Governor's Upper Yellowstone River Task Force
Annual Report
2002

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Cover Photo 1. Upper Yellowstone River in Paradise Valley. Photo courtesy of A. Hansen.

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5242 Highway 89 South
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Dear Governor Martz: January 2, 2003

On behalf of the Governor's Upper Yellowstone River Task Force, it is my pleasure to submit our *2002 Annual Report* for your review. 2002 has been a transitional year for the Task Force. We have moved from the behemoth data collection phase of our project—which ranged from two to four years of fieldwork for our seven research teams—to our analysis, data synthesis, and recommendation development phase in 2003.

As of December 31, 2002, all of our research data collection has been completed. Due to the immensity of our research undertaking, we have chosen to stagger study closure dates over a several month period. This has allowed studies that got started early on, to present first, and yet-to-be-completed research studies that started much later in the Task Force process, to go last. Beginning in September 2002, the Task Force started implementing a vigorous final research presentation schedule (outlined below). Given this aggressive schedule, we are confident that we will have sufficient time to formulate recommendations by August 2003. We have gotten assurances that all of these researchers will be able to satisfy this timeline.

2002/2003 Project Timeline

September 19, 2002	NRCS, Current Watershed Land Use Assessment
November 5, 2002	BBC, Socio-Economic Assessment
November 19, 2002	USGS-WRD, Hydrology/Hydraulic Analysis
December 12, 2002	DNRC, Geomorphology Study
January 7, 2003	UM, Riparian Trend Analysis
January 21, 2003	MSU, Fish Populations Study
February 11, 2003	MSU, Wildlife (Bird) Study
February 25, 2003	USGS-BRD, Fish Habitat Study
March 25, 2003	MSU, Historic Watershed Land Use Assessment
Late March – August 2003	Recommendation Development

The Task Force would like to recognize and thank the above-mentioned research teams for going to great lengths to achieve our deadlines. It has not been easy and has taken tremendous teamwork to make it happen. A large part of that teamwork must be credited to our volunteer Technical Advisory Committee. They have gone above and beyond the call of duty and have held the upper Yellowstone River research effort together since our inception. We've counted on them to give us sound scientific guidance and they have not let us down.

In addition, we would like to thank Todd O'Hair for supporting our effort and providing us with a crucial communications link to the governor's office. He has been a big help to the Task Force over the past two years and has assisted us in getting all of our studies done in a timely fashion. Other Montana State agencies have also stepped up their assistance to the project in 2002. In particular, we would like to recognize administrators and staff at the DNRC, DEQ, and MDT for their support. Their cooperation has been nothing short of extraordinary.

In closing, the Task Force is entering our final year greatly energized and with a positive outlook. The strides we have taken over the past five years—both scientifically and as a community—have surpassed most peoples' predictions. From the beginning, the Task Force has insisted on devoting the time needed to hear the research data, and we've avoided the temptation to make unsubstantiated decisions. We always said that science would lead us, and that has finally come to fruition over the past few months. The Task Force has also kept our process an open one, giving the public a voice in all aspects of the project and educating ourselves alongside them. We look forward to our final year and making recommendations by August 2003.

Best wishes,

John Bailey, Chair
Governor's Upper Yellowstone River Task Force

Governor's Upper Yellowstone River Task Force

2002 Annual Report

The *2002 Annual Report* is the fifth and final in a series of yearly reports produced by the Governor's Upper Yellowstone River Task Force (here after referred to as the Task Force). The purpose of the report is to provide Montana's Governor and the general public with information on Task Force activities and accomplishments over the past year. Additionally, because we are beginning our final eight months of work, this report will also outline our plans for 2003.

The main focus of this year's report is (1) to summarize our research investigations and the informational products being created under Task Force sponsorship, and (2) to provide our final year's schedule and projections for recommendation development in 2003. Past accomplishments of the Task Force and our overall goals are also briefly described in this report. Detailed information on previous Task Force activities may be found on our website at: upperyellowstonerivertaskforce.org, or are documented in our *1998*, *1999*, *2000,* and *2001 Annual Reports,* which are available upon request.

In order to minimize repetition and the length of this report, we have used acronyms for commonly used phrases or agency titles. To assist readers unfamiliar with these terms, we have provided a list of acronyms and their definitions in *Appendix A.*

Task Force History and Purpose

In response to a request from the citizens of Park County, Montana's former Governor Marc Racicot created the Task Force in November 1997. County residents had experienced back-to-back, near 100-year floods in 1996 and 1997, and consequently recognized the need for a more comprehensive and consolidated planning effort for the upper Yellowstone River.

Following her predecessor's lead, Montana's current Governor Judy Martz reappointed the Task Force to a third and final, two-year term on August 21, 2001 (see *Appendix B. Executive Order No. 21-01*).

As directed by the Governor's executive order, the purpose of the Task Force is "to provide a forum for the discussion of issues that effect the Upper Yellowstone River Basin, particularly, to bring together landowners, sportsmen and sportswomen, and community leaders to develop a shared understanding of the issues and competing values and uses that impact the upper Yellowstone River." Further, the Task Force is directed to (1) bring together many diverse groups, who have an interest in the upper Yellowstone River, and (2) ensure that future projects affecting the river are planned and conducted in a manner that will preserve the integrity, beauty, values, and function of the upper Yellowstone River for Montanans now and in the future.

The Task Force functions as a structured non-regulatory organization that involves citizens, communities, and governmental agencies. The overall goal of the Task Force is to develop a set of publicly-supported river corridor management recommendations that address potential adverse cumulative effects of river channel modification, floodplain development, and natural events on the human community and riparian ecosystem of the Upper Yellowstone River.

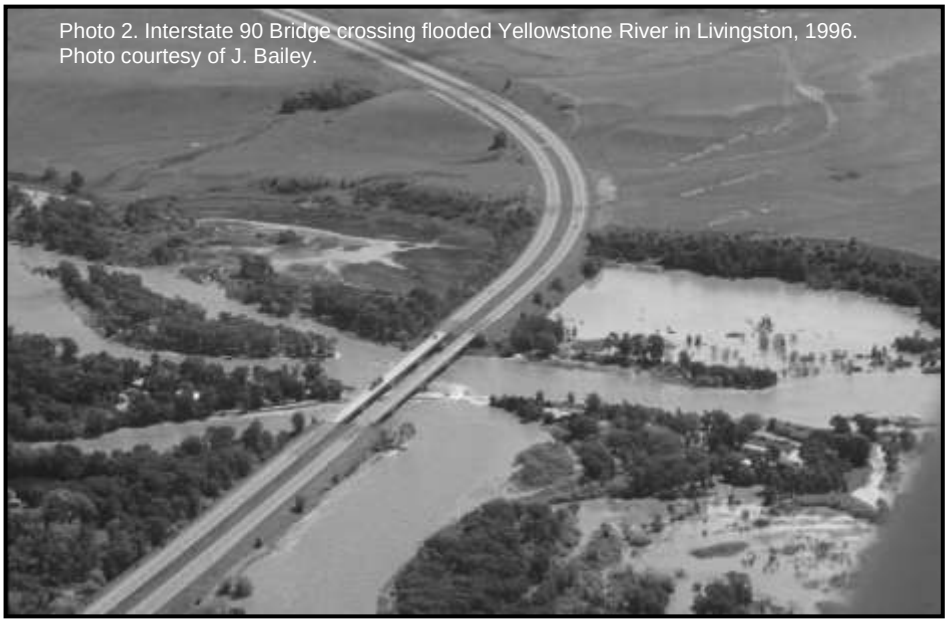


Photo 2. Interstate 90 Bridge crossing flooded Yellowstone River in Livingston, 1996. Photo courtesy of J. Bailey.

Who We Are

The Task Force is made up of a wide cross section of local area citizens, and local, state, and federal agency representatives. Individually, Task Force members represent specific constituencies within the local community; yet together, we form a balanced table of diverse groups strongly concerned about the natural and economic resources in the Upper Yellowstone River Basin.

The Task Force was developed in the spirit of partnership and collaboration, and uses a consensus-based approach to decision making. We work to raise awareness of environmental issues, and encourage members of the community to get involved in all Task Force activities and to express their views openly.

Photo 3. Task Force members. Photo by E. Galli-Noble.

The Task Force is set up with community participants functioning in a leadership role (see *Appendix C* for ground rules). Appointed by the governor, the 12 voting Task Force members represent the following interests: local businesses, property owners, ranchers, the angling community, conservation group(s), Park County, City of Livingston, and Park Conservation District. The eight non-voting Task Force members represent the following governmental agencies: Montana Department of Environmental Quality, Montana Department of Natural Resources and Conservation, Montana Department of Transportation, Montana Fish Wildlife and Parks, National Park Service (Yellowstone National Park), US Army Corps of Engineers, and US Forest Service. Agency partners provide technical knowledge and assistance, in addition to their regulatory and land management input.

From the beginning, the Task Force recognized the need to consolidate efforts in the upper Yellowstone River area, and to avoid duplication of effort. The make up of the Task Force is testament to the power of seating concerned citizens groups and governmental agencies as collaborative investigators and decision makers. Having many of the interested parties and agencies charged with regulation of river resources represented on the Task Force, has streamlined much of our research and outreach efforts thus far. In addition, and perhaps more importantly, we are not producing a study that will simply sit on a shelf. Quite the opposite is our intent. By giving regulatory agencies a voice in the process, we are helping to insure that our management recommendations have practical regulatory application.

The Community Is Our Partner

Since 1997, the Task Force has worked to accomplish our mission in a consensus-building manner, which stresses education, cooperation, broad-based community involvement, and voluntary participation. Through monthly meetings and educational activities we have strived to reach out to the community, provided an opportunity for the public to participate in the process, and provided a forum for individuals and groups to express their views openly and in the spirit of teamwork.

Information gathered by the Task Force belongs to everyone. All data—survey results, maps, and publications—will be available for the public's use and may be viewed or acquired by visiting our website at: upperyellowstonerivertaskforce.org, or by contacting the Task Force office.


Photo 4. December 12, 2002 Task Force meeting. Photo by E. Galli-Noble.

Science-Based Approach to Watershed Assessment

Over the past five years, the Task Force has set in motion an interdisciplinary study effort to assess the cumulative effects of bank stabilization, channel modification, and natural events on the physical, biological, and cultural attributes of the upper Yellowstone River. This scientific data will help us achieve our overall goal of developing a set of river corridor management recommendations. The Task Force-sponsored investigation is a collaborative and comprehensive way to provide useful information that regulatory agencies, landowners, and the interested public may use to facilitate improved management of the river and flood plain.

Photo 5. Fish Populations Study team collecting depth and velocity data. Photo courtesy of MSU.

Currently, the Task Force is completing the research phase of the project. Our project time line and associated research strategy called for collection and analysis of baseline biophysical and socio-economic information in the Upper Yellowstone River Study Area from 1999 through 2002. Each study has required one to three years of baseline data collection and analysis. The timing of that fieldwork has been driven by weather, flow conditions, and funding availability. All data collection has been completed as of December 31, 2002. Informational presentations—that is, presentations of research findings and analyses to the Task Force and public—are being conducted from September 2002 through March 2003 (see *Table 1*, page 6 for 2003 details).

Once individual research findings have been presented, the data synthesis phase of the project takes center stage. Data synthesis is necessary to link information from the independent research components into an integrated analysis of the cumulative effects of bank stabilization. The development of multiple-variable models for data synthesis began in late 2001, and has intensified in 2002.

The final project phase will be the development of management recommendations based on an integrated understanding of the upper Yellowstone River. This phase will be conducted in 2003. Education and application of the science become paramount at this point.

Timely and intelligible dissemination of relevant information to the Task Force and public is an important aspect of the development of river management recommendations.

The goal of the Task Force is to make river management recommendations to Governor Martz by August 21, 2003. We will also present these recommendations to other entities such as, conservation districts, the Corps, DNRC, and DEQ. It is our intent that such recommendations will guide the decision-making process. With defensible science as the foundation for recommendations, and with ongoing input and review from the local community and regulatory agency partners, these recommendations will have practical application in the Upper Yellowstone River Basin.

"Rivers shape our lives, the forms of our recreation, our industries, and the character and location of our major cities. They give life to us and they take our wastes. Thus, their conditions reflect what we think about ourselves and the land."

Hal Salwasser and Rita Cantu

Table 1. Governor's Upper Yellowstone River Task Force 2003 Timeline.

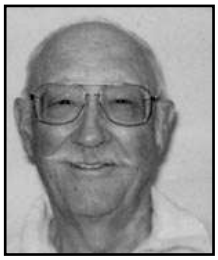
2003											
Jan	**Feb**	**March**	**April**	**May**	**June**	**July**	**August**	**Sept**	**Oct**	**Nov**	**Dec**
RESEARCH FINDINGS & PRESENTATIONS PERIOD			**PUBLIC OUTREACH/EDUCATON & RECOMMENDATION DEVELOPMENT PERIOD**					**POST-TASK FORCE PERIOD**			
1/07/03 U of M, Riparian Trend Analysis Presentation	2/11/03 MSU, Wildlife (Bird) Presentation	3/25/03 MSU, Historic Land Use Presentation	Recommendation Development					Task Force coordinator finalizes reports; data transfer to Park CD			
1/21/03 MSU, Fish Population Presentation	2/25/03 USGS-BRD, Fish Habitat Presentation	3/31/03 U of M, Riparian Trend Analysis Final Report DUE	4/03 2nd, DNRC Geomorphology Presentation	Educational Workshops, Conference (?)			**8/21/03 Recommendations to Governor DUE**	Corps Actions: SAMP Cooperative Agreement Group Actions			
1/31/03 USGS, Hydrology (Draft) Final Report DUE	2/28/03 BBC, Socio-Economic Final Report DUE	3/31/03 MSU, Wildlife Final Report DUE	4/15/03 MSU, Historic Land Use Final Report DUE	Round Table/Panel Discussion (?)			**8/21/03 Task Force Terminates**	State Agencies Actions			
	2/28/03 MSU, Fish Population Final Report DUE	3/31/03 USGS-BRD, Fish Habitat Final Report DUE	4/15/03 DNRC, Geomorphology (Draft) Final Report DUE					Monitoring Plan Adaptive Management Activities			

Task Force Voting Member Profiles

John Bailey, Chair, Fly Fishing Business Owner
John has been chair of the Task Force for five years. He is the owner of the internationally renowned Dan Bailey's Fly Shop in downtown Livingston. Born and raised in Paradise Valley, John has been fishing the upper Yellowstone River for more than 40 years. His home is located on a lagoon along the Yellowstone River.

Dave Haug, Vice Chair, Park Conservation District Supervisor
The Haug family has been farming and ranching in Park and Sweetgrass Counties for three generations, since the turn of the century. As a Supervisor for the Park Conservation District, Dave's Board issues 310 permits on the Yellowstone River. He is also a board member of the Livingston Ditch Association, which uses water from the Yellowstone. Currently, his family farms and manages timber on their property in the Upper Yellowstone River Study Area.

Roy Aserlind, Emeritus Professor, University of Wisconsin-Madison
Roy grew up in Livingston and has owned a home on Ninth Street Island for 30 years, where he and his wife, Margot, now live the year around. Roy's concerns for the Yellowstone are all first hand, going back to the 1940s and1950s when there was concerted effort to build the Allenspur Dam. There were also problems created by gold dredging near Chico Hot Springs resulting in a constantly muddied river, and a spruce budworm spraying episode that resulted in a massive poisoning of the river's aquatic insect life. Roy feels that he understands and appreciates the health and fragility of riverine structures.



Andrew Dana, local property owner along the Yellowstone River
Andrew Dana's family owns a working ranch on the Yellowstone River. He is an attorney who specializes in protection of agricultural, open-space, and natural lands and represents local, regional, and national land conservation organizations, as well as landowners. He consults nationally on land conservation issues and currently serves on the Advisory Council of the Yellowstone Park Foundation.

Doug Ensign, local property owner along the Yellowstone River
Doug and his wife, Zena, own and operate the Mission Ranch, a cattle ranch that has been in the family for two generations. The Yellowstone River flanks the ranch on its northern end for a stretch of two miles. The ranch contains extensive Yellowstone River bottom lands and several spring creeks.

Michelle Goodwine, CRS, ABR, GSI; past president of the Montana Association of REALTORS®. Michelle has worked as a REALTOR® for 15 years and owns Coldwell Banker Maverick Realty. Michelle is a Livingston native and she lives north of town on the Yellowstone River.

Jerry O'Hair, local property owner along the Yellowstone River
O'Hair family members are fourth generation Paradise Valley residents. Jerry owns and operates a working cattle ranch that adjoins the upper Yellowstone River for approximately three miles. The internationally famous Armstrong Spring Creek is also located on his ranch.

Brant Oswald, Conservation Group(s) Representative
Brant is a licensed Montana outfitter and co-manager of the Yellowstone Angler, a fly fishing shop in Livingston. He has served on the Board of Directors of both the Joe Brooks Chapter (Livingston) of Trout Unlimited and the Park County Environmental Council.

Rod Siring, local property owner along the Yellowstone River
Rod was born and raised in Montana, and he and his wife have spent the last 34 years in Park County. Rod is a retired Park Electric Cooperative manager, where he worked for 30 years. He enjoys fishing and boating on the Yellowstone.

Bob Wiltshire, Angling Community Representative
For more than 20 years, Bob has been closely involved with the fishery of the Yellowstone River. Employed by the Federation of Fly Fishers, Bob has 15 years of outfitting experience, a background in fishery management, is a frequent lecturer about fisheries issues, and contributes angling articles to a number of publications.

Ellen Woodbury, Park County Planner
Ellen has been the Park County Planning Director and Floodplain Administrator since 1992. She was nominated by the Park County Commissioners to represent the County on the Task Force. Ellen graduated from Montana State University and attended graduate school at Western Illinois University in Macomb, Illinois.

Jim Woodhull, City of Livingston Planner
Born and raised in Livingston, Jim has been with the Livingston City Planning Office since graduating from Montana State University, Bozeman in 1992.

Former Task Force Members

Mike Atwood, former Vice Chair, Natural Resource Industry Representative
Mike Atwood has worked with natural resource and land management issues for more than 20 years with emphasis in forestry, large forestland acquisitions, and management. Mike and wife, Toni, own property and a vacation home along the Yellowstone River south of the Emigrant bridge.

Tom Lane, former member, local property owner along the Yellowstone River
Long time residents of the Livingston area, the Lane family owns and operates cattle ranches throughout the state of Montana. Tom's family business includes a large operation and land holding along the upper Yellowstone River.

Task Force
Non-Voting Member Profiles

Ken Britton, District Ranger
USFS, Gallatin National Forest
Gardiner Ranger District
Gardiner Montana

Liz Galli-Noble, Task Force Coordinator
Livingston Montana

Tom Olliff, Chief, Branch of Natural Resources
NPS, Yellowstone National Park
Mammoth Wyoming

Tom Osen, Acting District Ranger
Terri Marceron, former District Ranger
USFS, Gallatin National Forest
Livingston Ranger District,
Livingston Montana

Robert Ray, Watershed Management
Section Supervisor
Montana DEQ
Planning, Prevention, and Assistance Division
Helena Montana

Laurence Siroky, Water Operations
Bureau Chief
Montana DNRC
Floodplain Program, Water Resources Division
Helena Montana

Photo 6. Task Force members. Photo by E. Galli-Noble

Allan Steinle, Montana State Program Manager
US Army Corps of Engineers,
Regulatory Branch
Helena Montana

Stan Sternberg, Environmental Program Manager
Environmental Services
Montana Department of Transportation
Helena Montana

Joel Tohtz, Fisheries Biologist
Montana FWP
Livingston Montana

Photo 7. December 12, 2002 Task Force meeting. Photo by E. Galli-Noble

Technical Advisory Committee

The Task Force appointed a Technical Advisory Committee (hereafter referred to as the TAC) in 1998. The TAC's role is (1) to assist the Task Force by offering scientific guidance, (2) to develop an integrated research program, and (3) to evaluate research proposals and results. The TAC is also taking the lead in data synthesis and interpretation of information for the Task Force.

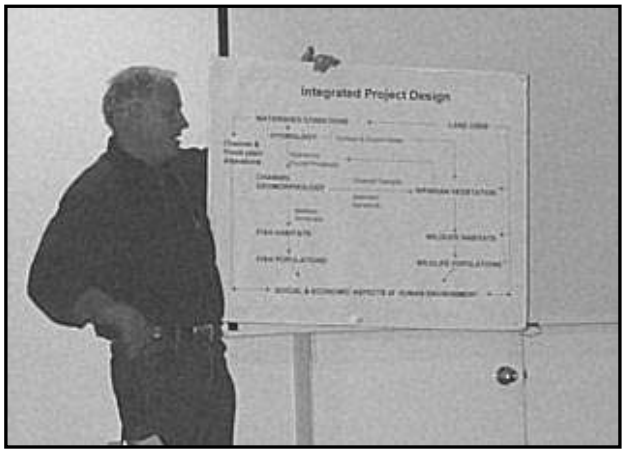


Photo 8. Dr. Duncan Patten, TAC chair. Photo by E. Galli-Noble.

The TAC is designed to provide guidance and advice to the Task Force, when requested, based on the results of the scientific investigations. The TAC is given both broad direction and specific missions by the Task Force, and has the flexibility to determine how best to accomplish its job. The TAC has no authority to make policy decisions or recommendations on behalf of the Task Force; rather, its role is to work as directed by the Task Force to ensure that (1) the right questions are asked, (2) the best approach and methods are used to answer questions, (3) the data collected are objective, defensible, and trustworthy, and (4) the answers provided are understandable and relevant.

As the Upper Yellowstone River Cumulative Effects Investigation has expanded over the past several years, so too has the TAC. Five individuals were officially appointed by the Task Force and form the nucleus of the committee. At present, and reflecting the expansion of the overall project, the TAC has grown to include agency liaisons and research team principal investigators (see *Table 2* for list of TAC members). Thus, the TAC has fostered communication and data sharing amongst the independent research efforts, and has insured that data synthesis is possible in the final phase of this cumulative effects project.

Photo 9. Fish Populations Study team educating the public. Photo by E. Galli-Noble.

Coordination and consistency between study components—particularly with respect to stratification and selection of sampling and detailed mapping sites—has been achieved through TAC oversight. In 2002, the full TAC formally met on two occasions, and informally met on dozens of occasions. Meetings focused on: project management, coordinating research study timelines, product delivery, data synthesis and modeling, and enhancing communications amongst on-going investigations: geomorphology, riparian vegetation, hydrology/hydraulics, fish populations, fish habitat, wildlife (bird), land use, and socio-economic.

In addition to study management, members of the TAC play other vital roles on the project. TAC members have provided the Task Force with a readily available scientific sounding board. TAC members have attended all eleven Task Force meetings in 2002, giving study updates and answering research-related questions.

Photo 10. Geomorphology Study team presenting to the Task Force. Photo by E. Galli-Noble.

In addition, TAC members joined experts from across the nation in a cumulative effects workshop for large river systems in the United States—focusing on the Yellowstone River. Hosted by MSU and the Big Sky Institute for Science and Natural History, the workshop was held at Chico Hot Springs on April 29 and 30, 2002.

Several members of the TAC also participated in the Montana Chapter of the American Water Resources Association annual conference. The conference, entitled *Future of the Yellowstone River,* was held in Livingston in early October 2002.

Finally, the TAC chair and four research team leaders have formally presented research findings to the Task Force from September through December 2002. The remaining five research teams will present in early 2003 (see *Table 1*, page 6 for details).

Photo 11. Geomorphology Study team collecting data atop the weeping wall, September 2001. Photo courtesy of DNRC.

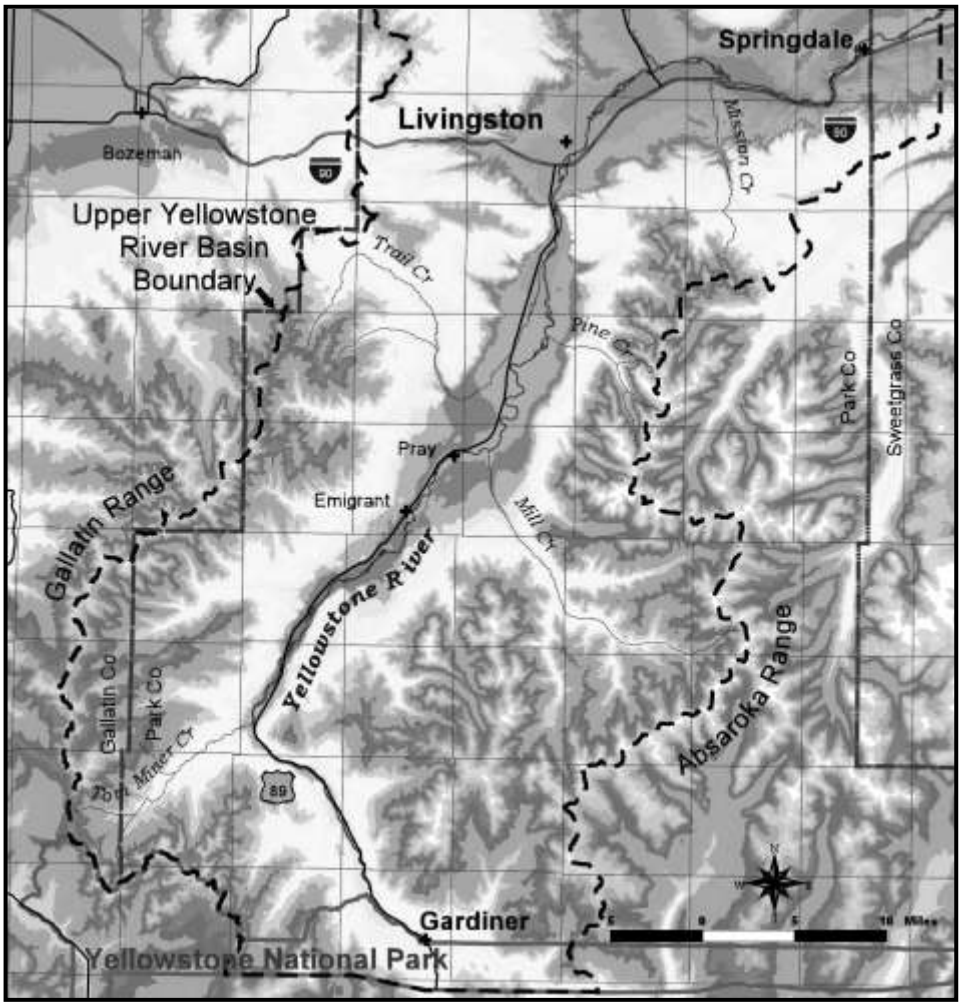
Table 2. 2002 Technical Advisory Committee Members and Researcher Team Leaders

Name	Profession / Title	Agency / Affiliation
***Dr. Duncan Patten, Chair**	**Riparian Ecologist**	**Montana State University**
**Dr. Zack Bowen	Fish Habitat Research Team Leader	USGS-BRD
*Tim Bryggman	Economist	Montana DNRC
***Chuck Dalby	Geomorphology Research Team Leader	Montana DNRC
Liz Galli-Noble	Coordinator, Liaison	Task Force
Mike Gilbert	Environmental Resources Specialist	US Army Corps of Engineers
*Tom Hallin	Professional Surveyor	Private Survey Business
**Dr. Andy Hansen	Wildlife Research Team Leader	Montana State University
Rob Hazlewood	Wildlife Biologist	USFWS
**Steve Holnbeck	Hydraulic Analysis Research Team Leader	USGS-Helena
**Dr. Mike Merigliano	Riparian Trend Analysis Team Leader	University of Montana
**Chuck Parrett	Hydraulic Analysis Research Team Leader	USGS-Helena
**Tom Pick	Watershed Land Use Assessment Team Leader	NRCS
*Jim Robinson	Geomorphology Research Team Leader	Montana DNRC
**Dr. Jay Rotella	Wildlife Research Team Leader	Montana State University
*Brad Shepard	Fisheries Biologist	American Fisheries Society
Allan Steinle	Environmental Resources Specialist	US Army Corps of Engineers
**Dr. Al Zale	Fish Populations Research Team Leader	Montana State University

* = TAC member officially appointed by the Task Force.
** = Research team leader.

Upper Yellowstone River Study Area

The Upper Yellowstone River Study Area was defined for the Task Force in the Governor's Executive Order No. 19-97 as "that reach of river (including its tributaries), beginning at the Yellowstone Park boundary and extending downstream to the bridge crossing at Springdale," Montana. Flanked by the Crazy and Bridger Mountain Ranges to the north, the Absaroka Range to the east, the Gallatin Range to the west, and Yellowstone National Park to the south, approximately 85 miles of the Yellowstone River flows within this 2,930 square-mile basin (see *Map 1* below).



Map 1. Upper Yellowstone River Study Area

The Upper Yellowstone River Basin represents a significant and valuable natural and economic resource for local area residents, citizens of Montana, and our nation as a whole. This unique ecosystem houses the Yellowstone River (the longest free flowing river in the lower 48 states), Yellowstone National Park, the Absaroka-Beartooth Wilderness Area, large populations of diverse wildlife, and viable and varied fish populations. It is home to more than 15,000 Montana residents and is visited by more than one million tourists each year.

The upper Yellowstone River, and its continued health, is essential to the local and regional economy. Park County, which makes up 2,667 square miles of this watershed, is largely supported by industries that rely heavily on the continued long-term health and well being of the Yellowstone River. Ranchers and farmers depend on the river to provide the elements necessary to sustain successful agricultural operations. They, in turn, provide the open space, wildlife and fish habitat, and scenic views that are enjoyed by the many other residents and visitors to the area.

Located in south central Montana, the upper Yellowstone River meanders through the heart of Park County. Park County is Montana's 12th most populous county. The city of Livingston is the county seat and the state's 11th largest city with approximately 8,500 residents. Most of Livingston's residents are directly affected by changes in the Yellowstone River, as it literally dissects the city from south to north. Channel modification has occurred with varying intensity throughout the study area. Relatively little channel modification has occurred between Gardiner and Mill Creek. A moderate amount of channel alteration has occurred between Mill Creek and Carters Bridge, and from Mission Creek to Springdale. The most intensive activity has occurred in the reach from Carters Bridge to Mission Creek.

"Problems cannot be solved at the same level of awareness that created them."

Albert Einstein

Addressing TMDL

Like many other river systems throughout Montana, the Montana DEQ has scheduled TMDL development for the Upper Yellowstone River and several tributaries in 2005.

The Task Force has worked closely with the DEQ for several years to ensure that much of the data collected by Task Force researchers will also provide the baseline data needed for TMDL plan development.

Upper Yellowstone River Cumulative Effects Investigation

Project Background

The Task Force was established in November 1997 and directed to bring together disparate community groups to discuss and develop a shared understanding of the issues and competing values and uses that impact the upper Yellowstone River. The Task Force envisioned a study that would focus mainly on the river channel. Over time, however, other state and federal actions have necessitated a broader project scope. The catalyst for that change centers around two actions: (1) a Special Area Management Plan in 1998, and (2) a law suit over the cumulative impact portions of the 404 Corps permit decision documents on the Yellowstone River in 2000.

The current river corridor study approach being conducted by the Task Force reflects a collaborative effort to address regulatory requirements where possible. A corridor and floodplain approach has been maintained as the primary geographic study area for the project. However, given that cumulative impact analysis requires a broader, watershed-level project area, watershed-scale data have been included in the overall study design.

Special Area Management Plan (SAMP)

The Corps' involvement on the project began in 1997 with their participation as an Ex-Officio member of the Task Force. Their role then expanded in 1998 with a Congressional authorization for the Corps to assess the effects of bank stabilization on the upper Yellowstone River by developing a SAMP *(*see *Appendix D* for details). Although somewhat rare, a Corps institutional response to the increase in permit activity is to initiate the development of a SAMP. In the case of the upper Yellowstone that increase in permits was a direct response to the 1996 and 1997 flood events.

1999 Energy and Water Development Appropriations
Senate Report #105-206

The [Senate] Committee recommendation includes $320,000 for the Corps to initiate and complete the Yellowstone River special area management plan, Gardiner to Springdale, Montana, study which will assess the long-term effects of streambank stabilization. Information provided by the study should help in making timely decisions based on a watershed approach, and possibly result in a general permit for the area. The Committee expects that this effort will be coordinated with the Yellowstone river task force.

A SAMP is a regulatory planning tool and process that allows the Corps to assess all permitting issues in a river corridor or watershed context, as opposed to evaluating permits individually on a case-by-case basis. Specific language within the appropriations bill (see box above) states that as part of the SAMP, the Corps would assess the long-term effects of bank stabilization, fully coordinate with the Task Force, apply a watershed-level approach to the management decision-making process, and potentially conclude the process with a general permit. General permits are the Corps' regulatory management tools for dealing with environmental cumulative impacts. These permits are designed to be updated every five years, thereby serving as monitoring and feedback tools. A determination of the Corps' final agency action will be based upon the

results of the technical studies, synthesis of these data, and full public involvement throughout any decision process.

In the upper Yellowstone, the SAMP is complimented by the Task Force cumulative effects assessment. The SAMP will provide biophysical, social, and economic baseline data, satisfying federal management plan needs. It will include a scope of analysis, cumulative impacts, evaluation of alternatives for river corridor planning, and development of a consensus-based river management strategy.

By using the SAMP as a proactive planning tool, the potential for future lawsuits will likely diminish. The SAMP goals and objectives are consistent with the Task Force charter under the Governor's executive order to develop a forum for comprehensive planning. The Task Force will play a lead role in developing recommendations for future river corridor management recommendations, which the SAMP must ultimately embody. All recommendations or determinations will be based upon the technical studies and cumulative effects analysis in consultation with the Task Force. In this manner, procedural and substantive compliance with environmental regulations can be achieved.

Montana Council of Trout Unlimited et al (plaintiffs) v. US Army Corps of Engineers (defendant)

The second action concerning the Corps was a 404-Permit lawsuit on the Yellowstone River. The United States District Court (Billings Division) in a May 2000 decision granted the plaintiffs motion for summary judgment and directed the Corps to re-open the 14 permits challenged (seven of those permits within the upper Yellowstone River study area). The court directed the Corps to reevaluate the cumulative impact portions of permit decision documents and determine whether or not an environmental impact statement needs to be completed for each project. The Corps is currently reevaluating the permits to comply with the court order. They have completed 11 of the 14 challenged permits, and are making progress on the three remaining permits.

This court decision clearly illustrates the need for better baseline river data and the difficultly of addressing cumulative impact analysis on the Yellowstone. The culmination of the Task Force and SAMP efforts is satisfying both state and national needs.

Project Overview

The Task Force Cumulative Effects Investigation is the pilot project for the Yellowstone River. It is not an investigation that will help solve just one management or pollution problem; rather, it will provide information upon which many management decisions may be based. Baseline data on the seven major components of this river system (described below) will provide information to a wide array of river users and managers for years to come. This investigation has become a "bench mark" study and protocol for our neighbors down river and hopefully for many other western river studies.

The overall goal of the Task Force is to develop a set of publicly-supported river corridor management recommendations that address potential adverse cumulative effects of river channel modification, floodplain development, and natural events on the human community and riparian ecosystem. Development of management recommendations will involve identification and evaluation of the river's natural and economic resources, in these phases:

1. Data collection, analysis, and mapping.
2. Education and presentation of research findings.
3. Data synthesis.
4. Development and selection of management recommendations.

Guiding principles that stay consistent through all these phases are:

1. Science Led Effort
Provide complete and comprehensive scientific data, which will allow for better understanding of the issues, resources, and uses that affect the integrity of the Upper Yellowstone River Watershed.

2. Investigate Issues Specific to Upper Yellowstone River Corridor and Watershed
Help explain how and why key elements of the watershed and river corridor (natural and human-induced) have changed over time.

3. Develop Recommendations that have Practical Application
Provide the Task Force and regulatory agencies with the information and analytical techniques necessary to evaluate river channel and floodplain problems, and proposed solutions.

Integrated Project Design

In 1998, the Task Force TAC developed an interdisciplinary study design (see *Figure 1*) to assess the cumulative effects of bank stabilization, natural, and other channel modification on the physical, biological, and cultural attributes of the upper Yellowstone River.

The investigation consists of seven interrelated research components:

1. Watershed Conditions and Land Use
2. Geomorphology
3. Hydrology and Hydraulics
4. Riparian Vegetation
5. Fish Habitat and Populations
6. Wildlife Habitat and Populations
7. Socio-Economic

These seven biophysical and social components form a cascade in which the attributes of each successive (or parallel) component are affected by processes and interactions within or between previous components. This hierarchical relationship is illustrated in the integrated project design (*Figure 1*).

Realistic physically and biologically based scenarios are being developed for analysis with TAC and Task Force oversight. These scenarios will provide the basis for analyzing the cumulative effects of different types and levels of bank stabilization and floodplain modification on the physical and biological environment. In this manner, scientifically sound predictions of how the river and its resources will likely change in response to a particular channel modification or series of modifications will be developed. Analyses will then be used as a basis to develop river corridor management recommendations.

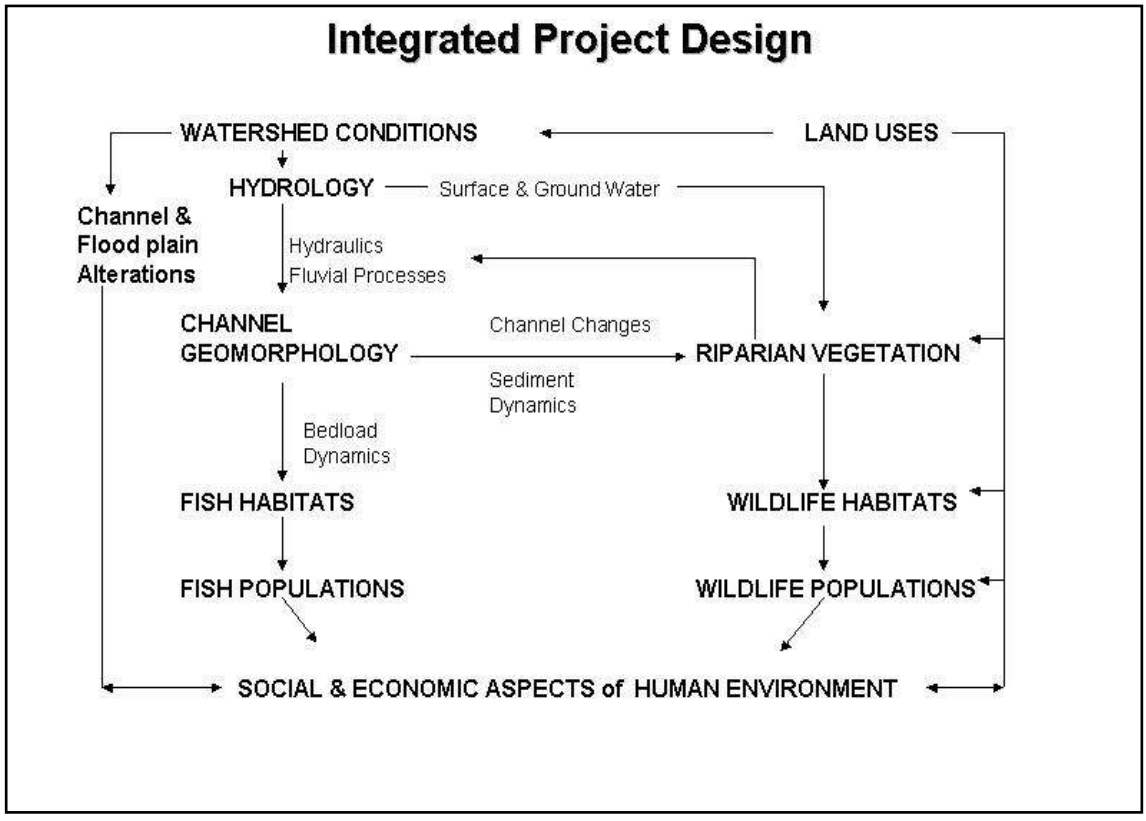


Figure 1. Integrated Project Design for the Upper Yellowstone River Cumulative Effects Investigation
This conceptual model, developed by the Task Force Technical Advisory Committee, shows the links amongst the seven interrelated components in the upper Yellowstone River investigation.

Research Component Status Report
2002

Seven Research Components of the Cumulative Effectives Investigation:

1. **WATERSHED CONDITIONS AND LAND USE**
   - **A. Yellowstone River Physical Features Inventory**
   - **B. Aerial Photography**
   - **C. National Wetland Inventory—Riparian/Wetlands/Land Use Mapping**
   - **D. Current Watershed Land Use Assessment**
   - **E. Historic Watershed Land Use Assessment**
   - **F. Contour/Topographic Mapping**
2. **GEOMORPHIC ANALYSIS**
3. **HYDROLOGY AND HYDRAULIC ANALYSIS**
4. **RIPARIAN TREND ANALYSIS**
5. **FISHERIES ANALYSES**
   - **A. Fish Populations Study**
   - **B. Fish Habitat Study**
6. **WILDLIFE (BIRD) ASSESSMENT**
7. **SOCIO-ECONOMIC ASSESSMENT**

1. WATERSHED CONDITIONS AND LAND USE

1A. Yellowstone River Physical Features Inventory

Title: Yellowstone River Physical Features Inventory–Gardiner to Springdale

Principal Investigator: Thomas Pick (Water Quality Specialist)
NRCS, Bozeman Montana

Other Participants: Task Force members, FWP, USFS, DNRC, MDT, Corps, local area outfitters, and consulting firms.

Goal: Compare the degree of change in specific physical features within the upper Yellowstone River corridor from past (1987) to current (1998) conditions. The physical features inventory was conducted as a first step in understanding cause and effect relationships in the Upper Yellowstone River Study Area. The results of this inventory have served as a prioritization tool to guide further data acquisition and analysis efforts by the Task Force.

Completion Date: 1998.

Product: Hard copy or electronic published document *Yellowstone River Physical Features Inventory Gardiner to Springdale*.

Access to Data: The physical features inventory may be viewed in an interactive application by visiting the Natural Resources Information System web site: http://nris.state.mt.us/webap/document/user.html.

1B. Aerial Photography


Photo 12. 1999 photo of Ninth Street Island and Interstate 90.

On April 11, 1999, low-flow (1,500 cubic feet per second) aerial photos of the upper Yellowstone River corridor were flown for the Task Force. The river corridor was flown at three scales: 1:6000, 1:8000, and 1:24000. Stretches of the river with greater channel complexity and/or more development in the flood plain were flown closer to the ground (1:6000- and 1:8000-scale), in order to show greater detail. These photos are the basis for two mapping projects: orthophoto quad maps and contour/topographic maps, which are described in detail in the *Topographic Mapping* section of this report.

Completion Date: Fall 1999.

Product: 1:6000, 1:8000, and 1:24000 aerial photos.

Access to Data: Copies of aerial photos can be purchased through the Task Force office.

1C. National Wetlands Inventory—Riparian/Wetlands/Land Use Mapping

Title: Riparian, Wetlands, and Land Use Mapping for the Yellowstone River Corridor: Gardiner to Springdale, Montana

Principal Investigator: Chuck Elliott (Regional Coordinator)
US Fish and Wildlife Service, National Wetlands Inventory, Denver Colorado

Other Participants: Mike Gilbert, US Army Corps of Engineers
Omaha District, Omaha Nebraska

Goal: Document land use and land cover within the Upper Yellowstone River Study Area corridor.

Objectives:

1. Document current baseline conditions.
2. Assist in impact assessment and alternatives analyses for Task Force and interagency needs.
3. Serve as supporting data for other environmental investigations.
4. Provide a basis for future monitoring as needed.

Progress: Digital maps of riparian, wetland, and land use themes were completed for the study corridor. Mapping was based on photo-interpretation of August 1999, 1:24000 color infrared aerial photography. Draft photo-interpretation was completed in winter 1999/2000. Ground truthing of this information and quality control were conducted by the USFWS National Wetlands Inventory team in conjunction with interagency personnel from May 7 to 10, 2000. Final photo-interpretation was completed on October 20, 2000. The corridor consists of portions of 14 USGS 7.5 minute quadrangles covering the Yellowstone River Valley from the northern boundary of Yellowstone National Park to the Springdale bridge. The lateral boundary begins for both sides of the Yellowstone River at the 5,400-foot contour and ends at the 4,300-foot contour. Funding was provided by the USFWS and Corps, Omaha District.

Completion Date: June 2001.

Product: 1:24000-scale riparian, wetlands, land cover data themes. Final report dated July 2001.

Access to Data: This data is available for downloading via the NWI Center in St. Petersburg, Florida at: www.nwi.fws.gov.

1D. Current Watershed Land Use Assessment

Title: Upper Yellowstone River Watershed Land Use Assessment

Principal Investigators: Thomas Pick (Water Quality Specialist)
Doug Harrison (State Resource Inventory Specialist)
Tom Potter (GIS Specialist)
NRCS, State Office Staff, Bozeman Montana

Dr. Richard Aspinall (Director)
Geographic Information and Analysis Center, Montana State University, Bozeman Montana

Goal: Depict the extent and spatial relationships of present (1999) and past (1970s) land cover/use in the Upper Yellowstone River Study Area.

Objectives:

1. Analyze and evaluate the relationships between four aspects of watershed integrity (hydrologic function, water quality, soil characterization, and upland wildlife habitat) and land cover/use change, as appropriate.
2. Provide resource management evaluations as appropriate related to land cover/use change and watershed function.
3. Serve as a supporting data layer for incorporation with other environmental studies.

Analysis Study Methods: Aerial photos and satellite imagery will be processed to characterize land cover/use classifications. The assessment will take place at two concurrent levels of study. The greater watershed area (Upper Yellowstone HUC 10070002 excluding the Boulder River and Shields River drainages and including the Yellowstone Headwaters HUC 10070001) will be characterized at a 1:100000-scale. Land cover/use within the valley floor area will be characterized at a scale of 1:24000. Additional data layers (soil, digital elevation) will be utilized as available.

Image analysis software will be used to perform an unsupervised classification of satellite data sets with limited field verification. Data cluster sets developed through this process will undergo a ground truth process to recognize the signature of selected land cover/use categories [NRCS Natural Resources Inventory (NRI)]. Final classification (present time) may require filters, stratification and/or additional ground truth verification for accuracy.

Analysis, Evaluation, and Results:
Land cover/use characterization of the watershed complete. Processing subwatershed characterization and sensitivity analyses.

Progress:
1999 Land Cover/Use Report completed December 2001. Park County Soil Survey Digital Data compiled October 2002. GIS analyses and data compilation complete. Draft Final Report editing and review in progress.

Future Work:
None proposed. Participation in data integration for cumulative effects study.

Completion Date: Presentation of preliminary findings to Task Force on September 19, 2002. Anticipated project completion date is February 28, 2003.

Products:

1. *A Satellite-Based Land cover Map for the Upper Yellowstone River Watershed, Montana and Wyoming, 2001*. Natural Resources Conservation Service, Bozeman, Montana.
2. Upper Yellowstone Watershed Land Cover/Use Assessment Report, 2003. Natural Resources Conservation Service, Bozeman, Montana.

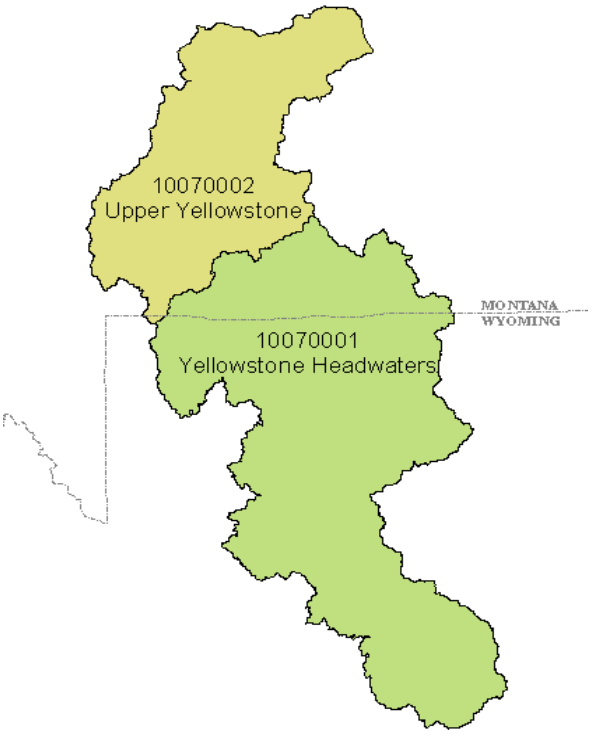
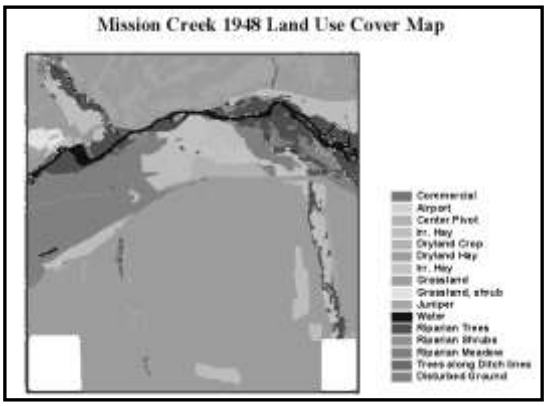


Figure 2. Upper Yellowstone River Watershed by 4th code (8-digit) hydrologic units.

Figure 3. Agricultural Lands, Irrigated.
Total area: 37,832 acres, percent of watershed area: 1.53
The cover type consists of irrigated agricultural lands used primarily for crop or hay production. Principle crops include winter wheat, barley, grass hay, and alfalfa hay. Areas of irrigated pasture are also included.

1E. Historic Watershed Land Use Assessment

Title: Historic Watershed Land Use Assessment



Principal Investigators: Dr. Andrew Hansen
Monica Brelsford
Dr. Bruce Maxwell
Montana State University
Bozeman, Montana

Goal: Map change in land cover and land use in sample portions of private and public lands in the Upper Yellowstone River Basin for the dates: 1948/49, 1979, 1998.

Objectives:

1. To map land use/cover for three historic years, 1948/49, 1979, 1998 in four sample areas along the upper Yellowstone River.
2. To characterize historical land use change by identifying areas where change have occurred, and the types of change that have occurred, and their relationship to geographical features (such as, distance to river, roads, or national forest).
3. To map house locations for the three historical years in the four sample areas.
4. To characterize house locations in relation to land use change and geographical features.

Analysis Study Methods:

1. Obtain aerial photos and georeference 30 photos within the four study areas. Obtain1948/49 photo mosaic from contractor, and georeference pieces to reduce the error in important areas within three of the four study areas.
2. Categorize historic land use types across four study areas and three time periods using ArcView to create polygons around each land use type. Compare polygons for each year within each study area by creating union tables in ArcView, these tables allow us to identify areas of change and identify types of change. Using the summary tables we will summarize data across years, and within study areas, as well as summarize types of land use change.
3. Using area photographs we locate home sites within each year and for each study area. Number of homes and their location in relation to land use type will be summarized across all study areas and across years.
4. House density information obtained from aerial photographs will be validated using standard regression analysis on well and septic data, or county assessor data.

Analysis, Evaluation, and Results:

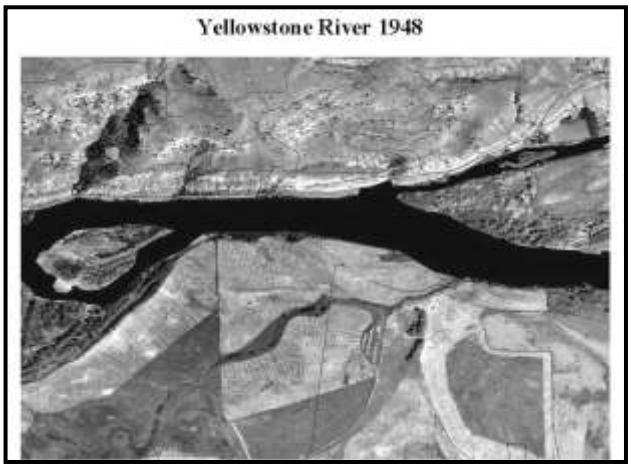
Analysis and results are in the early stages, and cannot be provided at this time.

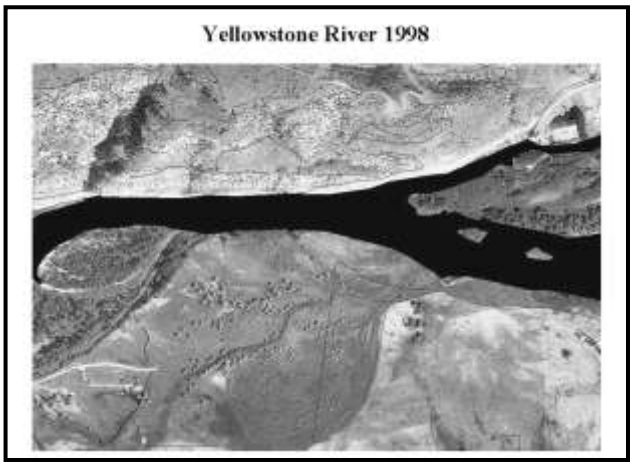
Progress:

1. Home locations have been mapped and validated for the 1948/49 and 1998 aerial photographs, and new homes have been mapped for a current 2002 map layer.
2. Polygons have been mapped for all four study areas for the 1998 aerial photo layer. Two of the study areas have also been mapped for 1979 and 1948.

Future Work:

1. Complete polygon maps for all three years in all four study areas.
2. Map historical home locations for the interim year 1979.
3. Validate land use maps by picking random points and assessing accuracy of mapped versus actual land use type by driving to those sites.
4. Compile data, and create summary tables and maps of land use change, describing types of change and amount of change.





Completion Date: Presentation of findings to the Task Force on March 25, 2003. Project completion in April 2003.

Products: A written summary of findings and digital format of useful data layers created in ArcView.

1F. Contour/Topographic Mapping

Title: Topographic Mapping of the Upper Yellowstone River Channel and Flood Plain from Gardiner to Springdale, Montana

Principal Investigator: US Army Corps of Engineers, Omaha Nebraska

Other Participants: Region 1 Engineering, US Forest Service, Missoula Montana
US Geological Survey, Water Resources Division, Helena Montana
Water Management Bureau, Montana DNRC, Helena Montana

Goal: Acquire ground-controlled aerial photos suitable for topographic and orthographic mapping of the contemporary upper Yellowstone River channel and flood plain; prepare digital orthophotos and topographic maps suitable for floodplain and other resource delineation.

Objectives:

1. Establish horizontal and vertical control for aerial photography.
2. Acquire low-flow, 'leaf off', 1:24000-scale aerial photography for the channel from Gardiner to Springdale for use in orthophoto preparation.
3. Acquire low-flow, 'leaf off', large scale (1:6000- or 1:8000-scale) aerial photography for the channel from Point of Rocks to Mission Creek for use in preparing two- and four-foot contour maps of the channel and flood plain.
4. Prepare orthophotos and contour maps using digital photogrammetric methods.

Progress: Topographic mapping of the river channel and flood plain provides the basic framework for describing contemporary river channel and floodplain resources, evaluating historic channel changes, hydraulic floodplain delineation, and monitoring future channel change. Contemporary topographic mapping at 1:6000 and 1:8000 scales is being accomplished using surveyed ground control and photogrammetric methods with photos obtained on April 11, 1999.

The US Forest Service completed preparation of 1:12000-scale orthophoto coverage of the study area in November 2000. The Corps assumed responsibility for production of contour maps in December 2000. Priority reaches were delivered to project researchers in September 2001. Final deliverables for all reaches were provided to researchers in February 2002.

Completion Date: All project topographic mapping is completed. These data will be used for the production of study floodplain maps. The USGS-WRD and Corps will be cooperating for floodplain mapping. These contour data are also to be used by the fisheries, geomorphology, and riparian trend analysis study teams**.**

Products: Digital orthophotos of the study area (Gardiner to Springdale). Digital topographic maps of the river and flood plain from Point of Rocks to Mission Creek. Study floodplain maps.

Access to Data: Currently, access to preliminary data is limited to study researchers. Final map products will be released once approval is secured from the original contracting agencies in consultation with the Task Force. Pursuing formal adoption of final floodplain maps will be the responsibility of the DNRC and Park County.

2. GEOMORHIC ANALYSIS

Title: Historical Channel Changes and Geomorphology of the Upper Yellowstone River

Principal Investigators: Chuck Dalby (Hydrologist) and Jim Robinson (Geologist)
Water Management Bureau, Montana DNRC, Helena Montana

Other Participants: Larry Dolan, and Mike Roberts (Hydrologists)
Dr. Jane Horton (GIS/Range Management)
Water Resources Division, Montana DNRC, Helena Montana

Dr. Michael Merigliano and Mary Louise Polzin (Riparian Ecologists)
University of Montana, School of Forestry, Missoula Montana

Goal: Develop a quantitative framework for evaluating historic river channel changes and the physical effect that historic channel modification (for example, bank stabilization measures) may have had on the river and flood plain; also provide a partial basis for estimating the potential cumulative effect of contemporary river management alternatives.

Objectives:

1. Channel and floodplain mapping.
2. Geomorphic channel description and classification.
3. Mapping and analysis of historical channel changes.
4. Geomorphic analysis of historic channel processes and cumulative effects of channel modification.

Methodology: This project uses a variety of scientific methods to map contemporary (1999) river channel and floodplain features, delineate historic river channel changes, and examine the relationship between historic channel modifications (for example, levees and bank stabilization) and channel changes. The information is being used to assess cumulative effects of channel modifications on physical attributes (channel geometry, plan pattern, bed-material characteristics) of the upper Yellowstone River from Gardiner to Springdale.

(1) Topographic and orthographic mapping of the river channel and flood plain provides the basic framework for describing and classifying current river channel and floodplain attributes (for example, channel pattern, width, slope), evaluating historic channel changes, and monitoring future channel change. Contemporary orthophotos (April 11, 1999), at small (1:24000) and large (1:6000 to 1:8000) scales, are being used as a base to map and describe a variety of physical channel features (for example, hydraulic units, gravel bars, islands, sediment sources and availability, bed and bank material, bank vegetation, channel modifications, woody debris, and civil works). Mapping of contemporary fluvial geomorphology is being accomplished through field mapping supplemented by stereo interpretation of aerial photography.

2) Geomorphic classification of the upper Yellowstone River provides a framework for understanding the relationship between the form and condition of the channel and the physical and biological processes that

shape and maintain its bed, banks, and island complexes. Reconnaissance-level classification(s) of the channel from Gardiner to Springdale will be delineated at 1:24000-scale, through air-photo interpretation and field reconnaissance. The Rosgen, Montgomery-Buffington, and Nanson-Croke channel classifications will be applied in cooperation with other investigators. These classifications serve as a basis for identifying homogeneous channel segments, assessing relative vertical and lateral channel stability, and identifying geomorphic strata from which representative samples can be extracted for further detailed study. Channel classification information may also be used to tailor regulatory permits and actions to site-specific river channel conditions. More refined channel classification will be developed for the detailed study segment (Point of Rocks to Mission Creek) based on higher resolution channel mapping and field description of fluvial features. For channel segments with sufficient historic aerial photo coverage, a quantitative classification based on rates of lateral (and where possible) vertical change will be developed.

(3) Mapping and analysis of historical river channel changes provides a factual basis for describing how the upper Yellowstone River has changed over time and will give insights into likely future channel changes. Systematic examination of the spatial and temporal distribution of channel changes in relation to historic channel forming flows, channel modifications, and other factors provides a basis for assessing the cumulative effect of channel modifications over time. Reconnaissance-level, historic river channel changes are being estimated for the channel extending from Gardiner to Springdale, by comparing successive maps of the same channel reach over time. More detailed analyses of historic channel changes, using historic aerial photos, are being done for selected sites within detail study reaches.

(4) Hypothesis tests and other statistical methods, applicable for comparison of control and treatment populations, will be used to assess the historic effects of channel modifications. A sediment-budget analysis that quantifies floodplain and channel sediment sources, and storage reservoirs will be developed for selected reaches in the detail study segment. For channel segments with sufficient information, the following will be defined: sources of sediment and rates of production, storage reservoirs and their relative activity, and the net sediment balance of the channel segment for discrete intervals of time. Contemporary (1999) channel morphology and stability will be analyzed using various geomorphic methods. Areas of historic, existing, and likely future channel instability (lateral or vertical), and potential areas of rapid future channel change (channel cutoffs and avulsions) will be identified. This analysis provides a means for defining channel reaches that may be especially sensitive to increases in coarse sediment inputs or modification of channel width or slope. A hydraulic model developed for floodplain delineation (USGS-WRD) within the detailed study segment will also be used to evaluate historic cumulative effects of channel confinement on water-surface elevations of floods. A sediment-transport model will be used to examine potential cumulative effects of hypothetical scenarios for channel management /stabilization, on channel characteristics and stability (USGS-WRD).

Progress:

Geomorphic channel description and classification: Geomorphic channel classification of the channel from Gardiner to Springdale was accomplished using information derived from the project topographic mapping, interpretation of 1999 and historic stereo air-photos, and field reconnaissance and survey. Information on bankfull channel characteristics, pool-riffle spacing, channel slope, surface and subsurface size-distribution of bed sediment, and abundance of large woody debris was collected through fieldwork at low-flow in 1999, 2000, and 2001.

Several geomorphic channel classifications were applied to the upper Yellowstone River, and the process-based classification of Montgomery and Buffington (MB) was found to be most applicable. The MB Classification, as modified for use on the upper Yellowstone River, recognizes six distinct channel types. Bedrock, cascade, and plane-bed channel types—which occur mainly between Gardiner and Mill Creek—are very stable, entrenched channels that have physically changed little since 1948 (49 percent of total channel length between Gardiner and Springdale). Pool-riffle and multiple-thread (anabranching) channels occur throughout the downstream drainage (40 percent of channel length), are more dynamic and locally show significant change in response to the 1974 and 1996/97 floods. Anabranching/braided channels are located in several segments between Pine Creek and Mission Creek (11 percent of channel length), are the most dynamic with generally the largest changes in lateral migration, and are prone to rapid lateral change (avulsion)—especially during large floods (more than 25-year recurrence interval).

Predominately alluvial (sand, gravel, cobble) channel reaches that are partly affected by natural obstructions (bedrock), or alluvial reaches that are significantly affected by bank stabilization, were delineated as a special class of “externally forced” channel morphology. For example, a multiple-thread anabranching channel that has been constrained to a single pool-riffle channel was classified as a forced pool-riffle anabranching channel. Of the total channel length between Gardiner and Springdale, about 14 percent (12 miles) was classified as affected by channel modification (riprap, levees, etc); another six percent (4.9 miles) was affected by combined natural and human constraints.

Photos 13 & 14. Geomorphology Study team collecting data. Photos courtesy of DNRC.

Pleistocene glaciers, originating from an ice-cap in Yellowstone National Park, advanced down the Paradise Valley with maximums approximately 20,000 years ago and 130,000 years ago. Paradise Valley glacial history has strongly influenced the current-day distribution of valley slopes, lateral channel confinement, sediment composition, and location of sediment sources—these factors, in turn, largely control the distribution of channel types in the study area.

Very stable bedrock, cascade, and plane-bed channels occur between Gardiner and Emigrant. Locally, these are interrupted by several disturbance/sedimentation zones with multiple-thread or anabranching channels. Moderately to very stable, incised to entrenched, single-thread, pool-riffle, and plane bed channels occur within much of the channel segment from Emigrant to near Mallards Rest. Downstream from Mallards Rest to Livingston, less stable pool-riffle and anabranching channels occur, and the Yellowstone River is a classic high-gradient (0.005 to 0.001) "wandering gravel-bed” river. In the vicinity of Livingston, the anabranching channel is partly constrained by bedrock (from Allenspur to Mayors Landing along the east bank) and there are occasional occurrences of bedrock throughout the channel downstream from Livingston to Springdale. Downstream from Livingston, the Yellowstone displays the same channel types as upstream, however a larger portion of the least stable channel type (anabranching/braided) occurs.

Mapping and analysis of historic channel changes: Potential sources of information on historic channel changes were identified and inventoried prior to conducting the analysis. Sources include historic aerial photos, ground photos, maps, and surveys. Mapping and analysis of historical river channel changes provides a factual basis for describing how the upper Yellowstone River has changed over time and gives insights into likely future channel changes. Systematic examination of channel changes in relation to historic channel forming flows, channel modifications, and other factors provides a basis for assessing the physical effects of channel modifications over time.

A series of partially rectified (a portion of the distortion has been removed) digital photo mosaics of the channel corridor were created in cooperation with a contractor. Nearly complete coverage of the Gardiner to Springdale study area was developed for 1948/49, 1954, 1965, 1973,1976, and 1991. This imagery provides the primary base for delineation of historic channel changes.

Reconnaissance-Level

Lateral channel changes (1948/49 to 1999) were estimated by digitizing the centerline trace of the low-water channel on the partially rectified channel mosaics for those years. Accuracy of the digitized centerline trace limits detection of lateral changes to a range of about $\pm$ 20 feet to $\pm$ 50 feet. The digitized channel traces were overlaid in a GIS and areas of low, or no, change were identified by the close agreement of the two lines. Channel locations, where the lines diverged greater than 50 feet, were identified for further data collection and analysis.

Detailed Channel Changes

Within geomorphology study segments, which cover about 70 percent of the Task Force study area, detailed channel changes are being mapped (work in progress) for those parts of the channel that have changed significantly between 1948/49 and 1999. The trace of the bankfull channel, waters edge, gravel bars, and islands is being digitized using the 1948/49, 1954, 1973, 1976, and 1991 channel mosaics (limited coverage of 1943 and 1987 are also being used). This information is being overlaid in a GIS to measure rates of lateral change over the years.

Information collected on historic channel changes and channel modification (detailed below) is being integrated to provide an analysis of how the upper Yellowstone River has changed over time and in response to historic channel modification.

Geomorphic analysis of historic channel processes and cumulative effects of channel modification:

Channel Modification and Bank Erosion Inventory

A Channel Modification and Bank Erosion Inventory (CMBEI) was prepared for the upper Yellowstone River from Gardiner to Springdale. Using the NRCS Physical Features Inventory (1998) as a starting point, 1999 aerial photos of the channel from Gardiner to Springdale were viewed in stereo and a variety of adjustments to the NRCS-PFI were made: some features were reclassified, spatial extent of features were increased or reduced as appropriate, and new features were added (in particular, eroding banks). Additional information used to supplement the stereo-photo interpretation included: field notes and mapping done in August and September 2000 and 2001, and the project topographic mapping. As a general rule, the CMBEI was edited to include all features present on the April 1999 aerial photos used for interpretation.

Historic Channel Modification Inventory

To better understand the history of channel modification and its effects on fluvial geomorphology, a historic inventory was compiled using information from several sources. Historic aerial photos were examined in stereo for the 1987, 1973, 1976, and 1954 photo series (work in progress), and modifications were mapped on the associated channel mosaics for each year. In the following table, information is summarized for the channel extending from the Interstate 90 Bridge to the Pine Creek Bridge, for the years: 1954, 1973, 1987, and 1999.

Table 3. Upper Yellowstone River Channel and Floodplain Modifications
(Interstate 90 Bridge to Pine Creek Bridge; 1954, 1973, 1987, 1999).

Modification	1954	1973	1987	1999
Dikes & Levees*	11,912	36,554	34,702	45,204
Riprap	3,688	22,132	30,114	32,684
Total Linear Feet	**15,600**	**58,686**	**64,816**	**77,888**
Barbs, Jetties, etc. (number of points)	19	45	36	129

* = Includes road-fill prisms that restrict lateral movement or flooding.

The Interstate 90 Bridge to Pine Creek Bridge segment is not representative of the entire Task Force study area; but is of particular interest, because it is one of the more dynamic segments of channel and it experienced significant channel changes in the 1996/97 floods. The segment also contains portions of the urban area of Livingston, several important bridges, the spring creeks, other areas of high recreational value, and important farm and ranchland.

In all, seven segments are being examined and analyzed: (1) Gardiner to Carbella Bridge; (2) Carbella Bridge to Eight Mile Creek; (3) Eight Mile Creek to Pine Creek Bridge; (4) Pine Creek Bridge to I-90 Bridge; (5) I-90 Bridge to RR-Bridge; (6) RR-Bridge to Shields River; and (7) Shields River to Springdale.

Future Work: Historic channel modification inventories are being completed. This information provides the basis for developing case histories of channel modification and the associated channel response. Hypothesis tests and other statistical methods, applicable for comparison of control and treatment populations, are being used to assess the historic effects of channel modifications. As hydraulic

information from the USGS-WRD and BRD becomes available, the analysis will be completed. Preliminary analysis indicates that at low flow, substantially revetted or laterally-confined channel reaches (partial bedrock control) are somewhat narrower and steeper than similar channel types lacking confinement.

Photo 15. Geomorphology Study team collecting data. Photo courtesy of DNRC.

A sediment-budget analysis that quantifies channel sediment sources is being developed for several channel segments between Mallards Rest and Carters Bridge. Historic topographic mapping was done (1948/49, 1973, 1976, and 1991) for seven large eroding banks, and volumetric estimates of sediment production are being made. Contemporary (1999) channel morphology and stability are being analyzed using various geomorphic methods. Areas of historic, existing, likely future channel instability (lateral or vertical), and potential areas of rapid future channel change (channel cutoffs and avulsions) are being identified. This analysis provides a means for defining channel reaches that may be especially sensitive to increases in coarse sediment inputs or modification of channel width or slope.

A hydraulic model developed for floodplain delineation (by the USGS-WRD) between Point of Rocks and Carters Bridge will also be used to evaluate historic cumulative effects of channel confinement on water-surface elevations of floods. The sediment-transport model developed by the USGS-WRD will be used to examine potential cumulative effects of alternative river management scenarios (for example, bank stabilization) on channel characteristics and stability.

Projected Completion Date: Preliminary presentation of findings to the Task Force on December 12, 2002. Follow-up presentation in April 2003. Project completion April 2003.

Products: A series of interim project reports are being prepared to convey project results to other investigators and the public, as the project progresses. The reports will be summarized into an overall completion report at the project's end. In addition to these reports, specific GIS map work products are being developed and are listed below. All spatial information (for example, topographic maps and interpretive maps) will be available in digital Arc Info/ArcView or AutoCAD 2000/LDD2 formats.

<u>GIS /Map Products</u> (in progress)

(1) *Reconnaissance-level fluvial geomorphology and channel classification of the upper Yellowstone River from Gardiner to Springdale Montana.*
This GIS product consists of several themes (map layers) delineating physical channel features (channel, gravel bars) and geomorphic channel classification (1:24000- to 1:12000-scale).

(2) *Reconnaissance-level historical channel changes of the upper Yellowstone River from Gardiner to Springdale, 1948 to1999.*
This GIS product consists of several themes that delineate channel features (channel, gravel bars) in the study area at successive points in time (1948, 1977 or 1980, and 1999) and describe lateral channel changes (1:24000-scale)

(3) *Fluvial geomorphology and channel characteristics of the upper Yellowstone River from Point of Rocks to Mission Creek.*
This GIS product consists of several themes (map layers) that describe the fluvial geomorphology of the river and flood plain (1:6000- and 1:8000-scale).

(4) *Historic channel changes of selected reaches of the upper Yellowstone River: Point of Rocks to Mission Creek*.
This GIS product consists of several themes (map layers) that describe historic channel changes, based on mapping of geo-referenced historic aerial photos of selected channel segments.

Interim Project Reports (in progress)

Description of bed-material at selected sites along the upper Yellowstone River.
This report will present qualitative and quantitative data collected on the surface and subsurface size distribution of bed-material within the active channel. Sampling methods and sites are given along with GIS themes that locate the information.

Retrospective analysis of historical channel changes of the upper Yellowstone River.
Statistical and geomorphic analysis report accompanying above GIS map.

Sediment budget analysis of upper Yellowstone River: 1948 to 1999.
Presents methods, data, and results of morphometric sediment budget analysis that identifies sediment sources and volumetric rates of transfer for selected channel reaches.

3. HYDROLOGY AND HYDRAULIC ANALYSIS

Title: Analysis of Hydraulic Characteristics, Floodplain Delineation, and Sediment-Transport Investigations for the Upper Yellowstone River from near Gardiner to Mission Creek in Park County, Montana

Principal Investigators: Steve Holnbeck (Hydraulic Engineer), Chuck Parrett (Supervisory Hydrologist)
US Geological Survey, Water Resources Division
Montana District Office, Helena Montana

Other Participants: Dave R. Johnson (Senior Hydrologic Technician). Other staff within the Montana District as required, and USGS technical experts outside the District on a consultation basis.

Goal: Analyze the potential effects of seasonal runoff, and river management and bank stabilization alternatives on sediment load, channel geometry, streambed profiles, and water surface elevations. Collect selected hydraulic and sediment data to support the modeling effort. Develop a floodplain delineation map.

Objectives:

1. Obtain channel geometry data at approximately 140 cross sections for the reach from Point of Rocks to the mouth of Mission Creek.
2. Delineate 100-year flood limits from Gardiner to Springdale. For the reach from Point of Rocks to Mission Creek, delineate the 100-year flood plain and floodway, and 500-year flood plain.
3. Sample bedload and suspended-sediment gradation and concentration, and perform other related data-collection efforts to characterize the sediment being transported in the Upper Yellowstone River Basin and to support modeling efforts.
4. Perform hydraulic and sediment-transport modeling to estimate relative changes in channel geometry, streambed profiles, and water surface elevations resulting from different sediment loads and water discharges.

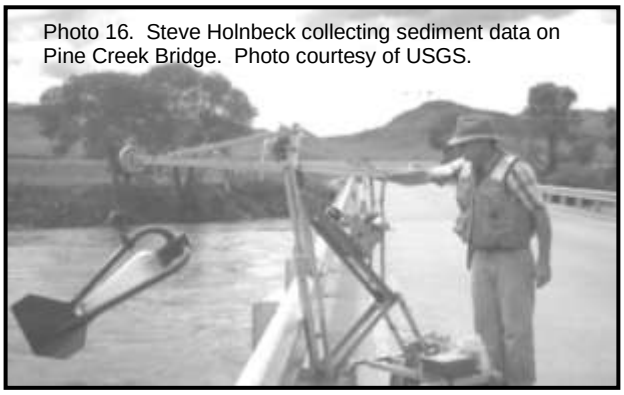


Photo 16. Steve Holnbeck collecting sediment data on Pine Creek Bridge. Photo courtesy of USGS.

Methodology: Survey river cross sections utilizing boats and ground crews, surveying equipment including conventional self-leveling level and electronic total station, and global positioning system (GPS) techniques. Apply the one-dimensional capabilities of the computer model HEC-RAS to perform water-surface profile analysis for floodplain delineation. Collect sediment-related data utilizing USGS field and laboratory resources, techniques, and equipment. Use the mobile-bed sediment transport model

BRI-STARS in a one-dimensional fashion to evaluate sediment-transport issues for various flood hydrographs and certain river management scenarios. Emphasis of BRI-STARS work will be placed on relative comparison of modeling results.

Progress: Sediment-transport modeling is 80 percent complete. Floodplain delineation is 90 percent complete.

Future Work: Complete modeling and floodplain delineation efforts and two reports.

Projected Completion Date: Presentation of preliminary findings to the Task Force on November 19, 2002. January 31, 2003 for completion of analysis and draft reports. Final reports will go through an internal USGS review and are projected to be released by the end of Fiscal Year 2003.

17. USGS-WRD team conducting cross-section survey. Photo courtesy of USGS.

Products: Two USGS Water-Resources Investigations Reports will be published. The first report will describe the sediment-transport modeling for the stream reach from Carters Bridge to Pine Creek Bridge. The second report will be a map report showing the delineated flood plain.

4. RIPARIAN TREND ANALYSIS

Title: Temporal Patterns of Channel Migration, Fluvial Events, and Associated Vegetation Along the Yellowstone River, Montana

Principal Investigator: Dr. Michael Merigliano (Riparian Ecologist)
University of Montana, School of Forestry, Missoula Montana

Other Participants: Mary Louise Polzin, John Corkery, Rachel Powers
University of Montana, School of Forestry, Missoula Montana

Goal: Determine relationship between fluvial geomorphic processes and floodplain vegetation.

Photo 18. Riparian Study team member aging cottonwood. Photo by E. Galli-Noble.

Objectives:

1. Determine floodplain turnover rate and stratify by geomorphic setting. Incorporate Hydrogeomorphic Model (HGM) data and methods where appropriate.
2. Relate the magnitude and frequency of flow events to floodplain erosion and deposition (turnover) and associated cottonwood patches.
3. Incorporate the influence of ice drives on vegetation and floodplain dynamics.
4. Characterize the age distribution of the forest along the study area and cottonwood patches that comprise the forest.
5. Assess cottonwood longevity and limitations (clearing, natural mortality, and floodplain erosion).
6. Create maps of channel migration history and existing floodplain vegetation.
7. Use information on historic changes, and hydraulic and geomorphic factors to evaluate cumulative effects of bank stabilization projects.

Photos 19 & 20. Photos show channel migration and cottonwood seedling establishment at sample site #28 over a 50-year period. The numbers on the 1999 photo indicate patches of trees with similar ages and therefore similar establishment years. Photos courtesy of University of Montana.

Methodology: Floodplain aging relies on cottonwood tree ages and sequential aerial photography. Cottonwood is one of the first plants to colonize new gravel bars and is also long lived. Some sampled tree ages exceed 200 years. The age distribution of the cottonwood forest on an aerial basis (rather than the usual stem numbers) is the main signal indicating floodplain erosion and deposition dynamics. Stand age and structure are related, and in turn, wildlife habitat and stand structure are also related. As stands age, trees not only get larger, their branch architecture changes, stems become more conducive to cavity nesters, and there are typically site changes that allow other plants to become established. Structure is related to wildlife habitat.

Progress: Fixed plots for age distribution within age patches was completed in 2002, with 752 trees sampled during the summer. These data were collected from the five remaining "confined wandering gravel bed" sites, as well as the nine "wandering gravel bed" sites, three "entrenched" sites, and three "confined coarse-textured" sites for strata fixed plots. Core samples were sanded and aged in the fall 2002. Delineation of age patches was completed and initial analysis of the floodplain turnover rate was completed.

"For Yellowstone River riparian vegetation to stay the same, *it must change."*

Dr. Michael Merigliano

Future Work:
Additional work is needed in the analysis of the floodplain turnover rate and for the completion of analysis of the tree establishment correlation to peak flood flows.

Projected Completion Date: Presentation of findings to the Task Force on January 7, 2003. Project completion in March 2003.

Products:

1. Maps showing existing vegetation and cottonwood patch age classes.
2. Age distribution of cottonwood forest.
3. Floodplain turnover rates (based on a decay curve of floodplain age by area derived from #2 for lower reaches below Emigrant). The upper reaches may not have an extensive true flood plain and the turnover concept will be modified accordingly.
4. The relation between flow events and cottonwood establishment, and the influence of ice drives.
5. Data (field maps and notes) on existing vegetation community types, and wildlife habitat variables (to be determined).
6. Assessment of cumulative effects of bank stabilization projects incorporating the results of hydraulic modeling and floodplain dynamics. The frame of reference will be the channel migration rate and associated cottonwood forest age distribution under conditions as close to natural as possible.

5. FISHERIES ANALYSES

5A. FISH POPULATIONS STUDY

Title: Comparative Use of Modified and Natural Habitats of the Upper Yellowstone River by Juvenile Salmonids

Principal Investigators: Dr. Alexander V. Zale (Assistant Unit Leader)
Montana Cooperative Fisheries Research Unit, US Geological Survey
Montana State University, Department of Biology, Bozeman Montana

Thomas E. McMahon (Professor of Fisheries Management)
Montana State University, Department of Biology, Bozeman Montana

Other Participants: Douglas L. Rider (Graduate Research Assistant)
Montana Cooperative Fisheries Research Unit, US Geological Survey
Montana State University, Department of Biology, Bozeman Montana

Montana Department of Fish, Wildlife and Parks

Goal: Estimate to what extent bank stabilization, flow deflection, and flow confinement structures have changed aquatic habitat use by juvenile salmonids in the Yellowstone River.

Objectives:

1. Conduct a literature review and associated consultations of experts to summarize pertinent research and to guide the development of a sampling program using appropriate capture methodologies to assess fish abundances in habitats of the Yellowstone River at appropriate times of the year.
2. Compare seasonal use of altered and analogous unaltered main-channel margins (bank habitats) by juvenile salmonids.
3. Assess juvenile fish use of lateral side channels to determine the effects of disconnecting them from the main channel.

Photo 21. Doug Rider collecting data in Yellowstone River side channel. Photo courtesy of MSU.

Photo 22. Fish Populations Study team collecting data along riprapped bank. Photo courtesy of MSU.

Methodology: Our primary approach is to sample juvenile salmonids along shoreline transects using electrofishing gear. Transects are 50 meters long and were selected randomly after stratification by bank type. Bank types evaluated are riprap, barbs, and jetties, and unaltered outside bends, inside bends, and straight shorelines. Fish abundances are expressed as numbers per 50 meters of shoreline captured during a single electrofishing pass and are compared among bank types using analysis of variance. Sampling is conducted prior to spring runoff (April 1 to May 15), during summer low flow (July 1 to August 31), and late autumn (October 1 to November 15). Two river reaches are sampled. The Upper Reach extends from a bit downstream from Mallards Rest to just upstream from the confluence of Nelson's Spring Creek. The Lower Reach begins at Carters Bridge and ends at Mayors Landing. The Upper Reach includes eight sites of each bank type (48 total sites) and the Lower Reach includes six sites of each type (36 total). Our primary emphasis is on the Upper Reach and we sample all of the sites there before moving to the Lower Reach. The onset of cold weather limits how many sites are sampled in the Lower Reach in autumn.

To determine if and to what extent juvenile salmonids use side channels, we conduct three-pass depletion electrofishing abundance estimates in ephemeral side channels during spring runoff. These abundance estimates allow inference of how many fish are displaced when a side channel is lost.

Progress: All fieldwork has been completed, and final analyses and report preparation are underway.

Future Work: None.

Projected Completion Date: Presentation of findings to Task Force on January 21, 2003. Final report completion in February 2003.

Products: A final report in standard scientific format describing the findings and relevance of the study will be produced. It will include an abstract (executive summary), introduction, and methods, results, and discussion sections.

5B. FISH HABITAT STUDY

Title: Effects of Channel Modification on Fish Habitat in the Upper Yellowstone River

Principal Investigators: Zack Bowen (Ecosystem Dynamics Science Program Director), Ken Bovee (Hydrologist), Terry Waddle (Hydrologist)
US Geological Survey—Fort Collins Science Center, Colorado

Other Participants: Jim Terrell (Fish and Wildlife Biologist)
US Geological Survey, Fort Collins Science Center, Colorado

Goal: Determine whether certain types of channel modification are potentially more detrimental to fish populations than others.

Objectives:
1. Quantify the relative severity of impacts of different types of channel modifications.
2. Identify potential linkages between critical habitat types and fish populations. Such knowledge may help guide regulatory agencies and riparian landowners toward management practices that meet the dual objectives of protecting property and minimizing impacts to fisheries.
3. Provide baseline data for evaluating future changes in the river corridor.

Null Hypotheses[3]:
(1) There is no difference in the area of shallow, low-velocity habitat over time between altered and unaltered reaches throughout the area defined by the floodplain model.
(2) There are no significant differences in the temporal distribution of habitat classes between altered and unaltered channels in the upper Yellowstone River.
(3) There are no significant differences in relative abundance of young salmonids in altered and unaltered channels in the upper Yellowstone River.
(4) The availability of key habitats in the upper Yellowstone River is unrelated to the relative abundance of young salmonids.

Measures:
Duration statistics for area of shallow, low-velocity habitat for 1980 to 2000.
Various habitat metrics for each sub-reach as a function of discharge, including some or all of the following: class area, mean patch size, patch density, patch richness, edge density, mean nearest neighbor index, mean shape index, habitat diversity, and interspersion/juxtaposition.
Temporal distribution (habitat duration statistics) of selected habitat metrics, by season, for a wet water year (1997), a near-normal water year (1998), and a dry year (2001). Duration statistics will be based on mean daily discharges at the Livingston gage for each water year.

[3]Null Hypothesis = a statistical hypothesis (theory) to be tested and accepted or rejected in favor of an alternative; specifically: the hypothesis that an observed difference (between the means of two samples) is due to chance alone and not due to a systematic cause.

Seasonal relative abundance of sub-yearling rainbow, brown, and cutthroat trout and mountain whitefish in altered and unaltered sub-reaches of the upper Yellowstone River.

Indicators:

Availability of shallow, low-velocity habitats.

Key habitat classes associated with relative abundance of juvenile salmonids.

Deviation from control sections versus treatment sections, in seasonal availability of key habitat classes during high, normal, and low water years.

Photos 23 & 24. Fish Habitat Study team collecting data during high water in June 2002. Photos courtesy of M. Gilbert.

Study Overview:

Phase 1 will be a map-based evaluation of area of shallow water habitat important to juvenile salmonids focusing on bankfull and overbank flows. We will develop a habitat versus flow relation using bankfull and overbank flows, and provide water surface area for flows near base flow and median flow. We will use data and estimated water surface elevations from the USGS WRD floodplain delineation study in conjunction with the digital elevation model produced through the geomorphology and topographic mapping efforts to develop a relation between flow and shallow water habitat throughout the area defined by the 100-year flood line from the WRD water surface elevation model.

Phase 2 will entail intensive data collection, hydraulic modeling, and habitat mapping in three reaches totaling 15.3 km:

Reach 1. River miles 513.4 to 510.8 (a bit downstream from Mallards Rest to just upstream from the Pine Creek Bridge; 2.6 miles).

Reach 2. River miles 509.2 to 506.6 (some distance downstream from Pine Creek Bridge to just upstream from the confluence of Nelson's Spring Creek; 2.6 miles).

Reach 3. River miles 500.8 to 496.5 (from just above Siebeck/Ninth Street Island to channel split below sewage treatment facility; 4.3 miles).

These reaches were selected to coincide with areas sampled as part of the Fish Populations Study and to represent different channel configurations.

Two-dimensional (2-D) habitat maps will be developed for each study reach for the same range of flows examined in the Fish Populations Study. Habitat map development will entail bathymetric data collection, 2-D hydraulic modeling, and geospatial mapping. Physical data requirements of the hydraulic model include a three-dimensional bathymetric map of each study site, a bed material map, and certain flow-related boundary conditions. We will employ global positioning system (GPS) and standard surveying techniques to establish elevation control and standard stream gaging techniques to determine discharge. We will obtain planform locations using GPS, depths by hydroacoustic sounding, and bed material types by post processing and analysis of hydroacoustic signals. For areas above the water surface we will incorporate the 1:6000 scale-digitized photogrammetry data being developed by the Corps in cooperation with the DNRC and USGS (Montana District). By combining overbank topography and in-channel bathymetry in a single bed file, accurate quantification of off-channel habitat (such as, overflow channels on flood plains and tributary mouths) is made possible. This is particularly important when quantifying fish habitat availability under flood conditions. These simulations may also be useful to other study components and will be made available to other investigators in this project.

A geographic information system (GIS) will be used to assemble the different data layers and transform field bathymetric data into a finite element mesh for flow simulation. We will use a finite element, depth averaged 2-D hydrodynamic model to simulate depths and velocities over a range of discharges at each site.

Photo 25. Fish Habitat Study sample site. Photo courtesy of M. Gilbert.

As part of the Fish Populations Study, Montana Cooperative Fisheries Research Unit (MTCFRU) is sampling fish populations seasonally at numerous sites. Included in the fish population data will be such information as relative abundance and age structure of trout, mountain whitefish, dace, and suckers. This information will be key to the determination of critical habitat types. Relative abundance data alone may help delineate critical habitat types. The seasonal sampling regime may be used to account for fish movement from site to site. If fish movement can be related to the appearance or disappearance of certain habitat types, supporting evidence may be provided regarding the importance of those habitats.

Photo 26. Fish Habitat Study team collecting data in 2002. Photo by E. Galli-Noble.

Habitat maps for each of the MTCFRU sampling locations will be constructed for 8 to 12 discharges, encompassing the same range of discharges examined under the Fish Populations Study. Maps for the same discharges that were present during fish sampling will be included. Generalized habitat suitability criteria developed through the MTCFRU literature review will be used to define habitat classes based on depth, velocity, substrate, and cover. We will coordinate with MTCFRU to select the appropriate metrics for this analysis.

Relationships between relative abundance of the target species or other biological metrics and site-specific habitat characteristics will be analyzed cooperatively with MTCRFU. Our goal will be to identify key habitat features that are associated with various population attributes. We will employ habitat time series analysis in this step, but we will confine the analysis to the most recent five-year period. We assume that the events shaping the age structure and relative abundance of fishes will have occurred during this most recent time period. Once these key habitat features have been identified, they will be used to describe the relative impacts of different channel modification activities. These relative impacts will also be analyzed by habitat time series. However, under the Fish Habitat Study, we propose to sample year-types from the period of record rather than using the entire record. This will result in a comparison of habitat characteristics between control and treatment under the hydrologic conditions of a dry year, a normal water supply, or a wet year, for example.

Progress: Two intensive field data collection trips were conducted during 2002. Bathymetric mapping data were collected throughout each of the three study reaches during peak runoff in June. Data were collected in main channels, major side channels, and all smaller side channels that were deep enough for boat access and data collection. Longitudinal water surface profiles were also measured at each site. A ground survey was made during July to collect topographic data in areas that were not accessible by boat during June. During the July trip, topographic data were also collected on exposed bars and tops of banks to facilitate accurate joining of data sets based on bathymetric surveys and aerial photogrammetry.

Photo 27. Fish Habitat Study team collecting data. Photo by E. Galli-Noble.

Data sets from our 2001 channel feature survey, the bathymetric survey, ground survey, and aerial photogrammetry were successfully joined and maps of combined in-channel and overbank topography were completed for each of the three study reaches. Large woody debris in or near the active channels was hand-digitized from the aerial photography. Topographic data were used to develop a computational mesh for the three study reaches. The topography described by the mesh was used in conjunction with water surface elevations and discharges to build and calibrate a two-dimensional flow model for each site. Model runs were completed for two of the three sites and the third is in progress. Model results for the two completed sites were brought into a GIS and used to complete fish habitat maps for a range of flows. These habitat maps incorporate localized velocity reductions resulting from large woody debris. Hydrographic data for building habitat-time series was obtained.

Coordination meetings with the Technical Advisory Committee, the Corps of Engineers, and cooperators working on floodplain mapping and fish population data collection were attended.

Future Work: Hydraulic and habitat modeling work will be completed. Relations between flow and habitat variables will be developed for each study site. These relations will be used in conjunction with hydrograph data to estimate habitat availability over time during different water years. Habitat availability and characteristics in modified and unmodified sub-reaches will be compared in conjunction with fish population data to examine relations among habitat availability, channel modification, and fish abundances.

Projected Completion Date: Presentation of findings to the Task Force on February 25, 2003. Project completion in March 2003.

Products: Phase 1 will result in an estimate of the area of shallow, low-velocity habitat over time throughout the study area. Phase 2 will produce a GIS database, habitat maps, and photos which will be analyzed in conjunction with data from the Fish Populations Study to describe the relations among fish abundances, physical habitat characteristics, and channel modifications in the three study reaches.

6. WILDLIFE (BIRD) ANALYSIS

Title: Riparian Habitat Dynamics and Wildlife along the Upper Yellowstone River

Principal Investigators: Dr. Andrew Hansen (Associate Professor of Ecology)
Dr. Jay Rotella (Ecology Department Head, Associate Professor)
Lurah Klaas (research assistant)
Montana State University, Bozeman Montana

Objectives:

1. Estimate the current spatial distribution and abundance of individual bird species and community diversity in riparian forest habitats along the upper Yellowstone River.
2. Determine the accuracy of the estimates of bird abundance and diversity.
3. Quantify the relative influence of channel characteristics (geomorphology and hydrology) and riparian vegetation (structure, composition, and spatial pattern), on bird species abundances and community diversity.
4. Estimate change in bird abundances and community diversity from 1950 to 2000 based on channel characteristics and riparian vegetation.
5. Estimate the relative importance of current riparian forests for wildlife in the context of the Upper Yellowstone River Watershed.

Photo 28. Bird Study team conducting vegetation measurements. Photo courtesy of M. Gilbert.

Goal: This study will determine relationships between riparian habitat dynamics and riparian avifauna, often used as indicators of habitat integrity for wildlife.

The study will take advantage of the extensive research that the Investigators have conducted on birds and vegetation in the neighboring Gallatin, Madison, and Henry's Fork Watersheds. Over the past six years, field surveys of birds, shrubs, and trees have been done at more than 100 sites across a range of cover types and elevations. Statistical models were then used to map the abundance of species over these watersheds based on cover type, parent material, and elevation. In the Task Force study, the statistical models for birds will be applied to the Upper Yellowstone Watershed and then field surveys will be used to quantify the accuracy of the predictions.

The study will focus on birds because:

1. Resources will not allow adequate sampling of all vertebrate species,
2. Birds can be sampled more cost effectively than other vertebrate species, and
3. The large number of bird species that can be sampled (more than100 species) allows this group to be good indicators of how habitat changes are likely to influence other vertebrate groups.

Photo 29. Lurah Klaas conducting avian survey. Photo courtesy of M. Gilbert.

Methods:

Objectives 1 and 2. Current bird distribution and validation

Statistical models developed for riparian forest bird species in the Gallatin, Madison, and Henry's Fork watersheds will be use to predict bird species abundances (for more than 50 species) in the Upper Yellowstone River Study Area. Point counts of bird abundance will be conducted in the study area during each of two breeding seasons. The results of the field surveys will be used to validate and, if necessary, improve, the habitat functions.

Objective 3. Influence of channel, vegetation, and land use on birds

The extent to which bird species abundances vary with channel and vegetation characteristics will be determined by statistical analysis. Data on the current distribution of the predictor variables will be obtained from the other studies of hydrology and riparian vegetation being conducted in the study area.

Multiple regression and mixed models will be used to evaluate the relationships between birds and the predictor variables. Mixed models evaluate the relationship between a response variable and fixed and random predictor variables. Fixed variables are those that meet the assumptions of independence. Random variables are not assumed to be independent; hence, the method is attractive when samples are spatially or temporally correlated. We have found in previous analyses of biodiversity that samples close in space or measured repeatedly over time are correlated. Hence, we will control for this correlation by considering spatial location and time periods as random variables.

Photo 30. Bird Study sample site in Paradise Valley. Photo courtesy of M. Gilbert.

Models based on channel, vegetation, and land use variables will be evaluated and "best" models selected based on Akaike's Information Criterion and Parsimony. The results will reveal the relative strength of each of these classes of predictor variables in explaining variation in bird species. We will also use the results to better extrapolate bird species abundances over riparian forests in the study area based on channel and vegetation characteristics.

Objective 4. Bird change: 1950 to 2000

The habitat functions generated in the above-stated objectives will also be used to predict change in bird abundance between 1950 and 2000, based on change in the predictor variables quantified using aerial photographs. The results will reveal the trajectories in species abundances over time and will provide important information for future floodplain, riparian, and channel management decisions.

Objective 5. Watershed context

An important criterion for evaluating bank stabilization and other channel characteristics is the importance of riparian vegetation along the river in the context of the entire Yellowstone watershed. We will use the habitat functions developed in previous studies and in this study to map bird distributions over the upper Yellowstone watershed from riparian habitats up in elevation to subalpine habitats. We will analyze these maps to determine what percentage of each bird species population is present in riparian forest along the Yellowstone River.

Progress: 2001 and 2002 bird and vegetation data collection is completed. Historical change project using 1948 and 1999 photos is complete and awaits analysis. Preliminary project writing is underway.

Future Work: Analysis of bird and vegetation data. Writing of final project report.

Projected Completion Date:
Presentation of findings to the Task Force on February 11, 2003. Project completion in March 2003.

Photo 31. Bird Study team collecting data in 2002. Photo courtesy of M. Gilbert.

Products:

1. Models of avian distribution and abundance based on channel features and vegetation characteristics.

2. Maps of riparian habitat and avian species distribution and abundance for 1950 and 2000.

3. A final report that details changes in avian abundance and distribution between 1950 and 2000, identifies habitat features that support high species diversity, and documents the importance of current riparian habitats for wildlife.

7. SOCIO-ECONOMIC ASSESSMENT

Title: Upper Yellowstone River Socio-Economic Assessment

Principal Investigators: BBC Research & Consulting
Denver Colorado
Edward Harvey (Project Leader)
Sara Flitner and Liz Bremmer (Facilitators)
Jeff Blend (Economics)
Andy Fritsch (Data Collection/Analysis)

Goal: Characterize the human environment within the Upper Yellowstone River Study Area.

Objectives:
1. Develop an economic portrait of the study area.
2. Provide a baseline social assessment of the study area.
3. Identify trends in land use, economic and social values and conditions.
4. Project the impacts 20 to 25 years into the future, assuming the "no action" alternative is selected.

Methods: Completed primary and secondary data pertaining to economic and social values, economic, and demographic conditions, land use and river management activities.

Progress: Study completed.

Completion Date: Presentation of findings to the Task Force on November 5, 2002. See *Appendix E* for study summary report. Completion of final report in February 2003.

Products: Final report.

Photo 32. Fishing the upper Yellowstone River east of Livingston, 2002. Photo by E. Galli-Noble.

Photo 33. Home on upper Yellowstone River in Livingston. Photo by E. Galli-Noble.

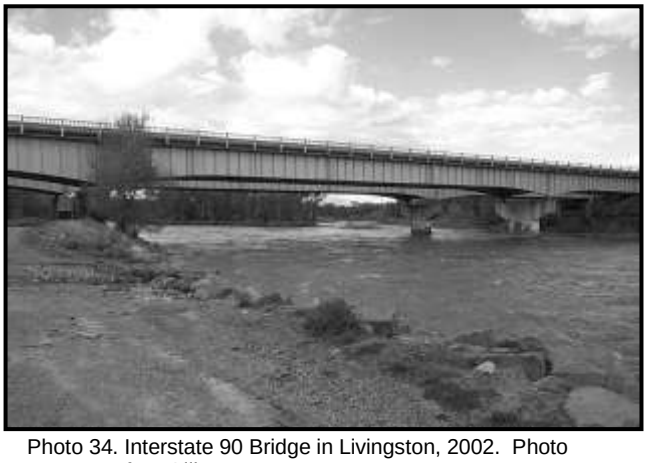


Photo 34. Interstate 90 Bridge in Livingston, 2002. Photo courtesy of M. Gilbert.

Financial Statement

The Governor's executive order directs the Task Force "... to seek or encourage others to seek grants, funds or other cooperative arrangements to implement recommendations of the Task Force… ." Throughout our tenure (1997 to 2002), the Task Force has done just that, actively pursued funding for the upper Yellowstone River research effort, educating the public, and supporting Task Force administration and operation.

Table 4 (page 39) addresses sources of funding for the entire project.

Photo 35. Upper Yellowstone River just downstream from the Railroad Bridge. Photo by E. Galli-Noble.

Table 5 (pages 40 and 41) summarizes our project budget status, as of December 31, 2002. The table shows all costs associated with the Cumulative Effects Investigation project, from initiation to the development of management recommendations.

Photo 36. Upper Yellowstone River east of Livingston. Photo by E. Galli-Noble.

Photo 37. Upper Yellowstone River Basin, 2002. Photo courtesy of M. Gilbert.

The Task Force benefits greatly from strong partnerships with a wide array of organizations and agencies. Many community members; local, state, and federal governmental agencies; and academics have generously donated technical support and assistance in each and every phase of project development and implementation. The $1,033,135 in-kind and match total shown in *Table 6* (page 42)—which makes up 38 percent of our entire project budget—illustrates how monumental these contributions have been and will continue to be for the Task Force.

Further, these tables include only documented contributions; many local citizens and technical experts have *informally* donated hundreds of hours to the project, which has not been documented. The Task Force can do little more than to give them our sincere thanks and recognize their efforts in this report.

Table 4. Governor's Upper Yellowstone River Task Force Funding Sources.
This table illustrates secured funding by source (grant and/or agency), and how much of that funding has been spent to date (December 31, 2002).

Source	Activity/Study 1998 - 2002	Date Completed	Total Funding Allocated (Dollars)	Funding Spent (Dollars)
Watershed Assistance Grant Montana DNRC	Coordination and Initial Assessment	6-30-99	2,100	2,100
HB 223 Conservation District Grant Montana DNRC	Aerial Photography	7-30-99	10,000	10,000
Riparian/Wetlands Education Grant Montana DNRC	Hydrologic Response to the 1988 Fires Workshop	6-30-00	1,000	1,000
Section 319 Water Quality Grant (#1) Montana DEQ	Task Force Coordinator	9-30-00	40,000	40,000
Task Force Start-Up Grant Montana DEQ	Aerial Photography Task Force Administration	6-30-01	49,138	49,138
Reclamation Development Grant Program (RDGP) 1999 Montana State Legislature Total: $299,443	Geomorphic Analysis (DNRC) Hydraulic Analysis (USGS) Riparian Trend Analysis (U of M) Task Force Project Coordination Grant Administration (PCD)	NA	45,614 103,250 95,000 22,500 22,258	288,622
US Army Corps of Engineers Budget Allocation: Fiscal Year 1999 = 372,000 Fiscal Year 2001 = 650,000 $1,022,000	Physical Features Inventory Hydraulic Analysis Riparian/Wetlands/Land Use Mapping Fish Populations Study Fish Habitat Study Topographic Mapping Wildlife (Bird) Assessment Socio-Economic Assessment HGM Case Study Riparian Trend Analysis Project Coordination	NA	25,700 6,500 29,422 97,536 200,000 180,000 106,000 145,312 5,000 55,000 100,000	980,470 (obligated)
Section 319 Water Quality Grant (#2) Montana DEQ	Task Force Coordinator and Office	3-21-02	58,000	58,000
Local Government Start-up Grant Program ESRI	GIS Software, Arc View program for Task Force Office	NA	5,000 estimated value	NA
HB 223 Conservation District Grant Montana DNRC	Riparian Trend Analysis	9-28-01	6,500	6,500
Watershed Planning Assistance Grant Montana DNRC	Watershed Land Use Assessment	1-31-01	10,000	10,000
Section 319 Water Quality Grant (#3) Montana DEQ	Task Force Coordinator/Coordination of Cumulative Effects Investigation	9-30-02	44,000	44,000
Section 319 Water Quality Grant (#4) Montana DEQ	Task Force Coordinator/Coordination of Cumulative Effects Investigation	NA	122,200	23,714
Regional Geographic Initiative Grant EPA	Geomorphology: Photo Rectification Project	12-20-02	30,000	30,000
STAR Grant EPA	Historic Watershed Land Use	NA	75,000	NA

Table 5. Governor's Upper Yellowstone River Task Force Budget Summary
This table summarizes costs associated with Task Force activities from inception (November 1997) to management recommendation delivery (August 2003).

Component / Task	Costs and Appropriated Funding (1997 - 2003; in dollars)			
	Grant Funding	Match or In-Kind Contribution	Other Funding Sources	Total
1. Park Conservation District Administration				
Park Conservation District Administration (8 or 10% fee)	24,000 (RDGP) 2,944 (319 #1) 4,268 (319 #2) 4,000 (319 #3) 12,200 (319 #4) 3,108 (Start Up) 1,000 (BLM) 483 (223) 1,000 (WPA) 100 (Ed Grant) 3,000 (EPA RGI)	0	0	
Subtotal	**56,103**	**0**	**0**	**56,103**
2. Task Force Project Administration, Coordination, & Management				
Task Force Administration / Operations **Task Force Coordinator (all duties)** **Outreach and Education** Public meetings, tours, workshops. **Data Dissemination/Report Publication** Web site, technical writing/editing, printing, mailings. **Management Recommendation Development**	22,500 (RDGP) 37,056 (319 #1) 53,732 (319 #2) 40,000 (319 #3) 110,000 (319 #4) 900 (Ed Grant) 28,297 (Start Up)	92,999 (TF) 16,000 (State) 33,333 (DNRC) (Note: See *4. General Project Support* for Corps contributions)	0	
Subtotal	**292,485**	**142,332**	**0**	**434,817**
3. Baseline Data Acquisition and Analysis				
Physical Features Inventory	2,100 (WPA)	1,200 (PCD) 8,000 (NRCS)	25,700 (Corps) 7,015 (TF/State) 7,000 (NRCS)	51,015
Aerial Photography	10,000 (HB223)	11,233 (Start Up)	4,500 (State)	25,733

Table 5 continued

Component / Task	Costs and Appropriated Funding (1997 - 2003; in dollars)			
	Grant Funding	Match or In-Kind Contribution	Other Funding Sources	Total
Geomorphic Analysis **Historic Photo Rectification Project**	22,386 (RDGP) 27,000 (EPA-RGI) 27,314 (RDGP)	172,670 (DNRC)	 1,800 (MSU, EPA-STAR) 14,020 (TF, 319)	195,056 70,134
Hydrology/Hydraulic Analysis	108,250 (RDGP)	168,250 (USGS)	60,000 (MDT) 6,500 (Start Up) 6,500 (Corps)	349,500
Topographic/Contour Mapping	0	0	180,000 (Corps)	180,000
NWI Riparian/Wetlands/Land Use Mapping	0	19,500 (USFWS)	29,422 (Corps)	48,922
Riparian Trend Analysis	94,993 (RDGP) 6,017 (HB223)	0	54,900 (Corps)	155,910
Fisheries Analyses **Fish Populations Study** **Fish Habitat Study**	 0 0	 0 205,000 (USGS)	 97,536 (Corps) 200,000 (Corps)	 97,536 405,000
Current Watershed Land Use Assessment	9,000 (WPA)	40,000 (NRCS) 7,950 (GIAC)	0	56,950
Historic Watershed Land Use Assessment	75,000 (MSU, EPA-STAR)	0	0	75,000
Wildlife (Bird) Assessment	0	0	106,000 (Corps) 9,000 (BLM)	115,000
Socio-Economic Assessment	0	6,500 (DEQ)	145,312 (Corps)	151,812
Subtotal	**$382,060**	**$640,303**	**$955,205**	**$1,977,568**
4. General Project Support / Match	0	142,000 (RDGP/Corps) 105,000 (Corps Budget) 3,500 (FWP)	0	**250,500**
Total Project Costs	**$730,648**	**$1,033,315**	**$955,205**	**$2,719,168**

TF = Task Force
FWP = Montana Fish Wildlife and Parks
State = contributions from Montana DEQ, MDT, FWP
RDGP = Reclamation and Development Grant Program
WPA = DNRC Watershed Planning and Assistance Grant
DNRC = Department of Natural Resources and Conservation
MDT = Montana Department of Transportation
EPA = Environmental Protection Agency
USFWS = US Fish Wildlife Service
319 = DEQ Section 319 Water Quality Grant
HB223 = DNRC House Bill 223 Grant
NWI = National Wetland Inventory
Start Up = Task Force Start Up Grant (DEQ)
NRCS = Natural Resources Conservation Service
EPA-RGI = Regional Geographic Initiative Grant (EPA)
EPA-STAR = 2000-STAR Grant (EPA)
Corps = US Army Corps of Engineers
PCD = Park Conservation District
BLM = Bureau of Land Management
USGS = US Geological Survey
GIAC = Geographic Information Analysis Center

Table 6. Governor's Upper Yellowstone River Task Force In-Kind and Match Contributions
This table lists documented in-kind and match contributions made in support of the Upper Yellowstone River Cumulative Effects Investigation to date (December 31, 2002).

Contributor	Estimated Contribution (Dollars)	Study/Activity (1997 – 2002)
Corps	**247,000**	**General Project Support**
GIAC, MSU	**7,950**	**Watershed Land Use Assessment**
Montana DNRC	**33,333** **172,670**	**Coordination/Education/Administration** **Geomorphic Analysis**
Montana FWP	**3,500**	**Research Team / Technical Support**
Montana State Agencies **DEQ, MDT**	**16,000** **6,500**	**Coordination/Education/Administration** **Economic assistance (Socio-Econ Study)**
NRCS	**8,000** **40,000**	**Physical Features Inventory** **Watershed Land Use Assessment**
Park Conservation District	**1,200**	**Physical Features Inventory**
Task Force	**92,999** **11,233**	**Project Coordination and Administration** **Aerial Photos**
USFWS	**19,500**	**Riparian/Wetlands/Land Use Mapping**
USGS-BRD	**205,000**	**Fish Habitat Study**
USGS, Montana District	**168,250**	**Hydrology/Hydraulic Analysis**
Total In-Kind & Match Contribution	**$1,033,135**	

Collaboration and Partnerships

Partnerships and Contributions

The Task Force takes very seriously our charge to establish partnerships and enhance communication amongst the diverse groups who are concerned about the Yellowstone River. With each successive year, we build stronger relationships with groups directly involved with the upper Yellowstone effort, as well as reaching out to other groups interested in learning more about cumulative effects and large river systems. Numerous other agencies and organizations are conducting research studies throughout the Yellowstone River Basin. The Task Force takes every opportunity to share technical information with these groups and will continue to do so in the future.

Task Force Partners—The Task Force structure illustrates how community-led, private/government collaborations provide an ideal approach to watershed management. Community members are empowered and given an opportunity to be a part of the management of their watershed. Regulatory agencies and academics work alongside local citizens, helping to guide the process in a scientifically sound and realistic fashion. Ultimately, management recommendations will be understood and supported by the community, and have practical application for regulatory agencies. Significant contributions have been made by partner agencies within the Task Force structure or those directly involved in the cumulative impact analysis of the Yellowstone River system. Those contributions, shown in *Tables 4* and *6* in the previous section, have been the building blocks for success throughout this project.

Task Force Subcommittees—Given the overwhelming amount of work that is being accomplished and the multitude of decisions brought before them, the Task Force has used specially-appointed subcommittees to add extra energy to particularly difficult or time-consuming issues.

Continuing their advisory role, the Socio-Economic Subcommittee provided significant assistance to the full Task Force and socio-economic research contractor in 2002. The subcommittee members met several times during the year, overseeing the socio-economic assessment team and reviewing the draft final report.

Another active subcommittee in 2002 was the Partnership and Cooperation Subcommittee. This subcommittee evolved out of the Socio-Economic Subcommittee in late 2001. Task Force subcommittee members representing: local landowners, Park Conservation District, Park County, City of Livingston, DEQ, DNRC, and Corps met several times in 2002 to address the development of a Cooperative Agreement (MOU) to be signed by local, state, and federal agencies on the Upper Yellowstone River project. The need for a cooperative agreement had been discussed for more than three years, and with the help of this dedicated team, details were finally worked out over the summer of 2002. A final Cooperative Agreement was signed by all parties in September 2002. The agreement was then brought before the full Task Force and accepted on October 7, 2002.

Three additional subcommittees met briefly in 2002. The first met early in the year to establish a Task Force website.

A second subcommittee was tasked with developing a set of standardized scientific questions that every research team would be asked to address as part of their presentations to the Task Force. The questions were designed to:

1. Provide a consistent basis for comparison for the Task Force/public in receiving/listening to individual research team presentations.
2. Ensure that researchers address/integrate Task Force questions into their presentation.
3. Ensure that research presentations focus on research findings, and what those findings mean and NOT values.
4. Ensure that researcher findings integrate with the Governor's executive order.
5. Address individualized research team presentations.

The full Task Force reviewed the draft questions and approved eight final standard questions in the fall of 2002 (see *Appendix F*). They have been used ever since.

The last special subcommittee appointed was tasked with formalizing a list of topics of consideration (see box below). Based on a 1997 list of issues developed by the full Task Force, this revised and fluid list outlines topics of concern that Task Force recommendations should address.

Task Force Topics of Consideration

Bank Stabilization
GIS Information
Roads and Crossings
Woody Debris
Uses of River and Locations of Use
Flood Plain
Sedimentation and Dredging Permitting
Indicators of a Healthy River
Fires
Plan Development
Fisheries

Upper Yellowstone River Landowners— Upper Yellowstone River landowners are to be praised for their support and cooperation throughout this effort. In addition to donating their time as Task Force members or attending Task Force monthly meetings, more than 700 private landowners have allowed seven Task Force research teams to access their properties to collect data over the past four years. The Task Force could not accomplish a scientifically based investigation without their support, patience, and trust, and we owe these local citizens great thanks.

Full Yellowstone River Cooperation—One other notable development in 2002 has been the strengthening cooperation between the Task Force and the Yellowstone River Conservation District Council (YRCDC). Over the past two years, both groups have made every attempt to share information and work together to benefit all citizens along the Yellowstone River.

The YRCDC was formed in 1999 with the purpose to provide local leadership, assistance, and guidance for the wise use and conservation of the Yellowstone River's natural resources. In much the same way as the Task Force, the YRCDC is working closely with the Corps on a cumulative effects assessment of the Yellowstone River. Given that the Task Force is already intensively studying the upper river, the YRCDC is focusing their efforts from Springdale east, on the middle and lower Yellowstone. The Task Force chair and coordinator have been invited to work with YRCDC members and staff to insure that the two river studies complement each other as much as possible and to exchange technical information. The Task Force fully intends to continue to provide assistance to, and share data with, the YRCDC until our study completion in August 2003.

Photo 38. Mike Merigliano demonstrates how to age a cottonwood tree during an educational workshop for the public. Photo by E. Galli-Noble.

Outreach and Education

Landowner Permission

Because the vast majority of land adjoining the upper Yellowstone River is privately owned, the Task Force feels that it is crucial to keep the public constantly informed of our investigations and actions along the river. In 2002, we contacted approximately 100 private landowners asking permission to access their properties to collect data for four investigative studies. Securing access to collect data was the main purpose for these communications; however, we also used the opportunity (1) to inform property owners about specific study objectives and timelines, (2) to educate them about our overall cumulative effects investigation, and (3) as a community outreach effort, which allowed them the opportunity to ask questions about the Task Force or comment on our river corridor effort.

Community Outreach

The Task Force was invited to do three formal presentations on the Upper Yellowstone Cumulative Effects Investigation in 2002. John Bailey and Liz Galli-Noble co-presented on two occasions in August, to the Federation of Fly Fishers and to the *Park City Utah Summer 2002 Tour* group. In October, the coordinator gave a project presentation to the Great Falls Travel/Conservation Club.

Summer Research Interns—Two Carleton College environmental studies students interned on the upper Yellowstone River project over the summer of 2002. Marc Antinoro and Keith Wolter assisted four Task Force research teams with data collection from June 15 to August 15, 2002. Their enthusiasm and hard work was much appreciated and greatly benefited the overall Task Force effort.

Photo 39. Carleton College student aging cottonwood tree. Photo by E. Galli-Noble.

Photo 40. Upper Yellowstone River tour. Photo by E. Galli-Noble.

Yellowstone River Tours

Educational tours are an important component of our public outreach. In addition to providing technical information to participants, these events also provide an opportunity for local residents to interact with Task Force members, our staff, and research team members. Fostering communication in this way helps to build trust and allows individuals to see river issues first hand.

The Task Force hosted three river tours in 2002. The Task Force chair, John Bailey and others donated their time and energy to make these events informative, visually revealing, and pleasant for our guests. Tour groups included:
(1) Corps Regulatory Branch, Omaha Office on July 23,
(2) EPA Administrator Christie Todd Whitman and her EPA Washington and Denver staff on August 7, and
(3) *Park City Utah Summer 2002 Tour* group on August 15, 2002.

Appendices

Appendix A. Acronyms

Task Force	Governor's Upper Yellowstone River Task Force
BLM	Bureau of Land Management
CD	Conservation District
Corps	US Army Corps of Engineers
DEQ	Montana Department of Environmental Quality
District / PCD	Park Conservation District
DNRC	Montana Department of Natural Resources and Conservation
DNRC-CARDD	DNRC-Conservation and Resource Development Division
DNRC-WMB	DNRC-Water Management Bureau
DNRC-WRD	DNRC-Water Resources Division
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESRI®	Environmental Systems Research Institute, Inc.
FWP	Montana Department of Fish, Wildlife, and Parks
FY	Fiscal Year (used by the federal government: October 1 to September 30)
GIAC	Geographic Information and Analysis Center, Montana State University
GIS	Geographic Information Systems
GPS	Global Positioning System
GYC	Greater Yellowstone Coalition
GYE	Greater Yellowstone Ecosystem
HB 223	House Bill 223 Grant (DNRC)
MDT / DOT	Montana Department of Transportation
MSU	Montana State University
MTCFRU	Montana Cooperative Fisheries Research Unit (MSU)
MWCC	Montana Watershed Coordinator Council
NAWQA	National Water Quality Assessment (USGS)
NEPA	National Environmental Policy Act
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRIS	Natural Resources Information System
NWI	National Wetland Inventory (USFWS)
RDGP	Reclamation and Development Grant Program (DNRC)
RFP	Request For Proposal
SAMP	Special Area Management Plan
Start Up	Task Force Start Up Grant (DEQ)
TAC	Technical Advisory Committee
TMDL	Total Daily Maximum Load (EPA/DEQ)
TNC	The Nature Conservancy
U of M	University of Montana
USDA	US Department of Agriculture
USDI	US Department of the Interior
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
USGS-BRD	USGS-Biological Resources Division
WPA	Watershed Planning and Assistance Grant (DNRC)
YNP	Yellowstone National Park
YRCDC	Yellowstone River Conservation District Council
319 Grant	Section 319 Water Quality Grant (DEQ)

State of Montana
Office of the Governor

Executive Order No. 21-01

EXECUTIVE ORDER CONTINUING THE
GOVERNORS UPPER YELLOWSTONE RIVER TASK FORCE

WHEREAS, the upper Yellowstone River and its tributaries, herein defined as that reach of the river (including tributaries) beginning at the Yellowstone Park boundary and extending downstream to the bridge crossing the river at Springdale, is a national treasure; and

WHEREAS, the recreational opportunities provided by the river provide significant contributions to Montana's economy; and

WHEREAS, the river is essential to Montanans who live along it, providing water for agricultural, domestic and commercial purposes; and

WHEREAS, the extreme floods of 1996 and 1997 created hardships for communities and Montana citizens who live adjacent to the river, causing damage to property and stream banks, as well as some nationally-renowned spring creeks in Paradise Valley; and

WHEREAS, previous decades of work done along the river for

purposes of flood control, construction of transportation corridors and other purposes have altered the natural flood plain of the river, with the potential to exacerbate damage to private and public property and fish habitat; and

WHEREAS, there is a need for a more comprehensive planning effort involving citizens, communities, and government agencies that have an interest in the upper Yellowstone River to ensure that future projects that affect the river are planned and conducted in a manner that will preserve the integrity, beauty, values, and function of the upper Yellowstone River for Montanans now and in the future.

NOW THEREFORE, I, JUDY MARTZ, Governor of the State of Montana, by virtue of the authority vested in me, do hereby continue the Upper Yellowstone River Task Force.

I. PURPOSE

A. The Upper Yellowstone River Task Force shall:

1. Provide a forum for the discussion of issues that effect the Upper Yellowstone River basin, particularly, to bring together landowners, sportsmen and sportswomen, and community leaders to develop a shared understanding of the issues and competing values and uses that impact the Upper Yellowstone River;

2. meet on a regular basis, the frequency to be determined by Task Force members, for the purpose of encouraging a comprehensive approach to action taken

along the Yellowstone River to ensure that its integrity remains intact while balancing the needs of communities and landowners to protect property;

3. seek or encourage others to seek grants, funds or other cooperative arrangements to implement recommendations of the Task Force; and

4. prepare an annual report to the Governor on the progress of the task force.

II. COMPOSITION

The Upper Yellowstone River Task Force shall be composed of no more than 12 voting members including representatives of the following: local businesses, property owners, farmers and ranchers who live along the river, the angling community, a conservation group or groups, Park County, the City of Livingston and the local Conservation District. Representatives of the Army Corps of Engineers, Departments of Natural Resources and Conservation, Environmental Quality, Fish, Wildlife & Parks, and Transportation shall serve as ex-officio members.

III. DURATION

This Task Force shall remain in existence for two years from the date of effect unless extended or terminated by subsequent Executive Order.

This Order is effective immediately.

GIVEN under my hand and the GREAT SEAL of the State of Montana, this 21st day of August, 2001.

Judy Martz

JUDY MARTZ, Governor

ATTEST:

Bob Brown

BOB BROWN, Secretary of State

Appendix C. Governor's Upper Yellowstone River Task Force Ground Rules

2002 – 2003 Term

Participation

1. The discussions of the Upper Yellowstone River Task Force will include the perspectives of individuals and organizations whose interests may be affected by the recommendations or activities of the Task Force.

   Voting Task Force members represent the following interests:
   - Local businesses
   - Property owners
   - Ranchers
   - Angling community
   - Conservation groups
   - Park County
   - City of Livingston
   - Park Conservation District

   Ex-officio members of the Task Force represent the following government agencies:
   - Montana Department of Environmental Quality
   - Montana Department of Fish, Wildlife and Parks
   - Montana Department of Natural Resources and Conservation
   - Montana Department of Transportation
   - US Army Corps of Engineers
   - National Park Service—Yellowstone National Park
   - US Forest Service—Livingston Ranger District
   - US Forest Service—Gardiner Ranger District

The Task Force will actively encourage the inclusion of a variety of perspectives in the following ways:

a) Members will candidly identify and share their values and interests and will do so as soon as possible.

b) Members will inform their constituency of the activities of the Task Force, seek the advice of their constituency and make every effort to speak for their constituency.

c) The Task Force will invite individuals with perspective not represented by members to discuss their views with the Task Force.

d) Task Force meetings will be open to the public. Individuals may request time on the Task Force agenda to discuss their concerns.

e) Notice of meetings will be provided to the news media.

f) A mailing list will be established and, upon request, individuals will receive notices of upcoming meetings and summaries of previous meetings.

g) The Task Force will hold special meetings at different locations, when needed, to share information and gather ideas, comments and concerns about Task Force proposals.

h) The Task Force will periodically prepare a summary of its activities and distribute this summary to the news media and individuals on the mailing list.

i) Task Force members agree to make every effort to attend every meeting. If a member is unable to attend a meeting, he or she may make arrangements for an alternate to attend the meeting, but should ensure that the alternate is fully informed of the issues under consideration and progress to date.

Decisions/Agreements

1. The Task Force will seek consensus agreements regarding policy decisions and recommendations. Consensus is defined as acceptance of an agreement. Members may not agree with all aspects of an agreement; however, they do not disagree enough to warrant opposition to the agreement. When Task force members accept an agreement, they commit themselves to implementing the agreement.

2. Participants who disagree with a proposal are responsible for offering a constructive alternative that seeks to accommodate the interests of all other participants.

3. Business or monetary decisions may be made by a voice vote of a majority (seven voting members) of the Task Force. The Chair may vote.

Communication with the Media

1. The Chair will be the spokesperson for the Task Force in communications with the media.

2. Each participant is free to speak to the media regarding their own view on the work of the Task Force. No participant may characterize the views of other participants expressed in this process to the media or in other forums.

3. With the exception of notices of meetings or events, written statements distributed to the news media will be reviewed by the Task Force.

Roles and Responsibilities

1. The Task Force Chair, will serve as the contact person for the Task Force and liaison with government agencies. The Chair, with the consent of the Task Force, is responsible for conducting and calling meetings, clarifying voting issues and appointing subcommittees, and providing direction to the Task Force Coordinator.

2. The Vice-Chair will assume the duties of the Chair in his absence.

3. The Coordinator will: help the participants design an appropriate process; coordinate pre- and post-meeting logistics; prepare documents to maintain an objective record of the process, including meeting summaries and annual and final reports; distribute agendas and meeting summaries; encourage everyone to participate; and moderate discussions as needed. The Coordinator is nonpartisan and is not an advocate for any particular interest or outcome.

Technical Advisory Committee

The overall goal of the Technical Advisory Committee (TAC) is to provide recommendations to the Task Force when requested based on the results of the scientific investigations. The TAC is given both broad direction and specific missions by the Task Force, and has the flexibility to determine how best to accomplish its job. The TAC has no authority to make policy decisions or recommendations on behalf of the Task Force; its role is to work as directed by the Task Force to ensure:

- The right questions are asked;
- The best approach and methods are used to answer questions;
- The data collected are objective, defensible, and trustworthy; and
- The answers provided are understandable and relevant.

Appendix D. US Army Corps of Engineers, Regulatory Guidance Letter 86-10

SUBJECT: Special Area Management Plans (SAMPS)

DATE: October 2, 1986 EXPIRES: December 31, 1988

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1. The 1980 Amendments to the Coastal Zone Management Act define the SAMP process as "a comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies, standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone." This process of collaborative interagency planning within a geographic area of special sensitivity is just as applicable in non-coastal areas.

2. A good SAMP reduces the problems associated with the traditional case-by-case review. Developmental interests can plan with predictability and environmental interests are assured that individual and cumulative impacts are analyzed in the context of broad ecosystem needs.

3. Because SAMPs are very labor intensive, the following ingredients should usually exist before a district engineer becomes involved in a SAMP:

a. The area should be environmentally sensitive and under strong developmental pressure.

b. There should be a sponsoring local agency to ensure that the plan fully reflects local needs and interests.

c. Ideally there should be full public involvement in the planning and development process.

d. All parties must express a willingness at the outset to conclude the SAMP process with a definitive regulatory product (see next paragraph).

4. An ideal SAMP would conclude with two products: 1) appropriate local/state approvals and a Corps general permit (GP) or abbreviated processing procedure (APP) for activities in specifically defined situations; and 2) a local/state restriction and/or an Environmental Protection Agency (EPA) 404(c) restriction (preferably both) for undesirable activities. An individual permit review may be conducted for activities that do not fall into either category above. However, it should represent a small number of the total cases addressed by the SAMP. We recognize that an ideal SAMP is difficult to achieve, and, therefore, it is intended to represent an upper limit rather than an absolute requirement.

5. Do not assume that an environmental impact statement is automatically required to develop a SAMP.

6. EPA's program for advance identification of disposal areas found at 40 CFR 230.80 can be integrated into a SAMP process.

7. In accordance with this guidance, district engineers are encouraged to participate in development of SAMPs. However, since development of a SAMP can require a considerable investment of time, resources, and money, the SAMP process should be entered only if it is likely to result in a definitive regulatory product as defined in paragraph 4 above.

8. This guidance expires 31 December 1988 unless sooner revised or rescinded.

Appendix E. Socio-Economic Assessment Summary Report

Note: *This report was written by BBC Research and Consulting and presented to the Task Force prior to the Socio-Economic Assessment presentation on November 5, 2002.*

DRAFT, 11/05/02

Introduction

In collaboration with the Governor's Upper Yellowstone River Task Force, the U.S. Army Corps of Engineers contracted with BBC Research & Consulting (BBC) to conduct a socioeconomic assessment of the Upper Yellowstone River Valley in 2002. This work is one of many studies that will contribute to the Corps' Special Area Management Plan and the Task Force's decision and recommendation process for the Montana Governor. BBC initiated data collection for this process in February 2002 with a public meeting to engender input from the stakeholders in the study area. BBC completed data compilation in September 2002 with another public meeting to review the assessment's preliminary results. The socioeconomic research and analyses conducted during that period are documented in individual Task Reports (1-7), which will be included in the draft final report for review.

Study Objectives

This study is intended to provide a socioeconomic portrait of the Upper Yellowstone River Valley. The Task Force and Corps set out the following objectives for the Upper Yellowstone River Socioeconomic Assessment:

- Identify recent and longer-term historical trends in social values and cultural heritage and resources.
- Identify present key stakeholder groups and the special interests they represent.
- Assess current social values of stakeholders for the management of the study area.
- Assess current cultural values and resources of stakeholders.
- Establish a baseline characterization of the current economic and demographic activity within the study area, with focus on economic and demographic trends, changes in public services and displacement of farms.
- Describe changes in land use and land use plans in recent years to provide a baseline picture of past trends.
- Depict current and historic management actions on the Upper Yellowstone River, with a focus on institutional frameworks, bank stabilization projects, water rights and irrigation uses.
- Consider the secondary by-products of growth and change in the study area by assessing potential change to the character of the resident population with changes in the elements of local quality of life.
- Describe the existing 404 permit process and project what might be expected for social and economic conditions in 2025 if current river management protocol remains as it stands today.
- Provide ample opportunity for the public to give input into the socioeconomic assessment process.

Based on early tasks, the Corps and BBC determined that economic values should be assessed and that the assessment of social and cultural values should be combined.

Methods

BBC implemented the following methodology for the socioeconomic assessment:

Task 1 — Historical Overview. BBC collected secondary data, including all the published histories about Park County, from the Park County library, Park County Historical Society, Montana State University Library and State Library in Helena. BBC interviewed local historians for firsthand accounts of local history to help synthesize the material into a coherent story of the study area. Various government agencies offered background about river management and other issues.

Task 2 — Stakeholders. BBC interviewed 37 local stakeholders through in-depth, 90-minute-plus meetings. BBC compiled these interviews into a report on the identified stakeholder groups and their views on the river.

Tasks 3 & 4 — Economic and Social/Cultural Values. BBC designed and carried out three surveys during summer 2002. The first was a telephone survey of Park County households. We completed 364 surveys out of a population of 6,828 households, producing survey results with a 95 percent confidence level. BBC also conducted a personal, door-to-door survey of 176 businesses in Park County. There are roughly 2,160 businesses in the county, implying that BBC's business survey results are accurate to at least the 90 percent confidence level. Finally, BBC surveyed 288 visitors to Park County out of an estimated population of visitors at the time of 70,000. These survey results are accurate at the 90 percent confidence level. These survey results were cross-tabulated and compared with one another to reveal a picture of values in the study area.

Task 5a — Local Economic Trends. BBC collected secondary data from federal, state and local government sources and interviewed local experts in planning, agriculture, economics and real estate to paint this picture of the local economy and demography. We analyzed and interpreted these data using descriptive techniques.

Task 5b — Land Use. BBC gathered land use data from public sources and interviewed local experts in planning, agriculture and real estate to depict land use in the study area.

Task 6 — Historic and Current River Management. BBC relied heavily on government sources for the information in this task. Federal, state and local agencies provided secondary data on water rights and uses and irrigation. BBC interviews with government officials also offered insight into the institutional frameworks of the various public agencies that manage the Upper Yellowstone River.

Task 7a — Quality of Life. BBC used the Tasks 1 through 4 reports as sources of information and insight into the elements of quality of life in the study area most potentially affected by river management.

Task 7b — 404 Permit Process and No-Action Scenario. BBC gathered data from the Corps on its 404 permit process. BBC used established forecasting techniques to draft its look into the social and economic conditions that might exist in the study area in 2025 if the current river management regimen does not change.

Task 8 — Identification of Preliminary Issues. BBC used its work in the previous seven tasks to draft this summary report that summarizes the socioeconomic assessment and identifies the major preliminary issues.

Task 9 — Public Participation. Two public meetings, stakeholder interviews and surveys of residents, businesses and households were conducted.

Results

A summary of the results by task is offered below.

Task 1 — Historical Overview

- Residents of Park County, from the original American Indians to today's inhabitants, have valued the river for many reasons, including drinking water, transportation, recreation and contributions to the scenery.

- The economy of Park County has evolved with the ebb and flow of different industries, including ranching, mining, timber, railroad transportation and tourism. Ranching has been a constant, while tourism is on the ascendancy as of 2002.

- Current land use patterns are the result of the economic evolution and movement of people in and out of the area over time.

- The communities of Park County have been strong and civically oriented from the beginning. Traditionally, ranchers have played and continue to play an important role in community leadership.

- Flood and erosion management along the Upper Yellowstone River have existed since white settlement, and most bank stabilization has occurred in the section of the river between Emigrant and Livingston. Floods have traditionally stimulated periods of bank stabilization efforts and installations of new structures on the river.

Task 2 — Stakeholders

- The stakeholder interview process and the perceptions gained from it suggest that there are a number of different stakeholder groups within the study area. They have different views about use of the Yellowstone River, threats to the river, management viewpoints and underlying basic values.

- The stakeholders came closest to agreement in their concern about overuse as a threat to the Upper Yellowstone River.

- There are contradictory views among stakeholder groups concerning the benefits of riprap and river management, subdivisions along the river, cattle grazing and lesser issues.

- There is widespread recognition of the importance of the Yellowstone River to the area and some recognition of the need to compromise to achieve a good management system.

Task 3 — Economic Values

- The water level in the river was considered important to the economy, and droughts were perceived as more negative than floods. When visitors thought about water levels in 2002, they viewed them as a positive part of their visitor experience generally.

- The household and business surveys indicated that locals perceived tourists, ranchers and longtime residents as important to the Park County economy. River-related and other tourist-related businesses were also considered important economic contributors. Spring creeks were not well understood by residents or businesses. New and seasonal residents were viewed as generally less important to the economy than the other groups.

- Both households and businesses more often than not believed that property owners should not have a right to subdivide and build in the floodplain. Visitors had mixed views on this issue.

- Using manmade structures, such as riprap, levees and dikes, to protect private property was supported by the majority of residents and businesses, though 30 percent disagreed. Less than half the visitors were opposed to these structures, and existing structures have generally not detracted from the visitor's experience.

- Residents and businesses perceived the river as being vitally important to the economy as an amenity to local quality of life, which attracts and holds residents and businesses. The river is also a central, valuable part of the visitor's experience.

- Residents and businesses perceived overuse of the Upper Yellowstone River as a major problem, but visitors did not agree.

- Residents and businesses agreed, and visitors confirmed, that riverbank vegetation is a vital part of the river and visitor experience. Scenery along the river generally contributes very positively to the visitor experience.

- Fishing, whitewater, the wild and undeveloped feel of the river, relatively little manmade noise, adequate public access, and the presence of ranching all contributed positively to the visitor experience.

- Residents and businesses generally agreed that management of the Upper Yellowstone River for flooding and erosion is the best thing for the overall economic and social well being of the county. Visitors believed that an unmanaged, free-flowing river is best.

- More households and businesses agreed than disagreed that prior river management — defined in the surveys as dikes, barbs, riprap, etc. — has been ineffective and inconsistent.

- And the best news is that if tourists could plan their trip over again, they would stay longer in Park County.

Task 4 — Social/Cultural Values

- Ranchers and longtime residents were perceived to be the most important groups contributing to the Park County social and cultural environment. Tourists, new permanent residents, and river-related and other tourist-related businesses were also viewed as making important contributions. Seasonal residents and spring creek related activities were seen as less important.

- Residents appreciated the contribution tourists make to the community through their patronage of local activities, arts, and cultural enterprises, and through the cultures and customs they bring with them.

- The beauty of the Upper Yellowstone River is paramount in its contributions to Park County quality of life.

- Fishing and other river-related recreational activities, like rafting and floating, are very important components of the quality of life here in Park County.

- Even though the river contributes much to the quality of life here through recreation and creating a beautiful place in which to live, residents were divided as to whether it is the single most important physical element of the community.

Task 5a — Local Economic Trends

- Park County's population and housing stock are growing, but almost all growth is occurring outside Livingston in more rural areas of the county. Minimal annexation around Livingston and a preference for rural lifestyles likely explain this phenomenon.
- Accounting for about eight percent of the total population, seasonal residents are a notable economic presence in the county.
- Personal incomes have risen quite substantially in the past 30 years; most growth has occurred in the nonfarm sectors. The greatest increase has come from dividends, interest, rent and transfer payments, which are disproportionately high in Park County as compared with the State of Montana.
- Tourism is clearly the strongest element of the Park County economy in 2002, generating sales, jobs and income for many residents and businesses.
- Ranching in 2002 is a relatively modest, stable component of the Park County economy. However, ranching is still important to Park County, generating income and earnings for hundreds of ranchers, their employees and their families and spreading secondary effects of local spending throughout the area.
- Out-migration of longtime ranchers is based upon increasing land prices ($25,000 to $35,000 per animal unit). High land values make it advantageous to relocate ranches to cheaper locales or for retirement. This may prompt concern on the part of local residents who value ranchers' contributions to the community, history and attractiveness of the area.

Task 5b — Land Use

- Residential development and land use change in the river valley is considered somewhat of a threat to the quality of life, but visitors do not see it as detraction yet. In fact, change has been rather slow historically.
- Park County and the Upper Yellowstone River study area have experienced changes in land use patterns in the past 30 years. Population density changes, coupled with land use maps, point to moderately increased urbanization.
- Wealthy, out-of-state landowners are replacing Montana ranchers. Large land parcels are remaining intact or growing larger, while some smaller parcels have been subdivided to make room for 5-, 10-, 20- and 40-acre parcels for residential development.
- Subdivisions have centered along the Upper Yellowstone River and its tributaries and along local infrastructure such as roads and communications lines. This development has supplanted some shrublands, grasslands and forestlands.
- The river corridor clearly has the greatest potential for growth, given the subdivided parcels there, but the entire study area has some growth potential depending upon infrastructure development. Infrastructure is one major limiting factor but is also a causative growth factor in Park County.
- National and local economic conditions will drive development. If the economy booms again, there will be increased demand for second homes in the Paradise Valley. If the economy slows down, residential growth will slow, as well.

Task 6 — Current and Historic River Management

- Physical modifications to the course of the river are primarily regulated by a combination of the USACE (at the federal level), MTDNRC (at the state level) and PCD (at the local level). Historic changes to the river were regulated by transportation or agricultural departments or not at all.
- The volume of water and diversions from the river are principally regulated by MTDNRC.
- Floodplain development and modifications are regulated primarily by local floodplain managers implementing state and federal requirements while considering local circumstances.
- As of 1998, for the Gardiner to Springdale river corridor, nine percent of the riverbank was riprapped, and there were more than 100 rock barbs and an additional 100 rock jetties. Eroding banks were estimated at 12 percent of the total riverbank in the study area.
- The changes in rock jetties and barbs were substantial between 1987 and 1998, although riprap also increased somewhat. The largest change occurred from Pine Creek Bridge to Carters Bridge.
- There are 2,277 active water rights in the study area; agriculture and stock watering account for 86 percent, while fish, wildlife and recreation purposes account for 5 percent of the rights granted. The remaining nine percent is domestic use, lawn and garden use, mining, power generation, industry, commerce, municipal use and fire protection.
- The total quantified rights amount to 2.2 million acre-feet per year and of this, 1.53 million are dedicated to fish, wildlife and recreational purposes mostly held by Montana Fish, Wildlife and Parks Department.
- Consumptive use for hay is about 25 inches per acre per year. Four acre-feet must be diverted to supply an acre-foot of consumptive use to study area crops.

Task 7a — Quality of Life

This task report brings together other elements of the socioeconomic study into a quality of life assessment for the study area. Aesthetics, scenery and recreation are widely recognized as central elements of the Upper Yellowstone River Valley quality of life, and the river itself plays an indispensable part. Noise is not a negative aspect of the local quality of life. Residential development and land use change in the river valley is considered somewhat of a threat to the quality of life, but visitors do not see it as a detraction yet. In fact, change has been rather slow historically. The displacement of ranching and others is also a moderate concern, and it is proceeding slowly.

Task 7b — 404 Permit Process and No-Action Scenario

The Corps' 404 permit process is described in a number of websites in detail. The no-action scenario assumes that conditions that existed during the 1990-2000 period will continue through 2025.

Synthesis

The individual findings from this study can be synthesized to bring meaning or clarity to the socioeconomic portrait of the Upper Yellowstone River Valley.

A comparison of issues, perceptions and realities. The survey and interview results from Tasks 2, 3 and 4 yielded certain issues that can be compared with the factual information from Tasks 5 and 6 (see Exhibit 8-1 on the following page).

Park County is highly sensitive to change. A pattern throughout the study was an apprehension about change. Some viewed change as a threat. Examples of these change anxieties are found in Exhibit 8-2 on page 9.

Exhibit 8-1.
Stakeholder Issues, Perceptions and Reality

Stakeholder Issue	Residents' View	Businesses' View	Visitors' View	Conclusions from data
Lower or higher than normal water levels affect businesses and community	Agree, normal best	Agree, normal best	Liked water level in 2002	Water level in 2002 was near average
Subdivision and building in floodplain a concern	Agree, building bad	Agree, building bad	Mixed perceptions	Subdivision already occurred; development increasing modestly along river
River important for bringing new people to area	Agree	Agree	N/A	New residents and businesses coming
River and visitor experience intertwined and vital to area	Agree	Agree	Agree	Tourism is increasingly important
Overuse of river a concern	Agree	Agree	Disagree	Use is increasing; limit unknown
Riverbank vegetation important to river experience	Agree	Agree	Agree	Vegetation analyzed in separate study
Scenery vitally important to residents and visitors	Agree	Agree	Agree	Undeniable scenery values
Fishing, whitewater, "wild feel," little noise, good access, ranching character important to visitor experience	N/A	N/A	Agree	Visitor experience increasingly important to economy, linked to river
Fishing and river recreation important to quality of life	Agree	Agree	N/A	Resident river recreation increasing
River single most important element of economy, community	Mixed	Mixed	N/A	River central to the economy
Flood/erosion management best for County	Generally agree	Generally agree	Disagree	Conclusions pending integrated study results
Prior management not consistent or effective	Agree	Agree	N/A	Many agencies managing river
Flood management structures a concern	Mixed	Mixed	Not affected much as of 2002	River management structures increasing
Ability to manage for floods a concern	Needed; mixed	Needed; mixed	Generally disagree	Conclusions pending integrated study results

Source: BBC Research & Consulting.

Exhibit 8-2.
An Examination of Change Anxieties among Park County Residents

Nature of change	Catalyst for change	Study observations
Changing economy	Economics	Economy is evolving toward retail trade and services
Influx of newcomers	Economics, attractiveness of area	Newcomers bring pluses and minuses with them
Rural residential development	Economics, lifestyle preferences	Most development is rural residential, and most is spurred by outsiders and wealth, "too much" is relative
Ranchers declining in economic importance, what happens to community?	Economics, lifestyle preferences	Ranchers are leaving slowly, have been important part of community, and can continue if connected with tourism
Tourism is precarious	Economics, visitor preferences	Tourism is the single most important economic sector; susceptible to many influences
Increasing use of the river	Economics, visitors, new residents	Use is increasing steadily, "too much" is relative
River increasingly important to quality of life and economy	Tradition, economics, new residents, tourism	Tourism is increasingly important to the economy, river vital to tourism, new residents appreciate river
River losing "wild feel"	Increased use, development	River usage is increasing, development is occurring along the river, "too much" is relative
Floods and drought wreck havoc	Natural cycles	Floods and droughts happen, but what should be done?
Increased river management	Floods, drought, overuse	Floods have always occurred and spurred management/river modification

Source: BBC Research & Consulting.

Behind these fears is a well-founded belief that the beauty and physical attributes of the area are the dominant component of quality of life and economic well being in the study area. Anxiety can come from seeing changes in other places in Montana, like Bozeman, Big Sky or other river valleys. "Things are just starting here." In fact, change has been relatively slow thus far.

River management and socioeconomic issues. The ultimate purpose of this socioeconomic assessment was to compare all the ways in which the residents, businesses and visitors of Park County view and value the Upper Yellowstone River versus the realities of that river and its role in the county's economy and community. The final step was then to overlay river management on those perceptions and realities and discuss how it potentially affects that picture.
Where does river management intersect with socioeconomic issues? Socioeconomic issues potentially affected by a change in river management are enumerated in Exhibit 8-3 below.

Exhibit 8-3.
Issues and Perceptions Affected by Flood and Erosion Management

Issues and perceptions
Preservation of income sources from river or spring creeks, subsequent family viability
Erosion prevention for protection of ranchlands or homes
Maintenance of riverside property values through protection, ability to build
Change to natural environment (i.e., management) bad for economy
Continued cattle grazing along riverbanks
Beauty of river valley affected by river management
Management affects "wild feel" of river, important to visitors and residents
Weeds spread by uncontrolled floods
Viability of fishery potentially impacted by management
Management inconsistent, ineffective, no overall plan
Erosion of gravelbanks threatens river integrity
River management and land use planning affect one another
Private property rights can supersede public right to river enjoyment, integrity
All property owners (private, ranchers, State, Federal) treated equally
River and environmental quality biggest attraction to area for visitors, new residents, old residents
Fishing, whitewater experience threatened by river management

Source: BBC Research & Consulting.

History revealed that the Upper Yellowstone River has been a vital component of life in the study area from the start. It provided food and drinking water, transportation and a vital element of a beautiful place in which to live. These values were intimately connected to both the economy and the community, bolstering settlement and growth and creating a quality of life that kept many families in the area for generations. Management of the river also played a role in the economy and community from the start. Floods threatened towns and settlements and eroded ranchland on the riverbanks. Residents riprapped the river, built bridges that created bottlenecks for river flow and raised levees to prevent flooding.

Current stakeholders, residents, businesses and visitors revealed that they believe the Upper Yellowstone River is not only vitally important to their economy and community but is also a great concern to them in many ways. They

understand that the river supports many river-related businesses directly and contributes to the economy by encouraging tourism. They perceive ranchers as very important to the economy and community, and the river provides ranchers much of their crucial irrigation water. They believe that the river contributes to the local quality of life through its scenery and recreation. This quality of life, they reckon, does much to attract and keep new residents and businesses.
Stakeholders, residents, businesses and visitors were also concerned about the river in its vital role in the economy and community. They fear rural and riverside residential development is slowly degrading the scenic and recreational values of the river that are so vital to the economy and local quality of life. They worry that too many residents and visitors are using the river for fishing, floating and rafting and that the overuse will drive away the tourism that has become vital to the economy. They are concerned that cattle grazing on the riverbanks degrades riparian vegetation and impairs the river experience.

And it is in their concerns for the river and the economy and community that river management arises as a major issue. Stakeholders, residents, businesses and visitors believe that river management is beneficial because it protects homes, land and spring creeks that are critical, up to a point, to the families, businesses and ranchers that depend on them. Many believe that being able to protect one's property using river management techniques is an imperative right to be protected. At the same time, others fear that riprap and levees degrade the scenic value and wild feel of the river and threaten the integrity of the fishery. Both elements of the river are fundamental parts of the area's tourism industry, and in fact, stakeholders indicated that the area's aesthetic quality is indisputably valuable.

Rural and riverside residential development are occurring and are changing the landscape along the river. Visitors revealed, however, that growth is not yet significantly affecting the river experience. The same is true of river management structures. Though some locals fear that riprap and levees are degrading the river experience, visitors overall did not notice them negatively affecting their river encounters. Overuse of the river is an important concern, but its relationship to river management is tenuous at best.

The facts about river management speak to stakeholders', residents', businesses' and visitors' concerns about the riprap, levees and barbs in the study area. Roughly, nine percent of the river is riprapped, and there are several hundred barbs and jetties. What the facts do not do is determine whether that amount of river management is too much, just right or not enough. Perceptions of river management only meet the reality of the existing structures.

Appendix F. Standardized Questions
Format for Research Team Presentations to the Task Force

The Task Force approved these questions on August 20, 2002.

QUESTIONS:

IN RELATIONSHIP TO YOUR STUDY….

1. Recognizing your study's budget and time constraints, how comprehensive are your data relative to the Task Force study area of the Yellowstone River?

2. Have you found significant differences in your results relative to different geomorphic sub-reaches of the Task Force study area of the Yellowstone River? Why? Why not?

3. How important is the connectivity between the floodplain and river in the interpretation of your data?

4. How have the resources you studied in the Upper Yellowstone River changed over the last 50 to 300 years?

5. Are there any particular river conditions—natural or anthropogenic—that your results indicate are important stressors on the river processes that you studied?

6. Recognizing the short-term nature of your study, do you think that the condition of Upper Yellowstone River Watershed—for example, its vegetation cover, recent drought, altering events such as fires, timber cutting, grazing, and residential development—have influenced your research results, relative to the river processes you studied?

7. What portion of your results do you see integrating with results of other Task Force studies?

8. What other questions were raised by your research?

NOTE:
These questions will be given to the research teams in advance of their presentations to the Task Force. These questions will be posted on the Task Force website.

Researchers will be encouraged to incorporate answers to these questions into their presentations. If any of these questions are not addressed by the researcher during the presentation session, Task Force members will directly ask them during the questions session.

EXISTING SIDEBOARDS:
Follow Task Force-approved October 2001 TAC Protocol

PURPOSE OF STANDARDIZED FORMAT (QUESTIONS):
1. Provide a consistent basis for comparison for the Task Force/public in receiving/listening to individual research team presentations.
2. Ensure that researchers address/integrate Task Force questions into their presentation.
3. Ensure that research presentations focus on research findings, and what those findings mean and NOT values.
4. Ensure that researcher findings integrate with the Governor's Executive Order establishing the Task Force.
5. Address individualized research team presentations (recognizing that the final closeout panel will have a different

set of questions linking all studies together).

500 copies of this public document were printed at a cost of $2.19 per copy, for a total cost of $1,095.00.

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