Appendix I, Old and Middle River Flow Management

Attachment I.10 Flow Into Junction Analysis

I.10.1 Junction Analysis Model Overview

Many routes can potentially be used by fish migrating through the Delta and survival through these routes can be significantly different (Newman 2008; Perry et al. 2010). Thus, routing of fish at junctions and how routing could be affected by project operations has the potential to influence through-Delta survival. In general, routes that keep fish in the mainstem Sacramento and San Joaquin Rivers are superior to routes leading into the interior Delta (Dauble et al. 2010; Perry et al. 2010), although some recent findings for the San Joaquin River have not supported this generality (Buchanan et al. 2013). Perry (2010) found that the routing of fish into the interior delta through the combined junction of Georgiana Slough and the Delta Cross Channel was a function of the total flow entering the interior delta through both of those junctions. This is the function represented in Figure 6.7 within Perry (2010). This function indicated that the slope of the relationship was less than 1. Cavallo et al. (2015) performed a meta-analysis of routing at 6 Delta junctions and found that the proportion of flow entering a junction explained 70% of the variation in routing. Similar to the Perry (2010) study, the slope of this relationship was less than 1 suggesting fish move into junctions at a rate less than the proportion of flow.

Both studies above present strong evidence that routing at junctions is a function of the proportion of flow into that junction. Thus, estimating the proportion flow entering a Delta junction can be strongly predictive of the proportion of migrating salmonids that may move from the main channel into a distributary. In this effort the daily proportion of flow entering a distributary junction is rolled up into monthly values. Increases in the proportion of flow into a distributary channel under alternative scenarios would allow us to evaluate the likelihood of fish migration into junctions.

I.10.2 Model Development

I.10.2.1 Methods

I.10.2.1.1 Routing methodology

For the present analysis of flow routing into junctions was based on the proportion of flow entering a junction away from the main stem, from DSM2-HYDRO outputs. Fifteen-minute data were used to calculate the daily proportion of flow that enters the junction, following the methods of Cavallo et al. (2015). The daily value calculated from the 15-minute data will be used to calculate summary statistics (box plots) for each month (December–June) and water year-type.

The combined evidence from the literature strongly indicates routing is a function of flow. Thus, it can be assumed routing of fish toward the interior delta will increase as the proportion of flow. entering the junction increases. However, the slope of the relationship will be less than 1.

I.10.2.2 Assumptions / Uncertainty

The method described here is simply a way of summarizing data from the DSM2 model. Thus, the assumptions and uncertainties that apply to the DSM2 model would also apply to this analysis. Here were do not directly predict routing of fish into these junctions although there is a model available to accomplish this (Cavallo et al. 2015). If the results of this analysis are used to infer fish movement, additional uncertainties are introduced.

First, flow routing is averaged over 24 hr. However, flow routing can change significantly within that period, particularly at junctions where tidal water movement dominates. Thus, fish arriving at a junction may experience very different instantaneous flow routing depending on their time of arrival. To link these data frames with fish movement requires the assumption that fish arrive at the junction uniformly over the 24-hour averaging period. Additionally, it must be assumed that the behavior of fish at junctions is the same over the range of hydrologic conditions modeled (e.g. the relationship is linear across the range of data).

I.10.2.3 Code and Data Repository

Analysis files for the Flow into Junction input data and Flow into Junction analysis are available upon request.

I.10.3 Results

Flow into a number of junctions of interest with respect to movement in the north Delta and towards the south Delta was analyzed: Sutter Slough, Steamboat Slough, the Delta Cross Channel, Georgiana Slough, the head of Old River, Turner Cut, Columbia Cut, the mouth of Middle River, the mouth of Old River, Fisherman's Cut, False River, the Central Valley Project, Mokelumne River, San Joaquin River, False River, and Jersey Point (Figure I.10-1). Presented below are plots including a subset of junctions which include Georgiana Slough, the head of Old River, Turner Cut, Delta Cross Channel, Columbia Cut, Middle River, the mouth of Old River, the State Water Project, Three Mile Slough, the Central Valley Project and Railroad Cut.

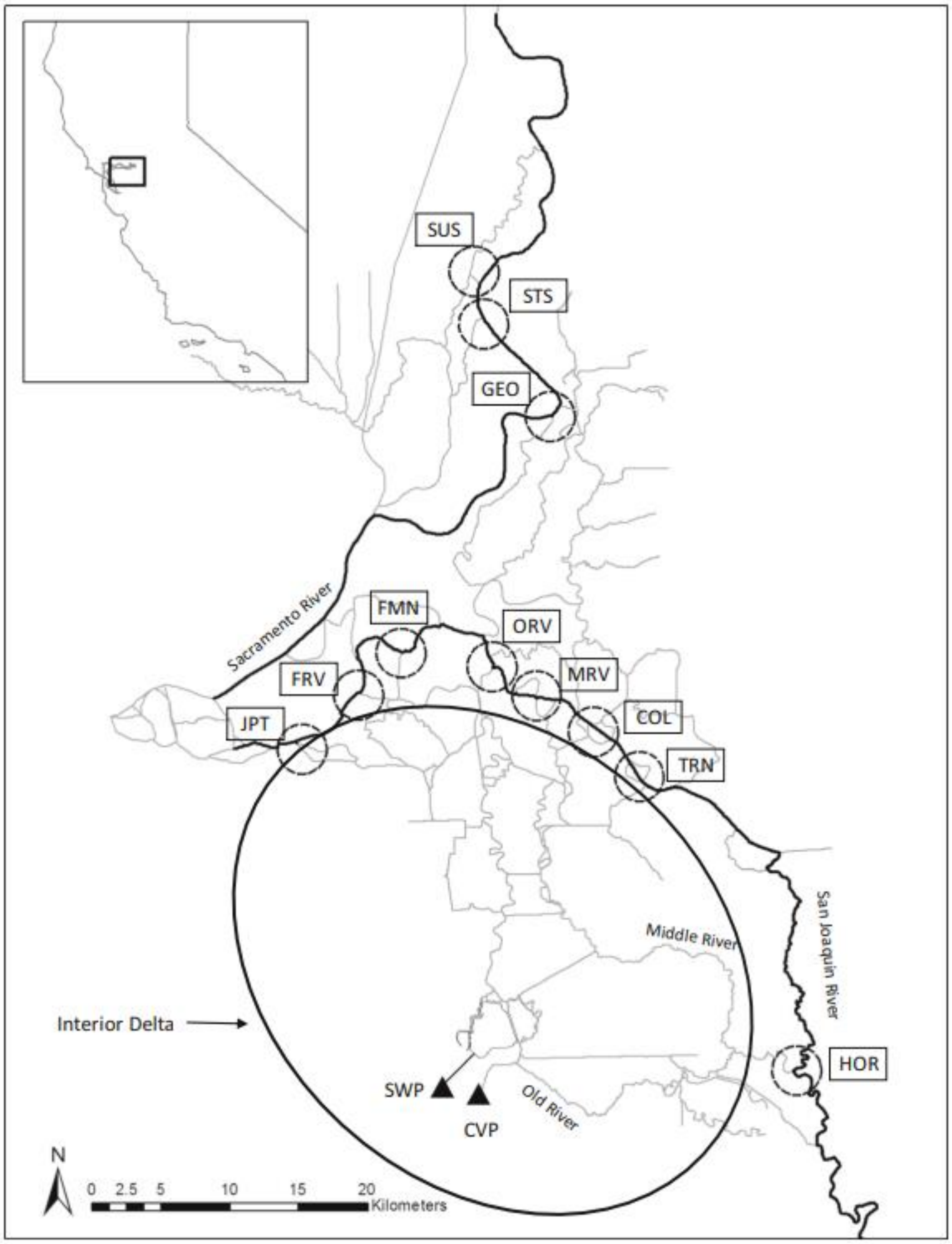

Figure I.10-1. Map of Junctions Analyzed for Flow Entry Based on DSM2-HYDRO Outputs. Note: Junction abbreviations include Sutter Slough (SUS), Steamboat Slough (STS), Georgiana Slough (GEO), the head of Old River (HOR), Turner Cut (TRN), Columbia Cut (COL), the mouth of Middle River (MRV), the mouth of Old River (ORV), Fisherman's Cut (FMN), False River (FRV), and Jersey Point (JPT). Also analyzed but not shown on the map was the Delta Cross Channel, immediately adjacent to GEO. Source: Cavallo et al 2015.

I.10.3.1 BA

I.10.3.1.1 Binned by inflow

The combined evidence from the literature strongly indicates routing is a function of flow. Thus, it can be assumed routing of fish into a junction will increase as the proportion of flow entering the junction increases. However, the slope of the relationship will likely be less than 1 based on the available studies (Perry 2010; Cavallo et al. 2015).

At the Georgiana Slough, Head of Old River, and CVP junctions, the proportion of flow into the junction was affected by river inflow levels (Figure I.10-2 and Figure I.10-3). At Georgiana Slough, the proportion entering the junction decreased from a high of 0.4405 under Alt2 without TUCP without VA at low Sacramento River inflow and medium San Joaquin inflow to a low of 0.2845 under Alt 2 without TUCP with Delta VA at high Sacramento River inflow and high San Joaquin inflow. Increases in San Joaquin River inflow resulted in less variation in proportion of flow entering the junction than Sacramento River inflow for the Proposed Action phases. When San Joaquin River inflows were high, the highest and lowest proportion of flow entering the junction ranged from 0.4211 under low Sacramento inflow in Alt 2 without TUCP without VA and 0.2845 under high Sacramento inflow conditions in Alt 2 without TUCP with DeltaVA.

At Head of Old River, the proportion of water routed into the junction increased from a low of 0.5527 under Alt 2 without TUCP with allVA at low Sacramento River inflows and high San Joaquin inflows to a high of 0.6612 under Alt 2 without TUCP withoutVA at high Sacramento River inflow and medium San Joaquin inflow. For the Proposed Action phases, a greater proportion of flow entered the junction (58-66%) at low and medium San Joaquin River inflow compared to high San Joaquin inflow (55-56%) regardless of Sacramento River inflow.

At CVP, the proportion of water routed into the junction increased from a low of 0.4425 under low Sacramento and San Joaquin inflows to a high of 0.6604 under low Sacramento inflow and high San Joaquin inflows. Increases in Sacramento River inflow resulted in less variation in proportion of flow entering the junction than San Joaquin River for the Proposed Action phases.

At the other junctions, routing was relatively insensitive to inflow from either the Sacramento River or the San Joaquin River. However, there was some variation when both San Joaquin River and Sacramento River flow levels were high.

The distribution of flow routing values for Alternatives EXP1 and/or EXP3 were shifted lower than the other alternatives at almost all junctions. These effects were greatest at junction that were farthest upstream and strongly riverine and at CVP. At junctions that are tides dominated, the differences between these two alternatives and all others were attenuated.

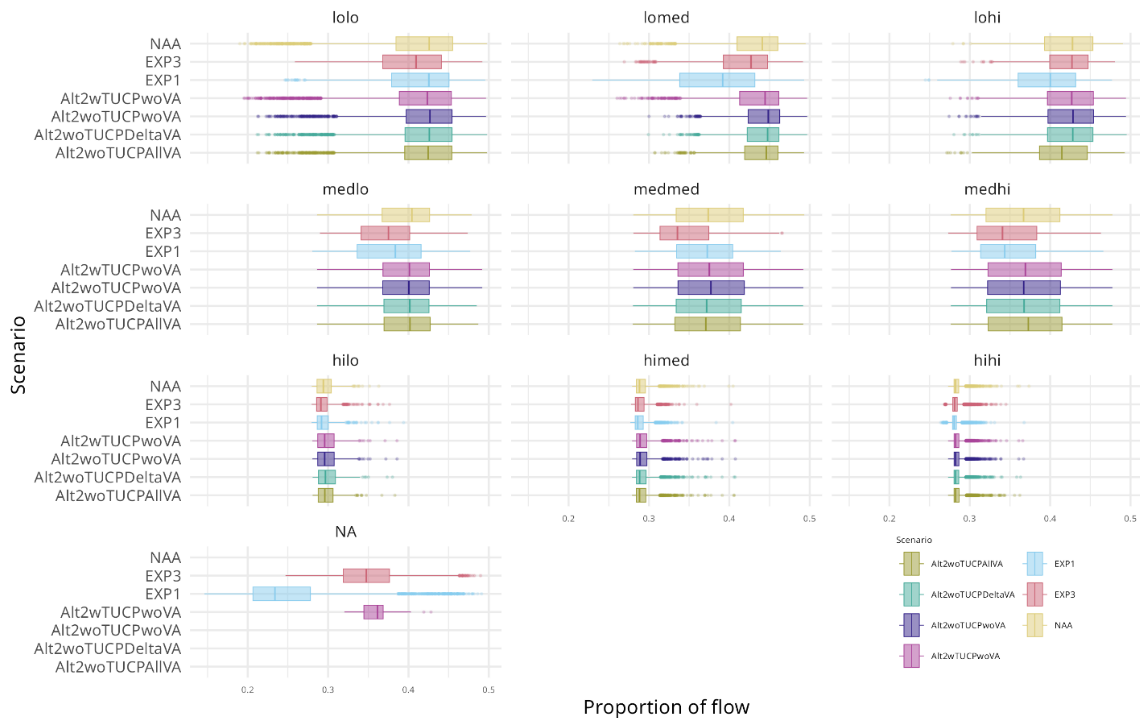

Figure I.10-2. Proportion of Flow Entering Georgiana Slough (GEO) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

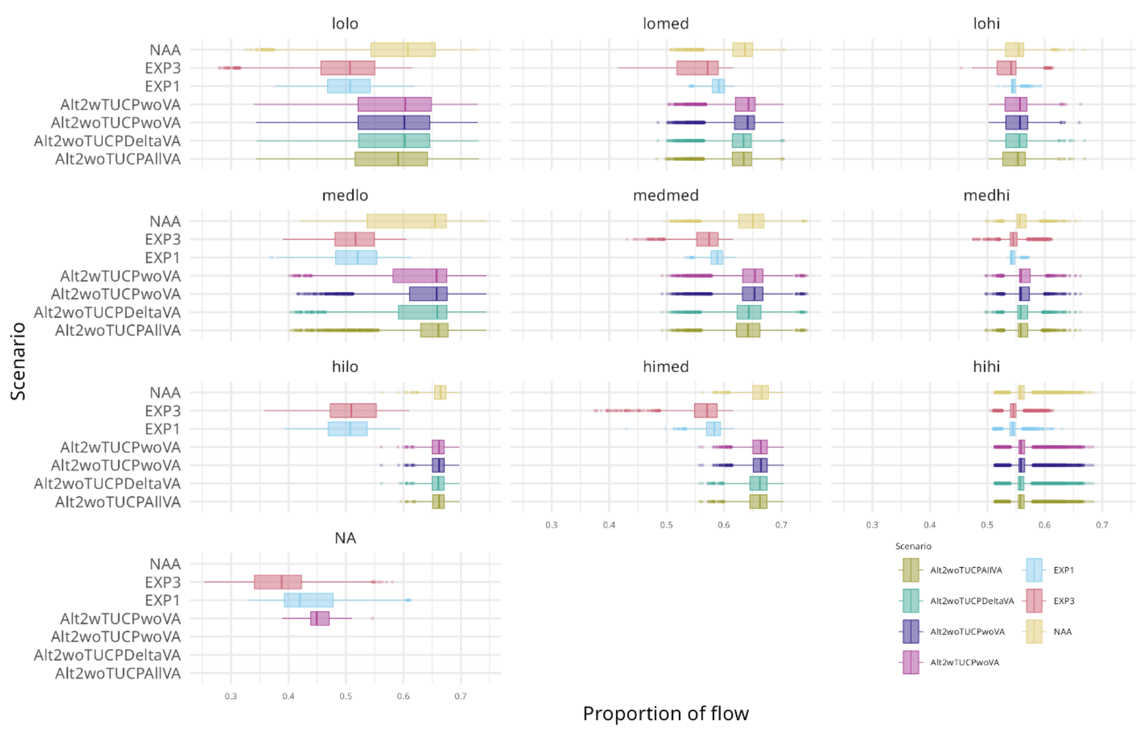

Figure I.10-3. Proportion of Flow Entering Head of Old River (HOR) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

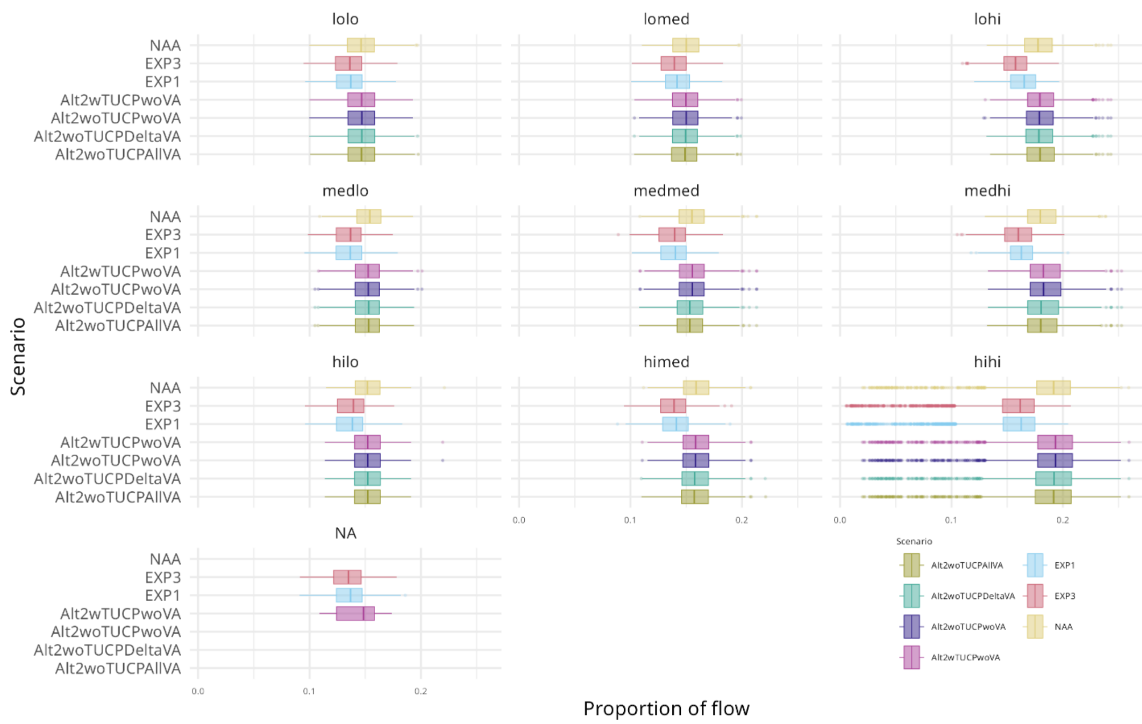

Figure I.10-4. Proportion of Flow Entering Turner Cut (TRN) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

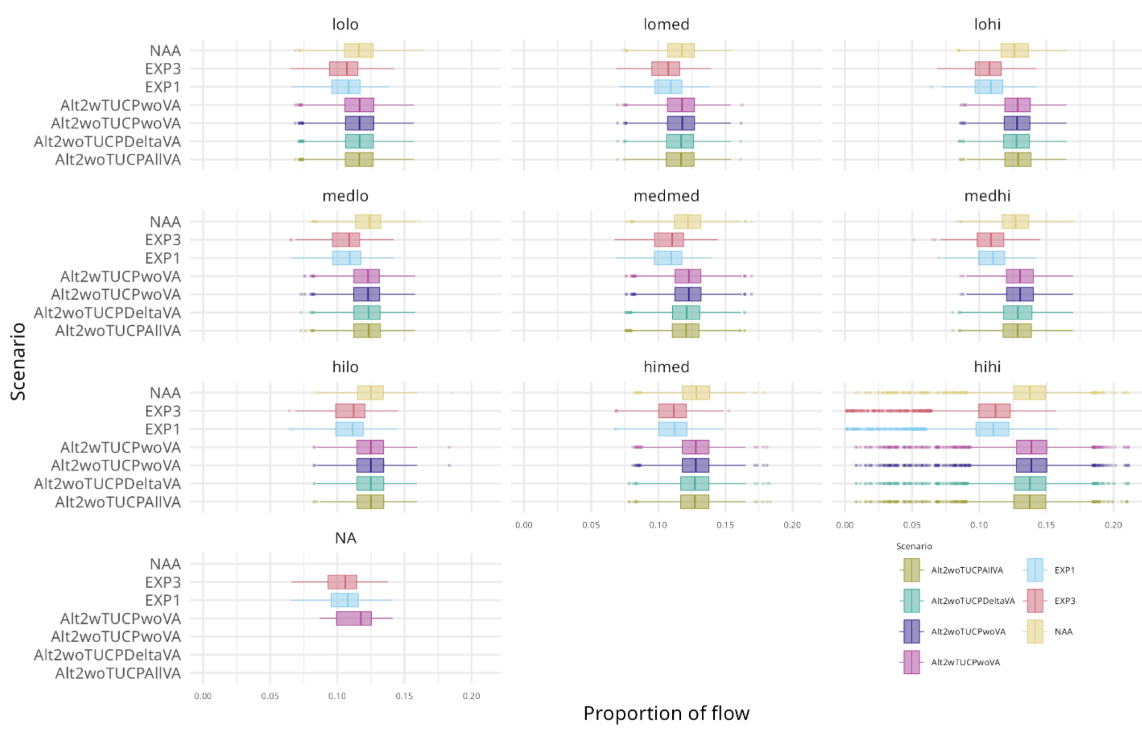

Figure I.10-5. Proportion of Flow Entering Columbia Cut (COL) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

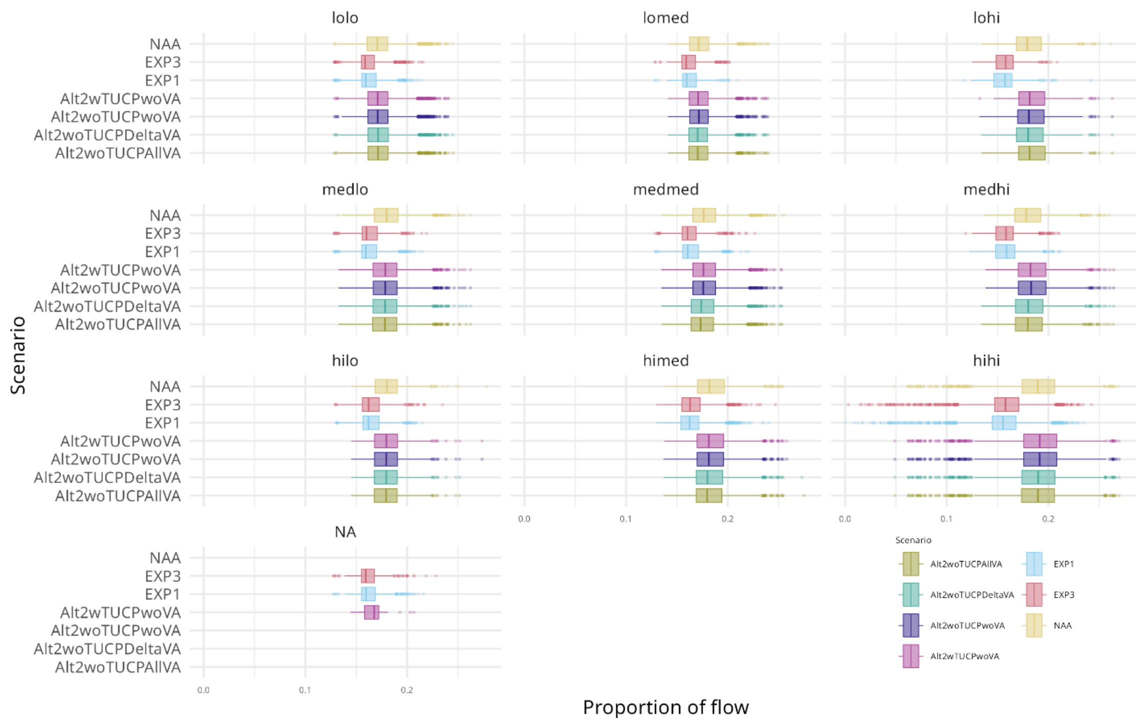

Figure I.10-6. Proportion of Flow Entering Middle River (MRV) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

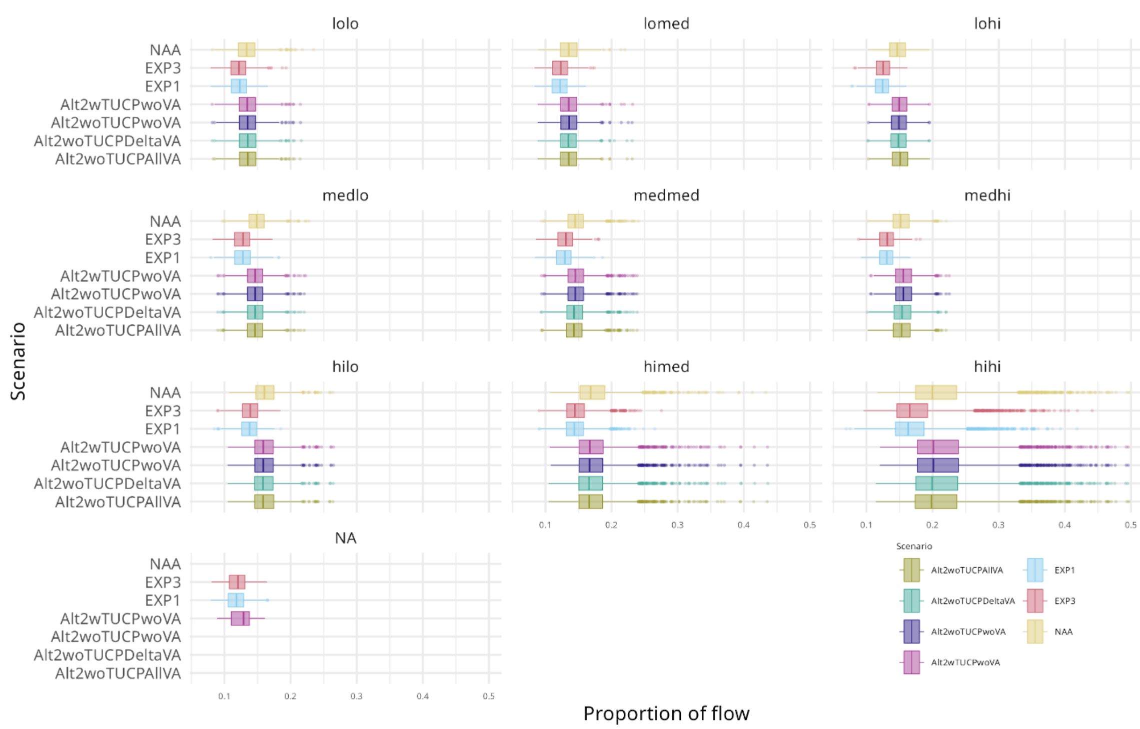

Figure I.10-7. Proportion of Flow Entering mouth of Old River (ORV) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

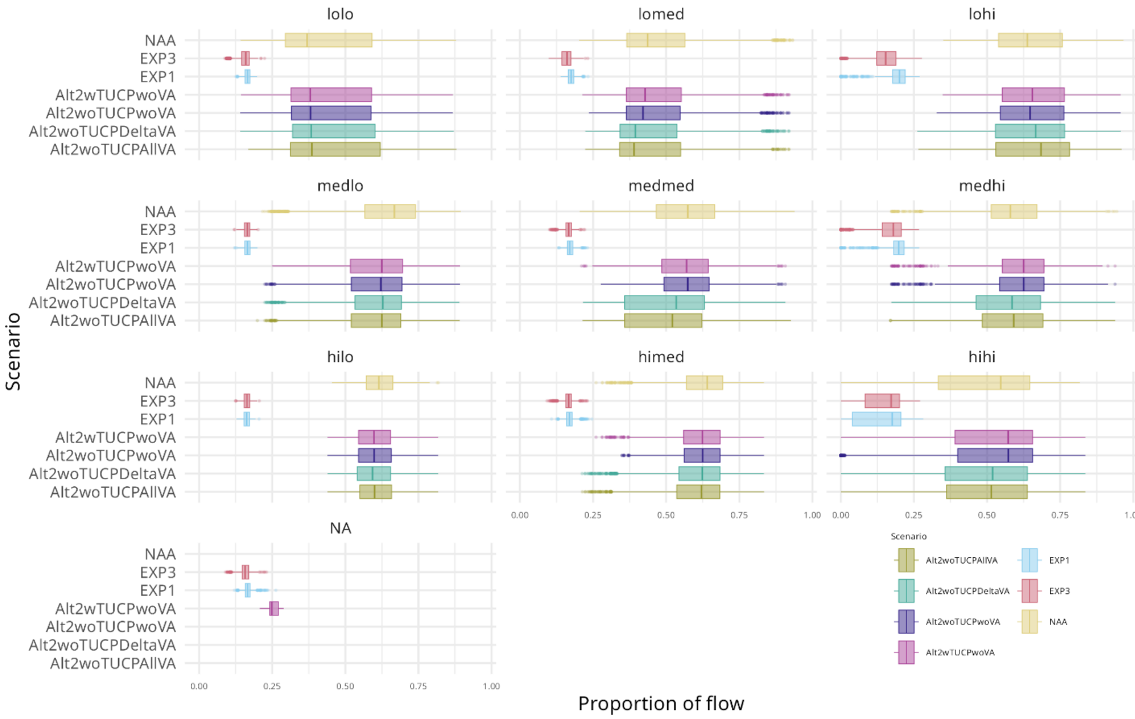

Figure I.10-8. Proportion of Flow Entering the Central Valley Project (CVP) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

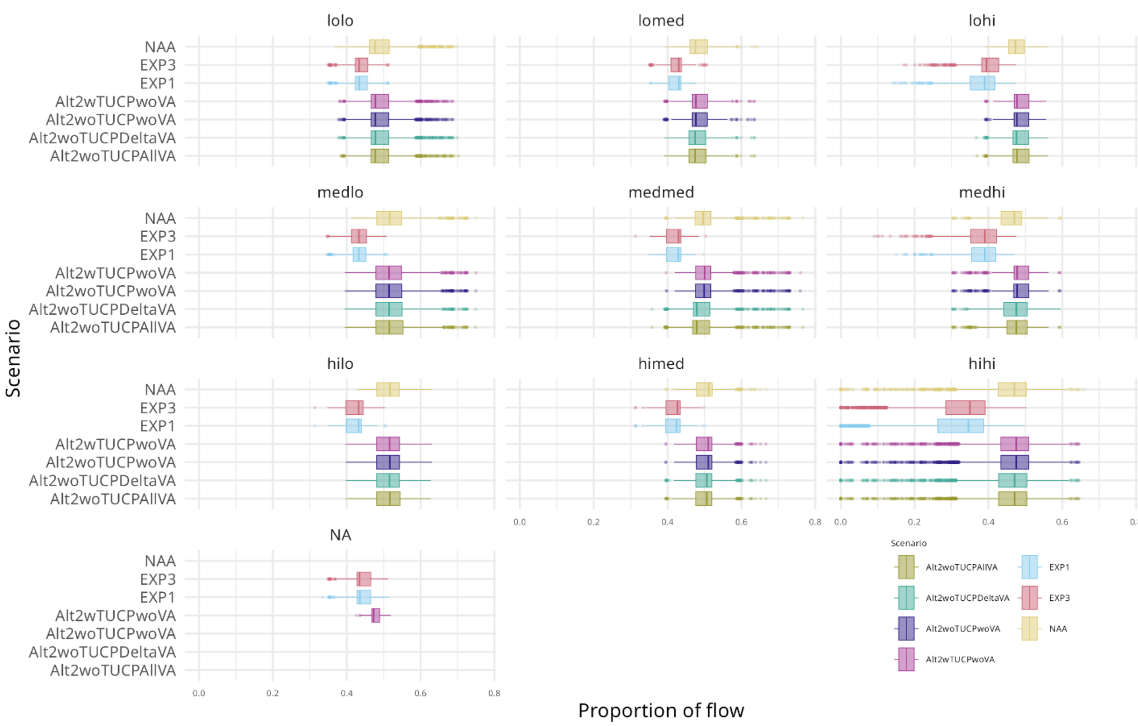

Figure I.10-9. Proportion of Flow Entering mouth of Railroad Cut (RRD) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

Table I.10-1. Proportion of flow entering junctions from DSM2-HYDRO Modeling data for EXP1, EXP3, NAA, and four phases of Alternative 2 by inflow group.

Junction	Flow_Bin	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
COL	lolo	0.1072	0.1058	0.1158	0.1161	0.1162	0.1163	0.1161
COL	lomed	0.1082	0.1063	0.1169	0.1170	0.1172	0.1164	0.1164
COL	lohi	0.1076	0.1075	0.1260	0.1281	0.1277	0.1273	0.1284
COL	medlo	0.1078	0.1075	0.1231	0.1221	0.1221	0.1223	0.1223
COL	medmed	0.1082	0.1087	0.1217	0.1221	0.1221	0.1205	0.1203
COL	medhi	0.1100	0.1088	0.1269	0.1301	0.1301	0.1285	0.1281
COL	hilo	0.1100	0.1104	0.1246	0.1244	0.1244	0.1243	0.1244
COL	himed	0.1112	0.1107	0.1279	0.1276	0.1275	0.1269	0.1269
COL	hihi	0.1076	0.1092	0.1362	0.1375	0.1375	0.1365	0.1363
COL	NA	0.1065	0.1048	NA	0.1144	NA	NA	NA
CVP	lolo	0.1655	0.1558	0.4328	0.4425	0.4441	0.4498	0.4537
CVP	lomed	0.1756	0.1583	0.4861	0.4697	0.4704	0.4528	0.4554
CVP	lohi	0.1798	0.1498	0.6573	0.6604	0.6475	0.6467	0.6566
CVP	medlo	0.1651	0.1641	0.6395	0.5979	0.5987	0.6038	0.5965
CVP	medmed	0.1711	0.1659	0.5713	0.5657	0.5697	0.5120	0.5048
CVP	medhi	0.1897	0.1675	0.5784	0.6119	0.6053	0.5643	0.5687
CVP	hilo	0.1630	0.1635	0.6182	0.6039	0.6044	0.6025	0.6069
CVP	himed	0.1694	0.1660	0.6219	0.6124	0.6159	0.5917	0.5899
CVP	hihi	0.1388	0.1419	0.4777	0.4969	0.4981	0.4716	0.4722
CVP	NA	0.1664	0.1573	NA	0.2543	NA	NA	NA
GEO	lolo	0.4101	0.4006	0.4103	0.4111	0.4183	0.4174	0.4165
GEO	lomed	0.3821	0.4172	0.4304	0.4330	0.4405	0.4397	0.4375
GEO	lohi	0.3908	0.4202	0.4191	0.4204	0.4211	0.4208	0.4114
GEO	medlo	0.3785	0.3742	0.3953	0.3957	0.3955	0.3957	0.3964
GEO	medmed	0.3708	0.3473	0.3759	0.3772	0.3779	0.3747	0.3735
GEO	medhi	0.3491	0.3484	0.3664	0.3686	0.3674	0.3671	0.3705
GEO	hilo	0.2952	0.2942	0.2970	0.2990	0.2991	0.2999	0.2988
GEO	himed	0.2891	0.2898	0.2921	0.2930	0.2930	0.2926	0.2925
GEO	hihi	0.2819	0.2826	0.2845	0.2846	0.2846	0.2845	0.2848
GEO	NA	0.2555	0.3523	NA	0.3606	NA	NA	NA
HOR	lolo	0.5037	0.4953	0.5900	0.5818	0.5810	0.5821	0.5763
HOR	lomed	0.5887	0.5549	0.6269	0.6310	0.6291	0.6248	0.6243
HOR	lohi	0.5470	0.5397	0.5538	0.5561	0.5567	0.5560	0.5527
HOR	medlo	0.5158	0.5136	0.6168	0.6283	0.6309	0.6273	0.6363

Junction	Flow_Bin	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
HOR	medmed	0.5863	0.5667	0.6419	0.6437	0.6435	0.6380	0.6372
HOR	medhi	0.5439	0.5497	0.5599	0.5635	0.5631	0.5613	0.5617
HOR	hilo	0.5039	0.5105	0.6629	0.6596	0.6597	0.6591	0.6603
HOR	himed	0.5806	0.5626	0.6622	0.6610	0.6612	0.6580	0.6583
HOR	hihi	0.5423	0.5462	0.5614	0.5618	0.5619	0.5610	0.5615
HOR	NA	0.4421	0.3844	NA	0.4564	NA	NA	NA
MRV	lolo	0.1613	0.1604	0.1724	0.1727	0.1728	0.1732	0.1732
MRV	lomed	0.1616	0.1606	0.1729	0.1726	0.1729	0.1721	0.1722
MRV	lohi	0.1568	0.1581	0.1819	0.1843	0.1835	0.1827	0.1845
MRV	medlo	0.1617	0.1622	0.1816	0.1803	0.1804	0.1802	0.1800
MRV	medmed	0.1626	0.1618	0.1782	0.1782	0.1781	0.1761	0.1758
MRV	medhi	0.1592	0.1585	0.1807	0.1850	0.1852	0.1825	0.1820
MRV	hilo	0.1638	0.1638	0.1817	0.1814	0.1814	0.1812	0.1813
MRV	himed	0.1640	0.1647	0.1845	0.1840	0.1840	0.1829	0.1827
MRV	hihi	0.1552	0.1577	0.1897	0.1912	0.1912	0.1898	0.1896
MRV	NA	0.1615	0.1607	NA	0.1674	NA	NA	NA
ORV	lolo	0.1227	0.1218	0.1338	0.1348	0.1350	0.1353	0.1354
ORV	lomed	0.1222	0.1230	0.1358	0.1357	0.1362	0.1352	0.1356
ORV	lohi	0.1239	0.1251	0.1469	0.1496	0.1490	0.1484	0.1507
ORV	medlo	0.1276	0.1272	0.1487	0.1465	0.1464	0.1466	0.1462
ORV	medmed	0.1284	0.1305	0.1459	0.1461	0.1460	0.1441	0.1437
ORV	medhi	0.1302	0.1312	0.1525	0.1566	0.1568	0.1546	0.1536
ORV	hilo	0.1374	0.1386	0.1626	0.1613	0.1613	0.1606	0.1612
ORV	himed	0.1447	0.1466	0.1755	0.1740	0.1738	0.1731	0.1731
ORV	hihi	0.1687	0.1731	0.2109	0.2132	0.2131	0.2114	0.2103
ORV	NA	0.1181	0.1200	NA	0.1257	NA	NA	NA
RRD	lolo	0.4341	0.4342	0.4875	0.4868	0.4863	0.4878	0.4864
RRD	lomed	0.4270	0.4279	0.4795	0.4814	0.4810	0.4764	0.4769
RRD	lohi	0.3745	0.3951	0.4737	0.4834	0.4821	0.4797	0.4803
RRD	medlo	0.4310	0.4306	0.5224	0.5195	0.5203	0.5195	0.5215
RRD	medmed	0.4242	0.4242	0.4984	0.5008	0.5003	0.4912	0.4893
RRD	medhi	0.3830	0.3818	0.4629	0.4811	0.4804	0.4709	0.4718
RRD	hilo	0.4273	0.4271	0.5158	0.5142	0.5144	0.5140	0.5146
RRD	himed	0.4170	0.4199	0.5056	0.5042	0.5043	0.5004	0.5002
RRD	hihi	0.3088	0.3200	0.4440	0.4514	0.4514	0.4457	0.4460
RRD	NA	0.4395	0.4393	NA	0.4755	NA	NA	NA

Junction	Flow_Bin	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
TRN	lolo	0.1366	0.1361	0.1464	0.1468	0.1468	0.1469	0.1469
TRN	lomed	0.1426	0.1395	0.1500	0.1496	0.1499	0.1493	0.1490
TRN	lohi	0.1638	0.1571	0.1783	0.1803	0.1795	0.1792	0.1808
TRN	medlo	0.1363	0.1361	0.1537	0.1523	0.1524	0.1525	0.1524
TRN	medmed	0.1396	0.1384	0.1550	0.1553	0.1552	0.1533	0.1533
TRN	medhi	0.1628	0.1594	0.1812	0.1843	0.1846	0.1827	0.1820
TRN	hilo	0.1372	0.1379	0.1524	0.1523	0.1523	0.1523	0.1523
TRN	himed	0.1410	0.1391	0.1589	0.1586	0.1585	0.1579	0.1578
TRN	hihi	0.1563	0.1558	0.1886	0.1902	0.1902	0.1890	0.1886
TRN	NA	0.1366	0.1351	NA	0.1441	NA	NA	NA

I.10.3.1.2 Binned by OMR

The combined evidence from the literature strongly indicates routing is a function of flow. Thus, it can be assumed routing of fish into a junction will increase as the proportion of flow entering the junction increases. However, the slope of the relationship will likely be less than 1 based on the available studies (Perry 2010; Cavallo et al. 2015). At junctions where tides are the predominant hydrologic driver such as Turner Cut, Middle River, mouth of Old River, and Columbia Cut, the proportion of flow entering the junction was of lower magnitude and more narrowly ranged between 10-20% across OMR values.

The effect of OMR on routing was medium at the CVP and junctions closest to the CVP including Head of Old River and Railroad Cut. At CVP, the proportion of flow entering the junction increased as OMR became more negative and ranged from a low of 0.3487 (-2,000) under Alt2 with TUCP without VA to a high of 0.7037 (<-5,500) under Alt2 without TUCP without VA. At Head of Old River, a similar pattern was apparent, and the proportion of flow entering the junction increased as OMR became more negative and ranged from a low of 0.5849 under Alt2 with tUCP without VA (-2,000) to a high of 0.700 (<-5,500) under Alt2 without TUCP without VA. Railroad Cut displayed a similar pattern with the proportion of flow entering the junction increasing with more negative OMR values ranging from a low of 0.4618 (-2,000) under Alt2 without TUCP Delta VA to a high of 0.5991 (<-5,500) under Alt2 without TUCP without VA.

At the Georgiana Slough junction, the proportion of the flow entering the junction was reduced as OMR became more negative, but was then greatest for OMR <-5500. The proportion of flow entering the junction ranged from a low of 0.3449 under Alt 2 without TUCP Delta VA to a high of 0.4343 under Alt 2 without TUCP Delta VA. For all phases of the Proposed Action, the proportion of flow entering the junction was lowest for the -5,000 OMR and greatest for <-5,500. This pattern may be related to Sacramento River flows during each OMR period since this junction is less hydrologically connected than the other junctions where OMR effects appeared to be stronger.

Within each OMR bin there were very small differences between alternatives regardless of the specific junction examined.

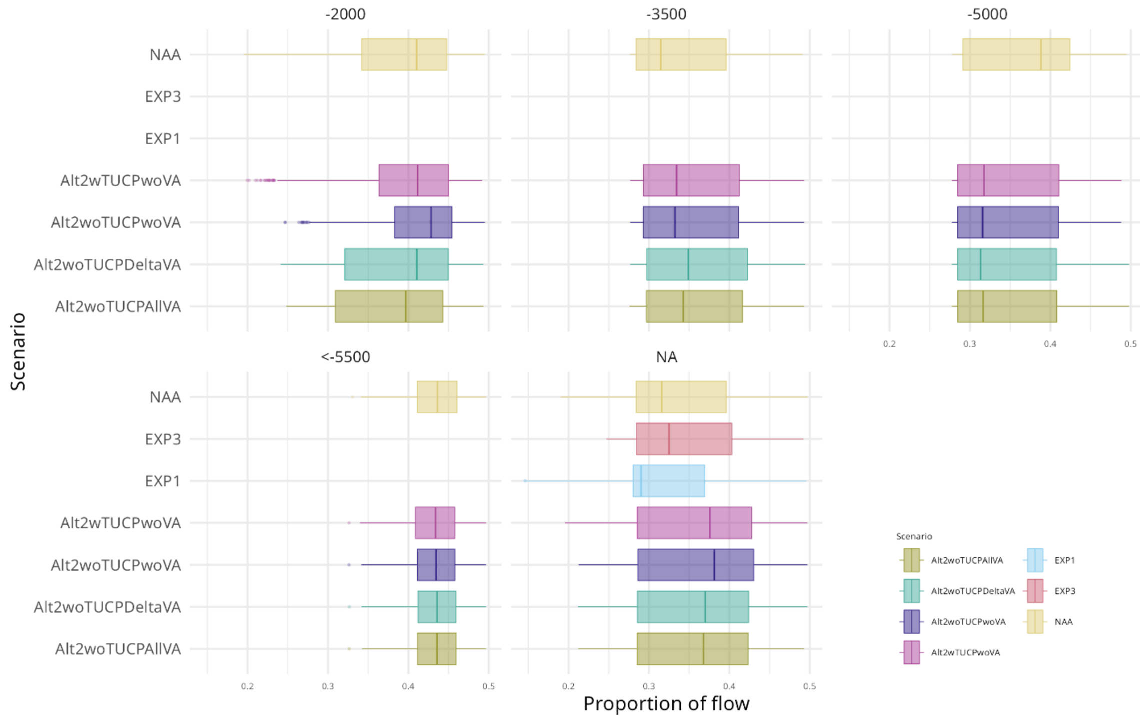

Figure I.10-10. Proportion of Flow Entering Georgiana Slough (GEO) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

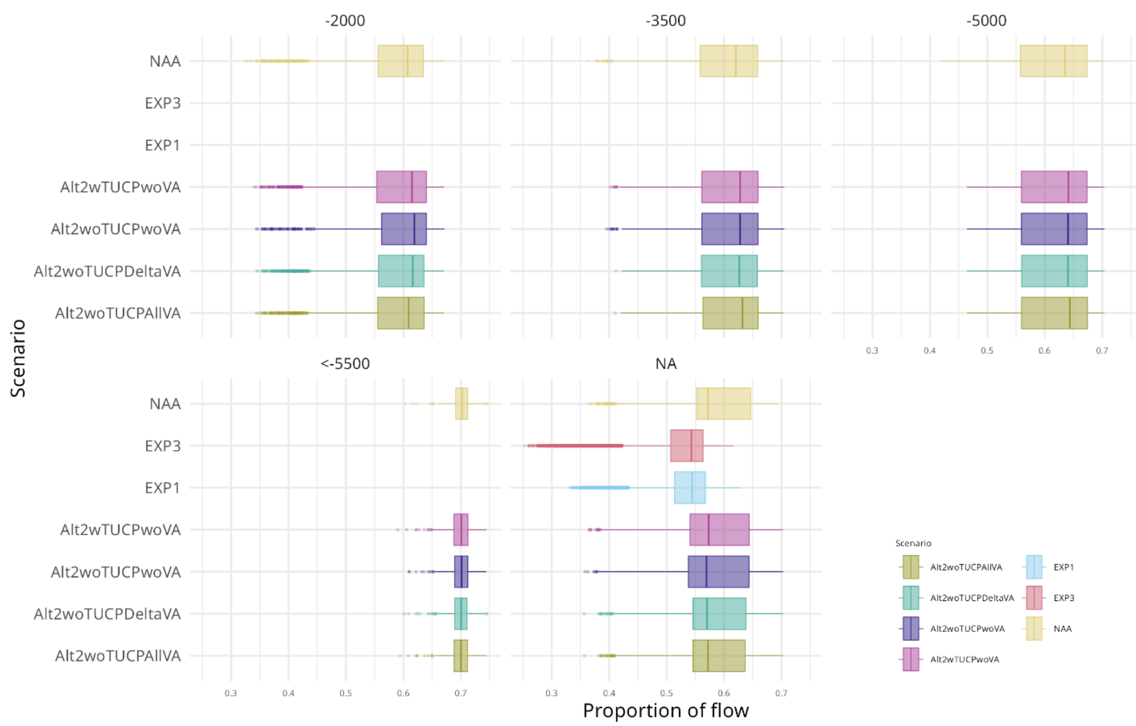

Figure I.10-11. Proportion of Flow Entering Head of Old River (HOR) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

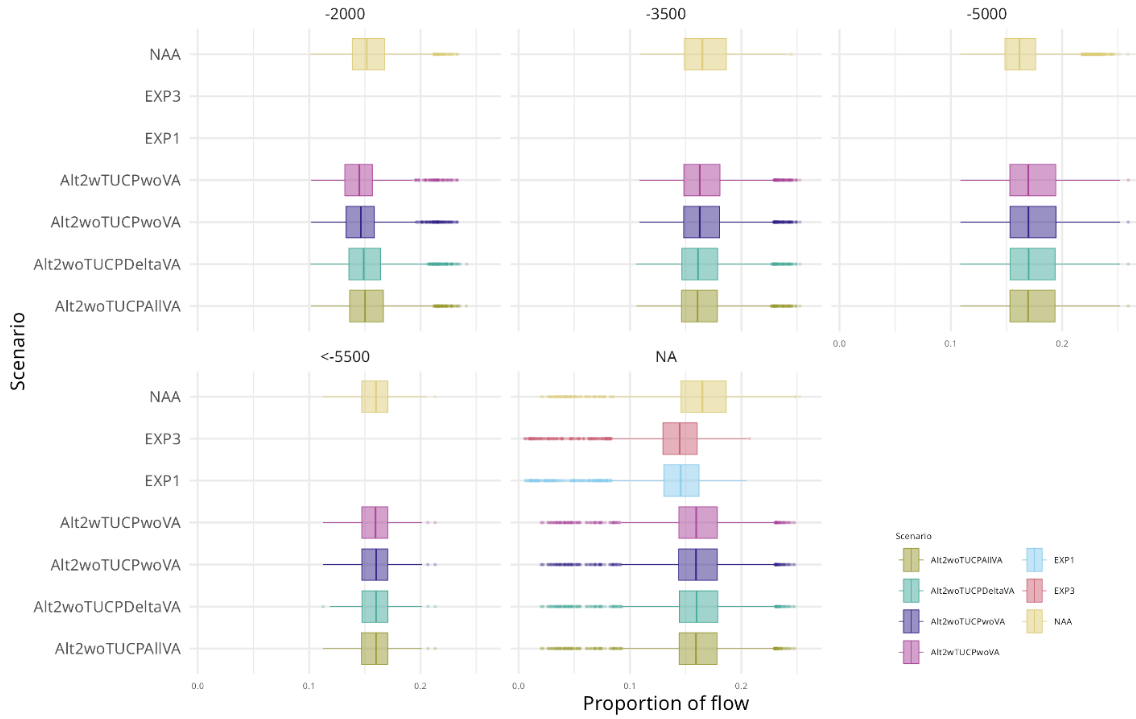

Figure I.10-12. Proportion of Flow Entering Turner Cut (TRN) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

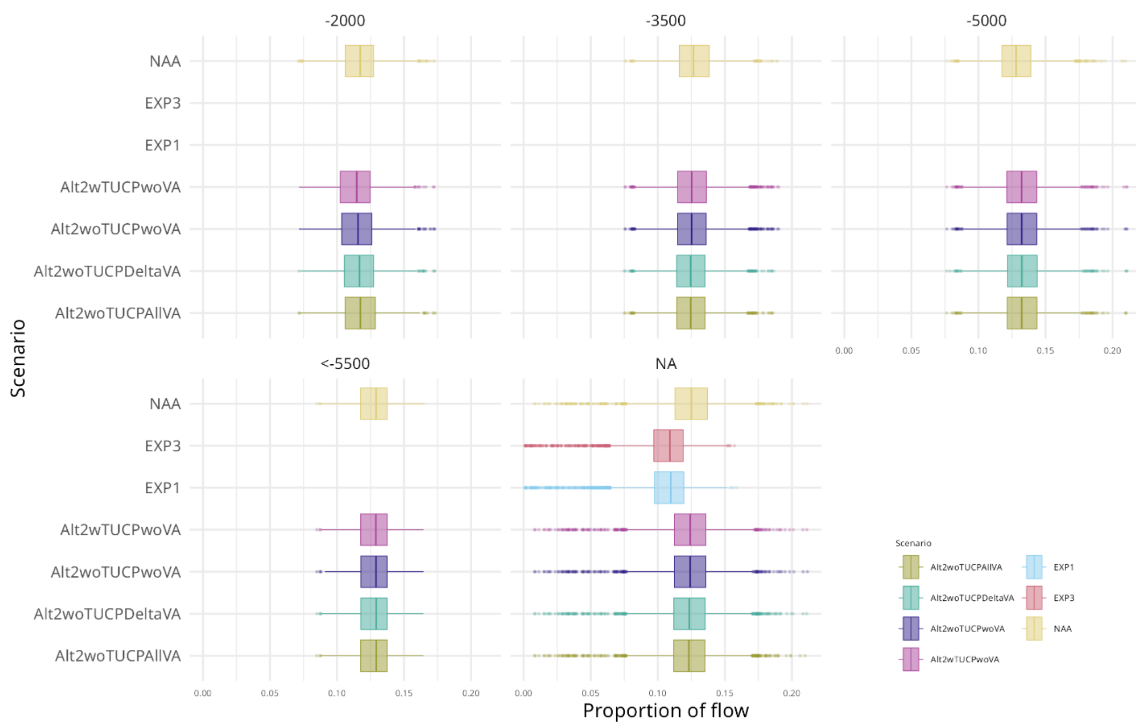

Figure I.10-13. Proportion of Flow Entering Columbia Cut (COL) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

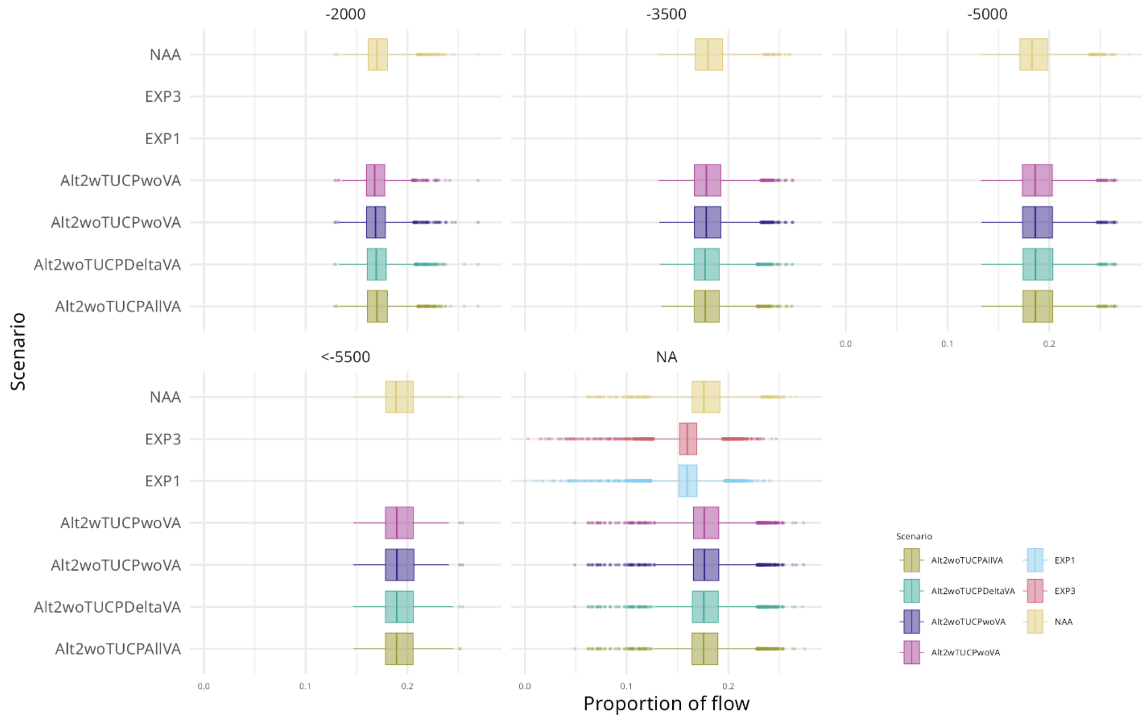

Figure I.10-14. Proportion of Flow Entering Middle River (MRV) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

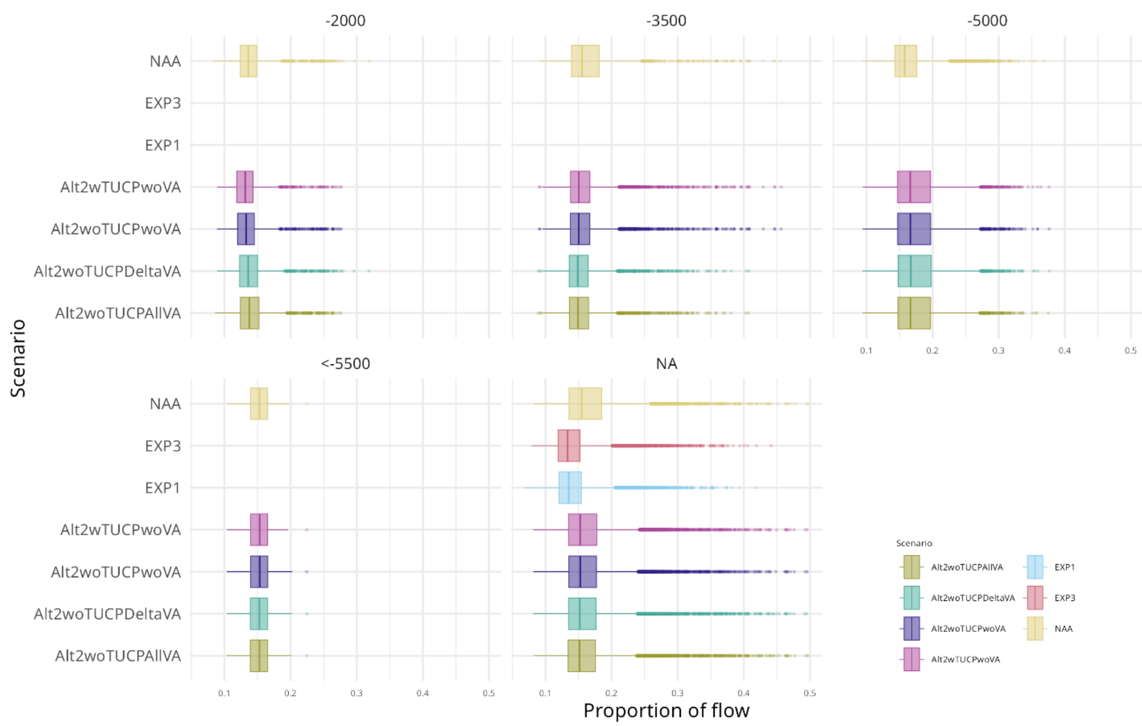

Figure I.10-15. Proportion of Flow Entering mouth of Old River (ORV) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

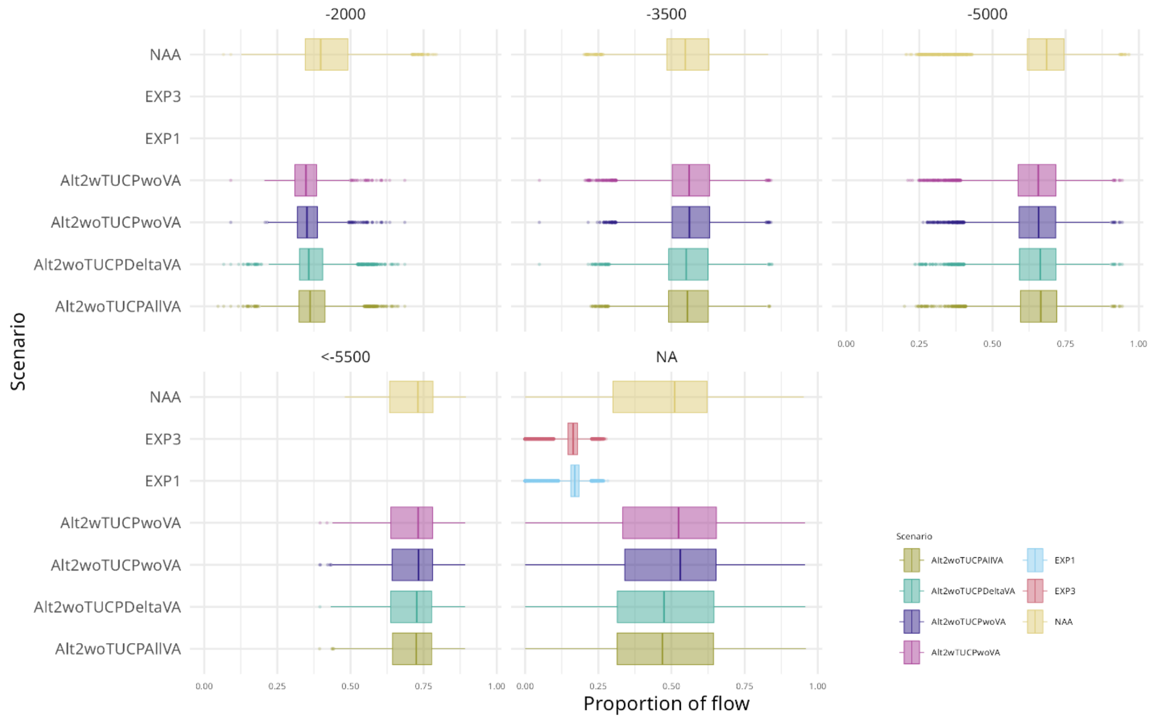

Figure I.10-16. Proportion of Flow Entering the Central Valley Project (CVP) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

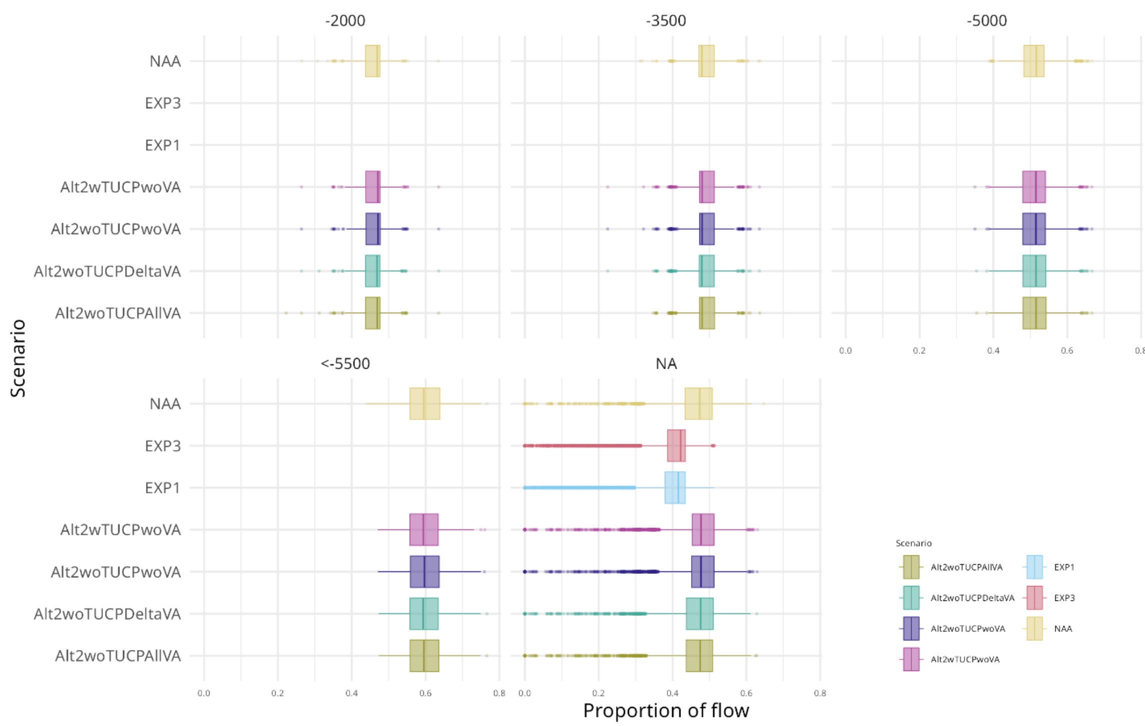

Figure I.10-17. Proportion of Flow Entering Railroad Cut (RRD) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

Table I.10-2. Proportion of flow entering junctions from DSM2-HYDRO Modeling data for EXP1, EXP3, NAA, and four phases of Alternative 2 by OMR.

Junction	OMR bin	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
COL	-2000	NA	NA	0.1170	0.1144	0.1157	0.1167	0.1174
COL	-3500	NA	NA	0.1271	0.1256	0.1255	0.1247	0.1247
COL	-5000	NA	NA	0.1284	0.1323	0.1324	0.1326	0.1325
COL	<-5500	NA	NA	0.1281	0.1280	0.1282	0.1282	0.1282
COL	NA	0.1082	0.1079	0.1243	0.1236	0.1235	0.1232	0.1230
CVP	-2000	NA	NA	0.4177	0.3487	0.3546	0.3710	0.3752
CVP	-3500	NA	NA	0.5437	0.5583	0.5604	0.5499	0.5492
CVP	-5000	NA	NA	0.6723	0.6419	0.6453	0.6476	0.6514
CVP	<-5500	NA	NA	0.7134	0.7025	0.7037	0.7014	0.7031
CVP	NA	0.1605	0.1555	0.4633	0.4890	0.4908	0.4722	0.4700
DCC	-2000	NA	NA	0.0175	0.0353	0.0253	0.0286	0.0271
DCC	-3500	NA	NA	0.0231	0.0164	0.0135	0.0202	0.0168
DCC	-5000	NA	NA	0.1251	0.0492	0.0496	0.0515	0.0526
DCC	<-5500	NA	NA	0.0000	0.0000	0.0000	0.0000	0.0000
DCC	NA	0.0000	0.0000	0.0255	0.0854	0.0913	0.0781	0.0771
GEO	-2000	NA	NA	0.3921	0.3981	0.4114	0.3894	0.3809
GEO	-3500	NA	NA	0.3424	0.3536	0.3524	0.3606	0.3576
GEO	-5000	NA	NA	0.3685	0.3471	0.3465	0.3449	0.3458
GEO	<-5500	NA	NA	0.4341	0.4317	0.4335	0.4343	0.4342
GEO	NA	0.3193	0.3455	0.3412	0.3633	0.3665	0.3615	0.3607
HOR	-2000	NA	NA	0.5906	0.5849	0.5972	0.5910	0.5879
HOR	-3500	NA	NA	0.6071	0.6126	0.6125	0.6120	0.6152
HOR	-5000	NA	NA	0.6124	0.6201	0.6198	0.6199	0.6208
HOR	<-5500	NA	NA	0.7011	0.6991	0.7003	0.6996	0.6993
HOR	NA	0.5306	0.5248	0.5896	0.5850	0.5825	0.5844	0.5840
MRV	-2000	NA	NA	0.1721	0.1698	0.1705	0.1713	0.1721
MRV	-3500	NA	NA	0.1824	0.1810	0.1810	0.1800	0.1801
MRV	-5000	NA	NA	0.1861	0.1889	0.1890	0.1894	0.1893
MRV	<-5500	NA	NA	0.1918	0.1917	0.1921	0.1917	0.1916
MRV	NA	0.1599	0.1603	0.1786	0.1789	0.1789	0.1782	0.1779
ORV	-2000	NA	NA	0.1385	0.1342	0.1365	0.1395	0.1411

Junction	OMR bin	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
ORV	-3500	NA	NA	0.1647	0.1568	0.1568	0.1542	0.1544
ORV	-5000	NA	NA	0.1653	0.1760	0.1762	0.1770	0.1764
ORV	<-5500	NA	NA	0.1524	0.1526	0.1529	0.1526	0.1526
ORV	NA	0.1407	0.1397	0.1686	0.1650	0.1649	0.1645	0.1638
RRD	-2000	NA	NA	0.4618	0.4641	0.4648	0.4618	0.4622
RRD	-3500	NA	NA	0.4865	0.4885	0.4885	0.4870	0.4883
RRD	-5000	NA	NA	0.5148	0.5128	0.5129	0.5133	0.5137
RRD	<-5500	NA	NA	0.5986	0.5965	0.5991	0.5964	0.5970
RRD	NA	0.3893	0.3966	0.4548	0.4672	0.4668	0.4633	0.4628
TRN	-2000	NA	NA	0.1539	0.1469	0.1486	0.1517	0.1532
TRN	-3500	NA	NA	0.1680	0.1657	0.1656	0.1643	0.1640
TRN	-5000	NA	NA	0.1641	0.1737	0.1738	0.1739	0.1737
TRN	<-5500	NA	NA	0.1596	0.1595	0.1597	0.1598	0.1597
TRN	NA	0.1456	0.1446	0.1658	0.1614	0.1613	0.1616	0.1613

I.10.3.2 EIS

I.10.3.2.1 Binned by inflow

The largest effects of inflow on proportion of flow entering a junction occurred at the two junctions with the greatest riverine influence (Georgiana Slough and Head of Old River) and at the CVP. At Georgiana Slough, the changes in routing occurred when either Sacramento River flow or San Joaquin flow was low (Table I.10-3). These changed ranged from the greatest reduction in routing of 11% under Alt3 when Sacramento River Flow was low and San Joaquin River flow was low, to the greatest increase of 6.1% under Alt1 when Sacramento River flow was medium and San Joaquin River flow was low compared to the NAA (Table I.10-3).

At Head of Old River, changes in the proportion of flow entering a junction were greatest under Alt1 and Alt3. Under Alt 3, all changes in routing increased the proportion of flow entering the junction (5.3% - 8.8%), whereas changes under Alt3 reduced the proportion of flow entering the junction (-8.9% to –7.4%; Table I.10-3) compared to the NAA. At CVP, changes in routing were greatest; particularly under Alts 1 and 3. Routing changes ranged from a 41.3% reduction under Alt 3 to a 26.6% increase under Alt 1 (Table I.10-3) compared to the NAA.

At other junctions that were in areas more influenced by tides, effects on inflow on the proportion of flow entering a junction were attenuated. (Figure I.10-18, Figure I.10-19, and Figure I.10-24). At other junctions, routing was relatively insensitive to inflow from either the Sacramento River or the San Joaquin River. However, there was a trend of increased routing under Alternative 1 when Sacramento River inflow was high and San Joaquin River inflow was low.

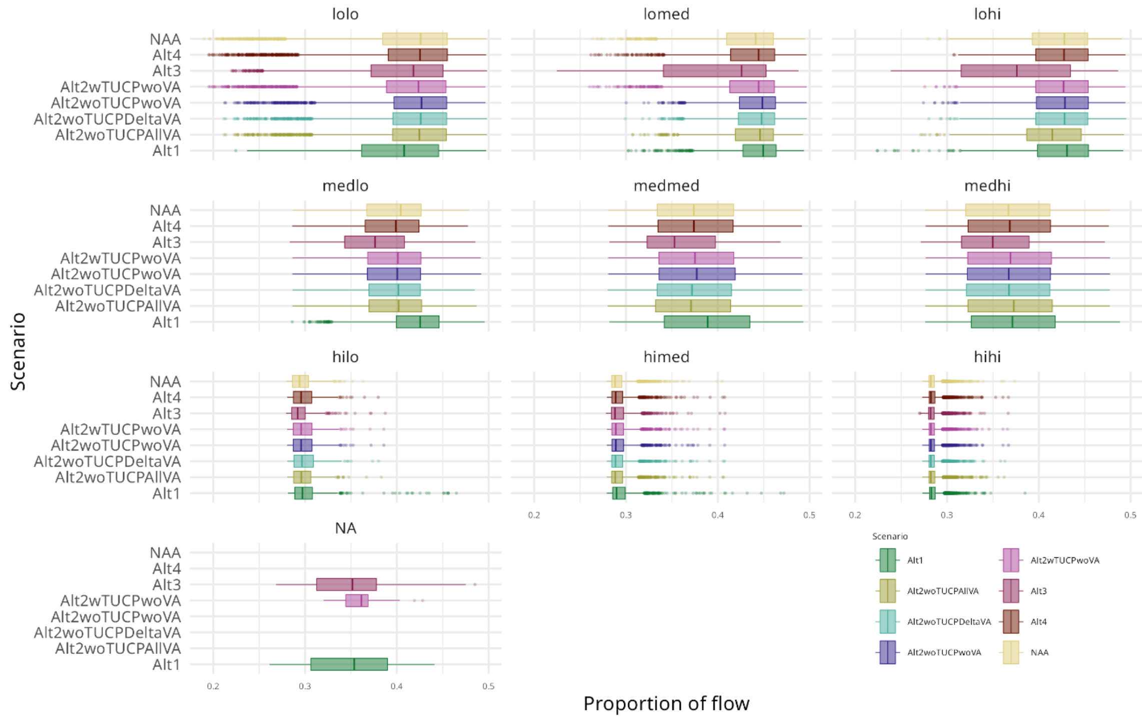

Figure I.10-18. Proportion of Flow Entering Georgiana Slough (GEO) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

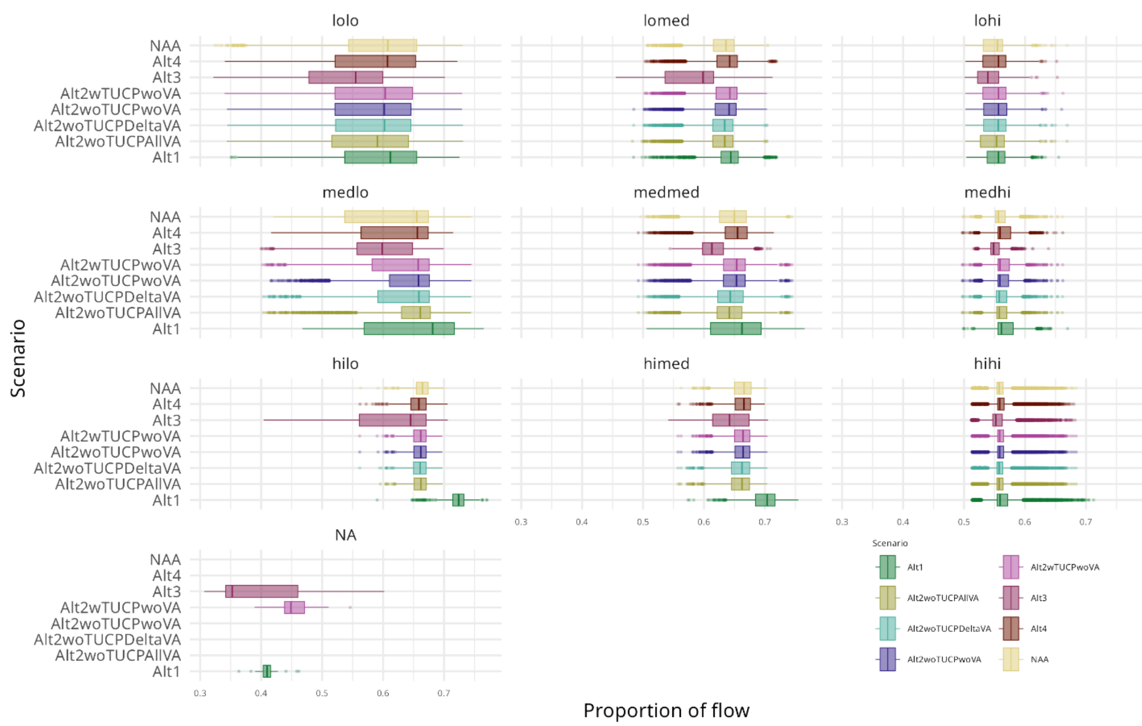

Figure I.10-19. Proportion of Flow Entering Head of Old River (HOR) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

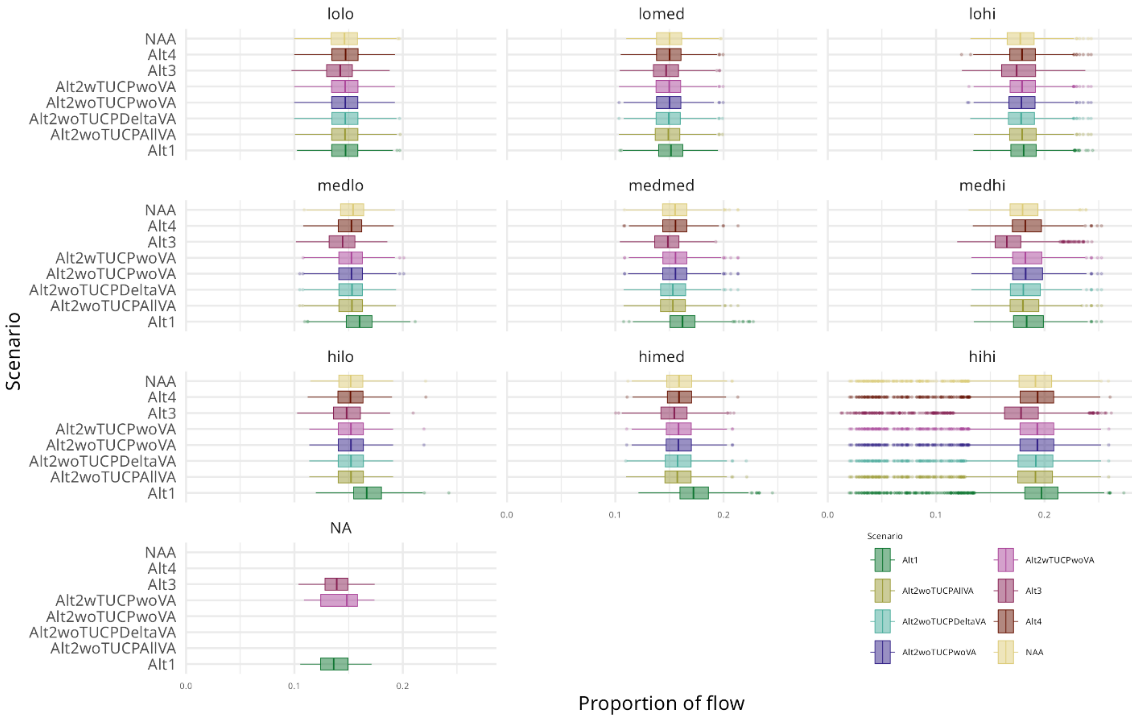

Figure I.10-20. Proportion of Flow Entering Turner Cut (TRN) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

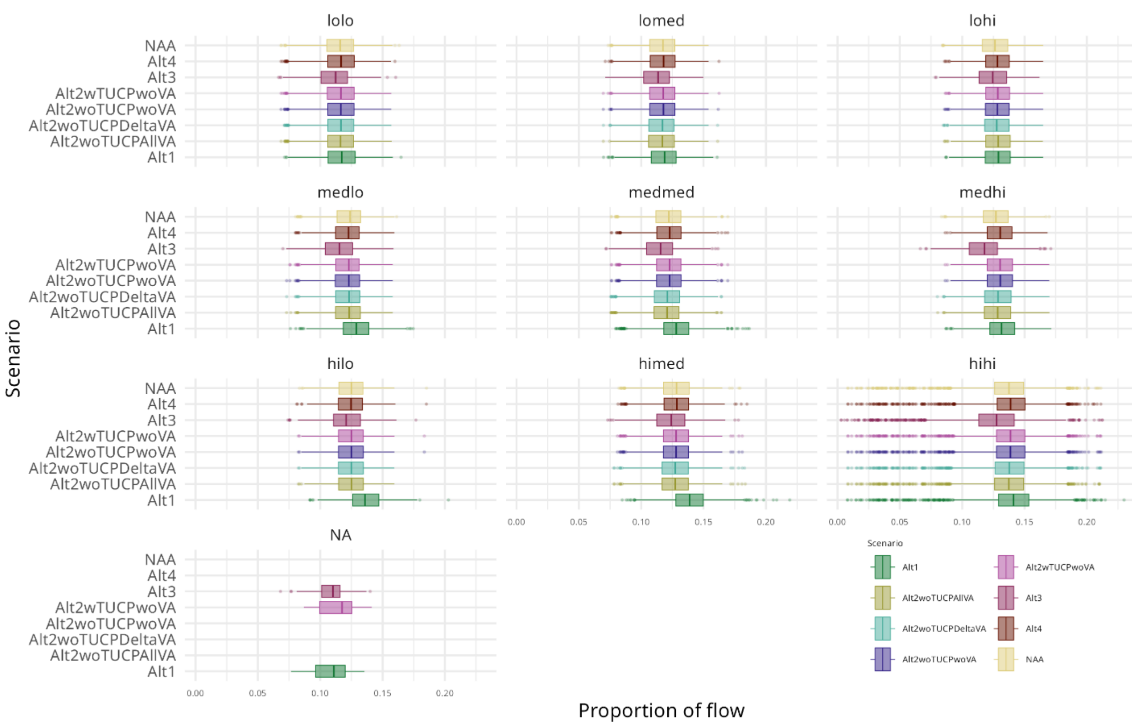

Figure I.10-21. Proportion of Flow Entering Columbia Cut (COL) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

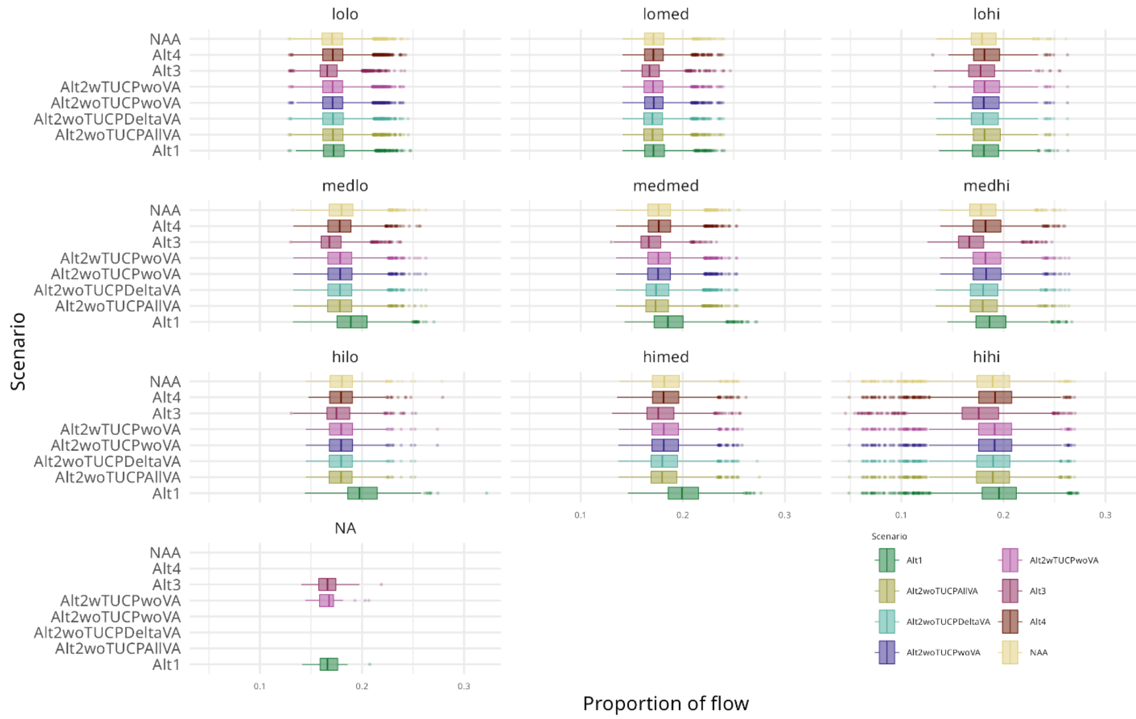

Figure I.10-22. Proportion of Flow Entering Middle River (MRV) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

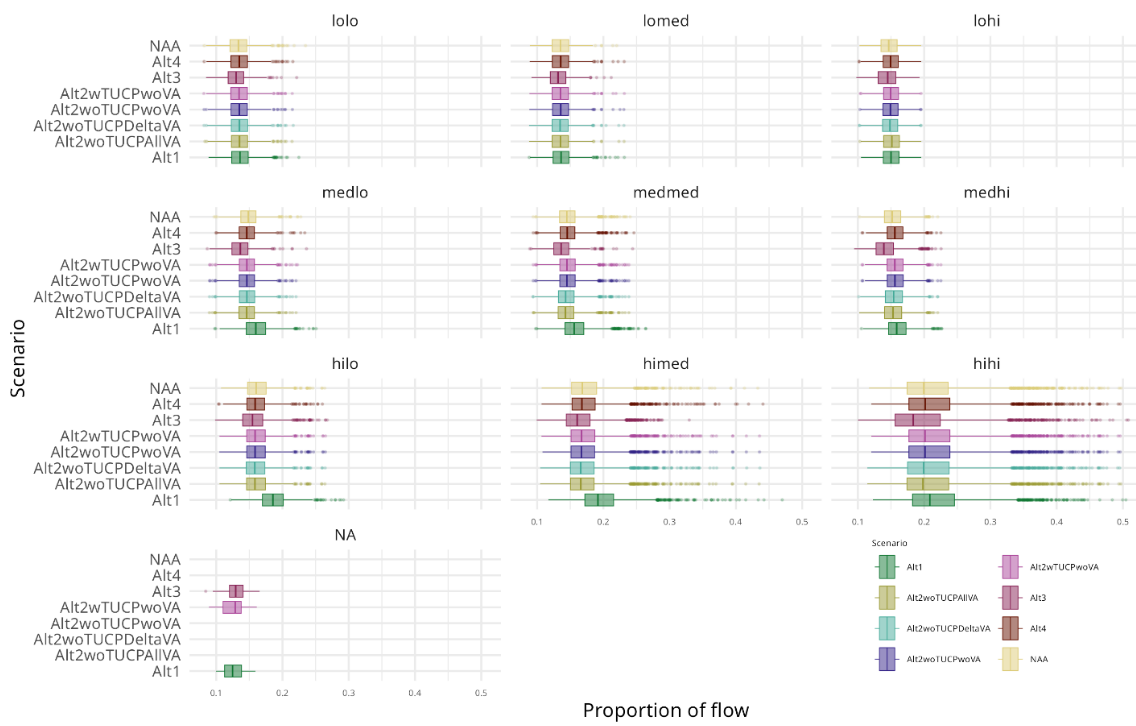

Figure I.10-23. Proportion of Flow Entering mouth of Old River (ORV) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

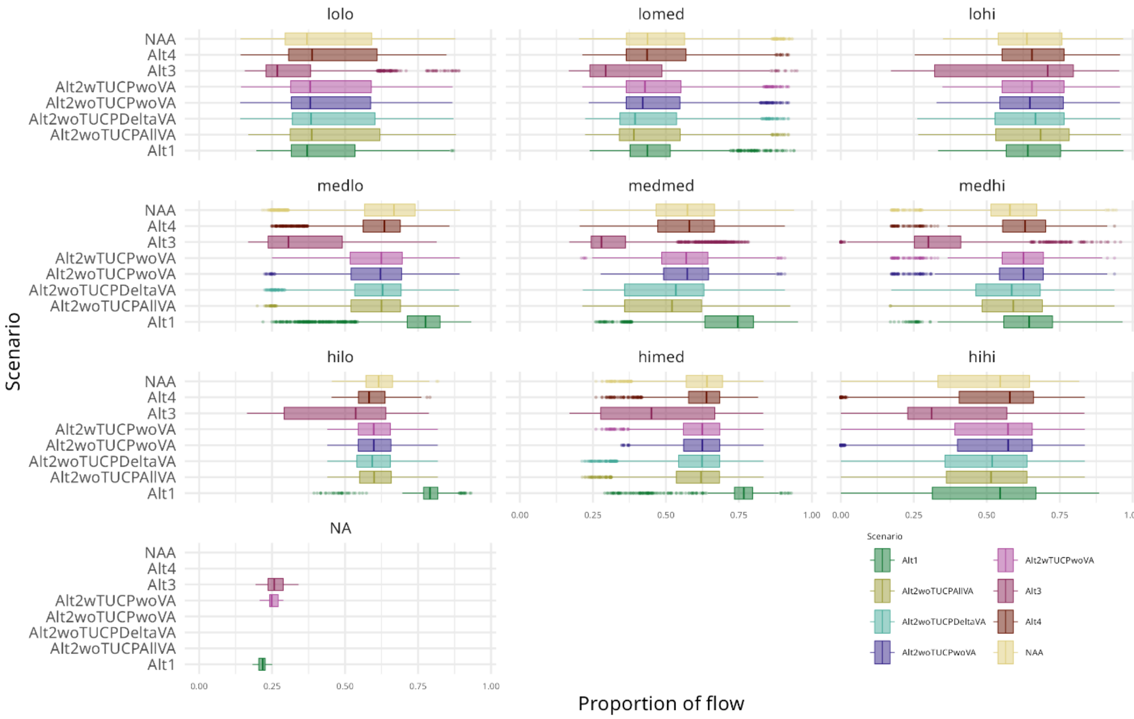

Figure I.10-24. Proportion of Flow Entering the Central Valley Project (CVP) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

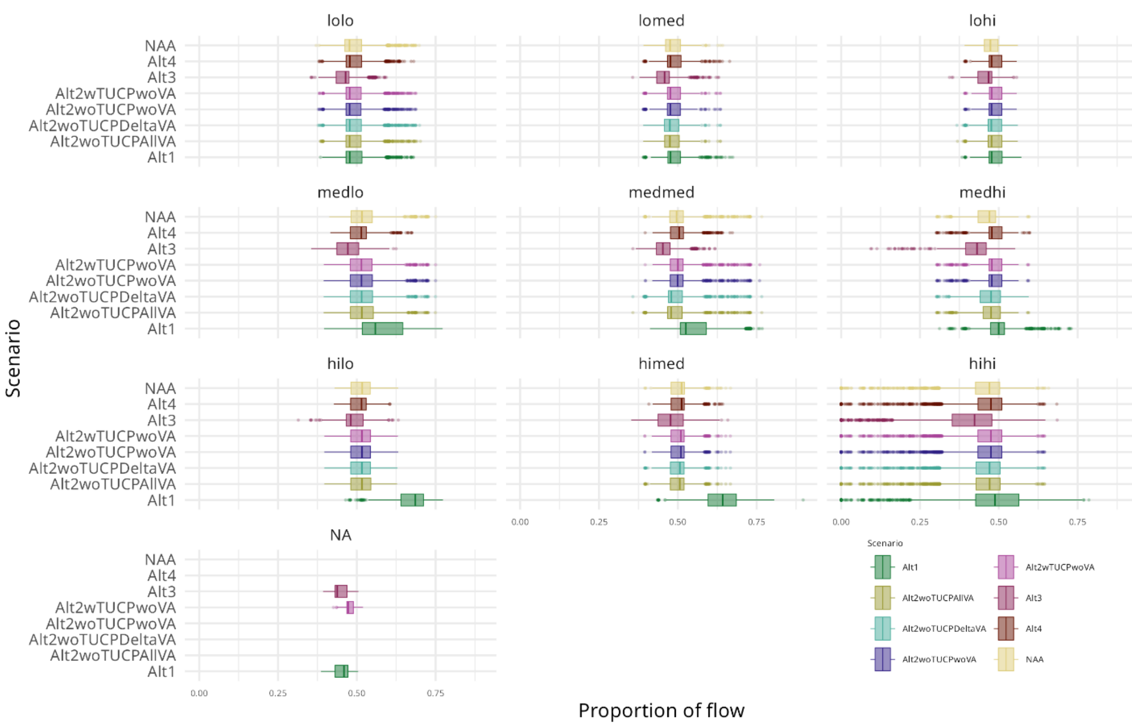

Figure I.10-25. Proportion of Flow Entering mouth of Railroad Cut (RRD) from DSM2-HYDRO Modeling Data for all alternatives by inflow group.

Table I.10-3. Proportion of flow entering junctions from DSM2-HYDRO Modeling data for NAA, Alternative 1, all phases of Alternative 2, Alternative 3, and Alternative 4 by inflow group. Percent difference from NAA are indicated in parenthesis.

Junction	Flow bin	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP DeltaVA	Alt2 woTUCP AllVA	Alt3	Alt4
COL	lolo	0.115818	0.1169 (0.9%)	0.1161 (0.3%)	0.1162 (0.3%)	0.1163 (0.4%)	0.1161 (0.3%)	0.1117 (-3.6%)	0.1163 (0.4%)
COL	lomed	0.116919	0.1182 (1.1%)	0.1170 (0.1%)	0.1172 (0.2%)	0.1164 (-0.5%)	0.1164 (-0.5%)	0.1128 (-3.5%)	0.1173 (0.3%)
COL	lohi	0.125969	0.1284 (1.9%)	0.1281 (1.7%)	0.1277 (1.4%)	0.1273 (1.0%)	0.1284 (1.9%)	0.1241 (-1.5%)	0.1279 (1.5%)
COL	medlo	0.123117	0.1285 (4.4%)	0.1221 (-0.8%)	0.1221 (-0.8%)	0.1223 (-0.7%)	0.1223 (-0.6%)	0.1150 (-6.6%)	0.1221 (-0.8%)
COL	medmed	0.121688	0.1278 (5.0%)	0.1221 (0.4%)	0.1221 (0.3%)	0.1205 (-1.0%)	0.1203 (-1.2%)	0.1150 (-5.5%)	0.1222 (0.4%)
COL	medhi	0.126851	0.1317 (3.8%)	0.1301 (2.5%)	0.1301 (2.6%)	0.1285 (1.3%)	0.1281 (1.0%)	0.1178 (-7.1%)	0.1301 (2.5%)
COL	hilo	0.124589	0.1363 (9.4%)	0.1244 (-0.2%)	0.1244 (-0.2%)	0.1243 (-0.2%)	0.1244 (-0.1%)	0.1209 (-3.0%)	0.1242 (-0.3%)
COL	himed	0.12788	0.1387 (8.5%)	0.1276 (-0.3%)	0.1275 (-0.3%)	0.1269 (-0.7%)	0.1269 (-0.8%)	0.1233 (-3.6%)	0.1279 (0.0%)
COL	hihi	0.13624	0.1398 (2.6%)	0.1375 (0.9%)	0.1375 (0.9%)	0.1365 (0.2%)	0.1363 (0.0%)	0.1264 (-7.3%)	0.1376 (1.0%)
COL	NA	NA	0.1095 (NA%)	0.1144 (NA%)	NA (NA%)	NA (NA%)	NA (NA%)	0.1091 (NA%)	NA (NA%)
CVP	lolo	0.432779	0.4301 (-0.6%)	0.4425 (2.3%)	0.4441 (2.6%)	0.4498 (3.9%)	0.4537 (4.8%)	0.3153 (-27.1%)	0.4473 (3.4%)
CVP	lomed	0.486077	0.4572 (-5.9%)	0.4697 (-3.4%)	0.4704 (-3.2%)	0.4528 (-6.9%)	0.4554 (-6.3%)	0.3737 (-23.1%)	0.4803 (-1.2%)
CVP	lohi	0.657335	0.6572 (-0.0%)	0.6604 (0.5%)	0.6475 (-1.5%)	0.6467 (-1.6%)	0.6566 (-0.1%)	0.5970 (-9.2%)	0.6565 (-0.1%)
CVP	medlo	0.639506	0.7418 (16.0%)	0.5979 (-6.5%)	0.5987 (-6.4%)	0.6038 (-5.6%)	0.5965 (-6.7%)	0.3756 (-41.3%)	0.6069 (-5.1%)
CVP	medmed	0.571324	0.7049 (23.4%)	0.5657 (-1.0%)	0.5697 (-0.3%)	0.5120 (-10.4%)	0.5048 (-11.6%)	0.3441 (-39.8%)	0.5708 (-0.1%)
CVP	medhi	0.578372	0.6347 (9.7%)	0.6119 (5.8%)	0.6053 (4.7%)	0.5643 (-2.4%)	0.5687 (-1.7%)	0.3503 (-39.4%)	0.6168 (6.6%)
CVP	hilo	0.618241	0.7827 (26.6%)	0.6039 (-2.3%)	0.6044 (-2.2%)	0.6025 (-2.6%)	0.6069 (-1.8%)	0.4893 (-20.8%)	0.5933 (-4.0%)

Junction	Flow bin	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP DeltaVA	Alt2 woTUCP AllVA	Alt3	Alt4
CVP	himed	0.621903	0.7517 (20.9%)	0.6124 (-1.5%)	0.6159 (-1.0%)	0.5917 (-4.9%)	0.5899 (-5.1%)	0.4667 (-24.9%)	0.6230 (0.2%)
CVP	hihi	0.477652	0.4834 (1.2%)	0.4969 (4.0%)	0.4981 (4.3%)	0.4716 (-1.3%)	0.4722 (-1.1%)	0.3646 (-23.7%)	0.5048 (5.7%)
CVP	NA	NA	0.2172 (NA%)	0.2543 (NA%)	NA (NA%)	NA (NA%)	NA (NA%)	0.2616 (NA%)	NA (NA%)
GEO	lolo	0.410285	0.3980 (-3.0%)	0.4111 (0.2%)	0.4183 (2.0%)	0.4174 (1.7%)	0.4165 (1.5%)	0.4068 (-0.9%)	0.4127 (0.6%)
GEO	lomed	0.430374	0.4422 (2.8%)	0.4330 (0.6%)	0.4405 (2.4%)	0.4397 (2.2%)	0.4375 (1.6%)	0.3973 (-7.7%)	0.4338 (0.8%)
GEO	lohi	0.419056	0.4215 (0.6%)	0.4204 (0.3%)	0.4211 (0.5%)	0.4208 (0.4%)	0.4114 (-1.8%)	0.3729 (-11.0%)	0.4215 (0.6%)
GEO	medlo	0.395275	0.4193 (6.1%)	0.3957 (0.1%)	0.3955 (0.1%)	0.3957 (0.1%)	0.3964 (0.3%)	0.3776 (-4.5%)	0.3931 (-0.5%)
GEO	medmed	0.375853	0.3880 (3.2%)	0.3772 (0.3%)	0.3779 (0.5%)	0.3747 (-0.3%)	0.3735 (-0.6%)	0.3615 (-3.8%)	0.3762 (0.1%)
GEO	medhi	0.366397	0.3725 (1.7%)	0.3686 (0.6%)	0.3674 (0.3%)	0.3671 (0.2%)	0.3705 (1.1%)	0.3554 (-3.0%)	0.3680 (0.4%)
GEO	hilo	0.297034	0.3032 (2.1%)	0.2990 (0.7%)	0.2991 (0.7%)	0.2999 (1.0%)	0.2988 (0.6%)	0.2944 (-0.9%)	0.2988 (0.6%)
GEO	himed	0.292112	0.2947 (0.9%)	0.2930 (0.3%)	0.2930 (0.3%)	0.2926 (0.2%)	0.2925 (0.1%)	0.2922 (0.0%)	0.2925 (0.1%)
GEO	hihi	0.284472	0.2851 (0.2%)	0.2846 (0.1%)	0.2846 (0.1%)	0.2845 (0.0%)	0.2848 (0.1%)	0.2838 (-0.2%)	0.2848 (0.1%)
GEO	NA	NA	0.3516 (NA%)	0.3606 (NA%)	NA (NA%)	NA (NA%)	NA (NA%)	0.3483 (NA%)	NA (NA%)
HOR	lolo	0.590008	0.5919 (0.3%)	0.5818 (-1.4%)	0.5810 (-1.5%)	0.5821 (-1.3%)	0.5763 (-2.3%)	0.5375 (-8.9%)	0.5852 (-0.8%)
HOR	lomed	0.626883	0.6396 (2.0%)	0.6310 (0.7%)	0.6291 (0.4%)	0.6248 (-0.3%)	0.6243 (-0.4%)	0.5805 (-7.4%)	0.6321 (0.8%)
HOR	lohi	0.553847	0.5565 (0.5%)	0.5561 (0.4%)	0.5567 (0.5%)	0.5560 (0.4%)	0.5527 (-0.2%)	0.5426 (-2.0%)	0.5555 (0.3%)
HOR	medlo	0.616789	0.6493 (5.3%)	0.6283 (1.9%)	0.6309 (2.3%)	0.6273 (1.7%)	0.6363 (3.2%)	0.5950 (-3.5%)	0.6241 (1.2%)
HOR	medmed	0.641871	0.6524 (1.6%)	0.6437 (0.3%)	0.6435 (0.3%)	0.6380 (-0.6%)	0.6372 (-0.7%)	0.6177 (-3.8%)	0.6451 (0.5%)
HOR	medhi	0.559906	0.5668 (1.2%)	0.5635 (0.7%)	0.5631 (0.6%)	0.5613 (0.3%)	0.5617 (0.3%)	0.5511 (-1.6%)	0.5646 (0.8%)

Junction	Flow bin	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP DeltaVA	Alt2 woTUCP AllVA	Alt3	Alt4
HOR	hilo	0.662915	0.7210 (8.8%)	0.6596 (-0.5%)	0.6597 (-0.5%)	0.6591 (-0.6%)	0.6603 (-0.4%)	0.6135 (-7.5%)	0.6569 (-0.9%)
HOR	himed	0.662172	0.6985 (5.5%)	0.6610 (-0.2%)	0.6612 (-0.2%)	0.6580 (-0.6%)	0.6583 (-0.6%)	0.6414 (-3.1%)	0.6621 (-0.0%)
HOR	hihi	0.561398	0.5666 (0.9%)	0.5618 (0.1%)	0.5619 (0.1%)	0.5610 (-0.1%)	0.5615 (0.0%)	0.5573 (-0.7%)	0.5624 (0.2%)
HOR	NA	NA	0.4113 (NA%)	0.4564 (NA%)	NA (NA%)	NA (NA%)	NA (NA%)	0.4085 (NA%)	NA (NA%)
MRV	lolo	0.172393	0.1741 (1.0%)	0.1727 (0.2%)	0.1728 (0.2%)	0.1732 (0.5%)	0.1732 (0.4%)	0.1676 (-2.8%)	0.1730 (0.3%)
MRV	lomed	0.172899	0.1734 (0.3%)	0.1726 (-0.2%)	0.1729 (-0.0%)	0.1721 (-0.5%)	0.1722 (-0.4%)	0.1692 (-2.2%)	0.1729 (-0.0%)
MRV	lohi	0.181865	0.1837 (1.0%)	0.1843 (1.3%)	0.1835 (0.9%)	0.1827 (0.5%)	0.1845 (1.4%)	0.1794 (-1.4%)	0.1840 (1.2%)
MRV	medlo	0.181626	0.1915 (5.4%)	0.1803 (-0.8%)	0.1804 (-0.7%)	0.1802 (-0.8%)	0.1800 (-0.9%)	0.1708 (-5.9%)	0.1797 (-1.1%)
MRV	medmed	0.178249	0.1877 (5.3%)	0.1782 (-0.0%)	0.1781 (-0.1%)	0.1761 (-1.2%)	0.1758 (-1.4%)	0.1688 (-5.3%)	0.1784 (0.1%)
MRV	medhi	0.180717	0.1887 (4.4%)	0.1850 (2.4%)	0.1852 (2.5%)	0.1825 (1.0%)	0.1820 (0.7%)	0.1700 (-5.9%)	0.1851 (2.4%)
MRV	hilo	0.181727	0.2012 (10.7%)	0.1814 (-0.2%)	0.1814 (-0.2%)	0.1812 (-0.3%)	0.1813 (-0.2%)	0.1780 (-2.1%)	0.1812 (-0.3%)
MRV	himed	0.184529	0.2013 (9.1%)	0.1840 (-0.3%)	0.1840 (-0.3%)	0.1829 (-0.9%)	0.1827 (-1.0%)	0.1788 (-3.1%)	0.1840 (-0.3%)
MRV	hihi	0.189682	0.1950 (2.8%)	0.1912 (0.8%)	0.1912 (0.8%)	0.1898 (0.1%)	0.1896 (-0.0%)	0.1774 (-6.5%)	0.1916 (1.0%)
MRV	NA	NA	0.1676 (NA%)	0.1674 (NA%)	NA (NA%)	NA (NA%)	NA (NA%)	0.1663 (NA%)	NA (NA%)
ORV	lolo	0.133844	0.1363 (1.8%)	0.1348 (0.8%)	0.1350 (0.9%)	0.1353 (1.1%)	0.1354 (1.1%)	0.1301 (-2.8%)	0.1350 (0.8%)
ORV	lomed	0.135829	0.1369 (0.8%)	0.1357 (-0.1%)	0.1362 (0.3%)	0.1352 (-0.4%)	0.1356 (-0.2%)	0.1320 (-2.8%)	0.1361 (0.2%)
ORV	lohi	0.146882	0.1500 (2.1%)	0.1496 (1.9%)	0.1490 (1.5%)	0.1484 (1.1%)	0.1507 (2.6%)	0.1445 (-1.6%)	0.1494 (1.7%)
ORV	medlo	0.148721	0.1606 (8.0%)	0.1465 (-1.5%)	0.1464 (-1.5%)	0.1466 (-1.4%)	0.1462 (-1.7%)	0.1362 (-8.4%)	0.1464 (-1.6%)
ORV	medmed	0.145901	0.1574 (7.9%)	0.1461 (0.1%)	0.1460 (0.1%)	0.1441 (-1.2%)	0.1437 (-1.5%)	0.1368 (-6.2%)	0.1462 (0.2%)

Junction	Flow bin	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP DeltaVA	Alt2 woTUCP AllVA	Alt3	Alt4
ORV	medhi	0.152472	0.1602 (5.0%)	0.1566 (2.7%)	0.1568 (2.8%)	0.1546 (1.4%)	0.1536 (0.8%)	0.1417 (-7.1%)	0.1565 (2.7%)
ORV	hilo	0.162649	0.1867 (14.8%)	0.1613 (-0.8%)	0.1613 (-0.8%)	0.1606 (-1.2%)	0.1612 (-0.9%)	0.1581 (-2.8%)	0.1608 (-1.2%)
ORV	himed	0.175514	0.1982 (12.9%)	0.1740 (-0.9%)	0.1738 (-1.0%)	0.1731 (-1.4%)	0.1731 (-1.4%)	0.1651 (-5.9%)	0.1749 (-0.3%)
ORV	hihi	0.21095	0.2187 (3.7%)	0.2132 (1.0%)	0.2131 (1.0%)	0.2114 (0.2%)	0.2103 (-0.3%)	0.1963 (-6.9%)	0.2131 (1.0%)
ORV	NA	NA	0.1257 (NA%)	0.1257 (NA%)	NA (NA%)	NA (NA%)	NA (NA%)	0.1289 (NA%)	NA (NA%)
RRD	lolo	0.487504	0.4908 (0.7%)	0.4868 (-0.2%)	0.4863 (-0.2%)	0.4878 (0.1%)	0.4864 (-0.2%)	0.4591 (-5.8%)	0.4883 (0.2%)
RRD	lomed	0.479453	0.4846 (1.1%)	0.4814 (0.4%)	0.4810 (0.3%)	0.4764 (-0.6%)	0.4769 (-0.5%)	0.4555 (-5.0%)	0.4833 (0.8%)
RRD	lohi	0.473717	0.4833 (2.0%)	0.4834 (2.0%)	0.4821 (1.8%)	0.4797 (1.3%)	0.4803 (1.4%)	0.4612 (-2.6%)	0.4824 (1.8%)
RRD	medlo	0.522414	0.5808 (11.2%)	0.5195 (-0.6%)	0.5203 (-0.4%)	0.5195 (-0.6%)	0.5215 (-0.2%)	0.4717 (-9.7%)	0.5131 (-1.8%)
RRD	medmed	0.498449	0.5498 (10.3%)	0.5008 (0.5%)	0.5003 (0.4%)	0.4912 (-1.4%)	0.4893 (-1.8%)	0.4562 (-8.5%)	0.5002 (0.4%)
RRD	medhi	0.462943	0.5001 (8.0%)	0.4811 (3.9%)	0.4804 (3.8%)	0.4709 (1.7%)	0.4718 (1.9%)	0.4248 (-8.2%)	0.4818 (4.1%)
RRD	hilo	0.51583	0.6666 (29.2%)	0.5142 (-0.3%)	0.5144 (-0.3%)	0.5140 (-0.4%)	0.5146 (-0.2%)	0.4912 (-4.8%)	0.5116 (-0.8%)
RRD	himed	0.505588	0.6328 (25.2%)	0.5042 (-0.3%)	0.5043 (-0.3%)	0.5004 (-1.0%)	0.5002 (-1.1%)	0.4805 (-5.0%)	0.5055 (-0.0%)
RRD	hihi	0.444012	0.4869 (9.7%)	0.4514 (1.7%)	0.4514 (1.7%)	0.4457 (0.4%)	0.4460 (0.4%)	0.4049 (-8.8%)	0.4529 (2.0%)
RRD	NA	NA	0.4490 (NA%)	0.4755 (NA%)	NA (NA%)	NA (NA%)	NA (NA%)	0.4465 (NA%)	NA (NA%)
TRN	lolo	0.146355	0.1470 (0.4%)	0.1468 (0.3%)	0.1468 (0.3%)	0.1469 (0.4%)	0.1469 (0.4%)	0.1422 (-2.9%)	0.1469 (0.4%)
TRN	lomed	0.150028	0.1516 (1.0%)	0.1496 (-0.3%)	0.1499 (-0.1%)	0.1493 (-0.5%)	0.1490 (-0.7%)	0.1471 (-1.9%)	0.1500 (-0.0%)
TRN	lohi	0.178251	0.1814 (1.8%)	0.1803 (1.2%)	0.1795 (0.7%)	0.1792 (0.5%)	0.1808 (1.4%)	0.1760 (-1.3%)	0.1801 (1.0%)
TRN	medlo	0.153657	0.1598 (4.0%)	0.1523 (-0.9%)	0.1524 (-0.8%)	0.1525 (-0.7%)	0.1524 (-0.8%)	0.1443 (-6.1%)	0.1522 (-0.9%)

Junction	Flow bin	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP DeltaVA	Alt2 woTUCP AllVA	Alt3	Alt4
TRN	medmed	0.154996	0.1621 (4.6%)	0.1553 (0.2%)	0.1552 (0.1%)	0.1533 (-1.1%)	0.1533 (-1.1%)	0.1480 (-4.5%)	0.1552 (0.1%)
TRN	medhi	0.181224	0.1854 (2.3%)	0.1843 (1.7%)	0.1846 (1.8%)	0.1827 (0.8%)	0.1820 (0.4%)	0.1680 (-7.3%)	0.1840 (1.5%)
TRN	hilo	0.152392	0.1675 (9.9%)	0.1523 (-0.1%)	0.1523 (-0.1%)	0.1523 (-0.1%)	0.1523 (-0.0%)	0.1487 (-2.4%)	0.1520 (-0.2%)
TRN	himed	0.158919	0.1725 (8.5%)	0.1586 (-0.2%)	0.1585 (-0.2%)	0.1579 (-0.6%)	0.1578 (-0.7%)	0.1544 (-2.9%)	0.1590 (0.0%)
TRN	hihi	0.188648	0.1937 (2.7%)	0.1902 (0.8%)	0.1902 (0.8%)	0.1890 (0.2%)	0.1886 (-0.0%)	0.1765 (-6.5%)	0.1904 (0.9%)
TRN	NA	NA	0.1376 (NA%)	0.1441 (NA%)	NA (NA%)	NA (NA%)	NA (NA%)	0.1388 (NA%)	NA (NA%)

I.10.3.2.2 Binned by OMR

The largest effect of OMR flows on the proportion of flow entering a junction occurred at CVP and junctions near CVP (HOR and RRC). At CVP, the proportion of flow entering a junction relative to NAA ranged from a 4.3% increase under Alt1 at <-5500 to a 16.5% decrease under Alt2 withoutTUCP withoutVA at –2,000 compared to the NAA. At Head of Old River, changes in the proportion of flow entering a junction ranged from a 6.8% reduction in routing under Alt3 at –2,000 and a 3% increase under Alt4 at –5,000 compared to the NAA. At Railroad Cut, the largest changes in in the proportion of flow entering a junction was estimated under Alt3. At –3,500 routing increased by 1.2% and under <-5,500 routing decreased by 8.9% compared to the NAA.

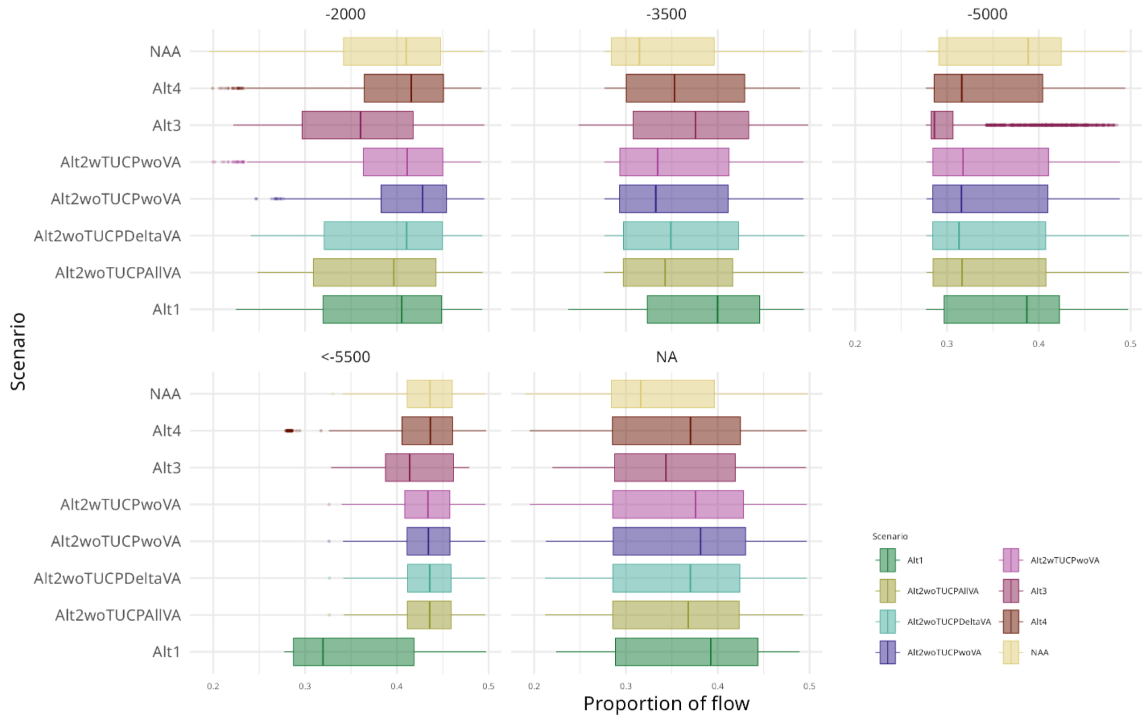

Figure I.10-26. Proportion of Flow Entering Georgiana Slough (GEO) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

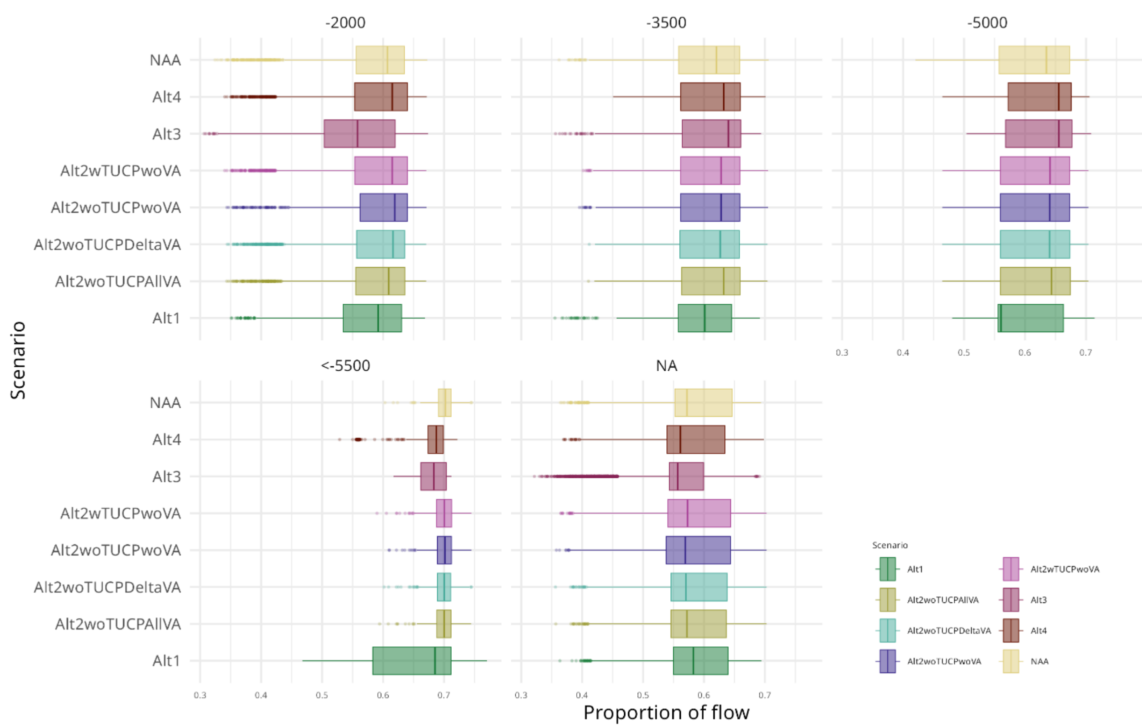

Figure I.10-27. Proportion of Flow Entering Head of Old River (HOR) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

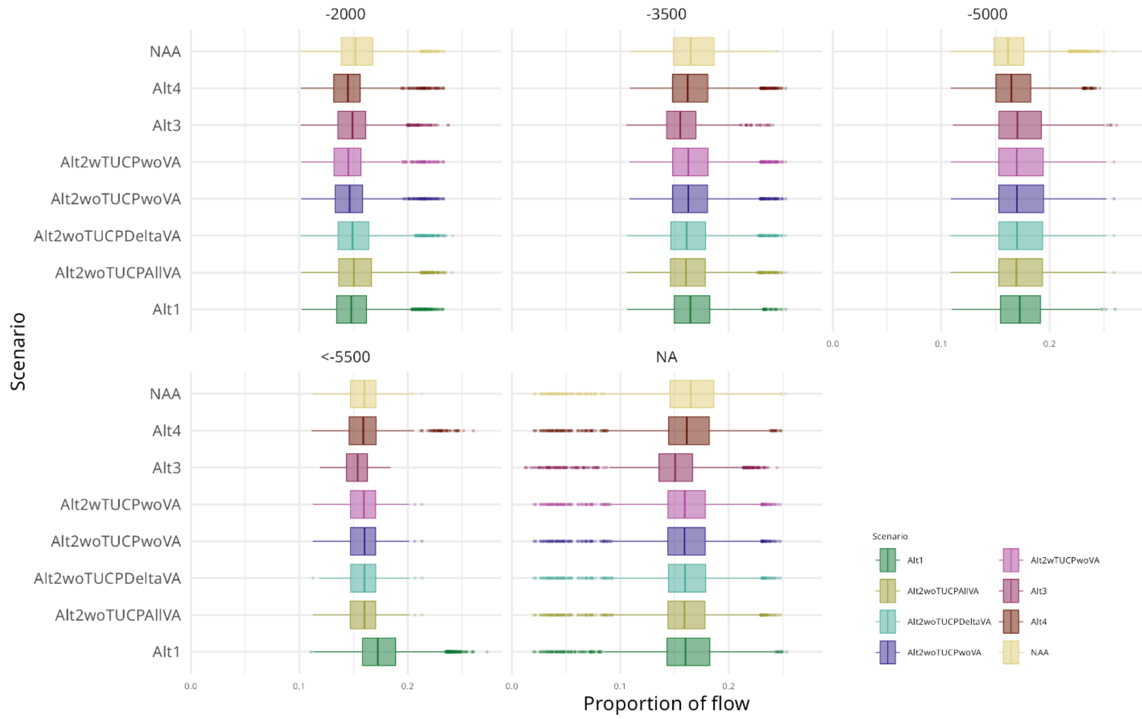

Figure I.10-28. Proportion of Flow Entering Turner Cut (TRN) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

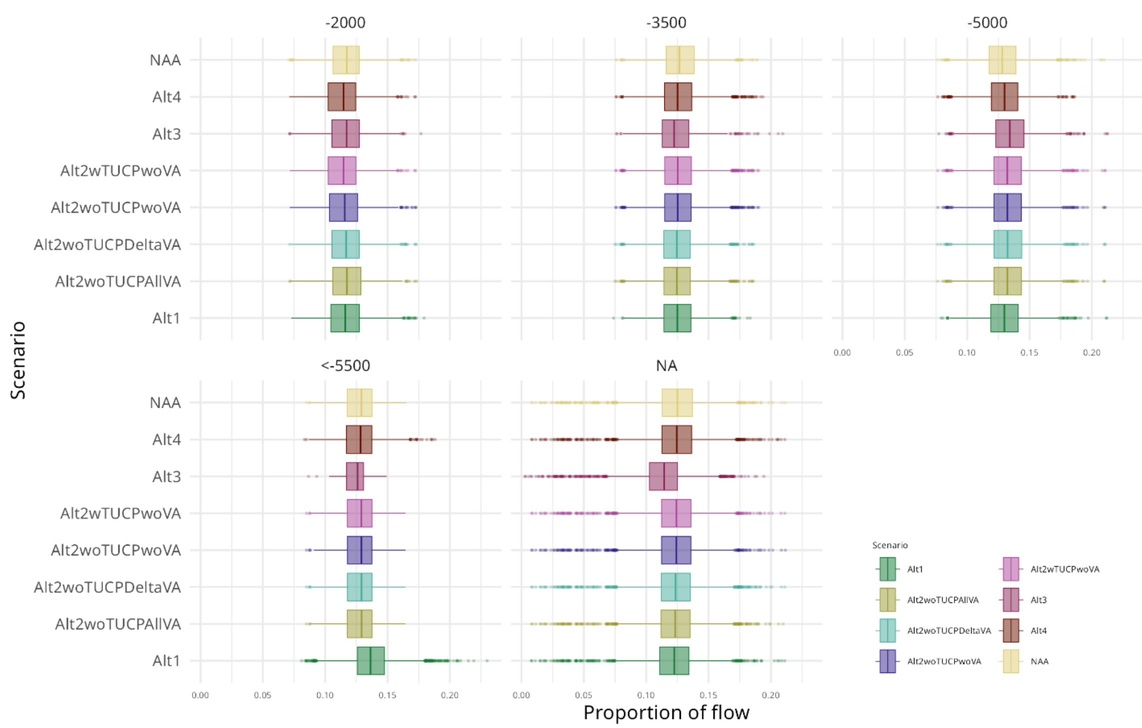

Figure I.10-29. Proportion of Flow Entering Columbia Cut (COL) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

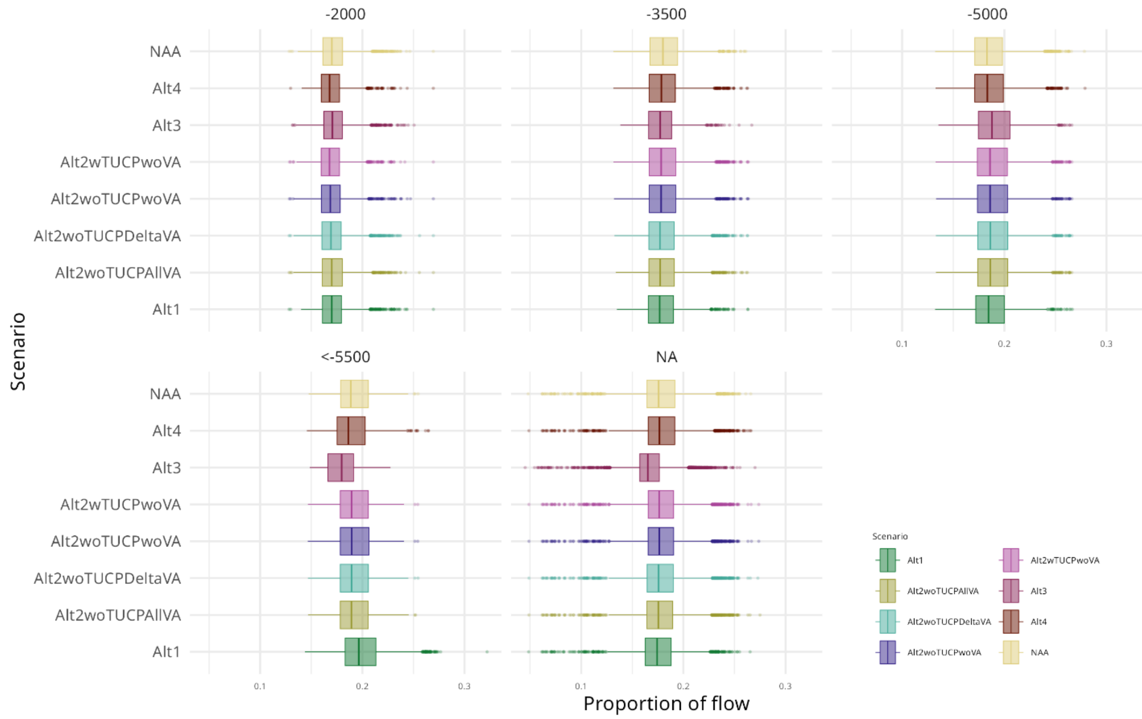

Figure I.10-30. Proportion of Flow Entering Middle River (MRV) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

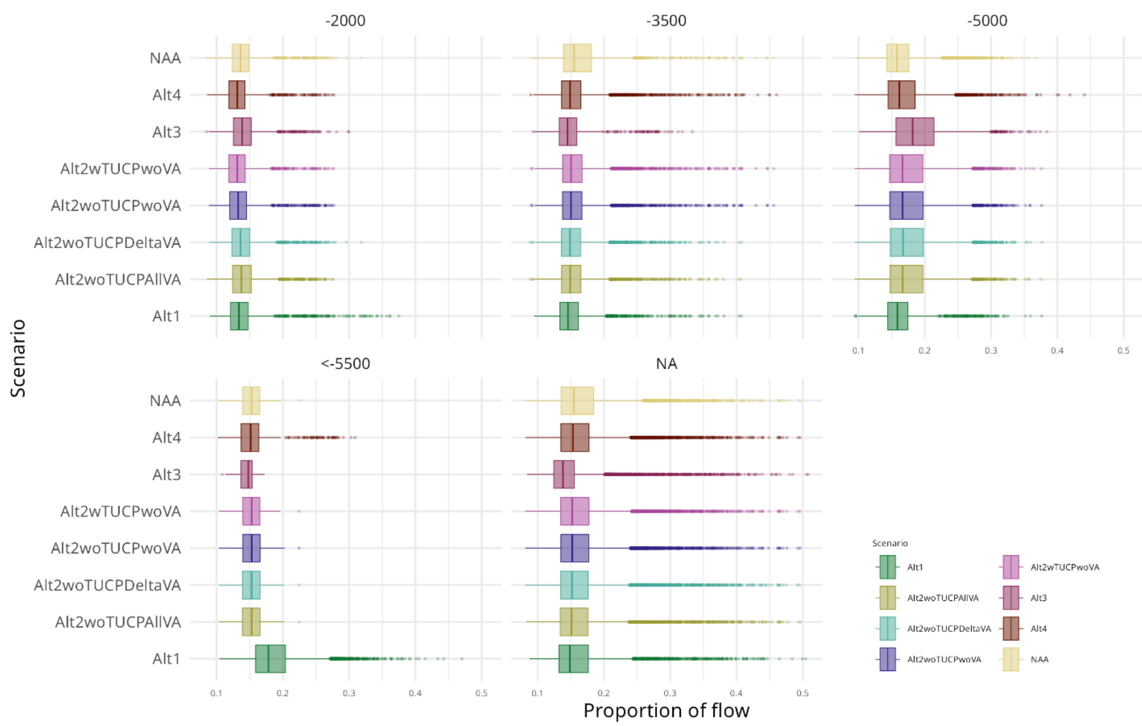

Figure I.10-31. Proportion of Flow Entering mouth of Old River (ORV) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

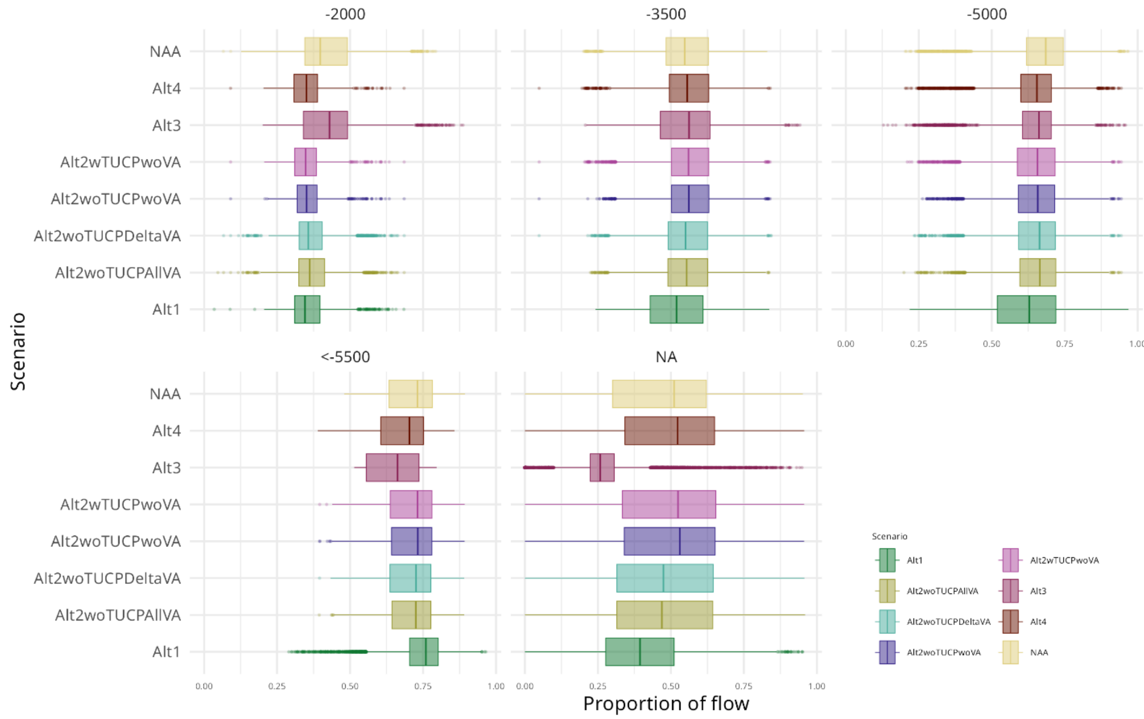

Figure I.10-32. Proportion of Flow Entering the Central Valley Project (CVP) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

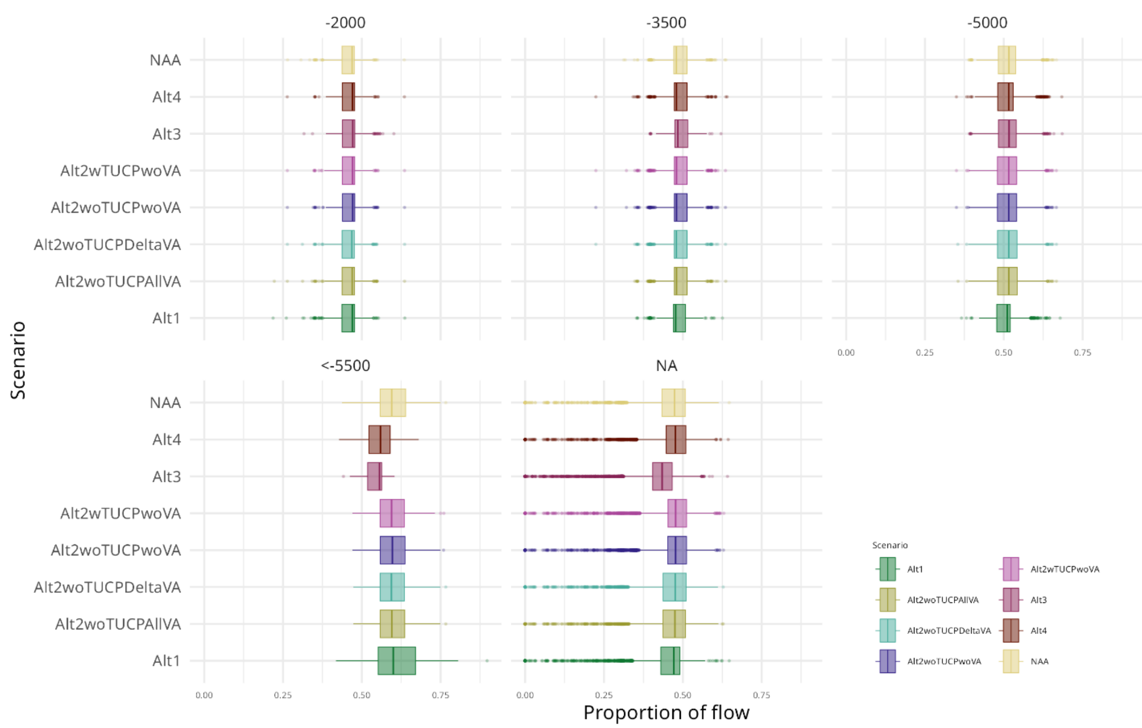

Figure I.10-33. Proportion of Flow Entering Railroad Cut (RRD) from DSM2-HYDRO Modeling Data for all alternatives by OMR group.

Table I.10-4. Proportion of flow entering junctions from DSM2-HYDRO Modeling data for NAA, Alternative 1, all phases of Alternative 2, Alternative 3 and Alternative 4 by OMR. Percent differences from NAA are indicated in parentheses.

Junction	OMR bin	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP DeltaVA	Alt2 woTUCP AllVA	Alt3	Alt4
COL	-2000	0.1170	0.1168 (-0.2%)	0.1144 (-2.2%)	0.1157 (-1.1%)	0.1167 (-0.2%)	0.1174 (0.3%)	0.1167 (-0.2%)	0.1143 (-2.2%)
COL	-3500	0.1271	0.1250 (-1.6%)	0.1256 (-1.2%)	0.1255 (-1.2%)	0.1247 (-1.9%)	0.1247 (-1.9%)	0.1233 (-3.0%)	0.1256 (-1.2%)
COL	-5000	0.1284	0.1303 (1.5%)	0.1323 (3.1%)	0.1324 (3.2%)	0.1326 (3.3%)	0.1325 (3.2%)	0.1342 (4.6%)	0.1297 (1.1%)
COL	<-5500	0.1281	0.1367 (6.8%)	0.1280 (-0.1%)	0.1282 (0.1%)	0.1282 (0.1%)	0.1282 (0.1%)	0.1238 (-3.3%)	0.1286 (0.4%)
COL	NA	0.1243	0.1216 (-2.1%)	0.1236 (-0.6%)	0.1235 (-0.6%)	0.1232 (-0.9%)	0.1230 (-1.0%)	0.1138 (-8.4%)	0.1240 (-0.2%)
CVP	-2000	0.4177	0.3581 (-14.3%)	0.3487 (-16.5%)	0.3546 (-15.1%)	0.3710 (-11.2%)	0.3752 (-10.2%)	0.4264 (2.1%)	0.3501 (-16.2%)
CVP	-3500	0.5437	0.5217 (-4.1%)	0.5583 (2.7%)	0.5604 (3.1%)	0.5499 (1.1%)	0.5492 (1.0%)	0.5506 (1.3%)	0.5535 (1.8%)
CVP	-5000	0.6723	0.6202 (-7.8%)	0.6419 (-4.5%)	0.6453 (-4.0%)	0.6476 (-3.7%)	0.6514 (-3.1%)	0.6317 (-6.0%)	0.6385 (-5.0%)
CVP	<-5500	0.7134	0.7441 (4.3%)	0.7025 (-1.5%)	0.7037 (-1.4%)	0.7014 (-1.7%)	0.7031 (-1.4%)	0.6508 (-8.8%)	0.6762 (-5.2%)
CVP	NA	0.4633	0.3935 (-15.1%)	0.4890 (5.5%)	0.4908 (5.9%)	0.4722 (1.9%)	0.4700 (1.4%)	0.2797 (-39.6%)	0.4905 (5.9%)
GEO	-2000	0.3921	0.3864 (-1.5%)	0.3981 (1.5%)	0.4114 (4.9%)	0.3894 (-0.7%)	0.3809 (-2.9%)	0.3603 (-8.1%)	0.3977 (1.4%)
GEO	-3500	0.3424	0.3857 (12.7%)	0.3536 (3.3%)	0.3524 (2.9%)	0.3606 (5.3%)	0.3576 (4.4%)	0.3730 (8.9%)	0.3641 (6.4%)
GEO	-5000	0.3685	0.3694 (0.3%)	0.3471 (-5.8%)	0.3465 (-6.0%)	0.3449 (-6.4%)	0.3458 (-6.1%)	0.3082 (-16.4%)	0.3448 (-6.4%)
GEO	<-5500	0.4341	0.3496 (-19.5%)	0.4317 (-0.6%)	0.4335 (-0.1%)	0.4343 (0.0%)	0.4342 (0.0%)	0.4200 (-3.2%)	0.4231 (-2.5%)
GEO	NA	0.3412	0.3752 (10.0%)	0.3633 (6.5%)	0.3665 (7.4%)	0.3615 (5.9%)	0.3607 (5.7%)	0.3549 (4.0%)	0.3613 (5.9%)
HOR	-2000	0.5906	0.5706 (-3.4%)	0.5849 (-1.0%)	0.5972 (1.1%)	0.5910 (0.1%)	0.5879 (-0.5%)	0.5502 (-6.8%)	0.5823 (-1.4%)
HOR	-3500	0.6071	0.6001 (-1.2%)	0.6126 (0.9%)	0.6125 (0.9%)	0.6120 (0.8%)	0.6152 (1.3%)	0.6143 (1.2%)	0.6152 (1.3%)

Junction	OMR bin	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP DeltaVA	Alt2 woTUCP AllVA	Alt3	Alt4
HOR	-5000	0.6124	0.5919 (-3.3%)	0.6201 (1.3%)	0.6198 (1.2%)	0.6199 (1.2%)	0.6208 (1.4%)	0.6295 (2.8%)	0.6306 (3.0%)
HOR	<-5500	0.7011	0.6558 (-6.5%)	0.6991 (-0.3%)	0.7003 (-0.1%)	0.6996 (-0.2%)	0.6993 (-0.3%)	0.6793 (-3.1%)	0.6754 (-3.7%)
HOR	NA	0.5896	0.5873 (-0.4%)	0.5850 (-0.8%)	0.5825 (-1.2%)	0.5844 (-0.9%)	0.5840 (-1.0%)	0.5597 (-5.1%)	0.5782 (-1.9%)
MRV	-2000	0.1721	0.1722 (0.0%)	0.1698 (-1.3%)	0.1705 (-0.9%)	0.1713 (-0.5%)	0.1721 (0.0%)	0.1726 (0.3%)	0.1698 (-1.3%)
MRV	-3500	0.1824	0.1795 (-1.6%)	0.1810 (-0.7%)	0.1810 (-0.8%)	0.1800 (-1.3%)	0.1801 (-1.2%)	0.1791 (-1.8%)	0.1809 (-0.8%)
MRV	-5000	0.1861	0.1873 (0.6%)	0.1889 (1.5%)	0.1890 (1.6%)	0.1894 (1.8%)	0.1893 (1.7%)	0.1909 (2.6%)	0.1862 (0.1%)
MRV	<-5500	0.1918	0.1990 (3.8%)	0.1917 (-0.1%)	0.1921 (0.1%)	0.1917 (-0.0%)	0.1916 (-0.1%)	0.1809 (-5.7%)	0.1894 (-1.3%)
MRV	NA	0.1786	0.1758 (-1.5%)	0.1789 (0.2%)	0.1789 (0.2%)	0.1782 (-0.2%)	0.1779 (-0.4%)	0.1671 (-6.4%)	0.1794 (0.4%)
ORV	-2000	0.1385	0.1415 (2.1%)	0.1342 (-3.1%)	0.1365 (-1.5%)	0.1395 (0.7%)	0.1411 (1.9%)	0.1408 (1.6%)	0.1344 (-2.9%)
ORV	-3500	0.1647	0.1527 (-7.2%)	0.1568 (-4.8%)	0.1568 (-4.7%)	0.1542 (-6.4%)	0.1544 (-6.3%)	0.1509 (-8.3%)	0.1566 (-4.9%)
ORV	-5000	0.1653	0.1639 (-0.9%)	0.1760 (6.4%)	0.1762 (6.6%)	0.1770 (7.1%)	0.1764 (6.7%)	0.1894 (14.6%)	0.1693 (2.4%)
ORV	<-5500	0.1524	0.1855 (21.7%)	0.1526 (0.1%)	0.1529 (0.3%)	0.1526 (0.1%)	0.1526 (0.1%)	0.1450 (-4.9%)	0.1568 (2.9%)
ORV	NA	0.1686	0.1646 (-2.4%)	0.1650 (-2.2%)	0.1649 (-2.2%)	0.1645 (-2.4%)	0.1638 (-2.9%)	0.1461 (-13.4%)	0.1650 (-2.2%)
RRD	-2000	0.4618	0.4611 (-0.2%)	0.4641 (0.5%)	0.4648 (0.6%)	0.4618 (0.0%)	0.4622 (0.1%)	0.4661 (0.9%)	0.4640 (0.5%)
RRD	-3500	0.4865	0.4821 (-0.9%)	0.4885 (0.4%)	0.4885 (0.4%)	0.4870 (0.1%)	0.4883 (0.4%)	0.4924 (1.2%)	0.4879 (0.3%)
RRD	-5000	0.5148	0.5063 (-1.6%)	0.5128 (-0.4%)	0.5129 (-0.4%)	0.5133 (-0.3%)	0.5137 (-0.2%)	0.5158 (0.2%)	0.5122 (-0.5%)
RRD	<-5500	0.5986	0.6040 (0.9%)	0.5965 (-0.3%)	0.5991 (0.1%)	0.5964 (-0.4%)	0.5970 (-0.3%)	0.5450 (-8.9%)	0.5582 (-6.7%)
RRD	NA	0.4548	0.4414 (-2.9%)	0.4672 (2.7%)	0.4668 (2.6%)	0.4633 (1.9%)	0.4628 (1.7%)	0.4233 (-6.9%)	0.4655 (2.4%)
TRN	-2000	0.1539	0.1514 (-1.7%)	0.1469 (-4.6%)	0.1486 (-3.5%)	0.1517 (-1.5%)	0.1532 (-0.5%)	0.1501 (-2.5%)	0.1468 (-4.6%)

Junction	OMR bin	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP DeltaVA	Alt2 woTUCP AllVA	Alt3	Alt4
TRN	-3500	0.1680	0.1678 (-0.1%)	0.1657 (-1.4%)	0.1656 (-1.5%)	0.1643 (-2.2%)	0.1640 (-2.4%)	0.1576 (-6.2%)	0.1660 (-1.2%)
TRN	-5000	0.1641	0.1743 (6.3%)	0.1737 (5.9%)	0.1738 (5.9%)	0.1739 (6.0%)	0.1737 (5.8%)	0.1738 (5.9%)	0.1677 (2.2%)
TRN	<-5500	0.1596	0.1749 (9.6%)	0.1595 (-0.1%)	0.1597 (0.1%)	0.1598 (0.1%)	0.1597 (0.1%)	0.1536 (-3.8%)	0.1623 (1.7%)
TRN	NA	0.1658	0.1619 (-2.4%)	0.1614 (-2.7%)	0.1613 (-2.7%)	0.1616 (-2.5%)	0.1613 (-2.7%)	0.1515 (-8.6%)	0.1636 (-1.4%)

I.10.4 References

Buchanan, R.A., Skalski, J.R., Brandes, P.L., Fuller, A. 2013. Route use and survival of juvenile chinook salmon through the San Joaquin River Delta. *North American Journal of Fisheries Management*, 33:1, 221-229.

Cavallo, B., Gaskill, P., Melgo, J., Zeug, S.C. 2015. Predicting juvenile Chinook Salmon routing in riverine and tidal channels of a freshwater estuary. *Springer Science: Environmental Biology Fish*. April 2014.

Newman K.B. 2008. *An evaluation of four Sacramento-San Joaquin River Delta juvenile salmon survival studies.* United States Fish and Wildlife Service. Stockton Fish and Wildlife Office.

Perry, R.W., Skalski, J.R., Brandes, P.L., Sandstrom, P.L., Klimley, A.P., Amann, A., and Macfarlane, B. 2010. Estimating Survival and Migration Route Probabilities of Juvenile Chinook Salmon in the Sacramento–San Joaquin River Delta. *North American Journal of Fisheries Management* 30:142–156, 2010.

Dauble, D., D. Hankin, J. J. Pizzimenti, and P. Smith. 2010. *The Vernalis adaptive management program: report of the 2010 review panel.* Prepared for the Delta Science Program. May 13, 2010.