Green River
Decision Support System
Feasibility Study
Executive Summary

Prepared for:
Wyoming Water Development Office

March 22, 2011
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Project No.: 1339WWD01

The technical material in this report was prepared by or under the supervision and
direction of the undersigned, whose seals as a Professional Engineer is affixed below:

Erin M. Wilson, P.E.

The following members of the Leonard Rice Engineers, Inc. staff contributed to the
preparation of this report:

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
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<tbody>
<tr>
<td>Project Principal</td>
<td>Erin M. Wilson, P.E.</td>
</tr>
<tr>
<td>Project Hydrologist</td>
<td>K. Kelly Close</td>
</tr>
<tr>
<td>Project Engineer</td>
<td>Kara Sobieski, P.E.</td>
</tr>
<tr>
<td>Project Engineer</td>
<td>Adam Kremers, F.E.</td>
</tr>
<tr>
<td>Data Processor</td>
<td>Martha Jones</td>
</tr>
</tbody>
</table>

In addition, the following individuals and firms were key to the successful completion
of this project:

<table>
<thead>
<tr>
<th>Name</th>
<th>Firm</th>
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<tbody>
<tr>
<td>Ken Knox, PhD, P.E.</td>
<td>URS Corporation</td>
</tr>
<tr>
<td>Victor Anderson, P.E.</td>
<td>States West Water Resources Corp.</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

INTRODUCTION

The Green River Decision support System (DSS) Feasibility Study addresses many of the data collection, data management, and water use modeling issues discussed in the Statewide Framework Water Plan. It also provides recommendations that shift the planning paradigm from prescriptive to proactive - acknowledging that predicting the future is less reliable than building a system that can look at many possible futures and easily react to unanticipated realities.

There are base assumptions that drive most traditional water resource plans including that past hydrology can be used to represent the range of hydrology likely to be seen in the future; economic outlook models and population forecasts can be used to reasonably predict ranges of future water demands; and current policies and procedures can be expected to dictate how future demands are satisfied.

The planning reports that result from this static methodology address water issues identified at the time of the planning study – and may be out of date before the study is completed. A decision support system uses a more proactive method, as it is comprised of a series of data and analysis tools, which can be used to dynamically address both anticipated and unanticipated water issues.

What is a Decision Support System?

A decision support system is an information-driven system that manages data and provides tools to access and analyze these data to make informed decisions. Raw data, including tabular and GIS-based mapping information, is stored and managed so it can be easily updated and extracted. Analysis tools, including water demand and allocation models, are used to analyze current and potential water scenarios. The analysis tools change raw data into useful information that can be applied by decision makers to address anticipated planning issues, and to answer “what if” and “how much” water supply and demand questions that arise in the future.

Why a Decision Support System Now?

The timing is right to move towards the Green River Decision Support System. Many aspects of previous planning efforts undertaken by Wyoming can be used in the Green River DSS, specifically:

- Wyoming can take full advantage of previous and current data collection efforts.
- The WWDC has provided web-based access to GIS layers and planning documents, and the SEO has initiated the development of data management systems.
- Wyoming is a leader in public education and has already garnered public acceptance and support for planning efforts.
More stringent federal regulations require project proponents to develop detailed models to show purpose and needs and water availability.

Green River Decision Support System Approach

The following general approach was taken during this Feasibility Study to identify and address the needs of the State.

- Needs Assessment – Identify the types of questions the DSS needs to answer
- Data Assessment – Determine the information required to answer the questions, and how to store and manage that information
- DSS Components – Identify the tools required to answer the questions
- System Integration – Determine how information is accessed to answer the questions
- Staffing Requirements – Define the agency and personnel roles to assure long term continuity
- User Involvement – Identify education and training programs to assure continued support
- Cost/Schedule Estimates – Determine the most cost-effective implementation schedule

Need for a Decision Support System

To determine the need for the Green River DSS, the roles and responsibilities of the two State agencies primarily responsible for the protection and development of the State’s water resources, the SEO and WWDC, were identified and documented. Needs of other entities with water interests, including water providers, were also considered and were determined to generally fall within the larger needs of the SEO and WWDC. The needs can be generally grouped into four categories:

- **Data and Information Needs**
  This category generally involves the review of existing data and the collection of new data including additional streamflow measurements, diversion measurements, reservoir measurements, and physical basin information. Much of this information is needed prior to the development of any models and will also impact the enhancement of the data management systems.

- **Data Management System Needs**
  There was no need identified for new database management systems; only the need for continued and increased efforts to enhance the existing e-Permit, Aquarius, Web Mapping Tool and WYWRAG systems.

- **Database Integration Needs**
  The need to query, extract, and format information from the e-Permit, Aquarius, and WYWRAG databases was identified. In addition, there is a need to allow relationships to be developed between the three databases based on unique structure identifiers.
• **DSS Modeling Components**
  Needs for modeling components were identified for compact reporting requirements and for determining project feasibility. The need for a standard method and tool to determine potential and actual consumptive use and the need for a standard surface water allocation tool was discussed. The need for a ground water model as the DSS expands into other basins was also discussed.

The development of standard procedures for data collection and modeling, and training on the DSS components, rounded out the Green River DSS needs.

**RECOMMENDATIONS AND IMPLEMENTATION**

The Green River DSS Feasibility Study provides recommendations on how to implement DSS procedures and components to address the needs identified by the WWDC, SEO and other water entities. The recommendations include specific tasks, a recommended implementation schedule, and address whether the task will include State staff responsibilities, consultant contract responsibilities, or capital purchases.

**Staffing Recommendations**

The Green River DSS Team is recommended to include existing and recommended future staff from the SEO, WWDC, and WRDS. Many of the Green River DSS Team members are existing positions and their specific expertise will allow them to serve as advisors during initial implementation and on-going use of the DSS, without adding significant responsibilities to their current workload. Four new positions are recommended to meet DSS needs that cannot be addressed without overloading current staff. The recommended Green River DSS Team staff members are as follows:

• **DSS Project Manager**: A new position within the SEO, this position will be an advocate for the Green River DSS and be responsible for managing the SEO DSS Team, overseeing data collection and management activities, and maintaining a strong relationship with the WWDC team members.

• **DSS Field Liaison**: A new position within the SEO, this position will initially help ground-truth and finalize the irrigated acreage assessment and then continue to assist with installing new diversion measurement flumes and temporary stream measurement sites, and help with subsequent site visits to record diversions.

• **Data Entry Staff**: Two new positions within the SEO, these positions will work with Division 4 to identify and obtain existing electronic information, digitize historical surface and ground water diversions from paper records, and perform quality control of water permit data migrated to the e-Permit database from the previous database.
Data Collection Recommendations

Once an assessment of available data and a summary of current on-going data collection efforts were performed, additional recommendations are made to either initiate new data collection efforts or follow defined procedures to help direct on-going efforts to continue to meet the identified Green River DSS needs. Data collection recommendations involve the following data types:

- Irrigated Acreage and Water Rights
- Streamflow Measurements
- Diversion Measurements
- Reservoir Measurements
- Climate Data
- Physical Basin Information

Data Storage and Management Recommendations

The current SEO database development efforts for the e-Permit, Aquarius, WRDS and WYWRAG database systems, as well as their hardcopy data system, were investigated to assess how the systems currently meet the needs of the Green River DSS and to identify recommended improvements. Many of the Green River DSS recommendations involve standardizing data management procedures, providing customized access forms, developing relational links between the systems, creating additional tables for historical information, and expanding the systems to accommodate new types of data.

DSS Modeling Recommendations

The recommended model platform for basin crop consumptive use modeling is StateCU, and the recommended platform for surface water allocation modeling is StateMod. Both publically available models are used in Wyoming and Colorado, and meet the needs identified for the Green River DSS. A StateCU model was previously developed for the Green River basin that estimates the consumptive use on irrigated acreage identified in the initial WYWRAG efforts. Likewise, a StateMod model was developed as part of the recent Green River Basin Plan update that represents a portion of the upper basin tributaries and the main stem Green River. It is recommended that these models be enhanced and extended to include additional data collected, digitized, and stored as part of the Green River DSS. It is also recommended that specific data to model integration tools be developed to allow data to be extracted from the SEO databases, missing data to be filled using identified standard procedures, and the data to be formatted for model input files.

Standard Procedure Recommendations

Standard procedures will provide guidance to the DSS Team and consultants, assist with training, and help meet the Green River DSS goal of developing data and tools that are consistent, reproducible, and transparent. Standard procedures will be developed for common recurring tasks associated with sharing data between consultants, WWDC, SEO and
WRDS. Likewise, standard modeling procedures will be developed. Recommendations also discuss the importance of developing initial standard procedures prior to initiating modeling efforts and revisiting these procedures as new data becomes available.

Training Workshops and Outreach Recommendations

Training is a critical aspect of the Green River DSS. Training recommendations focus first on training the DSS Team; then recommend the DSS Team develop training workshops for other State agency personnel, consultants, and the public. Recommended training workshops include:

- A general water resources management training session that introduces Wyoming water rights terminology and administration.
- An overview of the availability, storage, management, and access to water resources data that includes a general overview of the e-Permit, Aquarius and WYWRAG database systems.
- An introduction to historical consumptive use analyses and overview of how to create, review and use the results from a StateCU consumptive use model.
- An overview of how to create, review and use the results from the StateMod surface water allocation model.
- A series of public training sessions that provide an overview of the Green River DSS to educate the Green River Basin Advisory Group, other state agencies, and consultants on the DSS procedures and modeling standards.

Schedule

The recommended schedule for the Green River DSS spans over a three year time frame. Year one will include the completion of recommended data collection, enhancing the data storage and database designs, and developing standard DSS procedures. Year two efforts will continue with collection of data, primarily the addition of new diversion measurement devices, and begin the development of both the consumptive use and surface water allocation models. The surface water allocation model will be completed in year three. Also in year three, as the data management systems have generally been finalized and populated with available historical data, the final data access interfaces and the data to model integration will be completed.

Cost

The total estimated cost for the Green River DSS for the three year implementation period is $1.93 million. This cost estimate includes salary and benefits for new State staff positions, new consultant contracts, and capital costs for data measurement and collection devices. It also includes costs for the consultants currently developing the e-Permit and Aquarius databases to perform additional tasks and to expedite planned tasks.