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REPORT ON
UPPER LARAMIE RIVER
STORAGE PROJECTS - LEVEL II
EXECUTIVE SUMMARY

VOLUME I
STREAMFLOW MODELING

February 1, 1993

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Submitted To:

Wyoming Water Development Commission
Herschler Building
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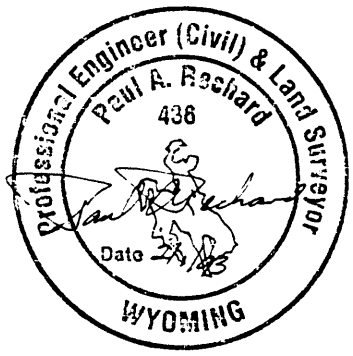

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1.0 INTRODUCTION

1.1 Background

Portions of the Upper Laramie River Basin have been irrigated since Wyoming was a territory. There are numerous water rights held by irrigators on the Laramie Plains and by the Wheatland Irrigation District. Historically, relationships between the entities utilizing water from the basin have often been contentious. However, recently, the Pioneer Canal - Lake Hattie Irrigation District and the Wheatland Irrigation District have been discussing the possibilities of cooperating even including the idea of storing a portion of Wheatland Irrigation District's water rights in Lake Hattie and allowing Lake Hattie to fill out of priority. Thus, the two major competing entities have indicated a willingness to cooperate and look towards an improved operation and management of the water available in the Upper Laramie River Basin. This study and report are intended to facilitate that cooperation.

1.2 Authorization

In 1991 The Wyoming Water Development Commission (WWDC) completed a Level I Investigation of water management and development opportunities in the Upper Laramie River Basin (States West Water Resources Corporation, 1991). That study recommended further investigation of several opportunities for improving the water utilization within the basin.

Therefore, the 1992 Wyoming Legislature authorized the WWDC to conduct a Level II Upper Laramie River Storage Project Study. The WWDC selected Western Water Consultants, Inc. (WWC) to undertake the investigation. The purposes of this study are to analyze water development and water management options for the Upper Laramie River Basin including

assessment of water storage alternatives for the City of Laramie, the Pioneer Canal-Lake Hattie Irrigation District, and the Wheatland Irrigation District. In addition to water storage alternatives, water rights issues, water storage and delivery policies, and infrastructure requirements are examined.

Specific objectives of the investigation include:

- Develop a detailed computer model of surface water hydrology and water rights of the Upper Laramie drainage to analyze water transfer and storage alternatives and assess potentials for improved water management in the basin;
- Assess the best procedures whereby the City of Laramie can make maximum use of its surface water rights, including potentials for reservoir storage alternatives;
- Investigate the feasibility of constructing a reservoir on the Laramie River below the existing Wheatland Reservoir No. 2 at the Dodge site based on the suitability of the site, estimated construction costs, and the degree to which evaporation would be reduced if this reservoir were constructed.

1.3 Project Location

The Upper Laramie River Basin is located in southeastern Wyoming and north-central Colorado. The drainage area, measured at the gaging station below Wheatland Reservoir No. 2 (at the Dodge Ranch) is 2,248 square miles, of which 606 square miles is non-contributing. The study area consists of all of the Laramie River Basin above the Wheatland Irrigation District's diversion tunnel to Bluegrass Creek. A map of the basin is presented on Figure 1-1.

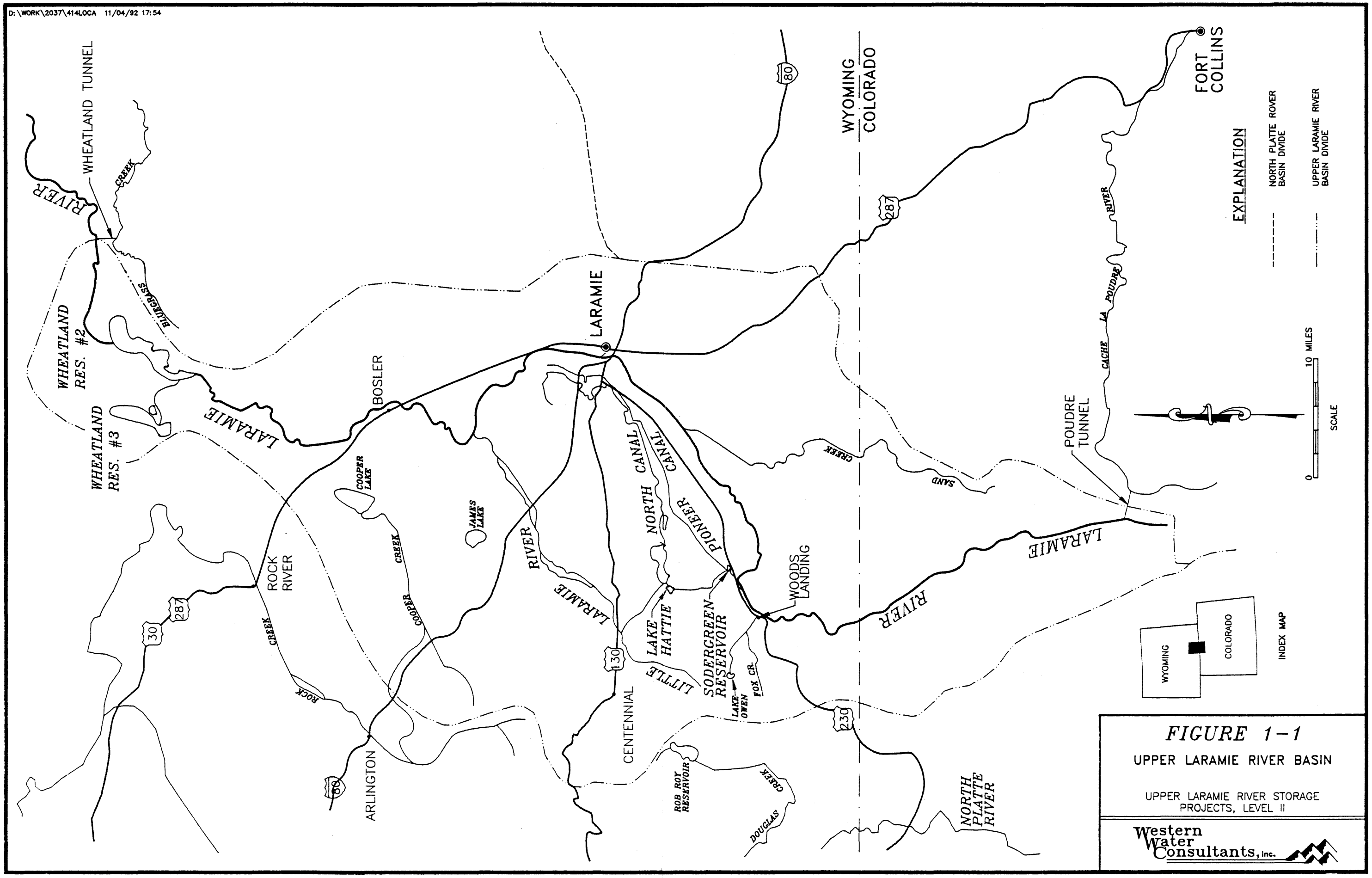

FIGURE 1-1

UPPER LARAMIE RIVER BASIN

UPPER LARAMIE RIVER STORAGE PROJECTS, LEVEL II

Western Water Consultants, inc.

2.0 WATER RESOURCES MODELING

2.0 WATER RESOURCES MODELING

2.1 Model Description

A water rights accounting model of the Laramie and Little Laramie Rivers was developed to analyze water transfer and storage alternatives to improve water management within the area. The model used is the Wyoming Integrated River System Operation Study (WIRSOS), a model that has been successfully applied to other rivers in Wyoming to address similar water resource issues. The model incorporates all surface water rights, irrigation uses, diversions, storage reservoirs, consumptive use of diversions and return flows, conveyance losses, tributary inflows, and ground-water contributions or depletions from streamflow.

The Upper Laramie River Basin model covers the area from the gaging stations, Laramie River and Pioneer Canal near Woods on the Laramie River and the Filmore gage on the Little Laramie River downstream to and including the Wheatland Tunnel Diversion. While it is recognized that the Laramie - Poudre Tunnel in Colorado has a significant impact on the Laramie River flows, the model was not extended upstream to include the diversion. The amount of water taken to the Poudre River is reflected in the recorded flows at the gage near Woods and since the diversion amounts will probably not change, it was concluded that the upstream point should be the gaging station. Likewise, there is considerable irrigated land above the Filmore gaging station. However, there are no streamflow data above the gage so it was concluded that the gage records at Filmore would reflect the best estimate of water available at that point. The model was initially calibrated to reproduce flows recorded

from 1951 to 1960, a ten year period of record. This calibration was then verified for the ten year period 1961 to 1970. These two time periods were selected for model calibration and verification because they provide the most complete historical gaging station data. After calibration and verification the model was utilized to assess the impacts of various water management strategies. The model was operated for the 40 year time period, 1951 through 1990.

The WIRSOS model was used to evaluate various water resource management scenarios. Scenarios examined include:

- storage of up to 50,000 acre feet of Wheatland Reservoir water in Lake Hattie Reservoir in addition to the storage of Lake Hattie water;
- storage of early season Pioneer Canal direct flow rights in Lake Hattie for use as late season irrigation water;
- storage of early season Pioneer Canal direct flow rights in Lake Hattie for use as late season irrigation water in conjunction with the storage of up to 50,000 acre-feet of Wheatland Reservoir water in Lake Hattie; and
- the proposed Dodge Reservoir (Volume II) alone and in conjunction with the previously mentioned scenarios. The discussion of these results are presented in Volume II.

All scenarios were modeled to determine:

- the amount of water savings realized from reduced evaporative losses and more efficient use of the basin water resources;
- impacts of the proposed scenarios on streamflows of the Laramie and Little Laramie Rivers.

The two improved water resource management strategies presented: storage of Wheatland Reservoir water out of priority in Lake Hattie Reservoir, and storage of early

season Pioneer Canal direct flow in Lake Hattie Reservoir, have significant institutional constraints associated with them. These constraints are discussed in detail in the report.

The WIRSOS model was used to evaluate various water resource management scenarios, including storage of Wheatland Reservoir water in Lake Hattie, storage of early season Pioneer Canal direct flow rights in Lake Hattie and combination of the two. There are other scenarios or variations that could be studied, however, the studies do indicate that significant improvement can be made in the management of the water resources of the basin.

- By transferring 50,000 acre-feet of Wheatland Reservoir No. 2 1898 water right to Lake Hattie; tunnel diversions remain unchanged, Lake Hattie deliveries increase by an average of 1,500 acre-feet per year, and total evaporation decreases by 2,000 acre-feet per year.

- The most significant management action would be the storage of early season Pioneer Canal Direct Flow rights in Lake Hattie. The major beneficiaries of this action are the users from Lake Hattie which receive an additional 4,000 acre-feet of water per year. Deliveries to the Wheatland Tunnel remain unchanged.

- When the two scenarios are combined, the Wheatland Tunnel deliveries increase an average of 2,000 acre-feet per year and the Lake Hattie deliveries increase 4,000 acre-feet per year. Evaporation from all reservoirs decrease about 1,000 acre-feet per year.

3.0 CONCLUSIONS

3.0 CONCLUSIONS

Based on the studies discussed in this report, it appears that there are possibilities to improve water management within the Upper Laramie River Basin. The river is well operated within the legal and institutional constraints of state water law and regulation. Thus, in order to accomplish improved water management, some institutional constraints need to be removed or revised. The removal or revision of these constraints will require negotiation and discussion before all parties are satisfied. However, the benefits of better water management seem to indicate that it would be worth pursuing their removal or revision.

The major requirement set forth in statute for undertaking a change is that any such changes be accomplished without injury to the rights of other lawful appropriators. While the model results reported on herein indicate that the types of improved management suggested could be accomplished with little impact to the river, additional studies will be necessary to conclusively show that the changes can be accomplished without injury.

An alternative to theoretical studies would be to institute the improved management concept on a year-by-year basis to determine what impacts there might be. This would be easy to accomplish for the storage of direct flow, but would necessitate the construction of the return canal in order to test the storage of Wheatland Reservoir No. 2 water in Lake Hattie.