

F-StL Stream Reach Summary

Study Reach: F-StL, St. Louis Creek - From St. Louis Campground downstream to the Fraser River at the Town of Fraser.

Reach Description: Approximate channel length: 4 miles, approximate channel slope 1.5%.

The study area for this tributary extends from the confluence with Fraser River, upstream to the St. Louis campground, approximately 4 miles. This reach of St. Louis Creek is relatively flat and sinuous. Floodplain vegetation consists of wetlands near the active channel and a timbered overstory nearer the uplands. Near the Town of Fraser, there are numerous water diversions and agriculture land uses dominating the overbanks. Within the USFS lands, there has been extensive logging in response to what appears to be severe pine beetle infestation.



St. Louis Creek at St. Louis diversion near campground



St. Louis Creek one mile upstream of Highway 40

Flow Recommendations:

Environmental Flow Methodology: A PHABSIM site was established below the Denver Water diversion in summer 2007. See Appendix A for methodology and Appendix E for PHABSIM survey information. In addition, CWCB instream flows have been set for several segments of St. Louis Creek. Those CWCB flows presented below are those for the segment at the Forest Service boundary where the 2007 study site was located. Forest Service by-pass flows at the Denver Water diversion are also presented.

Water Users:

- Irrigators, municipalities and industry flow-related issues: none reported
- Recreational flows: Angling is popular in St. Louis Creek. The upper portion of the study reach, which is on USFS land, also includes an extensive trail system in the floodplain of the river.

Summary of Flows:

Environmental, recommended flow target range

- 5 to 10 cfs, April through September
- 5 to 10 cfs, October through March
- Flushing flow of at least 70 cfs for a 3-day duration with a frequency of 1 in 2 years during the late May to late June period.

CWCB flows

- 6 cfs summer (05/15 – 09/15)
- 3.5 cfs for winter (09/16 – 05/14)

Forest Service By-pass Flows

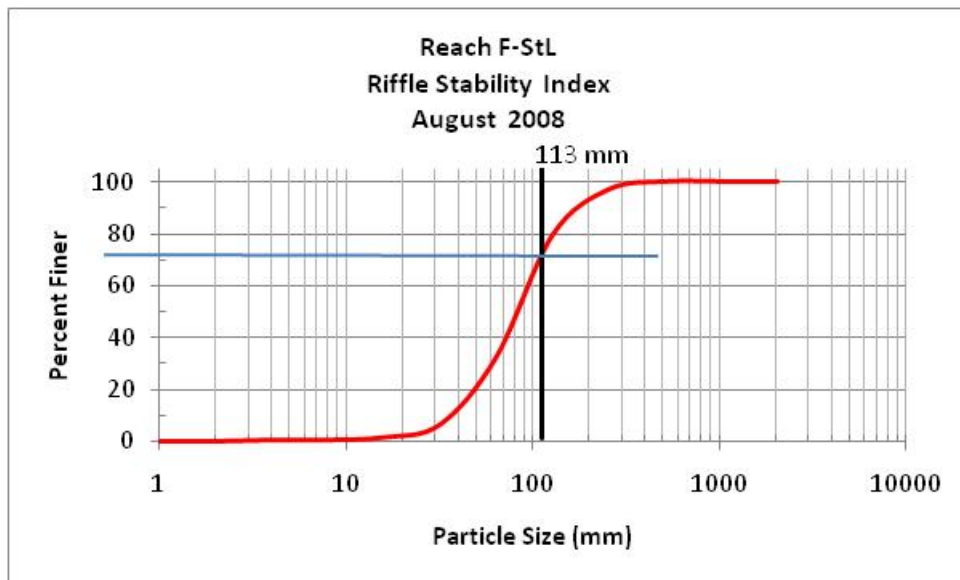
- 10 cfs summer (05/15 - 09/15)
- 3 cfs winter (09/16 - 05/14)

Water Users:

- Irrigators, municipalities and industry: The local diversions in this reach could potentially divert up to approximately 95 cfs. Most of the diversions are made in the summer for irrigation and likely have return flows.
- Recreation: none reported

Stream Assessments: In August 2008 Tetra Tech conducted three assessments in F-StL. These included Stream Reach Inventory/Channel Stability Evaluation (SRI/CSE), EPA Habitat Quality Assessment (HQA) and a Riffle Stability Index (RSI) evaluation. The SRI/CSE evaluation scored in the ‘good’ category, the EPA HQA evaluation scored in the ‘suboptimal’ range and the RSI of 73 indicates moderate instability of riffle bed particles with up to 73% mobilized during recent high flow events. Relevant issues revealed in the stream assessments include issues related to overbank disturbances such as extensive logging, agricultural uses, and floodplain encroachment. Results of the assessments are summarized in the following tables and plot. Details and methodology are presented in Appendix A

Reach F-StL Stream Assessments					
Stream Reach Inventory/Channel Stability Evaluation			EPA Habitat Quality Assessment		
Attribute			Attribute	Score	
Upper Banks			Channel		
1	Landform Slope	2	1	Aquatic Habitat Barriers/ Diversion	9
2	Mass wasting hazard	6	2	Aquatic Structure as Cover	13
3	Debris Jam Potential	4	3	Velocity/ Depth Regimes	11
4	Vegetation Cover	6	4	Channel Flow Status	14
		Upper Bank Score:	5	Channel Alteration	13
			6	Frequency of Riffles	17
Lower Banks			7	Channel Sinuosity	7
5	Channel Capacity	2	Channel Score		84
6	Bank Rock Content	5	Banks		
7	Flow obstructors & Deflectors	3	8	Bank Stability	16
8	Cutting	8	9	Riparian Vegetation Cover and Disturbance	14
9	Deposition	6	10	Riparian Vegetation zone width	14
		Lower Bank Score:	Bank Score		44
			Total Score		128
Channel Bottom			Notes		
10	Rock Angularity	2			
11	Brightness	2			
12	Consolidation/Particle Packing	3			
13	Bottom size distribution	8			
14	Bed Scour and Deposition	12			
15	Clinging Aquatic Veg	2			
		Channel Bottom Score:			29
		Total Score:			71



Spawning Observations: Conducted a spawning survey on 27 October 2008 in the vicinity of the PHABSIM site. Observed numerous adult brook trout and what appeared to be older brook trout redds, but no brown trout activity.

Hydrologic Records: USGS Gage Station 09026500 (St. Louis Creek near Fraser, CO), located upstream of the PHABSIM site, has been in operation since 1933. Daily streamflow exceedence plots, IHA analyses, and flood frequency analysis are presented for the post-transbasin period-of-record, 1936 to 2007. These data indicate the environmental flow ranges recommended have been commonly available within the reach. The flushing flow recommended is within the range of the 1.11 to 2.0 year return period flood events. The IHA analysis comparing 1936 - 1970 with 1971 - 2007 records indicates flows have been substantially reduced during the more recent period.

Water Temperature: F-StL is a Tier I stream reach as designated by CDPHE with a chronic temperature standard of 17°C MWAT and an acute temperature standard of 21.2°C DM. Temperature data reviewed in reach F-StL indicate stream temperatures for St. Louis Creek in this area are generally below the MWAT and DM standards.

Water Quality: No water quality data was available on this reach.

Water Supply Issues (UPCO): No water supply issues are reported for this reach.

Summary of Results and Additional Remarks:

1. The IHA analysis comparing 1936 - 1970 with 1971 - 2007 records indicates flows have been substantially reduced during the more recent period. However, the data indicates the environmental flow target ranges recommended have been commonly available within the reach.
2. The flow recommended for flushing is well supported by both the historic and the recent hydrologic record.
3. The environmental flow target recommendations are based upon adult and spawning habitat for brook trout. The CDOW and U. S. Forest Service are considering measures to restore Colorado River cutthroat trout. Should acceptable habitat suitability information for cutthroat trout become available, it may be beneficial to re-run the PHABSIM analysis for this native species.
4. This reach has been identified in the CNHP as a Potential Conservation Area immediately upstream of Fraser along the St. Louis River and is recommended for protection of wetland plant species from future development, particularly the proposed Fraser Valley Parkway.
5. The lower ½ mile of St. Louis appears to have been significantly impacted by development. The channel is straight and void of riparian vegetation.

Restoration Opportunities:

- ✓ Support efforts by the CDOW and the Forest Service to restore the native cutthroat trout in the upper portions of this reach.
- ✓ Consider channel improvements along the downstream ½ mile of St. Louis. Improvements might include the restoration of channel sinuosity, development of a low flow and overbank channel, planting for development of a riparian corridor and woody debris and cover for aquatic habitat.
- ✓ Consider enhancement of fish passage from the Fraser up into F-StL if supported by relevant fisheries data.

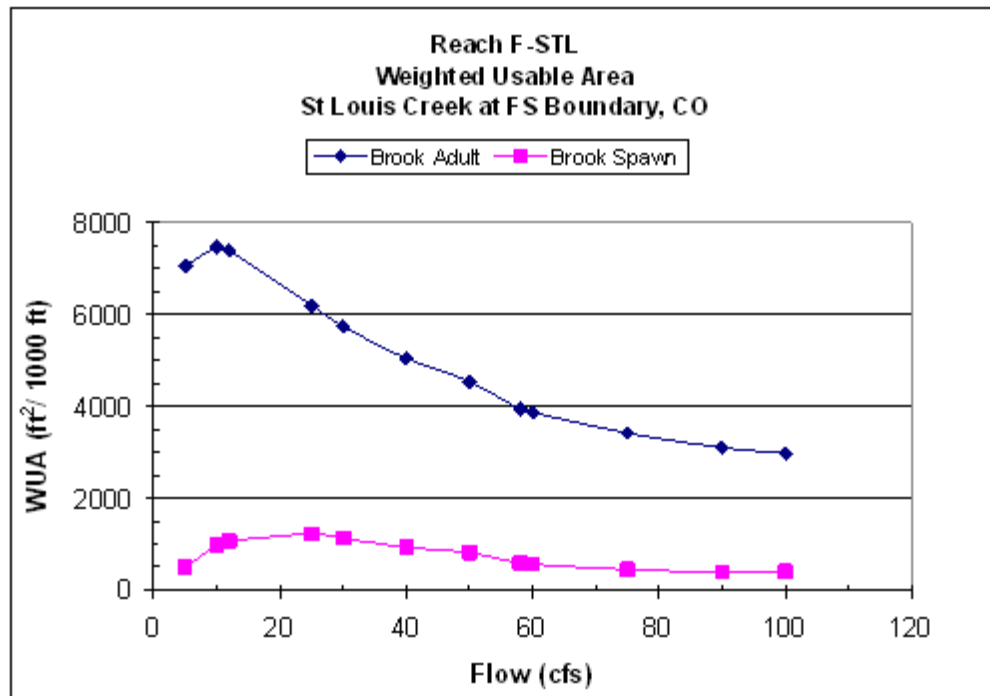
Monitoring: Continue to monitor flows for compliance with Forest Service by-pass and CWCB ISF requirements.

Support Data

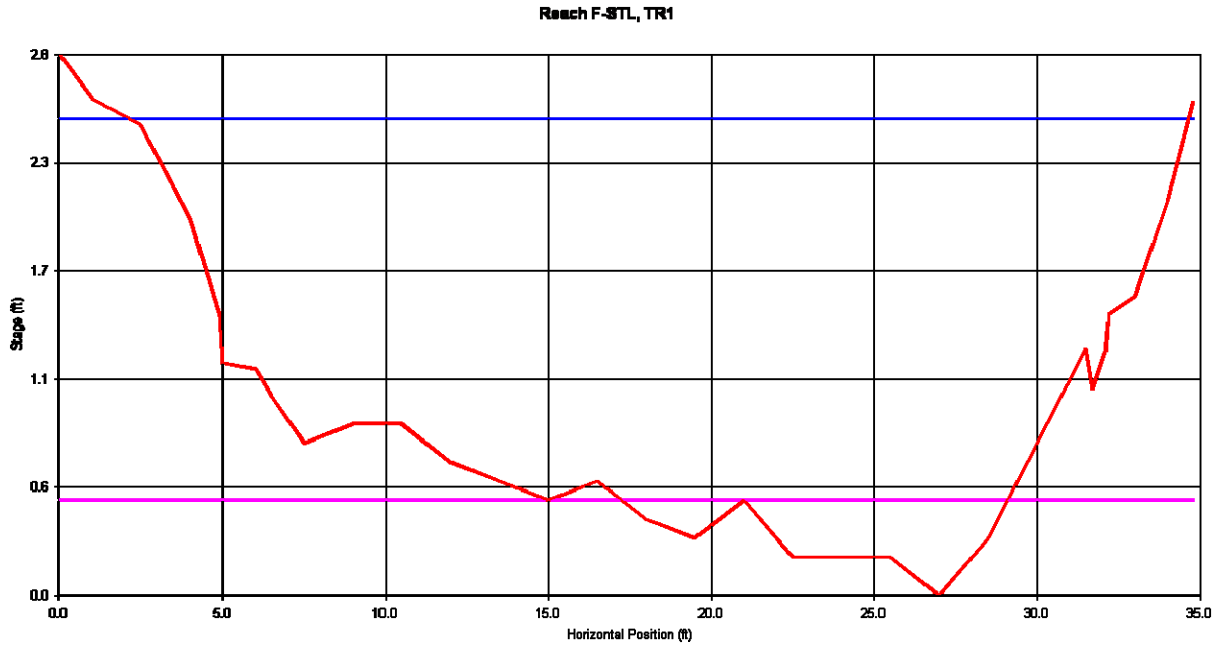
Weighted Useable Area Plots and Tables

Habitat-flow relations for the target species and life stages for Reach F-STL, TetraTech site.

Reach F-STL			
Discharge	Total Area	Brook Spawn	Brook Adult
(cfs)	(ft ²)	Weighted Usable Area (ft ² /1000 ft stream length)	
5.0	20579.1	487.0	7056.9
10.0	23148.7	989.0	7473.4
12.0	23936.8	1068.4	7397.1
25.0	26422.7	1225.5	6199.2
30.0	27221.9	1123.8	5741.4
40.0	27839.8	929.5	5046.6
50.0	28370.0	813.6	4536.9
58.0	28786.0	577.0	3941.6
60.0	28882.0	554.6	3867.8
75.0	30408.4	443.2	3417.3
90.0	31602.2	393.6	3106.7
100.0	32174.6	402.1	2977.7



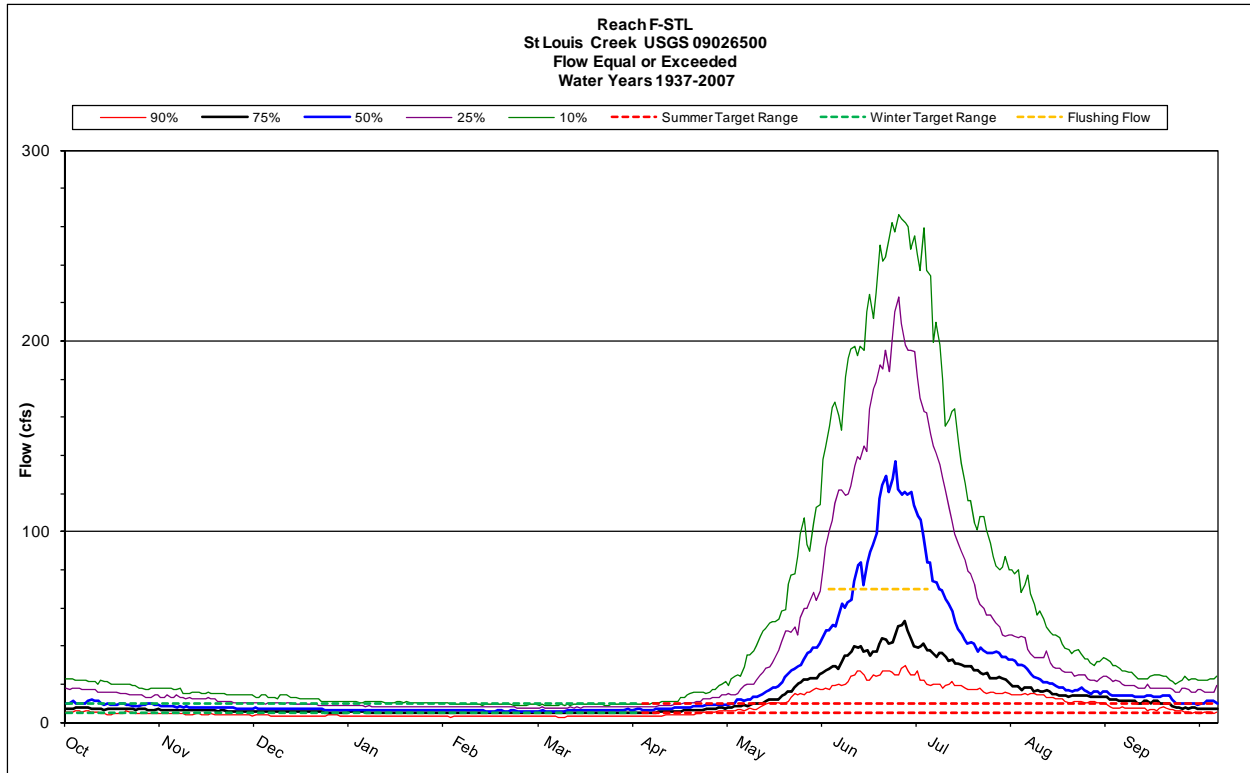
Transect and Bedload Threshold Plots and Tables



Reach F-STL
 St Louis Creek, TR1
 TT2007 site
 Resistance Method: Jarrett's Equation

STAGE (ft)	AREA (sq ft)	PERIM (ft)	WIDTH (ft)	R (ft)	DHYD (ft)	SLOPE (ft/ft)	n	VAVG (ft/s)	Q (cfs)	SHEAR (psf)
0.5	2.72	11.97	11.85	0.23	0.23	0.020	0.112	0.70	1.9	0.28
0.6	4.11	16.05	15.89	0.26	0.26	0.020	0.110	0.77	3.2	0.32
0.7	5.79	17.87	17.69	0.32	0.33	0.020	0.106	0.93	5.4	0.40
0.8	7.61	18.94	18.74	0.40	0.41	0.020	0.102	1.12	8.5	0.50
0.9	9.63	21.93	21.69	0.44	0.44	0.020	0.101	1.20	11.6	0.55
1.0	11.84	22.66	22.39	0.52	0.53	0.020	0.098	1.39	16.5	0.65
1.1	14.11	23.44	23.13	0.60	0.61	0.020	0.096	1.56	22.1	0.75
1.2	16.47	24.78	24.37	0.66	0.68	0.020	0.094	1.70	28.0	0.83
1.3	19.00	26.18	25.63	0.73	0.74	0.020	0.093	1.83	34.7	0.91
1.4	21.57	26.40	25.72	0.82	0.84	0.020	0.091	2.01	43.4	1.02
1.5	24.14	26.81	26.02	0.90	0.93	0.020	0.090	2.18	52.7	1.12
1.6	26.80	27.70	26.88	0.97	1.00	0.020	0.089	2.32	62.1	1.21
1.7	29.50	28.13	27.25	1.05	1.08	0.020	0.088	2.48	73.1	1.31
1.8	32.25	28.56	27.63	1.13	1.17	0.020	0.086	2.64	85.0	1.41
1.9	35.03	28.98	28.01	1.21	1.25	0.020	0.086	2.79	97.7	1.51
2.0	37.85	29.43	28.41	1.29	1.33	0.020	0.085	2.94	111.1	1.60
2.1	40.72	29.97	28.90	1.36	1.41	0.020	0.084	3.07	125.1	1.70
2.2	43.63	30.47	29.36	1.43	1.49	0.020	0.083	3.21	140.0	1.79
2.3	46.59	30.98	29.82	1.50	1.56	0.020	0.083	3.34	155.8	1.88
2.4	49.59	31.48	30.28	1.58	1.64	0.020	0.082	3.47	172.3	1.97
2.5	52.65	32.21	30.97	1.63	1.70	0.020	0.082	3.58	188.6	2.04

Hydrographs and Exceedence Plots and Tables



Return Period T (year)	Probability P (percent)	Flood Discharge Q (ft³/sec)
1.05	95.2	49
1.11	90.1	72
1.25	80	110
2	50	216
5	20	349
10	10	419
25	4	488

Flood frequency analysis for USGS gage 09026500, St Louis Creek near Fraser, Colorado, for 71 years of record (Water years 1936-2006).

IHA Results

Reach F-StL
Non-Parametric IHA Scorecard
St Louis Creek near Fraser USGS 09026500
Water Years 1936-2007

Period of Analysis: 1936-2007 (72 years)

Mean annual flow (cfs)	25.15
Mean flow/area (dimensionless)	25.15
Annual C. V.	1.72
Flow predictability (%)	0.53
Constancy/predictability	0.57
% of floods in 60d period	0.4
Flood-free season (days)	55

	Medians	Coeff. of Disp.
Parameter Group #1		
October (cfs)	9.35	0.8529
November (cfs)	7.85	0.7452
December (cfs)	6.8	0.5846
January (cfs)	6.45	0.4574
February (cfs)	6.05	0.5186
March (cfs)	6.3	0.4881
April (cfs)	7.9	0.443
May (cfs)	25.5	1.049
June (cfs)	104.5	1.205
July (cfs)	39	1.109
August (cfs)	17	0.6471
September (cfs)	12.25	0.7092
Parameter Group #2		
1-day minimum (cfs)	5	0.38
3-day minimum (cfs)	5.067	0.3914
7-day minimum (cfs)	5.157	0.374
30-day minimum (cfs)	5.393	0.417
90-day minimum (cfs)	6.033	0.4636
1-day maximum (cfs)	197.5	0.681
3-day maximum (cfs)	189.8	0.6769
7-day maximum (cfs)	172.5	0.7385
30-day maximum (cfs)	113.8	1.02
90-day maximum (cfs)	63.21	1.053
Number of zero days (count)	0	0
Base flow index (7day minimum in cfs/median in cfs)	0.2318	0.6689
Parameter Group #3		
Date of minimum (Julian day)	49.5	0.14
Date of maximum (Julian day)	172	0.0403
Parameter Group #4		
Low pulse count (#)	2.5	1.2
Low pulse duration (days)	7	2.179
High pulse count (#)	3	0.6667
High pulse duration (days)	9	4
The low pulse threshold is (cfs)	6.4	
The high pulse threshold is (cfs)	21	
Parameter Group #5		
Rise rate (cfs difference between consecutive days)	1	0.2125
Fall rate (cfs difference between consecutive days)	-1	0
Number of reversals	85	0.1882

Reach StL
IHA Percentile Data
St Louis Creek near Fraser USGS 09026500
Water Years 1936-2007

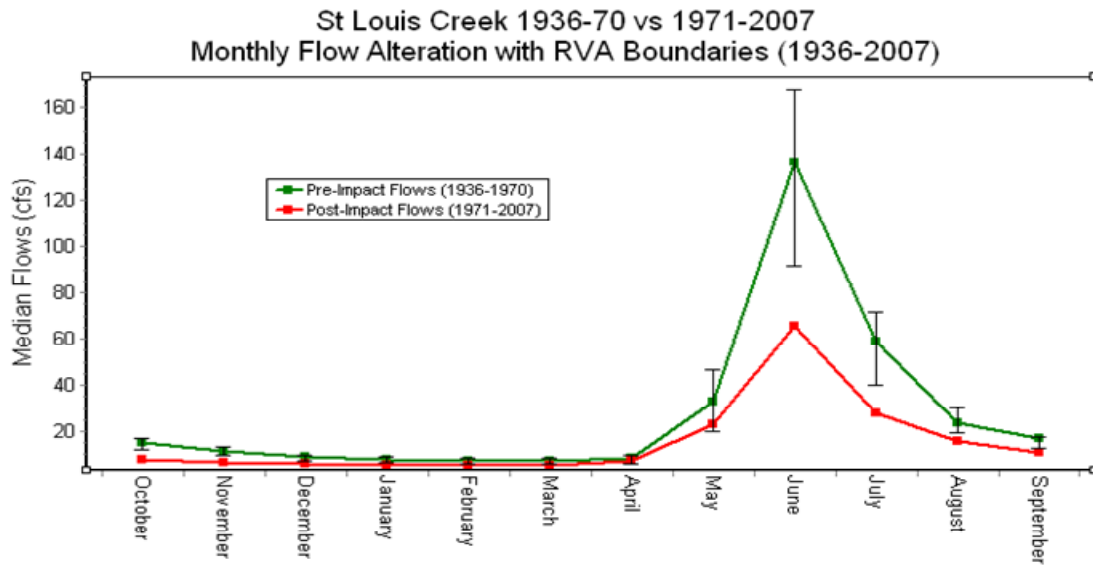
Parameter Group #1	Period of Analysis: 1936-2007 (72 years)					
	10%	25%	Period of Analysis		90%	(75-25)/50
			50%	75%		
October (cfs)	4.67	7.025	9.35	15	20.7	0.8529
November (cfs)	3.975	6.025	7.05	11.88	15	0.7452
December (cfs)	3.43	5.4	6.8	9.375	11.7	0.5846
January (cfs)	2.85	5.05	6.45	8	10	0.4574
February (cfs)	2.83	4.863	6.05	8	9.48	0.5186
March (cfs)	3.03	4.925	6.3	8	9.2	0.4881
April (cfs)	4.25	6.2	7.9	9.7	12.35	0.443
May (cfs)	11.3	15.25	25.5	42	63	1.049
June (cfs)	28.3	40.5	104.5	166.4	194.6	1.205
July (cfs)	16.3	26.25	39	69.5	96.4	1.109
August (cfs)	11.3	14	17	25	37	0.6471
September (cfs)	6.695	9.313	12.25	18	21.9	0.7092
Parameter Group #2						
1-day minimum (cfs)	2.33	4.1	5	6	7.4	0.38
3-day minimum (cfs)	2.33	4.2	5.067	6.183	7.523	0.3914
7-day minimum (cfs)	2.37	4.35	5.157	6.279	7.7	0.374
30-day minimum (cfs)	2.545	4.664	5.393	6.913	8.095	0.417
90-day minimum (cfs)	2.749	4.959	6.033	7.757	8.734	0.4636
1-day maximum (cfs)	47.2	129.3	197.5	263.8	330.4	0.681
3-day maximum (cfs)	45.6	123.1	189.8	251.6	318.5	0.6769
7-day maximum (cfs)	41.89	107.5	172.5	234.9	296	0.7385
30-day maximum (cfs)	34.31	64.58	113.8	180.6	232.3	1.02
90-day maximum (cfs)	27.82	38.99	63.21	105.5	128.6	1.053
Number of zero days (count)	0	0	0	0	0	0
Base flow index (7day minimum in cfs/median in cfs)	0.1131	0.1499	0.2318	0.305	0.3965	0.6689
Parameter Group #3						
Date of minimum (Julian day)	353.1	18.75	49.5	70	92	0.14
Date of maximum (Julian day)	153	161	172	175.8	184.4	0.0403
Parameter Group #4						
Low pulse count (#)	0	1	2.5	4	6	1.2
Low pulse duration (days)	1.4	3	7	18.25	69.4	2.179
High pulse count (#)	1	2	3	4	5.7	0.6667
High pulse duration (days)	1.5	2	9	38	84.8	4
Parameter Group #5						
Rise rate (cfs difference between consecutive days)	0.5	0.9	1	1.113	2	0.2125
Fall rate (cfs difference between consecutive days)	-1.85	-1	-1	-1	-0.5	0
Number of reversals	67.6	78	85	94	107.5	0.1882
EFC Monthly Low Flows						
October Low Flow (cfs)	6.21	7.175	8.825	15	18	0.8867
November Low Flow (cfs)	5	6.15	7.95	12	15	0.7358
December Low Flow (cfs)	5.2	5.9	7.3	9.6	12	0.5068
January Low Flow (cfs)	5	5.6	7	9	10	0.4857
February Low Flow (cfs)	4.73	5.2	6.325	8.125	9.67	0.4625
March Low Flow (cfs)	4.9	5.4	6.7	8.2	9.2	0.4179
April Low Flow (cfs)	5.61	6.6	7.9	9.35	11.9	0.3481
May Low Flow (cfs)	7.1	9.6	12	14.5	17.6	0.4083
June Low Flow (cfs)	12.4	14.5	18.5	19.5	20.6	0.2703
July Low Flow (cfs)	12	15	16	19.5	21	0.2813
August Low Flow (cfs)	9.51	12.38	15	18.5	21	0.4083
September Low Flow (cfs)	6.23	8.725	11	15.38	18	0.6045
EFC Parameters						
Extreme low peak (cfs)	2.305	3.038	3.6	3.8	3.9	0.2118
Extreme low duration (days)	1	2	5	37.63	122.1	7.125
Extreme low timing (Julian date)	211.8	286.1	341	26.13	44.55	0.2896
Extreme low freq. (#/year)	0	0	0	0	4	0
High flow peak (cfs)	15.5	18	23	25	41.5	0.3043
High flow duration (days)	2.5	3	5	12	27.5	1.8
High flow timing (Julian date)	111	153.5	220.5	251.5	274	0.2678
High flow frequency (#/year)	1	2	4	5	7.7	0.75
High flow rise rate (cfs difference between consecutive days)	1.917	2.5	3.733	4.25	5.25	0.4688
High flow fall rate (cfs difference between consecutive days)	-3.6	-2.779	-2	-1.314	-0.6212	-0.7325
Small Flood peak (cfs)	202	216	248	275	301	0.2379
Small Flood duration (days)	62	82.5	98	123.5	163	0.4184
Small Flood timing (Julian date)	155	166.5	172	175.5	181	0.02459
Small Flood freq. (#/year)	0	0	0	1	1	0
Small Flood riserate (cfs difference between consecutive days)	3.429	4.448	5.738	7.03	10.32	0.45
Small Flood fallrate (cfs difference between consecutive days)	-8.5	-6.296	-3.903	-2.597	-2.025	-0.9476
Large flood peak (cfs)	331	349	377	411	418	0.1645
Large flood duration (days)	59	59	90	133	153	0.8222
Large flood timing (Julian date)	162	170	174	180	185	0.02732
Large flood freq. (#/year)	0	0	0	0	0.7	0
Large flood riserate (cfs difference between consecutive days)	7.083	7.876	8.861	9.214	11.67	0.151
Large flood fallrate (cfs difference between consecutive days)	-21.5	-15.68	-7.089	-3.884	-3.266	-1.664

Reach F-StL
Non-Parametric IHA Scorecard
St Louis Creek near Fraser USGS 09026500
1936-70 vs 1971-2007

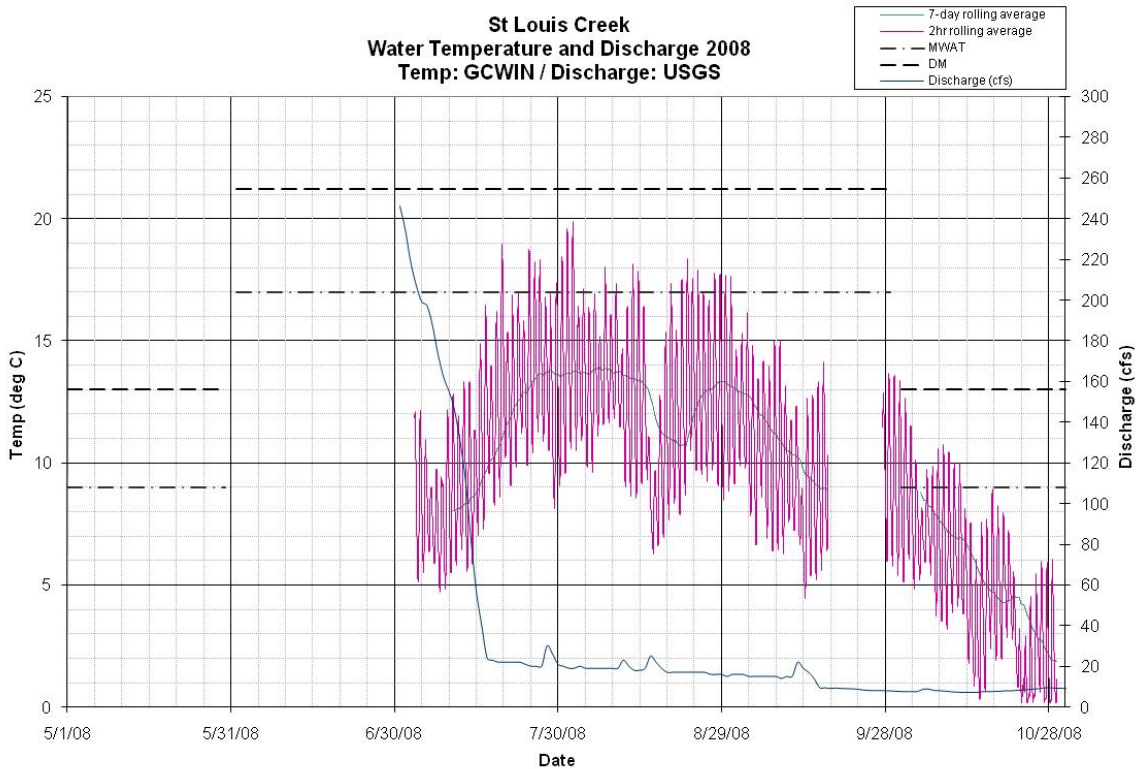
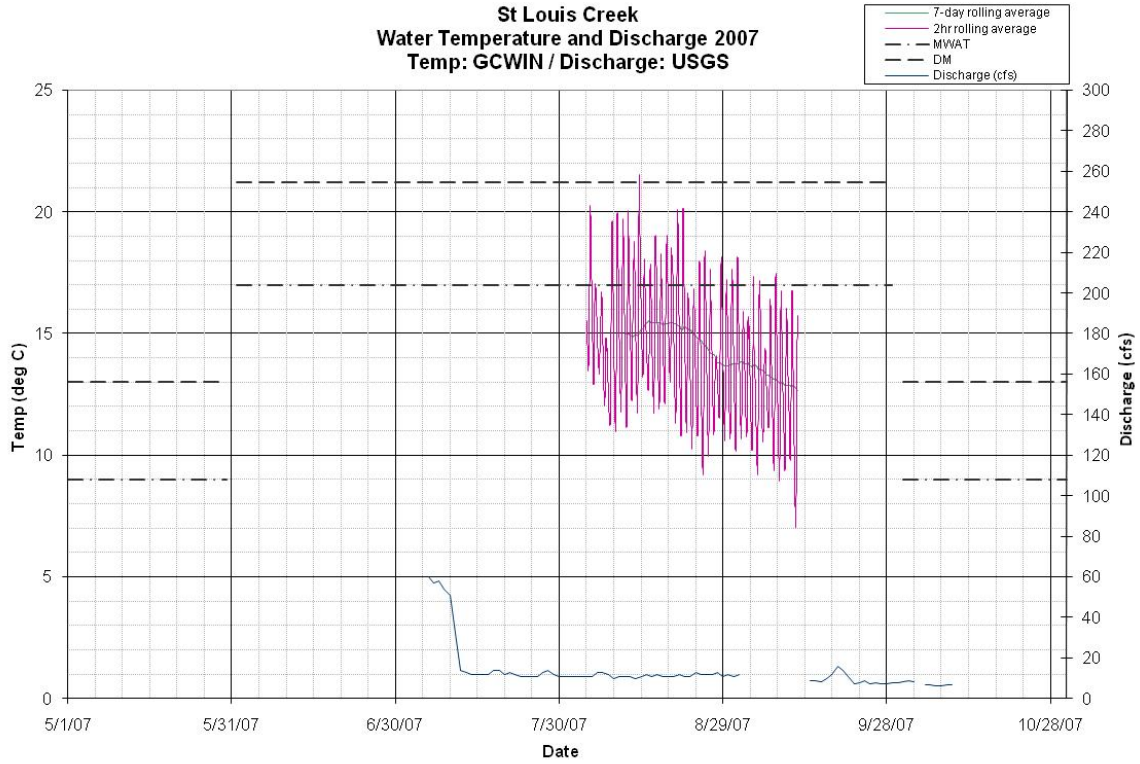
	Pre-impact period: 1936-1970 (35 years)		Post-impact period: 1971-2007 (37 years)					
Mean annual flow (cfs)	29.34		21.19					
Mean flow/area (dimensionless)	29.34		21.19					
Annual C. V.	1.55		1.91					
Flow predictability (%)	0.54		0.66					
Constancy/predictability	0.51		0.59					
% of floods in 60d period	0.62		0.63					
Flood-free season (days)	159		115					
	MEDIANS		COEFF. of DISP.		DEVIATION FACTOR		SIGNIFICANCE COUNT	
	Pre	Post	Pre	Post	Medians	C.D.	Medians	C.D.
Parameter Group #1								
October (cfs)	15	8	0.6267	0.3188	0.4667	0.4914	0.01201	0.02903
November (cfs)	11.5	6.8	0.8	0.2831	0.4087	0.6461	0.01001	0.03203
December (cfs)	9	6.2	0.7667	0.2903	0.3111	0.6213	0.01101	0.01001
January (cfs)	7.8	5.7	0.8205	0.2456	0.2692	0.7007	0.01602	0.02102
February (cfs)	7.5	5.6	0.7733	0.2232	0.2533	0.7114	0.01802	0.01301
March (cfs)	7.6	5.6	0.7632	0.2768	0.2632	0.6373	0.00	0.01602
April (cfs)	8.35	7.7	0.7665	0.3084	0.07784	0.5976	0.2272	0.04705
May (cfs)	33	23	1.152	0.7826	0.303	0.3204	0.1662	0.2302
June (cfs)	136.5	65.5	0.8901	1.542	0.5201	0.7324	0.09109	0.04004
July (cfs)	59	28	0.7797	0.9107	0.5254	0.1681	0.01401	0.5576
August (cfs)	24	16	0.8333	0.2188	0.3333	0.7375	0.004004	0.01902
September (cfs)	17	11	0.6088	0.325	0.3529	0.4662	0.004004	0.04004
Parameter Group #2								
1-day minimum (cfs)	5.7	4.8	0.8246	0.2396	0.1579	0.7094	0.04004	0.08509
3-day minimum (cfs)	6.133	4.867	0.7826	0.2158	0.2065	0.7243	0.005005	0.07407
7-day minimum (cfs)	6.171	4.971	0.7731	0.2213	0.1944	0.7138	0.007007	0.05606
30-day minimum (cfs)	6.497	5.2	0.784	0.2327	0.1996	0.7032	0.008008	0.04304
90-day minimum (cfs)	7.653	5.494	0.7153	0.2297	0.2821	0.6788	0.00	0.01301
1-day maximum (cfs)	202	191	0.6287	0.7408	0.05446	0.1783	0.6026	0.6647
3-day maximum (cfs)	197.3	170	0.6554	0.7627	0.1385	0.1638	0.3524	0.6777
7-day maximum (cfs)	181	153.4	0.6693	0.8063	0.1523	0.2047	0.3664	0.6006
30-day maximum (cfs)	146.3	94.7	0.6557	0.9217	0.3527	0.4056	0.0971	0.2082
90-day maximum (cfs)	91.91	50.61	0.6575	0.7045	0.4493	0.07145	0.02603	0.7217
Number of zero days (count)	0	0	0	0				
Base flow index (7day minimum in cfs/median in cfs)	0.1908	0.2701	0.5667	0.6345	0.4155	0.1196	0.007007	0.6917
Parameter Group #3								
Date of minimum (Julian day)	47	53	0.1557	0.1311	0.03279	0.1579	0.6737	0.5726
Date of maximum (Julian day)	172	172	0.05191	0.04372	0	0.1579	0.9449	0.6947
Parameter Group #4								
Low pulse count (#)	4	5	1	0.8	0.25	0.2	0.1071	0.6116
Low pulse duration (days)	8	5	1.688	2.1	0.375	0.2444	0.3213	0.5385
High pulse count (#)	2	2	1	1.25	0	0.25	0.1161	0.5375
High pulse duration (days)	36	24.5	1.694	1.551	0.3194	0.08464	0.3764	0.8398
The low pulse threshold is (cfs)	7.7							
The high pulse threshold is (cfs)	27							
Parameter Group #5								
Rise rate (cfs difference between consecutive days)	1	1	1	0.3	0	0.7	0.00	0.5025
Fall rate (cfs difference between consecutive days)	-1	-1	0	-0.2	0		0.00	
Number of reversals	88	85	0.1818	0.1824	0.03409	0.002941	0.5465	0.991

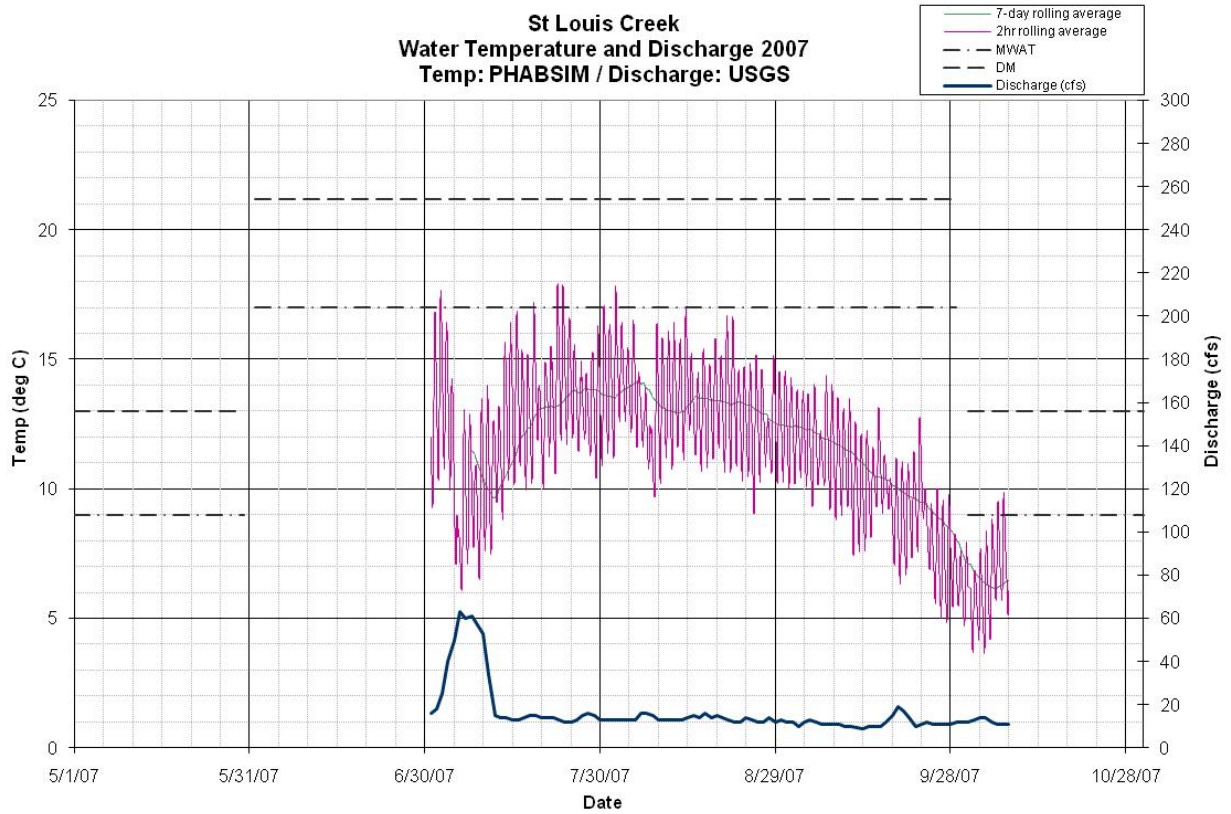
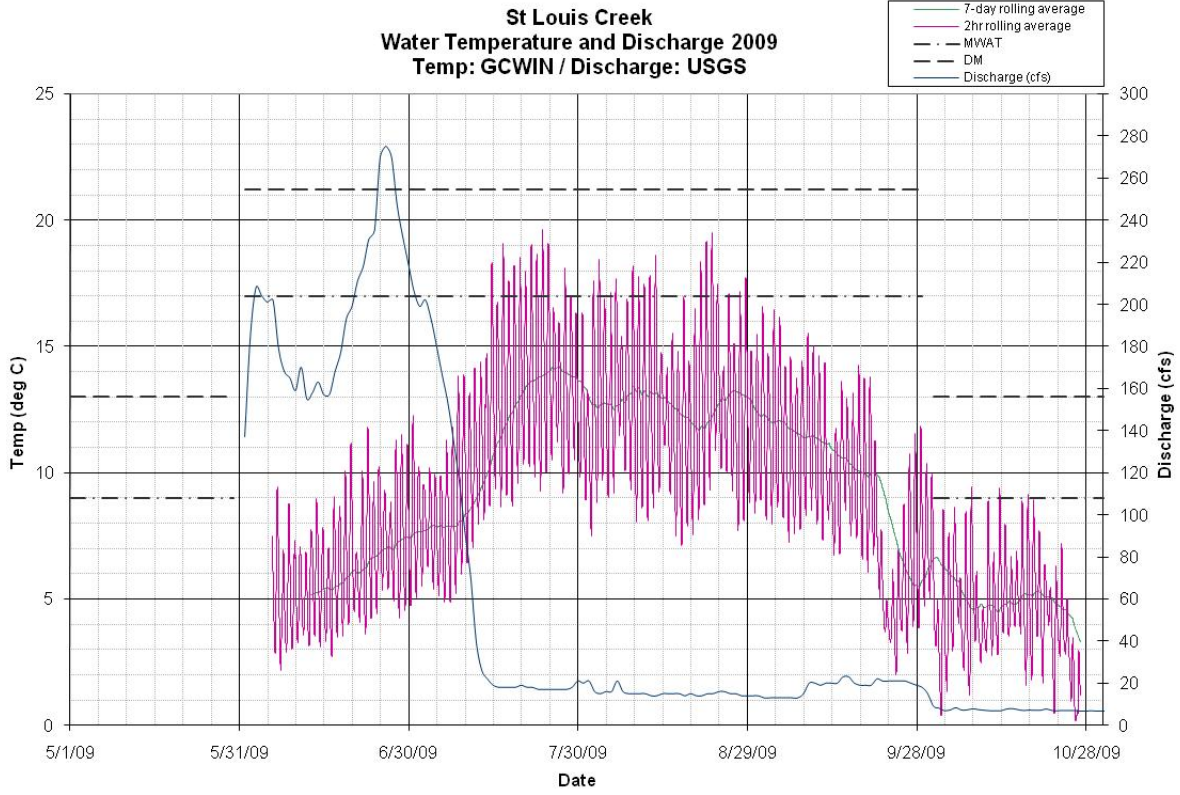
Reach F-STL
IHA Percentile Data
St Louis Creek near Fraser USGS 09026500
1936-70 vs 1971-2007

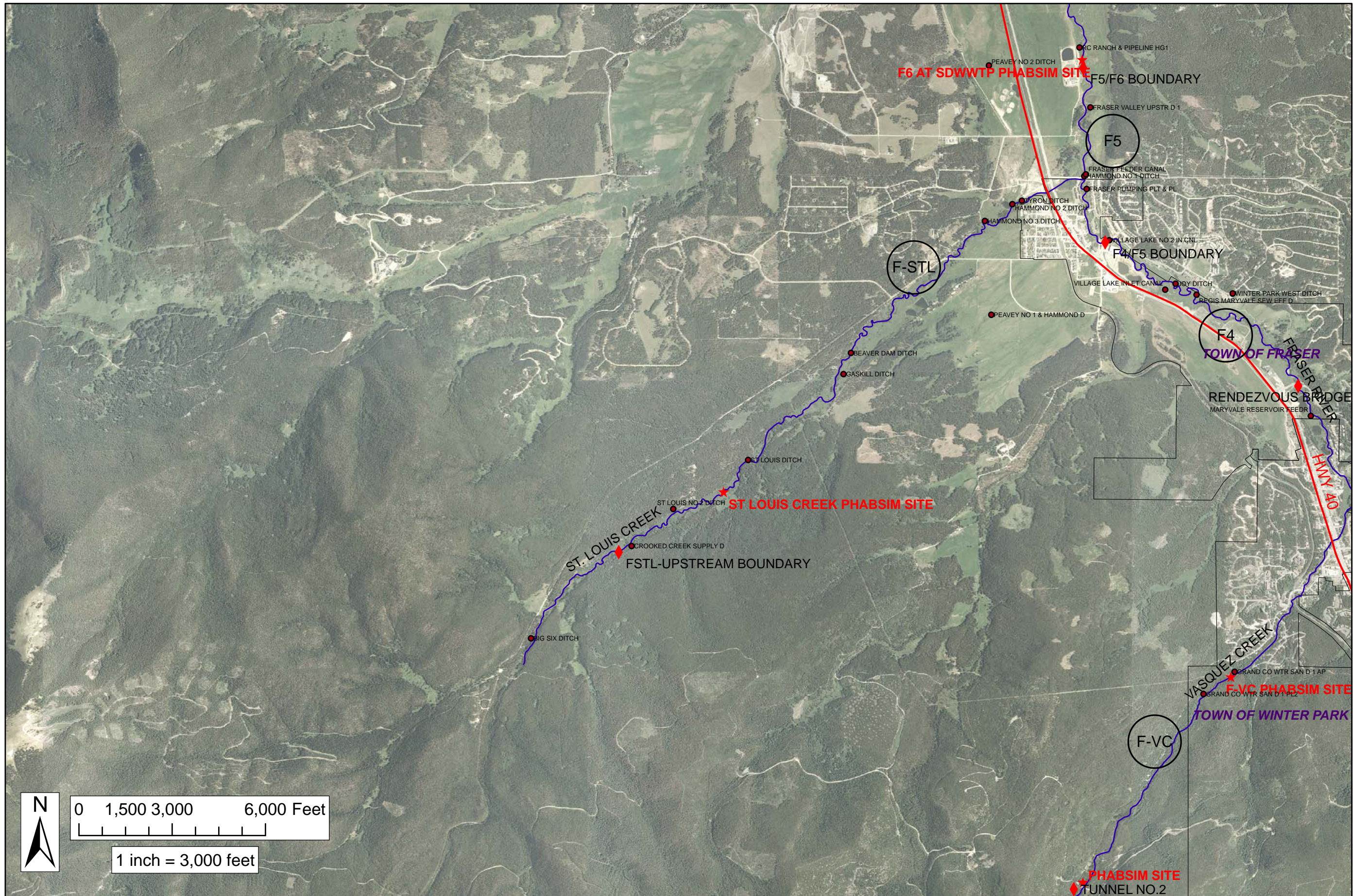
	Pre-impact period: 1936-1970 (35 years)					Post-impact period: 1971-2007 (37 years)						
	10%	25%	50%	75%	90%	(75-25)/50	10%	25%	50%	75%	90%	(75-25)/50
Parameter Group #1												
October (cfs)	3.78	7.6	15	17	21.4	0.6267	6.28	6.9	8	9.45	12.6	0.3188
November (cfs)	3.45	5.8	11.5	15	16	0.8	5.48	6.05	6.8	7.975	9.3	0.2831
December (cfs)	2.92	4.1	9	11	13	0.7667	5.08	5.4	6.2	7.2	8.42	0.2903
January (cfs)	2.46	3.6	7.8	10	11	0.8205	4.82	5.2	5.7	6.6	8.04	0.2456
February (cfs)	2.73	3	7.5	8.8	10	0.7733	4.58	5	5.6	6.25	7.2	0.2232
March (cfs)	2.52	3.2	7.6	9	9.48	0.7632	4.6	5.1	5.6	6.65	7.72	0.2768
April (cfs)	3.58	5.6	8.35	12	14.4	0.7665	5.85	6.65	7.7	9.025	11.1	0.3084
May (cfs)	11	16	33	54	79.4	1.152	13	15	23	33	44.2	0.7826
June (cfs)	34.1	50.5	136.5	172	200.2	0.8901	20.8	37	65.5	138	206.6	1.542
July (cfs)	31.8	37	59	83	110.8	0.7797	14.6	17.5	28	43	81.4	0.9107
August (cfs)	9.04	16	24	36	49.2	0.8333	11.8	14	16	17.5	25	0.2188
September (cfs)	4.42	8.65	17	19	27.7	0.6088	8.38	9.425	11	13	18.1	0.325
Parameter Group #2												
1-day minimum (cfs)	2.12	2.5	5.7	7.2	7.88	0.8246	3.9	4.3	4.8	5.45	5.92	0.2396
3-day minimum (cfs)	2.12	2.6	6.133	7.4	7.92	0.7826	4.133	4.433	4.867	5.483	5.947	0.2158
7-day minimum (cfs)	2.171	2.686	6.171	7.457	8.12	0.7731	4.226	4.521	4.971	5.621	6.114	0.2213
30-day minimum (cfs)	2.407	2.917	6.497	8.01	8.807	0.784	4.46	4.692	5.2	5.902	6.703	0.2327
90-day minimum (cfs)	2.672	3.237	7.653	8.711	9.406	0.7153	4.625	5.054	5.494	6.317	7.438	0.2297
1-day maximum (cfs)	52.6	136	202	263	328	0.6287	37.8	126.5	191	268	346.4	0.7408
3-day maximum (cfs)	46.6	122.5	197.3	251.3	304.2	0.6554	34.33	123.2	170	252.8	330.3	0.7627
7-day maximum (cfs)	44	116.1	181	237.3	288.8	0.6693	32.29	102.1	153.4	225.8	316.3	0.8063
30-day maximum (cfs)	39.37	88.9	146.3	184.8	237.8	0.6557	25.63	58.17	94.7	145.5	230.6	0.9217
90-day maximum (cfs)	31.22	51.89	91.91	112.3	133.8	0.6575	21.09	35.43	50.61	71.08	117.2	0.7045
Number of zero days (count)	0	0	0	0	0	0	0	0	0	0	0	0
Base flow index (7day minimum in cfs/median in cfs)	0.1002	0.1341	0.1908	0.2423	0.3168	0.5667	0.1296	0.1781	0.2701	0.3495	0.4481	0.6345
Parameter Group #3												
Date of minimum (Julian day)	360.6	18	47	75	96	0.1557	339.8	17	53	65	95	0.1311
Date of maximum (Julian day)	152	157	172	176	180.6	0.05191	153	161	172	177	190.4	0.04372
Parameter Group #4												
Low pulse count (#)	0	1	4	5	9.2	1	1.8	3	5	7	9.2	0.8
Low pulse duration (days)	1	2	8	15.5	52.3	1.688	1.4	2.5	5	13	52.7	2.1
High pulse count (#)	1	1	2	3	4	1	1	1.5	2	4	5.2	1.25
High pulse duration (days)	2.3	4	36	65	97.4	1.694	2.6	4	24.5	42	68.2	1.551
Parameter Group #5												
Rise rate (cfs difference between consecutive days)	0.6	1	1	2	2.04	1	0.4	0.7	1	1	1.03	0.3
Fall rate (cfs difference between consecutive days)	-2	-1	-1	-1	-0.56	0	-1	-1	-1	-0.8	-0.4	-0.2
Number of reversals	72	78	88	94	103.4	0.1818	61.2	78	85	93.5	111.2	0.1824
EFC Monthly Low Flows												
October Low Flow (cfs)	3.95	8.25	14	17	20	0.625	6.28	6.9	7.75	9.375	11.8	0.3194
November Low Flow (cfs)	3.6	4.8	11	14.5	16	0.8818	5.48	6.05	6.8	7.975	9.3	0.2831
December Low Flow (cfs)	3.3	4.1	9.15	11	13	0.7541	5.08	5.4	6.2	7.2	8.42	0.2903
January Low Flow (cfs)	3.65	7.425	8.25	10	11	0.3121	4.97	5.2	5.7	6.6	8.06	0.2456
February Low Flow (cfs)	3.45	7.05	8	9.1	10	0.2563	4.6	5.025	5.6	6.275	7.3	0.2232
March Low Flow (cfs)	3.2	6.025	7.9	9	9.54	0.3766	4.74	5.2	5.65	6.725	7.78	0.2699
April Low Flow (cfs)	3.6	5.8	8.35	10	12.7	0.503	5.85	6.5	7.7	9.025	10.6	0.3279
May Low Flow (cfs)	9	10.4	13.5	19.5	25.5	0.6741	6.86	9.55	12	15.5	22	0.4958
June Low Flow (cfs)	13	13.75	18.75	21.5	26	0.4133	12.9	17.75	21	24	24.7	0.2976
July Low Flow (cfs)	12	18	23	26.5	27	0.3696	12	16	20	23	26	0.35
August Low Flow (cfs)	7.6	14	20	23	26	0.45	11.8	13.5	15	17	20.3	0.2333
September Low Flow (cfs)	4.16	6.8	16	19	24.7	0.7625	7.68	9.3	11	12	18.2	0.2455
EFC Parameters												
Extreme low peak (cfs)	2.22	2.5	2.7	2.9	2.98	0.1481	2.2	2.2	2.2	2.2	2.2	0
Extreme low duration (days)	1	5.5	14	63	102	4.107	1	1	1	1	1	104
Extreme low timing (Julian date)	345.6	358	27	61.5	83.2	0.1899	22	22	22	22	22	22
Extreme low freq. (#/year)	0	0	0	1	4.8	0	0	0	0	0	0	0
High flow peak (cfs)	17	23	26	31	39	0.3077	17	18.75	23.5	33	74.75	0.6064
High flow duration (days)	3	3	4.75	9.625	41	1.395	2	2.75	4	7.25	36.25	1.125
High flow timing (Julian date)	109	123.9	171.5	234.5	268	0.3023	164.3	191.5	219.8	239.6	262	0.1315
High flow frequency (#/year)	1	2	3	5	6.4	1	0.8	2	3	6	8	1.333
High flow rise rate (cfs difference between consecutive days)	2.066	2.688	4	5	6.273	0.5781	2.725	3.973	5	6.459	9.875	0.4971
High flow fall rate (cfs difference between consecutive days)	-3.075	-2.75	-2	-1.333	-0.7594	-0.7083	-5.863	-3.972	-3.072	-2.241	-1.536	-0.5633
Small Flood peak (cfs)	202	212.5	244.5	274.5	304.9	0.2536	210.2	217	260	272	290.4	0.2115
Small Flood duration (days)	58.8	87.5	102	126.3	138.3	0.3799	37	51	64	83	92.4	0.5
Small Flood timing (Julian date)	154.1	160	171	174	176.3	0.03825	154.6	166	172	175	184.2	0.02459
Small Flood freq. (#/year)	0	0	0	1	1	0	0	0	0	1	1	0
Small Flood riserate (cfs difference between consecutive days)	3.344	4.332	5.832	8.645	13.04	0.7396	4.496	5.706	7.026	7.32	12.11	0.2297
Small Flood fallrate (cfs difference between consecutive days)	-9.622	-4.155	-3.484	-2.702	-2.123	-0.417	-16.83	-14	-9.773	-4.773	-4.256	-0.9442
Large flood peak (cfs)	349	349	355	377	377	0.07887	329	330	408	414.5	418	0.2071
Large flood duration (days)	56	56	113	133	133	0.6814	55	65	79	87	90	0.2785
Large flood timing (Julian date)	162	162	173	185	185	0.06284	170	172	174	179.5	180	0.02049
Large flood freq. (#/year)	0	0	0	0	0.4	0	0	0	0	0	1	0
Large flood riserate (cfs difference between consecutive days)	8.049	8.049	8.75	9.054	9.054	0.1149	6.702	7.289	8.861	10.62	11.67	0.3762
Large flood fallrate (cfs difference between consecutive days)	-16.1	-16.1	-4.493	-3.723	-3.723	-2.755	-24.06	-19.87	-8	-7.045	-7	-1.603



Surface Water Temperature Plots







GRAND COUNTY
STREAM MANAGEMENT PLAN
REACHES

Legend

- ◆ REACH BOUNDARY
- ★ PHABSIM SITES
- DIVERSIONS

REACH: F-STL
SHEET # :
1 OF 1

