THE STATE OF WYOMING

Water Development Office

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TECHNICAL MEMORANDUM

TO: Water Development Commission **DATE:** November 14, 2011

FROM: Chace Tavelli, P.E. **REFERENCE:** Bear River Basin Plan Update, 2011

SUBJECT: Spreadsheet Model Development – *Tab VI (2011)*

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1.0 Introduction

For the 2011 Bear River Basin Plan Update the structure of the hydrologic spreadsheet models has not been altered from the previous plan. The only changes to the model were updates to the USGS gage and diversion data. The gage data were updated as described in the "Surface Water Data Collection and Study Period Selection" technical memorandum. The gage and diversion data were updated through 2008 and added to the model constituting a new study period of 1971 through 2008.

2.0 Summary

It is recommended that the 2001 Bear River Basin Plan's Technical Memorandum (http://waterplan.state.wy.us/plan/bear/techmemos/modeldvpt/modeldvpt.html) be referenced for understanding the development of the spreadsheet models. There were no changes to the input, or the model structure, other than what is reflected in the following tables. Only changes to the model input are included herein. To see updated output please refer to the models for this update.

3.0 Tables

The following tables reflect the changes to the 2001 Basin Plan's model gage and diversion data input:

Table 2: Characterization of Wet, Normal, and Dry Years for Bear River Model Index Gages and Diversion Data Analysis

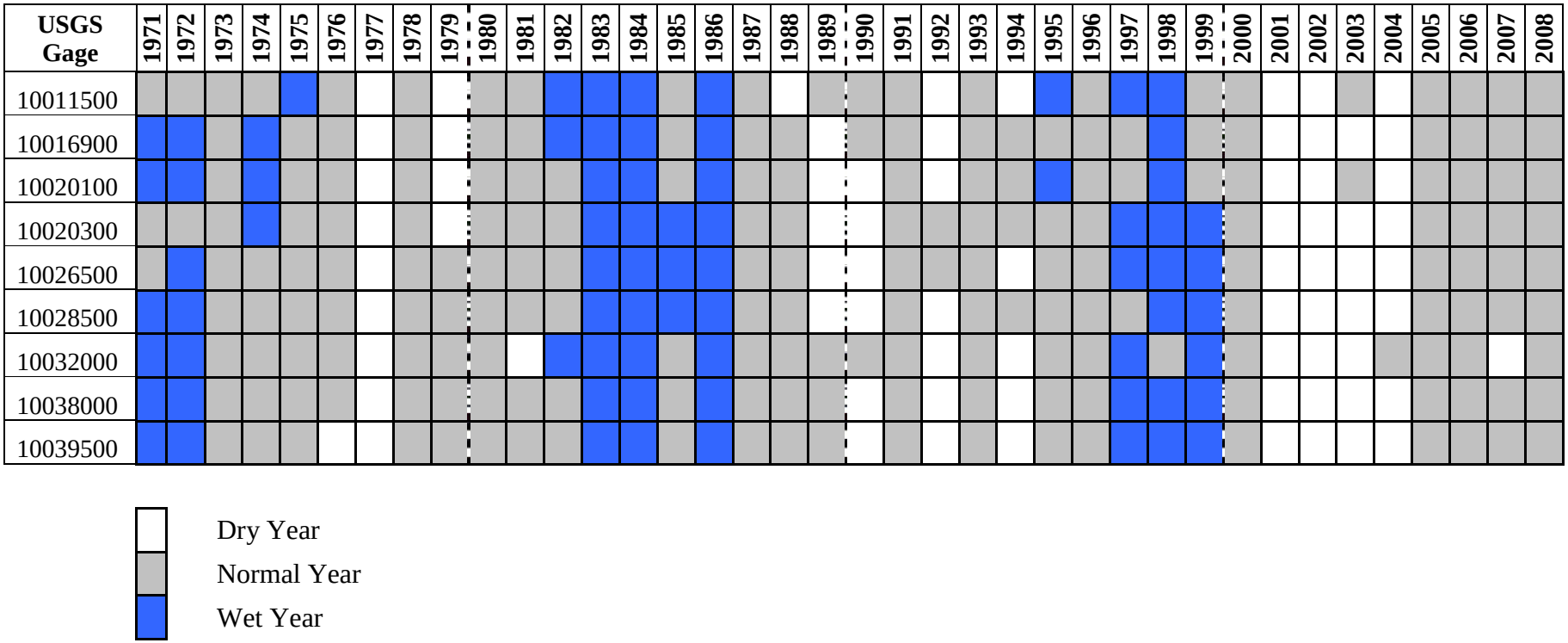

Table 3: Summary of Average Dry, Normal, and Wet Year Streamflow at USGS Gage Stations (Acre-Feet)

USGS 10011500 BEAR RIVER NEAR UTAH-WYOMING STATE LINE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry	2333	1965	2439	6854	29154	20547	7387	3516	2795	3160	2829	2511
Norm	2695	2309	2846	7319	38476	48085	14327	5351	4618	4309	3484	2927
Wet	3050	2629	3410	5364	38293	77143	39924	9723	9191	6208	4196	3605

USGS 10015700 SULPHUR CR.AB.RES.BL.LA CHAPELLE CR.NR EVANSTON,WY

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry	181	188	886	1144	1487	639	162	61	49	135	196	179
Norm	313	373	1227	2941	4223	2079	503	168	135	251	326	311
Wet	345	463	1594	3524	10034	4505	1158	501	448	604	593	468

USGS 10016900 BEAR RIVER AT EVANSTON, WY

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry	2432	2777	8389	12069	28821	16304	4232	2031	1409	1843	2646	2384
Norm	5003	4979	10800	20434	51292	46795	12148	3331	3054	5166	5035	5164
Wet	8696	9965	23068	30043	71331	79431	24423	8574	9261	12618	10487	9253

USGS 10020100 BEAR RIVER ABOVE RESERVOIR, NEAR WOODRUFF, UT

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry	2041	2221	7039	8909	19755	12860	2092	937	626	995	1900	1958
Norm	3599	3528	8124	18262	49634	39277	8224	2123	2610	3661	3784	3768
Wet	6525	7699	19370	25559	73219	96833	27295	6964	5744	9647	7956	6990

USGS 10020300 BEAR RIVER BELOW RESERVOIR, NEAR WOODRUFF, UT

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry	1093	1026	1165	1797	19313	31795	3779	1426	885	930	867	1059
Norm	2068	2125	4981	12526	45866	52991	16414	3533	3175	1449	1729	2061
Wet	5754	5393	12509	29944	75266	89185	27163	8235	7196	11164	8952	6103

USGS 10026500 BEAR RIVER NEAR RANDOLPH, UT

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry	1511	1042	3157	2580	4012	6828	2503	712	286	1629	1882	1727
Norm	3680	4238	9442	15905	27429	31485	15418	4752	2897	3243	3825	3642
Wet	7231	8224	22376	36543	68871	83223	30579	13141	10087	13622	12926	8758

USGS 10028500 BEAR RIVER BELOW PIXLEY DAM, NEAR COKEVILLE, WY

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry	1078	841	3059	2110	238	1173	2402	1007	752	1356	1745	1407
Norm	2663	2619	6469	13724	22015	24155	17401	6100	3528	3185	3427	3031
Wet	5414	5950	17292	33145	57170	61520	31946	13704	12078	10038	8743	6711

USGS 10032000 SMITHS FORK NEAR BORDER, WY

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry	3351	2982	3702	7379	15724	13201	7005	5030	4133	5037	4133	3663
Norm	3694	3213	3649	9437	30974	33746	17197	9053	6241	5388	4461	3945
Wet	4383	3764	4569	9896	50618	65822	29410	13229	8750	6485	5479	4833

USGS 10038000 BEAR RIVER BLW SMITHS FORK, NR COKEVILLE, WY

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry	7469	6632	11351	10784	14799	15875	10024	6432	5194	8409	9007	8030
Norm	10836	10766	19934	36738	59600	61725	36434	14001	10481	12262	12864	11916
Wet	15816	17199	40352	64742	126454	159849	66625	30536	25044	24176	22095	18079

USGS 10039500 BEAR RIVER AT BORDER, WY

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry	7441	6474	11598	10073	11819	12809	8906	4673	3856	7626	8702	7960
Norm	11255	11103	19960	37507	58284	58377	35012	13396	9661	11766	12745	12062
Wet	16489	17841	42333	70599	126688	163428	67594	29607	23870	24617	22902	18760

Table 4: Summary of Average Dry, Normal, and Wet Year Diversion Data

NODE	DIVERSION NAME	CONDITION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Node 1.01	Lannon & Lone Mountain	Dry Year	0	0	0	0	784	940	530	139	57	0	0	0
Node 1.01		Normal Year	0	0	0	0	665	1048	873	327	298	0	0	0
Node 1.01		Wet Year	0	0	0	0	534	949	1016	526	599	0	0	0
Node 1.02	Hilliard West Side	Dry Year	0	0	0	0	1110	1763	760	156	167	0	0	0
Node 1.02		Normal Year	0	0	0	0	421	1534	1538	318	439	0	0	0
Node 1.02		Wet Year	0	0	0	0	236	1255	1599	581	832	0	0	0
Node 1.03	Bear Canal	Dry Year	0	0	0	0	1966	3298	1684	532	409	0	0	0
Node 1.03		Normal Year	0	0	0	0	738	3550	2562	505	701	0	0	0
Node 1.03		Wet Year	0	0	0	0	604	2676	3786	1098	1493	0	0	0
Node 1.04	Crown & Pine Grove	Dry Year	0	0	0	0	689	1474	661	167	143	0	0	0
Node 1.04		Normal Year	0	0	0	0	506	1487	1202	542	359	0	0	0
Node 1.04		Wet Year	0	0	0	0	315	1494	1550	551	383	0	0	0
Node 1.05	McGraw & Big Bend	Dry Year	0	0	0	0	1066	931	321	132	70	0	0	0
Node 1.05		Normal Year	0	0	0	0	940	1533	696	474	267	0	0	0
Node 1.05		Wet Year	0	0	0	0	956	1774	1351	854	667	0	0	0
Node 1.06	Lewis	Dry Year	0	0	0	0	146	276	279	83	37	0	0	0
Node 1.06		Normal Year	0	0	0	0	151	305	393	222	87	0	0	0
Node 1.06		Wet Year	0	0	0	0	76	391	425	321	229	0	0	0
Node 1.07	Meyers No. 2	Dry Year	0	0	0	0	98	300	294	125	82	0	0	0
Node 1.07		Normal Year	0	0	0	0	66	214	374	260	137	0	0	0
Node 1.07		Wet Year	0	0	0	0	28	168	311	364	197	0	0	0
Node 1.08	Meyers No. 1	Dry Year	0	0	0	0	142	239	274	180	53	0	0	0
Node 1.08		Normal Year	0	0	0	0	101	242	270	174	54	0	0	0
Node 1.08		Wet Year	0	0	0	0	52	123	273	260	106	0	0	0
Node 1.09	Meyers Irrigation	Dry Year	0	0	0	0	215	247	229	113	100	0	0	0
Node 1.09		Normal Year	0	0	0	0	108	325	250	208	90	0	0	0
Node 1.09		Wet Year	0	0	0	0	38	252	323	180	76	0	0	0
Node 1.10	Evanston Pipeline	Normal Year	0	0	0	0	276	469	651	556	399	0	0	0
Node 1.10														
Node 1.10														
Node 1.11	Booth	Dry Year	0	0	0	0	405	679	458	251	202	0	0	0
Node 1.11		Normal Year	0	0	0	0	294	794	734	537	317	0	0	0
Node 1.11		Wet Year	0	0	0	0	292	642	848	500	437	0	0	0

Node 1.12	Anel	Dry Year	0	0	0	0	211	346	196	32	17	0	0	0
Node 1.12		Normal Year	0	0	0	0	203	676	309	126	71	0	0	0
Node 1.12		Wet Year	0	0	0	0	218	513	459	149	216	0	0	0
Node 1.13	Evanston Water Supply	Dry Year	0	0	0	0	118	255	213	137	43	0	0	0
Node 1.13		Normal Year	0	0	0	0	79	335	297	243	114	0	0	0
Node 1.13		Wet Year	0	0	0	0	40	112	264	166	130	0	0	0
Node 3.01	Evanston Water Ditch	Dry Year	0	0	0	0	526	1047	822	550	240	0	0	0
Node 3.01		Normal Year	0	0	0	0	294	1193	1038	773	331	0	0	0
Node 3.01		Wet Year	0	0	0	0	56	624	926	786	265	0	0	0
Node 3.02	Rocky Mtn & Blyth	Dry Year	0	0	0	0	537	529	346	185	148	0	0	0
Node 3.02		Normal Year	0	0	0	0	652	857	486	259	235	0	0	0
Node 3.02		Wet Year	0	0	0	0	207	502	717	471	425	0	0	0
Node 4.01	John Simms	Dry Year	0	0	0	0	695	659	383	295	208	0	0	0
Node 4.01		Normal Year	0	0	0	0	664	867	498	418	353	0	0	0
Node 4.01		Wet Year	0	0	0	0	491	1001	518	505	457	0	0	0
Node 4.02	S P Ramsey	Dry Year	0	0	0	0	776	652	290	169	111	0	0	0
Node 4.02		Normal Year	0	0	0	0	498	933	492	309	323	0	0	0
Node 4.02		Wet Year	0	0	0	0	346	987	827	335	306	0	0	0
Node 5.01	Chapman Canal	Dry Year	0	0	0	0	3022	2824	1468	393	338	0	0	0
Node 5.01		Normal Year	0	0	0	0	2984	3760	1859	739	568	0	0	0
Node 5.01		Wet Year	0	0	0	0	2037	2980	1681	493	590	0	0	0
Node 5.02	Morris Bros (Lower)	Dry Year	0	0	0	0	229	195	139	49	75	0	0	0
Node 5.02		Normal Year	0	0	0	0	186	248	123	45	86	0	0	0
Node 5.02		Wet Year	0	0	0	0	335	455	322	94	49	0	0	0
Node 5.04	Tunnel	Dry Year	0	0	0	0	980	953	310	103	63	0	0	0
Node 5.04		Normal Year	0	0	0	0	665	1409	396	158	133	0	0	0
Node 5.04		Wet Year	0	0	0	0	349	1669	621	334	247	0	0	0
Node 6.01	Woodruff Narrows	Dry Year	0	0	0	0	0	0	0	0	0	0	0	0
Node 6.01		Normal Year	0	0	0	0	0	0	0	0	0	0	0	0
Node 6.01		Wet Year	0	0	0	0	0	0	0	0	0	0	0	0
Node 7.01	Francis Lee	Dry Year	0	0	0	0	1697	2704	611	169	186	0	0	0
Node 7.01		Normal Year	0	0	0	0	1537	2682	1231	443	323	0	0	0
Node 7.01		Wet Year	0	0	0	0	1652	2985	1291	243	445	0	0	0
Node 7.02	Bear River Canal	Dry Year	0	0	0	0	1966	3298	1684	532	409	0	0	0
Node 7.02		Normal Year	0	0	0	0	738	3550	2562	505	701	0	0	0
Node 7.02		Wet Year	0	0	0	0	604	2676	3786	1098	1493	0	0	0

Node 7.03	Total Lower Utah	Dry Year	0	0	0	0	19706	43876	8754	3585	2540	0	0	0
Node 7.03		Normal Year	0	0	0	0	35953	58114	22558	3627	4812	0	0	0
Node 7.03		Wet Year	0	0	0	0	30719	67659	25779	1966	3120	0	0	0
Node 8.01	Pixley Diversions	Dry Year	0	0	0	0	1205	2928	1020	31	48	0	0	0
Node 8.01		Normal Year	0	0	0	0	2762	3896	987	29	138	0	0	0
Node 8.01		Wet Year	0	0	0	0	3257	4776	507	41	70	0	0	0
Node 8.02	BQ Diversions	Dry Year	0	0	0	0	1781	7433	2074	163	67	0	0	0
Node 8.02		Normal Year	0	0	0	0	3906	8458	2403	147	49	0	0	0
Node 8.02		Wet Year	0	0	0	0	3556	7539	2065	120	13	0	0	0
Node 10.02	Button Flat	Dry Year	0	0	0	0	122	233	123	24	5	0	0	0
Node 10.02		Normal Year	0	0	0	0	79	175	199	140	46	0	0	0
Node 10.02		Wet Year	0	0	0	0	15	152	183	138	59	0	0	0
Node 10.03	Emelle	Dry Year	0	0	0	0	270	613	405	125	27	0	0	0
Node 10.03		Normal Year	0	0	0	0	140	811	778	510	36	0	0	0
Node 10.03		Wet Year	0	0	0	0	55	593	647	432	72	0	0	0
Node 10.04	Cooper	Dry Year	0	0	0	0	278	352	87	17	0	0	0	0
Node 10.04		Normal Year	0	0	0	0	372	590	354	98	16	0	0	0
Node 10.04		Wet Year	0	0	0	0	302	580	160	32	23	0	0	0
Node 10.05	Covey	Dry Year	0	0	0	0	2111	2902	1469	591	300	0	0	0
Node 10.05		Normal Year	0	0	0	0	2615	5278	4678	2406	1063	0	0	0
Node 10.05		Wet Year	0	0	0	0	1970	5748	4924	3399	1542	0	0	0
Node 10.06	VH Canal	Dry Year	0	0	0	0	454	475	458	444	350	0	0	0
Node 10.06		Normal Year	0	0	0	0	460	653	643	625	413	0	0	0
Node 10.06		Wet Year	0	0	0	0	414	816	713	756	551	0	0	0
Node 10.07	Goodell	Dry Year	0	0	0	0	293	403	422	387	366	0	0	0
Node 10.07		Normal Year	0	0	0	0	246	429	458	406	303	0	0	0
Node 10.07		Wet Year	0	0	0	0	121	339	454	353	230	0	0	0
Node 10.08	Whites Water	Dry Year	0	0	0	0	906	1072	982	478	275	0	0	0
Node 10.08		Normal Year	0	0	0	0	849	1645	1265	1037	460	0	0	0
Node 10.08		Wet Year	0	0	0	0	737	1831	1517	1277	517	0	0	0
Node 10.09	S Branch Irrigating	Dry Year	0	0	0	0	660	556	311	82	39	0	0	0
Node 10.09		Normal Year	0	0	0	0	1043	1316	674	506	256	0	0	0
Node 10.09		Wet Year	0	0	0	0	1101	1999	1156	593	213	0	0	0
Node 11.02	Alonzo F. Sights	Dry Year	0	0	0	0	373	423	409	143	10	0	0	0
Node 11.02		Normal Year	0	0	0	0	509	1062	686	283	94	0	0	0

Node 11.02		Wet Year	0	0	0	0	743	2348	715	278	28	0	0	0
Node 11.03	Oscar E. Snyder	Dry Year	0	0	0	0	409	446	390	312	187	0	0	0
Node 11.03		Normal Year	0	0	0	0	938	1589	1077	422	362	0	0	0
Node 11.03		Wet Year	0	0	0	0	586	2227	1149	236	188	0	0	0
Node 11.04	Cook Brothers	Dry Year	0	0	0	0	2436	2430	1871	1852	1590	0	0	0
Node 11.04		Normal Year	0	0	0	0	1266	2975	1540	1157	1373	0	0	0
Node 11.04		Wet Year	0	0	0	0	1376	3634	1437	857	1206	0	0	0
Node 12.02	Total Idaho	Dry Year	0	0	0	0	14147	15309	8206	5183	4384	0	0	0
Node 12.02		Normal Year	0	0	0	0	15027	25359	14104	6943	6542	0	0	0
Node 12.02		Wet Year	0	0	0	0	11259	27536	13306	7598	6042	0	0	0
Node 12.03	Rainbow	Dry Year	6191	5851	12648	8361	1054	1050	2266	1134	1117	2634	4433	4689
Node 12.03		Normal Year	9434	9667	21323	40778	57927	45204	28848	11180	7337	11081	11909	10565
Node 12.03		Wet Year	15950	17427	44937	79472	144467	150698	65338	29502	24411	27512	24691	18517
Node 12.04	Stewart Dam	Dry Year	0	0	0	0	0	0	0	0	0	0	0	0
Node 12.04		Normal Year	0	0	0	0	0	0	0	0	0	0	0	0
Node 12.04		Wet Year	0	0	0	0	0	0	0	0	0	0	0	0

The following diversions are not modeled explicitly in the Bear River Model. They are included in the evaluation of Compact Allocations and Water Emergencies

Node 1.14	Hilliard East Side	Dry Year	0	0	0	0	349	460	705	154	164	0	0	0
Node 1.14		Normal Year	0	0	0	0	384	883	1022	278	209	0	0	0
Node 1.14		Wet Year	0	0	0	0	229	960	1447	579	612	0	0	0
Node 10.00	Quinn Bourne	Dry Year	0	0	0	0	103	159	86	29	33	0	0	0
Node 10.00		Normal Year	0	0	0	0	277	428	307	163	46	0	0	0
Node 10.00		Wet Year	0	0	0	0	420	628	595	333	75	0	0	0