TO: **SPOKANE RIVER INSTREAM FLOW WORK GROUP**

FROM: **MIKE HERMANSON**

SUBJECT: **MODELED SPOKANE RIVER FLOWS**

DATE: **NOVEMBER 27, 2007**

SPOKANE COUNTY
WATER RESOURCES

T E C H N I C A L M E M O R A N D O M

Introduction

This technical memorandum describes groundwater flow modeling performed in support of Washington State Department of Ecology (Ecology) Grant G0800066-Development of an Instream Flow (ISF) Rule Recommendation for the Spokane River. In July 2007 a workgroup comprised of members from WRIA 55/57 (Middle and Little Spokane) and WRIA 54 (Lower Spokane) Watershed Planning Units formed to develop a Spokane River ISF Recommendation to present to their respective planning units. One facet of the recommendation is the affect of groundwater withdrawals on river flows. Spokane County staff utilized the *USGS Ground-Water Flow Model for the Spokane Valley-Rathdrum Prairie Aquifer, Spokane County, Washington, and Bonner and Kootenai Counties, Idaho* (Bi-State Model) detailed in Scientific Investigations Report 2007-5044 to simulate and analyze river flow response to hypothetical groundwater withdrawals. This modeling effort and report only consider withdrawals and associated returns within the State of Washington. All inputs and outputs within the State of Idaho were left unchanged.

It is well documented that there is a dynamic interaction between the Spokane Valley Rathdrum Prairie (SVRP) Aquifer and the Spokane River, and that groundwater withdrawals from the SVRP Aquifer affect Spokane River flows. The majority of groundwater withdrawals from the SVRP aquifer are from water purveyors. Currently, approximately 52% of municipal water rights have been exercised. In accordance with Municipal Water Bill (2E2SHB) 1338 the remaining 48% is available to meet future demand. The Spokane River ISF Workgroup identified the determination of water availability as an important task to complete prior to developing an ISF recommendation. To determine water availability it is necessary to know the affect on river flows when 100% of municipal water rights are exercised.

Model Setup

The Bi-State Model was developed with MODFLOW-2000 (USGS). MODFLOW utilizes a modular design to simulate components of the groundwater flow system. The components are known as packages. The package in the Bi-State Model that represents

purveyor withdrawals is the Well Package. In addition to purveyor withdrawals the Well Package also simulates withdrawals for domestic use outside of water purveyor service areas, withdrawals for agricultural irrigation outside of water purveyor service areas, withdrawals by self supplied golf courses, and withdrawals by self-supplied industries. The Well Package also simulates returns to the groundwater flow system from percolation from irrigation, both landscape and agricultural, and return from septic system effluent. For a detailed discussion of the other components of the model refer to USGS Report 2007-5044.

To simulate 100% municipal water rights exercised it was necessary to modify three components of the Well Package; 1. Purveyor withdrawals 2. Increased percolation from landscape irrigation associated with increased pumping, and 3. Increased percolation from septic effluent associated with increased pumping. To facilitate constructing model scenarios the USGS provides (via the project website) the well package data broken into its various components and a software utility to combine the components into one consolidated data input file.

The first step in developing the data for the model scenario was to associate model cells listed in the purveyor pumping component of the well package with actual purveyor wells. Then each purveyor's water system plan was used to associate the well, or withdrawal point, with a water right. Since a one to one relationship did not occur in all instances accommodations were made estimate the water right associated with each withdrawal point. Table 1 details the relationship of withdrawal points, model cells and water rights for each purveyor.

In most cases the water right specifies an instantaneous withdrawal (Qi) and an annual withdrawal (Qa). To determine which would be used for the model scenario the Qa was compared to an annualized Qi. The annualized Qi was computed by assuming the full Qi would be withdrawn for the entire month of August, 24 hours a day and the other months at a percentage of August use based on use patterns for that purveyor. If the annualized Qi was less than the Qa then the Qi is the limiting factor and was used in the scenario. If it was not less than the Qa then the Qa was the limiting factor and was used in the scenario. In both cases the distribution of withdrawal throughout the year was determined from historic use patterns for each purveyor.

No new withdrawal points (wells) were added to the model. All increased withdrawal was assigned to an existing point. Increases were assigned based on the water right for that particular point. If the water right was not assigned to a particular point, as is the case with some consolidated water rights, then the increase was assigned to each point based on pumping capacity listed in the purveyor water system plan.

The second and third components of the well package that were modified for the scenario were return percolation from landscape irrigation within purveyor service areas and

return percolation from septic system effluent within purveyor service areas. In the original model each of these components were derived from several factors including indoor use vs. outdoor use, portions of the purveyor service area in the model domain vs. the portions outside of the model domain, changing purveyor service areas during the period of time modeled, increase of sewer hookups during the period of time modeled, etc. All of these factors make it complex to calculate returns from landscape irrigation and septic effluent percolation. Since the model represented percolation returns as uniform over each purveyor service area it is possible to calculate landscape irrigation and septic effluent percolation for the model scenario from the percentage change in pumping from the original model to the model scenario. Percentage change was developed for each purveyor service area for each month of the year based on the original withdrawal vs. the increased withdrawal for each purveyor service area. The percentage increase was applied to the original landscape irrigation and septic system effluent percolation.

Once the pertinent components of the well package were modified the utility provided by the USGS was utilized to construct a well package input file for the model. The model represents the period of time from September 1990 to September 2005. To ensure model stability the original well package was used for the period from 1990 to 1999 and the modified well package from 2000 to 2005. Three version of the scenario were run:

1. 100% withdrawal of inchoate rights, with no return percolation from landscape irrigation or septic system effluent;
2. 100% withdrawal of inchoate rights, with return percolation from landscape irrigation but not from septic system effluent; and
3. 100% withdrawal of inchoate rights, with return percolation from both landscape irrigation and septic system effluent.

These versions were chosen because projecting were water will be used in the future is complex and these scenarios represent the bounds of the possibilities.

Results

The goal of this modeling effort is to determine the impact of exercising 100% of water rights currently allocated for the SVRP Aquifer within the State of Washington on river flows during August, the critical low flow time. The model predicts that if 100% of purveyor water rights were exercised between the years 2000 and 2005 August river flows would be significantly reduced downstream of Pines Road. Between 2000 and 2005 flow reduction in August at the Spokane Gage ranged between 208 cfs and 280 cfs. Table 2 presents the river flows for each scenario at five locations between Post Falls and Nine Mile.

In addition to predicting flows at specific gages the model predicts river gains and losses for each model cell. By comparing the change in river gains and losses for each scenario it is possible to determine which sections of the river are impacted by increased

withdrawal. Figure 6 demonstrates that if 100% of purveyor water rights were exercised the river/aquifer interaction between Pines Rd and the Spokane Gage would be impacted but the interaction above and below that section would not. This indicates that the flow at the Barker Rd. Gage is dependent on the flow released from Post Falls Dam, which is dependent on inflows to Lake Coeur d'Alene. This also demonstrates that the best measure of impacts to river flow from groundwater withdrawal is the Spokane Gage.

In addition to the Spokane River, the Little Spokane River is also represented in the model. As was done with the Spokane River, river flow impacts were evaluated for each withdrawal scenario. Table 3 presents the results for August of 2000 to 2005. The results indicate that modeled groundwater withdrawal does not significantly impact the flow of the Little Spokane River at the "Near" Dartford Gage.

Table 2

Actual & Modeled Spokane River Flows August 2000-2005				
Year	No Change	Full Inchoate Right Exercised		
		Septic and Landscape Return	Landscape Return	No Return
Post Falls Gage (Stream Segment 33)				
2000	533	533	533	533
2001	376	376	376	376
2002	854	854	854	854
2003	360	360	360	360
2004	1002	1002	1002	1002
2005	473	473	473	473
Barker (Stream Segment 66)				
2000	284	284	284	284
2001	134	134	134	134
2002	592	592	592	592
2003	119	119	119	119
2004	739	739	739	739
2005	226	226	226	226
Spokane Gage (Stream Segment 125)				
2000	1084	853	844	810
2001	671	463	449	411
2002	1334	1110	1097	1054
2003	680	469	457	415
2004	1264	1055	1045	1004
2005	714	497	487	444
Gun Club (Stream Segment 159)				
2000	1169	948	939	898
2001	755	551	538	494
2002	1422	1203	1190	1141
2003	764	558	546	499
2004	1345	1144	1134	1087
2005	796	587	577	529
Nine Mile (Stream Segment 179)				
2000	1314	1094	1085	1044
2001	944	741	728	683
2002	1616	1398	1384	1335
2003	935	731	719	670
2004	1525	1326	1315	1268
2005	968	761	751	701

Table 3

Actual & Modeled Little Spokane River Flows August 2000-2005				
Year	No Change	Full Inchoate Right Exercised		
		Septic and Landscape Return	Landscape Return	No Return
Near Dartford Gage				
2000	240	238	237	236
2001	246	245	244	243
2002	244	243	242	241
2003	243	244	243	241
2004	243	242	241	239
2005	240	238	237	236

Table 1 - Purveyor Water Rights, Withdrawal Points and Model Cells

System Name / Water Right	Water Right gpm	Water Right AF/YR	Annulized Qi (AF/YR)	Allocation Method	Source	Capacity	Model Cell	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Within Spokane Valley-Rathdrum Prairie Aquifer, WRIA 57																			
G3-28115CWRIS	2500	1150	1,909		Well 1	900	L1R149C100	248,908	198,658	204,465	652,723	3,084,792	5,104,655	6,774,765	6,701,333	3,802,649	1,015,342	207,697	181,886
G3-00776-D	2,500	182	1,909	Qa	Well 2	700		193,595	154,512	159,028	507,674	2,399,283	3,970,287	5,269,262	5,212,148	2,957,616	789,710	161,542	141,467
CONSOLIDATED IRRIG DIST 19	81,550	22410																	
G3-*07171C	4580	1250	2,949		1 - A,B,C	4740	L1R143C122	549,113	438,257	451,068	1,439,965	6,805,320	11,261,313	14,945,722	14,783,724	8,388,975	2,239,933	458,198	401,257
G3-*09452C	695	225	447		2 - A,B,C	6815	L1R146C133	789,495	630,110	648,529	2,070,329	9,784,442	16,191,108	21,488,417	21,255,502	12,061,364	3,220,494	658,780	576,912
G3-*07172C	13200	3550	8,499		3 - A,B,C	6800	L1R146C136	787,757	628,723	647,101	2,065,772	9,762,906	16,155,471	21,441,120	21,208,718	12,034,816	3,213,406	657,330	575,643
G3-*09453C	1760	580	1,133		4 - A,B,C,D	10260	L1R143C135	1,188,587	948,633	976,362	3,116,886	14,730,503	24,375,754	32,350,866	32,000,213	18,158,414	4,848,462	991,795	868,543
G3-*07173C	10100	2700	6,503		5 - A,B,C	5580	L1R139C133	433,104	345,668	355,772	1,135,749	5,367,588	8,882,183	11,788,202	11,660,428	6,616,671	1,766,712	361,396	316,485
G3-*09454C	1295	450	834		6 - A,B,C	6140	L1R135C139	711,299	567,700	584,294	1,865,271	8,815,330	14,587,440	19,360,070	19,150,225	10,866,731	2,901,516	593,530	519,771
G3-*07174ALCWRIS	5560	1500	3,580	Qa	7 - A,B,C	6570	L1R133C143	761,113	607,458	625,214	1,995,900	9,432,690	15,609,036	20,715,906	20,491,364	11,627,756	3,104,717	635,097	556,172
G3-*09455C	580	280	373		8 - A,B,C	6140	L1R136C143	711,299	567,700	584,294	1,865,271	8,815,330	14,587,440	19,360,070	19,150,225	10,866,731	2,901,516	593,530	519,771
G3-*07175C	18500	4950	11,911		9 - A,B,C	7860	L1R136C148	910,555	726,730	747,973	2,387,790	11,284,771	18,673,823	24,783,412	24,514,783	13,910,832	3,714,319	759,796	665,375
G3-*09450C	3280	650	2,112		10 - A,B,C	6480	L1R131C146	750,686	599,136	616,649	1,968,559	9,303,475	15,395,213	20,432,126	20,210,661	11,468,472	3,062,187	626,397	548,554
G3-*07176C	18800	5000	12,104		11 - A,B,C	7050	L1R132C153	816,719	651,838	670,892	2,141,720	10,121,837	16,749,422	22,229,397	21,988,450	12,477,273	3,331,546	681,496	596,806
G3-*09451C	3200	1275	2,060				L1R139C134	213,320	170,255	175,231	559,399	2,643,738	4,374,806	5,806,129	5,743,196	3,258,957	870,171	178,001	155,881
EAST SIDE LIBERTY LAKE IMP CLUB	1,162	235.75																	
G3-21382C	812	236	620	Qa	Well A&B	550	L1R146C147	96,875	85,410	103,698	190,059	366,616	559,425	775,632	775,328	396,640	165,302	91,879	96,808
02290A	350	135	267	Qa	Valleyway Well	975	L1R145C147	171,733	151,408	183,828	336,923	649,910	991,708	1,374,983	1,374,446	703,134	293,035	162,876	171,614
EAST SPOKANE WATER DIST 1	3250	1234																	
					5		L1R148C108	428,112	416,836	430,179	534,954	762,810	1,083,294	1,580,586	2,530,732	791,624	487,484	330,484	380,348
G3-*02418C	600	448	329	Qi	8		L1R148C104	428,112	416,836	430,179	534,954	762,810	1,083,294	1,580,586	2,530,732	791,624	487,484	330,484	380,348
G3-*03395C	920	448	504	Qa	2		L1R150C104	856,224	833,672	860,357	1,069,907	1,525,619	2,166,587	3,161,171	5,061,465	1,583,247	974,968	660,967	760,696
G3-*00793S	585	270	321	Qa	1		L1R150C105	516,028	502,436	518,519	644,810	919,458	1,305,756	1,905,170	3,050,436	954,189	587,592	398,351	458,455
G3-22768	200	68	110	Qa	3		L1R150C106	129,963	126,540	130,590	162,397	231,567	328,857	479,821	768,258	240,314	147,986	100,325	115,463
IRVIN WATER DISTRICT #6	6400	1768																	
G3-27211C	1700	1273	1,272	Qa	Well 1	2000	L1R139C116	1,324,048	1,086,659	1,277,596	1,532,641	2,591,912	3,287,261	4,960,368	4,695,142	3,050,150	1,687,246	1,145,504	1,087,411
					Well 3		L1R139C118	1,324,048	1,086,659	1,277,596	1,532,641	2,591,912	3,287,261	4,960,368	4,695,142	3,050,150	1,687,246	1,145,504	1,087,411
G3-29978	2700		2,021		Well 5	2000	L1R137C117	514,850	422,542	496,787	595,960	1,007,853	1,278,236	1,928,816	1,825,684	1,186,036	656,078	445,424	422,835
G3-00415ALC	2000	495	1,497	Qa	Well 4	1300	L1R141C114	514,850	422,542	496,787	595,960	1,007,853	1,278,236	1,928,816	1,825,684	1,186,036	656,078	445,424	422,835
LIBERTY LAKE SEWER & WATER DISTRICT	11175	3935																	
G3-27708	4500	3600	3,435	Qa	Schultz Well (S05)	3108	L1R143C147	5,065,638	4,354,182	5,383,570	9,166,700	15,373,879	20,195,781	29,521,071	28,554,032	19,780,379	10,069,360	4,559,077	4,792,330
G3-29362 (includes 3 rights	2650		2,023	Qi	Valleyway Well (S04)	0	L1R145C147	2,713,754	2,332,614	2,884,076	4,910,768	8,236,066	10,819,246	15,814,973	15,296,913	10,596,708	5,394,339	2,442,380	2,567,338
G3-26247	2100	1825	1,603	Qi	Kenney Well (S02)	1783	L1R142C142	2,150,522	1,669,601	2,285,494	3,766,018	6,526,694	8,297,170	12,532,620	12,122,082	8,126,507	4,274,759	1,873,037	2,034,494
G3-01023C	2250	1680	1,718	Qa	Mission Well (S03)	1944	L1R143C144	2,363,964	2,031,952	2,512,333	4,277,793	7,174,477	9,424,698	13,776,500	13,325,215	9,230,843	4,699,035	2,127,569	2,236,421
G3-00811C	825	430	630	Qa	Sprague Well (S01)	628	L1R146C145	605,062	520,083	643,038	1,094,911	1,836,324	2,412,274	3,526,128	3,410,621	2,362,656	1,202,729	544,556	572,417
MILLWOOD, TOWN OF	4200	2400																	
G3-*05174CWRIS	500	800	377	Qi	Butler (S02)	750	L1R139C113	714,745	680,895	766,389	833,455	1,205,306	1,926,076	2,983,957	2,751,295	1,540,929	897,327	657,964	705,578
G3-26769CWRIS	2200	3520	1,659	Qi	New Park (S03)	2200	L1R140C110	3,144,876	2,995,936	3,372,111	3,667,203	5,303,345	8,474,735	13,129,412	12,105,696	6,780,088	3,948,237	2,895,041	3,104,542
G3-*02404CWRIS	1200	405	905	Qa	Old Park (S01)	1100	L1R140C111	804,995	766,871	863,161	938,696	1,357,500	2,169,282	3,360,742	3,098,701	1,735,503	1,010,632	741,045	794,671
MOAB IRRIGATION DIST # 20	6000	2932		Qa															
G3-01478C	4000	1932	2,300		Well 1	650		301,017	219,910	309,449	4,316,450	1,124,269	1,564,415	3,751,590	3,300,278	1,475,155	421,015	229,454	282,134
G3-24609C	2000	1000	1,150		Well 2	1800		833,587	608,982	856,935	11,953,247	3,113,359	4,332,225	10,389,018	9,139,230	4,085,045	1,165,887	635,411	781,294
					Well 3	2350		1,088,293	795,060	1,118,776	15,605,627	4,064,663	5,655,960	13,563,440	11,931,773	5,333,253	1,522,131	829,565	1,020,023
							L1R126C151	2,222,897	1,623,951	2,285,160	31,875,324	8,302,291	11,552,600	27,704,048	24,371,281	10,893,454	3,109,033	1,694,430	2,083,452
MODEL IRRIGATION DIST #18	9780	4115	7,466	Qa	System Maximum														
689-D	4200	779	3,206		Well #1	1000	L1R151C115	483,353	426,149	517,397	948,293	1,829,215	2,791,229	3,869,983	3,868,470	1,979,018	824,766	458,427	483,019
119-A	80	670	763		Well #3	1500		725,030	639,224	776,095	1,422,440	2,743,823	4,186,844	5,804,975	5,802,705	2,968,527	1,237,150	687,640	724,528
3211-A	375	670	458		Well #4	1500	L1R150C116	725,030	639,224	776,095	1,422,440	2,743,823	4,186,844	5,804,975	5,802,705	2,968,527	1,237,150	687,640	724,528
4109-A	525	670	763		Well #5	2000	L1R154C115	966,707	852,298	1,034,793	1,896,586	3,658,431	5,582,458	7,739,966	7,736,940	3,958,036	1,649,533	916,853	966,038
5558-A	1000	670	61		Well #7	2000	L1R156C118	966,707	852,298	1,034,793	1,896,586	3,658,431	5,582,458	7,739,966	7,736,940	3,958,036	1,649,533	916,853	966,038
G3-00342C	1000	526	611		Well #8	1700	L1R155C115	821,701	724,453	879,574	1,612,098	3,109,666	4,745,089	6,578,971	6,576,399	3,364,331	1,402,103	779,325	821,132
G3-20159C	600	540	3,206					-	-	-	-	-	-	-	-	-	-	-	-
G3-21962C	200	0	401					-	-	-	-	-	-	-	-	-	-	-	-
G3-26072C	1000		763					-	-	-	-	-	-	-	-	-	-	-	-
G3-26369C	800	1600	153					-	-	-	-	-	-	-	-	-	-	-	-

Table 1 - Purveyor Water Rights, Withdrawal Points and Model Cells

System Name / Water Right	Water Right gpm	Water Right AF/YR	Annulized Qi (AF/YR)	Allocation Method	Source	Capacity	Model Cell	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
MODERN ELECTRIC WATER CO.	37875	19061																	
G3-*04909ALC (3421A), Consolidated	36325	29061	27,731	Qa															
	3771	3017	3,007	Qi	Well 2	3000	L1R145C115	6,094,720	6,094,720	5,625,895	6,250,994	10,626,691	13,752,188	21,253,382	22,503,580	15,002,387	7,501,194	6,094,720	6,094,720
	5028	4022	4,009	Qi	Well 3	4000	L1R149C118	8,126,293	8,126,293	7,501,194	8,334,659	14,168,921	18,336,251	28,337,842	30,004,774	20,003,183	10,001,591	8,126,293	8,126,293
	6033	4827	4,811	Qi	Well 4	4800	L1R147C111	9,751,552	9,751,552	9,001,432	10,001,591	17,002,705	22,003,501	34,005,411	36,005,729	24,003,819	12,001,910	9,751,552	9,751,552
	5028	4022	4,009	Qi	Well 6	4000	L1R143C111	8,126,293	8,126,293	7,501,194	8,334,659	14,168,921	18,336,251	28,337,842	30,004,774	20,003,183	10,001,591	8,126,293	8,126,293
	4022	3218	3,207	Qi	Well 7	3200	L1R151C119	6,501,034	6,501,034	6,000,955	6,667,727	11,335,137	14,669,001	22,670,274	24,003,819	16,002,546	8,001,273	6,501,034	6,501,034
	2514	2011	2,005	Qi	Well 8	2000	L1R144C114	4,063,146	4,063,146	3,750,597	4,167,330	7,084,460	9,168,125	14,168,921	15,002,387	10,001,591	5,000,796	4,063,146	4,063,146
	9930	7944	7,918	Qi	Well 11	7900	L1R145C118	16,049,429	16,049,429	14,814,857	16,460,952	27,983,619	36,214,096	55,967,238	59,259,429	39,506,286	19,753,143	16,049,429	16,049,429
G3-*09500C (7127A)	1550	1300	1,236	Qi	Well 9	1500	L1R153C119	2,505,281	2,505,281	2,312,567	2,569,519	4,368,182	5,652,941	8,736,364	9,250,267	6,166,845	3,083,422	2,505,281	2,505,281
ORCHARD AVENUE IRRIGATION DIST 6	9160	3161	6,993	Qa															
G3-*00820ALCWRIS (581)	2000	1191	1,527		Well 1	3950	L1R141C106	671,946	536,292	551,968	1,762,075	8,327,624	13,780,392	18,288,978	18,090,743	10,265,532	2,740,991	560,693	491,015
G3-*CV1P461(0736-D)	6360	1970	4,855		Well 2	3200	L1R141C107	544,361	434,465	447,164	1,427,504	6,746,429	11,163,862	14,816,387	14,655,791	8,316,380	2,220,549	454,232	397,784
G3-*08186C (6072-A)	800	264	611																
*PASADENA PARK IRR DIST 17	5250	3500	4,187	Qa															
G3-*05641C	2000	1870	1,595		Well 1	500	L1R137C109	541,155	444,132	522,170	626,410	1,059,348	1,343,546	2,027,366	1,918,965	1,246,635	689,599	468,182	444,439
G3-20429	2000	1503	1,595		Well 2	1000	L1R138C112	1,082,311	888,263	1,044,340	1,252,820	2,118,695	2,687,091	4,054,732	3,837,929	2,493,271	1,379,198	936,364	888,877
G3-00881D	1250	127	997		Well 3	1727	L1R136C110	1,869,151	1,534,030	1,803,575	2,163,620	3,658,987	4,640,606	7,002,522	6,628,104	4,305,878	2,381,875	1,617,101	1,535,091
G3-*07330ALC	2000	920	1,595		Well 4	2000	L1R137C109	2,164,622	1,776,526	2,088,679	2,505,640	4,237,391	5,374,182	8,109,464	7,675,858	4,986,541	2,758,396	1,872,729	1,777,755
G3-28003CWRIS	180	72	144		Well 5	1500	L1R137C108	1,623,466	1,332,395	1,566,509	1,879,230	3,178,043	4,030,637	6,082,098	5,756,894	3,739,906	2,068,797	1,404,547	1,333,316
SPOKANE CO WATER DIST #3, SYS #1	2605	1708																	
G3-*01125C (1270-A)	500	137	362	Qa	S-04	0	L1R146C108	192,425	194,933	221,873	300,809	492,746	785,118	1,185,167	1,095,946	678,571	393,271	208,321	218,540
G3-01269 (1269-A)	500	137	362	Qa	S-05	500	L1R142C109	192,425	194,933	221,873	300,809	492,746	785,118	1,185,167	1,095,946	678,571	393,271	208,321	218,540
G3-*02807C (2143-A)	500	538	362	Qa	S-06	0	L1R145C105	755,654	765,503	871,298	1,181,279	1,935,016	3,083,165	4,654,158	4,303,787	2,664,752	1,544,378	818,080	858,210
G3-*04732CWRIS (3255-A)	500	800	362	Qa	S-07	0	L1R144C107	1,123,649	1,138,294	1,295,611	1,756,549	2,877,347	4,584,632	6,920,681	6,399,684	3,962,457	2,296,473	1,216,476	1,276,148
G3-00854C	605	370	438	Qa	S-11	1000	L1R149C101	519,688	526,461	599,220	812,404	1,330,773	2,120,392	3,200,815	2,959,854	1,832,636	1,062,119	562,620	590,219
*G3-*00607SWRIS*	120	46	87	Qa	S-10	2000		64,610	65,452	74,498	101,002	165,447	263,616	397,939	367,982	227,841	132,047	69,947	73,379
*G3-*01101C*	500	137	362	Qa				192,425	194,933	221,873	300,809	492,746	785,118	1,185,167	1,095,946	678,571	393,271	208,321	218,540
							L1R143C108	257,035	260,385	296,371	401,811	658,193	1,048,735	1,583,106	1,463,928	906,412	525,318	278,269	291,919
SPO CO WATER DIST #3, SYS #2	12450	4748																	
G3-20947C	1400	1787	1,014	Qi	S-13	0	L1R155C118	1,356,540	1,374,220	1,564,143	2,120,616	3,473,714	5,534,856	8,355,080	7,726,100	4,783,727	2,772,446	1,468,606	1,540,646
7361-A	3150	2530	2,281	Qi	S-15	3300	L1R154C120	3,052,215	3,091,995	3,519,321	4,771,386	7,815,857	12,453,426	18,798,930	17,383,725	10,763,385	6,238,004	3,304,363	3,466,454
G3-25972C	2700	4320	1,955	Qi	S-16	3400	L1R155C119	2,616,184	2,650,281	3,016,561	4,089,759	6,699,306	10,674,365	16,113,369	14,900,336	9,225,758	5,346,860	2,832,311	2,971,247
G3-26018C	1200	1920	869	Qi	S-18	NO WELL LISTED		1,162,748	1,177,903	1,340,694	1,817,671	2,977,469	4,744,162	7,161,497	6,622,372	4,100,337	2,376,382	1,258,805	1,320,554
310-A	100	104	72	Qi	S-18			96,896	98,159	111,724	151,473	248,122	395,347	596,791	551,864	341,695	198,032	104,900	110,046
757-D	100	64	72	Qa	S-18			89,892	91,064	103,649	140,524	230,188	366,771	553,654	511,975	316,997	183,718	97,318	102,092
2084-A	285	269	206	Qi	S-18			276,153	279,752	318,415	431,697	707,149	1,126,739	1,700,856	1,572,813	973,830	564,391	298,966	313,632
2315-A	740	688	536	Qi	S-18			717,028	726,373	826,761	1,120,897	1,836,106	2,925,567	4,416,257	4,083,796	2,528,541	1,465,436	776,263	814,342
G3-*06017C (6245-A)	2400	688	1,738	Qa	S-18			966,338	978,933	1,114,225	1,510,632	2,474,519	3,942,784	5,951,785	5,503,728	3,407,713	1,974,967	1,046,169	1,097,488
3211-A	375	600	272	Qi	S-18			363,359	368,095	418,967	568,022	930,459	1,482,551	2,237,968	2,069,491	1,281,355	742,620	393,377	412,673
							L1R153C113	3,672,414	3,720,277	4,234,435	5,740,915	9,404,013	14,983,919	22,618,809	20,916,039	12,950,468	7,505,545	3,975,798	4,170,826
TRENTWOOD IRRIGATION DISTRICT 3	2000	3200	1,150	Qi															
G3-26592C	2000	3200	1,527		S02	750	L1R136C121	62,117	40,989	63,857	862,000	232,002	312,415	774,170	681,038	294,590	86,880	45,822	58,221
G3-*06748C			0		S03	3000	L1R135C125	248,469	163,954	255,429	3,448,001	928,007	1,249,662	3,096,680	2,724,153	1,178,361	347,519	183,289	232,882
G3-*09701C			0		S04	2000	L1R136C120	165,646	109,303	170,286	2,298,667	618,671	833,108	2,064,454	1,816,102	785,574	231,679	122,193	155,255
G3-*09702C			0		S05	2300	L1R136C126	190,493	125,698	195,829	2,643,467	711,472	958,074	2,374,122	2,088,517	903,410	266,431	140,522	178,543
G3-*00604C			0		S06	2000	L1R136C125	165,646	109,303	170,286	2,298,667	618,671	833,108	2,064,454	1,816,102	785,574	231,679	122,193	155,255
VERA WATER & POWER\	46400	10081		Qa															
G3-27084C	13400	1477	9,133		Well 1	4000	L1R145C122	1,789,936	1,870,108	2,024,586	2,660,969	5,314,843	7,100,459	10,851,494	12,144,911	6,715,992	3,127,156	1,998,125	1,803,820
G3-*00696S	3400	2031	2,317		Well 2	5500	L1R145C125	2,461,162	2,571,399	2,783,806	3,658,833	7,307,908	9,763,131	14,920,804	16,699,252	9,234,490	4,299,839	2,747,422	2,480,252
G3-*00697S	1400	2068	954		Well 3	5600	L1R151C122	2,505,911	2,618,152	2,834,421	3,725,357	7,440,780	9,940,643	15,192,091	17,002,875	9,402,389	4,378,018	2,797,376	2,525,348
G3-*09128C	4000	369	2,726		Well 33	1000	L1R151C122	447,484	467,527	506,147	665,242	1,328,711	1,775,115	2,712,873	3,036,228	1,678,998	781,789	499,531	450,955
G3-*07938C	3100	443.1208791	2,113		Well 4	1200	L1R153C124	536,981	561,033	607,376	798,291	1,594,453	2,130,138	3,255,448	3,643,473	2,014,798	938,147	599,438	541,146
G3-*00693S	7100	812	4,839		Well 5	2200	L1R151C123	984,465	1,028,560	1,113,522	1,463,533	2,923,163	3,905,253	5,968,322	6,679,701	3,693,796	1,719,936	1,098,969	992,101
G3-*00695S	6300	1477	4,294		Well 6	4000	L1R149C122	894,968	935,054	1,012,293	1,330,485	2,657,421	3,550,230	5,425,747	6,072,455	3,357,996	1,563,578	999,063	901,910
G3-00711D	6300		4,294		Well 7		L1R148C123	894,968	935,054	1,012,293	1,330,485	2,657,421	3,550,230	5,425,747	6,072,455	3,357,996	1,563,578	999,063	901,910

Table 1 - Purveyor Water Rights, Withdrawal Points and Model Cells

System Name / Water Right	Water Right gpm	Water Right AF/YR	Annulized Qi (AF/YR)	Allocation Method	Source	Capacity	Model Cell	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
G3-*00694S	6000	1403	4,089		Well 8	3800	L1R149C126	1,700,439	1,776,603	1,923,357	2,527,921	5,049,100	6,745,436	10,308,919	11,537,665	6,380,193	2,970,798	1,898,219	1,713,629
G3-*00997S	1100	1218.582418	750		Well 9	3300	L1R149C126	1,476,697	1,542,839	1,670,284	2,195,300	4,384,745	5,857,879	8,952,482	10,019,551	5,540,694	2,579,903	1,648,453	1,488,151
Within Spokane Valley-Rathdrum Prairie Aquifer, WRIA 55 and 57																			
SPOKANE, CITY OF	241550	148185																	
G3-*00373S	54750	36000	41,796	Qa	Well Electric (S02)	39300	L1R141C101	74,827,674	67,726,090	71,942,002	81,992,843	148,658,274	196,534,760	274,002,315	245,285,912	167,352,208	98,042,329	70,252,149	71,543,446
G3-*00374S	14000	1870	11,486	Qa	Ray St (S04)	21550	L1R150C95	3,886,882	3,517,994	3,736,987	4,259,073	7,721,971	10,208,889	14,232,898	12,741,240	8,693,017	5,092,754	3,649,209	3,716,285
G3-*00370BBHSWRIS	7000	350	5,743	Qa	Ray St (S04)			727,491	658,448	699,436	797,153	1,445,289	1,910,755	2,663,911	2,384,724	1,627,035	953,189	683,007	695,561
504-D	1250	2000	1,026	Qi	Ray St (S04)			2,037,233	1,843,887	1,958,668	2,232,309	4,047,319	5,350,788	7,459,893	6,678,070	4,556,274	2,669,267	1,912,661	1,947,817
#507-D	2600	520	2,133	Qa	Ray St (S04)			1,080,844	978,266	1,039,162	1,184,341	2,147,286	2,838,835	3,957,811	3,543,019	2,417,310	1,416,167	1,014,753	1,033,405
G3-*00376	11600	1280	9,517	Qa	Hoffman Ave (S05)	10920	L1R137C92	2,660,540	2,408,039	2,557,938	2,915,301	5,285,628	6,987,903	9,742,305	8,721,277	5,950,301	3,485,949	2,497,854	2,543,767
G3-*00352C	63000	51240	51,687	Qa	Parkwater (S03)	63000	L1R142C101	106,504,722	96,396,802	102,397,450	116,703,146	211,590,276	279,734,475	389,996,629	349,123,614	238,197,975	139,546,915	99,992,225	101,830,171
728-A	11000	4080	9,025	Qa	Grace (S06)	19000	L1R141C89	8,480,470	7,675,624	8,153,427	9,292,522	16,847,938	22,273,939	31,053,596	27,799,070	18,966,584	11,111,464	7,961,910	8,108,257
592	20000	1000	16,409	Qa	Grace (S06)			2,078,546	1,881,280	1,998,389	2,277,579	4,129,396	5,459,299	7,611,175	6,813,498	4,648,672	2,723,398	1,951,449	1,987,318
3199-A	25000	20000	20,511	Qa	Nevada St (S01)	25000		41,570,930	37,625,606	39,967,779	45,551,579	82,587,930	109,185,978	152,223,508	136,269,951	92,973,449	54,467,960	39,028,971	39,746,359
G3-*CV2P658	9000	4760	7,384	Qa	Central Ave (S08)	16800	L1R134C85	9,893,881	8,954,894	9,512,331	10,841,276	19,655,927	25,986,263	36,229,195	32,432,248	22,127,681	12,963,375	9,288,895	9,459,633
G3-*05309C	7000	11480	5,743	Qi	Central Ave (S08)			11,408,502	10,325,769	10,968,542	12,500,930	22,664,987	29,964,413	41,775,401	37,397,193	25,515,133	14,947,894	10,710,901	10,907,777
G3-*05855C	7900	12640	6,481	Qi	Central Ave (S08)			12,875,310	11,653,368	12,378,783	14,108,193	25,579,057	33,816,980	47,146,524	42,205,403	28,795,650	16,869,766	12,088,017	12,310,205
G3-*00371CBHSWRIS	7000	350	5,743	Qa	Central Ave (S08)			727,491	658,448	699,436	797,153	1,445,289	1,910,755	2,663,911	2,384,724	1,627,035	953,189	683,007	695,561
					Baxter Well	0	L1R138C74	0	0	0	0	0	0	0	0	0	0	0	0
Within Spokane Valley-Rathdrum Prairie Aquifer, WRIA 55																			
NORTH SPOKANE IRRIGATION DISTRICT 8	5500	2114																	
G3-00556ALCWRIS	2300	1085	1,593	Qa	Wells 1, 2, 3, 4	1- 600	L1R130C93	1,690,503	1,337,129	1,603,206	2,423,429	3,870,198	6,202,814	9,921,850	9,270,275	5,047,950	2,523,000	1,849,880	1,522,367
G3-*00674SWRIS	1000	2114	693	Qi	Wells 2 & 4	2- 1400		1,016,824	804,273	964,316	1,457,673	2,327,894	3,730,944	5,967,914	5,575,997	3,036,302	1,517,565	1,112,688	915,691
G3-*00675SWRIS	1000	2114	693	Qi	Wells 1 & 3	3 - 850		1,016,824	804,273	964,316	1,457,673	2,327,894	3,730,944	5,967,914	5,575,997	3,036,302	1,517,565	1,112,688	915,691
G3-*07576CWRIS	1200	483	831	Qa	Wells 1 & 3	4 - 1200		752,546	595,238	713,685	1,078,817	1,722,862	2,761,253	4,416,823	4,126,767	2,247,152	1,123,142	823,495	677,699
SPO CO WATER DIST #3, SYS #3	3200	3000																	
G3-*03850CWRIS	1600	1500	1,158	Qi	S-20	800	L1R132C85	1,550,331	1,570,537	1,787,592	2,423,561	3,969,959	6,325,550	9,548,663	8,829,829	5,467,116	3,168,510	1,678,407	1,760,739
G3-*03849CWRIS	1600	1500	1,158	Qi	S-21	900	L1R128C85	1,550,331	1,570,537	1,787,592	2,423,561	3,969,959	6,325,550	9,548,663	8,829,829	5,467,116	3,168,510	1,678,407	1,760,739
SPO CO WATER DIST #3, SYS #4	3430	2242.8																	
G3-*05293C (3779-A)	500	470	362	Qi	S-24	0	L1R117C87	484,479	490,793	558,622	757,363	1,240,612	1,976,734	2,983,957	2,759,321	1,708,474	990,159	524,502	550,231
G3-*08023C (6086-A)	300	265	217	QI	S-25	300	L1R116C95	290,687	294,476	335,173	454,418	744,367	1,186,041	1,790,374	1,655,593	1,025,084	594,096	314,701	330,139
G3-00949C	1500	1772	1,086	Qi	S-26	1150	L1R116C93	1,453,436	1,472,378	1,675,867	2,272,088	3,721,837	5,930,203	8,951,872	8,277,964	5,125,421	2,970,478	1,573,506	1,650,693
G3-26510C	300	460	217	Qi	S-27	0	L1R119C95	290,687	294,476	335,173	454,418	744,367	1,186,041	1,790,374	1,655,593	1,025,084	594,096	314,701	330,139
G3-23578C	30	16	22	Qa	S-30 (not listed on WR)	750	L1R117C89	22,473	22,766	25,912	35,131	57,547	91,693	138,414	127,994	79,249	45,929	24,330	25,523
*WHITWORTH WATER DISTRICT 2	31472	21323																	
G3-20621ALCWRIS	1966	3171	1,394	Qi	S01-1,, S01-8		L1R130C83	802,021	781,169	880,985	1,464,263	2,790,769	3,996,817	5,866,460	5,346,455	3,471,002	1,528,477	710,862	703,306
					S02-1A		L1R128C83	802,021	781,169	880,985	1,464,263	2,790,769	3,996,817	5,866,460	5,346,455	3,471,002	1,528,477	710,862	703,306
G3-*06911CWRIS	1000	1161	709	Qi	S05-2A		L1R125C85	1,604,042	1,562,338	1,761,971	2,928,526	5,581,537	7,993,635	11,732,920	10,692,911	6,942,005	3,056,954	1,421,725	1,406,611
G3-26135CWRIS	3000	2000	2,127	Qa	S09-3B		L1R118C84	2,465,268	2,401,173	2,707,990	4,500,880	8,578,319	12,285,496	18,032,440	16,434,039	10,669,236	4,698,262	2,185,062	2,161,834
G3-26134CWRIS	3000	4800	2,127	Qi	S06-2B		L1R125C84	2,447,674	2,384,036	2,688,663	4,468,757	8,517,096	12,197,815	17,903,743	16,316,751	10,593,090	4,664,731	2,169,468	2,146,406
G3-09631C	500	159	355	Qa	S07-3		L1R121C83	195,989	190,893	215,285	357,820	681,976	976,697	1,433,579	1,306,506	848,204	373,512	173,712	171,866
G3-04928C	500	67.5	355	Qa	SA010-4		L1R119C79	83,203	81,040	91,395	151,905	289,518	414,635	608,595	554,649	360,087	158,566	73,746	72,962

Figure 1: Full Inchoate Water Right Exercised - August 2000

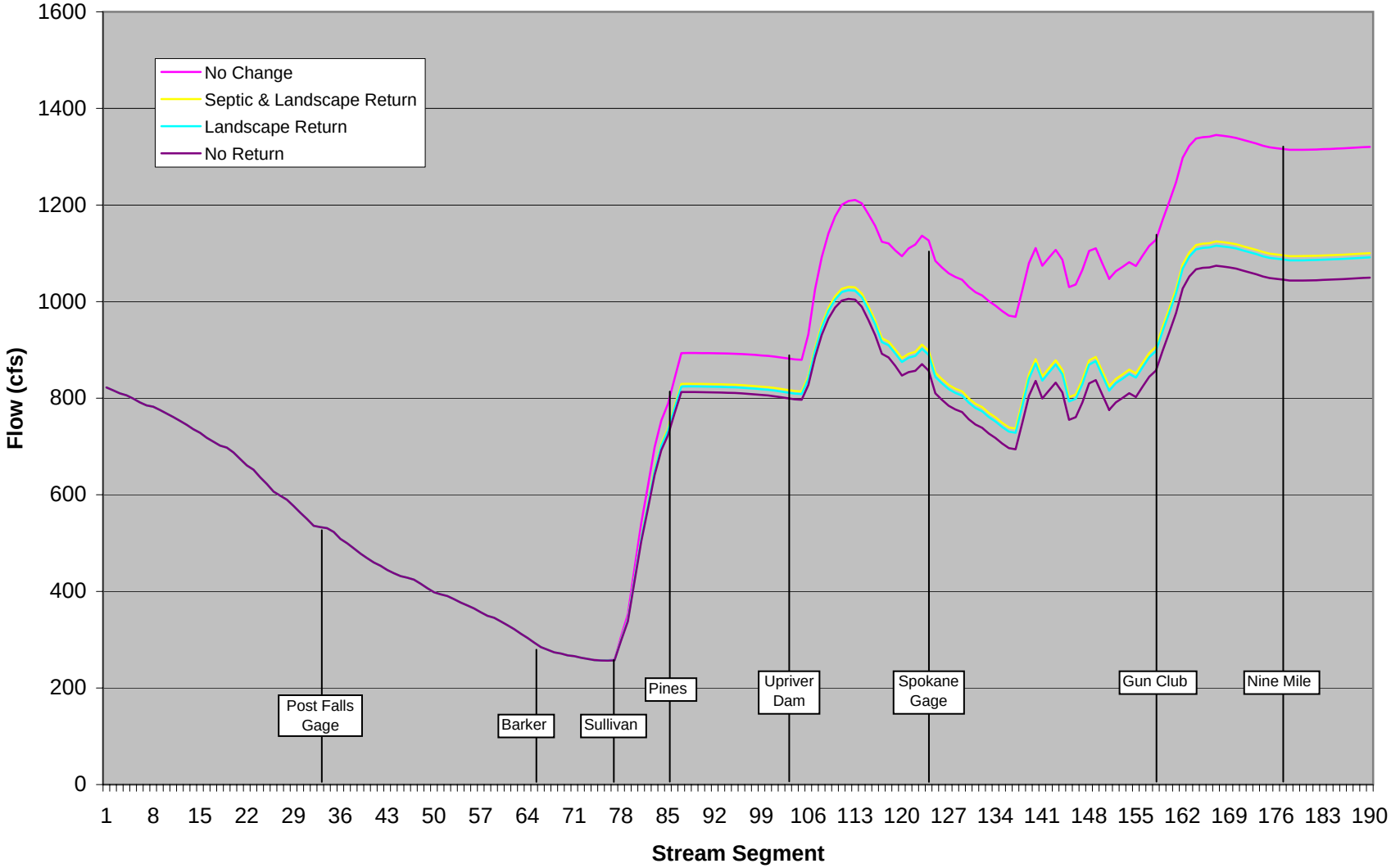

Figure 2: Full Inchoate Water Right Exercised - August 2001

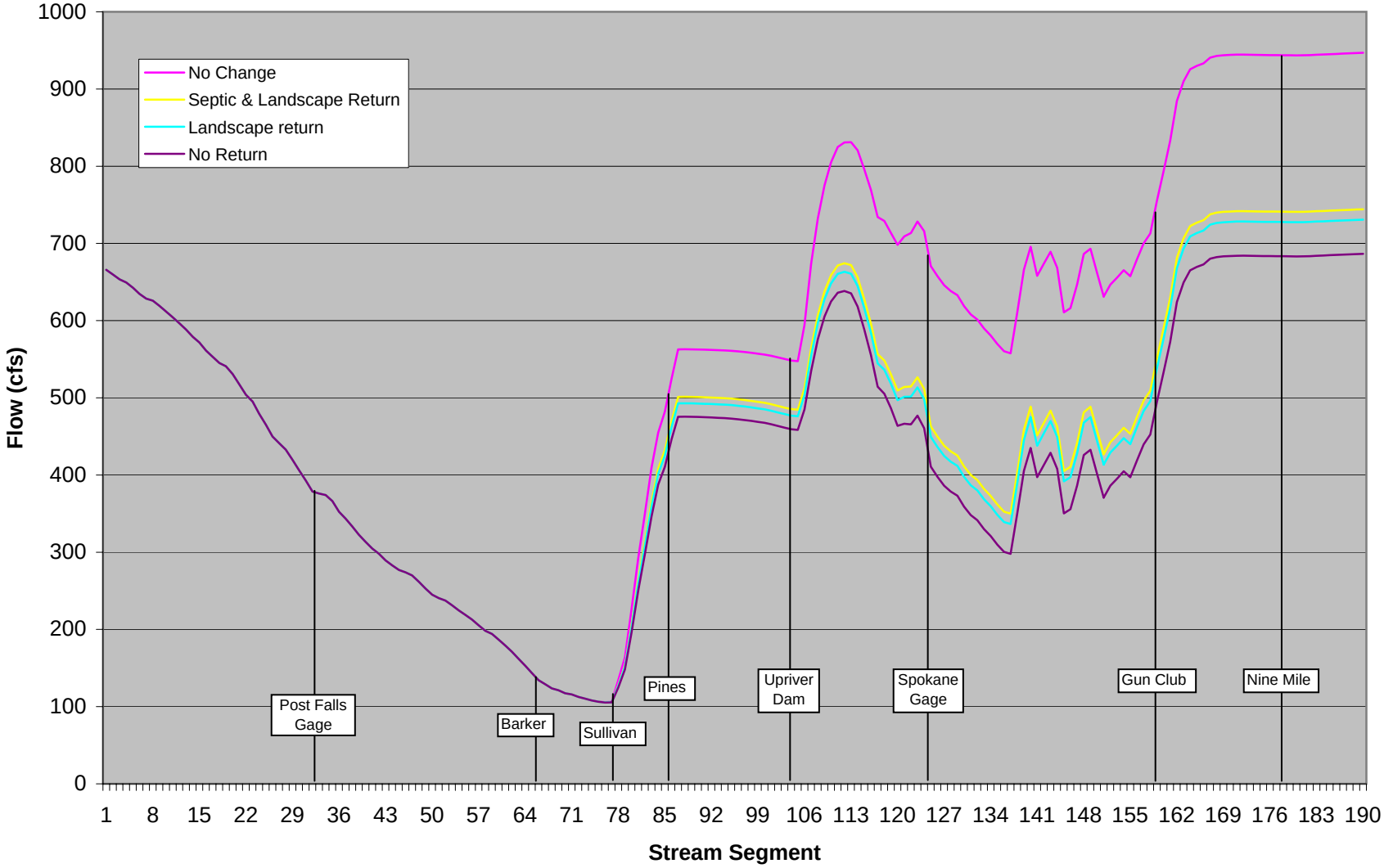

Figure 3: Full Inchoate Water Right Exercised - August 2002

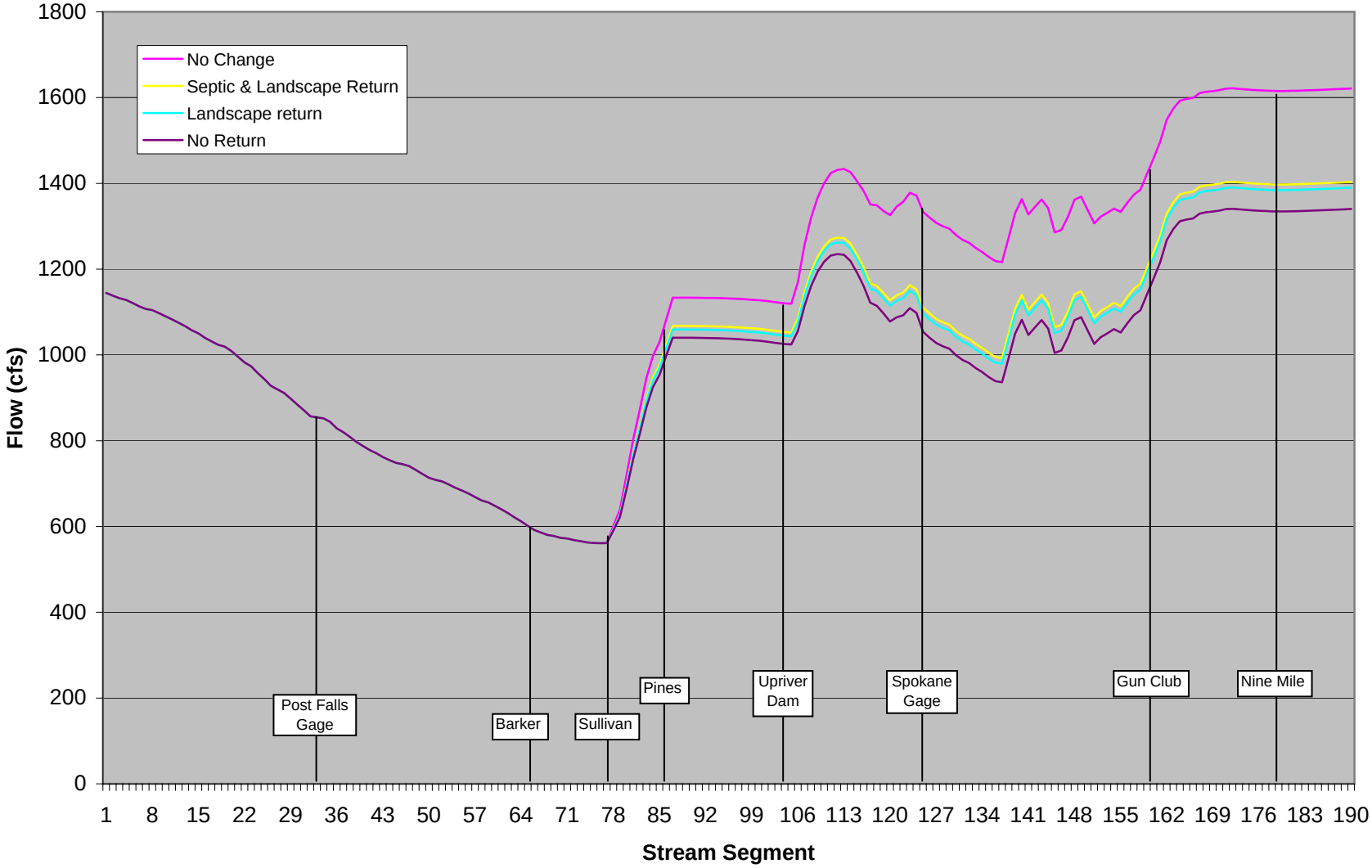

Figure 4: Full Inchoate Right Exercised - August 2003

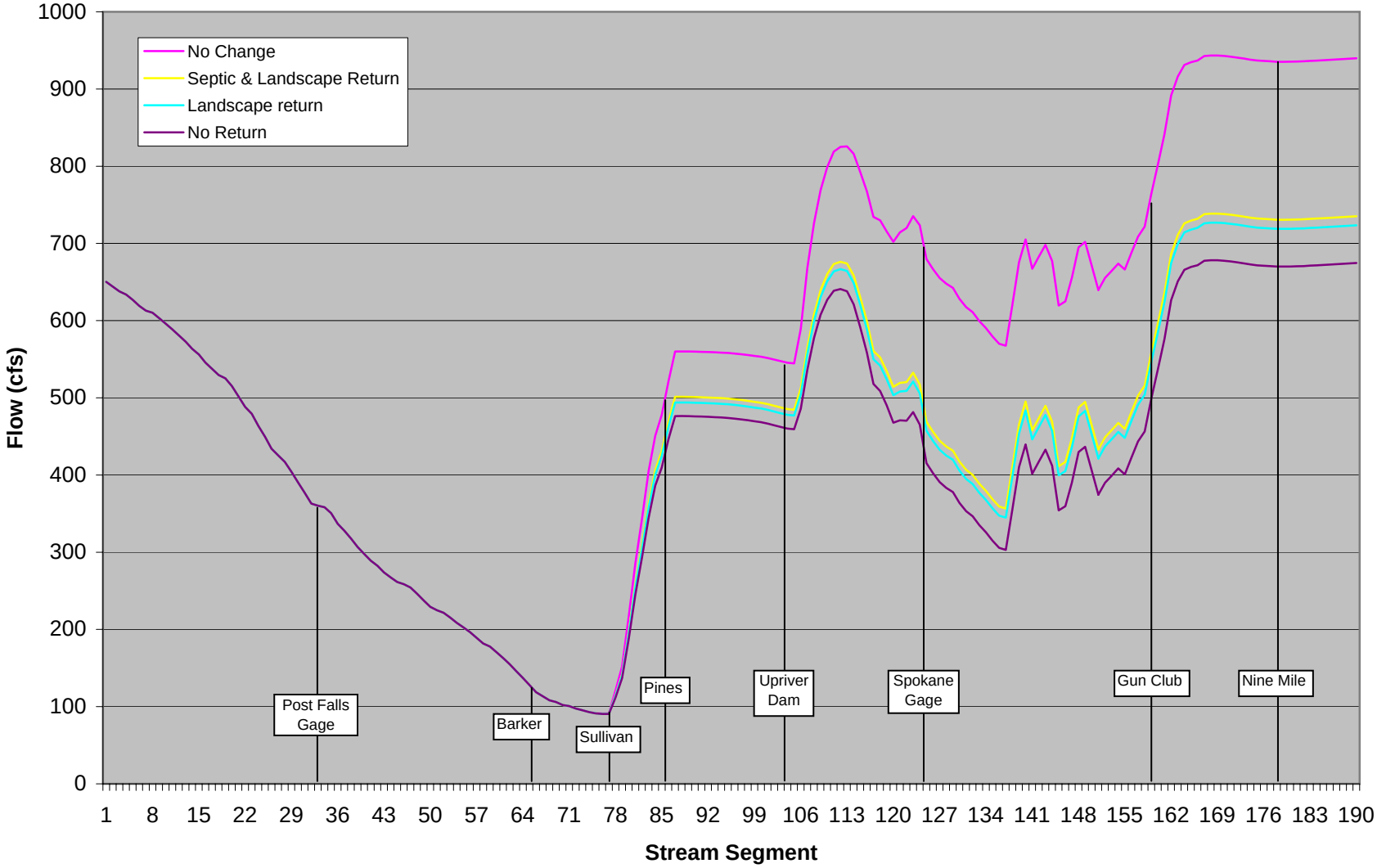

Figure 5: Full Inchoate Water Right Exercised - August 2004

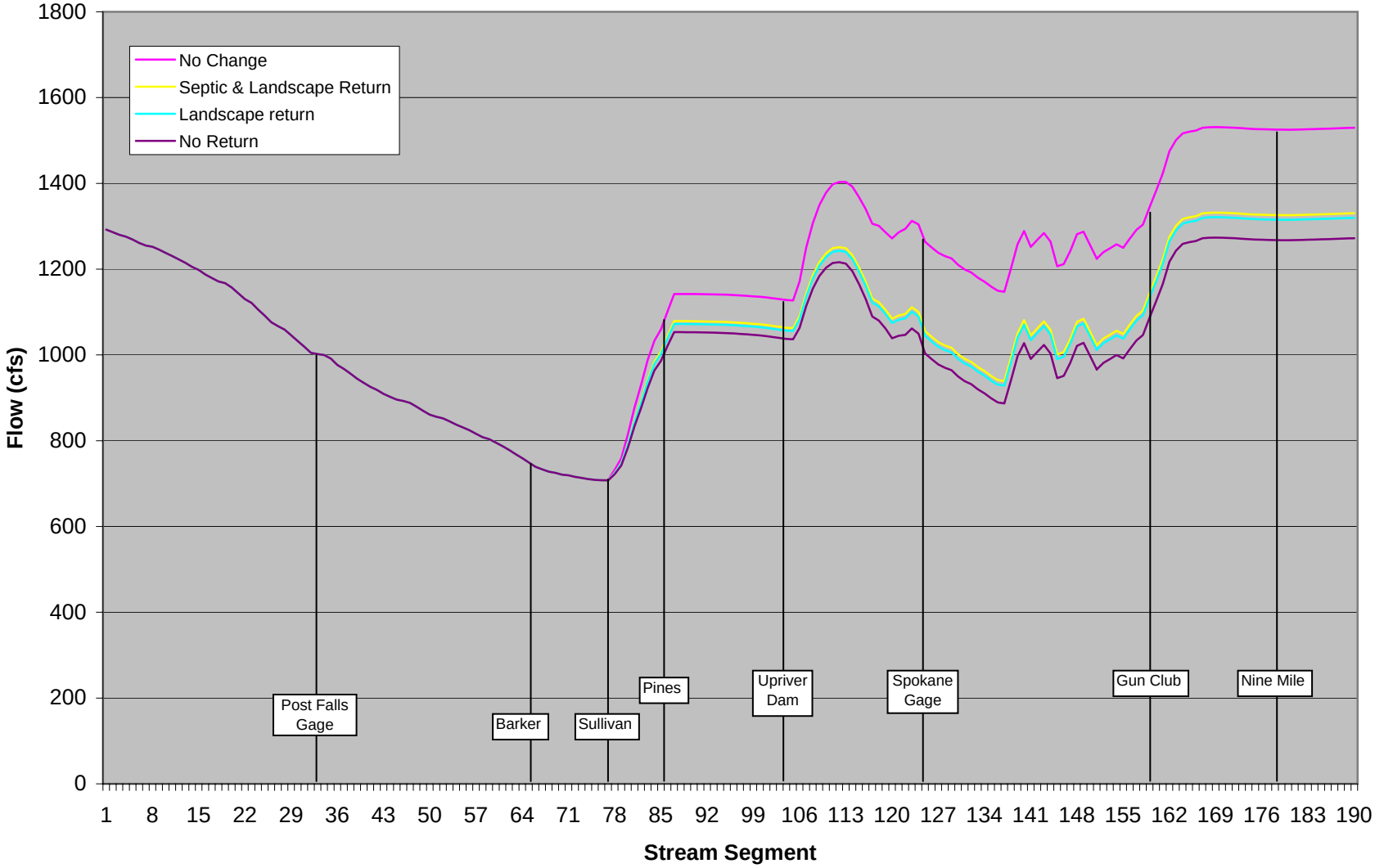

Figure 6: Aquifer/River Interaction - August 2005