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EXECUTIVE SUMMARY

FAYETTE IRRIGATION DISTRICT
REHABILITATION PROJECT

November 5, 1999

Submitted to:
Wyoming Water Development Commission

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Introduction

The Fayette Irrigation District is located in Sublette County near Boulder, Wyoming. Although the Fayette Ditch is an old irrigation system, the district itself was not formed until July of 1998. The Association that existed prior to the formation of the District was funded by volunteer payments. Consequently, the Fayette Irrigation System has seen many years of neglect due to the lack of funding for repairs. Besides needing repairs and cleaning, the existing irrigation system cannot deliver water to some of the land with adjudicated water rights.

The Fayette Irrigation District irrigates one ranch with approximately 300 irrigated acres. However, the majority of the adjudicated lands are below the ranch and part of the Barger and Big Country Ranches Subdivisions.

The Fayette Ditch begins at a diversion from Fall Creek in Section 2, T.33N., R.108W. Fall Creek flows out of Burnt Lake and the Meadow Creek drainage area flows into Fall Creek above the diversion. From the diversion, the ditch runs in a southerly direction until it crosses a road near the center of Section 21 at which point it flows down a natural drainage. Due to the velocity of the flowing water and highly erosive soils, the natural drainage is severely eroded which has created the “Grand Canyon”. The eroded bank is up to 35 feet deep in some areas and has created extreme sedimentation that has filled the first reservoir downstream. A second sedimentation reservoir was built downstream. Below this second reservoir, the water is diverted out of the natural drainage into the irrigation system.

The West Lateral begins where the Fayette Ditch presently leaves its intended course and runs down the natural drainage. It flows through an area where some subdivision lots with adjudicated water rights are less than one acre. The original lateral has been breached in various locations by the development of subdivision roads. This portion of
the ditch has not been in use for years and consequently, the land located directly below the ditch has not been irrigated since approximately 1972.

Furthermore, the users at the end of the district are not being provided reliable water supply due to the existing inefficient system. There is no current storage available to supplement late season irrigation water supply.

The general scope of the work for the project was to complete an agricultural water system rehabilitation study for the Fayette Irrigation District water users and provide reconnaissance level designs and cost estimates. Rio Verde Engineering (RVE) completed a thorough inventory of the system, including extensive GPS and conventional surveys, water surface profile models and structures analysis. Through frequent site visits, potential solutions for problem areas within the district were developed. RVE presented Phase I results including preliminary cost estimates and designs to the Fayette Irrigation District and the Wyoming Water Development Commission from which decisions were made concerning the main issues that should receive immediate focus.

Conceptual designs and cost estimates, particularly on the rehabilitation of the West Lateral, Christmann Pond and Grand Canyon options were presented. We were requested to provide a preliminary design on the Burnt Lake Dam in order to allow them to start the permitting process in the future. It was decided that the best solution at this time for the Grand Canyon erosion problem would be to reroute the water out of the Grand Canyon, into the West Lateral. The majority of the water would then be diverted into the Middle Diversion for approximately 2400 ft, where a new ditch would deliver the water back into the irrigation system at a point below the Grand Canyon and above the West Diversion.

RVE analyzed project financing, developed a System Operating Plan and addressed permit requirements.
PHASE I
Nomenclature

The following is a nomenclature map that sets a guideline for the terminology used in this report.
Inventory Existing System

Fayette Irrigation Ditch Structure Survey

Each structure on the system was noted at the time of the survey and given an identification name and station. We toured the system and rated each structure’s remaining life and condition.

HEC-RAS Modeling

We used HEC-RAS to obtain particular information about the Fayette Ditch. Each of the seven major sections of the irrigation system (excluding the Grand Canyon) was individually modeled. The primary objective of these models was to determine the flow capacity of each of the ditches and whether they could carry enough water to sufficiently irrigate the lands that they service.

Model Results

The survey information and models indicated that the most of the ditches were in tact. Some ditches will need work to carry the desired flows. The irrigable lands in the District call for 36 cfs. The Upper Fayette Ditch can handle 90 cfs with little additional work, which is 2.5 times the minimum required flow.

Although the West Lateral has not been used for many years, much of the ditch is still in place. In order to remove the water from the Grand Canyon or to service land directly below the West Lateral, it must be rehabilitated. Subdivision roads have breached the ditch in several locations and the ditch has been obliterated along certain stretches of the reach. However, the model shows that where the ditch is in place it can handle 100 cfs or 3.1 times the required flow.

The Middle Diversion will also have to be brought back into use if water is to be removed from the Grand Canyon. The water will be diverted from the West Lateral into the Middle Diversion and then into the new proposed cross-over ditch back into the system at a point below the Grand Canyon and above the West Diversion. The Middle Diversion is a deep cut channel resulting from past erosion. The model shows that it has plenty of capacity but high flow velocities, which indicate a need for drop structures to control erosion.

The West Diversion has a flow requirement of 5.8 cfs. According to the model, the ditch can handle 8 cfs with basic ditch cleaning. The Southwest Diversion can carry
18 cfs, which is 3.8 times the required flow. Minor ditch cleaning and rehabilitation of the Southeast Diversion could result in flows well over 12 cfs, which is 3.4 times the required flow of 3.5 cfs. The required flow for the Lower Main is 8.6 cfs.

As with all the ditches in the District, the upstream end of the ditch needs to carry most of the water and as water is diverted along the way, the required capacity of the main channel decreases. The Lower Main can carry up to 16 cfs or 1.8 times the required flow to the downstream end of the ditch with cleaning and other minor work. The following table summarizes flow requirements for the Fayette Irrigation District.

<table>
<thead>
<tr>
<th></th>
<th>Acres</th>
<th>1cfs/70ac</th>
<th>2cfs/70ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjudicated Acres</td>
<td>2129.0</td>
<td>30.4</td>
<td>60.8</td>
</tr>
<tr>
<td>Acres above Grand Canyon</td>
<td>250.0</td>
<td>3.6</td>
<td>7.2</td>
</tr>
<tr>
<td>Acres below Grand Canyon</td>
<td>1879.0</td>
<td>26.8</td>
<td>53.6</td>
</tr>
<tr>
<td>Acres SW of Highway</td>
<td>204.8</td>
<td>2.9</td>
<td>5.9</td>
</tr>
</tbody>
</table>

**Digitized Irrigable Lands**

<table>
<thead>
<tr>
<th></th>
<th>Acres</th>
<th>1cfs/70ac</th>
<th>2cfs/70ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total acres below ditches NE of highway</td>
<td>2540.5</td>
<td>36.3</td>
<td>72.6</td>
</tr>
<tr>
<td>Acres above Grand Canyon</td>
<td>606.5</td>
<td>8.7</td>
<td>17.3</td>
</tr>
<tr>
<td>Acres below Grand Canyon</td>
<td>1934.0</td>
<td>27.6</td>
<td>55.3</td>
</tr>
<tr>
<td>Area below West Lateral &amp; above West Div.</td>
<td>711.7</td>
<td>10.2</td>
<td>20.3</td>
</tr>
<tr>
<td>Area below Middle Diversion</td>
<td>1222.0</td>
<td>17.5</td>
<td>34.9</td>
</tr>
<tr>
<td>Area below West Diversion</td>
<td>373.0</td>
<td>5.3</td>
<td>10.7</td>
</tr>
<tr>
<td>Area below Lower Main</td>
<td>849.0</td>
<td>12.1</td>
<td>24.3</td>
</tr>
<tr>
<td>Area below Southwest Diversion</td>
<td>332.0</td>
<td>4.7</td>
<td>9.5</td>
</tr>
<tr>
<td>Area below Southeast Diversion</td>
<td>245.0</td>
<td>3.5</td>
<td>7.0</td>
</tr>
</tbody>
</table>

**Historical Flow Data**

We conducted some research on historical flows of Fall Creek. The US Geological Survey Water Resources Division has a website located at waterdata.usgs.gov. Flow data was found for a station on Fall Creek just above the Fayette Ditch diversion. Daily data was recorded from 1939 to 1971.
The average flows for May, June and July are more than enough to supply the Fayette Irrigation District its required flow of 35cfs. As long as water can be efficiently diverted at the main head gate on Fall Creek, abundant water is available during the peak growing season. According to a statistical analysis performed on the data, there is an 80% percent chance of having an average July flow of greater than 37cfs and a 98.4% chance of having an average July flow greater than 16 cfs. Fifty percent of the time there will be at least twice the required flow or 70 cfs available.

**Options**

Various options were presented to the Fayette Irrigation District and the WWDC. Some preliminary designs and cost estimates were prepared to aid in decision making. In order for us to proceed to Phase II, we had to be given some direction on which options the District and the WWDC wanted us to pursue further. In particular, we needed feedback on Storage Options, the Grand Canyon and the West Lateral.

**Phase I Results Meeting**

The Phase I Results meeting was held on Tuesday, September 21, 1999 at the Rio Verde Engineering office. We presented those in attendance with the work results up to that point. This meeting was crucial in determining what areas or items of concern need more investigation. Information that was presented at the end of Phase I contained adequate preliminary designs and cost estimates to decide which options could be ruled out and which ones needed further study. By the end of the meeting, the project was redirected to a list of items that the Fayette Irrigation District identified as projects that needed further analysis or investigation. These became the focus of Phase II of the project. They include:

1. Main headgate design
2. West Lateral rehabilitation
3. Southeast Diversion rehabilitation
4. Christmann’s drop structure design
5. Middle Diversion and Cross-Over Ditch (Grand Canyon)
6. BLM silt ponds
7. Southwest Diversion Drop Structure
8. 112+35 drop & diversion structure design
9. Christmann’s pond as a storage option
10. Seepage investigations
11. Burnt Lake Dam design (enough to start permitting at some point in future)
PHASE II

Project Benefits, Conceptual Designs and Cost Estimates

Estimated costs for these projects are based on 2001 dollars and 100 percent loan.

Main Headgate

The current headgate is in need of repair with only two out of the three gates working. The current diversion is highly inefficient particularly during low flows later in the season. As designed, the new diversion and headgate would enable the district to control flows in Fall Creek and in the ditch even during the late season low flows. Having the ability to control the diversion of high and low flows from Fall Creek would benefit the entire District. The estimated cost of $38,231.69 or $17.96 per District adjudicated acre. Amortized over 20 years, the cost per acre would be $1.48 based on a loan at 6%.

West Lateral

The West Lateral Rehabilitation would benefit the District by enabling them to retain 403 acres of their current adjudicated acre base and possibly add 276 irrigable acres to their base in the future. The economic increase per irrigated acre is estimated at $30 per acre based on a production of three quarters of a ton per acre at $40 per ton. The same benefit can be obtained by placing a value on the increase in grazing on irrigated versus non-irrigated lands.

One other benefit of rehabilitating the West Lateral is the ability to remove the irrigation water from the Grand Canyon. Erosion in the Grand Canyon is accelerated by the irrigation water flow.

The cost of the project is estimated at $71,215.30 or $33.35 per District adjudicated acre. Amortized over 20 years, the cost per acre would be $2.92 based on a loan at 6%.

Southeast Diversion

The benefits analysis is the same for the Southeast Diversion as the West Lateral. There are 245 adjudicated acres supplied by this ditch for which the economic benefits are $30 per irrigated acre.

The cost of rehabilitating the Southeast Diversion is estimated at $13,134.29 or $6.17 per District adjudicated acre. Amortized over 20 years, the cost per acre would be $0.54 based on a 6% loan.
Christmann Drop Structure

The current drop structure on the Upper Fayette Ditch washed out this past spring. Temporary repairs enabled the District to use the current structure this year. Those repairs may last longer. However, the current structure will need replaced because it will be a bottleneck to future flow requirements of the District.

The estimated cost of replacing this structure is $27,648.33 or $12.99 per District adjudicated acre. Amortized over 20 years, the cost per acre would be $1.13 based on a 6% loan.

Middle Diversion and Cross-Over Ditch

The benefits of this project are more difficult to quantify. As long as irrigation water flows down the Grand Canyon, erosion in the Grand Canyon will continue at an accelerated rate. The irrigation water has created a wash with steep banks up to 35 feet high. Safety has become a primary concern in the area and the problem continues to get worse as the water keeps down cutting and eroding in order to reach equilibrium. The wash is also encroaching on private lands as the banks fall in and the channel widens. Normal flows from spring runoff, when the ground is partially frozen, would be the only flows down the Grand Canyon if this project is built. The exception is if the District uses the West Lateral Emergency by-pass for repairs. The intent is that the by-pass be used only on a temporary or emergency basis, which will keep erosion to a minimum.

The estimated cost of this project is $119,594.48 or $56.17 per District adjudicated acre. Amortized over 20 years, the cost per acre would be $4.90 based on a loan at 6%.

BLM Silt Ponds

The first silt pond has become an important drop structure for the reduction of erosion below the Grand Canyon. Repairs are necessary to the drop pipe and earth dam. A spillway would take the pressure off of the drop pipe and supply fill for the earth dam repair. The main benefit would be the reduction of future erosion should this structure fail.

The second silt pond is a safety problem due to the size of the dam, lack of freeboard and materials used in construction of the dam. The State Engineer’s Office requested that look at this dam. This silt pond is no longer needed if irrigation water is removed from the Grand Canyon. We believe that the only solution is to remove the dam.
The estimated cost of these projects is $34,096.71 or $16.02 per District adjudicated acre. Amortized over 20 years, the cost per acre would be $1.40 based on a loan at 6%.

**Southwest Diversion Drop Structure/Diversion**

Due to the current structure elevations, erosion occurs when the water flows out of the downstream end of the structure and falls to the ditch. The soils in this area are highly erosive. A drop structure here would reduce the erosion and eliminate the need to annually clean the ditch below the structure due to sedimentation.

The cost of this project is $5,438.50 or $2.79 per District adjudicated acre. Amortized over 20 years, the cost per acre would be $0.24 based on a loan at 6%.

**Drop Structure 112+35 on Lower Main**

This structure on the Lower Main Ditch is failing and is a current source of erosion. Installation of a drop structure at the proper elevations will reduce the erosion potential.

The estimated cost of this project is $6,401.97 or $3.01 per District adjudicated acre. Amortized over 20 years, the cost per acre would be $0.26 based on a 6% loan.

**Christmann Pond**

Raising the pond level by 3 feet will provide 127.8 acre-feet of storage water, which could be used to supplement late season irrigation water flows. One acre-foot of water will provide 0.5 cfs for 24 hours. Over 15 days the supplemental flow would be 2.15 cfs which would supply 150 acres their adjudicated water right of 1 cfs per 70 acres. Over the long term, the best case would be that costs equal the benefits obtained based on a 20 to 30 year payback period. For this reason, we do not recommend construction of this project.

**Seepage**

Seepage becomes a problem when the available flows are less than the adjudicated water rights. Loss of water at this point becomes a hardship.

The estimated clean and move cost is $17,360.19 or $8.15 per District adjudicated acre. Amortized over 20 years, the cost per acre would be $0.71 based on a 6% loan.

**Burnt Lake**

Two feet of water in Burnt Lake would provide late season storage of up to 1580 acre-feet. This would provide the District it’s required flow based on adjudicated acres of 30.4 cfs for 26 days. Late season storage can prove valuable to the District especially
during drought years. In some cases, late season irrigation may prevent permanent wilting and save a hay crop.

The estimated cost of the Burnt Lake Dam is $344,997.50 or $239.24 per acre-foot of storage. The cost per District adjudicated acre is $176.96. Amortized over 20 years, the cost per acre is $15.43 based on a 6% loan. This project is not planned for construction at this time.

**Project Financing**

Any rehabilitation project will be funded based on a 50/50 grant-loan split. A Water Development Grant will cover half the costs, while the District will pay for the other half through use of a 6% loan acquired through the Wyoming Water Development Commission. The following table summarizes the per acre assessment that will be needed for each project.

<table>
<thead>
<tr>
<th>Project</th>
<th>Total Cost</th>
<th>Cum Cost</th>
<th>20 yrs</th>
<th>Cum Cost</th>
<th>30 yrs</th>
<th>Cum Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Headgate Alt.</td>
<td>$38,231.69</td>
<td>$19,115.85</td>
<td>$0.78</td>
<td>$0.78</td>
<td>$0.65</td>
<td>$0.65</td>
</tr>
<tr>
<td>West Lateral Rehab</td>
<td>$71,215.30</td>
<td>$54,723.50</td>
<td>$1.46</td>
<td>$2.24</td>
<td>$1.22</td>
<td>$1.87</td>
</tr>
<tr>
<td>Southeast Div. Rehab</td>
<td>$13,134.29</td>
<td>$61,290.65</td>
<td>$0.27</td>
<td>$2.51</td>
<td>$0.22</td>
<td>$2.09</td>
</tr>
<tr>
<td>Drop Structure 76+65</td>
<td>$27,648.33</td>
<td>$75,114.81</td>
<td>$0.57</td>
<td>$3.08</td>
<td>$0.47</td>
<td>$2.56</td>
</tr>
<tr>
<td>Middle Div &amp; Cross-Over</td>
<td>$119,594.48</td>
<td>$134,912.05</td>
<td>$2.45</td>
<td>$5.52</td>
<td>$2.04</td>
<td>$4.60</td>
</tr>
<tr>
<td>Southwest Div./Drop</td>
<td>$5,938.98</td>
<td>$137,881.54</td>
<td>$0.12</td>
<td>$5.65</td>
<td>$0.10</td>
<td>$4.70</td>
</tr>
<tr>
<td>Lower Main Drop/Div</td>
<td>$6,401.97</td>
<td>$141,082.52</td>
<td>$0.13</td>
<td>$5.78</td>
<td>$0.11</td>
<td>$4.81</td>
</tr>
<tr>
<td>Christmann Pond</td>
<td>$40,050.29</td>
<td>--</td>
<td>$0.82</td>
<td>--</td>
<td>$0.68</td>
<td>--</td>
</tr>
<tr>
<td>BLM Silt Pond</td>
<td>$34,096.71</td>
<td>$158,130.87</td>
<td>$0.70</td>
<td>$6.48</td>
<td>$0.58</td>
<td>$5.39</td>
</tr>
<tr>
<td>Seepage Control</td>
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<td>$167,639.82</td>
<td>$0.39</td>
<td>$6.87</td>
<td>$0.32</td>
<td>$5.71</td>
</tr>
<tr>
<td>Burnt Lake Dam</td>
<td>$376,745.89</td>
<td>--</td>
<td>$7.71</td>
<td>--</td>
<td>$6.43</td>
<td>--</td>
</tr>
</tbody>
</table>

Each project has been broken down so the District can pick and choose which projects they want to pursue. Depending on the District's financial status, they can phase in the various projects in accordance with their priorities.