Section 4

Mono Basin Tributaries:
Lee Vining, Rush, Walker, and Parker Creeks

Monitoring Results and Analysis
For Runoff Season 2007-2008

Mono Basin Tributaries: Lee Vining, Rush, Walker, and Parker Creeks

Monitoring Results and Analyses for Runoff Season 2007-08

FINAL

Prepared for:
Los Angeles Department of Water and Power

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May 5, 2008

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1 INTRODUCTION

The 2007 runoff season in the Mono Basin was the first Dry year since the monitoring program began, and followed a Wet runoff year in 2006, providing a useful contrast in runoff year types for the monitoring program. The 2007 season marked the 11th consecutive year of monitoring in the basin and the ninth official year following the State Water Resources Control Board (SWRCB) Decision 1631 and Order 98-05. The geomorphic and riparian field monitoring effort decreased significantly in RY 2007, and monitoring relied primarily on remotely installed instrumentation such as the pressure transducers/dataloggers installed in groundwater monitoring wells, and the temperature recorders deployed throughout the basin (Figure 1). There were minor modifications to 4bii and 8 side channel entrances, including lowering the bed elevation at the entrance and removing some riparian vegetation, to allow perennial flow into these channels.

2 HYDROLOGY

2.1 Runoff Year 2007-08 Annual Hydrographs

This section presents runoff year hydrographs and describes flow conditions at gaged and computed sites for the four tributaries. Runoff Year 2007 fell within the Dry runoff year type, with approximately 53,312 acre feet (af) (44% of average) estimated yield (above the basin diversions), which is well below the 83,655 af threshold between Dry and Dry-Normal I runoff year types. This annual runoff volume ranks second to last in the RY 1941-2007 period of record, with RY 1977 being only slightly drier (52,093 af). Eastern Sierra precipitation conditions were unusually dry in RY 2007 (Figure 2, blue line). Consequently, with a Dry runoff year type, Stream Restoration Flow (SRF) releases were not required for Rush Creek below Grant Reservoir, or for Lee Vining Creek below the conduit. Although diversions were allowable under D-1631 and Order 98-05, Parker and Walker creeks continued to have flow-through conditions without diversions during the entire runoff year.

2.1.1 Rush Creek

Following three successive runoff years in which Rush Creek's peak discharge below the Narrows exceeded 370 cfs (Figure 3), RY 2007 presented an extreme contrast in which no peak flows occurred. Based on the 'Rush Creek at Damsite' flow record for 1937–present, RY 2007 was the driest year on record, yielding only approximately 21,941 af (Reis 2008, pers. comm.), which was 36.5% of the average annual yield for 'Rush Creek at Damsite'. The SWRCB Order 98-05 does not require SRF releases for Dry year runoff types. Streamflow releases from Grant Reservoir into Rush Creek were equivalent to baseflows for the entire runoff year, with a targeted 31 cfs minimum release during April through September, and 36 cfs October through March, as required by the SWRCB Order 98-05. However, in RY 2007, LADWP requested, and was granted from the SWRCB, a short-term variance from its minimum instream flow release requirements, and baseflow releases to Rush Creek were changed from 36 cfs to approximately 26 cfs for the period November 1, 2007, through March 31, 2008. The resulting flow releases for Rush Creek below Mono Ditch remained as baseflows throughout the year (Figure 4). The estimated unimpaired 'Rush Creek Runoff' had a daily average peak flow of 161 cfs on May 22, 2007 (Figure 4, Table 1), which is also the second lowest unimpaired peak discharge on record, higher than only RY 1977. Measured daily average streamflows for 'Rush Creek at Damsite' were also relatively low in RY 2007, peaking at 148 cfs on May 22, but were not in the range of the lowest flows on record (Figure 4, Table 1).

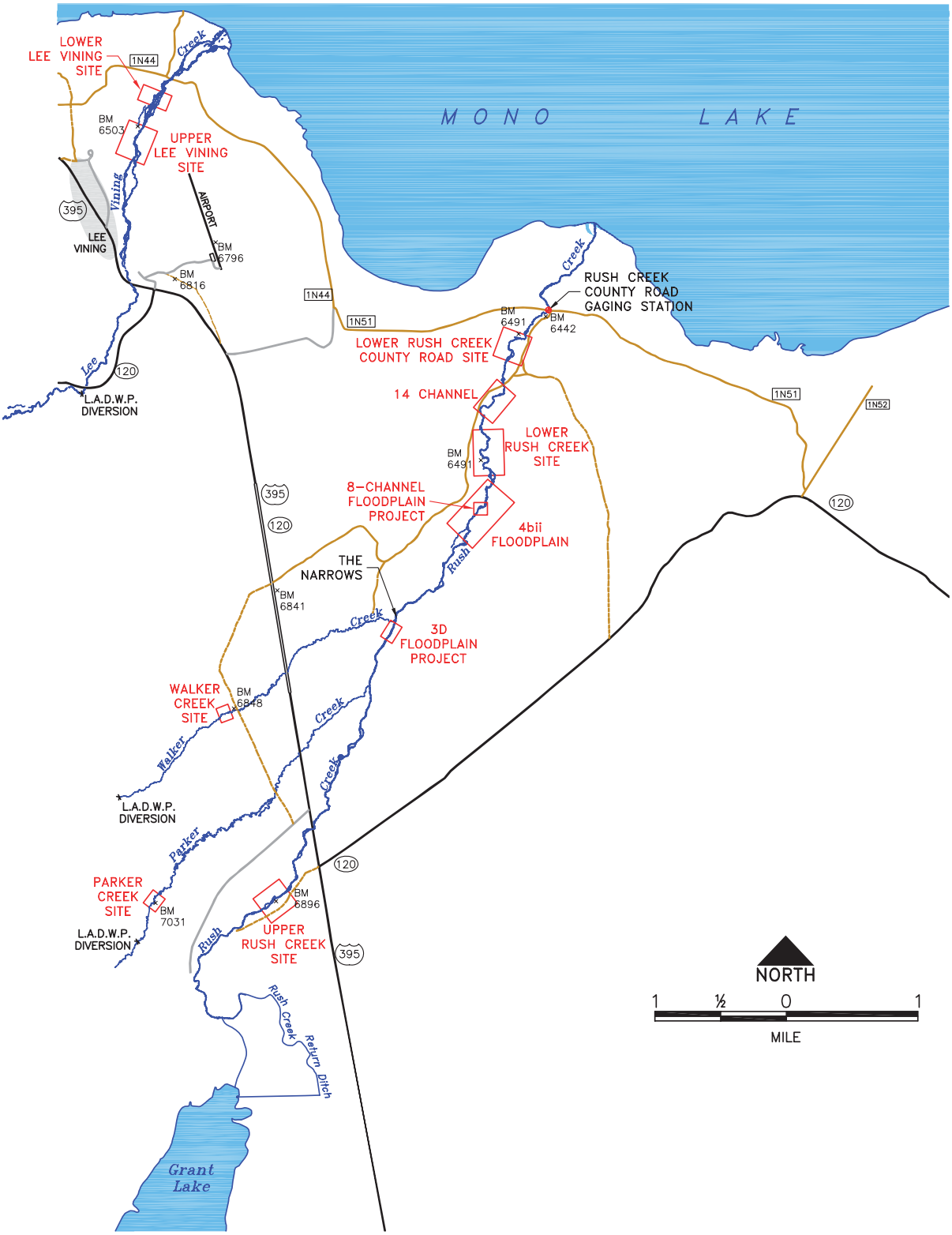

Figure 1. Location of Rush, Parker, Walker, and Lee Vining creek monitoring sites in the Mono Basin, CA.

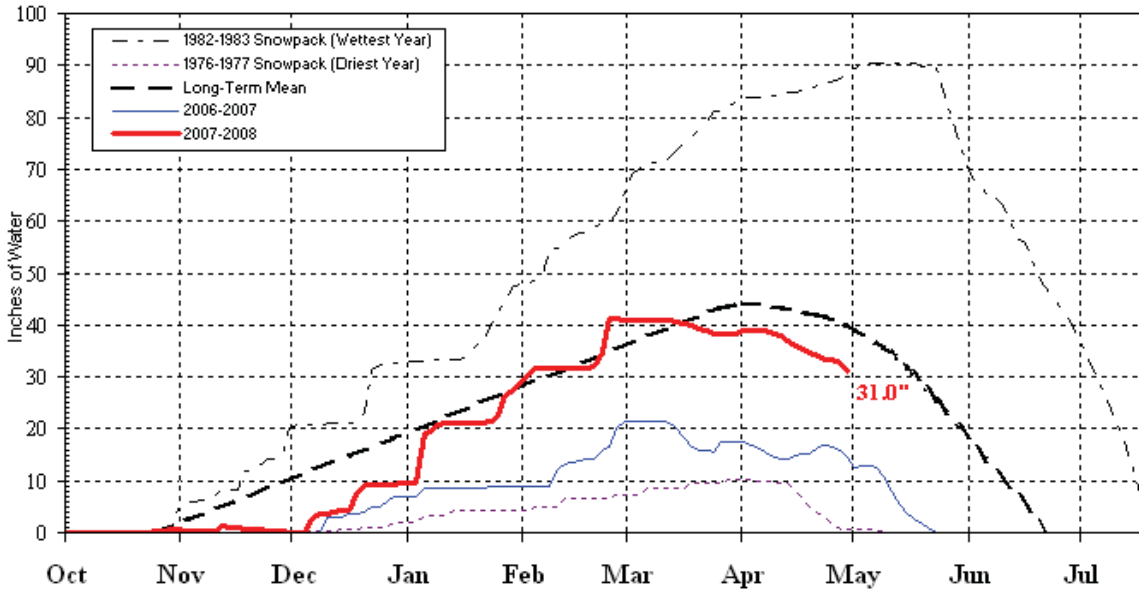

Figure 2. Precipitation conditions within the Eastern Sierra for Runoff Year 2007.

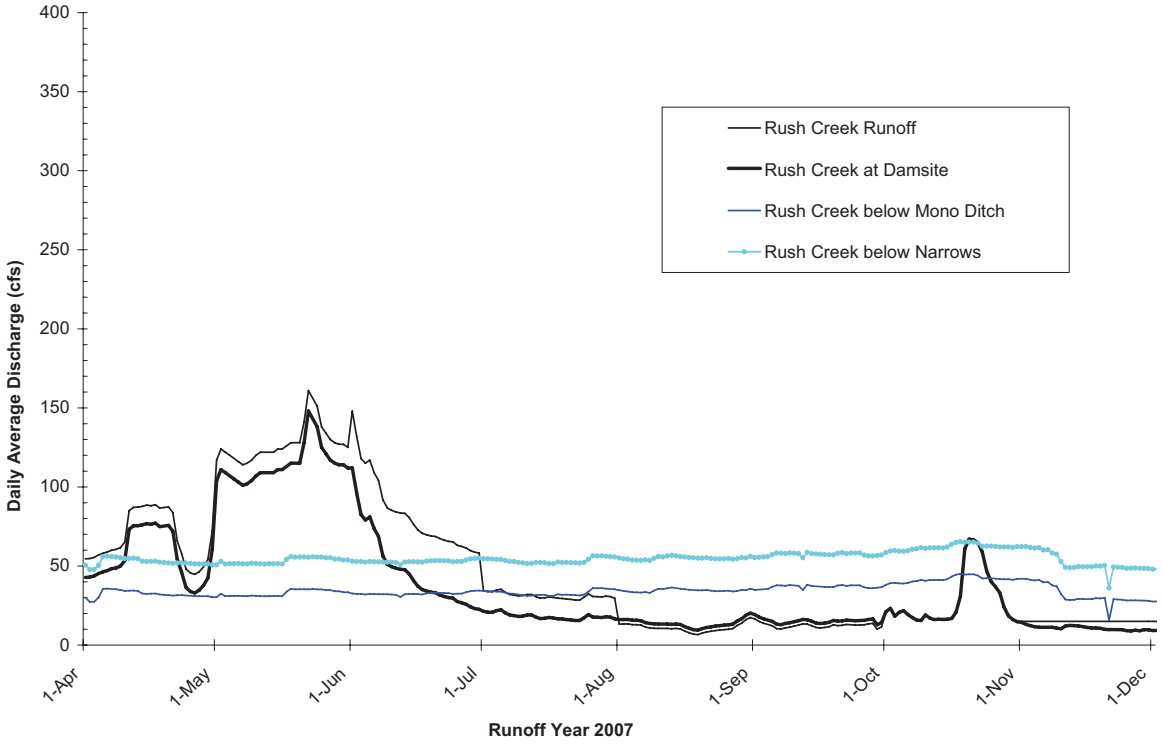

Figure 3. Rush Creek hydrographs for Runoff Year 2007.

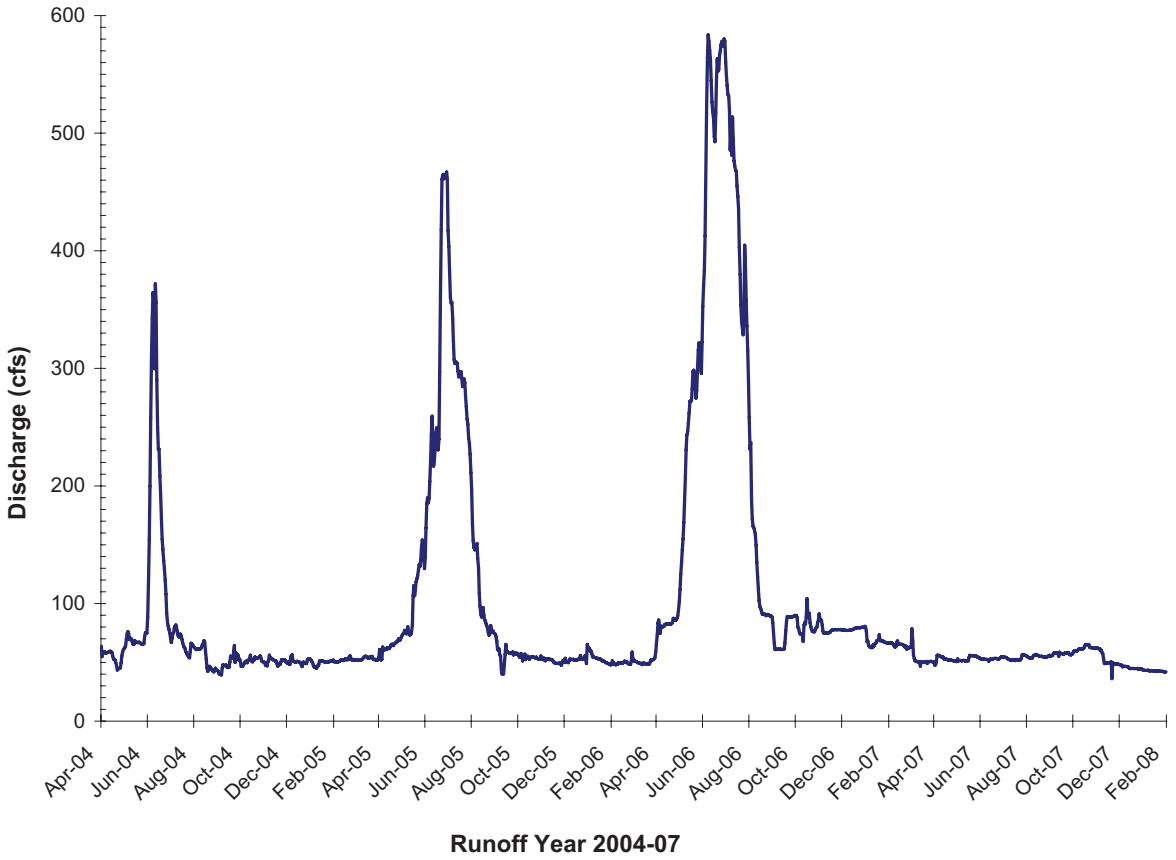

Figure 4. Annual hydrograph of daily average flows for Rush Creek below the Narrows for the past four runoff years, showing successively larger Stream Restoration Flow (SRF) releases from Runoff Years 2004-07, followed by Dry runoff conditions in which no SRF was released.

2.1.2 Lee Vining Creek

Lee Vining Creek also had an unusually dry runoff year. The peak discharge for 'Lee Vining Creek above Intake' for RY 2007 was 127 cfs on May 27, 2007. This was the lowest daily average peak discharge since a 95 cfs peak in RY 1990. In RY 2007 there were several small peaks in succession (87, 124, 127, 88, and 70 cfs; Figure 5, Table 1) through May and June, apparently fluctuating with periods of warming and cooling air temperatures. As with Rush Creek, there are no SRF requirements specified in the SWRCB Order 98-05 for Lee Vining Creek in a Dry Runoff Year, so 'Lee Vining above Intake' flows in excess of the 37 cfs baseflow requirement for April through September were captured and exported to Grant Reservoir. The diversion pattern thus mimicked 'above Intake' flows, and flows released below the Intake ('Lee Vining at Intake') were constant, flat-lined baseflows for the entire year. Flows "peaked" at 45 cfs on June 8, 2007, then declined to a minimum daily average flow of 9 cfs on December 27, 2007.

2.1.3 Parker and Walker creeks

During the RY 2007 Dry Runoff Year conditions, Parker and Walker creeks were operated without flow diversion, such that streamflows arriving at the Conduit structures were passed downstream. Both these tributaries to Rush Creek had the lowest daily average peak flows since 1990 when flow diversions ceased. Parker Creek peaked at 22 cfs on June 17, 2007 (Figure 6); Walker Creek peaked at 11 cfs on May 31, 2007 (Figure 7). Late-summer and fall baseflows dipped below 3 cfs on each creek for several months (September-October).

Table 1. Peak flow magnitudes and dates for gaged and computed locations along Rush, Parker, Walker, and Lee Vining creeks.

Station	RY 2001 (cfs)	Peak Date	RY 2002 (cfs)	Peak Date	RY 2003 (cfs)	Peak Date	RY 2004 (cfs)	Peak Date	RY 2005 (cfs)	Peak Date	RY 2006 (cfs)	Peak Date	RY 2007 (cfs)	Peak Date
Rush Creek Runoff [1]	491	26-May-01	243	31-May-02	460	19-Jun-03	228	5-May-04	541	16-Jun-05	630	7-Jun-06	161	22-May-07
Rush Creek at Damsite (5013)	231	26-May-01	102	01-Jun-02	311	19-Jun-03	118	9-Jul-04	441	16-Jun-05	483	7-Jun-06	148	22-May-07
Rush Creek below Return Ditch	162	11-Jun-01	168	8-Jun-02	203	7-Jun-03	343 (384)	11-Jun-04	403	29-Jun-05	477	7-10-June-06	no peak in RY 2007	
Rush Creek below Narrows (calculated) [2]	576	25-May-01	306	01-Jun-02	518	19-Jun-03	239	5-May-04	550	16-Jun-05	640	7-Jun-06	172	22-May-07
Rush Creek below Narrows (actual) [3]	202	11-Jun-01	225	8-Jun-02	283	3-Jun-03	354 (413)	11-Jun-04	467	29-Jun-05	584	8-Jun-06	no peak in RY 2007	
[Lower Rush Creek Main Planmap Reach]	128	11-Jun-01	144	8-Jun-02	181	3-Jun-03	241 (281)	11-Jun-04	174546	29-Jun-05	374	8-Jun-06		
[Lower Rush Creek 10-Channel]	76	11-Jun-01	81	8-Jun-02	102	3-Jun-03	113 (132)	11-Jun-04	98182	29-Jun-05	210	8-Jun-06		
Rush Creek at County Road Culvert (5186)			151	8-Jun-02					402	29-Jun-05				
Lee Vining Creek above Intake (5008)	201	17-May-01	238	30-May-02	332	30-May-03	152	5-May-04	374	28-May-05	444	7-Jun-06	127	27-May-07
Lee Vining Creek at Intake (5009)	201	17-May-01	236	31-May-02	317	31-May-03	141	15-Jun-04	372	28-May-05	457	7-Jun-06	45	8-Jun-07
[Upper Lee Vining Creek Mainstem]	140	17-May-01	164	31-May-02	231	31-May-03	103	5-May-04	289	28-May-05				
[Upper Lee Vining Creek A-4 Channel]	69	17-May-01	82	31-May-02	105	31-May-03	47	5-May-04	83	28-May-05				
[Upper Lee Vining Creek B-1 Channel]	89	17-May-01	105	31-May-02	139	31-May-03	62	5-May-04	100	28-May-05				
[Lower Lee Vining Creek Main Channel]	112	17-May-01	131	31-May-02	178	31-May-03	79	5-May-04	272	28-May-05				
[Lower Lee Vining Creek B-1 Channel]	89	17-May-01	105	31-May-02	139	31-May-03	62	5-May-04	100	28-May-05				
Parker Creek (5003)	56	26-May-01	37	1-Jun-02	49	31-May-03	33	7-Jun-04	74	13-Jul-05	64	29-Jun-06	22	16-Jun-07
Walker Creek (5002)	42	16-May-01	26	2-Jun-02	43	May 30-03	20	6-Jun-04	51	28-May-05	53	7-Jun-06	11	30-May-07

[1] Computed natural flows, assuming no flow regulation

[2] Computed by adding Rush Creek runoff + Parker Creek runoff + Walker Creek runoff

[3] Computed by adding Rush Creek below Return Ditch + Parker Creek + Walker Creek

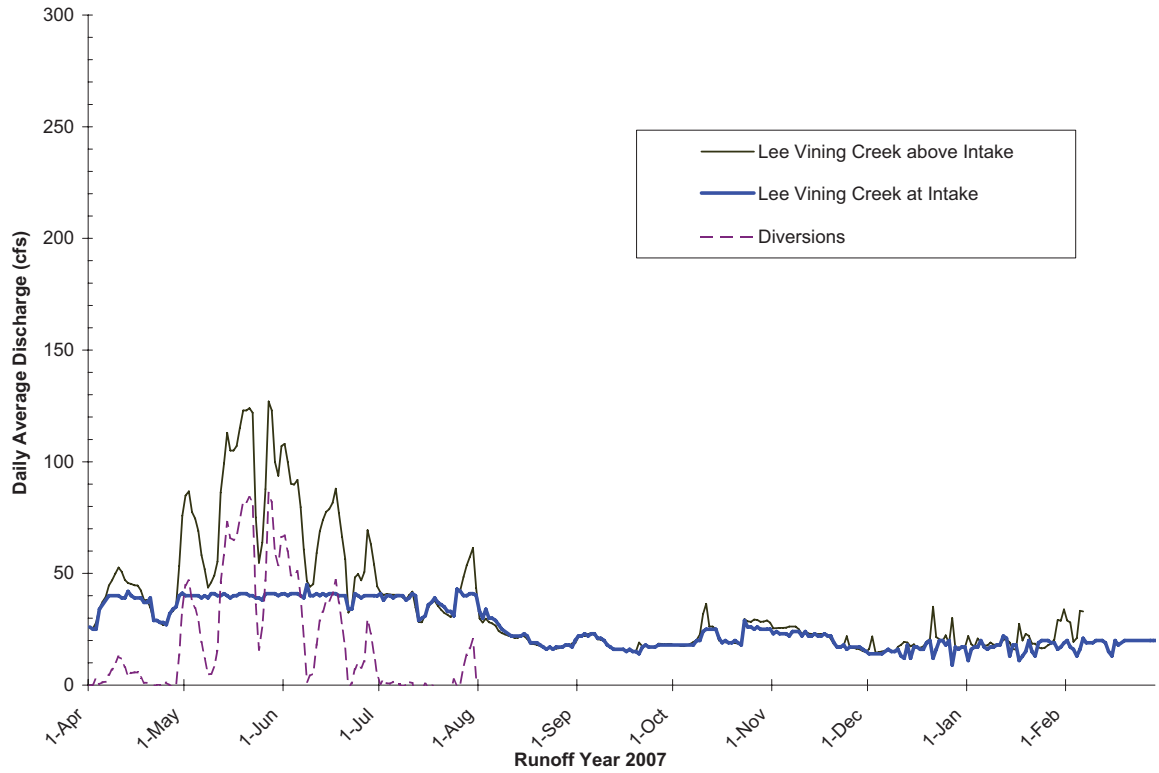

Figure 5. Lee Vining Creek hydrographs for Runoff Year 2007.

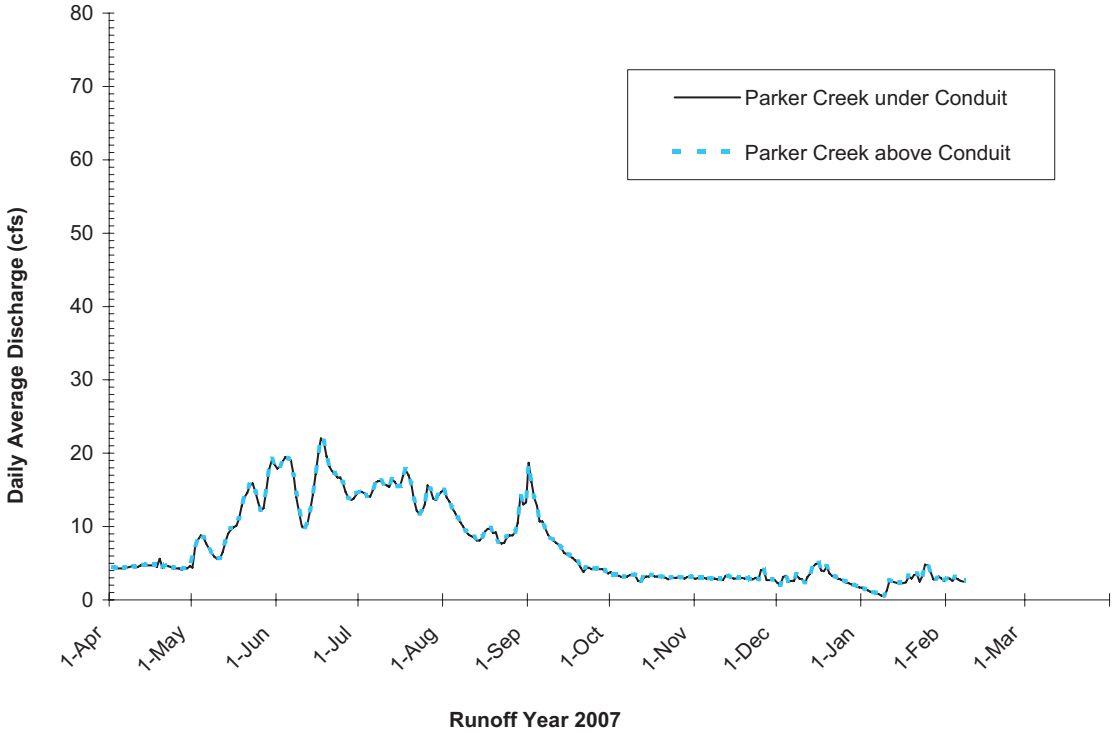

Figure 6. Parker Creek hydrograph for Runoff Year 2007.

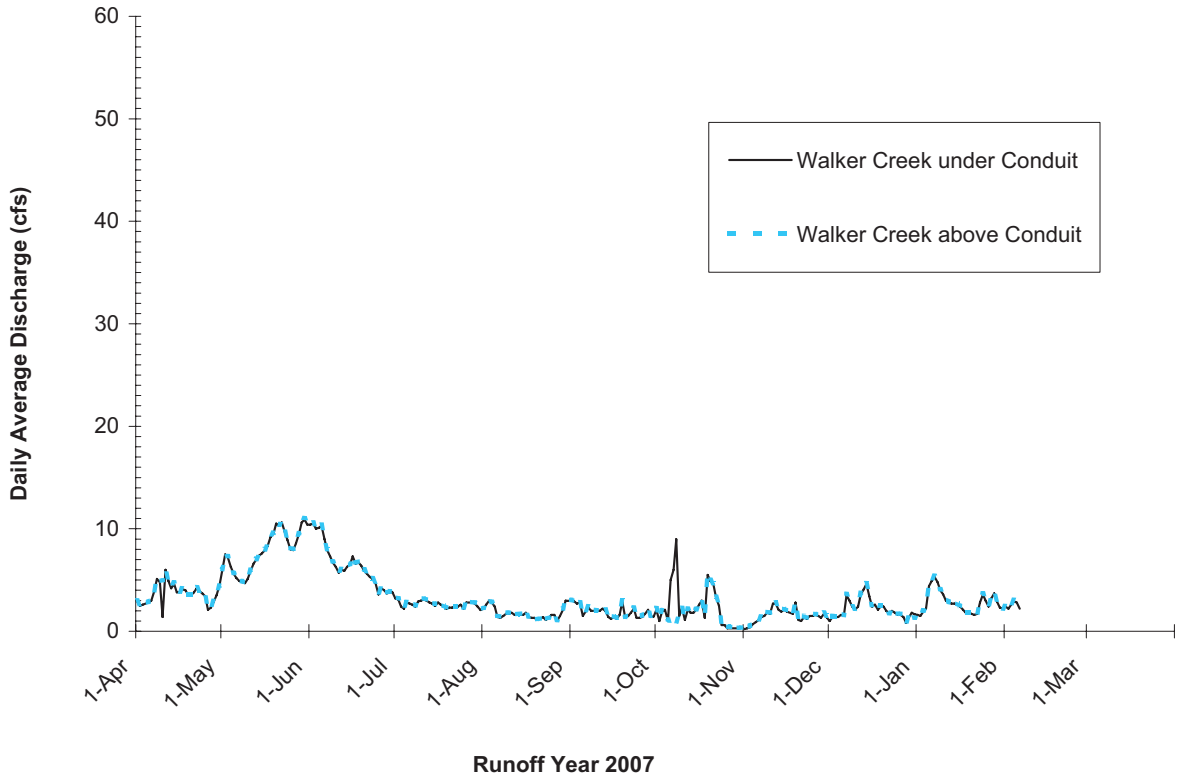

Figure 7. Walker Creek hydrograph for Runoff Year 2007.

2.2 Synoptic Streamflow Gaging

On March 20, 2008, a series of synoptic flow measurements was coordinated along Rush Creek to evaluate gains and losses of streamflow to groundwater during the atypically-low baseflow variance of 26 cfs flow releases. Presumably this discharge profile can be repeated at a similar flow during the summer/fall season when gains and losses may be different, and can be repeated during the same late-winter season when baseflows are typically higher (36-47 cfs). Casey Shannon (USFS) and Greg Reis (MLC) measured discharge at three locations in the lower Rush Creek bottomlands, while Darren Mierau (M&T) measured discharge at two locations in upper Rush Creek above the Narrows, and Parker and Walker creeks (Table 2). Measurements occurred between 9AM and 3PM and were not coordinated to assess the potential for diurnal fluctuations in flow; i.e., for the following discussion purposes, flows are assumed constant during daylight hours.

The discharge profile along the Rush Creek main channel indicated that flow losses *to* groundwater exceed flow gains *from* groundwater (if there are any), and thus the net flow accretion was negative. As indicated by our flow measurements, approximately 2.0 cfs (7.5%) was lost between the downstream end of the MGORD and Parker Creek, a distance of approximately 4 miles. Then, an additional 9.2 cfs were gained from Parker and Walker creeks, bringing the total Rush Creek discharge to 33.4 cfs entering the bottomlands. Finally, between the Narrows and the Rush Creek County Road crossing, approximately 6.1 cfs (18%) was lost to groundwater, reducing the main channel flow to 27.3 cfs at the County Road crossing.

The Casey-Reis team also measured discharge in the Rush Creek 10-Channel. During past monitoring years, flows have been routinely measured in the 10-Channel and either the mainstem channel within the split channel reach or below the 10 Falls, as a way to track the relative proportion of flow in each split channel over time. Flow proportions reported in past reports have generally varied with the 10-

Channel flow, ranging between approximately 20% to 30% of the total lower Rush Creek discharge. The 10-Channel has tended to convey a higher flow proportion at higher overall Rush Creek flows (i.e., during SRF releases). A trend toward capturing an increasing proportion of the total flow has also been observed. On March 20, 2007, the discharge measured in the 10-Channel (17.2 cfs) represented 63% of the lower Rush Creek flow, the highest proportion observed passing down the 10-Channel. Previous Annual Reports have also raised the prospect of the 10-Channel capturing a higher proportion or all of the lower Rush Creek flow, based on observations of the channel configuration at the 10-Channel and "main channel" divergence. Flow proportions into these two channels will continue to be observed during the 2008-09 field season.

Table 2. Discharge measurements on March 20, 2007, along Rush Creek to observe streamflow gains and losses prior to the snowmelt runoff and during the 26 cfs variance baseflow.

Measurement Location	Hydrographer(s)	Measured Flow (cfs)	Measurement Rating	Notes
Rush Creek Return Ditch	DM	26.2	Good (5%)	Excellent site at lower end of Ditch
Parker Creek	DM	3.0	Good (5%)	good site just downstream of Hwy 101, under powerlines
Walker Creek	DM	6.2	Good (5%)	good site just above confluence with Rush
Rush Creek above Parker confluence	DM	24.2	Fair (8%)	difficult measurement site with high roughness, turbulence, and eddies
Rush Creek 10-Channel	CS/GR	17.2	Good (5%)	good site just downstream of entrance
Rush Creek below 10-Channel Return	CS/GR	27.3	Good (5%)	good site where gage previously was and housing still exists
Rush Creek at County Road	CS/GR	27.3	Good (5%)	good site below County Rd adjacent to steep (river-runner's) right bank

2.3 Water Temperature Monitoring

2.3.1 Status of Water Temperature Monitoring

Water temperature monitoring has been ongoing in the four Mono Lake tributaries since October 1999, thus providing a database of eight water years of temperature data at ten locations along the streams. Summary data, presented in previous reports (e.g., McBain and Trush 2007, Tables 4a-d), were updated for this Annual Report (Tables 3a-d). We are currently using two different temperature dataloggers, the old Onset Corp. "Optic Stowaway" model and the new "Optic Pro V2" model. As of March 2008, all but two Stowaways have been upgraded to the Pro V2 model, and the remaining two will be replaced in June 2008. Thermograph locations are shown in Figure 8. Water temperature data were recorded hourly at each site. Data have been compiled in a MS Excel database by McBain & Trush and in an MS Access database by Brad Shepard. We are currently developing a common database.

Tables 3a. Temperature summaries for Rush Creek.

	WY2000	WY2001	WY2002	WY2003	WY2004	WY2005	2006	WY2007
Rush Creek at Return Ditch								
DAILY AVERAGE (°F)	49	49	51	47	43	45	46	50
ANNUAL MAX (°F)	67	69	71	69	64	65	65	78
ANNUAL MIN (°F)	34	34	32	32	32	32	32	33
MAX DAILY FLUX (°F)	9	10	9	6	9	9	11	18
WINTER MAX (°F)	43	42	43	43	44	40	42	51
WINTER MIN (°F)	34	34	32	32	32	32	32	33
WINTER AVERAGE (°F)	37	37	37	37	37	34	37	38
MAX WINTER FLUX (°F)	5	5	5	5	5	5	7	12
SUMMER MAX (°F)	67	69	71	69	NA	65	65	78
SUMMER MIN (°F)	55	53	57	60	NA	53	50	55
SUMMER AVERAGE (°F)	60	62	64	64	NA	57	55	64
MAX SUMMER FLUX (°F)	9	10	8	6	NA	9	8	18
DATE OF ANNUAL MAX	8/27/00 5:00 PM	8/19/01 7:00 PM	7/30/02 3:00 PM	8/20/03 2:30 PM	10/1/03 2:30 PM	9/10/05 3:52 PM	9/12/06 1:20 AM	8/3/07 12:44 PM
Start Date	10-Oct-99	1-Oct-00	1-Oct-01	1-Oct-02	1-Oct-03	1-Dec-04	1-Oct-05	1-Oct-06
End Date	30-Sep-00	30-Sep-01	30-Sep-02	30-Sep-03	6-May-04	30-Sep-05	30-Sep-06	30-Sep-07
Number of Days Sampled	357	365	365	365	218	303	365	365
Rush Creek at Old Highway 395								
DAILY AVERAGE (°F)						NA	47	49
ANNUAL MAX (°F)						66	67	72
ANNUAL MIN (°F)						NA	32	32
MAX DAILY FLUX (°F)						NA	11	15
WINTER MAX (°F)						NA	45	51
WINTER MIN (°F)						NA	32	32
WINTER AVERAGE (°F)						NA	34	37
MAX WINTER FLUX (°F)						NA	11	13
SUMMER MAX (°F)						66	67	72
SUMMER MIN (°F)						53	53	53
SUMMER AVERAGE (°F)						57	57	63
MAX SUMMER FLUX (°F)						12	11	15
DATE OF ANNUAL MAX						NA	9/12/06 1:38 AM	8/8/07 3:19 PM
Start Date						1-Jun-05	1-Oct-05	1-Oct-06
End Date						30-Sep-05	30-Sep-06	30-Sep-07
Number of Days Sampled						122	365	365
Rush Creek at the Narrows								
DAILY AVERAGE (°F)	48	48	42	45	48		46	49
ANNUAL MAX (°F)	71	73	67	67	72		67	73
ANNUAL MIN (°F)	32	32	32	32	31		32	32
MAX DAILY FLUX (°F)	20	20	18	21	16		14	20
WINTER MAX (°F)	52	50	50	51	49		56	54
WINTER MIN (°F)	32	32	32	32	31		32	32
WINTER AVERAGE (°F)	37	36	36	37	35		34	37
MAX WINTER FLUX (°F)	16	15	15	14	16		14	17
SUMMER MAX (°F)	71	73	67	67	61		67	73
SUMMER MIN (°F)	50	52	53	52	43		48	51
SUMMER AVERAGE (°F)	59	61	58	58	58		57	62
MAX SUMMER FLUX (°F)	17	16	14	14	14		14	18
DATE OF ANNUAL MAX	8/27/00 5:00 PM	8/19/01 6:00 PM	9/21/02 4:00 PM	5/27/03 4:01 PM	7/23/04 5:01 AM		5-Sep-06	7/22/07 3:52 PM
Start Date	10-Oct-99	1-Oct-00	1-Oct-01	1-Oct-02	1-Oct-03		21-Nov-05	10/1/06 12:29 AM
End Date	30-Sep-00	30-Sep-01	30-Sep-02	30-Sep-03	30-Sep-04		38991	30-Sep-07
Number of Days Sampled	357	365	365	365	366		313	365
Lower Rush Creek at the Meadows								
DAILY AVERAGE (°F)					not available	52		
ANNUAL MAX (°F)					74	68		
ANNUAL MIN (°F)					not available	32		
MAX DAILY FLUX (°F)					not available	18		
WINTER MAX (°F)					not available	NA		
WINTER MIN (°F)					not available	NA		
WINTER AVERAGE (°F)					not available	NA		
MAX WINTER FLUX (°F)					not available	NA		
SUMMER MAX (°F)					74	67		
SUMMER MIN (°F)					47	52		
SUMMER AVERAGE (°F)					61	58		
MAX SUMMER FLUX (°F)					18	13		
DATE OF ANNUAL MAX					not available	8/28/05 3:27 PM		
Start Date					7-Jun-04	10/1/2004 to 11/30/2004		
End Date					30-Sep-04	4/17/2005 to 9/30/2005		
Number of Days Sampled					116	226		
Rush Creek at County Road Culvert								
DAILY AVERAGE (°F)	48	48	49	45	49	NA	NA	49
ANNUAL MAX (°F)	72	71	75	74	75	NA	70	75
ANNUAL MIN (°F)	32	32	32	32	32	33	NA	32
MAX DAILY FLUX (°F)	22	18	21	18	24	NA	16	22
WINTER MAX (°F)	53	47	48	45	56	52	NA	55
WINTER MIN (°F)	32	32	32	32	32	34	NA	32
WINTER AVERAGE (°F)	37	36	36	37	36	36	NA	37
MAX WINTER FLUX (°F)	19	9	12	8	20	17	NA	17
SUMMER MAX (°F)	72	71	75	NA	75	NA	70	75
SUMMER MIN (°F)	48	52	51	NA	47	NA	48	48
SUMMER AVERAGE (°F)	60	61	62	NA	61	NA	61	62
MAX SUMMER FLUX (°F)	18	17	16	NA	18	NA	11	20
DATE OF ANNUAL MAX	8/27/00 8:00 PM	7/1/01 8:00 PM	7/25/02 5:00 PM	8/16/03 3:00 PM	7/22/04 3:01 PM	NA	NA	7/22/07 5:51 PM
Start Date	10-Oct-99	1-Oct-00	1-Oct-01	10/1/2003 to 3/21/2003	10/1/2003 to 3/21/2003	1-Oct-04	31-May-06	1-Oct-06
End Date	30-Sep-00	30-Sep-01	30-Sep-02	8/11/2003 to 9/30/2004	8/11/2003 to 9/30/2004	30-Jun-05	30-Sep-06	30-Sep-07
Number of Days Sampled	357	365	365	221	366	273	122	365

In March 2008, eight of the ten temperature dataloggers were downloaded in the field and the data were compiled into the existing database. Two loggers were deeply buried under snow and could not be retrieved. All temperature data were plotted as temperature graphs (Appendix A).

2.3.2 RY 2006-2007 Comparisons

Runoff Years 2006 and 2007 provided a good contrast of water temperature conditions in Rush Creek. RY 2006 was a Wet year. Rush Creek was supplied by a full Grant Reservoir and had high, sustained baseflows and SRF releases throughout the entire runoff year. Baseflow releases only dropped below 68 cfs (at the Return Ditch) for a two-week period in September when the fisheries crew was electrofishing. Stream Restoration Flows peaked at 477 cfs at the Return Ditch. In contrast, RY 2007 was a Dry year. Grant Reservoir was consequently drawn down, baseflow releases (at the Return Ditch) remained below 40 cfs from April through September, and hovered at approximately 31-35 cfs for most of the spring and summer months. There was no SRF release in RY 2007.

Tables 3b. Temperature summaries for Lee Vining Creek.

	WY2000	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007
Lee Vining below Parshall Flume								
DAILY AVERAGE (°F)						44	40	50.1
ANNUAL MAX (°F)						53	49	64.7
ANNUAL MIN (°F)						33	31	34.1
MAX DAILY FLUX (°F)						12	13	14.8
WINTER MAX (°F)						not available	47	NA
WINTER MIN (°F)						not available	31	NA
WINTER AVERAGE (°F)						not available	36	NA
MAX WINTER FLUX (°F)						not available	13	NA
SUMMER MAX (°F)						51	49	64.7
SUMMER MIN (°F)						43	47	42.0
SUMMER AVERAGE (°F)						47	48	53.1
MAX SUMMER FLUX (°F)						4	0	14.5
DATE OF ANNUAL MAX						not available	9/20/06 1:00 PM	7/30/07 3:11 PM
Start Date						17-Apr-05	21-Nov-05	04/24/07
End Date						15-Aug-05	30-Sep-06	9/30/2007
Number of Days Sampled						120	313	159
Lower Lee Vining at B1 Channel								
DAILY AVERAGE (°F)	43	44	44	42	46	45		
ANNUAL MAX (°F)	65	65	65	69	69	64		
ANNUAL MIN (°F)	32	32	30	31	32	32		
MAX DAILY FLUX (°F)	14	15	15	11	18	14		
WINTER MAX (°F)	47	48	46	47	47	not available		
WINTER MIN (°F)	32	32	30	31	32	not available		
WINTER AVERAGE (°F)	35	34	34	35	37	not available		
MAX WINTER FLUX (°F)	12	11	12	11	12	not available		
SUMMER MAX (°F)	65	65	65	not available	69	59		
SUMMER MIN (°F)	43	46	41	not available	43	51		
SUMMER AVERAGE (°F)	54	56	55	not available	54	55		
MAX SUMMER FLUX (°F)	15	15	13	not available	18	8		
DATE OF ANNUAL MAX	7/30/00 3:00 PM	8/7/01 2:00 PM	8/16/02 3:00 PM	8/20/03 2:30 PM	8/10/04 2:00 PM	8/9/05 6:00 PM		
Start Date	10-Oct-99	1-Oct-00	1-Oct-01	10/1/2002 to 3/21/2003	1-Oct-03	10/1/2004 to 11/27/2004		
End Date	30-Sep-00	30-Sep-01	30-Sep-02	8/12/2003 to 9/30/2003	29-Sep-04	4/18/2005 to 8/16/2005		
Number of Days Sampled	357	365	365	220	366	223		
Lower Lee Vining at County Road								
DAILY AVERAGE (°F)					not available	not available	not available	44
ANNUAL MAX (°F)					66	not available	60.4	67
ANNUAL MIN (°F)					not available	0	not available	32
MAX DAILY FLUX (°F)					not available	not available	not available	14
WINTER MAX (°F)					not available	47	not available	47
WINTER MIN (°F)					not available	32	not available	32
WINTER AVERAGE (°F)					not available	35	not available	35
MAX WINTER FLUX (°F)					not available	12	not available	11
SUMMER MAX (°F)					66	not available	60.4	67
SUMMER MIN (°F)					37	not available	36.5	43
SUMMER AVERAGE (°F)					53	not available	50.9	56
MAX SUMMER FLUX (°F)					14	not available	10.9	14
DATE OF ANNUAL MAX					8/10/04 3:15 PM	not available	7/28/06 4:43 PM	7/30/07 3:46 PM
Start Date					6-May-04	1-Oct-04	16-Jul-06	1-Oct-06
End Date					30-Sep-04	17-Apr-05	18-Oct-06	30-Sep-07
Number of Days Sampled					147	198	94	365

Tables 3c. Temperature summaries for Parker Creek.

	WY2000	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007
Upper Parker Creek								
DAILY AVERAGE (°F)	43	43	NA	43	NA	41	42	44
ANNUAL MAX (°F)	62	64	NA	69	NA	57	58	64
ANNUAL MIN (°F)	26	32	32	32	29	32	32	32
MAX DAILY FLUX (°F)	18	18	14	13	14	12	13	12
WINTER MAX (°F)	48	39	43	43	46	40	39	46
WINTER MIN (°F)	39	32	32	32	31	36	32	32
WINTER AVERAGE (°F)	41	33	33	33	33	38	32	34
MAX WINTER FLUX (°F)	18	3	9	8	9	5	5	9
SUMMER MAX (°F)	59	63	NA	69	NA	57	58	64
SUMMER MIN (°F)	52	47	NA	45	NA	37	40	44
SUMMER AVERAGE (°F)	54	55	NA	55	NA	49	51	56
MAX SUMMER FLUX (°F)	18	10	NA	11	NA	12	9	11
DATE OF ANNUAL MAX	7/30/00 6:00 PM	6/5/01 6:00 PM	NA	8/14/03 12:01 PM	NA	8/12/05 6:00 PM	7/28/06 1:18 AM	7/16/07 4:06 PM
Start Date	7-Nov-99	1-Oct-00	1-Oct-01	1-Oct-02	1-Oct-03	1-Oct-04	1-Oct-05	1-Oct-06
End Date	30-Sep-00	30-Sep-01	2-May-02	30-Sep-03	6-May-04	16-Aug-05	30-Sep-06	30-Sep-07
Number of Days Sampled	329	365	214	365	218	320	365	365
Lower Parker Creek								
DAILY AVERAGE (°F)					NA	NA	43	
ANNUAL MAX (°F)					72	NA	62	
ANNUAL MIN (°F)					NA	NA	32	
MAX DAILY FLUX (°F)					16	NA	16	
WINTER MAX (°F)					NA	NA	42	
WINTER MIN (°F)					NA	NA	32	
WINTER AVERAGE (°F)					NA	NA	33	
MAX WINTER FLUX (°F)					NA	NA	10	
SUMMER MAX (°F)					72	NA	62	
SUMMER MIN (°F)					50	NA	39	
SUMMER AVERAGE (°F)					60	NA	53	
MAX SUMMER FLUX (°F)					14	NA	13	
DATE OF ANNUAL MAX					8/11/04 4:15 PM	NA	9/5/06 1:18 AM	
Start Date					6-May-04	NA	10/10/05 14:29	
End Date					30-Sep-04	NA	9/30/06 23:18	
Number of Days Sampled					148	NA	355	

Tables 3d. Temperature summaries for Walker Creek.

	WY2000	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007
Upper Walker Creek								
DAILY AVERAGE (°F)	46	45	NA	45	45	42	44	
ANNUAL MAX (°F)	69	70	NA	77	76	69	69	
ANNUAL MIN (°F)	29	32	32	32	29	31	32	
MAX DAILY FLUX (°F)	NA	23	16	32	34	16	9	
WINTER MAX (°F)	55	38	45	42	47	37	38	
WINTER MIN (°F)	41	32	32	32	32	34	32	
WINTER AVERAGE (°F)	43	33	33	33	33	35	33	
MAX WINTER FLUX (°F)	24	6	12	9	12	4	4	
SUMMER MAX (°F)	68	70	NA	71	76	69	69	
SUMMER MIN (°F)	58	46	NA	43	35	35	41	
SUMMER AVERAGE (°F)	61	59	NA	59	58	56	58	
MAX SUMMER FLUX (°F)	32	19	NA	16	34	11	9	
DATE OF ANNUAL MAX	7/30/00 3:00 PM	8/16/01 4:00 PM	NA	5/22/03 3:00 PM	9/14/04 3:15 PM	7/19/05 5:00 PM	7/28/06 5:03 PM	
Start Date	7-Nov-99	1-Oct-00	1-Oct-01	1-Oct-02	1-Oct-03	1-Oct-04	1-Oct-05	
End Date	30-Sep-00	30-Sep-01	4-Apr-02	30-Sep-03	30-Sep-04	16-Aug-05	30-Sep-06	
Number of Days Sampled	329	365	186	365	366	320	365	
Lower Walker Creek								
DAILY AVERAGE (°F)					NA	43	46	46
ANNUAL MAX (°F)					76	71	101	72
ANNUAL MIN (°F)					NA	27	33	32
MAX DAILY FLUX (°F)					NA	17	60	21
WINTER MAX (°F)					NA	46	44	53
WINTER MIN (°F)					NA	34	33	32
WINTER AVERAGE (°F)					NA	36	35	35
MAX WINTER FLUX (°F)					NA	13	11	17
SUMMER MAX (°F)					76	71	101	72
SUMMER MIN (°F)					35	34	37	42
SUMMER AVERAGE (°F)					58	57	59	58
MAX SUMMER FLUX (°F)					34	17	60	21
DATE OF ANNUAL MAX					9/14/04 3:15 PM	7/17/05 6:00 PM	9/13/06 1:40 AM	7/12/07 3:49 PM
Start Date					6-May-04	1-Oct-04	1-Oct-05	1-Oct-06
End Date					30-Sep-04	15-Aug-05	30-Sep-06	30-Sep-07
Number of Days Sampled					147	318	365	365

The primary purpose of monitoring water temperature is its importance to trout habitat. We compared RY 2006 and 2007 using several temperature criteria to evaluate the temperature regime fish experienced both years (Table 4). This evaluation was intended to reveal the effects of different flow releases from Grant Lake on seasonal (and particularly spring and summer) water temperatures in Rush Creek, which will be needed in the upcoming baseflow and fish habitat assessments for Rush Creek. We also plotted water temperatures at three locations on Rush Creek: the Return Ditch, Hwy 395, and the County Road (Figures 9 and 10) to evaluate warming trends along Rush Creek. Several key trends were:

- Higher flow releases from the Return Ditch in RY 2006 resulted in colder temperatures and smaller daily fluctuations throughout the entire spring and summer seasons downstream at least as far as the Narrows.
- At higher baseflow releases in RY 2006, water temperatures increased between the Return Ditch and Hwy 395 and between Hwy 395 and the County Road. Whereas in RY 2007, flow releases from the Return Ditch appeared to have been elevated by a low Grant Reservoir level with summer water temperatures cooling slightly between the Return Ditch and Hwy 395.
- In RY 2006, maximum daily temperatures at the Return Ditch rarely exceeded 60°F, and only approached 65°F at Hwy 395 for a brief period at the height of summer (early August to mid September). Daily maximum temperatures at the County Road exceeded 68°F only occasionally at the height of summer. In contrast, RY 2007 daily maximum water temperatures at the Return Ditch exceeded 68°F for several months between mid June and late August, and as mentioned, actually cooled somewhat downstream.

Additional temperature analyses will be conducted during the Baseflow Habitat Assessment, as needed for analyses outlined in the BHA Study Plan (described in Section 6).

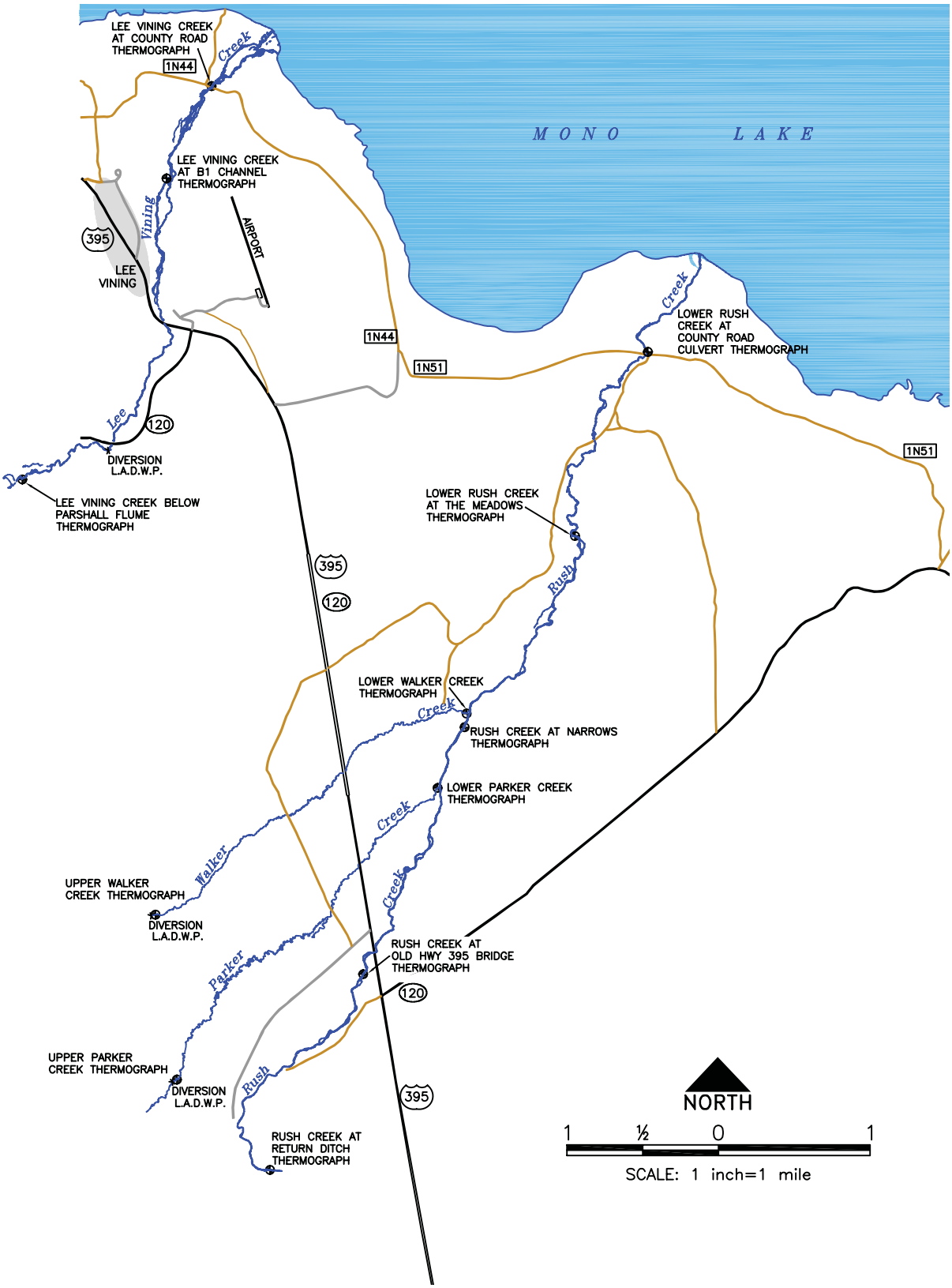

Figure 8. Location of water temperature dataloggers deployed in each of the four Mono Lake tributaries.

Table 4. Comparison of water temperature data for Rush Creek during RY 2006 (Wet runoff year) and RY 2007 (Dry runoff year). Optimal temperature requirements for good growth and survival of brown trout are 12 to 19 °C (53.4 to 66.2 °F).

Temperature Criterion (°F)	Rush Creek at Return Ditch		Rush Creek at Hwy 395		Rush Creek at the Narrows		Rush Creek at County Road	
	RY2006	RY2007	RY2006	RY2007	RY2006	RY2007	RY2006	RY2007
Daily Average	46.3	50.4	47.2	49.5	46.3	49.3	NA	49.1
MWAT	59.2	66.8	59.2	65	58.5	64.8	62.5	65.1
MWMT	62.8	76.5	64.7	71	65.1	71.2	69.4	72.6
IMT	65.4	78.1	66.7	72.2	67.2	73.2	70.1	74.9
Max dT	11.1	18.4	11.3	15.4	14.5	19.9	15.9	22

Daily Average is the arithmetic mean of all temperature recordings for the water year.
MWAT (Maximum Weekly Average Temperature) is the maximum seasonal or yearly value of the mathematical mean of multiple, equally spaced, daily temperatures over a running seven-day consecutive period (Brungs and Jones 1977, p.10).
MWMT (Maximum Weekly Maximum Temperature) (also known as the seven-day average of the daily maximum temperatures (7-DADM)) is the maximum seasonal or yearly value of the daily maximum temperatures over a running seven-day consecutive period.
IMT (Instantaneous Maximum Temperature) is the highest recorded temperature for the year.
Max dT (Maximum Daily Temperature Change) is the largest daily fluctuation (daily maximum temperature minus daily minimum temperature) for the year.

2.4 Groundwater Dynamics at the 8 Floodplain

2.4.1 Data review and analyses

For the past three runoff years, piezometer 8C-8 has been equipped with a pressure transducer and continuously recording datalogger to record seasonal and annual trends in groundwater elevation across the 8 Floodplain (Figure 11). In RY 2005 and 2006, the datalogger was deployed in the spring (May 28, 2005, and June 2, 2006) and removed before winter (October 11, 2005, and October 18, 2006) due to concerns over the effects of cold temperatures and snow on the monitoring equipment. In winter 2007-08, the datalogger remained deployed through the winter (April 27, 2007, to present), and data were downloaded on March 19, 2008.

During this three-year interval, Rush Creek has had Wet-Normal, Wet, and Dry runoff years, respectively. The 8 Channel has had variable flow conditions (intermittent and perennial) as a result primarily of mechanical manipulations at the 8-Channel entrance and along the 8-Channel. In 2005, the 8-Channel entrance was re-opened with mechanical equipment, and flow down the side channel began in June at a Rush Creek flow of approximately 250 cfs (described in RY 2005 Annual Report, Section 2.2, pg. 16). Streamflow and groundwater peaked nearly simultaneously in late June 2005, indicating that groundwater elevation responded to changes in flow into the 8-Channel. Groundwater then receded steeply to approximate pre-SFR levels as the 8-Channel dried up. As a measure of the potential effect of recession rate on riparian seedling survival, we estimated the number of days during the summer growing season (June-September) in which groundwater drawdown exceeded 2.5 cm/d. During the RY 2005 SRF recession, the 2.5 cm/d threshold was exceeded 13 days between July 9 and August 3, 2005.

In RY 2006, the datalogger was deployed June 2, 2006, when the 8-Channel was already flowing, and groundwater was near RY 2005 elevations as Wet Year snowmelt flows were ramping up rapidly. Streamflow and groundwater again peaked nearly simultaneously in late June and early July, followed by another steep groundwater recession. The 2.5 cm/d riparian recession threshold was exceeded 14 days between July 4 and August 8, 2006, with some days receding more than 6 cm/d. Because the datalogger was not deployed through the winter of 2006-07, we are unable to ascertain the minimum groundwater elevation, but speculate groundwater equilibrated above the 6,501.5 ft level, as it had begun to do as discharge stabilized at baseflow levels in late October. An alternative scenario is that groundwater elevation slowly receded to approximately RY 2005 elevations (~6,500.5 ft) through the late fall and winter.

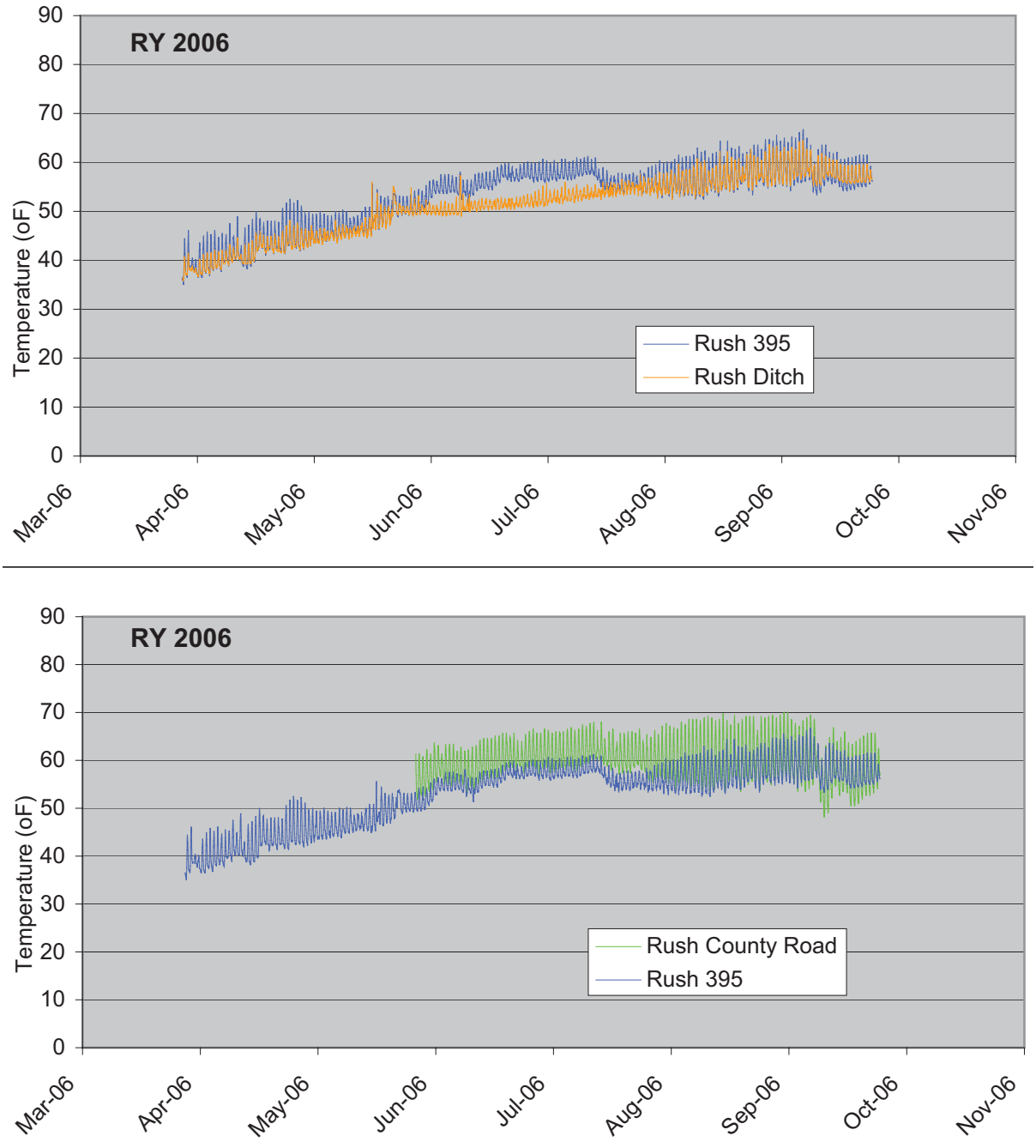

Figure 9. Water temperatures for three locations along Rush Creek for Runoff Year 2006 (Wet year). Temperatures were recorded every 15 minutes at each site along Rush Creek.

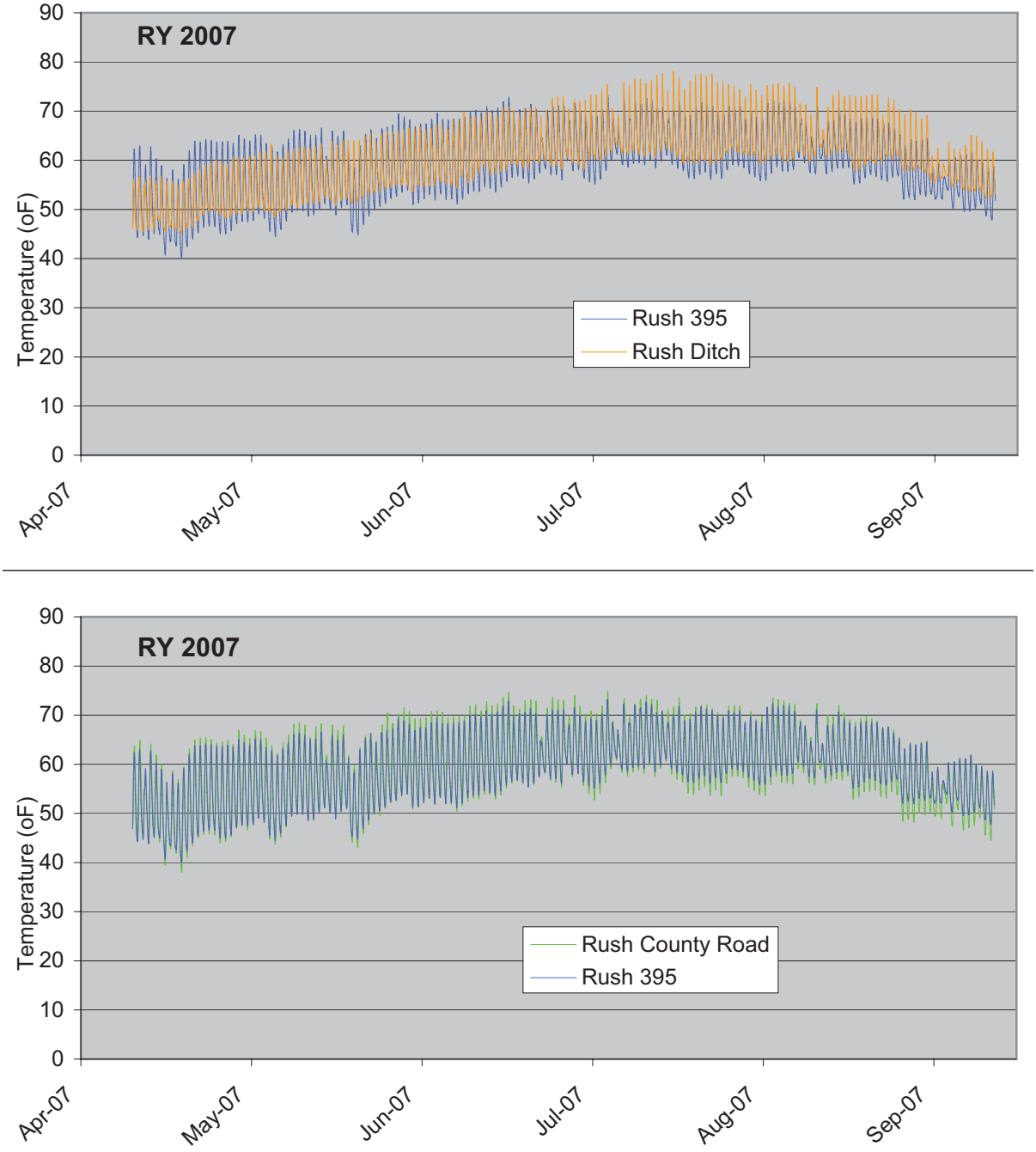

Figure 10. Water temperatures for three locations along Rush Creek for Runoff Year 2007 (Dry year). Temperatures were recorded every 15 minutes at each site along Rush Creek.

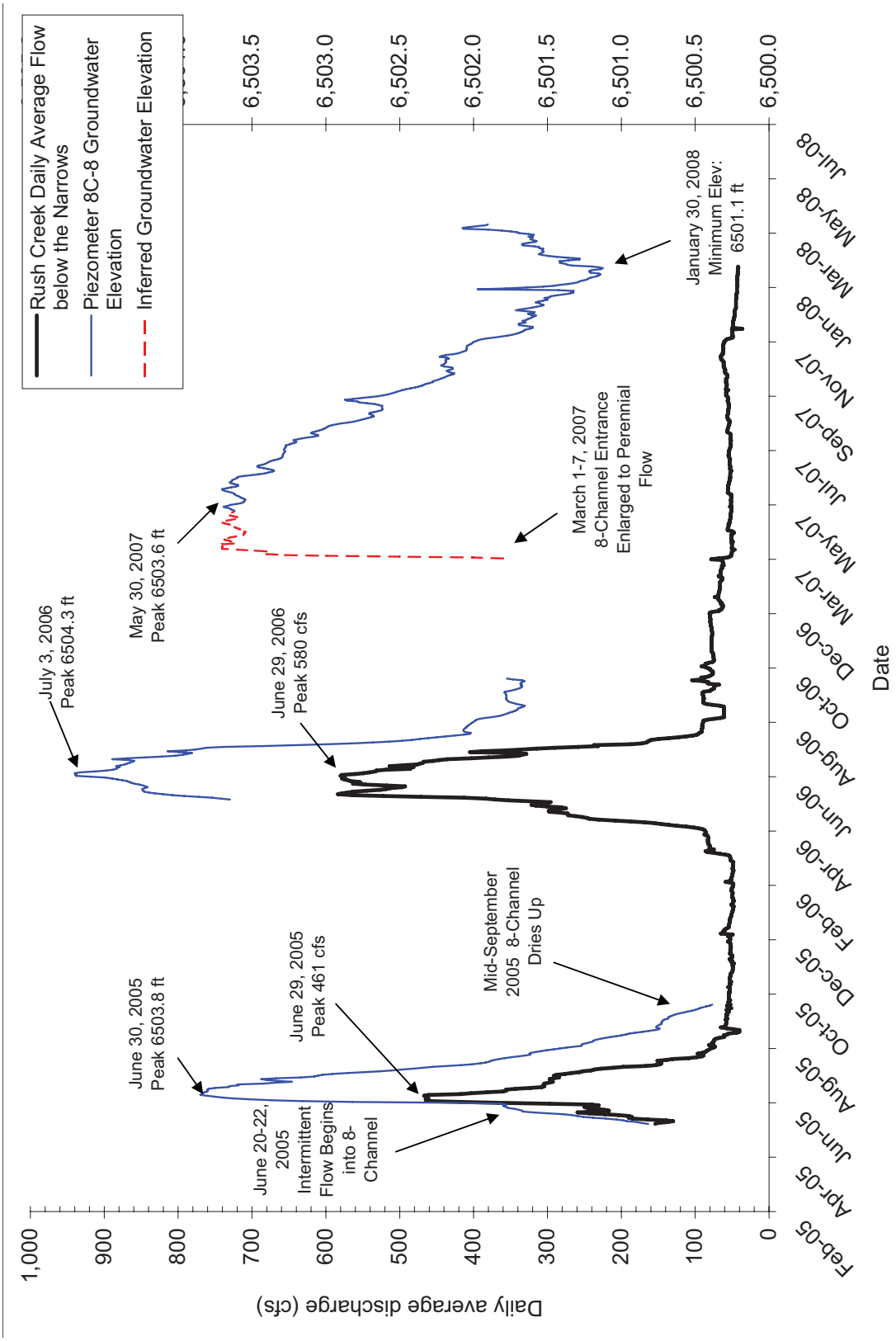

Figure 11. Plot of daily average flow for Rush Creek below the Narrows, and groundwater elevation recorded in the 8-Channel #8 piezometer (located below the 8 Floodplain near the lone Jeffrey Pine).

In March 2007, a crew from LADWP Northern District Construction and Watershed Resources spent two days expanding the entrance of the 8 Channel. The 8-Channel entrance was perched above the surface of the water flowing in the main channel of Rush Creek. To open the 8-Channel to allow flow at baseflow conditions, the entrance was improved by lowering the bed elevation. In addition, to ensure that the 8-Channel would persist, the bottom width of the entrance was widened from approximately two feet to approximately four feet, with the side slopes pulled back so that the bank material would not slide into the entrance. The datalogger was deployed April 27, 2007, and appeared to capture the peak groundwater elevation on May 30, 2007. This groundwater peak occurred one month earlier than the RY 2005 and 2006 peaks, and significantly, in the absence of Rush Creek SRF releases. Groundwater elevation eventually reached within 0.2 ft of the highest 2005 groundwater elevation when the Rush Creek SRF releases peaked at 461 cfs below the Narrows. However, despite a constant flow of approximately 8-10 cfs into the 8-Channel, groundwater elevation declined beginning in early June, 2007, and fell to base elevations that approximated those seen in previous years. But, despite the absence of SRF flows in RY 2007, and possibly because of perennial flow, the groundwater recession in the 8C-8 piezometer in RY 2007 was the most gradual recession observed during the three years of monitoring (Figure 11). The 2.5 cm/d threshold was not exceeded during the RY 2007 summer recession.

Our three years of groundwater monitoring data at piezometer 8C-8 suggested several interesting features of groundwater dynamics, including:

- Groundwater fluctuations in relatively remote floodplain locations, like at the 8C-8 piezometer at the back-side of the 8 Floodplain (more than 500 ft from the main channel), are temporally highly responsive to ephemeral and perennial flow in nearby side channels.
- Seasonal side channel flows that persist during and perhaps shortly after the Rush Creek SRF releases typically sustain groundwater elevations adequate to promote germination of woody riparian vegetation; however, continued survival of a given year's germinated riparian cohort may depend on soil moisture persistent beyond the groundwater recession.
- SRF peaks in the main channel appear to be capable of achieving higher groundwater elevations than flow distributed in side channels, as evidenced by the observation that despite the expanded 8-Channel capacity and perennial flow in RY 2007, groundwater elevation peaked higher RY 2006 when a large magnitude SRF peak occurred.
- The gradual groundwater recession in RY 2007 that occurred despite the perennial 8-Channel flow indicates that while perennial side channel flow may have less effect on the ultimate groundwater peak than the main channel streamflows, perennial side channel flow may contribute to a reduced groundwater recession rate, which would also result in longer-duration persistence of soil moisture potentially available to riparian vegetation.

3 GEOMORPHOLOGY

No channel monitoring was performed in RY 2007.

4 GEOMORPHIC AND RIPARIAN TERMINATION CRITERIA

There were no additional activities related to Termination Criteria in RY 2007.

5 SIDE CHANNEL AND CONSTRUCTION SITE MONITORING

In March 2007 a crew from LADWP Northern District Construction and Watershed Resources spent two days enhancing the entrance of the 8 Channel. The entrance to the 4bii was also enhanced by a crew utilizing hand tools to deepen the entrance to the channel and remove obstructions from the channel.

No additional monitoring was conducted at the side channel sites during RY 2007.

6 2008 MONITORING SEASON

The past several years emphasized field studies evaluating SRF flow releases and snowmelt runoff in Rush and Lee Vining creeks, followed by a Dry year in which no SRF releases occurred. Runoff Year 2008 is on track to be a Normal Runoff Year with a 380 cfs peak release from Grant Reservoir. Unimpaired peak flows are also anticipated for Lee Vining Creek below the LADWP intake structure. Several field activities are planned for RYR 2008, including:

- maintain the piezometer datalogger at the Rush Creek 8 Channel Piezometer 8C-8 with the LADWP Stevens datalogger with stage-height readings at 15-minute intervals; download data bi-annually; collect additional synoptic groundwater elevation readings opportunistically at the 3D and 8 Floodplains;
- maintain stream temperature recorders at ten locations on Rush, Lee Vining, Parker, and Walker creeks (locations described in McBain & Trush, 2005); record data hourly and download data bi-annually;
- depending on the Baseflow Habitat Assessment Study Plan, obtain new aerial photographs of selected reaches of Rush and Lee Vining creeks to be used for habitat mapping, preferably during May before riparian vegetation is fully developed;
- review LADWP's proposed plans for sediment bypass mechanisms on Parker and Walker Creeks, and provide comments and guidance as needed;
- possibly assist with scheduling, then attend a meeting in the basin in Fall 2008 with SCE to discuss opportunities and constraints regarding Rush Creek Operations.

7 LITERATURE CITED

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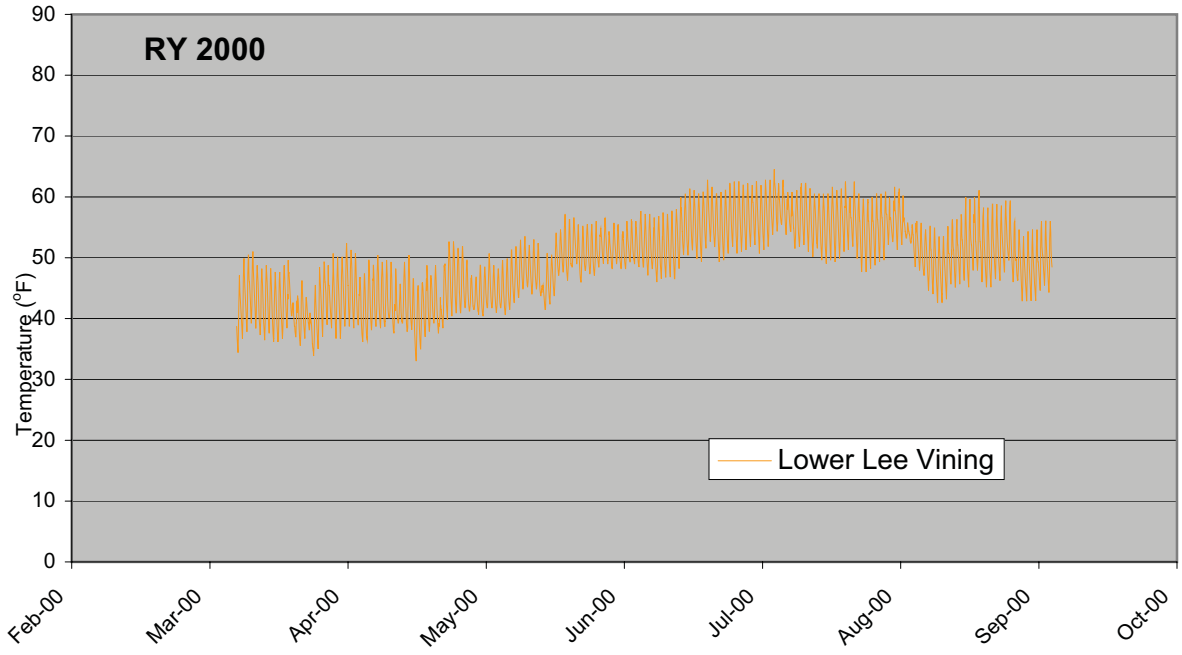
McBain & Trush Inc. 2005. Runoff year 2004 annual report.

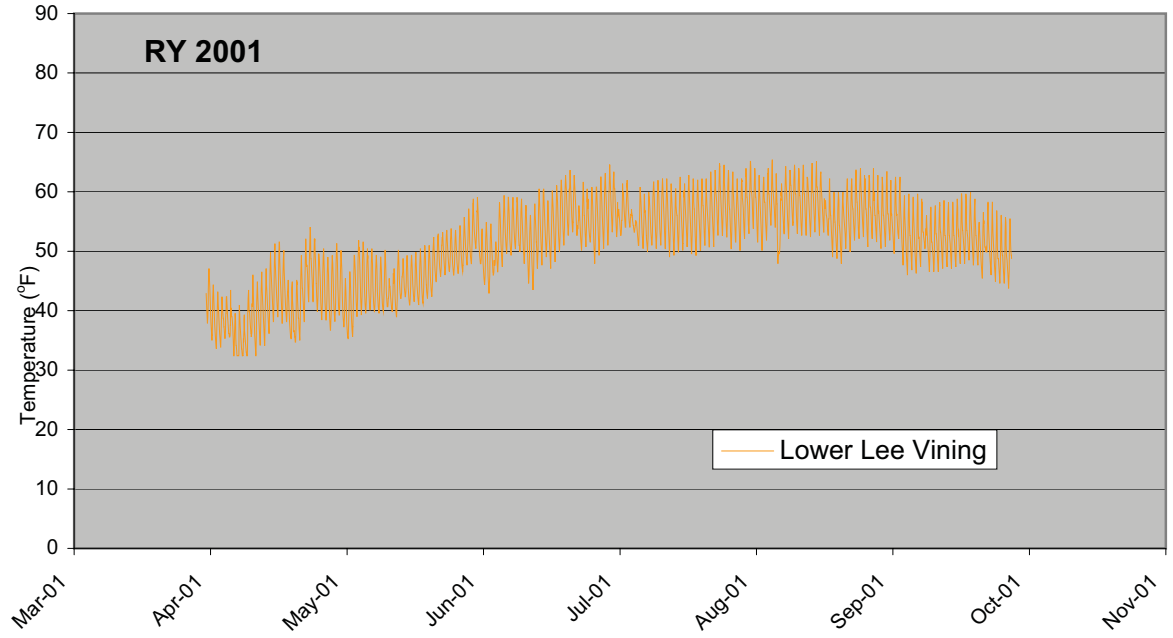
McBain & Trush Inc. 2004. Runoff year 2003 annual report.

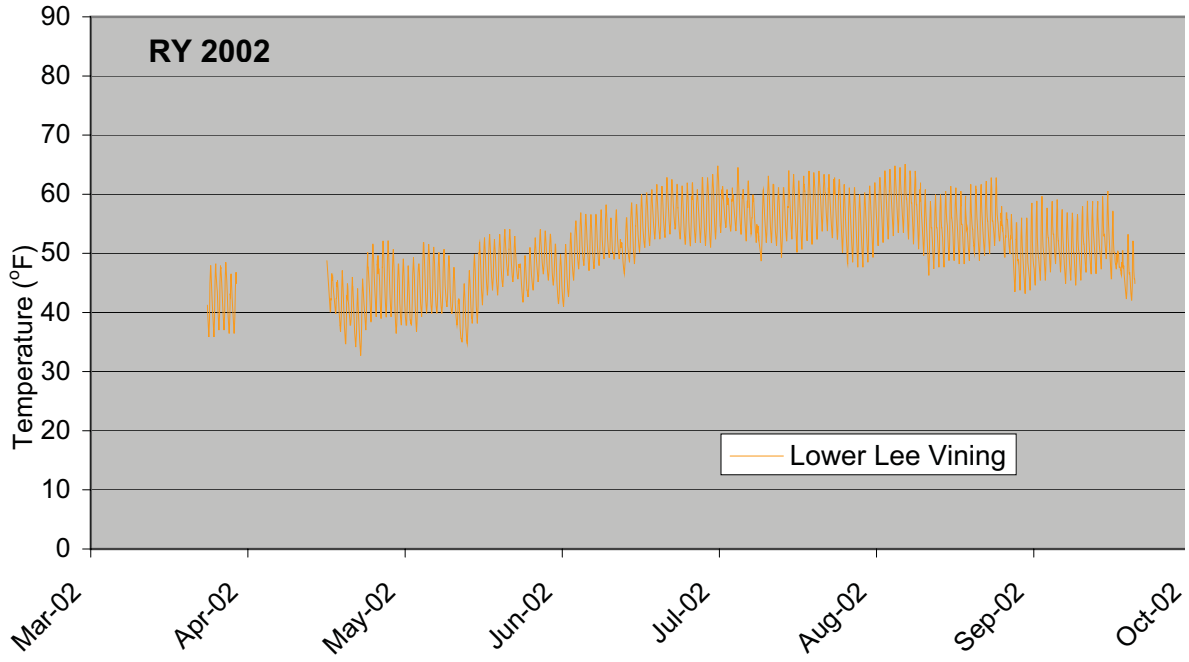
Reiss, G. 2008. Personal communication regarding annual runoff volume estimates at ‘Rush Creek at Damsite’ gage.

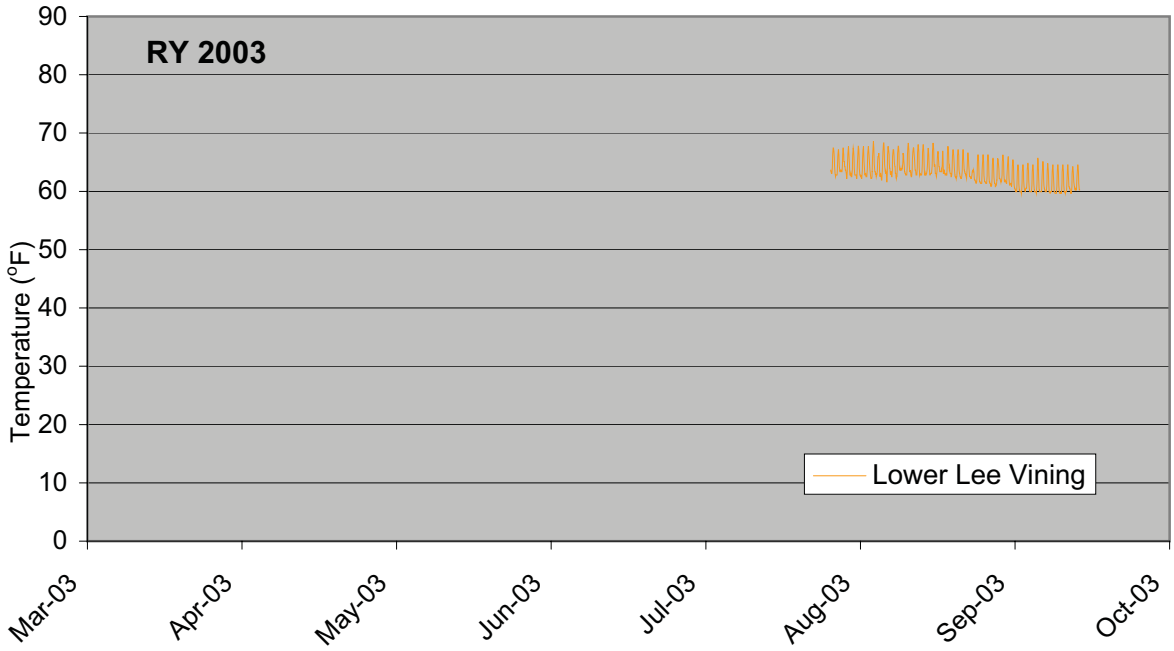
APPENDIX A

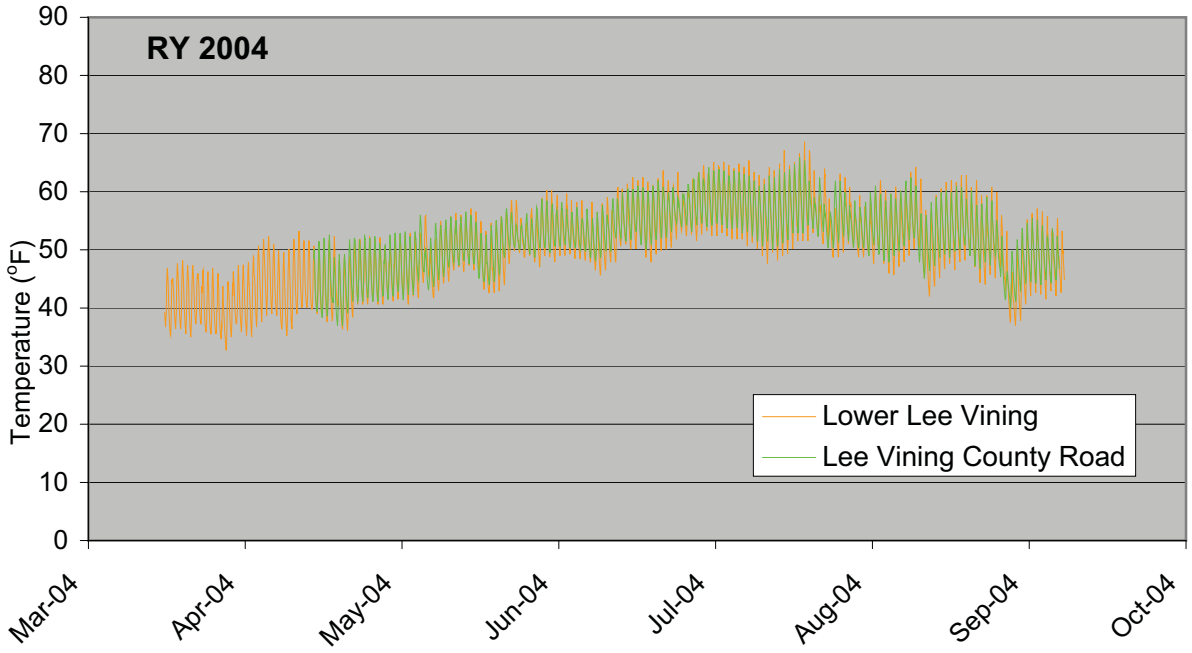
Stream Temperature Data for Rush and Lee Vining Creeks for Runoff Years 2000-07

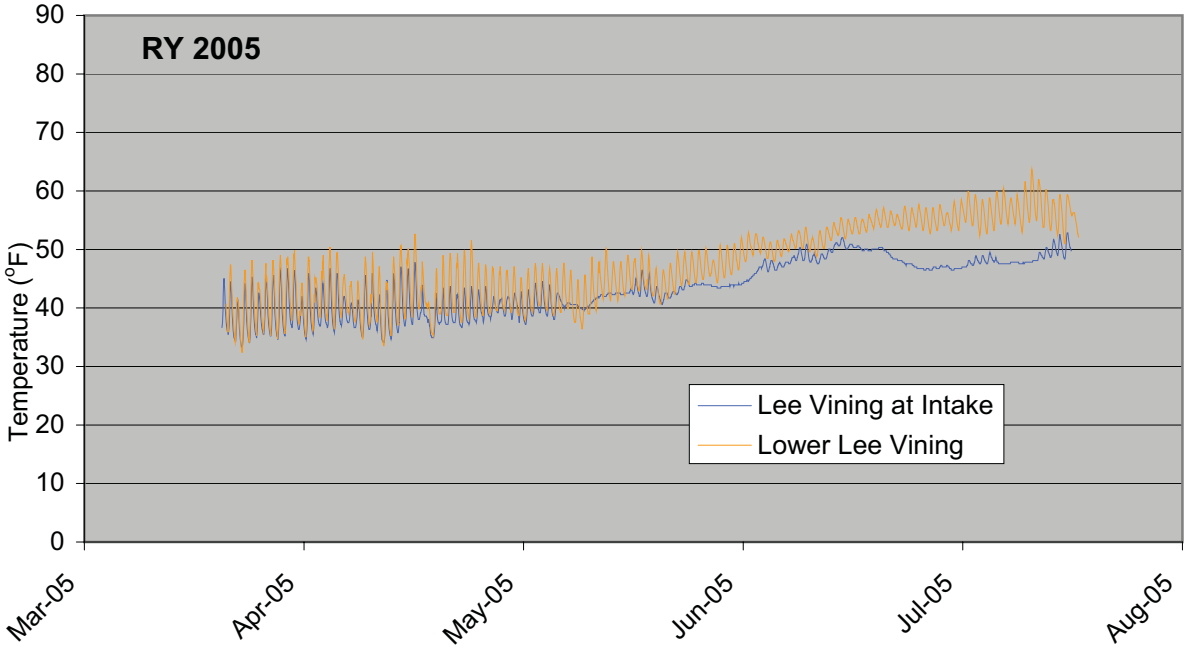

RY 2000
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Lower Lee Vining
Feb-00
Mar-00
Apr-00
May-00
Jun-00
Jul-00
Aug-00
Sep-00
Oct-00

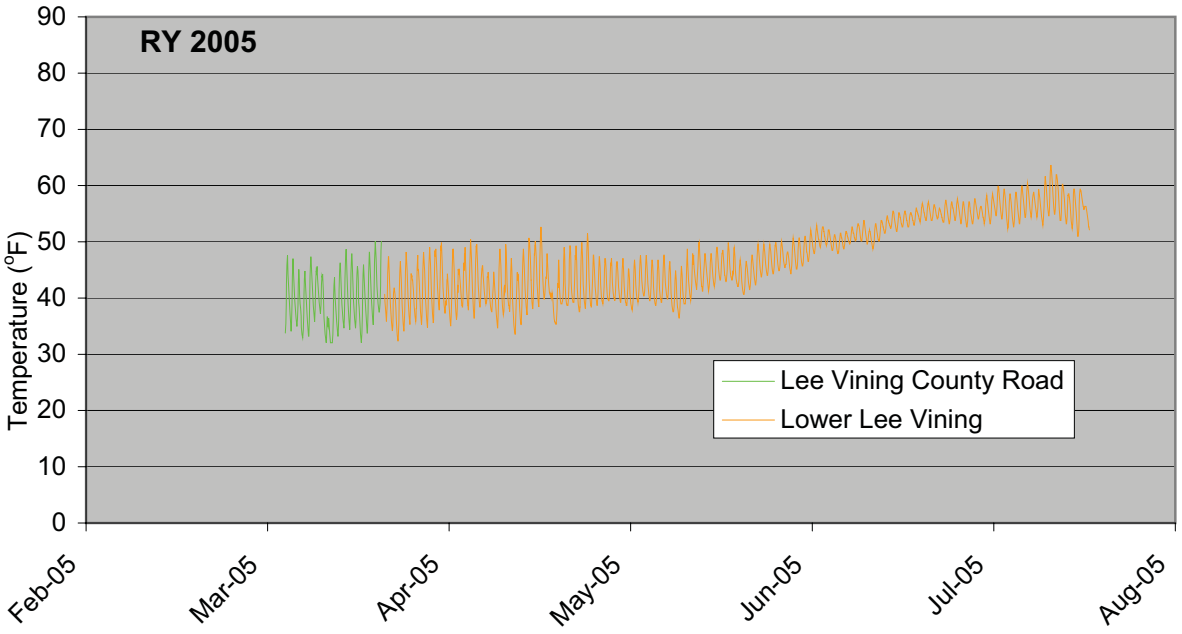

RY 2001
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Lower Lee Vining
Mar-01
Apr-01
May-01
Jun-01
Jul-01
Aug-01
Sep-01
Oct-01
Nov-01

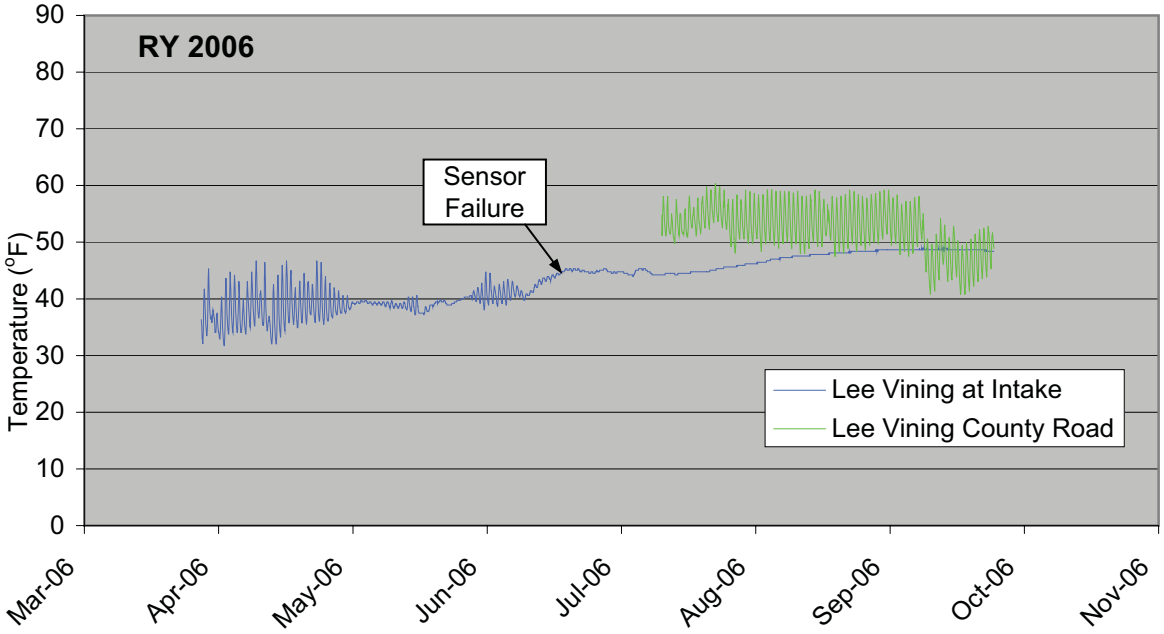

RY 2002
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Lower Lee Vining
Mar-02
Apr-02
May-02
Jun-02
Jul-02
Aug-02
Sep-02
Oct-02

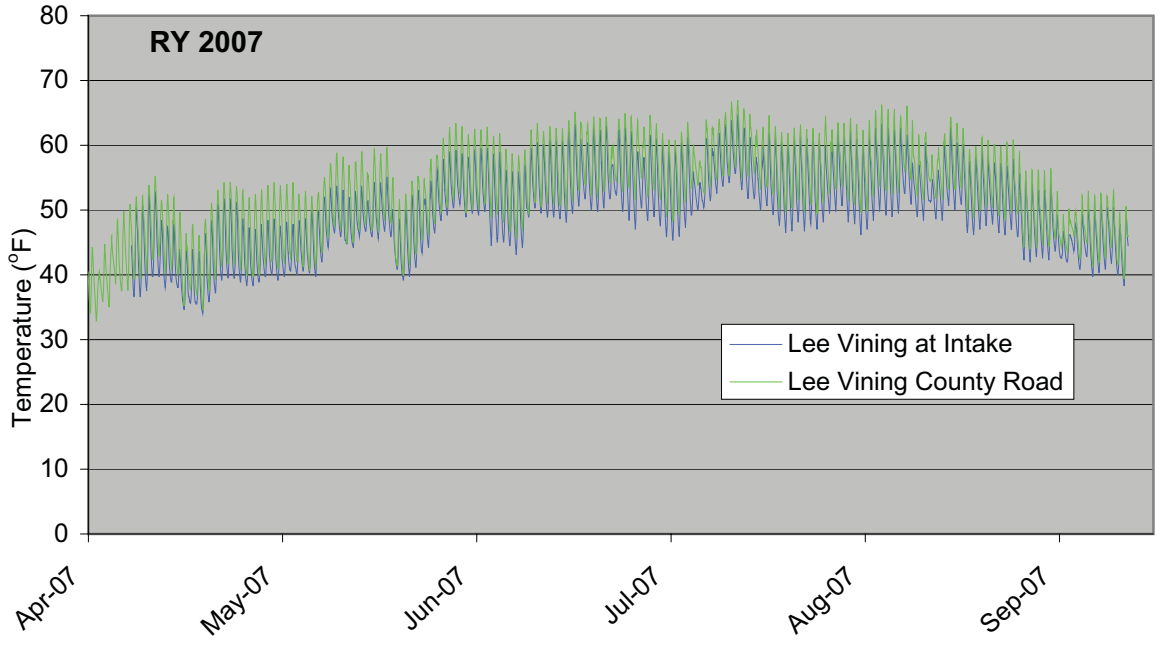

RY 2003
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Lower Lee Vining
Mar-03
Apr-03
May-03
Jun-03
Jul-03
Aug-03
Sep-03
Oct-03

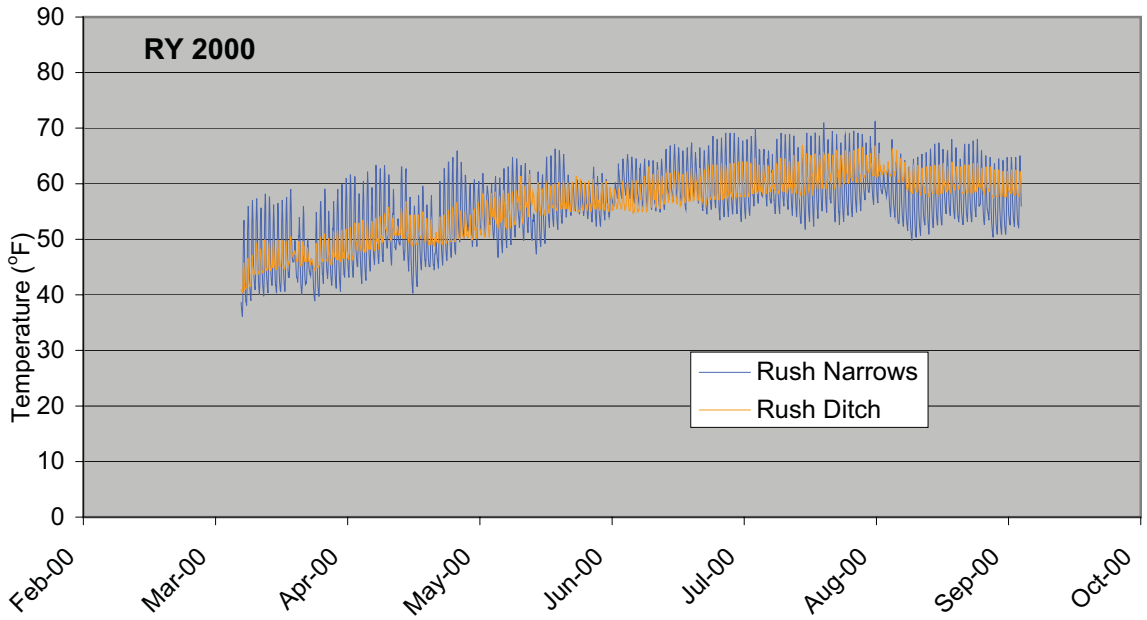

RY 2004
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Mar-04
Apr-04
May-04
Jun-04
Jul-04
Aug-04
Sep-04
Oct-04
Lower Lee Vining
Lee Vining County Road

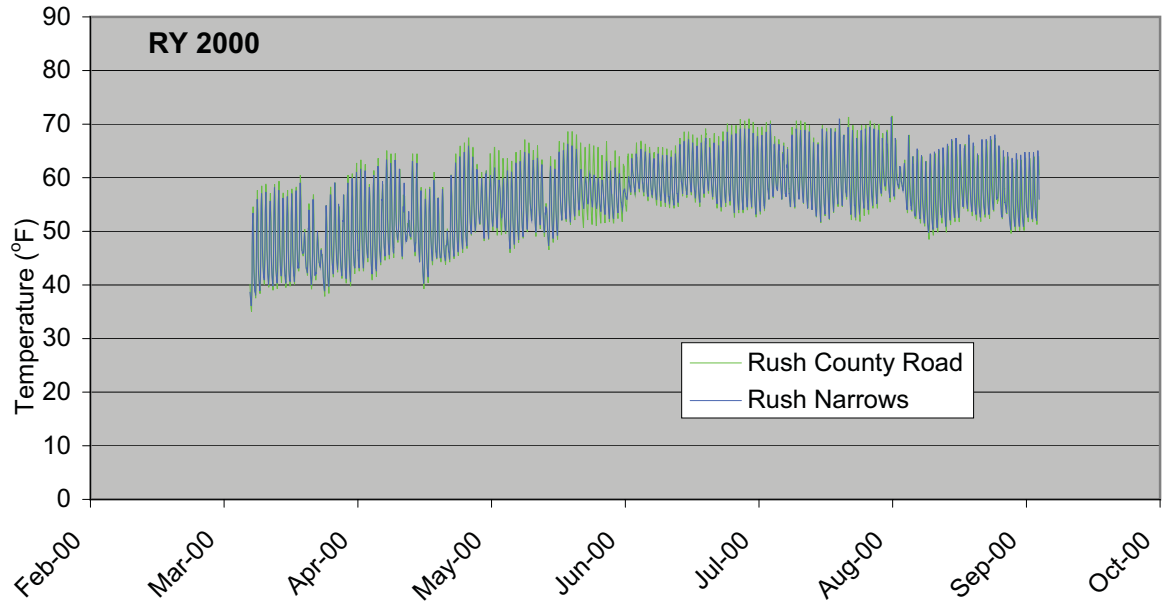

RY 2005
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Mar-05
Apr-05
May-05
Jun-05
Jul-05
Aug-05
Lee Vining at Intake
Lower Lee Vining

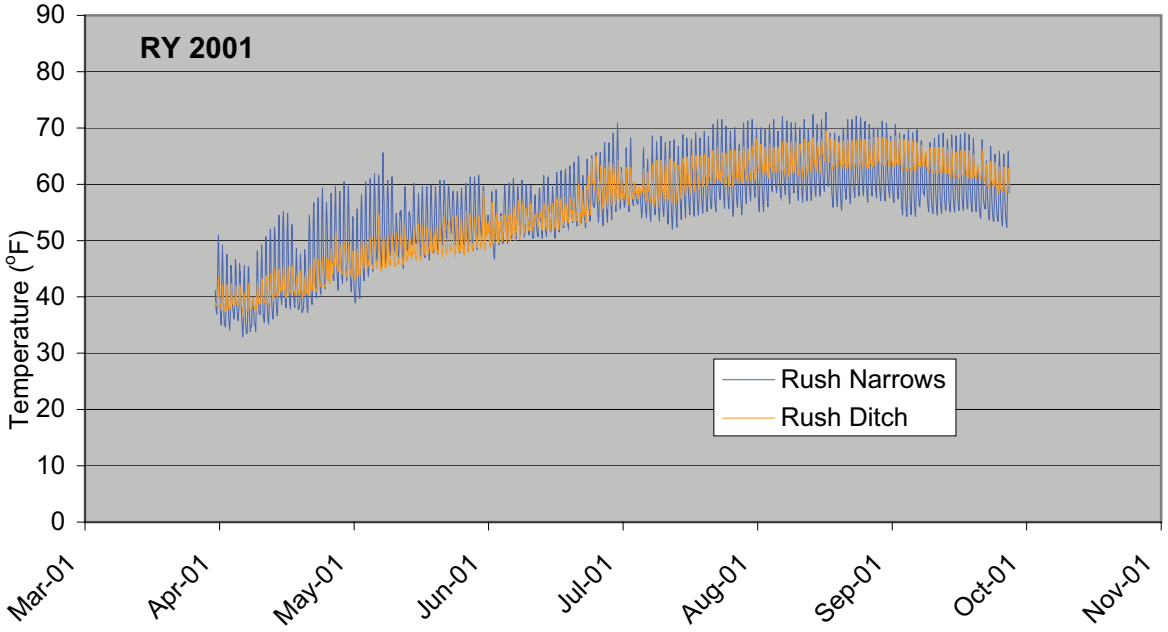

RY 2005
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Feb-05
Mar-05
Apr-05
May-05
Jun-05
Jul-05
Aug-05
Lee Vining County Road
Lower Lee Vining

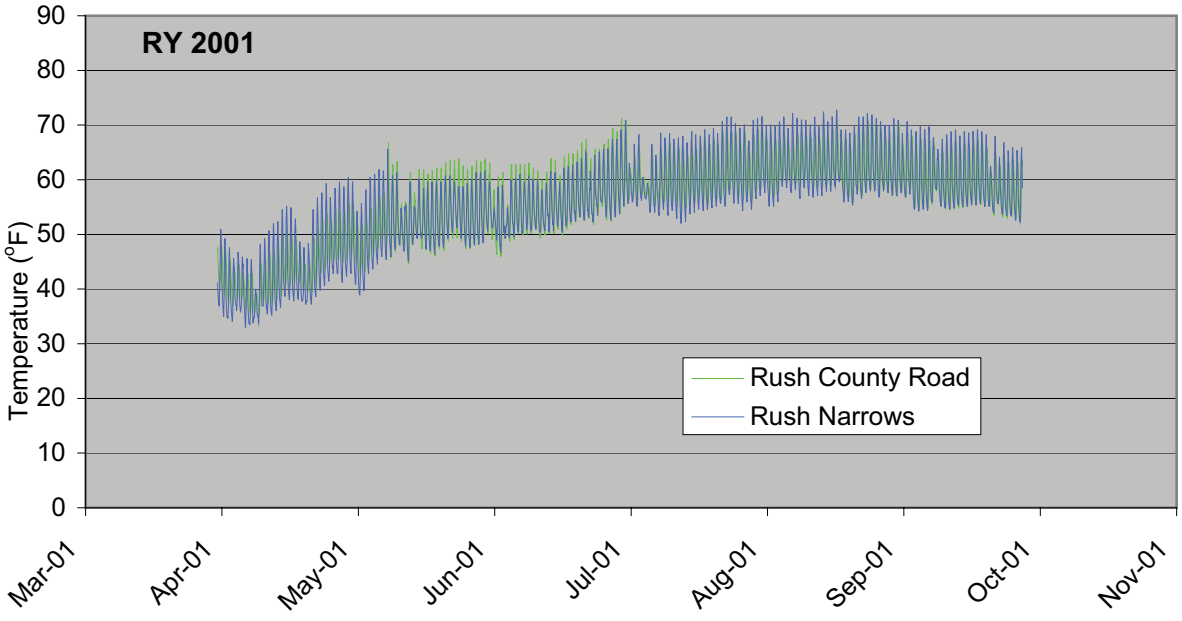

RY 2006
Sensor Failure
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Mar-06
Apr-06
May-06
Jun-06
Jul-06
Aug-06
Sep-06
Oct-06
Nov-06
Lee Vining at Intake
Lee Vining County Road

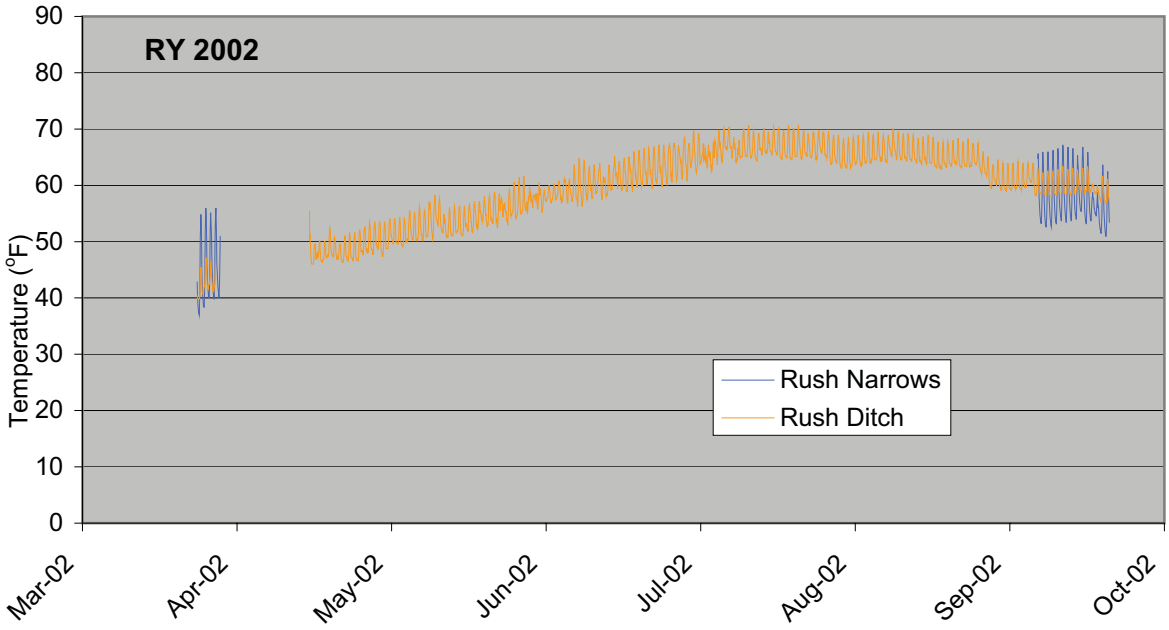

RY 2007
Temperature (°F)
80
70
60
50
40
30
20
10
0
Apr-07
May-07
Jun-07
Jul-07
Aug-07
Sep-07
Lee Vining at Intake
Lee Vining County Road

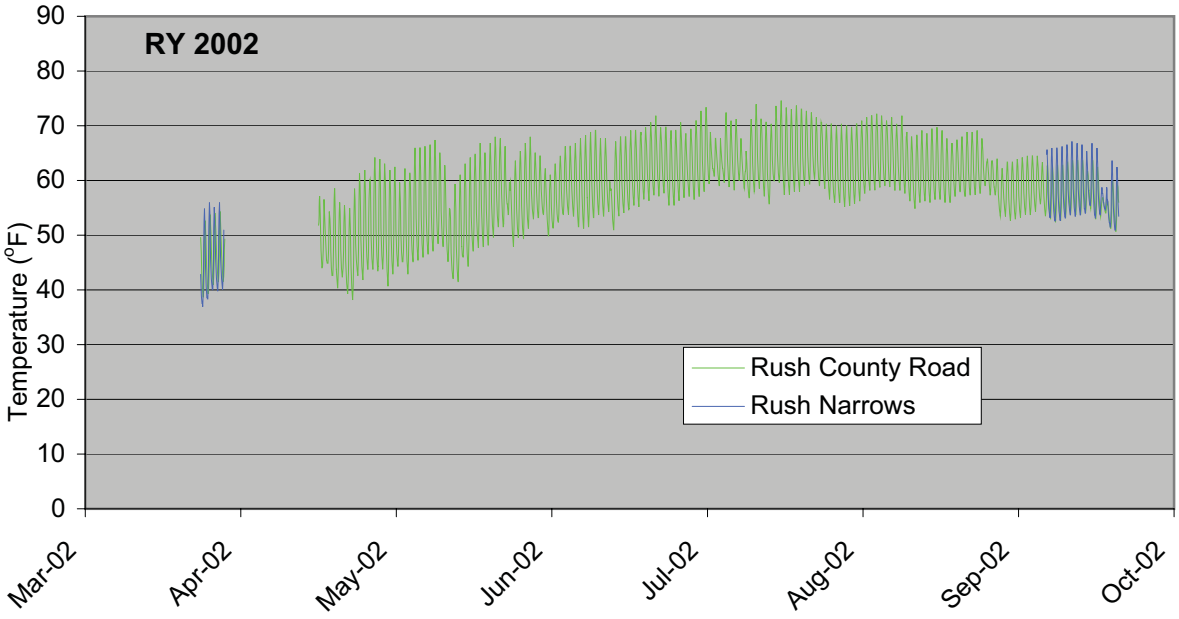

RY 2000
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Feb-00
Mar-00
Apr-00
May-00
Jun-00
Jul-00
Aug-00
Sep-00
Oct-00
Rush Narrows
Rush Ditch


RY 2000
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Feb-00
Mar-00
Apr-00
May-00
Jun-00
Jul-00
Aug-00
Sep-00
Oct-00
Rush County Road
Rush Narrows


RY 2001
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Mar-01
Apr-01
May-01
Jun-01
Jul-01
Aug-01
Sep-01
Oct-01
Nov-01
Rush Narrows
Rush Ditch


RY 2001
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Mar-01
Apr-01
May-01
Jun-01
Jul-01
Aug-01
Sep-01
Oct-01
Nov-01
Rush County Road
Rush Narrows


RY 2002
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Mar-02
Apr-02
May-02
Jun-02
Jul-02
Aug-02
Sep-02
Oct-02
Rush Narrows
Rush Ditch


RY 2002
Temperature (°F)
90
80
70
60
50
40
30
20
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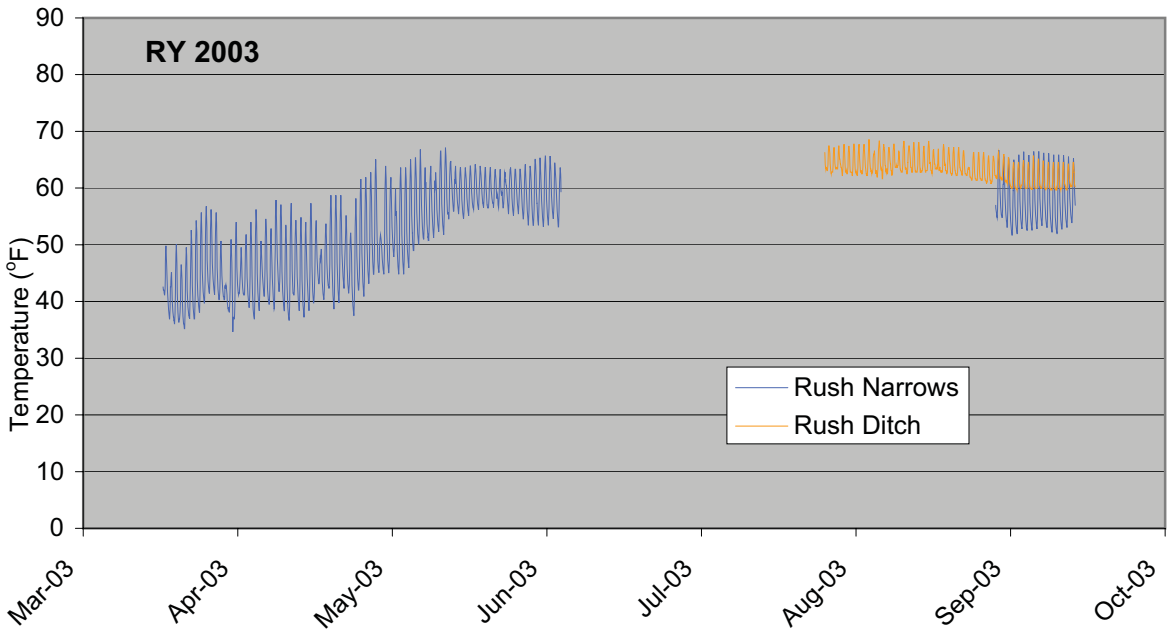
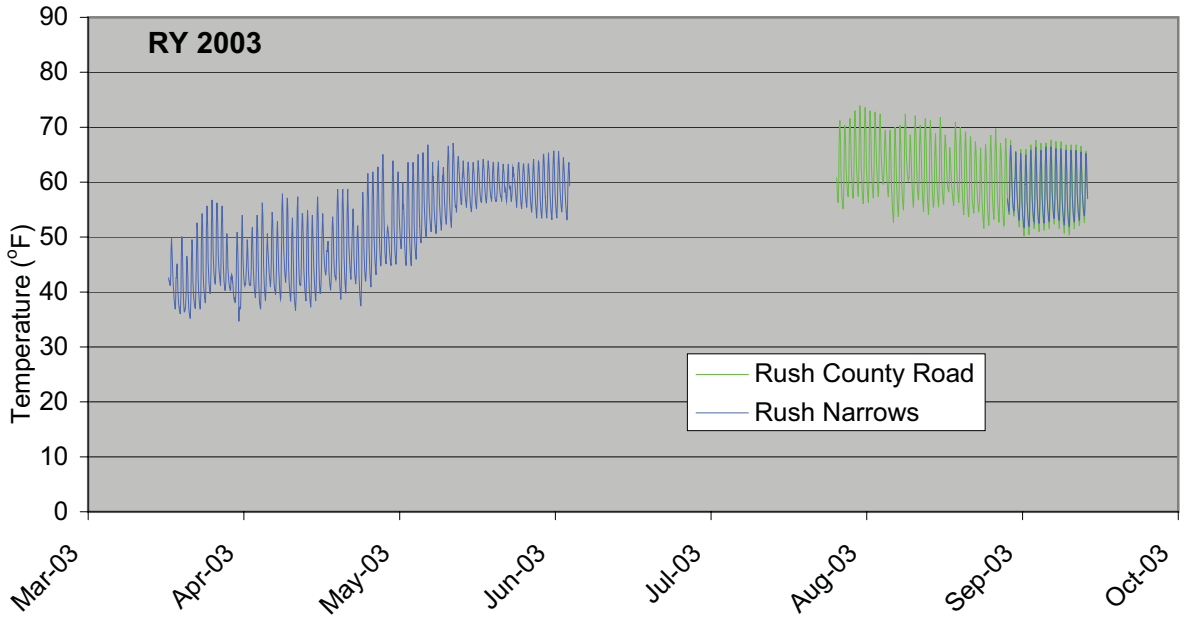
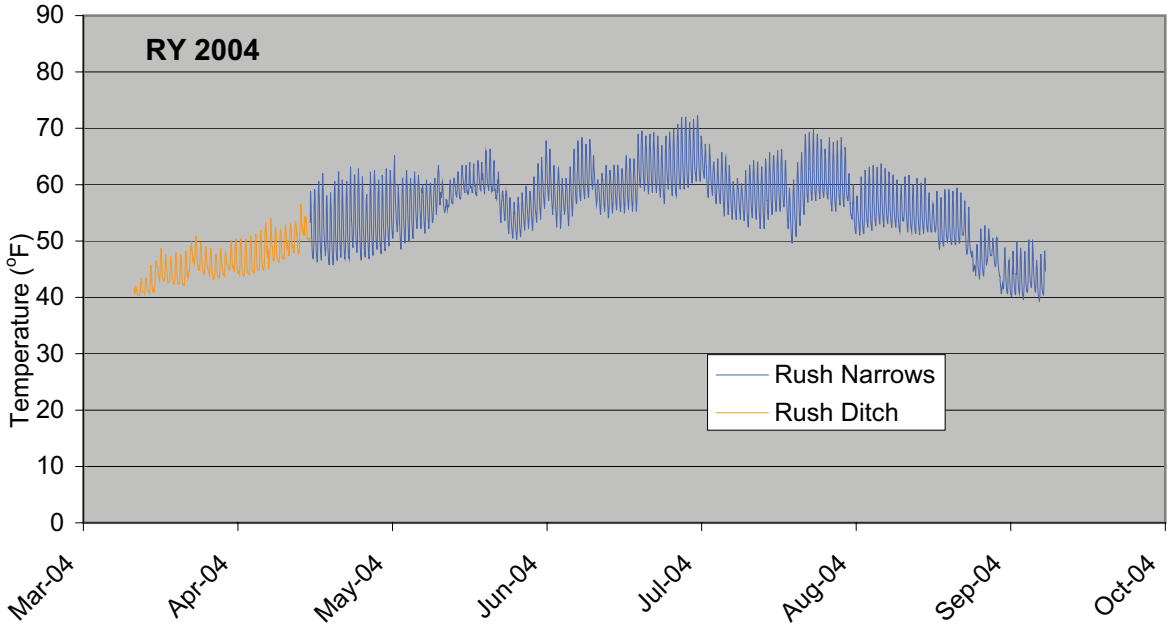
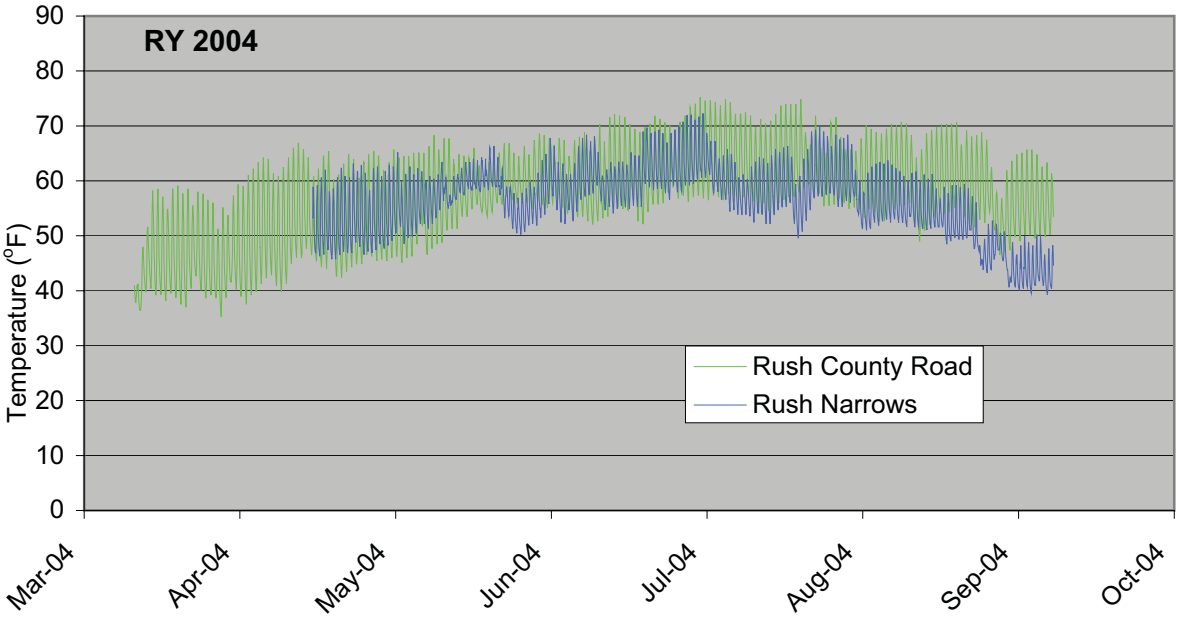
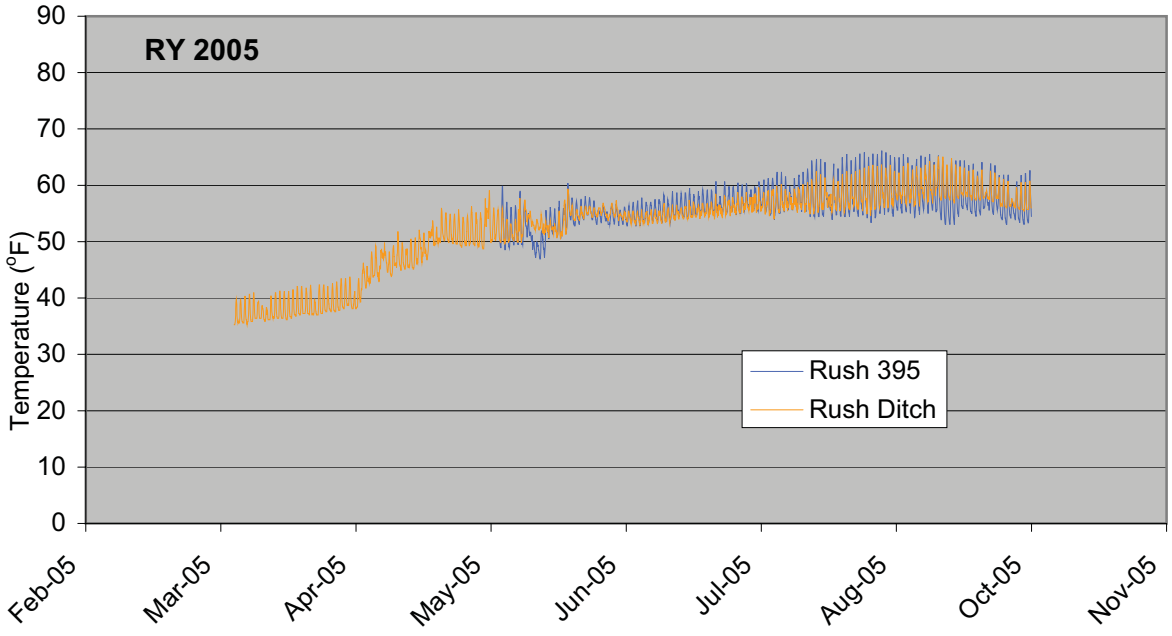
0
Mar-02
Apr-02
May-02
Jun-02
Jul-02
Aug-02
Sep-02
Oct-02
Rush County Road
Rush Narrows

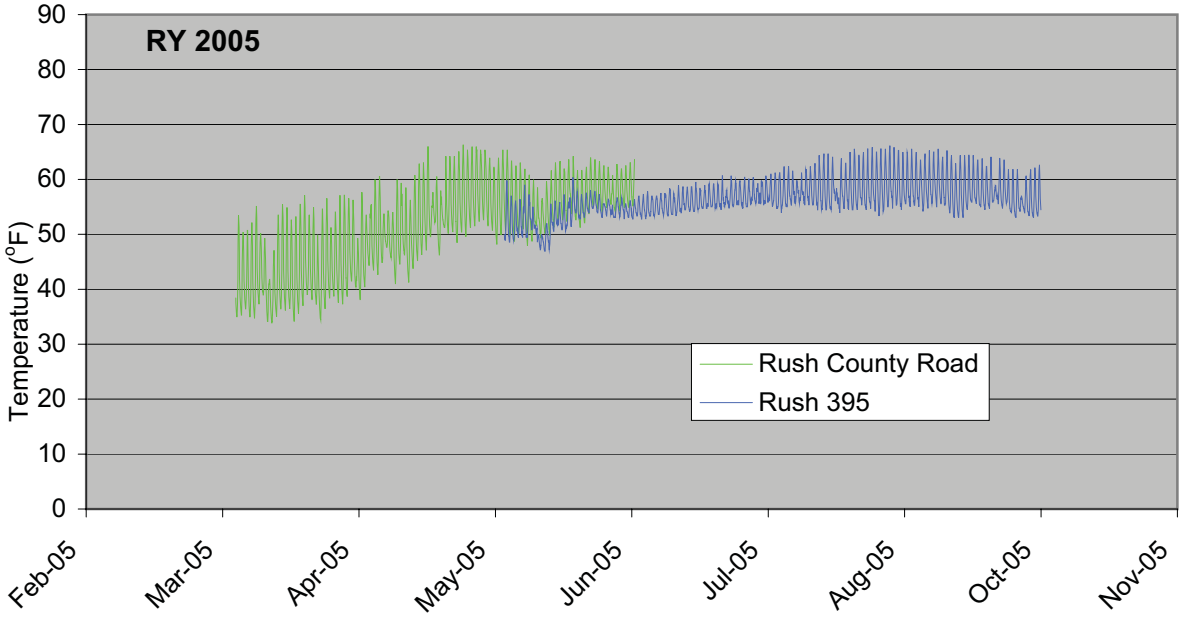

RY 2003
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Mar-03
Apr-03
May-03
Jun-03
Jul-03
Aug-03
Sep-03
Oct-03
Rush Narrows
Rush Ditch

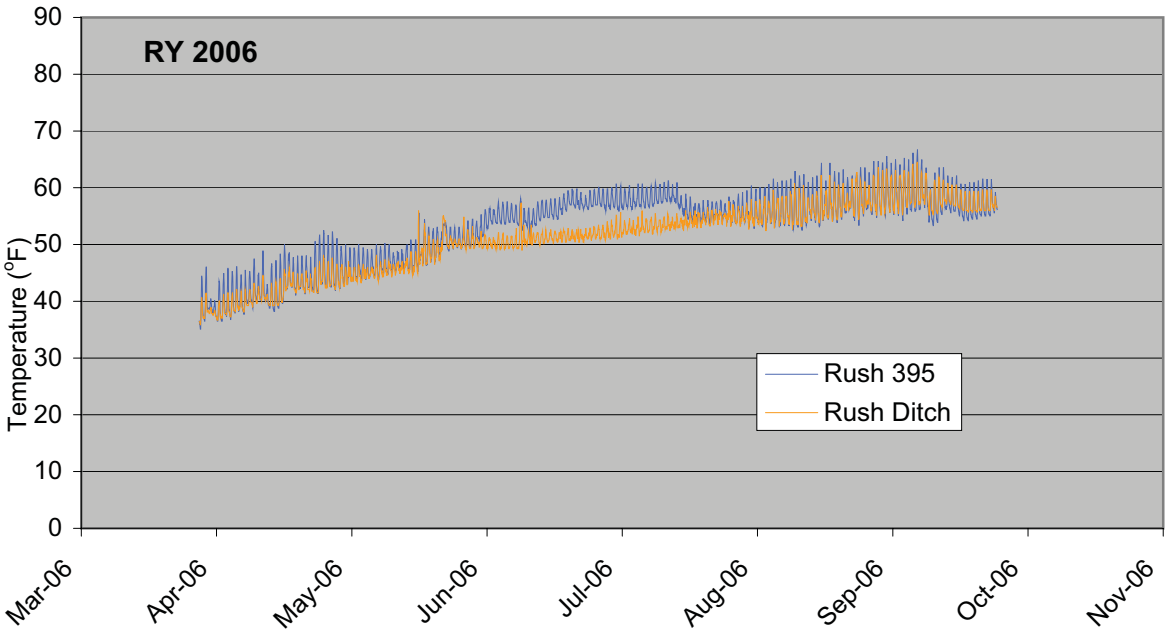

RY 2003
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Mar-03
Apr-03
May-03
Jun-03
Jul-03
Aug-03
Sep-03
Oct-03
Rush County Road
Rush Narrows

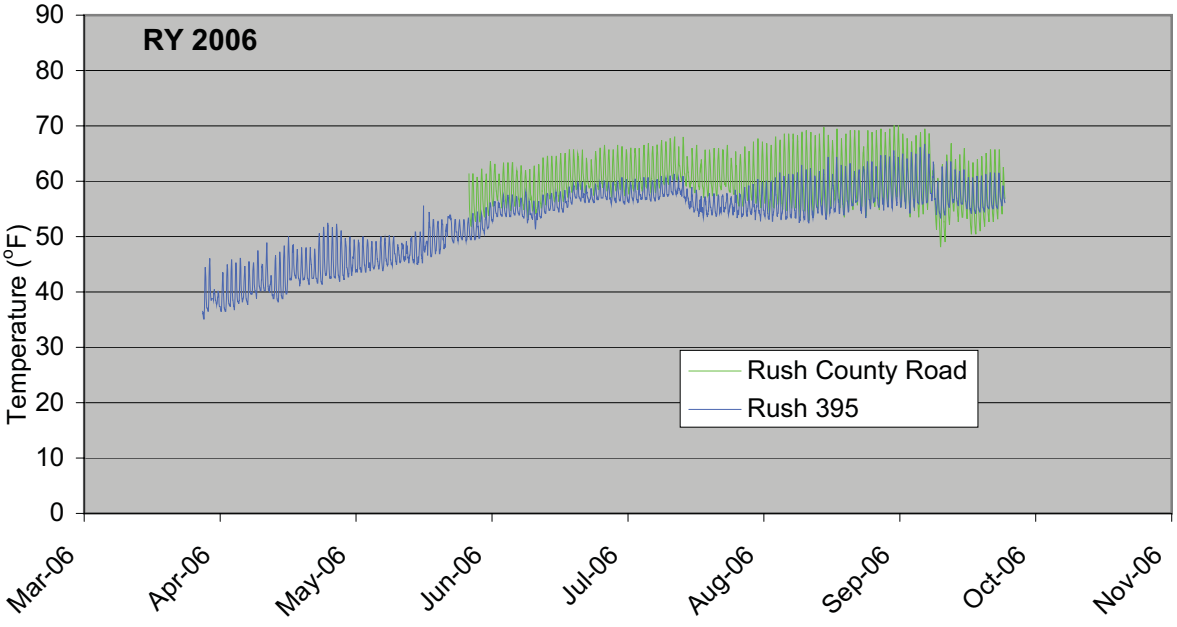

RY 2004
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Mar-04
Apr-04
May-04
Jun-04
Jul-04
Aug-04
Sep-04
Oct-04
Rush Narrows
Rush Ditch

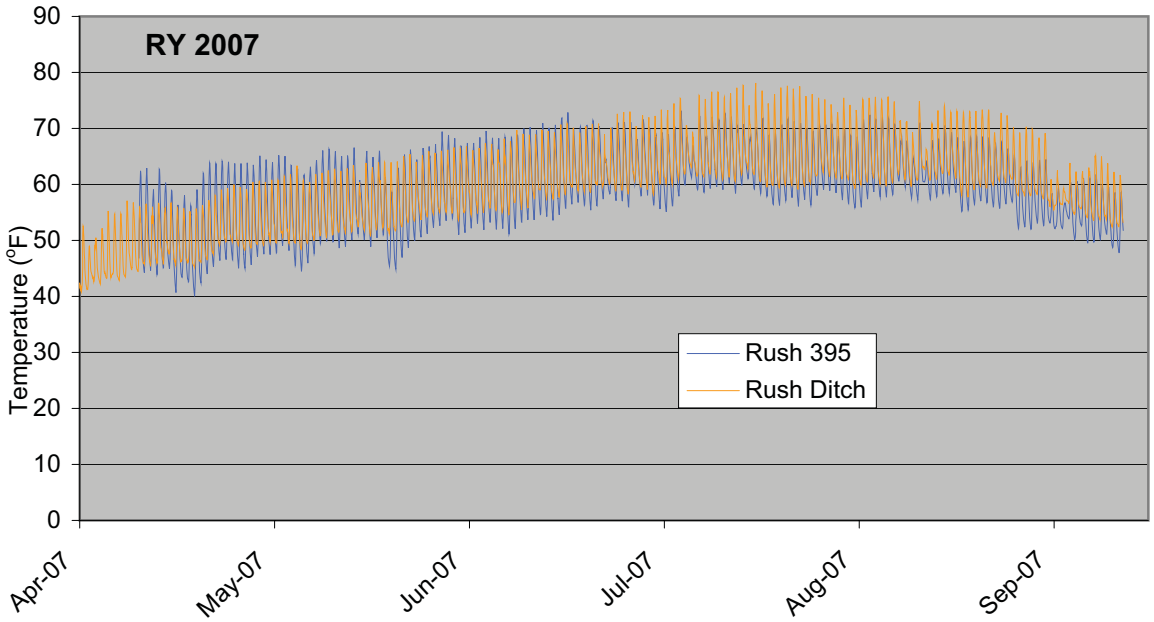

RY 2004
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Mar-04
Apr-04
May-04
Jun-04
Jul-04
Aug-04
Sep-04
Oct-04
Rush County Road
Rush Narrows

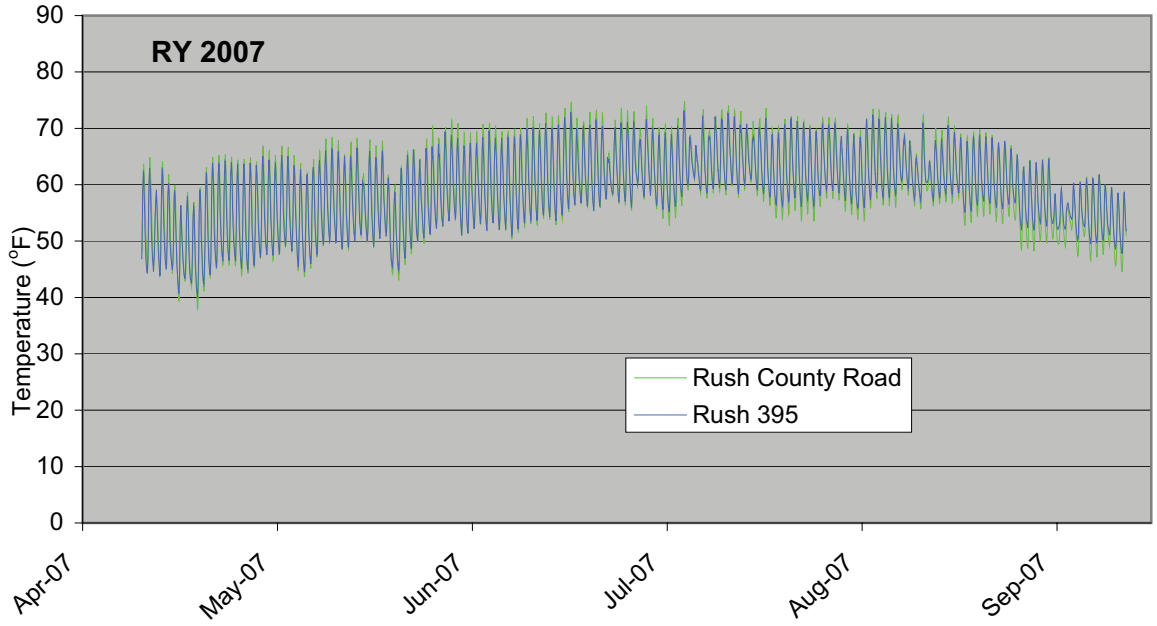

RY 2005
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Feb-05
Mar-05
Apr-05
May-05
Jun-05
Jul-05
Aug-05
Oct-05
Nov-05
Rush 395
Rush Ditch


RY 2005
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Feb-05
Mar-05
Apr-05
May-05
Jun-05
Jul-05
Aug-05
Oct-05
Nov-05
Rush County Road
Rush 395


RY 2006
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Mar-06
Apr-06
May-06
Jun-06
Jul-06
Aug-06
Sep-06
Oct-06
Nov-06
Rush 395
Rush Ditch


RY 2006
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Mar-06
Apr-06
May-06
Jun-06
Jul-06
Aug-06
Sep-06
Oct-06
Nov-06
Rush County Road
Rush 395


RY 2007
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Apr-07
May-07
Jun-07
Jul-07
Aug-07
Sep-07
Rush 395
Rush Ditch


RY 2007
Temperature (°F)
90
80
70
60
50
40
30
20
10
0
Apr-07
May-07
Jun-07
Jul-07
Aug-07
Sep-07
Rush County Road
Rush 395