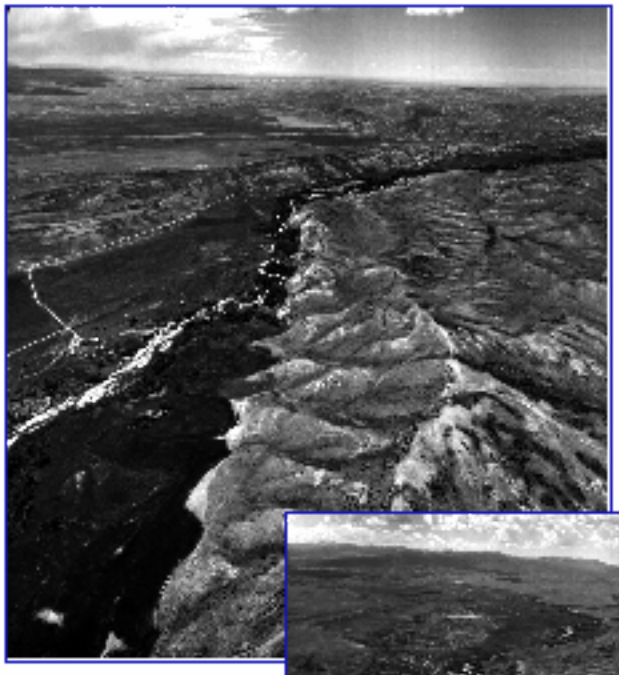
Wyoming's Bear River Basin Plan



Basin Planning Principles

- Grass Roots Participation
- Wyoming Water Law and Compact Agreement(s)
- Wyoming has the right to manage its resources for the benefit of its citizens

Grass Roots Participation

- State Water Plan Questionnaire
- Basin Advisory Group (BAG)
- Public Meetings
- Internet Availability

Bear River Basin Advisory Group
(The Process of Building Consensus)

"The best thing the planning process can do is encourage communication among interest groups. We need to put issues on the table locally before outsiders do. If I have to take cows off my allotment, I'd rather hear that from my neighbors than the federal government"

Craig Lowham, Rancher

"The plan must be a constructive document, not a road block. It must be an entire package, and not be used by one party against another"

Gerdon Park

Basin Advisory Group Structure

"... this will allow us to work from the bottom up instead of the top down..."

Truman Julian, Rancher

Nine local related water interests represented:

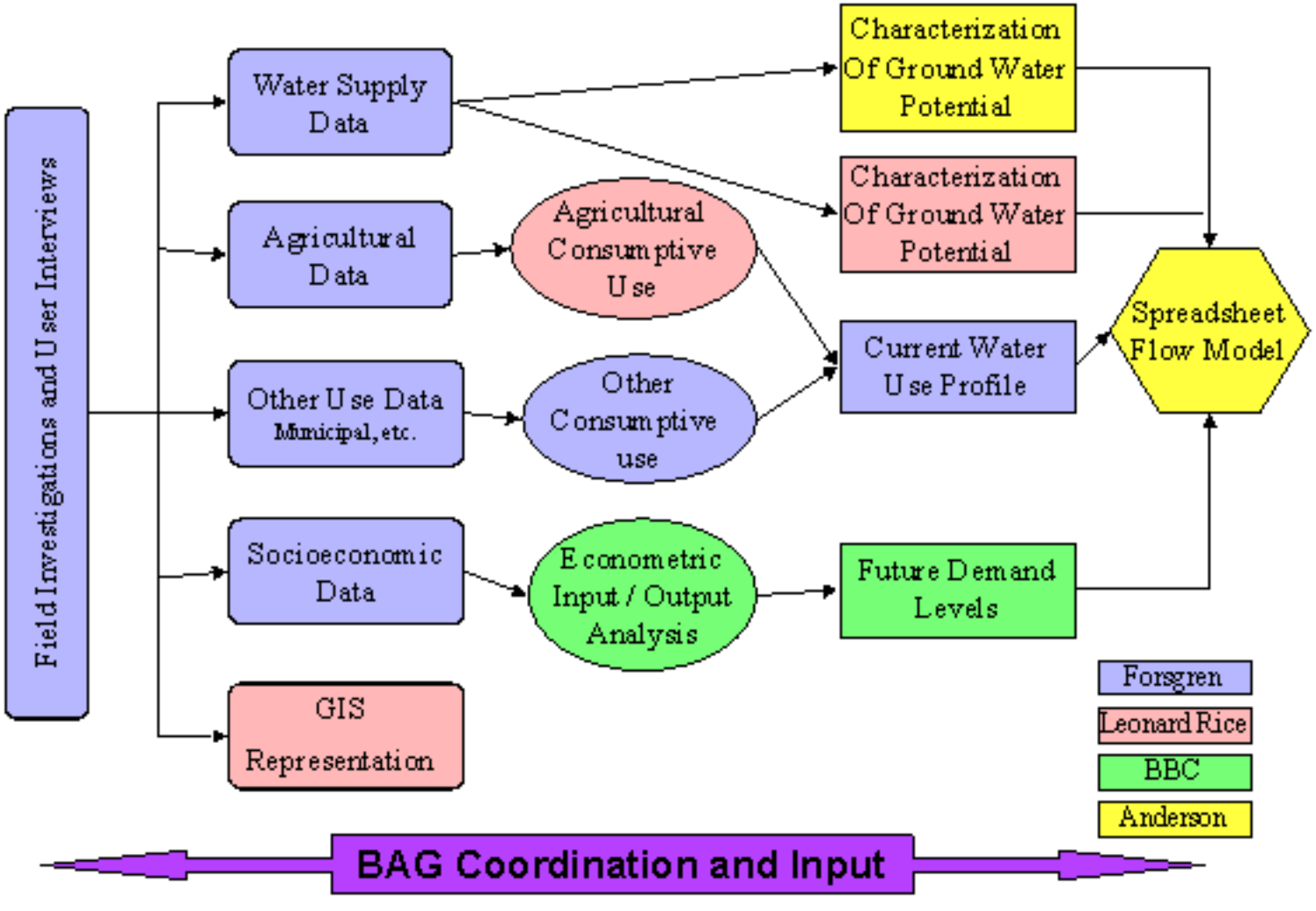
- Agriculture
- Municipalities
- Counties
- Industries
- Recreation
- Environment
- Conservation Districts
- Interstate Compact
- Active River Basin Task Force(s)

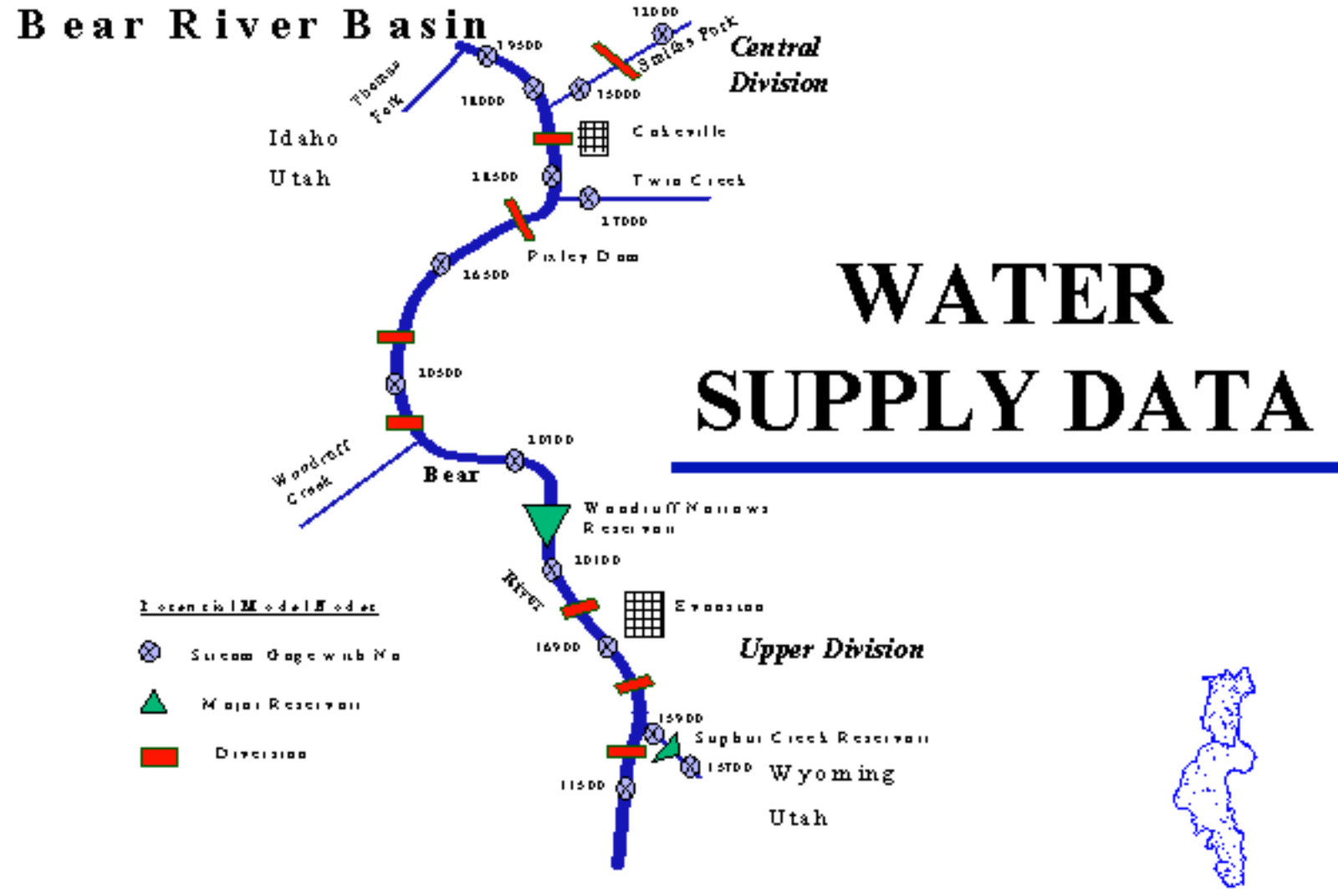
Wyoming Philosophy and Approach

The plan is a process. The product is a tool.
The future of the plan is dynamic.

- Useful to a technical professional.
- Useable to a 5th grade teacher.
- Accessible to everyone.

BASIN PLANNING PROCESS




Bear River Basin
WATER
SUPPLY DATA
Central
Division
Upper Division
Idaho
Utah
Wyoming
Utah
Bear
River
Thomas
Fork
Smiths Fork
Coldville
Twin Creek
Pixley Dam
Woodruff
Creek
Woodruff Narrows
Reservoir
Evanston
Sulphur Creek Reservoir
Potential Model Nodes
Stream Gage with No
Major Reservoir
Diversion
19500
18000
15000
12000
18500
17000
16500
10500
10100
10200
16900
15900
15700
11500

Surface Water Quality

- Reviewed Continuous Monitoring Stations
- Used Total Dissolved Solids as Indicator
  - Easily and Often Measured
- Used Stream Classifications as Indicator

Surface Water Quality Cont.

- Long Term Gages (~10 years or more)

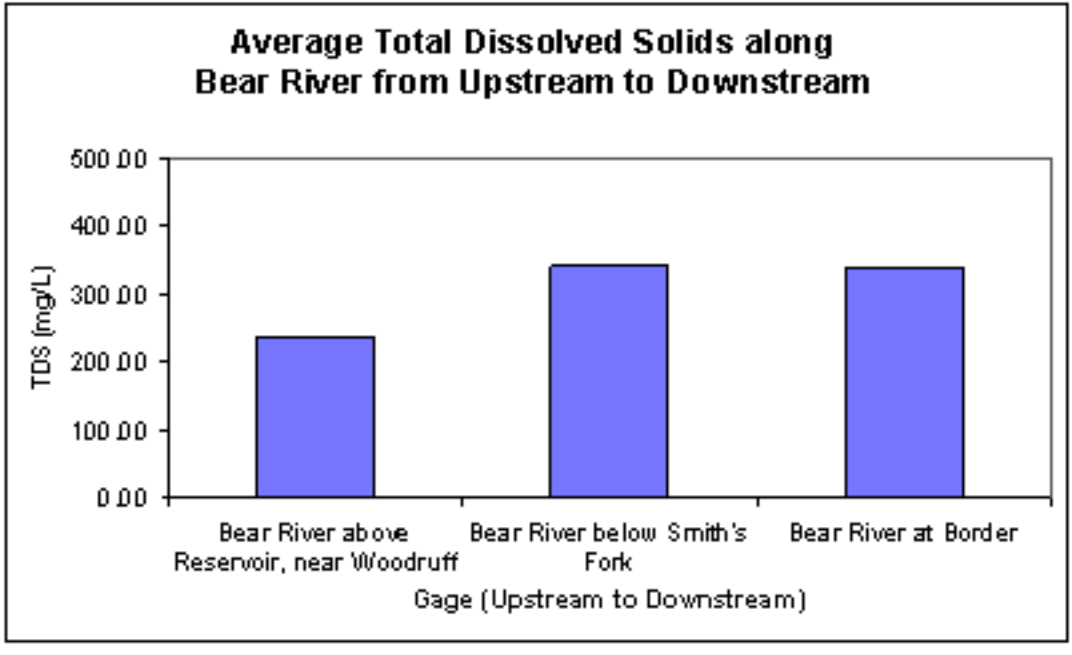
TABLE 1			
Gage ID	**Stream Name**	**Class ID**	**Period of Record**
10020100	Bear River above Reservoir near Woodruff	2	1985-Present
10027000	Twin Creek at Sage	2	1975-1981 and 1989-Present
10035000	Smiths Fork at Cokeville	2	1983-1988, 1989-1992 and 1993-Present
10038000	Bear River below Smiths Fork	2	1992-Present
10039500	Bear River at Border	2	1965-1989

Surface Water Quality Conclusions

- TDS Water Quality Standards
  - 500 mg/L Domestic Use
  - 2000 mg/L Agricultural and Livestock Use
- Only Twin Creek at Sage Exceeds Standard Frequently
- Bear River and other Tributaries Within Standards

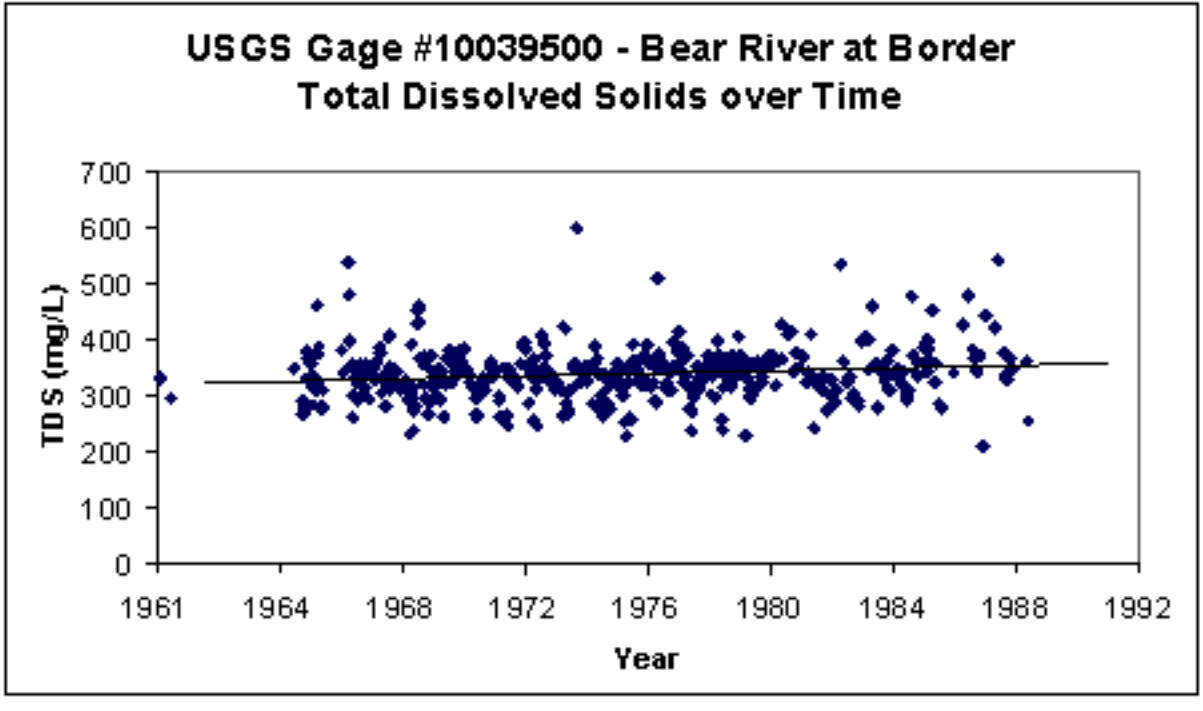
Surface Water Quality Conclusions (Cont.)

- Water Quality Degrades Slightly From Upstream to Downstream



Surface Water Quality Conclusions (Cont.)

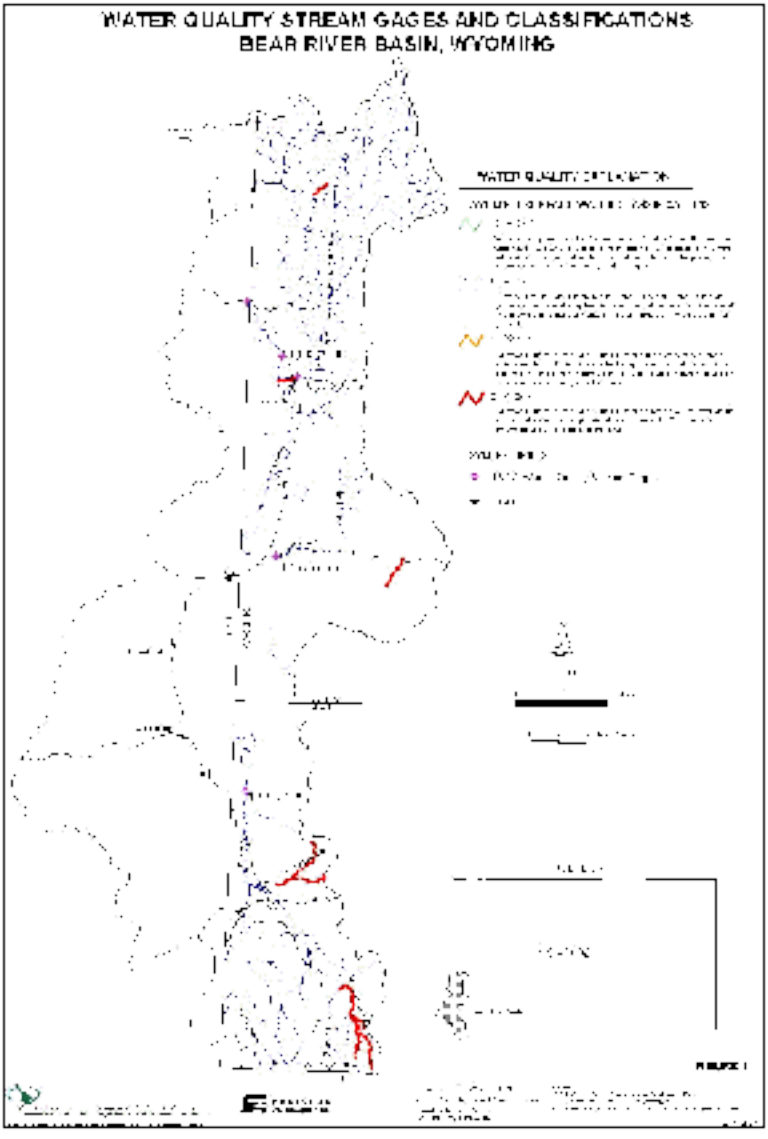
- Water Quality Degrades Slightly Over Time



Surface Water Quality Conclusions (Cont.)

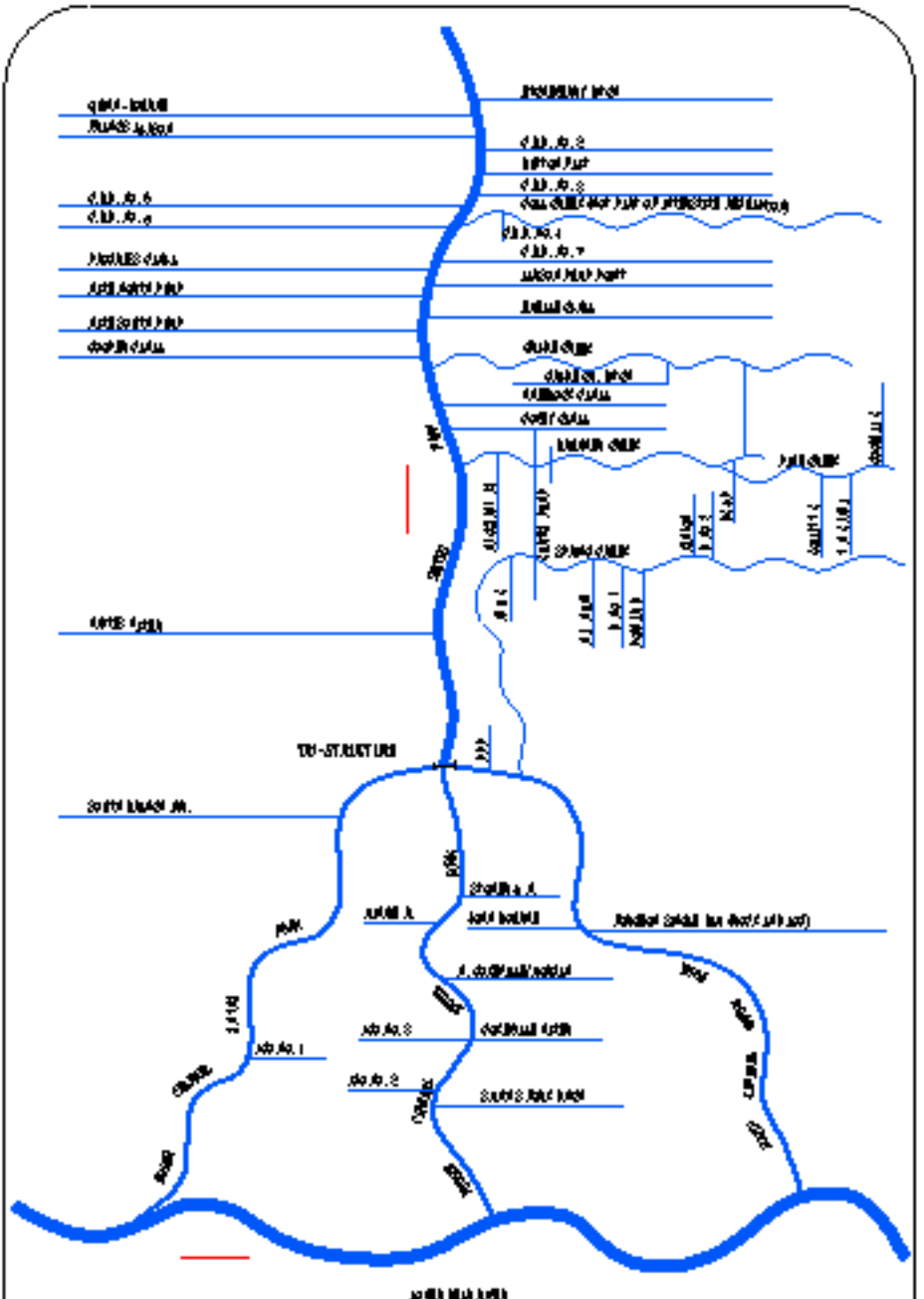
- DEQ Stream Classifications
  - Mostly Class 2 in Basin (Presently support fish or have adequate flow and quality to support fish)
  - Some Class 4 (Do not support fish, in the Bear River Basin because of intermittent flow, not due to quality problems)

WATER QUALITY STREAM GAGES AND CLASSIFICATIONS
BEAR RIVER BASIN, WYOMING



Basin Water Use

- **Agricultural**
- Municipal
- Industrial
- Environmental
- Recreational



SMITHS FORK DIVERSION SCHEMATIC

FIGURE 4

Key Ditch System	Average Annual Diversion (acre-feet)
Hilliard East Fork	2,860
Lannon and Lone Mountain	3,320
Hilliard West Side	4,310
Bear Canal	8,960
Crown and Pine Grove	4,210
Mc Graw (and Big Bend)	4,440
Lewis	1,250
Myers No 2	1,100
Myers No 1	870
Myers Irrigation	930
Booth	2,620
Anel	1,420
Evanston Water Supply	1,140
Evanston Water Ditch	3,450
Rocky Mountain Blythe	2,380
John Sims	2,780
SP Ramsey	2,720
Chapman	18,040
Morris Brothers	780
Tunnel	2,880
Francis Lee	6,550
Bear River Canal	9,230
Pixley Dam	7,555
BQ Dam	12,081

Upper Division Key Diversions

Central Division Key Diversions

Key Ditch System	Source	Average Annual Diversion (acre-feet)
Quinn Bourne	Smiths Fork	1,350
Button Flat	Smiths Fork	640
Emelle	Smiths Fork	2,260
Cooper	Smiths Fork	1,190
Covey	Smiths Fork, Bruner Creek, Spring Creek	16,380
VH Canal	Pine Creek	2,740
Goodell	Pine Creek	1,650
Whites Water	Smiths Fork	5,460
S. Branch Irrigating	North Channel Smiths Fork	3,900
Alonzo F. Sights	Bear River	2,990
Oscar E. Snyder	Bear River	4,040
Cook Brothers	Bear River	8,020

Key Diversion Documentation

ASSIGNED DUTY

Subject: Bear River Basin Plan
Key Structures and Diversions
HILLIARD EAST FORK DIVERSION

Date: September 10, 2000

Diversion Description: Diversion consists of a 7-foot wide wood structure with a single rectangular steel slide gate. Placing a rock dam across the main channel diverts river.

Hilliard East Fork diversion structure

Diversion Location: Diversion is on the East Fork of the Upper Bear in Utah. Irrigated lands are located in Wyoming as shown in the location map hereafter.

Latitude N 40° 54' 12.5"
Longitude W110° 48' 53.3"

Conveyance Description: Open Channel Canal, approximately 47,320 feet in length.[1]

Direct Flow Water Rights:[2]

Priority Date	Permit Number	Permitted Use	Permitted Acres	Flow (CFS)	Cumulative (CFS)	Comment
-1914	U21-337	Irrigation	2444	28.00	28.00	

Associated Storage Rights:

Reservoir	Shareholder	Volume (Acre-ft)	Est. % of Volume Used this Diversion	Comments
Whitney	Hilliard East Fork	458	100%	
Sulphur Canal	Dennis Cornelison	207	13%	
Sulphur Canal	Hilliard East Fork	913	100%	By Exchange
Sulphur Canal	John Lester	27	100%	By Exchange
Sulphur Canal	Broadbent Land Co.	451	100%	By Exchange

Irrigation Practices: Land is all flood irrigated. Irrigators on the lower reaches of the canal reportedly take turns rotating irrigation with a full canal.

Estimated Diversion Efficiency: Canal losses are relatively high due to porous nature of soils in the higher reaches of the Upper Bear.

Calculated Diversion Efficiency = Conveyance Efficiency X Application Efficiency:

Conveyance Efficiency:	40%
Application Efficiency:	55%
Overall Diversion Efficiency:	22%

Conveyance Efficiency is estimated by total length of main canal. Application Efficiency for Flood Irrigation and Sprinkler Irrigation is estimated at 55% and 85% respectively

Crop Types / Consumptive Use: Water is used entirely to irrigate meadow grasses, primarily Timothy, Meadow Foxtail, etc.

Return Flows: Excess return flow is primarily captured in Basco Hollow which empties into Sulphur Canal immediately below Sulphur Canal Reservoir. It's estimated that approximately 20% of the return flow enters the reservoir itself.

The following return flow pattern was adopted for modeling in this study area as follows:

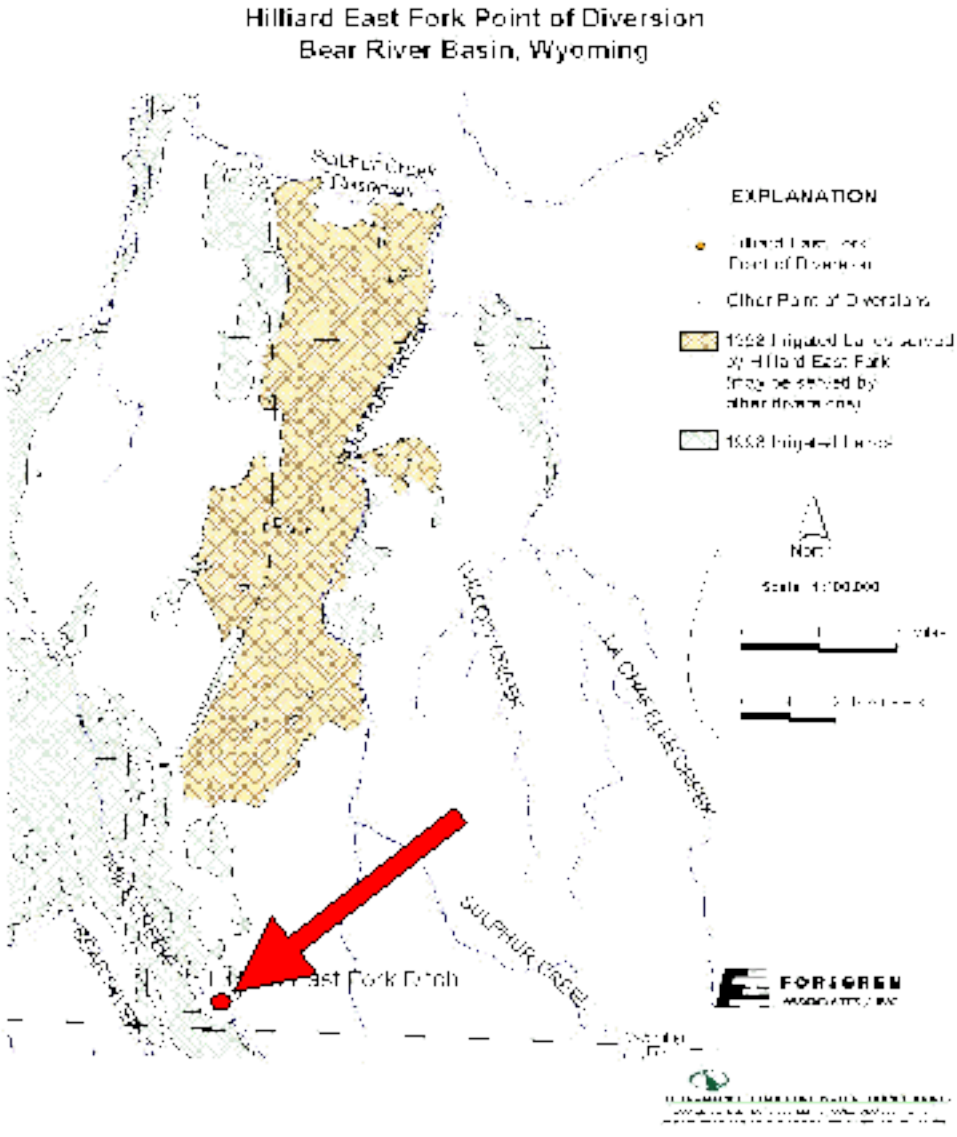
Month (after initial Diversion)	Percent of Return
0	30%
1	25%
2	15%
3	10%
	100%

Key Diversion Documentation

Other Operational Information: This diversion is typically one of the first regulated due to its relatively junior (1914) water right. The Hilliard East Diversion and upper portion of the canal are subject to ice problems during the early part of the irrigation season. Hilliard East irrigators, therefore, typically rely on as supplemental supply water right out of Mill Creek through June. Mill Creek is generally called into regulation after the month of June, at which time the Hilliard East irrigators utilize this diversion. The Hilliard Diversion is typically utilized from mid-July through mid-October.[1]

References:

- USDA -Soil Conservation Service Economic Research Service-Forest Service in Cooperation with the States of Idaho, Utah, Wyoming, Irrigation Conveyance Systems, Working Paper for the Bear River Basin Type IV Study, Idaho-Utah-Wyoming, April 1976
- Water rights summary obtained from State Engineer Interstate Register – revised April 14, 1999
- Irrigation practices based on field investigation and interview with Mr. Don Shoemaker, Water Superintendent – November 6, 1999.
- State of Utah Natural Resources, Water Budget Studies – Utah, Bear River study area, September 1984



Key Diversion Mapping

BEAR RIVER WYOMING DIVERSIONS

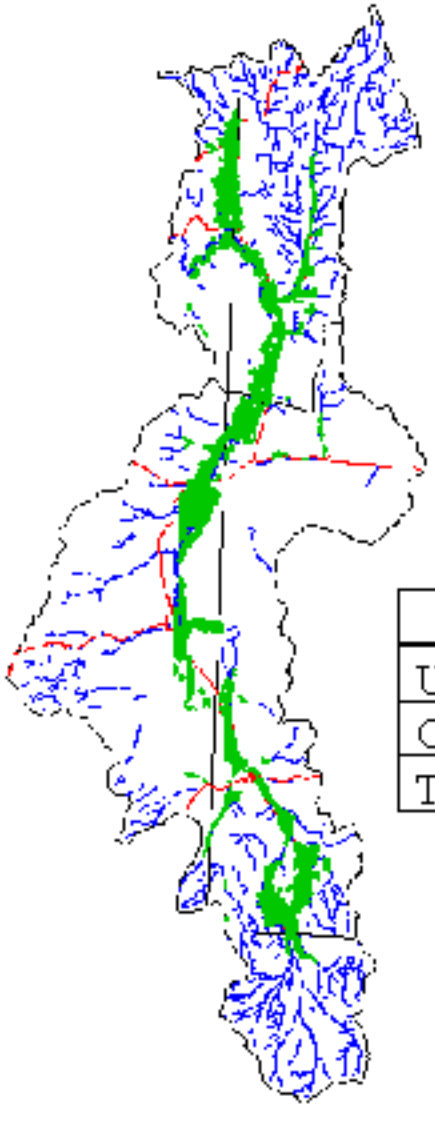
MONTHLY DIVERSION RECORDS

HILLIARD EAST FORK

YEAR	MAY			JUNE			JULY			AUGUST			SEPTEMBER		
	Total of Daily Ave for Month	Average CFS	Monthly Total Ac-Ft	Total of Daily Ave for Month	Average CFS	Monthly Total Ac-Ft	Total of Daily Ave for Month	Average CFS	Monthly Total Ac-Ft	Total of Daily Ave for Month	Average CFS	Monthly Total Ac-Ft	Total of Daily Ave for Month	Average CFS	Monthly Total Ac-Ft
* 1970															
1971	2	0.1	4.0	183	6.1	363.0	720	23.2	1428.1	126	4.1	249.9	340	11.3	674.4
1972	56	3.1	188.4	454	15.1	900.5	479	15.5	950.1	251	8.1	497.9	128	4.3	253.9
1973	0	0.0	0.0	198	6.6	392.7	507	16.4	1005.6	14	0.5	27.8	158	5.3	313.4
1974	0	0.0	0.0	125	4.2	247.9	678	21.9	1344.8	36	1.2	71.4	93	3.1	184.5
1975	0	0.0	0.0	0	0.0	0.0	387	12.5	767.6	514	16.6	1019.5	462	15.4	916.4
1976	0	0.0	0.0	648	21.6	1285.3	496	16.0	983.8	33	1.1	65.5	48	1.6	97.2
1977	47	1.5	93.2	285	9.5	565.6	3	0.1	6.0	41	1.3	81.3	0	0.0	0.0
1978	3	0.1	6.0	57	1.9	113.1	618	19.9	1225.8	116	3.7	230.1	291	9.7	577.2
1979	0	0.0	0.0	418	13.9	829.1	678	21.9	1344.8	0	0.0	0.0	0	0.0	0.0
1980	31	1.0	61.5	276	9.2	547.4	507	29.3	1756.0	187	6.0	370.9	305	10.2	605.9
1981	36	1.2	71.4	323	10.8	640.7	799	25.8	1584.8	63	2.0	125.0	0	0.0	0.0
1982	0	0.0	0.0	0	0.0	0.0	648	20.9	1285.3	217	7.0	430.4	644	21.5	1277.4
1983	0	0.0	0.0	18	0.6	35.7	327	10.5	648.6	416	13.4	825.1	119	4.0	236.0
1984	0	0.0	0.0	90	3.0	178.5	867	28.0	1719.7	225	7.3	446.3	153	5.1	303.5
1985	0	0.0	0.0	501	16.7	993.7	932	30.1	1848.6	122	3.9	242.0	82	2.7	162.6
1986	0	0.0	0.0	9	0.3	17.9	661	21.3	1311.1	146	4.7	289.6	351	11.7	696.2
1987	82	2.6	162.6	883	29.4	1751.4	694	22.4	1376.5	0	0.0	0.0	24	0.8	47.6
1988	0	0.0	0.0	991	32.0	1939.1	486	14.7	902.5	5	0.2	9.9	0	0.0	0.0
1989	73	2.4	144.8	646	21.5	1281.3	893	28.8	1771.2	44	1.4	87.3	0	0.0	0.0
1990	414	13.4	821.2	842	28.1	1670.1	872	28.1	1729.6	44	1.4	87.3	254	8.5	503.8
1991	0	0.0	0.0	133	4.4	263.8	916	29.5	1816.9	112	3.6	222.1	10	0.3	19.8
1992	189	6.1	374.9	797	26.6	1580.8	688	22.2	1364.6	0	0.0	0.0	0	0.0	0.0
1993	0	0.0	0.0	114	3.8	226.1	1004	32.4	1991.4	509	16.4	1009.6	435	14.5	864.8
1994	245	7.9	485.0	764	25.5	1515.4	697	22.5	1382.5	7	0.2	13.9	9	0.3	17.9
1995	0	0.0	0.0	0	0.0	0.0	509	16.4	1009.6	779	25.1	1546.1	771	25.7	1529.3
1996	0	0.0	0.0	304	10.1	603.0	1065	34.4	2112.4	258	9.6	591.1	0	0.0	0.0
1997	0	0.0	0.0	2656	8.9	526.8	1033	33.3	2048.9	279.2	9.0	553.8	1038	3.5	205.9
1998	0	0.0	0.0	0	0.0	0.0	717.2	23.1	1422.5	298.7	9.6	592.5	666.7	22.2	1322.4
1999	0	0.0	0.0	151	5.0	297.5	982	32.0	1967.6	434	14.0	860.8	508	17.0	1009.6
AVERAGES		1.4	88.2		10.6	624.0		22.6	1334.6		6.8	388.7		8.8	407.8

Notes: * 1. No published records are available for this diversion for 1970

2. Diversion is located at a high elevation making snow and ice a problem early in the season. Irrigators typically utilize a supplemental supply out of Mill Creek at least through June until Mill Creek regulation is called for.

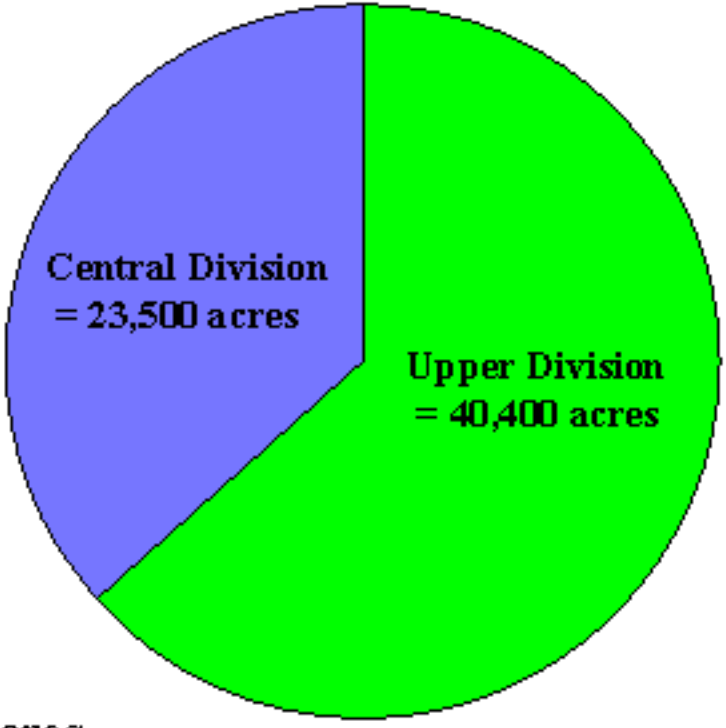


Irrigated Lands Mapping

Location	Irrigated Acreage (acres)
Upper Division	40,400
Central Division	23,500
Total Bear River Basin	63,900

1970 Irrigated Lands = 58,691 Acres

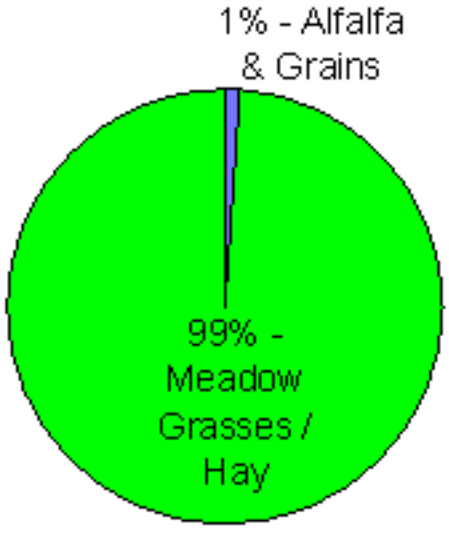
Basin Agricultural Summary
1998 Irrigated Acreage



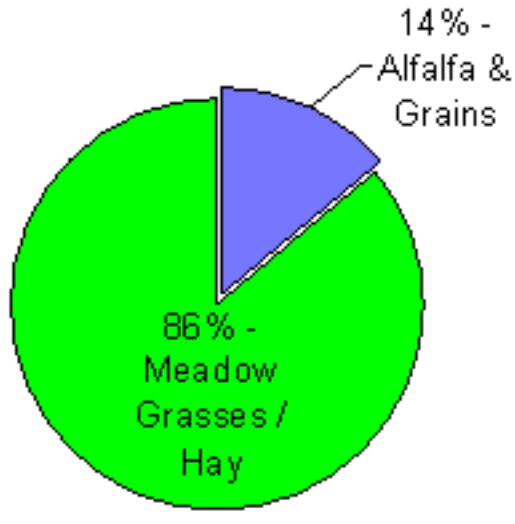
Total = 63,900 acres

Basin Agricultural Summary
2000 Basin Crop Types

Upper Division

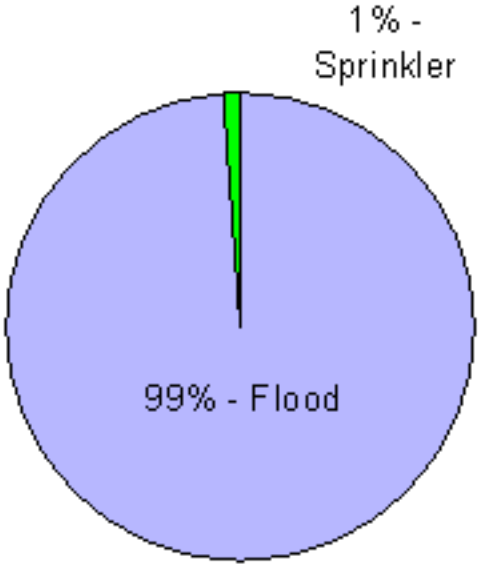


Central Division

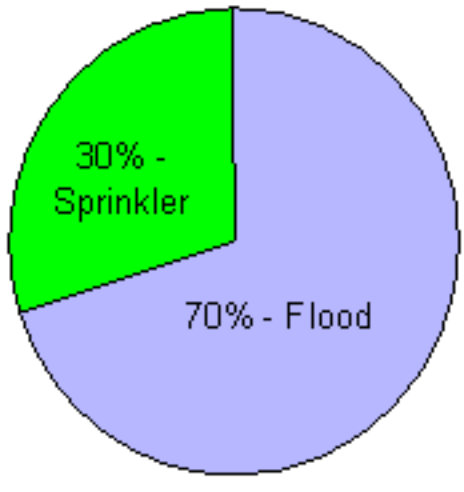


Basin Agriculture Summary
2000 Irrigation Application Methods

Upper Division



Central Division



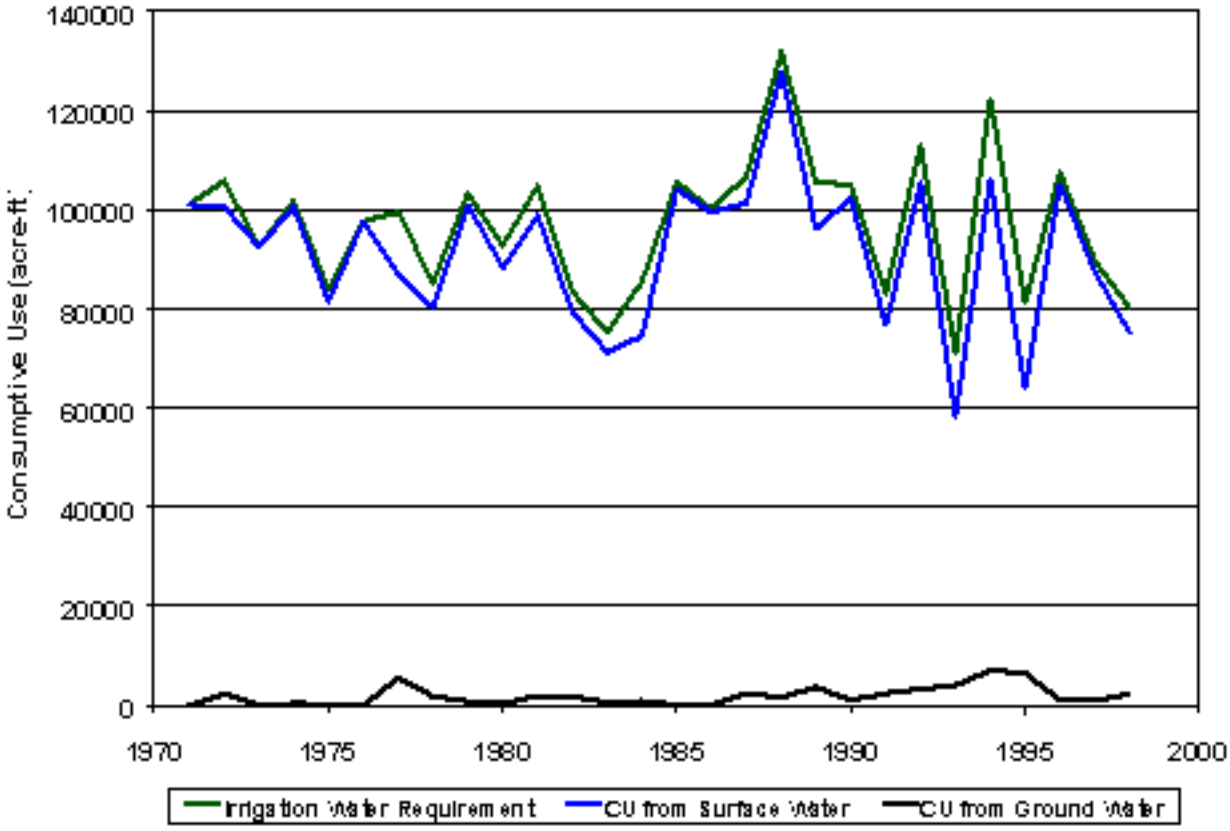
Upper Division Diversion Efficiencies

Modsl Node ID	Diversion Name	Conveyance Efficiency	Application Efficiency	Diversion Efficiency	Irrigation Methods
1.14	Hilliard East Fork	40 %	55 %	22 %	100 % Flood
1.01	Lannon and Lone Mountain	45 %	55 %	25 %	100 % Flood
1.02	Hilliard West Side	40 %	55 %	22 %	100 % Flood
1.03	Bear Canal	40 %	55 %	22 %	100 % Flood
1.04	Cowan and Pine Grove	50 %	55 %	27 %	100 % Flood
1.05	McGraw (and Big Bend)	55 %	55 %	30 %	100 % Flood
1.06	Lewis	55 %	55 %	30 %	100 % Flood
1.07	Myers No 2	50 %	55 %	27 %	100 % Flood
1.08	Myers No 1	50 %	55 %	27 %	100 % Flood
1.09	Myers Irrigation	55 %	55 %	30 %	100 % Flood
1.11	Booth	50 %	55 %	27 %	100 % Flood
1.12	Anal	55 %	55 %	30 %	100 % Flood
1.13	Evanston Water Supply	50 %	55 %	27 %	100 % Flood
3.01	Evanston Water Ditch	65 %	55 %	36 %	100 % Flood
3.02	Rocky Mountain Blythe	65 %	55 %	36 %	100 % Flood
4.01	John Simms	65 %	55 %	36 %	100 % Flood
4.02	SP Ramsey	60 %	55 %	33 %	100 % Flood
5.01	Chapman (WY portion)	50 %	55 %	27 %	100 % Flood
5.02	Morris Brothers	65 %	55 %	36 %	100 % Flood
5.03	Tunnel	65 %	55 %	36 %	100 % Flood
7.01	Francis Lee	60 %	55 %	33 %	100 % Flood
7.02	Bear River Canal	60 %	55 %	33 %	100 % Flood
7.03	Utah Aggregate Ditches	92 %	65 %	60 %	67 % Flood 33 % Center Pivot
8.00	BQ Dam Diversions	55 %	60 %	33 %	90 % Flood 10 % Center Pivot
8.01	Pixley Dam	55 %	60 %	33 %	90 % Flood 10 % Center Pivot S
Varies	Aggregate Systems	65 %	55 %	36 %	100 % Flood

Central Division Diversion Efficiencies

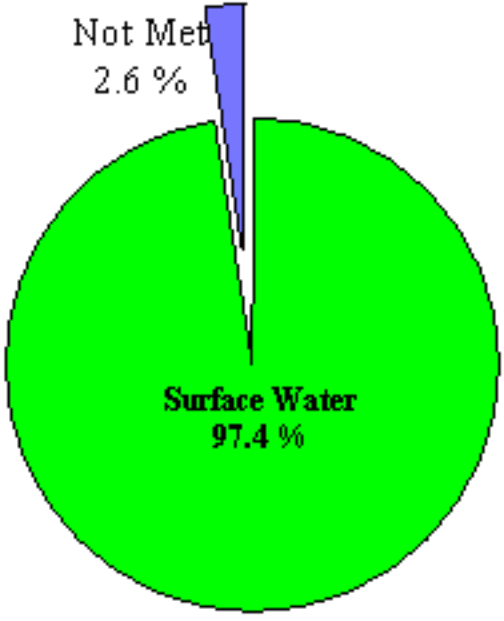
Model Node ID	Diversion Name	Conveyance Efficiency	Application Efficiency	Diversion Efficiency	Irrigation Methods
10.01	Quinn Bourne	65 %	55 %	36 %	100 % Flood
10.02	Button Flat	65 %	55 %	36 %	100 % Flood
10.03	Ernelle	65 %	55 %	36 %	100 % Hand-line Sprinkler
10.04	Cooper	65 %	55 %	36 %	100 % Flood
10.05	Covey	45 %	65 %	30 %	70 % Flood 30 % Center Pivot Sprinkler
10.06	VH Canal	55 %	85 %	47 %	100 % Center Pivot Sprinkler
10.07	Goodell	55 %	85 %	47 %	100 % Center Pivot Sprinkler
10.08	Whites Water	60 %	65 %	40 %	60 % Flood 40 % Hand-line Sprinkler
10.09	S. Branch Irrigating	60 %	70 %	42 %	40 % Flood 60 % Hand-line Sprinkler
11.01	Alonzo F. Sights	65 %	65 %	42 %	60 % Flood 40 % Hand-line Sprinkler
11.02	Oscar E. Snyder	65 %	55 %	36 %	100 % Flood
11.03	Cook Brothers	65 %	55 %	36 %	100 % Flood
Varies	Aggregate Systems	65 %	65 %	42 %	67 % Flood 33 % Center Pivot Sprinkler

Agricultural-Crop Consumptive Use Summary

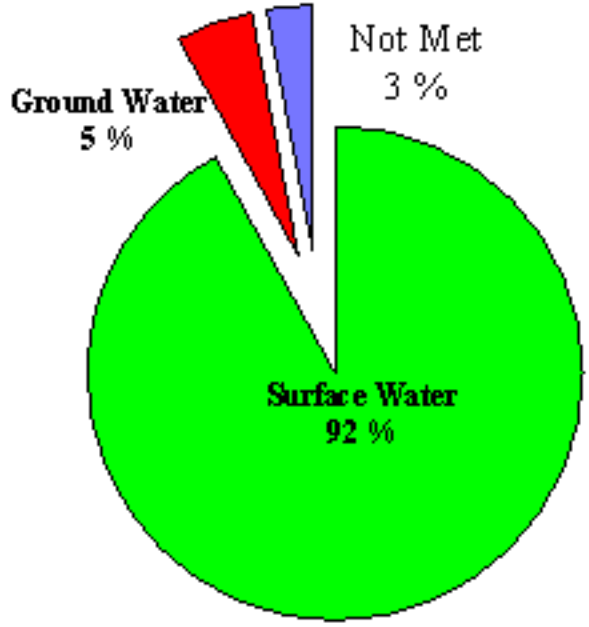


1971-1998 Average Annual Source of Irrigation Supply

Upper Division



Central Division



1971-1998 Average Annual Crop Consumptive Use

Irrigation Water Requirement	Upper Division	Lower Division	Total
From Surface Water	62,300	30,000	92,300
From Ground Water	300	1,600	1,900
Not Satisfied	1,700	1,000	2,700

Results in Acre-Feet

- Upper Division has supplemental water from Whitney Reservoir, Sulphur Creek Reservoir, and Woodruff Narrows Reservoir.
- Lower Division has some supplemental wells.
- **Without supplemental sources, both divisions would have an average annual shortage of over 20 percent.**

Agricultural - Livestock Use

- Livestock Water Use Based on:
  - 1998 County Livestock Statistics
  - Estimated Use
    - 12 gal/day for Cattle
    - 2 gal/day for Sheep
- Estimated Use = 530 acre-feet for 1998

Basin Water Use

- Agricultural
- **Municipal**
- Industrial
- Environmental
- Recreational

Municipal and Domestic Use

- Municipal Use
  - Evanston (Surface Water)
  - Cokeville (Ground Water)
- Domestic Use (Ground Water)

Evanston Municipal Use

- Diversion (Bear River/Sulphur Creek Reservoir) = 4,300 acre-feet per year
- Per Capita Use = 316 gal/capita/day
- Actual Annual Consumptive Use =2,700 acre-feet

Cokeville Municipal Use

- Pumping = 810 acre-feet per year
- Per Capita Use = 1440 gal/capita/day
- Actual Annual Consumptive Use = 45 acre-feet

Domestic (Rural) Use

- Based on Rural Population in the Basin
- Rural Use from Individual Wells
- Annual Consumptive Use = 500 acre-feet

Basin Water Use

- Agricultural
- Municipal
- **Industrial**
- Environmental
- Recreational

Industrial Use

- Current Industrial Uses
  - Chevron (Surface Water – 310 to 440 AF/year)
  - BP Amoco (Ground Water – 90 to 155 AF/year)

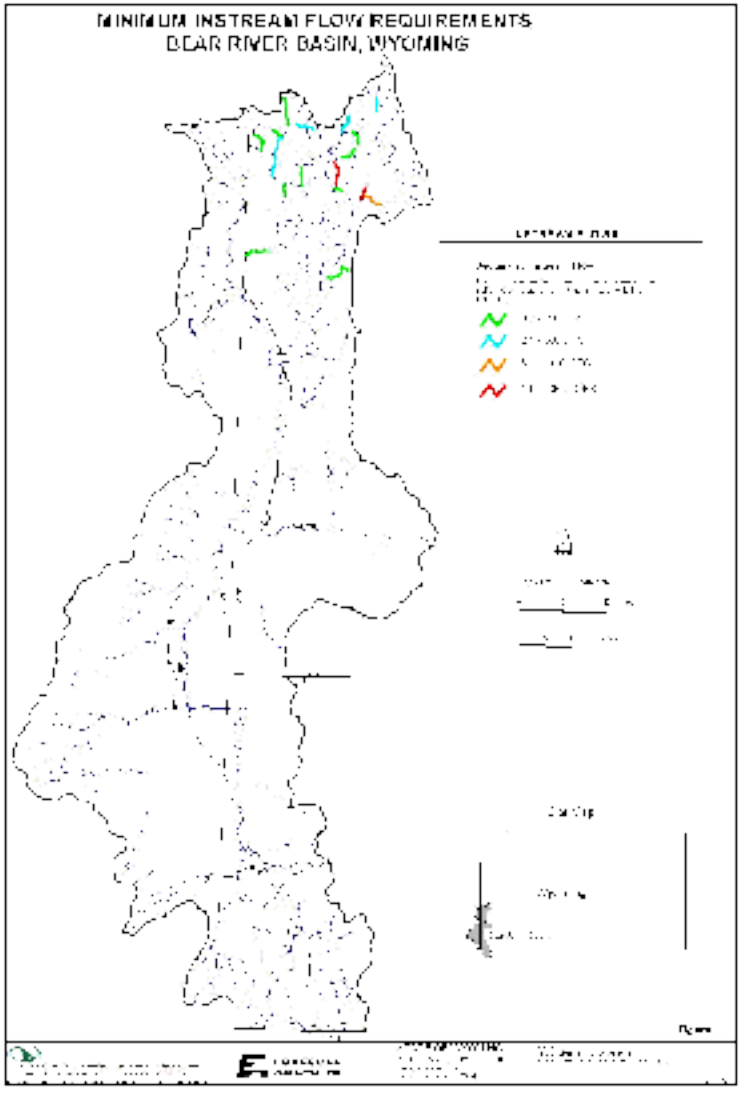
- Total Average Use = 400 to 595 acre-feet/year

Basin Water Use

- Agricultural
- Municipal
- Industrial
- **Environmental**
- Recreational

Environmental Use

- Current and Proposed Environmental Uses
  - Instream Flow Filings
  - Minimum Reservoir Releases
  - Minimum Reservoir Conservation Pools
  - Natural Wetlands
  - Bear Valley Wildlife Refuge



Instream Flow Filings

Environmental Use - Reservoirs

- Conservation Pools Provide Minimum Volume to Maintain Existing Aquatic Life

- Minimum Releases Provide Minimum Flow to Maintain Downstream Fisheries

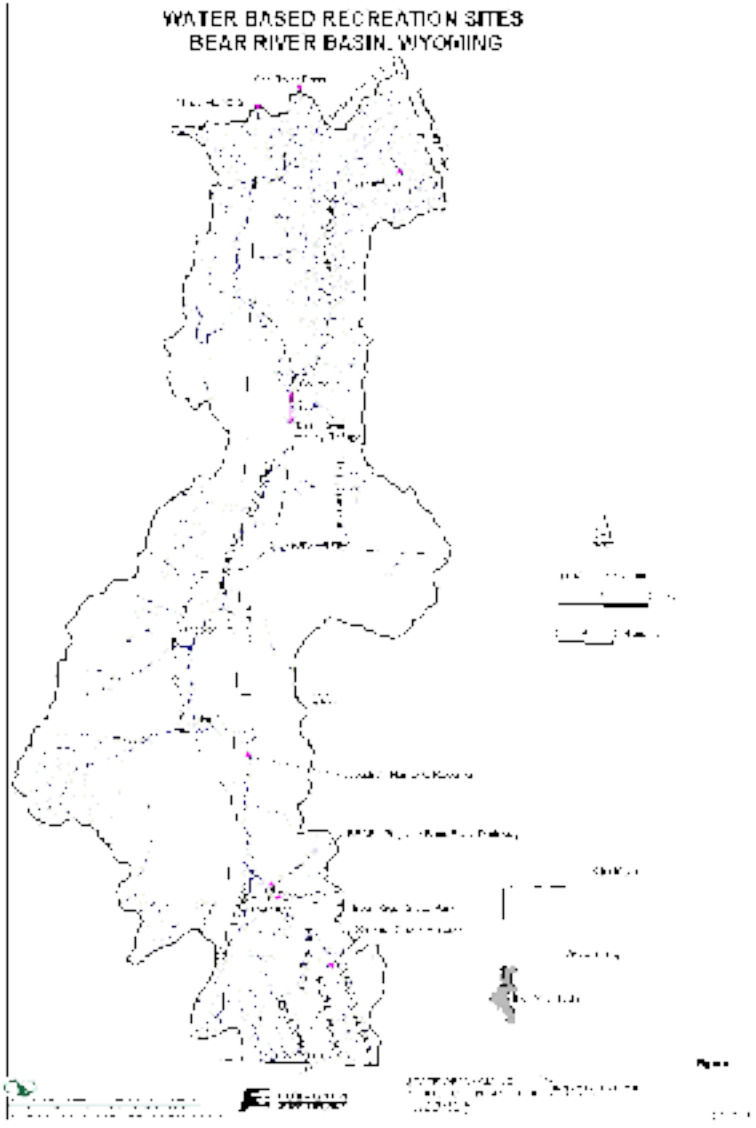
MINIMUM RESERVOIR POOLS AND RELEASES		
Reservoir	**Minimum Conservative Pool**	**Minimum Downstream Release**
Sulphur Creek Reservoir	**4,180 AF**	**9 CFS**
Woodruff Narrows Reservoir	**1,600 AF (Plus 4000 AF permitted to Fish & Wildlife)**	**10 CFS**
Source: Wyoming Game and Fish		

Environmental Use - Wildlife Refuge

- Land Acquisition Phase
  - Willing Buyer/Willing Seller Philosophy
- U.S. Fish and Wildlife and SEO Agreement
  - Water Use Quantity will not Increase from Historic
  - Timing of Depletions will be Maintained

Basin Water Use

- Agricultural
- Municipal
- Industrial
- Environmental
- **Recreational**



Current Recreational Uses

- Boating
- Fishing
- Water Fowl Hunting
- Swimming
- Destination Activities

Water-Based Recreation Destinations

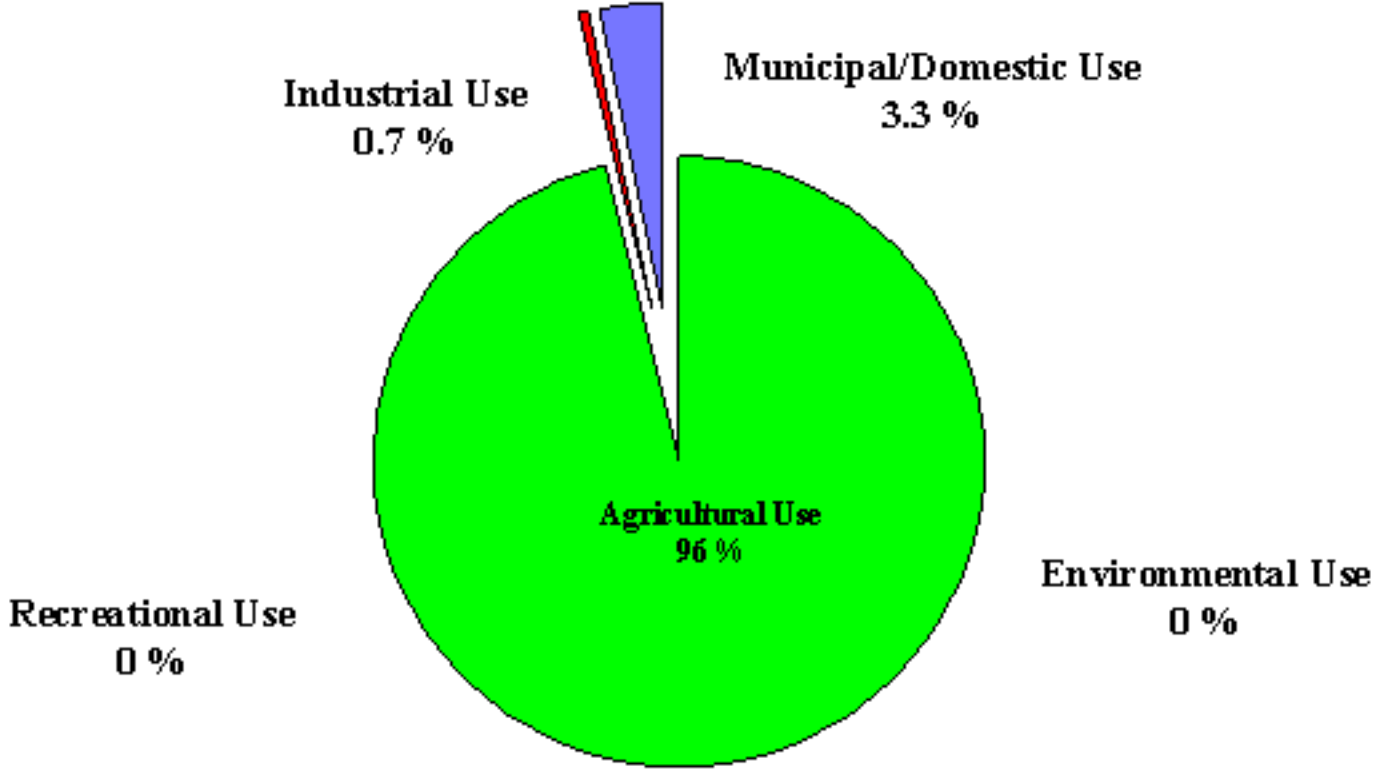
- Bridger-Teton National Forest
- BLM Lands
- Bear River State Park
- Sulphur Creek Reservoir
- Woodruff Narrows Reservoir
- Bear River Parkway

Consumptive Use Summary

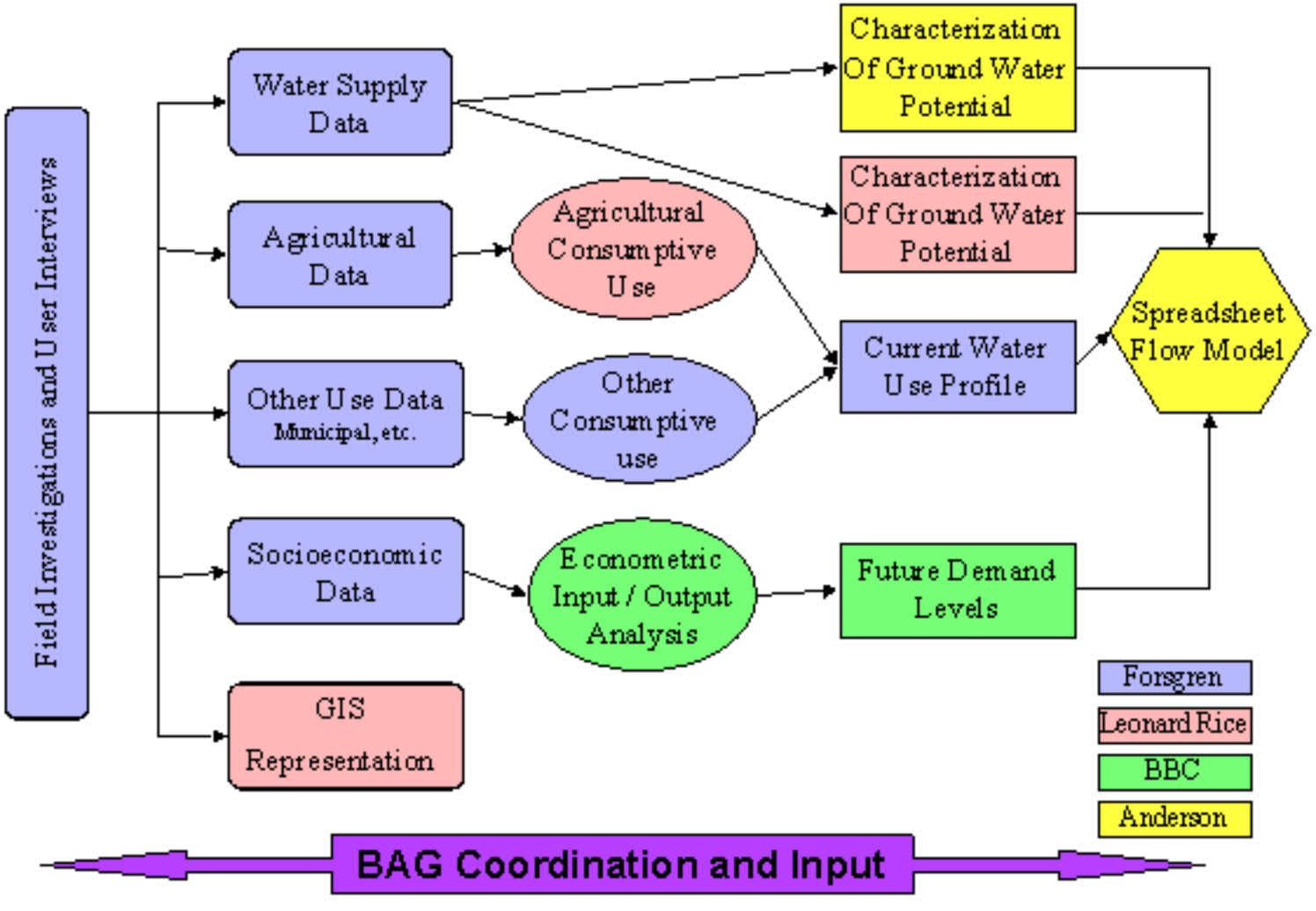
- Agricultural - 94,730 acre-feet
- Environmental - 0 acre-feet
- Industrial – 595 acre-feet
- Recreational - 0 acre-feet
- Municipal / Domestic - 3,245 acre-feet

- **Total = 98,570 acre-feet**

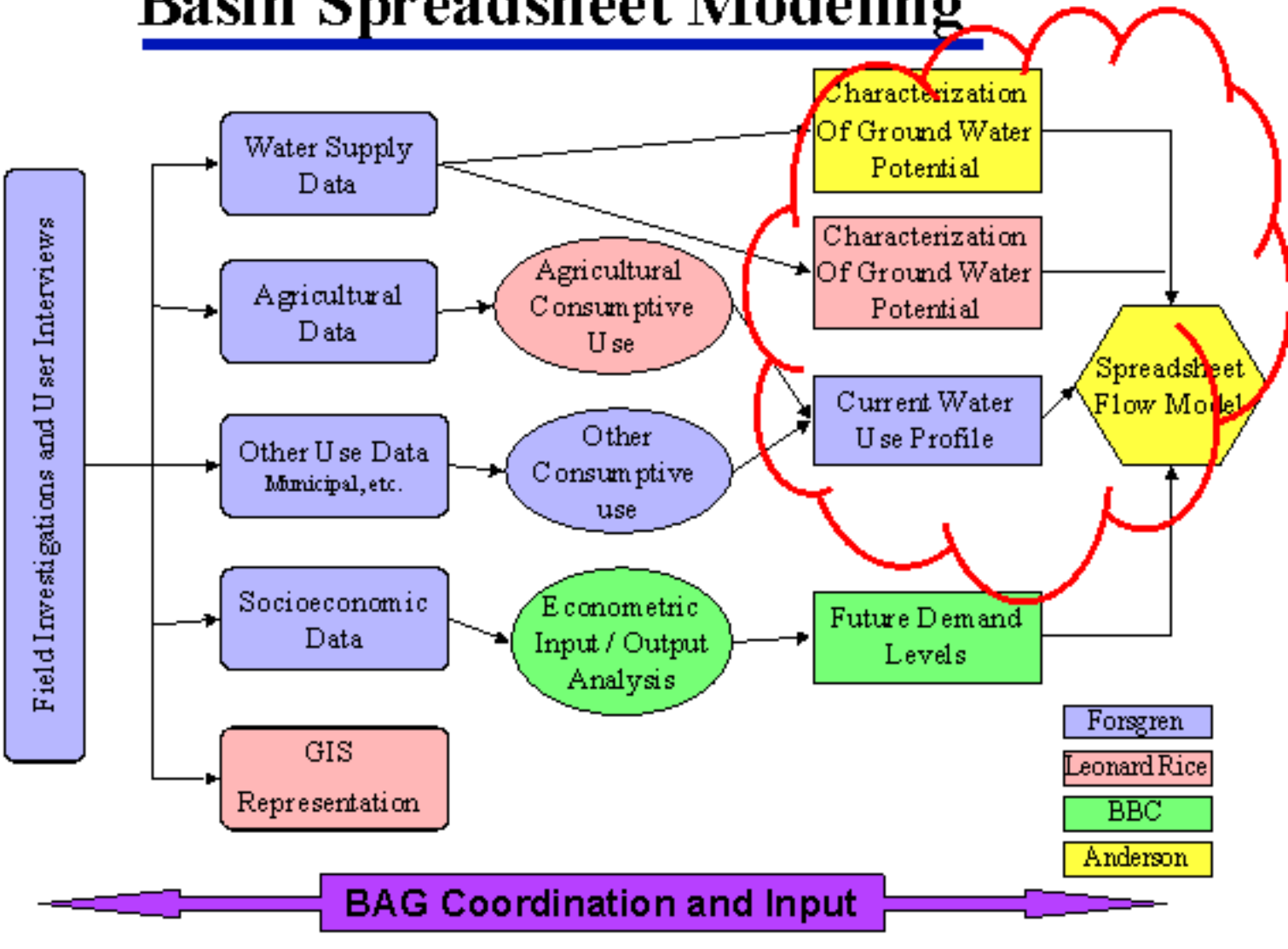
Bear River
Consumptive Use Summary



BASIN PLANNING PROCESS



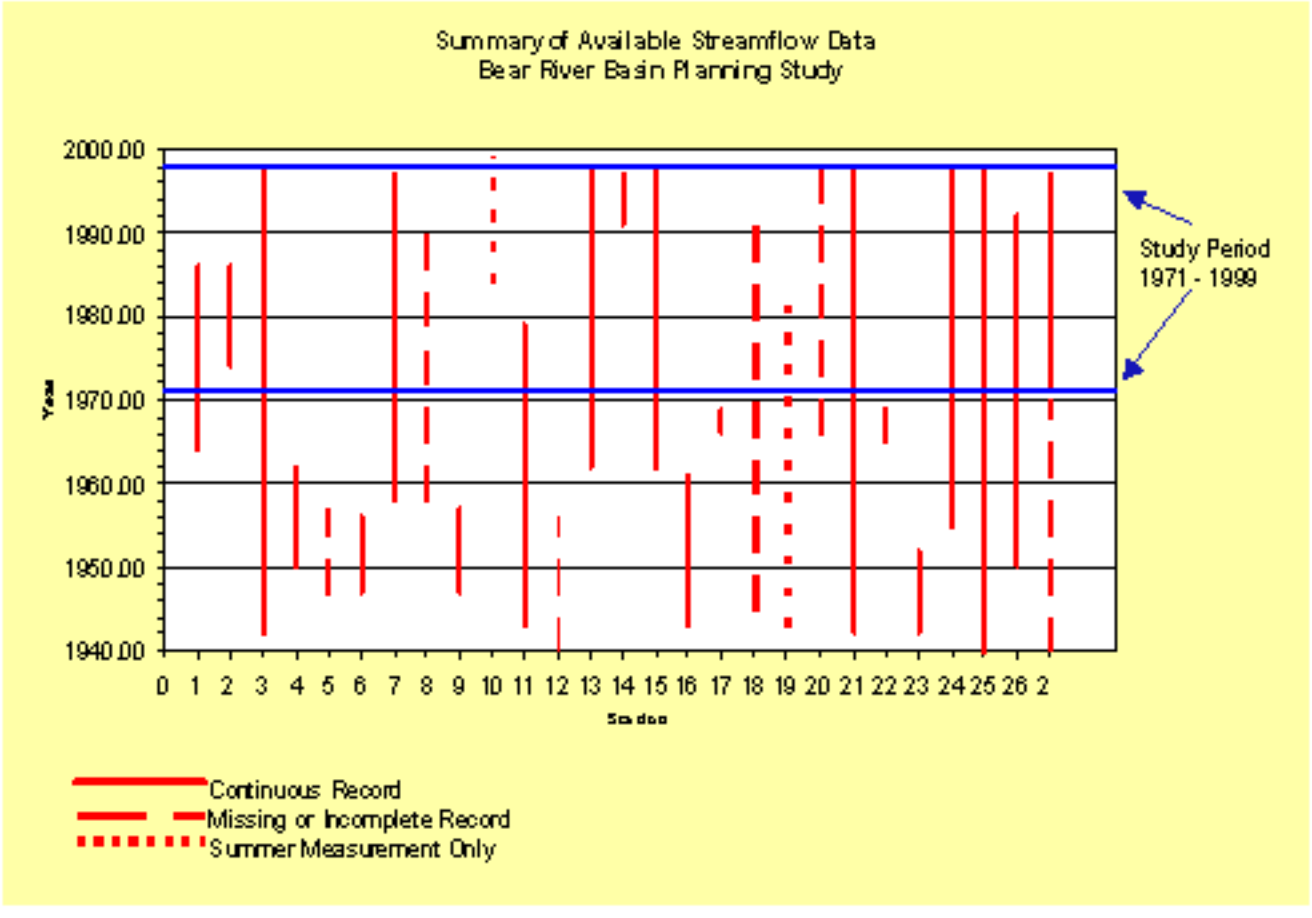
Basin Spreadsheet Modeling



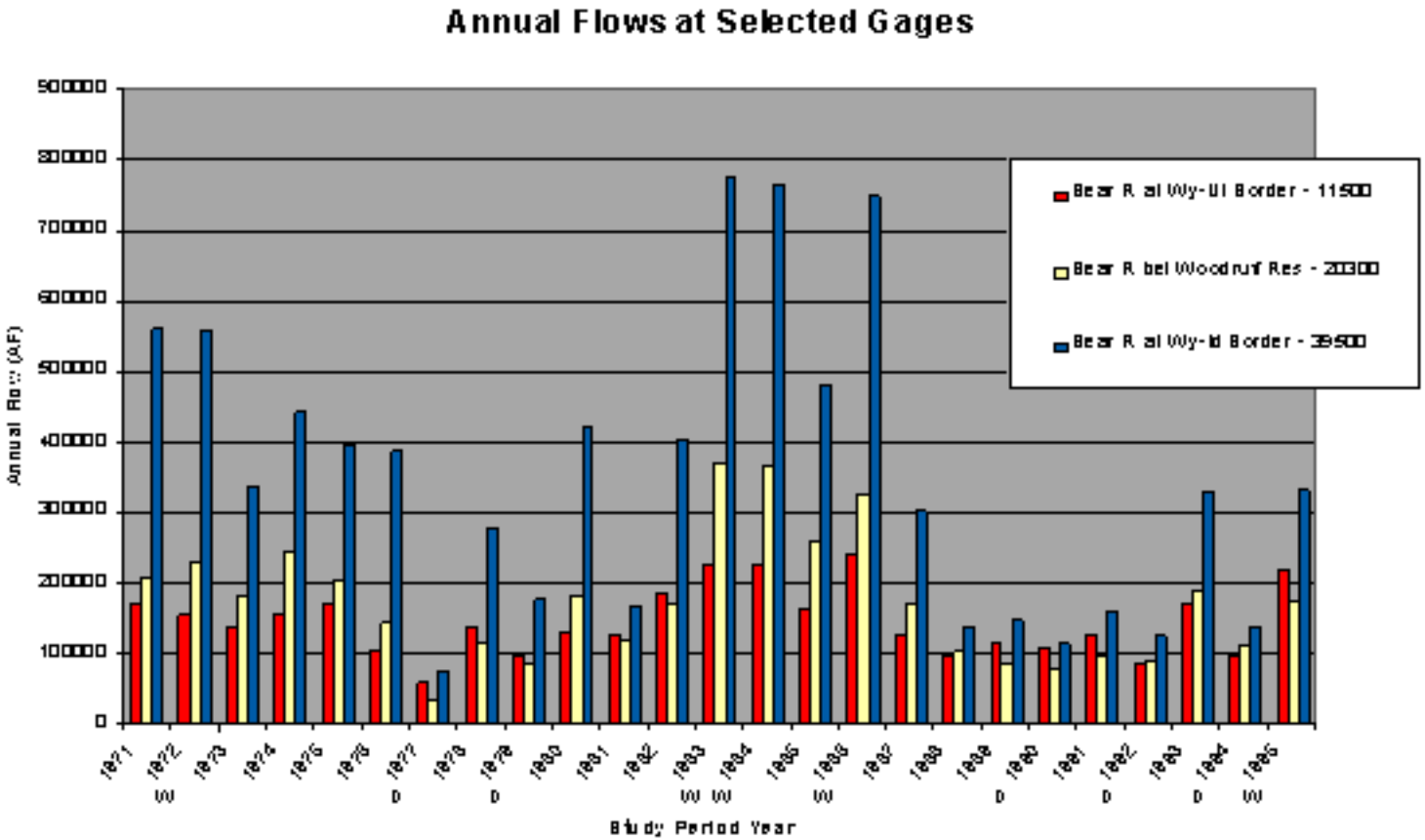
Basin Spreadsheet Modeling

- **Period Selection (Wet, Dry, and Normal Years)**
- Model Development
- Calibration
- Available Surface Water Determination

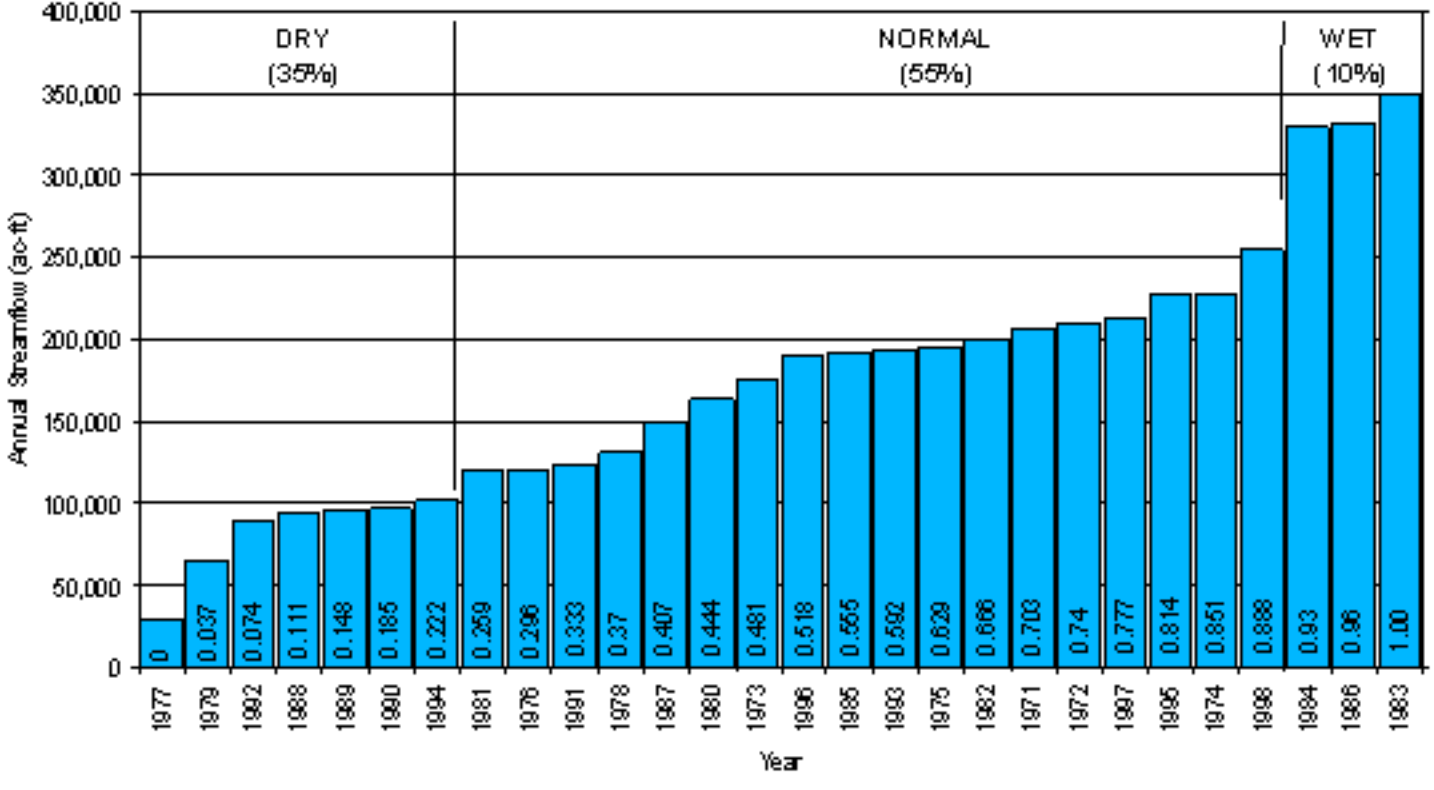
Period Selection



Wet, Dry, Normal Years



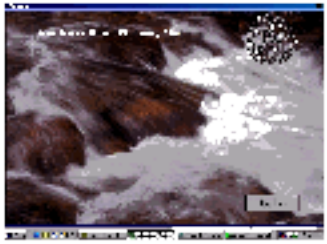
Ranked Annual Streamflow
Gage 10016900 Bear River at Evanston, Wyoming



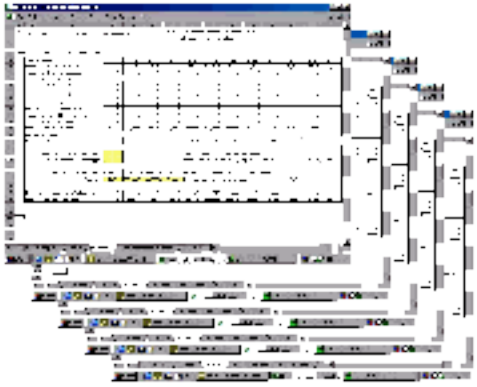
Basin Spreadsheet Modeling

- Period Selection
- **Model Development**
- Model Calibration
- Available Surface Water Determination

Spreadsheet Model Development



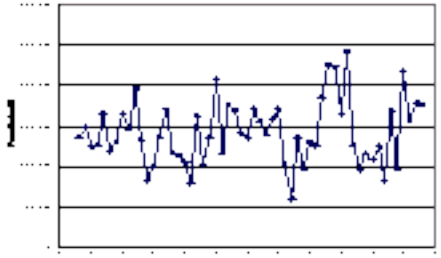
Graphical User Interface



Spreadsheet Model

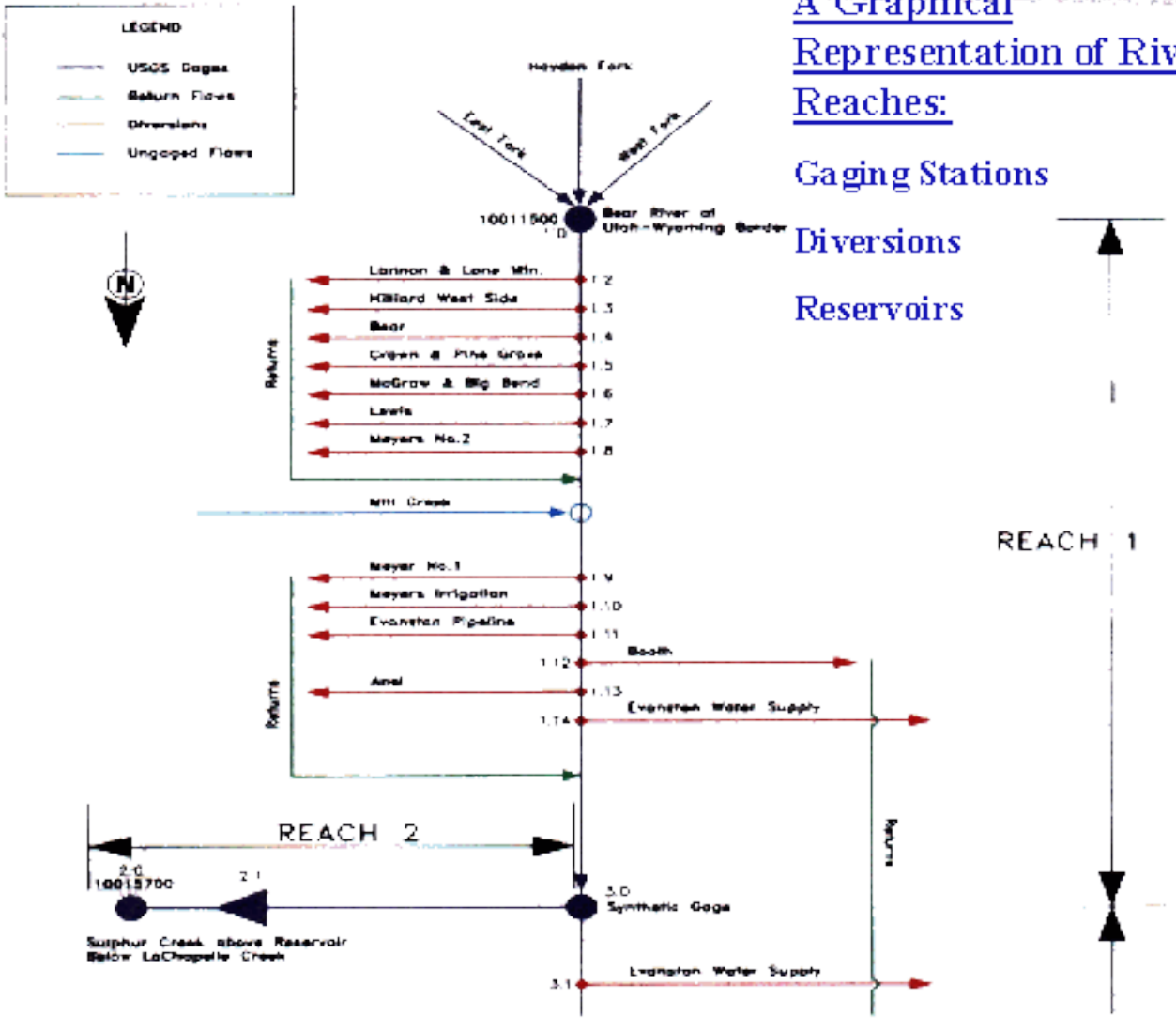
Series of tables representing reaches and nodes.

One reach per page of spreadsheet



Output and Results

The Node Diagram



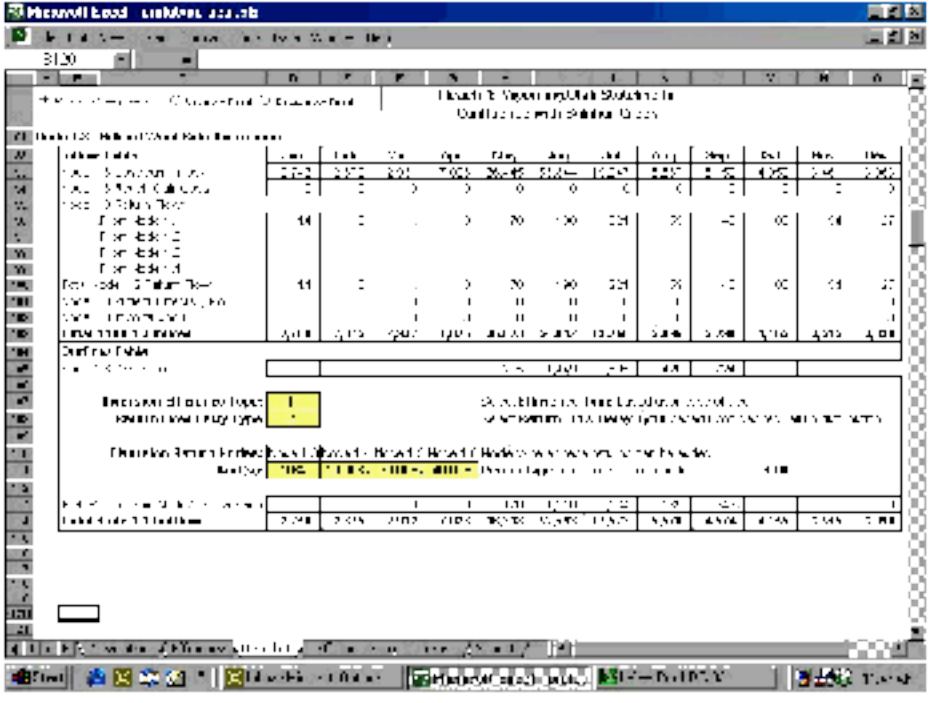
A Graphical Representation of River Reaches:

Gaging Stations

Diversions

Reservoirs

Anatomy of a Node



Types of Nodes

Gaging Station

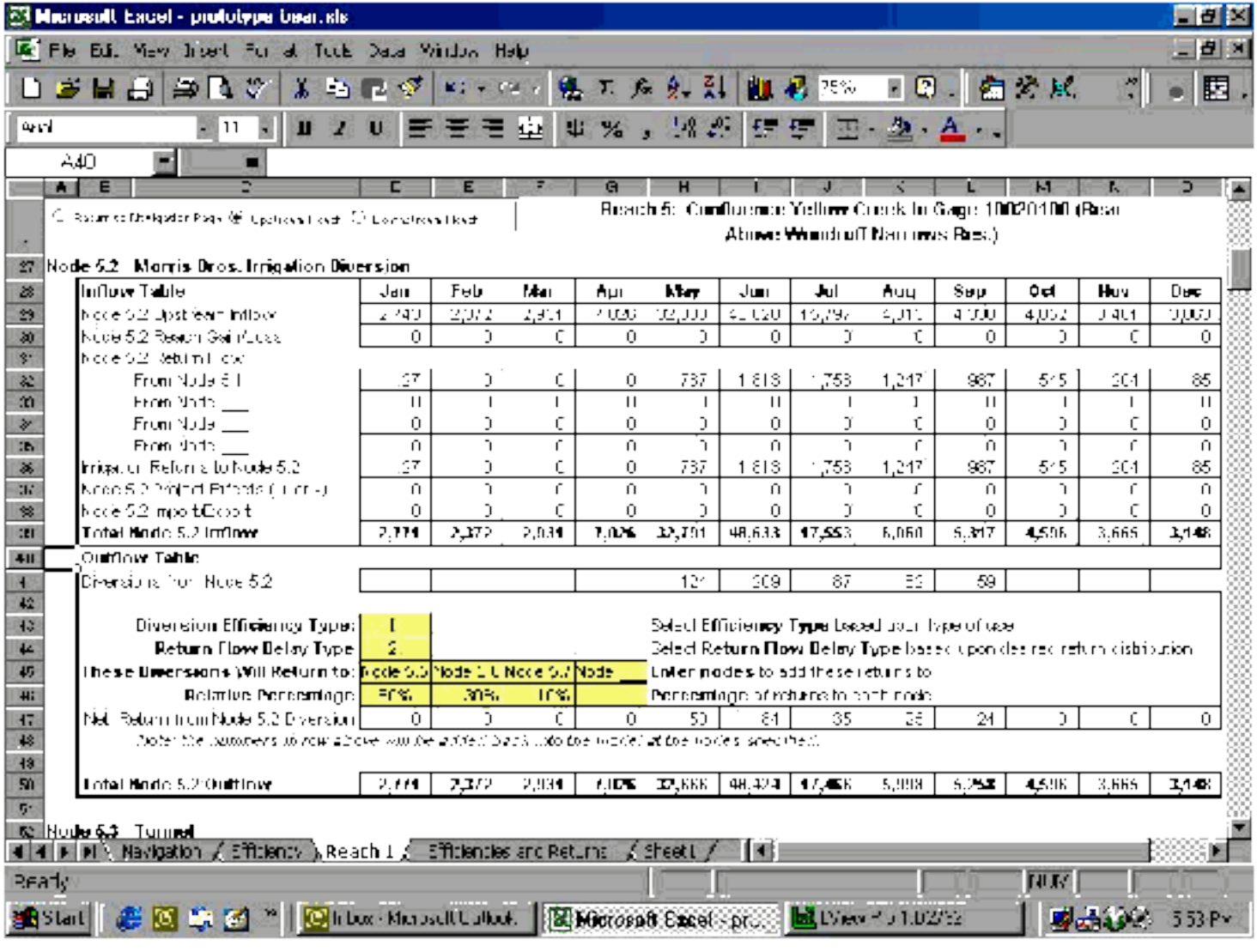
Diversion

Reservoir

A Node Consists of:

An accounting of:

- Flow from upstream node
- Irrigation Returns
- Reach gains / losses
- Import / export
- Diversions
- Evaporation (reservoirs)
- User Input Option



Microsoft Excel - prototype user.xls

File Edit View Insert Format Tools Data Window Help

A40

Reach 5: Confluence Yellow Creek to Gage 10802100 (Reach Above Woodruff Narrows Res.)

Node 5.2 Morris Bros. Irrigation Diversion

Inflow Table	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Node 5.2 Upstream Inflow	2,740	2,372	2,034	7,036	32,000	41,020	12,797	5,317	4,700	4,052	3,401	3,007
Node 5.2 Return Gain/Loss	0	0	0	0	0	0	0	0	0	0	0	0
Node 5.2 Return Flow												
From Node 5.1	37	0	0	0	737	1,618	1,753	1,217	987	515	301	85
From Node ___	11	1	1	11	1	11	1	1	11	1	1	11
From Node ___	0	0	0	0	0	0	0	0	0	0	0	0
From Node ___	0	0	0	0	0	0	0	0	0	0	0	0
Irrigation Returns to Node 5.2	37	0	0	0	737	1,618	1,753	1,217	987	515	301	85
Node 5.2 Wetland Entrada (Loss)	0	0	0	0	0	0	0	0	0	0	0	0
Node 5.2 Inputs/Export	0	0	0	0	0	0	0	0	0	0	0	0
Total Node 5.2 Inflow	2,774	2,372	2,034	7,036	32,737	48,633	17,553	6,060	5,317	4,566	3,665	3,148

Outflow Table

Diversions from Node 5.2					127	209	87	33	59			

Diversion Efficiency Type:	1				Select Efficiency Type based upon type of use
Return Flow Delay Type:	2				Select Return Flow Delay Type based upon desired return distribution
These Diversions Will Return to:	Node 5.3	Node 5.4	Node 5.7	Node	Enter nodes to add these returns to
Relative Percentage:	50%	30%	10%		Percentage of returns to each node

Net Return from Node 5.2 Diversion	0	0	0	0	50	81	35	33	24	0	0	0

Note: the numbers in row 42 above will be added back into the model at the nodes specified.

Total Node 5.2 Outflow	2,774	2,372	2,034	7,036	32,686	48,424	17,466	6,027	5,292	4,566	3,665	3,148

Node 5.3 Tunnel

Navigation / Efficiency / Reach 1 / Efficiencies and Returns / Sheet1 /

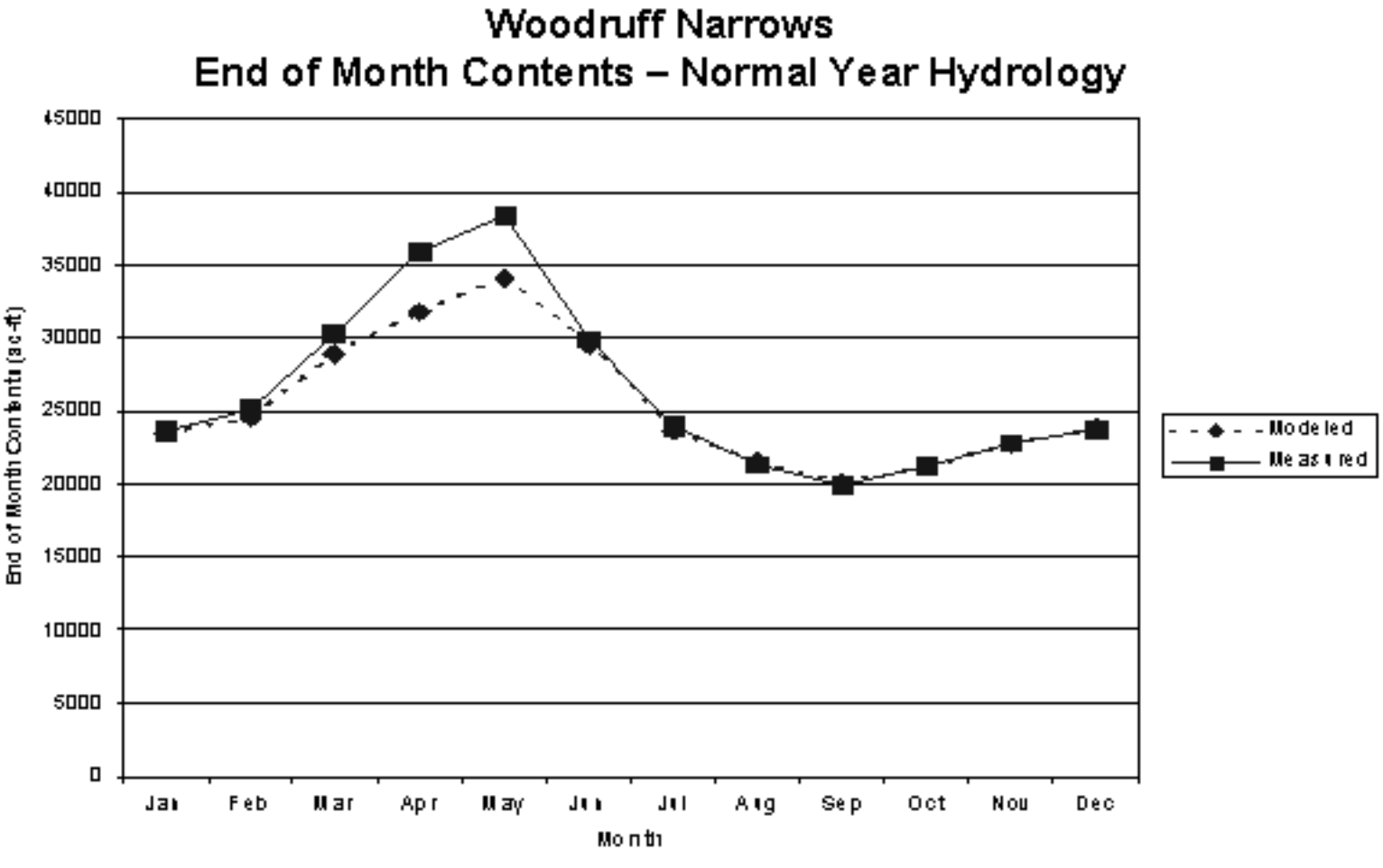
Ready

Start | In Box - Microsoft Outlook | Microsoft Excel - pro... | Drive-Pro 1.02/32 | 5:53 PM

Basin Spreadsheet Modeling

- Period Selection
- Model Development
- **Model Calibration**
- Available Surface Water Determination

Model Calibration



Basin Spreadsheet Modeling

- Period Selection
- Model Development
- Model Calibration
- **Available Surface Water Determination**

Return to Start | Compact Allocation: Central Division

Results Options

Normal Year Compact Allocation

Upper Division

May	Jun	Jul	Aug	Sep	
169	760	675	372	79	Upper Utah Section Diversion (1)
10,165	26,939	22,844	11,022	8,280	Upper Wyoming Section Diversion
3,632	-2,074	-4,155	-1,092	-841	Woodruff Narrows Reservoir Change in Storage Water
38,158	68,215	30,566	4,633	6,239	Lower Utah Section Diversions
5,077	10,927	3,324	147	162	Lower Wyoming Section Diversions
40,023	38,213	25,526	9,038	5,950	Bear River Below Pixley Dam
97,223	142,980	78,779	24,120	19,859	Total Upper Division Divertible Flow (ac-ft)
1,581	2,403	1,281	392	334	(cfs)

Is Total Upper Division Divertible Flow less than 1250 cfs? If so, Water Emergency (W.E.) exists.

No W.E.	No W.E.	No W.E.	W.E.	W.E.	
			145	119	Upper Utah Section Allocation
			11,891	9,796	Upper Wyoming Allocation
			9,769	8,047	Lower Utah Section Allocation
			2,316	1,907	Lower Wyoming Section Allocation

NOTE: (1) Upper Utah Division is not modeled explicitly in this model. Diversion data are included here for computation of Compact allocations.

Return to Start | Compact Allocation: Central Division

Results Options

Normal Year Compact Allocation

Upper Division

May	Jun	Jul	Aug	Sep	
169	760	675	372	79	Upper Utah Section Diversion (1)
10,165	26,939	22,844	11,022	8,280	Upper Wyoming Section Diversion
3,632	-2,074	-4,155	-1,092	-841	Woodruff Narrows Reservoir Change in Storage Water
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			2,316	1,907	Lower Wyoming Section Allocation

NOTE: (1) Upper Utah Diversion is not modeled explicitly in this model. Diversion data are included here for computation of Compact allocations.

Return to Start | Compact Allocation: Upper Division | Results Options

Normal Year Compact Allocation

Central Division

May	Jun	Jul	Aug	Sep	
9,409	23,804	21,358	11,988	5,567	(1) Wyoming Diversions
+	+	+	+	+	
14,094	27,139	14,878	7,282	6,947	(2) Idaho Diversions
+	+	+	+	+	
83,291	70,058	40,810	16,886	12,117	(3) Rainbow Inlet Canal plus Bear River Main Stem Flow below Stewart Dam
-	-	-	-	-	
106,795	121,001	77,046	36,155	24,631	Total Central Division Diversible Flow (ac-ft)
1,737	2,033	1,253	608	414	(cfs)
			W.E.	W.E.	
34,070	39,604	20,052	10,016	6,728	Flow of Bear River at Border Gaging Station (ac-ft)
573	666	326	168	113	(cfs)
		W.E.	W.E.	W.E.	
		33,130	15,547	10,591	Allocation to the State of Wyoming
		43,916	20,609	14,039	Allocation to the State of Idaho

Is Total Diversible Flow (2) < 870 cfs? If so, Water Emergency (W.E.) exists.

OR

Is Flow at Border < 350 cfs? If so, Water Emergency (W.E.) exists.

Return to Start | Compact Allocation : Upper Division

Results Options

Normal Year Compact Allocation

Central Division

May	Jun	Jul	Aug	Sep	
9,409	23,804	21,358	11,968	5,567	(1) Wyoming Diversions
+	+	+	+	+	
14,094	27,139	14,878	7,282	6,947	(2) Idaho Diversions
+	+	+	+	+	
83,291	70,058	40,810	16,886	12,117	(3) Rainbow Inlet Canal plus Bear River Main Stem Flow below Stewart Dam
-	-	-	-	-	
106,795	121,001	77,046	36,155	24,631	Total Central Division Diversible Flow (ac-ft)
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Is Total Diversible Flow (2) < 870 cfs? If so, Water Emergency (W.E.) exists.

OR

Is Flow at Border < 350 cfs? If so, Water Emergency (W.E.) exists.

Summary of Outflow by Reach

Normal Year Hydrology

Flow Downstream of Each Reach	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Reach 1	3,772	3,734	9,085	18,689	48,580	51,850	13,527	3,054	2,650	5,072	4,209	3,965
Reach 2	395	491	1,305	3,251	5,239	2,397	187	1,291	1,547	854	657	395
Reach 3	4,168	4,225	10,391	21,921	53,605	54,391	14,855	3,051	3,304	4,877	4,941	4,373
Reach 4	4,675	4,753	11,805	23,207	59,253	61,165	18,859	3,285	3,351	5,330	5,272	4,783
Reach 5	4,675	4,753	11,805	23,199	55,645	57,017	16,545	2,688	3,089	5,494	5,325	4,783
Reach 6	3,447	3,544	7,168	20,048	53,673	61,309	22,031	4,371	4,119	4,150	3,578	3,365
Reach 7	6,813	7,466	16,963	28,230	41,780	35,818	16,650	5,829	4,378	7,635	7,832	6,901
Reach 8- Riley Dam Release	4,745	4,836	11,520	18,627	40,023	35,213	25,826	9,036	5,950	6,162	5,932	5,260
Reach 9	13,649	13,859	28,008	52,402	88,565	92,123	50,178	19,419	14,348	16,943	16,393	14,929
Reach 10	7,177	7,113	12,268	25,622	41,323	44,000	19,130	7,845	6,930	9,170	8,605	7,872
Reach 11 - Rowat Border Gage	14,320	14,374	28,460	55,595	89,113	91,543	50,541	19,397	13,886	17,291	16,919	15,280
Reach 12 - Stewart Dam Release	259	291	485	378	646	2,935	1,004	691	949	659	513	422

Summary of Water Availability

Upper Division

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Flow below Pixley Dam (AF)												
Dry	1,972	1,885	3,744	9,994	1,859	7,801	8,342	2,572	1,492	1,725	2,255	1,959
Normal	4,745	4,398	11,520	18,827	40,059	93,219	25,528	9,058	5,950	8,182	5,992	5,280
Wet	8,093	7,198	20,228	92,192	89,560	92,995	40,990	20,259	18,027	15,040	19,919	8,975
2. Total Available Flow (AF)												
Dry	-	-	-	-	58,987	85,725	94,175	12,712	7,209	-	-	-
Normal	-	-	-	-	97,229	142,930	78,779	24,120	19,369	-	-	-
Wet	-	-	-	-	144,576	219,939	90,951	35,818	28,269	-	-	-
3. Min. Compact Flow Required (AF)	0	0	0	0	78,381	74,931	78,381	78,381	74,931	0	0	0
(cfs)	0	0	0	0	1,250	1,250	1,250	1,250	1,250	0	0	0
4. Available Flow for WY (AF)												
Dry	1,972	1,885	3,744	9,994	0	11,414	0	0	0	1,725	2,255	1,959
Normal	4,745	4,398	11,520	18,827	20,982	68,599	1,918	0	0	8,182	5,992	5,280
Wet	8,093	7,198	20,228	92,192	67,715	193,802	14,090	0	0	15,040	19,919	8,975
5. Preferable Reaches	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	4, 5, 6 & 7	4, 5, 6 & 7	4, 5, 6 & 7	none	none	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5

Notes: 1. Flow below Pixley Dam is gage 10023500 Bear River below Pixley Dam. This constitutes the flow out of the Upper Division.

2. Total Available Flow is combined diversions (present development) of Wyoming and Utah in Upper Division plus flow below Pixley Dam (1,250 cfs limit).

3. Minimum Compact Flow is minimum of flow above 1,250 cfs) Total Available Flow, including Pixley Dam releases) or zero for non-irrigation season.

4. Available Flow is physically available flow, based on present development, above required Compact flows, which is flow in item 1 during non-irrigation season or flow in item 2 above item 3 in irrig. seas

5. Preferable reaches are stream reaches where flow physically occurs but may be impacted by potential new diversions in other reaches of the division.

Summary of Water Availability

Central Division

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Flow at WYO ID Border Gage (AF)												
Dry	8,943	7,537	12,943	19,542	13,140	22,487	14,191	8,274	5,893	8,732	8,400	8,080
Normal	14,920	14,974	28,480	55,598	89,119	91,549	50,541	19,997	19,898	17,291	16,919	15,280
Wet	18,950	22,400	51,890	75,780	156,070	213,802	81,347	97,510	92,109	94,920	92,549	24,980
2. Flow below Stewart Dam (AF)												
Dry	581	844	824	451	490	888	869	736	706	721	407	909
Normal	259	291	435	973	848	2,508	1,004	891	949	859	519	422
Wet	183	201	435	490	11,587	29,122	19,782	840	742	511	984	914
3. Total Divertible Flow (AF)												
Dry	-	-	-	-	95,349	49,094	29,982	15,945	10,829	-	-	-
Normal	-	-	-	-	108,725	121,001	77,048	98,155	24,891	-	-	-
Wet	-	-	-	-	197,929	257,599	110,056	57,049	49,494	-	-	-
4. Min. Compact Flow Required (AF)	21,521	19,458	21,521	20,827	59,485	51,769	59,485	59,485	51,769	21,521	20,827	21,521
(cfs)	350	350	350	350	370	370	370	370	370	350	350	350
5. Available Flow for WY (AF)												
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Normal	0	0	8,999	34,769	59,900	89,292	29,551	0	0	0	0	0
Wet	0	2,982	30,169	54,959	134,549	191,775	50,560	9,543	0	12,799	11,718	2,959
6. Preferable Reaches	none	9, 11 & 12	9, 11 & 12	9, 11 & 12	9, 11 & 12	9, 11 & 12	9, 11 & 12	9, 11 & 12	none	9, 11 & 12	9, 11 & 12	9, 11 & 12

Notes: 1. Flow at WYO ID Border Gage or page 10 2500 Bear River at Border, above Idaho diversions. One of Compact flow limits controlling gage is flow of 350 cfs at this gage.

2. Flow below Stewart Dam regulated by PPSL, as referenced in compact as part of other minimum of 370 cfs in item 4 (other part is Total Divertible Flow).

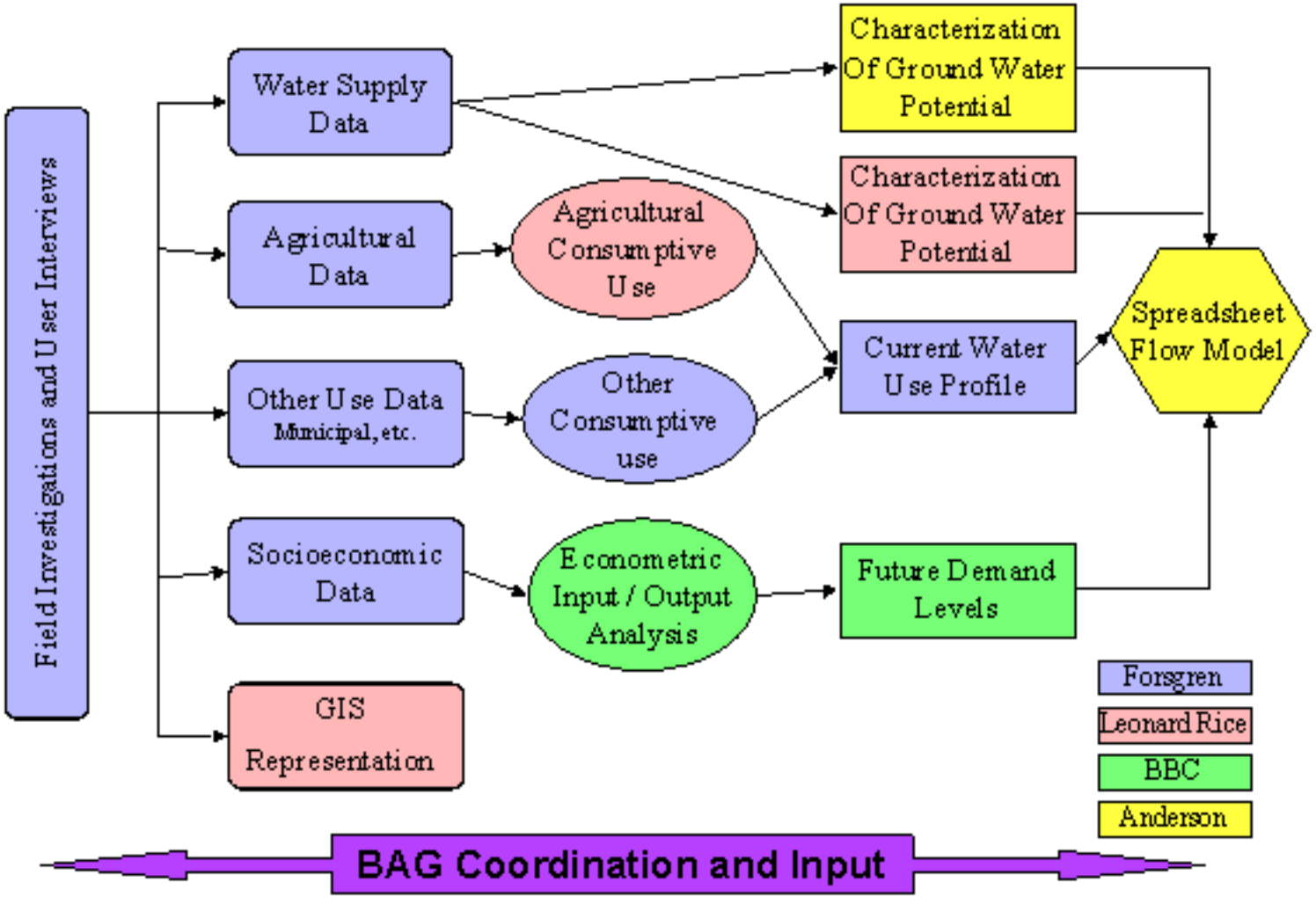
3. Total Divertible Flow is combined diversions (present development) of Wyoming and Idaho in Central Division plus flow below Stewart Dam.

4. Minimum Compact Flow is minimum of flow above 350 cfs at Border Gage or flow above 370 cfs (Total Divertible Flow, including Stewart Dam releases).

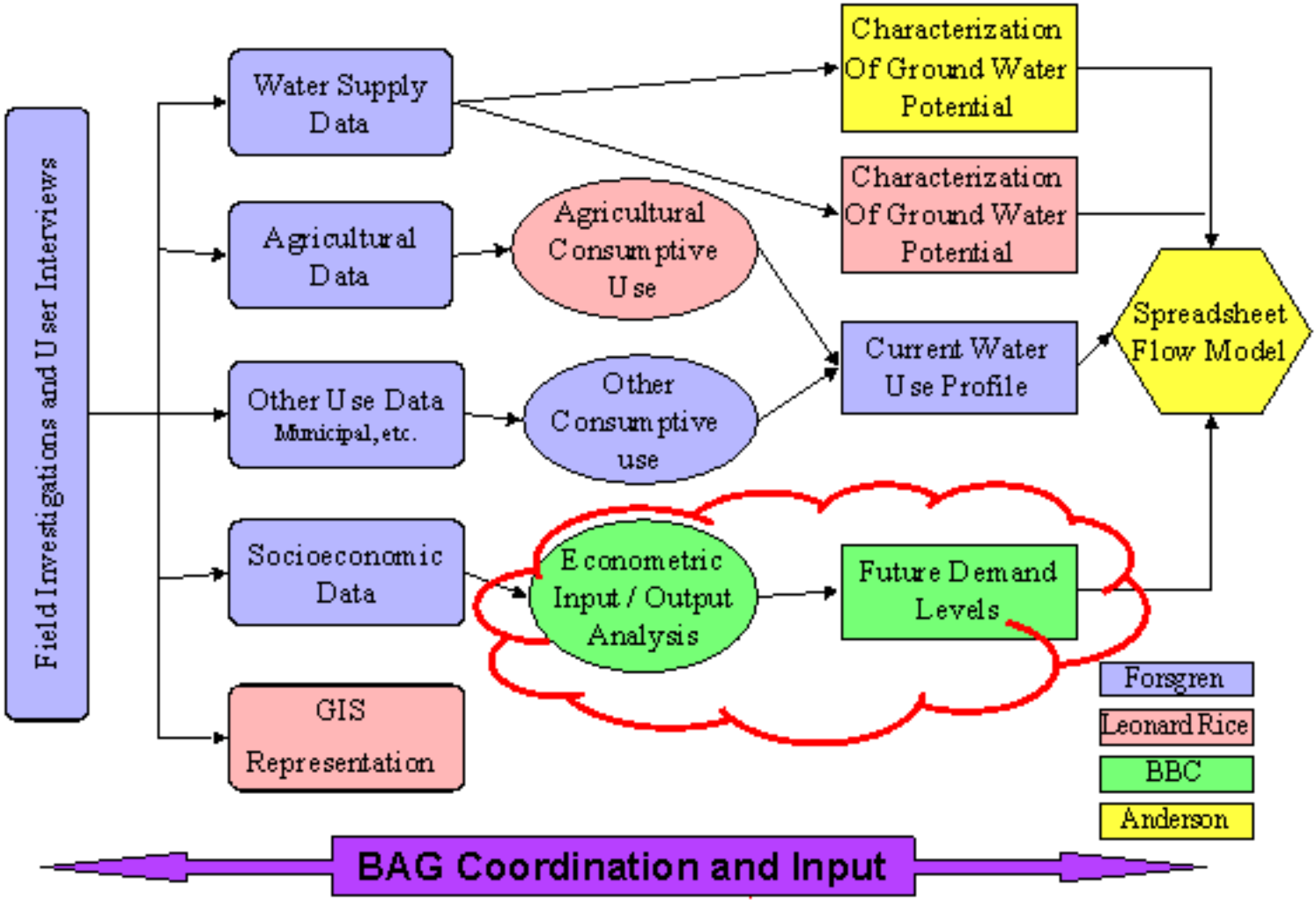
5. Available Flow is physically available flow, based on present development, above required Compact flows, which are minimum of flow in item 3 above 370 cfs or flow in item 1 above 350 cfs.

6. Preferable reaches are stream reaches where flow physically occurs, but may be impacted by potential projects in Upper Division and potential projects in other reaches of this division.

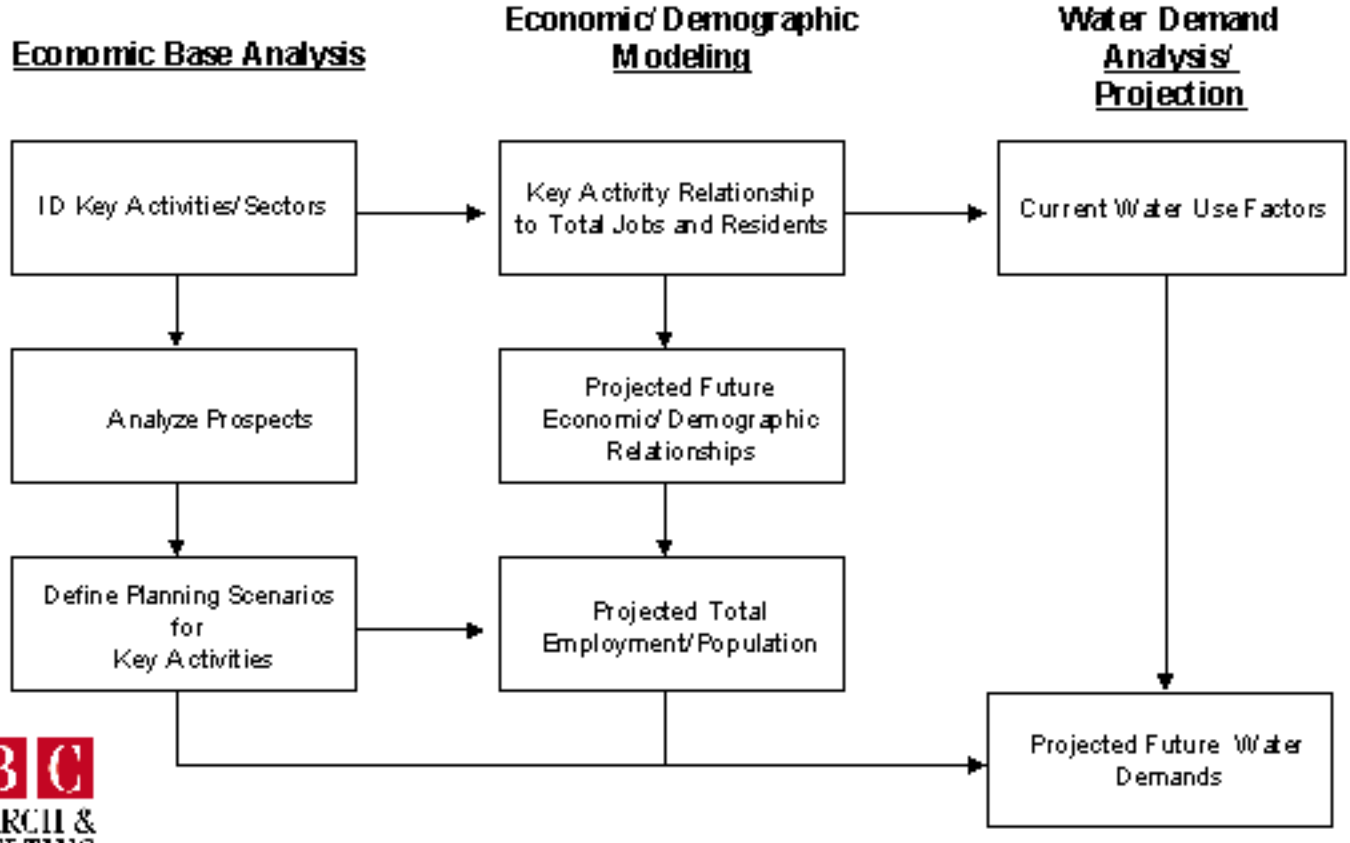
BASIN PLANNING PROCESS



Basin Economics / Future Demands



Overview of Bear River Basin Demand Projection Methodology



BBC RESEARCH & CONSULTING

Basin Economic Modeling

Key Economic Activities & Sectors

- Agriculture
- Energy
- Tourism
- Manufacturing / Commercial

Summary of Planning Scenarios – Key Activities

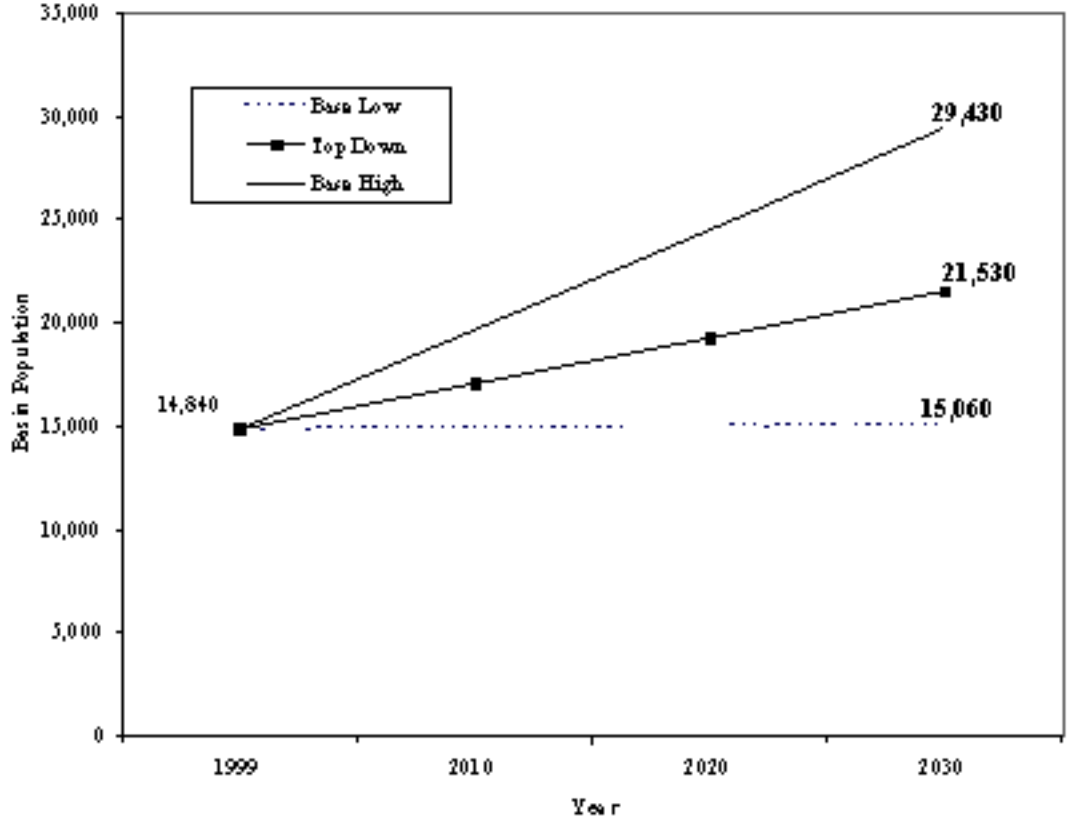
High Case

- ***Agriculture:*** Growth in livestock, small increase in acreage, little or no change in number of farms or farm workers.
- ***Energy:*** Enhanced recovery and high prices support production similar to current.
- ***Tourism:*** Substantial growth due to increased traffic and Evanston visibility.
- ***Manufacturing/Commercial:*** Major growth engine for region.

Low Case

- ***Agriculture:*** Decline in livestock and acreage due to grazing limitations, refuge implementation.
- ***Energy:*** Sector essentially gone by 2030.
- ***Tourism:*** Substantial growth, but less than High Case.
- ***Manufacturing/Commercial:*** Growth approximately offsets energy losses

Alternative Population Projections for Bear River Basin



Water Demand Factors by Economic Sector (Annual Diversions and Annual Consumptive Use)

Demand by Type of Use	Units	Diversions		Consumptive Use	
		Normal Year	High Demand Year	Normal Year	High Demand Year
Agriculture					
Irrigation	*acre feet per acre*	4.52	–	1.45	2.01
Surface Water		4.47	6.26	1.42	1.98
Ground Water		0.05	0.17	0.03	0.11
Livestock	*acre feet per animal unit*	0.02	0.02	0.02	0.02
Municipal					
Evanston					
Residential	*Gallons/capita per day*	157.68	172.72	95.38	110.89
Commercial	*Gallons/employee per day*	70.59	77.97	42.80	50.35
Institutional	*Gallons/capita per day*	80.63	104.71	49.47	73.74
Colorville	*Gallons/capita per day*	1,070.00	1,070.00	827.08	830.79
Rural Domestic	*Gallons/capita per day*	180.00	180.00	180.00	180.00
Industrial					
Natural Gas	*acre feet per Bcf of production*	1.91	2.69	1.91	2.69
Whitney(Chevron)		1.09	1.54	1.09	1.54
Whitney(BP-Amoco)		0.82	1.15	0.82	1.15

Current and Projected 2030 Water Demands
Diversion Needs, Normal and High Demand Years

By Type of Use	Current (2000)	2030		
		High Scenario	Middle Scenario	Low Scenario
Agricultural	295,200 - 419,700	312,200 - 443,900	293,200 - 416,800	277,600 - 394,700
Municipal	4,500 - 5,000	8,600 - 9,800	6,300 - 7,200	4,500 - 5,100
Rural Domestic/ Industrial	1,000 - 1,300	1,500 - 1,700	1,000 - 1,100	500
Total	300,700 - 426,000	322,300 - 455,400	300,500 - 425,100	282,600 - 400,300
By Source				
Surface Water	293,800 - 416,400	314,500 - 444,800	293,700 - 415,700	276,600 - 392,900
Ground Water	6,900 - 9,600	7,800 - 10,600	6,800 - 9,400	6,000 - 8,400
Total	300,700 - 426,000	322,300 - 455,400	300,500 - 425,100	282,600 - 400,300

Comparison of Projected Acre-Foot Increases in Bear River Basin Diversions Needed Versus Available Supply

(NORMAL YEAR)

Upper Division

	Projected Demand Growth by Month			Available	Surplus/
	Agriculture	Other	Total	Surface Supply	(Shortage)
Jan	2	156	158	4,745	4,587
Feb	2	150	152	4,836	4,684
Mar	2	152	155	11,520	11,365
Apr	38	145	183	18,627	18,444
May	813	237	1,050	19,049	17,999
Jun	2,725	491	3,217	66,197	62,980
Jul	3,210	698	3,908	97	(3,811)
Aug	1,457	803	2,260	0	(2,260)
Sep	405	551	956	0	(956)
Oct	42	269	311	6,162	5,851
Nov	2	141	143	5,932	5,789
Dec	2	143	145	5,260	5,115
Total	8,702	3,936	12,637	142,425	129,788

Comparison of Projected Acre-Foot Increases in Bear River Basin Diversions Needed Versus Available Supply

(NORMAL YEAR)

Central Division

	Projected Demand Growth by Month			Available	Surplus/
	Agriculture	Other	Total	Surface Supply	(Shortage)
Jan	2	0	2	0	(2)
Feb	2	0	2	0	(2)
Mar	2	0	2	6,939	6,937
Apr	10	0	10	34,769	34,759
May	610	0	610	53,300	52,690
Jun	2,804	0	2,804	69,232	66,428
Jul	3,008	0	3,008	23,551	20,543
Aug	1,575	0	1,575	0	(1,575)
Sep	319	0	319	0	(319)
Oct	22	0	22	0	(22)
Nov	3	0	3	0	(3)
Dec	2	0	2	0	(2)
Total	8,359	0	8,359	187,791	179,432

Comparison of Projected Acre-Foot Increases in Bear River Basin Diversions Needed Versus Available Supply

(DRY YEAR)

Upper Division

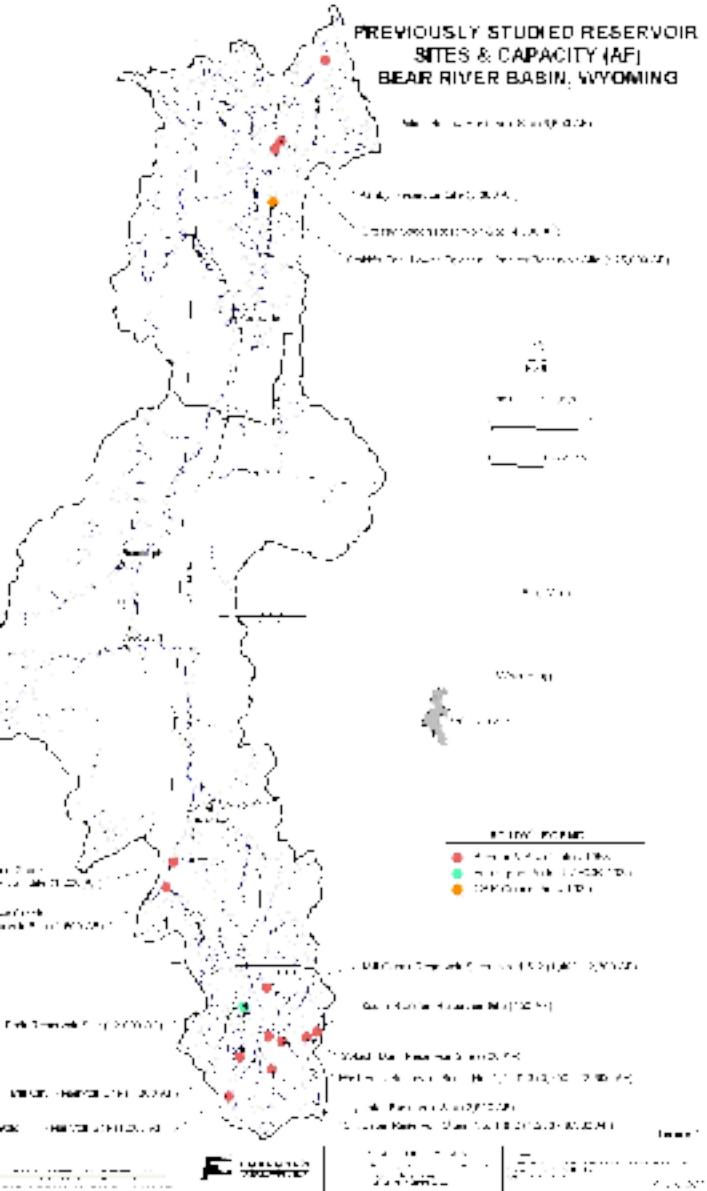
	Projected Demand Growth by Month			Available	Suplus/
	Agriculture	Other	Total	Surface Supply	(Shortage)
Jan	2	180	183	1,972	1,789
Feb	2	173	176	1,665	1,489
Mar	2	176	178	3,744	3,566
Apr	51	168	219	3,934	3,715
May	1,128	274	1,403	0	(1,403)
Jun	3,789	568	4,356	9,524	5,168
Jul	4,463	806	5,269	0	(5,269)
Aug	2,025	927	2,952	0	(2,952)
Sep	561	636	1,197	0	(1,197)
Oct	58	311	369	1,735	1,366
Nov	2	163	165	2,255	2,090
Dec	2	165	168	1,959	1,791
Total	12,088	4,547	16,635	26,788	10,153

Comparison of Projected Acre-Foot Increases in Bear River Basin Diversions Needed Versus Available Supply

(DRY YEAR)

Central Division

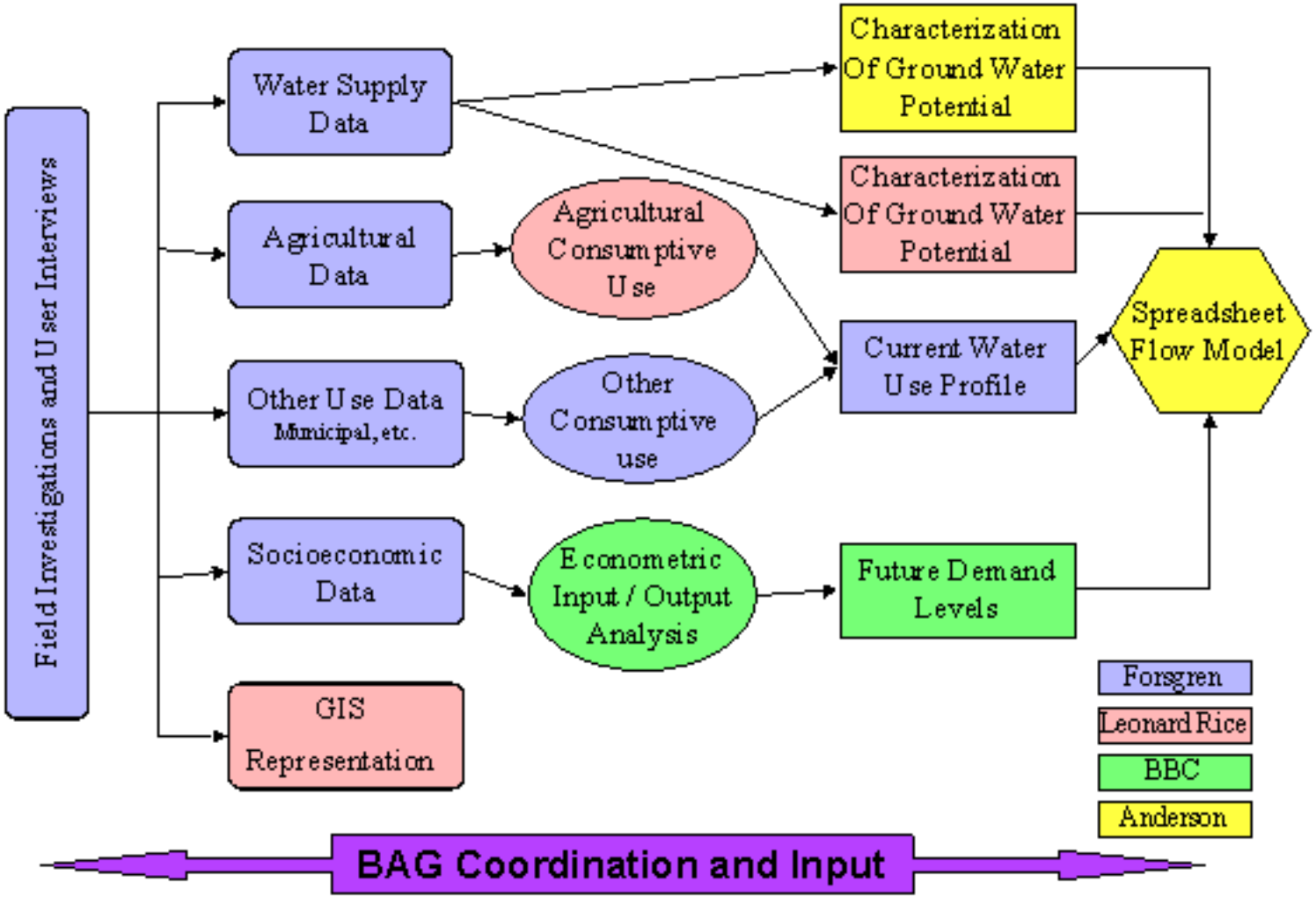
	Projected Demand Growth by Month			Available	Surplus/
	Agriculture	Other	Total	Surface Supply	(Shortage)
Jan	2	0	2	0	(2)
Feb	2	0	2	0	(2)
Mar	2	0	2	0	(2)
Apr	12	0	12	0	(12)
May	847	0	847	0	(847)
Jun	3,899	0	3,899	0	(3,899)
Jul	4,183	0	4,183	0	(4,183)
Aug	2,189	0	2,189	0	(2,189)
Sep	441	0	441	0	(441)
Oct	30	0	30	0	(30)
Nov	3	0	3	0	(3)
Dec	2	0	2	0	(2)
Total	11,612	0	11,612	0	(11,612)



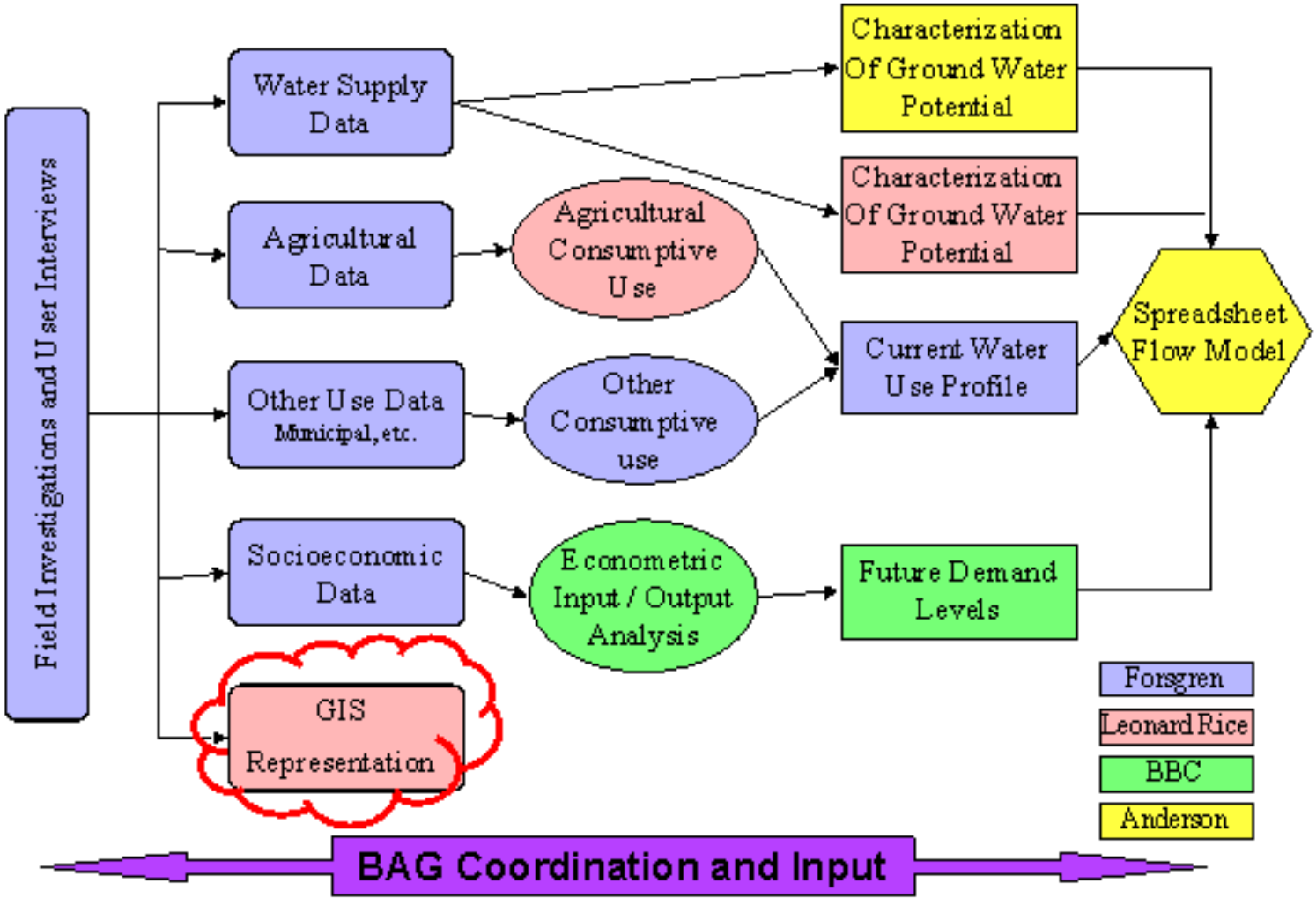
Previously Studied Potential Storage Sites

- **Banner & Assoc.** (1958)
  - Twin Creek
  - Upper Bear- East & West Forks & Mill Creek (13 sites)
  - Yellow Creek (2 sites)
  - Smiths Fork (3 sites)
- **Forsgren-Perkins / RBG** (1985)
  - West Fork Site
- **GBR Consultants** (1985)
  - Smiths Fork Teichert-Bagley site

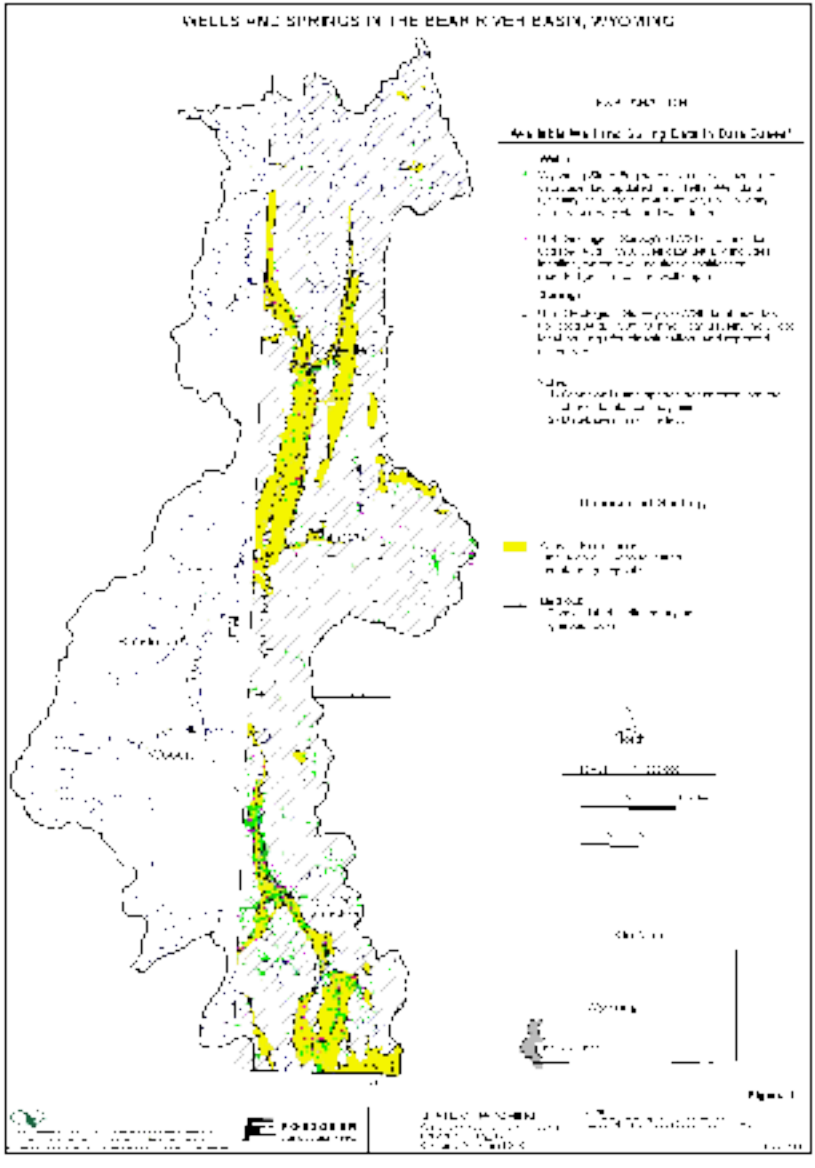
BASIN PLANNING PROCESS



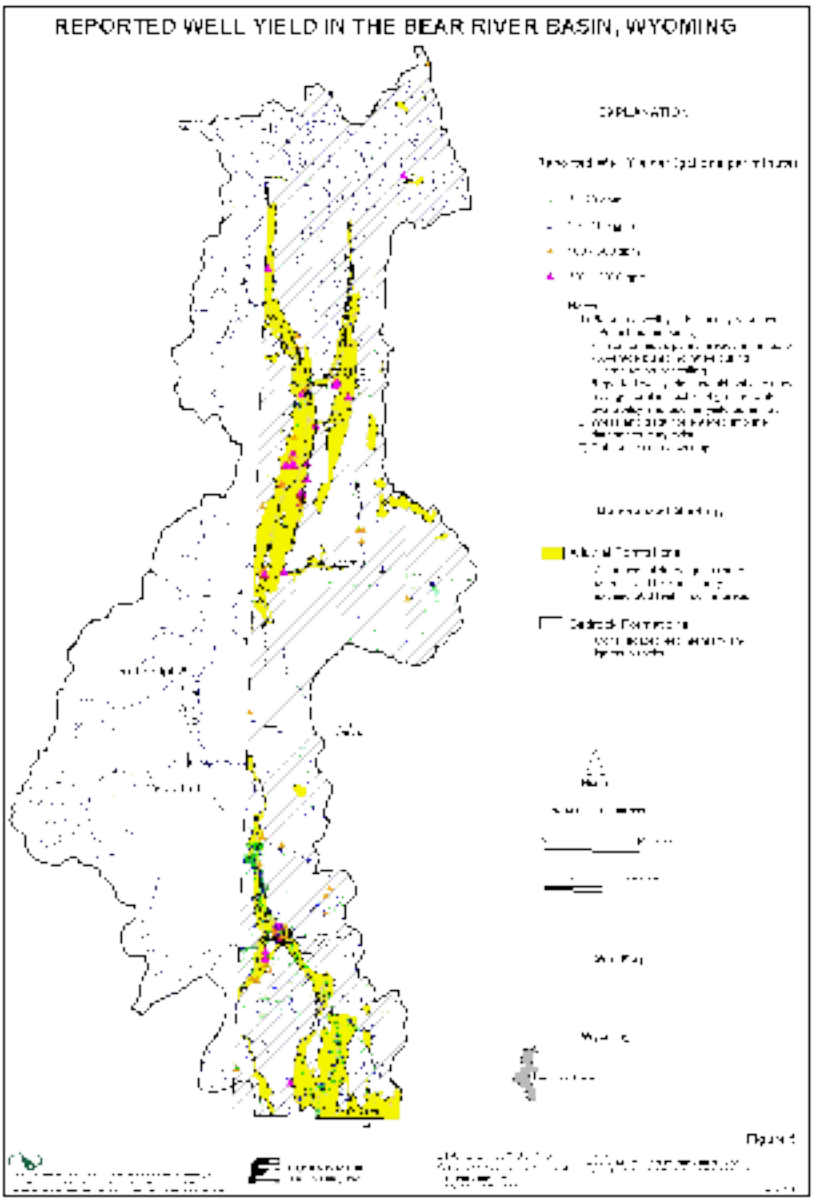
GIS REPRESENTATION



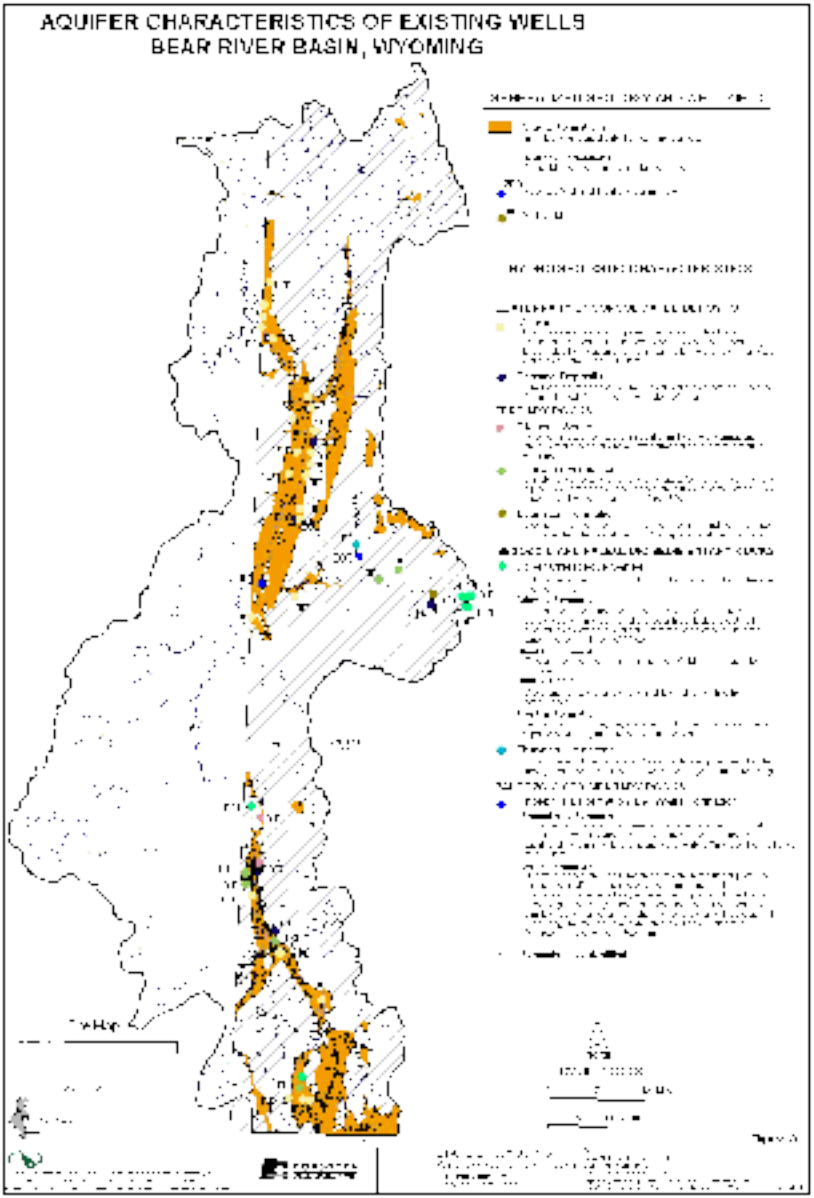
POTTY BREAK



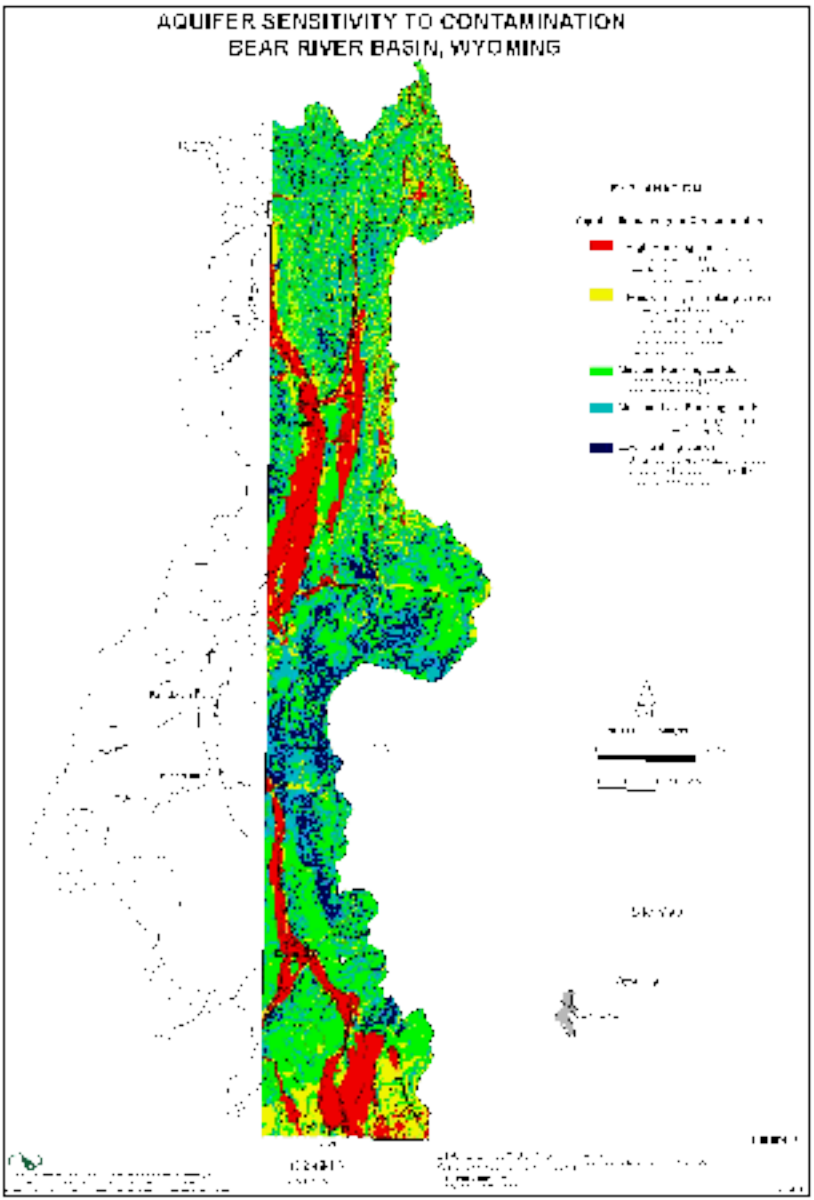
Documented Wells and Springs



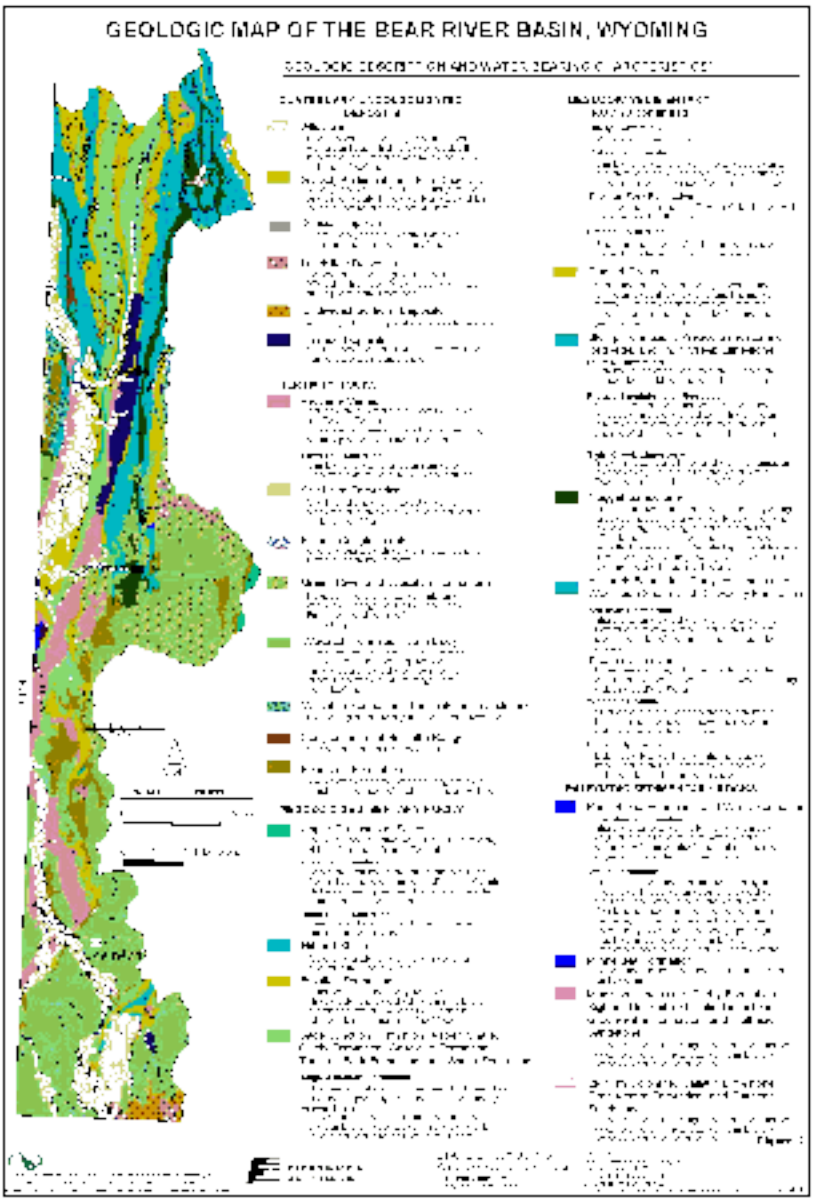
Reported Well Yields



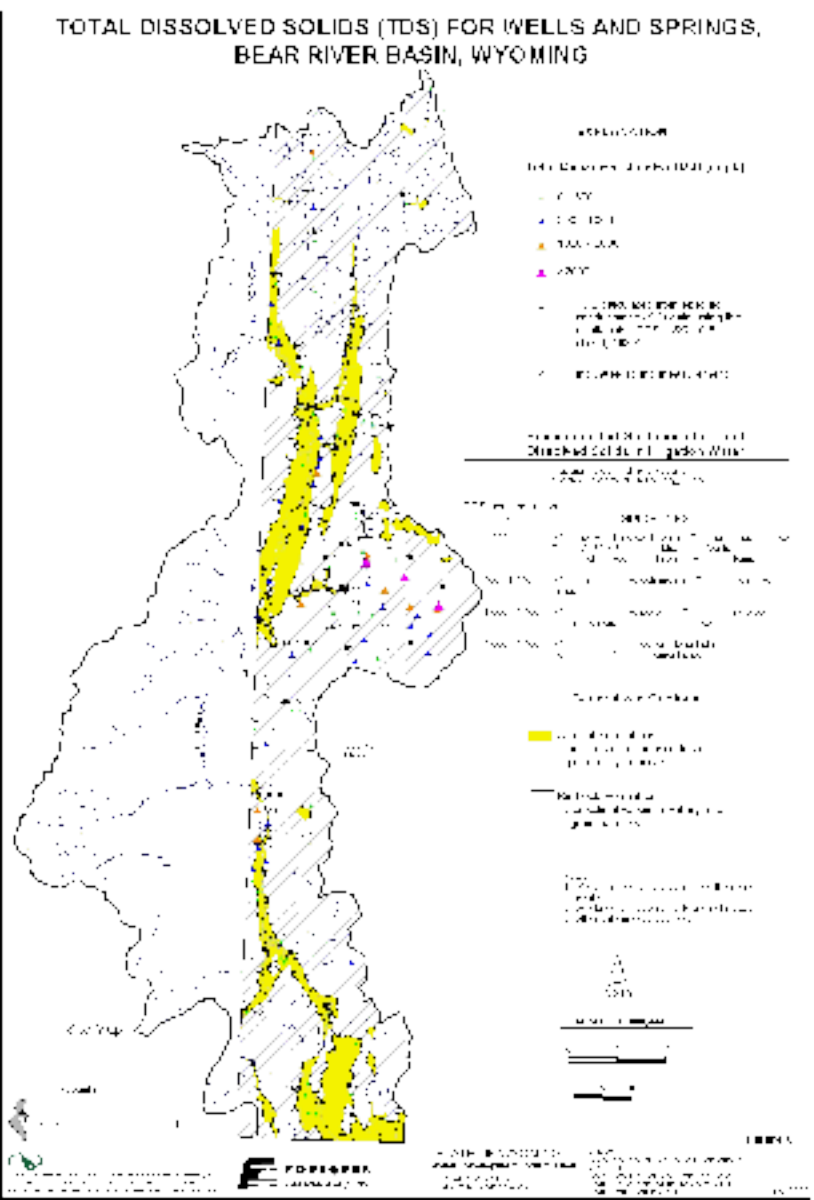
Well Aquifer Characteristics



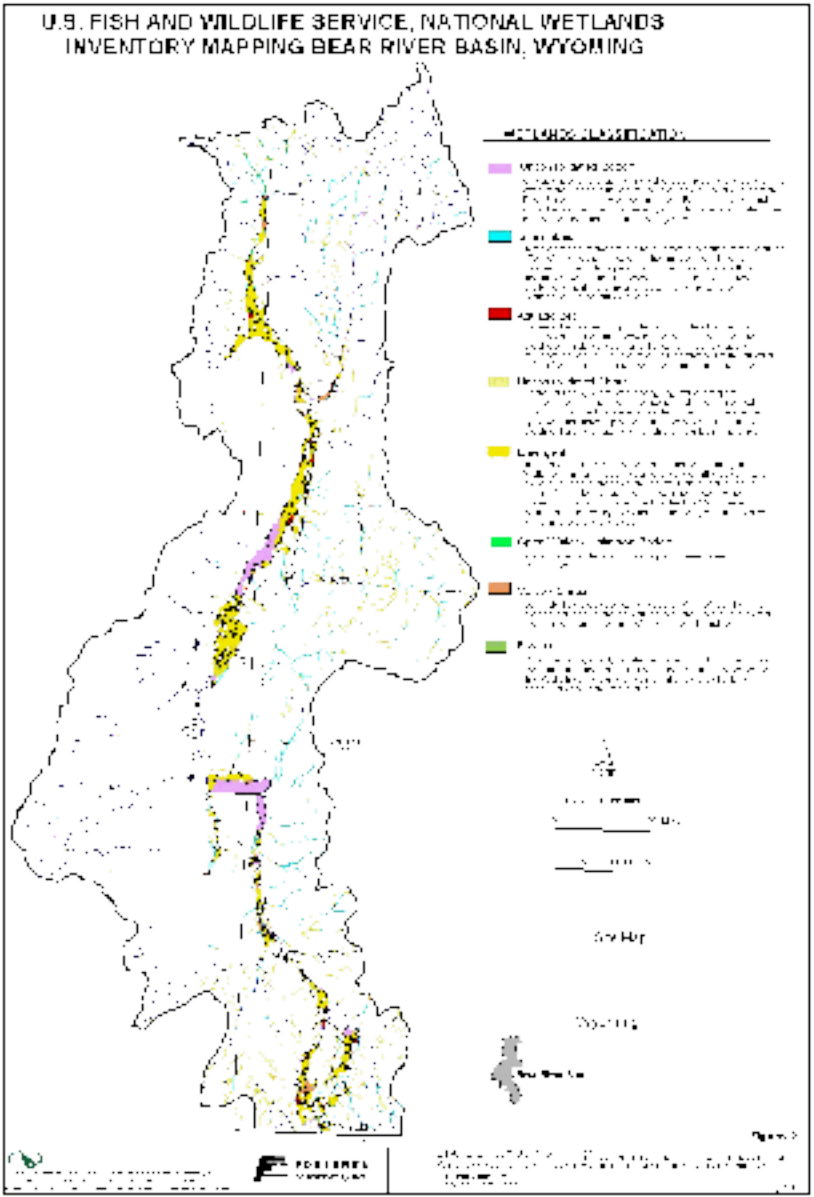
Aquifer Sensitivity to Contamination



Geologic Mapping of Basin



Total Dissolved Solids (TDS) For Wells & Springs



National Wetlands Inventory

(U.S. Fish & Wildlife)