LARAMIE REGIONAL AIRPORT
WATER SYSTEM IMPROVEMENTS

EXECUTIVE SUMMARY

LEVEL II

FEASIBILITY STUDY

DECEMBER, 1993

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Cheyenne, Wyoming

WRC Engineering, Inc.
Denver, Colorado
EXECUTIVE SUMMARY

PURPOSE OF THE STUDY

The purpose of this Level II Feasibility Study is to determine the most cost effective method of providing adequate fire flows the Laramie Regional Airport.

FINDINGS

GENERAL SYSTEM DESCRIPTION

The Laramie Regional Airport is located approximately 4 miles west of Laramie. The airport obtains its water supply from the City’s water distribution system. Water is transmitted to the airport through a 10-inch pipe. The capacity of the 10-inch pipe is inadequate to supply water in sufficient quantity for fire fighting purposes. Further development at the airport has been restricted until adequate fire flows can be provided.

OVERVIEW

This Level II Feasibility Study consists of evaluating the fire flow requirements at the airport; evaluating the City’s existing storage, transmission and distribution system to determine its capability to provide the recommended fire flow; evaluating alternatives and preparing alternative cost estimates; preparing an economic analysis and determining potential funding sources; and determining permitting requirements.

The recommended fire flow for the Laramie Regional Airport is 4000 gallons per minute for a 4 hour duration. The fire flow was determined using data obtained from field observations and the methodologies contained in the Insurance Service Organization Fire Suppression Rating Schedule and the Uniform Fire Code.

The Laramie Regional Airport is located in Zone 1 of the City’s system. The existing storage, transmission and distribution system in Zone 1 was evaluated to determine if there was capacity to meet the fire flow requirement. It was concluded that there was adequate storage. However the existing 10-inch pipe serving the airport is inadequate.

Eight alternatives were developed that could supply the recommended fire flow to the airport. For each alternative, cost estimates were prepared and computer models were created to determine the impacts on the existing system. Alternative No 2A was recommended and accepted by the project sponsor and participants as the preferred alternative. The estimated cost of Alternative No. 2A is $2,058,000. The proposed improvements include a 1.0 million gallon storage tank, 12-inch and 16-inch pipeline, a booster pump and a fire pump.
EVALUATION OF FIRE FLOW REQUIREMENTS

An evaluation of the existing types of construction and building uses at the Laramie Regional Airport (LRA) was conducted to determine fire flow requirements. The evaluation included site observations to determine the type of construction and current uses of the existing buildings, research of the City of Laramie Fire Ordinance, Insurance Services Office (ISO) Fire Suppression Rating Schedule, Specific Commercial Property Evaluations, 1991 Uniform Fire Code and calculation of the Needed Fire Flow for each of the existing buildings.

There are currently 16 buildings at LRA. The uses of the buildings and types of construction are varied. The Level II Feasibility Study presents descriptions and locations of the buildings.

The Needed Fire Flow (NFF) for each of the existing buildings was evaluated using the guidelines set forth in the ISO Fire Suppression Rating Schedule. The NFF calculation takes into consideration the type of construction, occupancy uses, exposure of adjacent buildings and the separations between the various uses within a building.

Table-1 presents the building area, factors and NFF calculations for each of the buildings. The NFF ranges from approximately 800 gallons per minute (gpm) at Building 13 to over 4,000 gpm at Building 11.

FUTURE FIRE FLOW REQUIREMENTS

The City of Laramie has adopted the Uniform Fire Code, as amended by City ordinance. The City Ordinance sets minimum standards for fire flow based on zoning. The LRA is located outside the City and is not subject to City Zoning requirements. For the purposes of establishing fire flow requirements the City considers the uses at LRA to be consistent with the City’s I-1 and I-2 zoning districts. The I-1 and I-2 zoning requires a minimum fire flow of 4,000 gpm. The duration of the fire-flow recommended by the Uniform Fire Code and Fire Suppression Rating Schedule is dependant on the flow rate.

2 hours less than 3,000 gpm
3 hours 3000 gpm to 4,000 gpm
4 hours more than 4,000 gpm

The Uniform Fire Code provides that "Fire-flow requirements may be modified downward by the chief for isolated buildings or group of buildings in rural areas or small communities when the development of full fire-flow requirements is impractical." In a draft Memorandum of Understanding between the City of Laramie and Laramie Regional Airport, the fire-flow duration is noted as being 1-hour. It appears that this requirement is not consistent in terms of providing appropriate durations for the recommended flow rates.
**TABLE - 1**  
NEEDED FIRE FLOW CALCULATION

A-EFFECTIVE AREA (SQUARE FEET)  
P-COEFFICIENT RELATED TO CLASS OF CONSTRUCTION  
O-OCCUPANCY FACTOR  
X-EXPOSURE FACTOR  
P-COMMUNICATION FACTOR  

\[ C = 18 \times F \times (A^{0.5}) \]  
\[ (X+P)_i = 1 + \sum(X_i+P_i) i = 1 \text{ to } N \]  
WHERE N = NUMBER OF BUILDING SIDES  

\[ \text{NFF-NEEDED FIRE FLOW} = C \times O \times (X+O) \]

<table>
<thead>
<tr>
<th>BUILDING NO.</th>
<th>BUILDING DESCRIPTION</th>
<th>A</th>
<th>CLASS</th>
<th>F</th>
<th>C</th>
<th>OCCUPANCY</th>
<th>O</th>
<th>(X+P)</th>
<th>NFF</th>
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<tr>
<td>1</td>
<td>University of Wyoming Hangar</td>
<td>14,000</td>
<td>3</td>
<td>0.8</td>
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<td>C-5</td>
<td>1.25</td>
<td>1.06</td>
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<td>2</td>
<td>Hangar 1</td>
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<td>1.61</td>
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<td>Hangar 2</td>
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<td>C-5</td>
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<td>1.69</td>
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<tr>
<td>4</td>
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<td>6</td>
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<td>C-2</td>
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<td>1.17</td>
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<td>14, 15 &amp; 16</td>
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EVALUATION OF EXISTING STORAGE, TRANSMISSION AND DISTRIBUTION SYSTEM

An evaluation of the existing storage, transmission and distribution system serving the City of Laramie and the Laramie Regional Airport (LRA) was conducted to determine the ability to meet fire flow requirements at LRA. The evaluation included review of the Water Masterplan Report, City of Laramie, Wyoming, prepared by Banner Associates, Inc., June 1983, (Masterplan) review of the City’s Water Distribution System Maps, conversations with the City and an evaluation of the ability of the existing system to provide the required fire flow. The Masterplan was reviewed to obtain an understanding of how the City’s water system is operated and determine the existing storage, distribution and transmission capacities.

The City’s water distribution system is divided into 5 pressure zones. LRA is part of Zone 1. Storage capacity in Zone 1 consists of an 8.0 million gallon (mg) reservoir located east of the City, and a 0.5 mg clear well at the treatment plant southwest of the City. Water is distributed into Zone 1 by gravity flow from the treatment plant and the reservoir. Except for periods of high demand, water from the Pope Well Field and Soldier Springs is transmitted by gravity flow to the City.

Water from the treatment plant is conveyed in 20-inch and 24-inch steel pipes. In the winter, flow from the treatment plant in the 20-inch and 24-inch pipes is turned off. The valve for the 20-inch pipe is located on the west side of the Roach Addition and the valve for the 24-inch is located near Wyoming Highway 230 on the west side of Laramie. The winter demands west of the two valves, which includes LRA, are supplied by available storage at the treatment plant. Water from the reservoir is distributed to the system in the 24-inch steel pipe and in 14-inch and 16-inch pipes located in Grand Avenue. Water from Pope Well Field and Soldier Springs is conveyed in 12-inch and 14-inch diameter pipes, respectively. The two pipes are combined into a 16-inch pipe which distributes flow to the system.

LRA is presently served by a 10-inch pipe that is connected to the 24-inch transmission line approximately 3 miles southwest of Laramie along Wyoming Highway 230. The University Booster Station, located on the access road from State Highway 230 to the University of Wyoming Dairy Farm, boosts the system pressure in the 10-inch pipe for delivery to LRA.

The Masterplan concluded that Zone 1 has adequate storage capacity to meet the future peak day demands, fire storage reserve of 2.0 mg and an emergency reserve equal to an 8-hour water supply at the peak daily demand of 550 gallons per capita per day (gpcd). The Masterplan analysis of the distribution system indicated that the system has sufficient capacity to meet peak hour flows. However, when the system was modeled using peak hour flows and required fire flows (1500 gpm to 6000 gpm) several areas in Zone 1 were found to have inadequate pressures. The Masterplan recommended improvements to the water distribution system that would alleviate the inadequate pressures.
The required fire flow for the LRA is 4000 gallons per minute (gpm) for 4 hours. The total storage volume for fire fighting is 0.96 mg assuming no resupply; 0.60 mg if 1500 gpm resupply is provided. There is adequate storage capacity to meet the future demands, including a fire reserve of 2 mg. However, during the winter months when the valves on 20-inch and 24-inch pipes are turned off, only 0.50 mg of storage is available at the treatment plant, which is inadequate to satisfy the fire fighting requirement.

EVALUATION OF ALTERNATIVES

Alternatives for supplying the needed fire flow to LRA were developed and evaluated to determine impacts on the City's existing water distribution system and to determine the estimated cost of each alternative. The alternatives were modeled using Cybernet™. Cybernet is a water distribution system analysis that works within AutoCADD™. The program uses the same algorithms as the widely used KYPIPE program developed by the University of Kentucky. The input into the program includes pipe length and diameter, Hazen-Williams Coefficient (C), node elevations, node demands, and the elevation or pressure of source nodes.

Eight alternatives were developed and evaluated to supply 4,000 gpm fire flow to the airport for four hours. Costs and impacts on the existing system were evaluated. The alternatives were developed in general conformance with the recommended improvements for Zone 1 contained in the Masterplan. A generalized model of the existing water distribution system was used to evaluate the impacts of each alternative on the existing distribution system.

The recommended alternative (alternative 2A) provides the required fire flow to the airport and generally conform to the Masterplan recommendations for Zone 1. A water storage tank is located at the airport. A 12-inch diameter pipe extends east from the tank, parallel to Highway 130 and connects to the existing system at the intersection of Grant Street and Van Buren Street. A 12-inch pipe is proposed in Van Buren Street to provide adequate resupply to the tank with minimal impacts to the existing system and to supplement the flows in West Laramie and the industrial park. It is anticipated that these pipes could be constructed within the existing highway right-of-way. A 1,500 gpm booster pump rated at 50 psi is to provided to resupply the tank. A 4,000 gpm fire pump rated at 50 psi is provided at the tank outlet to provide the required fire flow. A 24-inch bore is needed to cross State Highway 130. Alternative No. 2 is presented on the following page as Figure - 4, extracted from the final report.

ECONOMIC ANALYSIS / ABILITY TO PAY

The estimated cost of alternative 2A is $2.058 Million. Based on a total budget of $2.225 Million, and terms of 67% grant and 33% loan, and an annual interest rate of 4% for 25 years, the annual repayment by the sponsors would be $47,001.

If the sponsor's cost of the improvements are to be paid from water revenues, and assuming that there are 7000 taps on the water system, and the annual payment of $47,001, the cost of debt service would be approximately $0.56 per tap per month.
DETAILED COST ESTIMATES

The cost estimate for the selected alternative is shown on the following page. The total estimated cost of $2,058,000 includes construction, engineering, permitting and contingencies.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS:

Based on the criterion of a delivery rate of 4000 gallons per minute for four hours, eight alternative improvement plans were developed. Each alternative was evaluated for cost, effectiveness in meeting the criteria, construction and environmental problems associated with each alternative, consistency with the City of Laramie Master Plan, and benefits to the City of Laramie in addition to solving the immediate problem of fire flow to the airport.

The alternative which best meets all the criteria and considerations was Alternative 2A, which provides for construction of a one million gallon storage tank at the airport, 12-inch diameter pipe east from the tank, parallel to Highway 130 connecting to the existing system at the intersection of Grant Street and Van Buren Street. A 12-inch pipe is proposed in Van Buren Street to provide adequate resupply to the tank with minimal impacts to the existing system and to supplement the flows in West Laramie and the industrial park. It is anticipated that these pipes could be constructed within the existing highway right-of-way. A 1,500 gpm booster pump rated at 50 psi is to provided to resupply the tank. A 4,000 gpm fire pump rated at 50 psi is provided at the tank outlet to provide the required fire flow. A 24-inch bore is needed to cross State Highway 130.

RECOMMENDATION:

It is recommended that Alternative 2A as described above and in the Level II Feasibility Study be the basis for further development of the water supply improvements to Laramie Regional Airport.
### Laramie Regional Airport
#### Alternative Cost Estimate
##### Alternative No. 2A

<table>
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<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Item Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost of Project Components</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Water Storage Tank</td>
<td>1.00</td>
<td>MG</td>
<td>600,000</td>
<td>600,000</td>
</tr>
<tr>
<td>12-inch Tank Re-Supply Pipe W/</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Appurtenances</td>
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<td>LF</td>
<td>40</td>
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<td>16-inch Fire Line W/ Appurtenances</td>
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<td>LS</td>
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<tr>
<td>Fire Pump</td>
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<td>LS</td>
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**Contribution Cost Subtotal (CCS#1)**: $1,504,000

**Engineering Costs (CCS#1 * 10%)**: 150,400

**Subtotal #2**: $1,654,400

**Contingency (Subtotal #2 * 15%)**: 248,160

**Construction Cost Total**: $1,902,560

**Preparation to Final Designs and Specifications (CCS#1 * 10%)**: $150,400

**Permitting and Mitigation**: $5,040

**Acquisition of Access and Rights of Way**: $0

**Project Cost Total**: $2,058,000

1796—Est.Wk3  
WRC Engineering, Inc.  
14—Dec—93