TECHNICAL MEMORANDUM

SUBJECT: **Green River Basin Plan**
Surface Water Data Collection and Study Period Selection

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Introduction

Modeling the Green River Basin requires selection of an appropriate period of record for hydrologic analysis. The feasibility study (Boyle, 1998) determined that three 12-month spreadsheet models (one each representing normal-year, dry-year, and wet-year streamflows) constitute an appropriate level of detail for a modeling tool to verify existing 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 to develop normal, wet, and dry year flow estimates for the Green River basin spreadsheet models;
- select index gages and identify the historical normal, wet, and dry years out of the study period;
- 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., December 1995, "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.

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

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

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

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

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

This brief summary indicates that a potential study period could begin thirty to fifty years ago and extend through 1998 (most current data available). A thirty to fifty year period ending in 1998 should provide sufficient variability to capture a wide range of hydrologic conditions, including wet and dry cycles.

Review of Reservoirs

Because a single annual cycle will be used to model each hydrologic condition, the normal data developed for input to the model is best derived from an operationally consistent time period. Construction or major modification of a reservoir during the study period would influence the downstream gages, hence 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 completed 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, including 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. 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 –There are no major reservoirs currently in operation in this sub-basin. High Savery Dam, currently under design, can be included in future scenarios but does not influence choice of the historical study period.

- Henrys Fork River – There are no reservoirs within the Henrys Fork basin of sufficient size to impact the study period selection.

Initial screening of current basin operations suggests that the study period begin in 1971 and end in 1998. By 1971, every major existing reservoir except for Stateline 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 1998 and adjust the gage below Stateline Reservoir (09220000 – East Fork of Smith Fork below Robertson) from 1971 to 1979 to reflect representative operations of Stateline Reservoir, had it existed during this time period.

Review of Streamflow Records

Analysis of available streamflow data consisted of reviewing the USGS Water-Data Report, Volume 1, Surface Water. This report lists discontinued and active surface water discharge, water quality, sediment and biological stations. This information was supplemented by a review of data reported in the SEO Annual Hydrographer's Report. Based on this review, Table 1 shows the period of record for selected gages within the Upper Green River, Blacks Fork, Henrys 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 1930. The period of record is listed as calendar month-year. If records have been obtained from the Hydrographer's Report, only the year may be listed. Typically, flows have been recorded by the SEO for the April-September time period.

"e" indicates **approximate** drainage area

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; Present
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	Nov-97
09197000	Pine Creek below Fremont Lake	114.0		Apr-85 Apr-88	Sep-86; Present
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

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Station No.	Station Name	Drainage Area (mi^2)		Period of Record From	To
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	Present
09205490	N. Piney Creek above Apperson Creek, near Mason	29.6		Oct-82 1985 1989	Sep-84; 1987; Present
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	Present
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	Present
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	Sep-84
09208500	LaBarge Creek near Viola	172.0		Oct-40	Sep-49
09209400	Green River near LaBarge	3910.0	e	Oct-63	Present
09209500	Green River near Fontenelle	3970.0		Oct-46	Mar-65
09210500	Fontenelle Creek near Herschler Ranch, near Fontenelle	152.0		Oct-51	Present
09211000	Fontenelle Creek near Fontenelle	224.0		Oct-31	Sep-53
09211200	Green River below Fontenelle Reservoir	4280.0		Oct-63	Present
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	Present
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	Present

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Station No.	Station Name	Drainage Area (mi^2)		Period of Record From	To
09216000	Big Sandy River (Creek) below Eden	1610.0	e	Oct-54	Jun-81
09216050	Big Sandy River at Gasson Bridge, near Eden	1720.0	e	May-72	Present
09216500	Green River at Green River	7970.0	e	Oct-14	Sep-39
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	Present
	Blacks Fork				
09217900	Blacks Fork near Robertson	130	e	Jul-66 Oct-92	Sep-86 Present
09218500	Blacks Fork near Millburne	152		Oct-39 no winter records since Sep 92	Sep 98
09219000	Blacks Fork near Urie	261		Oct-37	Sep-55
09220000	East Fork of Smith Fork near Robertson	53		Jul-39 no winter records since Oct 71	Oct 98
09220500	West Fork of Smith Fork near Robertson	37.2		Jul-39 May 72 no winter records since Oct 71	Oct-71 Sep-81
09221500	Smith Fork at Mountainview	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	Present
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	Present
09225000	Blacks Fork near Green River	3,670	e	Oct-47	Jul-62
	Henrys Fork				

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Station No.	Station Name	Drainage Area (mi^2)		Period of Record From	To
09226000	Henrys 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	Henrys Fork near Burntfork	242		Oct-42	Sep-54
09228500	Burnt Fork near Burntfork	52.8		Apr-43	Sep-83
09229500	Henrys Fork near Manila	520.0	e	Oct-28	Sep-93
	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	Sep-47 Present
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	Present
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	Present
WWRC	Muddy Creek at Snyder's Oil Pad	556		1985	1985

Review of Hydrologic Conditions

The reservoir history and availability of gage records led to a preliminary conclusion that 1971-1998 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, annual flows were reviewed for the USGS gage 09188500 Green River at Warren Bridge near Daniel (Figure 1). This gage has the longest record of the Green River basin gages in Wyoming, and as an indicator of long-term versus short-term statistics, is assumed applicable to the entire basin. Characteristics of the long-term (1932-1998, excluding 1993) record and the proposed study period (1971-1998, excluding 1993) are tabulated below:

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

	1932-1998 (excluding 1993)Record	1971-1998 (excluding 1993) Record
Mean (af)	367,426	368,744
Standard Deviation	82,724	99,929
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	1977 / 1934 /1992	1977 / 1992 / 1988
Three lowest values (af)	203,260 / 208,720 / 213,910	203,260 / 213,910 / 232,330

The table shows that the means of the two periods are very similar. The standard deviation for the shorter period is higher due to the 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 most enduring drought of record (1987-1992) is captured in the model study period. 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, 1971-1998 is selected as the modeling study period. This 28-year period, on average, appears similar to long-term conditions, and includes wet, dry and normal years. It would be possible to use a longer study period in the Little Snake sub-basin, but 1971-1998 will be used in this sub-basin as well, for consistency. Conversely, data may prove limiting on Henry's Fork. Gage data will have to be filled (estimated) to draw normal, wet and dry year flows from 1971-1998 on Henry's Fork. It is assumed that adequate regression relationships can be found, but if they cannot, the study period may be modified for the Henry's Fork.

In this evaluation, traditional hydrologic techniques were used to estimate missing data. Typically, this means beginning by looking for a strong linear relationship between data that overlap in time at gages with similar hydrology. The basis of success for this procedure hinges on finding similarity in runoff characteristics between two streams, then using that similarity to "rebuild" missing data values at the deficient gage for the years when no overlap exists. The strength of a linear regression relationship is described by the "coefficient of determination," or r^2. This coefficient, derived mathematically through the regression exercise, is a measure of the variability in flow at one gage that can be explained by variability in the other. A perfect relationship would have an $r^2 = 1.0$; imperfect relationships have r^2 less than 1.0. Regression of hydrologic data resulting in $r^2 > 0.7$ is often considered strong enough for data estimating, although less strong relationships may be used if no other technique is better.

Index Gage Selection

The objective of this work is to identify gages to be used to identify normal, wet and dry years by ranking of annual flows. The gages selected as representative for this purpose are termed "index" gages. Ultimately, the top (largest annual flow amounts) 20 percent of the years were designated as wet years, the middle 60 percent designated as normal years, and the 20 percent with lowest annual flows designated as dry years. The purpose of this subtask was to select gages for this ranking task that provided coverage of the basin, were relatively free of influence by man's activities, and which were relatively complete during the study period.

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.

Figure 1
Green River at Warren Bridge, near Daniel, WY

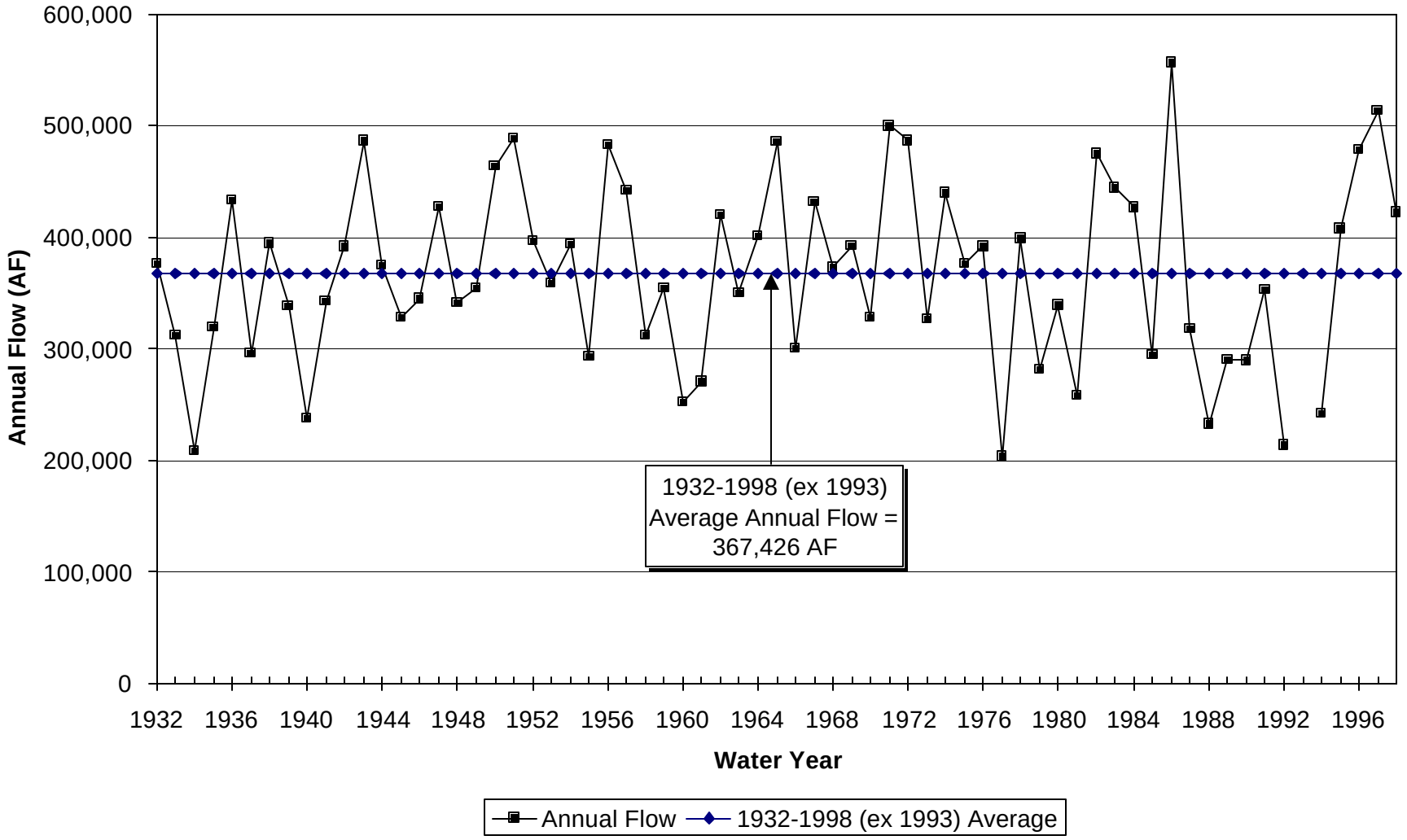

Table 3 - Potential Index Gages for Hydrologic Condition

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
Henrys Fork River	09229500	Henrys Fork near Manila
Little Snake River	09253000	Little Snake near Slater, CO
	09257000	Little Snake near Dixon

The above 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.

2. Which potential index gages have potential index gages located upstream that may be, to a greater degree, free from man's 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 America
   - 09257000 – Little Snake near Dixon.

3. When two potential gages are on the same tributary and one has year-round data and the other has seasonal data, discard the gage with seasonal data.

- 09213500 – Big Sandy River near Farson.

This screening process resulted in eight gages remaining under consideration. Five gages required some adjustment prior to determining the wet, dry and normal years. The required adjustments are described below:

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 October 1963 through September 1998, excluding water year 1993. The relationship is:

   Annual Flow at Green River at Warren Bridge 0.2198 x Annual Flow at Green River near LaBarge + 106,583 **(1)**

   $$\mathbf{r^2 = 0.92}$$

   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. A linear 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 using regression techniques. These gages share an overlapping period of record from October 1954 through September 1997. The relationship is:

   Annual Flow at Pine Creek above Fremont Lake = 0.16959 x Annual Flow at New Fork near Big Piney + 37211.63 **(2)**

   $$\mathbf{r^2 = 0.91}$$

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

3. 09216000 Big Sandy River below Eden and 09216050 Big Sandy River at Gasson Bridge

   These two gages share an overlapping period of record from May 1972 through July 1981. A linear relationship based upon the monthly flows was determined from the overlapping data:

Flow at Gasson Bridge = 1.0376* Flow below Eden + 722.365 **(3)**

r^2 = 0.99

This relationship was used to synthesize monthly flow data for the period of October 1970 through April 1972 for the Big Sandy River at Gasson Bridge gage prior to determining the wettest and driest 20 percent of the study years.

4. 09218500 – Blacks Fork near Millburne

   Only irrigation season flow measurements exist for the 1993-1998 water years. The wettest and driest 20 percent of the study period years were determined from the irrigation season flow measurements for the study period.

5. 09229500 – Henrys Fork near Manila

   It was originally assumed that the Blacks Fork near Millburne gage would be used as the Index gage for Henrys Fork. Later review of the available historical data for the Henrys 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 Henrys Fork.

   There are no data for water years 1994-1998. A linear regression relationship was developed between the monthly flow at the Blacks Fork near Lyman gage (09222000) and the monthly flow at the Henrys Fork near Manila gage. These gages share an overlapping period of record from October 1937 through September 1957 and June 1962 through September 1983. The relationship is:

   Monthly Flow at Henrys Fork near Manila = 0.5412* Monthly Flow at Blacks Fork near Lyman + 561.86 **(4)**

   r^2 = 0.87

   Prior to extending the records for the Henrys Fork near Manila gage, the Blacks Fork near Lyman gage records had to be filled from 1994 through 1998. A linear relationship was developed between the monthly flow at the Blacks Fork near Little America gage (09224700) and the monthly flow at the Blacks Fork near Lyman gage. These gages share an overlapping period of record from June 1962 through September 1983. The relationship is:

   Monthly Flow at Blacks Fork near Lyman = 0.4495* Monthly Flow at Blacks Fork near Little America + 319.43 **(5)**

   r^2 = 0.87

   The Lyman gage record developed using Equation (5) was supplied as the independent variable in Equation (4) to synthesize monthly data for water years 1994 through 1998 for the Henrys Fork near Manila gage. Note that Equation (4) was based entirely on actual data, but applied to regressed data. Once the Manila gage record was completed through this estimation technique, the wettest and driest 20 percent of the study years were identified.

Results

The wettest and driest 20 percent of the study period years, on an annual basis, were identified for each of the remaining gages. The index gages and corresponding wet and dry year selection are shown in Table 4. There was no exact duplication of hydrologic condition (i.e. wet and dry years did not correspond at all gages all the time), so all seven index gages will be used, applied to geographical areas as follows (see Figure 2):

- 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
- 09216050 Big Sandy River at Gasson Bridge - Big Sandy River and its tributaries
- 09218500 Blacks Fork near Millburne - Blacks Fork, Smiths Fork and Henrys Fork and their tributaries
- 09223000 Hams Fork below Pole Creek near Frontier - Hams Fork and its tributaries.
- 09229500 Henrys Fork near Manila – Henrys Fork and its tributaries
- 09253000 Little Snake near Slater, CO - Little Snake River and its tributaries.

Additional Surface Water Data

As part of this task, all gage data, reservoir content data, and evaporation data required for the Green River basin model were requested from the Water Resources Data System at the University of Wyoming.

Summary

One gage (Green River at Warren Bridge) was evaluated to establish the suitability of using 1971-1998 as the modeling study period. A total of eight gaging stations (listed above) emerged as providing information suitable for determining normal, wet and dry years for the sub-basins in which they were located. Further details regarding the regression analyses and streamflow values are available in the project working papers and in the surface water modeling memorandum.

Additional References

Boyle Engineering Corp, 1998, State Water Planning Process Feasibility Report, prepared for the Wyoming Water Development Commission.

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

Gage No.	Gage Name	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98
09188500	Green River at Warren Bridge	W	W	N	N	N	N	D	N	D	N	D	W	N	N	N	W	N	D	N	N	N	D	N	D	N	W	W	N
09196500	Pine Creek above Fremont Lake	W	W	N	N	N	N	D	N	N	N	D	W	W	N	N	W	N	D	D	N	N	D	N	D	N	N	W	N
09210500	Fontenelle Creek near Herschler Ranch, near Fontenelle	W	W	N	N	N	N	D	N	N	W	D	N	W	N	N	W	N	N	N	D	D	D	N	D	N	N	W	N
09216050	Big Sandy River at Gasson Bridge	N	N	N	N	N	N	D	N	N	W	N	N	W	W	N	W	N	D	D	D	N	D	D	N	W	N	W	N
09218500	Blacks Fork near Millburne	N	N	N	N	W	D	D	N	D	N	N	N	W	W	N	W	N	D	D	N	N	N	N	D	W	N	N	W
09223000	Hams Fork below Pole Creek near Frontier	W	W	N	N	N	N	D	N	N	N	D	W	W	W	N	W	N	D	N	D	N	D	N	D	N	N	N	N
09229500	Henrys Fork near Manila	W	N	W	N	W	D	D	N	D	N	N	N	W	W	N	N	N	N	D	D	N	N	N	D	N	N	N	W
09253000	Little Snake near Slater, CO	W	N	N	W	N	N	D	N	N	N	N	W	W	W	N	N	D	N	D	D	N	D	N	D	N	N	W	N

W Wet year N Normal Year D Dry Year

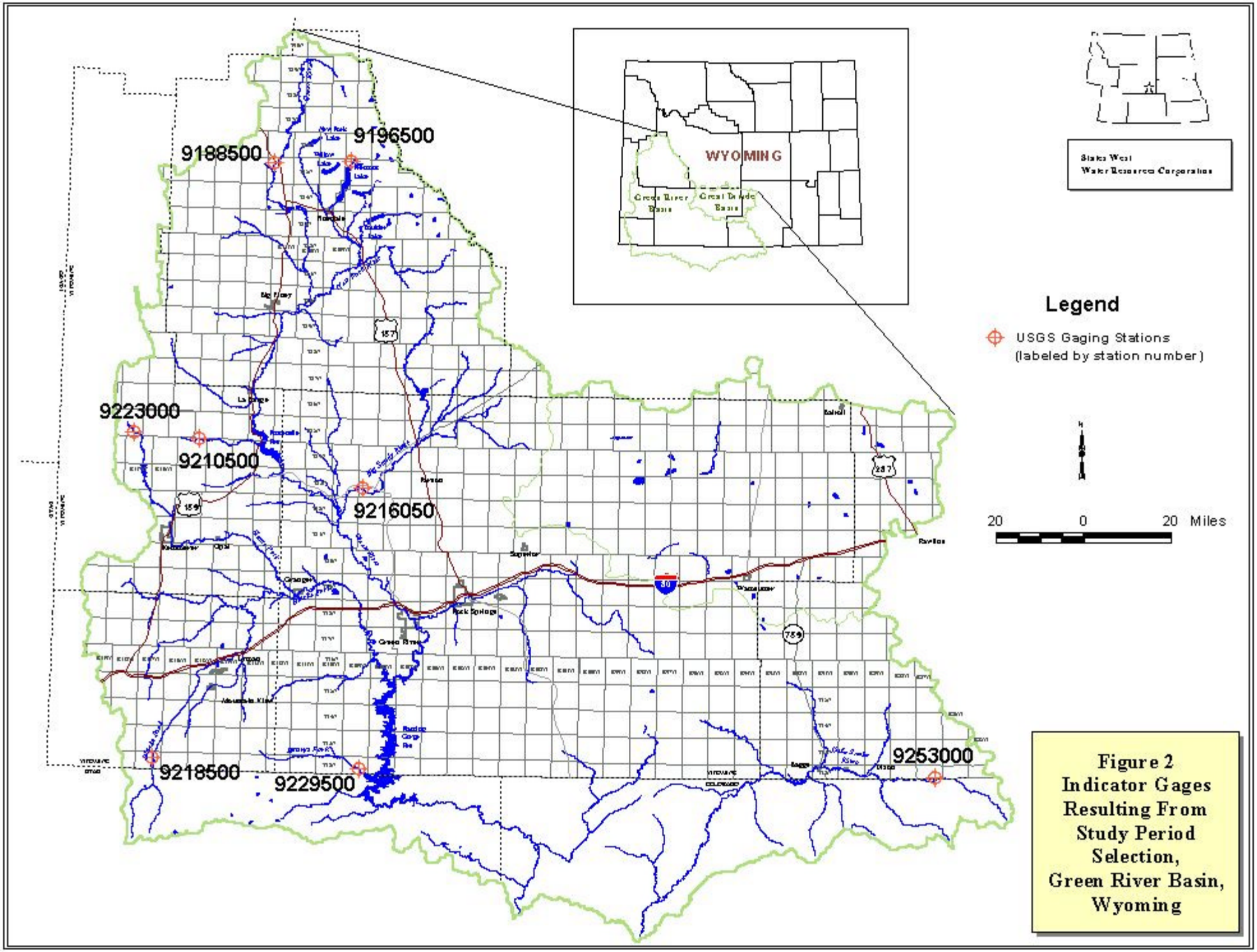

Figure 2
Indicator Gages Resulting From Study Period Selection, Green River Basin, Wyoming