TECHNICAL MEMORANDUM

SUBJECT: **Green River Basin Plan II**
Task 3A—Surface Water Data Collection and Study Period Selection

DATE: November 3, 2008

PREPARED BY: AECOM

Introduction

The feasibility study determined that three 12-month spreadsheet models (one each representing average-year, dry-year, and wet-year streamflows), constitute an appropriate level of detail for a modeling tool to verify existing surface water uses and evaluate future surface water uses. Gage flows used in the three spreadsheets are to be typical of three different conditions, and are to be developed by averaging observed streamflows that occurred during historical ”Normal”, “Wet”, or “Dry” years. Accordingly, the objectives of this task were to:

- determine the study period to be used for the Green River basin spreadsheet models
- select index gages and identify the top and bottom 20 percent of years in terms of annual flow at these gages. The top years are defined as Wet years, the bottom as Dry years, and the remaining years are defined as Normal years.
- assemble surface water information required for the spreadsheet

Study Period Selection

Literature Review

Several studies on the Green River basin were reviewed to determine the hydrologic study period used for each:

- Williams, Linda I., “A Model of the Green River Using the Wyoming Integrated River System Operation Study (WIRSOS),” M.S. Thesis, University of Wyoming, Department of Civil Engineering, December 1995.

  The study period used in this report was 1970-1992.

- Aqua Terra Consultants, Inc., “Final Report, Little Snake River Instream Flow Study Project,” prepared for the Wyoming Water Development Commission, February 26, 1993.

  The study period used in this report was 1947-1991.

- Stone & Webster Engineering Corporation, "Streamflow Depletion Study, Sandstone Reservoir", prepared for the Wyoming Water Development Commission, February 13, 1987.

  The study period used in this report was 1930-1982.

This brief summary gives an indication that a potential study period could begin thirty to fifty years ago and extend through 2007 (most current data available). A thirty to fifty year period ending in 2007 should provide sufficient variability to capture a wide range of hydrologic conditions.

Review of Reservoirs

Because a single annual cycle will be used to model each hydrologic condition, the average data developed for input to the model should be derived from an operationally consistent time period. Since construction or major modification of a reservoir during the study period would influence the downstream gages, reservoir history places significant control on selection of the study period. For this reason, major reservoirs (greater than 10,000 acre-feet) that have been constructed or modified during the past fifty years were reviewed to consider their influence on selection of the study period, with the following summarized results:

- Upper Green River - Construction of Fontenelle Reservoir was complete in April 1964 and the reservoir became fully functional during the late 1960's. During the late 1980's, Fontenelle Reservoir was drawn down for repair. This will be taken into consideration during modeling, but not for selection of the proposed study period. Other major reservoirs (>10,000 AF) within the Upper Green River basin, such as Big Sandy, Eden, New Fork, Willow, Fremont and Boulder, were permitted and constructed prior to Fontenelle Reservoir. Fremont Lake was modified in the 1990's; however, as with the work on Fontenelle Reservoir, the impacts of this modification will be taken into consideration during modeling.

- Blacks Fork River – Viva Naughton Reservoir was completed in 1960 and raised to its present level in 1967. Meeks Cabin Reservoir was completed in June 1971. Stateline Reservoir was completed in May 1979.

- Little Snake River –High Savery Reservoir was completed in 2004.

- Henry's Fork River – There are no sizable reservoirs within the Henry's Fork basin.

This initial screening of current basin operations suggests that the study period begin in 1971 and end in 2007. By 1971, every major existing reservoir except for Stateline and High Savery was in place. A twenty-year study period (1979-1998) consistent with the post-construction period of Stateline Reservoir may be too short for a quantitative analysis. An alternative is to select 1971 through 2007 and adjust the gage below Stateline Reservoir (09220000 – East Fork of Smith Fork below Robertson) from 1971 to 1979 for representative operations of Stateline Reservoir, had it existed during this time period. Similarly, it is desirable to reflect the most recent data and conditions in the spreadsheet, so flows below

High Savery Reservoir, for 2004 through 2007, will need to be adjusted to reflect consistent conditions. Because the period is short, this approach is feasible. The dry sequence, of which these years were a part, is of particular interest to water planners, and should not be excluded from the study period.

Review of Streamflow Records

Analysis of available streamflow data consisted of reviewing the USGS National Water Information Website (http://nwis.waterdata.usgs.gov/usa/nwis/monthly) and supplementing with a less comprehensive review of data reported in the SEO Annual Hydrographers' Report. The latter focused on key gages only after 1999. Based on this review, **Table 1** was prepared to show the period of record for selected gages within the Upper Green River, Blacks Fork, Henry's Fork, and Little Snake River basins. Some gage data may exist for periods prior to the period of record shown. These periods have not been listed because they are of short duration (less than 5 years continuous data) or are prior to 1950. The period of record is listed as calendar month-year. If records have been obtained from the Hydrographers Report, only the year may be listed. Typically, flows have been recorded by the SEO for the April-September time period.

Table 1 - USGS Gage Stations in the Green River Basin within Wyoming

Station No.	Station Name	Drainage Area (mi^2)		Period of Record From	To
	Upper Green River				
09188500	Green River at Warren Bridge, near Daniel	468.0		Oct-31 Oct-93	Sep-92; Sep-07
09189000	Beaver Creek near Daniel	141.0		Oct-38	Sep-54
09189495 / SEO	North Horse Creek above Sherman Ranger Station	42.8		Oct-82	Sep-84
09189500	Horse Creek at Sherman Ranger Station	43.0		Oct-54	Sep-74
09189550	South Horse Creek near Merna	33.3		Oct-82 Apr-85	Sep-84; Sep-85
09190000	Horse Creek near Daniel	105.0		Oct-31 Sep-82	Oct-54; Sep-85
09191300 / SEO	South Cottonwood Creek near Big Piney	21.4		Oct-82	Sep-84
09191500	Cottonwood Creek near Daniel	202.0		Oct-38	Sep-54
09192750	New Fork River above New Fork Lakes	21.8		Apr-85	Sep-85
09193000	New Fork River below New Fork Lake, near Cora	36.2		Oct-38 Apr-72	Oct-71; Oct-72
09196500	Pine Creek above Fremont Lake	75.8		Oct-54 Oct-00	Sep-97; Sep-07

Table 1 - USGS Gage Stations in the Green River Basin within Wyoming

Station No.	Station Name	Drainage Area (mi^2)		Period of Record From	To
09197000	Pine Creek below Fremont Lake	114.0		Apr-85 Apr-88 Oct-05	Sep-86; Sep-04; Sep-07
09198000	Pine Creek at Pinedale	118.0		Oct-15	Sep-54
09198500	Pole Creek below Little Half Moon Lake, near Pinedale	87.5		Oct-38	Sep-71
09199500	Fall Creek near Pinedale	37.2		Oct-38	Sep-71
09201000	New Fork River near Boulder	552.0		Oct-14	Sep-69
09202000	Boulder Creek below Boulder Lake, near Boulder	130.0		Oct-38 May-72	Oct-71; Sep-73
09203000	East Fork River near Big Sandy	79.2		Oct-38	Sep-92
09204000	Silver Creek near Big Sandy	45.4		Oct-38	Sep-71
09205000	New Fork River near Big Piney	1230.0	e	Sep-54	Sep -07
09205490	N. Piney Creek above Apperson Creek, near Mason	29.6		Oct-82 1985 1989	Sep-84; 1987; 1998
09205500	North Piney Creek near Mason (Marbleton)	58.0	e	Oct-31 May-72	Oct-71; Sep-72
SEO	Middle Piney Creek at Forest boundary			1992	1998
09206000	Middle Piney Creek below South Fork, near Big Piney, WY	34.3		Aug-39 Oct-41	Sep-40 ; Sep-54
SEO	South Piney Creek near Snider Basin			1992	1998
09207700	Dry Piney Creek near Big Piney	67.0	e	Oct-65	Sep-73
0920800	LaBarge Creek near LaBarge Meadows Ranger Station	6.3	e	Oct-40 Oct-50	Sep-42; Sep-81
09208400	LaBarge Creek above Viola	122.0		Oct-82 2004	Sep-84 2007
09209400	Green River near LaBarge	3910.0	e	Oct-63	Sep-07
09209500	Green River near Fontenelle	3970.0		Oct-46	Mar-65
09210500	Fontenelle Creek near Herschler Ranch, near Fontenelle	152.0		Oct-51	Sep-07
09211000	Fontenelle Creek near Fontenelle	224.0		Oct-31	Sep-53
09211200	Green River below Fontenelle Reservoir	4280.0		Oct-63	Sep-07
09212500	Big Sandy River (Creek) at Leckie Ranch near Big Sandy	94.0	e	Oct-39 Mar-72	Oct-71; Sep-87
09213500	Big Sandy River near Farson	322.0		Apr-53	Sep-07

Table 1 - USGS Gage Stations in the Green River Basin within Wyoming

Station No.	Station Name	Drainage Area (mi^2)		Period of Record From	To
09214000	Little Sandy Creek near Elkhorn	20.9		Oct-39	Sep-71
09214500	Little Sandy Creek above Eden	134.0		Oct-54	Sep-81
09215000	Pacific Creek near Farson	500.0	e	Oct-54	Sep-73
09215550	Big Sandy River below Farson	1097.0		Jun-81	Sep-99
09216000	Big Sandy River (Creek) below Eden	1610.0	e	Oct-54	Aug-81
09216050	Big Sandy River at Gasson Bridge, near Eden	1720.0	e	May-72	Sep-06
09216545	Bitter Creek near Bitter Creek	308.0		Jul-75	Sep-81
09216562	Bitter Creek above Salt Wells Creek	836.0		Jun-76	Sep-81
09216565	Salt Wells Creek near South Baxter	34.7		Oct-76	Sep-81
09216578	Dry Canyon Creek near South Baxter	3.7		1976	1980
09216750	Salt Wells Creek near Salt Wells	526.0		Jun-76	Sep-81
09217000	Green River near Green River	14000.0	e	Apr-51	Sep-07
Blacks Fork					
09217900	Blacks Fork near Robertson	130	e	Jul-66 Oct-92	Sep-86 Sep-98
09218500 / SEO / USBR	Blacks Fork near Millburne	152		Oct-39	Sep 07
09219000	Blacks Fork near Urie	261		Oct-37	Sep-55
09220000	East Fork of Smith Fork near Robertson	53		Jul-39 Sep 07 no winter records from Oct 71 to Mar 01	
09220500	West Fork of Smith Fork near Robertson	37.2		Jul-39 Oct-71 May 72 Sep-81 no winter records since Oct 71	
09221500	Smith Fork at Mountain View	192		Oct-41	Sep-57
09222000	Blacks Fork near Lyman	821		Oct-37 Jun-62	Sep-57 Sep-83
09222300	Little Muddy Creek near Glencoe	416		Jul-76	Sep-80
09222400	Muddy Creek near Hampton	963		Jul-75	Sep-81
09223000	Hams Fork below Pole Creek near Frontier	128		Oct-52	Sep 07
09223500	Hams Fork near Frontier	298		Oct-45 Apr-72	Oct-71 Sep-72
09224700	Blacks Fork near Little America	3,100	e	Jun-62	Sep 07
09225000	Blacks Fork near Green River	3,670	e	Oct-47	Jul-62
Henry's Fork					

Table 1 - USGS Gage Stations in the Green River Basin within Wyoming

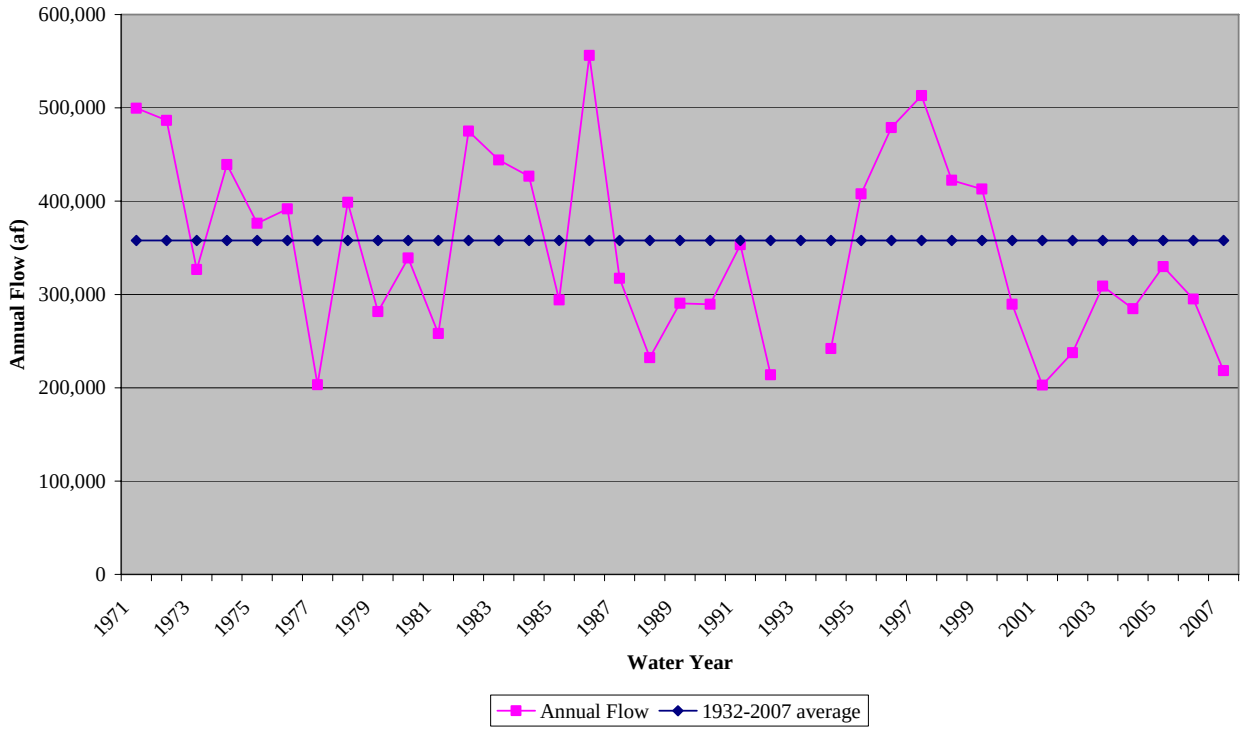
Station No.	Station Name	Drainage Area (mi^2)		Period of Record From	To
09226000	Henry's Fork near Lonetree	56	e	Oct-42 May-72	Oct-71 Sep-72
09226500	Middle Beaver Creek near Lonetree	28	e	Oct-48	Sep-70
09227000	East Fork Beaver Creek near Lonetree	8.2	e	Oct-48	Sep-62
09227500	West Fork Beaver Creek near Lonetree	23	e	Oct-48	Sep-62
09228000	Henry's Fork near Burntfork	242		Oct-42	Sep-54
09228500	Burnt Fork near Burntfork	52.8		Apr-43	Sep-83
09229500	Henry's Fork near Manila	520.0	e	Oct-28 May 01	Sep-93; Sep 07
Little Snake					
09251800	North Fork Little Snake River near Encampment	9.64		Oct-56	Oct-65
09251900	North Fork Little Snake River near Slater, CO	29.3		Apr-56	Sep-63
09253000	Little Snake River near Slater, CO	285		Oct-43 Oct-50 May-01	Sep-47; Sep-99; Sep-07
09253400	Battle Creek near Encampment	13		Apr-56 Apr-85	Sep-63 Sep-88
09253500	Battle Creek near Slater, CO			Oct-42	Sep-51
09255000	Slater Fork (Creek) near Slater, CO	161		Jul-31	Sep-07
09255400	East Fork Savery Creek near Encampment	5.57		Apr-56 Apr-85	Sep-58 Sep-88
09255500	Savery Creek at Upper Station, near Savery	200		Oct-40 Oct-52	Sep-41 Sep-71
09256000	Savery Creek near Savery	330		Oct-41 Oct-47 Apr-72 Apr-85	Sep-46 Sep-71 Sep-72 Sep-92
09257000	Little Snake River near Dixon	988		Oct-38 May-72 no winter records since Sep 71	Sep 71 Sep-97
09258000	Willow Creek near Dixon	24	e	Oct-53	Sep-93
09259000	Muddy Creek near Baggs	1257	e	Oct-87	Sep-91
09259700	Little Snake River near Baggs	3020	e	Oct 62	Sep 68
09260000	Little Snake River near Lily, CO	3730	e	Oct-21	Sep-07

"e" indicates approximate drainage area

Review of Hydrologic Conditions

The reservoir history and availability of gage records led Boyle to a preliminary conclusion that 1971-2007 should serve as the study period. Ideally, the modeling study period should be representative of long-term hydrologic conditions in the basin. To analyze this aspect of the proposed study period, Boyle reviewed annual flows at the USGS gage 09188500 Green River at Warren Bridge near Daniel, which are shown in **Figure 1**. This gage has the longest record of any of the Green River basin gages in Wyoming, and as an indicator of long-term versus short-term statistics, is applicable to the entire basin.

Figure 1
Green River at Warren Bridge near Daniel



Characteristics of the long-term (1932-2007, excluding 1993 because it is missing) record and the proposed study period (1971-2007, excluding 1993) are tabulated below:

Table 2
Characteristics of Annual Flow Series for
091885500 Green River at Warren Bridge near Daniel

	1932-2007 (1993 missing) Record	**1971-2007 (1993 missing) Record**
Mean (af)	357,852	348,340
Standard Deviation	82,724	96,859
Three highest years	1986 / 1997 / 1971	1986 / 1997 / 1971
Three highest values (af)	556,150 / 513,080 / 499,510	556,150 / 513,080 / 499,510
Three lowest years	2001 / 1977 / 1934	2001 / 1977 / 1992
Three lowest values (af)	202,741 / 203,260 / 208,720	202,741 / 203,260 / 213,910

Table 2 shows that means of the two periods are similar, with the recent period being somewhat drier. Standard deviation for the shorter period is higher, which is to be expected for a smaller sample size. Most notably, the short period includes the three highest annual flows of record, as well as two of the three driest. Furthermore, Figure 1 shows that the model study period captures several multi-year droughts: 1987 through 1991and 2000 through 2007. Usually the concern is that the short period does not include extremes found in the longer record, but in this case, extremes of both wet and dry are clearly included in the proposed study period.

Selected Study Period

Based on available records, existence of reservoirs, and representativeness of the period, 1971-2007 is selected as the modeling study period. This period encompasses a 37-year period which includes wet, dry and average years. It would be possible to begin the study period earlier in the Little Snake sub-basin, but in the interest of keeping the sub-basin spreadsheets consistent, 1971-2007 will be used for the Little Snake.

Index Gage Selection

Approach

The periods of record for gaging stations listed in Table 1 were reviewed. Gages that were in operation during most, if not all, of the study period were selected for evaluation as index gages. Additionally, if a gage was in operation seasonally throughout the study period, it was included in the evaluation as a potential index gage. **Table 3** lists the gages that met these initial screening criteria.

The list of potential index gages was further narrowed by applying the following criteria:

1. Were reservoir operations above the gage consistent throughout the study period?

- 09220000 – East Fork Smith Fork near Robertson - State Line Reservoir was constructed in 1979. Thus the record consists of pre-reservoir flows, flows that were modified by construction activities, and post-reservoir flows. The gage was eliminated from consideration for index gage status.

2. Which potential index gages have potential index gages located upstream that may be, to a greater degree, free from human influence?

   - 09205000 – New Fork River near Big Piney
   - 09209400 – Green River near LaBarge
   - 09211200 – Green River below Fontenelle Reservoir
   - 09217000 – Green River near Green River
   - 09224700 – Blacks Fork near Little American
   - 09257000 – Little Snake near Dixon
   - 09216050 – Big Sandy River at Gasson Bridge

   These seven gages were eliminated on the basis that a more "virgin" gage or gages existed in the watershed.

Table 3
Potential Index Gages for Hydrologic Condition

Basin	Gage No.	Gage Name
Upper Green River	09188500	Green River at Warren Bridge
	09196500	Pine Creek above Fremont Lake
	09205000	New Fork River near Big Piney
	09209400	Green River near LaBarge
	09210500	Fontenelle Creek near Herschler Ranch, near Fontenelle
	09211200	Green River below Fontenelle Reservoir
	09213500	Big Sandy River near Farson
	09216050	Big Sandy River at Gasson Bridge
	09217000	Green River near Green River
Blacks Fork River	09218500	Blacks Fork near Millburne
	09220000	East Fork Smith Fork near Robertson
	09223000	Hams Fork below Pole Creek near Frontier
	09224700	Blacks Fork near Little America
Henry's Fork River	09229500	Henry's Fork near Manila
Little Snake River	09253000	Little Snake near Slater, CO
	09257000	Little Snake near Dixon

This process resulted in eight gages remaining. The annual time series for four gages required minor filling prior to determining the Wet, Dry and Normal years. Filling was accomplished using linear regression techniques, a commonly accepted means of extending hydrologic time series. For each gage requiring filling, relationships with appropriately located gages having a common record were explored, and the gage with the highest coefficient of determination (R^2) was selected. (Excel spreadsheets showing these regressions are included in the project notebook.)

1. 09188500 – Green River at Warren Bridge, near Daniel

   There were no USGS data available for water year 1993. Provisional data for 1993 were found in Williams thesis (1995) and in HYDRODATA, USGS Daily Values – West I, Volume 8.0 (Hydrosphere, 1996). These data were discarded because winter flows appeared excessive. A linear regression relationship was developed between the annual flow at the Green River near LaBarge gage (09209400) and the annual flow at Green River at Warren Bridge. These gages share an overlapping period of record from 1963 through 2007, excluding water year 1993. The relationship is:

   Annual Flow at Green River at Warren Bridge = 0.214923* Annual Flow at Green River near LaBarge + 111,668 (1)

   R^2 = 0.92

   This relationship was used to estimate the annual flow at the Green River at Warren Bridge gage for 1993 prior to determining the wettest and driest 20 percent of the study years.

2. 09196500 – Pine Creek above Fremont Lake

   There are no data for water year 1998, 1999, or 2000. A linear regression relationship was developed between the annual flow at the New Fork near Big Piney gage and the annual flow at the Pine Creek above Fremont Lake gage. These gages share an overlapping period of record from 1954 through 2007, excluding the missing years. The relationship is:

   Annual Flow at Pine Creek above Fremont Lake = 0.16351* Annual Flow at New Fork near Big Piney + 40,757 (2)

   R^2 = 0.90

   This relationship was used to estimate the annual flow at the Pine Creek above Fremont Lake gage for 1998-2000 prior to determining the wettest and driest 20 percent of the study years.

3. 09253000 – Little Snake River near Slater, CO

   There are no data for water years 2000 and 2001. A linear regression relationship was developed between the annual flow at the Little Snake River Near Lily, CO gage (09260000) and the annual flow at the Little Snake River near Slater, CO gage

(09253000). These gages share an overlapping period of record from water year 1951 through water year 2007, excluding the two missing years. The relationship is:

Annual Flow at Little Snake River near Slater, CO = 0.31177* Annual Flow at Little Snake River near Lily, CO+ 39,224 (3)

R^2 = 0.87

This relationship was used to estimate the annual flow at the Little Snake River near Slater, CO gage for water year 2000 and 2001 prior to determining the wettest and driest 20 percent of the study years.

4. 09229500 – Henry's Fork near Manila

It was originally assumed that the Blacks Fork near Millburne gage would be used as the Index gage for Henry's Fork. Later review of the available historical data for the Henry's Fork near Manila, Utah gage determined that there were sufficient differences between the two basins to warrant the use of this gage as an index gage for Henry's Fork.

There are no data for water years 1994-2000, and partial water year data for 2001. The linear regression relationship between annual water year flow at the Blacks Fork near Little America, WY gage (09224700) and annual water year flow at the Henry's Fork near Manila gage (09229500) was the most favorable in terms of R^2 and was therefore selected to predict flow at gage 09229500. These gages share an overlapping period of record from 1963 through 2007, excluding 1994 through 2001. The relationship is:

Annual Flow at Henry's Fork near Manila = 0.23960*Annual Flow at Blacks Fork near Little America, WY+ 10,492 (4)

R^2 = 0.77

This relationship was used to estimate the annual flow at the Henry's Fork near Manila gage for water year 1994 through 2001 prior to determining the wettest and driest 20 percent of the study years.

For USGS station 09213500 Big Sandy River near Farson, data are available for the irrigation season only (April through September) for much of the period of record. For this gage, the determination of Wet, Normal, and Dry years was based on the total seasonal volume of flow rather than the annual volume. Monthly data for USGS station 09218500 Blacks Fork near Millburne is incomplete after 1992, but data for the missing periods were found in the Hydrographer's Report and USBR records for Meeks Cabin Reservoir releases.

Figure 2 is a map showing locations of these index gages:

Results

The wettest and driest 20 percent of the study period years, on an annual basis, were identified for each of the resulting index gages. **Figure 3** shows graphically the sorted annual series for each gage, and where the "DRY" and "WET" thresholds lie. The index gages and corresponding wet and dry year selection are shown in **Table 4**.

There was no exact duplication of hydrologic condition, so all eight index gages were be used, applied to geographical areas as follows:

- **09188500 Green River at Warren Bridge** - Upper Green River mainstem and tributaries located upstream of this gage
- **09196500 Pine Creek above Fremont Lake** - New Fork River and its tributaries
- **09210500 Fontenelle Creek near Herschler Ranch, near Fontenelle** - Upper Green River tributaries that rise in the Wyoming Range
- **09213500 Big Sandy River near Farson** - Big Sandy River and its tributaries
- **09218500 Blacks Fork near Millburne** - Blacks Fork, Smiths Fork and their tributaries
- **09223000 Hams Fork below Pole Creek near Frontier** - Hams Fork and its tributaries.
- **09229500 Henry's Fork near Manila** – Henry's Fork and its tributaries
- **09253000 Little Snake near Slater, CO** - Little Snake River and its tributaries.

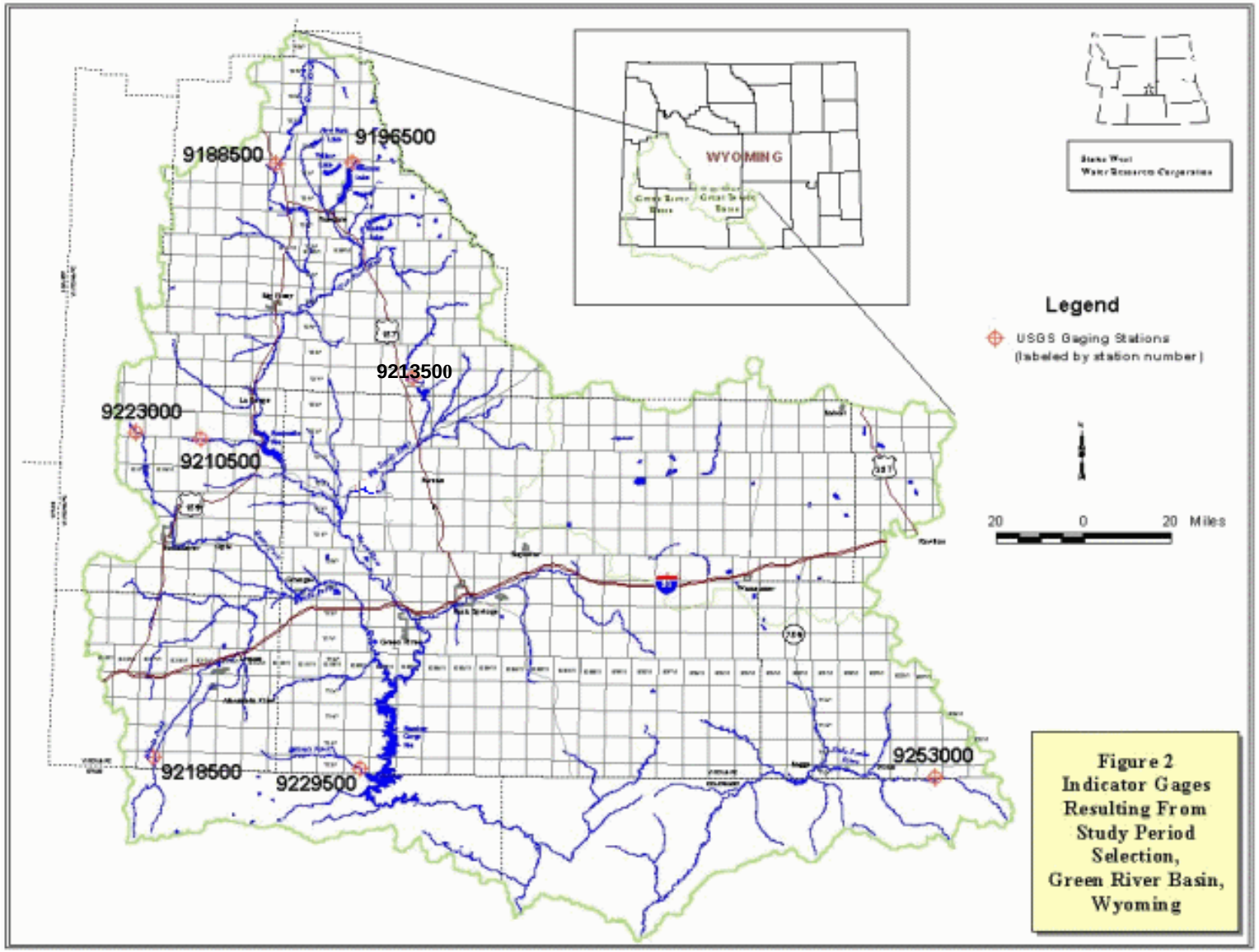


Figure 2
Indicator Gages Resulting From Study Period Selection, Green River Basin, Wyoming

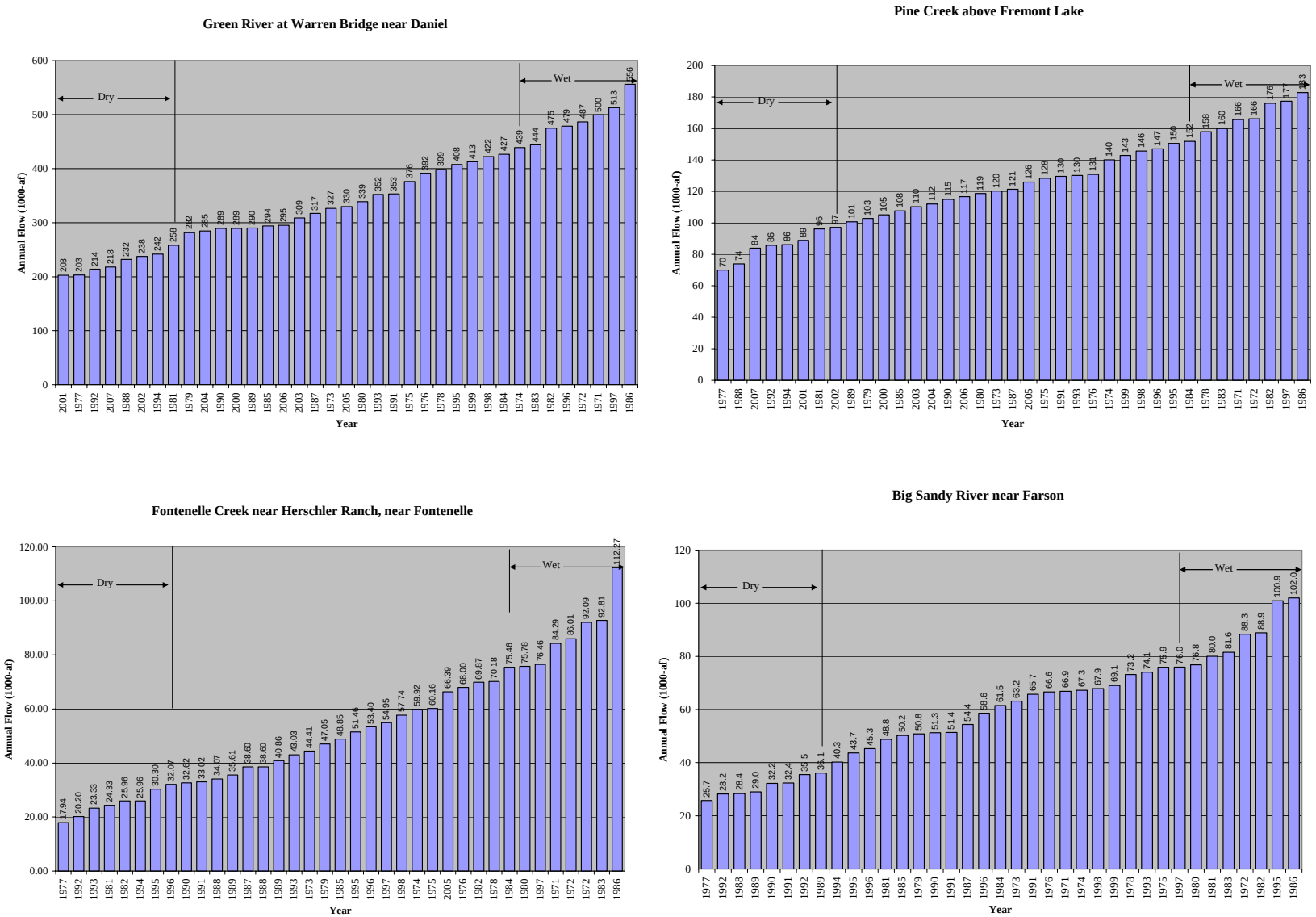


Figure 3 Annual Series for Index Gages, Showing Wet and Dry Years

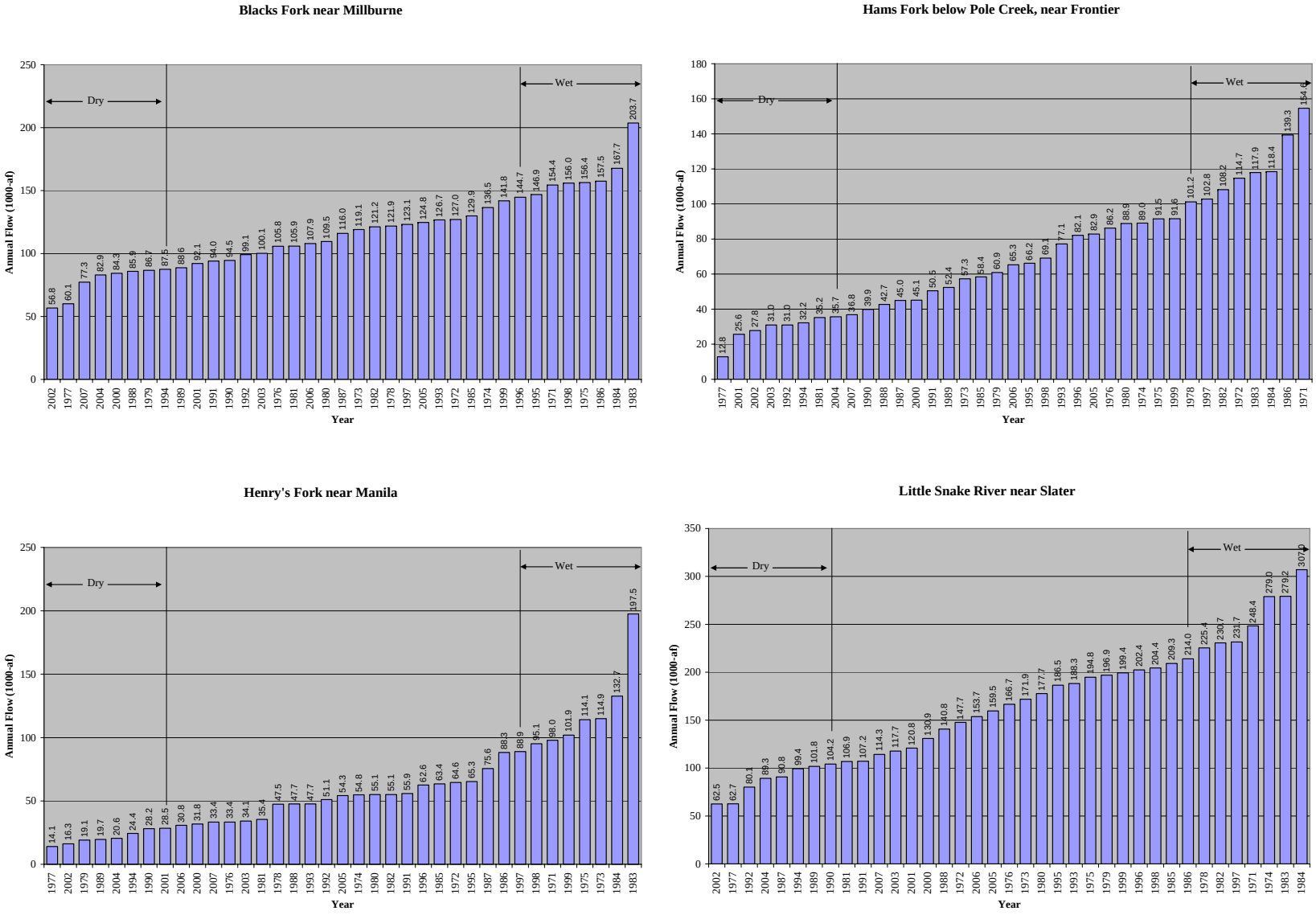
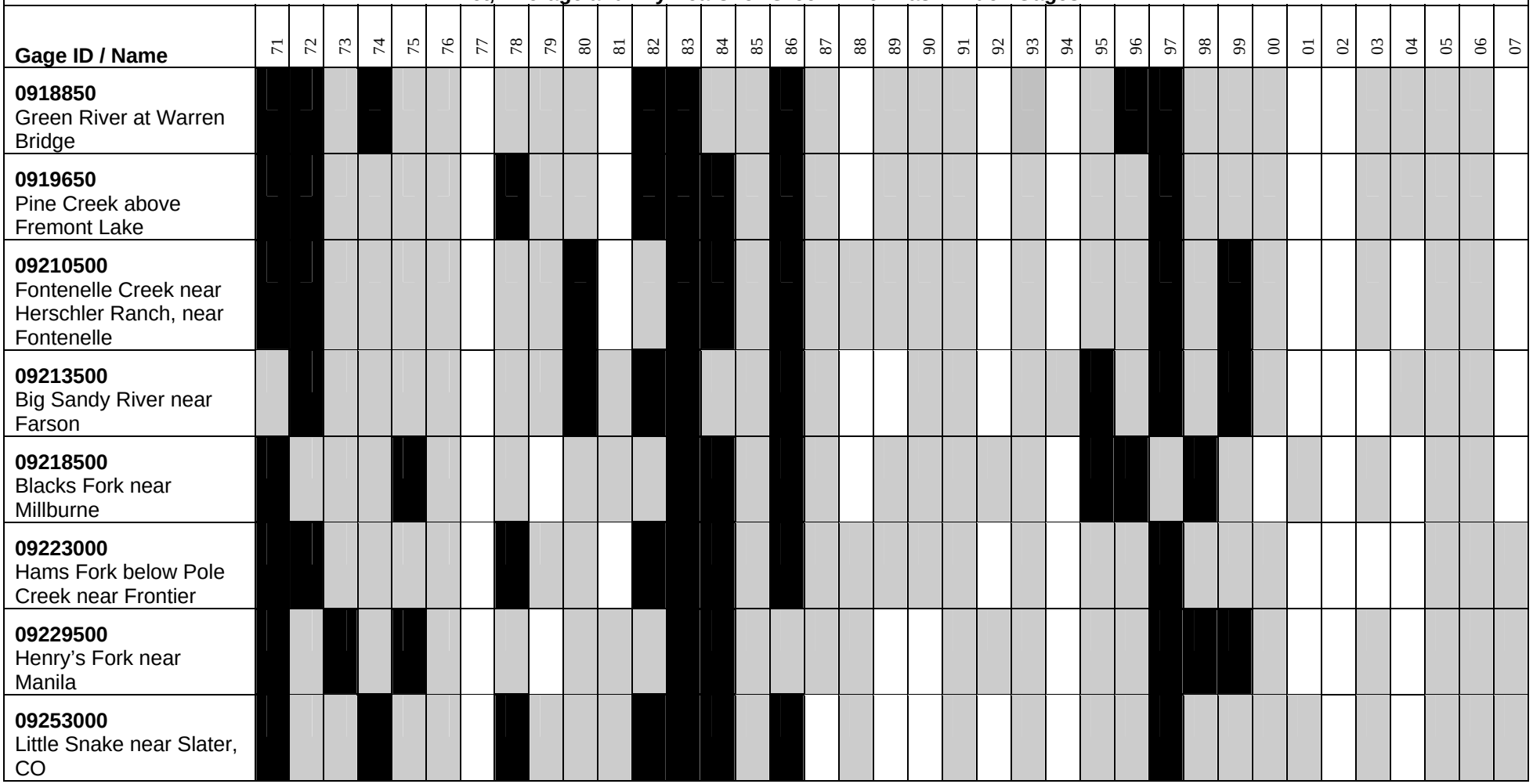


Figure 3 Annual Series for Index Gages, Showing Wet and Dry Years (cont'd)

Table 4
Wet, Average and Dry Years for Green River Basin Index Gages



Wet year Normal Year Dry Year

APPENDIX A

Changes from 2000 Green River Basin Plan

Green River Basin Plan Update

The first Green River Basin Plan was delivered to the State of Wyoming in 2001, and included spreadsheet models that covered the period 1971 through 1998. In 2007, the State updated the Basin Plan, and specifically, to extend the hydrologic study period of record for updating the spreadsheet model through Water Year 2007. The period from 1999 through 2007 was generally dry throughout the Rocky Mountain states; in fact, when the time series of annual flows for the Green River index gages were extended, re-sorted, and re-classified as Normal, Wet, or Dry, there was not a single Wet year among the extended data. The downward shift of the 20-th and 80th-percentile flows for the index gage Green River at Warren Bridge, shown below, is typical of all the index gages.

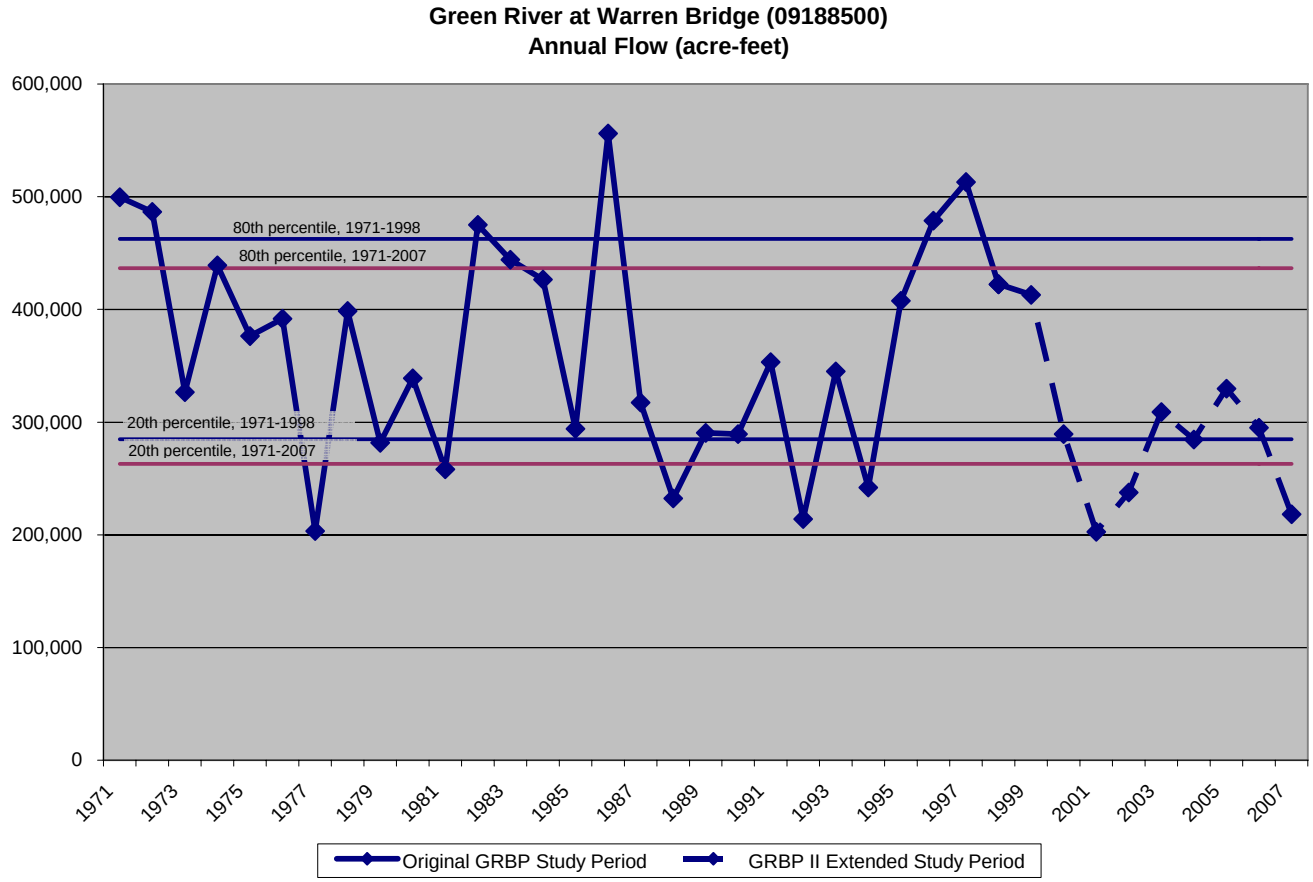


Table A-1 shows the Wet, Normal, and Dry year annual flows for index gages in the original Green River Basin Plan along with those for the updated Basin Plan.

Table A-1
Comparisons of Wet, Normal, and Dry Year Annual Flows for Index Gages, Updated Plan and Original Plan (GRBP I)
(values in acre-feet)

		WET		NORMAL		DRY	
Gage ID	Gage Name	Updated Value	GRBP I	Updated Value	GRBP I	Updated Value	GRBP I
09188500	Green River at Warren Bridge	486,600	501,500	342,300	366,800	226,000	238,500
09196500	Pine Creek above Fremont Lake	167,200	171,400	123,900	131,100	85,200	85,400
09210500	Fontenelle Creek near Herschler Ranch	86,900	89,000	49,900	53,900	25,000	25,700
09213500	Big Sandy River near Farson*	86,800	n/a	59,300	n/a	30,900	n/a
09218500	Blacks Fork near Millburne	160,900	164,700	113,600	120,200	77,700	85,800
09223000	Hams Fork below Pole Creek, near Frontier	119,700	125,500	65,700	73,700	28,900	32,300
09229500	Henrys Fork near Manila	117,800	125,400	51,800	59,800	23,600	22,900
09253000	Little Snake River near Slater	257,300	262,700	164,200	177,600	86,400	89,800

* Gage 09213500 was not an index gage in GRBP I