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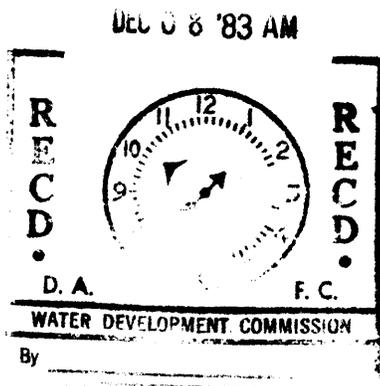
Priority Improvements of the LaPrele
Irrigation Project: Estimates of
Increased Returns to Irrigators

A Report To
Douglas Reservoir Water Users Association
and
Wyoming Water Development Commission

by

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Introduction:

The overall purpose of this report is to evaluate the ability of irrigators in the Douglas Reservoir Water Users Association to pay for identified priority improvements in their water delivery system. The priority improvements identified by the Douglas Reservoir Water Users Association and recommended by Nelson Engineering are flow measuring and control devices, maintenance roads along canals, Line Tunnel No. 2 and a siphon across Sand Creek. The 1983 construction costs for these improvements are estimated by Nelson Engineering to be \$1,259,630.

The significance of these improvements to irrigators lies in the increased average annual supply of water at the farm turnout. Modeling LaPrele Creek, Nelson Engineering estimated the above improvements in the water delivery system would increase the average annual supply from .83 to 1.02 acre-feet per acre at the farm turnout. This report focuses on estimating the increased returns to irrigators associated with such an increase in annual water supply.

Agriculture in the project area is predominantly ranching, integrated with irrigation. The irrigated lands are used primarily to grow forage for winter feed. With the existing water supply, the distribution of crops and crop yields obtained from a survey of producers were as follows:

<u>Crop</u>	<u>%</u>	<u>Yield</u>
Alfalfa	79	2.2 Tons/acre
Grass-hay	8	1.7 Tons/acre
Irrig.- Pasture	5	--
Oats	6	52 bu/acre
Barley	2	42 bu/acre

Procedure:

The impact of additional water provided through improvements in the water delivery system was evaluated in terms of increased returns to agricultural

producers in the LaPrele project. These increased returns are estimated by computing the difference between returns over selected costs under existing conditions and the returns over selected costs with the proposed improvements in the water delivery system.

In order to determine the difference in returns over selected costs, data on cropping patterns, crop yields, crop prices and selected production costs were obtained. The selected production costs included were fuel, purchased materials,^{1/} interest, labor and miscellaneous costs. The selected production costs represent those costs that will vary with the additional water supply and increased yields under the proposed improvements. Production costs such as real estate taxes, depreciation on machinery, repair costs, etc. under existing conditions are not likely to change under the proposed improvements to the LaPrele Irrigation Project.

Data on cropping patterns and crop yields were obtained from producers in the area through a survey conducted by Nelson Engineering. Crop prices are for September 1983 and were obtained from Biweekly Ag Statistics, September 30, 1983, published by the Wyoming Crop and Livestock Reporting Service. The selected production costs for present and future conditions were estimated using a computer program on the AGNET system located at Lincoln, Nebraska.

The final step in this analysis is to evaluate the ability of irrigators to pay for the proposed improvements in the water delivery system of the LaPrele Irrigation Project. This evaluation is made by comparing increased annual returns to irrigators with the added annual construction and operation and maintenance costs.

^{1/}Purchased materials include such items as twine, fertilizer, seed, etc.

Present Situation

Presently there are approximately 11,200 irrigated acres serviced by the LaPrele Irrigation Project. The average annual supply at the farm turnout has been estimated to be .83 acre-feet. With an average annual supply of 17,390 acre-feet at the diversion dam, the efficiency of the existing distribution system is approximately 53%.

In estimating returns and costs for the present situation, the typical ranch in the analysis had 125 irrigated acres with the following crop distribution and yields:

<u>Crop</u>	<u>Acres</u>	<u>%</u>	<u>Yield</u>
Alfalfa	102	82	2.2 Tons/acre
Grass-Hay	8	6	1.7 Tons/acre
Barley	10	8	42 bu/acre
Irrig. Pasture ^{2/}	5	4	--

Crop prices used in computing returns were as follows:^{3/}

<u>Crop</u>	<u>\$/unit</u>
Alfalfa	\$60.00/Ton
Grass-Hay	\$58.00/Ton
Barley	\$ 2.30/bu.

Using the above crop prices and producer yields the estimated gross returns per acre by crop under existing practices are as follows:

<u>Crop</u>	<u>Yield</u>	<u>Value/unit</u>	<u>Gross Return</u>
Alfalfa	2.2	\$60.00	\$132.00
Grass-Hay	1.7	\$58.00	\$ 98.60
Barley	42	\$ 2.30	\$ 96.60

^{2/} Irrigated pasture is not included in the analysis of the increased returns and costs associated with the delivery system improvements. It is not included for two reasons: First, irrigated pasture represents such a small proportion of the irrigated acreage. Second, with the small increase in water from the improvements in the water delivery system, irrigators are not likely to significantly alter their production practices and yields on irrigated pasture.

^{3/} Source: Biweekly Ag Statistics, Wyoming Crop and Livestock Reporting Service, September 30, 1983.

Crop production costs with present practices on the 125 acres of irrigated land were estimated using the computer program CROPBUDGET on the ACNET system. From these estimated crop production costs, only those production costs that are likely to change when the improvements in the delivery system are made were included in this analysis. Those selected costs and their annual values per acre are given by crop for the existing situation in Table 1.

Table 1. Selected Crop Production Costs Under Present Conditions.

Item	Crop		
	Alfalfa	Grass-Hay	Barley
Fuel	14.37	8.34	18.58
Purchased Materials ^{a/}	4.40	3.40	12.00
Interest on above costs (13.5% for 6 months)	1.27	.79	2.06
Labor	20.76	13.92	24.14
Establishment Charge ^{b/}	4.85	--	--
Subtotal	45.65	26.45	56.78
Misc. expenses (5% of above total)	2.28	1.32	2.84
Total	47.93	27.77	59.62

^{a/} Purchased materials include such items as seed, fertilizer, twine, etc.

^{b/} Establishment charge includes the cost of seed, an extra irrigation and the loss in putting up barley straw. These costs are depreciated over a 10 year period and a 7% interest charge is placed on the average investment.

Taking these estimated returns and selected production costs, the next step was to calculate the returns above the selected production costs for each crop. These returns above selected production costs for each crop are then weighted by the proportion of acres in that crop. The weighted returns above costs are then summed to arrive at a per acre return above costs under the present situation (see Table 2).

Table 2. Estimated per acre returns above selected costs for present situation.

Crop	Returns	Selected Costs	Return Above Costs	Weights	Weighted Returns Above Costs
Alfalfa	132.00	47.93	84.07	.82	68.93
Grass-Hay	98.60	27.77	70.83	.06	4.25
Barley	96.60	59.62	36.98	.08	2.96
Total					<u>76.14</u>

With the present irrigation water and production practices, the estimated returns above selected costs is \$76.14 per acre. The next step is to compute returns above the same selected costs for the proposed future situation.

Future Situation

Under the "with project" situation, the average annual supply of water at the farm turnout has been estimated to be 1.02 acre-feet/acre. This would mean an increase in annual supply of about .2 acre-feet/acre. If this increased water was available, producers in the LaPrele Irrigation Project indicated they would use the additional water on existing acreage as well as irrigate approximately 35 additional acres. However, it appears more likely that the additional .2 acre-feet might let irrigators complete an additional irrigation on existing irrigated lands rather than bringing new lands into production. The estimated ability of irrigators to pay in this analysis is based on this premise. The crops, acres and yields indicated by a group of irrigators in the LaPrele Irrigation Project after the suggested improvements are as follows:

<u>Crop</u>	<u>Acres</u>	<u>%</u>	<u>Yield</u>
Alfalfa	126	79	3.2
Grass-Hay	8	5	2.9
Barley	20	13	80
Irrig. Pasture	5	3	---

Taking the above yields and using the same crop prices, estimated gross returns per acre by crop after the proposed improvement would be the following:

<u>Crop</u>	<u>Yield</u>	<u>Value/unit</u>	<u>Gross Return</u>
Alfalfa	3.2	\$60.00	192.00
Grass-Hay	2.9	58.00	168.20
Barley	80	2.30	184.00

The projected gross returns are directly dependent on anticipated future yields after the improvements in the water delivery system. Because of the importance of crop yields in projected gross returns and therefore in increased income, two additional and more conservative estimates of future crop yields were used in this analysis. These more conservative estimates of crop yields and thereby gross returns are given below.

<u>Crop</u>	<u>Conservative Yields</u>		<u>Gross Returns</u>	
	<u>10% lower</u>	<u>20% lower</u>	<u>10% lower yields</u>	<u>20% lower yields</u>
Alfalfa	2.88	2.56	172.80	153.60
Grass-Hay	2.61	2.32	151.38	134.56
Barley	72	64	165.60	147.20

These conservative yields are perhaps more realistic in that they more closely reflect existing yields for these crops in Wyoming.

Crop production costs for the future situation were re-estimated for the 159 acres of irrigated land using the computer program CROPBUDGET. The same selected crop production costs as under the existing situation are used for the future situation. Those selected costs and their annual per acre values are given by crop for the future situation in Table 3.

Taking the projected returns and selected production costs, returns above the selected production costs were computed for each crop. Weighting these computed returns by the proportion of acres for each crop and summing over the crops gives the per acre returns above the selected production costs for the future situation (see Table 4).

Table 3. Selected per acre crop production costs under future conditions.

Item	Crop		
	Alfalfa	Grass-Hay	Barley
Fuel	16.03	9.92	22.30
Purchased Materials	20.40	27.40	42.38
Interest on above costs (13.5% for 6 months)	2.46	2.52	4.37
Labor	24.22	17.39	28.10
Establishment charge ^{a/}	8.50	--	--
Subtotal	<u>71.61</u>	<u>57.23</u>	<u>97.15</u>
Misc. expense (5% of above total)	<u>3.58</u>	<u>2.86</u>	<u>4.86</u>
Total	<u>75.19</u>	<u>60.09</u>	<u>102.01</u>

^{a/} Establishment charge includes the cost of seed, or extra irrigation and the loss in putting up the straw. These costs are depreciated over 6 years and a 7% interest charge is placed on the average investment.

Table 4. Estimated per acre returns above selected costs for future situation.

Crop	Returns	Selected Costs	Return Above Costs	Weights	Weighted
					Returns Above Costs
Projected Yields					
Alfalfa	192.00	75.19	116.81	.79	92.28
Grass-Hay	168.20	60.09	108.11	.05	5.41
Barley	184.00	102.01	81.99	.13	<u>10.66</u>
Total					<u>108.35</u>
10% Reduction in Yields					
Alfalfa	172.80	75.19	97.61	.79	77.11
Grass-Hay	151.38	60.09	91.29	.05	4.56
Barley	165.60	102.01	63.59	.13	<u>8.27</u>
Total					<u>89.94</u>
20% Reduction in Yields					
Alfalfa	153.60	75.19	78.41	.79	61.94
Grass-Hay	134.56	60.09	74.47	.05	3.72
Barley	147.20	102.01	45.19	.13	<u>5.87</u>
Total					<u>71.53</u>

Under the future situation, the estimated returns above selected costs range from \$108.35 to \$71.53 per acre. The next step was to estimate the increase in per acre returns associated with the improvements in the water delivery system.

Increased Returns

Having estimated the returns above selected costs for the present and future situations, the increase in returns can be estimated by obtaining the difference between these two returns. Differences between returns above selected costs for the future versus present for three alternative future yield levels are shown in Table 5. The estimated increase in income associated with the proposed improvements range from -\$4.61 to 32.21 per acre. This illustrates the importance of projected yields in determining the increased income per acre.

Table 5. Difference in returns above selected costs between future and present project conditions.

	Future	Present	Difference
Projected Yields	108.35	76.14	32.21
10% Reduction in Future Yields	89.94	76.14	13.80
20% Reduction in Future Yields	71.53	76.14	-4.61

In evaluating the ability of producers in the LaPrele Irrigation Project to pay for the proposed improvements, the more conservative increased income estimate of \$13.80 per acre will be used. Since this increase in income requires more intensive management, part of this income should go to producers for this management. Using 10% of the selected costs as a management fee for present and future conditions, the additional cost of management under the future situation is \$3.00 per acre. Deducting this from the increased income of \$13.80, leaves \$10.80 per acre to pay for the costs of the proposed

improvements of the water delivery system on the LaPrele Irrigation Project. The final step in this analysis is to compare this with the cost of the proposed improvements.

Improvement Costs:

As mentioned in the introduction, priority improvements identified by the Douglas Reservoir Water Users Association and recommended by Nelson Engineering and their construction costs are as follows:

<u>Item</u>	<u>Construction Cost</u>
Flow Measuring and Control Devices	\$472,250
Maintenance Roads Along Canals	200,580
Line Tunnel No. 2	413,200
Siphon Across Sand Creek	<u>173,600</u>
Total	\$1,259,630

Adding in a contingency cost factor of 20%, total construction costs come to just over \$1.5 million. Distributing these costs over the 11,200 acres of irrigated land in the LaPrele Irrigation Project, per acre construction costs would be about \$134.00. These per acre costs are amortized over 30 and 50 years for three different interest rates. The amortized annual per acre payments would be as follows:

<u>Per Acre Construction Cost</u>	<u>Interest rate</u>	<u>Annual Payments/acre</u>	
		<u>30 years</u>	<u>50 years</u>
\$134	4%	7.75	6.24
\$134	6%	9.74	8.50
\$134	8%	11.90	10.95

Any additional operation and maintenance costs would have to be added to the above annual payments on construction costs. It would appear that the primary increase in operation and maintenance cost would be the salary of a full-time irrigation project manager. If the salary of such a manager were approximately \$20,000 this would add an additional cost of 1.79 per acre. The annual costs per acre for the 50 year time period and three interest rates would then

become \$8.03, \$10.29 and \$12.74, respectively. Comparing these annual costs to the repayment ability of \$10.80, the proposed improvements would be economically feasible using the 50 year time horizon at 4 and 6% interest, but not at an 8% interest rate.

Summary

In summary, this author would recommend that at least the more conservative 10% lower yield estimates be used. Based on these yield levels, the results indicate that the maximum irrigators could afford to pay is about \$10 per acre per year. At that level the increased returns from the proposed improvements would pay for the additional costs using a 50 year time frame and a 6% interest rate. A small additional safeguard for the irrigators would be a 50 year repayment period and a 4% interest rate. However, any changes in yields, production costs, crop prices, construction costs or operation and maintenance costs could easily affect this conclusion.