660			169	5675			971	4873			956	4888			882	4962			218	5626		
Alternative 1	206	5638	1.170	0.279	164	5680	0.049	0.824	969	4875	0.001	0.980	956	4888	0.000	1.000	879	4965	0.003	0.959	211	5633	0.087	0.768
2005 Level of Development; Severe Fishery Restrictions																								
Existing Condition	171	5673			223	5621			973	4871			956	4888			943	4901			212	5632		
Alternative 1	171	5673	0.000	1.000	225	5619	0.962	0.327	974	4870	0.000	1.000	956	4888	0.000	1.000	944	4900	0.000	1.000	224	5620	0.288	0.591
2030 Level of Development; Severe Fishery Restrictions																								
Future Without Project	220	5624			359	5485			540	5304			474	5370			544	5300			451	5393		
Alternative 1	232	5612	0.278	0.598	380	5464	0.578	0.447	539	5305	0.000	1.000	475	5369	0.000	1.000	549	5295	0.016	0.899	421	5423	1.042	0.307

TABLE C6-4: CHI-SQUARED AND P-VALUES FOR WATER QUALITY STANDARDS VIOLATIONS IN ALTERNATIVE 2 AND WITHOUT PROJECT CONDITIONS

	Emmaton				Jersey Point				Brandt Bridge				Old River near Middle River				Old River near Tracy Bridge				Old River at Rock Slough			
	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value
2030 Level of Development; Moderate Fishery Restrictions																								
Future Without Project	247	5597			327	5517			554	5290			472	5372			503	5341			442	5402		
Alternative 2	246	5598	0.000	1.000	350	5494	0.759	0.384	556	5288	0.001	0.975	472	5372	0.000	1.000	505	5339	0.001	0.974	357	5487	9.479	0.002
2005 Level of Development; Moderate Fishery Restrictions																								
Existing Condition	184	5660			169	5675			971	4873			956	4888			882	4962			218	5626		
Alternative 2	170	5674	0.000	1.000	162	5682	0.112	0.738	970	4874	0.000	1.000	956	4888	0.000	1.000	881	4963	0.000	1.000	205	5639	0.353	0.552
2005 Level of Development; Severe Fishery Restrictions																								
Existing Condition	171	5673			223	5621			973	4871			956	4888			943	4901			212	5632		
Alternative 2	239	5605	0.000	1.000	224	5620	0.000	1.000	974	4870	0.000	1.000	956	4888	0.000	1.000	944	4900	0.000	1.000	227	5617	0.464	0.496
2030 Level of Development; Severe Fishery Restrictions																								
Future Without Project	220	5624			359	5485			540	5304			474	5370			544	5300			451	5393		
Alternative 2	239	5605	0.735	0.391	376	5468	0.372	0.542	539	5305	0.000	1.000	474	5370	0.000	1.000	546	5298	0.001	0.975	425	5419	0.771	0.380

TABLE C6-5: CHI-SQUARED AND P-VALUES FOR WATER QUALITY STANDARDS VIOLATIONS IN ALTERNATIVE 3 AND WITHOUT PROJECT CONDITIONS

	Emmaton				Jersey Point				Brandt Bridge				Old River near Middle River				Old River near Tracy Bridge				Old River at Rock Slough			
	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value
2030 Level of Development; Moderate Fishery Restrictions																								
Future Without Project	247	5597			327	5517			554	5290			472	5372			503	5341			442	5402		
Alternative 3	235	5609	0.262	0.609	320	5524	0.059	0.808	549	5295	0.016	0.899	472	5372	0.000	1.000	503	5341	0.000	1.000	335	5509	15.491	8.29E-05
2005 Level of Development; Moderate Fishery Restrictions																								
Existing Condition	184	5660			169	5675			971	4873			956	4888			882	4962			218	5626		
Alternative 3	204	5640	0.962	0.327	177	5667	0.146	0.702	970	4874	0.000	1.000	956	4888	0.000	1.000	879	4965	0.003	0.959	225	5619	0.084	0.771
2005 Level of Development; Severe Fishery Restrictions																								
Existing Condition	171	5673			223	5621			973	4871			956	4888			943	4901			212	5632		
Alternative 3	173	5671	0.003	0.956	225	5619	0.002	0.962	973	4871	0.000	1.000	956	4888	0.000	1.000	942	4902	0.000	1.000	234	5610	1.028	0.311
2030 Level of Development; Severe Fishery Restrictions																								
Future Without Project	220	5624			359	5485			540	5304			474	5370			544	5300			451	5393		
Alternative 3	217	5627	0.010	0.922	355	5489	0.013	0.908	543	5301	0.004	0.949	475	5369	0.000	1.000	541	5303	0.004	0.949	374	5470	7.533	0.006

TABLE C6-6: CHI-SQUARED AND P-VALUES FOR WATER QUALITY STANDARDS VIOLATIONS IN ALTERNATIVE 4 AND WITHOUT PROJECT CONDITIONS

	Emmaton				Jersey Point				Brandt Bridge				Old River near Middle River				Old River near Tracy Bridge				Old River at Rock Slough			
	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value	# of days **with** Water Quality Violation	# of days **without** Water Quality Violation	X^2	p-value
2030 Level of Development; Moderate Fishery Restrictions																								
Future Without Project	247	5597			327	5517			554	5290			472	5372			503	5341			442	5402		
Alternative 4	248	5596	0.000	1.000	330	5514	0.006	0.936	554	5290	0.000	1.000	472	5372	0.000	1.000	504	5340	0.000	1.000	423	5421	0.405	0.525
2005 Level of Development; Moderate Fishery Restrictions																								
Existing Condition	184	5660			169	5675			971	4873			956	4888			882	4962			218	5626		
Alternative 4	188	5656	0.025	0.874	169	5675	0.000	1.000	971	4873	0.000	1.000	956	4888	0.000	1.000	881	4963	0.000	1.000	199	5645	0.806	0.369
2005 Level of Development; Severe Fishery Restrictions																								
Existing Condition	171	5673			223	5621			973	4871			956	4888			943	4901			212	5632		
Alternative 4	172	5672	0.000	1.000	225	5619	0.002	0.962	973	4871	0.000	1.000	956	4888	0.000	1.000	943	4901	0.000	1.000	227	5617	0.464	0.496
2030 Level of Development; Severe Fishery Restrictions																								
Future Without Project	220	5624			359	5485			540	5304			474	5370			544	5300			451	5393		
Alternative 4	221	5623	0.000	1.000	356	5488	0.006	0.938	540	5304	0.000	1.000	474	5370	0.000	1.000	543	5301	0.000	1.000	418	5426	1.273	0.259

TABLE C6-7: BINOMIAL DISTRIBUTION TEST FOR POTENTIAL IMPACTS TO BENEFICIAL USES IN ALTERNATIVE 1

	Jones Pumping (CVP)				West Canal at Clifton Ct Forebay (SWP)				Barker Slough (NBA)				Cache Slough (City of Vallejo)				San Joaquin River at Empire Tract (City of Stockton DWSP)				San Joaquin River at Antioch (City of Antioch)			
	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value
2030 Level of Development; Moderate Fishery Restrictions	4	4	8	0.64	6	5	11	0.50	2	0	2	0.25	0	0	0	1.00	4	11	15	0.98	1	0	1	0.5
2005 Level of Development; Moderate Fishery Restrictions	3	3	6	0.66	4	2	6	0.34	0	2	2	1.00	0	1	1	1.00	2	1	3	0.50	0	0	0	1
2030 Level of Development; Severe Fishery Restrictions	5	3	8	0.36	7	5	12	0.39	0	0	0	1.00	0	0	0	1.00	4	5	9	0.75	0	0	0	1
2005 Level of Development; Severe Fishery Restrictions	2	0	2	0.25	3	0	3	0.13	0	0	0	1.00	0	0	0	1.00	1	0	1	0.50	1	1	2	0.75

TABLE C6-8: BINOMIAL DISTRIBUTION TEST FOR POTENTIAL IMPACTS TO BENEFICIAL USES IN ALTERNATIVE 2

	Jones Pumping (CVP)				West Canal at Clifton Ct Forebay (SWP)				Barker Slough (NBA)				Cache Slough (City of Vallejo)				San Joaquin River at Empire Tract (City of Stockton DWSP)				San Joaquin River at Antioch (City of Antioch)			
	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value
2030 Level of Development; Moderate Fishery Restrictions	6	3	9	0.25	8	3	11	0.11	2	0	2	0.25	0	0	0	1.00	5	7	12	0.81	1	0	1	0.5
2005 Level of Development; Moderate Fishery Restrictions	3	1	4	0.31	4	0	4	0.06	0	3	3	1.00	0	0	0	1.00	2	0	2	0.25	0	0	0	1
2030 Level of Development; Severe Fishery Restrictions	4	3	7	0.50	9	4	13	0.13	0	0	0	1.00	0	0	0	1.00	5	4	9	0.50	0	0	0	1
2005 Level of Development; Severe Fishery Restrictions	2	0	2	0.25	4	0	4	0.06	0	0	0	1.00	0	0	0	1.00	1	0	1	0.50	0	1	1	1

TABLE C6-9: BINOMIAL DISTRIBUTION TEST FOR POTENTIAL IMPACTS TO BENEFICIAL USES IN ALTERNATIVE 3

	Jones Pumping (CVP)				West Canal at Clifton Ct Forebay (SWP)				Barker Slough (NBA)				Cache Slough (City of Vallejo)				San Joaquin River at Empire Tract (City of Stockton DWSP)				San Joaquin River at Antioch (City of Antioch)			
	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value
2030 Level of Development; Moderate Fishery Restrictions	5	10	15	0.94	5	11	16	0.96	2	0	2	0.25	0	0	0	1.00	5	13	18	0.98	0	0	0	1
2005 Level of Development; Moderate Fishery Restrictions	3	2	5	0.50	4	2	6	0.34	10	0	10	0.001	0	1	1	1.00	8	2	10	0.05	1	0	1	0.5
2030 Level of Development; Severe Fishery Restrictions	7	6	13	0.50	7	7	14	0.60	1	0	1	0.50	0	0	0	1.00	9	7	16	0.40	1	0	1	0.5
2005 Level of Development; Severe Fishery Restrictions	1	0	1	0.50	1	0	1	0.50	0	0	0	1.00	0	0	0	1.00	1	0	1	0.50	1	0	1	0.5

TABLE C6-10: BINOMIAL DISTRIBUTION TEST FOR POTENTIAL IMPACTS TO BENEFICIAL USES IN ALTERNATIVE 4

	Jones Pumping (CVP)				West Canal at Clifton Ct Forebay (SWP)				Barker Slough (NBA)				Cache Slough (City of Vallejo)				San Joaquin River at Empire Tract (City of Stockton DWSP)				San Joaquin River at Antioch (City of Antioch)			
	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value	Sizeable Salinity Increase	Sizeable Salinity Decrease	Sum	p-value
2030 Level of Development; Moderate Fishery Restrictions	0	1	1	1.00	0	1	1	1.00	0	0	0	1.00	0	0	0	1.00	0	2	2	1.00	0	0	0	1
2005 Level of Development; Moderate Fishery Restrictions	0	0	0	1.00	0	0	0	1.00	0	1	1	1.00	0	0	0	1.00	0	1	1	1.00	1	0	1	0.5
2030 Level of Development; Severe Fishery Restrictions	1	4	5	0.97	1	5	6	0.98	0	0	0	1.00	0	0	0	1.00	1	3	4	0.94	0	0	0	1
2005 Level of Development; Severe Fishery Restrictions	0	0	0	1.00	0	0	0	1.00	0	0	0	1.00	0	0	0	1.00	0	0	0	1.00	0	0	0	1

C-7 FISHERY ANALYSIS

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Introduction

Appendix C-7 provides a description of the methods used for evaluating the fisheries effects that were discussed in Chapter 4.3. Supporting detailed results and analysis are also included. The possible direct effects on Delta fish include changes in the numbers of fish salvaged at the SWP and CVP export facilities as a result of changes in water project operations, as well as possible changes in the vulnerability of various species and life stages of fish to entrainment (e.g., small planktonic fish eggs and larvae passing through the intake screen into the diversion) at the Rock Slough, Old River, and AIP intakes and the proposed new Los Vaqueros Delta Intake. Possible indirect effects on Delta fisheries include alterations in hydrodynamic conditions affecting fishery habitat within the Delta.

The methods used in this portion of the fishery analysis for examining potential effects of the project on Delta fishery resources are as follows:

1. **Entrainment Indices from Field Data.** Comparison of entrainment indices for larval, juvenile, and adult fish, based on CalSim II modeling of the project alternatives and average fish density at Delta intakes as determined by field surveys;

2. **Delta Flow Surrogate for Delta Smelt Salvage at SWP and CVP Export Facilities.** Indirect estimation of changes in delta smelt salvage at the SWP and CVP export facilities based on CalSim II modeling and a flow surrogate for salvage;

3. **Particle Tracking Analysis**. Estimates of potential entrainment and changes in Delta circulation based on results of the particle tracking model (PTM);

4. **Hydrologic Effects of Operations**. Evaluation of changes in Delta flows based on CalSim II modeling of the project alternatives; and

5. **Old and Middle River Flow Evaluation Based on DSM2 Model Studies**. Evaluation of changes in flows in Old and Middle Rivers (OMR) based on DSM2 hydrodynamic modeling of the project alternatives.

The CalSim II and DSM2 studies described in Chapter 4.2 and previous chapters of Appendix C were used in performing these fishery impact analyses. Additional studies were run for the PTM analyses, as described within this chapter.

Entrainment Indices from Field Data

The four project alternatives for the Los Vaqueros Reservoir Expansion Project could affect fish populations in the Delta by changing levels of entrainment at the Rock Slough, Old River, and AIP Intakes, and, in Alternatives 1 and 2, the proposed new Los Vaqueros Delta intake (new Delta Intake), as well as at the SWP and CVP export pumps and their associated fish salvage facilities. To evaluate potential impacts of the project alternatives, entrainment estimates for delta smelt, longfin smelt, striped bass, and winter-run, spring-run, fall-run, and late fall-run salmon were developed. Historical fish survey field data and modeled diversions from the CalSim II model were integrated to produce fish entrainment estimates that account for the spatial and temporal distribution of specific Delta fish populations, and reflect the effects on these fish populations of changes in the timing, magnitude and location of pumping modifications. The entrainment estimates are represented as index values because they represent an estimate of average potential entrainment based on averages of available fish density data. These data are from fish surveys in the Delta conducted by CDFG, and from CVP and SWP fish salvage operations. The entrainment index values should be considered as relative indicators of entrainment, and not as precise numerical estimates of future fish entrainment.

Fish entrainment is assumed to vary in direct proportion to the seasonal density of fish in the immediate vicinity of an intake, the exclusion efficiency of any screens (which varies by fish length), and the diversion rate associated with the intake. The entrainment indices were developed through a two-step process as described below. First, average monthly densities were determined from available survey and entrainment data near the locations of the Rock Slough, Old River, AIP, and new Delta intakes, and the SWP and CVP export pumps. Then, the average monthly densities were multiplied by diversion values for the without project conditions and for the project alternatives from CalSim II output modeled monthly over a period representing 82 years of historical hydrology (see Appendix C). The results were summed across all intakes and averaged across the modeling period to produce the entrainment indices, which are given in numbers of fish entrained per year. To gauge the effects of the project alternatives, the entrainment indices developed from without project conditions were compared to the entrainment indices for each of the project alternatives.

Determination of Fish Density near Delta Water Intakes

Methodology

This section describes the method used to calculate fish densities from available field data. The general approach is described, including a discussion of the available data, followed by detailed descriptions of the procedures used to produce the survey- and salvage-based densities. Finally, the process used to consolidate the calculated densities into a final set of densities for use in calculation of the entrainment indices is described.

General Approach

Estimates of fish occurrence in the Delta that reflect the seasonal and geographic distribution of each of the selected fish species were calculated from results of fishery surveys conducted by CDFG, salvage of the selected species at the SWP and CVP export facilities, or a combination of both types of data. The data were converted to fish densities (number of fish per acre-foot (AF) of water). **Table C7-1** shows the fishery data used to calculate fish density for each intake and species.

TABLE C7-1: METHODS USED TO DETERMINE FISH DENSITIES.

Intakes	Methods Used to Determine Densities	
	Delta Smelt , Longfin Smelt, and Striped Bass	Chinook Salmon
Rock Slough, Old River, AIP and new Delta intakes	Integrated CDFG Surveys	Salvage Data
CVP and SWP export pumps	Integrated CDFG Surveys or Salvage Data	Salvage Data

Integrated survey data. Data were obtained from five surveys conducted by CDFG during various times of the year. These are the Fall Midwater Trawl (FMWT), the 20mm Survey (20mm), the Spring Kodiak Trawl (SKT), the Delta Smelt Larval Survey (DSLS), and the Summer Townet Survey (TNS). Data from the North Bay Aqueduct Survey (NBA) were not included, as the surveys do not take place near the Rock Slough, Old River, AIP, and new Delta intakes, or the SWP and CVP export pumps.

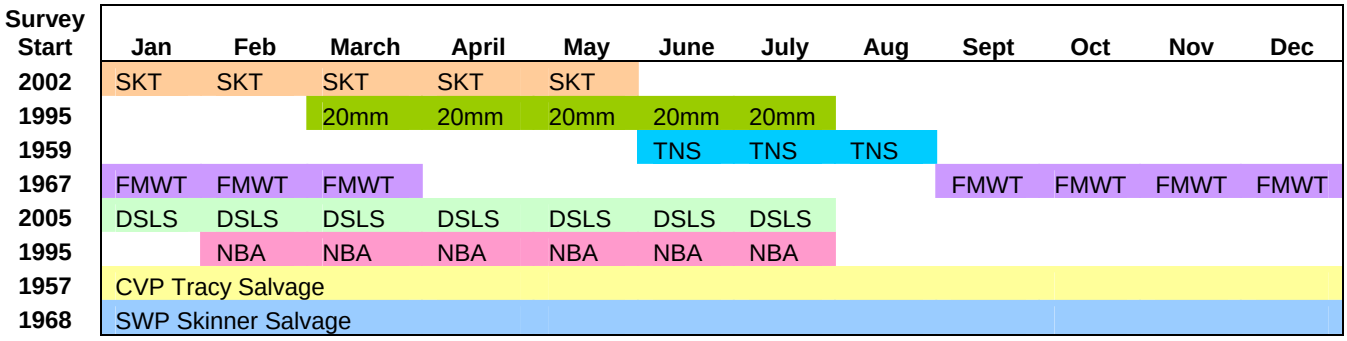


Figure C7-1: Fish surveys taking place throughout the year in the Bay-Delta.

Figure C7-1 shows that these surveys together span all the months of the year. Records of catch for all of the surveys were obtained from CDFG databases. The databases contain information on the size of the fish caught, which is important with respect to fish screen efficiency. Each survey consists of sampling at a number of stations, as shown in **Figure C7-2**.

To determine fish density associated with a given intake, the nearest survey station to the intake was selected and considered to be representative of the density of a selected species at the intake.

Once densities were determined individually for all of the surveys, the densities were then integrated for each of the intakes to provide a single fish density estimate for each species evaluated at each location for each month of the year.

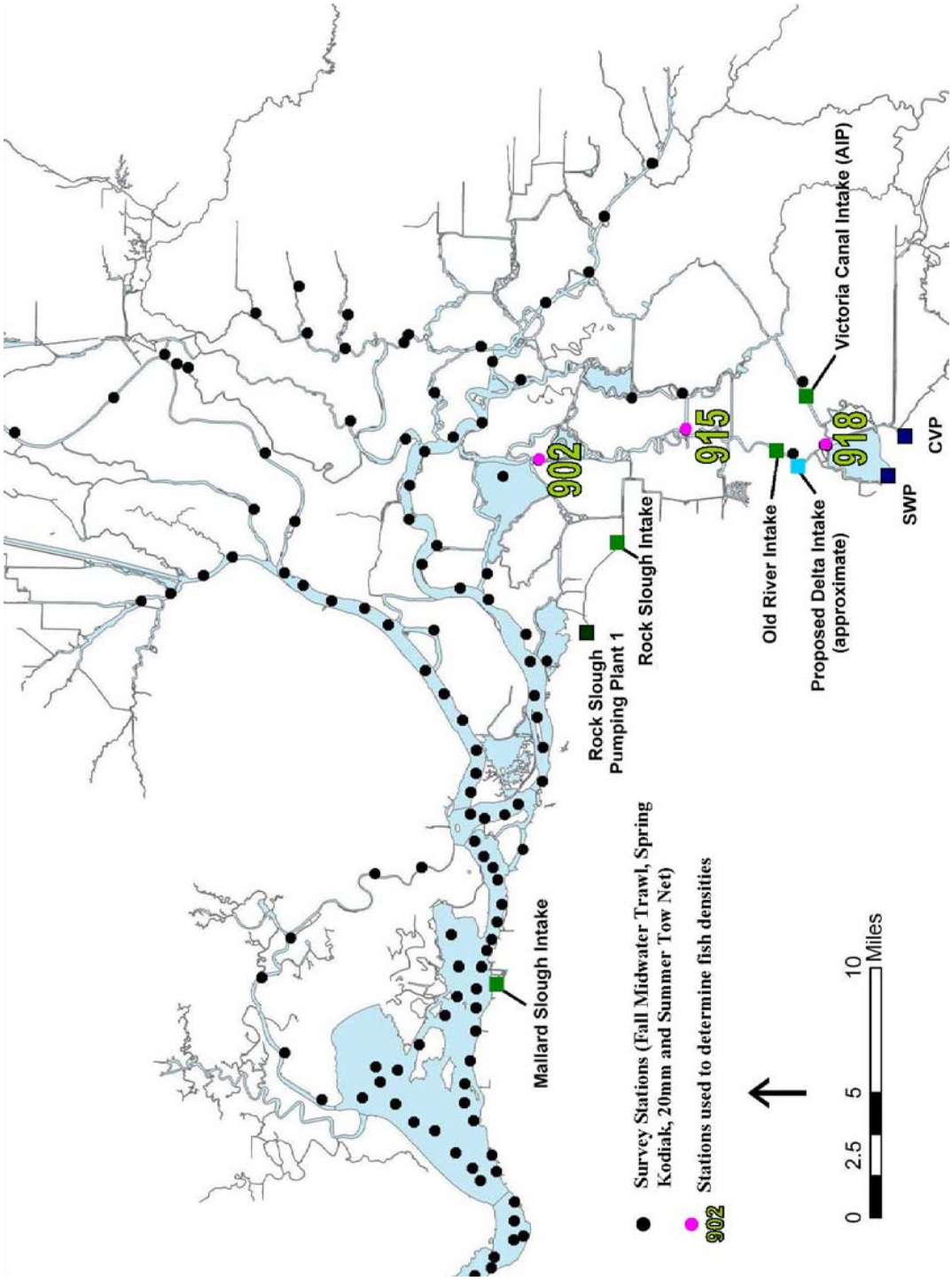


Figure C7-2: CDFG Fish Sampling Locations within the Delta and Suisun Bay

Salvage facility data. In addition to data obtained from the spatially-distributed CDFG fish surveys, data collected at the SWP and CVP fish salvage facilities were also used to estimate fish densities.

The sections that follow describe the procedures used to determine densities for each of the fish species included in the impact analysis.

Survey-Based Density Determination

The following procedure was used to determine fish densities from the five CDFG surveys discussed above.

Identify Representative Stations. For the Rock Slough, Old River, AIP, and new Delta intakes , the closest survey station was identified to represent the seasonal density of each fish species at the intake. The densities of larval, juvenile, and adult delta smelt, longfin smelt, and striped bass were estimated at the three locations described below representing each of the intake sites (with the station number taken from the 20mm trawl route, as shown in Figure C7-2):

- Station 902 – Rock Slough Intake
- Station 915 – Old River Intake and new Delta Intake
- Station 918 – on Old River, for AIP Intake

The fish catch at these survey locations provide the approximate fish densities at the Rock Slough, Old River and AIP Intakes. The new Delta Intake proposed in Alternatives 1 and 2 would be located on Old River close to the existing Old River Intake. For purposes of this analysis, flows at the new Delta Intake are assumed to be diverted at the same location as the existing Old River Intake, and the densities for Station 915 were used for both the Old River and new Delta intakes.

For the SWP and CVP export facilities, the survey-based densities were assumed to be the same as those observed at Station 918, which is the closest station surveyed by the CDFG 20mm trawls. As discussed below, if fish densities observed from salvage data at the SWP or CVP were higher than the densities observed in the CDFG fishery surveys at Station 918, then the salvage facility value was used for that month.

Determine Monthly Densities by Size Class. Catch per Unit Effort (CPUE) values were obtained from the CDFG survey databases and the corresponding volume of water sampled to estimate a monthly mean density over the time period of the survey. CPUE is a measure of the number of fish caught per unit volume of water sampled during a net tow (as determined by flow meter and net size), and is reported in terms of number of fish per 10,000 cubic meters. Assuming that the volume sampled is representative of the water column, CPUE serves as a measure of fish density. Monthly densities were determined for a range of size classes. This breakdown into size classes allows the application of a screen efficiency factor for intakes equipped with a positive barrier fish screen. Since screen efficiency is a function of the size (length) of the fish, length data provided by the various surveys is used to sort the fish densities into size classes. If an intake is screened, then a large percentage of the fish will be excluded by the screen mesh and are considered to not be entrained at the intake, which lowers the entrainment index. At present, the

Old River Intake is screened. The AIP Intake, which is currently under construction, will also have a positive barrier fish screen, as would the new Delta Intake, if constructed under Alternatives 1 or 2.

Density Determination Based on Salvage Facility Data

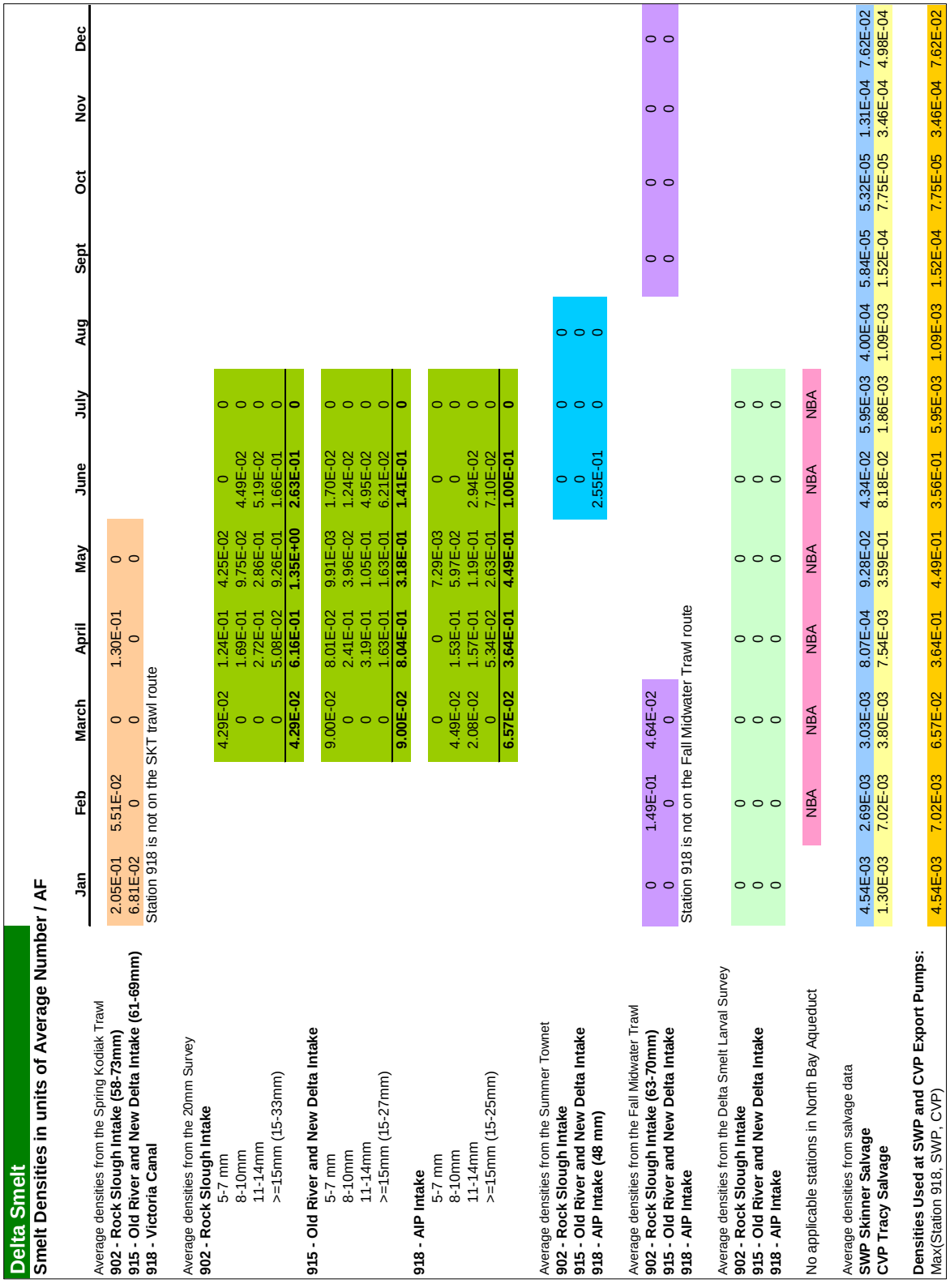
For the SWP and CVP export facilities, reported salvage data are also available. This section discusses the procedure that was used to determine densities of each of the selected fish species from the salvage data. Fish salvage and loss estimates are only available from these facilities for fish greater than 20 mm in length.

For this analysis, salvage data was used for the period from 1995 to 2007, which spans both non-POD and POD years, as well as a range of water year types. Salvage data prior to 1995 was not incorporated because measurement techniques were changed in 1995. Salvage data at the SWP and CVP facilities are reported daily. The average delta smelt, longfin smelt, and striped bass densities per month were calculated by averaging the daily salvage data across all days of that month, from 1995 through 2007 (e.g., for the month of May, averaging over all 31 days within May for the 13 year period averaged 403 days of salvage data). If no salvage is reported for a certain day, then salvage is assumed to be zero for that day.

For chinook salmon, estimated loss numbers derived from salvage data are available from CDFG and are used to determine densities for all four runs of salmon. Estimated loss is calculated by CDFG from raw salvage data and takes into account factors including predation, louver efficiencies and includes consideration of release and potential survival from the salvage process. Because of the consideration of other sources of losses other than salvage, estimated losses are higher than raw salvage numbers for chinook salmon. A representative salmon loss estimate for each month of the year is calculated by averaging monthly loss estimates obtained from the CDFG database from 1995 through 2007. Average monthly densities are then estimated by dividing the total number of salmon in each species category in each month by the total volume of water exported at each facility in that month (available in the same CDFG data set). The average monthly densities of salmon are calculated separately for the SWP and CVP export facilities. As a conservative estimate, the maximum salmon loss density between these two sites is selected to represent the salvage-based density used in the entrainment index calculations.

Consolidation of Densities for Entrainment Index Calculations

All sets of densities calculated using the survey and salvage data are shown in **Figure C7-3** to **Figure C7-6.** Since multiple surveys were used to determine the survey-based densities, and since salvage-based densities were also determined in the case of the SWP and CVP facilities, the results from these different sources were integrated to provide consolidated sets of monthly densities that spanned the entire year for each intake location, species, and size class (where applicable). This section describes how the densities that were ultimately used in the fishery impact calculations were determined.



Delta Smelt

Smelt Densities in units of Average Number / AF

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Average densities from the Spring Kodiak Trawl												
902 - Rock Slough Intake (58-73mm)	2.05E-01	5.51E-02	0	1.30E-01	0							
915 - Old River and New Delta Intake (61-69mm)	6.81E-02	0	0	0	0							
918 - Victoria Canal	Station 918 is not on the SKT trawl route											
Average densities from the 20mm Survey												
902 - Rock Slough Intake												
5-7 mm			4.29E-02	1.24E-01	4.25E-02	0	0					
8-10mm			0	1.69E-01	9.75E-02	4.49E-02	0					
11-14mm			0	2.72E-01	2.86E-01	5.19E-02	0					
>=15mm (15-33mm)			0	5.08E-02	9.26E-01	1.66E-01	0					
			4.29E-02	**6.16E-01**	**1.35E+00**	**2.63E-01**	**0**					
915 - Old River and New Delta Intake												
5-7 mm			9.00E-02	8.01E-02	9.91E-03	1.70E-02	0					
8-10mm			0	2.41E-01	3.96E-02	1.24E-02	0					
11-14mm			0	3.19E-01	1.05E-01	4.95E-02	0					
>=15mm (15-27mm)			0	1.63E-01	1.63E-01	6.21E-02	0					
			9.00E-02	**8.04E-01**	**3.18E-01**	**1.41E-01**	**0**					
918 - AIP Intake												
5-7 mm			0	0	7.29E-03	0	0					
8-10mm			4.49E-02	1.53E-01	5.97E-02	0	0					
11-14mm			2.08E-02	1.57E-01	1.19E-01	2.94E-02	0					
>=15mm (15-25mm)			0	5.34E-02	2.63E-01	7.10E-02	0					
			6.57E-02	**3.64E-01**	**4.49E-01**	**1.00E-01**	**0**					
Average densities from the Summer Townet												
902 - Rock Slough Intake						0	0	0				
915 - Old River and New Delta Intake						0	0	0				
918 - AIP Intake (48 mm)						2.55E-01	0	0				
Average densities from the Fall Midwater Trawl												
902 - Rock Slough Intake (63-70mm)	0	1.49E-01	4.64E-02						0	0	0	0
915 - Old River and New Delta Intake	0	0	0						0	0	0	0
918 - AIP Intake	Station 918 is not on the Fall Midwater Trawl route											
Average densities from the Delta Smelt Larval Survey												
902 - Rock Slough Intake	0	0	0	0	0	0	0					
915 - Old River and New Delta Intake	0	0	0	0	0	0	0					
918 - AIP Intake	0	0	0	0	0	0	0					
No applicable stations in North Bay Aqueduct		NBA	NBA	NBA	NBA	NBA	NBA					
Average densities from salvage data												
SWP Skinner Salvage	4.54E-03	2.69E-03	3.03E-03	8.07E-04	9.28E-02	4.34E-02	5.95E-03	4.00E-04	5.84E-05	5.32E-05	1.31E-04	7.62E-02
CVP Tracy Salvage	1.30E-03	7.02E-03	3.80E-03	7.54E-03	3.59E-01	8.18E-02	1.86E-03	1.09E-03	1.52E-04	7.75E-05	3.46E-04	4.98E-04
Densities Used at SWP and CVP Export Pumps:												
Max(Station 918, SWP, CVP)	4.54E-03	7.02E-03	6.57E-02	3.64E-01	4.49E-01	3.56E-01	5.95E-03	1.09E-03	1.52E-04	7.75E-05	3.46E-04	7.62E-02

Figure C7-3: Average monthly density of delta smelt calculated from CDFG field surveys and salvage.

Longfin Smelt

Smelt Densities in units of Average Number / AF

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Average densities from the Spring Kodiak Trawl												
902 - Rock Slough Intake	0	0	0	0	0	No reported longfin smelt found on SKT between 1995 to 2007 (survey started 2002)						
915 - Old River and New Delta Int	0	0	0	0	0							
918 - AIP Intake	Station 918 is not on the SKT trawl route											
Average densities from the 20mm Survey												
902 - Rock Slough												
5-7 mm			1.86E-01	1.29E-01	0	0	0					
8-10mm			2.75E-01	2.75E-01	0	0	0					
11-14mm			2.66E-01	3.40E-01	0	0	0					
>=15mm (15-27, 88mm)			4.43E-02	4.15E-01	3.97E-02	0	0					
			7.72E-01	**1.16E+00**	**3.97E-02**	**0**	**0**					
915 - Old River												
5-7 mm			1.99E-01	7.12E-02	0	0	0					
8-10mm			8.78E-02	1.80E-01	0	0	0					
11-14mm			6.24E-01	2.07E-01	2.37E-02	0	0					
>=15mm (15-20mm)			4.39E-02	1.44E-01	7.12E-02	0	0					
			9.55E-01	**6.02E-01**	**9.48E-02**	**0**	**0**					
918 - AIP												
5-7 mm			2.85E-01	3.87E-02	0	0	0					
8-10mm			4.49E-01	2.63E-01	0	1.64E-02	0					
11-14mm			9.80E-02	4.87E-01	0	0	0					
>=15mm (15-21mm)			2.61E-01	1.22E+00	0	0	0					
			1.09E+00	**2.01E+00**	**0**	**1.64E-02**	**0**					
Average densities from the Summer Townet												
902 - Rock Slough Intake						0	0	0	No longfin smelt measured at 900 stations after 1988			
915 - Old River and New Delta Intake						0	0	0				
918 - AIP Intake						0	0	0				
Average densities from the Fall Midwater Trawl												
902 - Rock Slough Intake	0	0	0	No longfin smelt measured on MWT at our stations					0	0	0	0
915 - Old River and New Delta Int	0	0	0						0	0	0	0
918 - AIP Intake	Station 918 is not on the Fall Midwater Trawl route											
Average densities from the Delta Smelt Larval Survey												
902 - Rock Slough (2005)												
5-7 mm	2.11E+00	8.62E-01	0	0	0	0	0					
8-10mm	2.81E+00	8.62E-01	0	0	0	0	0					
	4.92E+00	**1.72E+00**	**0**	**0**	**0**	**0**	**0**					
915 - Old River (2005, 2007)												
5-7 mm	2.20E+00	2.62E-01	0	0	0	0	0					
8-10mm	3.67E+00	3.93E-01	0	0	0	0	0					
	5.87E+00	**6.55E-01**	**0**	**0**	**0***	**0**	**0**	*Outlier from DSLS survey on May 9, 2005 disregarded				
918 - AIP (2005)												
5-7 mm	3.71E-01	9.77E-01	0	0	0	0	0					
8-10mm	1.86E+00	1.63E-01	0	0	0	0	0					
	2.23E+00	**1.14E+00**	**0**	**0**	**0**	**0**	**0**					
No applicable stations in North Bay Aqueduct		NBA	NBA	NBA	NBA	NBA	NBA					
Average densities from salvage data												
SWP Skinner Salvage	2.14E-04	3.62E-05	4.32E-05	1.45E-02	6.76E-02	1.10E-03	4.32E-05	2.42E-05	7.85E-06	1.07E-05	6.13E-06	6.23E-06
CVP Tracy Salvage	8.53E-05	1.40E-04	5.08E-04	6.43E-02	5.87E-02	2.29E-04	0	3.10E-06	0	0	0	2.65E-05
Densities Used at SWP and CVP Pumps:												
Max(Station 918, SWP, CVP)	2.23E+00	1.14E+00	1.09E+00	2.01E+00	6.76E-02	1.64E-02	4.32E-05	2.42E-05	7.85E-06	1.07E-05	6.13E-06	3.96E-05

Figure C7-4: Average monthly density of longfin smelt calculated from CDFG field surveys and salvage.

Striped Bass

Striped Bass Densities in units of Average Number / AF

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Average densities from the Spring Kodiak Trawl												
902 - Rock Slough Intake (88mm)	0	0	0.0256387	0	0	Only one striped bass caught in 7 years of surveying, on 3/4/02, size 88mm						
915 - Old River and New Delta Intake	0	0	0	0	0							
918 - AIP Intake	Station 918 is not on the SKT trawl route											
Average densities from the 20mm Survey												
902 - Rock Slough Intake												
5-7 mm			0	5.05E-01	3.86E+00	2.17E+00	2.05E-01					
8-10mm			0	3.93E-01	9.17E+00	5.12E+00	6.34E-01					
11-14mm			4.52E-02	5.61E-02	6.16E+00	4.80E+00	1.42E+00					
>=15mm			0	0	3.13E+00	1.96E+00	8.00E-01					
			4.52E-02	**9.54E-01**	**2.23E+01**	**1.40E+01**	**3.06E+00**					
915 - Old River and New Delta Intake												
5-7 mm			0	3.53E-01	1.81E+00	1.61E+00	4.13E-01					
8-10mm			0	4.33E-01	4.49E+00	5.76E+00	1.70E+00					
11-14mm			0	2.44E-01	6.56E+00	5.42E+00	2.21E+00					
>=15mm			0	0.00E+00	2.07E+00	1.69E+00	1.55E+00					
			0	**1.03E+00**	**1.49E+01**	**1.45E+01**	**5.88E+00**					
918 - AIP Intake												
5-7 mm			0	9.29E-02	4.51E-01	8.41E-01	2.89E-01					
8-10mm			0	3.23E-01	2.52E+00	4.35E+00	1.18E+00					
11-14mm			0	3.36E-01	7.33E+00	5.50E+00	2.78E+00					
>=15mm			0	0	3.47E+00	3.60E+00	2.25E+00					
			0	**7.52E-01**	**1.38E+01**	**1.43E+01**	**6.49E+00**					
Average densities from the Summer Townet												
902 - Rock Slough Intake						3.47E+00	2.68E+00	0				
915 - Old River and New Delta Intake (15-28mm)						2.01E+00	2.24E+00	7.46E-01				
918 - AIP Intake						2.28E+00	1.84E+00	0				
Average densities from the Fall Midwater Trawl												
902 - Rock Slough Intake	0	0	0	No striped bass measured on MWT at our stations					0	0	0	0
915 - Old River and New Delta Intake	0	0	0						0	0	0	0
918 - AIP Intake	Station 918 is not on the Fall Midwater Trawl route											
Average densities from the Delta Smelt Larval Survey												
902 - Rock Slough Intake(2005)												
5-7 mm	0	0	0	0	0	0	0					
8-10mm	0	0	0	0	0	0	0					
	0	**0**	**0**	**0**	**0**	**0**	**0**					
915 - Old River and New Delta Intake (2005, 2007)												
5-7 mm	0	0	0	0	0	6.11E-01	0	Two striped bass caught on 6/20/05, both 6mm				
8-10mm	0	0	0	0	0	0	0					
	0	**0**	**0**	**0**	**0**	6.11E-01	**0**					
918 - AIP Intake (2005)												
5-7 mm	0	0	0	0	0	0	0					
8-10mm	0	0	0	0	0	0	0					
	0	**0**	**0**	**0**	**0**	**0**	**0**					
No applicable stations in North Bay Aqueduct		NBA	NBA	NBA	NBA	NBA	NBA					
Average densities from salvage data												
SWP Skinner Salvage	7.47E-02	6.05E-02	3.46E-02	7.18E-03	9.72E-02	1.97E+00	1.40E+00	3.23E-01	3.59E-02	1.60E-01	2.89E-01	1.97E-01
CVP Tracy Salvage	2.36E-01	7.78E-02	8.21E-02	5.61E-02	1.10E+00	5.90E+01	2.94E-01	8.47E-02	4.00E-02	4.14E-02	6.38E-02	8.07E-02
Densities Used at SWP and CVP Export Pumps:												
Max(Station 918, SWP, CVP)	2.36E-01	7.78E-02	8.21E-02	7.52E-01	1.38E+01	1.43E+01	6.49E+00	3.23E-01	4.00E-02	1.60E-01	2.89E-01	1.97E-01

Figure C7-5: Average monthly density of striped bass calculated from CDFG field surveys and salvage.

Chinook Salmon

Salmon Densities in units of Average Number / AF

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Winter Run Salmon												
SWP Skinner Salvage	1.02E-02	5.96E-03	9.50E-03	3.42E-03	8.29E-05	0	0	0	0	0	0	2.26E-03
CVP Tracy Salvage	1.40E-03	1.09E-03	1.61E-03	1.81E-03	2.67E-05	0	0	0	0	0	0	3.00E-04
max density	**1.02E-02**	**5.96E-03**	**9.50E-03**	**3.42E-03**	**8.29E-05**	**0**	**0**	**0**	**0**	**0**	**0**	**2.26E-03**
Spring Run Salmon												
SWP Skinner Salvage	1.07E-05	2.14E-04	1.17E-02	1.43E-01	6.88E-02	9.31E-04	0	0	1.11E-05	1.14E-05	0	0
CVP Tracy Salvage	1.36E-05	7.75E-05	9.55E-03	5.75E-02	2.09E-02	4.28E-04	0	0	0	0	0	0
max density	**1.36E-05**	**2.14E-04**	**1.17E-02**	**1.43E-01**	**6.88E-02**	**9.31E-04**	**0**	**0**	**1.11E-05**	**1.14E-05**	**0**	**0**
Fall Run Salmon												
SWP Skinner Salvage	8.22E-04	1.66E-02	7.53E-03	5.48E-02	2.35E-01	2.82E-02	7.32E-04	9.40E-05	1.10E-03	2.10E-04	1.56E-04	1.74E-05
CVP Tracy Salvage	1.09E-02	2.69E-02	8.15E-03	2.09E-02	6.37E-02	1.76E-02	1.03E-04	2.23E-05	8.73E-05	1.10E-04	1.27E-04	1.44E-05
max density	**1.09E-02**	**2.69E-02**	**8.15E-03**	**5.48E-02**	**2.35E-01**	**2.82E-02**	**7.32E-04**	**9.40E-05**	**1.10E-03**	**2.10E-04**	**1.56E-04**	**1.74E-05**
Late Fall Run Salmon												
SWP Skinner Salvage	4.22E-03	3.71E-04	5.87E-05	2.17E-05	0	0	0	1.40E-05	1.45E-05	3.49E-05	8.17E-05	1.04E-03
CVP Tracy Salvage	3.85E-04	4.11E-05	0	8.67E-06	0	1.79E-05	0	0	0	2.06E-06	4.19E-05	2.49E-04
max density	**4.22E-03**	**3.71E-04**	**5.87E-05**	**2.17E-05**	**0**	**1.79E-05**	**0**	**1.40E-05**	**1.45E-05**	**3.49E-05**	**8.17E-05**	**1.04E-03**

Figure C7-6: Average monthly density of juvenile Chinook salmon calculated from SWP and CVP salvage.

Delta Smelt at Rock Slough, Old River, AIP and new Delta Intake. The surveys used in calculating the delta smelt densities were the SKT, FMWT, TNS, and 20mm surveys. Data from these surveys were used over the period 1995-2007. With the 20mm survey data starting in 1995, this time period spans both non-POD as well as POD years (POD years are 2001-2007), but the years were averaged equally to avoid giving undue weight to low sample results during the POD years. Densities of delta smelt by larval size classes are given by the 20mm survey. The juvenile and adult delta smelt size class densities (>= 20 mm) are provided by the other surveys. There were no periods that had overlapping survey results for the same size class, with the exception of February for adult smelt at Station 902, which had results from both SKT and FMWT surveys. In this case, the higher density (from FMWT) was used. Where data for non-overlapping size classes were available from 2 surveys for a given month, both data sets were used.

Longfin Smelt at Rock Slough, Old River, AIP and new Delta intakes. The surveys used in calculating the longfin smelt densities were the DSLS and the 20mm surveys. The other surveys did not detect any longfin smelt at the three locations considered in this analysis during the period of 1995 to 2007.

DSLS surveys were performed only in 2005 and 2007, and longfin smelt were detected only in 2007. Therefore, the monthly average density values calculated for longfin smelt are based on the results from a single survey event. These sample results indicate a relatively high density of longfin smelt, but these results may be outlier values. However, the DSLS numbers were used for January and February because larval longfin smelt are known to be present at that time, and the DSLS is the only source of longfin smelt survey data known to be available for this purpose. The DSLS also detected an unusually high number of longfin smelt in May 2005 at Station 915 (150 longfin smelt caught). For comparison, the total of all smelt caught for all months at stations 902, 914, and 918, was 40 smelt. Since the data from the single survey in May 2005 at Station 915 appeared to be an outlier, these data were not used in the impact analysis. Instead, for May, the density calculated from the 20mm trawl was used, which represents data from 13 years of surveys.

Unlike delta smelt, longfin smelt were classified into four size categories rather than five because only one adult longfin smelt (88 mm) was caught, in April 2002 in the 20mm survey. This smelt was placed into the ">=15 mm" category. There were no overlapping periods with monthly densities of the same size class once the DSLS May data from Station 915 were excluded from the analysis.

Striped Bass at Rock Slough, Old River, AIP and new Delta intakes. The surveys used in calculating the striped bass densities were the SKT, TNS, DSLS, and 20mm surveys. The FMWT did not detect any striped bass at the three locations considered in this analysis during the period of 1995 to 2007.

DSLS surveys were performed only in 2005 and 2007, and striped bass were detected only on June 20, 2005, at Station 915 near the Old River Intake. This data value overlaps with the 20mm trawl. Since the density determined from the 20mm trawl was calculated from more years of data,

the two striped bass caught on the DSLS survey were disregarded in favor of the June 20mm trawl results.

Similar to delta smelt, striped bass were classified into five size categories. In March 2002, one 88 mm striped bass was caught in the Spring Kodiak Trawl at Station 902 near the Rock Slough Intake. This striped bass was categorized into the ">=45 mm" category and included in the total density calculation.

Delta Smelt and Longfin Smelt at SWP and CVP Intakes. Densities for delta smelt and longfin smelt for the SWP and CVP export facilities were obtained either from CDFG survey data or from SWP and CVP salvage data from 1995-2007. The SWP and CVP export facilities are equipped with louvers which are not assumed to exclude larval or early juvenile lifestages from entrainment. Thus, the size of the fish was not relevant to the entrainment index calculation, and the total fish densities were utilized in these analyses. For survey-based density, CDFG Station 918, which is closest to the export facilities, was selected as representative of the smelt densities at both the SWP and CVP export facilities. Salvage-based densities were determined from reported salvage data separately for the SWP and CVP export facilities. For delta smelt, two different methods were used to calculate densities. The highest density value from the salvage- or survey-based methods was then used to represent the density of smelt potentially vulnerable to entrainment/salvage at the SWP and CVP intakes. Note that loss estimates derived from CVP and SWP salvage data were not used for delta smelt or longfin smelt, so the salvage values for these species do not include estimates of pre-screen losses. Salvage survival is assumed to be negligible for these species.

Striped Bass at SWP and CVP Intakes. Densities for striped bass at the SWP and CVP export facilities were obtained either from CDFG survey data or from SWP and CVP salvage data. Due to data availability for striped bass, the salvage data used was from 1995-2006. As was done for the smelt species, CDFG Station 918 was selected as representative of the striped bass densities at both the SWP and CVP export facilities. Salvage-based densities were determined from reported salvage data separately for the SWP and CVP export facilities. The highest density value from the salvage- or survey-based methods was then used to represent the density of striped bass potentially vulnerable to entrainment/salvage at the SWP and CVP intakes. The salvage density for the CVP export facility for the month of June (59 fish/AF) was an outlier, and therefore the density from the Station 918 20mm trawl (14.3 fish/AF) was used (see **Figure C7-5**).

Chinook Salmon at all Intakes. Spatially-distributed salmon data are not available from survey sampling within the Delta. Therefore, the densities based on loss estimates reported at the CDFG salvage data site for the SWP and CVP export facilities are assumed to be representative of the seasonal densities of juvenile Chinook salmon at all intake locations included in this analysis. Loss estimates take into consideration the pre-louver predation loss, salmon that went through the louvers, and salmon that were returned alive to the Delta after the salvage process, as estimated by CDFG.

The reported juvenile salmon densities at the SWP export facility tend to be higher than corresponding densities at the CVP facility. The higher of the two density estimates were used in the analysis to represent the density of juvenile Chinook salmon at the Rock Slough, Old River,

AIP and new Delta Intake locations. As the salmon reported in the SWP and CVP salvage are all juveniles, we assumed 100% exclusion efficiency at the screened intakes (Old River, AIP, and new Delta intakes), and 100% entrainment at the other intakes (Rock Slough Intake, SWP, and CVP export pumps).

Average Fish Densities

The average monthly fish density estimates near the Rock Slough, Old River, AIP, and new Delta intakes (for Alternatives 1 and 2) and the SWP and CVP export facilities are shown in **Figure C7-7**, **Figure C7-8**, **Figure C7-10**, and **Figure C7-12** (note that the y-axis scale on each graph is different). Due to the proximity of the Old River Intake to the new Delta Intake, densities at the new Delta Intake are assumed to be the same as those at the Old River Intake. As shown in the figures below, the period from January through July is the general period when fish densities are higher in the vicinity of the intakes (although there is significant variation among the species within that period), while the months of August through December represent a period of the year when densities are relatively low.

As shown in **Table C7-2,** the effectiveness of a positive barrier fish screen with a 1.75 mm mesh in reducing the densities of larval and juvenile fish vulnerable to entrainment into a water diversion ranges from 76.9% for 5-7mm larval fish to 100% for adults.

TABLE C7-2: EXCLUSION EFFICIENCY OF FISH SCREEN AT OLD RIVER, FUTURE AIP, AND NEW DELTA INTAKE.[1]

Size Class	Exclusion Efficiency (Percentage)
5-7 mm	0.769
8-10 mm	0.776
11-14 mm	0.951
>= 15 mm	0.995
>= 45 mm	1.000

These screen efficiencies were assumed in this analysis for the Old River Intake, AIP, and new Delta Intake. The actual effectiveness of the fish screens at these intakes is likely to be even higher than those determined by the study, as conditions used by the study included impingement losses from higher approach velocities towards the fish screens, in contrast to the Old River, AIP, and new Delta intakes, where the water is pumped perpendicular to the direction of river flow at a low approach velocity. This results in a high sweep velocity past the screened intake relative to the slow approach velocity towards the screen, which results in a low incidence of impingement. However, even the conservative application of the fish screen effectiveness estimates used here indicates that shifting water diversions from the SWP and CVP intakes to intakes with positive barrier fish screens can significantly reduce the entrainment losses of larval and early juvenile lifestages of fish such as delta and longfin smelt, as well as nearly completely prevent

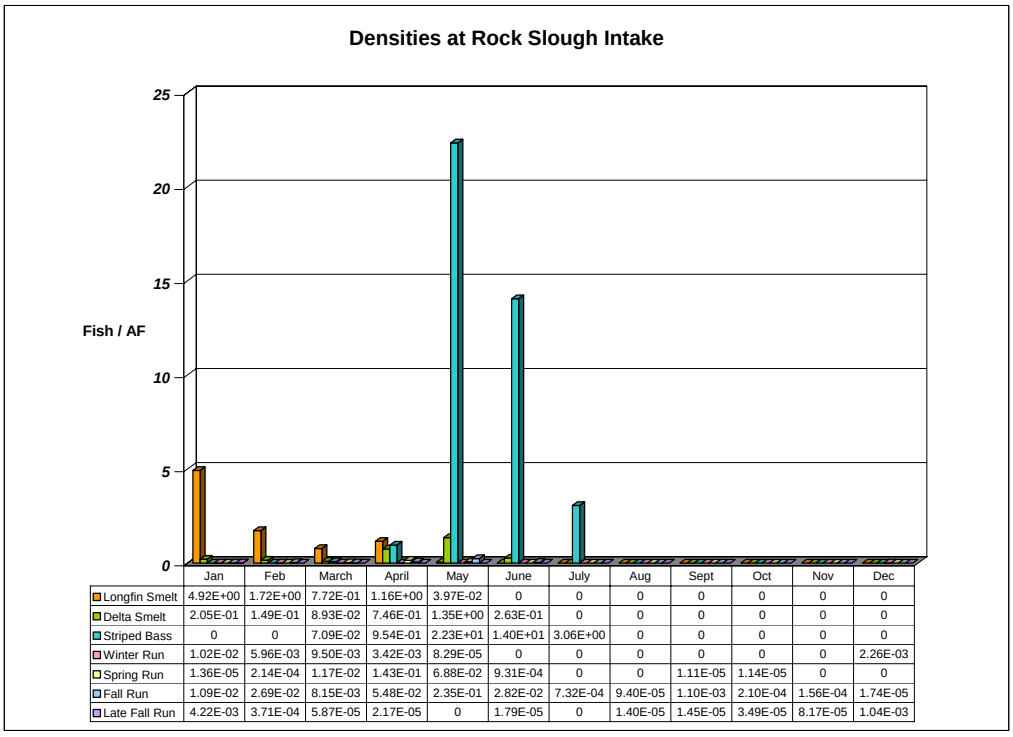
[1] "Reductions in Ichthyoplankton Entrainment with Fine, Mesh, Wedge-Wire Screens," North American Journal of Fisheries Management 7:386-393, 1987. Exclusion efficiency assumes a 1.75 mm fish screen mesh slot opening.

entrainment losses of adult smelt and juvenile Chinook salmon and striped bass. **Table C7-3** shows an example of how the total fish density is broken down into densities for each size class.

TABLE C7-3: EXAMPLE OF FISH DENSITY DATA CLASSIFIED BY FISH LENGTH

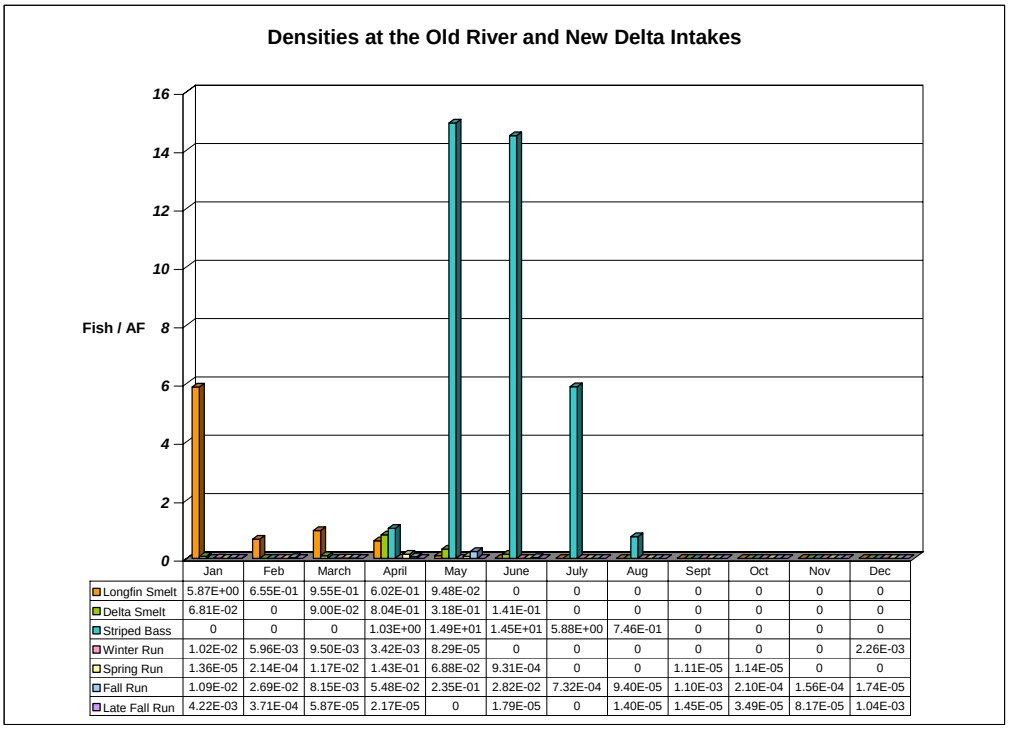
Larval Smelt Length	March	April	May	June	July
5-7mm	0.000	0.000	0.018	0.000	0.000
8-10mm	0.000	0.268	0.124	0.000	0.000
11-14mm	0.000	0.081	0.147	0.126	0.000
>=15mm	0.000	0.000	0.483	0.181	0.000
# / AF for All Lengths	**0.000**	**0.349**	**0.772**	**0.307**	**0.000**

Figure C7-9 and **Figure C7-11** show the average "effective" fish densities, which account for fish screen efficiency, at the Old River, AIP, and new Delta intakes. To calculate the average effective densities, the average fish densities for each size class are multiplied by the quantity (1.0 minus the screen efficiency). This gives the fish densities that would be expected to be entrained (pass through) the intake screen mesh and be lost from the Delta per acre-foot of diversion. These densities are then summed over all the length classes to estimate the total effective fish density. The effective fish densities estimated for the Rock Slough intake and the SWP and CVP intakes remain unchanged.



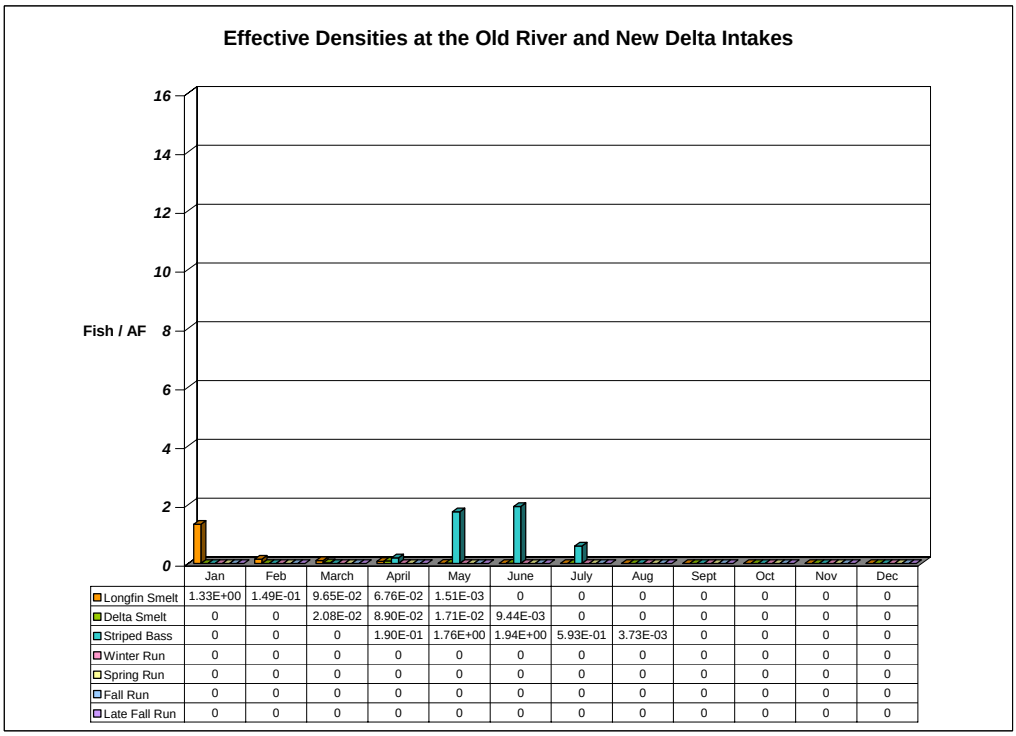
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Longfin Smelt	4.92E+00	1.72E+00	7.72E-01	1.16E+00	3.97E-02	0	0	0	0	0	0	0
Delta Smelt	2.05E-01	1.49E-01	8.93E-02	7.46E-01	1.35E+00	2.63E-01	0	0	0	0	0	0
Striped Bass	0	0	7.09E-02	9.54E-01	2.23E+01	1.40E+01	3.06E+00	0	0	0	0	0
Winter Run	1.02E-02	5.96E-03	9.50E-03	3.42E-03	8.29E-05	0	0	0	0	0	0	2.26E-03
Spring Run	1.36E-05	2.14E-04	1.17E-02	1.43E-01	6.88E-02	9.31E-04	0	0	1.11E-05	1.14E-05	0	0
Fall Run	1.09E-02	2.69E-02	8.15E-03	5.48E-02	2.35E-01	2.82E-02	7.32E-04	9.40E-05	1.10E-03	2.10E-04	1.56E-04	1.74E-05
Late Fall Run	4.22E-03	3.71E-04	5.87E-05	2.17E-05	0	1.79E-05	0	1.40E-05	1.45E-05	3.49E-05	8.17E-05	1.04E-03

Figure C7-7: Average monthly fish densities at the Rock Slough Intake



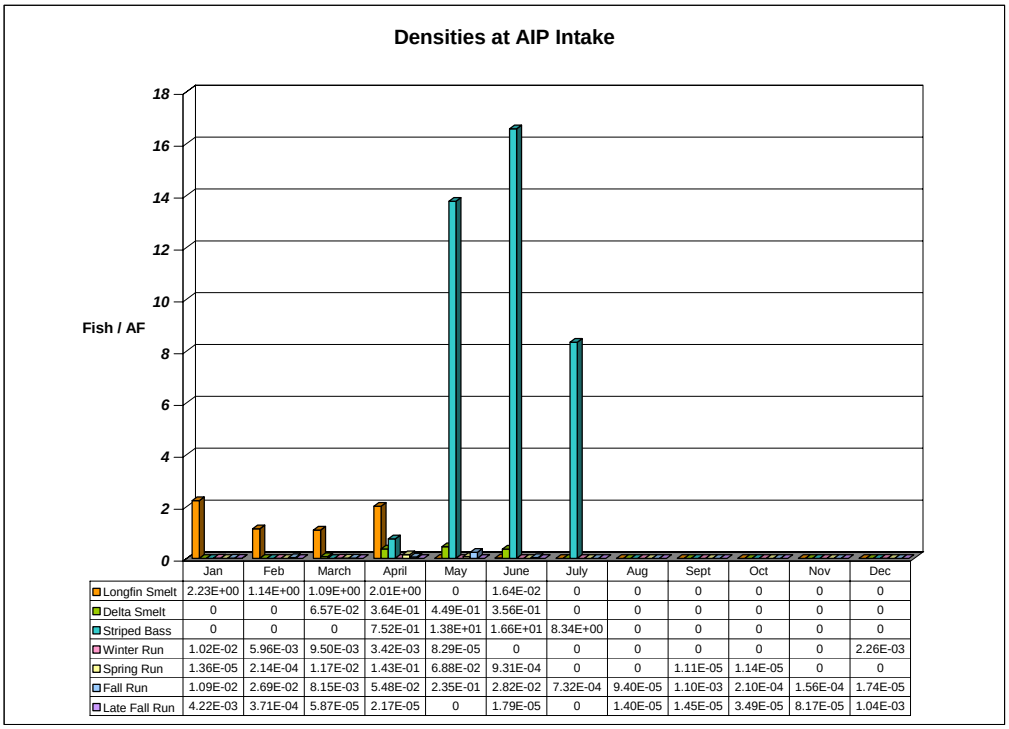
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Longfin Smelt	5.87E+00	6.55E-01	9.55E-01	6.02E-01	9.48E-02	0	0	0	0	0	0	0
Delta Smelt	6.81E-02	0	9.00E-02	8.04E-01	3.18E-01	1.41E-01	0	0	0	0	0	0
Striped Bass	0	0	0	1.03E+00	1.49E+01	1.45E+01	5.88E+00	7.46E-01	0	0	0	0
Winter Run	1.02E-02	5.96E-03	9.50E-03	3.42E-03	8.29E-05	0	0	0	0	0	0	2.26E-03
Spring Run	1.36E-05	2.14E-04	1.17E-02	1.43E-01	6.88E-02	9.31E-04	0	0	1.11E-05	1.14E-05	0	0
Fall Run	1.09E-02	2.69E-02	8.15E-03	5.48E-02	2.35E-01	2.82E-02	7.32E-04	9.40E-05	1.10E-03	2.10E-04	1.56E-04	1.74E-05
Late Fall Run	4.22E-03	3.71E-04	5.87E-05	2.17E-05	0	1.79E-05	0	1.40E-05	1.45E-05	3.49E-05	8.17E-05	1.04E-03

Figure C7-8: Average monthly fish densities at the Old River Intake and new Delta Intake, in front of the screen



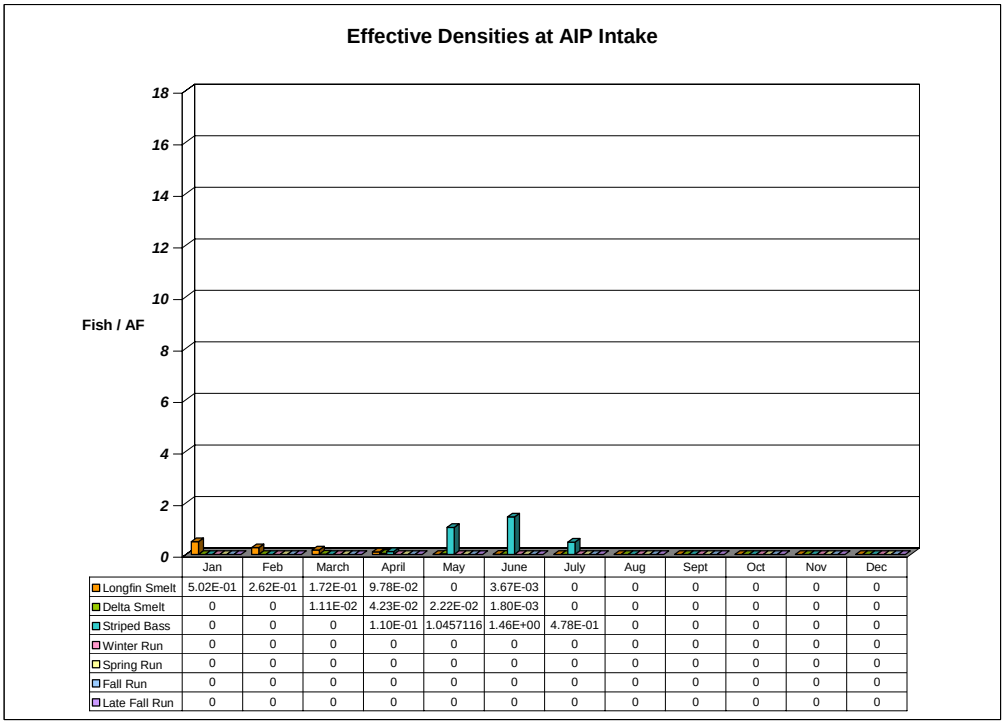
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Longfin Smelt	1.33E+00	1.49E-01	9.65E-02	6.76E-02	1.51E-03	0	0	0	0	0	0	0
Delta Smelt	0	0	2.08E-02	8.90E-02	1.71E-02	9.44E-03	0	0	0	0	0	0
Striped Bass	0	0	0	1.90E-01	1.76E+00	1.94E+00	5.93E-01	3.73E-03	0	0	0	0
Winter Run	0	0	0	0	0	0	0	0	0	0	0	0
Spring Run	0	0	0	0	0	0	0	0	0	0	0	0
Fall Run	0	0	0	0	0	0	0	0	0	0	0	0
Late Fall Run	0	0	0	0	0	0	0	0	0	0	0	0

Figure C7-9: Effective fish densities past the fish screen at the Old River Intake and new Delta Intake



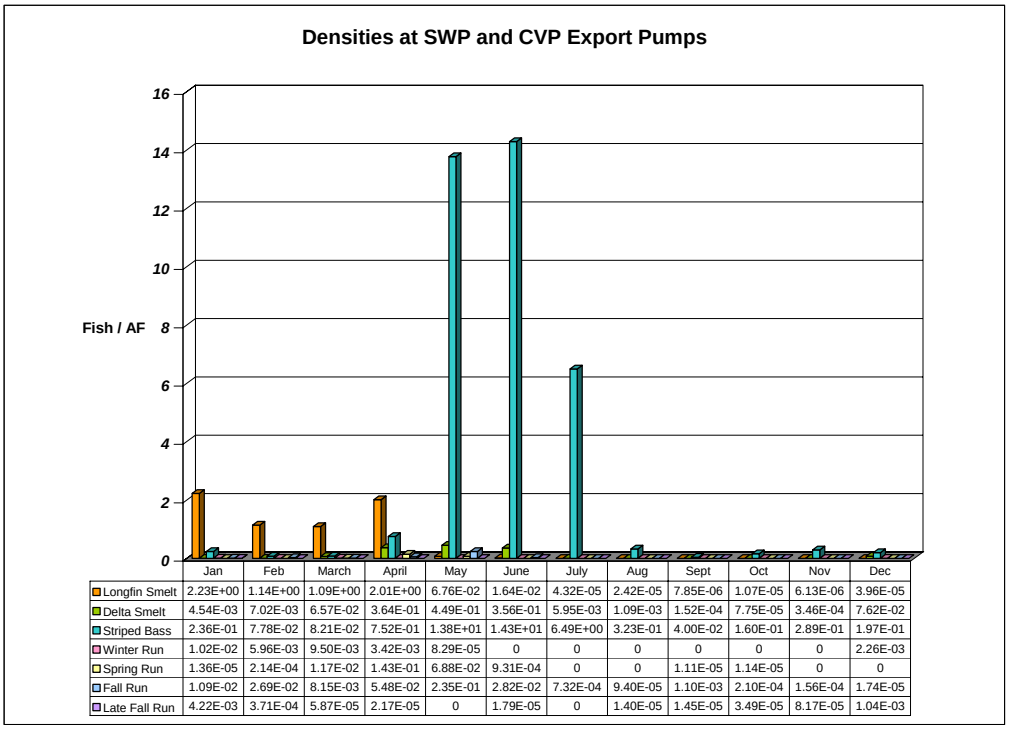
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Longfin Smelt	2.23E+00	1.14E+00	1.09E+00	2.01E+00	0	1.64E-02	0	0	0	0	0	0
Delta Smelt	0	0	6.57E-02	3.64E-01	4.49E-01	3.56E-01	0	0	0	0	0	0
Striped Bass	0	0	0	7.52E-01	1.38E+01	1.66E+01	8.34E+00	0	0	0	0	0
Winter Run	1.02E-02	5.96E-03	9.50E-03	3.42E-03	8.29E-05	0	0	0	0	0	0	2.26E-03
Spring Run	1.36E-05	2.14E-04	1.17E-02	1.43E-01	6.88E-02	9.31E-04	0	0	1.11E-05	1.14E-05	0	0
Fall Run	1.09E-02	2.69E-02	8.15E-03	5.48E-02	2.35E-01	2.82E-02	7.32E-04	9.40E-05	1.10E-03	2.10E-04	1.56E-04	1.74E-05
Late Fall Run	4.22E-03	3.71E-04	5.87E-05	2.17E-05	0	1.79E-05	0	1.40E-05	1.45E-05	3.49E-05	8.17E-05	1.04E-03

Figure C7-10: Average monthly fish densities at the AIP Intake, in front of the screen



	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Longfin Smelt	5.02E-01	2.62E-01	1.72E-01	9.78E-02	0	3.67E-03	0	0	0	0	0	0
Delta Smelt	0	0	1.11E-02	4.23E-02	2.22E-02	1.80E-03	0	0	0	0	0	0
Striped Bass	0	0	0	1.10E-01	1.0457116	1.46E+00	4.78E-01	0	0	0	0	0
Winter Run	0	0	0	0	0	0	0	0	0	0	0	0
Spring Run	0	0	0	0	0	0	0	0	0	0	0	0
Fall Run	0	0	0	0	0	0	0	0	0	0	0	0
Late Fall Run	0	0	0	0	0	0	0	0	0	0	0	0

Figure C7-11: Effective fish densities past the fish screen at the AIP Intake



	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Longfin Smelt	2.23E+00	1.14E+00	1.09E+00	2.01E+00	6.76E-02	1.64E-02	4.32E-05	2.42E-05	7.85E-06	1.07E-05	6.13E-06	3.96E-05
Delta Smelt	4.54E-03	7.02E-03	6.57E-02	3.64E-01	4.49E-01	3.56E-01	5.95E-03	1.09E-03	1.52E-04	7.75E-05	3.46E-04	7.62E-02
Striped Bass	2.36E-01	7.78E-02	8.21E-02	7.52E-01	1.38E+01	1.43E+01	6.49E+00	3.23E-01	4.00E-02	1.60E-01	2.89E-01	1.97E-01
Winter Run	1.02E-02	5.96E-03	9.50E-03	3.42E-03	8.29E-05	0	0	0	0	0	0	2.26E-03
Spring Run	1.36E-05	2.14E-04	1.17E-02	1.43E-01	6.88E-02	9.31E-04	0	0	1.11E-05	1.14E-05	0	0
Fall Run	1.09E-02	2.69E-02	8.15E-03	5.48E-02	2.35E-01	2.82E-02	7.32E-04	9.40E-05	1.10E-03	2.10E-04	1.56E-04	1.74E-05
Late Fall Run	4.22E-03	3.71E-04	5.87E-05	2.17E-05	0	1.79E-05	0	1.40E-05	1.45E-05	3.49E-05	8.17E-05	1.04E-03

Figure C7-12: Average monthly fish densities at the SWP and CVP fish salvage facilities

Development of Entrainment Index at Each Intake

Once the monthly average fish densities and monthly pumping flow rates were determined, the entrainment indices were calculated. This section presents the methodology used to calculate the entrainment indices, and analysis of the indices.

Methodology

For the Rock Slough Intake and the SWP and CVP export facilities, it is assumed that 100% of the fish density in the volume of water diverted is entrained into the facility and lost from the Delta. As noted above, CDFG loss estimates were used to estimate densities for Chinook salmon at the CVP and SWP facilities, so these values include an estimate of salvage survival. For screened intakes (Old River, AIP, and new Delta intakes), estimated average monthly fish densities were classified by size (length class), so that the number of each selected fish species entrained through the fish screens (accounting for size-specific fish exclusion by the fish screens) could be estimated. The fish density for each size class is multiplied by the intake flow rate, as determined in the CalSim II runs, and by (1.0 minus the screen efficiency) to estimate the number of each species entrained for each size class. The resultant numbers of entrained fish for each size class are then summed to determine the total number of entrained fish at a screened intake.

Flows are based on results of CalSim II simulations for each simulated month as summarized below:

- 2005 Level of Development, Severe Fishery Restrictions (Existing Condition and four alternatives)
- 2005 Level of Development, Moderate Fishery Restrictions (Existing Condition and four alternatives)
- 2030 Level of Development, Severe Fishery Restrictions (Future Without Project conditions and four alternatives)
- 2030 Level of Development, Moderate Fishery Restrictions (Future Without Project conditions and four alternatives)

Density-Based Pumping Modifications

To minimize the fish entrainment incurred at the Rock Slough, Old River, AIP, and new Delta intakes, the project diversions at these intakes estimated by the CalSim II studies were modified to shift pumping to the intake(s) with the lowest fish density. As described in Appendix C3, CalSim II generates a set of monthly diversion patterns at the Rock Slough, Old River, AIP and new Delta intakes that optimize water quality of diverted water, given facility capacity and delivery constraints, but do not consider fish densities. The revision of operations described here is a post-process of the CalSim II model output, and simulates adaptive management of these intakes in response to fishery information. Diversions are shifted to the intake(s) with the lowest fish density, provided that the water quality is better than or equal to 65 mg/L chlorides, and that there is pumping capacity at the intake(s) for the shifted pumping amount. If the intake with the lowest fish density does not have free capacity to accommodate all of the shifted diversion, then the intake with the second-lowest fish density is assumed to divert the rest of the shifted amount, provided water quality and capacity requirements are met. This new set of flow diversions optimizes the flow pattern for fish protection.

Figure C7-13, **Figure C7-14**, and **Figure C7-15** illustrate the minimizing of fish entrainment potential by optimizing the CalSim II flows to consider fish density. Figure C7-13a shows the unmodified diversions output by CalSim II, and Figure C7-13b shows an example of the shifted flow diversion that minimizes fish entrainment. The corresponding fish entrainment numbers for longfin smelt and delta smelt are shown in Figure C7-13a,b and Figure C7-14a,b. A comparison of Figure C7-13a to Figure C7-13b illustrates how the pumping at the Rock Slough and Old River Intakes has largely been shifted to the AIP Intake, which often has lower fish densities. Figure C7-14b demonstrates how this shifting of diversions away from Rock Slough and Old River Intakes greatly decreases the January entrainment numbers for longfin smelt when compared to the unmodified case in Figure C7-14a.

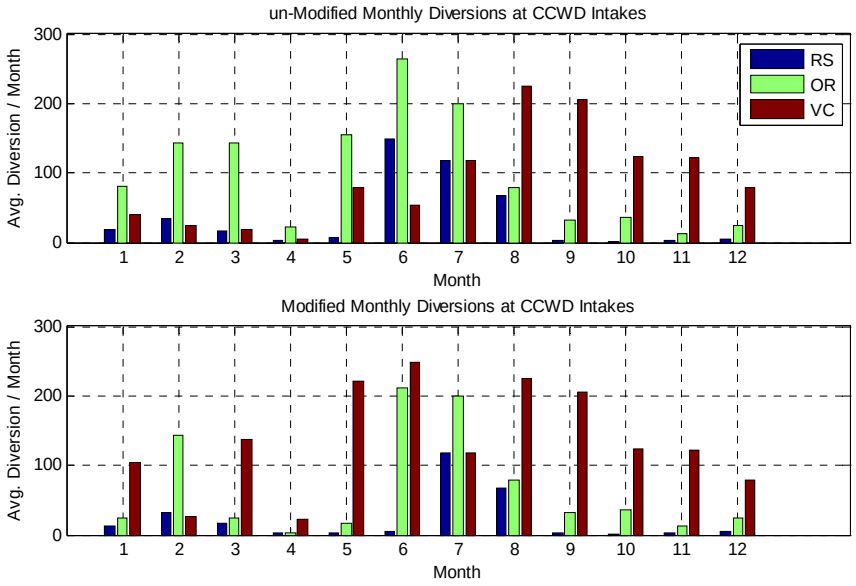


Figure C7-13: Alternative 4,
2030 Level of Development with Moderate Fishery Restrictions,
Diversions at the Rock Slough, Old River and AIP Intakes
Before and After Density-Based Flow Adjustments

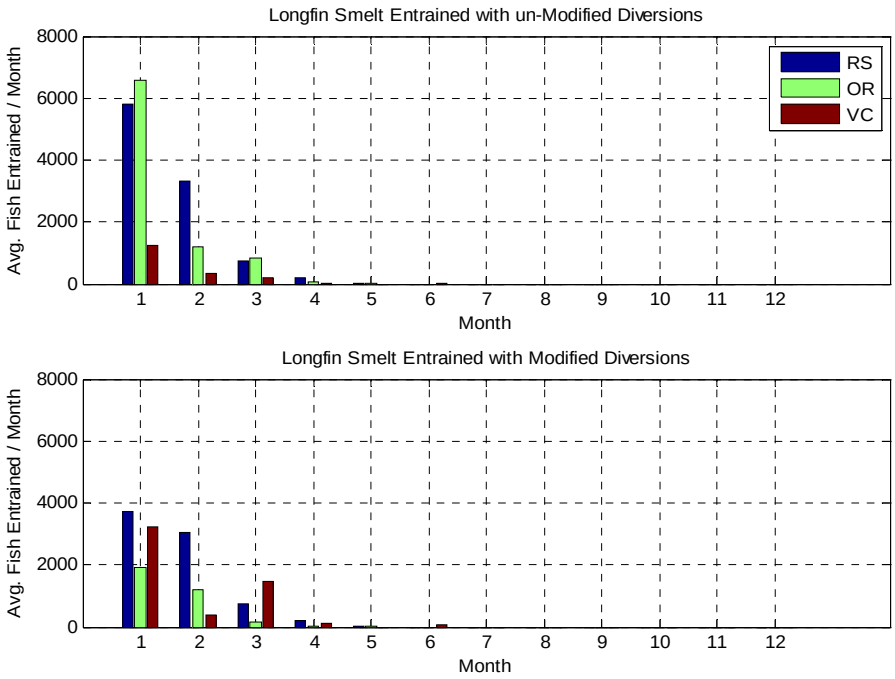


Figure C7-14: Alternative 4,
2030 Level of Development with Moderate Fishery Restrictions;
Longfin Smelt Entrainment at the Rock Slough, Old River and AIP Intakes
Before and After Density-Based Flow Adjustments

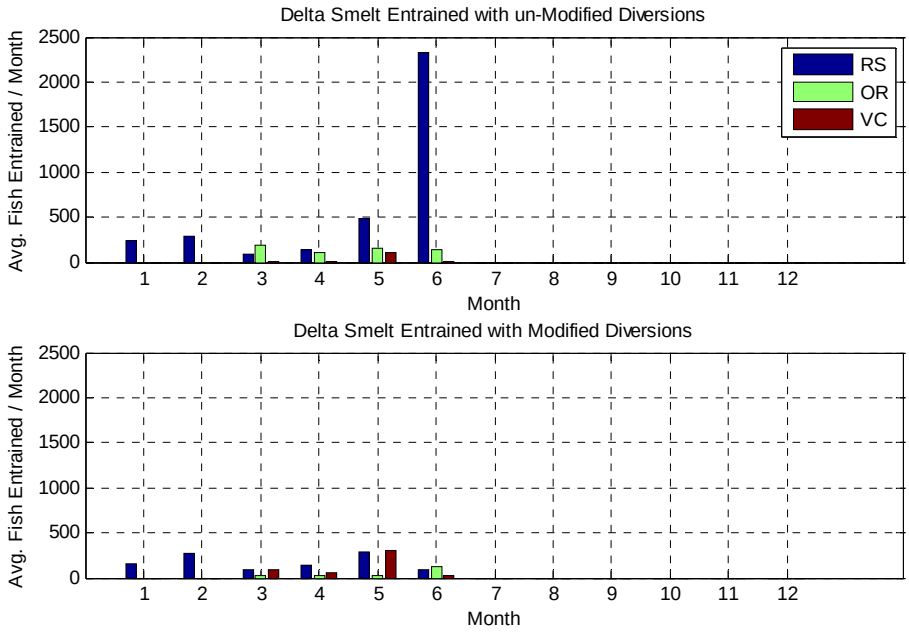


Figure C7-15: Alternative 4,
2030 Level of Development with Moderate Fishery Restrictions;
Delta Smelt Entrainment at the Rock Slough, Old River and AIP Intakes
Before and After Density-Based Flow Adjustments

For each of the project alternatives, the diversions at the intakes were modified to optimize intake use based on the densities of longfin smelt and delta smelt, subject to water quality and diversion capacity requirements. These revised flows are then used to estimate the fish entrainment potential for longfin smelt, delta smelt, and all four of the Chinook salmon sub-species. The fish entrainment indices presented in this section rely on the modified diversion pattern developed in this post-processing of CalSim II output. This post-process does not assume changes in the total monthly diversions or deliveries made by the project alternatives.

Delta Smelt, Longfin Smelt, and Striped Bass Entrainment for ALT1 and ALT2

In Alternatives 1 and 2, water is delivered to the South Bay water agencies through the expanded Los Vaqueros Reservoir system through the Old River, AIP and new Delta intakes instead of through the SWP and CVP south Delta export pumps. This shift in location of diversion allows use of more effectively screened intakes to deliver Delta water supplies to the South Bay water agencies. The resulting number of delta smelt and longfin smelt entrained at each intake are calculated as:

- RS_fish = Densities from Station 902 (Figure C7-7) multiplied by water pumped through the Rock Slough Intake
- OR_fish = Effective densities from Station 915 (Figure C7-9) multiplied by water pumped through the Old River and new Delta Intake

- VC_fish = Effective densities from Station 918 (Figure C7-11) multiplied by water pumped through the AIP Intake

- SWP_fish = Densities from the maximum value at either Station 918 or at the SWP or CVP export pumps (Figure C7-12) multiplied by water pumped by SWP for South Bay water agencies

- CVP_fish = Densities from max (Station 918, salvage) multiplied by water pumped by CVP for federal system deliveries to South Bay water agencies (SCVWD)

For each level of development, the fish entrainment index is calculated and compared to the index of the without project condition. The entrainment index value represents the sum of the fish entrained at each of the intakes as show below:

Total fish entrained Index = RS_fish + OR_fish + VC_fish + SWP_fish + CVP_fish

Delta Smelt, Longfin Smelt and Striped Bass Entrainment for ALT3

Alternative 3 does not include the shift in pumping of South Bay water agencies' Delta diversions to the expanded Los Vaqueros system, so there is no improvement in fish screening. However, Alternative 3 does include additional pumping of water from July through November for environmental uses south of the Delta. Accordingly, the following terms are included in the calculation of the entrainment index values for Alternative 3:

- SWP_ENV_fish = Densities from max (Station 918, salvage) multiplied by volume of additional water pumped by SWP for environmental purposes south of the Delta

- CVP_ENV_fish = Densities from max (Station 918, salvage) multiplied by volume of additional water pumped by CVP for environmental purposes south of the Delta

Total fish entrainment Index = RS_fish + OR_fish + VC_fish + SWP_ENV_fish + CVP_ENV_fish

In the Alternative 3 without project conditions, there is no additional water pumped for environmental purposes south of the Delta at SWP or CVP facilities and thus SWP_ENV_fish and CVP_EVN_fish are both zero.

Delta Smelt, Longfin Smelt and Striped Bass Entrainment for ALT4

In Alternative 4, the reservoir is expanded to 160 TAF but is operated largely the same as the existing reservoir, although the additional storage allows reduced diversions in extended droughts as the added storage is used for water quality blending and drought supplies. SWP and CVP operations are not directly affected by Alternative 4 operations. Thus the Alternative 4 entrainment index is represented as:

Total fish entrained Index = RS_fish + OR_fish + VC_fish

The without project conditions for ALT4 are calculated in the same way as the with-project case.

Salmon Entrainment

Salmon densities, as discussed in the methodology section, are derived from loss estimates developed from salvage data and are assumed to be the same at all the intakes included in this impact analysis. The Chinook salmon sub-species considered in this analysis are the winter run, spring run, fall run, and late fall-run sub-species.

Results of Entrainment Index Calculations

This section presents the results of the fish entrainment index calculations. The total estimated entrainment index and percent change for each species of fish are shown in **Table C7-4** and **Table C7-5** for the 2005 level of development and in **Table C7-6** and **Table C7-7** for the 2030 level of development. For each of the alternatives shown in the tables, the shaded numbers represent improvements (a reduction in estimated entrainment losses) in fish entrainment numbers when compared to the Existing Condition.

2005 Level of Development. As shown in Table C7-4 and Table C7-5, under both severe and moderate restrictions, Alternatives 1 and 2 show substantial reductions in entrainment losses for all species (ranging from 23% to about 80%) relative to the Existing Condition. Alternative 3 under moderate restrictions shows an increase across all species other than striped bass in estimated entrainment losses relative to the Existing Condition. This impact is not apparent in Alternative 3 under severe restrictions. Alternative 4 shows a significant reduction in entrainment of 20 to 60% for all species under both moderate and severe restrictions

TABLE C7-4: ESTIMATED FISH ENTRAINMENT INDEX FOR 2005 LEVEL OF DEVELOPMENT, MODERATE FISHERY RESTRICTIONS

	Delta Smelt		Longfin Smelt		Striped Bass		Winter Run Salmon		Spring Run Salmon		Fall Run Salmon		Late Fall Run Salmon	
	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base
Existing Condition	30,000		150,000		910,000		720		4,700		7,400		126	
Alt1	23,000	-23%	65,000	-57%	640,000	-30%	160	-78%	1,900	-60%	4,600	-38%	22	-83%
Alt2	23,000	-23%	72,000	-52%	650,000	-29%	170	-76%	2,000	-57%	4,700	-36%	19	-85%
Existing Condition	2,500		9,600		140,000		14		64		250		1	
Alt3	3,100	24%	11,000	15%	120,000	-14%	20	43%	110	72%	400	60%	2	100%
Alt4	2,200	-12%	8,900	-7%	130,000	-7%	12	-14%	52	-19%	210	-16%	1	0%

TABLE C7-5: ESTIMATED FISH ENTRAINMENT INDEX FOR 2005 LEVEL OF DEVELOPMENT, SEVERE FISHERY RESTRICTIONS

	Delta Smelt		Longfin Smelt		Striped Bass		Winter Run Salmon		Spring Run Salmon		Fall Run Salmon		Late Fall Run Salmon	
	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base
Existing Condition	32,000		150,000		890,000		710		4,800		7,500		120	
Alt1	24,000	-25%	66,000	-56%	710,000	-20%	160	-77%	2,000	-58%	4,900	-35%	25	-79%
Alt2	23,000	-28%	70,000	-53%	680,000	-24%	140	-80%	2,000	-58%	4,600	-39%	18	-85%
Existing Condition	5,400		13,000		170,000		33		340		670		1	
Alt3	4,700	-13%	13,000	0%	140,000	-18%	28	-15%	230	-32%	660	-1%	3	200%
Alt4	4,700	-13%	11,000	-15%	160,000	-6%	27	-18%	260	-24%	610	-9%	1	0%

2030 Level of Development. Table C7-6 and Table C7-7 present estimated entrainment indices and percent changes for the 2030 level of development.

As with the 2005 level of development, Alternatives 1, 2, and 4 show substantial reductions in entrainment, while Alternative 3 shows increases in entrainment for all species except longfin smelt in the moderate restrictions cases, but decreases in entrainment for longfin smelt, winter run, and spring run salmon under severe restrictions.

TABLE C7-6: ESTIMATED FISH ENTRAINMENT INDEX FOR 2030 LEVEL OF DEVELOPMENT, MODERATE FISHERY RESTRICTIONS

	Delta Smelt		Longfin Smelt		Striped Bass		Winter Run Salmon		Spring Run Salmon		Fall Run Salmon		Late Fall Run Salmon	
	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base
Future w/o Project	35,000		160,000		1,000,000		710		5,500		8,400		110	
Alt1	33,000	-6%	85,000	-47%	840,000	-16%	240	-66%	3,300	-40%	6,700	-20%	26	-76%
Alt2	33,000	-6%	97,000	-39%	850,000	-15%	240	-66%	3,400	-38%	6,800	-19%	23	-79%
Future w/o Project	4,900		21,000		230,000		36		110		500		6	
Alt3	5,200	6%	20,000	-5%	180,000	-22%	43	19%	180	64%	690	38%	7	17%
Alt4	4,200	-14%	19,000	-10%	210,000	-9%	34	-6%	71	-35%	420	-16%	6	0%

TABLE C7-7: ESTIMATED FISH ENTRAINMENT INDEX FOR 2030 LEVEL OF DEVELOPMENT, SEVERE FISHERY RESTRICTIONS

	Delta Smelt		Longfin Smelt		Striped Bass		Winter Run Salmon		Spring Run Salmon		Fall Run Salmon		Late Fall Run Salmon	
	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base	total fish entrained / year	% change compared to base
Future w/o Project	34,000		160,000		970,000		740		5,200		7,900		120	
Alt1	32,000	-6%	88,000	-45%	850,000	-12%	250	-66%	2,900	-44%	6,300	-20%	34	-72%
Alt2	31,000	-9%	94,000	-41%	810,000	-16%	230	-69%	2,900	-44%	6,100	-23%	28	-77%
Future w/o Project	7,300		23,000		250,000		62		360		840		6	
Alt3	7,700	5%	22,000	-4%	220,000	-12%	58	-6%	350	-3%	1,100	31%	7	17%
Alt4	6,500	-11%	22,000	-4%	230,000	-8%	60	-3%	310	-14%	750	-11%	6	0%

Discussion

The results of the entrainment index calculations are interpreted and discussed with respect to impact analysis in Chapter 4, Section 4.3. In general, Alternatives 1 and 2 show significant reductions in estimated entrainment losses for all species under both 2005 and 2030 levels of development and under both severe and moderate fisheries restrictions. This is largely because delivery of contracted state and federal system water to the South Bay water agencies is shifted to occur through the expanded Los Vaqueros Reservoir system and new South Bay Connection system, and thus is being diverted at the efficiently screened Old River, AIP, and new Delta intakes, instead of passing through the existing SWP and CVP export pump intakes. The improved screening provided by the shift in delivery results in a noticeable decrease in potential entrainment of 20 percent to 80 percent for the Chinook salmon, which are large enough to experience completely effective screen efficiency at the Old River, AIP and new Delta intakes. Improvement for the smelt species was similarly dramatic even though screening for the smaller size classes is not completely effective, with improvements of 6 percent to 28 percent for delta smelt and 40 percent to 57 percent for longfin smelt. These comparisons are relative to the

without project condition, in which Delta water supply for the South Bay water agencies is delivered through the CVP and SWP export facilities.

Alternative 3 shows increases in potential fish entrainment, largely due to the increase in pumping at Los Vaqueros intakes in fish-sensitive months in this alternative that are not balanced by a corresponding reduction in pumping at less efficiently screened SWP or CVP intakes. To reduce or avoid these impacts, the operating assumptions could be revised to limit diversions at times when Delta fish could be impacted. Any changes to the operational assumptions would require a reassessment of the benefits and potential impacts of Alternative 3.

Alternative 4 shows reductions in estimated entrainment losses for all species under both 2005 and 2030 levels of development and under both severe and moderate fisheries restrictions. These reductions in potential fish entrainment are smaller than in Alternatives 1 and 2, and are made possible by the increased storage capacity of Los Vaqueros Reservoir, since there would be an increased number of years in which the No Diversion Period would apply due to increased storage, particularly in dry periods.

Delta Flow Surrogate for Delta Smelt Salvage at SWP and CVP Export Facilities

Methodology

A flow surrogate for fish salvage at the SWP and CVP export facilities is presented here as one mechanism for evaluating the potential effects of the project on Delta fish species of concern. The number of adult delta smelt salvaged at the SWP Banks and CVP Jones pumping plants has been found to be a function of January and February export rates at Banks and Jones Pumping Plants and San Joaquin River flow at Vernalis based on field data, as shown in **Figure C7-16**.

The correlation shows that the quantity $Q_{(Banks+Jones)}$ minus $0.5*Q_{San\ Joaquin\ River}$ (total exports at the Jones and Tracy Pumping Plants (in cfs) minus one-half the San Joaquin River flow at Vernalis (in cfs)) predicts delta smelt salvage with an R-squared value of 0.66, using January and February data. This correlation is similar to, but better than, the correlation associated with Old and Middle River (OMR) net flow. OMR net flow was also developed to act as a surrogate for adult delta smelt salvage, using a similar data analysis approach; this relationship is provided for comparison in **Figure C7-17**. OMR net flow is the proxy by which the export pumping at Banks and Jones pumping facilities is regulated during the fish sensitive period under the remedies order issued by the U.S. district court on December 14, 2007, in the *NRDC vs. Kempthorne* decision. This order and its implementation in the modeling for this project are discussed in greater detail in Chapter C-4. As discussed in Chapter C-4, OMR net flow is a function of exports at Banks and Jones Pumping Plants and San Joaquin River flow at Vernalis, which in turn has been used to predict adult delta smelt salvage during the winter months. The fishery impacts were analyzed using the direct relationship to SWP and CVP exports and San Joaquin River flow as the flow surrogate, rather than the indirect and second-order relationship of OMR net flow, to predict fish salvage. The January and February flow data have shown statistical correlations to delta smelt salvage. While the relationships between flow factors (whether exports or OMR net flow) have not been developed for other months, this parameter is also presented for December and for March through June. This additional presentation is made because the metric may also be useful in estimating delta smelt salvage in months other than January and February, though it is only considered for such months as supporting information to other direct analyses, and because it provides a useful demonstration of the effect of assumed fishery restrictions on SWP and CVP project exports.

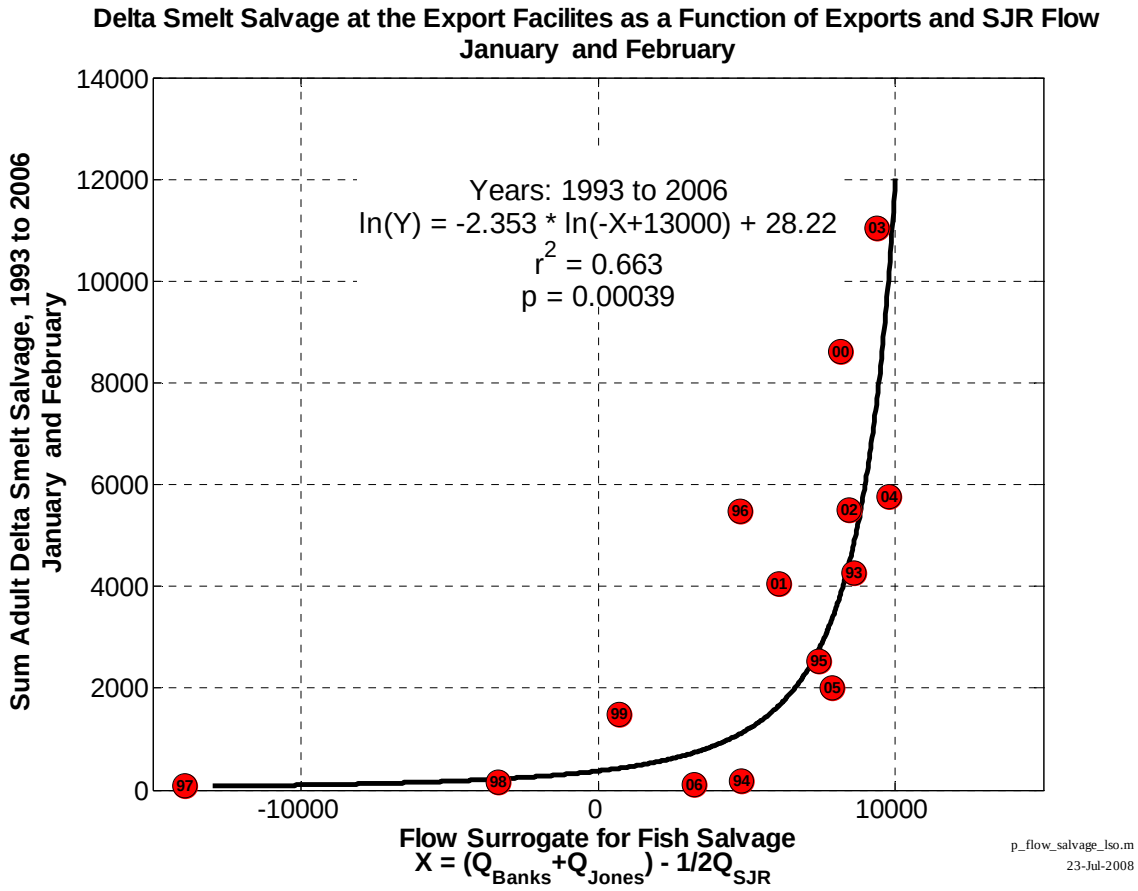


Figure C7-16: Flow Surrogate for Delta Smelt Salvage

Use of the flow surrogate allows comparison of alternatives with respect to fish salvage at the export facilities. As shown in Figure C7-16, the value of the flow surrogate for delta smelt salvage increases with increases in combined export and San Joaquin River flow rates greater than approximately 5,000 cfs. For example, a flow surrogate value of 10,000 cfs would indicate substantially more potential for entraining delta smelt at the export facilities than a flow surrogate value of 0.

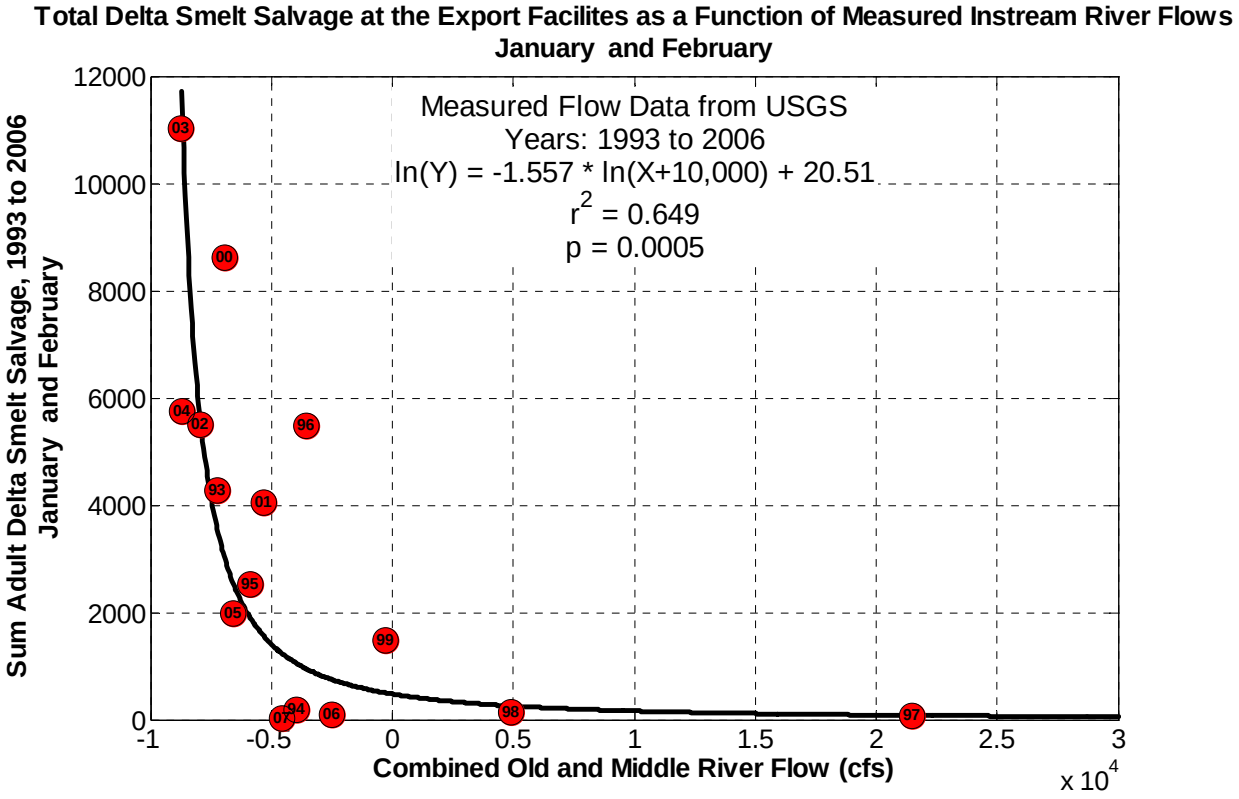


Figure C7-17: Delta Smelt Salvaged at the Export Facilities as a function of Old and Middle River Flow

Results

Table C7-8 presents the long-term (1922 to 2003) monthly average values of the flow surrogate for fish salvage at the export facilities for each of the project alternatives from December through June. As described above, the flow surrogate was developed using data from the months of January and February, so results from those months are directly considered in assessment of the potential of the project alternatives to affect delta smelt salvage at the CVP and SWP export facilities. The flow metric is also presented for the other months in which delta smelt are potentially susceptible to entrainment at the export facilities. This flow metric may also indicate the potential for delta smelt entrainment in months other than January and February, but such a relationship has not been developed, so values of this metric from other months are only considered as supporting information to other analyses.

The time period from December through June is also when the fishery restrictions are assumed to be implemented at the Banks and Jones export facilities (see Chapter C-4), and the effect of the fishery restrictions assumed is demonstrated in the values of the flow surrogate presented. The flow surrogate values tend to be generally highest in December (within the months evaluated),

and generally decrease until April, and then increase slightly in May and June. This pattern reflects the fishery restrictions that are imposed on the operation of the Banks and Jones pumping plants, in which export limitations are typically imposed beginning in December or January, and then generally become more restrictive in the spring. The lowest values in April and May also reflect the VAMP operations, which can further decrease export pumping at Banks and Jones and increase San Joaquin River flows. The flow surrogate values are also generally lower in the severe restrictions cases than in the moderate restrictions cases, reflecting the difference in maximum allowed export levels under each set of assumptions.

Alternatives 1 and 2 generally decrease the average value of this flow surrogate. This change is due to the shifting of contracted SWP and CVP deliveries to the expanded Los Vaqueros system, in which export pumping is reduced at the Banks and Jones facilities and diversions at the Old River, AIP and new Delta intakes are increased. This operation generally relocates a portion of the total export pumping to the more effectively screened intakes, so these alternatives tend to produce a beneficial change in Delta circulation and reduced direct impacts to fisheries.

The effects of Alternative 3 on the flow surrogate for delta smelt entrainment are generally neutral (providing neither a significant benefit nor significant impact), but occasionally this alternative causes an increase in the value of the flow surrogate. These increases occur at times when the CalSim II modeling shows an increased use of Los Vaqueros storage to meet service area demand, allowing increased use of the SWP and CVP unscreened Delta export facilities to export water for use at San Joaquin Refuges. These modeling results highlight a way that Alternative 3 operations could be modified to enhance benefits to the fisheries; operational rules could be developed so that the increased exports occur outside of the sensitive fishery period, with exports remaining the same or decreasing relative to the base case during the sensitive fishery period. Other than this effect, Alternative 3 does not have a significant benefit or impact on Delta circulation or fisheries.

The effects of Alternative 4 on the flow surrogate are generally neutral. Small changes in the average surrogate values between this alternative and the base case reflect the re-operation of the CalSim II model (discussed in Appendix C), and do not indicate any actual difference in Delta circulation and has no impact on Delta fisheries.

TABLE C7-8:
LONG-TERM MONTHLY AVERAGE AND PERCENT CHANGE IN LONG-TERM MONTHLY AVERAGE OF FLOW SURROGATE FOR FISH SALVAGE

	December		January		February		March		April		May		June	
	Long Term Monthly Average	Average Change from Base	Long Term Monthly Average	Average Change from Base	Long Term Monthly Average	Average Change from Base	Long Term Monthly Average	Average Change from Base	Long Term Monthly Average	Average Change from Base	Long Term Monthly Average	Average Change from Base	Long Term Monthly Average	Average Change from Base
2005 Level of Development														
Moderate Fishery Restrictions														
Existing Condition	6900	--	5200	--	3500	--	2600	--	180	--	440	--	2100	--
Alternative 1	6600	-4%	4900	-5%	3200	-9%	2300	-14%	21	-89%	240	-45%	1800	-14%
Alternative 2	6600	-4%	5000	-4%	3200	-8%	2300	-12%	23	-89%	250	-43%	1800	-13%
Alternative 3	6900	1%	5400	3%	3500	1%	2800	6%	200	12%	440	0%	2100	0%
Alternative 4	6900	0%	5300	1%	3500	0%	2700	2%	190	4%	440	0%	2100	0%
Severe Fishery Restrictions														
Existing Condition	6800	--	5200	--	2800	--	740	--	-360	--	-170	--	270	--
Alternative 1	6500	-4%	4900	-6%	2500	-9%	380	-50%	-510	-42%	-350	-106%	34	-85%
Alternative 2	6500	-4%	4800	-7%	2500	-9%	390	-49%	-500	-42%	-350	-100%	47	-81%
Alternative 3	6900	1%	5300	2%	2700	0%	770	3%	-350	4%	-170	2%	270	0%
Alternative 4	6800	0%	5300	1%	2800	0%	750	0%	-370	-3%	-170	0%	270	0%
2030 Level of Development														
Moderate Fishery Restrictions														
Future Without Project	6900	--	5400	--	3700	--	2700	--	240	--	480	--	2100	--
Alternative 1	6600	-4%	5000	-7%	3400	-6%	2300	-12%	110	-54%	300	-38%	1900	-13%
Alternative 2	6600	-4%	5000	-7%	3400	-7%	2400	-11%	120	-50%	310	-35%	1900	-13%
Alternative 3	6900	1%	5400	1%	3800	2%	2900	7%	270	13%	490	1%	2100	0%
Alternative 4	6900	0%	5300	-1%	3700	0%	2700	1%	240	-1%	480	0%	2100	0%
Severe Fishery Restrictions														
Future Without Project	6700	--	5300	--	2700	--	710	--	-340	--	-150	--	280	--
Alternative 1	6400	-5%	4900	-7%	2400	-8%	380	-46%	-460	-35%	-320	-113%	65	-79%
Alternative 2	6400	-4%	4900	-7%	2500	-7%	390	-45%	-460	-35%	-310	-107%	72	-75%
Alternative 3	6800	1%	5300	0%	2800	5%	870	21%	-310	11%	-160	-6%	280	1%
Alternative 4	6700	0%	5200	-2%	2700	1%	720	1%	-340	0%	-150	0%	280	1%

Particle Tracking Analysis

Methodology

The particle tracking model (PTM) simulates the transport and fate of neutrally buoyant particles in the Delta channels and estimates the probability that a parcel of water starting at one location will arrive at another location in a given time frame.

PTM uses velocity, flow, and water elevation information from DSM2-Hydro to simulate the movement of virtual particles in the Delta on a 15-minute time-step throughout the simulation period. If a particle leaves the Delta system by way of an export or diversion or through any other model boundary, this information is recorded for latter analysis and termed the "fate" of the particle. Additionally, the percentage of particles remaining within channels in each geographic region is tabulated and analyzed.

Use of PTM for fishery analysis has gained popularity over the last decade; however, the PTM tool has a number of limitations in application to fishery analysis. Chiefly, since the particles simulated in the model are neutrally buoyant (and therefore have no swimming behavior or other independent movement), results of these analyses are most relevant to the planktonic early larval stages of various organisms that do not move independently in the water column. The particles are not considered to reflect movements of juvenile or adult fish within the Delta, or of larvae that are able to move independently in the water column (for example, by varying their buoyancy). Additional assumptions and limitations of the analysis are described below.

Particle Release Locations and Model Output

For this analysis, particles were released in the model at various locations within the Delta that are either known to represent important fish habitat or important hydrologic locations. The release locations are identified by their DSM2 node number (**Table C7-9** and **Figure C7-18**). The biological relevance of each release location varies significantly depending on the aquatic species and the season. For instance, adult delta smelt generally move upstream into the Delta in the winter prior to spawning. Although PTM cannot simulate this swimming behavior of the adults, PTM may be a useful tool to predict the movement of delta smelt larvae after they hatch in the spring. **Figure C7-19** illustrates the average spatial distribution of delta smelt in the spring as determined by CDFG's 20-mm survey.

To evaluate hydrologic and operational variability, particle releases were simulated at the start of each month for water years 1976 through 1991. One thousand particles were released over a period of 26 hours (to encompass a full tidal cycle), starting at 11:00 pm on the second day of each month.

Particle movement was tracked for 120 days; after 28 days and 120 days, the particles were counted at each of the output locations shown in **Figure C7-20** and **Table C7-10**, classified as

flux past a specific location, potential entrainment at water intakes, or the percent remaining in channels in specific regions of the Delta and Suisun Bay and Marsh.

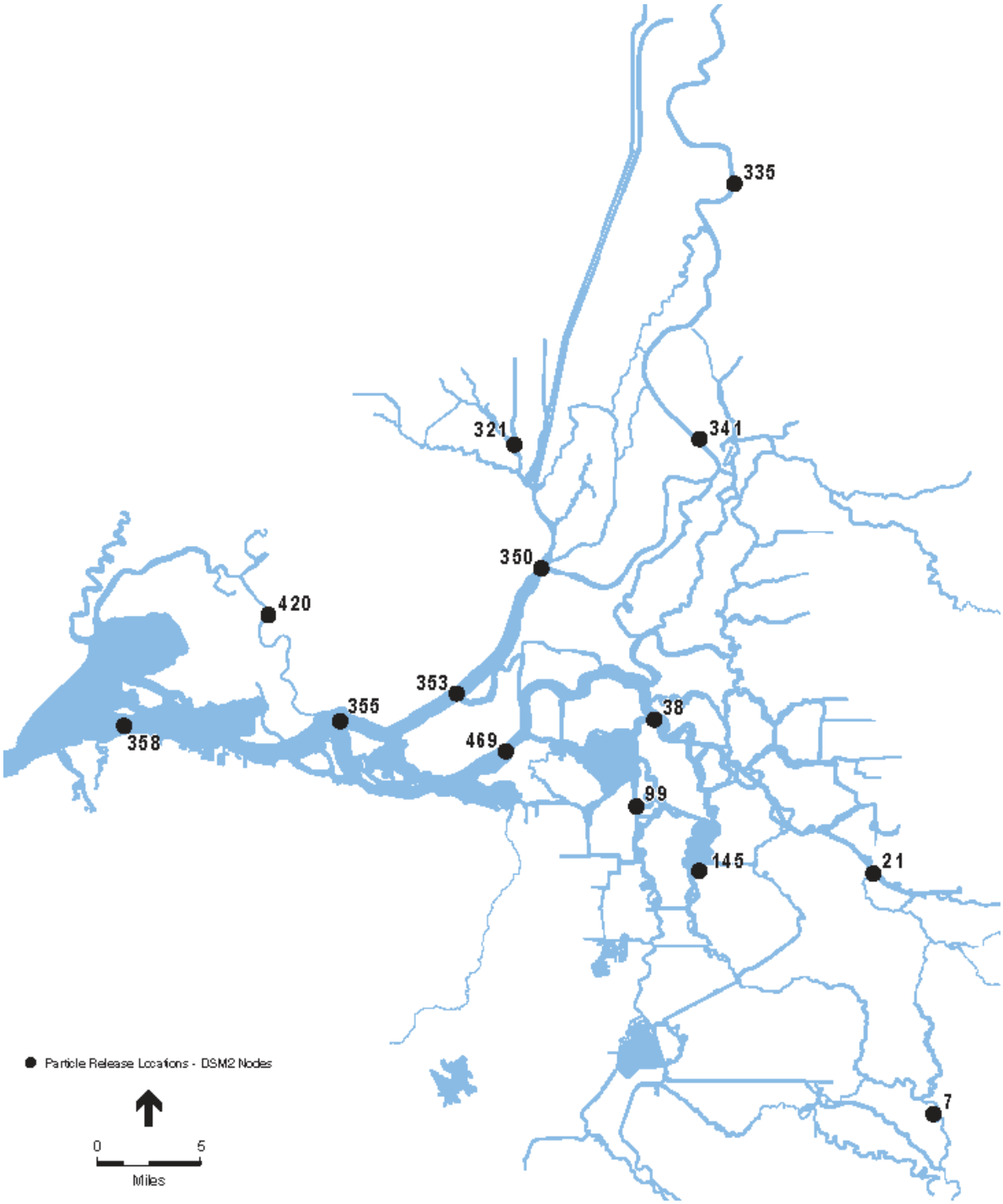


Figure C7-18: PTM Particle Release Locations

TABLE C7-9: PARTICLE RELEASE LOCATIONS IDENTIFIED BY DSM2 NODE NUMBER

DSM2 Node	Description
335	Sacramento River at Freeport
341	Sacramento River above Delta Cross Channel
321	Cache Slough
350	Sacramento River at Rio Vista
353	Sacramento River at Emmaton
355	Sacramento River at Collinsville
469	San Joaquin River at Jersey Island
38	San Joaquin River at mouth of Old River
99	Old River at Holland Tract
145	Middle River at Empire Tract
21	San Joaquin River west of Rough and Ready Island
7	San Joaquin River at Mossdale
358	Suisun Bay at Port Chicago
420	Montezuma Slough

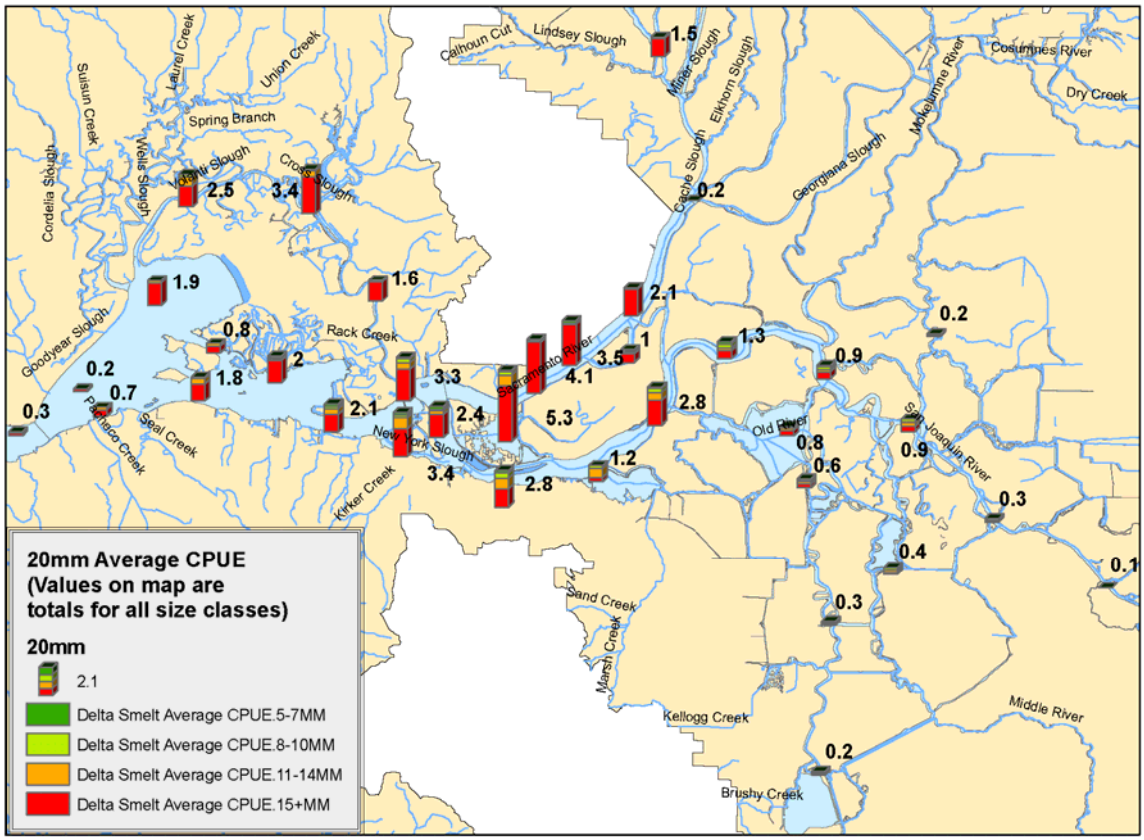


Figure C7-19: Average Distribution of Delta Smelt Larvae March through June 20-mm Survey

TABLE C7-10: PTM OUTPUT LOCATIONS

Name	Description
Flux Past Specific Location	
Past Chipps Island	Particles that pass Chipps Island
Past Martinez	Particles that pass Martinez
Past SMSCG	Particles that enter Montezuma Slough past the Suisun Marsh Salinity Control Gates
Potential Entrainment at Intakes	
Exports	Potential entrainment at Banks and Jones Pumping Plants combined
Agricultural Diversions	Potential entrainment at combined Agricultural Diversions in the Delta and Suisun Bay and Marsh
Old River	Potential entrainment at CCWD's existing intake on Old River (all alternatives) and the proposed new Delta intake on Old River (Alternatives 1 and 2 only) combined
Rock Slough	Potential entrainment at CCWD's existing intake on Rock Slough
AIP	Potential entrainment at the AIP on Victoria Canal
Remaining in Channel Regions	
South-Eastern Delta	Southeast of Victoria Canal and Trapper Slough. Includes Head of Old and Middle Rivers and San Joaquin River south of Rindge Tract
South-Central Delta	Centered on Old and Middle Rivers. Includes Franks Tract, Mildred Island and the channels around Los Vaqueros intakes and export locations
Eastern Delta	Encompassing Georgiana Slough, Snodgrass Slough, and all channels to the east. Includes San Joaquin River from Mokelumne River to Fourteen Mile Slough
Northern Delta	Sacramento River and tributaries above Rio Vista
Western Delta	Centered on Sherman Island. Includes western portion of San Joaquin and Sacramento Rivers and Three Mile Slough
Suisun Bay and Marsh	Region encompassing Suisun Bay and Marsh

For the purpose of particle fate assessment, PTM output locations and defined geographic regions are listed in Table C7-10 and illustrated in Figure C7-20. These output locations were selected because they are considered representative of major classes of particle fate. "Past Chipps Island" represents the percentage of particles that travel past Chipps Island at the western boundary of the Delta and into Suisun Bay. "Past SMSCG" represents the percentage of particles that enter Suisun Marsh past the Suisun Marsh Salinity Control Gates (SMSCG) on Montezuma Slough. "Past Martinez" represents the percentage of particles that travel past Martinez, the downstream boundary of the DSM2 model grid; once particles travel past Martinez, they cannot reenter the model domain on the subsequent tide. "Exports" represents the combined percentage of particles that were potentially entrained at the SWP Banks Pumping Plant and the CVP Jones Pumping Plant. "Old River" represents the combined percentage of particles that were potentially entrained at the Old River Intake (for all alternatives) and the new Delta Intake (Alternatives 1 and 2 only). "Rock Slough" and "AIP" represent potential entrainment at those respective Delta intakes. "Agricultural Diversions" represents the combined percentage of particles that were entrained in agricultural diversions located throughout the Delta and Suisun Bay and Marsh. The six regions defined under "Remaining in Channel Regions" represent the percentage of particles that remain within the Delta regions at the end of the simulation. The region boundaries are defined to group similar hydrodynamic, biological, water quality and/or water management characteristics.

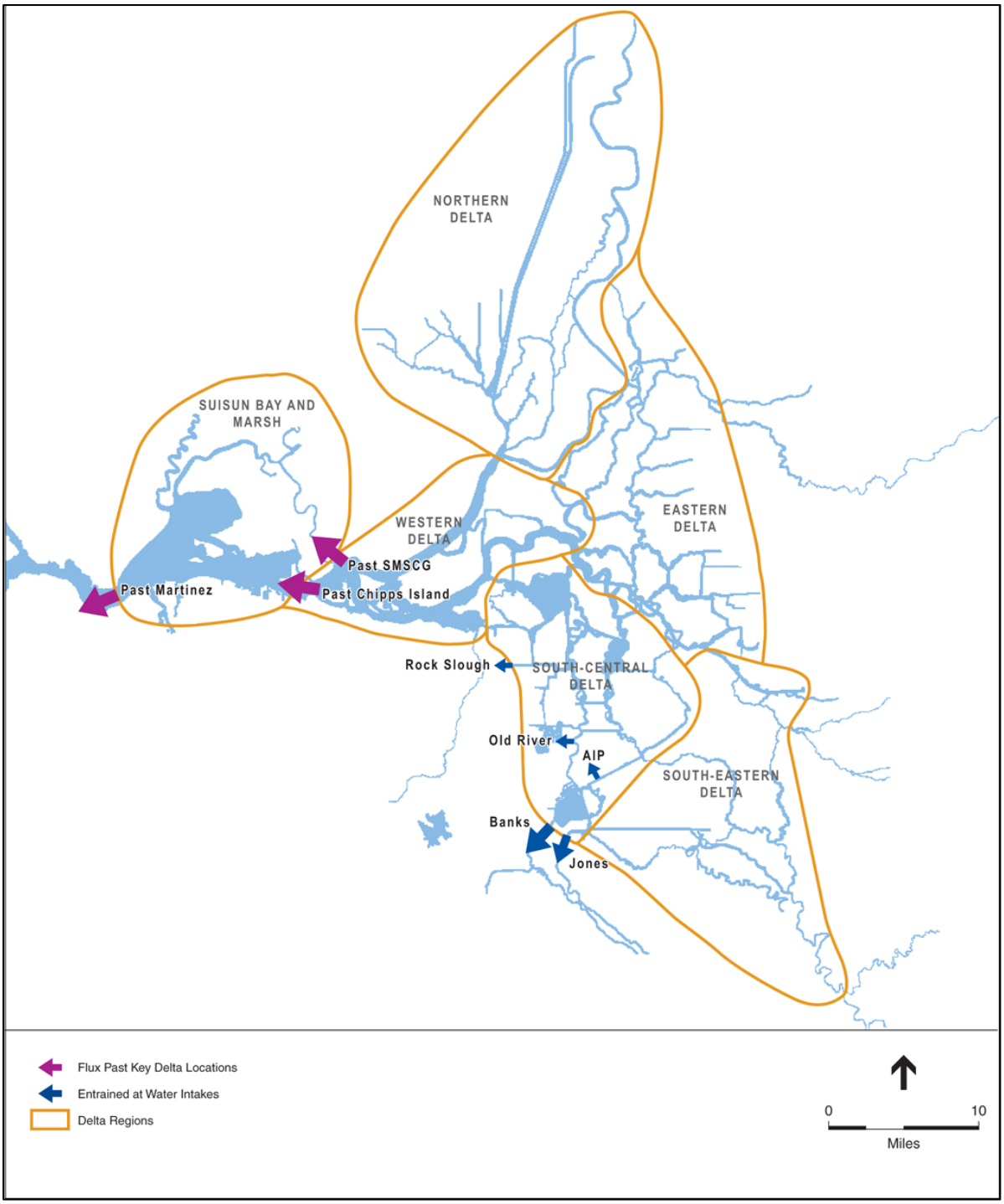


Figure C7-20: PTM Output Locations

Assumptions and Limitations

The application of DSM2-PTM to aquatic resources is limited by several factors, and requires consideration of the lifestage of the fish, the efficiency of fish screens at the intake with respect to size-specific exclusion of fish from entrainment, and modeling artifacts. The interpretation of these factors for this project analysis is described below.

Movement of aquatic organisms. PTM studies estimate the influence of modeled Delta hydrodynamics on neutrally buoyant particles. As such, the studies are only appropriate to represent the influence of Delta circulation on organic material and planktonic organisms (such as phytoplankton and zooplankton) that would behave as passively drifting particles. The interpretation is often extended to apply to the larval stages of some fish species rearing in the Delta, which may be advected (i.e., transported) by Delta tidal flows prior to developing the ability to swim and control their position in the water column. The particles are not considered to reflect movements of juvenile or adult fish within the Delta.

Biological interpretation of particle release timing and location. The particle tracking study is set up as a comprehensive analysis, with particle releases occurring at fourteen locations, every month of each year for the 16-year planning study (water years 1976 to 1991). In considering specific aquatic organisms, the seasonal timing and location in which particle releases are simulated should be interpreted appropriately. As discussed above, a practical application of PTM results for specific fish species must be limited to use for larval stages of Delta fish. It follows that this application of PTM should only be used at times and locations when larval stages are likely to occur (e.g. particle release locations in early spring on the lower Sacramento River may be interpreted to represent Delta smelt spawning locations, from which passively drifting larvae would be expected to emerge; see Figure C7-19). Therefore, to facilitate interpretation for various aquatic organisms, the PTM results are summarized by release location and the season of release (winter, spring, and fall).

Positive barrier fish screens. The PTM simulation assumes that particles are entrained at water intakes (removing particles from the channels) based on the flow split between the channel and the water diversion, without regard for any fish protection facilities. Therefore, PTM results must be further interpreted to account for the efficiency of positive barrier fish screens. Both delta smelt and longfin smelt larvae hatch at sizes (approximately 5 mm) that would be partially excluded from entrainment by positive barrier screens (see Table C7-2), making the use of screen efficiency assumptions appropriate for these species at screened water intakes.

For these analyses, larvae evaluated with PTM studies are assumed to be 5 mm, and no larval growth is assumed during the 120 day simulation period, which results in a conservative application of a relatively low screen efficiency to all particles at screened intakes, independent of growth since release (or "hatch") in the Delta. The potential entrainment at water intakes with positive barrier fish screens (Old River and AIP intakes) is reduced according to the screen exclusion efficiency as follows:

Potential entrainment = (PTM entrainment estimate) multiplied by
(1.0 minus the screen exclusion efficiency)

This method determines the potential entrainment through positive barrier fish screens, but does not determine the ultimate fate of the larvae that are protected from entrainment by the screens. Thus, the percent of particles that remains within the channels is underestimated in the PTM simulation. The particle tracking analysis confirms that particles thus excluded from entrainment at the positive barrier fish screens at project intakes would have the possibility of leaving the Delta, especially in the spring when fishery restrictions are applied at the CVP and SWP export facilities.

Geometry of Water Intakes. Because DSM2 is a one-dimensional model, it does not recognize the difference between an intake at the end of a channel and an intake on the side of a channel. Particles are entrained at water intakes in a PTM simulation based on advection and dispersion calculations made where the intake boundary intersects the one-dimensional arc that represents the Delta channel. This does not reflect the strong influence of longitudinal flow in the actual three-dimensional river, which tends to sweep neutral particles past side-of-channel intakes that have low approach velocities (Old River and AIP intakes have been designed to achieve an approach velocity of 0.2 ft/sec for the protection of delta smelt and other fish species; the new Delta Intake on Old River would be designed with similar criteria). This issue is not reflected in the larval fish entrainment analysis performed using PTM for this project, and could contribute to an over-estimate of larval entrainment at side-of-channel intakes.

Dispersion of particles. As discussed in Kimmerer and Nobriga (2008), PTM has limitations regarding the dispersion of particles, including the simplistic assumed velocity profiles that do not adjust for channel geometry or bottom roughness and the mixing of particles at channel nodes. These factors may have a significant effect on particle dispersion, especially in the near-field. Dispersion issues in the near-field are amplified in the central and south Delta due to the DSM2 channel grid, where nodes are very close together. Additionally, because agricultural diversions are simulated at almost every DSM2 node in the central and south Delta, simulated particle releases in this region are likely to contain errors in the estimation of agricultural entrainment that are due to the near-field dispersion issue.

Agricultural intakes. When particles are released in close proximity to simulated agricultural diversions, the particle tracking results are sensitive to small changes in hydrodynamics, such that minor changes in flows create relatively large changes in the percent of particles potentially entrained at nearby agricultural intakes. This is partly due to the underestimation of particle dispersion, addressed above, and the density of particles at the release location. When particles are released in the model, they are in a dense grouping until dispersion mixes the particles. When nodes are close together, dispersion does not have a sufficient time to act before particles are entrained at nearby simulated agricultural intakes.

Since the agricultural diversions are not altered between PTM simulations of project alternatives and PTM simulations of without project conditions, comparative changes in particle entrainment in the agricultural diversions appears to be an artifact of the modeling, and does not directly result

from the operation of the project alternatives, or provide biologically meaningful information about the effects of the project alternatives on Delta fish.

Open water areas. The open water areas of the Delta (e.g. Franks Tract and Mildred Island) are not well represented in the particle tracking analysis. The model assumes these regions are completely mixed environments, such that a particle that enters on one side of the flooded lake has the possibility of exiting on the other side of the lake in a short time period. In reality, these environments have complicated dynamics that effectively "trap" particles within the regions or can move them in ways that the model does not capture.

Results

For the Los Vaqueros Reservoir Expansion Project, the PTM tool is used to evaluate the direct and indirect effects of operation of each of the project alternatives. Direct effects are due to changes in potential entrainment of fish at water intakes. Indirect effects are due to changes in Delta circulation, which may affect aquatic habitat. The assessment relies on a comparative analysis of conditions within the estuary under without project conditions and with the proposed project under four sets of operational situations: 2005 level of development under moderate fishery restrictions; 2005 level of development under severe fishery restrictions; 2030 level of development under moderate fishery restrictions; and 2030 level of development under severe fishery restrictions.

A summary of percent particle fate for particles originating on the San Joaquin River at Jersey Island for the 2030 level of development under severe fishery restrictions is shown below. Results are summarized by the season during which the particles are released (e.g. Winter ("W") averages the results for particles released during December, January, and February). The release location on the San Joaquin River at Jersey Island is presented as an example of the PTM results to illustrate the choice of simulation period. Results for all release locations are evaluated for changes in Delta circulation and potential entrainment at water intakes, as shown in subsequent sections below.

Table C7-11 presents results 28 days after particles were released; this time frame has both biological and operational relevance. For delta smelt larvae, swim bladders are nearly fully developed and fin-folds begin to appear 25 to 40 days post-hatch (Bennett 2005); at this stage, neutrally buoyant particles may no longer represent larval movement. Additionally, since the CalSim II model simulates operations at a monthly time-step, significant changes in river flows and export operations at the start of each month cause abrupt changes in the particle movement within the Delta and Suisun Bay. Thus, limiting particle simulations to approximately one month may be appropriate for immediate application to predictions of smelt larvae entrainment through effectively screened intakes.

TABLE C7-11:
SEASONAL PERCENT PARTICLE FATE 28 DAYS AFTER PARTICLES ARE RELEASED

Seasonal[1] Percent Particle Fate, Long-term Average (1976-1991)

28 Days after Particles are Released at

San Joaquin River at Jersey Island

2030 Level of Development; Severe Fishery Restrictions

	Future Without Project			Change from Future Without Project (Alternative - Future Without Project)											
				Alt 1			Alt 2			Alt 3			Alt 4		
Monitoring Location	W	S	F	W	S	F	W	S	F	W	S	F	W	S	F
Potentially Entrained at Water Intakes															
Exports (Banks and Jones)	8	0	18	0	0	-1	0	0	0	1	0	0	0	0	-1
Agricultural Diversions	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Rock Slough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Old River[2]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AIP[2]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Remaining in Channel Regions															
South-Eastern Delta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South-Central Delta	7	5	12	0	0	0	0	0	0	0	0	0	0	0	0
Eastern Delta	4	3	7	0	0	0	0	0	0	0	0	0	0	0	0
Northern Delta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Western Delta	10	13	23	0	0	0	0	0	0	0	0	0	0	0	0
Suisun Bay and Marsh	13	16	16	0	0	0	0	0	0	0	0	0	0	0	0
Past Specific Locations															
Past Suisun Gates	6	5	4	0	0	0	0	0	0	0	0	0	0	0	0
Past Chipps Island	67	72	37	0	-1	0	-1	-1	0	-1	0	0	0	0	0
Past Martinez	59	62	24	0	-1	0	-1	-1	0	-1	0	0	0	0	1

1 Seasonal averages:
W is Winter (December through February), S is Spring (March through June), and F is Fall (September through November)
2 Output from the particle tracking model has been adjusted to account for fish screens at the Old River and AIP intakes for each alternative and the new Delta Intake for Alternatives 1 and 2, assuming the larvae are 5mm in length and do not grow after hatch.

At the end of 28 days, a percentage of particles are still remaining in Delta channels. Due to the uncertainty in the ultimate fate of particles that are still remaining within the channels 28 days after release, the simulations were continued through 120 days post-release (**Table C7-12**), when almost all particles have moved out of the Delta. Because the results are more conclusive with respect to ultimate particle fate, the analysis of impacts to aquatic resources relies on the results 120 days after particles are released. When applied to entrainment estimates, this approach using 120 days of simulation may conservatively over-estimate the number of smelt entrained through effectively screened intakes in the latter portion of each simulation.

TABLE C7-12:
SEASONAL PERCENT PARTICLE FATE 120 DAYS AFTER PARTICLES ARE RELEASED

Percent Particle Fate, Long-term Average (1976-1991)
120 Days after Particles are Released at
San Joaquin River at Jersey Island
2030 Level of Development; Severe Fishery Restrictions

	Future Without Project			Change from Future Without Project (Alternative - Future Without Project)											
				Alt 1			Alt 2			Alt 3			Alt 4		
Monitoring Location	W	S	F	W	S	F	W	S	F	W	S	F	W	S	F
Potentially Entrained at Water Intakes															
Exports (Banks and Jones)	13	5	35	0	0	-1	0	0	-1	1	0	0	0	0	-1
Agricultural Diversions	1	3	2	0	0	0	0	0	0	0	0	0	0	0	0
CCWD Rock Slough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Old River[2]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AIP[2]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Remaining in Channel Regions															
South-Eastern Delta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South-Central Delta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eastern Delta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Northern Delta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Western Delta	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Suisun Bay and Marsh	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Past Specific Locations															
Past Suisun Gates	8	6	9	0	0	0	0	0	0	0	0	0	0	0	0
Past Chipps Island	77	84	53	0	0	0	-1	-1	0	-1	0	0	0	0	1
Past Martinez	85	89	61	0	0	0	-1	-1	0	-1	0	0	0	0	1

1 Seasonal averages:
W = Winter (December through February), S = Spring (March through June), and F = Fall (September through November)
2 Output from the particle tracking model has been adjusted to account for fish screens at the Old River and AIP intakes for each alternative and the new Delta Intake for Alternatives 1 and 2, assuming the larvae are 5mm in length and do not grow after hatch.

Delta Circulation

To assess changes in Delta circulation due to each project alternative, the change in the percentage of particles that travel past Chipps Island, the western boundary of the Delta, relative to without project conditions, is analyzed below. This analysis, along with the analysis presented in the "Hydrologic Effects of Operations" and "Old and Middle River Flow Evaluation" sections within this appendix, supports the findings for Impact 4.3.6.

Table C7-13 through **Table C7-16** show the percentage of neutrally buoyant particles that have traveled past Chipps Island 120 days after the particles originated at the specified release locations for each of the four sets of conditions. The three leftmost numeric columns of each table show the average percentage of particles that pass Chipps Island for the without-project alternative for particles released during Winter (December through February), Spring (March through June), and Fall (September through November). The remaining columns show the change from the without project condition in percentage of particles that have traveled past Chipps Island for each season.

In general, the percentage of particles passing Chipps Island tends to be greatest for particles originating in the Western Delta or upstream on the Sacramento River. Particles originating in the central and southern Delta have a lower probability of passing Chipps Island, yet a notable percentage of the particles originating in the spring do pass Chipps Island within 120 days after release. For instance, without the project, for the 2005 level of development under moderate fishery restrictions, 37 percent of particles originating in the spring on Old River at Holland Tract pass Chipps Island within 120 days after release; for the 2005 level of development under severe fishery restrictions, this increases to 52 percent (an increase of 15 percent), indicating the relative change in Delta circulation due to the different levels of fishery restrictions assumed for these analyses[2]. Thus the fishery restrictions do, as expected, alter Delta circulation, and increase the probability that particles in the south-central Delta may avoid entrainment at South Delta salvage facilities and exit the Delta by moving with the water, without any swimming behavior or other motility.

Changes in particle fate between the alternatives and the without project condition were assessed. For all scenarios, there are small decreases in the percent of particles passing Chipps Island mostly in the range of 1 to 2 percent; this is consistent with the small change in Delta outflow discussed in the "Hydrologic Effects of Operations" section. Additionally, this level of change is within the level of model noise in CalSim II (see section 4.2), which is used as input for the PTM model.

The greatest reduction in the percent of particles passing Chipps Island occurs in the spring for particles originating on Old River at Holland Tract, with a maximum decrease of 4 to 5 percent

[2] As discussed in Section C3, the moderate and severe fishery restrictions were designed to capture the range of potential actions and resulting CVP and SWP export operations under the anticipated future fishery restrictions, based on the interim remedial order. Applying these restrictions represents a departure from recent historical operations at the export facilities, which had been shown to limit the escapement of particles from the south Delta in spring to a much greater degree in similar PTM studies.

occurring in the 2030 level of development under severe fisheries restrictions for Alternatives 1 and 2. To determine whether a 4 to 5 percent reduction would significantly impact Delta fisheries and other aquatic resources, we evaluated the following additional information regarding particles originating on Old River at Holland Tract under the future (2030) without project condition under severe fishery restrictions:

- As mentioned in the "Assumptions and Limitations" section above, PTM results for the percent of particles traveling past Chipps Island assumes zero screen efficiency. Positive barrier fish screens such as those at Old River and AIP intakes have been shown to provide entrainment reductions for fish as small as 5 mm in fork length (the approximate size of delta smelt when they hatch). Incorporating a screen efficiency factor that reduces entrainment and leaves more particles in the flow field would effectively increase the percentage of particles traveling past Chipps Island.

- On average, in the without project condition, 45 percent of particles released in the spring travel past Chipps Island within 120 days (Table C7-12). The variability around the average is characterized by the standard deviation. For the same time period, the standard deviation is 28 percent, indicating that a reduction of 4 to 5 percent in Alternatives 1 and 2 in comparison to the without project condition is a small fraction of the variability in the without project condition.

- On average, in the without project condition, 25 percent of particles originating on Old River at Holland Tract are entrained into agricultural diversions. In Alternatives 1 and 2, this increases 4 and 5 percent, respectively, which corresponds to the reduction in particles passing Chipps Island (Table C7-12). Alternatives 1 and 2 do not increase or otherwise alter agricultural diversions; the 4 to 5 percent increase in particles entrained in the agricultural diversions appears to be an artifact of the modeling, and does not directly result from the operation of the project alternatives.

Overall, the particle tracking results presented in Table C7-13 through Table C7-16 indicate no significant changes in particle behavior between the without project conditions and each of the project alternatives, with respect to the movement of neutrally buoyant particles through the Delta. These results support the conclusion that the project alternatives do not create adverse impacts related to Delta hydrologic conditions.

TABLE C7-13:
SEASONAL PERCENT PARTICLES TRAVELING PAST CHIPPS ISLAND

2005 LEVEL OF DEVELOPMENT; MODERATE FISHERY RESTRICTIONS

Seasonal[1] Percent Particles Traveling Past Chipps Island

120 days after Particles are Released at Locations listed below

2005 Level of Development; Moderate Fishery Restrictions

	Existing Condition			Change from Existing Condition											
				Alt 1			Alt 2			Alt 3			Alt 4		
Release Location	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**
Sacramento River at Freeport	68	71	38	0	0	-1	-1	0	-1	-1	0	-1	0	0	0
Sacramento River above Delta Cross Channel	62	71	32	0	0	-1	0	0	-1	0	0	-1	0	0	0
Cache Slough at Sac Ship Channel	45	11	16	0	0	-1	0	0	0	0	0	0	0	0	0
Sacramento River at Rio Vista	79	82	57	0	0	-1	0	0	-1	-1	0	-1	0	0	0
Sacramento River at Emmaton	84	87	68	0	0	0	0	0	0	-1	0	0	0	0	0
Sacramento River at Collinsville	89	91	79	0	0	0	0	0	0	-1	0	0	0	0	0
San Joaquin River at Jersey Island	77	83	54	0	0	-1	-1	0	0	-1	0	-1	0	0	0
San Joaquin River at mouth of Old River	48	62	20	0	-1	0	0	-1	0	0	0	-1	0	0	0
Old River at Holland Tract	24	37	4	0	-1	0	0	-2	0	0	0	0	0	0	0
Middle River at Empire Cut	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0
San Joaquin River west of Rough and Ready Is.	23	32	4	0	-1	0	0	-1	0	0	0	0	0	0	0
San Joaquin River at Mossdale	13	18	2	0	0	0	0	0	0	0	0	0	0	0	0
Suisun Bay at Port Chicago	-2	-1	-4	0	0	0	0	0	0	0	0	0	0	0	0
Montezuma Slough	-1	0	4	0	0	0	0	0	0	0	0	0	0	0	0

1 Seasonal averages:
W is Winter (December through February), S is Spring (March through June), and F is Fall (September through November)

TABLE C7-14:
SEASONAL PERCENT PARTICLES TRAVELING PAST CHIPPS ISLAND

2005 LEVEL OF DEVELOPMENT; SEVERE FISHERY RESTRICTIONS

Seasonal[1] Percent Particles Traveling Past Chipps Island

120 days after Particles are Released at Locations listed below

2005 Level of Development; Severe Fishery Restrictions

	Existing Condition			Change from Existing Condition											
				Alt 1			Alt 2			Alt 3			Alt 4		
Release Location	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**
Sacramento River at Freeport	68	74	38	0	0	0	0	0	-1	0	0	0	0	0	-1
Sacramento River above Delta Cross Channel	62	75	32	0	0	0	0	0	0	0	0	0	0	0	0
Cache Slough at Sac Ship Channel	46	12	16	-1	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Rio Vista	79	84	57	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Emmaton	84	88	68	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Collinsville	88	92	80	0	0	0	0	0	0	0	0	0	0	0	0
San Joaquin River at Jersey Island	77	85	54	0	0	0	0	0	0	0	0	0	0	0	0
San Joaquin River at mouth of Old River	50	72	19	-1	-1	0	-1	-1	0	0	0	0	0	0	0
Old River at Holland Tract	25	52	4	0	-2	0	0	-3	0	0	0	0	0	0	0
Middle River at Empire Cut	12	20	0	0	-1	0	0	-1	0	0	-1	0	0	0	0
San Joaquin River west of Rough and Ready Is.	26	41	3	0	-1	0	0	-1	0	0	0	0	0	0	0
San Joaquin River at Mossdale	15	22	2	0	-1	0	0	-1	0	0	0	0	0	0	0
Suisun Bay at Port Chicago	-2	-1	-4	0	0	0	0	0	0	0	0	0	0	0	0
Montezuma Slough	-1	0	3	0	0	0	0	0	0	0	0	0	0	0	0

1 Seasonal averages:
W is Winter (December through February), S is Spring (March through June), and F is Fall (September through November)

TABLE C7-15:
SEASONAL PERCENT PARTICLES TRAVELING PAST CHIPPS ISLAND

2030 LEVEL OF DEVELOPMENT; MODERATE FISHERY RESTRICTIONS

Seasonal[1] Percent Particles Traveling Past Chipps Island

120 days after Particles are Released at Locations listed below

2030 Level of Development; Moderate Fishery Restrictions

	Future Without Project			Change from Future Without Project											
				Alt 1			Alt 2			Alt 3			Alt 4		
Release Location	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**
Sacramento River at Freeport	65	70	36	0	-1	0	-1	-1	0	0	0	0	0	0	0
Sacramento River above Delta Cross Channel	60	69	30	0	-1	0	-1	-1	0	0	0	0	0	0	0
Cache Slough at Sac Ship Channel	47	11	15	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Rio Vista	79	81	54	-1	-1	0	-1	-1	0	0	0	1	0	0	0
Sacramento River at Emmaton	83	86	67	0	-1	0	0	0	0	1	0	0	0	0	0
Sacramento River at Collinsville	88	90	78	0	0	0	0	0	0	0	0	0	0	0	1
San Joaquin River at Jersey Island	75	81	52	0	-1	1	0	-1	0	0	0	1	0	0	1
San Joaquin River at mouth of Old River	45	59	18	0	-2	0	-1	-2	0	0	0	0	0	1	0
Old River at Holland Tract	20	32	3	0	-3	0	0	-3	0	0	-1	0	0	0	0
Middle River at Empire Cut	10	12	0	0	0	0	0	0	0	0	0	0	0	0	0
San Joaquin River west of Rough and Ready Is.	20	30	3	0	-2	0	-1	-2	0	0	-1	0	0	0	0
San Joaquin River at Mossdale	12	17	2	0	-1	0	0	-1	0	0	-1	0	0	0	0
Suisun Bay at Port Chicago	-2	-1	-5	0	0	0	0	0	0	0	0	0	0	0	0
Montezuma Slough	-1	0	3	0	0	1	0	0	1	0	0	1	0	0	1

1 Seasonal averages:
W is Winter (December through February), S is Spring (March through June), and F is Fall (September through November)

TABLE C7-16:
SEASONAL PERCENT PARTICLES TRAVELING PAST CHIPPS ISLAND

2030 LEVEL OF DEVELOPMENT; SEVERE FISHERY RESTRICTIONS

Seasonal[1] Percent Particles Traveling Past Chipps Island

120 days after Particles are Released at Locations listed below

2030 Level of Development; Severe Fishery Restrictions

	Future Without Project			Change from Future Without Project											
				Alt 1			Alt 2			Alt 3			Alt 4		
Release Location	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**
Sacramento River at Freeport	68	73	37	0	-1	0	0	-1	0	-1	0	0	0	0	0
Sacramento River above Delta Cross Channel	63	73	31	-1	-1	0	-1	-2	0	-1	0	0	0	0	0
Cache Slough at Sac Ship Channel	47	11	16	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Rio Vista	79	83	56	0	0	0	0	-1	0	0	0	0	0	0	0
Sacramento River at Emmaton	84	87	67	0	0	0	0	0	-1	0	0	0	0	0	0
Sacramento River at Collinsville	88	91	79	0	0	0	0	0	0	0	0	0	0	0	0
San Joaquin River at Jersey Island	77	84	53	0	0	0	-1	-1	0	-1	0	0	0	0	1
San Joaquin River at mouth of Old River	50	68	19	-1	-1	0	-2	-2	0	-1	1	0	0	0	0
Old River at Holland Tract	23	45	3	0	-4	0	-1	-5	0	0	0	0	0	1	0
Middle River at Empire Cut	10	17	0	0	-1	0	0	-1	0	0	-1	0	0	0	0
San Joaquin River west of Rough and Ready Is.	25	38	3	-1	-2	0	-1	-2	0	-1	-1	0	-1	0	0
San Joaquin River at Mossdale	14	20	2	0	-1	0	-1	-1	0	0	0	0	0	0	0
Suisun Bay at Port Chicago	-2	-1	-5	0	0	0	0	0	0	0	0	0	0	0	0
Montezuma Slough	-1	0	4	0	0	0	0	0	0	0	0	0	0	0	0

1 Seasonal averages:
W is Winter (December through February), S is Spring (March through June), and F is Fall (September through November)

Potential Entrainment

To assess changes in potential entrainment, the change in the total percentage of particles potentially entrained at any water intake is analyzed below. This analysis, along with the analysis presented in the "Entrainment Indices from Field Surveys" and "Delta Flow Surrogate for Delta Smelt Salvage at SWP and CVP Export Facilities" sections within this appendix, support the findings for Impact 4.3.7.

Table C7-17 through **Table C7-20** show the total percentage of particles potentially entrained at the any of the water intakes, including intakes on Old River, Victoria Canal, and Rock Slough; the SWP Banks Pumping Plant; the CVP Jones Pumping Plant; and the agricultural intakes. The three leftmost numeric columns of each table show the average percentage of particles entrained for the without project alternative for particles released during Winter (December through February), Spring (March through June), and Fall (September through November). The remaining columns show the change from the without project condition in percentage of particles that are entrained at any of the water intakes (listed above) for each season.

In general, PTM results indicate the project alternatives do not significantly increase the number of particles "pulled" into the south Delta, as is evident in the results for particle releases along the Sacramento River (near delta smelt spawning habitat) and on the San Joaquin River at Jersey Point.

In Alternatives 1 and 2, there is generally a reduction in the percentage of particles entrained, which reflects a benefit of reduced potential for fish entrainment in these alternatives. The benefits are related to the relocation of some South Bay water agencies' Delta diversions to the expanded Los Vaqueros system, which provides improved fish screening relative to the SWP and CVP facilities. The benefit for larval fish as determined by PTM is not as substantial as the reductions for individual species evaluated with the fish indices (see "Entrainment Indices from Field Surveys") because the PTM analysis assumes all larvae hatch at 5mm in length and do not grow after hatching. Since positive barrier fish screens are less than 100% efficient for the smaller size classes (e.g. planktonic larvae less than approximately 15 mm), this assumption results in a conservative estimate for the number of larval fish protected by positive barrier fish screens.

PTM results for Alternatives 3 and 4 show no significant change from the without project condition, as all changes remain below 2 percent, which is within the noise of the CalSim II model (see Chapter 4, Section 4.2) and also relatively low when compared to the seasonal variability.

TABLE C7-17:
SEASONAL PERCENT OF PARTICLES POTENTIALLY ENTRAINED AT WATER INTAKES

2005 LEVEL OF DEVELOPMENT; MODERATE FISHERY RESTRICTIONS

Seasonal[1] Percent Particles Entrained at Water Intakes[2]

120 days after Particles are Released at Locations listed below

2005 Level of Development; Moderate Fishery Restrictions

	Existing Condition			Change from Existing Condition											
				Alt 1			Alt 2			Alt 3			Alt 4		
Release Location	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**
Sacramento River at Freeport	25	20	54	-1	-1	-1	-1	-1	0	1	0	1	0	0	0
Sacramento River above Delta Cross Channel	32	22	62	-1	-1	-1	-1	-1	-1	0	0	1	0	0	0
Cache Slough at Sac Ship Channel	22	69	36	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Rio Vista	12	10	33	0	0	0	0	0	0	1	0	1	0	0	0
Sacramento River at Emmaton	6	5	20	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Collinsville	2	2	9	0	0	0	0	0	0	0	0	0	0	0	0
San Joaquin River at Jersey Island	15	10	36	0	0	0	0	0	0	0	0	1	0	0	0
San Joaquin River at mouth of Old River	48	30	76	-2	-1	-1	-2	-1	-2	0	0	1	0	0	0
Old River at Holland Tract	73	58	95	-3	-2	-2	-3	-2	-2	0	1	0	0	0	0
Middle River at Empire Cut	85	82	98	-4	-7	-3	-4	-7	-3	1	1	0	0	0	0
San Joaquin River west of Rough and Ready Island	73	62	94	-3	-3	-2	-4	-3	-2	1	1	1	0	0	0
San Joaquin River at Mossdale	84	79	95	-2	-2	-1	-2	-2	-1	0	0	0	0	0	0
Suisun Bay at Port Chicago	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Montezuma Slough	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

1 Seasonal averages:
W is Winter (December through February), S is Spring (March through June), and F is Fall (September through November)

2 Output from the particle tracking model has been adjusted to account for fish screens at the Old River and AIP intakes for each alternative and the new Delta Intake for Alternatives 1 and 2, assuming the larvae are 5mm in length and do not grow after hatch.

TABLE C7-18:
SEASONAL PERCENT OF PARTICLES POTENTIALLY ENTRAINED AT WATER INTAKES

2005 LEVEL OF DEVELOPMENT; SEVERE FISHERY RESTRICTIONS

Seasonal[1] Percent Particles Entrained at Water Intakes[2]

120 days after Particles are Released at Locations listed below

2005 Level of Development; Severe Fishery Restrictions

	Existing Condition			Change from Existing Condition											
				Alt 1			Alt 2			Alt 3			Alt 4		
Release Location	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**
Sacramento River at Freeport	24	17	54	-1	0	-1	-1	0	-1	0	0	0	0	0	1
Sacramento River above Delta Cross Channel	30	17	62	-1	0	-1	-1	0	-1	0	0	0	0	0	0
Cache Slough at Sac Ship Channel	21	69	36	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Rio Vista	12	8	33	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Emmaton	6	4	20	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Collinsville	2	2	8	0	0	0	0	0	0	0	0	0	0	0	0
San Joaquin River at Jersey Island	14	7	36	0	0	0	0	0	-1	0	0	0	0	0	0
San Joaquin River at mouth of Old River	44	21	77	-2	-1	-2	-2	-1	-2	0	0	0	0	0	0
Old River at Holland Tract	72	40	96	-3	-2	-2	-3	-2	-3	0	0	0	0	0	0
Middle River at Empire Cut	86	72	98	-5	-10	-3	-5	-11	-3	1	2	0	0	0	0
San Joaquin River west of Rough and Ready Island	68	51	94	-4	-3	-3	-4	-3	-3	0	1	0	0	0	0
San Joaquin River at Mossdale	82	74	96	-2	-2	-2	-2	-2	-2	0	0	0	0	0	0
Suisun Bay at Port Chicago	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Montezuma Slough	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

1 Seasonal averages:
W is Winter (December through February), S is Spring (March through June), and F is Fall (September through November)

2 Output from the particle tracking model has been adjusted to account for fish screens at the Old River and AIP intakes for each alternative and the new Delta Intake for Alternatives 1 and 2, assuming the larvae are 5mm in length and do not grow after hatch.

TABLE C7-19:
SEASONAL PERCENT OF PARTICLES POTENTIALLY ENTRAINED AT WATER INTAKES

2030 LEVEL OF DEVELOPMENT; MODERATE FISHERY RESTRICTIONS

Seasonal[1] Percent Particles Entrained at Water Intakes[2]

120 days after Particles are Released at Locations listed below

2030 Level of Development; Moderate Fishery Restrictions

	Future Without Project			Change from Future Without Project											
				Alt 1			Alt 2			Alt 3			Alt 4		
Release Location	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**
Sacramento River at Freeport	27	22	55	-1	1	-1	-1	0	-1	0	0	1	0	0	0
Sacramento River above Delta Cross Channel	34	24	64	-1	0	-1	0	0	-2	0	0	0	0	0	0
Cache Slough at Sac Ship Channel	22	68	35	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Rio Vista	13	11	35	0	1	-1	0	0	-1	0	0	0	0	0	-1
Sacramento River at Emmaton	7	6	21	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Collinsville	2	2	10	0	0	-1	0	0	-1	0	0	0	0	0	-1
San Joaquin River at Jersey Island	16	11	39	0	1	-2	0	1	-1	0	0	-1	0	0	-1
San Joaquin River at mouth of Old River	50	34	78	-1	0	-2	-1	0	-2	0	0	0	-1	0	0
Old River at Holland Tract	77	63	96	-2	1	-2	-2	1	-2	0	1	0	0	0	0
Middle River at Empire Cut	87	84	97	-4	-7	-2	-4	-7	-2	1	1	1	1	0	0
San Joaquin River west of Rough and Ready Island	76	64	93	-3	-1	-2	-3	-1	-2	0	1	1	0	0	1
San Joaquin River at Mossdale	86	81	95	-1	-1	-2	-2	-1	-2	0	1	1	0	0	0
Suisun Bay at Port Chicago	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Montezuma Slough	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

1 Seasonal averages:
W is Winter (December through February), S is Spring (March through June), and F is Fall (September through November)

2 Output from the particle tracking model has been adjusted to account for fish screens at the Old River and AIP intakes for each alternative and the new Delta Intake for Alternatives 1 and 2, assuming the larvae are 5mm in length and do not grow after hatch.

TABLE C7-20:
SEASONAL PERCENT OF PARTICLES POTENTIALLY ENTRAINED AT WATER INTAKES

2030 LEVEL OF DEVELOPMENT; SEVERE FISHERY RESTRICTIONS

Seasonal[1] Percent Particles Entrained at Water Intakes[2]

120 days after Particles are Released at Locations listed below

2030 Level of Development; Severe Fishery Restrictions

	Future Without Project			Change from Future Without Project											
				Alt 1			Alt 2			Alt 3			Alt 4		
Release Location	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**	**W**	**S**	**F**
Sacramento River at Freeport	24	19	54	-1	0	-1	-1	0	-1	1	0	0	0	0	0
Sacramento River above Delta Cross Channel	30	20	62	-1	0	-1	0	1	-1	1	0	0	0	0	0
Cache Slough at Sac Ship Channel	21	68	35	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Rio Vista	12	10	34	0	0	-1	0	0	-1	0	0	0	0	0	0
Sacramento River at Emmaton	6	5	21	0	0	0	0	0	0	0	0	0	0	0	0
Sacramento River at Collinsville	2	2	9	0	0	0	0	0	0	0	0	0	0	0	0
San Joaquin River at Jersey Island	14	9	37	0	0	-1	0	0	-1	1	0	0	0	0	-1
San Joaquin River at mouth of Old River	44	25	77	-1	0	-2	-1	1	-2	1	-1	0	0	0	0
Old River at Holland Tract	74	49	96	-3	1	-3	-3	2	-2	0	-1	0	0	0	0
Middle River at Empire Cut	87	75	97	-5	-9	-2	-5	-10	-2	1	0	1	0	0	1
San Joaquin River west of Rough and Ready Is.	69	55	93	-3	-1	-2	-3	-1	-2	1	1	1	0	0	1
San Joaquin River at Mossdale	82	76	95	-2	-2	-2	-1	-2	-2	0	0	0	0	0	0
Suisun Bay at Port Chicago	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Montezuma Slough	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

1 Seasonal averages:
W is Winter (December through February), S is Spring (March through June), and F is Fall (September through November)

2 Output from the particle tracking model has been adjusted to account for fish screens at the Old River and AIP intakes for each alternative and the new Delta Intake for Alternatives 1 and 2, assuming the larvae are 5mm in length and do not grow after hatch.

Potential Effects of Project Alternatives on Fishery Habitat within the Delta due to Changes in Hydrology

The proposed project and alternatives would alter the location and timing of water diversions from the Delta. The following analysis addresses the potential for these changes to adversely or beneficially affect Delta fish populations or the quality and quantity of aquatic habitat within the Bay-Delta estuary. Potential effects of proposed project Alternatives on fishery habitat within upstream tributaries and the mainstem Sacramento River are not addressed in this analysis.

Methodology

Effects on fish populations were analyzed using a number of different parameters that have been shown to be, or are thought to be, significant factors that affect habitat conditions and the reproduction of various fish and macroinvertebrate species inhabiting the Bay-Delta estuary. These habitat parameters are grouped into the following three categories:

- those that indicate flows upstream of the Delta, including
    - total Delta inflow (**Table C7-23** and **Table C7-24**),
    - Sacramento River flow at Freeport (**Table C7-25** and **Table C7-26**), and
    - San Joaquin River flow at Vernalis (**Table C7-27** and **Table C7-28**);
- those that are currently regulated by SWRCB D-1641 for fish and wildlife beneficial use, including
    - net Delta outflow (**Table C7-29** and **Table C7-30**),
    - the location of X2 (**Table C7-31** and **Table C7-32**), and
    - the Export-to-Inflow Ratio (**Table C7-33** and **Table C7-34**); and
- those that indicate circulation within the Delta, including
    - particle tracking analysis (see "Particle Tracking Analysis" above),
    - net flow on the lower San Joaquin River (Qwest) (**Table C7-35** and **Table C7-36**), and
    - net flow in Old and Middle rivers (see "Old and Middle River Flow Evaluation" below).

The biological relevance for each of these parameters is discussed in Section 4.3, with a discussion of the potential significance of any changes due to the operation of the project alternatives.

The assessment relies on a comparative analysis of operational and resulting environmental conditions within the estuary between without project conditions and each of the project alternatives. The changes in these parameters for each alternative are obtained from the hydrologic modeling results, which describe water diversion operations over a range of environmental and hydrologic conditions (see Appendix C-3). Hydrologic modeling results provide the technical foundation for assessing adverse effects of project diversions and CVP and SWP export operations on fish species and their habitat within the Bay-Delta estuary.

As described in Section 4.2 and Appendix C-3, moderate and severe fishery restrictions were simulated, in an attempt to bracket the range of background conditions that might occur, and to evaluate the environmental effects of the project alternatives under this range of conditions. Additionally, comparisons were performed for both the 2005 level of development and the 2030 level of development.

Changes to each of the parameters are evaluated on a monthly basis, for each month of the modeling simulation. For the purpose of evaluating the potential effect of each project alternative, the incremental changes for each alternative are averaged by water year type, resulting in a long-term monthly average for each water year type (e.g. long-term average incremental change in January of wet water years).

Results

Each parameter is averaged by month, for each water year type, in the following sections.

Total Pumping at SWP Banks Pumping Plant and CVP Jones Pumping Plant

TABLE C7-21: TOTAL COMBINED PUMPING (CFS) AT BANKS AND JONES UNDER 2005 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		8,275	8,719	8,558	7,643	6,050	3,982	2,652	2,861	2,609	9,034	9,614	8,977
	Change from Existing Condition	Alt 1	-2.3%	-3.0%	-3.5%	-4.1%	-4.4%	-9.2%	-5.5%	-6.2%	-9.0%	-3.5%	-4.1%	-4.4%
		Alt 2	-2.2%	-3.0%	-3.4%	-4.8%	-4.2%	-8.9%	-5.5%	-6.1%	-8.5%	-3.2%	-4.0%	-4.6%
		Alt 3	0.3%	0.2%	1.0%	1.4%	0.0%	0.6%	0.5%	0.1%	0.0%	-0.1%	-0.1%	1.1%
		Alt 4	0.0%	-0.1%	0.1%	0.8%	0.1%	0.1%	-0.3%	0.0%	0.0%	0.0%	0.0%	0.1%
Wet	Existing Condition		9,237	10,090	8,093	8,598	8,768	6,790	4,555	5,148	5,230	9,601	10,545	10,775
	Percent Change from Existing Condition	Alt 1	-2.6%	-3.0%	-3.8%	-4.6%	-3.6%	-5.5%	-4.2%	-4.1%	-7.3%	-4.6%	-4.1%	-4.1%
		Alt 2	-2.6%	-3.0%	-3.5%	-4.3%	-3.5%	-4.9%	-4.2%	-4.1%	-7.0%	-4.5%	-4.2%	-4.1%
		Alt 3	0.2%	0.3%	1.9%	1.6%	-0.7%	-0.9%	0.6%	0.0%	0.0%	0.1%	0.2%	0.1%
		Alt 4	0.1%	-0.1%	0.0%	0.6%	0.0%	0.0%	-0.4%	0.0%	0.0%	-0.1%	-0.1%	0.0%
Above Normal	Existing Condition		8,079	8,842	9,486	7,486	5,902	4,675	2,816	2,687	3,123	8,956	10,417	10,224
	Percent Change from Existing Condition	Alt 1	-1.8%	-2.6%	-3.1%	-4.6%	-5.1%	-9.1%	-5.4%	-5.1%	-8.4%	-3.7%	-3.6%	-3.8%
		Alt 2	-1.8%	-2.6%	-3.0%	-4.7%	-5.0%	-9.0%	-5.4%	-5.0%	-8.4%	-3.8%	-3.7%	-3.8%
		Alt 3	0.3%	0.1%	-0.1%	-0.3%	-0.3%	0.4%	-0.3%	-0.7%	-0.3%	0.3%	-0.6%	0.7%
		Alt 4	0.1%	0.1%	-0.2%	0.1%	1.0%	0.4%	-0.8%	-0.2%	0.0%	-0.1%	0.0%	0.0%
Below Normal	Existing Condition		8,286	8,989	8,741	6,845	6,069	3,255	2,036	2,195	1,424	10,026	10,370	9,628
	Percent Change from Existing Condition	Alt 1	-2.6%	-2.8%	-3.4%	-5.0%	-4.9%	-10.2%	-7.4%	-7.4%	-16.4%	-3.4%	-3.2%	-4.3%
		Alt 2	-2.6%	-2.8%	-3.7%	-7.7%	-4.9%	-10.5%	-7.2%	-6.4%	-14.8%	-2.5%	-2.9%	-4.9%
		Alt 3	-0.4%	0.2%	1.3%	0.8%	-0.5%	7.2%	1.7%	0.2%	0.0%	-0.4%	0.1%	0.6%
		Alt 4	-0.6%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.3%	0.0%
Dry	Existing Condition		7,732	7,868	9,193	7,587	4,023	1,865	1,359	1,386	820	10,319	10,057	7,631
	Percent Change from Existing Condition	Alt 1	-2.3%	-2.9%	-3.5%	-3.7%	-5.6%	-20.9%	-9.5%	-12.5%	-9.2%	-2.0%	-4.8%	-5.7%
		Alt 2	-2.1%	-3.0%	-3.7%	-3.5%	-5.6%	-20.9%	-8.7%	-12.5%	-7.2%	-1.6%	-4.7%	-5.6%
		Alt 3	0.9%	0.5%	0.3%	2.1%	0.0%	0.0%	0.0%	0.7%	0.0%	-0.5%	-0.7%	3.6%
		Alt 4	0.2%	0.1%	0.1%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.2%
Critical	Existing Condition		7,192	6,590	7,471	6,743	3,327	1,230	1,022	1,066	484	4,800	5,245	5,092
	Percent Change from Existing Condition	Alt 1	-1.6%	-3.8%	-3.1%	-1.9%	-4.2%	-24.7%	-6.8%	-16.3%	-26.7%	-4.2%	-4.8%	-4.8%
		Alt 2	-1.6%	-4.0%	-2.5%	-5.4%	-2.7%	-24.6%	-7.2%	-16.8%	-26.8%	-3.2%	-4.7%	-4.8%
		Alt 3	0.0%	0.0%	1.3%	2.4%	5.1%	0.0%	0.0%	1.4%	0.0%	-0.1%	1.1%	1.9%
		Alt 4	0.2%	-0.6%	1.3%	1.2%	-0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.4%

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		8,448	8,869	8,629	7,607	6,770	5,889	3,191	3,475	4,459	8,302	9,186	9,009
	Change from Existing Condition	Alt 1	-2.0%	-2.8%	-3.3%	-3.2%	-4.5%	-6.1%	-5.0%	-5.7%	-6.5%	-4.2%	-4.8%	-4.7%
		Alt 2	-2.2%	-2.9%	-3.3%	-2.8%	-4.3%	-5.4%	-4.9%	-5.4%	-6.3%	-4.3%	-4.7%	-4.6%
		Alt 3	0.5%	0.2%	0.5%	2.3%	0.5%	2.5%	0.7%	0.0%	-0.2%	-0.3%	-1.0%	1.3%
		Alt 4	0.1%	0.0%	0.0%	1.0%	0.1%	0.7%	0.3%	0.0%	0.0%	-0.2%	-0.8%	0.2%
Wet	Existing Condition		9,576	10,239	8,432	8,608	9,313	8,248	5,016	5,648	6,644	9,346	10,467	10,805
	Percent Change from Existing Condition	Alt 1	-2.5%	-3.1%	-3.7%	-3.6%	-4.4%	-4.4%	-4.2%	-4.1%	-6.4%	-4.2%	-4.4%	-4.4%
		Alt 2	-2.4%	-2.9%	-3.6%	-3.3%	-4.2%	-3.8%	-4.2%	-3.9%	-6.4%	-4.8%	-3.8%	-4.2%
		Alt 3	-0.1%	0.0%	0.0%	1.4%	-0.6%	3.0%	1.3%	0.0%	0.0%	0.9%	-0.5%	0.0%
		Alt 4	0.1%	-0.1%	0.0%	-0.1%	0.0%	0.1%	0.4%	0.0%	0.0%	0.0%	-0.1%	0.2%
Above Normal	Existing Condition		7,867	8,895	9,426	7,514	6,951	6,910	3,407	3,448	5,149	8,293	10,268	10,317
	Percent Change from Existing Condition	Alt 1	0.6%	-2.1%	-3.1%	-4.2%	-4.3%	-6.3%	-4.4%	-5.1%	-6.2%	-3.9%	-4.4%	-4.2%
		Alt 2	-0.6%	-2.3%	-2.9%	-3.9%	-4.3%	-6.2%	-4.4%	-5.6%	-6.2%	-4.0%	-4.4%	-4.2%
		Alt 3	2.5%	0.7%	0.1%	0.0%	0.1%	1.2%	-1.4%	0.2%	0.3%	-0.6%	-0.5%	0.8%
		Alt 4	1.0%	0.4%	0.0%	0.4%	0.3%	0.0%	0.0%	-0.5%	0.0%	0.0%	0.0%	0.1%
Below Normal	Existing Condition		8,615	9,101	8,611	6,813	6,778	5,416	2,627	2,762	3,858	9,241	9,922	9,461
	Percent Change from Existing Condition	Alt 1	-2.9%	-2.9%	-3.7%	-4.7%	-3.9%	-6.3%	-6.7%	-8.0%	-8.9%	-5.4%	-4.9%	-4.4%
		Alt 2	-3.0%	-3.5%	-3.4%	-4.5%	-3.1%	-5.1%	-6.8%	-7.0%	-8.8%	-5.2%	-5.0%	-4.4%
		Alt 3	-0.6%	0.3%	0.6%	0.3%	-0.2%	1.3%	1.2%	0.2%	-1.2%	-0.4%	0.3%	0.9%
		Alt 4	-0.2%	0.0%	0.7%	0.0%	0.2%	0.0%	0.0%	0.0%	0.3%	-0.4%	-0.6%	-0.1%
Dry	Existing Condition		7,802	8,205	9,163	7,405	4,929	4,123	1,911	2,129	3,064	9,180	9,287	7,623
	Percent Change from Existing Condition	Alt 1	-2.3%	-2.7%	-3.4%	-0.4%	-5.5%	-8.9%	-5.2%	-7.3%	-6.7%	-3.4%	-4.5%	-6.2%
		Alt 2	-2.3%	-2.6%	-4.0%	0.8%	-5.3%	-7.7%	-5.5%	-6.1%	-6.1%	-2.9%	-4.8%	-5.9%
		Alt 3	-0.1%	0.4%	0.4%	4.7%	0.3%	4.8%	0.5%	0.1%	-0.6%	-1.3%	-2.3%	4.0%
		Alt 4	-0.1%	0.0%	0.1%	4.2%	0.0%	4.0%	0.3%	0.2%	-0.9%	-0.7%	-1.8%	0.8%
Critical	Existing Condition		7,362	6,603	7,479	6,763	3,829	2,957	1,602	1,643	1,829	3,637	4,315	5,361
	Percent Change from Existing Condition	Alt 1	-1.7%	-3.1%	-2.0%	-3.9%	-4.9%	-9.2%	-7.6%	-11.7%	-1.3%	-4.2%	-9.0%	-5.1%
		Alt 2	-1.8%	-3.1%	-1.8%	-4.1%	-5.0%	-9.3%	-6.6%	-12.4%	-0.4%	-5.2%	-8.8%	-4.5%
		Alt 3	2.3%	-0.5%	2.7%	5.5%	8.8%	0.0%	0.0%	-0.8%	0.7%	-3.0%	-4.6%	3.0%
		Alt 4	0.0%	0.2%	-0.8%	0.2%	0.1%	0.4%	0.0%	0.5%	1.6%	0.5%	-2.9%	0.4%

TABLE C7-22: TOTAL COMBINED PUMPING (CFS) AT BANKS AND JONES UNDER 2030 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		7,835	8,731	8,448	7,702	5,917	3,884	2,653	2,867	2,590	9,243	9,612	8,716
	Change from Future Without Project	Alt 1	-2.2%	-2.7%	-3.9%	-4.5%	-3.7%	-8.5%	-4.5%	-5.9%	-8.3%	-3.4%	-3.7%	-4.3%
		Alt 2	-2.2%	-2.6%	-3.3%	-5.1%	-3.4%	-8.3%	-4.6%	-5.6%	-8.1%	-3.2%	-3.6%	-4.3%
		Alt 3	0.6%	0.3%	1.0%	0.3%	2.2%	3.9%	1.4%	-0.3%	0.1%	-0.5%	-0.5%	0.9%
		Alt 4	0.0%	0.1%	0.1%	-1.6%	0.3%	0.2%	0.0%	0.0%	0.1%	0.2%	0.1%	0.1%
Wet	Future Without Project		8,897	10,473	8,253	8,985	8,533	6,689	4,594	5,215	5,264	10,009	10,602	10,842
	Percent Change from Future Without Project	Alt 1	-2.6%	-2.6%	-3.6%	-4.1%	-3.1%	-4.6%	-4.3%	-3.8%	-6.8%	-3.9%	-3.9%	-4.0%
		Alt 2	-2.6%	-2.6%	-3.4%	-6.7%	-2.2%	-4.3%	-4.3%	-3.6%	-6.5%	-3.2%	-3.3%	-4.0%
		Alt 3	0.0%	0.2%	0.0%	-2.0%	2.6%	4.9%	1.9%	-0.1%	0.1%	-0.5%	-0.2%	0.4%
		Alt 4	-0.2%	0.1%	0.0%	-3.1%	0.8%	0.4%	0.0%	0.0%	0.0%	0.4%	0.5%	0.0%
Above Normal	Future Without Project		7,544	8,463	9,383	7,656	6,097	4,670	2,778	2,660	3,132	8,834	10,180	9,751
	Percent Change from Future Without Project	Alt 1	-2.1%	-3.1%	-2.8%	-3.4%	-4.7%	-8.9%	-3.5%	-3.9%	-7.9%	-3.9%	-3.1%	-4.0%
		Alt 2	-2.2%	-3.0%	-2.9%	-2.7%	-4.4%	-8.9%	-4.0%	-3.7%	-7.8%	-3.5%	-2.7%	-4.1%
		Alt 3	0.5%	-0.2%	0.1%	0.6%	1.6%	0.3%	0.7%	0.0%	0.0%	-0.4%	0.2%	-0.1%
		Alt 4	0.5%	-0.2%	-0.1%	0.2%	0.0%	0.0%	0.1%	0.0%	0.0%	-0.4%	0.0%	0.0%
Below Normal	Future Without Project		7,998	9,076	8,627	6,530	5,755	3,155	2,061	2,223	1,392	9,511	9,556	8,967
	Percent Change from Future Without Project	Alt 1	-2.0%	-2.8%	-6.9%	-8.0%	-3.0%	-9.0%	-5.2%	-7.1%	-15.7%	-2.6%	-3.5%	-4.2%
		Alt 2	-1.9%	-2.4%	-3.6%	-6.0%	-3.0%	-9.1%	-5.3%	-6.1%	-15.2%	-3.1%	-4.1%	-4.2%
		Alt 3	0.7%	0.3%	0.7%	2.6%	2.8%	8.4%	1.8%	-2.2%	0.0%	-0.1%	-0.3%	0.1%
		Alt 4	-0.1%	0.2%	-0.2%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.1%	-0.2%	-0.1%
Dry	Future Without Project		7,112	7,807	9,025	7,424	3,893	1,751	1,333	1,337	745	10,502	10,222	7,097
	Percent Change from Future Without Project	Alt 1	-1.8%	-2.6%	-3.1%	-4.8%	-5.1%	-20.5%	-6.9%	-11.6%	-9.7%	-2.7%	-3.8%	-4.9%
		Alt 2	-2.0%	-2.6%	-3.2%	-4.8%	-6.0%	-20.5%	-6.6%	-11.7%	-9.0%	-2.4%	-3.9%	-5.3%
		Alt 3	0.9%	0.5%	0.5%	-0.1%	-0.3%	0.0%	0.0%	0.2%	0.0%	-0.3%	-0.2%	3.2%
		Alt 4	0.3%	0.0%	0.3%	-2.1%	-0.6%	0.0%	0.0%	0.0%	1.3%	0.3%	0.1%	0.3%
Critical	Future Without Project		6,724	6,209	6,859	6,750	3,293	1,072	991	1,037	421	5,792	6,046	5,209
	Percent Change from Future Without Project	Alt 1	-1.8%	-2.8%	-3.1%	-2.6%	-4.4%	-28.5%	-4.0%	-19.8%	-21.6%	-4.3%	-4.7%	-4.6%
		Alt 2	-1.8%	-2.8%	-3.1%	-2.5%	-4.4%	-28.5%	-4.1%	-19.7%	-21.6%	-4.5%	-4.8%	-4.7%
		Alt 3	1.5%	1.3%	5.8%	4.5%	4.8%	0.0%	0.0%	0.0%	0.0%	-1.8%	-3.6%	2.4%
		Alt 4	0.0%	0.1%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	-0.1%	0.2%

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		8,126	8,889	8,580	7,773	6,916	5,829	3,235	3,503	4,444	8,694	9,527	8,942
	Change from Future Without Project	Alt 1	-2.4%	-2.8%	-3.6%	-5.2%	-3.4%	-5.5%	-4.1%	-5.2%	-6.2%	-3.8%	-4.2%	-4.5%
		Alt 2	-2.5%	-2.8%	-3.2%	-5.1%	-3.6%	-5.3%	-3.7%	-4.9%	-6.1%	-3.9%	-4.1%	-4.4%
		Alt 3	0.8%	0.7%	0.8%	0.5%	1.3%	3.4%	0.9%	0.1%	0.1%	-0.9%	-0.6%	1.7%
		Alt 4	0.0%	0.1%	0.0%	-0.9%	0.1%	0.2%	-0.1%	0.0%	-0.2%	0.0%	-0.1%	-0.1%
Wet	Future Without Project		9,171	10,537	8,452	8,762	9,516	8,341	5,101	5,751	6,737	10,078	10,851	10,910
	Percent Change from Future Without Project	Alt 1	-2.1%	-2.9%	-4.5%	-5.9%	-3.8%	-4.4%	-3.8%	-3.5%	-6.3%	-4.5%	-4.2%	-3.8%
		Alt 2	-2.5%	-2.9%	-2.9%	-6.2%	-3.7%	-4.1%	-3.2%	-3.5%	-6.0%	-4.6%	-4.2%	-3.9%
		Alt 3	0.5%	0.8%	1.1%	1.0%	1.0%	5.7%	1.3%	-0.1%	-0.1%	-0.7%	-0.7%	0.0%
		Alt 4	0.1%	-0.1%	0.0%	0.1%	0.0%	0.3%	0.0%	0.0%	0.0%	-0.2%	-0.1%	0.0%
Above Normal	Future Without Project		7,462	8,409	9,283	7,878	7,045	6,821	3,393	3,446	5,064	8,694	10,685	10,326
	Percent Change from Future Without Project	Alt 1	-2.9%	-3.0%	-3.4%	-5.9%	-3.7%	-4.9%	-4.1%	-5.2%	-6.5%	-3.0%	-2.6%	-4.0%
		Alt 2	-2.8%	-3.0%	-3.1%	-4.4%	-3.9%	-4.2%	-4.0%	-5.1%	-6.5%	-3.0%	-2.4%	-4.0%
		Alt 3	1.4%	0.0%	0.0%	-2.8%	1.3%	2.5%	0.0%	0.0%	0.0%	0.0%	0.7%	0.6%
		Alt 4	-0.3%	0.0%	0.0%	-2.9%	0.2%	0.5%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%
Below Normal	Future Without Project		8,357	9,296	8,778	6,902	7,075	5,222	2,750	2,750	3,865	9,404	9,893	9,229
	Percent Change from Future Without Project	Alt 1	-3.6%	-3.0%	-3.5%	-4.4%	-2.8%	-5.0%	-5.0%	-7.4%	-9.1%	-4.2%	-5.1%	-4.1%
		Alt 2	-3.5%	-3.0%	-3.4%	-4.0%	-2.8%	-4.9%	-4.7%	-6.2%	-8.7%	-4.1%	-5.2%	-4.1%
		Alt 3	0.6%	0.4%	0.6%	0.3%	-0.2%	1.5%	1.4%	0.6%	-1.9%	-1.4%	-0.9%	1.0%
		Alt 4	-0.3%	0.1%	0.1%	-3.8%	0.1%	0.0%	-1.0%	-0.1%	-1.0%	0.0%	-0.8%	0.0%
Dry	Future Without Project		7,511	8,025	8,981	7,671	4,898	3,978	1,909	2,144	2,912	9,386	9,774	7,423
	Percent Change from Future Without Project	Alt 1	-2.2%	-2.3%	-3.0%	-5.3%	-2.4%	-8.0%	-4.0%	-6.1%	-4.2%	-2.9%	-3.8%	-7.1%
		Alt 2	-2.2%	-2.3%	-3.2%	-4.9%	-3.6%	-7.8%	-4.0%	-5.5%	-3.4%	-3.2%	-3.7%	-6.5%
		Alt 3	0.7%	0.9%	0.6%	-1.0%	1.0%	0.8%	0.6%	-0.1%	1.3%	-0.6%	-0.1%	5.4%
		Alt 4	0.2%	0.4%	0.3%	0.0%	0.2%	0.0%	0.6%	0.0%	0.1%	0.5%	0.5%	-0.6%
Critical	Future Without Project		7,178	6,618	7,323	6,695	3,997	2,876	1,590	1,606	1,833	3,829	4,705	5,239
	Percent Change from Future Without Project	Alt 1	-1.2%	-2.5%	-2.6%	-3.0%	-4.1%	-10.1%	-5.0%	-11.6%	-2.4%	-3.5%	-6.8%	-4.0%
		Alt 2	-1.0%	-2.6%	-3.3%	-4.5%	-4.4%	-10.2%	-4.2%	-11.6%	-5.0%	-3.6%	-5.3%	-3.7%
		Alt 3	1.8%	1.3%	2.3%	6.0%	5.9%	0.1%	0.0%	1.3%	4.8%	-3.1%	-3.2%	4.7%
		Alt 4	0.1%	0.2%	-0.6%	0.3%	0.1%	0.1%	0.0%	0.0%	-0.7%	-0.3%	-0.3%	0.3%

Delta Inflow

TABLE C7-23: DELTA INFLOW (CFS) UNDER 2005 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		14,752	19,273	32,886	49,983	60,786	50,834	33,691	27,564	21,162	21,913	17,433	16,396
	Change from Existing Condition	Alt 1	-0.1%	-0.2%	-0.1%	0.0%	-0.1%	0.0%	-0.1%	0.1%	0.4%	0.3%	-0.3%	-0.1%
		Alt 2	-0.1%	-0.2%	-0.1%	0.0%	-0.1%	0.0%	-0.1%	0.1%	0.4%	0.6%	-0.2%	-0.2%
		Alt 3	-0.1%	0.0%	-0.1%	0.0%	0.0%	0.0%	-0.1%	0.0%	-0.3%	0.1%	0.0%	0.6%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
Wet	Existing Condition		17,493	26,023	59,172	93,415	107,477	88,016	57,974	47,162	35,356	25,432	18,821	23,049
	Percent Change from Existing Condition	Alt 1	-0.3%	-0.4%	-0.1%	0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%
		Alt 2	-0.5%	-0.4%	-0.1%	0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	-0.3%	-0.1%	-0.2%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.1%	0.1%
		Alt 4	0.1%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	-0.1%
Above Normal	Existing Condition		13,444	20,054	27,596	55,810	70,084	62,505	35,583	29,122	21,729	23,307	17,575	15,993
	Percent Change from Existing Condition	Alt 1	0.6%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.3%	-0.1%	-0.2%
		Alt 2	0.7%	-0.2%	-0.1%	-0.1%	0.1%	0.0%	0.1%	0.2%	0.1%	0.3%	0.0%	-0.3%
		Alt 3	0.3%	0.0%	-0.2%	0.0%	0.0%	0.0%	-0.3%	-0.1%	-0.1%	0.3%	-0.1%	0.5%
		Alt 4	0.1%	0.2%	-0.2%	0.0%	0.0%	0.0%	-0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Below Normal	Existing Condition		14,244	16,378	23,299	30,108	44,919	31,958	26,157	21,156	15,795	22,312	18,083	14,857
	Percent Change from Existing Condition	Alt 1	-0.2%	0.2%	0.3%	-0.4%	-0.1%	0.0%	-0.1%	0.3%	0.4%	0.5%	-0.1%	0.0%
		Alt 2	-0.1%	0.2%	0.2%	-0.3%	-0.1%	-0.1%	-0.2%	0.1%	0.5%	1.1%	0.5%	-0.6%
		Alt 3	-0.2%	0.0%	0.4%	-0.3%	0.1%	0.0%	0.0%	0.1%	-0.2%	0.0%	0.0%	0.5%
		Alt 4	-0.2%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%
Dry	Existing Condition		13,367	15,838	18,874	21,192	28,416	27,271	17,645	15,377	11,891	21,017	18,142	12,530
	Percent Change from Existing Condition	Alt 1	0.0%	0.1%	-0.4%	0.0%	-0.2%	0.1%	-0.5%	0.2%	2.4%	1.1%	-1.2%	-0.3%
		Alt 2	0.0%	0.1%	-0.5%	0.0%	0.0%	0.0%	-0.5%	0.2%	2.6%	1.4%	-1.2%	-0.3%
		Alt 3	0.1%	0.1%	-0.4%	0.0%	0.1%	-0.1%	-0.1%	-0.2%	-1.0%	0.5%	-0.1%	2.5%
		Alt 4	0.0%	0.0%	0.0%	0.0%	-0.3%	0.1%	0.1%	0.0%	-0.1%	0.1%	0.1%	0.2%
Critical	Existing Condition		12,789	12,398	13,426	16,426	17,387	15,965	12,043	9,298	10,007	13,775	12,466	9,978
	Percent Change from Existing Condition	Alt 1	-0.2%	-0.1%	-0.3%	0.0%	-0.1%	0.0%	-0.6%	0.0%	0.2%	-0.1%	0.0%	-0.1%
		Alt 2	-0.2%	-0.1%	-0.4%	0.0%	-0.1%	0.0%	-0.6%	-0.1%	0.4%	0.5%	0.0%	-0.1%
		Alt 3	-0.4%	0.1%	0.3%	0.1%	-0.1%	-0.1%	-0.5%	0.0%	-1.6%	0.1%	-0.1%	0.2%
		Alt 4	-0.2%	0.0%	0.9%	0.0%	0.2%	0.0%	-0.2%	0.0%	-0.1%	-0.1%	0.3%	-0.1%

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		14,979	19,138	32,757	49,911	60,770	50,906	33,731	27,556	22,293	21,511	16,845	16,394
	Change from Existing Condition	Alt 1	0.3%	0.1%	0.0%	0.0%	-0.1%	0.1%	-0.3%	0.2%	0.3%	0.2%	-0.5%	-0.2%
		Alt 2	0.0%	0.0%	0.0%	-0.1%	-0.1%	0.1%	-0.2%	0.2%	0.4%	0.3%	-0.5%	-0.1%
		Alt 3	0.1%	0.2%	0.1%	0.0%	-0.2%	0.1%	0.0%	0.0%	-0.5%	0.2%	-0.5%	0.7%
		Alt 4	0.2%	-0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	-0.3%	0.1%
Wet	Existing Condition		17,861	25,718	58,578	93,245	107,316	88,111	57,879	47,227	35,630	25,535	18,733	23,042
	Percent Change from Existing Condition	Alt 1	-0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.2%	-0.1%	-0.1%
		Alt 2	-0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.2%	-0.1%
		Alt 3	-0.3%	0.1%	0.2%	0.0%	-0.1%	0.0%	0.0%	0.0%	-0.1%	0.3%	-0.3%	0.0%
		Alt 4	0.4%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%
Above Normal	Existing Condition		13,369	19,836	27,998	55,622	69,935	62,470	35,458	29,212	22,749	23,067	17,413	16,128
	Percent Change from Existing Condition	Alt 1	2.2%	-0.3%	0.1%	0.1%	0.0%	0.0%	-0.1%	0.5%	-0.1%	0.4%	-0.1%	-0.4%
		Alt 2	1.3%	-0.3%	0.1%	-0.1%	0.0%	0.0%	-0.1%	0.2%	-0.1%	0.4%	-0.1%	-0.4%
		Alt 3	1.5%	0.1%	0.0%	-0.1%	0.0%	0.0%	0.1%	-0.1%	-0.1%	0.2%	0.0%	0.6%
		Alt 4	0.5%	0.0%	0.0%	0.1%	0.0%	-0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%
Below Normal	Existing Condition		14,574	16,259	22,857	30,095	44,558	31,963	26,101	21,017	17,203	21,994	17,335	14,594
	Percent Change from Existing Condition	Alt 1	0.0%	0.2%	0.2%	-0.1%	-0.3%	0.3%	-0.2%	-0.1%	-0.1%	-0.5%	-0.6%	0.2%
		Alt 2	-1.0%	-0.2%	0.1%	-0.1%	-0.3%	0.3%	-0.2%	-0.1%	0.1%	-0.3%	-0.6%	0.2%
		Alt 3	-0.2%	0.6%	0.1%	0.3%	-0.3%	0.0%	0.0%	-0.1%	-0.8%	0.3%	0.3%	0.9%
		Alt 4	0.0%	0.0%	0.3%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	-0.2%	-0.1%	-0.1%
Dry	Existing Condition		13,425	15,991	18,909	21,255	28,084	27,424	17,930	15,151	13,963	20,070	17,048	12,487
	Percent Change from Existing Condition	Alt 1	0.3%	0.1%	-0.2%	0.0%	0.0%	0.4%	-1.4%	1.0%	1.3%	0.5%	-1.2%	-0.6%
		Alt 2	0.4%	0.1%	-0.2%	0.0%	-0.1%	0.4%	-1.4%	1.1%	1.7%	1.0%	-1.5%	-0.4%
		Alt 3	-0.2%	0.3%	0.0%	-0.1%	0.0%	1.3%	-0.1%	0.0%	-1.5%	0.2%	-1.4%	2.5%
		Alt 4	0.0%	-0.1%	0.0%	0.0%	0.0%	0.7%	0.0%	0.1%	-0.2%	-0.3%	-1.0%	0.5%
Critical	Existing Condition		13,146	12,262	13,891	16,411	18,694	16,051	12,283	9,512	11,377	12,833	11,308	10,217
	Percent Change from Existing Condition	Alt 1	-0.1%	0.0%	-0.3%	-0.2%	-2.0%	0.4%	-1.1%	0.7%	2.1%	0.3%	-1.1%	-0.3%
		Alt 2	-0.2%	0.1%	-0.3%	-0.2%	0.0%	0.3%	-1.0%	0.5%	2.2%	0.2%	-1.0%	0.0%
		Alt 3	0.8%	-0.5%	-0.4%	0.1%	-3.2%	-0.1%	-0.3%	-0.1%	-1.8%	-0.7%	-1.8%	1.1%
		Alt 4	-0.1%	0.0%	-0.1%	-0.1%	-1.0%	0.0%	-0.3%	0.1%	-0.1%	0.0%	-1.0%	0.0%

TABLE C7-24: DELTA INFLOW (CFS) UNDER 2030 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		14,091	18,971	32,794	50,056	60,826	50,781	33,790	27,471	20,961	22,159	17,374	15,759
	Change from Future Without Project	Alt 1	-0.1%	0.0%	0.0%	-0.1%	-0.1%	0.0%	-0.2%	0.1%	0.4%	0.2%	-0.2%	-0.1%
		Alt 2	-0.1%	-0.4%	-0.1%	-0.1%	-0.1%	0.0%	-0.1%	0.1%	0.6%	0.4%	-0.1%	-0.1%
		Alt 3	0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.3%	-0.1%	-0.1%	0.4%
		Alt 4	0.0%	-0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.0%
Wet	Future Without Project		16,531	25,957	58,823	93,586	107,738	87,889	58,192	46,835	35,009	25,853	18,761	22,305
	Percent Change from Future Without Project	Alt 1	-0.2%	0.5%	-0.1%	0.0%	-0.1%	0.1%	0.0%	0.0%	0.0%	0.2%	0.0%	-0.1%
		Alt 2	-0.2%	-0.1%	-0.1%	0.0%	-0.1%	0.1%	0.0%	0.0%	0.0%	0.5%	0.4%	-0.1%
		Alt 3	0.0%	0.3%	0.2%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	-0.4%	0.0%	0.4%
		Alt 4	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.5%	0.0%
Above Normal	Future Without Project		12,799	19,200	28,183	56,149	70,157	62,014	35,749	28,923	21,468	23,019	17,402	15,099
	Percent Change from Future Without Project	Alt 1	0.1%	-0.8%	0.1%	-0.2%	0.1%	0.0%	-0.1%	0.1%	0.0%	0.0%	0.4%	-0.1%
		Alt 2	0.2%	-2.3%	0.0%	-0.4%	0.1%	-0.1%	-0.1%	0.0%	0.0%	0.5%	0.6%	-0.1%
		Alt 3	0.1%	-1.8%	0.1%	-0.2%	0.0%	-0.1%	0.0%	-0.2%	-0.2%	0.2%	0.5%	-0.2%
		Alt 4	0.3%	-1.3%	0.2%	-0.2%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.1%	0.3%	0.1%
Below Normal	Future Without Project		13,922	16,219	23,487	30,218	44,403	31,932	26,056	21,109	15,743	21,828	17,172	13,916
	Percent Change from Future Without Project	Alt 1	0.0%	-0.3%	0.7%	-0.1%	0.0%	0.0%	-0.6%	0.0%	0.4%	0.6%	-0.2%	0.0%
		Alt 2	0.1%	-0.2%	0.0%	-0.1%	0.1%	0.0%	-0.5%	0.0%	1.3%	0.4%	-0.6%	0.0%
		Alt 3	-0.1%	0.0%	0.0%	-0.2%	0.0%	0.0%	0.0%	-0.3%	-0.2%	0.2%	0.1%	-0.1%
		Alt 4	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.1%	-0.1%
Dry	Future Without Project		12,779	15,544	18,457	21,034	28,413	27,616	17,688	15,441	11,688	21,313	18,238	11,923
	Percent Change from Future Without Project	Alt 1	-0.1%	0.0%	-0.4%	0.0%	-0.2%	-0.1%	-0.3%	0.7%	2.6%	0.4%	-0.6%	0.1%
		Alt 2	-0.1%	0.0%	-0.3%	0.0%	-0.4%	0.1%	-0.2%	0.7%	2.6%	0.6%	-0.7%	-0.1%
		Alt 3	0.2%	0.1%	-0.2%	0.0%	-0.5%	0.2%	0.0%	0.0%	-0.5%	0.4%	0.3%	1.7%
		Alt 4	0.0%	0.0%	-0.1%	-0.1%	-0.4%	0.0%	0.0%	0.0%	0.1%	0.1%	0.2%	0.2%
Critical	Future Without Project		12,264	11,957	13,372	16,325	17,633	15,885	12,138	9,532	10,017	14,949	13,282	10,140
	Percent Change from Future Without Project	Alt 1	-0.1%	-0.1%	0.0%	0.0%	-0.1%	0.0%	-0.3%	-0.2%	1.0%	-0.2%	-0.5%	-0.6%
		Alt 2	-0.1%	-0.1%	0.0%	0.0%	-0.1%	0.0%	-0.1%	-0.1%	1.9%	-0.3%	-0.7%	-0.7%
		Alt 3	0.1%	0.4%	-1.7%	0.0%	0.0%	-0.1%	-0.6%	-0.3%	-2.2%	-0.9%	-2.0%	0.2%
		Alt 4	-0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	-0.3%	-0.5%

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		14,365	18,692	32,385	49,654	60,512	50,742	33,783	27,544	22,156	22,029	17,188	16,042
	Change from Future Without Project	Alt 1	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	-0.3%	0.2%	0.1%	0.1%	-0.3%	-0.1%
		Alt 2	-0.1%	0.1%	-0.1%	0.0%	0.0%	0.1%	-0.2%	0.2%	0.3%	0.1%	-0.2%	-0.1%
		Alt 3	0.3%	0.1%	0.0%	0.0%	-0.1%	0.0%	0.1%	-0.2%	-0.7%	0.0%	-0.2%	0.9%
		Alt 4	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.1%	0.1%	-0.1%
Wet	Future Without Project		16,720	25,474	57,863	92,862	106,937	88,107	58,083	46,834	35,330	26,485	19,008	22,391
	Percent Change from Future Without Project	Alt 1	0.2%	0.1%	0.1%	0.0%	-0.1%	0.0%	0.0%	0.1%	-0.1%	-0.3%	-0.2%	0.1%
		Alt 2	0.0%	0.1%	-0.1%	0.0%	-0.1%	0.0%	0.0%	0.1%	-0.1%	-0.3%	-0.2%	0.0%
		Alt 3	0.2%	0.5%	0.1%	-0.1%	-0.1%	0.0%	0.0%	0.0%	-0.1%	-0.4%	-0.4%	0.0%
		Alt 4	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
Above Normal	Future Without Project		12,701	18,617	27,689	55,286	69,839	61,778	35,383	28,860	22,482	23,587	17,923	15,887
	Percent Change from Future Without Project	Alt 1	-0.1%	-0.4%	0.1%	0.1%	0.1%	0.1%	-0.2%	0.2%	-0.2%	0.5%	0.7%	-0.1%
		Alt 2	0.0%	-0.4%	-0.4%	0.1%	0.0%	0.1%	-0.1%	0.1%	-0.2%	0.5%	0.9%	0.0%
		Alt 3	1.3%	-0.6%	-0.2%	0.2%	0.0%	0.3%	0.2%	-0.5%	-0.4%	0.4%	0.8%	0.6%
		Alt 4	-0.2%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.3%	0.0%
Below Normal	Future Without Project		14,240	16,075	22,883	30,158	44,044	31,765	25,949	20,839	17,179	22,202	17,399	14,259
	Percent Change from Future Without Project	Alt 1	-0.5%	0.7%	0.0%	-0.1%	0.0%	0.1%	-0.4%	-0.1%	-0.3%	-0.1%	-1.0%	0.4%
		Alt 2	-0.5%	0.7%	0.0%	-0.1%	0.0%	0.0%	-0.5%	-0.1%	0.0%	0.2%	-1.0%	0.5%
		Alt 3	0.0%	-0.1%	0.2%	-0.1%	-0.2%	0.0%	0.2%	-0.3%	-1.0%	0.1%	-0.3%	0.9%
		Alt 4	-0.2%	-0.3%	-0.1%	0.0%	0.0%	0.0%	-0.2%	-0.1%	-0.2%	0.1%	-0.2%	0.0%
Dry	Future Without Project		13,224	15,321	18,468	20,816	28,147	27,287	17,998	15,893	13,749	20,461	17,561	12,297
	Percent Change from Future Without Project	Alt 1	0.0%	0.0%	0.0%	0.1%	-0.2%	0.2%	-1.0%	1.1%	1.8%	0.4%	-0.6%	-1.2%
		Alt 2	0.1%	0.1%	-0.1%	0.0%	-0.2%	0.4%	-1.0%	1.1%	2.2%	0.3%	-0.5%	-0.9%
		Alt 3	0.0%	0.1%	0.1%	0.0%	-0.6%	0.0%	0.0%	-0.2%	-1.1%	0.5%	0.0%	3.2%
		Alt 4	0.2%	0.0%	0.0%	0.0%	-0.3%	0.1%	0.0%	0.1%	0.0%	0.3%	0.2%	-0.4%
Critical	Future Without Project		12,783	12,180	13,842	16,410	18,359	16,068	12,351	9,730	11,707	12,964	11,708	10,142
	Percent Change from Future Without Project	Alt 1	-0.1%	0.0%	-0.1%	0.0%	1.1%	0.2%	-0.9%	0.9%	-0.3%	0.9%	-0.5%	-0.2%
		Alt 2	0.0%	0.0%	-0.1%	0.0%	1.0%	0.2%	-0.6%	1.0%	0.4%	1.0%	0.0%	-0.1%
		Alt 3	0.7%	0.3%	-0.2%	0.0%	0.6%	-0.4%	-0.5%	0.1%	-3.4%	0.0%	-1.1%	1.5%
		Alt 4	-0.1%	0.0%	0.0%	0.0%	1.1%	0.0%	-0.2%	0.0%	-0.5%	-0.1%	-0.1%	-0.1%

Sacramento River Inflow

TABLE C7-25: SACRAMENTO RIVER INFLOW (CFS) UNDER 2005 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		11,910	15,539	25,741	34,475	40,240	34,931	24,085	19,836	15,575	18,272	14,880	13,410
	Change from Existing Condition	Alt 1	-0.1%	-0.2%	-0.1%	0.0%	-0.1%	0.0%	-0.2%	0.2%	0.5%	0.4%	-0.4%	-0.1%
		Alt 2	-0.1%	-0.2%	-0.1%	-0.1%	0.0%	0.0%	-0.2%	0.1%	0.6%	0.7%	-0.2%	-0.3%
		Alt 3	-0.2%	0.0%	-0.1%	0.0%	0.0%	0.0%	-0.1%	0.0%	-0.4%	0.1%	0.0%	0.8%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.1%	0.0%
Wet	Existing Condition		14,166	21,000	45,024	55,845	61,345	52,667	39,568	32,867	23,921	17,931	14,583	18,607
	Percent Change from Existing Condition	Alt 1	-0.3%	-0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	-0.2%	0.0%	0.0%
		Alt 2	-0.5%	-0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	-0.1%	-0.1%
		Alt 3	-0.4%	-0.1%	-0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.2%	0.1%
		Alt 4	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	-0.1%
Above Normal	Existing Condition		11,033	16,621	21,753	44,104	51,360	47,401	26,657	21,988	15,808	20,171	15,183	13,126
	Percent Change from Existing Condition	Alt 1	0.7%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.1%	0.4%	-0.1%	-0.3%
		Alt 2	0.8%	-0.1%	0.0%	0.0%	0.1%	0.0%	0.1%	0.3%	0.1%	0.3%	0.0%	-0.3%
		Alt 3	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.4%	-0.2%	-0.1%	0.3%	-0.2%	0.6%
		Alt 4	0.2%	0.2%	-0.2%	0.1%	0.1%	0.0%	-0.4%	0.0%	0.0%	0.0%	0.0%	0.0%
Below Normal	Existing Condition		11,491	13,041	18,747	25,119	35,108	25,177	18,927	14,955	12,740	20,243	15,897	12,226
	Percent Change from Existing Condition	Alt 1	-0.2%	0.2%	0.3%	-0.4%	-0.1%	0.0%	-0.2%	0.4%	0.5%	0.5%	-0.1%	0.0%
		Alt 2	-0.1%	0.2%	0.3%	-0.4%	-0.2%	-0.2%	-0.3%	0.1%	0.6%	1.2%	0.6%	-0.7%
		Alt 3	-0.3%	0.0%	0.5%	-0.3%	0.2%	0.0%	0.0%	0.1%	-0.3%	0.0%	0.0%	0.6%
		Alt 4	-0.2%	-0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%
Dry	Existing Condition		10,564	12,636	15,739	18,062	23,581	23,071	13,498	11,796	10,106	19,629	16,676	10,417
	Percent Change from Existing Condition	Alt 1	0.0%	0.1%	-0.5%	0.0%	-0.3%	0.1%	-0.8%	0.2%	2.8%	1.2%	-1.3%	-0.3%
		Alt 2	0.1%	0.1%	-0.6%	0.0%	0.1%	-0.1%	-0.7%	0.2%	3.0%	1.5%	-1.3%	-0.3%
		Alt 3	0.2%	0.1%	-0.5%	0.0%	0.1%	-0.2%	-0.1%	-0.2%	-1.2%	0.5%	-0.1%	3.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	-0.4%	0.1%	0.1%	0.0%	-0.2%	0.1%	0.1%	0.2%
Critical	Existing Condition		10,407	9,897	11,114	14,075	14,366	13,204	9,862	7,204	8,772	12,777	11,339	8,303
	Percent Change from Existing Condition	Alt 1	-0.2%	-0.2%	-0.3%	0.0%	-0.1%	0.0%	-0.8%	-0.1%	0.2%	-0.1%	0.0%	-0.1%
		Alt 2	-0.2%	-0.2%	-0.4%	0.0%	-0.1%	0.0%	-0.8%	-0.1%	0.5%	0.5%	0.0%	-0.2%
		Alt 3	-0.5%	0.1%	0.4%	0.1%	-0.1%	-0.1%	-0.6%	-0.1%	-1.8%	0.1%	-0.2%	0.3%
		Alt 4	-0.3%	-0.1%	1.1%	0.0%	0.2%	0.0%	-0.2%	0.0%	-0.2%	-0.2%	0.3%	-0.1%

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		12,136	15,406	25,620	34,425	40,290	35,005	24,146	19,826	16,705	17,866	14,287	13,406
	Change from Existing Condition	Alt 1	0.4%	0.1%	0.0%	0.0%	-0.2%	0.1%	-0.4%	0.3%	0.4%	0.2%	-0.6%	-0.2%
		Alt 2	0.0%	0.0%	0.0%	-0.1%	-0.1%	0.1%	-0.3%	0.3%	0.5%	0.3%	-0.5%	-0.2%
		Alt 3	0.2%	0.2%	0.0%	0.0%	-0.3%	0.2%	0.0%	0.0%	-0.7%	0.2%	-0.6%	0.9%
		Alt 4	-0.2%	-0.1%	0.0%	0.0%	-0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	-0.4%	0.2%
Wet	Existing Condition		14,530	20,689	44,602	55,824	61,385	52,718	39,551	32,931	24,193	18,032	14,494	18,600
	Percent Change from Existing Condition	Alt 1	-0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	-0.1%	0.3%	-0.1%	-0.1%
		Alt 2	-0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	-0.1%	0.0%	0.3%	-0.1%
		Alt 3	-0.3%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.4%	-0.3%	0.0%
		Alt 4	-0.7%	-0.2%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%
Above Normal	Existing Condition		10,954	16,405	21,833	43,738	51,214	47,467	26,533	22,078	16,826	19,928	15,019	13,259
	Percent Change from Existing Condition	Alt 1	2.7%	-0.4%	0.1%	0.0%	0.0%	-0.1%	-0.1%	0.7%	-0.2%	0.4%	-0.1%	-0.5%
		Alt 2	1.6%	-0.4%	0.2%	-0.3%	0.0%	-0.1%	-0.1%	0.2%	-0.1%	0.5%	-0.1%	-0.5%
		Alt 3	1.9%	0.1%	0.0%	-0.1%	0.0%	0.0%	0.1%	-0.1%	-0.2%	0.2%	0.0%	0.7%
		Alt 4	0.6%	-0.1%	0.0%	0.2%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%
Below Normal	Existing Condition		11,816	12,944	18,306	25,105	34,750	25,181	18,863	14,813	14,144	19,920	15,137	11,961
	Percent Change from Existing Condition	Alt 1	0.0%	0.2%	0.2%	0.0%	-0.3%	0.3%	-0.3%	-0.2%	-0.1%	-0.5%	-0.7%	0.2%
		Alt 2	-1.2%	-0.3%	0.2%	-0.1%	-0.4%	0.3%	-0.3%	-0.1%	0.1%	-0.3%	-0.7%	0.2%
		Alt 3	-0.3%	0.5%	0.1%	0.4%	-0.4%	0.0%	0.0%	-0.1%	-1.0%	0.3%	0.3%	1.0%
		Alt 4	0.0%	0.0%	0.4%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	-0.2%	-0.1%	-0.1%
Dry	Existing Condition		10,628	12,789	15,778	18,131	23,256	23,224	13,776	11,568	12,174	18,675	15,578	10,372
	Percent Change from Existing Condition	Alt 1	0.4%	0.1%	-0.2%	0.0%	-0.1%	0.4%	-1.8%	1.3%	1.5%	0.6%	-1.3%	-0.7%
		Alt 2	0.5%	0.1%	-0.3%	0.1%	-0.2%	0.5%	-1.8%	1.4%	2.0%	1.1%	-1.6%	-0.5%
		Alt 3	-0.2%	0.4%	0.0%	-0.1%	0.0%	1.5%	-0.1%	0.0%	-1.7%	0.2%	-1.6%	3.0%
		Alt 4	0.0%	-0.1%	0.0%	0.0%	0.1%	0.9%	0.0%	0.1%	-0.2%	-0.3%	-1.1%	0.6%
Critical	Existing Condition		10,764	9,762	11,579	14,065	15,673	13,296	10,102	7,417	10,142	11,834	10,180	8,539
	Percent Change from Existing Condition	Alt 1	-0.1%	0.0%	-0.3%	-0.2%	-2.4%	0.4%	-1.4%	0.8%	2.3%	0.3%	-1.2%	-0.3%
		Alt 2	-0.2%	0.1%	-0.4%	-0.2%	0.0%	0.3%	-1.2%	0.7%	2.5%	0.3%	-1.1%	0.0%
		Alt 3	1.0%	-0.6%	-0.5%	0.1%	-3.8%	-0.1%	-0.4%	-0.1%	-2.0%	-0.7%	-2.0%	1.2%
		Alt 4	-0.2%	0.0%	-0.2%	-0.1%	-1.1%	0.0%	-0.4%	0.2%	-0.1%	0.0%	-1.2%	0.1%

TABLE C7-26: SACRAMENTO RIVER INFLOW (CFS) UNDER 2030 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		11,263	15,242	25,678	34,526	40,358	35,075	24,196	19,785	15,451	18,539	14,870	12,791
	Change from Future Without Project	Alt 1	-0.1%	0.1%	0.0%	-0.1%	0.0%	0.0%	-0.2%	0.1%	0.6%	0.3%	-0.2%	-0.1%
		Alt 2	-0.1%	-0.5%	-0.1%	-0.1%	0.0%	0.0%	-0.2%	0.1%	0.8%	0.5%	-0.1%	-0.2%
		Alt 3	0.1%	-0.1%	-0.1%	0.0%	-0.1%	0.1%	0.0%	-0.1%	-0.4%	-0.1%	-0.1%	0.5%
		Alt 4	0.0%	-0.2%	0.0%	-0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.2%	0.3%	0.0%
Wet	Future Without Project		13,240	20,939	44,988	56,129	61,700	52,719	39,769	32,610	23,599	18,327	14,589	17,877
	Percent Change from Future Without Project	Alt 1	-0.3%	0.6%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.3%	0.0%	-0.1%
		Alt 2	-0.3%	-0.2%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.7%	0.5%	-0.1%
		Alt 3	0.1%	0.4%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	-0.5%	0.0%	0.5%
		Alt 4	-0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.6%	0.0%
Above Normal	Future Without Project		10,405	15,782	21,955	44,075	51,440	47,314	26,876	21,779	15,710	19,906	15,027	12,231
	Percent Change from Future Without Project	Alt 1	0.2%	-0.8%	0.0%	-0.1%	0.1%	0.0%	-0.1%	0.1%	0.0%	0.0%	0.4%	-0.1%
		Alt 2	0.3%	-2.6%	0.2%	-0.5%	0.1%	0.0%	-0.1%	0.1%	0.0%	0.6%	0.7%	-0.2%
		Alt 3	0.1%	-2.2%	0.1%	-0.2%	0.0%	0.0%	0.0%	-0.2%	-0.3%	0.3%	0.5%	-0.2%
		Alt 4	0.3%	-1.6%	0.2%	-0.3%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.1%	0.3%	0.1%
Below Normal	Future Without Project		11,178	12,894	18,891	25,219	34,722	25,271	18,771	14,900	12,753	19,801	15,037	11,322
	Percent Change from Future Without Project	Alt 1	0.0%	-0.4%	0.9%	-0.1%	0.0%	0.0%	-0.8%	0.0%	0.5%	0.7%	-0.3%	0.0%
		Alt 2	0.2%	-0.3%	0.0%	-0.2%	0.2%	0.0%	-0.7%	0.0%	1.6%	0.4%	-0.7%	0.0%
		Alt 3	-0.1%	0.0%	0.0%	-0.2%	0.1%	0.0%	0.1%	-0.4%	-0.3%	0.2%	0.2%	-0.1%
		Alt 4	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.1%	-0.1%
Dry	Future Without Project		9,970	12,343	15,306	17,906	23,650	23,563	13,602	11,931	9,999	19,989	16,824	9,832
	Percent Change from Future Without Project	Alt 1	-0.1%	0.0%	-0.5%	0.0%	-0.3%	-0.1%	-0.4%	0.9%	3.0%	0.4%	-0.7%	0.1%
		Alt 2	-0.1%	0.0%	-0.4%	0.0%	-0.5%	0.2%	-0.3%	0.9%	3.1%	0.6%	-0.8%	-0.1%
		Alt 3	0.3%	0.1%	-0.2%	0.0%	-0.6%	0.2%	0.0%	0.0%	-0.5%	0.4%	0.3%	2.0%
		Alt 4	0.1%	0.0%	-0.1%	-0.1%	-0.4%	0.0%	-0.1%	0.0%	0.1%	0.1%	0.2%	0.3%
Critical	Future Without Project		9,875	9,449	11,041	13,955	14,675	13,313	9,997	7,484	8,868	13,988	12,195	8,486
	Percent Change from Future Without Project	Alt 1	-0.2%	-0.1%	0.0%	0.0%	-0.1%	0.0%	-0.4%	-0.3%	1.1%	-0.2%	-0.5%	-0.7%
		Alt 2	-0.1%	-0.1%	0.0%	0.0%	-0.1%	0.0%	-0.2%	-0.1%	2.2%	-0.4%	-0.7%	-0.8%
		Alt 3	0.1%	0.5%	-2.0%	0.0%	0.1%	-0.1%	-0.7%	-0.4%	-2.5%	-1.0%	-2.2%	0.3%
		Alt 4	-0.2%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	-0.4%	-0.5%

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		11,533	14,982	25,486	34,318	40,232	34,988	24,241	19,857	16,644	18,406	14,680	13,073
	Change from Future Without Project	Alt 1	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	-0.4%	0.3%	0.1%	0.1%	-0.3%	-0.2%
		Alt 2	-0.1%	0.1%	-0.1%	0.0%	0.0%	0.1%	-0.3%	0.3%	0.3%	0.2%	-0.3%	-0.1%
		Alt 3	0.4%	0.2%	0.1%	0.0%	-0.2%	0.0%	0.0%	-0.2%	-0.9%	0.0%	-0.2%	1.1%
		Alt 4	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	-0.1%	0.1%	0.1%	-0.1%
Wet	Future Without Project		13,424	20,452	44,562	55,857	61,489	52,659	39,745	32,610	23,919	18,957	14,834	17,962
	Percent Change from Future Without Project	Alt 1	0.3%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	-0.2%	-0.4%	-0.2%	0.1%
		Alt 2	0.0%	0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	-0.2%	-0.5%	-0.2%	0.0%
		Alt 3	0.2%	0.6%	0.1%	0.0%	-0.1%	0.0%	0.1%	0.0%	-0.2%	-0.5%	-0.5%	0.0%
		Alt 4	0.0%	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%
Above Normal	Future Without Project		10,299	15,230	21,703	43,547	51,123	47,356	26,689	21,715	16,721	20,469	15,545	13,018
	Percent Change from Future Without Project	Alt 1	-0.1%	-0.5%	-0.1%	0.1%	0.1%	0.0%	-0.2%	0.2%	-0.2%	0.6%	0.8%	-0.1%
		Alt 2	0.0%	-0.5%	-0.1%	0.0%	0.1%	0.0%	-0.2%	0.2%	-0.2%	0.6%	1.0%	0.0%
		Alt 3	1.5%	-0.8%	-0.3%	0.2%	0.0%	0.0%	-0.5%	-0.7%	-0.6%	0.5%	0.9%	0.8%
		Alt 4	-0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.3%	0.0%
Below Normal	Future Without Project		11,496	12,773	18,346	25,159	34,366	25,104	18,663	14,628	14,185	20,169	15,254	11,662
	Percent Change from Future Without Project	Alt 1	-0.6%	0.9%	0.0%	-0.1%	0.0%	0.1%	-0.6%	-0.2%	-0.4%	-0.1%	-1.1%	0.5%
		Alt 2	-0.6%	0.9%	0.0%	-0.1%	0.0%	0.1%	-0.7%	-0.1%	0.0%	0.2%	-1.2%	0.6%
		Alt 3	0.0%	-0.2%	0.2%	-0.1%	-0.3%	-0.1%	0.3%	-0.4%	-1.2%	0.1%	-0.4%	1.1%
		Alt 4	-0.2%	-0.3%	-0.1%	0.0%	0.1%	0.0%	-0.3%	-0.2%	-0.2%	0.1%	-0.2%	0.0%
Dry	Future Without Project		10,414	12,173	15,321	17,688	23,384	23,234	13,906	12,380	12,057	19,132	16,143	10,204
	Percent Change from Future Without Project	Alt 1	0.0%	0.1%	0.0%	0.1%	-0.2%	0.3%	-1.3%	1.4%	2.1%	0.4%	-0.6%	-1.4%
		Alt 2	0.2%	0.1%	-0.1%	0.0%	-0.3%	0.4%	-1.3%	1.5%	2.5%	0.4%	-0.5%	-1.0%
		Alt 3	0.0%	0.1%	0.1%	0.0%	-0.7%	0.0%	0.0%	-0.3%	-1.3%	0.5%	0.0%	3.9%
		Alt 4	0.2%	0.0%	0.0%	0.0%	-0.4%	0.2%	0.0%	0.1%	0.0%	0.3%	0.2%	-0.4%
Critical	Future Without Project		10,394	9,672	11,514	14,049	15,401	13,494	10,210	7,682	10,557	12,003	10,621	8,483
	Percent Change from Future Without Project	Alt 1	-0.1%	0.0%	-0.1%	0.0%	1.3%	0.2%	-1.1%	1.2%	-0.3%	1.0%	-0.5%	-0.2%
		Alt 2	0.0%	0.0%	-0.1%	0.0%	1.2%	0.2%	-0.8%	1.2%	0.5%	1.0%	0.0%	-0.1%
		Alt 3	0.9%	0.4%	-0.2%	0.0%	0.8%	-0.4%	-0.6%	0.1%	-3.7%	0.0%	-1.2%	1.8%
		Alt 4	-0.2%	0.0%	0.0%	0.0%	1.3%	0.0%	-0.3%	0.0%	-0.6%	-0.1%	-0.1%	-0.1%

San Joaquin River Flow at Vernalis

TABLE C7-27: SAN JOAQUIN RIVER FLOW AT VERNALIS (CFS) UNDER 2005 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		2,547	2,731	3,484	4,857	6,598	6,478	6,022	6,065	4,681	3,244	2,129	2,570
	Change from Existing Condition	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wet	Existing Condition		2,976	3,483	5,411	9,346	11,819	12,520	10,472	11,035	9,618	6,666	3,367	3,635
	Percent Change from Existing Condition	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Above Normal	Existing Condition		2,160	2,277	3,248	4,418	6,393	5,920	5,993	5,466	4,984	2,801	2,026	2,507
	Percent Change from Existing Condition	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Below Normal	Existing Condition		2,488	2,500	2,954	3,055	5,919	4,662	5,202	4,976	2,368	1,775	1,840	2,290
	Percent Change from Existing Condition	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Dry	Existing Condition		2,482	2,485	2,304	2,168	2,672	2,549	3,111	2,976	1,553	1,292	1,362	1,974
	Percent Change from Existing Condition	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Critical	Existing Condition		2,171	2,190	1,929	1,705	2,173	1,959	1,732	1,798	1,074	912	1,036	1,548
	Percent Change from Existing Condition	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		2,548	2,731	3,484	4,857	6,595	6,478	6,023	6,066	4,684	3,247	2,131	2,571
	Change from Existing Condition	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wet	Existing Condition		2,977	3,483	5,411	9,345	11,813	12,520	10,472	11,036	9,619	6,668	3,368	3,635
	Percent Change from Existing Condition	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Above Normal	Existing Condition		2,161	2,277	3,249	4,418	6,391	5,920	5,993	5,467	4,986	2,805	2,028	2,508
	Percent Change from Existing Condition	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Below Normal	Existing Condition		2,489	2,501	2,954	3,055	5,916	4,662	5,203	4,979	2,372	1,781	1,844	2,292
	Percent Change from Existing Condition	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Dry	Existing Condition		2,483	2,485	2,305	2,168	2,672	2,549	3,113	2,979	1,557	1,298	1,366	1,976
	Percent Change from Existing Condition	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Critical	Existing Condition		2,172	2,190	1,929	1,705	2,173	1,959	1,732	1,799	1,074	913	1,036	1,548
	Percent Change from Existing Condition	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

TABLE C7-28: SAN JOAQUIN RIVER FLOW AT VERNALIS (CFS) UNDER 2030 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		2,533	2,703	3,447	4,824	6,506	6,339	5,990	6,040	4,619	3,236	2,097	2,569
	Change from Future Without Project	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wet	Future Without Project		2,957	3,452	5,365	9,306	11,732	12,462	10,446	11,010	9,626	6,729	3,345	3,663
	Percent Change from Future Without Project	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Above Normal	Future Without Project		2,141	2,248	3,200	4,376	6,371	5,713	5,930	5,483	4,822	2,772	2,003	2,500
	Percent Change from Future Without Project	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Below Normal	Future Without Project		2,475	2,476	2,911	3,027	5,774	4,545	5,255	5,017	2,323	1,754	1,812	2,278
	Percent Change from Future Without Project	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Dry	Future Without Project		2,482	2,461	2,282	2,142	2,574	2,375	3,042	2,905	1,455	1,227	1,312	1,955
	Percent Change from Future Without Project	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Critical	Future Without Project		2,151	2,166	1,907	1,681	2,069	1,739	1,676	1,727	988	874	994	1,527
	Percent Change from Future Without Project	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		2,534	2,704	3,447	4,824	6,503	6,340	5,991	6,041	4,621	3,239	2,099	2,570
	Change from Future Without Project	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wet	Future Without Project		2,957	3,452	5,365	9,305	11,726	12,463	10,447	11,010	9,626	6,730	3,347	3,663
	Percent Change from Future Without Project	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Above Normal	Future Without Project		2,142	2,248	3,200	4,376	6,369	5,714	5,930	5,483	4,824	2,776	2,007	2,502
	Percent Change from Future Without Project	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Below Normal	Future Without Project		2,476	2,476	2,911	3,027	5,771	4,545	5,254	5,019	2,327	1,760	1,816	2,280
	Percent Change from Future Without Project	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Dry	Future Without Project		2,482	2,461	2,282	2,142	2,574	2,375	3,043	2,908	1,459	1,232	1,316	1,957
	Percent Change from Future Without Project	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Critical	Future Without Project		2,151	2,167	1,907	1,681	2,069	1,740	1,676	1,728	988	874	995	1,527
	Percent Change from Future Without Project	Alt 1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Delta Outflow

TABLE C7-29: DELTA OUTFLOW (CFS) UNDER 2005 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		5,161	9,743	24,095	43,797	55,745	46,645	29,756	22,275	14,065	8,116	4,652	5,488
	Change from Existing Condition	Alt 1	-0.8%	-0.6%	-0.3%	0.0%	-0.1%	-0.1%	0.5%	-1.4%	-0.2%	0.4%	-0.6%	-0.6%
		Alt 2	-1.4%	-1.1%	-0.6%	-0.1%	-0.2%	-0.2%	0.5%	-1.5%	-0.3%	0.5%	-0.5%	-0.7%
		Alt 3	-0.6%	-0.1%	-0.5%	-0.3%	0.0%	-0.1%	0.0%	-0.6%	0.3%	-0.2%	-0.1%	0.2%
		Alt 4	-0.1%	0.1%	-0.1%	-0.2%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.1%	-0.2%
Wet	Existing Condition		6,986	15,250	51,342	87,501	100,265	81,552	52,656	39,732	25,784	11,158	5,104	10,301
	Percent Change from Existing Condition	Alt 1	-1.2%	-1.1%	-0.3%	0.1%	-0.1%	-0.1%	0.4%	-1.1%	0.1%	-0.1%	-0.5%	-0.4%
		Alt 2	-2.3%	-1.5%	-0.5%	0.0%	-0.2%	-0.1%	0.4%	-1.1%	0.0%	0.0%	-0.5%	-0.4%
		Alt 3	-1.0%	-0.3%	-0.6%	-0.1%	0.0%	0.1%	0.0%	-0.4%	0.4%	-0.3%	-0.3%	0.1%
		Alt 4	-0.1%	0.0%	-0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.3%
Above Normal	Existing Condition		4,085	10,419	17,926	50,517	66,077	57,747	31,524	24,070	14,003	9,635	4,009	3,734
	Percent Change from Existing Condition	Alt 1	0.0%	-0.5%	-0.2%	0.0%	0.1%	0.0%	0.6%	-1.6%	-0.4%	0.2%	0.0%	-2.0%
		Alt 2	-0.7%	-1.7%	-0.9%	-0.3%	0.0%	0.0%	0.6%	-1.7%	-0.5%	0.2%	0.0%	-2.0%
		Alt 3	0.5%	-0.1%	-0.3%	0.0%	0.0%	0.0%	-0.2%	-0.7%	0.1%	-0.2%	-0.2%	-0.7%
		Alt 4	0.1%	0.2%	-0.4%	-0.1%	-0.1%	-0.1%	-0.2%	0.1%	0.0%	0.0%	0.0%	0.0%
Below Normal	Existing Condition		4,593	6,507	14,176	24,002	39,755	28,329	22,696	16,334	9,763	7,454	4,477	3,320
	Percent Change from Existing Condition	Alt 1	-0.2%	-0.2%	0.1%	-0.3%	-0.1%	-0.5%	0.7%	-2.2%	-0.6%	1.0%	-1.1%	-0.9%
		Alt 2	-0.3%	-0.8%	-0.1%	0.0%	-0.3%	-0.7%	0.6%	-2.5%	-0.6%	1.2%	-0.4%	-1.8%
		Alt 3	-0.2%	-0.1%	0.0%	-0.4%	0.2%	-1.2%	0.1%	-1.2%	0.5%	-0.1%	-0.3%	0.5%
		Alt 4	0.3%	-0.1%	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%	0.0%	0.0%	0.1%	-0.4%
Dry	Existing Condition		4,281	7,120	9,217	14,135	24,759	24,936	14,769	11,523	6,411	5,872	4,904	3,050
	Percent Change from Existing Condition	Alt 1	-0.3%	0.0%	-0.7%	-0.3%	-0.3%	0.0%	0.4%	-2.5%	-1.1%	1.4%	-1.5%	-0.3%
		Alt 2	-0.8%	-0.3%	-1.4%	-0.8%	-0.2%	-0.2%	0.4%	-2.5%	-1.2%	1.6%	-1.6%	-0.3%
		Alt 3	-0.6%	0.1%	-0.7%	-1.3%	0.2%	-0.1%	0.1%	-1.0%	-0.3%	-0.5%	0.4%	1.7%
		Alt 4	0.0%	0.2%	0.1%	-1.0%	-0.2%	0.1%	0.2%	0.0%	-0.2%	0.0%	0.1%	0.0%
Critical	Existing Condition		4,263	4,844	5,116	9,972	14,090	13,845	9,092	5,712	5,241	4,144	4,140	3,000
	Percent Change from Existing Condition	Alt 1	-1.3%	1.1%	-0.4%	-0.9%	-0.5%	-0.4%	0.6%	-0.2%	-0.2%	0.0%	0.6%	0.0%
		Alt 2	-1.2%	1.2%	-1.7%	0.5%	-1.1%	-0.8%	0.6%	-0.9%	-0.1%	0.1%	0.4%	0.0%
		Alt 3	-0.6%	1.0%	-0.3%	-1.2%	-1.3%	0.2%	0.0%	0.4%	-0.2%	0.0%	0.2%	0.0%
		Alt 4	-0.6%	1.0%	0.5%	-0.8%	0.5%	0.1%	0.0%	0.1%	-0.3%	0.0%	0.4%	0.0%

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		5,216	9,457	23,899	43,760	54,987	44,781	29,264	21,649	13,342	8,461	4,492	5,456
	Change from Existing Condition	Alt 1	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.1%	0.3%	-1.4%	0.2%	0.2%	-0.7%	-0.3%
		Alt 2	-1.3%	-0.8%	-0.5%	-0.5%	-0.2%	-0.2%	0.3%	-1.5%	0.2%	0.3%	-0.9%	-0.4%
		Alt 3	-0.1%	0.3%	0.0%	-0.4%	-0.3%	-0.3%	0.0%	-0.6%	0.4%	-0.2%	0.0%	0.2%
		Alt 4	0.3%	-0.2%	0.0%	-0.2%	-0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	-0.1%
Wet	Existing Condition		7,010	14,790	50,405	87,303	99,542	80,187	52,100	39,297	24,646	11,528	5,091	10,261
	Percent Change from Existing Condition	Alt 1	-1.0%	0.0%	0.0%	-0.1%	0.0%	-0.1%	0.4%	-1.1%	0.3%	-0.1%	-0.5%	-0.2%
		Alt 2	-2.0%	-0.6%	-0.3%	-0.2%	-0.1%	-0.2%	0.4%	-1.1%	0.2%	-0.1%	-0.5%	-0.4%
		Alt 3	-0.3%	0.2%	0.2%	-0.2%	-0.1%	-0.3%	-0.1%	-0.4%	0.3%	-0.2%	0.0%	-0.1%
		Alt 4	0.7%	-0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	-0.1%	-0.1%
Above Normal	Existing Condition		4,230	10,148	18,392	50,308	64,854	55,469	30,814	23,414	13,005	10,087	4,009	3,781
	Percent Change from Existing Condition	Alt 1	0.4%	-1.4%	-0.1%	0.0%	0.0%	-0.1%	0.5%	-1.3%	-0.2%	0.0%	0.0%	-2.0%
		Alt 2	-0.4%	-2.2%	-0.6%	-0.4%	0.0%	-0.1%	0.4%	-1.7%	-0.1%	0.0%	0.0%	-2.0%
		Alt 3	0.3%	-0.4%	0.0%	-0.1%	0.0%	-0.3%	0.3%	-0.8%	0.3%	-0.5%	-0.2%	-0.7%
		Alt 4	-0.2%	-0.5%	-0.1%	0.0%	0.0%	-0.1%	0.0%	0.2%	0.0%	0.0%	0.0%	-0.1%
Below Normal	Existing Condition		4,594	6,269	13,880	24,052	38,647	26,137	22,060	15,664	8,745	7,935	4,204	3,222
	Percent Change from Existing Condition	Alt 1	0.3%	-0.1%	-0.1%	0.0%	-0.4%	-0.2%	0.7%	-2.8%	0.3%	0.3%	-0.6%	0.0%
		Alt 2	-2.9%	-0.8%	-0.6%	-0.6%	-0.7%	-0.5%	0.7%	-2.8%	0.2%	0.4%	-0.7%	0.0%
		Alt 3	0.1%	1.2%	0.0%	0.4%	-0.4%	-0.6%	0.0%	-1.3%	0.9%	0.2%	-0.1%	1.2%
		Alt 4	0.0%	0.0%	0.1%	0.0%	0.0%	-0.1%	0.1%	0.1%	-0.1%	-0.2%	0.0%	-0.8%
Dry	Existing Condition		4,273	6,941	9,300	14,381	23,491	22,763	14,511	10,525	6,228	6,088	4,556	3,005
	Percent Change from Existing Condition	Alt 1	1.0%	-0.1%	-0.5%	-2.3%	-0.1%	0.1%	-0.9%	-2.6%	0.5%	1.4%	-2.6%	-0.1%
		Alt 2	0.7%	-0.8%	-0.8%	-3.1%	-0.3%	-0.1%	-0.9%	-2.8%	0.5%	2.0%	-3.2%	-0.1%
		Alt 3	0.2%	0.5%	-0.1%	-2.9%	-0.1%	0.1%	-0.1%	-1.3%	0.4%	0.1%	-0.8%	1.0%
		Alt 4	0.3%	-0.1%	0.0%	-2.1%	0.1%	0.2%	0.0%	0.1%	0.0%	0.1%	-0.1%	0.0%
Critical	Existing Condition		4,451	4,700	5,564	9,931	14,890	12,156	8,772	5,316	5,220	4,366	3,920	3,000
	Percent Change from Existing Condition	Alt 1	-0.4%	0.5%	-2.0%	0.1%	-2.4%	-0.3%	0.4%	0.1%	-0.3%	-0.2%	1.3%	0.0%
		Alt 2	-0.5%	0.3%	-2.4%	-0.7%	-0.1%	-0.9%	0.3%	0.1%	-0.3%	-0.2%	1.2%	0.0%
		Alt 3	-0.2%	0.3%	-3.8%	-3.2%	-6.1%	0.1%	0.2%	0.0%	0.3%	-0.6%	1.8%	0.2%
		Alt 4	-0.2%	-0.2%	1.0%	-0.1%	-1.2%	0.1%	-0.2%	0.4%	-0.3%	0.4%	0.6%	0.0%

TABLE C7-30: DELTA OUTFLOW (CFS) UNDER 2030 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		4,891	9,389	24,113	43,838	55,898	46,668	29,842	22,122	13,826	8,100	4,549	5,105
	Change from Future Without Project	Alt 1	-0.7%	-0.2%	-0.1%	0.0%	-0.2%	-0.2%	0.3%	-1.5%	-0.1%	0.4%	-0.5%	-0.4%
		Alt 2	-0.8%	-1.5%	-0.6%	-0.1%	-0.3%	-0.3%	0.4%	-1.6%	0.0%	0.4%	-0.6%	-0.4%
		Alt 3	0.1%	-0.2%	-0.3%	-0.1%	-0.3%	-0.3%	0.0%	-0.8%	0.3%	-0.5%	0.3%	0.0%
		Alt 4	0.0%	-0.3%	0.0%	0.2%	-0.1%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.1%	-0.2%
Wet	Future Without Project		6,306	14,774	50,849	87,330	100,718	81,494	52,805	39,265	25,320	11,085	4,899	9,433
	Percent Change from Future Without Project	Alt 1	-1.1%	0.3%	-0.4%	-0.1%	-0.2%	-0.2%	0.4%	-1.2%	0.1%	0.2%	-0.5%	-0.5%
		Alt 2	-1.5%	-1.1%	-0.5%	0.1%	-0.3%	-0.2%	0.4%	-1.2%	-0.1%	0.3%	-0.4%	-0.4%
		Alt 3	0.5%	0.4%	0.2%	0.2%	-0.3%	-0.3%	-0.2%	-0.5%	0.3%	-0.5%	-0.2%	0.2%
		Alt 4	-0.2%	-0.1%	-0.1%	0.3%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	-0.2%
Above Normal	Future Without Project		3,922	9,919	18,612	50,719	65,932	57,228	31,711	23,854	13,674	9,405	4,001	3,354
	Percent Change from Future Without Project	Alt 1	-0.4%	-1.8%	-0.4%	-0.3%	0.1%	-0.1%	0.3%	-2.1%	-0.5%	-0.1%	0.0%	-0.2%
		Alt 2	-0.3%	-5.1%	-0.7%	-0.8%	-0.1%	-0.1%	0.4%	-2.1%	-0.5%	0.4%	0.0%	-0.4%
		Alt 3	-0.1%	-3.3%	0.0%	-0.3%	-0.2%	-0.3%	0.0%	-1.1%	0.3%	-0.4%	0.0%	-0.4%
		Alt 4	0.3%	-2.3%	0.3%	-0.3%	-0.1%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%
Below Normal	Future Without Project		4,510	6,207	14,484	24,464	39,554	28,387	22,566	16,222	9,702	7,410	4,321	3,068
	Percent Change from Future Without Project	Alt 1	-0.3%	-0.6%	3.0%	0.9%	-0.3%	-0.7%	0.0%	-2.5%	0.1%	0.4%	-0.7%	-0.8%
		Alt 2	-0.4%	-1.2%	-0.5%	-0.2%	-0.3%	-0.7%	0.1%	-2.6%	1.2%	0.0%	-0.8%	-0.7%
		Alt 3	-0.3%	0.3%	-0.2%	-0.7%	-0.4%	-1.4%	0.2%	-1.6%	0.1%	0.0%	0.1%	-0.4%
		Alt 4	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.2%	0.3%	-0.3%	0.2%	-0.5%
Dry	Future Without Project		4,270	6,823	8,952	14,160	24,871	25,379	14,850	11,586	6,256	5,980	4,880	3,007
	Percent Change from Future Without Project	Alt 1	-0.6%	-0.1%	-0.9%	0.7%	-0.4%	-0.4%	0.5%	-2.2%	-0.6%	1.4%	-1.2%	-0.2%
		Alt 2	-0.4%	-0.3%	-1.3%	0.0%	-0.7%	-0.2%	0.5%	-2.2%	-0.7%	1.5%	-1.4%	-0.2%
		Alt 3	0.3%	0.6%	-0.3%	0.1%	-0.3%	0.2%	0.3%	-1.1%	1.2%	-0.9%	0.9%	-0.1%
		Alt 4	0.3%	0.6%	-0.2%	1.1%	-0.3%	0.0%	0.0%	0.0%	0.1%	-0.2%	0.4%	0.0%
Critical	Future Without Project		4,173	4,758	5,661	9,842	14,363	13,915	9,193	5,938	5,242	4,313	4,110	3,000
	Percent Change from Future Without Project	Alt 1	-0.5%	-0.3%	-0.3%	0.0%	0.2%	-0.7%	0.6%	-0.3%	-1.3%	0.0%	0.3%	0.0%
		Alt 2	-0.6%	-0.5%	-0.4%	-0.9%	0.0%	-0.7%	0.7%	-0.6%	0.1%	-0.1%	0.0%	0.0%
		Alt 3	-0.8%	0.3%	-10.2%	-2.3%	-0.6%	0.3%	0.2%	0.5%	-0.7%	-1.7%	0.9%	0.0%
		Alt 4	0.0%	0.0%	0.0%	0.2%	0.1%	0.0%	0.2%	0.0%	0.1%	-0.2%	-0.2%	0.0%

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		4,862	8,956	23,572	43,380	54,586	44,657	29,250	21,550	13,153	8,514	4,436	5,146
	Change from Future Without Project	Alt 1	-0.3%	-0.1%	-0.1%	0.3%	0.0%	-0.3%	0.3%	-1.6%	0.0%	0.0%	-0.4%	-0.2%
		Alt 2	-0.6%	-0.5%	-0.6%	0.0%	-0.1%	-0.3%	0.2%	-1.6%	0.0%	0.0%	-0.5%	-0.2%
		Alt 3	0.3%	-0.1%	-0.2%	-0.1%	-0.3%	-0.5%	0.1%	-0.9%	0.0%	-0.1%	0.1%	0.3%
		Alt 4	0.0%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%
Wet	Future Without Project		6,200	14,221	49,686	86,838	98,947	80,052	52,180	38,715	24,158	11,655	4,890	9,439
	Percent Change from Future Without Project	Alt 1	-0.4%	-0.1%	0.0%	0.1%	0.0%	-0.1%	0.4%	-1.1%	0.3%	-0.5%	-0.6%	-0.3%
		Alt 2	-0.9%	-0.5%	-0.5%	0.0%	-0.2%	-0.2%	0.3%	-1.1%	0.2%	-0.6%	-0.6%	-0.3%
		Alt 3	0.2%	0.2%	-0.1%	-0.2%	-0.2%	-0.6%	-0.1%	-0.5%	0.4%	-0.3%	-0.4%	-0.2%
		Alt 4	-0.2%	0.4%	0.1%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.2%
Above Normal	Future Without Project		3,900	9,400	18,230	49,660	64,668	54,834	30,719	22,990	12,739	10,093	4,001	3,526
	Percent Change from Future Without Project	Alt 1	-0.1%	-1.1%	0.0%	0.6%	0.0%	-0.3%	0.4%	-1.7%	0.0%	-0.1%	0.0%	-0.1%
		Alt 2	-0.3%	-1.5%	-1.2%	0.0%	0.0%	-0.3%	0.3%	-1.7%	0.0%	-0.1%	0.0%	-0.1%
		Alt 3	2.1%	-1.0%	-0.3%	0.7%	-0.1%	-0.1%	0.3%	-1.4%	0.3%	-0.5%	0.0%	1.2%
		Alt 4	0.0%	-0.1%	-0.1%	0.3%	-0.1%	-0.1%	0.1%	0.1%	0.1%	-0.2%	0.0%	0.0%
Below Normal	Future Without Project		4,458	5,863	13,710	24,046	37,869	26,114	21,744	15,426	8,649	7,887	4,214	3,128
	Percent Change from Future Without Project	Alt 1	-0.1%	1.6%	-0.2%	0.1%	-0.2%	-0.8%	0.5%	-2.9%	0.2%	0.2%	-0.5%	0.4%
		Alt 2	-0.3%	1.2%	-0.6%	-0.7%	-0.2%	-0.9%	0.3%	-3.0%	0.2%	0.5%	-0.8%	0.5%
		Alt 3	-0.3%	-0.4%	0.2%	0.1%	-0.3%	-0.9%	0.4%	-1.9%	0.4%	0.1%	-0.2%	1.6%
		Alt 4	0.0%	-0.7%	-0.1%	1.1%	0.0%	0.0%	0.0%	0.0%	0.2%	0.2%	0.1%	-0.1%
Dry	Future Without Project		4,315	6,397	9,015	13,702	23,602	22,772	14,591	11,219	6,133	6,237	4,615	3,026
	Percent Change from Future Without Project	Alt 1	0.1%	-0.4%	-0.4%	1.4%	-0.6%	-0.3%	-0.5%	-2.6%	0.5%	0.9%	-1.4%	-0.4%
		Alt 2	-0.1%	-0.7%	-1.0%	0.4%	-0.6%	-0.2%	-0.6%	-2.7%	0.4%	1.1%	-1.5%	-0.4%
		Alt 3	-0.3%	0.0%	0.1%	0.5%	-0.7%	-0.5%	0.2%	-1.2%	0.2%	-0.1%	-0.3%	1.0%
		Alt 4	0.4%	0.1%	0.1%	0.2%	-0.3%	0.2%	0.0%	0.1%	0.0%	0.2%	-0.2%	-0.1%
Critical	Future Without Project		4,219	4,553	5,675	10,012	14,364	12,252	8,843	5,558	5,508	4,277	3,877	3,000
	Percent Change from Future Without Project	Alt 1	-0.8%	-0.1%	-0.8%	0.5%	1.9%	-0.7%	0.3%	-0.3%	-5.0%	1.3%	2.0%	0.0%
		Alt 2	-0.9%	-0.2%	-0.1%	0.3%	1.5%	-0.8%	0.4%	-0.3%	-3.0%	0.5%	1.4%	0.0%
		Alt 3	0.8%	0.3%	-2.8%	-3.4%	-0.6%	-0.4%	0.0%	-1.2%	-4.9%	1.3%	2.2%	0.0%
		Alt 4	-0.1%	-0.1%	0.9%	0.1%	1.6%	-0.1%	-0.1%	0.2%	-0.8%	0.0%	0.3%	0.0%

X2 Location

TABLE C7-31: X2 LOCATION (PREVIOUS MONTH, KM) UNDER 2005 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		85	85	82	77	70	64	63	66	69	74	78	83
	Change from Existing Condition	Alt 1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
		Alt 2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
		Alt 3	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wet	Existing Condition		83	83	79	68	59	55	55	58	61	66	73	81
	Change from Existing Condition	Alt 1	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 2	0.0	0.1	0.2	0.2	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 3	0.0	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal	Existing Condition		85	86	82	78	67	60	59	63	66	72	75	83
	Change from Existing Condition	Alt 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
		Alt 2	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0
		Alt 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Below Normal	Existing Condition		85	86	84	80	73	66	66	68	70	75	79	84
	Change from Existing Condition	Alt 1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.1	-0.1	0.1
		Alt 2	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.2	0.1	-0.1	0.0
		Alt 3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry	Existing Condition		87	87	84	81	77	71	68	72	74	80	82	84
	Change from Existing Condition	Alt 1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.2	0.1	-0.1	0.1
		Alt 2	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.2	0.1	-0.1	0.1
		Alt 3	-0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Critical	Existing Condition		87	87	86	85	80	76	75	77	81	83	86	87
	Change from Existing Condition	Alt 1	0.0	0.1	-0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
		Alt 2	0.0	0.1	-0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
		Alt 3	-0.1	0.0	-0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
		Alt 4	0.0	0.1	-0.1	-0.1	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		85	85	83	77	70	64	64	67	70	75	78	84
	Change from Existing Condition	Alt 1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 2	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.1
		Alt 3	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wet	Existing Condition		83	83	79	68	59	55	56	58	61	67	73	81
	Change from Existing Condition	Alt 1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 2	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal	Existing Condition		85	86	82	78	67	60	59	63	66	73	75	83
	Change from Existing Condition	Alt 1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 2	0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Below Normal	Existing Condition		85	86	84	80	73	66	66	68	71	76	78	84
	Change from Existing Condition	Alt 1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
		Alt 2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.2	0.0	0.0	0.1
		Alt 3	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry	Existing Condition		87	87	85	81	77	71	70	72	75	80	82	85
	Change from Existing Condition	Alt 1	0.0	-0.1	0.0	0.0	0.2	0.1	0.0	0.1	0.2	0.0	-0.1	0.2
		Alt 2	0.0	0.0	0.0	0.0	0.3	0.1	0.1	0.1	0.3	0.0	-0.1	0.2
		Alt 3	0.0	0.0	-0.1	0.0	0.3	0.1	0.0	0.0	0.1	0.0	0.0	0.1
		Alt 4	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Critical	Existing Condition		87	87	86	85	80	75	76	78	82	84	85	87
	Change from Existing Condition	Alt 1	0.1	0.0	0.0	0.1	0.0	0.2	0.1	0.0	0.0	0.0	0.0	-0.1
		Alt 2	0.1	0.0	0.0	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.0	-0.1
		Alt 3	-0.1	0.0	0.0	0.2	0.3	0.7	0.2	0.1	0.0	0.0	0.0	-0.1
		Alt 4	0.0	0.0	0.0	-0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.1

TABLE C7-32: X2 LOCATION (PREVIOUS MONTH, KM) UNDER 2030 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		86	86	83	77	70	64	63	66	69	74	78	84
	Change from Future Without Project	Alt 1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
		Alt 2	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 3	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wet	Future Without Project		83	84	80	68	59	55	55	58	61	66	73	82
	Change from Future Without Project	Alt 1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 2	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 3	0.0	-0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal	Future Without Project		85	87	83	79	67	60	59	63	66	72	76	83
	Change from Future Without Project	Alt 1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0
		Alt 2	0.0	0.0	0.5	0.2	0.1	0.1	0.0	0.0	0.2	0.1	0.0	0.0
		Alt 3	-0.1	0.0	0.4	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Below Normal	Future Without Project		86	86	84	80	73	66	66	68	70	75	79	84
	Change from Future Without Project	Alt 1	0.1	0.0	0.1	-0.3	-0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0
		Alt 2	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.2	0.0	0.0	0.1
		Alt 3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry	Future Without Project		88	87	85	82	77	71	68	71	74	80	82	84
	Change from Future Without Project	Alt 1	0.0	0.0	0.0	0.0	-0.1	0.0	0.1	0.0	0.2	0.1	-0.1	0.1
		Alt 2	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.2	0.1	-0.1	0.1
		Alt 3	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.1	-0.1	0.0	-0.1
		Alt 4	0.0	0.0	-0.1	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Critical	Future Without Project		88	87	86	85	80	76	75	77	81	83	85	86
	Change from Future Without Project	Alt 1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0
		Alt 2	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
		Alt 3	0.0	0.1	0.0	0.5	0.3	0.1	0.0	0.0	-0.1	0.0	0.1	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		86	86	83	77	70	64	64	67	70	75	78	84
	Change from Future Without Project	Alt 1	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0
		Alt 2	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0
		Alt 3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wet	Future Without Project		83	84	80	68	59	55	56	58	62	67	73	82
	Change from Future Without Project	Alt 1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
		Alt 2	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
		Alt 3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal	Future Without Project		85	87	83	79	67	60	59	63	67	73	75	83
	Change from Future Without Project	Alt 1	0.0	0.0	0.1	0.0	-0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 2	0.0	0.0	0.1	0.1	-0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 3	0.0	-0.1	0.0	0.0	-0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Below Normal	Future Without Project		86	86	84	80	73	66	66	68	71	76	79	84
	Change from Future Without Project	Alt 1	0.0	0.0	-0.1	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.0
		Alt 2	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.3	0.0	0.0	0.1
		Alt 3	-0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry	Future Without Project		87	87	85	82	77	71	69	72	75	80	82	84
	Change from Future Without Project	Alt 1	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.1	0.2	0.0	-0.1	0.1
		Alt 2	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.3	0.0	-0.1	0.1
		Alt 3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Critical	Future Without Project		88	87	86	84	80	76	76	78	82	83	85	87
	Change from Future Without Project	Alt 1	0.1	0.1	0.0	0.1	0.0	-0.1	0.0	0.0	0.0	0.4	0.0	-0.1
		Alt 2	0.1	0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.2	0.0	-0.1
		Alt 3	-0.1	0.0	0.0	0.2	0.3	0.2	0.1	0.0	0.1	0.4	0.0	-0.2
		Alt 4	0.0	0.0	0.0	-0.1	0.0	-0.1	0.0	0.0	0.0	0.1	0.0	0.0

E:I Ratio

TABLE C7-33: EXPORT-TO-INFLOW RATIO (%) UNDER 2005 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		57	52	42	27	14	9	8	10	10	41	54	57
	Change from Existing Condition	Alt 1	0.1	0.0	0.1	0.1	0.0	0.0	-0.5	0.0	-0.1	-0.3	-0.1	0.0
		Alt 2	0.1	0.0	0.0	-0.2	0.0	0.0	-0.5	0.0	-0.1	-0.3	-0.1	0.0
		Alt 3	0.2	0.1	0.5	0.5	0.1	0.1	0.0	0.0	0.0	-0.2	0.0	0.3
		Alt 4	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wet	Existing Condition		56	49	22	13	10	9	8	11	15	39	57	50
	Change from Existing Condition	Alt 1	0.1	0.2	0.1	-0.1	0.0	0.0	-0.4	-0.1	0.0	0.0	0.0	0.0
		Alt 2	0.1	0.2	0.1	0.0	0.0	0.0	-0.4	-0.1	0.0	-0.1	0.0	0.0
		Alt 3	0.3	0.2	0.8	0.2	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0
		Alt 4	0.0	-0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
Above Normal	Existing Condition		59	49	47	19	9	8	9	10	13	38	59	64
	Change from Existing Condition	Alt 1	-0.1	0.1	0.0	0.0	-0.1	0.0	-0.5	-0.1	-0.1	-0.2	-0.4	0.2
		Alt 2	-0.1	0.1	-0.1	-0.1	-0.1	0.0	-0.5	-0.1	-0.1	-0.3	-0.5	0.2
		Alt 3	0.0	0.1	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	-0.3	0.1
		Alt 4	0.0	0.1	0.0	-0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Below Normal	Existing Condition		58	57	49	28	14	10	8	11	9	44	57	65
	Change from Existing Condition	Alt 1	-0.1	0.1	-0.1	0.2	-0.1	0.0	-0.6	-0.1	0.0	-0.4	0.2	0.0
		Alt 2	-0.1	0.1	-0.3	-0.8	-0.1	0.0	-0.6	-0.1	-0.1	-0.5	-0.1	0.0
		Alt 3	-0.1	0.1	0.5	0.3	-0.1	0.5	0.1	0.0	0.0	-0.3	0.0	0.1
		Alt 4	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-0.1
Dry	Existing Condition		57	53	52	42	16	7	8	9	7	48	55	61
	Change from Existing Condition	Alt 1	0.1	0.0	0.0	-0.1	0.1	0.0	-0.8	0.0	-0.2	-0.7	-0.2	-0.2
		Alt 2	0.1	0.0	-0.1	0.0	0.0	0.0	-0.7	0.0	-0.2	-0.8	-0.2	-0.2
		Alt 3	0.5	0.3	0.4	0.7	0.0	0.0	0.0	0.1	0.1	-0.4	-0.5	0.6
		Alt 4	0.1	0.1	0.1	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Critical	Existing Condition		56	52	55	42	21	8	9	12	5	32	40	51
	Change from Existing Condition	Alt 1	0.4	-0.5	0.3	1.0	0.2	0.0	-0.5	0.1	0.0	-0.4	0.1	0.3
		Alt 2	0.4	-0.7	0.7	-0.3	0.5	0.0	-0.6	0.1	0.0	0.1	0.1	0.3
		Alt 3	0.3	-0.2	0.4	1.3	1.1	0.0	0.0	0.2	0.1	-0.2	0.6	0.8
		Alt 4	0.3	-0.4	0.2	0.8	-0.4	0.0	0.0	0.0	0.0	0.0	0.3	0.2

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		57	53	41	27	15	15	11	14	21	38	53	57
	Change from Existing Condition	Alt 1	0.2	0.2	0.1	0.3	0.0	0.0	-0.6	-0.1	0.0	-0.2	-0.2	0.0
		Alt 2	0.2	0.1	0.1	0.5	0.0	0.0	-0.6	-0.2	-0.1	-0.4	-0.2	0.0
		Alt 3	0.3	0.1	0.4	0.8	0.4	0.3	0.1	0.0	0.1	-0.2	-0.5	0.4
		Alt 4	0.1	0.1	0.0	0.4	0.0	0.1	0.0	0.0	0.0	-0.1	-0.4	0.1
Wet	Existing Condition		56	51	22	13	11	12	10	12	21	38	57	50
	Change from Existing Condition	Alt 1	0.0	0.0	0.0	0.1	0.0	0.0	-0.4	-0.1	0.0	0.2	-0.1	0.0
		Alt 2	0.1	0.0	0.0	0.2	0.0	0.0	-0.4	-0.1	0.0	-0.1	0.1	0.0
		Alt 3	0.0	0.0	0.0	0.2	0.0	0.5	0.1	0.0	0.0	0.4	-0.2	0.0
		Alt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
Above Normal	Existing Condition		57	50	46	19	11	12	11	13	23	36	59	64
	Change from Existing Condition	Alt 1	1.3	0.9	0.0	0.0	0.0	-0.1	-0.5	-0.1	0.0	-0.1	-0.5	0.1
		Alt 2	0.7	0.7	-0.1	0.0	0.0	-0.1	-0.5	-0.1	0.0	-0.2	-0.5	0.1
		Alt 3	1.4	0.7	0.1	0.0	0.0	0.2	-0.1	0.0	0.1	-0.3	-0.3	0.1
		Alt 4	0.9	0.4	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0
Below Normal	Existing Condition		59	57	48	28	16	17	11	14	23	41	57	65
	Change from Existing Condition	Alt 1	-0.3	0.0	0.0	0.0	-0.1	0.0	-0.8	-0.1	-0.2	-0.5	-0.3	0.0
		Alt 2	0.0	-0.1	0.2	0.0	0.0	0.0	-0.8	-0.1	-0.4	-0.6	-0.6	0.0
		Alt 3	-0.3	0.0	0.3	0.0	-0.1	0.2	0.1	0.0	-0.1	-0.4	-0.1	0.0
		Alt 4	-0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1	-0.1	-0.3	0.0
Dry	Existing Condition		57	55	51	40	20	17	11	14	22	44	54	61
	Change from Existing Condition	Alt 1	-0.1	0.1	0.0	1.4	0.1	0.0	-0.5	-0.1	-0.4	-0.7	0.2	-0.2
		Alt 2	-0.1	0.1	-0.3	1.8	0.1	0.0	-0.5	-0.1	-0.5	-0.8	0.2	-0.2
		Alt 3	0.1	0.0	0.2	2.0	0.0	0.5	0.1	0.0	0.2	-0.7	-0.7	0.9
		Alt 4	0.0	0.0	0.0	1.7	0.0	0.5	0.0	0.0	-0.2	-0.3	-0.8	0.2
Critical	Existing Condition		56	53	53	43	21	19	13	17	16	26	36	52
	Change from Existing Condition	Alt 1	0.3	0.1	1.0	0.2	0.2	0.0	-0.9	-0.3	0.8	0.1	-1.0	0.2
		Alt 2	0.3	0.1	1.1	0.1	0.1	0.0	-0.8	-0.4	0.8	-0.2	-0.9	0.4
		Alt 3	1.0	-0.1	1.7	2.2	2.8	0.0	0.1	0.0	0.4	-0.7	-1.5	0.8
		Alt 4	0.1	0.1	-0.4	0.1	0.1	0.1	0.1	0.1	0.3	0.2	-0.9	0.2

TABLE C7-34: EXPORT-TO-INFLOW RATIO (%) UNDER 2030 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		56	52	41	27	13	8	8	10	10	42	55	57
	Change from Future Without Project	Alt 1	0.2	0.1	-0.2	-0.3	0.1	0.0	-0.4	-0.1	0.0	-0.3	-0.1	0.1
		Alt 2	0.1	0.3	0.0	-0.3	0.1	0.0	-0.4	-0.1	-0.1	-0.2	-0.1	0.1
		Alt 3	0.3	0.3	0.6	0.3	0.3	0.3	0.1	0.0	0.0	-0.3	-0.3	0.4
		Alt 4	0.0	0.2	0.0	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.1
Wet	Future Without Project		56	51	22	13	10	9	8	11	15	40	57	51
	Change from Future Without Project	Alt 1	0.0	0.0	0.0	0.0	0.0	0.1	-0.4	-0.1	0.0	-0.1	0.0	0.0
		Alt 2	0.0	0.2	0.0	-0.6	0.1	0.1	-0.4	-0.1	0.0	0.1	0.1	0.0
		Alt 3	0.0	0.0	0.0	-0.4	0.3	0.5	0.1	0.0	0.0	-0.1	-0.1	0.0
		Alt 4	0.0	0.1	0.0	-0.5	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Above Normal	Future Without Project		58	49	47	18	10	8	9	10	13	38	58	65
	Change from Future Without Project	Alt 1	0.2	0.0	0.0	0.0	-0.1	0.0	-0.4	0.0	0.0	-0.4	-0.5	0.0
		Alt 2	0.0	1.1	-0.2	0.1	-0.1	0.0	-0.4	0.0	0.0	-0.4	-0.4	0.0
		Alt 3	0.3	1.1	0.0	0.3	0.1	0.0	0.0	0.0	0.0	-0.2	-0.2	0.1
		Alt 4	0.1	0.9	-0.1	0.1	0.0	0.0	0.0	0.0	0.0	-0.2	-0.2	0.0
Below Normal	Future Without Project		57	57	49	28	14	10	8	11	9	43	55	64
	Change from Future Without Project	Alt 1	0.2	0.2	-1.6	-0.9	0.2	0.0	-0.4	-0.2	-0.1	-0.4	0.0	0.0
		Alt 2	0.2	0.4	0.0	-0.1	0.2	0.0	-0.5	-0.2	-0.2	-0.5	-0.1	0.0
		Alt 3	0.5	0.2	0.5	0.5	0.3	0.5	0.1	-0.2	0.0	-0.4	-0.4	0.1
		Alt 4	-0.1	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0
Dry	Future Without Project		55	53	52	40	16	7	8	9	6	49	56	59
	Change from Future Without Project	Alt 1	0.3	0.2	0.0	-0.7	0.2	0.0	-0.6	0.0	-0.1	-0.4	0.0	0.0
		Alt 2	0.2	0.2	0.0	-0.7	0.0	0.0	-0.5	-0.1	-0.1	-0.3	0.0	-0.1
		Alt 3	0.4	0.3	0.4	0.2	0.1	0.0	0.0	0.0	0.0	-0.3	-0.4	0.9
		Alt 4	0.2	0.0	0.2	-1.0	0.0	0.0	0.0	0.0	0.1	0.1	-0.1	0.0
Critical	Future Without Project		55	50	51	44	20	7	8	11	4	36	44	51
	Change from Future Without Project	Alt 1	0.2	0.1	0.1	0.3	0.0	0.0	-0.3	-0.1	-0.1	-0.1	0.0	0.6
		Alt 2	0.2	0.1	0.1	0.4	0.0	0.0	-0.3	-0.1	-0.1	-0.2	0.0	0.6
		Alt 3	0.8	0.5	2.9	1.5	0.9	0.0	0.1	0.1	0.1	-0.5	-1.0	1.1
		Alt 4	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		57	54	41	27	16	15	11	14	21	39	54	58
	Change from Future Without Project	Alt 1	0.1	0.2	0.1	-0.5	0.0	0.0	-0.4	-0.1	0.1	0.0	-0.1	0.0
		Alt 2	0.1	0.2	0.1	-0.4	0.0	0.0	-0.4	-0.1	0.0	-0.2	-0.1	0.1
		Alt 3	0.4	0.4	0.4	0.2	0.3	0.4	0.1	0.1	0.3	-0.4	-0.4	0.5
		Alt 4	0.0	0.1	0.0	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
Wet	Future Without Project		57	52	22	13	11	12	10	12	21	39	58	52
	Change from Future Without Project	Alt 1	0.2	0.0	-0.4	-0.1	-0.1	0.1	-0.4	0.0	0.0	0.0	0.0	0.0
		Alt 2	0.0	0.1	0.0	-0.2	-0.1	0.1	-0.3	0.0	0.0	0.0	0.0	0.0
		Alt 3	0.2	0.4	0.2	0.2	0.1	1.0	0.1	0.0	0.0	-0.1	-0.2	0.0
		Alt 4	0.1	-0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0
Above Normal	Future Without Project		57	50	46	19	11	12	11	13	23	37	59	65
	Change from Future Without Project	Alt 1	0.0	0.4	-0.1	-1.2	0.0	0.1	-0.5	-0.1	0.0	0.0	-0.2	0.0
		Alt 2	0.1	0.3	0.0	-1.0	-0.1	0.1	-0.5	-0.1	0.0	0.0	-0.3	0.0
		Alt 3	0.2	0.2	0.2	-1.3	0.2	0.4	0.0	0.0	0.1	-0.1	0.0	0.0
		Alt 4	-0.1	0.0	0.0	-1.2	0.0	0.1	0.0	0.0	0.0	-0.1	0.0	0.0
Below Normal	Future Without Project		58	59	49	29	17	17	12	13	23	42	57	65
	Change from Future Without Project	Alt 1	-0.2	-0.1	0.3	-0.1	0.1	0.0	-0.5	-0.1	-0.2	-0.5	-0.4	0.0
		Alt 2	-0.2	-0.1	0.3	-0.1	0.1	0.0	-0.5	-0.2	-0.4	-0.7	-0.5	0.0
		Alt 3	0.4	0.4	0.4	0.1	0.0	0.2	0.1	0.1	-0.2	-0.7	-0.6	0.1
		Alt 4	-0.1	0.2	0.1	-1.1	0.0	0.0	-0.1	0.0	-0.2	0.0	-0.5	0.0
Dry	Future Without Project		56	55	52	42	20	16	11	14	21	45	55	60
	Change from Future Without Project	Alt 1	0.1	0.5	0.1	-1.2	0.2	0.0	-0.3	-0.2	-0.2	0.0	0.2	-0.4
		Alt 2	0.1	0.4	0.0	-0.7	0.2	0.0	-0.3	-0.2	-0.3	-0.3	0.3	-0.2
		Alt 3	0.5	0.5	0.3	-0.2	0.3	0.1	0.1	0.0	0.6	-0.5	-0.1	1.3
		Alt 4	0.0	0.3	0.1	0.0	0.2	0.0	0.1	0.0	0.0	0.1	0.2	-0.1
Critical	Future Without Project		56	53	51	43	23	19	13	17	16	26	38	51
	Change from Future Without Project	Alt 1	0.6	0.5	0.9	0.1	-0.3	0.0	-0.6	-0.4	1.0	0.4	-0.6	0.8
		Alt 2	0.7	0.4	0.4	-0.5	-0.4	0.0	-0.5	-0.4	0.5	0.2	0.0	0.9
		Alt 3	0.8	0.5	1.3	2.3	1.5	0.1	0.1	0.3	1.4	-1.0	-1.4	1.4
		Alt 4	0.1	0.1	-0.3	0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.2

Net Flow on Lower San Joaquin River (Qwest)

TABLE C7-35: NET FLOW (CFS) ON LOWER SAN JOAQUIN RIVER (QWEST) UNDER 2005 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		-951	-929	1444	6043	9716	9830	8124	6523	5183	-1242	-2906	-1542
	Change from Existing Condition	Alt 1	-29	-29	-41	-24	-38	-63	169	-348	-79	-19	10	-19
		Alt 2	-55	-73	-109	-40	-94	-95	165	-360	-99	-47	-1	-14
		Alt 3	-13	-6	-86	-112	-10	-39	13	-122	80	-39	-2	-61
		Alt 4	-2	10	-10	-68	-9	-2	22	8	-5	-5	-9	-14
Wet	Existing Condition		-951	-457	7162	14772	17252	17467	14313	12518	9455	2029	-2286	-692
	Change from Existing Condition	Alt 1	-47	-75	-93	-3	-75	-62	198	-450	39	5	-22	-39
		Alt 2	-88	-142	-198	-93	-137	-124	201	-451	5	5	-19	-39
		Alt 3	-26	-33	-209	-160	5	41	-17	-151	103	-16	-35	-10
		Alt 4	-16	-1	-8	-69	-17	-2	23	1	-9	-6	-14	-20
Above Normal	Existing Condition		-1293	-972	-127	7551	12110	10641	8195	6392	4895	-1079	-3777	-2940
	Change from Existing Condition	Alt 1	-54	-37	-45	-15	21	-21	174	-462	-62	-30	12	-47
		Alt 2	-92	-131	-124	-91	-36	-30	177	-467	-73	-26	-3	-45
		Alt 3	-9	-8	4	15	12	-32	14	-148	25	-63	8	-81
		Alt 4	-9	-7	-14	-52	-96	-34	29	24	-4	-4	-5	-4
Below Normal	Existing Condition		-1084	-1546	-345	2409	7970	6664	7067	4954	3777	-3281	-3802	-2769
	Change from Existing Condition	Alt 1	7	-33	-33	7	-16	-139	184	-407	-102	0	-35	-27
		Alt 2	-7	-70	-57	97	-66	-150	170	-433	-114	-80	-81	4
		Alt 3	13	-4	-72	-24	15	-328	16	-209	79	1	-15	-32
		Alt 4	29	1	5	20	-2	0	18	17	1	-11	-3	-24
Dry	Existing Condition		-818	-1219	-2097	-200	3723	5143	4107	2835	2363	-4457	-3882	-1733
	Change from Existing Condition	Alt 1	-10	-13	0	-41	-27	-34	146	-306	-277	-81	81	17
		Alt 2	-36	-32	-53	-101	-65	-44	129	-309	-299	-109	75	15
		Alt 3	-35	4	-2	-186	34	11	28	-96	68	-107	34	-172
		Alt 4	1	13	17	-135	20	13	27	0	-4	-12	-8	-16
Critical	Existing Condition		-651	-753	-1970	-769	2023	3199	1898	1027	2088	-1294	-868	-271
	Change from Existing Condition	Alt 1	-36	63	4	-91	-61	-61	120	-8	-25	10	25	7
		Alt 2	-34	72	-47	54	-136	-108	123	-48	-33	-44	19	9
		Alt 3	12	39	-50	-127	-164	46	52	29	106	-7	22	-18
		Alt 4	-8	55	-68	-80	43	9	12	8	-4	16	-7	5

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Existing Condition		-1054	-1104	1401	6072	8978	7904	7600	5906	3637	-610	-2648	-1573
	Change from Existing Condition	Alt 1	-37	-26	-46	-104	-9	-82	170	-368	-17	-11	30	4
		Alt 2	-59	-74	-145	-205	-59	-147	164	-380	-36	-11	16	-8
		Alt 3	-16	2	-65	-174	-67	-190	2	-131	131	-39	64	-77
		Alt 4	-14	-8	-4	-77	-8	-37	5	8	-2	9	40	-22
Wet	Existing Condition		-1182	-664	6753	14740	16688	16014	13851	12027	8119	2327	-2237	-726
	Change from Existing Condition	Alt 1	-45	-24	-56	-103	2	-73	219	-435	89	-49	-19	-9
		Alt 2	-100	-103	-158	-172	-63	-165	217	-446	73	-8	-60	-26
		Alt 3	16	8	0	-131	-11	-275	-55	-142	92	-72	33	-8
		Alt 4	-30	-7	-12	-11	-18	-18	-18	1	-10	-12	-6	-26
Above Normal	Existing Condition		-1095	-1083	187	7481	11015	8407	7593	5658	3155	-455	-3661	-2988
	Change from Existing Condition	Alt 1	-186	-93	-35	-46	36	-71	168	-439	-2	-63	10	-28
		Alt 2	-142	-164	-356	-160	-5	-81	156	-436	-1	-74	10	-28
		Alt 3	-133	-52	-227	-6	15	-138	71	-153	64	-79	-10	-92
		Alt 4	-60	-45	-24	-53	-19	3	10	22	1	-7	-6	-11
Below Normal	Existing Condition		-1317	-1687	-267	2462	7173	4469	6479	4407	1736	-2571	-3544	-2679
	Change from Existing Condition	Alt 1	21	-22	-40	12	-58	-127	202	-405	32	90	51	-18
		Alt 2	-25	-27	-114	-131	-157	-196	195	-430	8	72	43	-19
		Alt 3	28	-3	-24	22	-44	-152	3	-195	180	-28	-38	-49
		Alt 4	2	1	-45	9	-6	-8	25	17	-13	11	6	-18
Dry	Existing Condition		-864	-1508	-2031	-3	2744	2837	3603	2035	674	-3567	-3453	-1745
	Change from Existing Condition	Alt 1	13	-20	-20	-323	-8	-64	84	-407	-105	13	24	49
		Alt 2	-5	-64	-40	-447	-48	-127	89	-436	-143	-25	33	34
		Alt 3	28	-2	-14	-397	-10	-272	5	-142	176	-21	137	-194
		Alt 4	13	9	3	-306	17	-139	11	-1	19	42	117	-41
Critical	Existing Condition		-715	-794	-1887	-796	1690	1437	1370	447	1069	-406	-269	-441
	Change from Existing Condition	Alt 1	-11	21	-84	30	-21	-85	159	-48	-185	-34	139	21
		Alt 2	-8	9	-98	-44	-10	-147	130	-38	-200	-31	129	1
		Alt 3	-86	59	-167	-330	-384	22	50	4	161	34	217	-72
		Alt 4	6	-7	72	2	-16	5	20	11	-8	16	109	-3

TABLE C7-36: NET FLOW (CFS) ON LOWER SAN JOAQUIN RIVER (QWEST) UNDER 2030 LEVEL OF DEVELOPMENT

Severe Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		-754	-1082	1506	5989	9768	9802	8083	6400	5081	-1460	-3002	-1498
	Change from Future Without Project	Alt 1	-25	-30	22	47	-58	-125	147	-366	-85	-70	-3	-9
		Alt 2	-35	-83	-108	-9	-126	-137	144	-379	-97	-92	-10	-5
		Alt 3	-3	-6	-43	-15	-151	-178	2	-150	86	-32	21	-47
		Alt 4	1	-3	-2	117	-28	-13	11	7	7	-27	-20	-8
Wet	Future Without Project		-936	-938	6985	14445	17463	17506	14229	12265	9410	1663	-2492	-1048
	Change from Future Without Project	Alt 1	-43	-71	-125	-21	-104	-177	205	-466	25	-212	-27	-28
		Alt 2	-65	-133	-183	138	-221	-210	205	-477	-8	-257	-66	-28
		Alt 3	27	-13	-28	144	-299	-353	-75	-200	78	14	-9	-41
		Alt 4	-1	-22	-8	262	-82	-36	4	1	-5	-47	-55	-17
Above Normal	Future Without Project		-1017	-860	-71	7355	11878	10479	8181	6342	4627	-1134	-3676	-2701
	Change from Future Without Project	Alt 1	-27	-43	139	-62	-5	-18	121	-512	-65	-4	-46	1
		Alt 2	-30	-161	-129	-255	-92	-25	136	-517	-66	-40	-72	1
		Alt 3	-13	-64	213	-46	-127	-65	10	-207	79	-74	-59	2
		Alt 4	-13	-38	2	-50	-52	-16	18	17	11	-17	-36	-7
Below Normal	Future Without Project		-957	-1752	-266	2731	8064	6618	7050	4871	3688	-3025	-3352	-2391
	Change from Future Without Project	Alt 1	-15	2	295	238	-138	-193	138	-398	-37	-70	-5	-23
		Alt 2	-33	-52	-74	-24	-177	-198	140	-421	-32	-61	34	-24
		Alt 3	-10	22	-26	-129	-192	-389	24	-213	38	-31	-12	-1
		Alt 4	-6	-5	12	-1	-1	7	13	27	31	-22	-1	-8
Dry	Future Without Project		-412	-1302	-2052	-63	3749	5128	4086	2765	2266	-4615	-4012	-1373
	Change from Future Without Project	Alt 1	-17	-2	-26	101	-29	-86	121	-347	-256	31	21	-15
		Alt 2	-11	-27	-68	4	-58	-82	107	-346	-270	4	26	3
		Alt 3	-7	32	-5	8	42	13	46	-126	113	-108	5	-144
		Alt 4	11	42	-8	171	21	0	8	0	1	-24	-3	-19
Critical	Future Without Project		-371	-508	-1387	-820	2005	3157	1870	990	2000	-1994	-1507	-413
	Change from Future Without Project	Alt 1	-9	-10	-22	2	42	-101	96	3	-141	24	60	44
		Alt 2	-14	-20	-25	-84	6	-104	76	-31	-136	30	64	47
		Alt 3	-44	-22	-406	-230	-99	50	73	52	125	24	226	-17
		Alt 4	11	7	1	24	8	0	19	0	11	0	24	33

Moderate Fishery Restrictions

			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Water Years	Future Without Project		-974	-1234	1390	5924	8750	7819	7504	5765	3538	-1016	-2982	-1656
	Change from Future Without Project	Alt 1	-11	-25	-42	141	-17	-144	157	-393	-23	-15	19	7
		Alt 2	-23	-58	-120	13	-56	-174	135	-403	-39	-19	4	-1
		Alt 3	-17	-70	-62	-33	-106	-259	2	-160	114	-17	25	-88
		Alt 4	1	1	4	72	-8	-19	14	9	7	-14	-12	3
Wet	Future Without Project		-1168	-1075	6726	14638	16457	15838	13710	11715	8014	1584	-2674	-1103
	Change from Future Without Project	Alt 1	-51	-40	-53	156	6	-104	198	-461	104	-6	-8	-34
		Alt 2	-57	-95	-229	86	-90	-161	169	-462	79	-4	-8	-32
		Alt 3	-5	-67	-116	-130	-167	-509	-59	-181	131	28	35	-24
		Alt 4	-17	7	-2	-29	-17	-40	0	1	-7	-6	-19	-12
Above Normal	Future Without Project		-970	-916	236	7084	10889	8327	7530	5533	2956	-845	-4042	-3085
	Change from Future Without Project	Alt 1	2	-46	-34	245	-27	-181	169	-431	33	-94	-92	2
		Alt 2	-13	-82	-114	-38	-46	-225	153	-437	33	-93	-113	0
		Alt 3	-30	-4	-14	256	-67	-245	17	-188	106	-117	-98	-30
		Alt 4	14	-5	-27	203	-65	-48	22	19	22	-47	-39	-4
Below Normal	Future Without Project		-1234	-1980	-499	2360	6687	4490	6321	4312	1592	-2807	-3618	-2572
	Change from Future Without Project	Alt 1	46	9	-41	54	-52	-231	194	-421	58	28	98	-27
		Alt 2	35	-16	-85	-139	-71	-249	170	-453	21	13	91	-32
		Alt 3	-16	-8	-13	30	-46	-233	38	-241	159	-4	31	-36
		Alt 4	16	-7	2	261	-1	2	41	20	40	-1	29	-4
Dry	Future Without Project		-681	-1327	-1993	-235	2710	2806	3557	2008	644	-3753	-3795	-1616
	Change from Future Without Project	Alt 1	3	-31	-39	179	-94	-130	81	-448	-153	0	7	91
		Alt 2	-15	-54	-78	50	-85	-133	70	-461	-194	17	-6	61
		Alt 3	-15	-204	-5	71	-37	-103	19	-106	123	-74	-12	-250
		Alt 4	0	5	4	29	0	5	5	4	-2	-31	-37	28
Critical	Future Without Project		-692	-882	-1741	-718	1376	1336	1334	437	1035	-626	-628	-416
	Change from Future Without Project	Alt 1	-23	-4	-32	51	100	-111	126	-95	-252	-31	117	12
		Alt 2	-36	-7	2	27	67	-122	100	-99	-203	-69	58	6
		Alt 3	-32	-11	-134	-343	-184	4	53	-74	18	54	176	-106
		Alt 4	9	-3	53	4	50	-3	16	12	0	12	20	9

Old and Middle River Flow Evaluation

Methodology

Estimates of net flow in Old and Middle rivers (OMR) were calculated from DSM2 studies and evaluated for the without project conditions and each of the project alternatives. This evaluation of net OMR flows provides context for reviewers, because the SWP and CVP Delta exports are currently limited by the interim ruling in *NRDC vs Kempthorne*, which relies in part on measured OMR flows to control salvage of delta smelt at the SWP and CVP export facilities.

In this analysis, the positive direction of net flow in Old and Middle rivers is assumed to be towards the north, downstream towards the San Francisco Bay. Hourly flow values were extracted from the DSM2 output at DSM2 channel 106 for Old River and DSM2 channels 144 and 145 for Middle River, which correspond to the current OMR flow measurement locations on Old and Middle Rivers per *NRDC vs Kempthorne*. To determine net flow in Old and Middle rivers, the hourly flow values at these three locations are added[3] and then a Godin filter is applied to determine the tidally averaged flow (or the tidal residual).

Results

The assessment relies on a comparative analysis of net OMR flow for the water years 1976 through 1991 under without project conditions and with the proposed project for four sets of operational conditions: 2005 level of development under moderate fishery restrictions; 2005 level of development under severe fishery restrictions; 2030 level of development under moderate fishery restrictions; and 2030 level of development under severe fishery restrictions. Long-term average net OMR flow with and without each of the project alternatives for both the 2005 and 2030 level of development are presented in Section 4.3. Detailed results are presented below.

The tables and figures provided are described below in the sequence in which they appear for each set of conditions. Note that in some of the figures, net flow (i.e. the tidally filtered flow) is referred to as the tidal residual.

Tables of Old and Middle River Net Flow. The monthly average of the tidally filtered flow in Old and Middle rivers is presented for each month of the 16 year simulation, covering water years 1976 through 1991. At the bottom of the table, the long-term monthly averages are provided for the entire 16 year period, along with average monthly values for wetter water year types (wet, above normal and below normal water years), and for dryer water year types (dry and critical water years). The 16-year study period does not include sufficient years in each water year type category to present average values for each water year type (e.g. there is only one below normal water year from 1976 to 1991). Grouping the year types into wetter and dryer water year categories reduces the uneven weighting that would occur by taking long term averages over individual water year types.

[3] Combined flow in Old and Middle rivers is equal to the flow in channel 106 plus the flow in channel 144 minus the flow in channel 145. The flow in channel 145 is subtracted because channel 145 is defined in the DSM2 model with positive flow to the south while channels 106 and 144 are defined with positive flow to the north.

A table is presented for the without project condition (Existing Condition for the 2005 level of development and Future Without Project for the 2030 level of development) and for each alternative. Following the same format, another table presents differences in the monthly averages of OMR net flow between the alternative and the without project conditions. In the table of differences, a positive value means that OMR net flow was increased in the northward direction by the alternative, relative to the without project condition. For instance, if OMR net flow is positive (water is moving north towards the Bay on average) in the without project condition, a positive value in the difference table implies the water in Old and Middle rivers in the alternative is moving that much faster towards the Bay, while a negative values in the difference table implies the water, although likely still moving to the north, is moving that much slower. Likewise, if OMR net flow is negative (water is moving south towards the SWP and CVP export pumps on average) in the without project condition, a positive value in the difference table implies the water in Old and Middle rivers in the alternative, although likely still moving to the south, is moving that much slower on average, while a negative value in the difference table implies the water is moving that much faster towards the south..

Figures Comparing Each Alternative to the Without Project Condition. Four figures are provided for each project alternative to illustrate the change in OMR net flow compared to the without project condition.

- The first figure provides a direct comparison between the OMR tidal residuals (net flows) for the project alternative versus the without project condition for the months of January through June, which corresponds to the period when OMR net flow limits are specified in *NRDC vs Kempthorne*. This figure illustrates the levels of OMR net flow at which the differences occur.

- The second figure plots time series of OMR tidal residual for the project alternative and without project condition; the changes between the alternative and without project condition (positive value indicates that OMR net flow northward is increased by the alternative) are also shown.

- The third figure compares the long-term (16-year) monthly average OMR net flow for the without project condition and the project alternative.

- The forth figure shows the differences between the project alternative and the without project condition long term (16-year) monthly average OMR net flow. A positive value means that the alternative is increasing OMR net flow northward.

2005 Level of Development, Moderate Fishery Restrictions

Existing Condition

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

Existing Condition

2005 Level of Development; Moderate Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-9,550	-9,576	-9,411	-6,683	-3,397	-2,655	-973	-1,545	-3,281	-6,565	-6,074	-6,725
1977	-8,048	-6,366	-6,341	-4,123	-196	-956	-808	-725	-2,909	-2,525	-3,713	-4,513
1978	-2,206	-2,891	-5,615	-3,897	-4,657	-4,925	-1,532	-1,882	-3,718	-4,005	-6,193	-9,776
1979	-8,368	-8,953	-8,310	-5,317	-5,279	-3,975	326	-1,705	-3,874	-8,001	-8,459	-8,963
1980	-8,346	-9,622	-9,510	-4,429	5,924	1,503	-427	-1,091	-2,763	-4,380	-8,495	-9,670
1981	-7,468	-6,846	-9,158	-5,099	-3,665	-3,575	-846	-1,380	-3,633	-11,237	-10,609	-6,607
1982	-7,376	-9,610	-9,477	-2,800	-3,412	-1,412	7,514	-417	-3,853	-5,576	-9,767	-7,901
1983	-8,344	-6,757	229	7,196	11,874	22,717	5,296	6,326	6,772	2,465	-7,362	-7,214
1984	-7,871	-2,479	4,936	1,190	-2,713	-3,113	222	-519	-3,794	-6,601	-6,114	-8,963
1985	-9,417	-9,438	-9,197	-6,678	-3,641	-2,519	-646	-1,086	-3,586	-10,313	-10,069	-7,604
1986	-7,818	-8,224	-9,086	-6,558	-2,610	7,161	250	-1,601	-2,195	-2,807	-7,572	-9,577
1987	-7,379	-7,189	-6,481	-6,098	-3,002	-3,141	-709	-1,448	-3,455	-10,375	-9,889	-6,938
1988	-6,085	-5,958	-8,998	-5,081	-2,730	-948	-1,098	-1,574	-2,342	-4,257	-3,444	-4,292
1989	-3,753	-5,598	-4,368	-6,596	-590	-3,504	-1,112	-1,785	-3,482	-11,057	-10,629	-6,681
1990	-8,506	-6,625	-6,303	-6,665	-2,333	-2,710	-967	-1,183	-2,370	-4,444	-3,673	-4,534
1991	-4,468	-3,152	-2,898	-1,166	-459	-3,636	-1,421	-1,716	-1,723	-3,613	-3,979	-4,113
Avg	-7,188	-6,830	-6,249	-3,925	-1,305	-356	192	-833	-2,513	-5,831	-7,253	-7,129
W/AN/BN	-7,190	-6,934	-5,262	-2,088	-125	2,565	1,664	-127	-1,918	-4,129	-7,709	-8,866
D/C	-7,186	-6,750	-7,017	-5,354	-2,224	-2,627	-953	-1,382	-2,976	-7,154	-6,898	-5,778

Alternative 1

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

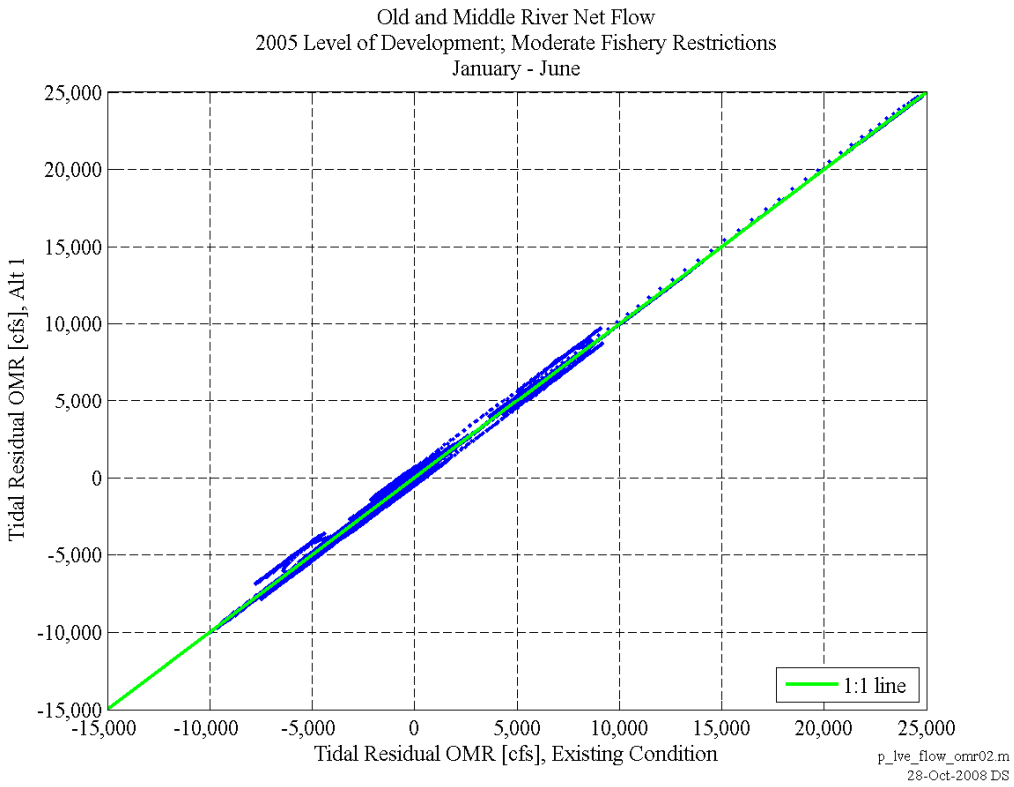
Alternative 1
2005 Level of Development; Moderate Fishery Restrictions

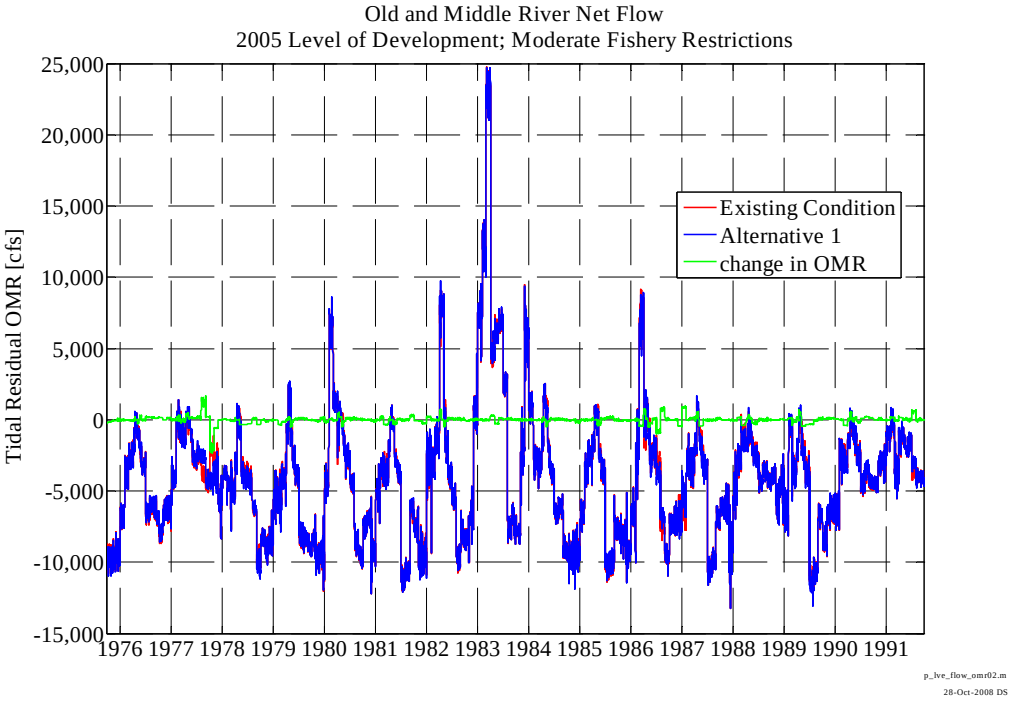
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-9,728	-9,653	-9,421	-6,687	-3,415	-2,696	-974	-1,560	-3,289	-6,386	-5,925	-6,636
1977	-7,901	-6,375	-6,224	-4,121	-143	-982	-634	-597	-2,789	-2,344	-2,509	-4,287
1978	-4,193	-3,512	-5,646	-3,880	-4,662	-5,022	-1,530	-2,209	-4,050	-4,288	-6,094	-10,098
1979	-8,376	-9,060	-8,345	-5,328	-5,632	-4,123	385	-1,965	-3,807	-7,908	-8,384	-8,985
1980	-8,379	-9,727	-9,383	-4,558	5,970	1,458	-141	-1,372	-2,652	-4,326	-8,426	-9,636
1981	-7,476	-6,845	-9,234	-5,108	-3,487	-3,896	-850	-1,586	-3,583	-11,236	-10,603	-6,317
1982	-7,430	-9,700	-9,732	-2,598	-3,413	-1,435	7,812	-692	-3,749	-5,524	-9,712	-7,879
1983	-8,404	-6,780	254	7,197	11,843	22,706	5,587	6,065	6,878	2,512	-7,305	-7,194
1984	-7,875	-2,488	4,920	1,186	-2,727	-3,134	224	-808	-3,709	-6,577	-6,060	-8,962
1985	-9,480	-9,462	-9,346	-6,682	-3,651	-2,526	-641	-1,355	-3,528	-10,180	-9,915	-7,624
1986	-7,907	-8,254	-9,160	-6,576	-2,617	6,743	619	-1,959	-2,132	-3,631	-6,814	-9,537
1987	-7,376	-7,188	-6,906	-5,233	-3,011	-3,054	-425	-1,870	-3,473	-10,387	-9,903	-6,868
1988	-6,086	-5,966	-9,003	-5,127	-2,580	-1,342	-999	-1,657	-2,528	-4,235	-3,449	-4,292
1989	-3,754	-5,614	-4,332	-6,597	-495	-3,658	-800	-2,183	-3,807	-11,366	-10,683	-6,640
1990	-8,445	-6,514	-6,208	-6,616	-2,340	-3,102	-715	-1,169	-2,500	-4,358	-3,457	-4,396
1991	-4,477	-3,120	-2,914	-1,174	-325	-3,676	-1,258	-1,682	-1,723	-3,032	-4,000	-4,112
Avg	-7,330	-6,891	-6,292	-3,869	-1,293	-484	354	-1,037	-2,528	-5,829	-7,077	-7,091
W/AN/BN	-7,509	-7,075	-5,299	-2,080	-177	2,456	1,851	-420	-1,889	-4,249	-7,542	-8,899
D/C	-7,191	-6,749	-7,065	-5,261	-2,161	-2,770	-811	-1,518	-3,024	-7,058	-6,716	-5,686

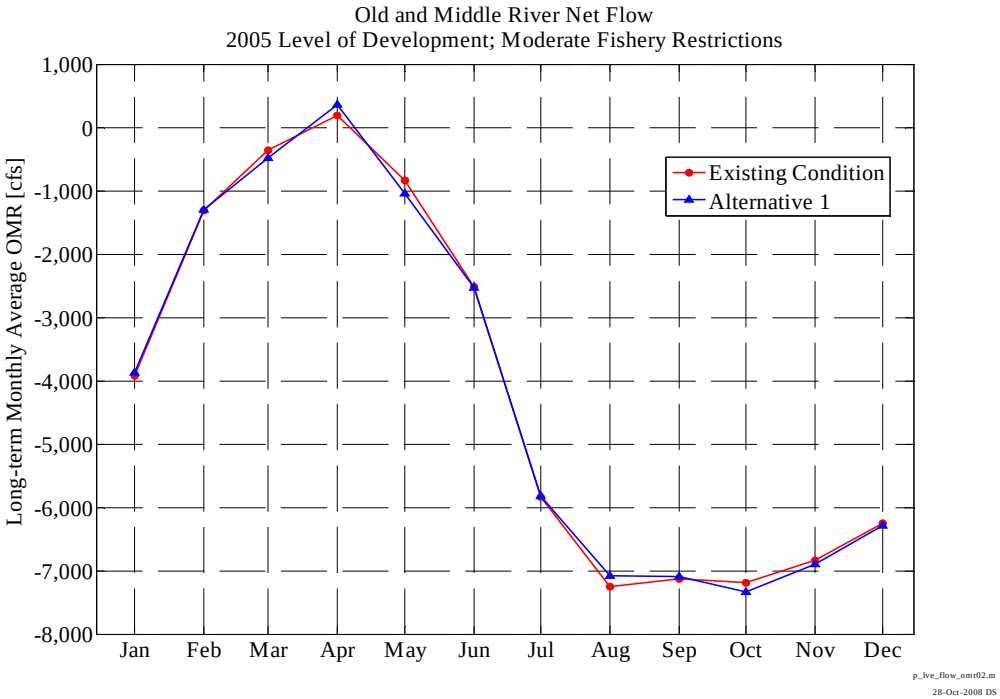
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

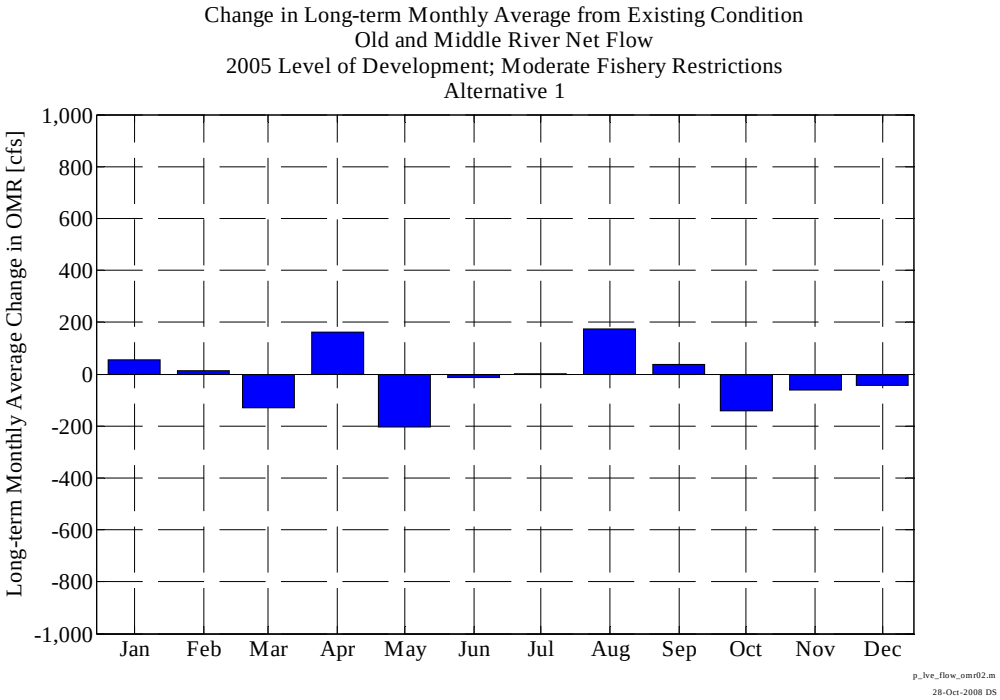
Alternative 1 - Existing Condition
2005 Level of Development; Moderate Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-178	-78	-11	-4	-18	-41	-2	-16	-8	179	149	89
1977	147	-9	117	2	53	-26	174	128	120	181	1,204	226
1978	-1,987	-621	-31	17	-5	-97	2	-327	-332	-283	99	-322
1979	-8	-107	-35	-12	-353	-148	60	-260	66	93	74	-22
1980	-34	-104	127	-129	46	-45	286	-281	112	54	69	35
1981	-8	1	-76	-9	177	-321	-4	-206	51	1	6	290
1982	-53	-90	-255	202	-1	-23	297	-274	105	52	56	22
1983	-60	-23	24	0	-30	-11	291	-261	105	47	57	20
1984	-4	-9	-17	-4	-13	-20	2	-289	85	24	54	1
1985	-62	-23	-149	-3	-10	-8	5	-269	58	134	154	-20
1986	-88	-31	-74	-18	-7	-418	369	-358	63	-825	758	40
1987	3	1	-425	865	-8	88	284	-423	-17	-12	-13	70
1988	-1	-8	-5	-47	150	-395	99	-83	-186	21	-6	0
1989	-2	-17	36	-1	94	-154	312	-398	-325	-309	-55	41
1990	61	111	95	49	-7	-391	252	14	-130	86	216	138
1991	-9	31	-16	-8	134	-39	163	34	0	581	-21	1
Avg	-143	-61	-43	56	13	-128	162	-204	-15	2	175	38
W/AN/BN	-319	-141	-37	8	-52	-109	187	-293	29	-120	167	-32
D/C	-6	1	-48	94	63	-143	143	-135	-49	96	182	93


Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 1
Tidal Residual OMR [cfs], Existing Condition
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
Tidal Residual OMR [cfs]
Existing Condition
Alternative 1
change in OMR
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
Long-term Monthly Average OMR [cfs]
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Existing Condition
Alternative 1
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Existing Condition
Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
Alternative 1
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

Alternative 2

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

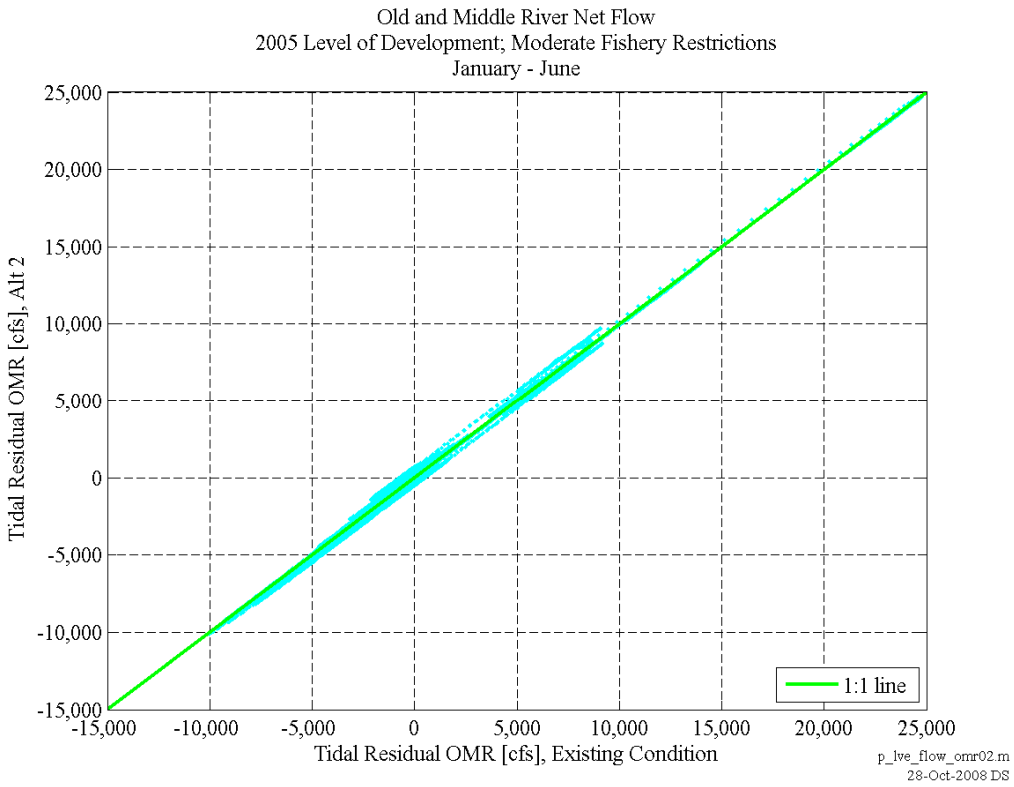
Alternative 2
2005 Level of Development; Moderate Fishery Restrictions

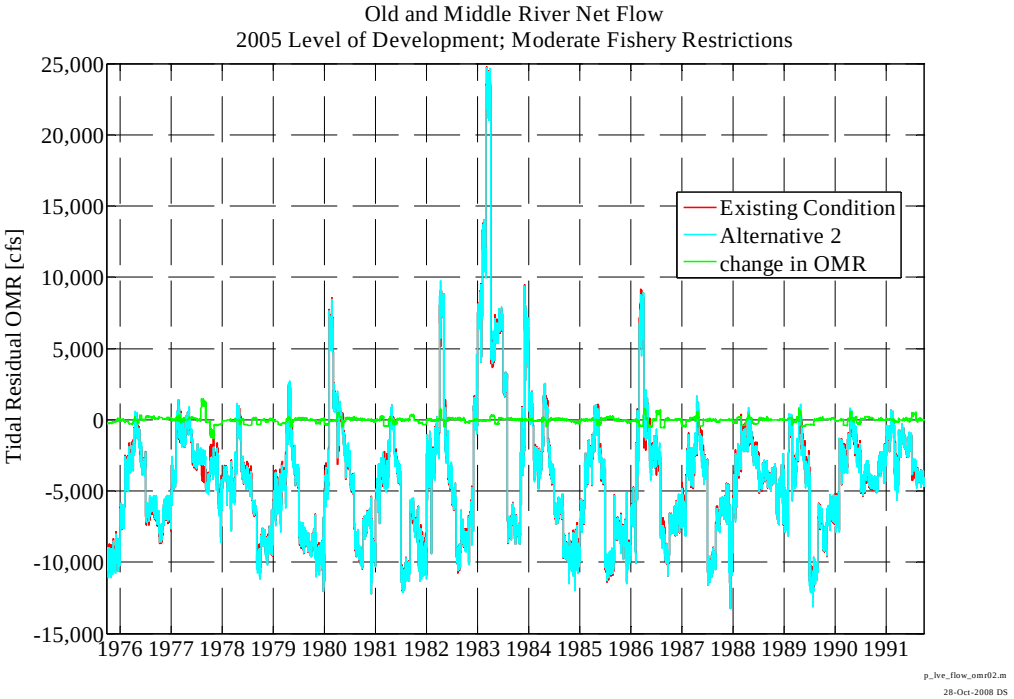
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-9,797	-9,751	-9,422	-6,689	-3,517	-2,933	-976	-1,560	-3,294	-6,353	-5,902	-6,648
1977	-7,906	-6,330	-6,225	-4,125	-144	-974	-799	-613	-2,799	-2,537	-2,537	-4,625
1978	-3,158	-3,294	-5,939	-3,964	-4,658	-5,023	-1,531	-2,036	-4,048	-4,394	-6,095	-10,097
1979	-8,376	-9,063	-8,285	-5,439	-5,633	-4,220	383	-1,965	-3,808	-7,917	-8,391	-8,982
1980	-8,373	-9,850	-9,491	-4,759	5,819	1,451	-141	-1,372	-2,652	-4,326	-8,426	-9,636
1981	-7,476	-6,845	-9,234	-5,109	-3,487	-4,029	-852	-1,585	-3,583	-11,242	-10,607	-6,315
1982	-7,426	-9,843	-9,802	-2,797	-3,477	-1,430	7,812	-692	-3,749	-5,524	-9,712	-7,879
1983	-8,521	-6,862	230	7,152	11,798	22,670	5,587	6,065	6,878	2,512	-7,305	-7,194
1984	-7,875	-2,488	4,920	1,185	-2,825	-3,177	224	-808	-3,709	-6,576	-6,060	-8,958
1985	-9,478	-9,560	-9,414	-6,682	-3,651	-2,526	-641	-1,355	-3,528	-10,180	-9,915	-7,623
1986	-7,911	-8,261	-9,246	-6,624	-2,694	6,740	619	-2,070	-2,180	-2,314	-8,087	-9,556
1987	-7,376	-7,188	-6,453	-6,519	-3,053	-3,054	-428	-1,870	-3,479	-10,380	-9,906	-7,088
1988	-6,087	-5,970	-9,014	-5,286	-2,578	-1,342	-999	-1,660	-2,629	-4,169	-3,403	-4,292
1989	-3,761	-5,610	-4,350	-6,599	-497	-3,663	-773	-2,176	-3,807	-11,415	-10,657	-6,647
1990	-8,463	-6,606	-6,212	-6,748	-2,344	-3,102	-714	-1,169	-2,589	-4,391	-3,482	-4,399
1991	-4,468	-3,137	-2,915	-1,137	-461	-3,777	-1,418	-1,696	-1,724	-3,203	-4,001	-4,112
Avg	-7,278	-6,916	-6,303	-4,009	-1,338	-524	334	-1,035	-2,544	-5,776	-7,155	-7,128
W/AN/BN	-7,377	-7,094	-5,373	-2,178	-239	2,430	1,850	-411	-1,895	-4,077	-7,725	-8,900
D/C	-7,201	-6,777	-7,026	-5,433	-2,193	-2,822	-845	-1,521	-3,048	-7,097	-6,712	-5,750

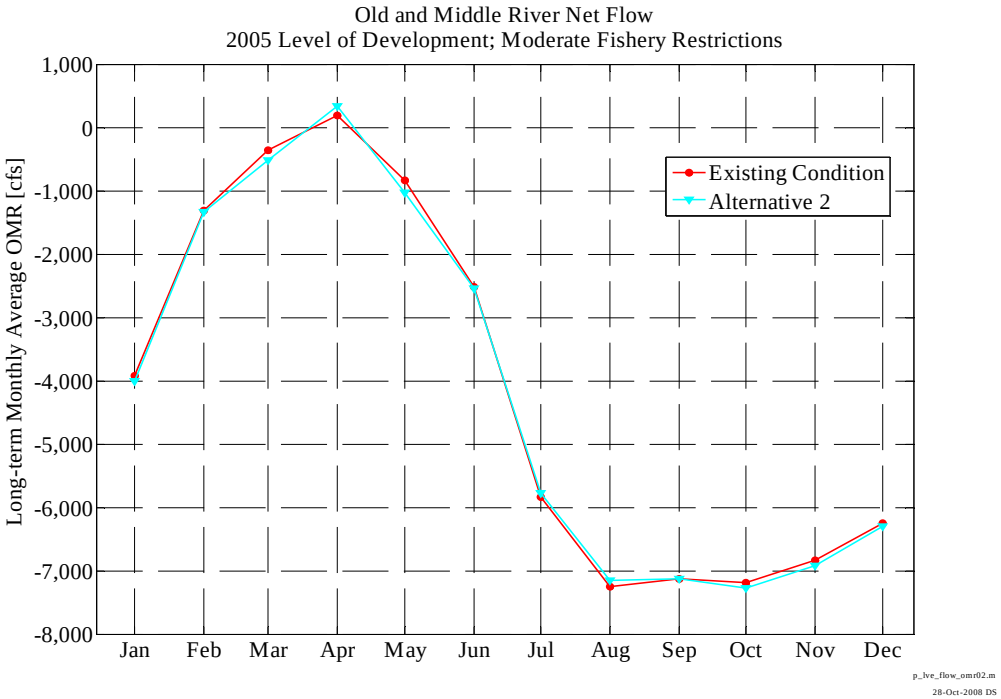
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

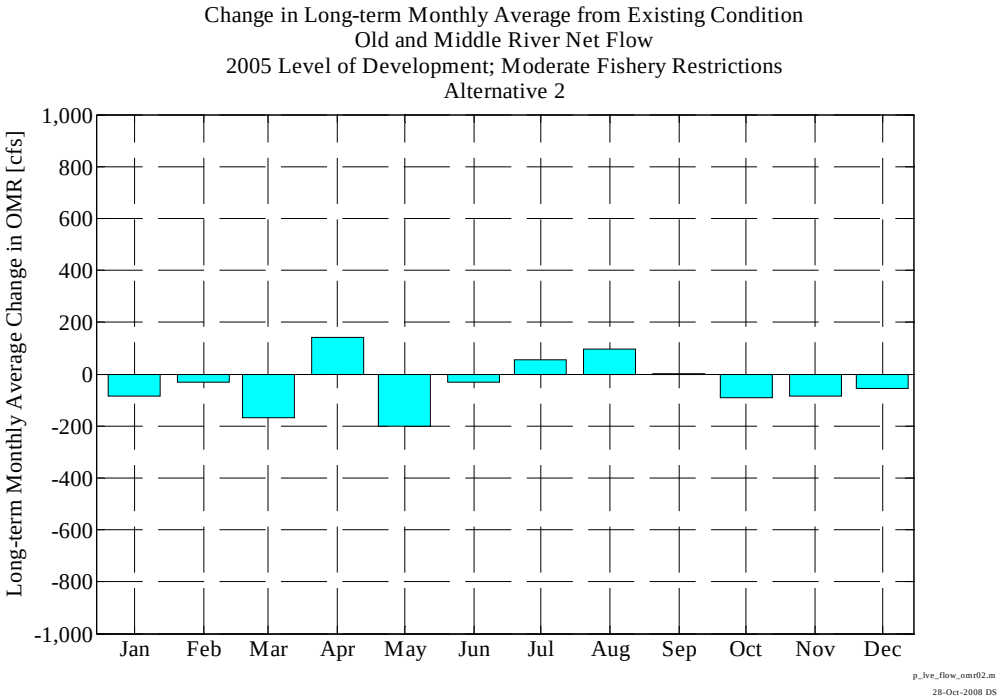
Alternative 2 - Existing Condition
2005 Level of Development; Moderate Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-247	-176	-11	-6	-120	-278	-3	-16	-14	213	172	77
1977	142	36	116	-2	52	-18	9	112	110	-11	1,176	-112
1978	-952	-402	-324	-68	-1	-98	2	-153	-329	-389	98	-320
1979	-8	-110	25	-122	-354	-246	57	-261	66	84	68	-19
1980	-28	-228	19	-330	-105	-52	286	-281	112	54	69	35
1981	-8	1	-76	-9	177	-454	-6	-206	51	-5	2	292
1982	-50	-233	-325	3	-65	-18	297	-274	105	52	56	22
1983	-177	-105	1	-44	-76	-48	291	-261	106	47	57	20
1984	-4	-9	-17	-5	-112	-64	2	-289	85	24	54	5
1985	-60	-122	-217	-4	-10	-8	5	-269	58	133	154	-19
1986	-93	-38	-161	-66	-84	-421	369	-469	15	493	-515	21
1987	2	1	28	-421	-51	88	281	-423	-24	-5	-17	-150
1988	-2	-12	-16	-205	151	-394	99	-87	-287	87	41	0
1989	-8	-12	18	-3	93	-159	340	-391	-325	-358	-29	34
1990	43	19	91	-83	-11	-391	253	14	-218	53	191	135
1991	0	15	-17	30	-2	-140	3	21	0	410	-21	1
Avg	-91	-86	-54	-84	-32	-169	143	-202	-31	55	97	1
W/AN/BN	-187	-161	-112	-90	-114	-135	186	-284	23	52	-16	-34
D/C	-15	-28	-9	-78	31	-195	109	-138	-72	58	185	29


Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 2
Tidal Residual OMR [cfs], Existing Condition
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
Tidal Residual OMR [cfs]
Existing Condition
Alternative 2
change in OMR
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
Long-term Monthly Average OMR [cfs]
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Existing Condition
Alternative 2
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Existing Condition
Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
Alternative 2
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

Alternative 3

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

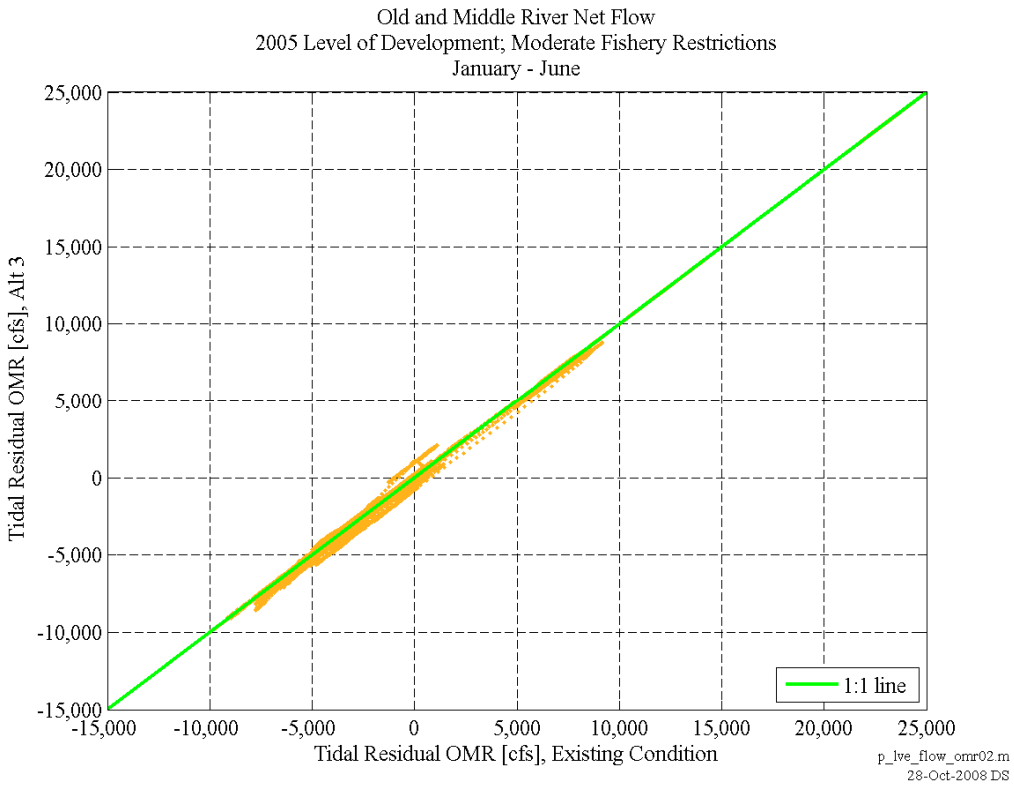
Alternative 3
2005 Level of Development; Moderate Fishery Restrictions

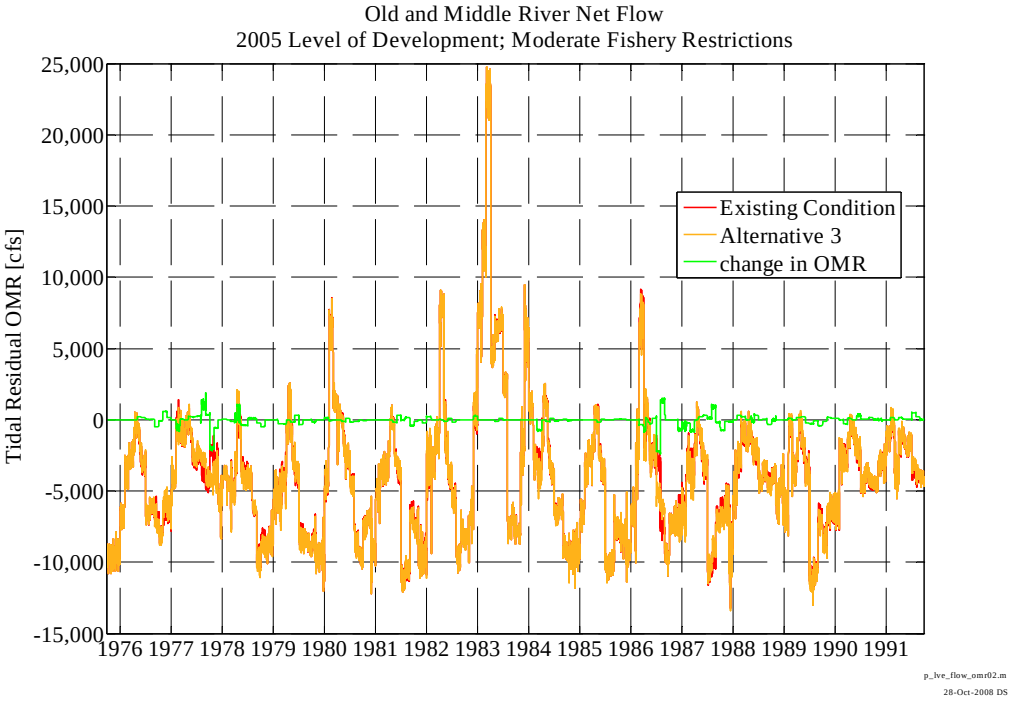
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-9,552	-9,577	-9,411	-6,671	-3,389	-2,655	-973	-1,340	-3,137	-6,530	-6,038	-7,217
1977	-8,104	-5,804	-6,202	-4,137	-744	-929	-803	-504	-2,715	-2,285	-2,724	-4,127
1978	-4,215	-3,492	-5,622	-3,872	-4,657	-5,048	-1,001	-2,177	-4,129	-3,926	-6,091	-10,007
1979	-8,852	-8,957	-8,332	-5,317	-5,542	-4,281	324	-1,859	-3,580	-8,325	-8,476	-8,955
1980	-8,516	-9,628	-9,515	-4,301	5,853	1,501	-427	-1,228	-2,693	-4,551	-8,601	-9,680
1981	-7,537	-6,848	-9,161	-5,101	-3,655	-3,575	-846	-1,557	-3,340	-11,257	-10,460	-7,022
1982	-7,507	-9,616	-9,697	-2,590	-3,411	-1,417	7,525	-541	-3,763	-5,746	-9,779	-7,906
1983	-8,346	-6,753	489	7,205	11,878	22,722	5,296	6,209	6,862	2,455	-7,371	-7,220
1984	-7,875	-2,475	4,941	1,189	-2,714	-3,845	211	-655	-3,705	-6,688	-6,131	-8,942
1985	-9,456	-9,445	-9,196	-6,679	-3,642	-2,520	-646	-1,264	-3,528	-10,323	-10,078	-7,581
1986	-7,756	-8,205	-9,081	-6,552	-2,606	6,804	-79	-1,828	-2,108	-5,011	-6,235	-9,564
1987	-7,385	-7,190	-7,171	-6,527	-3,251	-3,909	-722	-1,266	-3,159	-10,259	-9,019	-7,125
1988	-6,810	-6,082	-9,144	-5,079	-2,425	-720	-1,096	-1,590	-2,042	-4,260	-3,380	-4,612
1989	-3,767	-5,581	-4,368	-6,594	-485	-3,503	-964	-1,590	-3,712	-11,323	-10,717	-7,109
1990	-8,637	-6,462	-6,197	-6,564	-2,329	-3,014	-897	-1,177	-2,092	-4,404	-3,641	-4,367
1991	-4,454	-3,113	-2,920	-1,156	-311	-3,632	-1,262	-1,667	-1,706	-3,122	-3,771	-4,100
Avg	-7,423	-6,827	-6,287	-3,922	-1,339	-501	227	-877	-2,409	-5,972	-7,032	-7,221
W/AN/BN	-7,581	-7,018	-5,260	-2,034	-171	2,348	1,693	-297	-1,874	-4,542	-7,526	-8,896
D/C	-7,300	-6,678	-7,086	-5,390	-2,248	-2,717	-912	-1,328	-2,826	-7,085	-6,648	-5,918

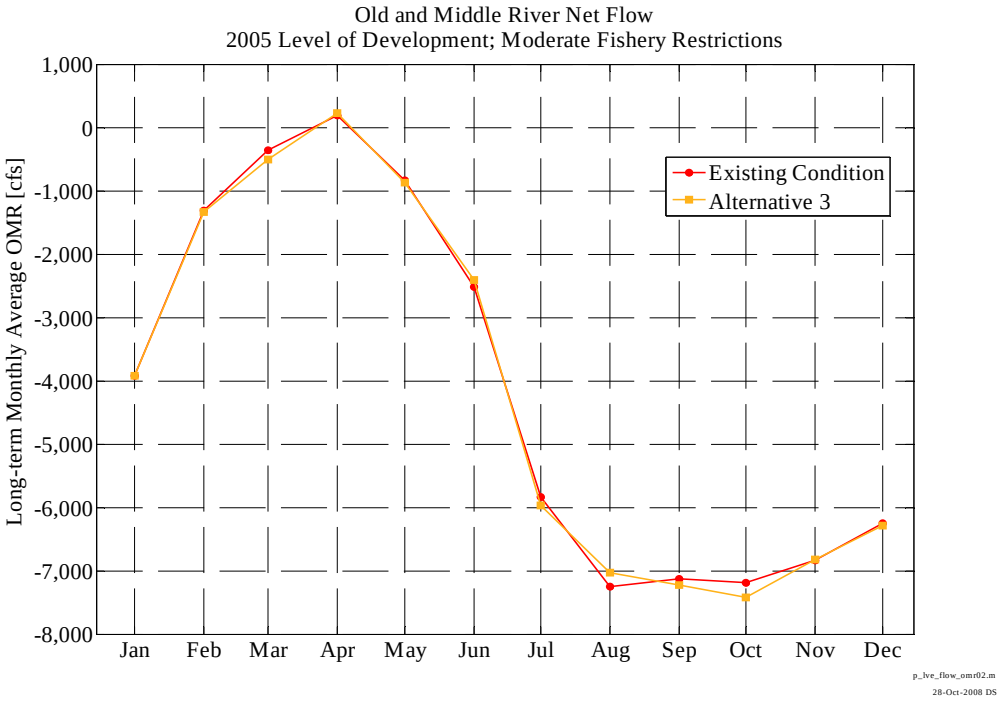
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

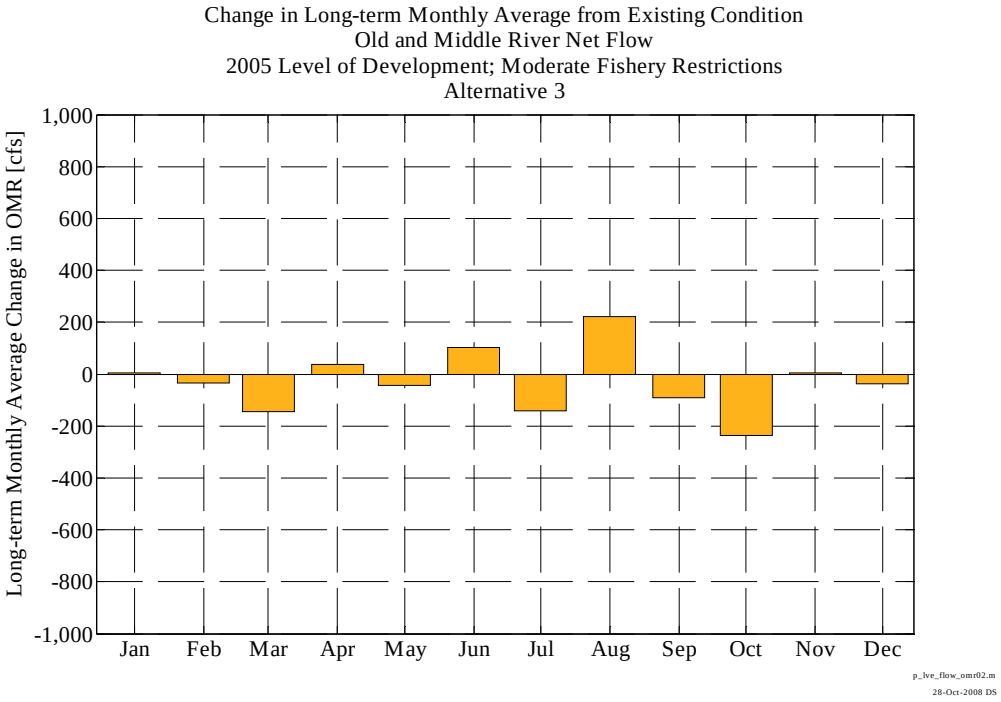
Alternative 3 - Existing Condition
2005 Level of Development; Moderate Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-2	-2	-1	12	8	0	0	205	144	35	37	-493
1977	-56	563	139	-14	-548	28	5	221	194	241	989	386
1978	-2,008	-601	-7	25	0	-123	531	-295	-410	79	102	-230
1979	-484	-4	-22	0	-263	-306	-2	-154	294	-324	-17	8
1980	-170	-6	-5	128	-71	-2	0	-137	70	-170	-106	-10
1981	-69	-2	-4	-2	9	0	0	-177	293	-19	148	-415
1982	-131	-6	-220	210	1	-5	11	-123	90	-170	-12	-6
1983	-2	5	260	9	4	5	0	-117	90	-10	-10	-7
1984	-4	4	5	-1	-1	-732	-11	-136	89	-88	-17	21
1985	-39	-6	1	0	-1	-1	0	-178	58	-10	-9	23
1986	63	19	5	6	4	-357	-329	-227	87	-2,205	1,337	13
1987	-7	-1	-690	-428	-249	-767	-13	182	296	117	870	-186
1988	-725	-124	-146	2	305	228	1	-16	300	-4	63	-321
1989	-14	16	0	2	105	1	148	195	-230	-266	-89	-428
1990	-131	163	106	101	4	-303	70	7	279	40	32	167
1991	14	39	-23	10	147	4	159	49	17	491	209	12
Avg	-235	3	-38	4	-34	-146	36	-44	104	-141	220	-92
W/AN/BN	-391	-84	2	54	-46	-217	29	-170	44	-413	182	-30
D/C	-114	72	-69	-35	-24	-90	41	54	150	69	250	-140


Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 3
Tidal Residual OMR [cfs], Existing Condition
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
Tidal Residual OMR [cfs]
Existing Condition
Alternative 3
change in OMR
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
Long-term Monthly Average OMR [cfs]
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Existing Condition
Alternative 3
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Existing Condition
Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
Alternative 3
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

Alternative 4

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

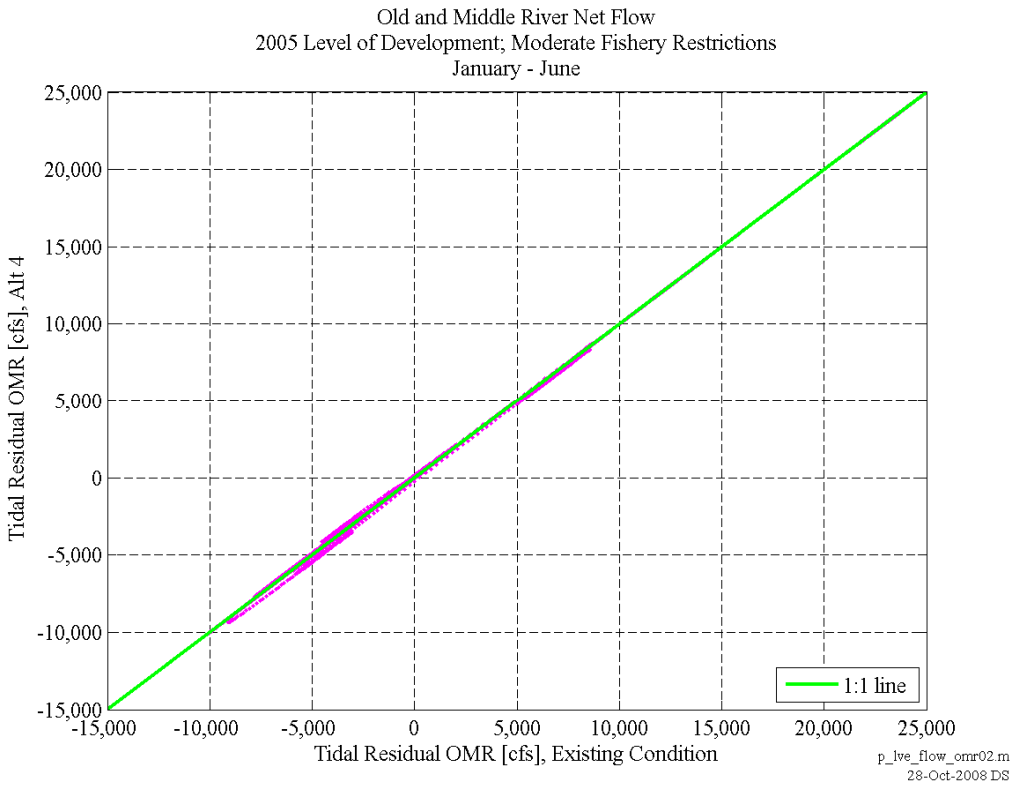
Alternative 4
2005 Level of Development; Moderate Fishery Restrictions

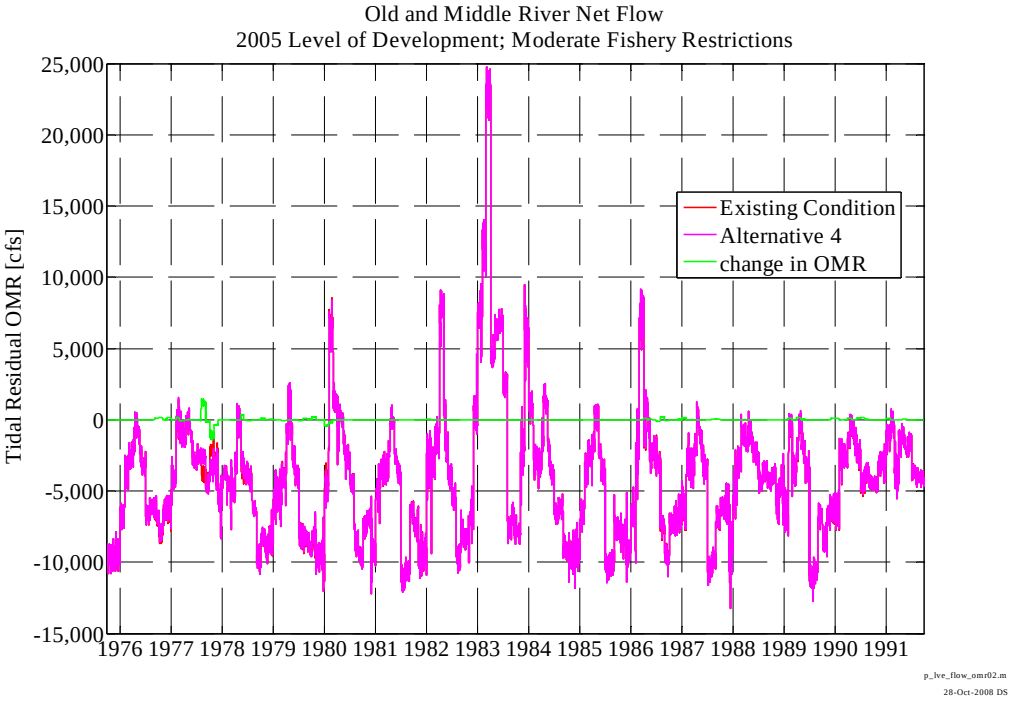
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-9,551	-9,576	-9,411	-6,681	-3,396	-2,655	-973	-1,545	-3,276	-6,562	-6,072	-6,623
1977	-7,895	-6,356	-6,215	-4,115	-61	-1,003	-808	-720	-2,929	-2,527	-2,513	-4,623
1978	-3,293	-3,289	-5,620	-3,897	-4,657	-4,923	-1,532	-1,708	-3,717	-4,079	-6,198	-9,776
1979	-8,304	-8,951	-8,271	-5,316	-5,279	-4,056	325	-1,705	-3,874	-8,066	-8,349	-8,945
1980	-8,159	-9,629	-9,510	-4,850	5,720	1,500	-427	-1,091	-2,764	-4,385	-8,500	-9,674
1981	-7,479	-6,847	-9,164	-5,102	-3,653	-3,575	-846	-1,380	-3,633	-11,249	-10,612	-6,624
1982	-7,387	-9,621	-9,477	-2,763	-3,412	-1,411	7,514	-417	-3,854	-5,581	-9,771	-7,903
1983	-8,345	-6,755	231	7,199	11,875	22,719	5,296	6,326	6,772	2,461	-7,365	-7,216
1984	-7,873	-2,478	4,938	1,190	-2,714	-3,114	222	-519	-3,794	-6,605	-6,118	-8,962
1985	-9,409	-9,439	-9,197	-6,678	-3,641	-2,519	-646	-1,086	-3,586	-10,326	-10,073	-7,602
1986	-7,815	-8,224	-9,086	-6,558	-2,610	7,162	330	-1,585	-2,195	-2,930	-7,392	-9,630
1987	-7,379	-7,190	-6,468	-5,976	-3,000	-3,141	-709	-1,448	-3,455	-10,377	-9,872	-6,885
1988	-6,086	-5,957	-8,994	-5,080	-2,730	-948	-1,098	-1,574	-2,342	-4,255	-3,442	-4,292
1989	-3,753	-5,598	-4,368	-6,597	-487	-3,503	-965	-1,771	-3,482	-11,063	-10,633	-6,672
1990	-8,506	-6,621	-6,200	-6,565	-2,330	-2,710	-895	-1,177	-2,300	-4,281	-3,644	-4,532
1991	-4,476	-3,146	-2,918	-1,091	-456	-3,637	-1,421	-1,683	-1,723	-3,644	-3,980	-4,113
Avg	-7,232	-6,855	-6,233	-3,930	-1,302	-363	211	-818	-2,510	-5,842	-7,158	-7,130
W/AN/BN	-7,311	-6,993	-5,256	-2,142	-154	2,554	1,676	-100	-1,918	-4,169	-7,670	-8,872
D/C	-7,170	-6,748	-6,993	-5,321	-2,195	-2,632	-929	-1,376	-2,970	-7,143	-6,760	-5,774

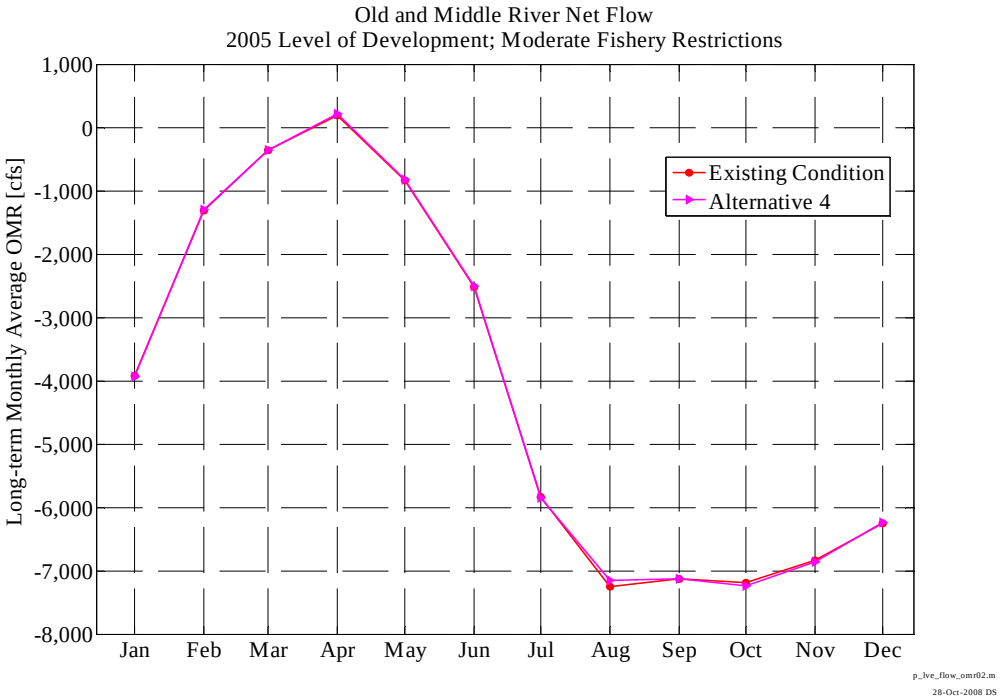
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

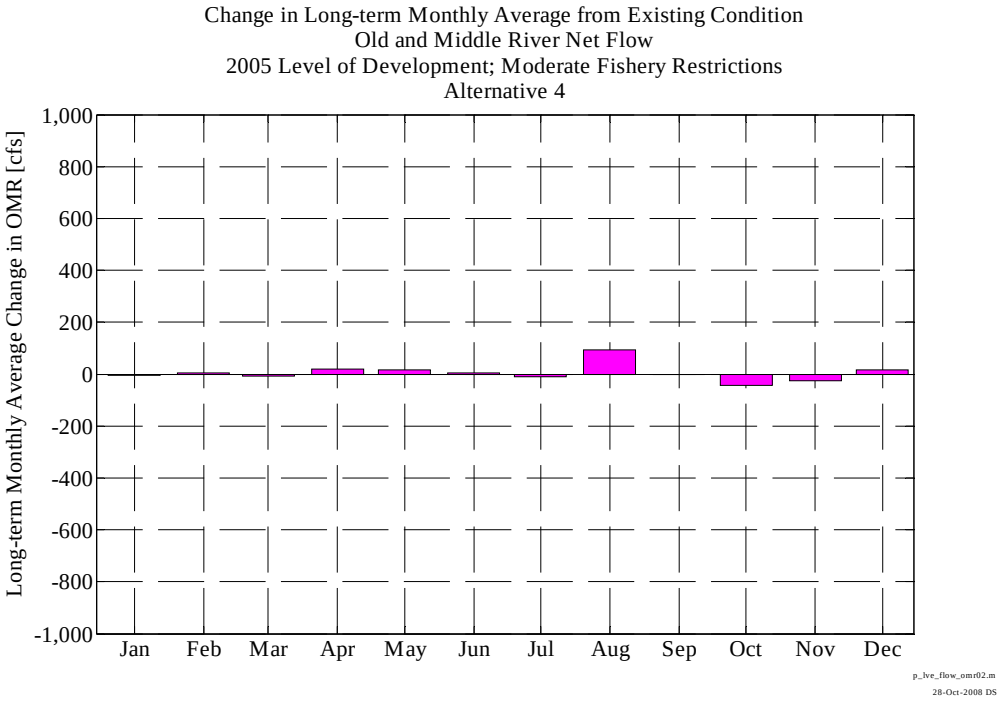
Alternative 4 - Existing Condition
2005 Level of Development; Moderate Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-1	-1	0	2	1	0	0	0	4	3	2	102
1977	153	10	126	8	135	-46	0	5	-20	-1	1,200	-111
1978	-1,086	-398	-5	0	0	2	0	174	1	-75	-5	0
1979	64	2	38	1	0	-81	0	0	-1	-65	110	17
1980	187	-7	0	-421	-204	-3	0	0	-1	-5	-4	-3
1981	-11	-1	-7	-3	12	0	0	0	0	-12	-4	-17
1982	-11	-10	0	37	0	1	0	0	0	-5	-4	-2
1983	-1	2	1	2	1	2	0	0	0	-4	-4	-2
1984	-1	2	2	0	0	-1	0	0	0	-4	-4	1
1985	8	0	0	0	0	0	0	0	0	-13	-4	2
1986	3	0	0	0	0	1	81	16	0	-123	180	-53
1987	-1	-1	13	123	3	0	0	0	0	-1	17	53
1988	-1	1	4	1	-1	0	0	0	0	2	1	0
1989	0	-1	-1	-1	103	1	147	14	0	-6	-4	9
1990	0	4	102	100	3	0	72	7	70	163	29	1
1991	-9	5	-20	76	2	0	0	33	0	-31	0	0
Avg	-44	-25	16	-5	3	-8	19	16	3	-11	94	0
W/AN/BN	-121	-59	5	-54	-29	-11	11	27	0	-40	38	-6
D/C	16	2	24	34	29	-5	24	7	6	11	138	4


Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 4
Tidal Residual OMR [cfs], Existing Condition
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
Tidal Residual OMR [cfs]
Existing Condition
Alternative 4
change in OMR
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
Long-term Monthly Average OMR [cfs]
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Existing Condition
Alternative 4
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Existing Condition
Old and Middle River Net Flow
2005 Level of Development; Moderate Fishery Restrictions
Alternative 4
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

2005 Level of Development, Severe Fishery Restrictions

Existing Condition

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

Existing Condition

2005 Level of Development; Severe Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-9,537	-9,572	-9,409	-6,670	-2,297	-332	-322	-625	-967	-8,612	-8,029	-6,348
1977	-7,698	-6,464	-6,349	-1,720	-944	-176	-531	-515	-1,176	-3,162	-3,905	-4,139
1978	-4,122	-3,515	-5,623	-3,896	-3,507	-2,704	-997	-1,163	-2,004	-4,351	-6,220	-9,778
1979	-8,368	-8,937	-8,084	-5,309	-4,219	-2,825	845	-1,093	-1,597	-8,716	-9,167	-9,238
1980	-8,342	-9,607	-9,507	-2,665	6,967	1,500	80	-505	-1,734	-4,618	-8,502	-9,670
1981	-7,381	-7,202	-9,156	-5,095	-2,383	-1,394	-175	-612	-1,419	-10,976	-10,023	-6,134
1982	-6,647	-9,582	-9,473	-2,813	-3,386	-358	7,493	-417	-2,166	-5,551	-9,767	-7,901
1983	-8,344	-6,757	95	7,195	11,806	22,723	5,305	6,336	6,782	2,474	-7,362	-7,205
1984	-7,862	-2,472	4,940	1,190	-2,659	-1,726	744	74	-1,528	-7,010	-6,591	-9,595
1985	-9,478	-9,433	-9,196	-6,678	-2,582	-205	-47	-589	-1,393	-9,103	-8,785	-7,173
1986	-7,284	-8,460	-9,076	-6,547	-2,553	8,043	763	-1,015	-2,163	-2,688	-7,507	-9,576
1987	-7,131	-7,392	-7,631	-6,426	-2,187	-1,351	-393	-534	-1,236	-11,265	-9,893	-6,226
1988	-6,091	-5,959	-8,957	-5,077	-1,973	-140	-448	-765	-1,165	-6,109	-6,475	-4,337
1989	-4,046	-4,903	-5,390	-6,729	-2,234	-1,270	-648	-994	-1,277	-11,673	-11,249	-7,626
1990	-8,380	-5,915	-4,803	-5,127	-2,369	-339	-658	-390	-1,221	-5,901	-4,802	-4,534
1991	-4,318	-3,253	-2,769	-1,465	-2,175	-1,420	-564	-788	-1,145	-4,708	-4,664	-4,144
Avg	-7,189	-6,839	-6,274	-3,615	-1,043	1,127	653	-225	-963	-6,373	-7,684	-7,102
W/AN/BN	-7,281	-7,047	-5,247	-1,835	350	3,522	2,033	317	-630	-4,351	-7,874	-8,995
D/C	-7,118	-6,677	-7,073	-4,999	-2,127	-736	-421	-646	-1,222	-7,946	-7,536	-5,629

Alternative 1

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

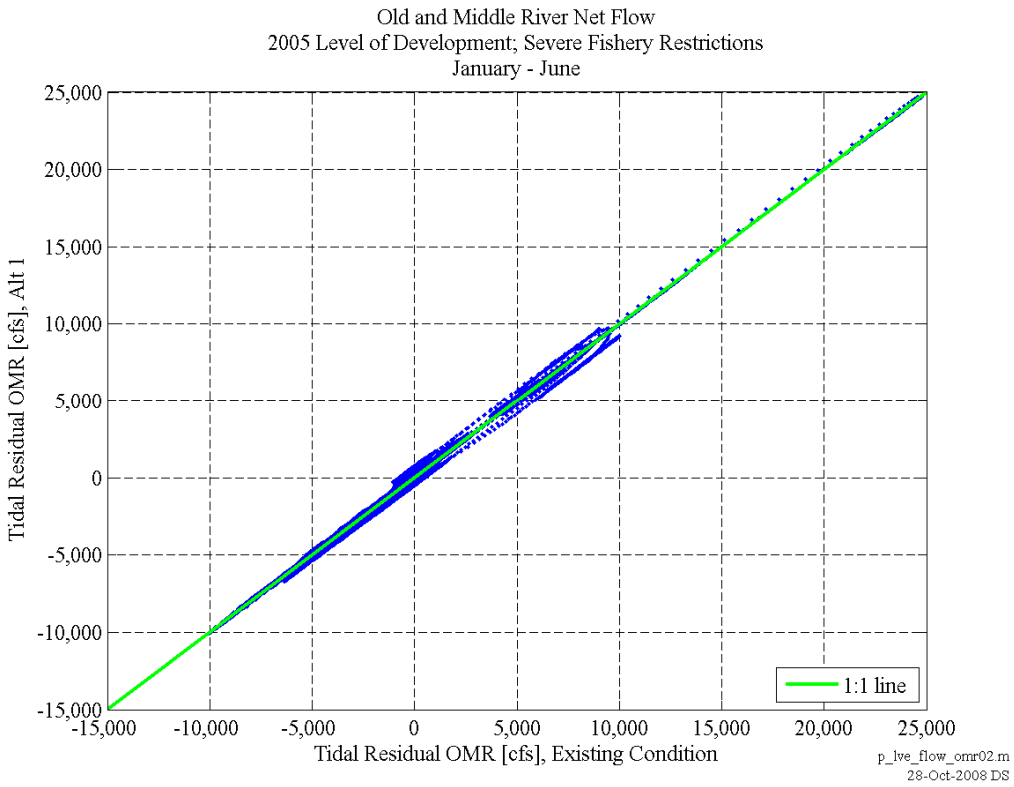
Alternative 1
2005 Level of Development; Severe Fishery Restrictions

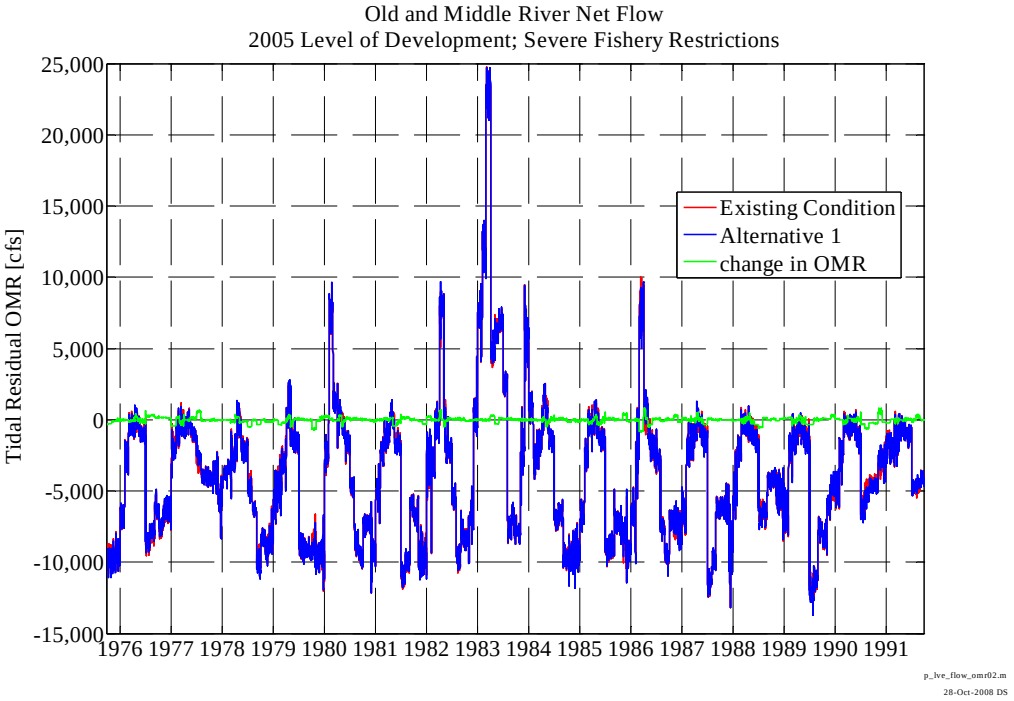
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-9,821	-9,707	-9,421	-6,680	-2,326	-427	-226	-653	-1,039	-8,373	-7,731	-6,212
1977	-7,531	-6,332	-6,268	-2,159	-804	-363	-501	-464	-1,076	-2,597	-3,956	-4,146
1978	-4,138	-3,549	-5,657	-3,899	-3,512	-2,855	-803	-1,330	-2,135	-4,840	-6,237	-10,101
1979	-8,374	-9,088	-8,237	-5,322	-4,570	-3,027	969	-1,346	-1,536	-8,670	-9,185	-9,273
1980	-8,975	-9,688	-9,340	-2,449	7,023	1,447	225	-783	-1,605	-4,570	-8,433	-9,635
1981	-7,375	-7,212	-9,237	-5,105	-2,388	-1,313	-126	-1,043	-1,587	-10,833	-9,887	-6,117
1982	-6,667	-9,691	-9,774	-2,598	-3,387	-393	7,788	-691	-2,056	-5,498	-9,712	-7,879
1983	-8,445	-6,794	74	7,195	11,781	22,700	5,594	6,073	6,886	2,519	-7,305	-7,186
1984	-7,868	-2,482	4,923	1,186	-2,675	-1,756	743	-220	-1,512	-6,961	-6,505	-9,584
1985	-9,636	-9,445	-9,302	-6,681	-2,597	-412	46	-865	-1,383	-9,039	-8,712	-7,168
1986	-7,281	-8,076	-9,160	-6,574	-2,580	7,256	1,149	-1,414	-2,095	-2,634	-7,633	-9,549
1987	-7,128	-7,132	-7,770	-6,327	-2,213	-1,359	-178	-559	-1,548	-11,205	-9,888	-6,231
1988	-6,089	-5,969	-8,970	-5,135	-1,977	-206	-324	-892	-1,481	-6,648	-6,357	-4,344
1989	-3,993	-4,969	-5,321	-6,615	-2,102	-1,402	-531	-1,047	-1,573	-12,000	-11,200	-7,628
1990	-8,287	-5,868	-4,506	-5,058	-2,380	-515	-557	-422	-1,216	-6,184	-5,407	-4,756
1991	-4,574	-2,724	-2,900	-1,676	-2,152	-1,511	-560	-809	-1,130	-4,729	-4,411	-4,138
Avg	-7,261	-6,795	-6,304	-3,619	-1,054	991	794	-404	-1,005	-6,391	-7,660	-7,122
W/AN/BN	-7,393	-7,052	-5,310	-1,780	297	3,339	2,238	41	-579	-4,379	-7,858	-9,030
D/C	-7,159	-6,595	-7,077	-5,048	-2,104	-834	-329	-750	-1,337	-7,956	-7,505	-5,638

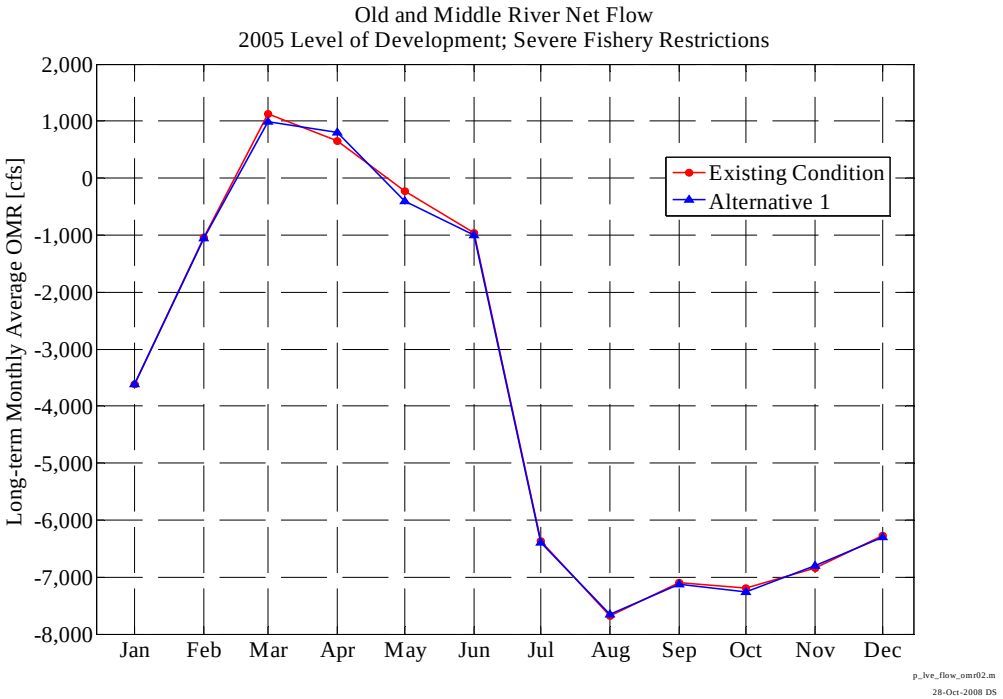
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

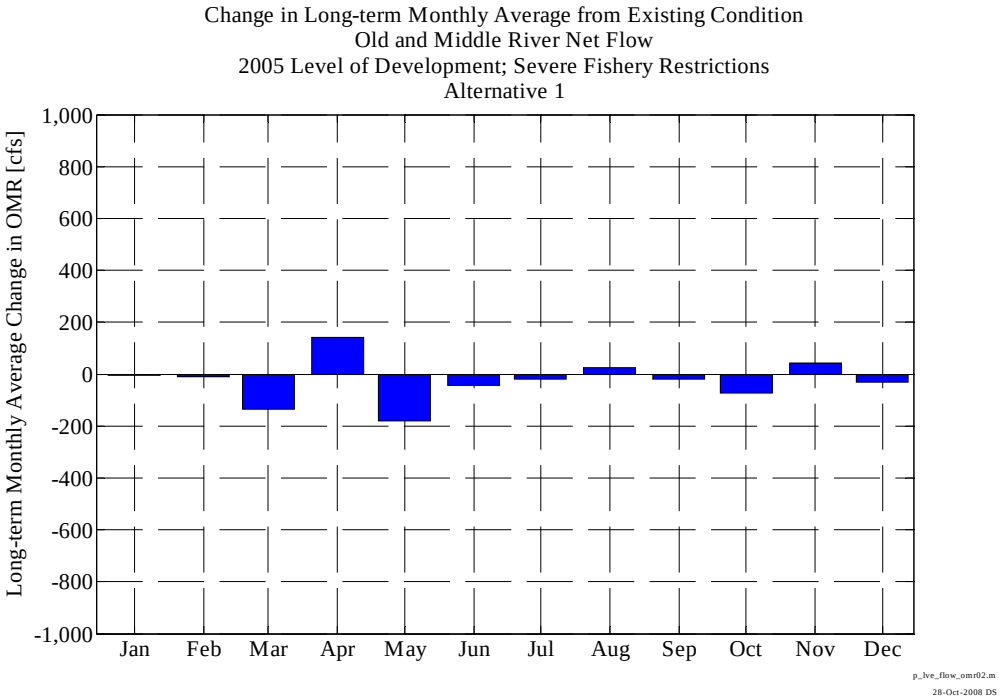
Alternative 1 - Existing Condition
2005 Level of Development; Severe Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-284	-136	-11	-10	-29	-95	96	-28	-73	239	297	136
1977	167	132	81	-439	140	-187	29	51	100	564	-51	-6
1978	-16	-34	-34	-2	-5	-150	194	-167	-131	-489	-16	-323
1979	-6	-151	-153	-13	-351	-201	124	-253	60	46	-18	-35
1980	-633	-81	167	216	56	-53	145	-278	129	48	69	35
1981	5	-10	-81	-10	-4	81	49	-431	-168	143	136	17
1982	-20	-109	-301	215	-1	-36	295	-274	110	54	56	22
1983	-101	-37	-21	0	-25	-23	290	-262	104	45	57	19
1984	-5	-10	-17	-4	-16	-30	-1	-294	15	49	86	11
1985	-158	-12	-106	-3	-15	-207	94	-276	10	64	74	5
1986	3	385	-84	-27	-27	-787	386	-398	68	55	-125	27
1987	3	260	-139	100	-26	-8	216	-25	-312	59	5	-4
1988	2	-9	-13	-58	-3	-66	123	-127	-316	-538	118	-6
1989	54	-65	69	114	132	-132	117	-54	-297	-327	50	-2
1990	93	47	297	69	-11	-176	101	-32	5	-282	-605	-222
1991	-256	528	-131	-211	23	-91	4	-21	15	-20	253	6
Avg	-72	44	-30	-4	-10	-135	141	-179	-42	-18	24	-20
W/AN/BN	-111	-5	-63	55	-53	-183	205	-275	51	-27	16	-35
D/C	-42	82	-4	-50	23	-98	92	-105	-115	-11	31	-9


Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 1
Tidal Residual OMR [cfs], Existing Condition
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
Tidal Residual OMR [cfs]
Existing Condition
Alternative 1
change in OMR
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
Long-term Monthly Average OMR [cfs]
2,000
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Existing Condition
Alternative 1
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Existing Condition
Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
Alternative 1
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

Alternative 2

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

Alternative 2

2005 Level of Development; Severe Fishery Restrictions

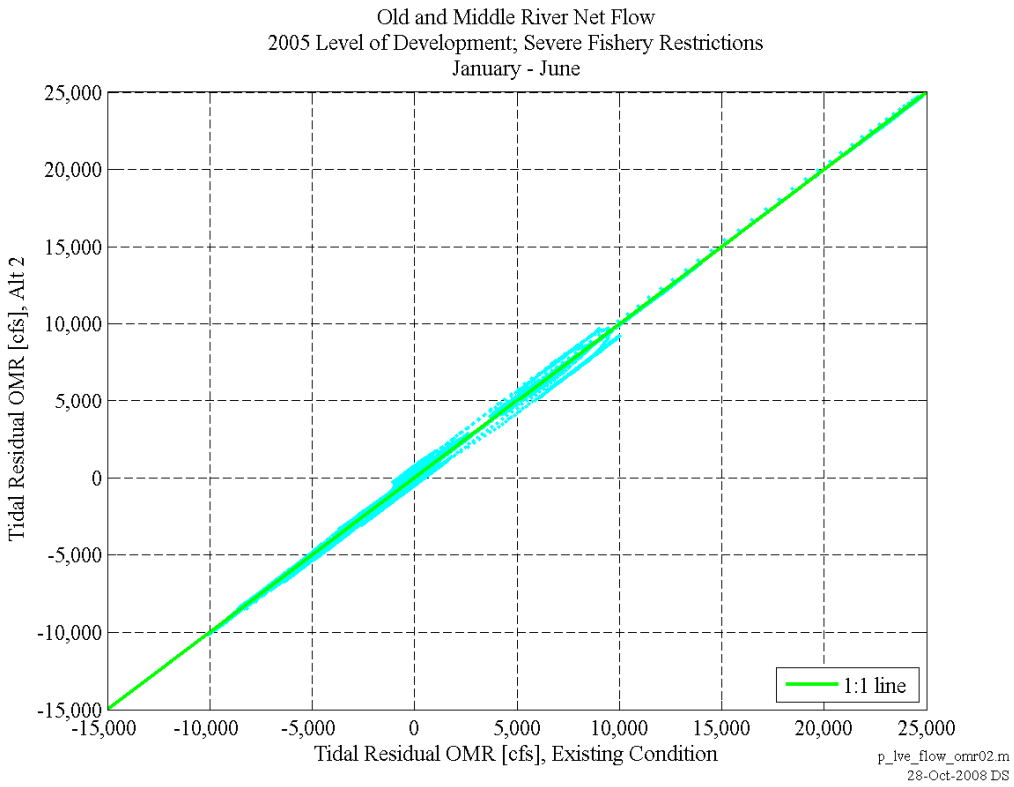
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-9,822	-9,784	-9,421	-6,682	-2,421	-623	-227	-653	-1,047	-8,378	-7,735	-6,219
1977	-7,532	-6,334	-6,226	-1,684	-815	-386	-501	-464	-1,189	-2,868	-3,922	-4,144
1978	-4,137	-3,536	-5,943	-3,963	-3,507	-2,861	-798	-1,341	-2,135	-4,817	-6,214	-10,101
1979	-8,374	-9,088	-8,252	-5,323	-4,570	-3,158	966	-1,346	-1,536	-8,669	-9,184	-9,274
1980	-9,110	-9,865	-9,341	-2,417	6,916	1,446	225	-783	-1,605	-4,570	-8,433	-9,635
1981	-7,376	-7,212	-9,237	-5,105	-2,388	-1,313	-126	-1,043	-1,621	-10,836	-9,887	-6,118
1982	-6,668	-9,838	-9,798	-2,847	-3,453	-390	7,788	-691	-2,056	-5,498	-9,712	-7,879
1983	-8,521	-6,862	74	7,150	11,738	22,676	5,595	6,075	6,888	2,521	-7,305	-7,185
1984	-7,866	-2,480	4,924	1,185	-2,771	-1,788	743	-221	-1,512	-6,960	-6,504	-9,584
1985	-9,763	-9,590	-9,383	-6,682	-2,703	-479	65	-864	-1,383	-9,060	-8,733	-7,168
1986	-7,281	-8,075	-9,242	-6,627	-2,635	7,254	1,149	-1,484	-2,188	-2,604	-7,576	-9,548
1987	-7,128	-7,191	-7,745	-6,350	-2,230	-1,359	-178	-559	-1,548	-11,205	-9,887	-6,232
1988	-6,089	-5,971	-8,973	-5,308	-1,978	-206	-324	-1,041	-1,482	-6,644	-6,356	-4,344
1989	-3,997	-4,959	-5,345	-6,615	-2,102	-1,402	-641	-1,051	-1,573	-12,000	-11,199	-7,577
1990	-8,311	-5,868	-4,527	-5,237	-2,377	-542	-558	-422	-1,216	-6,272	-5,383	-4,720
1991	-4,539	-2,790	-2,900	-1,610	-2,159	-1,577	-561	-809	-1,115	-4,715	-4,391	-4,138
Avg	-7,282	-6,840	-6,333	-3,632	-1,091	956	789	-419	-1,020	-6,411	-7,651	-7,117
W/AN/BN	-7,423	-7,106	-5,368	-1,835	245	3,311	2,238	30	-592	-4,371	-7,847	-9,029
D/C	-7,173	-6,633	-7,084	-5,030	-2,130	-876	-339	-767	-1,353	-7,998	-7,499	-5,629

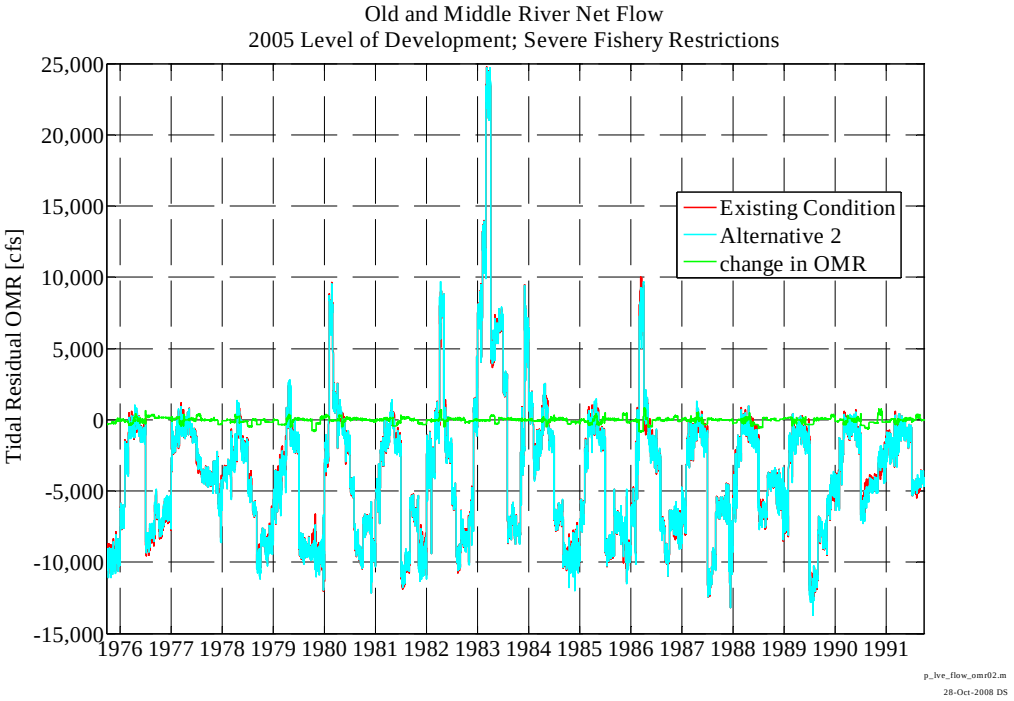
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

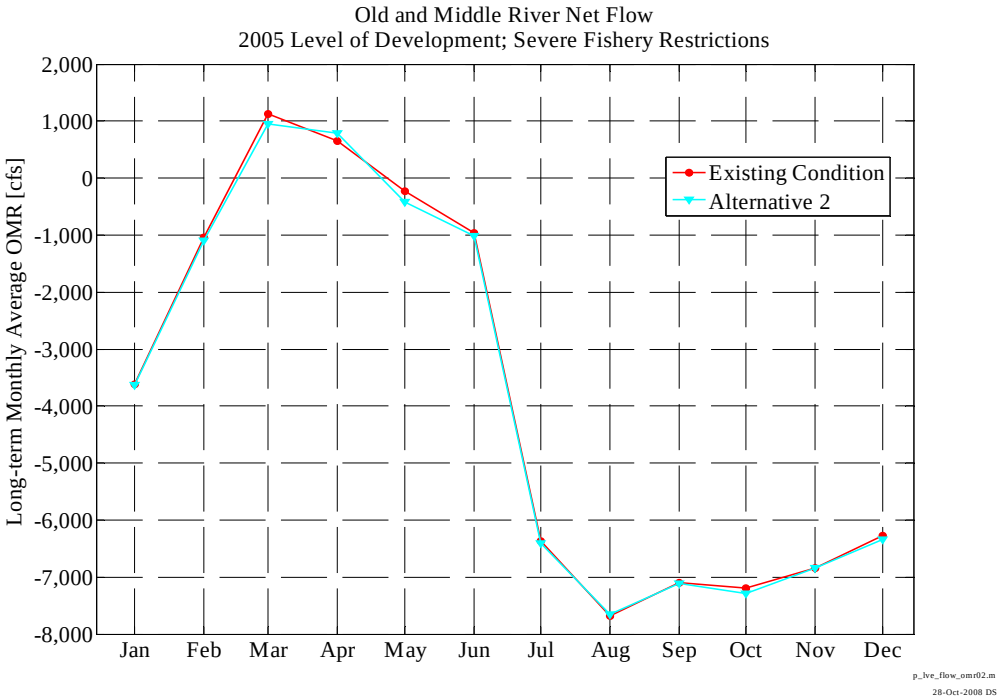
Alternative 2 - Existing Condition

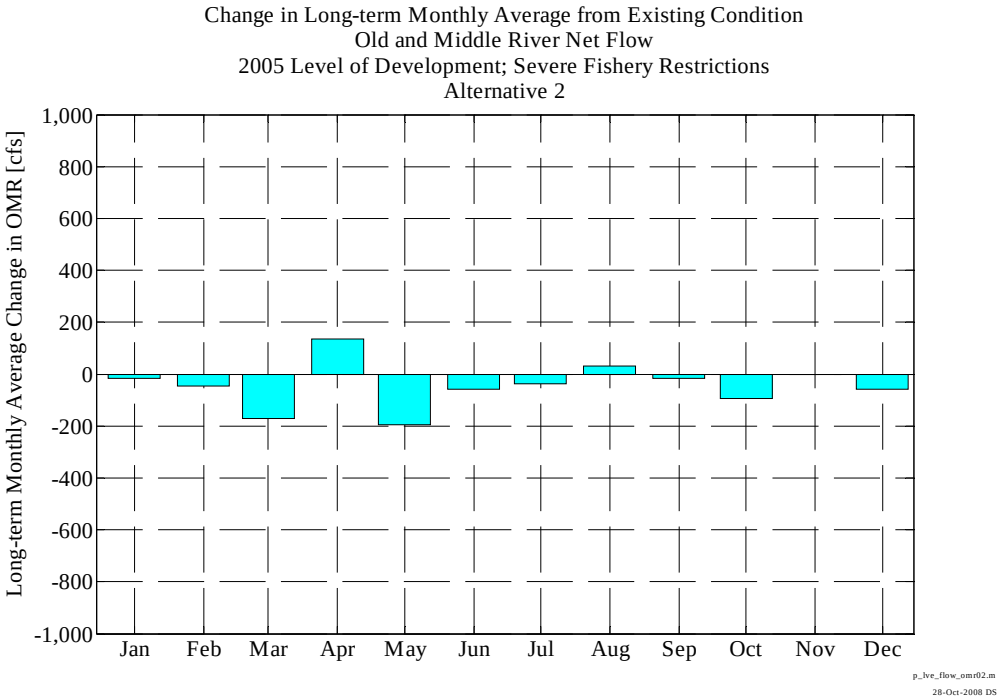
2005 Level of Development; Severe Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-284	-212	-12	-12	-124	-291	95	-28	-80	234	293	129
1977	166	130	122	36	129	-210	29	51	-13	294	-17	-5
1978	-15	-21	-320	-67	0	-157	199	-179	-131	-466	6	-323
1979	-6	-151	-168	-13	-351	-333	121	-253	60	47	-17	-35
1980	-768	-258	166	248	-51	-54	145	-278	129	48	69	35
1981	5	-11	-81	-10	-4	81	49	-431	-202	141	136	16
1982	-21	-256	-325	-34	-67	-32	295	-274	110	54	56	22
1983	-177	-105	-21	-44	-68	-47	291	-261	106	47	57	20
1984	-4	-9	-17	-5	-112	-62	-1	-296	15	50	87	11
1985	-285	-156	-188	-4	-121	-274	112	-275	10	43	52	5
1986	3	386	-166	-81	-82	-790	386	-469	-25	84	-69	27
1987	3	201	-114	77	-43	-8	216	-25	-312	59	6	-6
1988	2	-12	-16	-231	-4	-66	123	-276	-317	-535	119	-6
1989	49	-56	45	113	132	-132	7	-58	-297	-327	50	49
1990	70	47	277	-110	-8	-203	101	-31	4	-371	-580	-186
1991	-221	463	-131	-145	16	-157	3	-21	30	-7	273	7
Avg	-93	-1	-59	-18	-47	-171	136	-194	-57	-38	33	-15
W/AN/BN	-141	-59	-121	0	-104	-211	205	-287	38	-20	27	-35
D/C	-55	44	-11	-32	-3	-140	82	-122	-131	-52	37	0


Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 2
Tidal Residual OMR [cfs], Existing Condition
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
Tidal Residual OMR [cfs]
Existing Condition
Alternative 2
change in OMR
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
Long-term Monthly Average OMR [cfs]
2,000
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Existing Condition
Alternative 2
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Existing Condition
Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
Alternative 2
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

Alternative 3

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

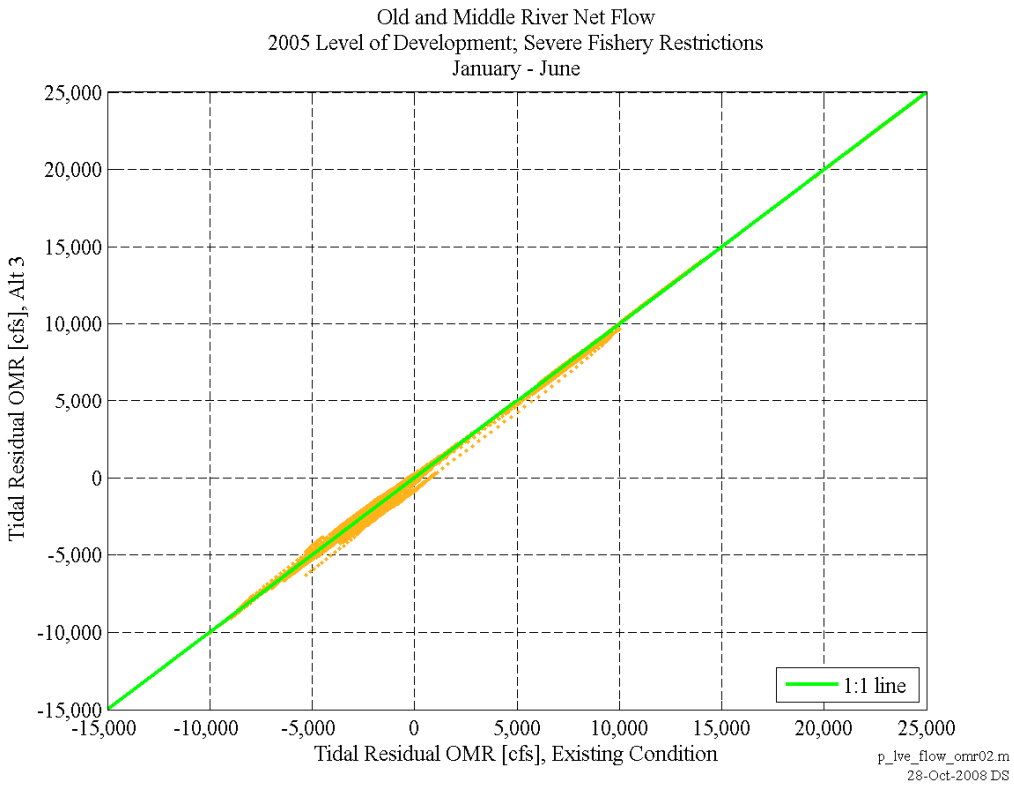
Alternative 3
2005 Level of Development; Severe Fishery Restrictions

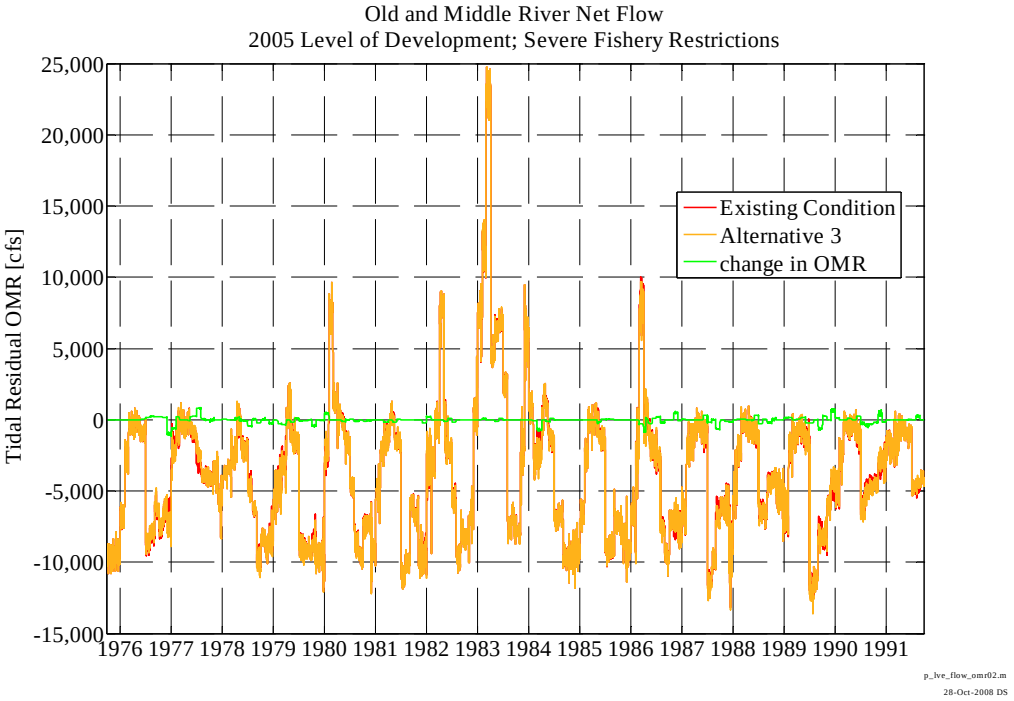
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-9,539	-9,574	-9,410	-6,663	-2,292	-332	-322	-624	-938	-8,467	-7,797	-6,134
1977	-7,508	-6,308	-7,341	-2,340	-750	-172	-527	-430	-941	-2,376	-3,864	-4,142
1978	-4,159	-3,522	-5,623	-3,878	-3,507	-2,702	-914	-1,190	-2,080	-4,792	-6,190	-10,008
1979	-8,370	-8,941	-8,329	-5,316	-4,482	-3,174	842	-1,248	-1,530	-8,800	-9,250	-9,238
1980	-8,777	-9,621	-9,547	-2,233	6,977	1,498	80	-644	-1,728	-4,598	-8,603	-9,679
1981	-7,484	-7,245	-9,160	-5,097	-2,384	-1,545	-176	-789	-1,362	-10,992	-10,038	-6,145
1982	-6,682	-9,590	-9,700	-2,590	-3,385	-369	7,493	-540	-2,075	-5,720	-9,779	-7,906
1983	-8,346	-6,753	97	7,200	11,875	22,722	5,296	6,210	6,862	2,455	-7,371	-7,220
1984	-7,875	-2,475	4,941	1,189	-2,714	-2,415	733	-62	-1,440	-7,028	-6,610	-9,618
1985	-9,471	-9,439	-9,195	-6,678	-2,583	-205	-48	-788	-1,337	-9,087	-8,768	-7,172
1986	-7,284	-8,480	-9,076	-6,546	-2,575	7,749	439	-1,260	-2,073	-2,490	-7,706	-9,585
1987	-7,131	-6,927	-7,690	-6,395	-2,182	-1,350	-393	-530	-943	-11,453	-9,886	-6,875
1988	-6,095	-6,074	-9,113	-5,075	-1,920	-94	-447	-778	-872	-6,384	-6,440	-4,540
1989	-4,028	-4,897	-5,405	-6,607	-2,085	-1,268	-606	-844	-1,507	-11,905	-11,251	-8,257
1990	-8,131	-5,920	-4,162	-4,993	-2,368	-339	-569	-390	-964	-6,169	-5,198	-4,862
1991	-4,516	-2,848	-2,907	-1,488	-2,166	-1,420	-564	-788	-1,117	-4,726	-4,403	-4,135
Avg	-7,212	-6,788	-6,351	-3,594	-1,034	1,037	645	-293	-878	-6,408	-7,697	-7,220
W/AN/BN	-7,356	-7,055	-5,319	-1,739	313	3,330	1,996	181	-581	-4,425	-7,930	-9,036
D/C	-7,100	-6,581	-7,154	-5,037	-2,081	-747	-406	-662	-1,109	-7,951	-7,516	-5,807

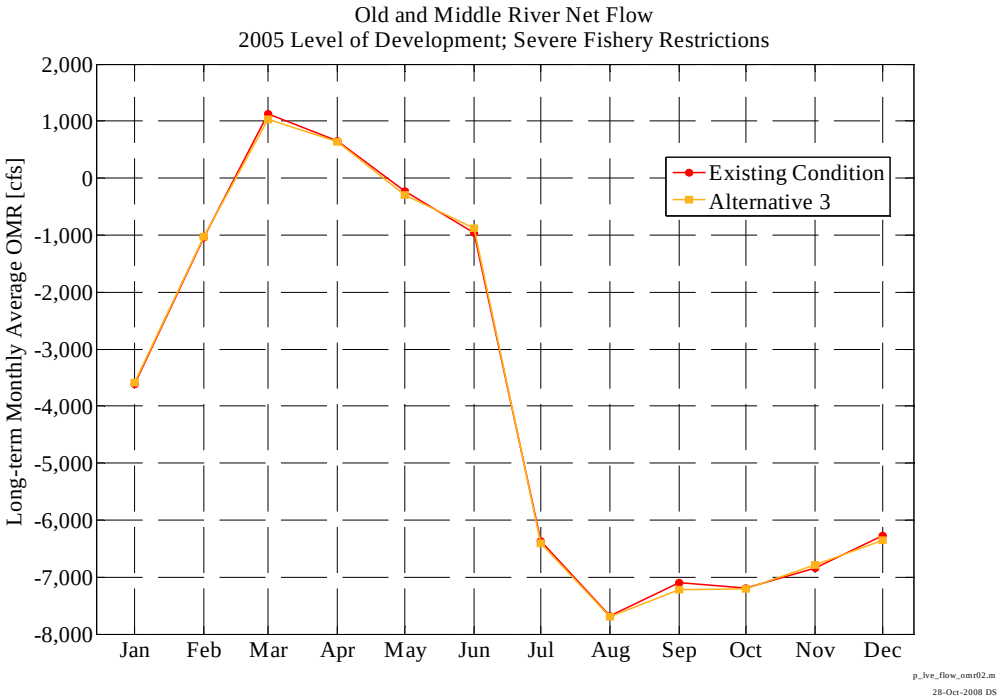
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

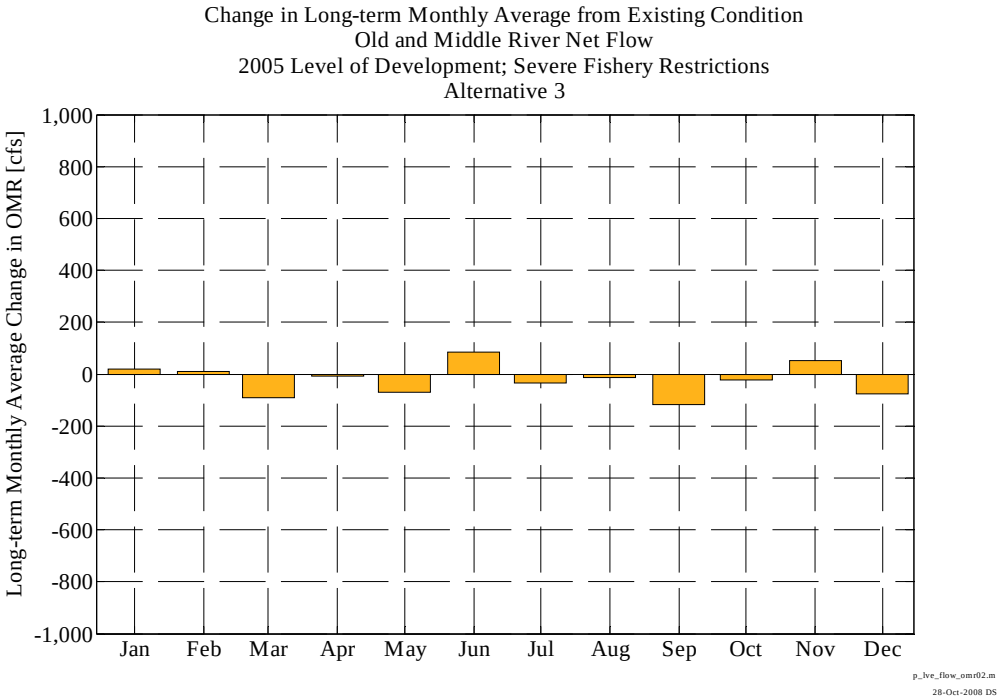
Alternative 3 - Existing Condition
2005 Level of Development; Severe Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-2	-2	-1	8	5	0	0	1	28	145	232	214
1977	190	156	-992	-620	194	5	4	85	235	786	41	-3
1978	-37	-7	0	19	0	2	83	-27	-76	-441	30	-231
1979	-3	-4	-245	-6	-263	-348	-2	-155	67	-84	-83	0
1980	-435	-15	-40	432	10	-2	0	-138	5	20	-101	-9
1981	-103	-43	-4	-2	0	-151	-1	-177	57	-16	-16	-11
1982	-35	-7	-226	224	2	-11	0	-123	90	-169	-12	-6
1983	-2	4	2	6	70	-1	-9	-126	80	-19	-10	-15
1984	-12	-3	1	-1	-55	-689	-11	-136	87	-18	-19	-23
1985	6	-6	1	0	-1	0	0	-198	56	16	18	1
1986	0	-20	0	1	-23	-294	-324	-244	90	198	-199	-10
1987	0	465	-59	32	5	1	0	4	293	-188	7	-649
1988	-4	-115	-156	2	53	45	0	-13	293	-275	35	-203
1989	19	7	-15	121	149	3	42	150	-230	-232	-2	-630
1990	250	-5	641	134	1	0	89	1	256	-267	-396	-328
1991	-198	404	-138	-23	9	0	0	0	28	-18	261	9
Avg	-23	51	-77	20	10	-90	-8	-69	85	-35	-13	-118
W/AN/BN	-75	-7	-73	96	-37	-192	-38	-136	49	-73	-56	-42
D/C	18	96	-80	-39	46	-11	15	-16	113	-5	20	-178


Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 3
Tidal Residual OMR [cfs], Existing Condition
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
Tidal Residual OMR [cfs]
Existing Condition
Alternative 3
change in OMR
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
Long-term Monthly Average OMR [cfs]
2,000
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Existing Condition
Alternative 3
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Existing Condition
Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
Alternative 3
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

Alternative 4

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

Alternative 4

2005 Level of Development; Severe Fishery Restrictions

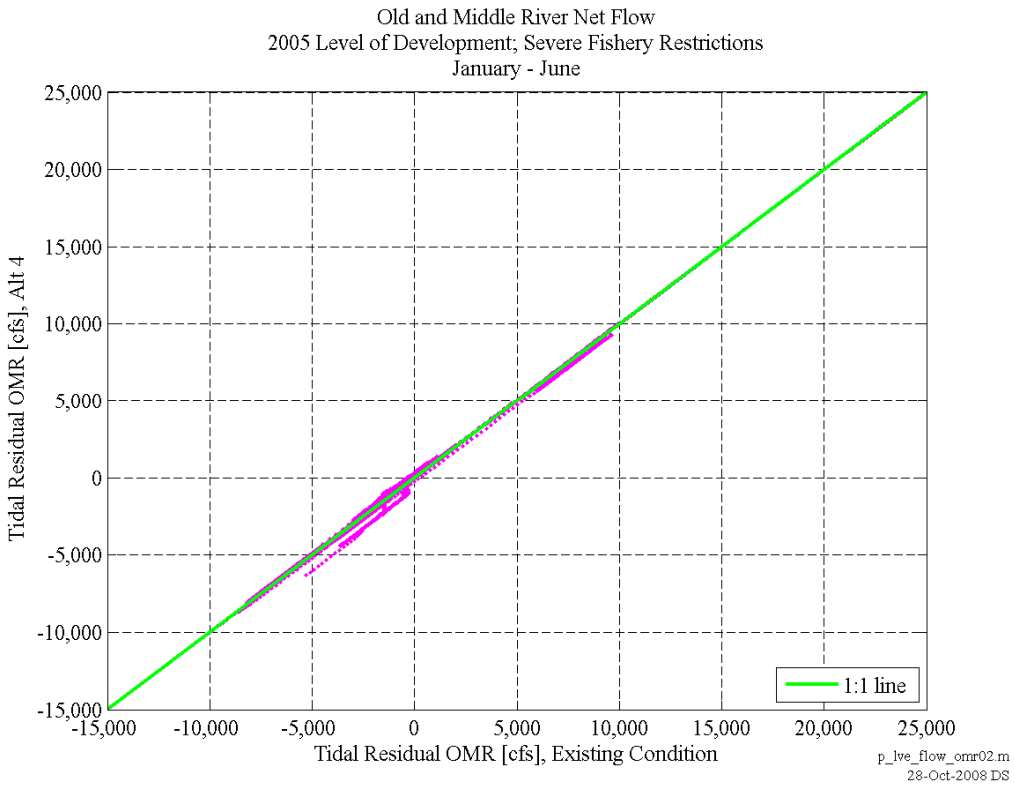
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-9,538	-9,572	-9,410	-6,669	-2,296	-332	-322	-625	-966	-8,490	-7,816	-6,161
1977	-7,516	-6,313	-7,322	-2,487	-634	-169	-531	-515	-1,176	-2,922	-3,974	-4,143
1978	-4,124	-3,549	-5,623	-3,896	-3,507	-2,703	-752	-1,132	-2,002	-4,430	-6,222	-9,778
1979	-8,300	-8,933	-8,102	-5,310	-4,219	-2,882	844	-1,093	-1,597	-8,776	-9,035	-9,237
1980	-8,349	-9,622	-9,507	-2,851	6,666	1,498	80	-505	-1,734	-4,623	-8,506	-9,673
1981	-7,392	-7,212	-9,163	-5,099	-2,383	-1,394	-175	-612	-1,419	-10,976	-10,016	-6,134
1982	-6,659	-9,597	-9,473	-2,765	-3,386	-378	7,493	-417	-2,166	-5,555	-9,771	-7,903
1983	-8,345	-6,756	96	7,197	11,807	22,725	5,305	6,336	6,782	2,470	-7,365	-7,207
1984	-7,864	-2,470	4,942	1,190	-2,659	-1,727	744	74	-1,528	-7,012	-6,592	-9,595
1985	-9,476	-9,435	-9,195	-6,678	-2,582	-205	-47	-589	-1,393	-9,117	-8,790	-7,173
1986	-7,284	-8,466	-9,078	-6,548	-2,557	8,099	861	-999	-2,163	-2,688	-7,453	-9,660
1987	-7,132	-7,454	-7,549	-6,464	-2,185	-1,351	-393	-534	-1,236	-11,262	-9,888	-6,208
1988	-6,091	-5,955	-8,952	-5,075	-1,973	-140	-448	-765	-1,165	-6,134	-6,488	-4,337
1989	-4,046	-4,883	-5,430	-6,610	-2,096	-1,268	-607	-993	-1,277	-11,676	-11,251	-7,662
1990	-8,347	-5,912	-4,705	-5,124	-2,369	-339	-658	-390	-1,221	-6,069	-5,211	-4,634
1991	-4,501	-2,876	-2,905	-1,478	-2,171	-1,420	-564	-788	-1,144	-4,692	-4,547	-4,141
Avg	-7,185	-6,813	-6,336	-3,667	-1,034	1,126	677	-222	-963	-6,372	-7,683	-7,103
W/AN/BN	-7,275	-7,056	-5,249	-1,855	306	3,519	2,082	323	-630	-4,373	-7,849	-9,008
D/C	-7,115	-6,624	-7,181	-5,076	-2,077	-735	-416	-646	-1,222	-7,926	-7,553	-5,621

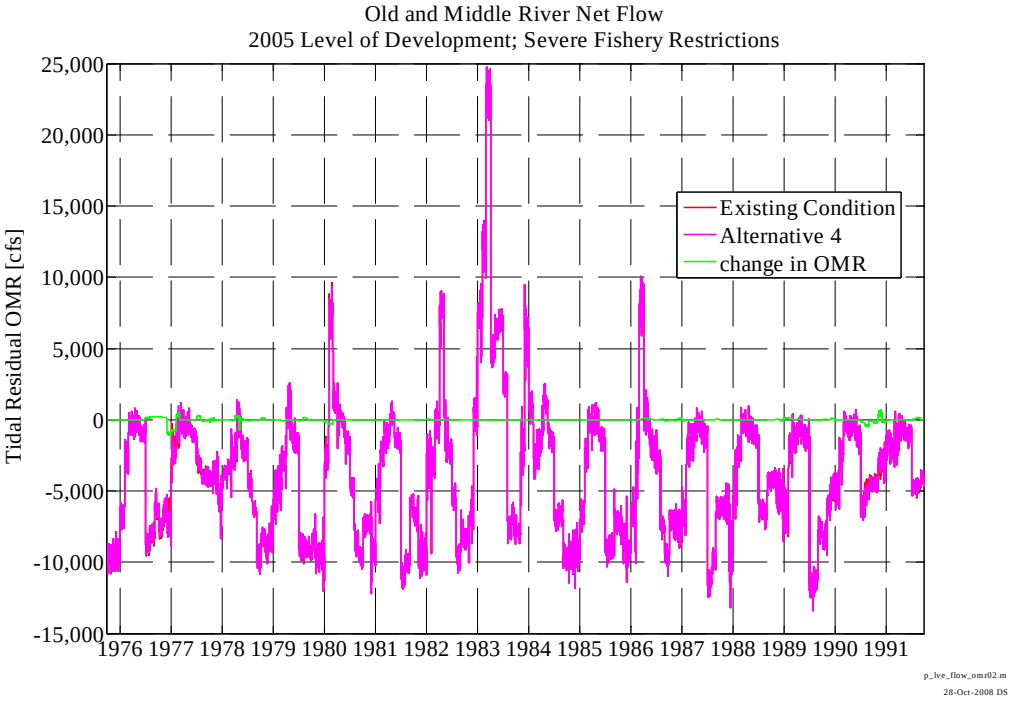
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

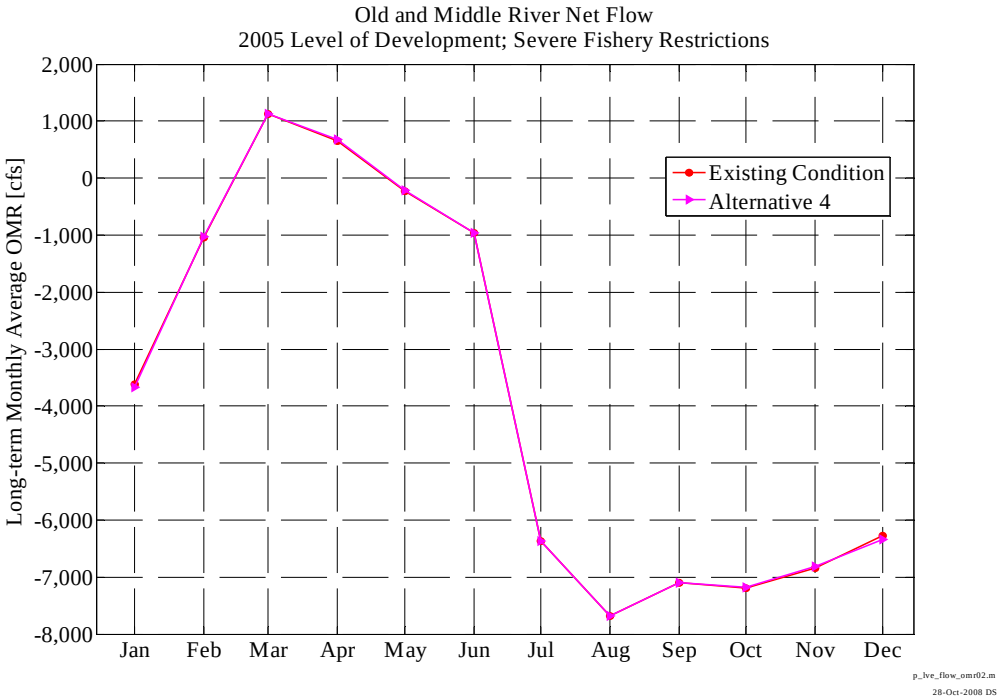
Alternative 4 - Existing Condition

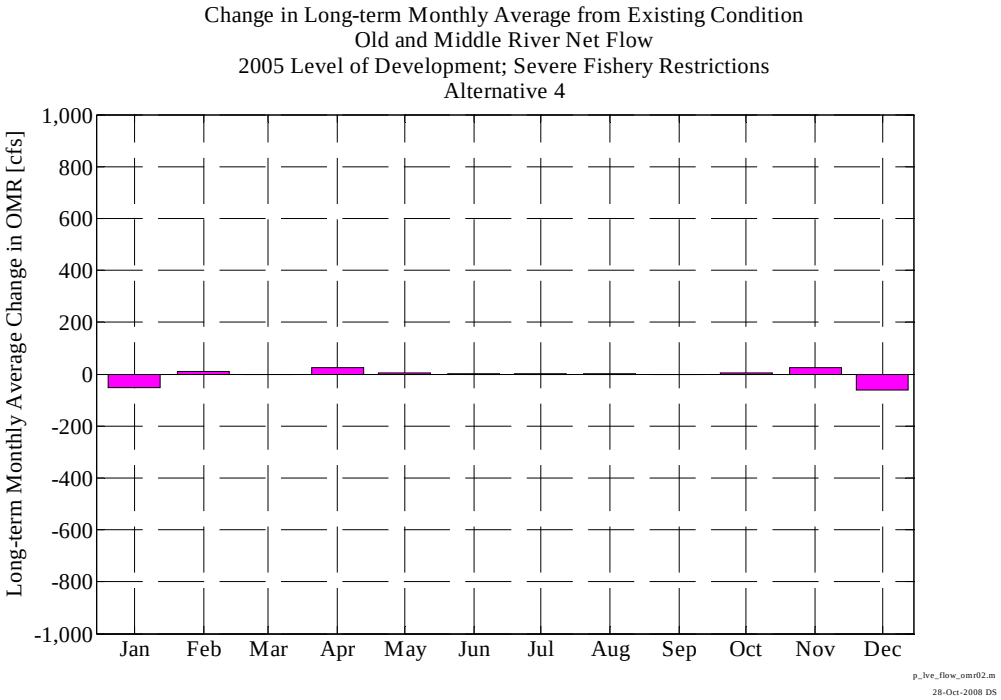
2005 Level of Development; Severe Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-1	-1	0	1	1	0	0	0	1	122	212	187
1977	181	151	-973	-767	310	7	0	0	0	240	-69	-3
1978	-2	-33	0	0	0	1	245	31	2	-79	-2	0
1979	68	3	-18	0	0	-56	0	0	-1	-60	132	1
1980	-7	-15	0	-186	-301	-3	0	0	0	-4	-4	-3
1981	-11	-10	-7	-3	0	0	0	0	0	1	7	0
1982	-12	-14	0	48	0	-20	0	0	0	-4	-4	-2
1983	-1	2	1	2	1	2	0	0	0	-4	-4	-2
1984	-1	2	2	0	0	-1	0	0	0	-2	-1	0
1985	2	-1	0	0	0	0	0	0	0	-14	-5	0
1986	0	-5	-1	-2	-4	56	98	16	0	0	54	-85
1987	0	-62	82	-38	2	0	0	0	0	3	5	18
1988	0	4	5	2	0	0	0	0	0	-24	-13	0
1989	0	21	-40	118	138	3	42	1	0	-3	-2	-36
1990	33	3	98	2	0	0	0	0	0	-167	-408	-100
1991	-183	376	-136	-13	4	0	0	0	1	16	117	3
Avg	4	26	-62	-52	9	-1	24	3	0	1	1	-1
W/AN/BN	6	-9	-2	-20	-43	-3	49	7	0	-22	25	-13
D/C	2	53	-108	-78	51	1	5	0	0	19	-17	8


Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 4
Tidal Residual OMR [cfs], Existing Condition
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
Tidal Residual OMR [cfs]
Existing Condition
Alternative 4
change in OMR
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
Long-term Monthly Average OMR [cfs]
2,000
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Existing Condition
Alternative 4
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Existing Condition
Old and Middle River Net Flow
2005 Level of Development; Severe Fishery Restrictions
Alternative 4
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

2030 Level of Development, Moderate Fishery Restrictions

Existing Condition

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

Future Without Project

2030 Level of Development; Moderate Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-10,541	-10,551	-9,748	-6,699	-3,362	-2,631	-979	-1,591	-3,328	-6,503	-6,176	-6,527
1977	-7,159	-6,319	-5,995	-4,732	-328	-1,123	-828	-697	-2,009	-2,227	-3,602	-4,559
1978	-2,302	-3,172	-5,657	-3,770	-4,725	-5,107	-1,632	-1,900	-3,965	-5,885	-7,654	-8,913
1979	-8,670	-9,736	-7,222	-5,324	-5,287	-4,075	330	-1,746	-3,859	-9,734	-9,183	-8,256
1980	-7,619	-10,500	-9,874	-6,487	3,691	-212	-457	-1,140	-2,485	-5,760	-7,868	-9,053
1981	-8,709	-7,633	-8,742	-5,097	-3,615	-3,614	-844	-1,440	-3,605	-10,727	-10,375	-6,016
1982	-6,142	-10,430	-9,845	-2,815	-3,964	-2,826	7,267	-556	-3,846	-5,176	-9,003	-7,323
1983	-10,162	-5,241	-347	5,325	11,590	20,844	3,494	4,316	5,482	804	-7,212	-7,160
1984	-10,402	-2,558	5,198	-119	-3,484	-3,138	226	-557	-3,777	-8,351	-9,154	-7,735
1985	-9,952	-10,473	-9,538	-6,715	-3,665	-2,539	-632	-1,149	-3,566	-11,532	-11,167	-8,175
1986	-7,107	-8,622	-9,399	-6,592	-2,622	7,822	253	-1,673	-2,024	-2,781	-7,130	-9,231
1987	-8,111	-7,871	-6,881	-5,153	-3,011	-3,112	-703	-1,497	-3,428	-10,026	-8,954	-5,850
1988	-6,438	-6,430	-9,009	-5,054	-2,717	-1,070	-1,105	-1,696	-2,373	-5,337	-5,047	-4,789
1989	-3,903	-6,669	-3,269	-6,752	-1,180	-3,474	-1,196	-1,838	-3,458	-11,968	-11,554	-7,688
1990	-8,480	-6,203	-5,818	-5,171	-2,891	-2,689	-908	-1,234	-3,353	-5,267	-4,664	-4,676
1991	-4,420	-4,231	-1,940	-2,333	-2,531	-3,603	-1,469	-1,722	-1,809	-2,569	-3,839	-4,136
Avg	-7,507	-7,290	-6,130	-4,218	-1,756	-659	51	-1,007	-2,588	-6,440	-7,661	-6,880
W/AN/BN	-7,486	-7,180	-5,307	-2,826	-686	1,901	1,354	-465	-2,068	-5,269	-8,172	-8,239
D/C	-7,524	-7,376	-6,771	-5,301	-2,589	-2,651	-963	-1,429	-2,992	-7,351	-7,264	-5,824

Alternative 1

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

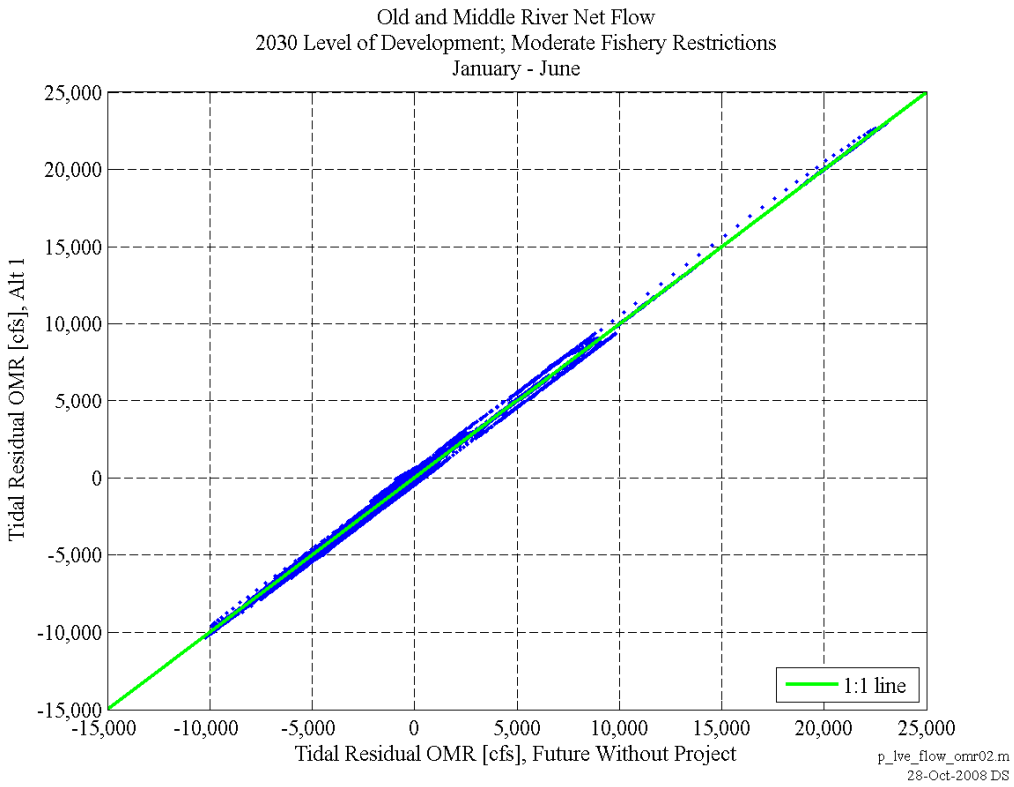
Alternative 1
2030 Level of Development; Moderate Fishery Restrictions

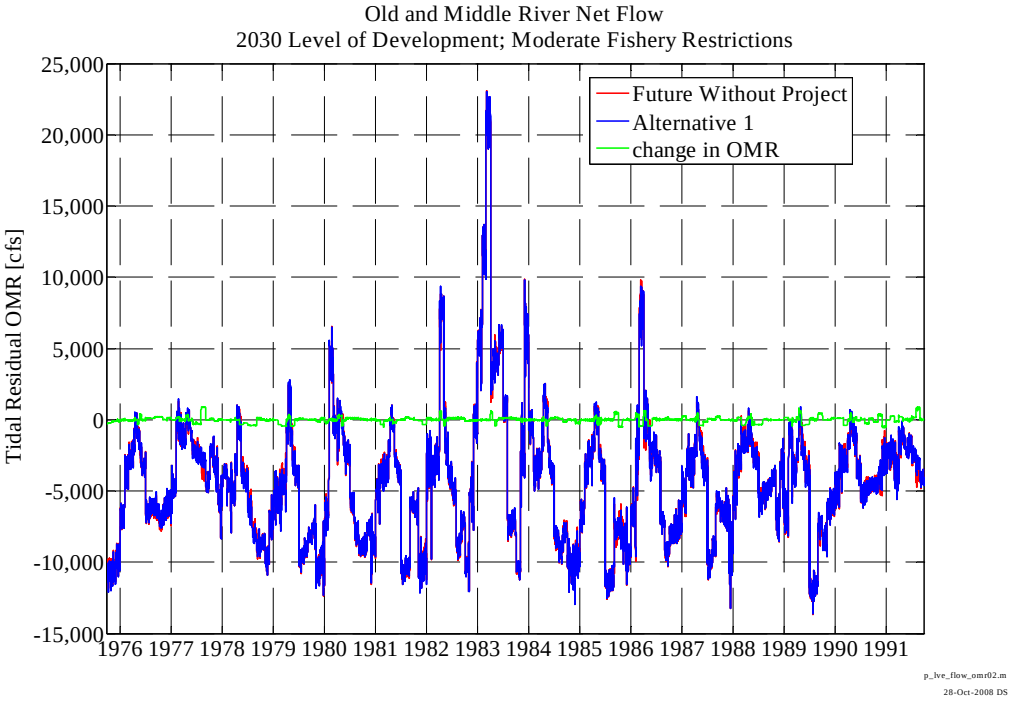
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-10,779	-10,685	-9,805	-6,702	-3,382	-2,700	-977	-1,611	-3,326	-6,416	-6,070	-6,328
1977	-6,967	-6,322	-5,874	-4,727	-171	-1,139	-693	-700	-2,298	-2,496	-2,730	-4,547
1978	-2,224	-3,261	-5,647	-3,770	-4,727	-5,118	-1,629	-2,237	-4,199	-6,298	-8,066	-8,815
1979	-8,672	-9,771	-7,229	-5,347	-5,625	-4,506	429	-2,165	-3,856	-9,670	-9,142	-8,257
1980	-7,611	-10,611	-9,788	-6,662	3,697	-246	-218	-1,378	-2,369	-5,649	-7,759	-8,995
1981	-8,703	-7,629	-8,709	-5,134	-3,942	-3,701	-844	-1,638	-3,613	-10,716	-10,222	-5,958
1982	-6,137	-10,500	-10,181	-2,726	-3,964	-2,836	7,527	-789	-3,738	-5,066	-8,888	-7,235
1983	-10,250	-5,283	-386	5,302	11,588	20,837	3,755	4,085	5,591	910	-7,105	-7,077
1984	-10,358	-2,570	5,170	-127	-3,493	-3,156	229	-807	-3,687	-8,211	-9,090	-7,878
1985	-9,934	-10,492	-9,767	-6,723	-3,677	-2,576	-534	-1,343	-3,566	-11,508	-11,169	-7,726
1986	-7,568	-8,634	-9,372	-6,608	-2,317	7,402	543	-2,105	-1,937	-2,790	-7,120	-9,150
1987	-8,106	-7,868	-6,871	-4,914	-3,007	-3,104	-514	-1,882	-3,580	-9,973	-8,939	-5,637
1988	-6,434	-6,445	-9,021	-5,098	-2,574	-1,444	-1,027	-1,786	-2,696	-5,658	-5,011	-4,797
1989	-3,903	-6,665	-3,279	-6,617	-1,185	-3,594	-830	-2,199	-3,795	-11,903	-11,553	-7,251
1990	-8,487	-6,204	-5,709	-5,086	-2,796	-3,062	-762	-1,230	-3,404	-5,223	-4,927	-4,610
1991	-4,571	-3,911	-2,424	-2,347	-2,285	-3,724	-1,259	-1,729	-1,825	-2,425	-3,059	-4,128
Avg	-7,544	-7,303	-6,181	-4,205	-1,741	-792	200	-1,220	-2,644	-6,443	-7,553	-6,774
W/AN/BN	-7,546	-7,233	-5,347	-2,848	-692	1,768	1,520	-771	-2,028	-5,253	-8,167	-8,201
D/C	-7,543	-7,358	-6,829	-5,261	-2,558	-2,783	-827	-1,569	-3,123	-7,369	-7,076	-5,665

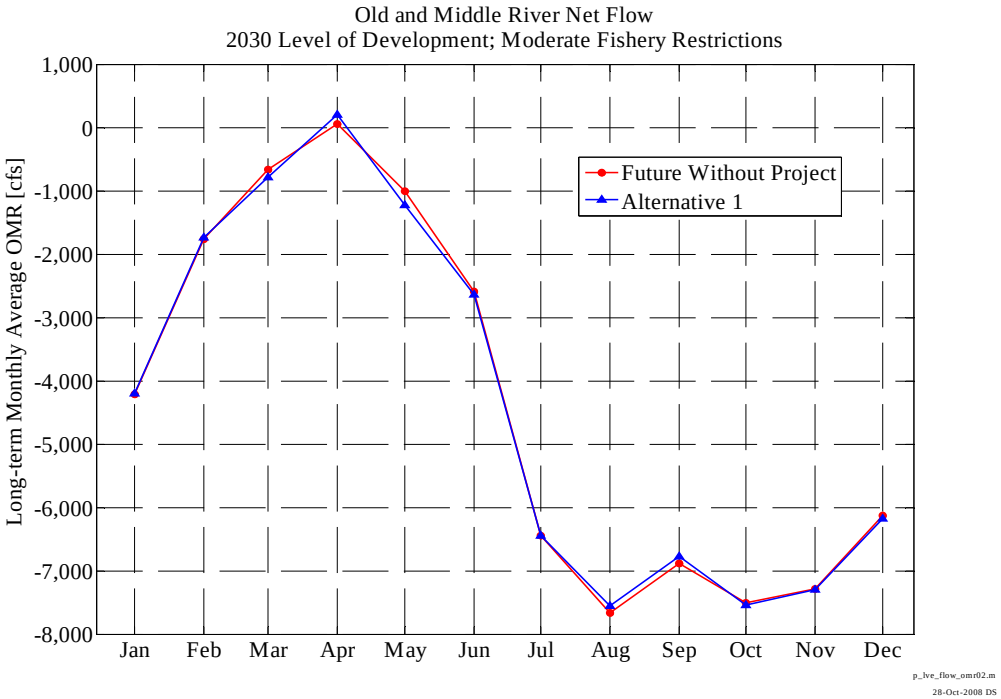
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

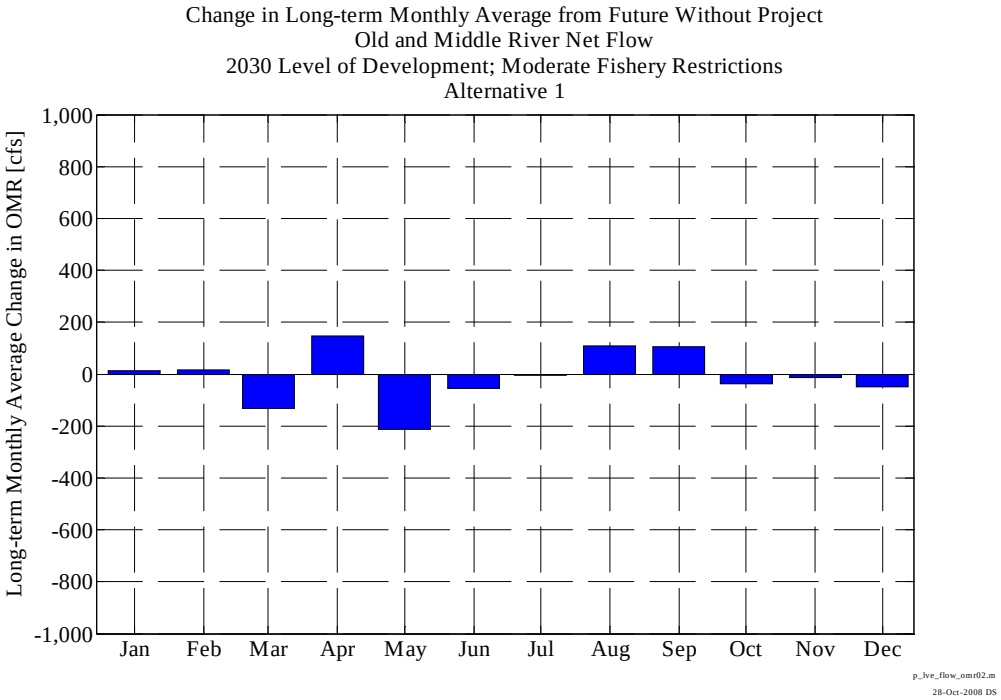
Alternative 1 - Future Without Project
2030 Level of Development; Moderate Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-238	-135	-57	-3	-20	-69	2	-20	1	87	107	198
1977	192	-3	121	5	157	-16	135	-3	-289	-269	872	12
1978	78	-89	10	0	-2	-11	3	-336	-234	-412	-413	99
1979	-3	-35	-7	-23	-338	-431	99	-419	3	64	41	-1
1980	8	-111	86	-175	6	-34	240	-238	116	111	109	58
1981	6	4	33	-37	-326	-86	0	-198	-8	12	152	58
1982	5	-70	-336	89	0	-10	260	-233	107	110	115	88
1983	-88	-43	-39	-23	-2	-7	261	-231	109	107	107	83
1984	44	-13	-27	-8	-9	-18	3	-250	90	140	64	-144
1985	19	-19	-229	-9	-12	-37	98	-194	0	23	-3	449
1986	-462	-12	27	-16	306	-420	289	-432	87	-9	10	80
1987	4	3	10	239	3	8	189	-385	-152	53	14	213
1988	3	-15	-12	-44	142	-374	78	-90	-324	-321	36	-8
1989	0	4	-11	135	-5	-120	366	-361	-336	65	1	436
1990	-7	-1	109	86	95	-373	146	4	-51	43	-263	65
1991	-150	320	-484	-14	246	-121	210	-8	-16	143	780	7
Avg	-37	-13	-50	13	15	-132	149	-212	-56	-3	108	106
W/AN/BN	-60	-53	-41	-22	-6	-133	165	-306	40	16	5	38
D/C	-19	18	-58	40	31	-132	136	-139	-131	-18	189	159


Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 1
Tidal Residual OMR [cfs], Future Without Project
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
Future Without Project
Alternative 1
change in OMR
Tidal Residual OMR [cfs]
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
Long-term Monthly Average OMR [cfs]
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Future Without Project
Alternative 1
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Future Without Project
Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
Alternative 1
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

Alternative 2

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

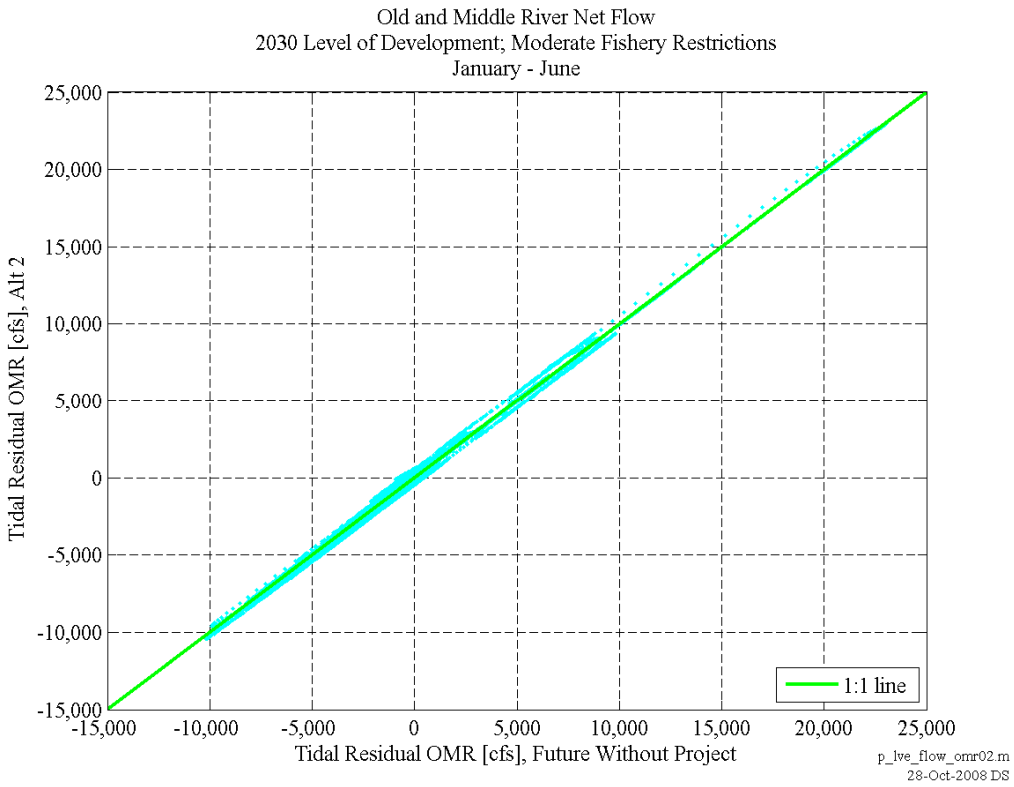
Alternative 2
2030 Level of Development; Moderate Fishery Restrictions

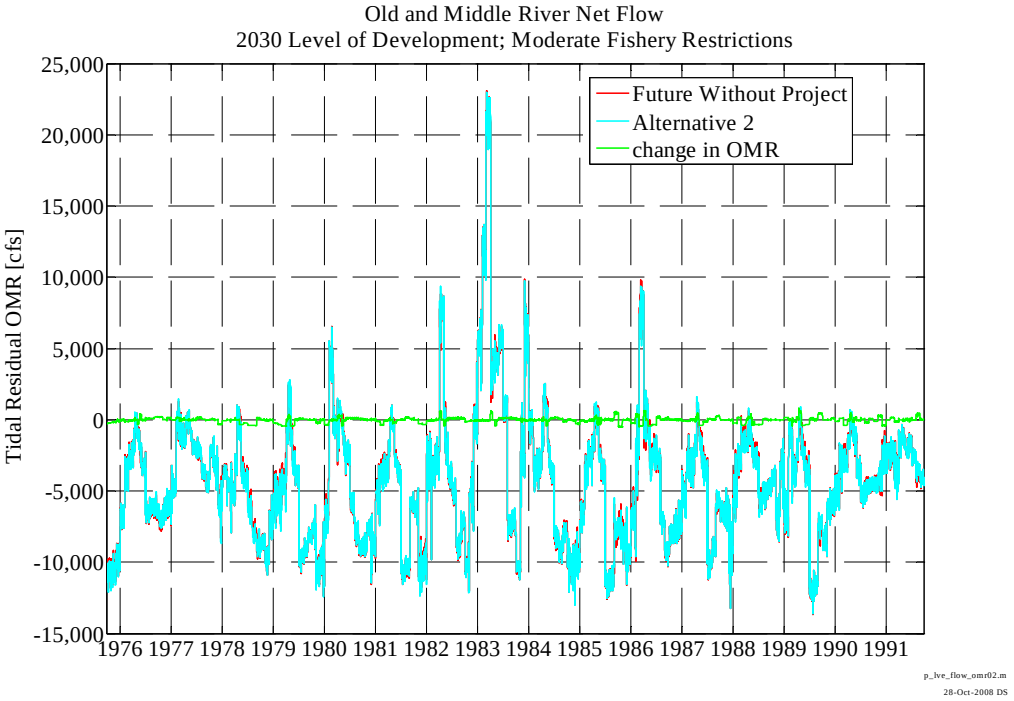
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-10,781	-10,746	-9,806	-6,703	-3,481	-2,701	-977	-1,611	-3,327	-6,430	-6,084	-6,328
1977	-6,971	-6,322	-5,877	-4,726	-172	-1,139	-815	-706	-2,020	-2,094	-3,542	-4,560
1978	-2,269	-3,178	-5,970	-3,839	-4,725	-5,118	-1,629	-2,237	-4,198	-6,287	-8,056	-8,817
1979	-8,674	-9,776	-7,230	-5,566	-5,627	-4,506	429	-2,165	-3,856	-9,669	-9,141	-8,257
1980	-7,613	-10,699	-9,868	-6,839	3,649	-237	-218	-1,378	-2,369	-5,649	-7,759	-8,995
1981	-8,703	-7,629	-8,710	-5,218	-3,975	-3,702	-844	-1,638	-3,613	-10,722	-10,229	-5,963
1982	-6,137	-10,717	-10,182	-2,882	-4,022	-2,839	7,527	-789	-3,738	-5,066	-8,889	-7,235
1983	-10,289	-5,316	-418	5,281	11,550	20,795	3,755	4,085	5,591	910	-7,105	-7,077
1984	-10,358	-2,570	5,134	-127	-3,533	-3,156	229	-807	-3,687	-8,211	-9,090	-7,878
1985	-9,933	-10,529	-9,820	-6,790	-3,791	-2,577	-534	-1,343	-3,566	-11,508	-11,170	-7,726
1986	-7,568	-8,634	-9,372	-6,837	-2,319	7,402	543	-2,105	-2,368	-2,608	-7,119	-9,150
1987	-8,106	-7,868	-6,872	-5,230	-3,108	-3,105	-516	-1,882	-3,586	-9,984	-8,948	-5,607
1988	-6,434	-6,447	-9,022	-5,286	-2,576	-1,444	-1,027	-1,785	-2,696	-5,678	-4,996	-4,792
1989	-3,895	-6,666	-3,280	-6,617	-1,186	-3,594	-830	-2,199	-3,795	-11,903	-11,554	-7,243
1990	-8,488	-6,204	-5,723	-5,292	-2,798	-3,062	-762	-1,230	-3,391	-5,213	-4,864	-4,603
1991	-4,541	-3,970	-2,343	-2,352	-2,394	-3,732	-1,466	-1,744	-1,835	-2,569	-3,492	-4,126
Avg	-7,548	-7,329	-6,210	-4,314	-1,782	-795	179	-1,221	-2,653	-6,418	-7,627	-6,772
W/AN/BN	-7,558	-7,270	-5,415	-2,973	-718	1,763	1,519	-771	-2,089	-5,226	-8,165	-8,201
D/C	-7,539	-7,376	-6,828	-5,357	-2,609	-2,784	-863	-1,571	-3,092	-7,345	-7,209	-5,661

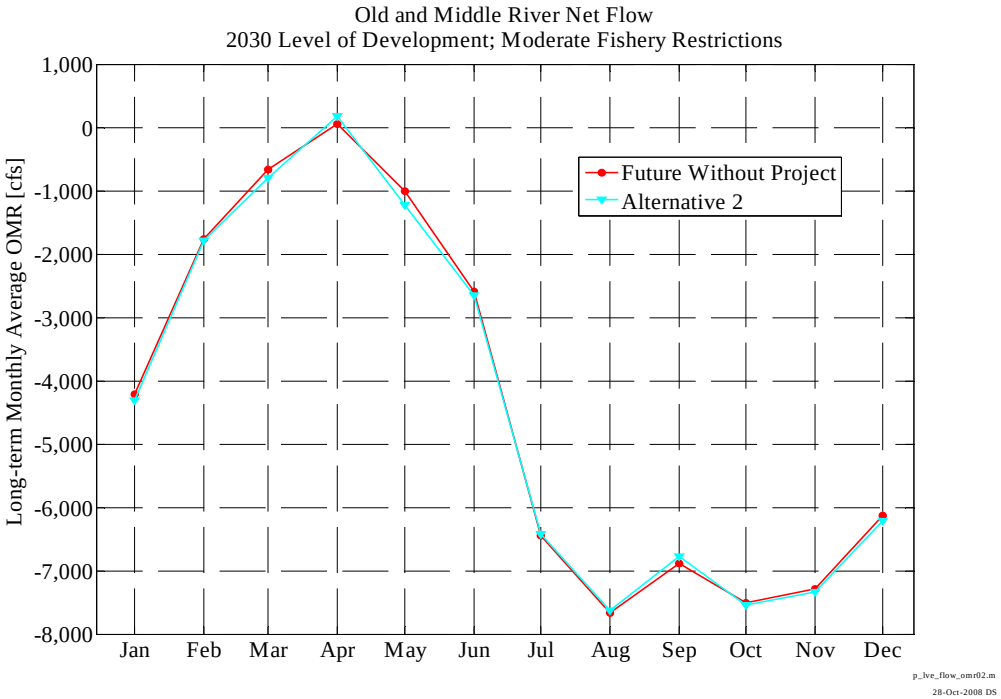
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

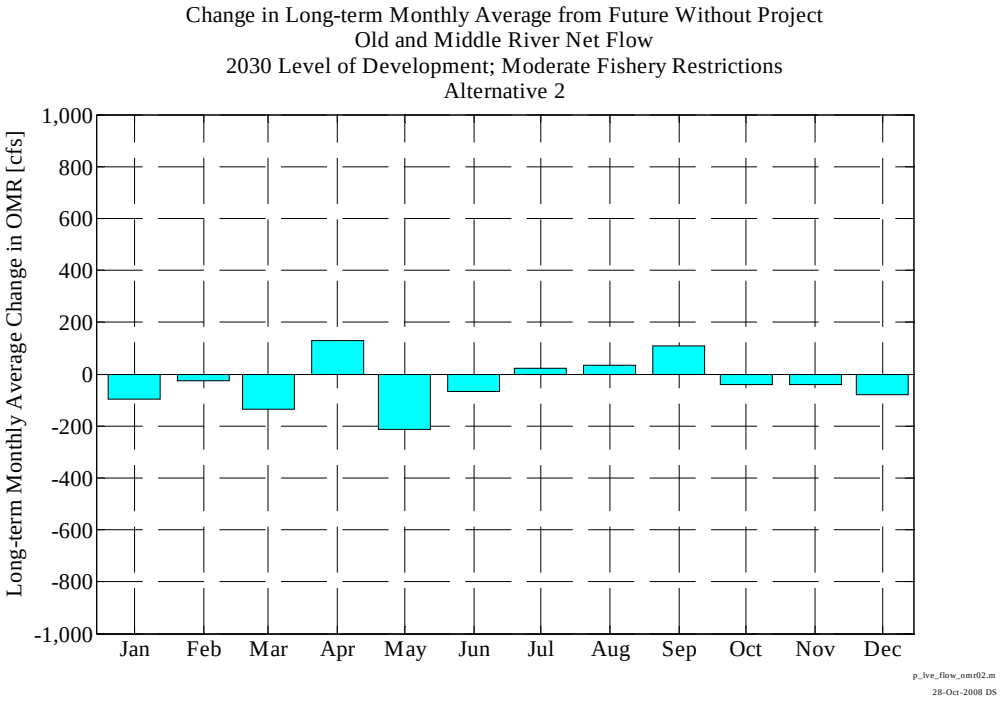
Alternative 2 - Future Without Project
2030 Level of Development; Moderate Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-240	-196	-57	-4	-119	-70	2	-20	1	73	92	199
1977	188	-3	118	6	156	-16	13	-9	-12	133	60	0
1978	32	-6	-313	-70	-1	-11	3	-336	-233	-402	-402	96
1979	-4	-40	-8	-243	-340	-431	99	-419	3	65	42	-1
1980	6	-199	6	-352	-42	-25	240	-238	116	111	109	58
1981	6	4	32	-121	-360	-87	0	-198	-8	6	146	54
1982	5	-287	-337	-67	-57	-13	260	-233	107	110	114	88
1983	-127	-76	-71	-44	-39	-49	261	-231	109	107	107	83
1984	44	-13	-63	-8	-49	-19	3	-250	90	140	64	-143
1985	19	-56	-281	-75	-126	-38	98	-194	0	23	-3	449
1986	-461	-12	27	-245	303	-420	289	-432	-343	173	11	80
1987	4	3	8	-77	-98	7	187	-385	-158	42	6	242
1988	3	-17	-13	-232	141	-374	78	-89	-324	-340	50	-2
1989	8	3	-12	135	-5	-120	366	-361	-336	65	1	445
1990	-8	-2	95	-121	93	-373	146	4	-37	54	-200	73
1991	-120	262	-403	-19	138	-129	3	-22	-26	-1	347	10
Avg	-40	-40	-80	-96	-25	-135	128	-213	-66	22	34	108
W/AN/BN	-72	-90	-108	-147	-32	-138	165	-306	-22	43	6	37
D/C	-15	0	-57	-57	-20	-133	99	-142	-100	6	56	163


Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 2
Tidal Residual OMR [cfs], Future Without Project
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
Future Without Project
Alternative 2
change in OMR
Tidal Residual OMR [cfs]
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
Long-term Monthly Average OMR [cfs]
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Future Without Project
Alternative 2
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Future Without Project
Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
Alternative 2
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

Alternative 3

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

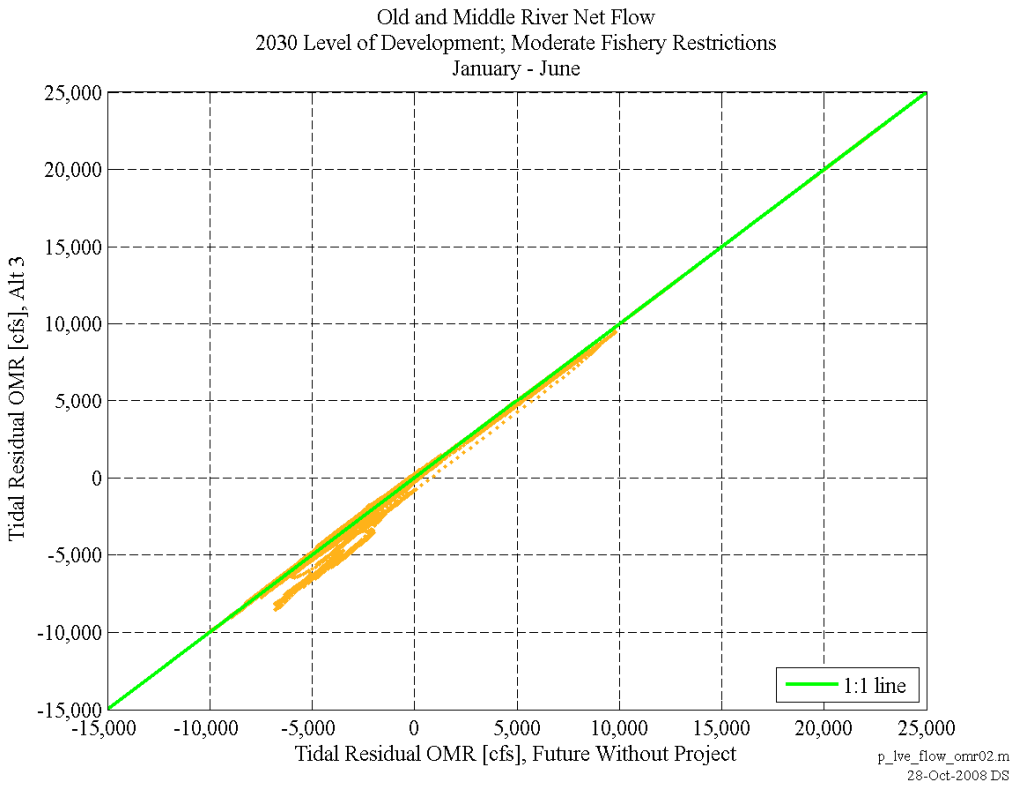
Alternative 3
2030 Level of Development; Moderate Fishery Restrictions

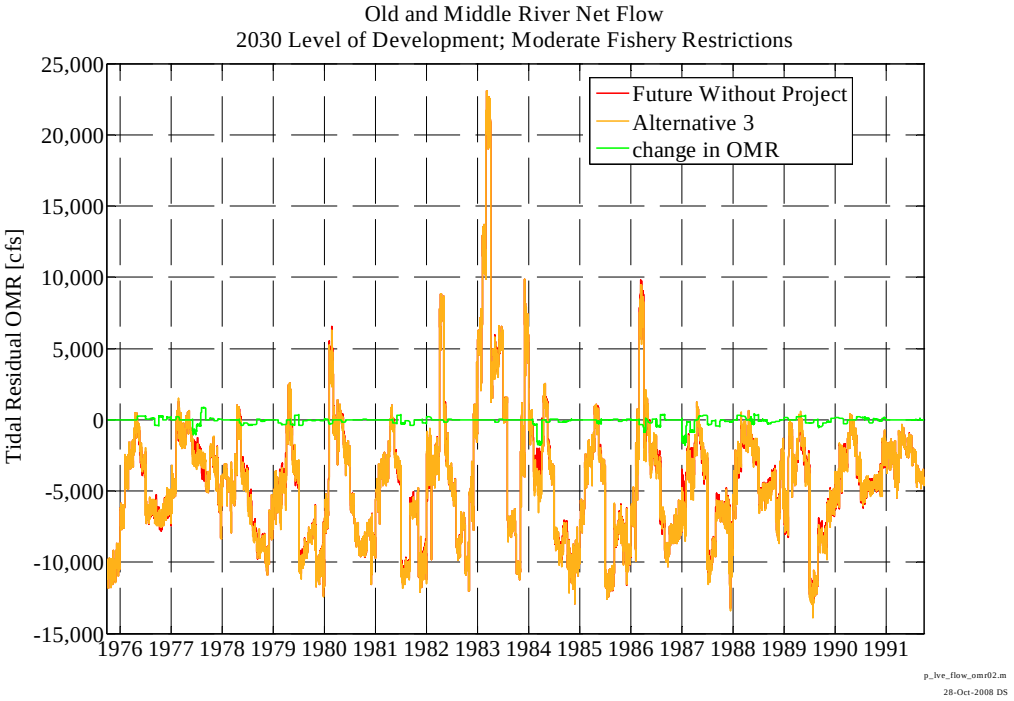
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-10,543	-10,552	-9,749	-6,688	-3,362	-2,631	-978	-1,323	-3,092	-6,464	-6,104	-6,923
1977	-6,936	-6,331	-5,823	-4,741	-134	-1,124	-819	-691	-2,816	-2,588	-2,776	-4,546
1978	-2,225	-3,233	-5,625	-3,769	-4,725	-5,107	-1,633	-2,213	-4,198	-6,249	-7,982	-8,886
1979	-8,767	-9,757	-7,226	-5,322	-5,532	-4,411	327	-2,081	-3,556	-10,109	-9,249	-8,257
1980	-7,681	-10,498	-9,931	-6,451	3,406	-245	-458	-1,324	-2,480	-5,777	-7,899	-9,061
1981	-8,681	-7,634	-8,764	-5,096	-3,613	-3,615	-845	-1,669	-3,301	-10,979	-10,456	-6,403
1982	-6,145	-10,421	-10,084	-2,620	-3,963	-2,848	7,266	-716	-3,822	-5,203	-9,017	-7,328
1983	-10,164	-5,236	-345	5,331	11,594	20,849	3,494	4,162	5,506	777	-7,236	-7,167
1984	-10,406	-2,553	5,203	-120	-3,823	-4,748	202	-731	-3,753	-8,324	-9,334	-7,884
1985	-10,012	-10,462	-9,538	-6,715	-3,665	-2,540	-632	-1,356	-3,569	-11,534	-11,156	-8,120
1986	-7,220	-8,656	-9,355	-6,579	-2,615	7,496	-110	-1,870	-2,006	-3,223	-6,802	-9,232
1987	-8,111	-7,871	-6,880	-6,527	-3,203	-3,908	-717	-1,253	-3,120	-10,357	-9,010	-6,295
1988	-6,437	-6,563	-9,146	-5,048	-2,414	-813	-1,103	-1,807	-2,061	-5,411	-5,086	-5,046
1989	-4,098	-6,805	-3,278	-6,607	-1,187	-3,474	-996	-1,578	-3,696	-12,205	-11,556	-8,172
1990	-8,711	-6,347	-5,736	-5,040	-2,798	-2,968	-911	-1,234	-3,136	-5,105	-4,590	-4,883
1991	-4,375	-4,299	-1,843	-2,323	-2,531	-3,603	-1,469	-1,730	-1,818	-2,572	-3,838	-4,134
Avg	-7,532	-7,326	-6,132	-4,270	-1,785	-856	39	-1,088	-2,557	-6,583	-7,631	-7,021
W/AN/BN	-7,515	-7,194	-5,338	-2,790	-808	1,569	1,298	-682	-2,044	-5,444	-8,217	-8,259
D/C	-7,545	-7,429	-6,751	-5,421	-2,545	-2,742	-941	-1,404	-2,957	-7,468	-7,175	-6,058

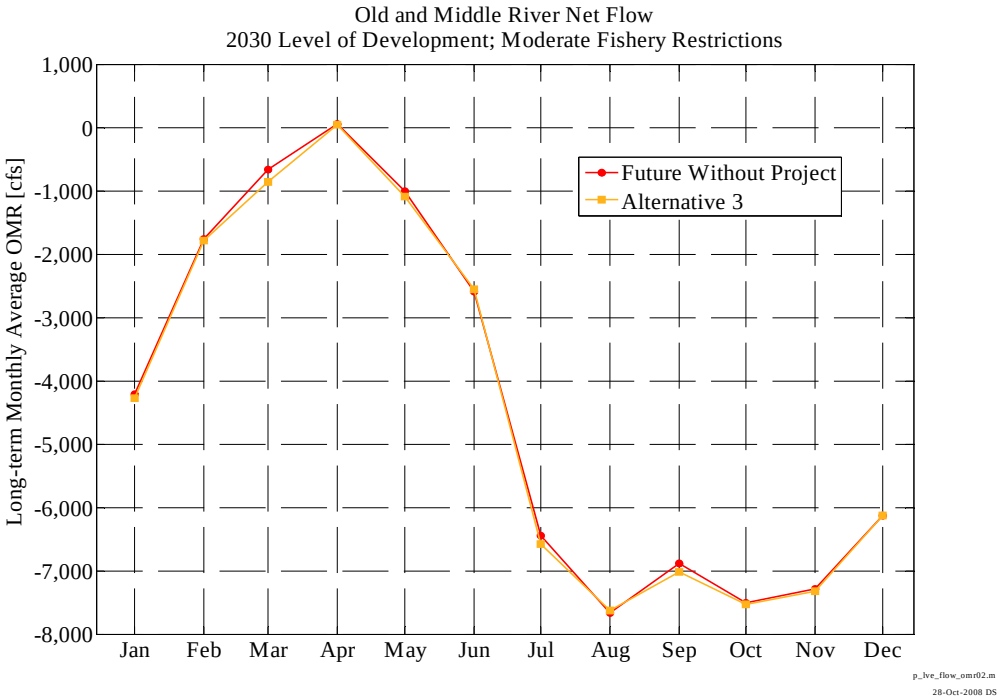
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

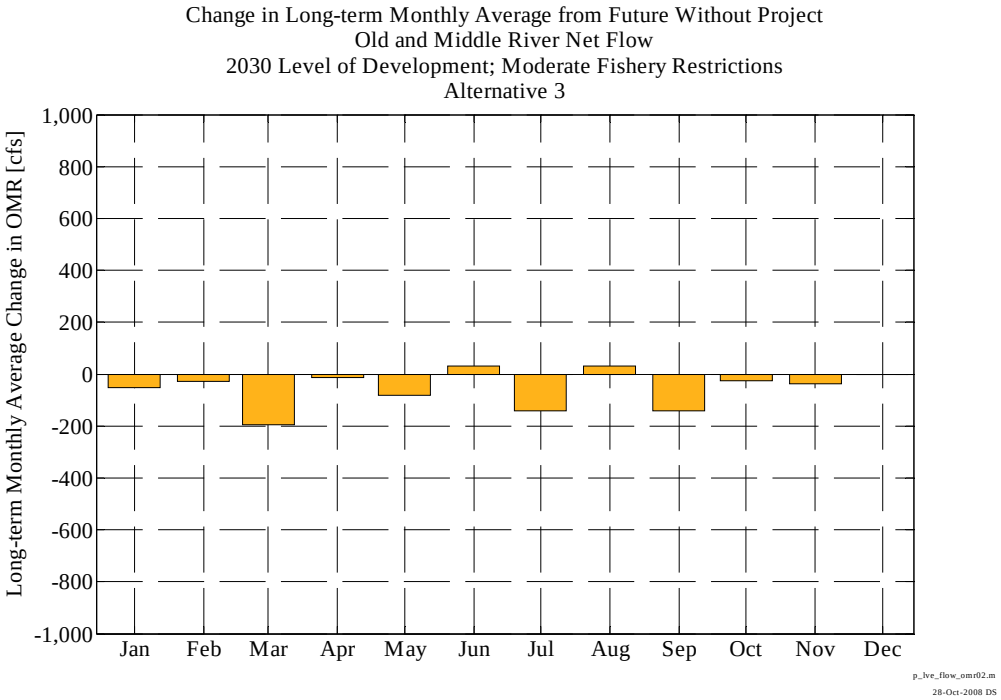
Alternative 3 - Future Without Project
2030 Level of Development; Moderate Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-2	-2	-1	11	1	0	0	268	236	38	73	-397
1977	223	-12	172	-9	194	0	9	6	-808	-361	826	13
1978	77	-61	32	0	0	0	-1	-313	-233	-364	-328	28
1979	-98	-21	-4	2	-245	-336	-4	-335	303	-376	-66	-1
1980	-62	2	-57	36	-285	-33	-1	-183	4	-17	-32	-8
1981	28	-2	-22	1	2	0	0	-229	304	-252	-82	-387
1982	-3	9	-239	195	2	-22	0	-160	24	-28	-14	-6
1983	-2	5	2	6	4	5	0	-154	24	-27	-24	-7
1984	-4	4	5	-1	-339	-1,610	-23	-173	24	27	-180	-149
1985	-60	12	1	0	-1	-1	0	-207	-3	-3	11	56
1986	-113	-34	44	13	7	-327	-363	-196	18	-441	328	-2
1987	0	0	1	-1,373	-192	-796	-13	244	308	-331	-56	-445
1988	1	-133	-137	6	303	257	2	-111	311	-74	-39	-256
1989	-194	-136	-9	145	-6	0	200	259	-237	-237	-1	-484
1990	-231	-145	81	131	94	-279	-3	0	217	162	75	-208
1991	45	-68	97	9	0	0	0	-8	-9	-3	1	2
Avg	-25	-36	-2	-52	-29	-196	-12	-81	30	-143	31	-141
W/AN/BN	-29	-14	-31	36	-122	-332	-56	-216	23	-175	-45	-21
D/C	-21	-54	20	-120	44	-91	22	25	36	-118	90	-234


Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 3
Tidal Residual OMR [cfs], Future Without Project
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
Tidal Residual OMR [cfs]
Future Without Project
Alternative 3
change in OMR
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
Long-term Monthly Average OMR [cfs]
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Future Without Project
Alternative 3
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Future Without Project
Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
Alternative 3
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

Alternative 4

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

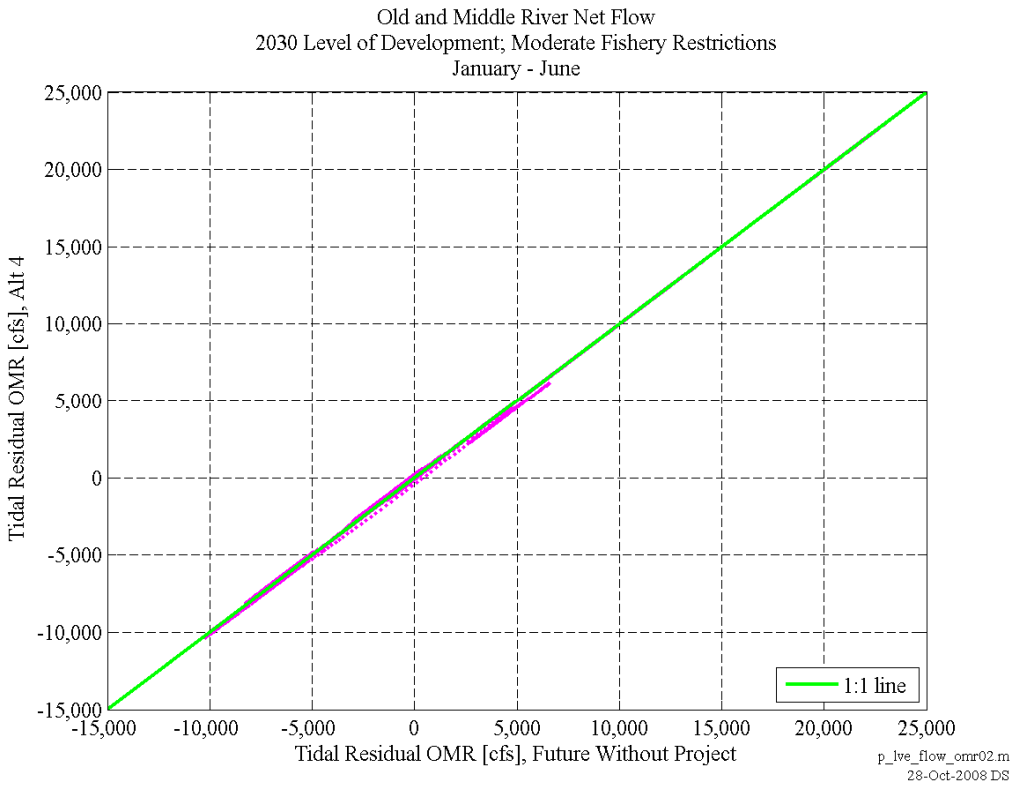
Alternative 4
2030 Level of Development; Moderate Fishery Restrictions

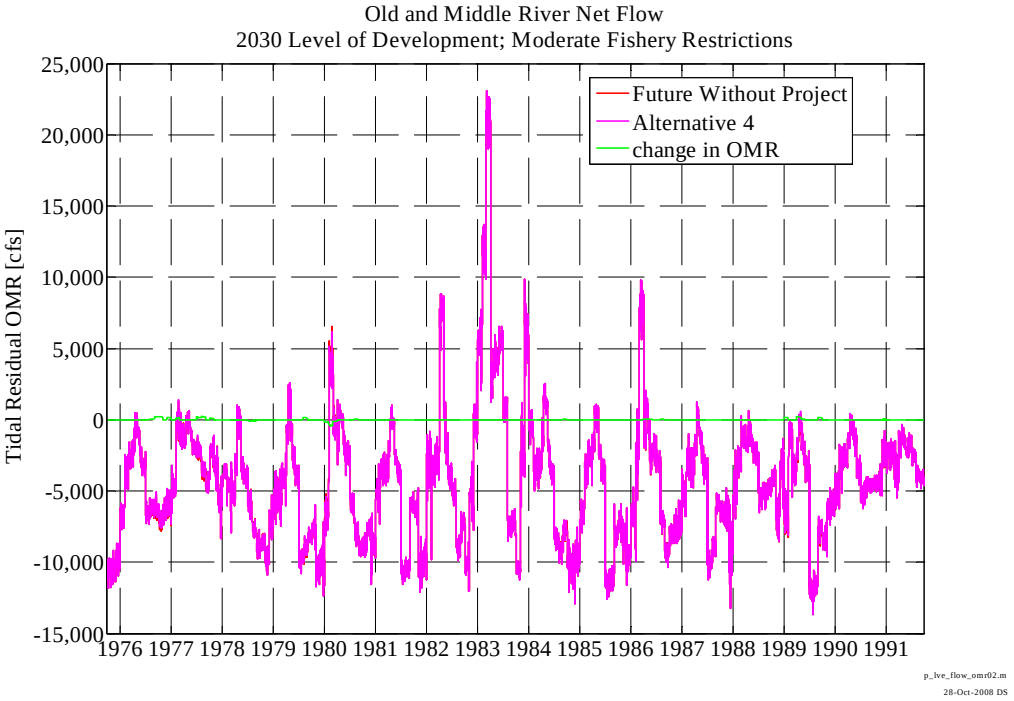
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-10,542	-10,551	-9,749	-6,699	-3,362	-2,631	-979	-1,591	-3,328	-6,504	-6,142	-6,328
1977	-6,970	-6,324	-5,866	-4,727	-214	-1,132	-828	-699	-2,009	-2,066	-3,386	-4,563
1978	-2,217	-3,205	-5,657	-3,769	-4,725	-5,107	-1,632	-1,900	-3,965	-5,928	-7,696	-8,915
1979	-8,673	-9,739	-7,225	-5,325	-5,287	-4,075	330	-1,746	-3,859	-9,752	-9,032	-8,256
1980	-7,621	-10,501	-9,874	-6,644	3,282	-317	-458	-1,140	-2,484	-5,769	-7,847	-9,056
1981	-8,737	-7,633	-8,735	-5,098	-3,613	-3,615	-844	-1,440	-3,605	-10,728	-10,377	-6,023
1982	-6,142	-10,434	-9,845	-2,815	-3,964	-2,829	7,267	-556	-3,846	-5,176	-9,000	-7,325
1983	-10,163	-5,239	-346	5,327	11,591	20,846	3,494	4,316	5,481	803	-7,212	-7,162
1984	-10,403	-2,556	5,199	-119	-3,484	-3,139	226	-557	-3,777	-8,346	-9,159	-7,708
1985	-9,956	-10,478	-9,538	-6,715	-3,665	-2,539	-632	-1,149	-3,566	-11,536	-11,168	-8,169
1986	-7,108	-8,621	-9,399	-6,589	-2,618	7,823	277	-1,657	-2,024	-2,783	-7,076	-9,241
1987	-8,111	-7,871	-6,880	-5,151	-3,010	-3,112	-703	-1,497	-3,428	-10,027	-8,956	-5,853
1988	-6,437	-6,430	-9,010	-5,053	-2,717	-1,070	-1,105	-1,696	-2,373	-5,339	-5,046	-4,796
1989	-3,894	-6,664	-3,272	-6,618	-1,181	-3,474	-996	-1,821	-3,458	-11,968	-11,556	-7,538
1990	-8,479	-6,202	-5,820	-5,172	-2,891	-2,689	-908	-1,234	-3,360	-5,289	-4,666	-4,697
1991	-4,413	-4,245	-1,927	-2,331	-2,531	-3,603	-1,469	-1,722	-1,809	-2,569	-3,839	-4,136
Avg	-7,492	-7,293	-6,121	-4,219	-1,774	-666	65	-1,006	-2,588	-6,436	-7,635	-6,860
W/AN/BN	-7,475	-7,185	-5,307	-2,848	-744	1,886	1,358	-463	-2,068	-5,279	-8,146	-8,237
D/C	-7,504	-7,378	-6,755	-5,285	-2,576	-2,652	-940	-1,428	-2,993	-7,336	-7,237	-5,789

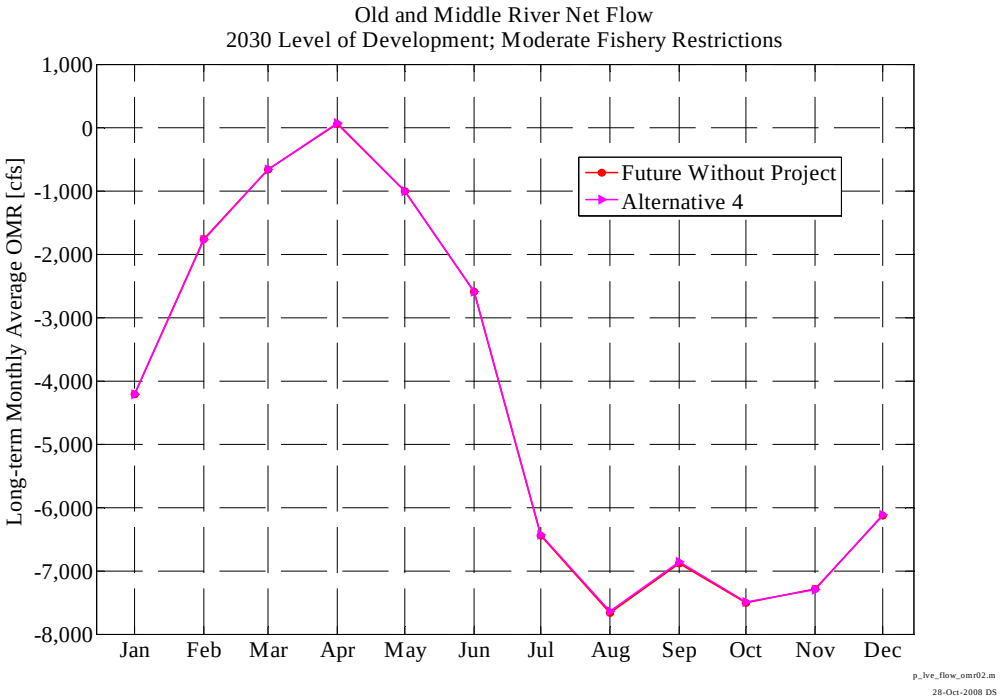
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

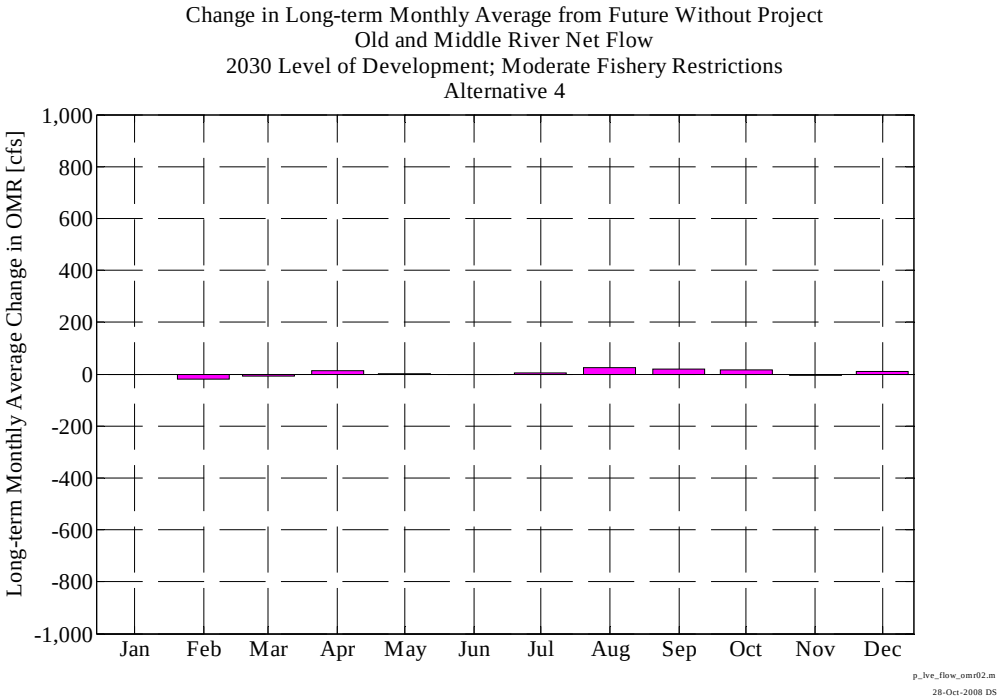
Alternative 4 - Future Without Project
2030 Level of Development; Moderate Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-1	-1	0	0	0	0	0	0	0	-1	34	198
1977	189	-4	129	5	114	-8	0	-2	0	161	217	-3
1978	85	-33	0	0	0	0	-1	0	0	-42	-43	-1
1979	-3	-2	-2	-1	0	0	0	0	0	-18	151	0
1980	-2	-1	0	-157	-409	-106	-1	0	0	-9	21	-3
1981	-28	0	7	-1	3	0	0	0	0	-1	-2	-6
1982	0	-4	0	0	0	-3	0	0	0	0	3	-2
1983	-1	2	1	2	1	2	0	0	0	0	0	-2
1984	-2	2	2	0	0	-1	0	0	0	5	-5	27
1985	-3	-5	0	0	0	0	0	0	0	-4	-1	6
1986	-2	1	0	3	4	0	23	16	0	-1	54	-10
1987	0	0	0	2	0	0	0	0	0	-1	-2	-4
1988	0	-1	-1	1	0	0	0	0	0	-2	0	-6
1989	9	5	-3	134	0	0	200	17	0	0	-1	150
1990	1	1	-2	0	1	0	0	0	-7	-23	-1	-21
1991	7	-13	14	1	0	0	0	0	0	0	0	0
Avg	16	-3	9	-1	-18	-7	14	2	-1	4	27	20
W/AN/BN	11	-5	0	-22	-58	-15	3	2	0	-9	26	1
D/C	19	-2	16	16	13	-1	22	2	-1	14	27	35


Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 4
Tidal Residual OMR [cfs], Future Without Project
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
Future Without Project
Alternative 4
change in OMR
Tidal Residual OMR [cfs]
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
Long-term Monthly Average OMR [cfs]
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Future Without Project
Alternative 4
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Future Without Project
Old and Middle River Net Flow
2030 Level of Development; Moderate Fishery Restrictions
Alternative 4
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

2030 Level of Development, Severe Fishery Restrictions

Existing Condition

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

Future Without Project
2030 Level of Development; Severe Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-10,541	-10,553	-9,748	-6,690	-2,266	-267	-297	-666	-1,003	-8,056	-7,644	-6,226
1977	-6,361	-4,460	-4,324	-4,447	-1,068	-114	-531	-652	-1,208	-3,775	-4,557	-4,132
1978	-4,109	-4,087	-5,667	-3,769	-3,616	-2,734	-856	-865	-2,799	-6,138	-8,109	-9,023
1979	-8,306	-8,975	-5,476	-3,282	-4,195	-2,911	854	-1,136	-1,571	-8,172	-8,031	-8,187
1980	-8,620	-10,511	-9,873	-4,335	5,287	-139	51	-553	-2,171	-5,286	-7,870	-9,050
1981	-7,588	-7,621	-9,096	-5,102	-2,563	-1,338	-137	-660	-1,381	-10,961	-9,509	-5,500
1982	-6,134	-10,421	-9,844	-2,816	-3,992	-1,331	7,280	-556	-2,193	-5,148	-8,999	-7,323
1983	-10,162	-5,241	-347	5,320	11,590	20,844	3,494	4,316	5,482	804	-7,212	-7,160
1984	-10,402	-2,558	5,198	-118	-2,385	-1,769	748	37	-1,490	-8,091	-7,982	-8,027
1985	-9,741	-10,478	-9,537	-6,713	-2,603	-223	-27	-516	-1,352	-11,303	-10,862	-8,090
1986	-6,229	-8,151	-9,483	-6,580	-1,228	7,904	769	-1,078	-2,208	-2,439	-6,506	-9,222
1987	-7,765	-7,402	-7,271	-4,394	-2,118	-1,374	-395	-699	-1,203	-11,047	-9,262	-5,596
1988	-5,864	-5,281	-5,470	-3,948	-2,150	-133	-552	-864	-1,136	-9,787	-8,024	-4,954
1989	-4,575	-4,684	-6,117	-4,806	-1,009	-1,186	-721	-1,045	-1,249	-11,913	-11,538	-6,914
1990	-7,369	-6,182	-3,677	-5,114	-2,423	-306	-739	-476	-1,230	-8,181	-6,938	-5,920
1991	-4,950	-2,868	-3,063	-1,836	-2,308	-1,346	-600	-860	-1,113	-5,436	-5,034	-4,178
Avg	-7,420	-6,842	-5,862	-3,664	-1,065	849	521	-392	-1,114	-7,183	-8,005	-6,844
W/AN/BN	-7,709	-7,135	-5,070	-2,226	209	2,838	1,763	24	-993	-4,924	-7,816	-8,284
D/C	-7,195	-6,614	-6,478	-4,783	-2,056	-699	-444	-715	-1,208	-8,940	-8,152	-5,723

Alternative 1

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

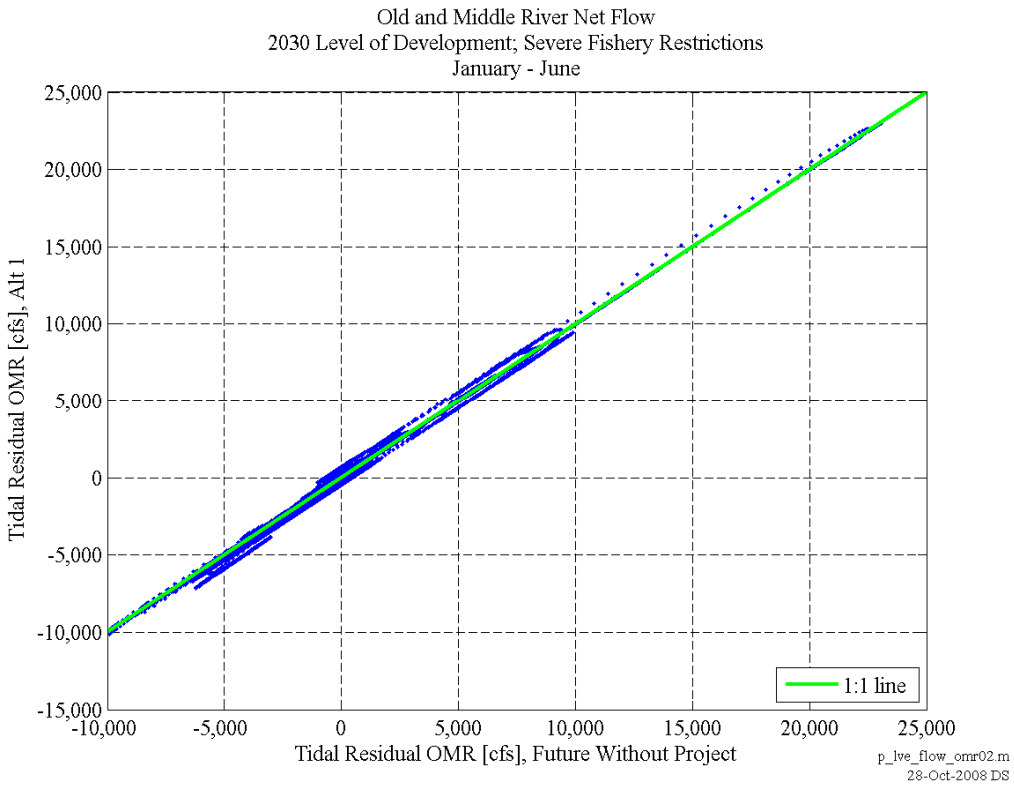
Alternative 1
2030 Level of Development; Severe Fishery Restrictions

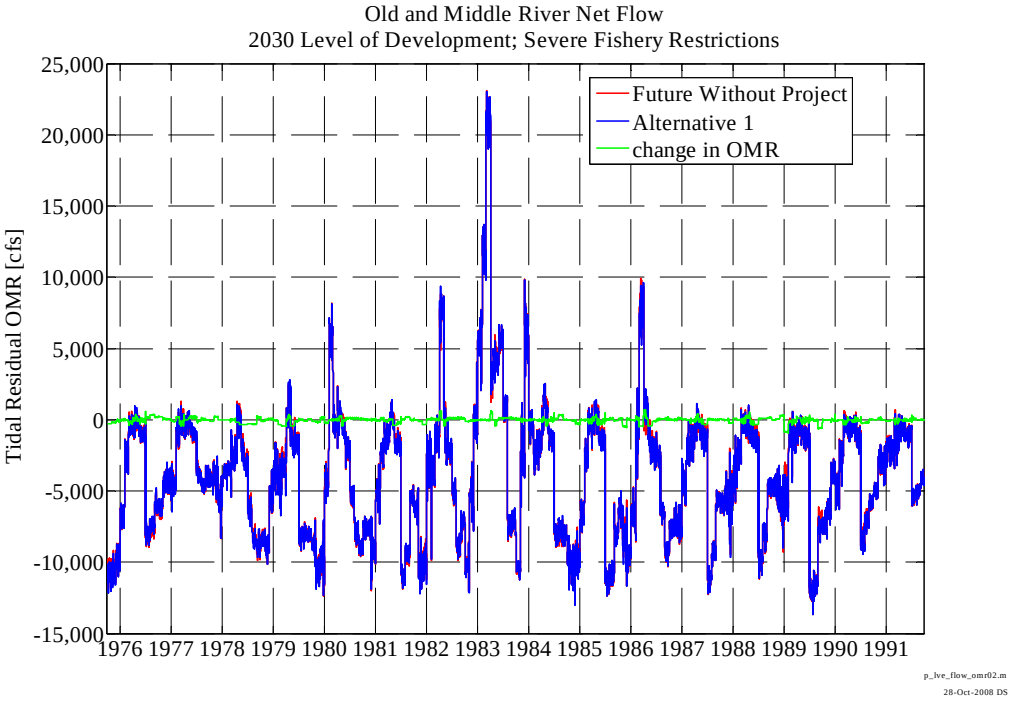
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-10,829	-10,750	-9,806	-6,697	-2,295	-483	-203	-701	-1,059	-7,904	-7,311	-6,055
1977	-6,155	-4,417	-4,281	-4,577	-895	-325	-495	-495	-1,039	-3,862	-4,530	-4,129
1978	-4,234	-3,879	-5,669	-3,770	-3,619	-2,733	-1,022	-1,199	-3,141	-6,407	-8,421	-8,845
1979	-8,432	-8,952	-5,427	-3,319	-4,531	-3,341	953	-1,555	-1,681	-8,159	-8,117	-8,155
1980	-8,762	-10,679	-9,735	-4,554	5,270	-149	174	-791	-2,054	-5,176	-7,760	-8,996
1981	-7,585	-7,617	-9,079	-5,160	-2,461	-1,430	-132	-1,051	-1,611	-10,939	-9,324	-5,508
1982	-6,131	-10,528	-10,180	-2,796	-3,948	-1,329	7,540	-789	-2,080	-5,037	-8,882	-7,235
1983	-10,279	-5,300	-401	5,302	11,585	20,829	3,755	4,085	5,591	910	-7,104	-7,077
1984	-10,358	-2,570	5,156	-127	-2,395	-1,806	748	-218	-1,472	-8,038	-7,686	-8,022
1985	-9,756	-10,541	-9,813	-6,725	-2,621	-320	73	-736	-1,449	-11,274	-10,781	-8,151
1986	-6,157	-8,614	-9,437	-6,608	-1,133	7,465	1,145	-1,509	-2,320	-2,405	-6,472	-9,144
1987	-7,760	-7,399	-7,158	-4,358	-2,135	-1,465	-240	-803	-1,528	-11,023	-9,254	-5,616
1988	-5,838	-5,294	-5,708	-3,867	-2,152	-198	-320	-1,054	-1,462	-9,727	-7,943	-4,805
1989	-4,567	-4,647	-5,835	-5,658	-1,132	-1,312	-602	-1,096	-1,278	-11,867	-11,572	-7,497
1990	-7,370	-6,180	-3,704	-5,153	-2,453	-514	-727	-516	-1,252	-8,413	-7,144	-5,897
1991	-4,950	-2,801	-3,068	-1,927	-2,325	-1,481	-597	-881	-1,143	-5,378	-5,047	-4,179
Avg	-7,448	-6,886	-5,884	-3,750	-1,077	713	628	-582	-1,186	-7,169	-7,959	-6,832
W/AN/BN	-7,765	-7,218	-5,099	-2,267	176	2,705	1,899	-282	-1,022	-4,902	-7,778	-8,211
D/C	-7,201	-6,627	-6,495	-4,903	-2,052	-836	-360	-815	-1,313	-8,932	-8,101	-5,760

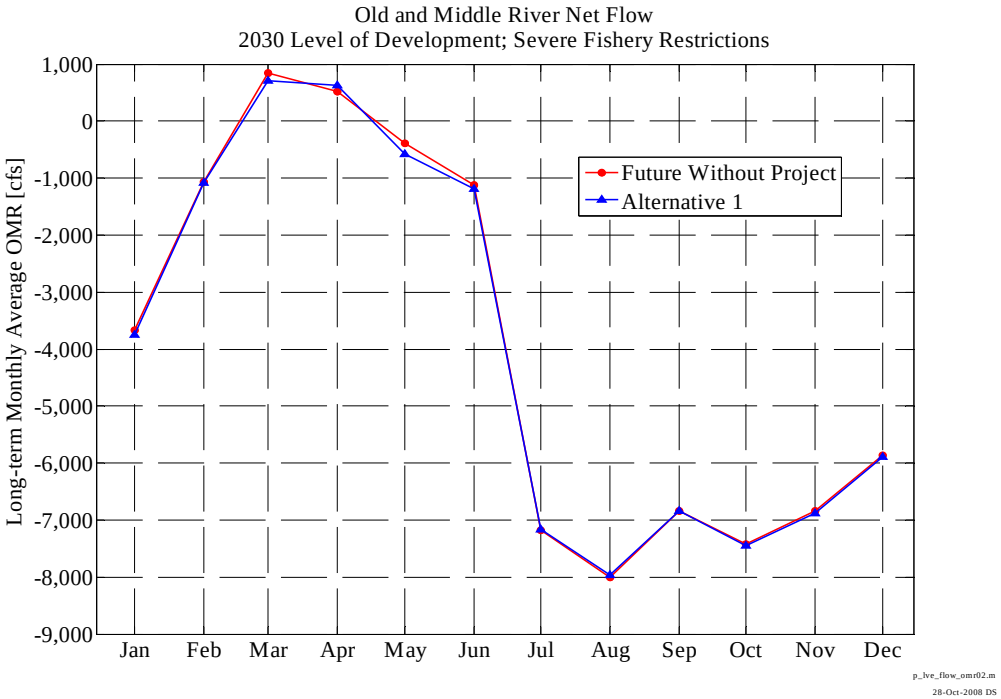
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

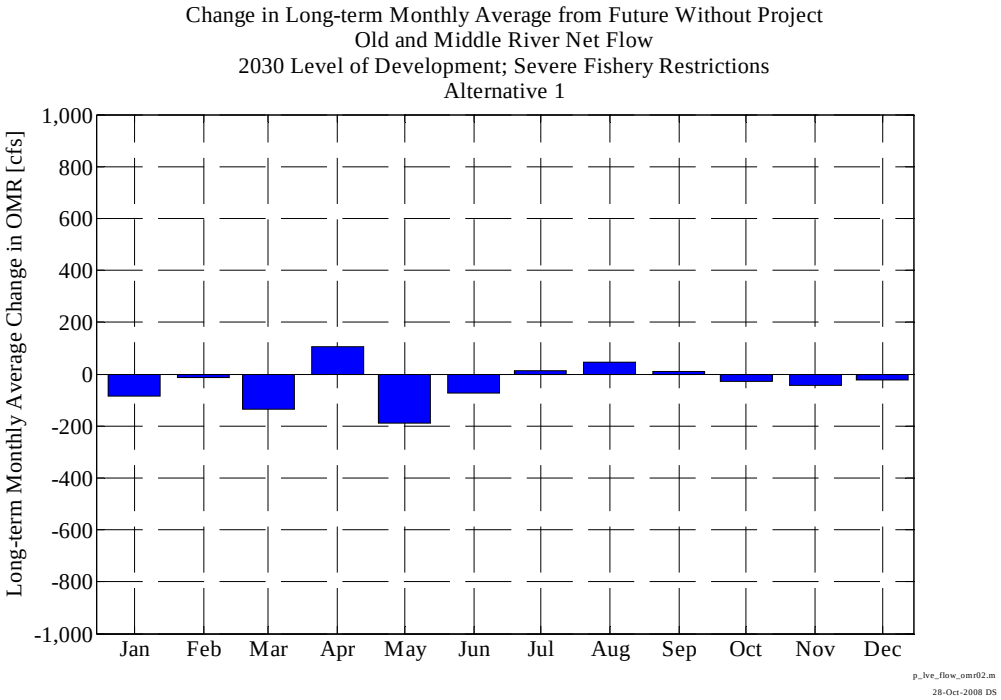
Alternative 1 - Future Without Project
2030 Level of Development; Severe Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-288	-197	-58	-8	-28	-216	94	-35	-56	152	333	171
1977	206	43	43	-130	173	-211	36	156	169	-87	27	2
1978	-124	208	-2	-1	-3	1	-166	-334	-342	-269	-312	178
1979	-126	22	49	-37	-336	-430	99	-419	-110	13	-86	32
1980	-141	-168	138	-219	-18	-9	123	-238	116	111	110	54
1981	3	4	17	-59	101	-92	5	-392	-230	23	185	-8
1982	3	-107	-336	20	44	2	260	-233	113	110	117	88
1983	-117	-60	-54	-18	-4	-15	261	-231	109	107	107	83
1984	44	-13	-41	-8	-10	-37	0	-256	18	53	296	5
1985	-15	-63	-275	-11	-18	-97	100	-220	-97	29	81	-62
1986	72	-463	46	-28	96	-440	376	-432	-111	34	34	78
1987	5	3	113	36	-17	-91	155	-103	-324	25	7	-20
1988	27	-14	-237	81	-1	-65	232	-189	-326	60	81	149
1989	8	37	282	-852	-124	-126	118	-51	-30	45	-34	-583
1990	-2	2	-27	-40	-30	-209	12	-40	-22	-232	-206	24
1991	0	67	-5	-90	-17	-135	4	-21	-31	58	-13	-1
Avg	-28	-44	-22	-85	-12	-136	107	-190	-72	14	45	12
W/AN/BN	-56	-83	-29	-42	-33	-133	136	-306	-29	23	38	74
D/C	-6	-13	-16	-119	4	-138	84	-99	-105	8	51	-36


Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 1
Tidal Residual OMR [cfs], Future Without Project
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
-10,000
-5,000
0
5,000
10,000
15,000
20,000
25,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
Tidal Residual OMR [cfs]
Future Without Project
Alternative 1
change in OMR
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
Long-term Monthly Average OMR [cfs]
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
-9,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Future Without Project
Alternative 1
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Future Without Project
Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
Alternative 1
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

Alternative 2

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

Alternative 2

2030 Level of Development; Severe Fishery Restrictions

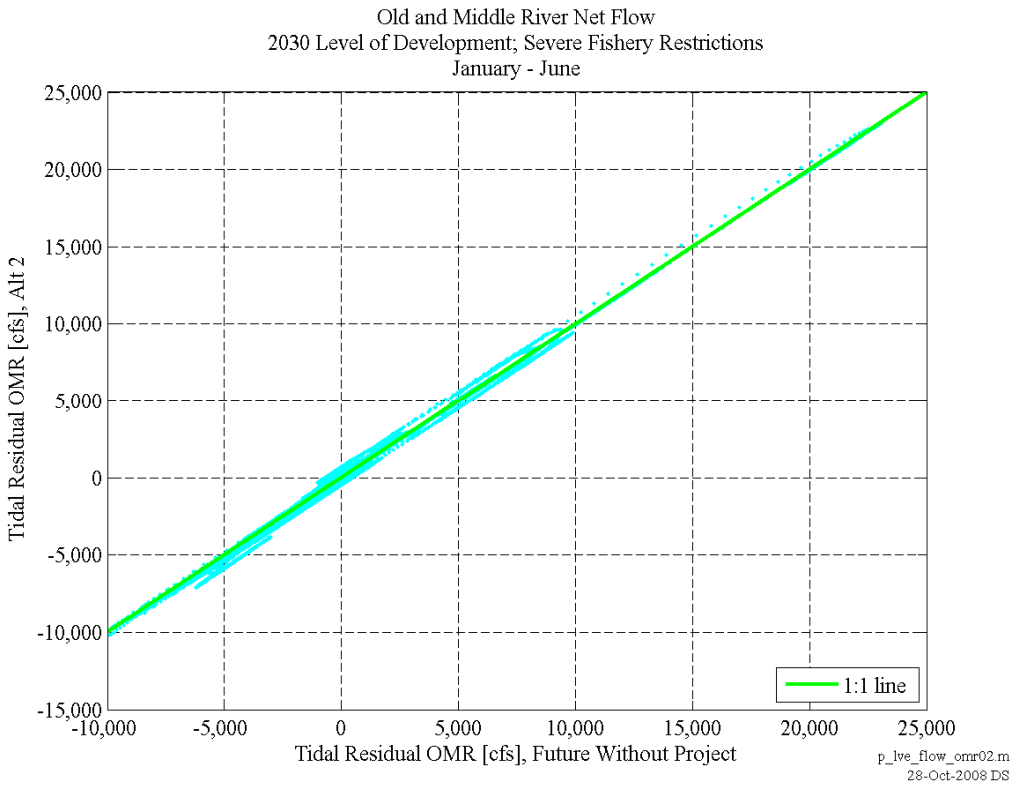
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-10,829	-10,806	-9,807	-6,698	-2,386	-483	-203	-701	-1,061	-7,914	-7,321	-6,055
1977	-6,158	-4,413	-4,283	-4,563	-896	-325	-500	-667	-1,219	-3,795	-4,574	-4,130
1978	-4,114	-4,081	-5,991	-3,839	-3,616	-2,733	-888	-1,184	-3,141	-6,476	-8,443	-8,845
1979	-8,454	-8,964	-5,421	-3,516	-4,533	-3,341	953	-1,555	-1,682	-8,160	-8,117	-8,182
1980	-8,812	-10,799	-9,736	-4,687	5,203	-149	174	-791	-2,054	-5,176	-7,760	-8,996
1981	-7,585	-7,617	-9,083	-5,210	-2,564	-1,431	-132	-1,051	-1,610	-10,942	-9,327	-5,508
1982	-6,131	-10,720	-10,181	-2,927	-3,951	-1,339	7,540	-789	-2,080	-5,037	-8,882	-7,235
1983	-10,280	-5,309	-418	5,276	11,550	20,795	3,755	4,085	5,591	910	-7,104	-7,077
1984	-10,358	-2,570	5,134	-127	-2,434	-1,833	748	-218	-1,472	-8,038	-7,686	-8,021
1985	-9,756	-10,578	-9,872	-6,803	-2,731	-320	73	-736	-1,449	-11,280	-10,787	-8,154
1986	-6,154	-8,615	-9,432	-6,792	-1,136	7,464	1,145	-1,509	-2,552	-2,418	-6,240	-9,140
1987	-7,760	-7,504	-7,294	-4,485	-2,220	-1,466	-240	-803	-1,528	-11,039	-9,290	-5,636
1988	-5,874	-5,334	-5,747	-3,989	-2,152	-198	-320	-1,118	-1,463	-9,667	-7,891	-4,785
1989	-4,567	-4,642	-5,844	-5,639	-1,036	-1,314	-715	-1,097	-1,278	-11,868	-11,589	-7,465
1990	-7,373	-6,182	-3,704	-5,342	-2,427	-514	-727	-516	-1,252	-8,395	-7,131	-5,893
1991	-4,948	-2,807	-3,069	-1,920	-2,433	-1,481	-597	-881	-1,143	-5,394	-5,033	-4,179
Avg	-7,447	-6,934	-5,922	-3,829	-1,110	708	629	-596	-1,212	-7,168	-7,948	-6,831
W/AN/BN	-7,758	-7,294	-5,149	-2,373	155	2,695	1,918	-280	-1,056	-4,914	-7,747	-8,214
D/C	-7,206	-6,654	-6,523	-4,961	-2,094	-837	-373	-841	-1,334	-8,921	-8,105	-5,756

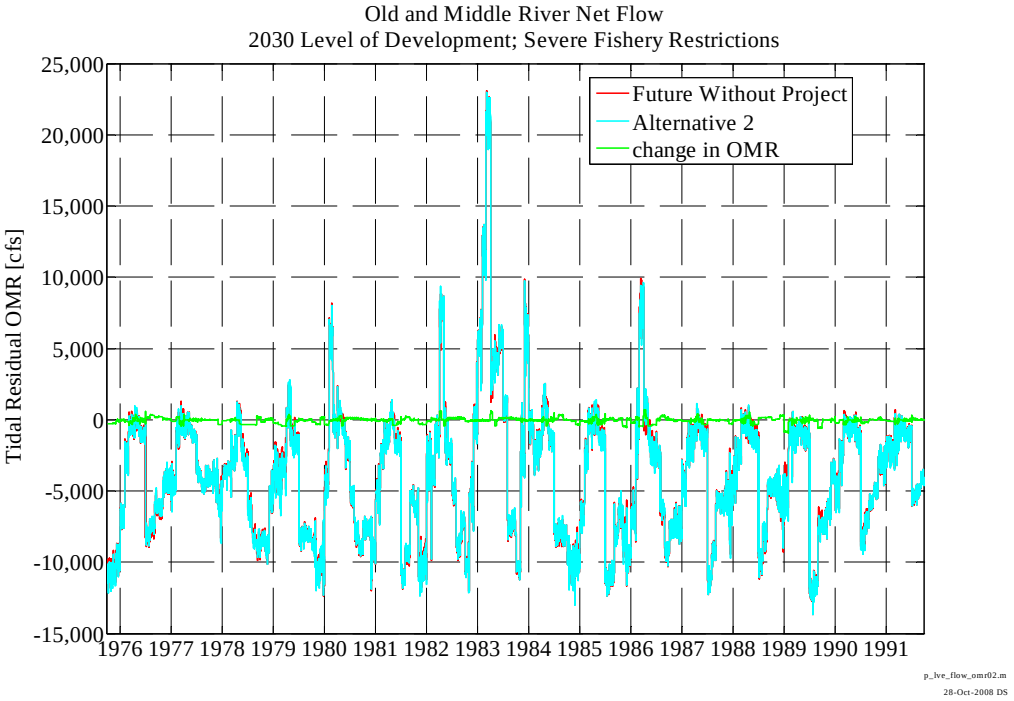
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

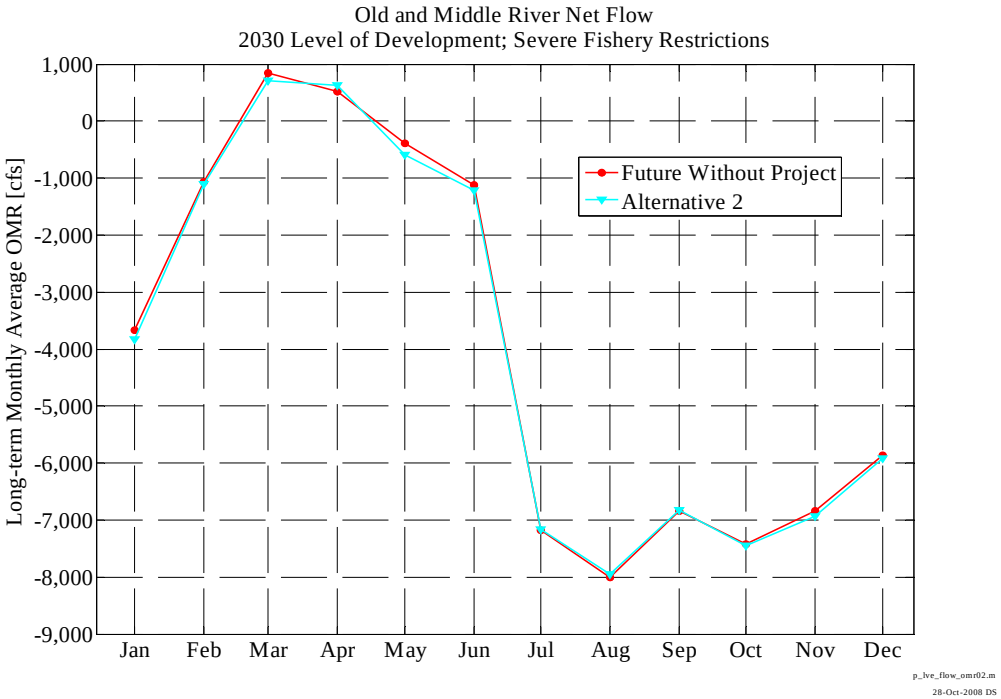
Alternative 2 - Future Without Project

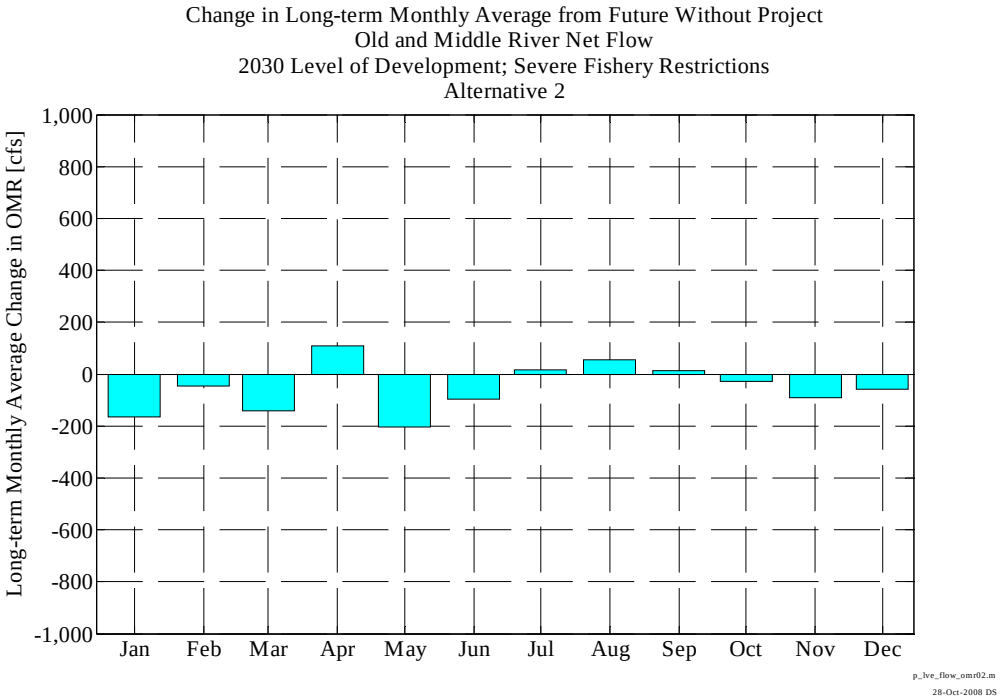
2030 Level of Development; Severe Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-288	-253	-58	-8	-120	-217	94	-35	-58	142	324	171
1977	203	47	41	-116	172	-211	31	-16	-11	-20	-17	2
1978	-5	6	-325	-70	-1	1	-33	-319	-342	-338	-334	178
1979	-148	11	56	-234	-338	-430	99	-419	-111	11	-86	5
1980	-192	-288	137	-352	-84	-10	123	-238	116	111	110	54
1981	4	4	13	-108	-2	-92	5	-392	-229	19	182	-7
1982	3	-299	-337	-112	41	-8	260	-233	113	110	117	88
1983	-118	-69	-71	-44	-39	-49	261	-231	109	107	107	83
1984	44	-13	-63	-8	-49	-63	0	-256	18	53	296	5
1985	-15	-101	-335	-90	-129	-97	100	-220	-97	24	75	-65
1986	75	-464	50	-212	92	-440	376	-432	-343	21	265	82
1987	5	-102	-22	-90	-102	-91	155	-104	-324	8	-28	-40
1988	-10	-53	-277	-41	-2	-65	232	-254	-326	120	133	169
1989	8	42	273	-833	-27	-128	5	-52	-30	45	-51	-552
1990	-4	0	-27	-228	-4	-208	12	-40	-22	-214	-192	28
1991	2	60	-6	-84	-125	-135	4	-21	-31	42	1	-1
Avg	-27	-92	-59	-164	-45	-140	108	-204	-98	15	56	12
W/AN/BN	-49	-159	-79	-147	-54	-143	155	-304	-63	11	68	71
D/C	-11	-39	-44	-178	-38	-138	71	-126	-125	18	47	-33


Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 2
Tidal Residual OMR [cfs], Future Without Project
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
-10,000
-5,000
0
5,000
10,000
15,000
20,000
25,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
Tidal Residual OMR [cfs]
Future Without Project
Alternative 2
change in OMR
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
Long-term Monthly Average OMR [cfs]
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
-9,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Future Without Project
Alternative 2
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Future Without Project
Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
Alternative 2
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

Alternative 3

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

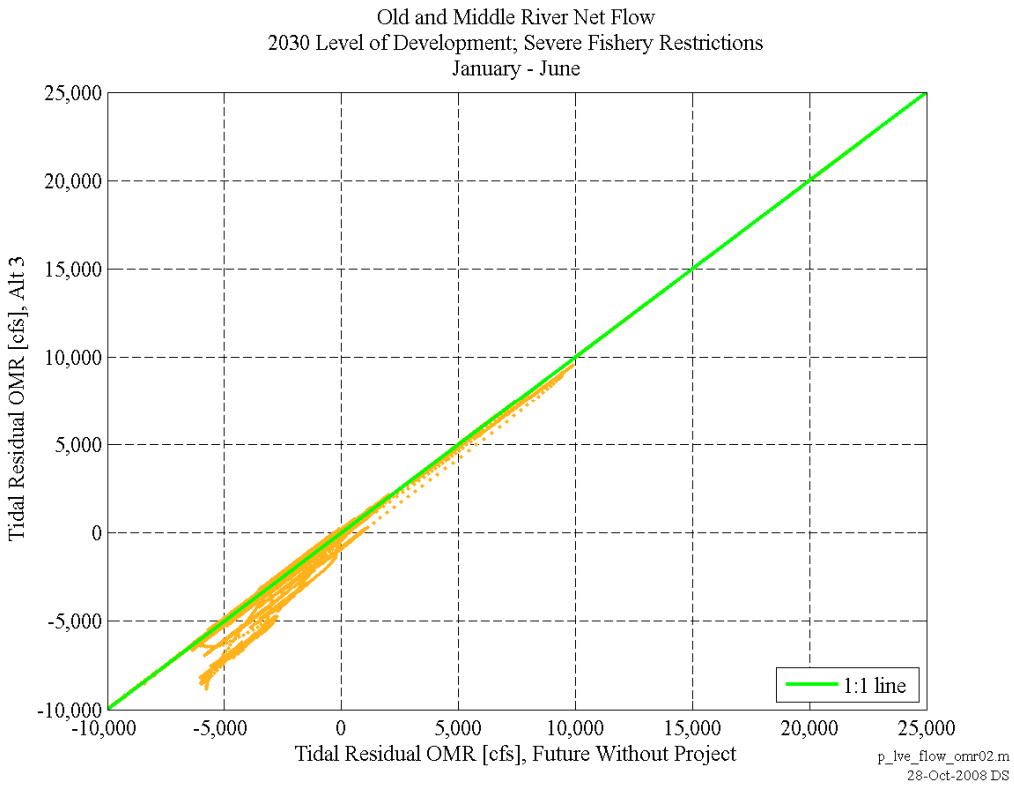
Alternative 3
2030 Level of Development; Severe Fishery Restrictions

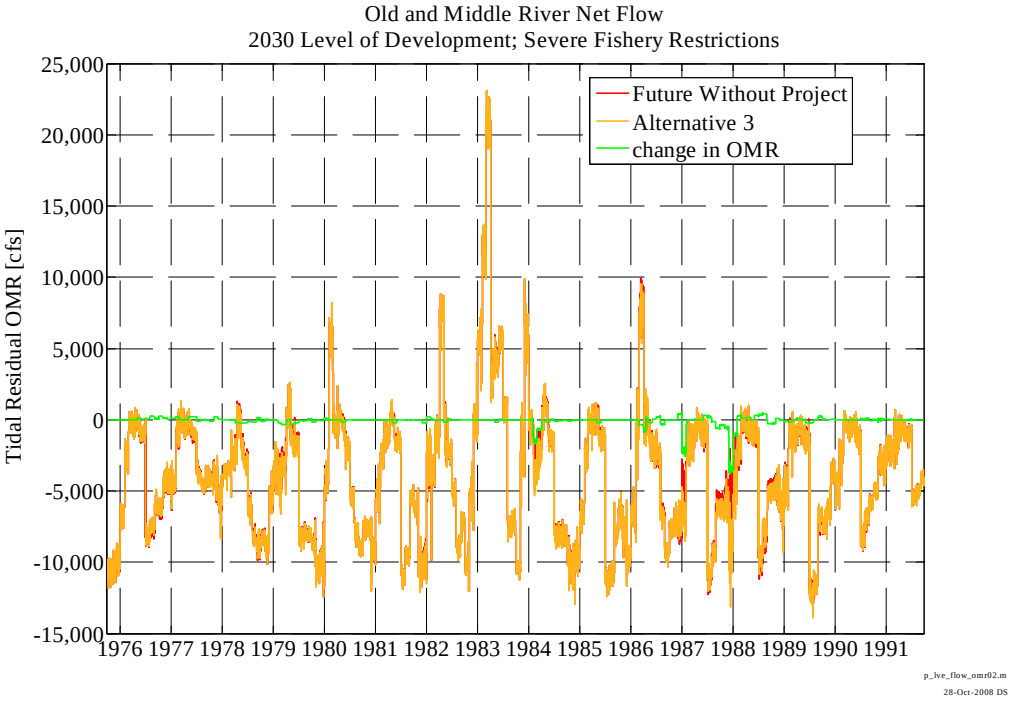
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-10,543	-10,555	-9,749	-6,678	-2,266	-266	-297	-577	-948	-8,011	-7,385	-6,155
1977	-6,120	-4,348	-4,285	-4,364	-875	-107	-522	-437	-1,023	-3,886	-4,546	-4,131
1978	-4,231	-3,881	-5,642	-3,769	-3,616	-2,733	-1,063	-1,104	-3,046	-6,271	-8,284	-8,889
1979	-8,406	-8,936	-5,512	-3,281	-4,439	-3,245	851	-1,471	-1,808	-8,217	-8,116	-8,127
1980	-8,788	-10,510	-9,945	-4,269	5,285	-141	51	-736	-2,167	-5,312	-7,900	-9,058
1981	-7,581	-7,621	-9,116	-5,101	-2,561	-1,339	-137	-889	-1,387	-10,986	-9,512	-5,502
1982	-6,134	-10,425	-10,083	-2,620	-3,945	-1,366	7,279	-716	-2,169	-5,175	-9,011	-7,328
1983	-10,164	-5,236	-345	5,326	11,594	20,849	3,494	4,162	5,506	777	-7,236	-7,167
1984	-10,406	-2,553	5,203	-120	-3,822	-2,454	737	-136	-1,467	-8,192	-8,058	-8,027
1985	-9,827	-10,492	-9,537	-6,714	-2,603	-223	-27	-750	-1,357	-11,331	-10,866	-8,084
1986	-6,265	-8,177	-9,483	-6,576	-1,249	7,558	440	-1,260	-2,185	-2,246	-6,815	-9,233
1987	-7,765	-7,402	-6,880	-6,526	-2,154	-1,374	-395	-699	-899	-10,850	-9,386	-6,212
1988	-6,227	-5,855	-8,872	-5,044	-1,870	-42	-422	-863	-831	-9,441	-7,613	-5,249
1989	-4,822	-4,590	-6,113	-4,935	-1,173	-1,184	-641	-1,044	-1,488	-12,149	-11,539	-6,697
1990	-7,330	-6,180	-3,661	-5,113	-2,423	-306	-739	-476	-1,252	-8,119	-6,868	-5,969
1991	-4,949	-2,888	-3,045	-1,819	-2,307	-1,346	-600	-860	-1,140	-5,458	-5,061	-4,178
Avg	-7,472	-6,853	-6,067	-3,850	-1,151	768	500	-491	-1,104	-7,179	-8,012	-6,875
W/AN/BN	-7,770	-7,103	-5,115	-2,187	-27	2,638	1,684	-180	-1,048	-4,948	-7,917	-8,261
D/C	-7,240	-6,659	-6,807	-5,144	-2,026	-687	-420	-733	-1,147	-8,915	-8,086	-5,798

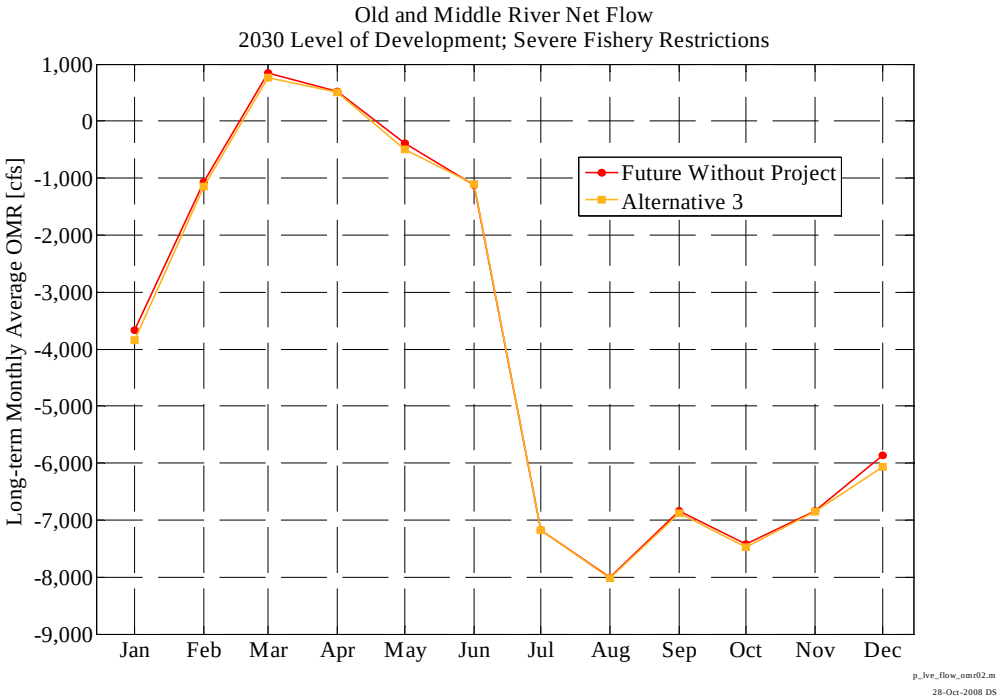
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

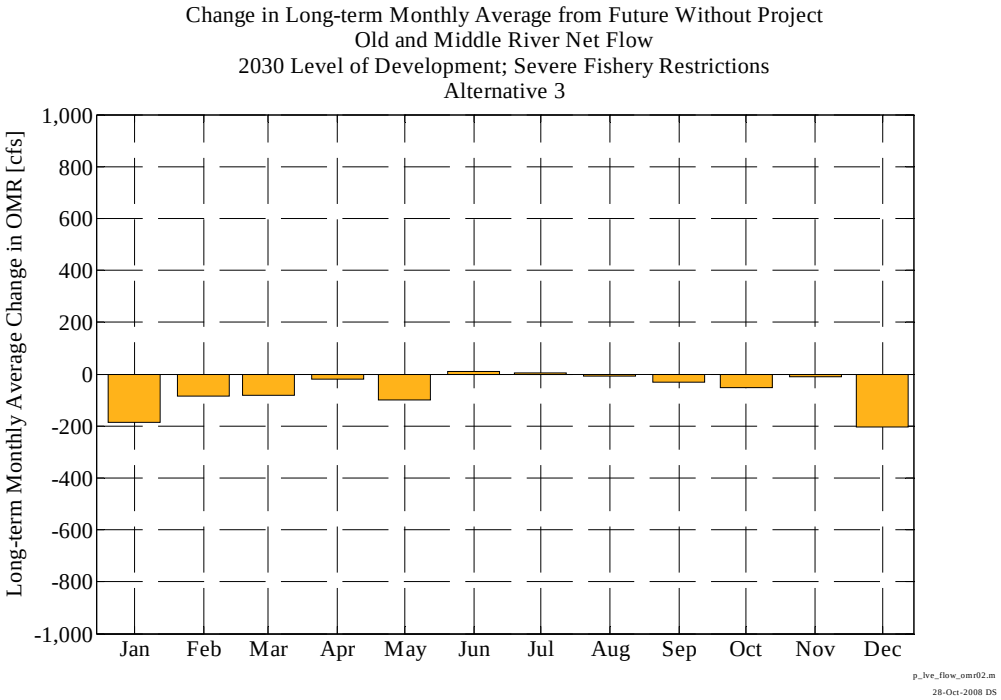
Alternative 3 - Future Without Project
2030 Level of Development; Severe Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-2	-2	-1	12	1	1	0	89	55	45	260	71
1977	241	112	40	83	194	8	10	215	185	-111	11	0
1978	-121	206	25	0	0	1	-207	-240	-246	-133	-175	134
1979	-100	39	-35	0	-244	-335	-4	-336	-238	-45	-85	59
1980	-167	0	-72	67	-2	-2	0	-183	4	-26	-30	-8
1981	8	0	-20	1	2	0	0	-229	-6	-25	-3	-2
1982	0	-4	-239	195	46	-35	0	-160	24	-28	-12	-6
1983	-2	5	2	6	4	5	0	-154	24	-27	-24	-7
1984	-4	4	5	-1	-1,437	-684	-11	-173	24	-101	-76	0
1985	-86	-15	0	0	-1	0	0	-234	-5	-28	-3	5
1986	-35	-26	0	5	-20	-346	-329	-182	23	193	-309	-11
1987	1	0	391	-2,132	-36	0	0	0	305	197	-124	-616
1988	-363	-575	-3,402	-1,096	280	91	130	1	306	347	411	-295
1989	-247	94	4	-129	-164	2	79	1	-239	-236	-2	217
1990	39	2	16	0	0	0	0	0	-22	62	71	-49
1991	1	-20	18	18	0	0	0	0	-28	-22	-27	0
Avg	-52	-11	-204	-186	-86	-81	-21	-99	10	4	-7	-32
W/AN/BN	-62	32	-45	39	-236	-199	-79	-204	-55	-24	-101	23
D/C	-45	-45	-328	-360	31	11	24	-17	61	25	66	-74


Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 3
Tidal Residual OMR [cfs], Future Without Project
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
Tidal Residual OMR [cfs]
Future Without Project
Alternative 3
change in OMR
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
Long-term Monthly Average OMR [cfs]
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
-9,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Future Without Project
Alternative 3
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Future Without Project
Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
Alternative 3
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
p_lve_flow_omr02.m
28-Oct-2008 DS

Alternative 4

Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

Alternative 4

2030 Level of Development; Severe Fishery Restrictions

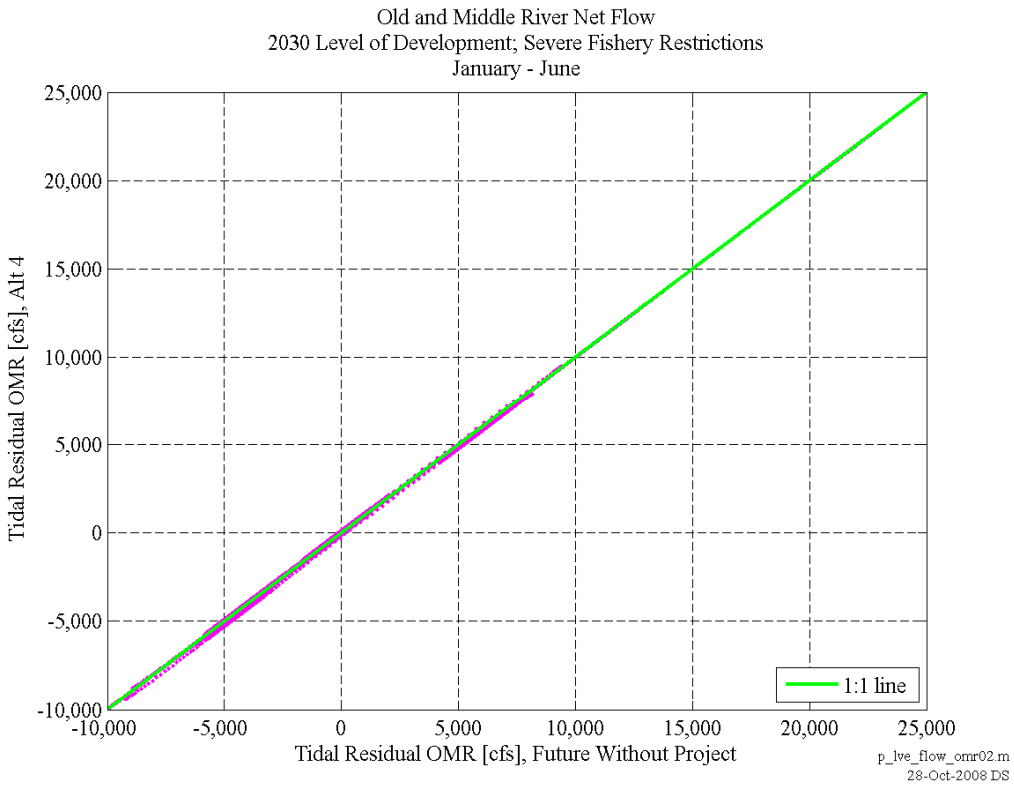
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-10,542	-10,554	-9,749	-6,688	-2,266	-266	-297	-666	-999	-8,053	-7,424	-6,022
1977	-6,151	-4,373	-4,309	-4,480	-1,066	-114	-531	-652	-1,208	-3,775	-4,557	-4,132
1978	-4,108	-4,089	-5,667	-3,769	-3,616	-2,734	-880	-866	-2,799	-6,120	-8,091	-9,023
1979	-8,279	-8,961	-5,485	-3,282	-4,195	-2,911	854	-1,136	-1,571	-8,169	-7,889	-8,176
1980	-8,881	-10,516	-9,873	-4,613	5,064	-243	50	-553	-2,171	-5,295	-7,762	-9,051
1981	-7,707	-7,623	-8,933	-5,101	-2,559	-1,339	-137	-660	-1,381	-10,984	-9,494	-5,513
1982	-6,134	-10,430	-9,844	-2,816	-3,959	-1,338	7,280	-556	-2,193	-5,148	-8,995	-7,325
1983	-10,163	-5,239	-346	5,322	11,591	20,846	3,494	4,316	5,481	803	-7,212	-7,162
1984	-10,403	-2,556	5,199	-119	-2,386	-1,770	748	37	-1,491	-8,091	-7,982	-8,026
1985	-9,739	-10,483	-9,537	-6,714	-2,603	-223	-27	-516	-1,352	-11,304	-10,862	-8,091
1986	-6,228	-8,599	-9,446	-6,578	-1,230	7,905	888	-1,061	-2,208	-2,430	-6,455	-9,240
1987	-7,766	-7,453	-7,301	-4,393	-2,118	-1,374	-395	-699	-1,203	-11,050	-9,269	-5,599
1988	-5,872	-5,290	-5,471	-3,839	-2,149	-133	-423	-863	-1,136	-9,780	-7,969	-4,729
1989	-4,567	-4,645	-6,114	-4,865	-1,006	-1,186	-720	-1,045	-1,242	-11,912	-11,536	-7,049
1990	-7,367	-6,182	-3,681	-5,114	-2,423	-306	-739	-476	-1,230	-8,326	-7,061	-5,927
1991	-4,950	-2,828	-3,065	-1,890	-2,308	-1,346	-600	-860	-1,113	-5,414	-5,038	-4,178
Avg	-7,429	-6,864	-5,851	-3,684	-1,077	842	535	-391	-1,114	-7,190	-7,975	-6,828
W/AN/BN	-7,742	-7,199	-5,066	-2,265	181	2,822	1,776	26	-993	-4,921	-7,769	-8,286
D/C	-7,185	-6,603	-6,462	-4,787	-2,055	-699	-430	-715	-1,207	-8,955	-8,135	-5,693

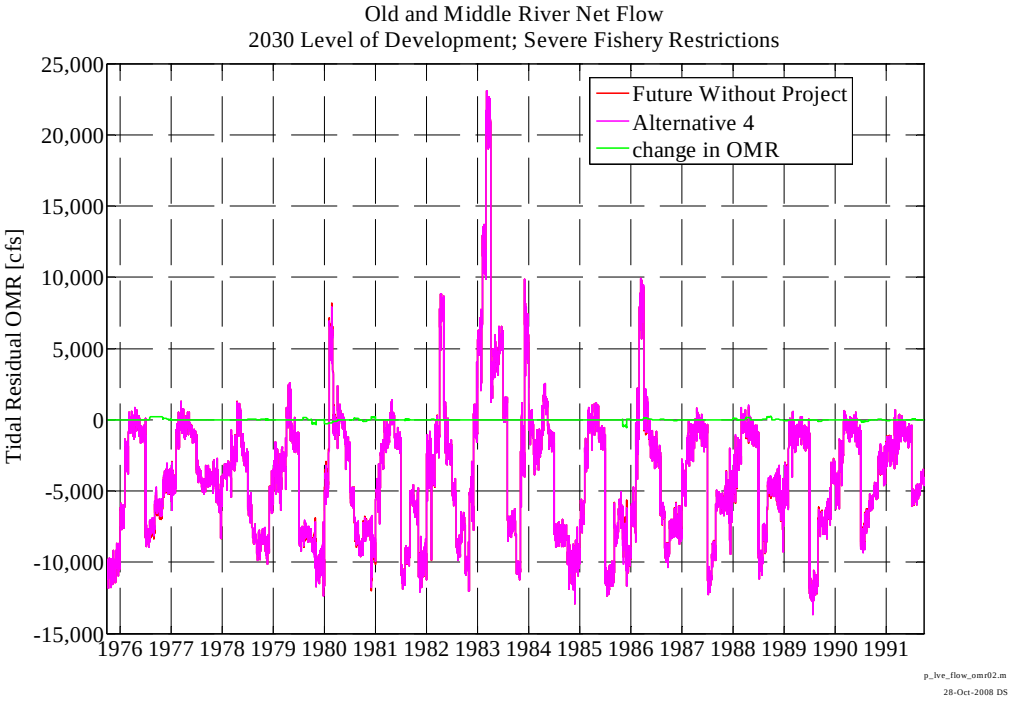
Change in Old and Middle River Net Flow
Monthly Average of Tidally Filtered Simulated Values (cfs)

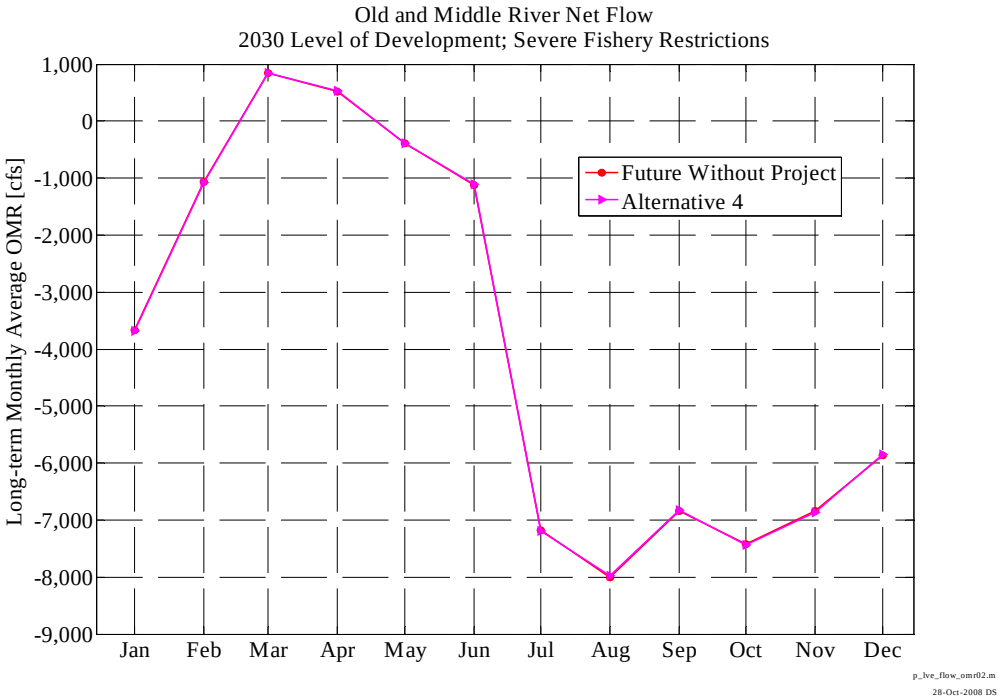
Alternative 4 - Future Without Project

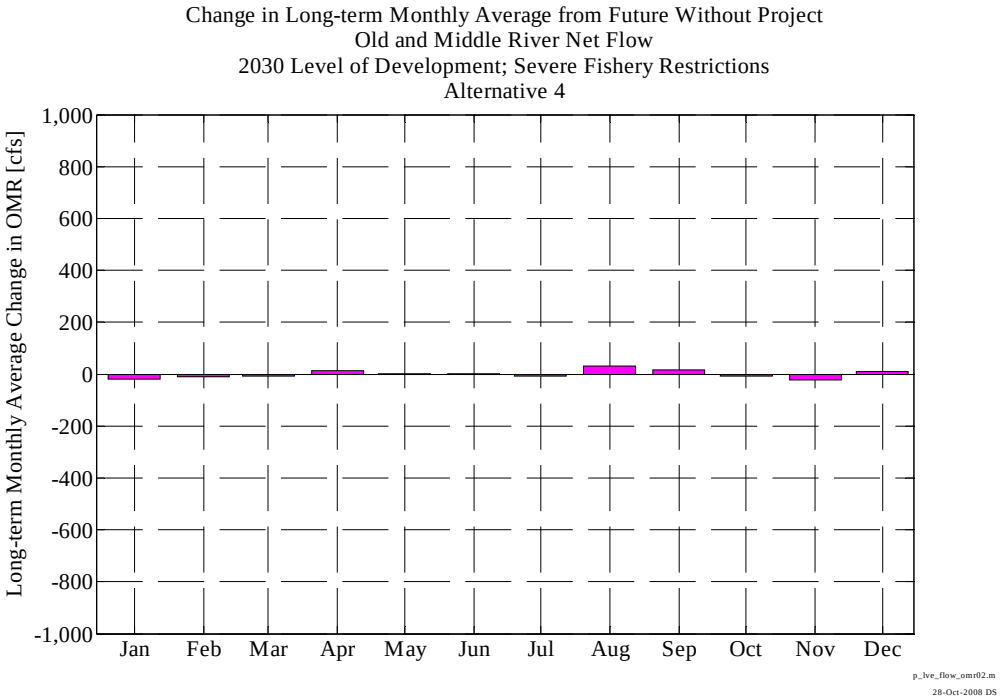
2030 Level of Development; Severe Fishery Restrictions

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	-1	-1	0	1	0	0	0	0	4	3	220	205
1977	210	87	15	-33	3	0	0	0	0	0	0	0
1978	1	-2	0	0	0	0	-25	-1	0	19	19	0
1979	27	14	-9	0	0	0	0	0	0	3	142	11
1980	-260	-5	0	-277	-223	-104	-1	0	0	-8	108	-1
1981	-119	-2	163	0	4	0	0	0	0	-22	15	-13
1982	0	-9	0	0	33	-7	0	0	0	0	3	-2
1983	-1	2	1	2	1	2	0	0	0	0	0	-3
1984	-2	2	2	0	0	-1	0	0	0	0	0	0
1985	2	-5	0	0	0	0	0	0	0	-1	0	-2
1986	2	-448	37	3	-2	1	119	17	0	9	51	-18
1987	-1	-51	-30	1	0	0	0	0	0	-3	-7	-3
1988	-8	-9	0	109	1	0	129	1	0	7	55	225
1989	8	39	3	-60	3	0	0	0	6	0	2	-135
1990	2	0	-4	0	0	0	0	0	0	-146	-123	-6
1991	0	40	-2	-54	-1	0	0	0	0	21	-3	0
Avg	-9	-22	11	-19	-11	-7	14	1	1	-7	30	16
W/AN/BN	-33	-64	4	-39	-27	-16	13	2	0	3	46	-2
D/C	10	11	16	-4	1	0	14	0	1	-16	17	30


Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
January - June
Tidal Residual OMR [cfs], Alt 4
Tidal Residual OMR [cfs], Future Without Project
1:1 line
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
Tidal Residual OMR [cfs]
Future Without Project
Alternative 4
change in OMR
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
p_lve_flow_omr02.m
28-Oct-2008 DS


Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
Long-term Monthly Average OMR [cfs]
1,000
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
-9,000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Future Without Project
Alternative 4
p_lve_flow_omr02.m
28-Oct-2008 DS


Change in Long-term Monthly Average from Future Without Project
Old and Middle River Net Flow
2030 Level of Development; Severe Fishery Restrictions
Alternative 4
Long-term Monthly Average Change in OMR [cfs]
1,000
800
600
400
200
0
-200
-400
-600
-800
-1,000
Jan
Feb
Mar
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