1.0 INTRODUCTION

The Bedford Community Pipeline was built in 1948. It has served the people of Bedford for 39 years without any major changes or improvements.

In 1986 the current directors of the pipeline made an agreement with The Wyoming Water Development Commission to help them improve their pipeline.

The Wyoming Water Development Commission has retained Forsgren-Perkins Engineering of Evanston, Wyoming to perform an investigation and evaluation of Bedford's domestic water system i.e. The Bedford Community Pipeline.

Funding of projects by the Wyoming Water Development Commission is based on a concept of four development levels. The determination of need and feasibility is made in Level I. Level II includes preliminary design activities such as water rights, economic analysis, and refined cost estimates. Final design activities are completed in Level III and construction of improvements in Level IV. With smaller, less complex projects it is sometimes possible to combine or even skip levels in the interest of time and/or funding issues. This report documents the activities and findings of studies under Level I of the water development program.

1.1 GENERAL

The town of Bedford is situated in Western Wyoming less than 10 miles from the Idaho - Wyoming border, Figure 1.1. Bedford is one of many small farming communities in the picturesque Star Valley. It lies in a small secluded valley 12 miles northeast of Afton and 3 1/2 miles southeast of the town of Thayne as shown by figure 1.2.

There is great potential for growth and development in the Star Valley as well as in the town of Bedford.

1.2 PROCESS

Forsgren-Perkins with the assistance of the Bedford Pipeline Board of Directors performed a number of field measurements and information gathering activities in order to provide a basic information base with which further analysis and alternatives development could take place. In this regard a somewhat detailed
questionnaire was developed and sent out to the people within the Bedford service area. Besides quantifying connections, service history and current problems the questionnaire requested development plans from property owners. A 90% return was experienced on the questionnaire and the results were a primary source of information for various study aspects.

Personal interviews along with house counts were used to correlate with other available information. Twenty four hour pressure flow measurements were made along with several spot pressure checks throughout the system. Stream flow measurements on Strawberry Creek were made as well as measurements of several springs including "Big Spring", the present source of supply for Bedford. Water quality samples were also taken and laboratory tests performed. Transmission and distribution lines were uncovered and inspected as to present condition of pipe and bedding materials.

The last portion of the study included modeling and analysis of the various parts of the system. Computer modeling was utilized for hydrologic modeling, water rights analysis, transmission line modeling and storage and distribution modeling. The results of the modeling were analyzed and recommendations were made.

2.0 EXISTING CONDITIONS

The Bedford Community Pipeline began operation in 1948. It has 59 owners serving 67 connections. The pipeline has not been expanded from its original size but a few connections have been moved from one location to another to accommodate people building new homes and abandoning others. If an owner moves out of the area his connection is sold to someone waiting for a hookup. Currently there are approximately 30 families who want to connect to the pipeline.

The system receives its water from a large spring that surfaces approximately 1.5 miles up Strawberry Creek Canyon as seen in Figure 2.1. The spring water is collected in a spring box with a 3,500 gallons capacity. From the spring box the water is transmitted through a 6-inch steel pipe 1.7 miles to the distribution system. The distribution network is comprised of approximately 15 miles of steel pipe. The pipes range in size from 6-inch diameter to 1 1/4-inch diameter. There are smaller diameter pipes
leading to private connections. Transmission and distribution systems, sizes and locations are also shown in figure 2.1.

The Bedford water system is 40 years old but remains in reasonable condition considering its age. The owners of the water system have historically provided maintenance to the system on an "as needed" basis. Over the years, several leaks have been repaired but major line replacement has not been necessary. No water auditing or definitive leak testing has been done in recent years and there may be system losses which are not apparent from surface examination.

In the 1950's a hydropower plant was constructed about 1/2 mile up Strawberry Creek Canyon. The Lower Valley Power Authority currently runs the plant generating approximately 1500 KW 4 months a year and as much as possible based on available Strawberry Creek flows in the winter months, some years as little as 500 KW. The power generated depends on available water from its diversion reservoir 2 1/2 miles upstream from the plant.

The diversion reservoir directs water into a 36 inch penstock carrying 50 cfs during the peak months. The diversion for the penstock is approximately 1 1/2 miles above the spring intake box used for the Bedford Pipeline. The penstock goes into the plant and back into Strawberry Creek 1 mile below the intake box therefore bypassing the spring source. There has been some concern that this diversion may cause the source spring to produce less water than it would naturally.

3.0 SYSTEM DESIGN CRITERIA

In order to project needs and analyze the feasibility of an improved water system certain criteria must be chosen. These criteria must encompass future needs, safety, economics, and efficiency. For the Town of Bedford, population, design period, and consumption as well as the geometrics and physical constraints of the area were utilized in formulating the design criteria.

Using several sources of information along with local questionnaires it was possible to estimate expected Bedford population for short and long term scenarios. A short term population (10 year) of 520 persons and a long term (30 year) population of 760 persons were established for the purposes of this study.
Water consumption characteristics were identified through field measurements and local interviews and historic data. The average and peak per capita consumption in the Bedford area is much higher than expected even for Star Valley communities. Conservation will be an important part of any expanded system. For modeling and projection purposes, present usage was assumed to drop by 30-40% during the short term design period. Fire protection levels were utilized according to recommended insurance service organization guidelines. Other system components such as storage and pressure residuals were designed based on State of Wyoming requirements and accepted practice.

4.0 ALTERNATIVES/ANALYSIS

Previous sections of this report have outlined the present condition of the Bedford Water System and the criteria under which it is to be evaluated and alternatives developed. System components include water source, raw water supply, storage, treatment, transmission and distribution.

The results of these analyses are detailed and alternatives developed to meet the existing and future needs of the Bedford System. The alternatives attempt to respond to anticipated population needs as well as various levels of fire protection and water supply security. The final sections of the report summarize the estimated costs of alternatives and recommends "best alternatives".

The suggested best alternatives are selected based on the consultants view of capital vs operational costs expansion capacity/capability, and overall practicality for the Bedford area.

4.1 WATER SUPPLY ANALYSIS

The source of water for the Bedford water system has been the Strawberry Creek drainage. Water right filings on the Strawberry Creek date back to the early 1920's and include rights for power generation. The water supply analysis focuses on the available water rights standpoint and from a hydrological view. An analysis of the spring presently utilized by the Bedford users was completed along with 3 other springs which were evaluated as secondary water sources. The potential of utilizing new or existing wells as a secondary or emergency water source is also considered in this evaluation.
The results of these analyses indicate that physically there is water available at the point of diversion most of the time. The only exception being when during low winter flows power diversions deplete the spring flows enough to cause concern. Present water rights, although adequate if transferred up the canyon, are not senior enough to guarantee a firm supply during late summer if regulation were enforced. Some additional senior rights will be required to insure adequate legal supplies of water for the Bedford area.

4.2 RAW WATER SUPPLY/STORAGE/TREATMENT

A new raw water supply line is proposed to convey water from developed springs down strawberry Creek Canyon and into new storage facilities. A treatment process consisting of standby disinfection will also be required and is proposed at the entrance to the storage reservoir. The analysis of these segments of the water system is discussed in this section.

4.2.1 EXISTING SYSTEM CONSTRAINTS

The present supply line consists of approximately 9,000 feet of old 6" diameter steel pipe. It is anticipated that this line will be replaced as part of this project. The line will tap into one or more of the springs and must be sized based on a long term design population. Strawberry Creek Canyon is steep sided and has a narrow valley floor. The existing roads, stream, power facilities, and vegetation will all provide conflicts which must be addressed in the location of the new line. The canyon has a severe avalanche problem and construction, placement, and operational characteristics of the supply line, spring box connections, and valve-PRV stations must be considered. The majority of the line will be located on US Forest Service lands and appropriate approvals and permits will be required. Special construction and design constraints may be necessary through National Forest lands.

4.2.2 RAW WATER SUPPLY LINE ANALYSIS

The raw water supply must be sized to provide long term summer peak flows to the Bedford area. With pipe length of 10,000 feet (upper springs to storage tank), Hazen-Williams Coefficient of 100, and an overall elevation difference of 220 feet the following pipeline capacities are predicted.

- 8" diameter - 810 gallons per minute
- 10" diameter - 1,450 gallons per minute
- 12" diameter - 2,350 gallons per minute
Short term vs. long term and present consumption rates vs.
reduced consumption rates were evaluated to compare average
demand with estimated pipeline capacity. The following
flow rates summarize the average demands.

<table>
<thead>
<tr>
<th>Number of Connections</th>
<th>Present Consumption</th>
<th>Reduced Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Term</td>
<td>159</td>
<td>731 gpm</td>
</tr>
<tr>
<td>Long Term</td>
<td>235</td>
<td>1,081 gpm</td>
</tr>
</tbody>
</table>

As is seen, an 8-inch supply line providing 810 gallons per
minute would meet the average short term demand. In order
to satisfy long term demands a 10-inch supply line will be
necessary. The design criteria established for the raw
supply line based on a long term (40-50 year pipeline life)
service period would dictate that at least a 10-inch diame-
ter pipeline be considered for the Bedford raw water supply
line.

4.2.3 PEAKING STORAGE ANALYSIS

The primary purposes of storage reservoirs in a water sys-
tem are to provide fire demand and peaking storage. The
amount of fire storage is generally dependent on the type
of buildings and land use in the area which the water sys-
tem serves. The higher the intensity of the fire demand
the greater the storage required. In Wyoming, water
providers are not required to provide fire protection to
their customers. The amount of fire flow capacity only
affects the insurance ratings for the area.

Peaking storage is the amount of water necessary on a daily
basis to provide for peak hourly demands on the system.
The capacity of the raw water supply will not always be
able to meet the demand such as during summer
afternoon/early evening irrigation usage. With adequate
storage, the system can provide for these peak demands and
then recover during the early morning hours. Peaking stor-
age capacity is determined by evaluating the peak demands
compared to supply capacity. The short term vs long term
and fire flow vs no fire flow conditions are summarized be-
low in terms of required storage capacities.

- Short term, no fire demand = 250,000 gallons
- Short term, fire demand = 450,000 gallons
- Long term, fire demand = 700,000 gallons

The long term storage requirements are not as critical
since storage capacity can be added as necessary and be
sized based on the conditions at that time.
4.2.4 TREATMENT/DISINFECTION

Basic treatment of the Bedford water supply will occur in the soils surrounding the springs which are developed. The collection boxes, raw water supply lines, and storage tanks will also provide safe, uncontaminated zones to both settle and isolate the water supply. In the past, water systems of this type were approved and periodic testing utilized to verify the quality of the water. As long as the water met standards; no additional treatment was required. Currently all water supplies are required to have at least standby disinfection capability.

There are several different types and kinds of disinfection units which could be considered for the Bedford system. Chlorination is preferred because of the residual disinfection ability it provides. This feature is particularly beneficial because of the tremendous amount of pipe in the Bedford system compared to the number of services. There are different types of chlorination which can be considered. The fact that the disinfection unit will be standby and not used more than a few months a year if at all, its projected location on the supply line near the storage tank, and requiring only weekly or monthly flow rate modifications indicates that either a liquid chlorine or perhaps a gas chlorination system is preferred.

The unit would be located in its own building near the storage reservoir location and should be easily accessible even during winter conditions.

4.2.5 FINISHED WATER TRANSMISSION LINES

Part of the water supply system will be the main transmission lines running from the storage tank to the smaller distribution lines. These larger diameter transmission lines were modeled with the distribution lines and are discussed in Section 4.3.

4.3 TRANSMISSION/DISTRIBUTION SYSTEMS

The existing transmission/distribution system serving the Bedford area has been previously described and is shown in Figure 2.1. Computer modeling via network analysis programs was utilized to simulate present conditions, analyze system weaknesses, and identify system upgrades for projected growth.

4.3.1 COMPUTER MODEL DEVELOPMENT/ANALYSIS STRATEGY

The network analysis program utilized for computer modeling of the Bedford Water System is called "WATER II". This
program developed by Forsgren-Perkins and marketed to many other consultants all over the United States analyzes steady state flow and pressure characteristics in pipe networks.

In analyzing a water transmission/distribution network, the basic strategy is to model the performance or response of a pipe network to demands placed upon it. These demands may be steady and applied over a large part of the network such as summer irrigation demands or intense and applied over a short period at a single location in the network such as a fire demand or major leak. The computer model when calibrated to the actual system allows several demands to be placed on the piping system and the system response analyzed. The system response in these cases are the capacities and pressures of the pipe network during the demand.

Thus the transmission/distribution system can be tested for all the conditions which may occur and the response checked to see if the criteria established for design and other requirements are met. Growth and additional demands can be added and system modifications can be tested to determine what size lines should be and where new lines may be needed to keep the system performing as required.

4.3.2 ANALYSIS OF PRESENT SYSTEM

The Bedford system is experiencing low pressures associated with high demand periods as previously described in this report. The goal in modeling the existing system is to further define the system weaknesses, to understand its sensitivities, and to predict the external demands under which the system fails to meet the accepted design criteria.

The system was coded and calibrated using field data collected during the study period. The correlation of the model was good compared to expectations from field measurements.

Following calibration the model was stressed by placing additional demands at various locations in the system. These demands simulate additional growth, leaks, and fire flows. There are several areas that were already critical such as the northeast corner of the system. The additional demand simply expands the critical zone.

4.3.3 ANALYSIS OF PROPOSED SYSTEMS

As the projected growth was placed artificially on the computer model of the system, it was possible to try
transmission/distribution enhancements to handle growth and fire protection. The expected growth came largely from the questionnaires and included where the growth would most likely occur. This information was then coded and the models ran utilizing these established growth patterns.

After consideration of many alternatives and input from the pipeline directors two alternatives were chosen to focus on and develop cost estimates for.

4.3.3.1 MINIMUM LONG TERM SYSTEM: The first alternative will be called a Minimum Long Term System. It provides desirable pressures for a projected 30 year population assuming a demand of 3 gpm per connection, which is a reduction from the current usage rate of 4.6 gpm per connection. The system includes 2 new looping pipes. The first line begins from the existing PRV box at the canyon mouth and goes north west connecting with the north branch. This loop helps alleviate the pressure problem in the northeast corner of the system. The second loop is made between the south branch and the southwest branch. This relieves pressure problems in the area. A new 8" transmission line brings water from the canyon mouth (storage tank) to the center of town. The existing 6" transmission line presently in service will be utilized and closely monitored. As it is appropriate it will be removed from service and abandoned.

All the new lines and their sizes are shown in figure 4.8. As shown all but 7 lines are set up to be replaced. The new pipes are all six inch except for the new main which will be eight inch. This system is adequate for a projected thirty year population, the pressure contours for the population are depicted in figure 4.9. These results were derived using 3 gpm per connection. This system was also ran with a fire placed at critical places in the system. Figure 4.10 shows the results of the worst case residential fire. This system will not be adequate to protect the community from fires.

4.3.3.2 FIRE PROTECTED LONG TERM SYSTEM: The second alternative will be called the Fire Protected Long Term System. It provides potential for a 30 year projected population and fire protection for a residential fire anywhere in the system. The system layout is the same as the first alternatives. This includes two new looping lines and a replacement of the main line. The difference is the sizing of the pipes. This system leaves no original lines. The minimum pipe size is six inches which is the minimum for fire protection. The main line from the canyon mouth to the city center is a ten inch line. There are eight inch lines extending from the city center north to the northeast corner and from the canyon mouth south to the southeast corner of the system. The system is shown in
In figure 4.12 the pressure contours are shown with a demand of 4.6 gpm at every connection. A fire demand is depicted in figure 4.13. This is a worst case residential fire.

The individual component costs are assembled in outline form in Table 4.7. Where a range of cost is shown for a component such as the small springs development the midpoint of the range is generally shown unless another estimate seems to fit the estimate better. As has been mentioned several times in this report, these costs are based on very preliminary information with various assumptions made. Costs will definitely be refined as the project evolves into final design.

Finally, the alternative costs are included in a few project scenarios to allow comparison and some ideas of the scope of the proposed project. The first scenario is what is considered a minimum project. It's purpose is to provide some additional water through an improved spring system and a larger 10" transmission. It also provides some storage and a backup well. The project will not replace the small pipes in the distribution system.

**MINIMUM PROJECT**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Big Spring Development</td>
<td>$100,000</td>
</tr>
<tr>
<td>2. Raw Water Supply Line</td>
<td>$280,000</td>
</tr>
<tr>
<td>3. Storage Tank/Disinfection</td>
<td>$210,000</td>
</tr>
<tr>
<td>4. Transmission/Distribution</td>
<td>$300,000</td>
</tr>
<tr>
<td>5. Backup Well</td>
<td>$40,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$930,000</strong></td>
</tr>
</tbody>
</table>

Based on the best information available at this time the next scenario is the recommended long term project with no fire protection. It meets design criteria assuming a reduced usage rate. It includes the development of Big Spring, the 10 inch supply, 250,000 gallon tank, and replacement of much of the present demand transmission/distribution system. It also includes a backup well system.

**RECOMMENDED PROJECT - MINIMUM LONG TERM SYSTEM**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Big Spring Development</td>
<td>$100,000</td>
</tr>
<tr>
<td>2. Raw Water Supply</td>
<td>$280,000</td>
</tr>
<tr>
<td>3. Storage Tank/Disinfection</td>
<td>$210,000</td>
</tr>
<tr>
<td>4. Transmission/Distribution</td>
<td>$973,000</td>
</tr>
<tr>
<td>5. Well Backup System</td>
<td>$40,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$1,603,000</strong></td>
</tr>
</tbody>
</table>
EXISTING PIPE SIZ
6"

NEW PIPE SIZE
6"

MINIMUM LONG TERM SYSTEM
FIGURE NO. 4.8
FORSNREN-PERKINS ENGINEERING, p.a.
EXISTING PIPE SIZE

6" - 60 PRESSURE ZONE

NEW PIPE SIZE

MINIMUM LONG TERM SYSTEM SUMMER FLOWS WITH CONSERVATION

Fig. 4.9

FORSGREN-PERKINS ENGINEERING, p.a.
PRESSURES IN P.S.I.

MINIMUM LONG TERM SYSTEM WITH FIRE FLOWS

FIGURE NO. 4.10

FORSIGREN-PERKINS ENGINEERING, p.a.
EXISTING PIPE SIZE

NEW PIPE SIZE

FIRE PROTECTED
LONG TERM SYSTEM

FIGURE NO. 4.11

FORSGREN-PERKINS ENGINEERING, p.a.
PRESSURES IN P.S.I.

(2") EXISTING PIPE SIZE
6" NEW PIPE SIZE

FIRE PROTECTED LONG TERM SYSTEM SUMMER FLOWS
FIGURE NO. 4.12
FORSgren-Perkins ENGINEERING, p.a.
PRESURES IN P.S.I.

EXISTING PIPE SIZE

NEW PIPE SIZE

FIRE PROTECTED
LONG TERM SYSTEM
WITH FIRE FLOWS

FIGURE NO. 4.13

FORSgren-PERKINS ENGINEERING, p.a.
### Table 4.7 Alternative Cost Summary

#### I. Springs Development
- **A. Big Springs** .................. $55,000
- **B. Springs #1-3** ................. $25,000
- **C. Total for Big Springs plus Two Additional** ................... $100,000

#### II. Raw Water Supply Line
- **A. 8 Inch Diameter** ................ $240,000
- **B. 10 Inch Diameter** ............... $280,000
- **C. 12 Inch Diameter** ............... $320,000

#### III. Storage Tank/Disinfection
- **A. 250,000 Gallon** ................ $210,000
- **B. 500,000 Gallon** ................ $350,000

#### IV. Transmission/Distribution
- **A. Minimum Long Term System** .... $973,000
- **B. Fire Protected Long Term System** ................... $1,273,000
The final scenario presented is the recommended long term project with residential fire protection provided. The project includes the development of the springs, the 10 inch supply, a 500,000 gallon tank and total replacement of the existing distribution system. It also includes a backup well.

RECOMMENDED PROJECT - FIRE PROTECTED LONG TERM SYSTEM

1. Big Springs Development............. $ 100,000
2. Raw Water Supply.................... $ 280,000
3. Storage Tank/Disinfection............ $ 350,000
4. Transmission/Distribution........... $1,273,000
5. Well Backup System.................. $ 40,000
   Total............................... $2,043,000

4.4.8 FUNDING SUMMARY/LOCAL COSTS

The previous section presented estimated costs for three different project scenarios. If preliminary assumptions are made as to participation from the Wyoming Water Development Commission and the Farm Loan Board, some project funding proposals can be addressed and anticipated connection fees and monthly costs to the people of Bedford can be estimated. It must be remembered that no commitments have been made to fund this project at any level or by any agency. The information presented here is only for information and comparison.

In the minimum project, it is assumed that the WWDC will fund the entire system which includes springs development, raw water supply and storage, primary transmission, and backup well. The costs of this system are estimated at $930,000. With a 75% WWDC Grant, the loan amount would be $232,500 and at 4% for 30 years the repayment cost would equal $13,450 per year. Adding reserve and operation maintenance of $1,500 and $3,500 respectively, the total would be $18,450 or $15.38 per connection per month. This is summarized below along with similar costs for the other two recommended projects:
## I - MINIMUM PROJECT

<table>
<thead>
<tr>
<th></th>
<th>W/TANK</th>
<th>W/O TANK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1- System Costs:</strong></td>
<td>$930,000</td>
<td>$720,000</td>
</tr>
<tr>
<td><strong>2- Grant Funding: WWDC</strong></td>
<td>$697,500</td>
<td>$540,000</td>
</tr>
<tr>
<td><strong>3- Loan Requirements:</strong></td>
<td>$232,500</td>
<td>$180,000</td>
</tr>
</tbody>
</table>

### Annual Payments
- 30 years @ 4%
  - $13,450
  - $10,410
- Reserve
  - $1,500
  - $1,200
- Operation/Maint
  - $3,500
  - $3,300
- Total Annual Cost
  - $18,450
  - $14,910
- Monthly User Cost
  - $15.38
  - $12.43

### Monthly User Cost (100 Connections)

## II - LONG TERM - NO FIRE

<table>
<thead>
<tr>
<th></th>
<th>W/TANK</th>
<th>W/O TANK</th>
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</thead>
<tbody>
<tr>
<td><strong>1- System Costs:</strong></td>
<td>$1,603,000</td>
<td>$1,393,000</td>
</tr>
<tr>
<td><strong>2- Grant Funding: WWDC</strong></td>
<td>$743,000</td>
<td>$585,000</td>
</tr>
<tr>
<td>: FLB</td>
<td>$307,000</td>
<td>$307,000</td>
</tr>
<tr>
<td>Total Amount</td>
<td>$1,050,000</td>
<td>$892,000</td>
</tr>
<tr>
<td><strong>3- Loan Requirements:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WWDC</td>
<td>$247,000</td>
<td>$195,000</td>
</tr>
<tr>
<td>FLB</td>
<td>$306,000</td>
<td>$306,000</td>
</tr>
<tr>
<td>Total Loans:</td>
<td>$553,000</td>
<td>$501,000</td>
</tr>
</tbody>
</table>

### Annual Payments
- 30 yrs @ 4%
  - $14,284
  - $11,277
- (247,000, 195,000)
- 30 yrs @ 8.5%
  - $28,474
  - $28,474
- (306,000, 306,000)
- Reserve
  - $2,000
  - $1,800
- Operation & Maintenance
  - $2,500
  - $2,300
- Total Annual Cost
  - $47,258
  - $43,851
- Monthly User Cost
  - $32.82
  - $30.45

### Monthly User Cost (120 Connections)

## III - LONG TERM - LIMITED FIRE

<table>
<thead>
<tr>
<th></th>
<th>W/TANK</th>
<th>W/O TANK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1- System Costs:</strong></td>
<td>$2,043,000</td>
<td>$1,693,000</td>
</tr>
<tr>
<td><strong>2- Grant Funding: WWDC</strong></td>
<td>$868,000</td>
<td>$606,000</td>
</tr>
<tr>
<td>: FLB</td>
<td>$444,000</td>
<td>$444,000</td>
</tr>
<tr>
<td>Total Grants</td>
<td>$1,312,000</td>
<td>$1,050,000</td>
</tr>
</tbody>
</table>

### Loan Requirements:
- WWDC
  - $289,000
  - $202,000
- FLB
  - $442,000
  - $442,000
- Total Loans
  - $731,000
  - $644,000
<table>
<thead>
<tr>
<th></th>
<th>W/TANK</th>
<th>W/O TANK</th>
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</thead>
<tbody>
<tr>
<td>30 yrs @ 4%</td>
<td>$16,713</td>
<td>$11,682</td>
</tr>
<tr>
<td>($289,000, 202,000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 yrs @ 8.5%</td>
<td>$41,128</td>
<td>$41,128</td>
</tr>
<tr>
<td>($442,000, 442,000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserve</td>
<td>$2,500</td>
<td>$2,500</td>
</tr>
<tr>
<td>Operation &amp; Maint.</td>
<td>$2,500</td>
<td>$2,500</td>
</tr>
<tr>
<td>Total Annual Cost</td>
<td>$62,841</td>
<td>$57,810</td>
</tr>
<tr>
<td>Monthly User Cost</td>
<td>$43.64</td>
<td>$40.15</td>
</tr>
</tbody>
</table>

The monthly cost can be decreased by the assessment of a one-time connection fee. For example, if a connection fee of $500. were established, $60,000 would be raised by 120 connections. This would reduce the monthly payment about $4.00.

It should be noted that many issues could affect the amount individual customers will be required to pay. As mentioned previously, the estimates are very preliminary. The costs could change as the design is more defined. Interest rates, WWDC & PLB participation, service population all could significantly change the monthly user cost. Other sources of funding might be pursued or loan amounts reduced due to values of the existing Bedford system which may be eligible for local matching funds.
5.0 SUMMARY AND RECOMMENDATIONS

5.1 SUMMARY

The Bedford community pipeline has served its customers for many years. Its condition and capacity are at a point where new facilities need to be planned, funded, and constructed to insure continuing reliable service, allow for reasonable community growth, and provide the additional benefits of expanded service, fire protection, and higher levels of capacity and pressure.

The Wyoming Water Development Commission has funded a Level I study to define the issues, determine feasibility, preliminary costs, and options to satisfy needs. This report presents the results of these Level I investigations. A combination of field measurements and local contacts as well as records research has allowed the definition of current and future project issues, the establishment of design criteria, analysis of alternatives and their costs, and the formulation of recommended action.

Perhaps the primary physical problem in the Bedford area is the condition and sizes of the present water system. The source of water is a large spring located about 1.5 miles up Strawberry Creek Canyon. Although there is excellent quality and quantity during most of the year, there are needed improvements to insure protection from contamination and increase capacity. Additional springs in the area should also be developed.

The existing transmission line is 6 inch diameter steel pipe over 40 years old. Many leaks have been repaired in recent years particularly where the pipe is buried in the road leading up the canyon. The problem appears to be traffic in conjunction with shallow depths and poor bedding. The pipe also has limited capacity and should be replaced with larger diameter pipe.

The distribution system comprises over 15 miles of small diameter pipe. Its condition is an issue but the primary problem remains the sizes of various branches. Many of the higher areas in the community served by small lines have less than legal minimum pressures at times during peak summer flows. The risk to health and safety is present at these times. The consumption in the Bedford area is very high compared to other similar communities. Conservation would certainly lessen the impact of peak flow problems but still does not provide additional capacity for growth or any fire protection. Computer modeling of the system has identified areas where upgraded pipe sizes would increase flow and pressure strategically.
The issue of water rights was addressed in some detail in this Level I study. Bedford has the needed quantity of rights and with transfers up the canyon would have plenty for their long term needs. However, the date of priority of these rights is not sufficient to consistently have a legal supply of water in late summer. Additional early priority supplies are needed to firm up the Bedford supply. This does not appear to be a major problem but the lengthy application/approval process adds to the expense of water right acquisition. A backup well has been suggested as one alternative to short water supplies. If water rights were regulated and use denied, the well could still be pumped to provide a backup supply.

Other facilities will probably be required. These include water storage, disinfection, and pressure regulation stations. These should be located and designed for ease of operation and maintenance and to provide easy expansion and upgrade.

After consideration of many alternatives, a small number were cost estimated and presented to the Water Development Commission staff, the community as a group and the Board of Directors in particular. The selection of various alternatives and costs involved are summarized in the report.

5.2 RECOMMENDATIONS

1) The residents of Bedford should act together to expeditiously form a water and sewer district. The available resources of the Water Development Commission, Lincoln County, and professional advisors should be utilized to accomplish the various tasks required including petitions, hearings, and election.

2) The findings of the Level I study (documented in this report) should be the basis for seeking Commission approval and legislative funding to continue the Bedford project into Level II or perhaps even moving to Level III, Phase I. Level II activities should include further work on water rights transfers/filings, additional field monitoring of springs, canyon surveying and location work, more detailed design and cost development, and an "ability to pay analysis" for the residents of Bedford.

3) It is the consensus of the community that an alternative be pursued which includes adequate capacity to serve a long term population of 690 (218 service connections). This alternative system would supply basic residential fire protection to the community and would include the following facilities:
WATER SUPPLY

1. Improve Big Spring - Collection Systems
2. Develop two additional spring sources
3. Develop groundwater as backup if required

RAW WATER PIPELINE

1. New 10" line from springs to town

DISTRIBUTION SYSTEM

1. Upgrade existing lines to 6" minimum
2. Install fire hydrants in developed areas

STORAGE

1. Provide peaking storage (250,000 gallons)
2. Provide residential fire storage (250,000 gallons)
3. Total 500,000 gallons

4) Long term water system capacities have been projected on the basis of a 30 - 35 percent reduction in per capita consumption for the Bedford area. Serious consideration must be given to means of accomplishing these reductions including pressure management, restrictive pipe sizing, and probably most effective, individual metering. Metering will be a requirement of FLB.

5) The new district must address the issue of water rights in the Strawberry Creek Drainage as part of this project. Existing rights must be transferred and additional early priority water rights be acquired to firm up water supplies for year around operation. A backup water well may be required for emergency supply and to provide additional summer water rights.

6) Additional system monitoring and metering should be done throughout the next several months to further understand the abnormally high water usage. This work may need to be followed up by additional measurements including leak detection, pressure gradient, and recording pitot tube studies.

7) The existing springs should be monitored for flow and periodic quality assessments/tests to assist in design and planning for the new system. These measurements should be made monthly throughout winter and spring runoff.