# CR 1 Stream Reach Summary

**Study Reach:** CR1, North Fork Colorado River – From Red Top diversion downstream to Shadow Mountain Reservoir.

**Reach Description:** Approximate channel length: 3 miles, approximate channel slope 1.7%.

The North Fork of the Colorado River originates in Rocky Mountain National Park along the Continental divide, flowing southerly to its confluence with Shadow Mountain Lake. Over 90% of the basin is on federally owned lands, including Arapahoe National Forest and Rocky Mountain National Park. Shadow Mountain Reservoir is one of three significant water bodies in the east central portion of Grand County; the other two being Grand Lake and Granby Reservoir. Shadow Mountain Reservoir and Granby Reservoir were constructed as part of the Colorado-Big Thompson (C-BT) Project during the 1940's. Today the lake and two reservoirs are operated in an integrated manner as part of the C-BT project (HRC 2003).

Approximately three miles upstream of Shadow Mountain Lake is the Redtop Valley Ditch, supplying irrigation water to four ranches located west of Granby Reservoir. The cessation of irrigation on two of these ranches is proposed in the 10825 Water Supply Study for support of the Upper Colorado River Endangered Fish (Grand River). Under current conditions, the existing Redtop Valley Ditch is decreed over 160 cubic feet per second (cfs) of water, which reportedly dries up the three mile reach between the headgate and Shadow Mountain Lake during irrigation season. Implementation of the preferred alternative would reduce the diversions to approximately half by volume, thereby increasing flows down the Colorado mainstem.

***Colorado River North Fork upstream of Shadow MountainReservior***

**Flow Recommendations:**

***Environmental Flow Methodology***: A study site has not yet been established within this reach

***Water Users:***

- Irrigators, municipalities and industry flow-related issues: The Grand Ditch and Redtop Valley Ditch are the major diversion in this reach. Under current conditions, the existing Redtop Valley Ditch is decreed over 160 cubic feet per second (cfs) of water, which reportedly dries up the three mile reach between the headgate and Shadow Mountain Lake during irrigation season. Implementation of the preferred alternative would reduce the diversions to approximately half by volume. There are no reported problems diverting flows, however, local residents report that the downstream 3 miles of the North Fork is often dewatered during irrigation season.

- The Grand Ditch, which diverts flows high in the watershed, within the Park boundaries, had a bank failure several years ago reportedly resulting in large volumes of sediment deposition in and near the mouth of the North Fork at its confluence with Shadow Mountain Lake.

- Recreational flows: Angling is popular in this reach.

***Summary of Flows:***

Environmental, recommended flow ranges

- Environmental flow recommendations have not yet been made for this reach, however, given the potential for diversion alterations at the Redtop Valley Ditch, this reach is recommended for further study.
- The proposed Redtop Valley Ditch modifications for the 10825 water will increase flows in portions of the river that, under current conditions, are often dewatered. Thus, conditions for fisheries will likely improve.

CWCB flows

- No ISF are available for this reach.

Water Users

Irrigators, municipalities and industry: Between the Redtop Valley Ditch and Shadow Mountain Reservoir there are no local diversions.

**Stream Assessments:** No stream assessments were conducted in CR1.

**Spawning Observations:** No spawning observations have yet been made in CR1.

**Hydrologic Records:** USGS Gage Station 09011000 located immediately upstream of the high water line for Shadow Mountain Reservoir was operated from 1904 - 1918 and 1936 - 1986. Daily streamflow exceedence plots and IHA analysis compare the early period with the post-transbasin construction period (1957 - 1986). Median monthly flows for the early period ranged from 20 cfs in January up to 834 cfs in June, while for the more recent period, the January median declined to 15 cfs and the June median declined to 403 cfs. Since 1990, seasonal records have been collected by the Northern Colorado Water Conservancy District.

USGS Gage 9010500 is located approximately 8 miles upstream of Shadow Mountain Lake and has been in operation since 1953. Daily streamflow exceedence plots compared with the flow records below the Redtop Valley diversion indicate diversions occur typically from early June through early August. Diversion records reviewed from 1975 to 2008 for the Red Top Valley Ditch indicate typical diversions of 86 to 186 cfs during the months of May, June, July and August.

**Water Temperature:** CR1 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 CR1 indicate stream temperatures for the Colorado River in this area are generally below the MWAT and DM standards except when diversions are in-place and CR1 becomes highly dewatered.

**Water Quality:** The Three Lakes Watershed Assessment (HRC 2003) indicates that all the lakes are in a mesotrophic or moderately nourished tropic state and that the water quality of each of the Three Lakes is very similar due to the manner in which the CB-T system operates. The study also indicates that the more developed sub-watersheds contribute a disproportionate amount of nutrients to the system. These more developed watersheds include Stillwater, Windy Gap and Willow Creek. However, the Three Lakes Clean Lakes Watershed Assessment report recommends that the North Fork of the Colorado River be considered for pollutant reduction. No detailed recommendations are included as to sources or pollutants. A comprehensive study of the Three Lakes area is being under taken as part of the Windy Gap EIS (HRC 2003b) which, when available, may provide better insights as to the possible pollutants within this largely undeveloped watershed.

**Water Supply Issues:** No reported water supply issues.

**Summary of Results and Additional Remarks:**

1. Under current conditions the diversion into Redtop Valley Ditch significantly reduces flows into CR1. Local residents report that downstream of the diversion (essentially CR1) is often dewatered during irrigation season.
2. Implementation of the preferred alternative for 10825water would reduce the existing diversions by approximately half, thereby increasing flows into the Colorado River. This provides an opportunity to re-establish flows during the critical months of July, August and September for the support of fisheries and associated habitat in CR1. Thus, further studies are recommended for the development of environmental flows.

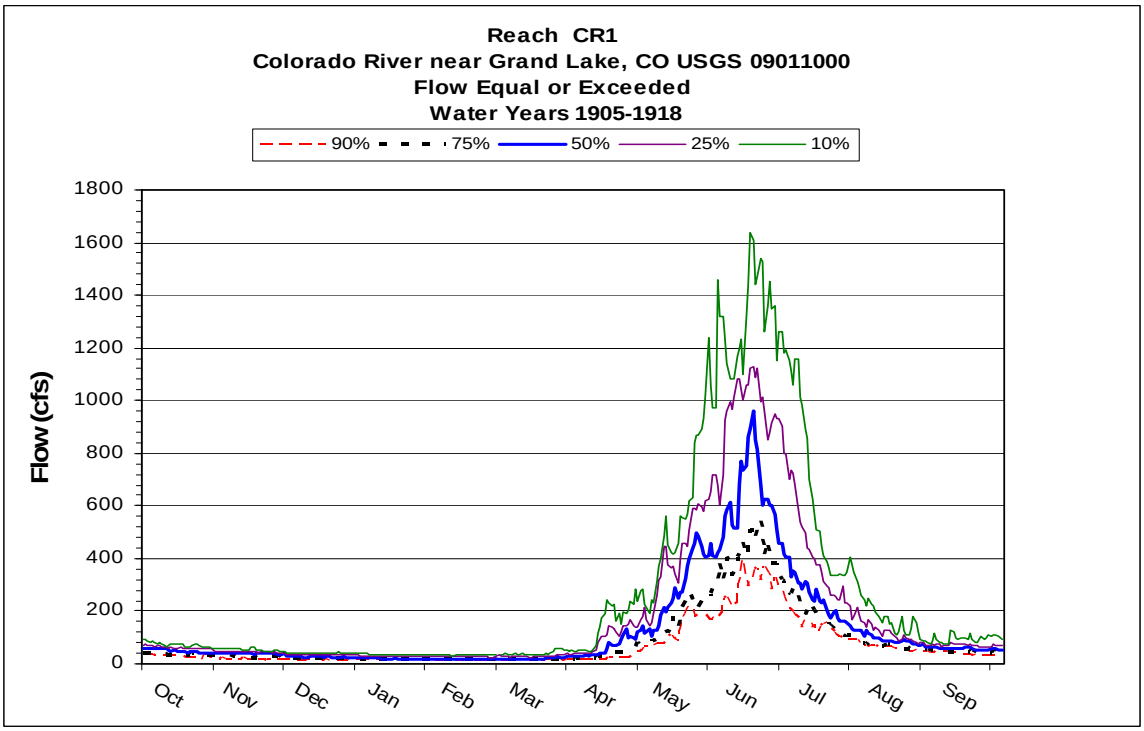
**Restoration Opportunities:**

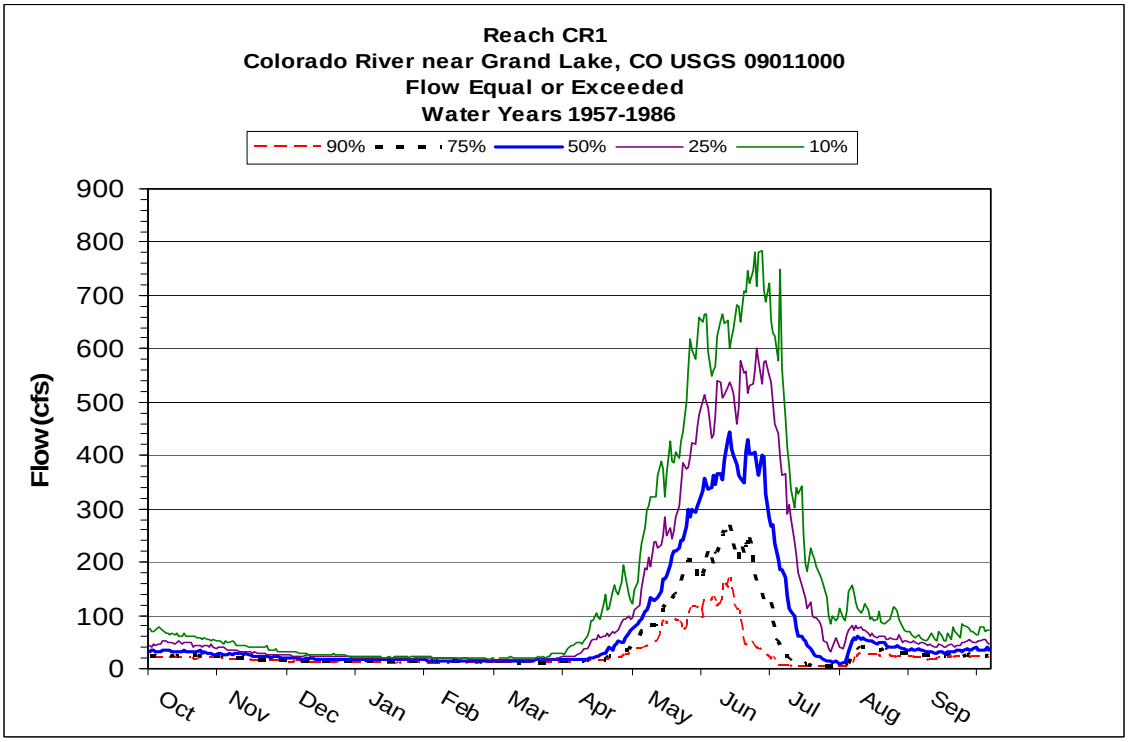
- ✓ To facilitate the implementation of the 10825 Water Supply preferred alternative it is recommended that a study site be established and evaluated for developing environmental flow recommendations.

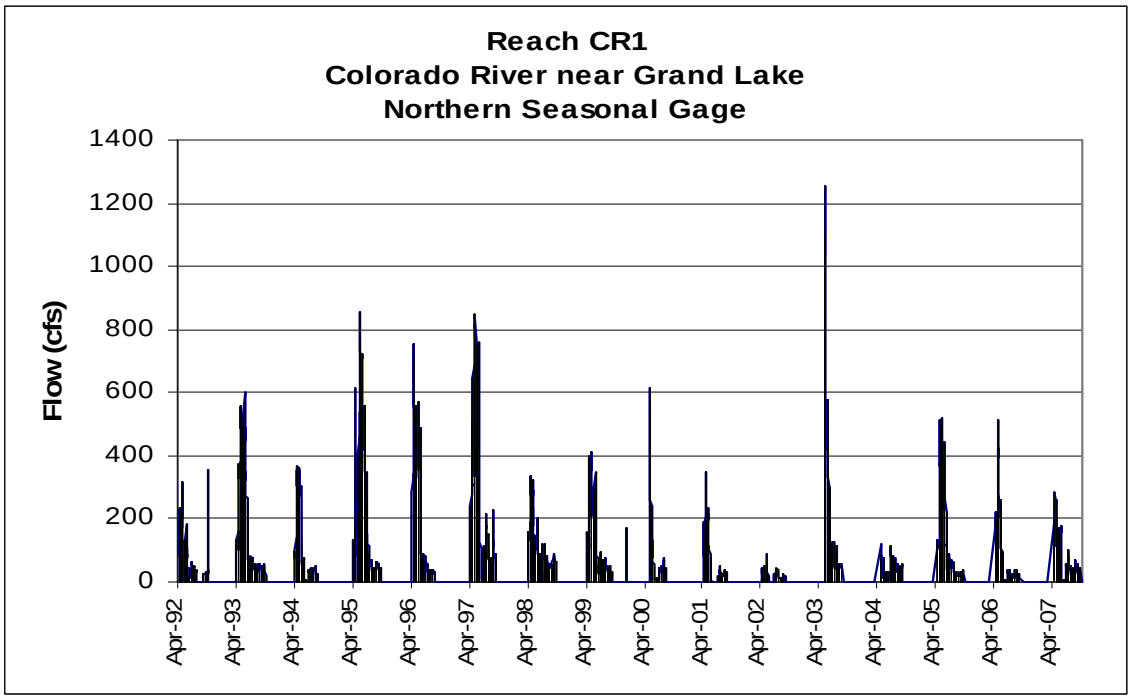
**Monitoring:** Monitor streamflows and surface water temperature until additional studies and assessments are complete. Following assessments and evaluation, additional monitoring may be recommended.

## Support Data

### Hydrographs and Exceedence Plots and Tables





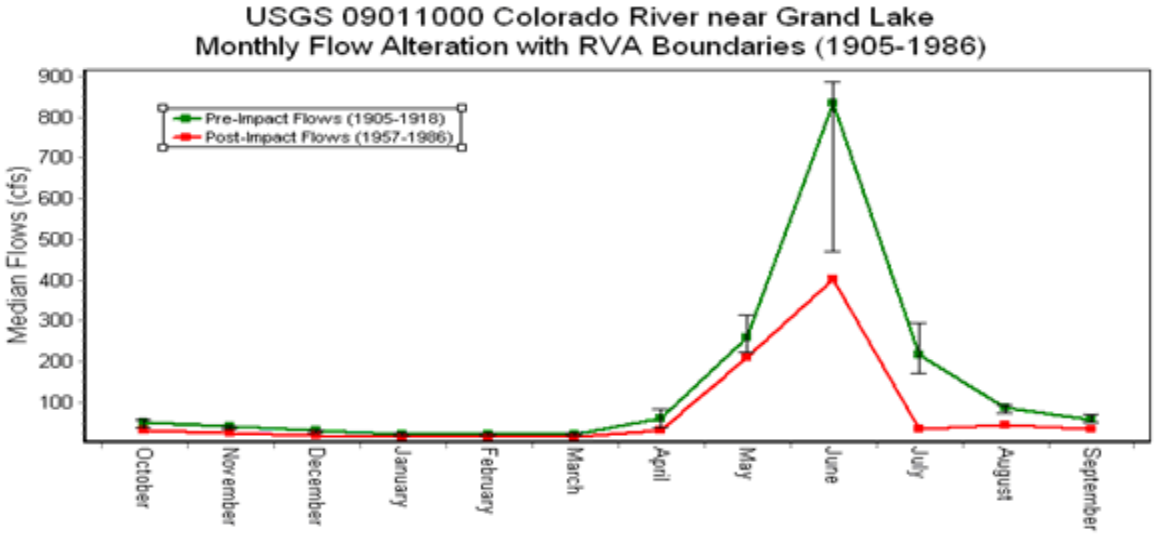

| Return Period T (year) | Probability P (percent) | Flood Discharge Q ($ft^3/sec$) |
|---|---|---|
| 1.05 | 95.2 | 273 |
| 1.11 | 90.1 | 341 |
| 1.25 | 80 | 437 |
| 2 | 50 | 665 |
| 5 | 20 | 942 |
| 10 | 10 | 1102 |
| 25 | 4 | 1277 |

Flood frequency analysis for USGS 09011000 Colorado River near Grand Lake, CO, for 30 years of record
(Water years 1957-1986)

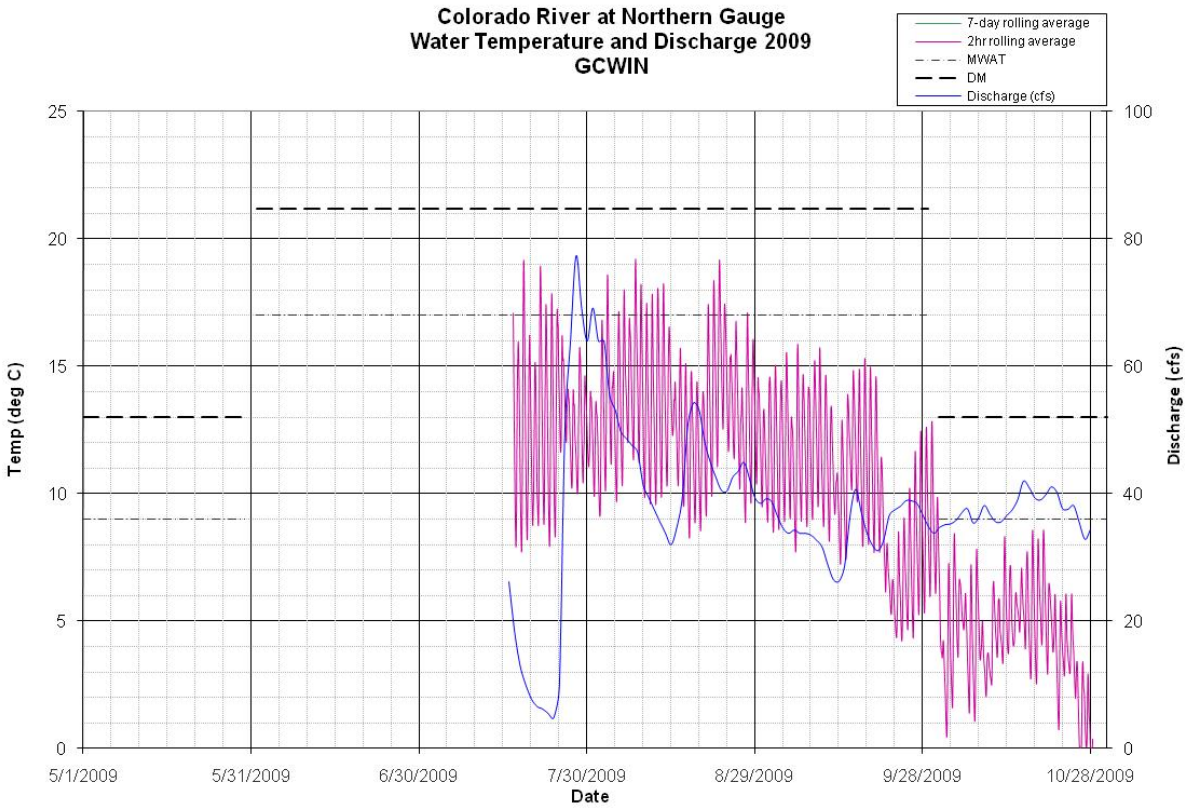
## IHA Results

| **Reach CR1** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Non-Parametric IHA Scorecard** | | | | | | | | |
| **USGS 09011000 Colorado River near Grand Lake** | | | | | | | | |
| | | | | | | | | |
| **Pre-impact period: 1905-1918 ( 13 years)** | | | **Post-impact period: 1957-1986 ( 30 years)** | | | | | |
| Mean annual flow | 143.1 | | | 81.91 | | | | |
| Mean flow/area | 143.1 | | | 81.91 | | | | |
| Annual C. V. | 1.65 | | | 1.74 | | | | |
| Flow predictability | 0.66 | | | 0.55 | | | | |
| Constancy/predictability | 0.43 | | | 0.48 | | | | |
| % of floods in 60d period | 0.64 | | | 0.69 | | | | |
| Flood-free season | 215 | | | 168 | | | | |
| | | | | | | | | |
| | **MEDIANS** | | **COEFF. of DISP.** | | **DEVIATION FACTOR** | | **SIGNIFICANCE COUNT** | |
| | **Pre** | **Post** | **Pre** | **Post** | **Medians** | **C.D.** | **Medians** | **C.D.** |
| | | | | | | | | |
| **Parameter Group #1** | | | | | | | | |
| October (cfs) | 50 | 31 | 0.49 | 0.6129 | 0.38 | 0.2508 | 0.01802 | 0.4885 |
| November (cfs) | 40 | 24.25 | 0.4375 | 0.4691 | 0.3938 | 0.07216 | 0.002002 | 0.8438 |
| December (cfs) | 30 | 18 | 0.3333 | 0.5139 | 0.4 | 0.5417 | 0.01702 | 0.1221 |
| January (cfs) | 20 | 16 | 0.525 | 0.3438 | 0.2 | 0.3452 | 0.01502 | 0.3153 |
| February (cfs) | 20 | 15 | 0.475 | 0.325 | 0.25 | 0.3158 | 0.005005 | 0.2513 |
| March (cfs) | 20 | 15 | 0.425 | 0.2167 | 0.25 | 0.4902 | 0.002002 | 0.1381 |
| April (cfs) | 61 | 29.75 | 0.9385 | 1.298 | 0.5123 | 0.3834 | 0.2112 | 0.3083 |
| May (cfs) | 260 | 211 | 0.7038 | 0.6197 | 0.1885 | 0.1196 | 0.1502 | 0.7628 |
| June (cfs) | 834.5 | 403.3 | 0.6411 | 0.677 | 0.5168 | 0.05599 | 0.03203 | 0.8859 |
| July (cfs) | 218 | 35 | 0.6399 | 2.844 | 0.8394 | 3.444 | 0.2382 | 0.002002 |
| August (cfs) | 85 | 44 | 0.3471 | 0.4659 | 0.4824 | 0.3424 | 0.009009 | 0.3764 |
| September (cfs) | 58 | 35 | 0.3707 | 0.5107 | 0.3966 | 0.3777 | 0.04905 | 0.2492 |
| | | | | | | | | |
| **Parameter Group #2** | | | | | | | | |
| 1-day minimum (cfs) | 20 | 8.1 | 0.55 | 1 | 0.595 | 0.8182 | 0.04404 | 0.04905 |
| 3-day minimum (cfs) | 20 | 8.683 | 0.55 | 0.9463 | 0.5658 | 0.7205 | 0.03504 | 0.07207 |
| 7-day minimum (cfs) | 20 | 9.607 | 0.5357 | 0.9439 | 0.5196 | 0.7619 | 0.04204 | 0.06006 |
| 30-day minimum (cfs) | 20 | 13.83 | 0.4583 | 0.382 | 0.3083 | 0.1664 | 0.003003 | 0.7107 |
| 90-day minimum (cfs) | 20 | 15.19 | 0.4083 | 0.2699 | 0.2408 | 0.339 | 0.00 | 0.3654 |
| 1-day maximum (cfs) | 1110 | 623.5 | 0.8324 | 0.4707 | 0.4383 | 0.4345 | 0.001001 | 0.2092 |
| 3-day maximum (cfs) | 1110 | 592 | 0.7565 | 0.4658 | 0.4667 | 0.3842 | 0.002002 | 0.2322 |
| 7-day maximum (cfs) | 1051 | 547.6 | 0.6912 | 0.5083 | 0.4788 | 0.2647 | 0.002002 | 0.4785 |
| 30-day maximum (cfs) | 816.2 | 425.2 | 0.7092 | 0.5681 | 0.4791 | 0.199 | 0.002002 | 0.7157 |
| 90-day maximum (cfs) | 498.5 | 244.3 | 0.5006 | 0.6237 | 0.51 | 0.2457 | 0.003003 | 0.5315 |
| Number of zero days (count) | 0 | 0 | 0 | 0 | | | | |
| Base flow index (7day minimun in cfs/median in cfs) | 0.1371 | 0.1174 | 0.4515 | 0.6206 | 0.1434 | 0.3745 | 0.2723 | 0.2753 |
| | | | | | | | | |
| **Parameter Group #3** | | | | | | | | |
| Date of minimum (Julian day) | 1 | 202 | 0.2664 | 0.3477 | 0.9016 | 0.3051 | 0.00 | 0.1291 |
| Date of maximum (Julian day) | 167 | 161 | 0.03279 | 0.06079 | 0.03279 | 0.8542 | 0.1932 | 0.04004 |
| | | | | | | | | |
| **Parameter Group #4** | | | | | | | | |
| Low pulse count (#) | 1 | 4.5 | 2 | 0.8889 | 3.5 | 0.5556 | 0.001001 | 0.1602 |
| Low pulse duration (days) | 74 | 6.5 | 1.223 | 1.673 | 0.9122 | 0.368 | 0.02402 | 0.5746 |
| High pulse count (#) | 3 | 3 | 0.6667 | 0.3333 | 0 | 0.5 | 0.3684 | 0.2192 |
| High pulse duration (days) | 5 | 9.5 | 5.05 | 3.329 | 0.9 | 0.3408 | 0.0961 | 0.5986 |
| The low pulse threshold is (cfs) | 25 | | | | | | | |
| The high pulse threshold is (cfs | 130 | | | | | | | |
| | | | | | | | | |
| **Parameter Group #5** | | | | | | | | |
| Rise rate (cfs difference between consecutive days) | 14 | 5 | 0.6786 | 0.6 | 0.6429 | 0.1158 | 0.001001 | 0.9039 |
| Fall rate (cfs difference between consecutive days) | -9 | -3 | -0.5 | -0.6667 | 0.6667 | 0.3333 | 0.002002 | 0.6136 |
| Number of reversals | 70 | 91.5 | 0.4286 | 0.2322 | 0.3071 | 0.4581 | 0.00 | 0.1512 |
| | | | | | | | | |

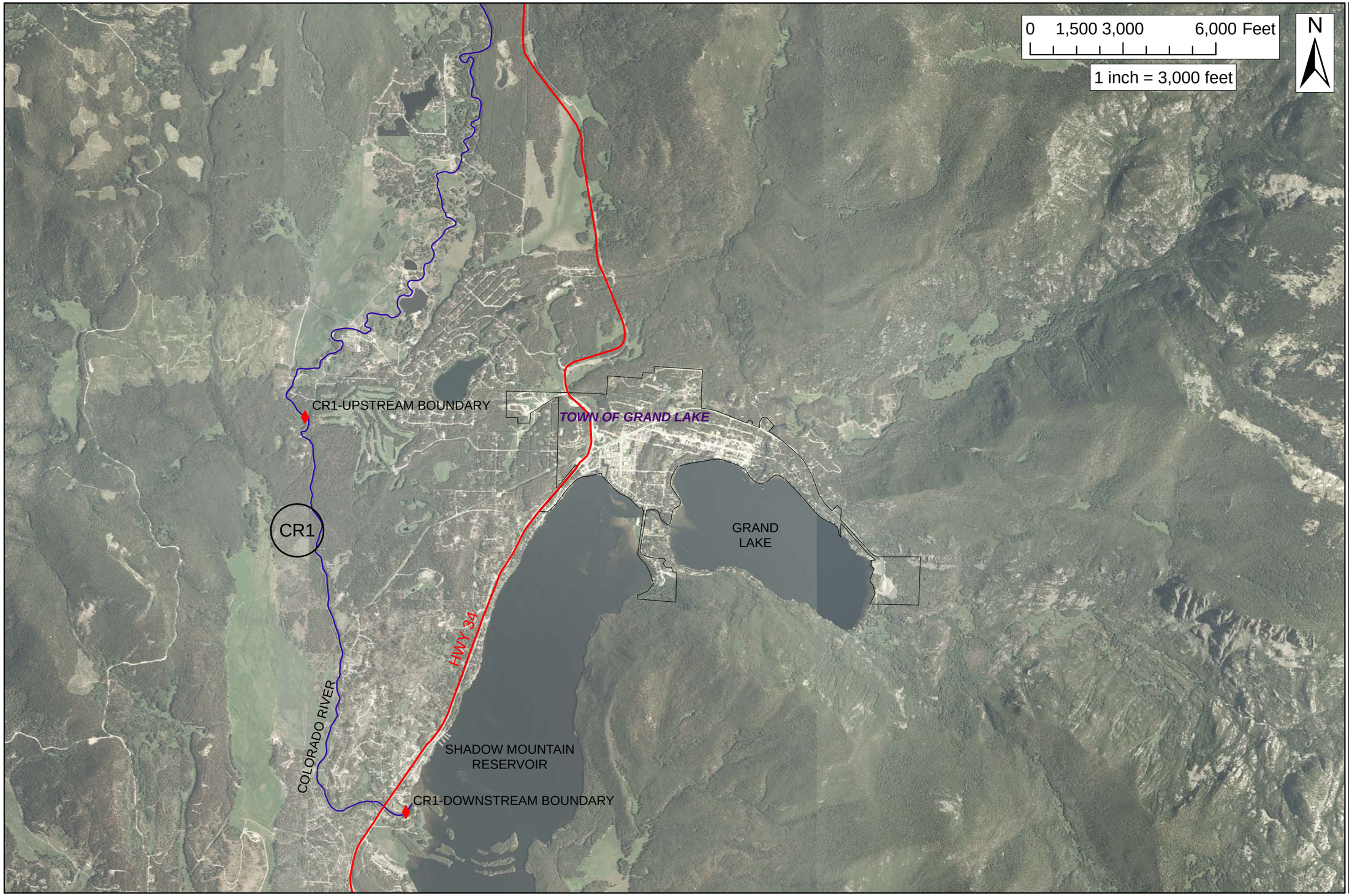
| CR1 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **IHA Percentile Data** | | | | | | | | | | | | |
| **USGS 09011000 Colorado River near Grand Lake** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | **Pre-impact period: 1905-1918 ( 13 years)** | | | | | | **Post-impact period: 1957-1986 ( 30 years)** | | | | | |
| | **Pre-Impact** | | | | | | **Post-Impact** | | | | | |
| | **10%** | **25%** | **50%** | **75%** | **90%** | **(75-25)/50** | **10%** | **25%** | **50%** | **75%** | **90%** | **(75-25)/50** |
| **Parameter Group #1** | | | | | | | | | | | | |
| October (cfs) | 28.8 | 37 | 50 | 61.5 | 66.8 | 0.49 | 20.1 | 25 | 31 | 44 | 58.9 | 0.6129 |
| November (cfs) | 18 | 28 | 40 | 45.5 | 52.6 | 0.4375 | 16 | 17.88 | 24.25 | 29.25 | 41.05 | 0.4691 |
| December (cfs) | 13.8 | 23.5 | 30 | 33.5 | 39.4 | 0.3333 | 12.2 | 14 | 18 | 23.25 | 26 | 0.5139 |
| January (cfs) | 15.4 | 17 | 20 | 27.5 | 34 | 0.525 | 11 | 13.75 | 16 | 19.25 | 21.9 | 0.3438 |
| February (cfs) | 14 | 17 | 20 | 26.5 | 31.8 | 0.475 | 11 | 13.75 | 15 | 18.63 | 19.9 | 0.325 |
| March (cfs) | 14.4 | 19 | 20 | 27.5 | 32.4 | 0.425 | 13 | 13.75 | 15 | 17 | 21 | 0.2167 |
| April (cfs) | 18.6 | 30.5 | 61 | 87.75 | 110 | 0.9385 | 16 | 17.88 | 29.75 | 56.5 | 80.25 | 1.298 |
| May (cfs) | 147.2 | 205 | 260 | 388 | 524 | 0.7038 | 95.1 | 147.3 | 211 | 278 | 356.3 | 0.6197 |
| June (cfs) | 324.4 | 395 | 834.5 | 930 | 1086 | 0.6411 | 55.75 | 232.9 | 403.3 | 505.9 | 593.6 | 0.677 |
| July (cfs) | 148.4 | 162.5 | 218 | 302 | 410.8 | 0.6399 | 4.02 | 5.475 | 35 | 105 | 141.4 | 2.844 |
| August (cfs) | 60 | 65.5 | 85 | 95 | 111.6 | 0.3471 | 25 | 35.5 | 44 | 56 | 87.9 | 0.4659 |
| September (cfs) | 35 | 49 | 58 | 70.5 | 76.1 | 0.3707 | 23.5 | 25.38 | 35 | 43.25 | 51.7 | 0.5107 |
| | | | | | | | | | | | | |
| **Parameter Group #2** | | | | | | | | | | | | |
| 1-day minimum (cfs) | 10.4 | 14 | 20 | 25 | 30.6 | 0.55 | 3.02 | 3.9 | 8.1 | 12 | 14.9 | 1 |
| 3-day minimum (cfs) | 10.67 | 14 | 20 | 25 | 30.8 | 0.55 | 3.203 | 4.033 | 8.683 | 12.25 | 14.93 | 0.9463 |
| 7-day minimum (cfs) | 11.29 | 14.29 | 20 | 25 | 31.11 | 0.5357 | 3.48 | 4.611 | 9.607 | 13.68 | 15 | 0.9439 |
| 30-day minimum (cfs) | 13.3 | 15.83 | 20 | 25 | 31.4 | 0.4583 | 5.947 | 10.24 | 13.83 | 15.53 | 18.43 | 0.382 |
| 90-day minimum (cfs) | 15.16 | 17.96 | 20 | 26.13 | 32.36 | 0.4083 | 10.97 | 13.62 | 15.19 | 17.72 | 19.33 | 0.2699 |
| 1-day maximum (cfs) | 481 | 696 | 1110 | 1620 | 1784 | 0.8324 | 267.7 | 475.3 | 623.5 | 768.8 | 1181 | 0.4707 |
| 3-day maximum (cfs) | 455.7 | 645.3 | 1110 | 1485 | 1679 | 0.7565 | 250.4 | 456 | 592 | 731.8 | 999.1 | 0.4658 |
| 7-day maximum (cfs) | 415.1 | 600.9 | 1051 | 1327 | 1506 | 0.6912 | 216.3 | 422.3 | 547.6 | 700.7 | 886 | 0.5083 |
| 30-day maximum (cfs) | 335.9 | 454 | 816.2 | 1033 | 1072 | 0.7092 | 170 | 311.5 | 425.2 | 553 | 681.7 | 0.5681 |
| 90-day maximum (cfs) | 228.6 | 305.7 | 498.5 | 555.2 | 573 | 0.5006 | 98.71 | 181.2 | 244.3 | 333.5 | 420 | 0.6237 |
| Number of zero days (count) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Base flow index (7day minimun in cfs/median in cfs) | 0.07664 | 0.1081 | 0.1371 | 0.17 | 0.2598 | 0.4515 | 0.06063 | 0.07453 | 0.1174 | 0.1474 | 0.1748 | 0.6206 |
| | | | | | | | | | | | | |
| **Parameter Group #3** | | | | | | | | | | | | |
| Date of minimum (Julian day) | 301.2 | 326 | 1 | 57.5 | 79.6 | 0.2664 | 52.2 | 84 | 202 | 211.3 | 215.9 | 0.3477 |
| Date of maximum (Julian day) | 153 | 159.5 | 167 | 171.5 | 179.2 | 0.03279 | 133.1 | 150 | 161 | 172.3 | 177.8 | 0.06079 |
| | | | | | | | | | | | | |
| **Parameter Group #4** | | | | | | | | | | | | |
| Low pulse count (#) | 0 | 0 | 1 | 2 | 7.2 | 2 | 1 | 3 | 4.5 | 7 | 10.9 | 0.8889 |
| Low pulse duration (days) | 2.5 | 4.5 | 74 | 95 | 106 | 1.223 | 2.1 | 4.875 | 6.5 | 15.75 | 159.1 | 1.673 |
| High pulse count (#) | 1.4 | 2.5 | 3 | 4.5 | 6.6 | 0.6667 | 1 | 2 | 3 | 3 | 4 | 0.3333 |
| High pulse duration (days) | 1.4 | 3.25 | 5 | 28.5 | 67.6 | 5.05 | 2.05 | 4 | 9.5 | 35.63 | 50 | 3.329 |
| | | | | | | | | | | | | |
| **Parameter Group #5** | | | | | | | | | | | | |
| Rise rate (cfs difference between consecutive days) | 4 | 6 | 14 | 15.5 | 18.8 | 0.6786 | 2.775 | 3 | 5 | 6 | 7.45 | 0.6 |
| Fall rate (cfs difference between consecutive days) | -16.8 | -11 | -9 | -6.5 | -3 | -0.5 | -5 | -4 | -3 | -2 | -2 | -0.6667 |
| Number of reversals | 24 | 50 | 70 | 80 | 100.6 | 0.4286 | 74 | 81 | 91.5 | 102.3 | 106.8 | 0.2322 |
| | | | | | | | | | | | | |
| **EFC Monthly Low Flows** | | | | | | | | | | | | |
| October Low Flow (cfs) | 28.8 | 37 | 50 | 61.5 | 66.8 | 0.49 | 21.1 | 25 | 31 | 42.25 | 58.55 | 0.5565 |
| November Low Flow (cfs) | 22 | 33 | 40 | 45.5 | 51.4 | 0.3125 | 20 | 21.5 | 24.5 | 30 | 41.5 | 0.3469 |
| December Low Flow (cfs) | 21.3 | 25 | 30 | 34.25 | 39.8 | 0.3083 | 19 | 19.75 | 21.5 | 25.25 | 28.5 | 0.2558 |
| January Low Flow (cfs) | 19.3 | 20 | 24.5 | 29.25 | 34.5 | 0.3776 | 19 | 19 | 20 | 21.25 | 22 | 0.1125 |
| February Low Flow (cfs) | 19.1 | 20 | 22.5 | 28.13 | 33.45 | 0.3611 | 19 | 19 | 19.5 | 20.25 | 21.9 | 0.0641 |
| March Low Flow (cfs) | 20 | 20 | 26 | 30.38 | 35.4 | 0.399 | 19 | 19 | 21 | 23.5 | 29 | 0.2143 |
| April Low Flow (cfs) | 21 | 28.5 | 37 | 49 | 81.2 | 0.5541 | 22 | 27.38 | 35.5 | 45.75 | 60.6 | 0.5176 |
| May Low Flow (cfs) | 71 | 73 | 94 | 110 | 130 | 0.3936 | 37.4 | 71 | 89 | 105 | 125.8 | 0.382 |
| June Low Flow (cfs) | | | | | | | 35.3 | 42.5 | 70.75 | 108.8 | 119.1 | 0.9364 |
| July Low Flow (cfs) | 90 | 99.25 | 103 | 118 | 124 | 0.182 | 24.75 | 29 | 38.25 | 51 | 65.05 | 0.5752 |
| August Low Flow (cfs) | 57 | 62.5 | 77 | 85 | 91.4 | 0.2922 | 25.55 | 32.63 | 41.75 | 51.25 | 68.6 | 0.4461 |
| September Low Flow (cfs) | 34.4 | 48 | 56 | 70 | 71.6 | 0.3929 | 23.55 | 26.5 | 33.25 | 40 | 45.95 | 0.406 |
| | | | | | | | | | | | | |
| **EFC Parameters** | | | | | | | | | | | | |
| Extreme low peak (cfs) | 11 | 11.75 | 16 | 17.25 | 18 | 0.3438 | 6.705 | 12.63 | 15 | 17.13 | 18 | 0.3 |
| Extreme low duration (days) | 2 | 2.75 | 10 | 61.5 | 69 | 5.875 | 2.1 | 4.375 | 12 | 21.38 | 75.15 | 1.417 |
| Extreme low timing (Julian date) | 1 | 25.75 | 38.75 | 68.75 | 98 | 0.1175 | 296.4 | 324.6 | 77.5 | 148.9 | 212.7 | 0.4802 |
| Extreme low freq. (#/year) | 0 | 0 | 0 | 2 | 14.4 | 0 | 2 | 2 | 3.5 | 6 | 8.8 | 1.143 |
| High flow peak (cfs) | 82.8 | 98 | 165 | 202.5 | 730 | 0.6333 | 64.7 | 81.38 | 93.5 | 120.8 | 151.2 | 0.4211 |
| High flow duration (days) | 3 | 3.5 | 5 | 6 | 64.6 | 0.5 | 3 | 3 | 4 | 5 | 9.6 | 0.5 |
| High flow timing (Julian date) | 122.2 | 146 | 217 | 236 | 281.4 | 0.2459 | 124.9 | 159 | 207.3 | 220.3 | 226 | 0.1673 |
| High flow frequency (#/year) | 1 | 1.5 | 5 | 6.5 | 8.6 | 1 | 3.1 | 5 | 6 | 8.25 | 10 | 0.5417 |
| High flow rise rate (cfs differenc between consecutive days) | 14.2 | 17.99 | 26 | 31.11 | 92.1 | 0.5046 | 13.03 | 15 | 18.75 | 21.95 | 29.71 | 0.3707 |
| High flow fall rate (cfs difference between consecutive days) | -33.2 | -18 | -12.98 | -10.67 | -6.6 | -0.5652 | -15.39 | -13.04 | -10.83 | -8.875 | -7.738 | -0.3842 |
| Small Flood peak (cfs) | 1110 | 1193 | 1480 | 1640 | 1700 | 0.3024 | 1200 | 1200 | 1220 | 1220 | 1220 | 0.01639 |
| Small Flood duration (days) | 75 | 82.5 | 92.5 | 98.5 | 103 | 0.173 | 64 | 64 | 70 | 82 | 82 | 0.2571 |
| Small Flood timing (Julian date) | 153 | 159 | 169.5 | 176.8 | 182 | 0.0485 | 146 | 146 | 173 | 182 | 182 | 0.09836 |
| Small Flood freq. (#/year) | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.9 | 0 |
| Small Flood riserate (cfs difference between consecutive days) | 21.78 | 22.19 | 32.95 | 40.43 | 43.6 | 0.5535 | 28.71 | 28.71 | 36.97 | 72.5 | 72.5 | 1.185 |
| Small Flood fallrate (cfs difference between consecutive days) | -35.12 | -33.81 | -27.21 | -21.76 | -21.37 | -0.443 | -40.52 | -40.52 | -21.12 | -21.04 | -21.04 | -0.9227 |
| Large flood peak (cfs) | | | 1840 | | | | | | | | | |
| Large flood duration (days) | | | 83 | | | | | | | | | |
| Large flood timing (Julian date) | | | 167 | | | | | | | | | |
| Large flood freq. (#/year) | 0 | 0 | 0 | 0 | 0.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Large flood riserate (cfs difference between consecutive days) | | | 39.09 | | | | | | | | | |
| Large flood fallrate (cfs difference between consecutive days) | | | -43.2 | | | | | | | | | |


USGS 09011000 Colorado River near Grand Lake
Monthly Flow Alteration with RVA Boundaries (1905-1986)
Median Flows (cfs)
900
800
700
600
500
400
300
200
100
Pre-Impact Flows (1905-1918)
Post-Impact Flows (1957-1986)
October
November
December
January
February
March
April
May
June
July
August
September

## Surface Water Temperature Plots



# GRAND COUNTY STREAM MANAGEMENT PLAN REACHES




**Legend**

- REACH BOUNDARY
- PHABSIM SITES
- DIVERSIONS

REACH: CR1

SHEET # : 1 OF 1

GRAND COUNTY Colorado · Est 1874

TETRA TECH