CR5 Stream Reach Summary

Study Reach: CR5, Colorado River - Williams Fork confluence downstream to the KB Ditch.

Reach Description: Approximate channel length: 6.75 miles, approximate channel slope 0.3%.

This portion of the Colorado River lies entirely within the State designated Gold Medal fishery, which spans from Fraser River to Troublesome Creek. Troublesome Creek is located immediately downstream of CR5. Along this reach, there are numerous public access points to the river that are heavily utilized by both private and commercial fisherman. Most of these access points and the fishery itself are managed by the CDOW. Reeder Creek confluences with the Colorado River in the downstream portion of this reach. The source of Reeder Creek flows are predominately return flows from Big Lake Ditch.

The channel is wide and shallow with gentle longitudinal slopes. The channel banks immediate adjacent to the river exhibit healthy vegetation stands including willows, sedges and cottonwood canopies. Agricultural land uses dominate the overbanks, just beyond the cottonwood canopy. Algae were observed in the summer of 2007, but not to the same extent observed in the upstream reaches between Windy Gap and Hot Sulphur Springs.

Fishing access downstream of Williams Fork and Parshall

From overlook at "Breeze Unit" fishing access looking at constructed wetlands (gravel pit restoration)

Flow Recommendations:

***Environmental Flow Methodology*:** A PHABSIM study site was established at the downstream end of this reach during summer 2007. See Appendix A for methodology and Appendix E for PHABSIM survey information. In addition, in 2006 Miller Ecological Consultants, Inc. established a site at the upstream end of the reach in the Kemp/Breeze State Wildlife Park. The data were provided through the Northern Colorado Water Conservation District (Miller, 2007). The recommended environmental flow ranges presented below are derived using both sets of data. CWCB instream flows have also been set.

Water Users:

- Irrigators, municipalities and industry flow-related issues:
  - The KB ditch, a headgate diversion located on the downstream end of this reach, generally functions adequately unless the river is exceptionally low. Headgates in the area at and above KB are generally functional but sometimes require reworking the river to get the water (Thompson 2007).
  - Transfer of irrigation rights to Denver Water, tentatively scheduled to occur in 2010, will reduce flows in Reeder Creek and the Colorado River. These flows are substantial and appear to offset some flow diverted by KB ditch.
  - Recreation: angling is the dominant form of recreation in this reach.

Summary of Flows:

<u>Environmental, recommended flow ranges</u>

- 250 to 500 cfs, April through September
- 150 to 250 cfs, October through March
- Flushing flow, at least 800 cfs for a 3-day duration with a frequency of 1 in 2 years during the late May to late June period.

CWCB Flows

- 135 cfs year round (1/1 – 12/31)

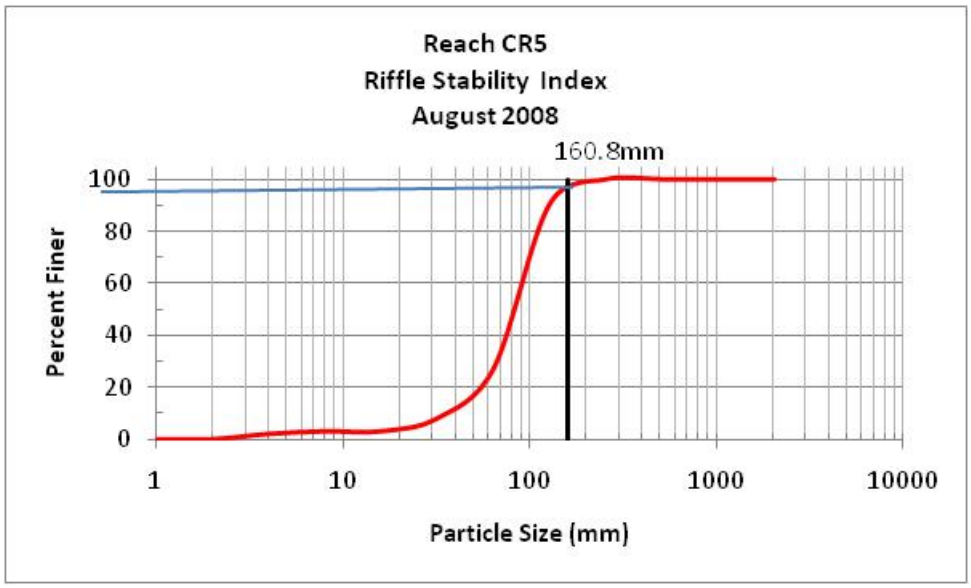
Water Users:

- Irrigators, municipalities and industry: The local diversions in this reach could potentially divert up to approximately 115 cfs. Most of the diversions are made in the summer for irrigation and will likely have some return flows. The KB ditch is included in this total.
- Recreation:
  - Angling: 60-300 cfs

Stream Assessments: In August 2008 Tetra Tech conducted three stream assessments in CR5. 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 high end of the 'suboptimal' category and the RSI of 97 indicates the riffle substrate is highly unstable with up to 97% of the particles mobilized during recent high flow events. Relevant issues revealed in the stream assessments include excessive fine sediment deposition in moderate to low velocity areas and occasional low flow. Results of the assessments are summarized in the following table and plot. Details and methodology are presented in Appendix A.

Reach CR5
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	18
2	Mass wasting hazard	3	2	Aquatic Structure as Cover	12
3	Debris Jam Potential	4	3	Velocity/ Depth Regimes	16
4	Vegetation Cover	6	4	Channel Flow Status	15
	Upper Bank Score:	**15**	5	Channel Alteration	15
Lower Banks			6	Frequency of Riffles	16
5	Channel Capacity	4	7	Channel Sinuosity	8
6	Bank Rock Content	7		**Channel Score**	**100**
7	Flow obstructors & Deflectors	3	**Banks**		
8	Cutting	4	8	Bank Stability	18
9	Deposition	4	9	Riparian Vegetation Cover and Disturbance	16
	Lower Bank Score:	**22**	10	Riparian Vegetation zone width	16
Channel Bottom				**Bank Score**	50
10	Rock Angularity	3		**Total Score**	**150**
11	Brightness	2	**Notes**		
12	Consolidation/Particle Packing	4			
13	Bottom size distribution	8			
14	Bed Scour and Deposition	12			
15	Clinging Aquatic Veg	3			
	Channel Bottom Score:	**32**			
	Total Score:	**69**			



Spawning Observations: A trout spawning survey was conducted in CR5 on 30 October 2008. An important spawning bar was located in mid-channel just downstream from Parshall, with numerous adult brown trout actively spawning. Thirteen completed redds were identified and measured. We recommend a surveyed cross-section be established across this spawning bar for monitoring purposes. This cross section can also be used to supplement flushing flow analysis in CR5.

Hydrologic Records: No USGS streamflow records are available for this reach. Northern has operated a seasonal gage station near Parshall since 1992. These records suggest the recommended environmental flow ranges are quite commonly present within the reach, at least over the summer period.

Water Temperature: CR5 is a Tier II stream reach as designated by CDPHE with a chronic temperature standard of 18.2°C MWAT and an acute temperature standard of 23.8°C DM. Temperature data reviewed in reach CR5 indicate stream temperatures for the Colorado River in this area are generally below the MWAT and DM standards. However, some exceedences have occurred and resulted in placement of this reach on the 303 (d) list of impaired waters for temperature, with a high priority.

Water Quality: No water quality concerns were noted from the available data.

Water Supply Issues (UPCO): UPCO reports that flows in this reach are generally adequate under current conditions, with occasional shortages under future conditions; however, the UPCO user tool indicates low flows are now and will continue to be slightly below the CWCB ISF.

Summary of Results and Additional Remarks:

1. Recommended environmental flow ranges are quite commonly present within the reach, at least over the summer period.
2. The stream assessments indicate excessive fine sediment deposition in some areas and occasional low flow.
3. Onsite observations indicate isolated stream bed manipulation to facilitate irrigation diversions.
4. CR5 is currently on the proposed 303(d) list, with high priority.
5. Flows for recreation are generally adequate except late summer low flows that are believed to be impacting the fisheries. There is little float boating in CR5 due to limited access and low flows.

6. This reach is within a designated Gold Medal Waters for fishing by the Colorado Wildlife Commission. This reach also has significant bald eagle and river otter habitat.
7. As with CR 4, trout in this reach have been impacted by whirling disease along with elevated water temperatures both of which are believed to be exasperated by the warm, nutrient rich environment of Windy Gap located upstream. It is likely that cool water releases from Williams Fork Reservoir help the temperatures and water quality in this reach, as compared to CR4. Ongoing studies of TAM production and introduction of whirling disease resistant rainbow trout are two efforts concurrently ongoing to increase the rainbow trout populations (TU 2004).
8. 2007 brown trout population estimates in the upper end of the reach indicate a density of over 7700 trout > 6"/mile and over 290 trout > 14"/mile (Jon Ewert, 2008). Brown trout comprise over 99 percent of the population.
9. Reeder Creek currently provides irrigation return flows from Big Lake Ditch into lower CR5. It is possible that operations of Big Lake Ditch will change in the near future. The timing and volume of these important late season return flows could be negatively affected. Additional study may be of value.
10. CDOW indicates that there is a stretch of the river downstream of the Breeze Unit that appears excessively wide and very shallow, often preventing fish movement through the shallow reach. CDOW would like to see restoration in this area. (Pers. Comm., Jon Ewert, CDOW, 2008).
11. Review of future flow conditions as depicted by Denver Water's PACSM model indicate that the late summer flows, flushing flows and winter base flows, without flow enhancements or restoration, may be occasionally lower than target ranges in this reach.

Restoration Opportunities: Proposed flow enhancement and flushing flow recommendations made for CR4 will provide direct benefits in CR5 as well. Additional opportunities include the following:

- ✓ Increase aquatic cover with 'cover and pool' structures and construct channel bar enhancements to narrow the low flow channel. See Appendix F for details.

- ✓ Inspect headgates at irrigation diversions and replace as needed where stream bed manipulation is currently required to maintain adequate headwater.

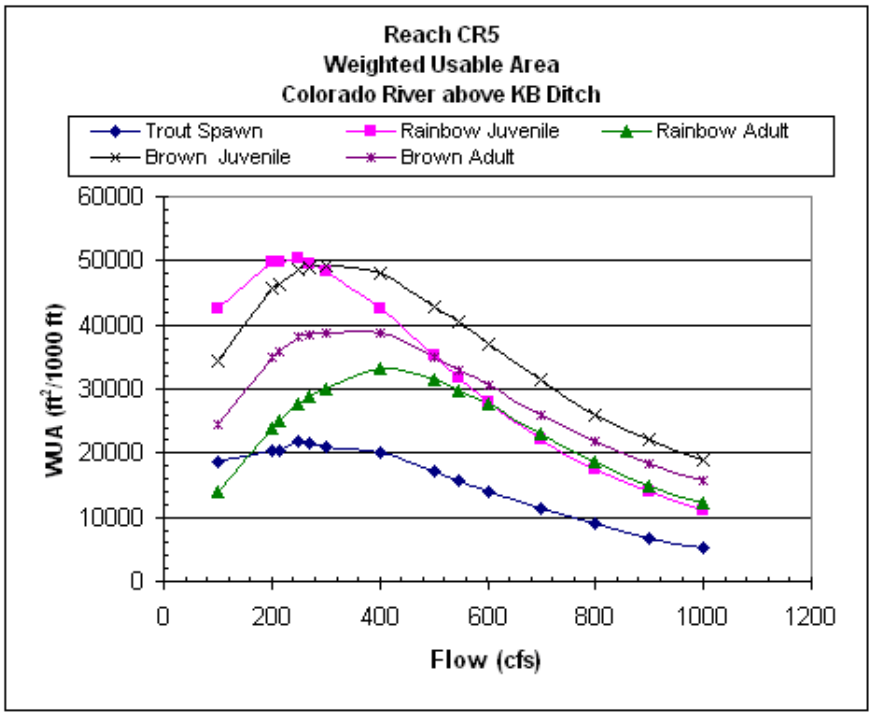
Monitoring: Establish and implement a monitoring program. Parameters should include streamflow; water quality; air temperature; intergravel fine sediments; fish population and diversity; and benthic macro invertebrates. Continue to monitor surface water temperatures. Monitor recreational use, particularly angling.

Support Data

Weighted Useable Area Plots and Tables

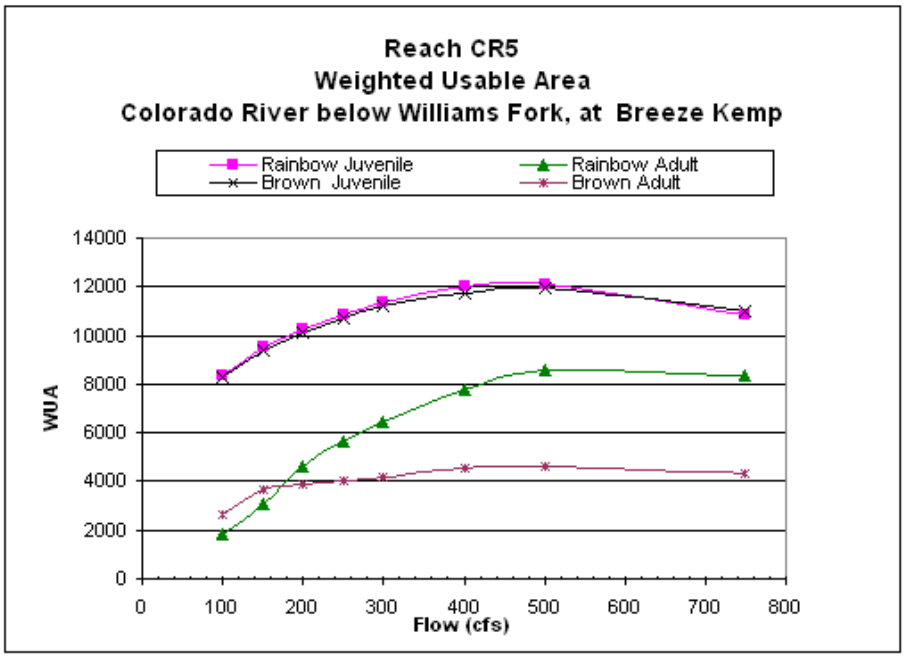
Habitat-flow relations for the target species and life stages for Reach C5, Tetra Tech site.

Reach CR5						
Discharge	Total Area	Trout Spawn	Rainbow Juvenile	Rainbow Adult	Brown Juvenile	Brown Adult
(cfs)	(ft^2)	Weighted Usable Area (ft^2/1000 ft stream length)				
100.0	54436.8	18678.3	42446.4	13901.1	34364.4	24469.2
200.0	59742.0	20254.0	49819.7	24007.3	45661.4	34949.1
214.0	62980.4	20264.7	49800.5	25074.1	46393.1	35701.5
250.0	64555.5	21703.7	50274.3	27789.7	48569.6	38103.0
270.0	65479.9	21417.9	49615.5	28901.4	48990.7	38561.4
300.0	67144.3	20893.1	48387.1	30062.3	49228.4	38843.3
400.0	67354.7	20042.6	42590.9	33152.5	48018.2	38877.2
500.0	68146.0	17101.5	35120.4	31407.2	42703.3	35022.4
547.0	69107.7	15680.8	31722.1	29748.8	40357.1	32927.7
600.0	69986.2	14113.5	28101.2	27534.4	37098.5	30464.7
700.0	70850.8	11327.7	22192.8	22951.9	31350.6	25945.6
800.0	116387.8	8896.4	17602.9	18590.0	25934.1	21884.1
900.0	72783.2	6794.2	14032.3	14986.5	22130.4	18491.1
1000.0	73191.5	5143.1	11115.0	12111.7	18921.7	15721.3

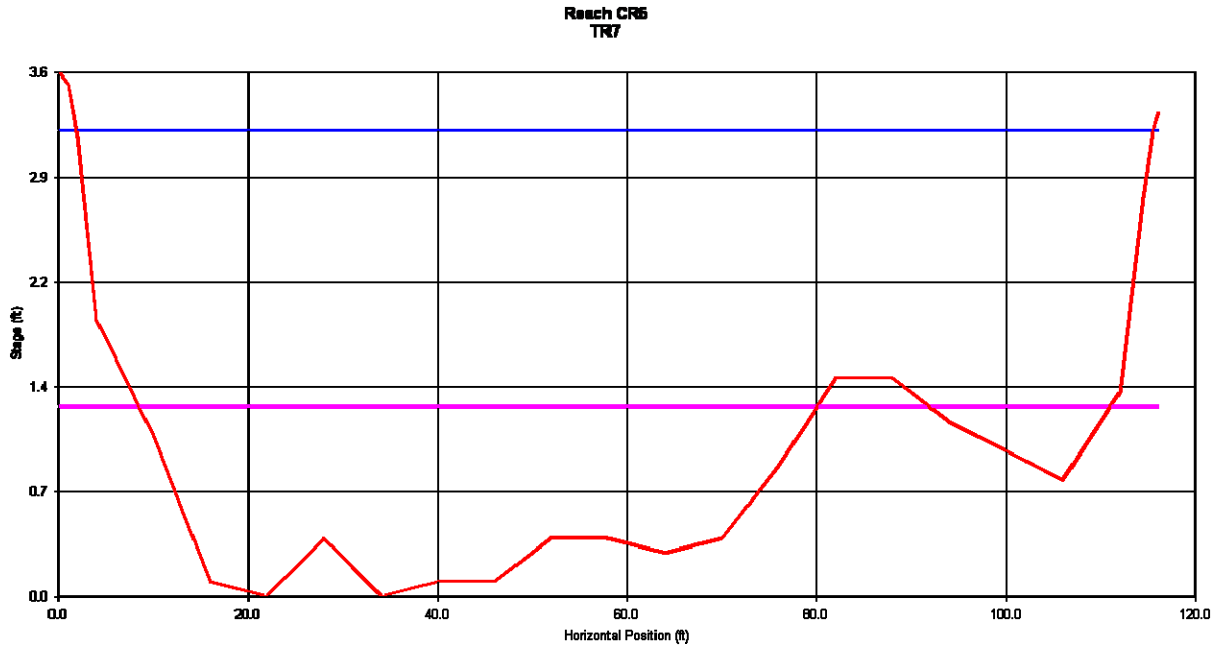


Habitat-flow relations for the target species and life stages for Reach C5, from Miller Ecological Consultants River 2D data.

CR5						
Discharge	Total Area	Trout Spawn	Rainbow Juvenile	Rainbow Adult	Brown Juvenile	Brown Adult
(cfs)	(ft^2)	Weighted Usable Area				
100			8391	1855	8265	2649
150			9507	3054	9373	3643
200			10228	4648	10133	3902
250			10851	5669	10730	4040
300			11358	6476	11210	4203
400			12032	7754	11760	4516
500			12081	8593	11913	4639
750			10877	8380	10976	4306



Transect and Bedload Threshold Plots and Tables

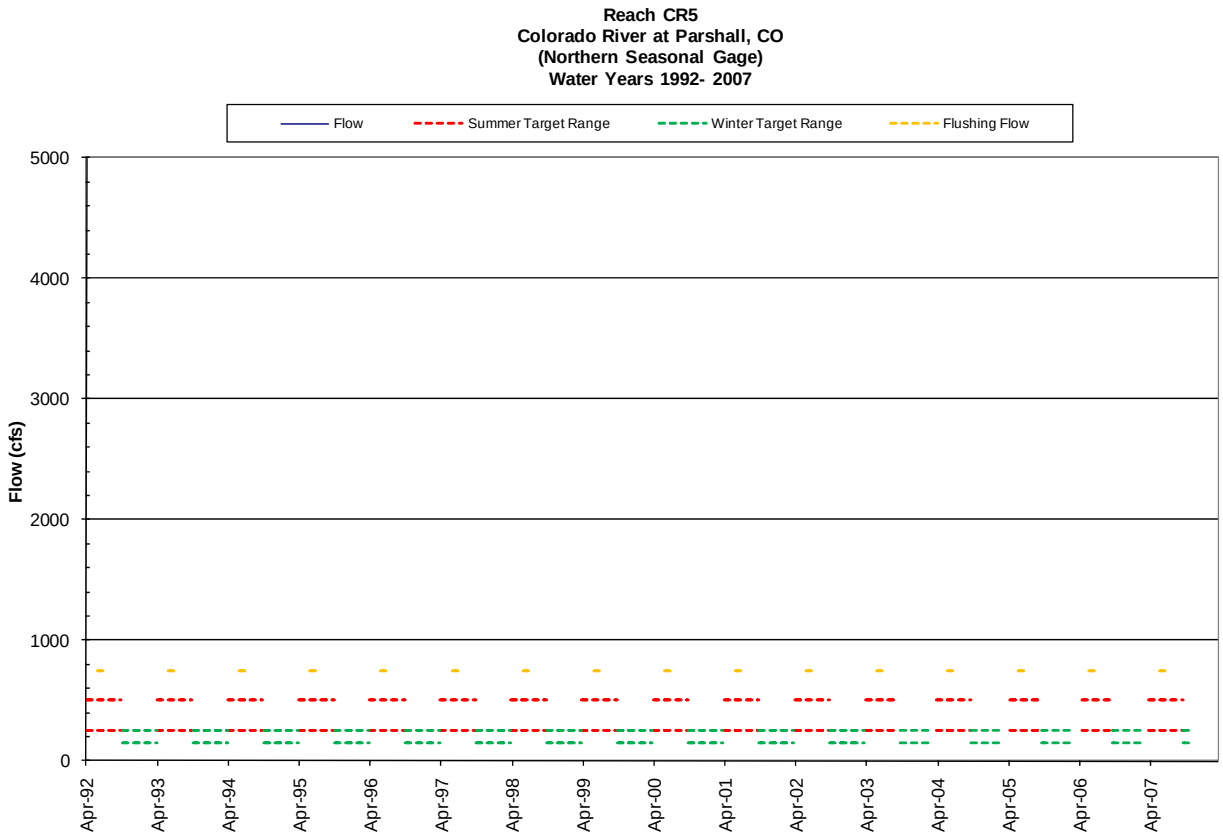


Reach CR5, TR7
TT2007 site

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)
1.3	67.10	84.71	84.50	0.79	0.79	0.001	0.029	1.37	92.0	0.05
1.4	75.79	89.47	89.25	0.85	0.85	0.001	0.029	1.45	109.8	0.05
1.5	84.91	93.45	93.18	0.91	0.91	0.001	0.029	1.54	130.4	0.06
1.6	94.27	94.42	94.12	1.00	1.00	0.001	0.028	1.66	156.6	0.06
1.7	103.73	95.39	95.06	1.09	1.09	0.001	0.028	1.78	185.0	0.07
1.8	113.28	96.36	96.00	1.18	1.18	0.001	0.028	1.90	215.5	0.07
1.9	122.93	97.33	96.93	1.26	1.27	0.001	0.027	2.02	248.2	0.08
2.0	132.64	97.73	97.28	1.36	1.36	0.001	0.027	2.14	284.3	0.08
2.1	142.38	98.13	97.63	1.45	1.46	0.001	0.027	2.27	322.5	0.09
2.2	152.16	98.53	97.97	1.54	1.55	0.001	0.026	2.39	363.0	0.10
2.3	161.98	98.93	98.32	1.64	1.65	0.001	0.026	2.50	405.6	0.10
2.4	171.83	99.33	98.67	1.73	1.74	0.001	0.026	2.62	450.4	0.11
2.5	181.71	99.73	99.01	1.82	1.84	0.001	0.026	2.74	497.3	0.11
2.6	191.63	100.13	99.36	1.91	1.93	0.001	0.025	2.85	546.2	0.12
2.7	201.58	100.53	99.71	2.01	2.02	0.001	0.025	2.96	597.3	0.13
2.8	211.57	100.95	100.07	2.10	2.11	0.001	0.025	3.07	650.3	0.13
2.9	221.60	101.38	100.46	2.19	2.21	0.001	0.025	3.18	705.3	0.14
3.0	231.66	101.81	100.84	2.28	2.30	0.001	0.025	3.29	762.3	0.14
3.1	241.77	102.25	101.22	2.36	2.39	0.001	0.025	3.40	821.4	0.15
3.2	251.91	102.76	101.69	2.45	2.48	0.001	0.024	3.50	881.8	0.15

Hydrographs and Exceedence Plots



IHA Results

Reach CR5
Non-Parametric IHA Scorecard
Colorado River at Parshall (Northern seasonal)
Season from Julian date 92.to 274. (April 1 through Sept 30)

Period of Analysis: 1992-2007 (16 years)

Mean annual flow (cfs)	554.9
Mean flow/area (dimensionless)	554.9
Annual C. V.	1.09
Flow predictability (%)	0.52
Constancy/predictability	0.75
% of floods in 60d period	0.72
Flood-free season (days)	45

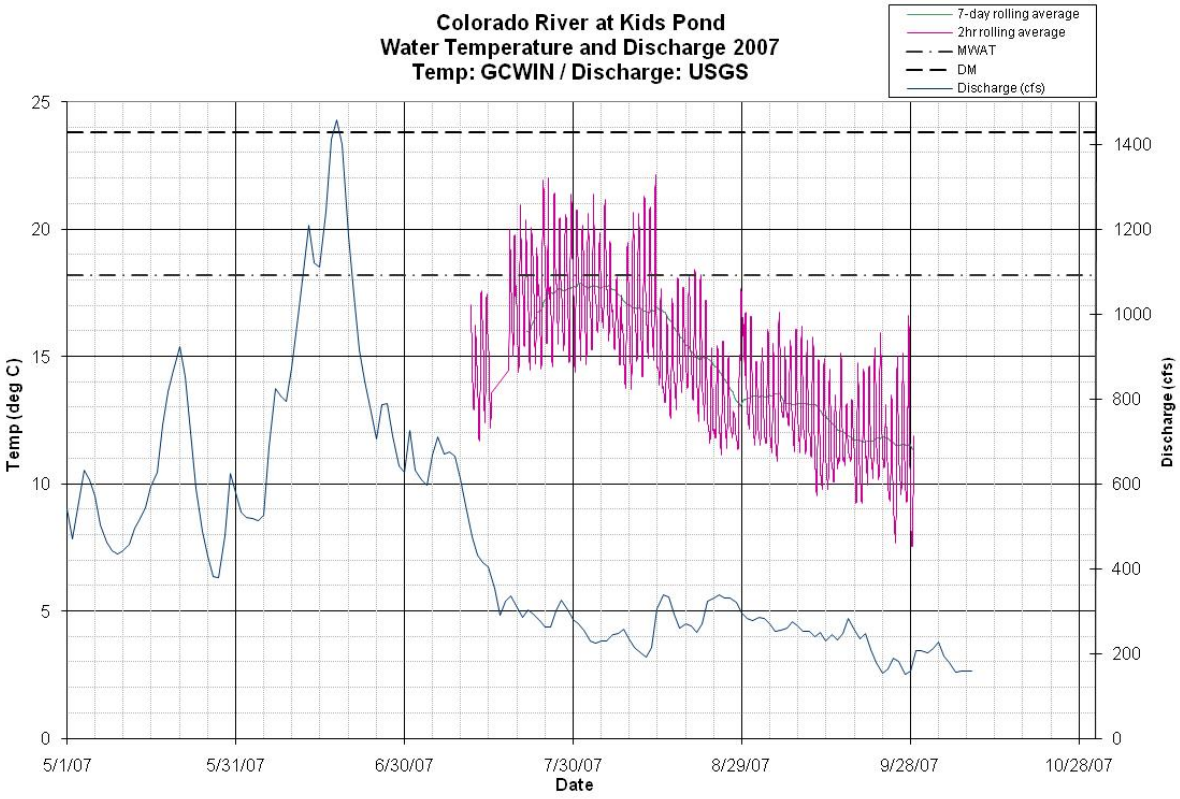
	Medians	**Coeff. of Disp.**
Parameter Group #1		
October (cfs)		
November (cfs)		
December (cfs)		
January (cfs)		
February (cfs)		
March (cfs)		
April (cfs)	344.5	0.9108
May (cfs)	540	1.3
June (cfs)	665	1.745
July (cfs)	390	0.5647
August (cfs)	312.5	0.3176
September (cfs)	266.3	0.3319
Parameter Group #2		
1-day minimum (cfs)	158	0.625
3-day minimum (cfs)	160	0.6596
7-day minimum (cfs)	163.9	0.6612
30-day minimum (cfs)	235.9	0.3612
90-day minimum (cfs)	327.1	0.5066
1-day maximum (cfs)	1539	0.9223
3-day maximum (cfs)	1511	0.9281
7-day maximum (cfs)	1349	1.08
30-day maximum (cfs)	890.3	1.202
90-day maximum (cfs)	621	1.188
Number of zero days (count)	0	0
Base flow index (7day minimun in cfs/median in cfs)	0.3543	0.4014
Parameter Group #3		
Date of minimum (Julian day)	227	0.3982
Date of maximum (Julian day)	172.5	0.0806
Parameter Group #4		
Low pulse count (#)	3	1.417
Low pulse duration (days)	5.5	1.455
High pulse count (#)	2	1.375
High pulse duration (days)	5.5	4.955
The low pulse threshold is (cfs)	249.9	
The high pulse threshold is (cfs)	595.8	
Parameter Group #5		
Rise rate (cfs difference between consecutive days)	15	0.8667
Fall rate (cfs difference between consecutive days)	-18.75	-1.26
Number of reversals	57	0.1667

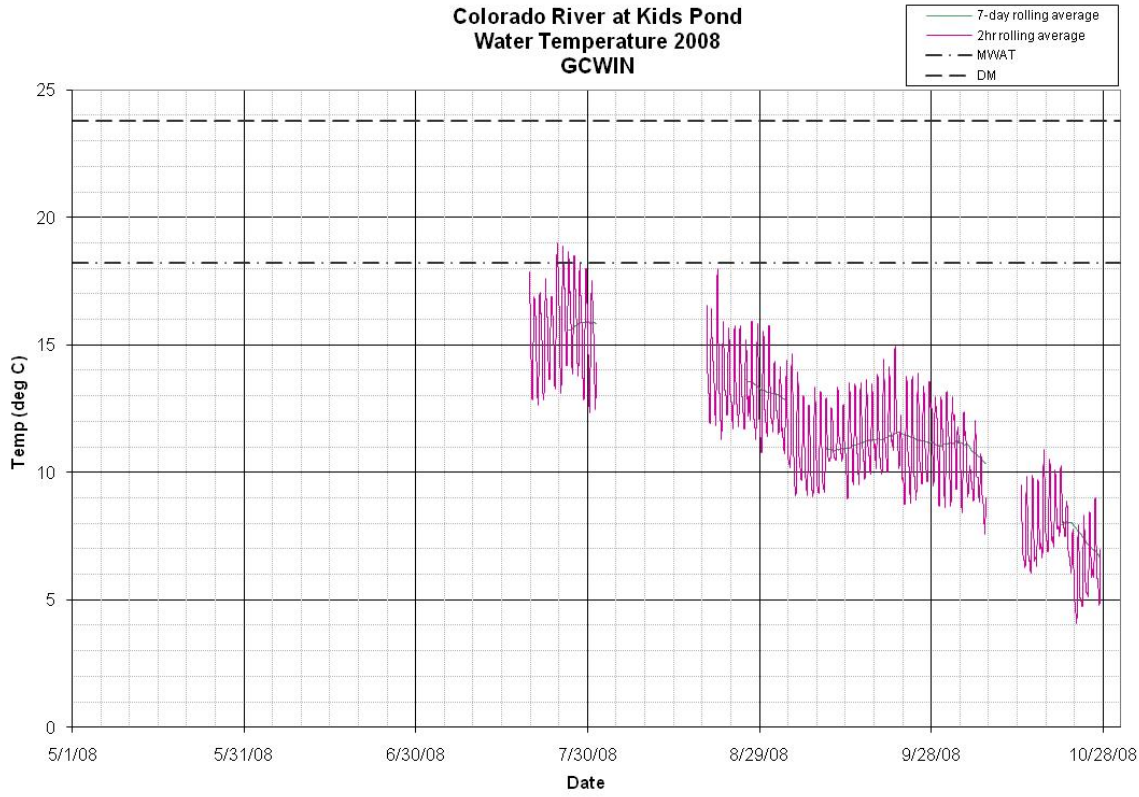
Reach CR5
IHA Percentile Data
Colorado River at Parshall (Northern seasonal)
Season from Julian date 92.to 274.(April 1 through Sept 30)

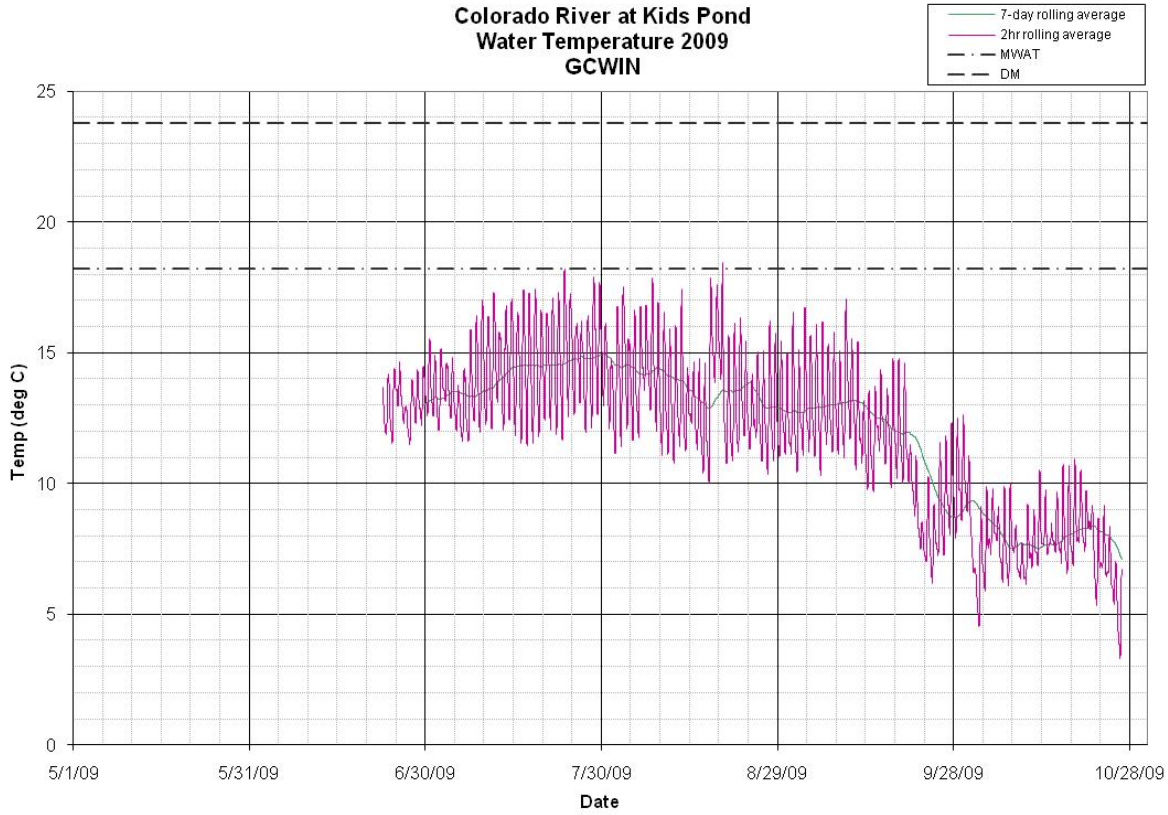
Period of Analysis: 1992-2007 (16 years)

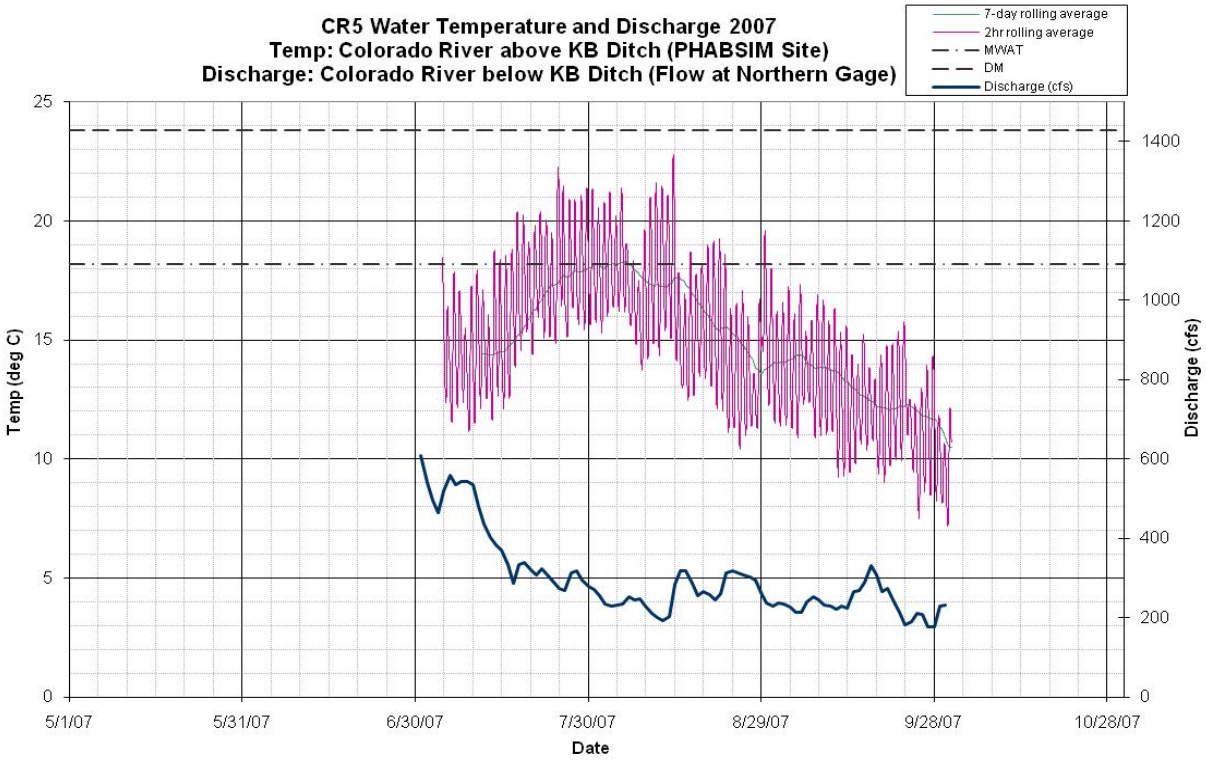
	Period of Analysis					
	10%	**25%**	**50%**	**75%**	**90%**	**(75-25)/50**
Parameter Group #1						
October (cfs)						
November (cfs)						
December (cfs)						
January (cfs)						
February (cfs)						
March (cfs)						
April (cfs)	98.3	178.9	344.5	492.7	1141	0.9108
May (cfs)	98	208.3	540	910.2	1886	1.3
June (cfs)	153	234.1	665	1394	2755	1.745
July (cfs)	259	335.3	390	555.5	1070	0.5647
August (cfs)	233.7	274.3	312.5	373.5	497.8	0.3176
September (cfs)	161.7	234	266.3	322.4	395.7	0.3319
Parameter Group #2						
1-day minimum (cfs)	77	115.8	158	214.5	236.2	0.625
3-day minimum (cfs)	80.03	119.8	160	225.3	239.6	0.6596
7-day minimum (cfs)	83.2	124.6	163.9	233	257.2	0.6612
30-day minimum (cfs)	98.3	172.5	235.9	257.7	291.3	0.3612
90-day minimum (cfs)	130	280.9	327.1	446.6	630.7	0.5066
1-day maximum (cfs)	491.6	765	1539	2184	4119	0.9223
3-day maximum (cfs)	461.5	728.3	1511	2131	4090	0.9281
7-day maximum (cfs)	394.4	630.2	1349	2088	3971	1.08
30-day maximum (cfs)	326.5	481.9	890.3	1552	2774	1.202
90-day maximum (cfs)	285.7	386.1	621	1124	1978	1.188
Number of zero days (count)	0	0	0	0	24	0
Base flow index (7day minimun in cfs/median in cfs)	0.1041	0.2737	0.3543	0.4159	0.5455	0.4014
Parameter Group #3						
Date of minimum (Julian day)	92	114.3	227	260	271.9	0.3982
Date of maximum (Julian day)	151.7	154.5	172.5	184	200.3	0.0806
Parameter Group #4						
Low pulse count (#)	0.7	2	3	6.25	9.3	1.417
Low pulse duration (days)	2.2	3.5	5.5	11.5	57.2	1.455
High pulse count (#)	0	1	2	3.75	6.6	1.375
High pulse duration (days)	1.6	3.5	5.5	30.75	64.2	4.955
Parameter Group #5						
Rise rate (cfs difference between consecutive days)	3.053	8	15	21	44.15	0.8667
Fall rate (cfs difference between consecutive days)	-45.1	-35.13	-18.75	-11.5	-7.35	-1.26
Number of reversals	32.1	51.25	57	60.75	66.2	0.1667
EFC Monthly Low Flows						
October Low Flow (cfs)						
November Low Flow (cfs)						
December Low Flow (cfs)						
January Low Flow (cfs)						
February Low Flow (cfs)						
March Low Flow (cfs)						
April Low Flow (cfs)	144.5	178.9	266.2	309.8	379	0.4918
May Low Flow (cfs)	161	173	245	384.8	406	0.8643
June Low Flow (cfs)	187.4	216.3	231	307.5	424	0.395
July Low Flow (cfs)	252.4	295.5	307	334.5	399.4	0.127
August Low Flow (cfs)	223.7	269.5	307.5	345.5	389.6	0.2471
September Low Flow (cfs)	202	246.8	273.5	322.4	393	0.2765
EFC Parameters						
Extreme low peak (cfs)	111	114	118	120.8	122.5	0.0572
Extreme low duration (days)	1.5	1.75	4	57.25	109	13.88
Extreme low timing (Julian date)	122.5	130.3	249	280	294	0.4092
Extreme low freq. (#/year)	0	0	0	1	3.3	0
High flow peak (cfs)	419.5	435.3	511.5	660	1021	0.4394
High flow duration (days)	1.75	4.5	8.5	14.88	42	1.221
High flow timing (Julian date)	135.5	159	192	203.5	259.3	0.1216
High flow frequency (#/year)	0	1	2	4.75	6.6	1.875
High flow rise rate (cfs differnenc between consecutive days)	23.15	51.21	71.58	103.9	150.7	0.736
High flow fall rate (cfs difference between consecutive days)	-142	-69.49	-51	-32.95	-12.44	-0.7164
Small Flood peak (cfs)	1621	1747	2184	2529	3721	0.3581
Small Flood duration (days)	19	32	91	269	282	2.604
Small Flood timing (Julian date)	151	152	159	175	181	0.06284
Small Flood freq. (#/year)	0	0	0	1	1	0
Small Flood riserate (cfs difference between consecutive days)	8.323	13.92	43.9	103.2	190.7	2.033
Small Flood fallrate (cfs difference between consecutive days)	-208.6	-103.2	-65.72	-26.75	-26.11	-1.164
Large flood peak (cfs)			5049			
Large flood duration (days)			123			
Large flood timing (Julian date)			159			
Large flood freq. (#/year)	0	0	0	0	0.3	0
Large flood riserate (cfs difference between consecutive days)			91.04			
Large flood fallrate (cfs difference between consecutive days)			-65.68			

Surface Water Temperature Plots

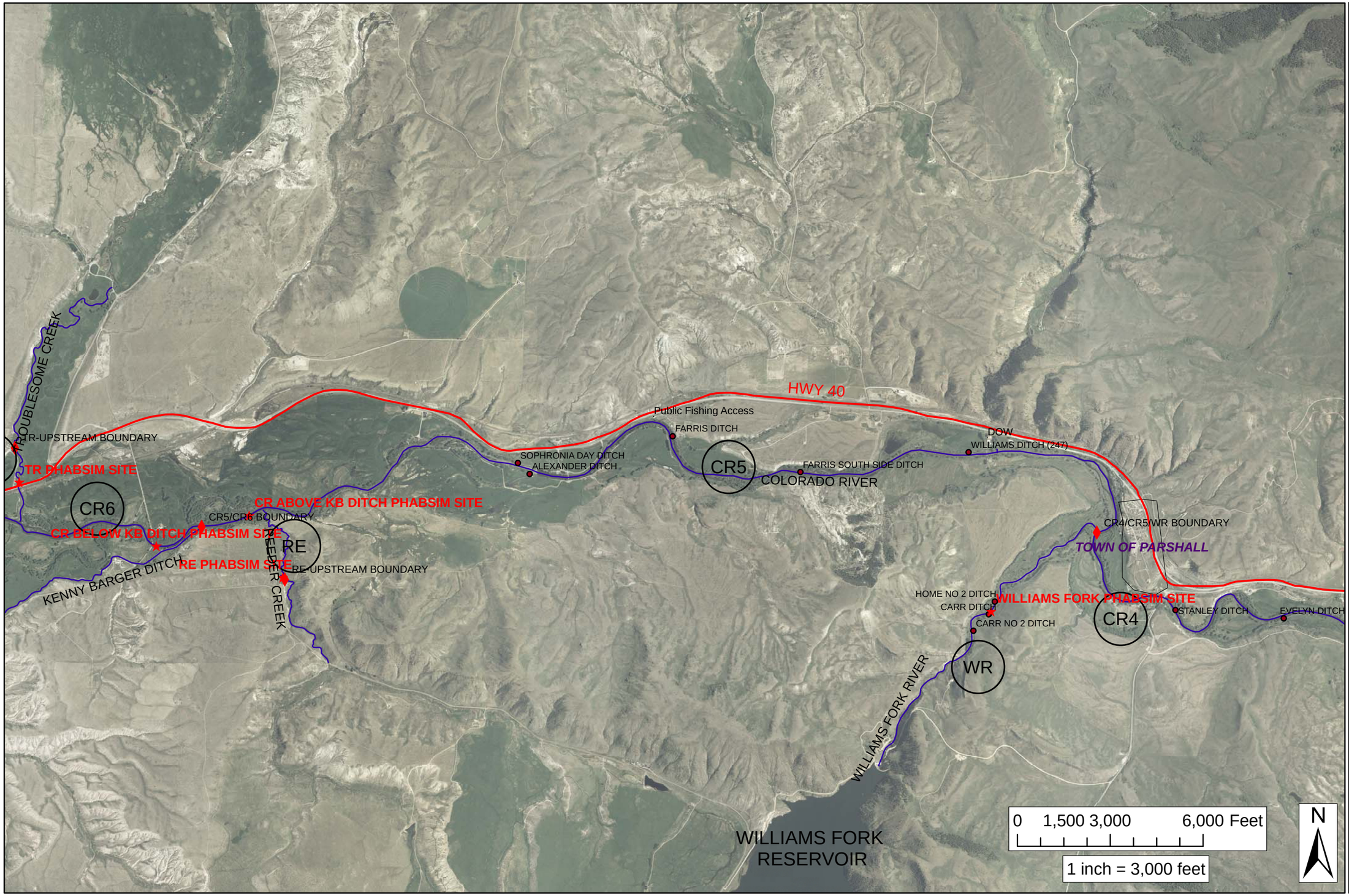



Colorado River at Kids Pond
Water Temperature 2008
GCWIN
7-day rolling average
2hr rolling average
MWAT
DM
Temp (deg C)
0
5
10
15
20
25
5/1/08
5/31/08
6/30/08
7/30/08
8/29/08
9/28/08
10/28/08
Date


Colorado River at Kids Pond
Water Temperature 2009
GCWIN
7-day rolling average
2hr rolling average
MWAT
DM
Temp (deg C)
0
5
10
15
20
25
5/1/09
5/31/09
6/30/09
7/30/09
8/29/09
9/28/09
10/28/09
Date


CR5 Water Temperature and Discharge 2007
Temp: Colorado River above KB Ditch (PHABSIM Site)
Discharge: Colorado River below KB Ditch (Flow at Northern Gage)
7-day rolling average
2hr rolling average
MWAT
DM
Discharge (cfs)
Temp (deg C)
Discharge (cfs)
Date
0
5
10
15
20
25
0
200
400
600
800
1000
1200
1400
5/1/07
5/31/07
6/30/07
7/30/07
8/29/07
9/28/07
10/28/07

GRAND COUNTY STREAM MANAGEMENT PLAN REACHES



Legend

- REACH BOUNDARY
- PHABSIM SITES
- DIVERSIONS

REACH: CR5

SHEET # :
1 OF 1

GRAND COUNTY Colorado · Est 1874

TETRA TECH