

PEAK FLOW FORECASTS

FLOW EXTREMES, NOT SUPPLY

Peak flow forecasts are fundamentally different than water supply volume forecasts. Although the watershed snowpack is a principal component in both analyses, peak flows are not a supply question at all. Rather, peak flows characterize runoff extremes by predicting maximum mean daily flow at a single point during the spring snowmelt season. This extreme is related to the water supply volume, but the relationship is not direct or constant from year to year. As such, peak flow forecasts contain much more uncertainty than water supply volume forecasts.

REGULATED VS. NATURAL FLOWS

An even more fundamental limitation is that peak forecasts describe **regulated** (actual or observed) in-stream flow well into the future, something difficult to do considering the quantity and changing nature of diversions in the Colorado River and Great Basin watersheds. (Note: supply forecasts deal with hypothetical "natural" flow - that which would have resulted in the absence of regulation). The Colorado Basin River Forecast Center routinely forecasts regulated streamflow, but only for several days into the future. Further into the future the ability to forecast reservoir regulation becomes more limited.

DIFFERENT USES AND USERS

Peak flow forecasts are used for different purposes than water supply volume forecasts. Users of these forecasts would include river recreationists, flood control agencies, emergency service directors, wildlife managers and anyone interested in the combined effect of watershed yield **and** human regulation on the actual (observed) in-stream maximum mean daily flows at a site.

FLOOD FLOWS

The National Weather Service defines flood flow as the flow at which damage to structures begins to occur. Over-bank flow may occur but still be below the defined flood flow. Flood flows contained in this document change from year to year due to such channel processes as deposition and scouring. Therefore, the flood flows that follow should only be applied to the current runoff season. It should also be noted that they are instantaneous flows and not maximum mean daily flows.

IMPORTANT NOTE:

Please note that the following peak flow forecasts will be updated during the first week in April and again the first week in May. The updated forecasts can be accessed through the CBRFC homepage (<http://www.cbrfc.gov>) or by calling the appropriate Service Hydrologist (see page 16 and 17).

INTERPRETIVE NOTES

PEAK FLOW DEFINED

The peak flow forecast represents the maximum mean daily flow (the highest average flow for an entire day during the runoff season) at a point during the April through July period, unless otherwise noted. It does not represent the instantaneous peak (the maximum flow at a single moment). In the case of smooth snowmelt regimes (hydrographs), it may be acceptable to approximate one with the other. In Arizona, the normal snowmelt period is from March to May. Occasionally, heavy rainfall events can produce higher peak flows than the snowmelt peak flows. For verification and calibration purposes, the maximum mean daily flow during the March through May period was used regardless of the runoff source. The Average Peak and Normal Time of Peak (defined as the average date of peak plus/minus one standard deviation which should include approximately 70% of the peaks) for a given gage are all derived from 1971 through 2000 data whereas the Historic Peak is derived from the period of record, including the most recent years, after reservoir regulation began.

FORECAST PROBABILITIES

Peak flow forecasts are presented in terms of probabilities or, more specifically, exceedance probabilities. The forecast labeled “most probable” is actually the 50% exceedance level meaning there are equal chances of being below the value or above the value (i.e., 50 chances out of 100 of being exceeded). The other exceedance probabilities associate the likelihood of exceeding other levels. In general, a close bunching of the exceedance forecasts indicates low variability and that the user can have a high degree of confidence in the forecast information. Conversely, a large spread in the exceedance forecasts indicates high variability.

MODELLING TECHNIQUES

The peak flow forecasts that follow have been derived using a combination of (1) physically-based conceptual models and (2) statistical regression models. The conceptual model is the National Weather Service River Forecasting System in the Extended Streamflow Prediction (ESP) mode. Since the conceptual model requires reservoir operation plans for up to five months into the future, ESP application is limited to basins where regulation is minimal (mostly in the headwater areas). The farther downstream a forecast point is, the more likely it is that a statistical regression was used between natural snowmelt runoff volume and the observed maximum mean daily flow to generate the forecast. Such an approach performs better when the correlation between regulated and unregulated flow is strong and is constant from year to year.

UPPER COLORADO PEAK FLOW FORECASTS

Mean daily flows in cubic feet per second (cfs)

STATION NAME	Historic Peak	Average Peak	Flood* Flow	2001 Peak	2001 Date	2002 Forecast Exceedance Probability					Normal time of peak
						90%	75%	50%	25%	10%	
COLORADO - KREMMLING, NR	12,700	3,900	8,300	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5/15 - 6/27
EAGLE - GYPSUM, BLO	6,580	3,600	6,000	2,340	6/02	1,500	2,000	2,500	3,500	4,800	6/1 - 6/21
ROARING FORK - GLENWOOD SPRINGS	11,200	6,150	11,860	3,460	6/02	2,000	2,800	3,600	4,800	6,000	6/3 - 6/18
COLORADO - CAMEO, NR	38,000	17,500	28,300	9,180	6/03	4,500	7,500	10,000	14,000	20,000	5/29 - 6/18
PLATEAU CK - CAMEO, NR	4,100	1,460	5,700	455	5/15	200	300	500	1,200	2,000	5/9 - 6/11
EAST - ALMONT, NR	5,000	2,080	2,870	1,340	5/17	700	1,000	1,300	1,600	2,000	5/28 - 6/17
NF GUNNISON - SOMERSET, NR	7,080	3,310	14,400	1,820	5/02	1,100	1,300	1,800	2,600	3,400	5/11 - 6/2
SURFACE CK - CEDAREEDGE	640	210	2,050	100	5/14	40	70	110	170	200	5/3 - 6/8
UNCOMPAHGRE - COLONA, NR	1,900	1,390	3,040	680	6/13	N/A	N/A	N/A	N/A	N/A	5/20 - 6/27
COLORADO - CO-UT STATELINE, NR	68,300	26,150	47,500	13,000	5/18	6,000	9,000	12,500	16,000	23,000	5/22 - 6/16
DOLORES - DOLORES	6,950	2,980	10,280	2,760	5/14	800	1,100	1,600	2,200	2,500	5/9 - 6/4
SAN MIGUEL - PLACERVILLE, NR	2,740	1,310	2,790	930	5/21	500	700	950	1,200	1,500	5/26 - 6/23
DOLORES - CISCO, NR (see note1 below)	12,900	6,050	N/A	1,670	4/20	N/A	N/A	N/A	N/A	N/A	4/26 - 6/5
COLORADO - CISCO, NR	69,500	28,800	61,000	13,700	5/19	7,000	10,000	14,000	18,000	25,000	5/20 - 6/15
GREEN - DANIEL, NR, WARREN BRIDGE, AT	5,620	2,975	N/A	1,960	5/17	1,500	1,900	2,200	2,500	2,900	5/30 - 6/30
NEW FORK - BIG PINEY, NR	9,110	5,285	N/A	2,800	5/18	2,200	2,900	3,600	4,200	5,200	5/31 - 6/24
GREEN - LABARGE, NR	18,800	9,270	11,400	4,370	5/18	N/A	N/A	N/A	N/A	N/A	5/30 - 6/24
BIG SANDY - FARSON, NR	1,690	820	1,400	465	5/17	N/A	N/A	N/A	N/A	N/A	5/28 - 6/23
GREEN - GREEN RVR WY, NR	15,400	7,110	15,500	e1600	5/02	N/A	N/A	N/A	N/A	N/A	5/23 - 7/11
HAMS FORK - FRONTIER, NR, POLE CK, BLO	2,000	825	1,600	310	5/16	300	480	550	870	1,000	5/10 - 6/9
BLACKS FORK - LITTLE AMERICA, NR	6,970	2,440	5,190	512	5/07	600	900	1,200	1,900	2,600	5/2 - 6/27

N/A - NOT AVAILABLE (NOT A FLOOD FORECAST POINT OR NO FORECAST PROCEDURE EXISTS)

note1 - for re-bases below M cPhee Reservoir call 970-565-7562

* Flood flow is for current year only and is an instantaneous value

UPPER COLORADO PEAK FLOW FORECASTS (continued)

Mean daily flows in cubic feet per second (cfs)

STATION NAME	Historic	Average	Flood*	2001	2001	2002 Forecast Exceedance Probability					Normal time of peak
	Peak	Peak	Flow	Peak	Date	90%	75%	50%	25%	10%	
YAMPA - STEAMBOAT SPRINGS	5,870	3,240	4,470	2,610	5/17	1,500	1,800	2,200	2,700	3,300	5/19 - 6/12
YAMPA - MAYBELL, NR	24,400	10,475	24,800	7,650	5/17	4,200	5,200	6,400	7,900	9,200	5/13 - 6/10
LITTLE SNAKE - LILY, NR	13,400	4,745	35,000	2,700	5/03	1,200	1,700	2,200	3,100	3,500	5/5 - 6/12
YAMPA - DEERLODGE PARK	32,300	13,955	16,550	9,490	5/18	4,900	6,100	8,000	10,000	12,000	5/11 - 6/6
GREEN - JENSEN, NR (see note1 below)	38,500	17,600	23,700	14,400	5/18	9,500	10,700	12,600	14,600	16,600	5/14 - 6/11
ROCK CK - UPR STILLWATER RES	2,080	1,350	N/A	1,370	5/16	600	750	900	1,100	1,300	5/25 - 6/20
DUCHESNE - TABIONA, NR	1,630	765	4,100	610	5/17	250	330	500	700	900	5/15 - 6/15
DUCHESNE - RANDLETT, NR	7,000	2,755	7,400	2,440	5/26	N/A	N/A	N/A	N/A	N/A	4/27 - 7/5
WHITE - MEEKER, NR	6,320	3,200	5,500	2,390	5/16	1,500	1,700	2,100	2,600	3,400	5/21 - 6/14
GREEN - GREEN RIVER, UT (see note1 below)	47,200	22,560	47,000	18,500	5/21	10,500	13,500	16,500	19,500	22,500	5/18 - 6/16
SAN RAFAEL - GREEN RIVER, NR	3,600	910	N/A	150	5/27	N/A	N/A	N/A	N/A	N/A	5/17 - 7/16
MUDDY CK - EMERY, NR	515	205	N/A	140	5/27	50	80	120	160	190	5/19 - 6/18
DIRTY DEVIL - HANKSVILLE, NR, POISON SPGS **	1,310	445	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3/12 - 5/31
ESCALANTE - ESCALANTE, NR **	227	72	N/A	117	5/17	N/A	N/A	N/A	N/A	N/A	3/24 - 6/2
CATARACT CANYON (estimated)	116,700	51,350	N/A	e32000	5/22	17,000	24,000	31,000	37,000	44,000	5/20 - 6/16
SAN JUAN - PAGOSA SPRINGS	4,640	2,485	11,300	2,940	5/17	560	715	925	1,380	1,740	5/15 - 6/12
ANIMAS - DURANGO	10,700	4,675	8,350	4,770	5/16	1,810	2,160	2,500	2,990	3,660	5/28 - 6/14
SAN JUAN - BLUFF, NR (see note2 below)	15,200	7,340	40,900	7,630	5/29	2,310	2,660	3,040	3,490	4,160	5/21 - 7/4

N/A - NOT AVAILABLE (NOT A FLOOD FORECAST POINT OR NO FORECAST PROCEDURE EXISTS)

NOTE1 - Peak flow forecasts on the Green River below Flaming Gorge Reservoir are based on USBR planned regulation.

NOTE2 - Peak flow forecasts on the San Juan below Navajo Reservoir are based on USBR planned regulation.

* Flood flow is for current year only and is an instantaneous value

** Runoff period March - June

LOWER COLORADO PEAK FLOW FORECASTS

Mean daily flows in cubic feet per second (cfs)

STATION NAME	Historic	Average	Flood*	2001	2001	2002 Forecast Exceedance Probability					Normal time of peak
	Peak	Peak	Flow	Peak	Date	90%	75%	50%	25%	10%	
VIRGIN - LITTLEFIELD, NR	17,000	1,915	19,500	320	4/29	120	190	300	630	775	3/15 - 5/6
VIRGIN - HURRICANE, NR	9,620	1,520	6,600	530	5/02	100	150	240	550	665	3/14 - 5/9
SANTA CLARA - PINE VALLEY, NR	212	65	N/A	80	5/14	N/A	N/A	N/A	N/A	N/A	4/25 - 5/25

STATION NAME	Historic	Average	Flood*	2001	2001	2002 Forecast Exceedance Probability					Normal time of peak
	Peak	Peak	Flow	Peak	Date	90%	75%	50%	25%	10%	
BLACK - FT. APACHE, NR	24,200	3,960	N/A	1,240	4/07			120	400	700	3/8 - 4/13
WHITE - FT. APACHE, NR	5,130	1,410	N/A	740	4/21		40	70	250	350	3/19 - 4/24
SALT - ROOSEVELT, NR	77,200	9,610	N/A	2,480	4/07			250	550	800	3/6 - 4/9
TONTO CK - ROOSEVELT, NR, GUN CK, ABV	32,200	4,090	N/A	830	3/11			20	150	250	3/3 - 4/4
OAK CREEK - SEDONA, NR	8,600	1,550	17,500	520	3/14			40	200	400	3/6 - 4/9
VERDE - HORSESHOE DAM, ABV, TANGLE CK	65,100	8,530	N/A	2,950	3/15			**	250	350	3/6 - 4/9
AGUA FRIA - ROCK SPRINGS, NR	23,600	2,565	N/A	1,020	3/10			**		10	2/28 - 4/3

N/A - NOT AVAILABLE (NOT A FLOOD FORECAST POINT OR NO FORECAST PROCEDURE EXISTS)

* Flood flow is for current year only and is an instantaneous value

** snowmelt peak likely has already occurred

GREAT BASIN PEAK FLOW FORECASTS

Mean daily flows in cubic feet per second (cfs)

STATION NAME	Historic Average Flood*					2002 Forecast Exceedance Probability					Normal time of peak
	Peak	Peak	Flow	Peak	Date	90%	75%	50%	25%	10%	
BEAR - UTAH-WYOMING STATELINE, NR	2,680	1,610	4,300	1,500	5/16	700	900	1,200	1,600	1,900	5/22 - 6/14
LOGAN - LOGAN, NR, STATE DAM, ABV	1,870	985	1,400	720	5/16	200	350	550	850	950	5/18 - 6/10
BLACKSMITH FORK - HYRUM, NR, UP&L DAM	1,530	490	N/A	120	4/29	20	100	250	400	500	4/24 - 5/20
WEBER - OAKLEY, NR	4,170	1,625	3,100	1,540	5/16	700	900	1,200	1,500	1,700	5/24 - 6/16
CHALK CK - COALVILLE	1,420	600	1,900	245	5/16	50	150	300	550	750	5/5 - 5/31
PROVO - WOODLAND, NR	2,530	1,685	3,000	1,970	5/16	700	1,000	1,400	1,800	2,300	5/11 - 6/6
PROVO - HAILSTONE, NR	3,560	2,150	N/A	2,940	5/16	600	1,200	2,000	2,800	3,300	5/14 - 6/7
LITTLE COTTONWOOD CK - SALT LAKE CITY, NR	762	470	700	360	5/16	200	300	400	500	600	5/23 - 6/20
BIG COTTONWOOD CK - SALT LAKE CITY, NR	980	430	700	460	5/16	200	250	350	450	550	5/18 - 6/9
MILL CK - SALT LAKE CITY, NR	153	65	150	25	5/16	15	35	50	65	80	5/18 - 6/10
PARLEYS CK - SALT LAKE CITY, NR	605	180	300	70	4/29	30	70	150	200	250	4/23 - 5/22
EMIGRATION CK - SALT LAKE CITY, NR	164	55	120	15	4/30	10	35	50	70	90	4/11 - 5/19
CITY CK - SALT LAKE CITY, NR	322	90	150	45	5/16	20	45	65	90	110	5/12 - 6/1
SEVIER - HATCH	1,430	495	1,200	515	5/17	85	120	185	250	320	5/6 - 6/2

N/A - NOT AVAILABLE (NOT A FLOOD FORECAST POINT OR NO FORECAST PROCEDURE EXISTS)

* Flood flow is for current year only and is an instantaneous value



RECREATIONAL INFORMATION

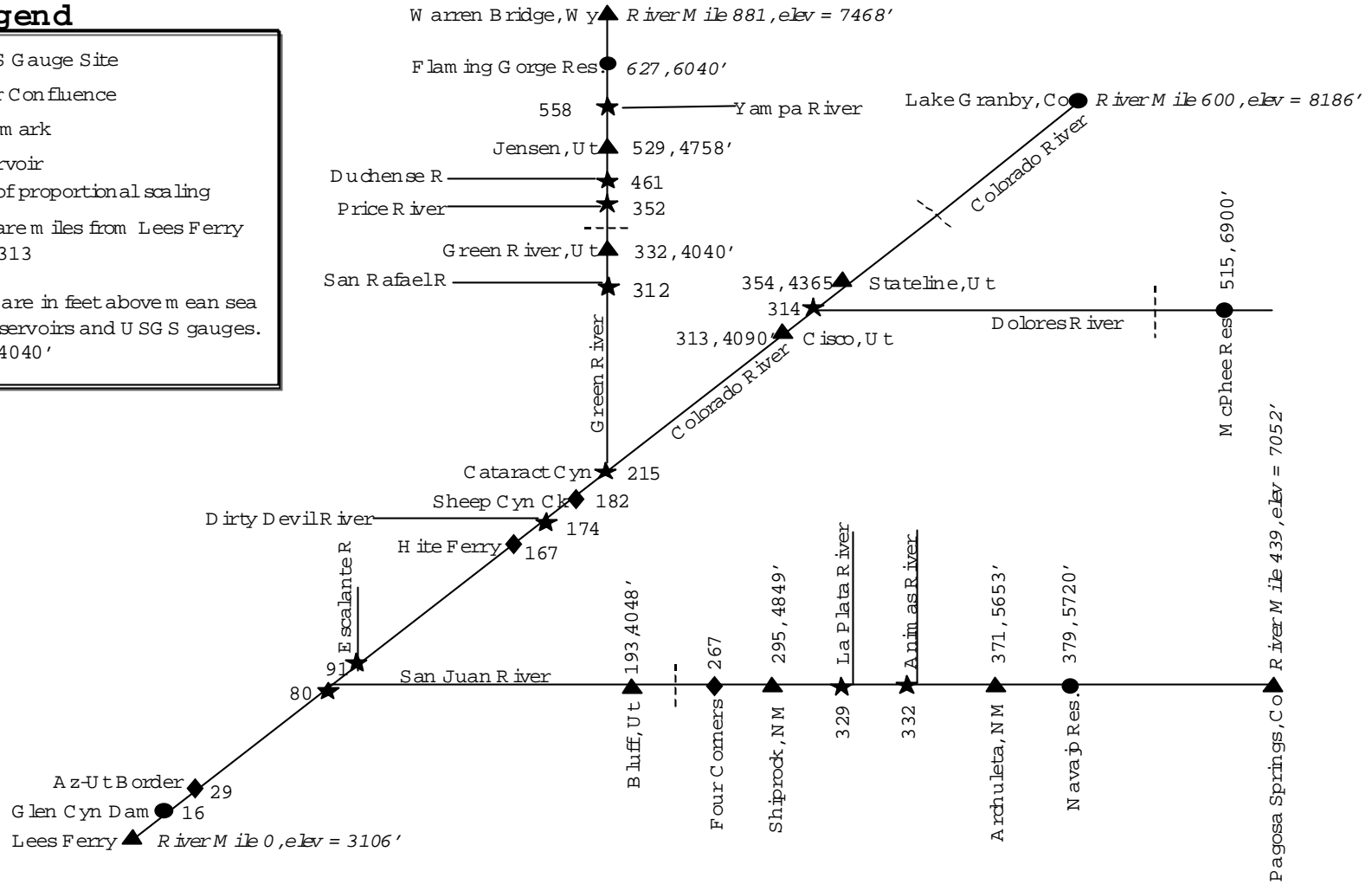
RECREATIONAL RIVER REACHES

Legend

- ▲ U S G S Gauge Site
- ★ River Confluence
- ◆ Landmark
- Reservoir
- End of proportional scaling

Distances are miles from Lees Ferry
Example: 313

Elevations are in feet above mean sea level for reservoirs and U S G S gauges.
Example: 4040'



HIGHLIGHTED RIVER RECREATIONAL SITES

HISTORICAL PERSPECTIVE...

River recreationists often ask questions such as - “What were the big years at this river site and how big were they?...or conversely, what were the low years?”. Ranked for each highlighted river site below are the five highest and lowest annual peak mean daily flows and the years in which they occurred for the April - July flow period window. Since reservoir regulation plays a major role in determining observed peak flows, the highest flows have been analyzed over two different historical periods: the post regulation period alone (after upstream regulatory reservoirs were in-place) and the entire period of record (including both pre- and post-regulatory data). As would be expected, higher (but more short-lived) peaks were generally observed in the pre-regulatory era.

A PEAK AMONG PEAKS...

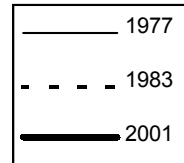
Streamflow varies dramatically over the course of the snowmelt season. To characterize the magnitude of a year with a single seasonal peak sometimes can be an oversimplification. Illustrating that point are the hydrographs (or graphs of mean daily flow versus time) for several years shown below. Included are plots for a sample low year (1977), sample high year (1983), and last year (2001).

RIVER VELOCITIES...

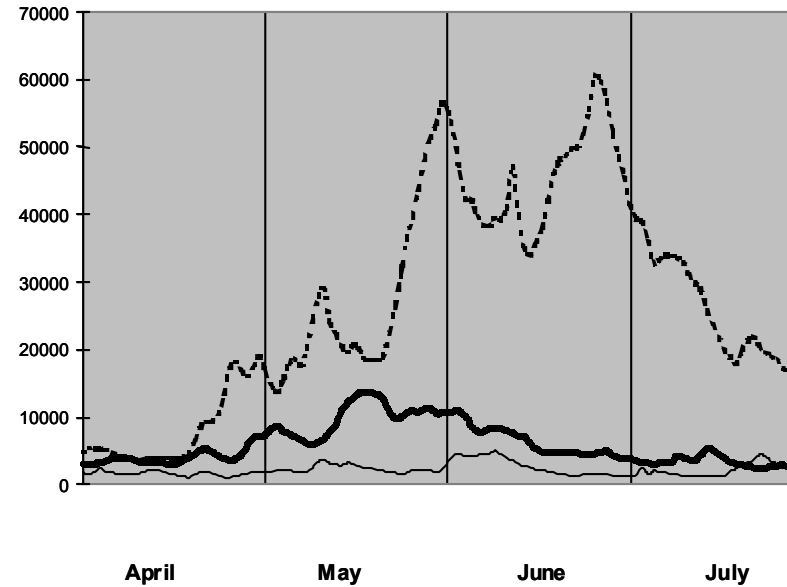
To help river runners approximate their travel times, information on average river velocities at various flow levels is presented for the highlighted river sites. When utilized with the river reach (distance) information displayed earlier, recreationists can make a ballpark calculation ($\text{time} = \text{distance}/\text{velocity}$). River velocity actually varies with depth and proximity to the channel boundary, but if considered collectively at all points in a cross-section, it can be expressed as an average. These data, as much of the information in this report, were obtained from the U. S. Geological Survey.

Colorado near Cisco, UT

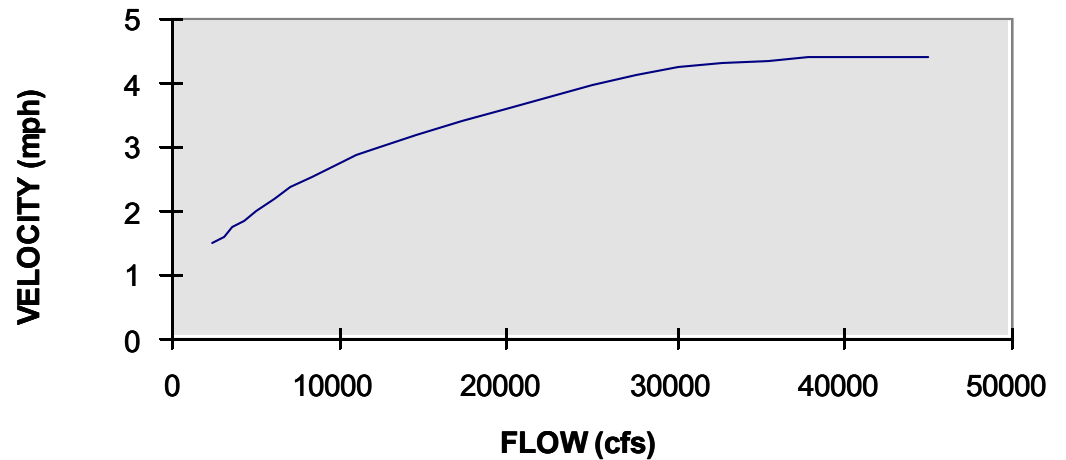
Highest 5 Peak Flows 1914-1917 and 1923-2001	
cfs	date
76800	6/19/17
69500	5/27/84
65600	6/3/14
63400	5/15/41
63400	6/10/57
Highest 5 Peak Flows Post Regulation 1961-2001	
cfs	date
69500	5/27/84
60500	6/27/83
51400	6/19/95
47600	5/23/93
44600	5/29/79
Lowest 5 Peak Flows 1914-1917 and 1923-2001	
cfs	date
4970	7/24/77
9600	5/31/89
11800	6/9/81
12100	5/20/63
12200	6/12/90



MEAN DAILY FLOW APRIL-JULY



Velocity vs Flow



In general, the higher the flow, the higher the velocity. The velocity reaches a maximum, for the most extreme events, between 5 and 7 mph.

Green near Green River, UT

**Highest 5 Peak Flows
1896-1899 and 1905-2001**

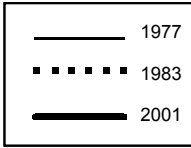
cfs	date
68100	6/27/17
64100	6/16/21
63000	5/29/1897
62200	6/13/09
54600	6/12/12

**Highest 5 Peak Flows
Post Regulation 1961-2001**

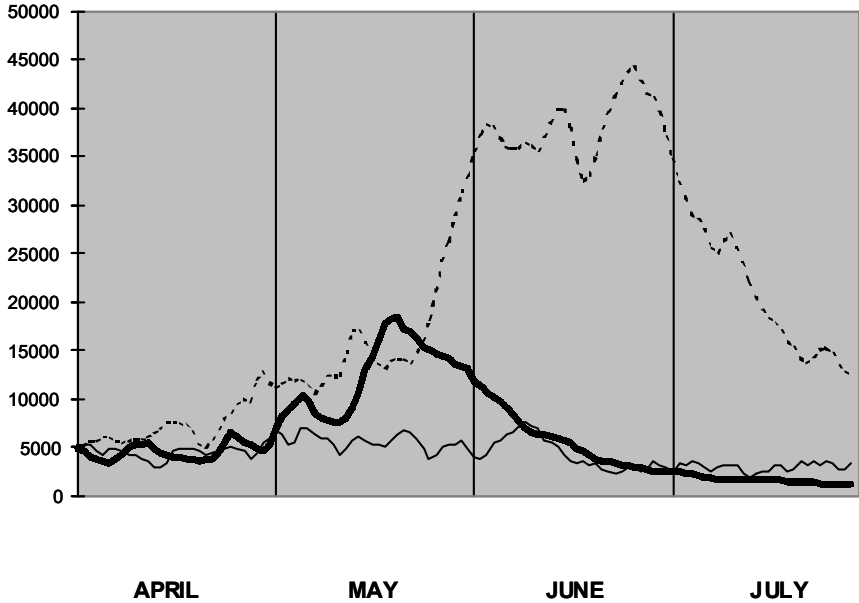
cfs	date
47200	5/20/84
44200	6/27/83
35400	6/8/86
31900	6/9/97
30300	5/24/73

**Lowest 5 Peak Flows
1896-1899 and 1905-2001**

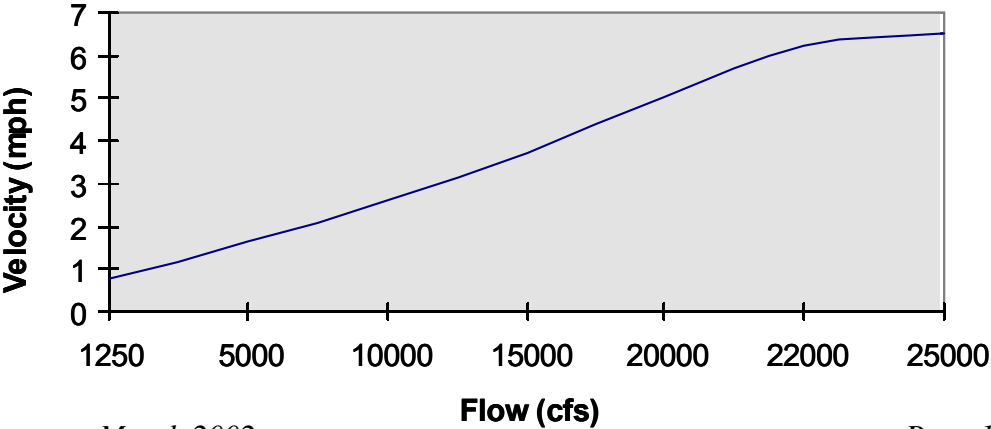
cfs	date
7600	6/10/77
7840	5/16/89
9370	5/15/63
10700	5/14/92
11000	6/14/90



MEAN DAILY FLOW APRIL-JULY



Velocity vs Flow



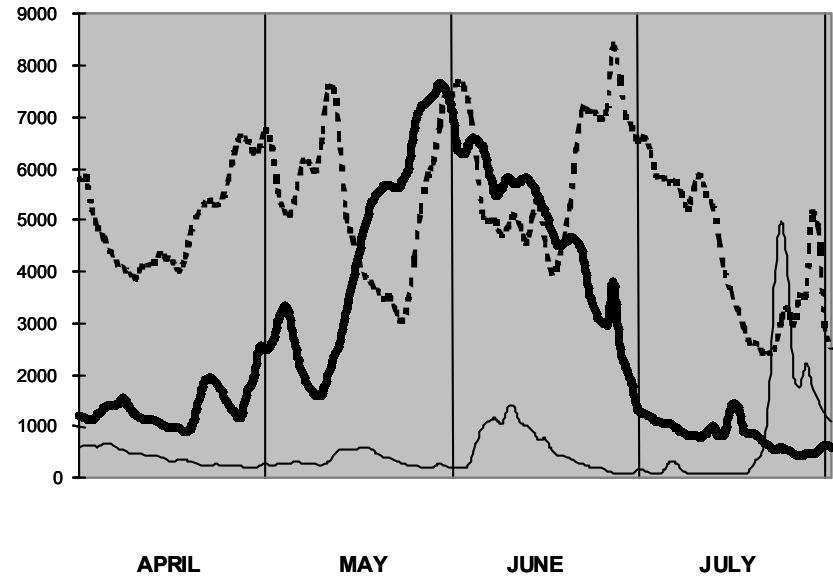
In general, the higher the flow, the higher the velocity. The velocity reaches a maximum, for the most extreme events, between 5 and 7 mph.

San Juan near Bluff, UT

5 Highest Flows 1915-1917 and 1927-2001	
in cfs	date
52000	6/30/27
33800	5/14/41
25400	6/20/49
18700	6/17/17
18500	6/17/35
5 Highest Flows Post Regulation 1961-2001	
in cfs	date
15200	5/29/79
12200	4/30/85
11700	5/22/73
11600	6/19/95
11300	6/12/87
5 Lowest Flows 1915-1917 and 1927-2001	
in cfs	date
2570	5/19/74
2660	5/10/63
2750	6/23/71
2820	7/29/89
3190	6/10/72



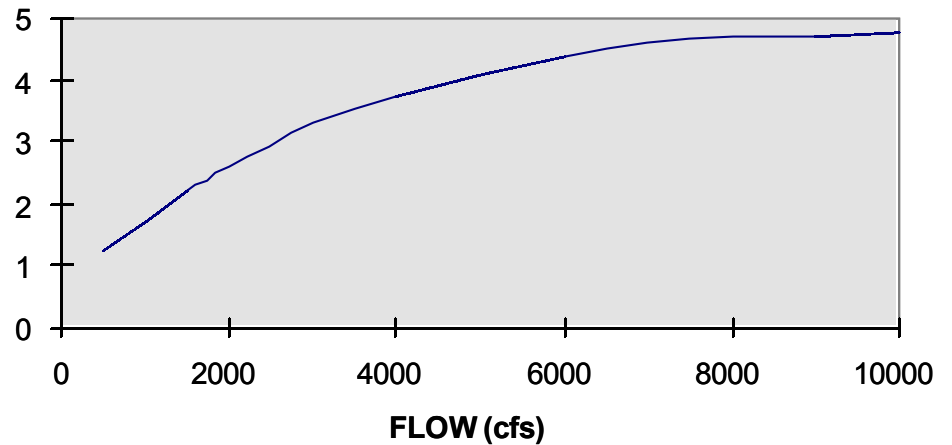
MEAN DAILY FLOW APRIL -JULY



In general, the higher the flow, the higher the velocity. The velocity reaches a maximum, for the most extreme events, between 5 and 7 mph.

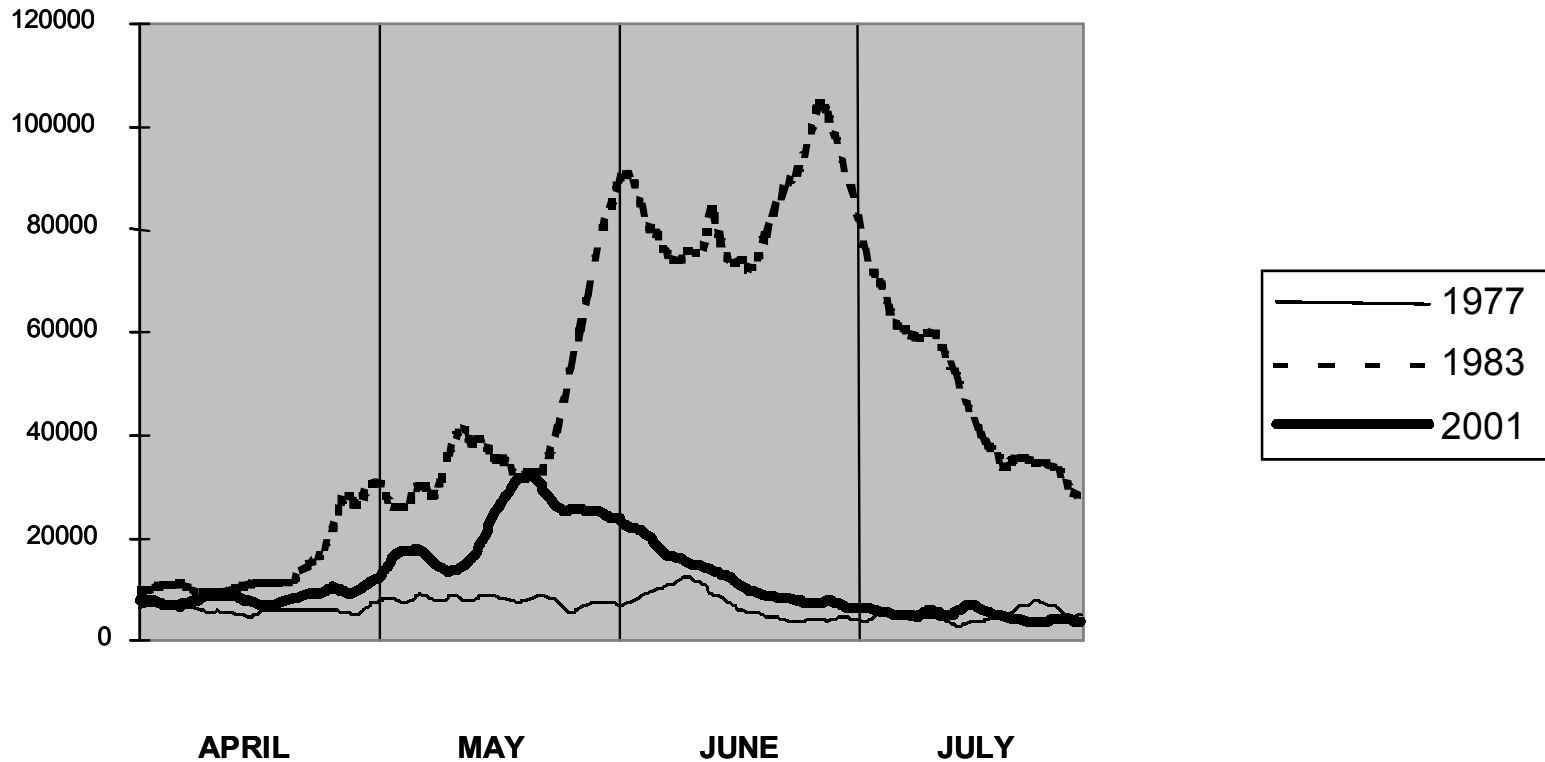
VELOCITY (mph)

Velocity vs Flow



Cataract Canyon

MEAN DAILY FLOW APRIL-JULY



The data above for Cataract Canyon have been synthesized from the Green River near Green River, Utah and the Colorado River near Cisco, Utah gages. The flows from these observed upstream points were routed (lagged in time) to Cataract Canyon and added. Information on the distances between river points and assumed average velocities used to make such calculations are shown earlier in this report.

PHONE NUMBERS OF INTEREST

FOR WEATHER INFORMATION:		FOR RIVER RUNNING CONDITIONS, PERMITS, ETC.			
		River	Reach	Organization	Number
NEW MEXICO	505-243-0702	COLORADO	Above Westwater Canyon	BLM Grand Jctn	970-244-3000
ARIZONA	602-275-0073		Westwater Canyon	BLM Moab	435-259-6111
NORTHERN ARIZONA	928-774-3301		Cisco thru Cataract Canyon	Canyonlands NP	435-259-7164
UTAH	801-524-5133		Grand Canyon	Grand Canyon NP	928-638-7888
WYOMING	307-635-9901	DIRTY DEVIL		BLM Hanksville	435-542-3461
SOUTHWESTERN WYOMING	307-857-3898	ESCALANTE		BLM Escalante	435-826-5499
WESTERN COLORADO	970-243-0914				
SOUTHERN NEVADA	702-736-3854	GREEN	Ledore to US40	Dinosaur NM	970-374-2468
			Desolation Cyn to Green Rvr	BLM Price	435-636-3622
SOUTHEASTERN DAHO	208-233-0137	MUDDY CREEK		BLM Price	435-636-3622
		SAN JUAN	Below Bluff	BLM Monticello	435-587-2141
		VERMILION	Zion NP	Zion NP	435-772-3256
			St. George to Littlefield	BLM Arizona Strip	435-688-3200
		YAMPA	Deer Lodge to confluence	Dinosaur NM	970-374-2468



FLOOD POTENTIAL INFORMATION

SERVICE HYDROLOGISTS

The graphic on the following page depicts the areas of responsibility of the various Service Hydrologists or Hydro Focal Points. The following list links these individuals and their corresponding areas of responsibility. **A Service Hydrologist/Hydro Focal Point is the National Weather Service hydrologic coordinator and spokesperson for a given hydrologic service area and is the person to contact for current flood potential, streamflows, snowpack information and updates to peak flow forecasts.** Following their phone number is a URL to their homepage.

1) Albuquerque, NM	Ed Polasko	505-243-0702	http://www.srh.noaa.gov/abq/
2) Cheyenne, WY	Ray Gomez	307-772-2468x493	http://www.crh.noaa.gov/cys/
3) Boulder, CO	Treste Huse	303-494-3210x493	http://www.crh.noaa.gov/den/
4) El Paso, TX	Tim Brice	505-589-4088	http://www.srh.noaa.gov/elp/
5) Flagstaff, AZ	Tom Clemmons	928-556-9161x229	http://www.wrh.noaa.gov/Flagstaff/
6) Grand Junction, CO	Brian Avery	970-243-7007x633	http://www.crh.noaa.gov/git/
7) Las Vegas, NV	Harold Daley	702-263-9744x228	http://www.wrh.noaa.gov/Lasvegas/
8) Phoenix, AZ	Tom Zickus	602-275-8881x228	http://www.phx.noaa.gov/
9) Pocatello, ID	Bill Wojcik	208-233-0834	http://www.wrh.noaa.gov/Pocatello/
10) Pueblo, CO	Larry Walrod	719-948-9429x895	http://www.crh.noaa.gov/pub/
11) Riverton, WY	Melissa Claghorn	307-857-3898	http://www.crh.noaa.gov/riw/
12) Salt Lake City, UT	Brian McInerney	801-524-5142x228	http://www.wrh.noaa.gov/Saltlake/
13) Tucson, AZ	Erik Pytlak	520-670-5156x228	http://www.wrh.noaa.gov/Tucson/

**NATIONAL WEATHER SERVICE HYDROLOGIC SERVICE AREAS
IN THE CBRFC AREA OF RESPONSIBILITY**

