GUNBARREL LATERAL DITCH STUDIES

EXECUTIVE SUMMARY

Rehabilitation Plan
Preferred Alternate B
TASK ‘B’

GUNBARREL LATERAL DITCH STUDIES

EXECUTIVE SUMMARY

Rehabilitation Plan
Preferred Alternate B
on Gunbarrel Ditch Water Delivery System

November 13, 1995

Prepared For: Wyoming Water Development Commission
Wheatland Irrigation District
Gunbarrel Ditch Company

Prepared By: Kennedy Engineering
608 9th Street
Wheatland, WY 82201
1.0 NARRATIVE:

1.1 - The Gunbarrel Ditch Company consists of the landowners who receive irrigation water from the Gunbarrel Ditch. See Exhibit A for the boundaries of the Gunbarrel Ditch Company.

TOTAL ASSESSED ACREAGE IN GUNBARREL DITCH CO. = 2659 ACRES

This total assessed acreage number includes road rights-of-way, seeped lands, other non-irrigated lands within building lots and feedlots, and in at least two instances land that is not irrigated from the Gunbarrel Ditch consisting of approximately 90 acres of Earl Call’s property in Section 9 and approximately 70 acres of Everett Kirkhart’s property in Section 10.

1.2 - The Gunbarrel Ditch headgate is located on Lateral No. 1 in the Wheatland Irrigation District in the NW\(\frac{1}{4}\)SW\(\frac{1}{4}\) of Section 33, T24N, R68W. The Wheatland Irrigation District delivers water to the Gunbarrel Ditch Company in Lateral No. 1. The Gunbarrel Ditch Company then is responsible for delivery of the water to the fields at the headgates located on the Gunbarrel Ditch.

Circa 1965, the portion of the Gunbarrel Ditch along the west sides of Section 21 and Section 16; and along the north side of the NW\(\frac{1}{4}\) of Section 16 and the south side of the SW\(\frac{1}{4}\)SE\(\frac{1}{4}\) of Section 9, consisting of approximately 2 3/4 miles was improved with concrete lining. This concrete lining is generally in very good condition. A walk-through inspection of the entire length of the concrete lining was performed on June 29, 1995. The concrete lining shows little evidence of thermal stress. Only five (5) small "blow-outs" of the lining were found and two of these had already been patched. There was some minor cracking mostly in the area of juncture between the bottom and sides of the ditch. Toward the end of the ditch there is a short stretch where an extension has been placed on top of the original lining which has a longitudinal crack between the original lining and the extension. In the last 1/4 mile of ditch there are two different sections, of approximately 50 feet each, of "V" ditch which enlarge back to a 1 foot wide bottom trapezoidal section. These two sections should be replaced. The ditch is fast and self cleans except for some gravel which has been trapped south of the Palmer Canyon Road crossing, and except for silt and debris trapped in a flat area along the west side of Section 16.

However, the head portion of the Gunbarrel Ditch from the headgate in Lateral No. 1 to the Southwest Corner of Section 21, consisting of approximately 1 1/2 miles, remains as unlined dirt ditch.

1.3 - The unlined dirt portion of the Gunbarrel Ditch is the source of several different problems affecting the Gunbarrel Ditch Company, Platte County Roads and the general ecology of the area noted as follows:

* Erosion of the ditch: ground slope is comparatively steep, water velocity high and erosion is severe especially along the ± 3/8 mile which parallels the west side of Grange Road south of Jefferson Road.

* Soil and debris carried away by erosion is transported downstream and deposited in diversion boxes and flatter/slower portions of the concrete lined ditch especially north of Palmer Canyon Road.

* Erosion of the ditch parallel with Grange Road threatens safe shoulder slopes and results in an even greater roadside hazard for the public traveling this Platte County road.

Note: The Platte County road rights-of-way in the irrigated "Wheatland Flats" area are normally only 40 feet total, being 20 feet each side of Section lines. The Gunbarrel Ditch is adjacent to this narrow right-of-way and severely hampers the County’s...
The Gunbarrel Ditch crosses Grange Road twice, Jefferson Road once and Washington Road once in the stretch of 1¼ mile dirt ditch. These crossings are made with C.M.P. culverts without headwalls. The culverts on Grange Road have clearance between 7 feet to 10 feet from the culvert ends to the asphalt road shoulders. The culverts on Jefferson and Washington Roads have clearance of approximately 3 feet from the culvert ends to the graveled road shoulders. These crossings are also within the area of the intersections with the asphalt paved Grange Road. There is no guard rail protecting any of these road crossing culverts. There is some erosion around the ends of the culverts.

Weed seed can freely enter the open ditch and is carried and spread into the downstream fields. This increases the necessity, frequency and expense of herbicide application in the downstream fields.

Water is lost by seepage and evaporation. Measurements were taken on 7/21/95 and 7/24/95 to quantify the loss between the 5 foot Parshall flume at the Gunbarrel Headgate and the concrete diversion box in the Southwest corner of Section 21 where the concrete lining begins. These measurements were taken around 5:30 p.m. and 10:30 a.m. respectively at ambient temperature of 80°F to 85°F. The resulting water loss was 4.60 c.f.s. and 4.51 c.f.s. respectively. This results in an average water loss of approximately 9.1 acre-feet daily.

The open ditch closely parallels the Platte County road known as Grange Road and is a roadside hazard. There have been several incidents of vehicles leaving the road surface and landing in the ditch. As previously mentioned, the road right-of-way is narrow and the ditch is adjacent.

1.4 - Several different alternatives were investigated for the rehabilitation of the Gunbarrel Ditch. (See Appendix A) These alternatives were presented to the WWDC Coordinator and the Gunbarrel Ditch Landowners and discussed at length on August 8, 1995. After this meeting the Gunbarrel Ditch Company consensus was for Alternate B.
ALTERNATE 'B' - Proposed Improvements

NOTE: Refer to Exhibit A to correlate numbers and description of facilities.

1. - Existing Headgate: To Remain - Existing dirt channel from headgate to 5 foot Parshall Flume to be concrete lined with rectangular channel section. (3.5' deep x 10' wide x 120').

2. - Existing 5' Parshall Flume: To Remain - Existing concrete lined channel between P.F. and concrete chute to be removed & replaced at revised elevation & slope so P.F. will not run submerged. (3.5' deep trapezoidal with 6.0' bottom x 50').

3. - Existing concrete lined chute, ± 750 L.F., abandoned in place.

4. - Existing drop at end of concrete chute abandoned in place.

5. - Remove existing 48" C.M.P. culvert under Grange Road. Place new 24" pipeline in same location where the Grange Road asphalt is cut for the removal of the culvert. Compact the backfill and replace the base and asphalt on Grange Road.

6. - Backfill the existing dirt Gunbarrel Ditch as it parallels the Grange Road leaving a 'V' ditch approximately 2 feet below the road surface for road drainage. (approx. 6,000 c.y. backfill)

7. - Remove existing 57"x38" pipe arch culvert under Jefferson Road. Compact the backfill and replace the base for the County Road. (Note: the 24" pipeline will not follow the loop in the dirt Gunbarrel Ditch at this point but will continue parallel with and on the west side of Grange Road.)

8. - Remove existing 57"x38" pipe arch culvert under Grange Road. Place new 24" pipeline in same location where the Grange Road asphalt is cut for the removal of the culvert. Compact the backfill and replace the base and asphalt on Grange Road.

9. - Generally, the new 24" pipeline will follow the dirt Gunbarrel Ditch with 4 foot of burial from the finish grade after backfilling the ditch. (Approximately 8510 L.F. of 24" P.V.C. pipeline.)

10. - Exist. concrete check/drop with abandoned headgate to the east to be removed.

11. - Exist. concrete check/drop with headgate to the east to be removed. Due to the elevation of the hydraulic grade line, a diversion box is impracticable. Construct turnout to the east with a 24"x12" tee, 12" lead pipe and riser with 12" alfalfa valve and hydrant in a concrete erosion control box.

12. - Existing concrete check/drop with two headgate to the east to be removed. Construct concrete diversion box with center wall height matching the hydraulic grade line at design capacity of 30.3 c.f.s. for the 24" pipeline. (Note: box will extend approximately 10 feet above ground.) Diversion box to have two (2) headgates (12") to the east with 12" lead pipes and risers to deliver to existing 9" Parshall flumes.

13. - Remove existing 57"x38" pipe arch culvert under Washington Road. Construct 24" pipeline across road in same cut made for removal of culvert. Compact backfill and replace aggregate base on County Road.

14. - Remove existing concrete check/drop with two headgates to the east. Construct concrete diversion box at end of 24" pipeline with center wall height matching the hydraulic grade line at design capacity of 30.3 c.f.s. for
15. - Extend 30" C.S.P. culvert to N. end of Hightower Road crossing at center Section 9, 24/68.

16. - Concrete Headwall at N. end 30" C.S.P.

17. - Remove existing concrete lining in ditch north & east of Hightower Road crossing at Center Sec. 9; 24/68; Replace with concrete lined trapezoidal ditch = (1' bottom, 1:1 side slopes, 2' deep)

18. - Remove existing dual 15" R.C.P. culverts in driveway approach at 276 Hightower Road & replace with reinforced concrete box (2'x4'x25')

19. - Remove existing concrete lining in ditch east of 276 Hightower Road & replace with concrete lined trapezoidal ditch: (1' bottom, 1:1 side slopes, 2' deep)
### 3.0 COST ESTIMATES:

**ALTERNATE 'B'**

**TASK B – GUNBARREL DITCH IMPROVEMENTS**

Engineer’s opinion of probable cost for construction of proposed improvements:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item Description</th>
<th>Unit</th>
<th>Est. Quant.</th>
<th>Est. Unit Cost</th>
<th>Total Est. Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Concrete lined rect. channel (3.5'x10') from Gunbarrel H.G. to 5' P.F. (± 120')</td>
<td>c.y.</td>
<td>25</td>
<td>$200.00</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>2.a</td>
<td>Remove existing concrete lined channel between 5' P.F. &amp; conc. chute</td>
<td>s.y.</td>
<td>80</td>
<td>$3.00</td>
<td>$240.00</td>
</tr>
<tr>
<td>2.b</td>
<td>Construct reinforced concrete drop box entrance into 24' P.V.C. pipeline tied to outlet of existing 5' P.F.</td>
<td>c.y.</td>
<td>7</td>
<td>$500.00</td>
<td>$3,500.00</td>
</tr>
<tr>
<td>3</td>
<td>Abandon existing concrete chute in place.</td>
<td>0</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>4</td>
<td>Abandon existing drop @ end of conc. chute in place.</td>
<td>0</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>5.a</td>
<td>Remove exist. 48&quot; C.M.P. culvert under Grange Road.</td>
<td>L.S.</td>
<td>1</td>
<td>$500.00</td>
<td>$500.00</td>
</tr>
<tr>
<td>5.b</td>
<td>Replace base &amp; asphalt on Grange Road.</td>
<td>s.y.</td>
<td>40</td>
<td>$30.00</td>
<td>$1,200.00</td>
</tr>
<tr>
<td>6.a</td>
<td>Backfill of existing dirt ditch (7300 L.F.) leaving 2' deep 'V' ditch for road drainage.</td>
<td>c.y.</td>
<td>6000</td>
<td>$3.00</td>
<td>$18,000.00</td>
</tr>
<tr>
<td>7.a</td>
<td>Remove existing 57&quot;x38&quot; C.M.P. arch culvert under Jefferson Road.</td>
<td>L.S.</td>
<td>1</td>
<td>$500.00</td>
<td>$500.00</td>
</tr>
<tr>
<td>7.b</td>
<td>Replace Base aggregate.</td>
<td>s.y.</td>
<td>35</td>
<td>$15.00</td>
<td>$525.00</td>
</tr>
<tr>
<td>8.a</td>
<td>Remove existing 57&quot;x38&quot; C.M.P. arch culvert under Grange Road.</td>
<td>L.S.</td>
<td>1</td>
<td>$500.00</td>
<td>$500.00</td>
</tr>
<tr>
<td>8.b</td>
<td>Replace base &amp; asphalt.</td>
<td>s.y.</td>
<td>40</td>
<td>$30.00</td>
<td>$1,200.00</td>
</tr>
<tr>
<td>9</td>
<td>Replace existing open ditch with 24&quot; ULTRA RIB P.V.C. Pipeline (ASTM F-794; SCS 441-JJ)</td>
<td>L.F.</td>
<td>8510</td>
<td>$26.00</td>
<td>$221,260.00</td>
</tr>
<tr>
<td>10</td>
<td>Remove exist. conc. check/drop</td>
<td>L.S.</td>
<td>1</td>
<td>$500.00</td>
<td>$500.00</td>
</tr>
<tr>
<td>11.a</td>
<td>Remove exist. conc. check/drop.</td>
<td>L.S.</td>
<td>1</td>
<td>$500.00</td>
<td>$500.00</td>
</tr>
<tr>
<td>11.b</td>
<td>24&quot;x12&quot; Tee in pipeline with 12&quot; alfalfa valve &amp; hydrant in concrete box for T.O. to East.</td>
<td>L.S.</td>
<td>1</td>
<td>$1,500.00</td>
<td>$1,500.00</td>
</tr>
<tr>
<td>12.a</td>
<td>Remove exist. conc. check/drop</td>
<td>L.S.</td>
<td>1</td>
<td>$500.00</td>
<td>$500.00</td>
</tr>
<tr>
<td>12.b</td>
<td>Construct reinforced concrete Diversion box w/Two headgates to East.</td>
<td>c.y.</td>
<td>10</td>
<td>$500.00</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>13.a</td>
<td>Remove existing 57&quot;x38&quot; C.M.P. arch culvert under Washington Rd.</td>
<td>L.S.</td>
<td>1</td>
<td>$500.00</td>
<td>$500.00</td>
</tr>
<tr>
<td>13.b</td>
<td>Replace Base aggregate</td>
<td>s.y.</td>
<td>25</td>
<td>$15.00</td>
<td>$375.00</td>
</tr>
<tr>
<td>14.a</td>
<td>Remove existing concrete check/drop</td>
<td>L.S.</td>
<td>1</td>
<td>$500.00</td>
<td>$500.00</td>
</tr>
<tr>
<td>Item No.</td>
<td>Item</td>
<td>Unit</td>
<td>Est. Quant.</td>
<td>Est. Unit Cost</td>
<td>Total Est. Item Cost</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
<td>-------------</td>
<td>----------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>14.b</td>
<td>Construct reinforced concrete Diversion box w/two headgates to East.</td>
<td>c.y.</td>
<td>10</td>
<td>$500.00</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>15.</td>
<td>Extend 30&quot; C.S.P. culvert to N. end of Hightower Road crossing at center Sec. 9, 24/68.</td>
<td>L.F.</td>
<td>13</td>
<td>$50.00</td>
<td>$650.00</td>
</tr>
<tr>
<td>16.</td>
<td>Concrete Headwall at N. end 30&quot; C.S.P.</td>
<td>c.y.</td>
<td>1</td>
<td>$500.00</td>
<td>$500.00</td>
</tr>
<tr>
<td>17.</td>
<td>Remove existing concrete lining in ditch north &amp; east of Hightower Road crossing at Center Sec. 9; 24/68; Replace with concrete lined trapezoidal ditch = (1' bottom, 1:1 side slopes, 2' deep)</td>
<td>S.F.</td>
<td>1000</td>
<td>$2.00</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>18.</td>
<td>Remove existing dual 15&quot; R.C.P. culverts in driveway approach at 276 Hightower Road &amp; replace with reinforced concrete box (2'x4'x25&quot;)</td>
<td>c.y.</td>
<td>5</td>
<td>$500.00</td>
<td>$2,500.00</td>
</tr>
<tr>
<td>19.</td>
<td>Remove existing concrete lining in ditch east of 276 Hightower Road &amp; replace with concrete lined trapezoidal ditch: (1' bottom, 1:1 side slopes, 2' deep)</td>
<td>S.F.</td>
<td>500</td>
<td>$2.00</td>
<td>$1,000.00</td>
</tr>
</tbody>
</table>

**SUBTOTAL ESTIMATED CONSTRUCTION COST - 1995 DOLLARS**

$273,450.00

LESS ITEMS NO. 5a, 5b, 6a, 7a, 7b, 8a, 8b, 13a and 13b PERFORMED BY PLATTE COUNTY ROAD & BRIDGE DEPT. (SEE APPENDIX 'D')

$23,300.00

**SUBTOTAL**

$250,150.00

**ESTIMATED CONSTRUCTION COST - 1997 DOLLARS (1995 DOLLARS X 1.06)**

$265,159.00

**ENGINEERING COST @ 10%**

$26,515.90

**SUBTOTAL**

$291,674.90

**CONTINGENCY @ 15%**

$43,751.24

**CONSTRUCTION COST TOTAL - 1997 DOLLARS**

$335,426.14

**PREPARATION OF FINAL DESIGNS AND SPECIFICATIONS**

$13,257.95

**PERMITTING AND MITIGATION**

$1,000.00

**LEGAL FEES**

$5,000.00

**AQUISITION OF ACCESS AND RIGHTS-OF-WAY**

$0.00

**PROJECT COST TOTAL**

$354,684.09

Per Acre per year cost - 30 year loan at 4% for 33% of $354,684.09

$2.55
4.0 ECONOMIC ANALYSIS/ABILITY TO PAY

4.1 - This project will not increase any acreage under irrigation. The existing crops within the Gunbarrel Ditch Company generally consist of:

1. Alfalfa
2. Beans (Pinto) (White)
3. Corn
4. Sugar Beets
5. Small Grains
6. Sorghum

4.2 - This project will not directly increase crop yields within the Gunbarrel Ditch Company due to any calculable increase in water delivery to the fields. The Wheatland Irrigation District policy is to deliver water to the Gunbarrel Ditch Headgate plus the estimated ditch loss in order to deliver the farmers' water requests. Some benefit to the District as a whole will be realized due to the estimated water savings in the unlined dirt ditch of 9.1 acre-feet/day (approx. 1274 acre-feet/year based on 140 irrigating days per year).

4.3 - The Farmers in the Gunbarrel Ditch Company currently pay the following irrigation taxes:

<table>
<thead>
<tr>
<th>Wheatland Irrigation Dist.</th>
<th>$9.50/acre/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gunbarrel Ditch Company</td>
<td>$0.75/acre/year</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$10.25/acre/year</strong></td>
</tr>
</tbody>
</table>

These charges are assessed regardless of the supply of water available. It is noteworthy to correlate these irrigation taxes to the cost per acre-foot of water.

On 10/4/95 the Wheatland Irrigation District computed the 10-year average water supply (1986 through 1995) as 1.016 feet per acre within the District as a whole. Therefore the Gunbarrel Ditch Company pays an average of $10.09 per acre-foot for their irrigation water.

In comparison, the 10-year average water supply (1986 through 1995) is computed by the Goshen Irrigation District (G.I.D.) as 1.53 feet per acre within the district as a whole. The Irrigation Taxes within the G.I.D. are $18.76/acre. Therefore the farmers within the G.I.D. pay an average of $12.26 per acre-foot for their irrigation water.

4.4 - This project will benefit Platte County through the roadside safety enhancement and the elimination and reduction of maintenance problems. Platte County has agreed to participate in the project through work in kind by the Road & Bridge Department to the equivalent estimated cost of $23,300. (See Appendix 'D')

4.5 - This project will reduce the maintenance costs for the Gunbarrel Ditch Company. The Gunbarrel Ditch does not have an itemized accounting of the portion of the $0.75 per acre assessment used in maintaining the 1½ miles of open dirt ditch which would be replaced by pipeline. The $0.75 assessment is for operation and maintenance of the entire 4 3/8 miles in the Gunbarrel Ditch system. The unlined dirt ditch should require more maintenance than the concrete lined portion.

An estimate of the maintenance cost savings resulting from this project is somewhere between $0.10 to $0.15 per acre per year.

4.6 - An extremely intangible benefit from this project would be the mitigation of liability for accidental injury and/or loss resulting from the proximity of the open ditch and culvert crossings to the County Roads. The liability for an accident involving the ditch would be increased if erosion or some other unattended routine maintenance item could be proven as a contributing cause.

Although it is impractical to establish a monetary estimate for the liability mitigation, the landowners in the Gunbarrel Ditch Company generally agree that this is the most important reason for their support of the project.
The individual landowners, Wheatland Irrigation District and Platte County are also potential beneficiaries from the mitigation of the liability.

4.7 - The reduction of the spread of weed seed is another benefit which is difficult to assign a monetary savings as resulting from this project. It is assumed that less weed seed from the untilled and less attended land at the head of the Gunbarrel Ditch will contaminate the water. This should result in less herbicide use by the Gunbarrel Ditch farmers which not only would marginally reduce the overall cost of farming but may even mitigate potential contamination of ground water and have other ecological benefits.

CONCLUSION:

The direct benefits of this project to the Gunbarrel Ditch Company are generally intangible.

The total cost of the project after applying the work in kind credit by the Platte County Road & Bridge Department is estimated to be approximately $355,000 in 1997 Dollars.

If the Wheatland Irrigation District as a whole were to participate in the amount of $4.00 per acre-foot per year for the estimated water savings of 1274 acre-feet and the W.W.D.C. were to grant 67% of the project cost and loan the remainder to the WID/Gunbarrel Ditch Company at 4% interest for 39 years:

\[
\text{Loan amount} = 355,000 \times 0.33 = 117,150 \\
\text{Total Yearly Payment} = 6,775 \text{ for 30 years} \\
\text{W.I.D.} = \frac{5096}{55,000} = \text{approx. } \$0.09/\text{acre/year} \\
\text{Gunbarrel Ditch Company} = \frac{1679}{2659} = \text{approx. } \$0.63/\text{acre/year}
\]

NOTE: At this time, the Wheatland Irrigation District has not agreed to participate with any direct monetary obligation in this project.

However the numbers are crunched, the total obligation which may be considered acceptable to the Gunbarrel Ditch Company should not exceed $13.00 per acre-foot per year. It must be remembered that the Gunbarrel Ditch Company is also part of the Wheatland Irrigation District and may also be obligated to help pay for projects that the W.I.D. is considering such as the Laramie River Diversion Dam and Sand Creek Reservoir, etc., etc.

Many of the farmers in the W.I.D. and Gunbarrel Ditch Company must supplement their irrigation water supply with wells at their own expense. All things considered, such as only 1 foot per acre per year average supply from the W.I.D. and potential district-wide additional obligations, the Gunbarrel Ditch Co. could be pushing the economic feasibility limit of $25.00 per acre for irrigation water.