Frenchman Valley Appraisal Study
Agricultural Economic Analysis

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The agricultural assessment of the Frenchman Valley Appraisal Study focuses exclusively on effects to irrigated lands in the Frenchman Valley Irrigation District (FVID). More specifically, this analysis focuses solely upon the changes in pumping costs that will be borne by farmers under each of the selected Alternatives.

Affected Environment -

The Frenchman Valley Irrigation District lands lie along the Frenchman Creek in Hitchcock County. Annual precipitation generally averages about 21 inches per year.

The primary irrigated crops in the district include corn, soybeans, and alfalfa. Primary dryland crops include a wheat-eco fallow corn-fallow rotation.

Data from the 2002 census of agriculture shows that there were 299 farms in Hitchcock County encompassing 433,525 acres of land. The average size of farms was 1,450 acres. There were 119 irrigated farms in Hitchcock County in 2002, with a total of 228,403 acres. The average size of irrigated farms was 1,919 acres. The number of farms in Hitchcock County has generally been on a downward trend over time while the size of the remaining farms has trended upward. For example, the 1992 census of agriculture showed that the number of farms was 399, with the average size of those 1992 farms being 1,097 acres. There were 128 irrigated farms in 1992 with and average size of 1,303 acres.

The 2000 census of population shows that 3,111 people live in Hitchcock County in 1,292 homes. The median income for those households was $28,287 in 2000.

Frenchman Valley Irrigation District -

There are 9,295 acres in the District. Cropping pattern and yield data obtained from a 1998 repayment study showed that the primary irrigated crops in the District were corn, alfalfa, and soybeans. On a percentage basis, corn accounted for 86 percent of the irrigated acres, alfalfa was 7.75 percent, and soybeans were 6 percent.

Crop yields were obtained from the National Agricultural Statistics Service website so that a county average yield could by calculated and presented for informational purposes. The county average yields for Hitchcock County are shown in Table 1.

Table 1. Hitchcock County Average Yields, 2002-2006.

	2002	2003	2004	2005	2006	AVG
Corn	141	164	187	190	187	173.8
Soybeans	44	48	52	57	59	52
Alfalfa	4.5	5	5.1	5.4	4.3	4.9

Even though the crop yield data was obtained, it is used only in a qualitative manner in the analysis. The qualitative caveat on the yields shown in Table 1 is that the analysis assumes that those yields can be consistently attained by applying 12 acre-inches of water. Because of that assumption, the analysis can proceed by focusing only on pumping costs because all the other costs of production will be held constant throughout the period of study. Pumping costs will fluctuate depending on the energy cost. It is assumed that energy costs will increase by 5 percent per year.

Analysis Methodology -

This analysis will proceed based on the following assumptions:

1) Water applications will be a constant 12 acre-inches for all years.
2) Storage water deliveries will come every 5 years, at different rates for the selected Alternatives.
3) In years that storage water is available, pumping will make up the difference between the storage water amount and the 12 acre-inches that is assumed to be the "full" supply.
4) Pumping energy costs will be inflated 5 percent per year over the analysis period.

The basic assumption for this analysis is that 12 acre-inches of irrigation water will result in the county average yields shown in Table 1. In the years where storage water is delivered to District acres, there will be less pumping. For example, in years that no storage water is delivered to farms, 12 acre-inches of water per acre will be pumped. On the year that 4 acre-inches of storage water is delivered, only 8 acre-inches of water will be pumped. Thus, the impacts will be based on a change in pumping energy.

Yield will be held constant over the period of analysis. Pumping energy costs will be inflated 5 percent per year.

After estimating the pumping cost for each year in the period of analysis and for the amount pumped under each Alternative, the costs will be deflated back to current-year (2008) dollars. The current planning rate of 4.875 percent will be used as the deflator. Once the pumping costs have been estimated for each Alternative, they will be compared to the Future Without Alternative. The pumping costs for each Alternative will be shown.

Environmental Consequences -

The focus of the agricultural analysis is on a comparison of pumping costs for each of the proposed "action" alternatives compared to the No Action Alternative.

Future No Action Alternative -

Under this Alternative, the District will receive 3 acre-inches of storage water every 5 years. In those years that no storage water is delivered, each irrigated acre will receive 4 acre-inches of natural flow deliveries and 8 acre-inches of pumped water. In the years that storage water is delivered each acre will receive 4 acre-inches of natural flow water, 5 acre-inches of pumped water, and 3 acre-inches of storage water. Table 2 shows the water delivery schedule, the amount delivered from pumping or storage water, the net present value of the pumping cost per acre-inch, the pumping cost per acre, and the total pumping cost for all acres in the District.

Table 2. Future Without Alternative – Natural Flows, Amount Pumped, Storage Water Deliveries, Total Deliveries per Acre, Pumping Costs per Acre, and the Total Pumping Costs for 9,295 Acres in FVID.

Year	Natural Flow	Pumped	Surface Water Del.	Total Water Del.	Pumping Cost/Acre	NPV of Total Cost
2008	4	5	3	12	$8.34	$77,551
2009	4	8		12	$9.67	$89,918
2010	4	8		12	$10.96	$101,855
2011	4	8		12	$11.37	$105,726
2012	4	8		12	$11.67	$108,430
2013	4	5	3	12	$7.48	$69,509
2014	4	8		12	$12.21	$113,505
2015	4	8		12	$12.35	$114,834
2016	4	8		12	$12.77	$118,702
2017	4	8		12	$13.02	$121,038
2018	4	5	3	12	$8.41	$78,189
2019	4	8		12	$13.56	$126,008
2020	4	8		12	$13.70	$127,359
2021	4	8		12	$13.97	$129,841
2022	4	8		12	$14.18	$131,816
2023	4	5	3	12	$9.08	$84,415
2024	4	8		12	$14.64	$136,069
2025	4	8		12	$14.81	$137,635
2026	4	8		12	$14.99	$139,365
2027	4	8		12	$15.22	$141,497
2028	4	5	3	12	$9.68	$89,969
2029	4	8		12	$15.53	$144,305
2030	4	8		12	$15.69	$145,808
2031	4	8		12	$15.88	$147,571
2032	4	8		12	$16.06	$149,308
2033	4	5	3	12	$10.17	$94,507
2034	4	8		12	$16.29	$151,382
2035	4	8		12	$16.46	$152,974
2036	4	8		12	$16.58	$154,092
2037	4	8		12	$16.69	$155,131
2038	4	5	3	12	$10.54	$97,976

2039	4	8		12	$16.94	$157,418
2040	4	8		12	$17.06	$158,603
2041	4	8		12	$17.14	$159,337
2042	4	8		12	$17.25	$160,364
2043	4	5	3	12	$10.88	$101,096
2044	4	8		12	$17.45	$162,158
2045	4	8		12	$17.54	$163,027
2046	4	8		12	$17.64	$163,930
SUM of Pumping Costs						$4,962,218

The net present value of pumping costs ranged from $8.34 per acre in 2008 to an estimated $17.64 per acre in 2046, on a net present value basis. When all the pumping costs for all the years and the 9,295 acres in the District are added up, there will be an outlay of $4.96 million dollars for pumping costs.

Flow Through Alternative -

Under the Flow Through Alternative, there are no storage deliveries to the District. Thus, the irrigated acres in the District will pump 7.4 acre-inches every year of the study period and 4.6 acre-inches of natural flow water will be delivered annually. Pumping costs are based on pumping 7.4 acre-inches annually with an increasing cost for electrical energy. Table 3 shows the natural flow amounts, amount pumped per year, total deliveries per acre per year, pumping costs per year, and the total amount of pumping expenses that will accrue.

Table 3. Flow Through Alternative – Amount Pumped, Storage Water Deliveries, Total Deliveries Per Acre, Pumping Costs per Acre, and the Total Pumping Costs for 9,295 Acres in FVID.

Year	Natural Flow	Pumped	Surface Water Del.	Total Water Del.	Pumping Cost/Acre	NPV of Total Cost
2008	4.6	7.4		12	$9.24	$85,917
2009	4.6	7.4		12	$9.49	$88,177
2010	4.6	7.4		12	$9.94	$92,427
2011	4.6	7.4		12	$10.34	$96,090
2012	4.6	7.4		12	$10.67	$99,214
2013	4.6	7.4		12	$10.90	$101,322
2014	4.6	7.4		12	$11.30	$104,992
2015	4.6	7.4		12	$11.43	$106,222
2016	4.6	7.4		12	$11.86	$110,247
2017	4.6	7.4		12	$12.05	$111,960
2018	4.6	7.4		12	$12.32	$114,497
2019	4.6	7.4		12	$12.54	$116,557
2020	4.6	7.4		12	$12.75	$118,548
2021	4.6	7.4		12	$13.00	$120,809
2022	4.6	7.4		12	$13.19	$122,604
2023	4.6	7.4		12	$13.41	$124,612

2024	4.6	7.4		12	$13.61	$126,476
2025	4.6	7.4		12	$13.76	$127,897
2026	4.6	7.4		12	$13.93	$129,469
2027	4.6	7.4		12	$14.14	$131,416
2028	4.6	7.4		12	$14.30	$132,901
2029	4.6	7.4		12	$14.41	$133,965
2030	4.6	7.4		12	$14.56	$135,333
2031	4.6	7.4		12	$14.73	$136,943
2032	4.6	7.4		12	$14.90	$138,529
2033	4.6	7.4		12	$15.05	$139,871
2034	4.6	7.4		12	$15.13	$140,599
2035	4.6	7.4		12	$15.28	$142,046
2036	4.6	7.4		12	$15.39	$143,054
2037	4.6	7.4		12	$15.49	$143,991
2038	4.6	7.4		12	$15.62	$145,162
2039	4.6	7.4		12	$15.73	$146,212
2040	4.6	7.4		12	$15.85	$147,280
2041	4.6	7.4		12	$15.90	$147,796
2042	4.6	7.4		12	$16.01	$148,856
2043	4.6	7.4		12	$16.11	$149,747
2044	4.6	7.4		12	$16.19	$150,469
2045	4.6	7.4		12	$16.27	$151,251
2046	4.6	7.4		12	$16.37	$152,173
SUM of Pumping Costs						$4,955,631

Pumping costs range from $9.24 per acre to $16.37 per acre on a net present value basis. The net present value of pumping costs for all 9,295 acres in the District add up to $4.96 million.

Groundwater Recharge Alternative -

No storage water is delivered under this Alternative. No natural flows are delivered either. Irrigated acres within the District will only receive 12 acre-inches of pumped irrigation water each year of the study period. Table 4 shows the amount pumped per year, total deliveries per year, pumping costs per year, and the total amount of pumping expenses that will accrue.

Table 4. Groundwater Recharge Alternative – Natural Flows, Amount Pumped, Storage Water Deliveries, Total Deliveries, Pumping Costs per Acre, and the Total Pumping Costs for 9,295 Acres in the FVID.

Year	Natural Flow	Pumped	Surface Water Del.	Total Water Del.	Pumping Cost/Acre	NPV of Total Cost
2008	0	12		12	$14.76	$137,198
2009	0	12		12	$15.27	$141,976
2010	0	12		12	$15.92	$147,947
2011	0	12		12	$16.57	$153,978
2012	0	12		12	$17.12	$159,129
2013	0	12		12	$17.59	$163,468

2014	0	12	12	$18.15	$168,659
2015	0	12	12	$18.45	$171,489
2016	0	12	12	$19.08	$177,326
2017	0	12	12	$19.38	$180,171
2018	0	12	12	$19.83	$184,350
2019	0	12	12	$20.27	$188,381
2020	0	12	12	$20.55	$191,039
2021	0	12	12	$20.95	$194,761
2022	0	12	12	$21.21	$197,178
2023	0	12	12	$21.63	$201,033
2024	0	12	12	$21.96	$204,103
2025	0	12	12	$22.16	$205,980
2026	0	12	12	$22.49	$209,047
2027	0	12	12	$22.83	$212,245
2028	0	12	12	$23.10	$214,694
2029	0	12	12	($1.95)	($18,162)
2030	0	12	12	$23.53	$218,712
2031	0	12	12	$23.78	$221,001
2032	0	12	12	$24.09	$223,962
2033	0	12	12	$24.30	$225,847
2034	0	12	12	$24.43	$227,073
2035	0	12	12	$24.69	$229,462
2036	0	12	12	$24.87	$231,138
2037	0	12	12	$25.06	$232,964
2038	0	12	12	$25.24	$234,632
2039	0	12	12	$25.43	$236,371
2040	0	12	12	$25.62	$238,136
2041	0	12	12	$25.71	$239,006
2042	0	12	12	$25.88	$240,545
2043	0	12	12	$26.04	$242,028
2044	0	12	12	$26.19	$243,428
2045	0	12	12	$26.33	$244,724
2046	0	12	12	$26.47	$246,070
SUM of Pumping Costs					$7,761,089

Pumping costs range from $14.76 per acre to $26.47 per acre. The net present value of pumping costs for all 9,295 acres in the District add up to $7.76 million.

Recreation Without Storage Deliveries Alternative -

No storage water is assumed to be delivered under this Alternative. Irrigated acres within the FVID will receive 4 acre-inches of natural flow water and 8 acre-inches of pumped irrigation water each year of the study period. Table 5 shows the amount pumped per year, total deliveries per year, pumping costs per year, and the total amount of pumping expenses that will accrue.

Table 5. Recreation Without Storage Deliveries Alternative – Natural Flows Delivered, Amount Pumped, Storage Water Deliveries, Total Deliveries, Pumping Costs per Acre, and the Total Pumping Costs for 9,295 Acres in the FVID.

Year	Natural Flow	Acre-Inches Pumped	Storage Water Del.	Total Water Del.	Pumping Cost/Acre	NPV of Total Cost
2008	4	8		12	$9.92	$92,174
2009	4	8		12	$9.67	$89,918
2010	4	8		12	$10.96	$101,855
2011	4	8		12	$11.37	$105,726
2012	4	8		12	$11.67	$108,430
2013	4	8		12	$11.72	$108,979
2014	4	8		12	$12.21	$113,505
2015	4	8		12	$12.35	$114,834
2016	4	8		12	$12.77	$118,702
2017	4	8		12	$13.02	$121,038
2018	4	8		12	$13.27	$123,340
2019	4	8		12	$13.56	$126,008
2020	4	8		12	$13.70	$127,359
2021	4	8		12	$13.97	$129,841
2022	4	8		12	$14.18	$131,816
2023	4	8		12	$14.42	$134,022
2024	4	8		12	$14.64	$136,069
2025	4	8		12	$14.81	$137,635
2026	4	8		12	$14.99	$139,365
2027	4	8		12	$15.22	$141,497
2028	4	8		12	$15.40	$143,130
2029	4	8		12	$15.53	$144,305
2030	4	8		12	$15.69	$145,808
2031	4	8		12	$15.88	$147,571
2032	4	8		12	$16.06	$149,308
2033	4	8		12	$16.20	$150,565
2034	4	8		12	$16.29	$151,382
2035	4	8		12	$16.46	$152,974
2036	4	8		12	$16.58	$154,092
2037	4	8		12	$16.69	$155,131
2038	4	8		12	$16.81	$156,251
2039	4	8		12	$16.94	$157,418
2040	4	8		12	$17.06	$158,603
2041	4	8		12	$17.14	$159,337
2042	4	8		12	$17.25	$160,364
2043	4	8		12	$17.36	$161,352
2044	4	8		12	$17.45	$162,158
2045	4	8		12	$17.54	$163,027
2046	4	8		12	$17.64	$163,930
SUM of Pumping Costs						$5,338,819

Pumping costs range from $9.92 per acre to $17.64 per acre on a net present value basis. The net present value of pumping costs for all 9,295 acres in the District add up to $5.34 million.

Recreation With Irrigation Deliveries -

Under this Alternative, the District will deliver 2 acre-inches of storage water every 5 years. Irrigated acres will receive 8 acre-inches of pumped water and 4 acre-inches of natural flow in four of every five years. In the fifth year, these acres will receive 5 acre-inches of pumped water, 4 acre-inches of natural flow, and 3 acre-inches of storage water. Table 6 shows the amount pumped per year, total deliveries per year, pumping costs per year, and the total amount of pumping expenses that will accrue.

Table 6. Recreation With Storage Deliveries Alternative – Natural Flows, Amount Pumped, Storage Water Deliveries, Total Deliveries, Pumping Costs per Acre, and the Total Pumping Costs, FVID

Year	Natural Flow	Pumped	Surface Water Del.	Total Water Del.	Pumping Cost/Acre	NPV of Total Cost
2008	4	6	2	12	$7.55	$70,194
2009	4	8		12	$10.26	$95,327
2010	4	8		12	$10.68	$99,276
2011	4	8		12	$11.11	$103,267
2012	4	8		12	$11.48	$106,672
2013	4	6	2	12	$8.93	$82,992
2014	4	8		12	$12.15	$112,972
2015	4	8		12	$12.30	$114,326
2016	4	8		12	$12.72	$118,217
2017	4	8		12	$12.97	$120,576
2018	4	6	2	12	$10.06	$93,497
2019	4	8		12	$13.51	$125,588
2020	4	8		12	$13.70	$127,359
2021	4	8		12	$13.97	$129,841
2022	4	8		12	$14.18	$131,816
2023	4	6	2	12	$10.93	$101,558
2024	4	8		12	$14.64	$136,069
2025	4	8		12	$14.81	$137,635
2026	4	8		12	$14.99	$139,365
2027	4	8		12	$15.22	$141,497
2028	4	6	2	12	$11.64	$108,168
2029	4	8		12	$15.53	$144,305
2030	4	8		12	$15.69	$145,808
2031	4	8		12	$15.88	$147,571
2032	4	8		12	$16.06	$149,308
2033	4	6	2	12	$12.24	$113,733
2034	4	8		12	$16.29	$151,382
2035	4	8		12	$16.46	$152,974
2036	4	8		12	$16.58	$154,092
2037	4	8		12	$16.69	$155,131

2038	4	6	2	12	$12.69	$117,954
2039	4	8		12	$16.94	$157,418
2040	4	8		12	$17.06	$158,603
2041	4	8		12	$17.14	$159,337
2042	4	8		12	$17.25	$160,364
2043	4	6	2	12	$13.08	$121,617
2044	4	8		12	$17.45	$162,158
2045	4	8		12	$17.54	$163,027
2046	4	8		12	$17.64	$163,930
SUM of Pumping Costs						$5,074,924

Pumping costs range from $7.55 per acre to $17.64 per acre on a net present value basis. The net present value of pumping costs for all 9,295 acres in the District add up to $5.07 million.

Comparison of Alternatives -

To complete the analysis, the results from each of the Alternatives are compared to the Future Without Alternative. The comparison will focus on the sum of pumping costs from Tables 2-6 above. Table 7 shows the sum of the pumping costs for each of the Alternatives.

Table 7. Sum of Pumping Costs for All Acres in the District, by Alternative.

Alternative	Acre-Inches Pumped	Total Costs	Difference
Future Without	8 or 5	$4,962,218	
Flow Through	7.4	$4,955,631	($6,587)
Groundwater Recharge	12	$7,761,089	$2,798,871
Recreation w/o Deliveries	8	$5,338,819	$376,601
Recreation w/ Deliveries	8 or 6	$5,074,924	$112,706

The Future Without Alternative had pumping costs of $4.962 million. In this Alternative, 3 acre-inches of storage water were delivered every 5 years over the period of study. Thus, a repeating cycle of pumping 8 acre-inches for four years was followed by one year of pumping 5 acre-inches of water. Each year, there were 4 acre-inches of natural flow delivered.

The Flow Through Alternative had 4.6 acre-inches of natural flow delivered annually. Thus, for each acre to receive a 12 acre-inch supply of irrigation water, 7.4 acre-inches were pumped. There were no storage water deliveries made in any year. Total pumping costs for the Flow Through Alternative, at $4.755 million were $6,600 lower than the Future Without Alternative pumping costs.

The Groundwater Recharge Alternative had no natural flow deliveries made, nor were there any storage water deliveries. Under this Alternative, the highest pumping costs are

seen, estimated at $7.76 million. Pumping costs for this Alternative are $2.8 million higher than the Future Without Alternative.

The Recreation Without Deliveries Alternatives had no storage water deliveries. However, there were natural flow deliveries of 4 acre-inches annually, so the amount pumped per acre was 8 acre-inches. Total pumping costs came to $5.34 million under this Alternative, $377,000 higher than the Future Without Alternative pumping costs.

The Recreation With Deliveries Alternative pumping costs came to $5.07 million. A repeating cycle of four years of pumping 8 acre-inches of water combined with 4 acre-inches of natural flow deliveries was followed by one year of pumping 6 acre-inches of water combined with 4 acre-inches of natural flow deliveries and 2 acre-inches of storage water deliveries. The Recreation With Deliveries Alternative had pumping costs of $113,000 more than the Future Without Alternative.