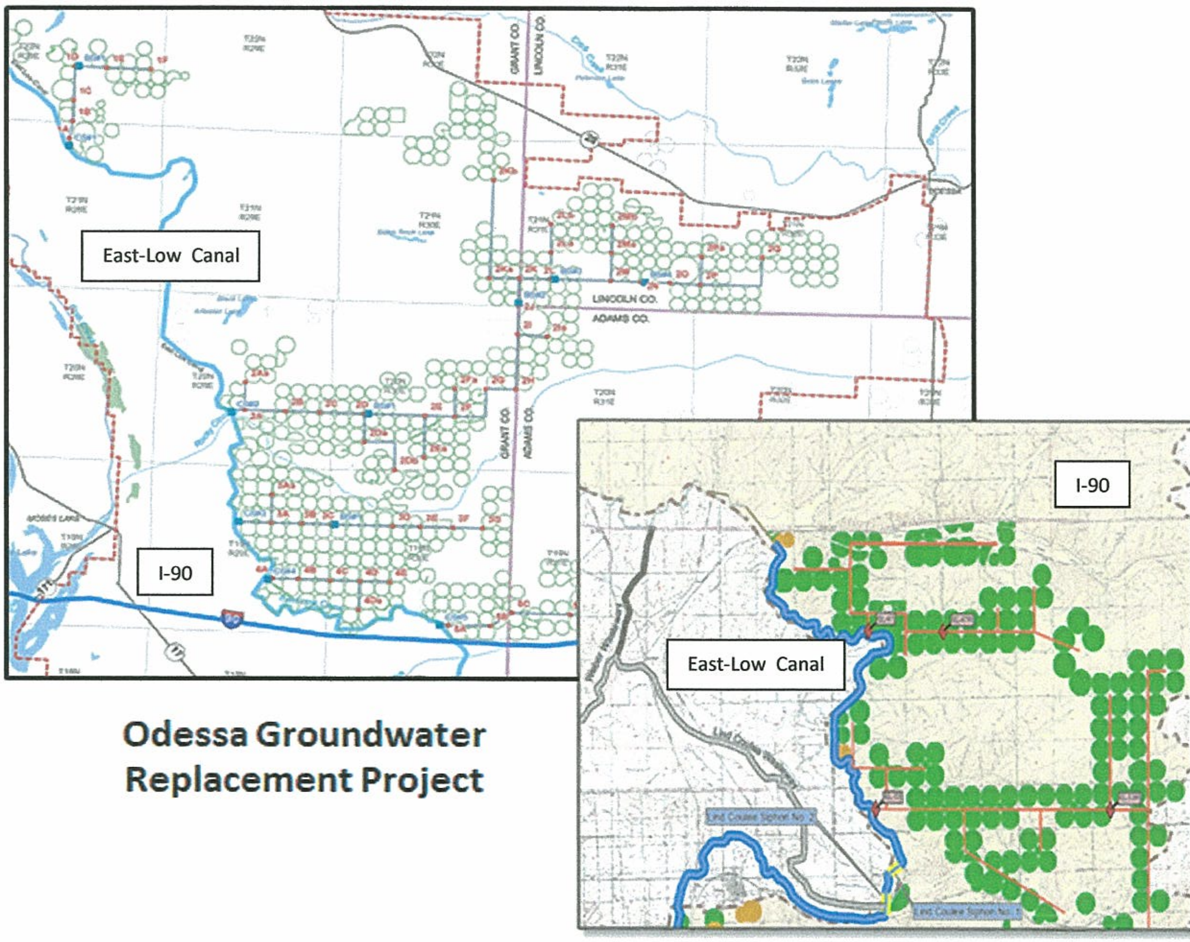
Odessa Subarea Surface Water Supply Alternatives

Economic and Technical Review



Odessa Groundwater Replacement Project

PREPARED FOR THE ADAMS COUNTY COMMISSION
WITH SUPPORT FROM THE COLUMBIA RIVER OFFICE, ECOLOGY

Prepared By
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with Support from IRZ Consulting

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Table of Contents

I. Executive Summary....3
- a. Executive Summary....3

II. Study Area Alternatives and Operations Under Review....7
- a. State-USBR Project (Modified Partial Replacement)....7
- b. Project Alternatives and Operations....7

III. Economic Analyses Methodology and Review....12
- a. Benefit/Cost Analyses Methodology and Economic Impacts....12
- b. Benefit/Cost Analyses Results....19
- c. Regional Economic Development Analyses....22
- d. Project(s) Construction Impacts....31
- e. Property Tax Impacts for Adams County....33

IV. Technical Analyses/Pre-Construction Engineering for the North-I-90 Surface Water Supply Alternative....35
- a. Process....35
- b. Meeting with water Users....35
- c. Initial Project Area Tour....35
- d. Office Analysis....36
- e. Second Field Tour....38
- f. Final Design & Cost Estimate....39
- g. Final Water User Meeting....39
- h. Conclusion....39

V. References and Key Sources....44

VI. Appendices A and B....46

Tables

1. Review Summary--East-Low Canal Capacity....8
2. Odessa Subarea B/C Analysis, State-USBR Project....20
3. Odessa Subarea B/C Analysis, Private-State Project....21
4. Proposed Crop Mix....24
5. Estimated Crop Mix, Per Acre Crop Revenue....25
6. Proposed Crop Mix, Per Acre Crop Revenue State-USBR Project....26
7. Total Economic Impacts of Irrigated Crop Production, P-S-USBR....28
8. Estimated Local, State, and Federal Tax Revenues, P-S-USBR....29
9. Total Economic Impacts of Irrigated Crop Production, State-USBR....30
10. Estimated Local, State, and Federal Revenues, State-USBR....31
11. Regional Economic Impacts from the Odessa P-S Project Construction...32
12. Expected Net Impact on Property Tax Revenue, Adams County....34
13. Estimated Project Capital Costs....39

Figures

1. State-USBR Project North/South of I-90, East-Low Canal........................5
2. Private-State Project North of I-90, East-Low Canal..............................6
3. State-USBR Project North/South of I-90, East-Low Canal.....................10
4. Private-State Project North of I-90, East-Low Canal..............................11

Charts

1. State-USBR Project, B/C Analysis Methodology....................................17
2. Private-State Project, B/C Analysis Methodology..................................18

Maps

1. Odessa Groundwater Replacement Project N-of I-90 General...............41
2. Odessa Groundwater Replacement Project N-I-90 Field Groups.............42
3. Odessa Groundwater Replacement Project N-I-90 Proposed System.......43

I. Executive Summary

a. Executive Summary

The CSRIA Review is provided to the Adams County Commission and Columbia River Office (Department of Ecology, WA), and it covers economic and technical analyses of surface water supply alternatives for irrigated lands, for the Odessa Subarea in Eastern Washington. This review provides some additional perspective toward the extensive environmental and technical issues assessed within the Ecology-USBR Draft EIS (2010), including a state approach to determining direct benefits and costs for project development.

<u>Two Project Alternatives Are Examined:</u>

- A Modified Partial Replacement Alternative (State-USBR Project), with 45,000 acres located South of I-90, and 25,000 acres located North of I-90 (see Figure 1, general Project location map).
- A Private-State Project, with 75,000 acres (including existing water service contract ground) located North of I-90 (see Figure 2).

<u>Project(s) Benefit/Cost (B/C) Analyses:</u>

Estimates for the B/C analyses convey that:

- The State-USBR Project direct net benefits amount to about $1.235 billion, and the Project costs amount to about $1.172 billion (2010$, present value, rounded). The B/C ratio is about 1.05. Overall, the Project is displaying greater benefits than costs given the complex set of economic variables under consideration; Project operations would commence in 2017. It is anticipated that most of the Project costs would be paid by federal and state sources—local improvement districts (LIDs) also could be involved for repayment options.
- The Private-State Project net benefits amount to about $1.457 billion and costs to about $0.727 billion (2010$, present value, rounded). The B/C ratio is about 2.0 per the analysis assumptions employed. The Project benefits are expected to significantly exceed costs; Project operations would commence in 2013. It is anticipated that most of the Project costs would be repaid by private irrigators, relying initially on state capital resources for construction funds.
- For both project alternatives, additional value estimates are currently being revised for the municipal/industrial and power sectors. These changes will further reduce costs and increase benefits, with resulting higher B/C ratios.

<u>Project(s) Regional Economic Development (RED) Impacts:</u>

Economic impact estimates (RED) are derived for the project(s):

- Measured in terms of statewide, annual household income (value added impacts), the combined Project(s) impact (120,000 acres) would be about $438 million; the State-USBR Project (70,000 acres) annual household income impact would be about $244 million.

Project(s) Construction Impacts:

Project construction impacts are expressed in terms of total state direct and indirect employment, labor income, and the value of all goods and services used during construction (net output changes of all economic sectors):

- Within the Ecology-USBR Draft 2010 EIS, total direct and indirect economic impacts, from construction of the initial version of the partial replacement alternative (57,000 acres below I-90), are estimated to be about 2,196 jobs, $114 million of labor income, and $321 million of output for the regional area (totals during the construction period).
- The Private-State Project construction is estimated to produce about 860 direct jobs (annual FTEs during the construction period), and about 1,650 to 1,820 jobs taking into account direct and indirect employment throughout the region/state. Construction labor income impacts are estimated to be about $106 million; and the total value of goods and services affected throughout the state is potentially about $250 to $489 million.

Project(s) Development Factors and Considerations:

For Review analysis purposes, water supply sources for the Project(s) would be from Lake Roosevelt and Banks Lake operations; Conservation Operation & Maintenance (O&M) programs within the Columbia Basin Project; and perhaps from new legislative proposals (RCW 90.90 amendments) to allow for new water permits to produce biofuels and organics crops, from mainstem Columbia-Snake River pools.

Project(s) development involves cost levels and timing driven by the magnitude of infrastructure changes needed to deliver new surface water supplies:

- One USBR estimate suggests that the State-USBR Project could be in initial operation by 2017, with full operations commencing by about 2024 (phased development). The capital costs for the Project include major East-Low Canal modifications and some limited waste way improvements. Direct construction costs are estimated to exceed $10,500 per acre (preliminary estimate).
- A pre-construction engineering estimate for the Private-State Project suggests that initial operations could be in place by 2013, with full development completed by 2015. The capital costs for the Project would be primarily directed toward Canal pumping stations and water system delivery mainlines, with some modifications to the waste ways. Direct construction costs are estimated to be about $4,500 per acre (not including limited costs to waste way modifications depending on further Canal modeling assessments).

Figure 1. State-USBR Project North/South of I-90, East-Low Canal Modified Partial Replacement Alternative (70,000 Acres)

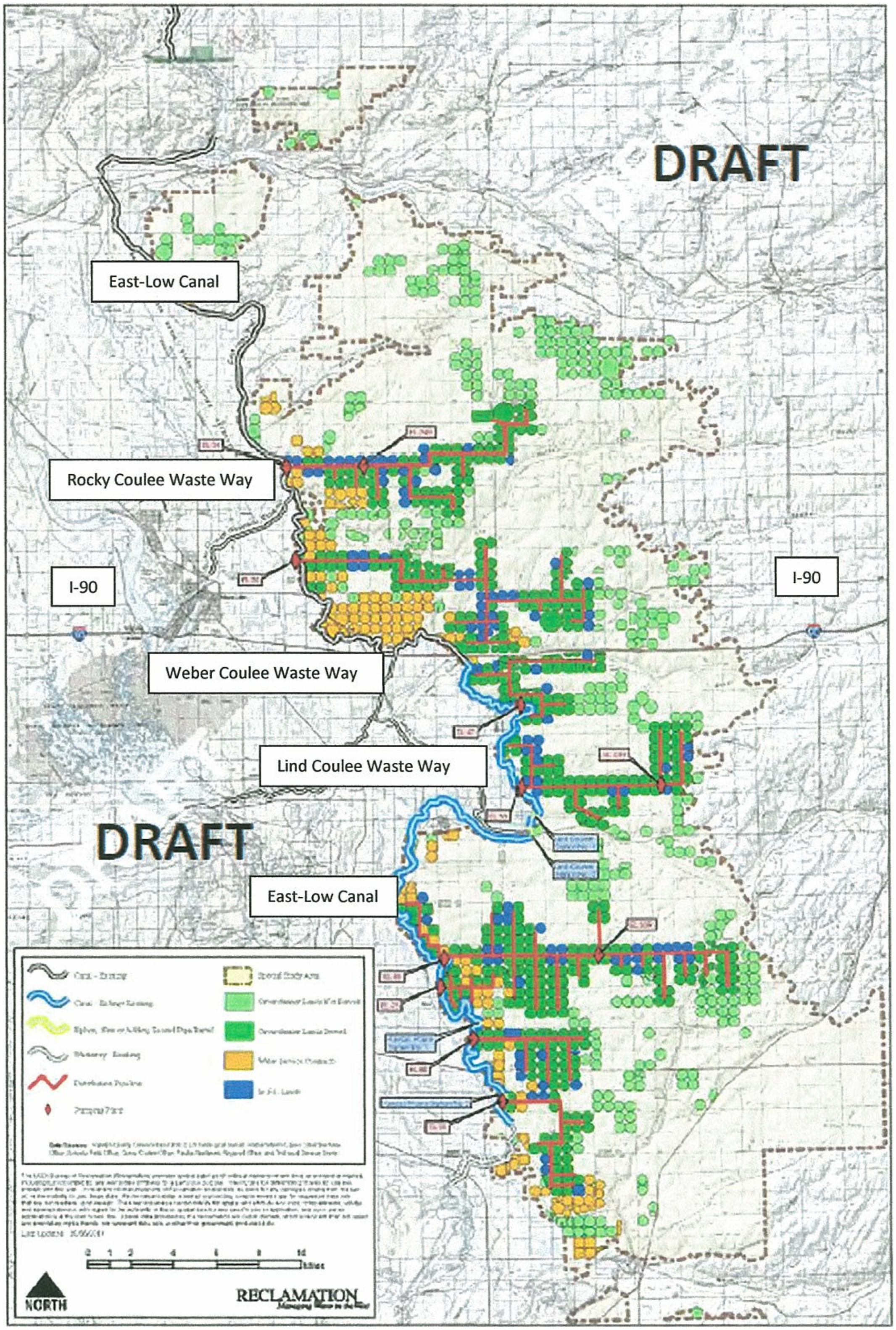
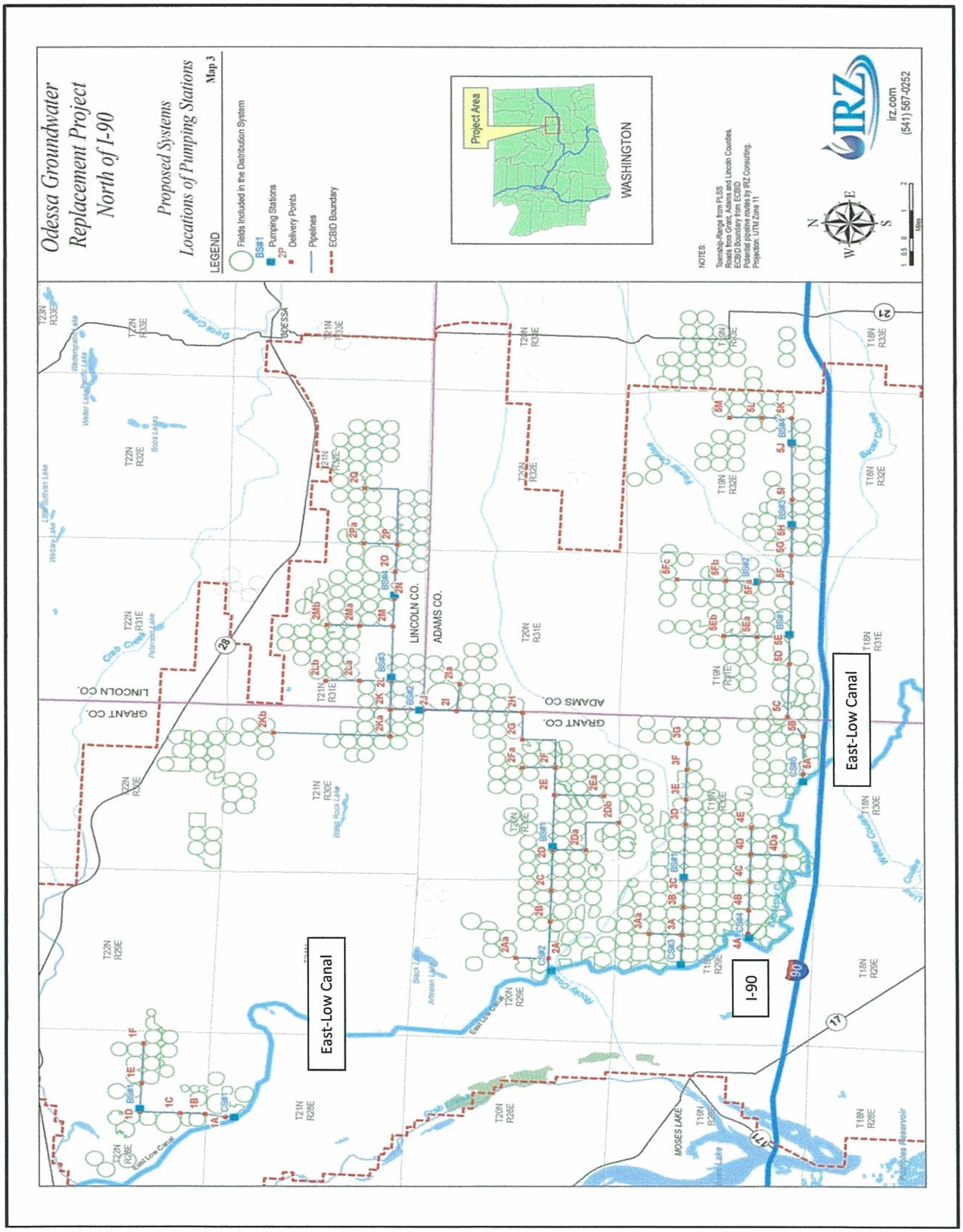


Figure 2. Private-State Project North of I-90, East-Low Canal (75,000 Acres)



II. Study Area Alternatives and Operations Under Review

This Review examines key economic and technical features surrounding two potential surface water alternatives for the Odessa Subarea: 1) a Modified Partial Replacement Alternative, referred to here as the State-USBR Project; and 2) a Private-State Project Alternative (see Figures 3 and 4 below). Both project alternatives involve receiving surface water from the Columbia River via existing U.S. Bureau of Reclamation (USBR) pumping plant and headwork facilities, located on Lake Roosevelt and Banks Lake. Both alternatives would deliver new water supplies from the East-Low Canal. And both alternatives would provide surface water to a portion of the Odessa Subarea currently operating under groundwater right permits issued by the Washington State Department of Ecology.

a. State-USBR Project (Modified Partial Replacement Alternative)

The State-USBR-Project is so named, because this alternative would be principally funded by the U.S. Bureau of Reclamation (USBR) and the state of Washington, to pay for heavy construction improvements to the East-Low Canal. The State and USBR funding could come from Columbia River Program (RCW 90.90) funds (or other state resources) and conventional federal budget sources. And it can involve participation by local improvement districts (LIDs) to pay for portions of the water distribution system separate from construction modifications to the East-Low Canal. This Project would likely be under East Columbia Basin District operations. Water delivery would be for firm annual water supplies.

The Project would deliver new surface water to portions of the Odessa Subarea located North of I-90, East of Moses Lake, with about 25,000 acres not including land already receiving water service contracts; and portions of the Subarea located South of I-90, with about 45,000 acres not including land already receiving water service contracts.

b. Private-State Project Alternative

The Private-State Project is so named, because this alternative would be principally funded by the private sector (irrigators) and state of Washington, to cover the costs of new irrigation pumping and distribution systems, connected to the East-Low Canal. Depending on future considerations, some modifications to existing East-Low Canal waste way facilities may be funded by the state, as well. State funding would likely be allocated from the Columbia River Program funds (RCW 90.90) and possibly through revenue bonds—state funding resources require further considerations. Private sector funding would be through annual payments to either state or local entities, as well as annual O&M payments to USBR for water service delivery. It would likely involve formation of local improvement districts (LIDs). This Project would likely be under East Columbia Basin District operations.

The Project would deliver new surface water to portions of the Odessa Subarea located North of I-90, East of Moses Lake, about 75,000 acres including land already receiving water service contracts.

In Appendix A and Review Summary Table 1, estimates are provided for the added irrigated acres to be served by the project(s), and for the required capacity needs for East-Low Canal. These estimates take into account water supply deliveries to both North and South of I-90, as depicted under both a State-USBR Project and the Private State Project set of operations. The extent of the Private-State Project lying North of I-90 is limited to available canal capacity (North of I-90) for future service to South of I-90 lands—this includes existing water service contracts and the new project lands per the State-USBR estimate (about 45,000 acres).

Table1. Review Summary-East-Low Canal Capacity for New Water Allocations and Distribution

Odessa East-Low Canal--Peak Daily Flow Water Allocations

	USBR Pref. Alt.	Existing WSC	TOTAL	Priv.-State-Alt. Above-I-90*	Priv.-State-Alt. Below-I-90*	TOTAL
Irrigated Acres	70,000	19,000	89,000	75,000	54,500	129,500
Total Acre-ft.**	216,300	47,500	275,010	187,500	136,250	323,750
Flow Rate/gpm/acre	6.5	6.5	6.5	6.5	6.5	6.5
Daily G/Day	655,200,000	177,840,000	833,040,000	702,000,000	510,120,000	1,212,120,000
Daily Acre-ft.	2,011	546	2,557	2,154	1,566	3,720
Daily cfs (Peak)	1,012	275	1,287	1,085	788	1,873
Daily cfs (Peak) @75% On-Field Cap.Factor	NA	NA	NA	814	591	1,405
Daily cfs (Peak) @70% On-Field Cap.Factor	NA	NA	NA	759	552	1,311

*Includes water service contracts. On-farm water delivery at 2.5 acre-ft./acre/year, and 70-75% on-farm capacity factor.

** Water supplies for Private-State-Alternative from Banks Lake operations/Lake Roosevelt, and CBP CBP Conservation O&M, and new allocations from biofuel-organic permits under amendments to RCW 90.90.

NOTE: USBR staff indicate that existing Canal model runs include interim Lake Roosevelt water (10,000 acres), in addition to the Modified Preferred Alternative. Consequently, marginal available canal capacity exceeds the daily peak cfs indicated above (>1,287 cfs).

Under the operational regime reviewed for the Private-State Project alternative, new irrigated acre water duties, for field delivery, would be set at about 2.5 acre-ft./acre; and on farm water application factors (capacity factors) would be set at 70%. This would allow for: 1) the maximum development of acreage North of I-90; and 2) adequate canal capacities to ensure water deliveries North and South of I-90.

To safely operate the East-Low Canal while serving large pump stations, waste ways must be available to waste excess water that may be in the canal system if all pumps failed owing to mechanical or electrical failures—catastrophic failure conditions. The waste ways that can be utilized to waste water associated with pumping off the East-Low Canal, North of I-90, are the Rocky Coulee Waste Way, the Weber Coulee Waste Way, and the Lind Coulee Waste Way. The operational use of the waste ways has been discussed with USBR staff, as well as received initial review by IRZ Consulting irrigation engineers.

The Rocky Coulee Waste Way has significant capacity, and would likely be utilized under any pump failure (for canal-serviced mainlines above the waste way). It could be utilized to waste excess waters from the bifurcation works to the waste way. No significant additional works would be needed to make the waste way operational.

The Weber Coulee Waste Way could be utilized. This waste way wastes water from the canal into Weber Coulee. Water would then flow down Weber Coulee a few miles to its intersection with Lind Coulee. Any wasting of water down Weber Coulee Waste Way would result in significant erosion in Weber Coulee, depositing significant materials in Lind Coulee and Potholes reservoir. The erosion channel would be significant, and the USBR considers it a "one-time" option for this reason.

To deal with the Weber Waste Way erosion issue, the USBR considered in their 2007-08 review acquiring/expanding the USBR right-of-way and perhaps making some structural reinforcement changes at the head gate. The land acquisition approach would be a low-cost approach to making the waste way more functional—a factor that contributes to both project(s) operation. Also, this waste way would operate in conjunction with Lind Coulee Waste Way operations, for North of I-90 operations.

The Lind Coulee Waste Way has significant capacity to take excess water. There appears to be some capacity to transport excess water down the existing channel of the East-Low Canal located South of I-90 to this Waste Way, but additional enlargement of the Canal is proposed under the State-USBR Project, in part to deliver additional water to project lands South of Lind Coulee. Some additional modeling needs to be conducted to determine the amount of water that the Canal could safely transport to the waste way now that the second Weber Siphon is in place. At the Lind Waste Way, a second gate would be installed, as well. But until the additional irrigated acreage South of the Lind Coulee Waste Way is served, some additional Canal capacity should be in place without the need for direct Canal expansion.

Further modeling of the new operations for canal system should be conducted, but it would appear that with some work on the waste way gates, and the intertie of pumps and waste way operations, there is significant capacity to waste water in case of dramatic pump failures. By utilizing conjunctively all three waste ways, the operational integrity of the East-Low Canal should be maintained.

Figure 3. State-USBR Project North/South of I-90, East-Low Canal Modified Partial Replacement Alternative (70,000 Acres)

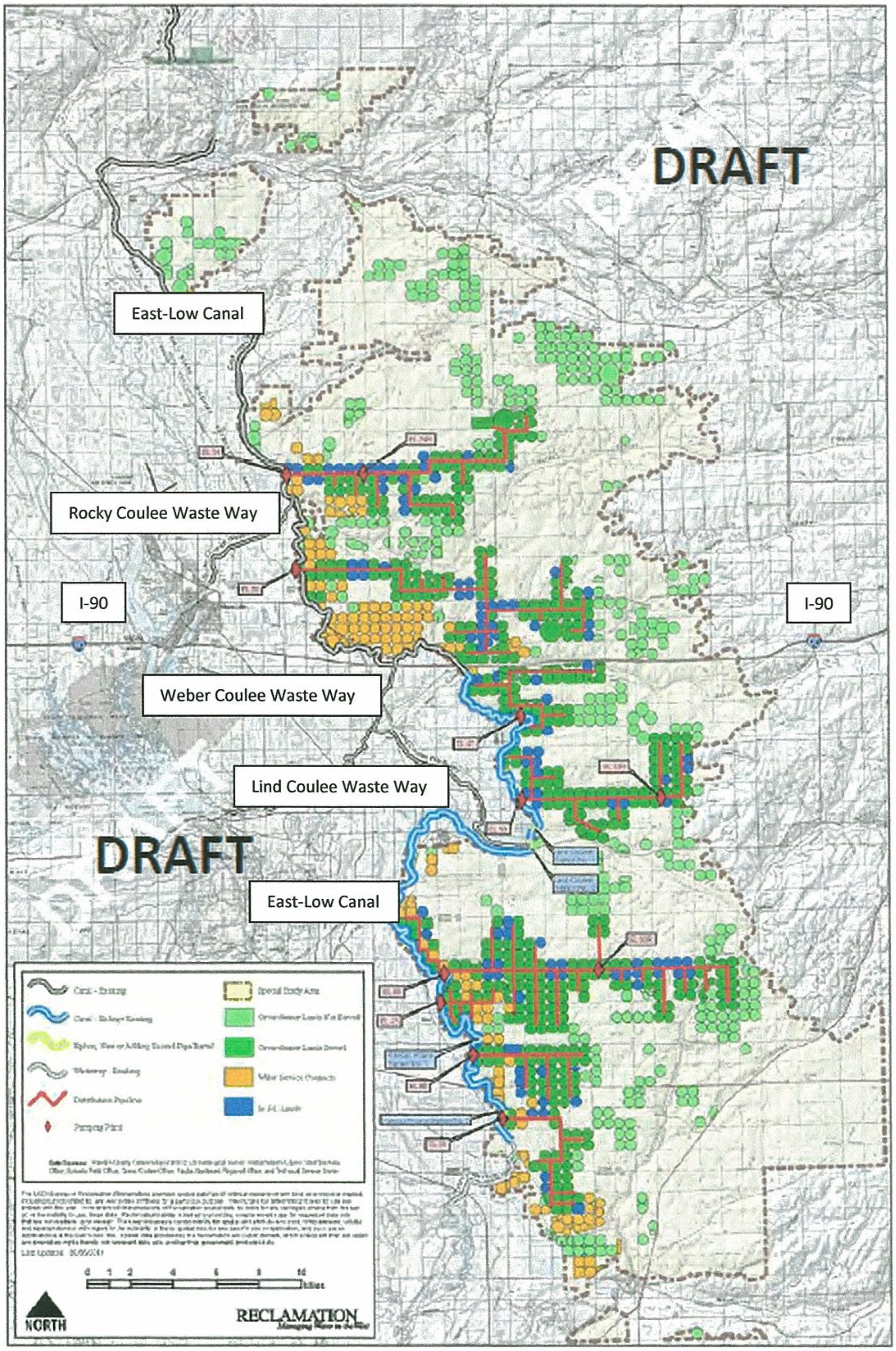
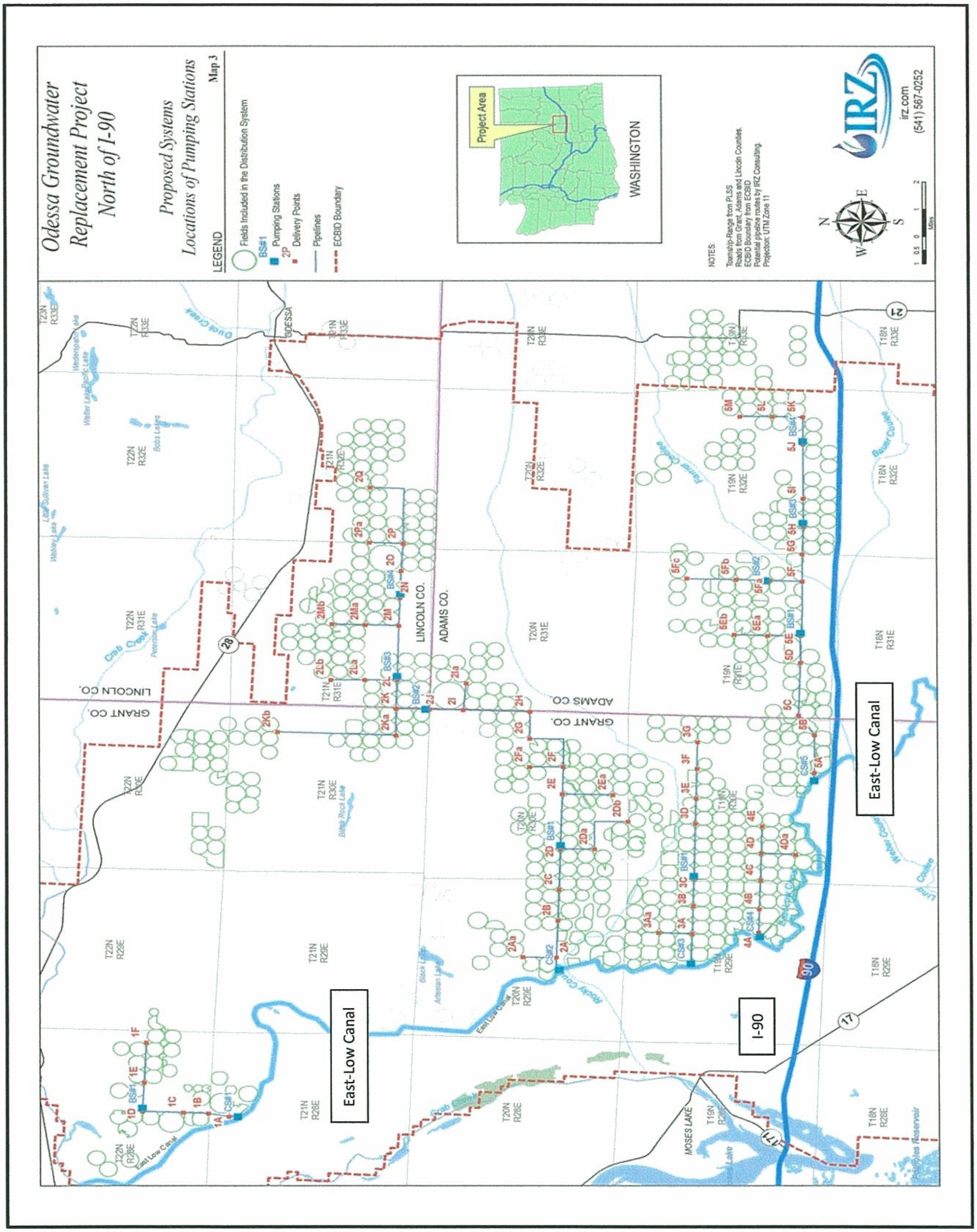


Figure 4. Private-State Project North of I-90, East-Low Canal (75,000 Acres)



III. Economic Analyses Methodology and Review

The project alternatives' impacts can be viewed from two different economic perspectives: 1) a direct net, national economic development (NED) or state direct net value perspective; or 2) a regional economic development (RED) perspective, where state and local employment/income impacts are the central focus. Adopting both perspectives, the Project economic impacts are summarized in the following sections.

The Review further embraces a "state perspective" toward the direct (NED-type) economic analyses of the projects. This relies on an NED-type methodology but with modifications reflecting some state economic assumptions; and includes current practices and understanding in applying key economic analysis methods and assumptions, for Western water resources projects.

The regional economic development (RED) perspective is more focused on economic impacts "on the ground," describing impacts resulting from regional and state direct project employment, secondary employment and income, and the overall ramifications of purchases of goods and services throughout the state economy.

a. Benefit/Cost Analyses Methodology and Economic Impacts

Direct Net (NED-Type) Analyses Assumptions

- The project(s) present value (PV) period starts in 2010--all B/C values are vintage to the 2010-11 period (2010$). The life-cycle analysis period is 2010-2067, reflecting a minimum of 50-years of operation for the State-USBR Project. The 50-year period is used to be reasonably consistent with other types of state infrastructure projects, and to recognize the limitations of the economic assumptions used over very long time periods.

- The Project PV period covers 2010 through 2067:

    - With the State-USBR N/S-I-90 Project, construction/operations commencing in 2017-2023; Project operations are considered at maximum operation in 2024.

    - With the Private-State N-I-90 Project, construction/operations commencing in 2013-2015; Project operations are considered at maximum operation in 2016.

- No interest during construction is included in the economic analysis (as opposed to financial analysis) to be consistent with a general state perspective toward economic analyses—affects all state-funded alternatives equally. The state perspective does not consider deferred revenues during the construction period, as this affects all projects funded with general obligation bonds; or some projects are non-revenue type in function.

- The direct project(s) benefits are:

  Irrigated Agriculture Land-Water values: The approach applied here to estimate the direct net value of the project(s) irrigated land is to adopt a net income value of the land perspective structurally equivalent to income capitalization. This conveys that the market value of the irrigated ground, with firm irrigation water supply, represents its capitalized value. In annual equivalents (annualized value), the future cash flows dictate what the present value should be and what an investor is willing to pay (capital value) or a lender willing to receive on an annual (payment) basis. The annualized value of the property's market value is equivalent to direct net value—return to ownership/management.

  Market value (capitalized annual net value) is based on reviewing actual irrigated land market values for the immediate Columbia Basin area and adjacent lands. Land values are considered for the 2007-2011 period, reviewing the market analyses prepared by Clark Jennings & Associates (2010) for Adams County, and the market transactions (and water market transactions) familiar to the Columbia-Snake River Irrigators Association (CSRIA). This review indicates that an appropriate, mid-range market value for the project(s) area would be about $4,650 (production irrigated ground). To fully take into account net value, the value of the land as dry-land farming ground ($425 per acre) is subtracted, with the remaining estimated value being about $4,225 per acre.

  The market value is equivalent to its annualized present value—using a 15-year present value period with a 5% discount rate (financial assumptions). This depicts a commercial lending period for irrigated agriculture ground and cost of capital—amounting to about $405/acre in 2010$. The $405/acre value is the net annual value per acre that is used within the benefit/cost analysis framework. It is noted that this value estimate ($405/acre) is comparable to the direct net value used by Ecology-USBR in the Draft 2010 EIS (for irrigated ground), and to the converted value of irrigation water estimates observed by CSRIA for Eastern Washington ($1,300-1,500/acre-ft., capitalized value; about $135/acre annualized value).

  The use here of full land capital values incorporates the above discussion and CSRIA experience with irrigated land markets. The use of full market value (capital value per acre) is based on the observation that the market is growing skeptical of the irrigated land production/economic viability, for the Odessa Subarea). The market is skeptical, because of the observations and concerns raised by the USBR (Draft 2010 EIS), the State, the groundwater management area (GWMA), and the Conservation Districts that a majority of the irrigated acres will remain in production past the next 7-10 years. Already, some irrigation pumps (or pivots) have ceased operation, and others have been reset within the aquifer(s) to a level that what would be considered as at the edge of economic viability.

Aside from any "local salvage value," the outside market (irrigators, food processing facilities) perceives this ground with high risk, and effectively views the irrigated land value as now approaching zero (not sellable as production agriculture irrigated land to a market with other alternatives). CSRIA considers the current condition of the irrigated ground as unmarketable to "outside parties." What is at risk to the state is the full market value of the irrigated ground.

Municipal Values: The estimates of municipal benefits from the project(s) may be the most speculative in nature for all the benefits/costs. The value represents the reduced pumping costs associated with reduced pumping lifts perceived to be associated with limiting drafting of the deep aquifer(s)—resulting from irrigated acres shifting from groundwater to surface water. Although some groundwater modeling estimates have been made, the empirical changes to the aquifer(s) discharge under new surface water conditions are unknown.

The average value for the multiple cities/industrial entities involved is estimated here to be about $47/acre-ft. for the affected pumping, based on the information contained within the Ecology-USBR 2010 Draft EIS (subject to interpretation). Others have suggested that the total, increased net costs to the municipal entities may exceed this cost (benefit), unless relief to aquifer pumping occurs. Additional information here is forthcoming.

- The direct project(s) costs are:

  Construction Costs: This includes all field and non-contract costs (environmental, engineering, and administrative) with contingencies, as estimated provided by USBR in their 2010 Draft EIS analyses (and per staff discussions), and per IRZ Consulting pre-construction cost estimates. The base construction costs are estimated to be:

    - For the State-USBR Project, about $750 million. The Draft EIS estimate was about $730 million, but USBR staff have indicated that additional changes to costs and project configuration will slightly increase the cost estimate (to appear in the final EIS). This is about $10,700 per acre, including the costs of East-Low Canal modifications.

    - For the Private-State Project, about $339 million. This estimate is based on current vendor/contractor costs with high-cost range assumptions. Actual costs may be considerably lower. This is about $4,500 per acre, not including East-Low Canal modification costs.

      The need for East-Low Canal (waste way) modification costs is tied to catastrophic system failures, where large portions of system flows would be forced back into the mainstem canal system. The Private-State Project would rely on Rocky Coulee Waste Way, and/or the

Weber Coulee Waste Way, and Lind Coulee Waste Way. The USBR staff currently assumes that Lind Coulee Waste Way would require some modification (second gate installed) to fully utilize this waste way, but this also assumes that the full water volume carrying capacity would be operational for the below I-90 portion of the State-USBR Project. The above requires some further modeling to determine total allocations and cost allocations.

Project(s) Annual OM&R costs: This includes the annual operation, maintenance, and replacement costs estimated by CSRIA, using USBR and other state project data and cost estimates. The annual OM&R costs are approximately equal to about 0.5% of the contract construction costs, or about 20% present value of the contract constriction costs, over the 50-year life-cycle period.

Project Foregone Power Cost (with System Pumping Costs Included): The water withdrawals from Lake Roosevelt affect power production throughout the Columbia River system at and below Grand Coulee Dam. Also power costs include the direct system pumping from Lake Roosevelt to Banks Lake (as noted within the Ecology-USBR 2010 Economics Report to Draft EIS). Based on the Draft 2010 USBR EIS data, the power impact costs are estimated here to be about $121/acre for the State-USBR project and about $98/acre for the Private-State Project. USBR staff indicate that this value is being revised by Bonneville Power Administration, and the values presented in the Final Ecology-USBR EIS are expected to be lower.

Real Discount and Escalation Rates

The review benefit/cost (B/C) analyses adopt real discount and escalation rates with consideration for the long-term nature of the project operations and intergenerational equity considerations; with consideration for real marginal benefit and cost changes during the most substantive period of discounting; and with appreciation for real dollar increases to water, power, and construction development.

- The PV period discount rate is 3.0 percent (real social time preference rate). This rate "mirrors" the real, long-term federal bonding rate over time (with inflation removed), but it is not tied per se to a direct empirical financial instrument. It attempts to deal equitably with the intergenerational nature of the benefits and costs.

- The Project(s) benefits are expressed in real (2010$) terms with real escalation rates (2.5 percent), depicting assumptions about higher marginal costs for water/power supply in the West. There is appreciable consensus among economists that water (energy) costs will escalate in real terms at or above 2.0%.

- The Project(s) costs are expressed in real (2010$) terms with real escalation rates (2.5 percent), depicting assumptions about higher marginal costs for water/power supply in the West. There is appreciable consensus among economists that water (energy) costs will escalate in real terms at or above 2.0 percent.

- The Project(s) capital construction costs are expressed in real (2010$) terms with real escalation rates (2.5 percent), depicting assumptions about real construction cost increases (2017-2023).

Charts 1 and 2 below summarize the present value, discounting, and escalation regime for the B/C analyses.

Chart 1. State-USBR Project, B/C Analysis Methodology

B/C Analysis:

Benefits:

PV At 2010$ Start of Engineering-Construction Period, 3.0% Discount/Interest Rate, with 2.5% Real Escalation Rates (50 Years Life-Cycle Approach).

Irrigated Agriculture Water Supply:

Net Annualized Capital Land Values-Return to Ownership-Management and Consistent with Marginal Water Values (Estimated at $405/acre).

Water Delivery Start in 2017 (Completed in 2019, 2021, and 2023).

Municipal/Industrial Groundwater Pumping:

Reduced Net Power Pumping Costs with Reductions to Groundwater Lift (USBR Estimate at About $47/acre-ft. Affected)

Pumping Reductions Increase 2012-2023 and Held Constant Thereafter.

2010-11	2020	2030	2040	2050	2060	2067

Costs:

PV At 2010$ Start of Engineering-Construction Period, 3.0% Discount/Interest Rate, with 2.5% Real Escalation Rates (50 Years Life-Cycle Approach).

Construction—Field-Non-Construction Contract:

* Field Costs (with Contingency).
* Non-Construction Contract Costs: Env/Eng/Adm. (20% of Field Costs During Construction)
* Interest During Construction (Not Included)

Construction Period Phased 2017-2023.

Construction, OM&R:

Annual OM&R Costs Based on about 0.5% of Field Construction Costs (Annually); About 20% of Field Capital Costs.

O&MR Starts in 2018 and Increases to 2024, and Held Constant (annual) Thereafter.

Foregone Power and System Pumping Use

Marginal Value of Power Based on BPA-USBR Estimates (At About $121/Acre with System Pumping Costs Included).

Power Costs Start in 2017 and Increases to 2024, and Held Constant (annual) Thereafter.

Chart 2. Private-State Project, B/C Analysis Methodology

B/C Analysis:

Benefits:

PV At 2010$ Start of Engineering-Construction Period, 3.0% Discount/Interest Rate, with 2.5% Real Escalation Rates (50 Years Life-Cycle Approach).

Irrigated Agriculture Water Supply:

Net Annualized Capital Land Values-Return to Ownership-Management and Consistent with Marginal Water Values (Estimated at $405/acre).

Water Delivery Start in 2013 (Completed in 2014, 2015)

Municipal/Industrial Groundwater Pumping:

Reduced Net Power Pumping Costs with Reductions to Groundwater Lift (USBR Estimate at About $47/acre-ft. Affected).

Pumping Reductions 2014-2016 and Held Constant Thereafter

2010-11	2020	2030	2040	2050	2060	2067

Costs

PV At 2010$ Start of Engineering-Construction Period, 3.0% Discount/Interest Rate, with 2.5% Real Escalation rates (50 Years Life-Cycle Approach).

Construction--Field and Non-Construction Contract Costs

* Field Costs (with Contingency)
* Non-Construction Contract Costs: Env/Eng/ Adm. (20% of Field Costs During Construction).
* Interest During Construction (Not Included).

Construction Period Phased 2013-2015

Construction, OM&R:

Annual OM&R Costs Based on about 0.5% of Field Construction Costs (Annually); About 20% of Field Capital Costs.

O&MR Starts in 2014 and increases to 2016, and Held Constant (annual) Thereafter

Foregone Power and System Pumping Use

Marginal Value of Power Based on BPA-USBR Estimates (At About $98/Acre with System Pumping Costs Included).

Power Costs Start in 2013 and increases to 2015, and Held Constant (annual) Thereafter

b. Benefit/Cost Analyses Results

Tables 2 and 3 display the results of the benefit/cost (B/C) analyses. Relying on the economic perspectives and assumptions noted above, the State-USBR Project direct net benefits amount to about $1.235 billion, and the Project costs amount to about $1.172 billion (2010$, present value, rounded). The B/C ratio is about 1.05. Overall, the Project is displaying greater benefits than costs given the complex set of economic variables under consideration.

From a state direct net value perspective, the Project development benefits are greater than the costs of Project construction and operation, given the life-cycle cost review conducted here. This perspective assumes some relative escalation (2.5 percent) in monetary values between the costs of water resources development today versus other "product" costs tomorrow; and a social time preference discount rate of 3.0 percent (approximately equal to the federal government's real, long-term discount/interest rate). Stated differently, the value of future benefits to future residents is given more emphasis, than just consideration of the "up-front" costs of Project construction, and the value of water and power is assumed to escalate in real terms.

In Table 3, the estimated Private-State Project benefits amount to about to about $1.457 billion, and the costs amount to about $0.727 billion. The B/C ratio is about 2.0 per the analysis assumptions presented. Depending on the assumptions about including some portion of the costs for modifying the Weber Coulee and Lind Coulee Waste Ways, the total project costs would modestly increase, but the B/C ratio would not be substantively changed.

For both project alternatives, additional value estimates are currently being revised for the municipal/industrial and power sectors. The municipal/industrial benefit estimates are being revised to take into account additional construction costs (foregone benefits) that may be avoided with surface water supplies in place for irrigation. And the Draft 2010 EIS foregone power and system power costs are being revised by Bonneville Power Administration. Both of these changes will further reduce costs and increase benefits, with resulting higher B/C ratios.

Table 2. Odessa Subarea B/C Analysis

State-USBR Project (N/S-I-90 Water Allocations from East-Low Canal)

Real Discount Rate and Escalation Rate

Benefits:	PV (2010$)	Annual. PV	Discount Rate	Escalation Rate	Ag. $/Acre (2010)
Irrigated Ag.	$1,181,839,500	$45,932,800	3.0%	2.5%	$405
Municipal/Industrial	$53,384,000	$2,074,800	3.0%	2.5%	
Total Benefits	$1,235,223,500	$48,007,600			
Costs:	PV	Annual. PV			
Capital Construction	$712,127,500	$27,677,200	3.0%	2.5%	
OM&R	$116,964,400	$4,545,900	3.0%	2.5%	
System Pumping Operations	$0	$0	3.0%	2.5%	
Foregone Power	$342,979,000	$13,331,600	3.0%	2.5%	
Total Costs:	$1,172,071,000	$45,554,700			
State B/C:	1.05	1.05			

NOTE:

Est. Annual Cost Per Delivered Irrigation Water in $/Acre-ft.:	$260
For Average Annual Acre Delivery 2017-2067:	70,000

System pumping costs above included in BPA foregone power impacts.

Table 3. Odessa Subarea B/C Analysis

Private-State Project (N-I-90 Water Allocations from East-Low Canal)

Real Discount and Escalation Rate

Benefits:	PV (2010$)	Annual. PV	Discount Rate	Escalation Rate	Ag. $/Acre (2010)
Irrigated Ag.	$1,397,747,700	$54,324,200	3.0%	2.5%	$405
Municipal	$59,951,100	$2,330,200	3.0%	2.5%	
Total Benefits	$1,457,698,800	$56,654,400			
Costs:	PV	Annual. PV			
Capital Construction	$331,715,200	$12,892,300	3.0%	2.5%	
OM&R	$55,172,500	$2,144,300	3.0%	2.5%	
System Pumping Operations	$0	$0	3.0%	2.5%	
Foregone Power	$339,918,300	$13,211,000	3.0%	2.5%	
Total Costs:	$726,806,000	$28,248,700			
State B/C:	2.00	2.00			

NOTE:

Est. Annual Cost Per Delivered Irrigation Water in $/Acre-ft.: $151

For Average Annual Acre Delivery 2014-2067: 75,000

System pumping costs above included in BPA foregone power impacts.

c. Regional Economic Development Analyses

Economic Impact Assessment Methodology

An economic impact assessment focuses on overall economic activity due to some change in one or several economic sectors. The commonly used economic impact measures within standard regional economic impact analysis are changes (gains or losses) in output (value of all sales of goods and services), employment, and income.[1/] The total change in the economic impact measures comes from:

- Direct economic impacts: are impacts created by initial economic activities, such as an increase in agricultural production. The direct impact has ripple effects that reverberate throughout the local economy.

- Indirect economic impacts: occur in economic sectors that buy/sell goods and services to the other sectors that are directly affected. For affected agricultural production sectors, these goods and services include fertilizers, harvesting machinery, transportation and many other inputs utilized in the production of agricultural products. A change in economic activities in an agricultural production sectors also affects economic activities in other sectors through forward linkages (i.e., food processing, transportation, etc.). Hence, a direct change in economic activity in one sector of the economy can have substantial indirect effects on sales/purchases, employment, and income in other sectors.

- Induced economic impacts: are those caused by changes in household spending patterns due to changes in household income, resulting from direct and indirect impacts.

The total regional economic development (RED) or impact on a region's production, employment, and income is the sum of their respective direct, indirect, and induced impacts.

Estimating indirect and induced impacts is accomplished using an input-output modeling framework. An input-output model depicts the structure of an economy in terms of industries' trade transactions with each other locally and non-locally, and industries' relationship with local households. The model captures what each economic sector must purchase from every local and nonlocal sector, so as to produce a dollar's worth of goods and services; and the model also provides households expenditure patterns per dollar of income. In impact analysis, the input-output model traces linkages among sectors of an economy and calculates the total impact resulting from a direct impact in

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[1/] There are different types of income (or earned income): a) labor income includes employee compensation (wages and salaries and benefits paid by businesses) and proprietors' income, b) other property incomes consist of dividends, interests, and rents. Value added is another economic impact measure that many economists use in economic impact analysis. Value added includes labor income, other property incomes and indirect business taxes. *Value added is considered to be a form of gross income, and it is the wealth produced in a region due to economic activity.*

one or more sector(s).

The economic impact analyses are often conducted using a non-survey economic input-output model called IMPLAN (IMpact analysis for PLANning) maintained by the Minnesota Implan Group (MIG). For each industry sector, IMPLAN estimates the production, household consumption, export, import, indirect business taxes, and inter-industry trade data using the available regional and national data sources. The regionalized inter-industry trade data are based on detailed input-output tables of the national economy, but the IMPLAN adjusts the national data to fit the economic condition and the estimated trade balance of a region. The most recent data available for model construction is for base year 2009, but the regional economic impacts are stated in 2011$ dollar using IMPLAN inflator.

Impact Region and Time Reference

The direct economic impacts of the project(s) (referred to here as either Private-State Project or State-USBR Project) would most directly occur in Adams, Franklin, Grant, and Lincoln Counties, but the overall impacts affect the statewide (and national) economy. To effectively estimate the economic impact of the projects, this report focuses regional economic impact on Washington State's economy. The direct changes are "local" in location, but the indirect and induced impacts reach-out throughout the state.

The regional economic impact study conducted in this review assesses the regional economic impact using a static approach. In other words, this report attempts to assess the regional economic impact of the Project, assuming the Project is implemented today given today's economic condition—often referred to as "overnight development."

The focus here is on the regional/state value of the irrigation Project to the state, *the impact of the irrigated agriculture industry.* The Draft Ecology-USBR EIS covers other impact areas affecting the state economy (USBR-Ecology, 2010).

The potential direct impacts of the project(s) are as follow: the production of agricultural products; agricultural services; and the value-added economic activities beyond the farm-gate such as food processing, transportation, and wholesale trade.

Proposed Crop Mix and Production Value

The current cropping pattern within the project(s) lands does not reflect the irrigation crop mix in surrounding regions, such as the Columbia Basin Project (CBP), the Lower Snake River-Horse Heaven Hills regions, or Umatilla and Morrow Counties in Oregon. All have similar—though not exact--agronomical and climatic conditions, but the farmers in those areas have stable and adequate irrigation water. Consequently, they have been adopting high–tech irrigation systems and water management techniques to support their production of high value crops. With a more reliable water supply condition, farmers within the project(s) area would naturally allocate more of their lands to high-value crops than they currently do.

Table 4 displays specific crop acreages for the project(s), as reviewed here.

Table 4. Proposed Crop Mix, Projected Crop Acreages Project(s)

	Proposed Crop Mix (%)	Water Project(s)	
		State-USBR and P-S Project (acres)	State-USBR Project (acres)
Corn for Grain	25%	30,000	17,500
Dry edible Beans	5%	6,000	3,500
Alfalfa	13%	15,600	9,100
Wheat	13%	15,600	9,100
Potatoes	25%	30,000	17,500
Green Peas	7%	8,400	4,900
Sweet Corn	12%	14,400	8,400
Total	**100%**	**120,000**	**70,000**

Source: Pacific Northwest Project and CSRIA.

To estimate expected per-acre average production and annual revenue for each crop, data on crop prices and crop yields are collected from various sources—including the National Agricultural Statistics Service (NASS) data base, the WA State Dept. of Agriculture, and direct consultations with food processors and growers in the project(s) area (including staff and members of the Columbia-Snake River Irrigators Association).

The expected per acre annual revenue for each crop was estimated by multiplying crop price by its crop yield. All crop prices were adjusted to $2009 by Consumer Price Index. Tables 5 and 6 display the expected per acre crop revenues. The expected per acre crop revenues are then multiplied to their respective crop acres, to calculate the expected farm-gate crop production value for the project(s).

In last few decades, the increased production of high-value crops such as potatoes, green peas, grapes, carrots, onions, etc., has stimulated the development of food processing plants in the region. Recognizing the role of food processors in the region, the next step is to include market utilization for crop production among foreign and/or domestic export markets, local food processors, and local consumption (local residents and other local businesses), based on knowledge of local markets, food processing distribution, and previous studies.

Table 5. Estimated Crop Mix, Per Acre Crop Revenue, Farm-gate Crop Production Value, and Market Utilization, Private-State and State-USBR Projects (120,000 acres), in $2009

	Proposed Crop Mix (%)	Expected Crop Revenue $/ac	Farm-Gate Crop Production Value (million$)	Market Utilization	
				Local Food Processors (million$)	Domestic or Foreign Export Markets (million$)
Corn for Grain	25%	$ 1,163	$ 34.89	$ -	$ 34.89
Dry edible Beans	5%	$ 632	$ 3.79	$ -	$ 3.79
Alfalfa	13%	$ 988	$ 15.41	$ -	$ 15.41
Wheat	13%	$ 792	$ 12.36	$ -	$ 12.36
Potatoes	25%	$ 4,224	$ 126.73	$ 107.72	$ 19.01
Green Peas	7%	$ 679	$ 5.70	$ 5.70	$ -
Sweet Corn	12%	$ 744	$ 10.71	$ 10.71	$ -
Total	**100%**	**$ 1,747**	**$ 210**	**$ 124**	**$ 85**

Source: Pacific Northwest Project and CSRIA.

Table 6. Proposed Crop Mix, Per Acre Crop Revenue, Farm-gate Crop Production Value, and Market Utilization, State-USBR Project (70,000 acres), in $2009

	Proposed Cropmix (%)	Expected Crop Revenue $/ac	Farm-Gate Crop Production Value (million$)	**Market Utilization**	
				Local Food Processors (million$)	Domestic or Foreign Export Markets (million$)
Corn for Grain	25%	$ 1,163	$ 20.36	$ -	$ 20.36
Dry edible Beans	5%	$ 632	$ 2.21	$ -	$ 2.21
Alfalfa	13%	$ 988	$ 8.99	$ -	$ 8.99
Wheat	13%	$ 792	$ 7.21	$ -	$ 7.21
Potatoes	25%	$ 4,224	$ 73.93	$ 62.84	$ 11.09
Green Peas	7%	$ 679	$ 3.33	$ 3.33	$ -
Sweet Corn	12%	$ 744	$ 6.25	$ 6.25	$ -
Total	**100%**	**$ 1,747**	**$ 122**	**$ 72**	**$ 50**

Source: Pacific Northwest Project.

Total Value of Processed Products

To estimate the value of processed products, this review uses Gross Absorption Coefficient or GAC value. The GAC value is the value of an input (e.g. potato) for each dollar value of a final product (i.e., french fries). To determine the GACs value for vegetable crops included in the proposed crop mix, several sources were reviewed (IMPLAN database, 2009; Holland and Yeo[2/], Holland and Beleiciks;[3/] Ziari & Olsen;[4] Huppert, Daniel, et. al;[5] and Burt and Brewer) Based on these sources, this review

[2/] Washington State Potato Commission sponsored study.

[3/] Holland, David and Nick Beleiciks, 2006 "The Economic Impact of Potatoes in Washington State", EB 1953E. Pullman: Coll. of Agr. and Home Econ., Wash. State University.

[4/] Ziari, Houshmand and Darryll Olsen. 1998. "Economic Impacts Study for Eastern Oregon, Opportunity Costs of Columbia River Management Actions," IRZ Consulting and Pacific Northwest Project. Hermiston, Oregon.

[5/] Huppert, Daniel, Gareth Green, William Beyers, Andrew Subtoviak and Andrew Wenzl. 2004. "Economics of Columbia River Initiative. Final Report to the Washington Department of Ecology and CRI Economics Advisory Committee". January 13, 2004.

uses the GAC values of $0.4042 for french fries adopted from Holland and Yeo study and GAC value of $0.28 for sweet corn and $0.33 for processed green peas adopted from Ziari and Olsen study. Compared with other GAC values discussed above, the GAC of $0.4042 for potato provides a better projection of market utilization of local potato production within the region.

Direct Impacts of Forward Linkages beyond Farm–gate and Factory-gate

Farm-gate crop production value and factory-gate food processed value were estimated above; however, if we stop at this point, additional induced regional economic activities such as wholesale trade and transportation activities that occur beyond farm-gate and factory-gate are largely ignored.[6/] To incorporate these forward linkages, direct impacts on these sectors were estimated using wholesale trade margin and transportation margins (transportation margins for truck, water, and railroads services) found in 2009 IMPLAN database and other sources.

Total Economic Impact of Irrigated Crop Production

Prior to the estimation of the total economic impacts, several adjustments were made to the IMPLAN model/database:

- To eliminate the potential differences in output and earning per worker between sectors in the Four-counties and the State, the IMPLAN model for the State was modified to reflect the same worker productivity as the Four-counties. Without these adjustments, the impact results could be overestimated or underestimated.

- To prevent any of the affected sectors from buying more inputs at the County level than at the State level, regional purchasing coefficients (RPCs)[7/] at the State and County levels were examined and subsequently adjusted.

- To avoid cross hauling, the option of an industry buying goods and services from its own sector was eliminated prior to estimation.

- To reflect the local production function technology for the frozen food sector, GAC value for vegetable crop was adjusted.

Combined Private-State and State-USBR Projects (P-S-USBR Project)

Output Impact: Per Table 7, the project(s) was estimated to stimulate economic activities in the State by $1.01 billion. Of this total, about $465 million would be direct

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[6/] It should be noted that all direct impacts entered in IMPLAN model for economic impact analysis are in producer prices (e.g., prices at farmgate or factory gate). So, to consider induced activities in transportation and wholesale trade, they should be estimated outside the model.
[7/] Regional purchasing coefficient represents the proportion of local demand for goods and services that is met by local suppliers.

impact and $547 million would be indirect and induced impact. The agricultural industry (consists of agricultural production, food processors and agricultural services sectors) is accounted for 54% ($545 million) of the total output and the indirect and induced effects in other sectors represent an additional $470 million of the output.

Employment Impact: The $1.01 billion additional economic activities stemming from the P-S-USBR Projects would create 6,935 jobs (3,024 jobs directly and 3,911 jobs indirectly). The agricultural industry accounts for 60% (or 4,139 jobs) of the total impact and the remaining sectors account for 2,796 jobs.

Value-Added Impact: From perspective of regional policymakers, value-added measure is the most appropriate economic measure to assess the regional contribution of a project or a policy option. Value-added impact is measured by taking the value of goods and services produced as a result of the proposed project and deducting the cost of intermediate inputs (the cost of goods and services used up in the production process); the calculation excludes the cost of land, labor and capital. Hence, economists consider it as an estimate of the returns to locally employed resources such as land, labor, capital, and management throughout the regional economy.[8/] The total value-added impact stemming from the P-S-UBSR was estimated to be $438 million ($141 million directly and $297 million indirectly). This translates to about $3,650 income per acre of irrigated land.

Table 7. Total Economic Impacts of Irrigated Crop Production Private-State and State-USBR Projects, $2011

Impact Type	Output ($million)	Employment (# jobs)	Labor Income ($million)	Value Added ($million)
Direct Effect	$ 469	3,024	$ 102	$ 141
Indirect Effect	$ 335	2,369	$ 136	$ 171
Induced Effect	$ 212	1,542	$ 69	$ 126
Total Effect	**$ 1,015**	**6,935**	**$ 306**	**$ 438**

* Labor income consists of employee compensation plus proprietor's income.
* Value added consists of labor income, other property income, and indirect business income.
Source: IMPLAN Modeling.

Fiscal Impact Analysis: The INPLAN modeling runs also allow for a crude estimate of tax revenues generated from the Projects. Table 8 presents the impact of P-S-UBSR Project (120,000 acres) on local, State and Federal tax revenues. The total contribution of the P-S-USBR Project to local and state indirect business tax revenue is estimated at $25.74 million. Sales tax and property tax would account for 36% (or $9.18 million) and 51% (or $13.25 million) of total IBTs, respectively. The total annual contribution to Federal tax revenue stemming from P-S-USBR Project was estimated at $63.19 million.

Table 8. Estimated Local, State, and Federal Tax Revenues Resulting from Private-State and State-USBR Project, $2011

	Tax Revenues			
	Local & State		Federal	
	Direct ($million)	Total ($million)	Direct ($million)	Total ($million)
Indirect Bus Tax: Sales Tax	$ 2.14	$ 9.18		
Indirect Bus Tax: Property Tax	$ 3.09	$ 13.25		
Indirect Bus Tax: Others	$ 0.78	$ 3.31		
Employee Compensation*			$ 10.3	$ 29.51
Proprietor Income Tax			$ 1.09	$ 3.91
Indirect Business Taxes			$ 1.62	$ 6.93
Personal Income Tax			$ 6.22	$ 18.84
Corporate Profits Tax			$ 1.28	$ 4.00
Total	**$ 6.01**	**$ 25.74**	**$ 20.51**	**$ 63.19**

* Social Insurance tax
Source: IMPLAN Modeling.

State-USBR PROJECT

The 70,000 acres of new irrigated lands under the State-USBR Project is estimated to annually produce crop production around $122 million. Of this total, $50 million would be utilized by export markets and $72 million would be used by in-state food processors. The value of processed products was estimated to be around $189 million. The State-USBR Project would also induce economic activity in transportation sector (specifically, transport by truck, rail, and water) by $9 million and wholesale trade sector by $20 million. The direct, indirect and induced economic impacts of USBR Project on State's economy are presented in Table 9.

Output Impact: The State-USBR Project was estimated to stimulate economic activities in the State by $586 million. Of this total, $274 million would be direct impact and $312 million would be indirect and induced impact. The agricultural industry (consists of agricultural production, food processors and agricultural services sectors) is accounted for 55% ($321 million) of the total output and the indirect and induced effects in other sectors represent an additional $266 million of output.

Employment Impact: The $586 million additional economic activities stemming from the P-S-USBR would create 4,025 jobs (1,758 jobs directly and 2,269 jobs indirectly). The agricultural industry accounts for 60% (or 2,403 jobs) of the total employment impact and the remaining sectors account for 1,622 jobs.

Value-Added Impact: The total value-added impact stemming from the UBSR was estimated to be $244 million ($78 million directly and $166 million indirectly). This translates to $3,486 income per acre of irrigated land. Of $244 million value-added impact, $99 million attributed to agricultural industry and $145 million by other sectors supporting the agricultural industry.

Fiscal Impact Analysis: Table 10 presents the impact of the State-UBSR Project on local, State, and Federal tax revenues (IMPLAN modeling estimate). The total contribution of the State-USBR Project to local and state indirect business tax revenue is estimated at $14.35 million. Sales tax and property tax would account for 35% (or $5.10 million) and 51% (or $7.39 million) of total IBTs, respectively.

The total annual contribution to Federal tax revenue stemming from the State-USBR Project was estimated at $35.20 million. Of this total, social insurance tax accounts for 47% (or $16.44 million), Proprietor Income Tax accounts for 6% (or $2.17 million), indirect business tax account for 11% (or $3.87 million), personal income tax accounts for 30% (or $10.49 million), and corporation tax accounts for 6% (or $2.23 million).

Table 9. Total Economic Impacts of Irrigated Crop

Impact Type	Output ($million)	Employment (# jobs)	Labor Income ($million)	Value-Added ($million)
Direct Effect	$ 274	1,758	$ 56	$ 78
Indirect Effect	$ 194	1,374	$ 76	$ 95
Induced Effect	$ 119	894	$ 38	$ 70
Total Effect	**$ 586**	**4,025**	**$ 171**	**$ 244**

* Labor income consists of employee compensation plus proprietor's income.

* Value added consists of labor income, other property income, and indirect business income.
Source: IMPLAN Modeling.

Table 10. Local, State and Federal Tax Revenues Resulting from State-USBR Project, $2011

	Tax Revenues			
	Local & State		Federal	
	Direct ($million)	Total ($million)	Direct ($million)	Total ($million)
Indirect Bus Tax: Sales Tax	$ 1.20	$ 5.10		
Indirect Bus Tax: Property Tax	$ 7.39	$ 7.39		
Indirect Bus Tax: Others	$ 1.86	$ 1.86		
Employee Compensation*			$ 5.71	$ 16.44
Proprietor Income Tax			$ 0.61	$ 2.17
Indirect Business Taxes			$ 0.91	$ 3.87
Personal Income Tax			$ 3.46	$ 10.49
Corporate Profits Tax			$ 0.72	$ 2.23
Total	**$ 3.36**	**$ 14.35**	**$ 11.41**	**$ 35.20**

* Social Insurance tax
Source: IMPLAN Modeling.

d. Project(s) Construction Impacts

Within the USBR Draft EIS, the total direct and indirect economic impacts from construction of the initial version of the partial replacement alternative (57,000 acres below I-90) was estimated to be about 2,196 jobs, $114 million of labor income, and $321 million of output for the regional area (total over construction period).

For the Private-State Project, an estimate of the likely construction impacts to the overall statewide and regional area is provided below. The values in Table 11 reflect total construction impacts that would occur over a period of years depending on the timing of construction phases.

The Private-State Project construction is estimated to produce about 860 jobs (annual FTEs during the construction period), and about 1,650 to 1,820 jobs taking into account direct and indirect employment affects throughout the region and state. Total state, construction labor income impacts are estimated to be about $106 million.

The estimated value of total goods' and services' purchases throughout the state is difficult to determine at this time, given the yet to be designated contracting and vender firms. Nevertheless, an initial range of potential impacts suggests that $250 to $489 million could "pass through" the state economy, as a result of the Project (all direct and secondary economic impacts).

Project staging locations have been identified and it is assumed that much of the direct employment benefits would accrue to the regional study area counties. For analysis purposes here, the direct and secondary employment and income estimates are primarily allocated within Washington State.

Additional review is forthcoming for Project construction-related public services and labor force needs. The time frame for construction, construction locations, and relatively minor increases in local population centers (and existing services) do not suggest significant impacts.

Most service needs would be directed toward multiple, site-specific construction staging areas, where land, transportation services, congestion, power and fuel, and other public and private sector service demands would substantially increase.

Table 11. Regional Economic Impacts from the Odessa Private-State Project Construction

Economic Sector	RED Direct Employment	Statewide Employment Multiplier	Statewide Direct and Indirect Employment
Construction	710	1.9	1,350
		2.1	1,490
Professional-Tech Services	150	2.0	300
		2.2	330
Total	860	------	1,650
		------	1,820
	Direct Labor Income	Statewide Income Multiplier	Statewide Direct and Indirect Income
Construction	$39,125,000	2.0	$78,250,000

Professional-Tech Services	$13,000,000	2.2	$28,600,000
Total	$52,125,000	------	$106,850,000
Economic Impact	Estimated Statewide Direct 2010$	Statewide Total Output$ (Low)	Statewide Total Output$ (High)
Total Direct @40%	$135,000,000	$249,750,000	$324,000,000
Total Direct @60%	$202,500,000	$374,625,000	$486,000,000

Sources: PNP direct construction workforce estimates (preliminary); IMPLAN Model 2009 data and modeling results for Washington State; WA State I/O Model estimates (per 2002 industry structure).

e. Property Tax Impacts for Adams County, Irrigated vs. Non-Irrigated Lands.

For county property taxes, the open space taxation act (RCW 84.34) requires certain agricultural, timber, and open space lands to be valued at their current use rather than their market value. The current use value is calculated based on the capitalized value of "net cash rental." The capitalized rate is indicative of long term loans secured by a mortgage on farm land.

The current use value for agricultural lands varies by year, by location, by crops, and by agronomic conditions and practices. For example, in Franklin County, the current average irrigated cropland use value in 2011 is about $2,000 per acre, while current use value for dry-land crops is about $300. The current use values for irrigated and dry-land croplands for Adams County are about $1,976 and $210 per acre, respectively.

Counties determine the amount of property tax based on tax levy rates, which are specific to each county. The 2011 average total tax levy rates for Adams County and Franklin County are 1.350%[9/]

Table 12 illustrates the expected property tax revenue implications--or potential revenue differences--on irrigated croplands for Adams County, as a result of the Project(s). It is roughly estimated that Adams County could receive about 70% of the total tax revenue from the Project(s) irrigated acreage, as opposed to dry-land acres. This would be about $1.1 to $2.0 million more with irrigation than in dry-land farming conditions.

The above estimate is for illustrative purposes, but represents the range of the County tax impacts affected by Project(s) development.

[9/] The total levy rate and current use values for each county are obtained from personal communications with their respective County assessor staffs.

Table 12: Expected Net Impact on Property Tax Revenue, Adams County

	Levy Rate (2009)	Crop Use Value		% of acres	Tax Revenue Increase	
		Irrigated Cropland	Dryland Cropland		P-S-USBR Project (120,000 acres)	State-USBR Project (70,000 acres)
Adams County	1.35%	$1,976	$210	70%	$2,003,000	$1,168,000

Under the Private-State Project alternative, the differential property tax funds would be lower than that displayed in Table 12, as a small proportion of the irrigated acreage resides within Adams County. More property benefits would be within Grant County.

IV. Technical Analyses/Pre-Construction Engineering for the North-I-90 Surface Water Supply Alternative

IRZ Consulting, working with Columbia Snake River Irrigators Association (CSRIA), has reviewed the pre-construction engineering, and associated estimated costs of delivering water from the East-Low Canal to parcels currently irrigated from deep wells in the Odessa Sub-Area lying north of I-90. The delivery of this water would be provided through the pumping of water through pressurized pipes. The results of this review component are used within the economic analyses to determine whether this proposal is a viable option for maintaining the irrigation of these parcels, suffering from severely declining well water levels.

a. Process

In order to develop a design, and the associated costs, several steps were taken to calculate the final results. The final conceptual design and costs are based on the best information available. They are based on a feasibility level approach, and not a construction level approach.

b. Meeting With Water Users

A meeting was held with water users that would be served by this proposed project. At that meeting those users provided input into the proposed project in whole, along with suggested specific pipeline and pump locations. The previous USBR studies and proposed pipeline locations were reviewed. Proposed design criteria for an annual water duty of 2.5 acre-feet per acre, pivot package rates of 6.5 gpm per acre, and an on-farm system capacity of 70-75% were discussed and agreed to as being reasonable. Additionally, key delivery points were discussed with individual users.

c. Initial Project Area Tour

After receiving input at the meeting, a tour of potential pump sites and pipeline routes was taken. The routes that USBR had previously proposed for pipelines were the basis of the tour, along with their proposed pump stations at the East-Low Canal.

The USBR had limited their project to lands not currently being served with East-Low Canal water under Special Service Contracts, and to those they generally viewed as being close enough to the canal to be economical. During this initial field tour, potential routes and pump stations were reviewed that could serve significantly more acres than previously considered by the USBR. An initial survey of power facilities, road crossings, and potential obstructions were noted. One potential northern route was looked at and considered not feasible owing to extremely rough rocky terrain.

d. Office Analysis

Upon completion of the initial meeting and tour, office work and analysis began. First, GIS information was obtained, including geo-referenced aerial imagery, roads, contours, and shape files from Mark Neilson with GWMA, showing irrigated field boundaries. Ownership of existing irrigated parcels was obtained from county assessor records and digitized. Total acreages were obtained from digitized records. This information was then used to create a base map of the project area (see Map 1), which displaying the considered fields color coded by ownership.

It was determined that all currently irrigated acres lying East of the East-Low Canal and North of I-90, that could be readily, intuitively, and economically served with piped water would be considered under this project. This included a vast majority of the parcels currently being served with Special Service Contracts or deep wells lying within the East Columbia Basin Irrigation District (ECBID) boundary, or that could reasonably be assumed to be included inside the boundary, in the future. Parcels that would take a significant amount of pipeline, or small individual pump stations to serve a relatively small acreage, were not included. The acreage being considered totaled to approximately 75,000 acres.

Working from the base map, fields to be served were grouped and a delivery point located. To serve the identified delivery points, five separate systems were laid out. A map was created (see Map 2) that identifies the considered fields, color coded by delivery service point.

There were several considerations in determining the location of the five main canal pump stations in the design. The location of the property to be served lent itself well to the five stations. The maintenance of the canal, if a pump station were to fail for some reason, was an important factor in having multiple stations. The likelihood of multiple stations failing at one time is more unlikely then for one or two stations to fail.

Finally, the size of the pipelines serving fewer stations would be much larger; or having to run multiple pipelines to serve the area, making them much more difficult and costly to construct. If more than five stations were constructed, it would instill greater complexity in the operation of the canal. Currently there are over 20 small pump stations north of I-90 on the canal serving the Special Service Contracts. It has been noted this makes the operation of the canal problematic at times, and so fewer pump stations would minimize the locations, where canal flows would need to be monitored.

In laying out the five pipeline systems serving the project, several things were considered. The pipelines are located along county roads where possible to provide access for hauling equipment and materials. These corridors run, in general, on an east-west-north-south grid. This may increase the length of pipelines slightly, but placing pipelines through the middle of cropped fields was minimized where ever possible to prevent cropland disturbance. The pipelines were intended to be as centrally located as possible in the area to be served by the individual pipelines.

Alternatives were looked at, and the current locations appear to serve the areas effectively. Another factor involved in the location of some of the pipelines was the location of blocks of similar ownership. Several of the pipes are terminated, or have a delivery point located, to serve a block of similar ownership, and that owner will need to provide pipes, and necessary booster pumps to serve their individual center pivots. From the initial field tour, a number of routes were eliminated based upon rough and rocky terrain that would have increased pipeline installation costs significantly. The final construction design will likely be somewhat different than that proposed, based upon more detailed analysis beyond the scope allowed under this review.

At each delivery point, land owners would connect to the main pipeline, to receive water for the portion of the property served by that delivery point. The area served at a delivery point was based upon adjacency and ownership. The land owners would then need to pipe and provide booster pumps to serve the area served from that delivery point. The basic delivery volume was based upon 6.5 gpm per acre and a system delivery factor of 70% for most delivery points. Slightly higher delivery factors were utilized for delivery points serving smaller acreages near the end of pipelines.

With the required delivery rates at each delivery point established, the type and size of each section of pipeline could be determined. To facilitate this, a simple hydraulic model of each system was developed. The criteria utilized to size the pipelines were the following:

- The maximum velocity in the pipes would be maintained between 4 and 6 feet per second.
- PVC pipe would be utilized through 48" diameter.
- Coated and lined steel pipe would be utilized from 51" through 84".
- If pipelines greater than 84" were required similar size parallel pipes would be utilized.
- The minimum pressure at each delivery point would be 20 PSI.
- The minimum pressure at high points, not delivery points would be 10 PSI.
- Topographic digital information was used to establish the elevations at delivery and high points.
- The pressure rating of the PVC pipes would be maintained as low as possible.
- PVC pipes in certain areas were required to have higher pressure ratings.
- The maximum operating pressure for PVC pipe was considered to be 75% of the pressure rating of the pipe.
- Inline booster stations were located to maintain as low of an operating pressure as possible, and still maintain 20 PSI at all delivery points.

With all the pipelines sized, the model utilized the flows established at each delivery point, and the required pressures, as well as the pipeline pressure limits, to assist in locating and sizing the pump stations. Through a number of iterations, optimum pump locations were established with the required capacity, pressure, and horsepower at each station determined. Map 3 displays the general layout of the five systems with the locations of the delivery points, and booster pumping stations.

Given the required volumes, pressure, and horsepower located at each station, a breakdown on a reasonable mix of pumps that would meet those needs was established. This breakdown is designed to provide flexibility in providing the needs of the system over a fairly broad range of conditions. Associated with that flexibility is the incorporation of at least one variable frequency drive (VFD) at each station. These VFDs will provide an ability to closely match pump capacity to demand.

A preliminary cost estimate was run on System 4, the simplest system, to see if it appeared reasonable to proceed with the project. Utilizing costs obtained from suppliers, contractors, and previous construction projects with similar materials, costs to construct this system were determined. This initial determination clearly indicated that the cost to construct this system was far below previous estimates, and that even when utilizing very conservative numbers, it appeared reasonable to proceed with the full analysis.

e. Second Field Tour

Upon completion of the initial layout, a second field tour was performed to verify locations on the ground. The tour focused on locations of power lines, roads and any potential obstructions to pipeline installation. There were a number of roads identified that would need to be crossed. The counties have been subsequently contacted, and all have noted that the roads could be open cut.

There is power located at or near most main and booster pump station locations. There will be a need to upgrade or construct new sub-stations and power transmission lines to serve those pumps. There would be three different power companies serving the project: Grant County PUD, Big Bend Electric, and Inland Power and Light. Big Bend Electric provided rough estimates of the costs associated with providing power to the booster pumps they would serve. This was the best information available to estimate the cost of power to serve the other main and booster pump stations that would be served by the other utilities. The three utilities will be able to provide specific numbers for future detailed analysis.

The tour identified a need to relocate a portion of System 2, so that the pipeline ran along more county roads, and so that power lines were closer to booster pump stations. This relocation has been incorporated into the final conceptual design. Several farmsteads will pose a slight relocation issue for final construction, but no severe rough or rocky terrain was noted. Overall, the final routes selected should be good construction corridors.

f. Final Design & Cost Estimate

Utilizing the information obtained from the second field tour, the System 2 pipeline location, and subsequent pump sizing and locations were finalized. The other four systems remained as initially designed.

With the system layouts finalized, the costs associated with installing those systems were estimated. A detailed summary of capital costs for each system is provided in Appendix B. A summary of the capital costs for the Project, as a whole, is provided in Table 13.

Table 13. Estimated Project Capital Costs.

Description	Total Cost	Unit Cost
Pipelines: Pipe, Apputenances, Installation	$223,000,000	$3,000
Pumping Stations: Structures, Pumps, and Panels	22,000,000	$300
Utilities: Sub-Stations and Trans. Lines	$16,000,000	$200
Sub-Total for All Construction	**261,000,000**	**$3,500**
Contingency	$52,000,000	$700
Engineering and Legal	$13,000,000	$200
Washington Sales Tax	$13,000,000	$200
TOTAL	**330,000,000**	**$4,500**

Also, the annual energy usage was calculated. The usage for each pumping station was calculated based on the pumping head, an assumed efficiency, and the annual volume of water pumped. The usage for each serve area was calculated based on the portion of water used in that area to the total water pumped through each pumping station serving the area. These calculated energy usage amounts are presented in Appendix B.

g. Final Water User Meeting

A meeting was held with the water users and the design, and initial cost estimates were presented. Several of those present made comments, and were in general agreement that the design and costs seemed reasonable for development.

h. Conclusion

The conceptual level design and associated costs associated with replacing 75,000 acres of deep well irrigated land east of the East-Low Canal, and north of I-90 with water from the East-Low Canal have been completed. From this analysis it appears that the project is certainly feasible to construct, and the associated costs appear reasonable. The results of the full economic review will provide the final determination on the feasibility of the project (noted above).

There are several issues that need to be resolved prior to commencing the project. Some of them are:

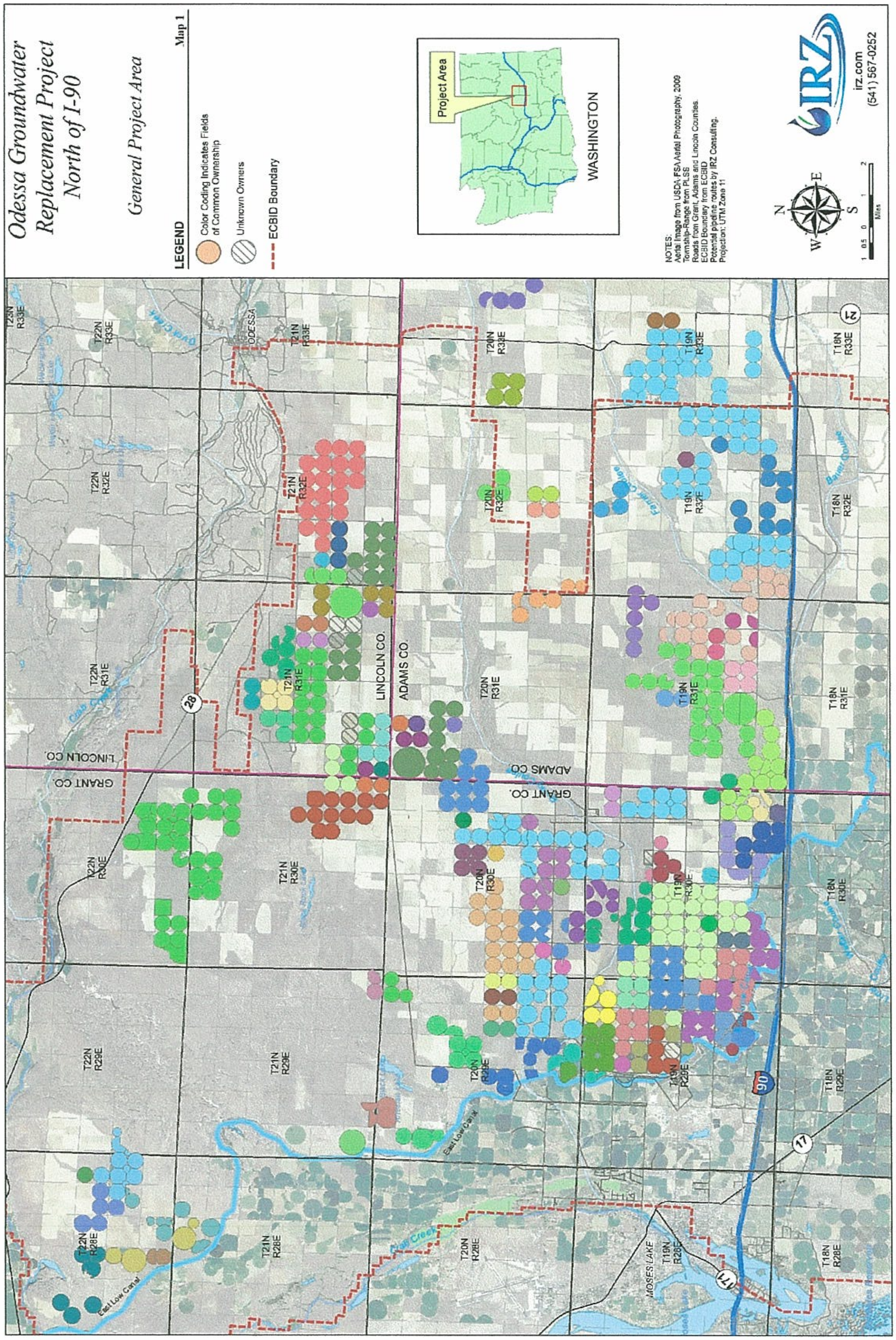
- The main East- Low Canal must have its integrity maintained. Measures to insure this must be determined. The ECBID and the USBR must be consulted and measures implemented.

- The capacity of the East-Low Canal must be verified and optimized using additional model runs, per the revised assumptions adopted in this review. The number of acres that can be served is directly linked to that capacity.

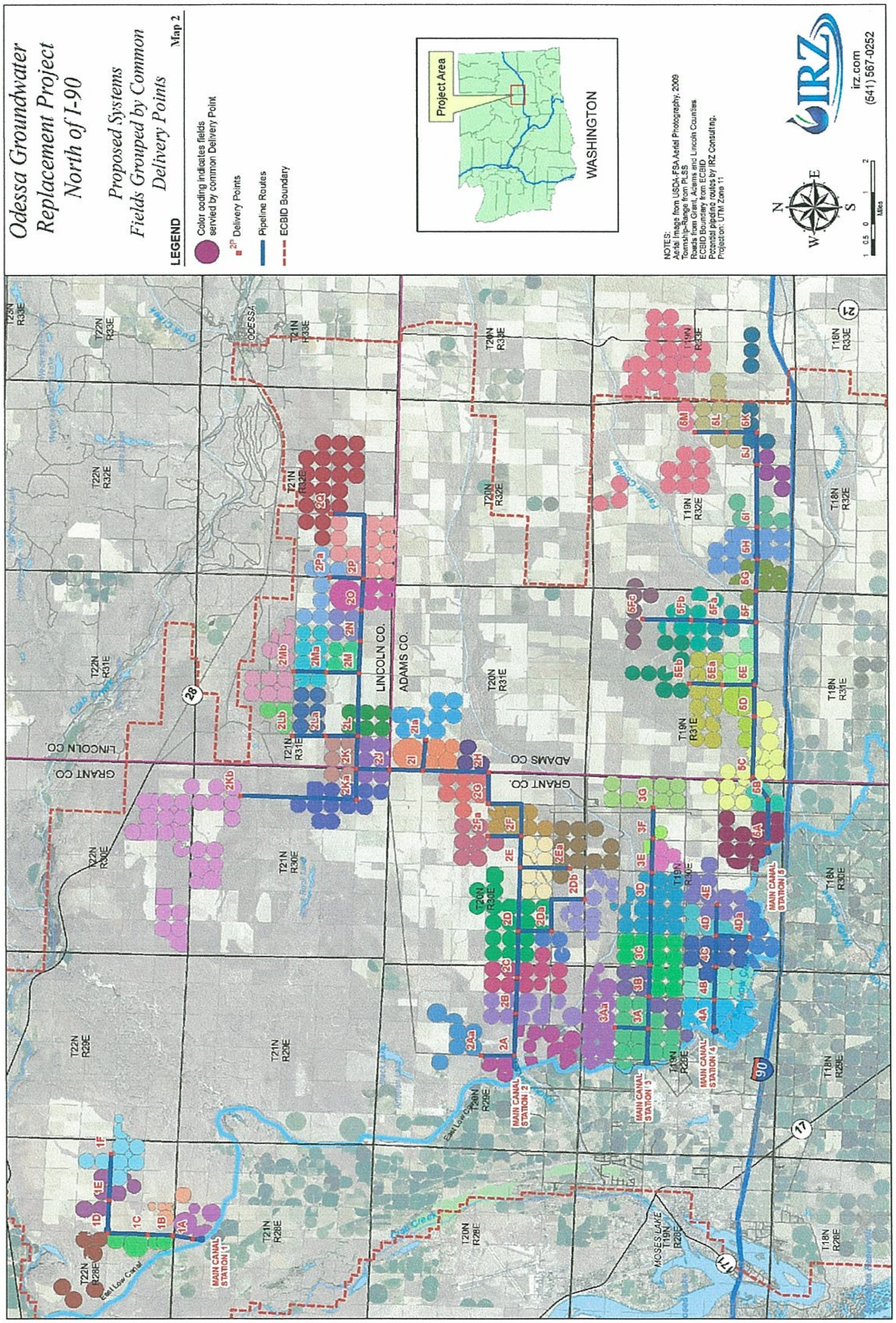
- The ability to add acres to the ECBID must be determined. There are a number of acres that could be served effectively, and are currently being irrigated from deep wells, but are not within the district boundaries.

- The entity that will operate the project needs to be determined. The ECBID would be a likely candidate.

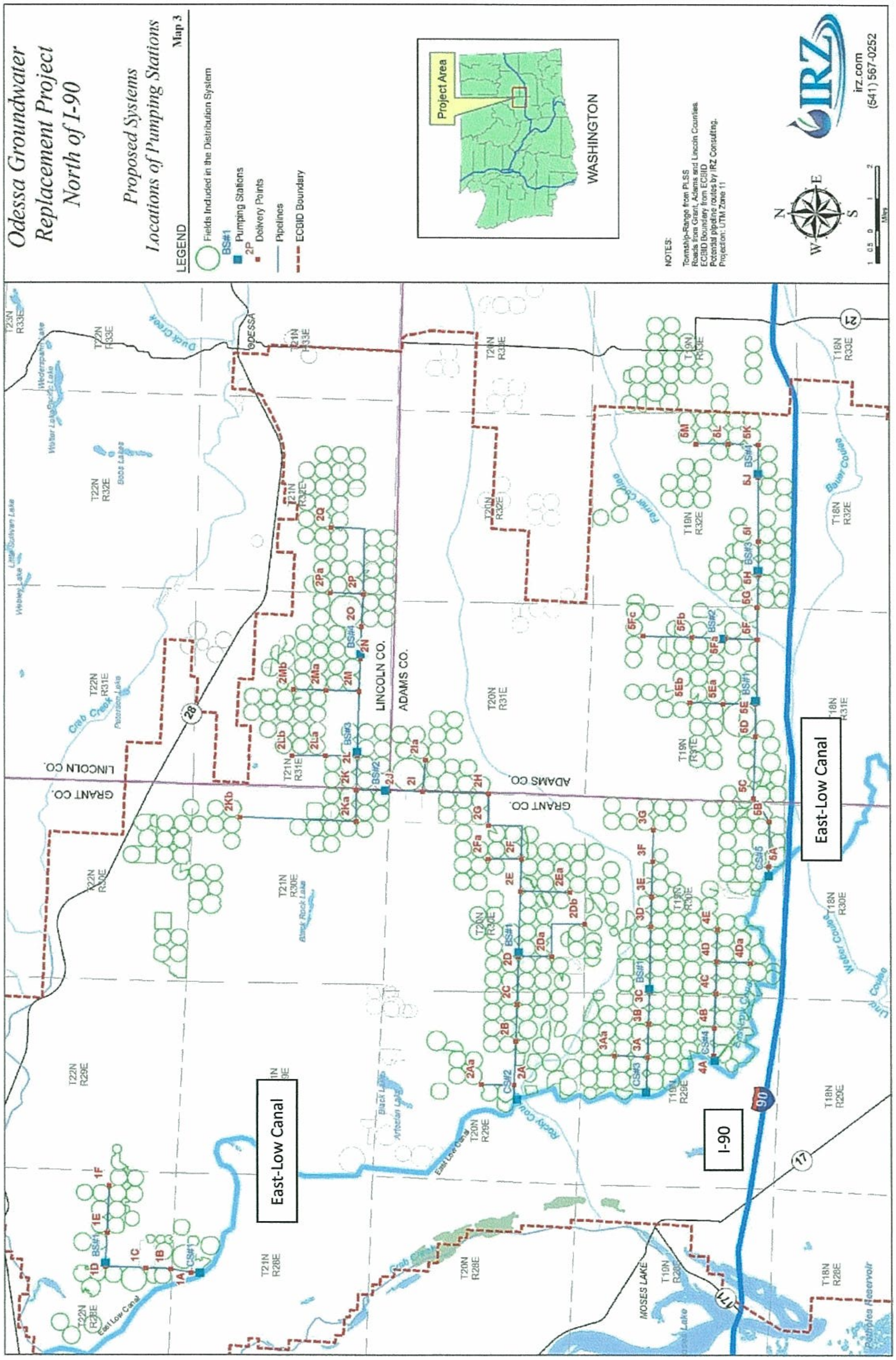
Map 1.


Odessa Groundwater Replacement Project North of I-90
General Project Area
Map 1
LEGEND
Color Coding Indicates Fields of Common Ownership
Unknown Owners
ECBID Boundary
Project Area
WASHINGTON
NOTES:
Aerial Image from USDA FSA Aerial Photography, 2009
Township-Range from PLSS
Roads from Grant, Adams and Lincoln Counties.
ECBID Boundary from ECBID
Potential pipeline routes by IRZ Consulting.
Projection: UTM Zone 11
Miles
IRZ
irz.com
(541) 567-0252
LINCOLN CO.
ADAMS CO.
GRANT CO.
ODESSA
MOSES LAKE
East Low Canal

Map 2


Odessa Groundwater Replacement Project North of I-90
Proposed Systems Fields Grouped by Common Delivery Points
Map 2
LEGEND
Color coding indicates fields serviced by common Delivery Point
Delivery Points
Pipeline Routes
ECBID Boundary
Project Area
WASHINGTON
NOTES:
Aerial Image from USDA-FSA Aerial Photography, 2009
Township-Range from PLSS
Roads from Grant, Adams and Lincoln Counties.
ECBID Boundary from ECBID
Potential pipeline routes by IRZ Consulting.
Projection: UTM Zone 11
Miles
IRZ
irz.com
(541) 567-0252
LINCOLN CO.
ADAMS CO.
GRANT CO.
ODESSA
MOSES LAKE
MAIN CANAL STATION 1
MAIN CANAL STATION 2
MAIN CANAL STATION 3
MAIN CANAL STATION 4
MAIN CANAL STATION 5

Map 3


Odessa Groundwater
Replacement Project
North of I-90
Proposed Systems
Locations of Pumping Stations
Map 3
LEGEND
Fields Included in the Distribution System
Pumping Stations
Delivery Points
Pipelines
ECBID Boundary
Project Area
WASHINGTON
irz.com
(541) 567-0252
East-Low Canal
I-90
LINCOLN CO.
ADAMS CO.
GRANT CO.

V. References and Key Sources

This review has used information and data from several sources, most principally from those identified below and/or noted within the Review text. Other information and data are from sources proprietary to CSRIA, Pacific Northwest Project, and IRZ Consulting; or from other project assessment work conducted by the above principal investigators.

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APPENDIX A.

East-Low Canal Capacities and Operations Analyses

Table 1. Baseline Water Allocation: Odessa Sub-Area Water Allocation Alternatives from the East Low Canal (9/27/2011)

USBR-State Baseline Alternative with North-South I-90 Allocation, 7/2011
(Marginal Water-Acres in Addition to Existing Water Service Contracts)

Above I-90: Acre-ft.*	Above I-90: Incremental** Peak-Day CFS	Above I-90: On-Farm Capacity Factor	Above I-90: Acre-ft./Acre	Above I-90: Total Irrigated Acres	Below I-90: Acre-ft.*	Below I-90: Incremental** Peak-Day CFS	Below I-90: On-Farm Capacity Factor	Below I-90: Acre-ft./Acre	Below I-90: Total Acres	Above/Below I-90 All Acres
77,250	339	100%	3.09	25,000	139,050	610	100%	3.09	45,000	**70,000**

Private-State-USBR Partnership Alternative with North-South I-90 Allocation
(Marginal Water-Acres in Addition to Existing Water Service Contracts)

Above I-90: Acre-ft.*	Above I-90: Incremental** Peak-Day CFS	Above I-90: On-Farm Capacity Factor	Above I-90: Acre-ft./Acre	Above I-90: Total Irrigated Acres	Below I-90: Acre-ft.*	Below I-90: Incremental** Peak-Day CFS	Below I-90: On-Farm Capacity Factor	Below I-90: Acre-ft./Acre	Below I-90: Total Acres	Above/Below I-90 All Acres
77,250	254	75%	2.50	30,900	139,050	457	75%	2.50	55,620	**86,520**

Private-State-USBR Partnership Alternative with North-South I-90 Allocation
(Marginal Water-Acres with Existing Water Service Contracts Included in New Service Allocation--Baseline Acres at 16,864)

Above I-90: Acre-ft.*	Above I-90: Incremental** Peak-Day CFS	Above I-90: On-Farm Capacity Factor	Above I-90: Acre-ft./Acre	Above I-90: Total Irrigated Acres	Below I-90: Acre-ft.*	Below I-90: Incremental** Peak-Day CFS	Below I-90: On-Farm Capacity Factor	Below I-90: Acre-ft./Acre	Below I-90: Total Acres	Above/Below I-90 All Acres
77,250	254	75%	2.50	30,900	139,050	457	75%	2.50	55,620	**86,520**
21,080	69	75%	2.50	8,432	21,080	69	75%	2.50	8,432	**16,864**
98,330	**323**			**39,332**	**160,130**	**527**			**64,052**	**103,384**

Above I-90 with Conservation O&M Water:*** Acre-ft.*	Incremental** Peak-Day CFS	On-Farm Capacity Factor	Average Acre-ft./Acre	Total Irrigated Acres	Below I-90: Acre-ft.*	Below I-90: Incremental** Peak-Day CFS	Below I-90: On-Farm Capacity Factor	Below I-90: Acre-ft./Acre	Below I-90: Total Acres	Above/Below I-90 All Acres
77,250	254	75%	2.50	30,900	139,050	457	75%	2.50	55,620	**86,520**
21,080	69	75%	2.50	8,432	21,080	69	75%	2.50	8,432	**16,864**
38,250	126	75%	2.50	15,300						
136,580	**449**			**54,632**	**160,130**	**527**			**64,052**	**118,684**
		Total Reallocated Acres: With Existing Water Service Contracts		65,252			Total Reallocated Acres: With Existing Water Service Contracts		53,432	118,684

* Based on baseline water allocation of 3.09 acre-ft./acre (with USBR estimated delivered system efficiency of 0.97% from canal turn-out), using about 950 cfs of East-Low Canal capacity. Water Service Contracts estimated at 2.50 acre-ft./acre, using about 140 cfs of East Low Canal capacity.

** Assumes 27% of seasonal water duty delivered in July--daily peak flow per month.

*** Assumes that 75,000 CBP acres are enrolled in Conservation O&M and annual water savings is transferred to North Odessa Subarea above I-90.

NOTE: East Low Canal capacity (at Main Canal Turn-Off) rated by USBR at 4,300 cfs, with current peak flows at 3,600 cfs; Webber Sciphon/South I-90 retrofitted to 3,600 cfs. Main-system canal losses rated at 10.5%. Acre-ft./acre values indicated above take into account on-farm efficiencies.

The Private-State-USBR Partnership Alternative depicted above would use about 976 cfs from the East Low Canal capacity; the USBR baseline and existing Water Service Contract capacity would be about 1,090 cfs (950 cfs for additional 86,520 acres plus the existing Water Service Contracts using about 140 cfs).

Table 2. Baseline Water Allocation: Odessa Sub-Area Water Allocation Alternatives from the East Low Canal (9/27/2011)

USBR-State Baseline Alternative with North-South I-90 Allocation, 7/2011
(Marginal Water-Acres in Addition to Existing Water Service Contracts)

Above I-90: Acre-ft.*	Incremental** Peak-Day CFS	On-Farm Capacity Factor	Acre-ft./Acre	Total Irrigated Acres	Below I-90: Acre-ft.*	Incremental** Peak-Day CFS	On-Farm Capacity Factor	Acre-ft./Acre	Total Acres	Above/Below I-90 All Acres
77,250	339	100%	3.09	25,000	139,050	610	100%	3.09	45,000	**70,000**

Private-State-USBR Partnership Alternative with North-South I-90 Allocation
(Marginal Water-Acres in Addition to Existing Water Service Contracts)

Above I-90: Acre-ft.*	Incremental** Peak-Day CFS	On-Farm Capacity Factor	Acre-ft./Acre	Total Irrigated Acres	Below I-90: Acre-ft.*	Incremental** Peak-Day CFS	On-Farm Capacity Factor	Acre-ft./Acre	Total Acres	Above/Below I-90 All Acres
77,250	254	75%	2.50	30,900	139,050	457	75%	2.50	55,620	**86,520**

Private-State-USBR Partnership Alternative with North-South I-90 Allocation
(Marginal Water-Acres with Existing Water Service Contracts Included in New Service Allocation--Baseline Acres at 16,864)

Above I-90: Acre-ft.*	Incremental** Peak-Day CFS	On-Farm Capacity Factor	Acre-ft./Acre	Total Irrigated Acres	Below I-90: Acre-ft.*	Incremental** Peak-Day CFS	On-Farm Capacity Factor	Acre-ft./Acre	Total Acres	Above/Below I-90 All Acres
77,250	254	75%	2.50	30,900	139,050	457	75%	2.50	55,620	**86,520**
21,080	69	75%	2.50	8,432	21,080	69	75%	2.50	8,432	**16,864**
98,330	**323**			**39,332**	**160,130**	**527**			**64,052**	**103,384**

Above I-90 with Conservation O&M Water*** and Other Water Supplies: Acre-ft.*	Incremental** Peak-Day CFS	On-Farm Capacity Factor	Average Acre-ft./Acre	Total Irrigated Acres	Below I-90: Acre-ft.*	Incremental** Peak-Day CFS	On-Farm Capacity Factor	Acre-ft./Acre	Total Acres	Above/Below I-90 All Acres
101,620	334	75%	2.50	40,648	139,050	457	75%	2.50	55,620	**96,268**
21,080	69	75%	2.50	8,432	21,080	69	75%	2.50	8,432	**16,864**
38,250	126	75%	2.50	15,300						
160,950	**529**			**64,380**	**160,130**	**527**			**64,052**	**128,432**
		Total Reallocated Acres: With Existing Water Service Contracts		**75,000**			Total Reallocated Acres: With Existing Water Service Contracts		**53,432**	**128,432**

* Based on baseline water allocation of 3.09 acre-ft./acre (with USBR estimated delivered system efficiency of 0.97% from canal turn-out), using about 950 cfs of East-Low Canal capacity. Water Service Contracts estimated at 2.50 acre-ft./acre, using about 140 cfs of East Low Canal capacity.

** Assumes 27% of seasonal water duty delivered in July--daily peak flow per peak month.

*** Assumes that 75,000 CBP acres are enrolled in Conservation O&M and annual water savings is transferred to North Odessa Subarea above I-90, and with other water supplies.

NOTE: East Low Canal capacity (at Main Canal Turn-Off) rated by USBR at 4,300 cfs, with current peak flows at 3,600 cfs; Webber Sciphon/South I-90 retrofitted to 3,600 cfs. Main-system canal losses rated at 10.5%. Acre-ft./acre values indicated above take into account on-farm efficiencies.

Total East-Low Canal capacity use for additional 75,000 acres above I-90 and 53,432 acres below I-90 would be about 1,056 cfs (with Water Service Contracts).

Table 3. Odessa East-Low Canal--Peak Daily Flow Water Allocations

	USBR Pref. Alt.	Existing WSC	TOTAL	Priv.-State-Alt. Above-I-90*	Priv.-State-Alt. Below-I-90*	TOTAL
Irrigated Acres	70,000	16,864	86,864	75,000	53,432	128,432
Total Acre-ft.**	216,300	52,110	268,410	187,500	133,580	321,080
Flow Rate/gpm/acre	6.5	6.5	6.5	6.5	6.5	6.5
Daily G/Day	655,200,000	157,847,040	813,047,040	702,000,000	500,123,520	1,202,123,520
Daily Acre-ft.	2,011	484	2,495	2,154	1,535	3,689
Daily cfs (Peak)	1,012	244	1,256	1,085	773	1,858
Daily cfs (Peak) @75% On-Field Cap.Factor	NA	NA	NA	814	580	1,393
Daily cfs (Peak) @70% On-Field Cap.Factor	NA	NA	NA	759	541	1,300

*Includes water service contracts. On-farm water delivery at 2.5 acre-ft./acre/year, and 70-75% on-farm capacity factor.

** Water supplies for Private-State-Alternative from Banks Lake operations/Lake Roosevelt and CBP Conservation O&M.

APPENDIX B.

Estimated Capital Costs

Odessa North of I-90 Project

Potential Water Delivery Systems by Area

System		Areas Served from Cluster Main (acres)	a (acres)	b (acres)	c (acres)	Sub-Totals (acres)
1						
	A	578				578
	B	357				357
	C	629				629
	D	816				816
	E	777				777
	F	1,075				1,075
						4,232
2						
	A	1,289	959			2,248
	B	1,235				1,235
	C	1,367				1,367
	D	2,266	356	983		3,605
	E	990	1,407			2,397
	F	900	927			1,827
	G	911				911
	H	392				392
	I	1,043	1,152			2,195
	J	750				750
	K	752	1,524	4,106		6,381
	L	751	743	388		1,882
	M	489	993	1,372		2,854
	N	500				500
	O	997				997
	P	1,690	962			2,652
	Q	2,580				2,580
						34,773
3						
	A	1,861	1,556			3,418
	B	1,013				1,013
	C	1,632				1,632
	D	1,881				1,881
	E	468				468
	F	168				168
	G	1,167				1,167
						9,746

Odessa North of I-90 Project
Potential Water Delivery Systems by Area

System		Areas Served from Cluster			
	Main (acres)	a (acres)	b (acres)	c (acres)	Sub-Totals (acres)
4					
A	1,249				1,249
B	1,034				1,034
C	1,224				1,224
D	665	670			1,335
E	1,275				1,275
					6,116
5					
A	1,575				1,575
B	409				409
C	1,884				1,884
D	772				772
E	529	1,536	989		3,055
F	250	493	970	682	2,395
G	817				817
H	1,451				1,451
I	669				669
J	522				522
K	882				882
L	1,240				1,240
M	4,287				4,287
					19,957
				Total:	**74,824**

System 1 Estimated Capital Costs

Estimated Pipe Costs **Area Served:** **4,232 acres**

Pipe Size (in)	Description	QTY (feet)	Unit Cost Pipe ($/ft)	Unit Cost Install. ($/ft)	Total Cost Pipe ($)	Total Cost Install. ($)	Total Cost Total ($)
42	PVC C905 100 PSI Pipe	4,820	$125	$47	$608,000	$227,000	$835,000
36	PVC C905 100 PSI Pipe	10,480	$95	$38	$1,004,000	$399,000	$1,403,000
30	PVC C905 100 PSI Pipe	5,560	$70	$32	$393,000	$178,000	$571,000
20	PVC C905 100 PSI Pipe	7,780	$30	$23	$236,000	$179,000	$415,000
48	Gravel Rd Crossing 18 NE	80	$265	$121	$22,000	$10,000	$32,000
42	Paved Rd Crossing 20 NE	80	$205	$125	$17,000	$10,000	$27,000
36	Paved Rd Crossing J NE	80	$175	$104	$14,000	$9,000	$23,000
	Pipeline Appurtenances				$449,000	$197,000	$646,000
				Totals:	**$2,743,000**	**$1,209,000**	**$3,952,000**

Estimated Canal Pump Station Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total Cost Total ($)
1	Pump (4120 gpm @ 190 ft) 250 HP 480V 1180 RPM	4	$55,000	$2,000	$220,000	$8,000	$228,000
2	Pump (2070 gpm @ 190 ft) 125 HP 480V 1180 RPM	2	$35,000	$2,000	$70,000	$4,000	$74,000
3	250 HP VFD 480V	1	$50,000	$15,000	$50,000	$15,000	$65,000
4	250 HP Soft Start 480V	3	$25,000	$7,000	$75,000	$21,000	$96,000
5	125 HP Soft Start 480V	2	$16,000	$4,000	$32,000	$8,000	$40,000
6	4120 gpm plumbing	4	$20,000	$12,000	$80,000	$48,000	$128,000
7	2070 gpm plumbing	2	$13,000	$10,000	$26,000	$20,000	$46,000
8	By-Pass	1	$15,000	$9,000	$15,000	$9,000	$24,000
9	Intake Structure	1	$50,000	$25,000	$50,000	$25,000	$75,000
10	Intake Screens	2	$20,000	$2,000	$40,000	$4,000	$44,000
11	Building and Fence	1	$30,000	$5,000	$30,000	$5,000	$35,000
12	Miscellaneous	1	$35,000		$35,000		$35,000
				Totals:	**$723,000**	**$167,000**	**$890,000**

System 1 Estimated Capital Costs Continued

Estimated Booster Pump Station #1 Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total ($)
1	Pump (3750 gpm @ 85 ft) 100 HP 480V 1770 RPM	2	$15,000	$1,000	$30,000	$2,000	$32,000
2	Pump (1880 gpm @ 85 ft) 50 HP 480V 1770 RPM	1	$8,000	$1,000	$8,000	$1,000	$9,000
3	100 HP VFD 480V	1	$20,000	$10,000	$20,000	$10,000	$30,000
4	100 HP Soft Start 480V	1	$14,000	$4,000	$14,000	$4,000	$18,000
5	50 HP Soft Start 480V	1	$8,000	$3,000	$8,000	$3,000	$11,000
6	3750 gpm plumbing	2	$20,000	$12,000	$40,000	$24,000	$64,000
7	1880 gpm plumbing	1	$13,000	$10,000	$13,000	$10,000	$23,000
8	By-Pass	1	$10,000	$5,000	$10,000	$5,000	$15,000
9	Building and Fence	1	$30,000	$5,000	$30,000	$5,000	$35,000
10	Miscellaneous	1	$30,000		$30,000		$30,000
				Totals:	**$203,000**	**$64,000**	**$267,000**

Estimated Utility Costs

Item	Description	QTY	Unit Cost Lump Sum ($/Qty)	Total Cost Lump Sum ($)		Total ($)
1	For Canal Pump Station; Rebuild 1 mile of Grant Co. PUD OH Getaway.	1	$32,500	$32,500		$32,500
2	For Canal Pump Station; Rebuild 1 mile of Grant Co. PUD OH Distribution.	1	$105,500	$105,500		$105,500
3	For Pump Stations; Grant Co. PUD Switches.	2	$11,500	$23,000		$23,000
4	Additional Grant Co. PUD Costs.	1	$38,000	$38,000		$38,000
			Totals:	**$199,000**		**$199,000**
			System 1 Totals:	**$3,868,000**	**$1,440,000**	**$5,308,000**

System 2 Estimated Capital Costs

Estimated Pipe Costs **Area Served:** **34,773 acres**

Size (in)	Description	QTY (feet)	Unit Cost Pipe ($/ft)	Unit Cost Install. ($/ft)	Total Cost Pipe ($)	Total Cost Install. ($)	Total Cost Total ($)
84	0.375" Wall Steel Pipe	51,850	$470	$309	$24,565,000	$16,022,000	$40,587,000
78	0.375" Wall Steel Pipe	15,600	$440	$283	$6,919,000	$4,415,000	$11,334,000
72	0.375" Wall Steel Pipe	31,960	$405	$258	$13,048,000	$8,246,000	$21,294,000
66	0.312" Wall Steel Pipe	69,280	$330	$184	$23,046,000	$12,748,000	$35,794,000
48	PVC C905 100 PSI Pipe	16,020	$165	$54	$2,665,000	$866,000	$3,531,000
42	PVC C905 100 PSI Pipe	23,990	$125	$47	$3,023,000	$1,128,000	$4,151,000
36	PVC C905 100 PSI Pipe	16,080	$95	$38	$1,540,000	$612,000	$2,152,000
30	PVC C905 100 PSI Pipe	5,300	$70	$32	$374,000	$170,000	$544,000
24	PVC C905 100 PSI Pipe	25,810	$45	$25	$1,171,000	$646,000	$1,817,000
20	PVC C905 165 PSI Pipe	5,300	$50	$23	$268,000	$122,000	$390,000
20	PVC C905 100 PSI Pipe	29,060	$30	$23	$879,000	$669,000	$1,548,000
14	PVC C905 100 PSI Pipe	5,340	$15	$17	$81,000	$91,000	$172,000
90	Paved Rd Crossing 8 NE	160	$760	$331	$122,000	$53,000	$175,000
90	Gravel Rd Crossing Q NE	160	$760	$301	$122,000	$49,000	$171,000
30	Paved Rd Crossing 8 NE	80	$125	$85	$10,000	$7,000	$17,000
24	Gravel Rd Crossing 7 NE	80	$100	$52	$8,000	$5,000	$13,000
84	Gravel Rd Crossing S NE	160	$710	$271	$114,000	$44,000	$158,000
30	Paved Rd Crossing 8 NE	80	$125	$85	$10,000	$7,000	$17,000
30	Gravel Rd Crossing 7 NE	80	$125	$69	$10,000	$6,000	$16,000
72	Gravel Rd Crossing V NE	160	$615	$215	$99,000	$35,000	$134,000
72	Gravel Rd Crossing 9 NE	160	$615	$215	$99,000	$35,000	$134,000
72	Paved Rd Crossing W NE	160	$615	$241	$99,000	$39,000	$138,000
72	Gravel Rd Crossing X NE	160	$615	$215	$99,000	$35,000	$134,000
72	Gravel Rd Crossing 10 NE	160	$615	$215	$99,000	$35,000	$134,000
24	Gravel Rd Crossing X NE	80	$100	$52	$8,000	$5,000	$13,000
90	Gravel Rd Crossing 12 NE	80	$760	$301	$61,000	$25,000	$86,000
90	Gravel Rd Crossing 13 NE	80	$760	$301	$61,000	$25,000	$86,000
54	Paved Rd Crossing X NE	80	$310	$172	$25,000	$14,000	$39,000
72	Gravel Rd Crossing Lesser	80	$615	$215	$50,000	$18,000	$68,000
72	Gravel Rd Crossing Graed	80	$615	$215	$50,000	$18,000	$68,000
30	Gravel Rd Crossing Bates	80	$125	$69	$10,000	$6,000	$16,000
42	Gravel Rd Crossing Kagel	80	$205	$104	$17,000	$9,000	$26,000
42	Gravel Rd Crossing Batum	80	$205	$104	$17,000	$9,000	$26,000
	Pipeline Appurtenances (20% of pipe costs)				$15,500,000	$9,203,000	$24,703,000
				Totals:	**$94,269,000**	**$55,417,000**	**$149,686,000**

System 2 Estimated Capital Costs Continued

Estimated Canal Pump Station Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total ($)
1	Pump (13800 gpm @ 344 ft) 1500 HP 4160V 1180 RPM	11	$200,000	$10,000	$2,200,000	$110,000	$2,310,000
2	Pump (9200 gpm @ 344 ft) 1000 HP 4160V 1180 RPM	1	$175,000	$10,000	$175,000	$10,000	$185,000
3	Pump (5520 gpm @ 344 ft) 600 HP 4160V 1180 RPM	1	$140,000	$8,000	$140,000	$8,000	$148,000
4	Pump (2760 gpm @ 344 ft) 300 HP 4160V 1180 RPM	1	$75,000	$5,000	$75,000	$5,000	$80,000
5	1500 HP VFD 4160V	1	$200,000	$20,000	$200,000	$20,000	$220,000
6	1500 HP Soft Start 4160V	10	$80,000	$15,000	$800,000	$150,000	$950,000
7	1000 HP Soft Start 4160V	1	$65,000	$15,000	$65,000	$15,000	$80,000
8	600 HP Soft Start 4160V	1	$45,000	$10,000	$45,000	$10,000	$55,000
9	300 HP Soft Start 4160V	1	$25,000	$7,000	$25,000	$7,000	$32,000
10	13800 gpm plumbing	11	$40,000	$20,000	$440,000	$220,000	$660,000
11	9200 gpm plumbing	1	$35,000	$15,000	$35,000	$15,000	$50,000
12	5520 gpm plumbing	1	$25,000	$12,000	$25,000	$12,000	$37,000
13	2760 gpm plumbing	1	$15,000	$10,000	$15,000	$10,000	$25,000
15	By-Pass	2	$15,000	$9,000	$30,000	$18,000	$48,000
16	Intake Structure	2	$100,000	$50,000	$200,000	$100,000	$300,000
17	Intake Screens	16	$20,000	$2,000	$320,000	$32,000	$352,000
18	Building and Fence	2	$100,000	$20,000	$200,000	$40,000	$240,000
19	Miscellaneous	2	$100,000		$200,000		$200,000
				Totals:	**$5,190,000**	**$782,000**	**$5,972,000**

System 2 Estimated Capital Costs Continued

Estimated Booster Pump Station #1 Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total ($)
1	Pump (12000 gpm @ 211 ft) 800 HP 4160V 1180 RPM	10	$150,000	$10,000	$1,500,000	$100,000	$1,600,000
2	Pump (6000 gpm @ 211 ft) 400 HP 4160V 1180 RPM	1	$100,000	$7,000	$100,000	$7,000	$107,000
3	Pump (3000 gpm @ 211 ft) 200 HP 4160V 1180 RPM	1	$65,000	$5,000	$65,000	$5,000	$70,000
4	800 HP VFD 4160V	1	$100,000	$15,000	$100,000	$15,000	$115,000
5	800 HP Soft Start 4160V	1	$55,000	$13,000	$55,000	$13,000	$68,000
6	400 HP Soft Start 4160V	1	$40,000	$10,000	$40,000	$10,000	$50,000
7	200 HP Soft Start 4160V	1	$20,000	$5,000	$20,000	$5,000	$25,000
8	12000 gpm plumbing	10	$40,000	$20,000	$400,000	$200,000	$600,000
9	6000 gpm plumbing	1	$30,000	$12,000	$30,000	$12,000	$42,000
10	3000 gpm plumbing	1	$18,000	$10,000	$18,000	$10,000	$28,000
11	By-Pass	2	$10,000	$5,000	$20,000	$10,000	$30,000
12	Building and Fence	1	$100,000	$20,000	$100,000	$20,000	$120,000
13	Miscellaneous	1	$60,000		$60,000		$60,000
				Totals:	**$2,508,000**	**$407,000**	**$2,915,000**

Estimated Booster Pump Station #2 Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total ($)
1	Pump (12090 gpm @ 104 ft) 400 HP 480V 1180 RPM	6	$70,000	$3,000	$420,000	$18,000	$438,000
2	Pump (6040 gpm @ 104 ft) 200 HP 480V 1180 RPM	2	$50,000	$2,000	$100,000	$4,000	$104,000
3	Pump (3020 gpm @ 104 ft) 100 HP 480V 1180 RPM	1	$30,000	$2,000	$30,000	$2,000	$32,000
4	400 HP VFD 480V	1	$85,000	$15,000	$85,000	$15,000	$100,000
5	400 HP Soft Start 480V	5	$30,000	$8,000	$150,000	$40,000	$190,000
6	200 HP Soft Start 480V	2	$20,000	$5,000	$40,000	$10,000	$50,000
7	100 HP Soft Start 480V	1	$14,000	$4,000	$14,000	$4,000	$18,000
8	12090 gpm plumbing	6	$40,000	$20,000	$240,000	$120,000	$360,000
9	6040 gpm plumbing	2	$30,000	$12,000	$60,000	$24,000	$84,000
10	3020 gpm plumbing	1	$18,000	$10,000	$18,000	$10,000	$28,000
11	By-Pass	2	$10,000	$5,000	$20,000	$10,000	$30,000
12	Building and Fence	1	$100,000	$20,000	$100,000	$20,000	$120,000
13	Miscellaneous	1	$60,000		$60,000		$60,000
				Totals:	**$1,337,000**	**$277,000**	**$1,614,000**

System 2 Estimated Capital Costs Continued

Estimated Booster Pump Station #3 Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total ($)
1	Pump (8000 gpm @ 100 ft) 250 HP 480V 1770 RPM	5	$25,000	$1,000	$125,000	$5,000	$130,000
2	Pump (4000 gpm @ 100 ft) 125 HP 480V 1770 RPM	1	$17,000	$1,000	$17,000	$1,000	$18,000
3	Pump (2720 gpm @ 100 ft) 100 HP 480V 1770 RPM	1	$15,000	$1,000	$15,000	$1,000	$16,000
4	250 HP VFD 480V	1	$40,000	$15,000	$40,000	$15,000	$55,000
5	250 HP Soft Start 480V	4	$25,000	$7,000	$100,000	$28,000	$128,000
6	125 HP Soft Start 480V	1	$16,000	$4,000	$16,000	$4,000	$20,000
7	100 HP Soft Start 480V	1	$14,000	$4,000	$14,000	$4,000	$18,000
8	8000 gpm plumbing	5	$30,000	$12,000	$150,000	$60,000	$210,000
9	4000 gpm plumbing	1	$20,000	$12,000	$20,000	$12,000	$32,000
10	2720 gpm plumbing	1	$18,000	$10,000	$18,000	$10,000	$28,000
11	By-Pass	1	$10,000	$5,000	$10,000	$5,000	$15,000
12	Building and Fence	1	$75,000	$15,000	$75,000	$15,000	$90,000
13	Miscellaneous	1	$50,000		$50,000		$50,000
				Totals:	**$650,000**	**$160,000**	**$810,000**

Estimated Booster Pump Station #4 Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total ($)
1	Pump (4860 gpm @ 98 ft) 150 HP 480V 1770 RPM	6	$17,000	$1,000	$102,000	$6,000	$108,000
2	Pump (2430 gpm @ 98 ft) 75 HP 480V 1770 RPM	1	$12,000	$1,000	$12,000	$1,000	$13,000
3	150 HP VFD 480V	1	$30,000	$12,000	$30,000	$12,000	$42,000
4	150 HP Soft Start 480V	5	$18,000	$4,000	$90,000	$20,000	$110,000
5	75 HP Soft Start 480V	1	$12,000	$3,000	$12,000	$3,000	$15,000
6	4860 gpm plumbing	6	$20,000	$12,000	$120,000	$72,000	$192,000
7	2430 gpm plumbing	1	$13,000	$10,000	$13,000	$10,000	$23,000
8	By-Pass	1	$10,000	$5,000	$10,000	$5,000	$15,000
9	Building and Fence	1	$30,000	$5,000	$30,000	$5,000	$35,000
10	Miscellaneous	1	$40,000		$40,000		$40,000
				Totals:	**$459,000**	**$134,000**	**$593,000**

System 2 Estimated Capital Costs Continued

Estimated Utility Costs

			Unit Cost	Total Cost		
Item	Description	QTY	Lump Sum ($/Qty)	Lump Sum ($)		Total ($)
1	For Canal Pump Station; New Grant Co. PUD Sub-Station.	1	$2,400,000	$2,400,000		$2,400,000
2	For Canal Pump Station; Build 3 miles of Grant Co. PUD OH 230 kV Transmission.	3	$1,000,000	$3,000,000		$3,000,000
3	For Booster Pump Station 1; New Grant Co. PUD Sub-Station.	1	$1,137,000	$1,137,000		$1,137,000
4	For Booster Pump Station 1; Build 4 mile of Grant Co. PUD OH Transmission.	4	$152,000	$608,000		$608,000
5	For Booster Pump Station 2; Rebuild 6 miles of Grant Co. PUD OH Transmission.	6	$133,000	$798,000		$798,000
6	For Booster Pump Station 2; Build 1 mile of new Grant Co. PUD OH Transmission.	1	$152,000	$152,000		$152,000
7	Booster Pump Station 2; Upgrade or Install 2 Grant Co. PUD Regulator Banks.	2	$54,000	$108,000		$108,000
8	For Pump Stations; Grant Co. PUD Switches.	3	$11,500	$34,500		$34,500
9	Additional Grant Co. PUD Costs.	1	$814,000	$814,000		$814,000
9	For Booster Pump Station 3; Upgrade Inland Power and Light Sub-Station.	1	$1,000,000	$1,000,000		$1,000,000
10	For Booster Pump Station 3; Recondition 4 miles of Inland Power and Light OH Transmission.	4	$50,000	$200,000		$200,000
11	For Booster Pump Station 4; Recondition 4 miles of Inland Power and Light OH Transmission.	4	$50,000	$200,000		$200,000
			Totals:	**$10,451,500**		**$10,451,500**
			System 2 Totals:	**$114,864,500**	**$57,177,000**	**$172,041,500**

System 3 Estimated Capital Costs

Estimated Pipe Costs **Area Served:** **9,757 acres**

Size (in)	Description	QTY (feet)	Unit Cost Pipe ($/ft)	Unit Cost Install. ($/ft)	Total Cost Pipe ($)	Total Cost Install. ($)	Total ($)
66	0.312" Wall Steel Pipe	5,700	$330	$184	$1,897,000	$1,049,000	$2,946,000
48	PVC C905 100 PSI Pipe	10,640	$165	$54	$1,770,000	$575,000	$2,345,000
42	PVC C905 100 PSI Pipe	10,670	$125	$47	$1,345,000	$502,000	$1,847,000
30	PVC C905 100 PSI Pipe	4,880	$70	$32	$345,000	$157,000	$502,000
24	PVC C905 100 PSI Pipe	11,150	$45	$25	$506,000	$279,000	$785,000
20	PVC C905 100 PSI Pipe	5,200	$30	$23	$158,000	$120,000	$278,000
72	Paved Rd Crossing O NE	80	$615	$241	$50,000	$20,000	$70,000
72	Gravel Rd Crossing P NE	80	$615	$215	$50,000	$18,000	$68,000
54	Gravel Rd Crossing Q NE	80	$310	$147	$25,000	$12,000	$37,000
54	Gravel Rd Crossing R NE	80	$310	$147	$25,000	$12,000	$37,000
48	Gravel Rd Crossing S NE	80	$265	$121	$22,000	$10,000	$32,000
48	Gravel Rd Crossing T NE	80	$265	$121	$22,000	$10,000	$32,000
36	Gravel Rd Crossing U NE	80	$175	$85	$14,000	$7,000	$21,000
30	Gravel Rd Crossing V NE	80	$125	$69	$10,000	$6,000	$16,000
28	Gravel Rd Crossing W NI	80	$115	$65	$10,000	$6,000	$16,000
	Pipeline Appurtenances				$1,205,000	$557,000	$1,762,000
				Totals:	**$7,454,000**	**$3,340,000**	**$10,794,000**

Estimated Canal Pump Station Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total ($)
1	Pump (7320 gpm @ 210 ft) 500 HP 480V 1180 RPM	5	$80,000	$3,000	$400,000	$15,000	$415,000
2	Pump (3670 gpm @ 210 ft) 250 HP 480V 1180 RPM	2	$55,000	$2,000	$110,000	$4,000	$114,000
3	500 HP VFD 480V	1	$90,000	$15,000	$90,000	$15,000	$105,000
4	500 HP Soft Start 480V	3	$35,000	$8,000	$105,000	$24,000	$129,000
5	250 HP Soft Start 480V	2	$25,000	$7,000	$50,000	$14,000	$64,000
6	7320 gpm plumbing	5	$30,000	$12,000	$150,000	$60,000	$210,000
7	3670 gpm plumbing	2	$20,000	$12,000	$40,000	$24,000	$64,000
8	By-Pass	1	$15,000	$9,000	$15,000	$9,000	$24,000
9	Intake Structure	1	$100,000	$50,000	$100,000	$50,000	$150,000
10	Intake Screens	5	$20,000	$2,000	$100,000	$10,000	$110,000
11	Building and Fence	1	$50,000	$5,000	$50,000	$5,000	$55,000
12	Miscellaneous	1	$40,000		$40,000		$40,000
				Totals:	**$1,250,000**	**$230,000**	**$1,480,000**

System 3 Estimated Capital Costs Continued

Estimated Booster Pump Station #1 Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total ($)
1	Pump (6080 gpm @ 104 ft) 200 HP 480V 1770 RPM	2	$20,000	$1,000	$40,000	$2,000	$42,000
2	Pump (3040 gpm @ 104 ft) 100 HP 480V 1770 RPM	2	$15,000	$1,000	$30,000	$2,000	$32,000
3	200 HP VFD 480V	1	$35,000	$15,000	$35,000	$15,000	$50,000
4	200 HP Soft Start 480V	1	$20,000	$6,000	$20,000	$6,000	$26,000
5	100 HP Soft Start 480V	1	$14,000	$4,000	$14,000	$4,000	$18,000
6	6080 gpm plumbing	2	$30,000	$12,000	$60,000	$24,000	$84,000
7	3040 gpm plumbing	2	$18,000	$10,000	$36,000	$20,000	$56,000
8	By-Pass	1	$10,000	$5,000	$10,000	$5,000	$15,000
9	Building and Fence	1	$50,000	$5,000	$50,000	$5,000	$55,000
10	Miscellaneous	1	$40,000		$40,000		$40,000
				Totals:	**$335,000**	**$83,000**	**$418,000**

Estimated Utility Costs

Item	Description	QTY	Unit Cost Lump Sum ($/Qty)	Total Cost Lump Sum ($)		Total ($)
1	For Canal Pump Station; Recondition 2 miles of Grant Co. PUD OH Transmission.	2	$123,000	$246,000		$246,000
2	For Booster Pump Station 1; Build 1 mile of Grant Co. PUD OH Transmission.	1	$76,000	$76,000		$76,000
3	For Pump Stations; Grant Co. PUD Switches.	2	$11,500	$23,000		$23,000
4	Additional Grant Co. PUD Costs.	1	$100,000	$100,000		$100,000
			Totals:	**$445,000**		**$445,000**
			System 3 Totals:	**$9,484,000**	**$3,653,000**	**$13,137,000**

System 4 Estimated Capital Costs

Estimated Pipe Costs **Area Served:** **6,118 acres**

Size (in)	Description	QTY (feet)	Unit Cost Pipe ($/ft)	Unit Cost Install. ($/ft)	Total Cost Pipe ($)	Total Cost Install. ($)	Total ($)
48	PVC C905 125 PSI Pipe	780	$165	$54	$130,000	$43,000	$173,000
48	PVC C905 100 PSI Pipe	4,510	$165	$54	$751,000	$244,000	$995,000
42	PVC C905 100 PSI Pipe	5,610	$125	$47	$707,000	$264,000	$971,000
36	PVC C905 100 PSI Pipe	5,180	$95	$38	$497,000	$197,000	$694,000
24	PVC C905 100 PSI Pipe	5,240	$45	$25	$238,000	$131,000	$369,000
16	PVC C905 100 PSI Pipe	5,480	$20	$19	$111,000	$105,000	$216,000
54	Paved Rd Crossing O NE	80	$310	$172	$25,000	$14,000	$39,000
42	Paved Rd Crossing S NE	80	$205	$125	$17,000	$10,000	$27,000
30	Gravel Rd Crossing T NE	80	$125	$69	$10,000	$6,000	$16,000
24	Gravel Rd Crossing 2 NE	80	$100	$52	$8,000	$5,000	$13,000
	Pipeline Appurtenances				$487,000	$197,000	$684,000
				Totals:	**$2,981,000**	**$1,216,000**	**$4,197,000**

System 4 Estimated Capital Costs Continued

Estimated Canal Pump Station Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total Cost Total ($)
1	Pump (7300 gpm @ 220 ft) 500 HP 480V 1180 RPM	3	$80,000	$3,000	$240,000	$9,000	$249,000
2	Pump (4400 gpm @ 220 ft) 300 HP 480V 1180 RPM	1	$55,000	$2,000	$55,000	$2,000	$57,000
3	Pump (2200 gpm @ 220 ft) 150 HP 480V 1180 RPM	1	$35,000	$2,000	$35,000	$2,000	$37,000
4	Pump (1400 gpm @ 220 ft) 100 HP 480V 1180 RPM	1	$30,000	$2,000	$30,000	$2,000	$32,000
5	500 HP VFD 480V	1	$90,000	$15,000	$90,000	$15,000	$105,000
6	500 HP Soft Start 480V	2	$35,000	$8,000	$70,000	$16,000	$86,000
7	300 HP Soft Start 480V	1	$26,000	$7,000	$26,000	$7,000	$33,000
8	150 HP Soft Start 480V	1	$18,000	$4,000	$18,000	$4,000	$22,000
9	100 HP Soft Start 480V	1	$14,000	$4,000	$14,000	$4,000	$18,000
10	7300 gpm plumbing	3	$30,000	$12,000	$90,000	$36,000	$126,000
11	4400 gpm plumbing	1	$20,000	$12,000	$20,000	$12,000	$32,000
12	2200 gpm plumbing	1	$13,000	$10,000	$13,000	$10,000	$23,000
13	1400 gpm plumbing	1	$10,000	$9,000	$10,000	$9,000	$19,000
14	By-Pass	1	$15,000	$9,000	$15,000	$9,000	$24,000
15	Intake Structure	1	$50,000	$25,000	$50,000	$25,000	$75,000
16	Intake Screens	3	$20,000	$2,000	$60,000	$6,000	$66,000
17	Building and Fence	1	$50,000	$5,000	$50,000	$5,000	$55,000
16	Miscellaneous	1	$50,000		$50,000		$50,000
				Totals:	**$936,000**	**$173,000**	**$1,109,000**

Estimated Utility Costs

Item	Description	QTY	Unit Cost Lump Sum ($/Qty)	Total Cost Lump Sum ($)		Total ($)
1	No Upgrade Required on Grant Co. PUD System	0	$0	$0		$0
2	For Pump Stations; Grant Co. PUD Switches.	1	$11,500	$11,500		$11,500
3	Additional Grant Co. PUD Costs.	1	$50,000	$50,000		$50,000
			Totals:	**$61,500**		**$61,500**
			System 4 Totals:	**$3,978,500**	**$1,389,000**	**$5,367,500**

System 5 Estimated Capital Costs

Estimated Pipe Costs **Area Served:** **19,957 acres**

Size (in)	Description	QTY (feet)	Unit Cost Pipe ($/ft)	Unit Cost Install. ($/ft)	Total Cost Pipe ($)	Total Cost Install. ($)	Total Cost Total ($)
84	0.375" Wall Steel Pipe	23,470	$470	$309	$11,120,000	$7,253,000	$18,373,000
78	0.375" Wall Steel Pipe	5,320	$440	$283	$2,360,000	$1,506,000	$3,866,000
66	0.312" Wall Steel Pipe	15,760	$330	$184	$5,243,000	$2,900,000	$8,143,000
60	0.312" Wall Steel Pipe	5,360	$305	$164	$1,648,000	$880,000	$2,528,000
54	0.250" Wall Steel Pipe	5,450	$240	$147	$1,319,000	$802,000	$2,121,000
51	0.250" Wall Steel Pipe	10,500	$230	$138	$2,435,000	$1,449,000	$3,884,000
48	PVC C905 100 PSI Pipe	10,040	$165	$54	$1,670,000	$543,000	$2,213,000
42	PVC C905 100 PSI Pipe	5,910	$125	$47	$745,000	$278,000	$1,023,000
30	PVC C905 100 PSI Pipe	10,900	$70	$32	$770,000	$349,000	$1,119,000
24	PVC C905 100 PSI Pipe	5,300	$45	$25	$241,000	$133,000	$374,000
20	PVC C905 100 PSI Pipe	5,340	$30	$23	$162,000	$123,000	$285,000
16	PVC C905 100 PSI Pipe	7,940	$20	$19	$161,000	$151,000	$312,000
90	Paved Rd Crossing W NE	80	$760	$331	$61,000	$27,000	$88,000
72	Gravel Rd Crossing Mood	80	$615	$215	$50,000	$18,000	$68,000
36	Gravel Rd Crossing Webe	80	$175	$85	$14,000	$7,000	$21,000
30	Paved Rd Crossing Roser	80	$125	$85	$10,000	$7,000	$17,000
72	Paved Rd Crossing Deal	80	$615	$241	$50,000	$20,000	$70,000
36	Gravel Rd Crossing Webe	80	$175	$85	$14,000	$7,000	$21,000
30	Paved Rd Crossing Roser	80	$125	$85	$10,000	$7,000	$17,000
66	Paved Rd Crossing Roxbc	80	$480	$218	$39,000	$18,000	$57,000
60	Gravel Rd Crossing Batur	80	$440	$166	$36,000	$14,000	$50,000
60	Gravel Rd Crossing Damc	80	$440	$166	$36,000	$14,000	$50,000
54	Gravel Rd Crossing Lobe	80	$310	$147	$25,000	$12,000	$37,000
54	Gravel Rd Crossing Webe	80	$310	$147	$25,000	$12,000	$37,000
48	Paved Rd Crossing Roser	80	$265	$142	$22,000	$12,000	$34,000
	Pipeline Appurtenances				$5,543,000	$3,309,000	$8,852,000
				Totals:	**$33,809,000**	**$19,851,000**	**$53,660,000**

System 5 Estimated Capital Costs Continued

Estimated Canal Pump Station Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total ($)
1	Pump (8280 gpm @ 307 ft) 800 HP 4160V 1180 RPM	11	$150,000	$10,000	$1,650,000	$110,000	$1,760,000
2	Pump (4140 gpm @ 307 ft) 400 HP 4160V 1180 RPM	1	$100,000	$7,000	$100,000	$7,000	$107,000
3	Pump (2070 gpm @ 307 ft) 200 HP 4160V 1180 RPM	1	$65,000	$5,000	$65,000	$5,000	$70,000
4	800 HP VFD 4160V	1	$100,000	$15,000	$100,000	$15,000	$115,000
5	800 HP Soft Start 4160V	10	$55,000	$13,000	$550,000	$130,000	$680,000
6	400 HP Soft Start 4160V	1	$40,000	$10,000	$40,000	$10,000	$50,000
7	200 HP Soft Start 4160V	1	$20,000	$5,000	$20,000	$5,000	$25,000
8	8280 gpm plumbing	11	$35,000	$15,000	$385,000	$165,000	$550,000
9	4140 gpm plumbing	1	$20,000	$12,000	$20,000	$12,000	$32,000
10	2070 gpm plumbing	1	$13,000	$10,000	$13,000	$10,000	$23,000
11	By-Pass	2	$15,000	$9,000	$30,000	$18,000	$48,000
12	Intake Structure	2	$100,000	$50,000	$200,000	$100,000	$300,000
13	Intake Screens	10	$20,000	$2,000	$200,000	$20,000	$220,000
14	Building and Fence	1	$100,000	$20,000	$100,000	$20,000	$120,000
15	Miscellaneous	1	$100,000		$100,000		$100,000
				Totals:	**$3,573,000**	**$627,000**	**$4,200,000**

Estimated Booster Pump Station #1 Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total ($)
1	Pump (9970 gpm @ 123 ft) 400 HP 480V 1180 RPM	5	$100,000	$7,000	$500,000	$35,000	$535,000
2	Pump (4980 gpm @ 123 ft) 200 HP 480V 1180 RPM	2	$65,000	$5,000	$130,000	$10,000	$140,000
3	400 HP VFD 480V	1	$85,000	$15,000	$85,000	$15,000	$100,000
4	400 HP Soft Start 4160V	4	$30,000	$8,000	$120,000	$32,000	$152,000
5	200 HP Soft Start 4160V	2	$20,000	$5,000	$40,000	$10,000	$50,000
6	9970 gpm plumbing	5	$35,000	$15,000	$175,000	$75,000	$250,000
7	4980 gpm plumbing	2	$20,000	$12,000	$40,000	$24,000	$64,000
8	By-Pass	1	$10,000	$5,000	$10,000	$5,000	$15,000
9	Building and Fence	1	$100,000	$20,000	$100,000	$20,000	$120,000
10	Miscellaneous	1	$50,000		$50,000		$50,000
				Totals:	**$1,250,000**	**$226,000**	**$1,476,000**

System 5 Estimated Capital Costs Continued

Estimated Booster Pump Station #2 Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total ($)
1	Pump (3810 gpm @ 164 ft) 200 HP 480V 1770 RPM	1	$20,000	$1,000	$20,000	$1,000	$21,000
2	Pump (2380 gpm @ 164 ft) 125 HP 480V 1770 RPM	1	$17,000	$1,000	$17,000	$1,000	$18,000
3	Pump (1910 gpm @ 164 ft) 100 HP 480V 1770 RPM	1	$15,000	$1,000	$15,000	$1,000	$16,000
4	200 HP VFD 480V	1	$35,000	$15,000	$35,000	$15,000	$50,000
5	125 HP Soft Start 480V	1	$16,000	$4,000	$16,000	$4,000	$20,000
6	100 HP Soft Start 480V	1	$14,000	$4,000	$14,000	$4,000	$18,000
7	3810 gpm plumbing	1	$20,000	$12,000	$20,000	$12,000	$32,000
8	2380 gpm plumbing	1	$13,000	$10,000	$13,000	$10,000	$23,000
9	1910 gpm plumbing	1	$13,000	$10,000	$13,000	$10,000	$23,000
10	By-Pass	1	$10,000	$5,000	$10,000	$5,000	$15,000
11	Building and Fence	1	$30,000	$5,000	$30,000	$5,000	$35,000
12	Miscellaneous	1	$47,000		$47,000		$47,000
				Totals:	**$250,000**	**$68,000**	**$318,000**

Estimated Booster Pump Station #3 Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total ($)
1	Pump (7420 gpm @ 165 ft) 400 HP 480V 1770 RPM	4	$35,000	$2,000	$140,000	$8,000	$148,000
2	Pump (3710 gpm @ 165 ft) 200 HP 480V 1770 RPM	2	$20,000	$1,000	$40,000	$2,000	$42,000
3	400 HP VFD 480V	1	$85,000	$15,000	$85,000	$15,000	$100,000
4	400 HP Soft Start 480V	4	$30,000	$8,000	$120,000	$32,000	$152,000
5	200 HP Soft Start 480V	1	$20,000	$5,000	$20,000	$5,000	$25,000
6	7420 gpm plumbing	4	$30,000	$12,000	$120,000	$48,000	$168,000
7	3710 gpm plumbing	2	$30,000	$12,000	$60,000	$24,000	$84,000
8	2720 gpm plumbing	1	$20,000	$10,000	$20,000	$10,000	$30,000
9	By-Pass	1	$10,000	$5,000	$10,000	$5,000	$15,000
10	Building and Fence	1	$75,000	$15,000	$75,000	$15,000	$90,000
11	Miscellaneous	1	$50,000		$50,000		$50,000
				Totals:	**$740,000**	**$164,000**	**$904,000**

System 5 Estimated Capital Costs Continued

Estimated Booster Pump Station #4 Costs

Item	Description	QTY	Unit Cost Material ($/Qty)	Unit Cost Install. ($/Qty)	Total Cost Material ($)	Total Cost Install. ($)	Total ($)
1	Pump (7830 gpm @ 98 ft) 250 HP 480V 1770 RPM	3	$25,000	$1,000	$75,000	$3,000	$78,000
2	Pump (3910 gpm @ 98 ft) 125 HP 480V 1770 RPM	2	$17,000	$1,000	$34,000	$2,000	$36,000
3	250 HP VFD 480V	1	$40,000	$15,000	$40,000	$15,000	$55,000
4	250 HP Soft Start 480V	2	$25,000	$7,000	$50,000	$14,000	$64,000
5	125 HP Soft Start 480V	2	$16,000	$4,000	$32,000	$8,000	$40,000
6	7830 gpm plumbing	3	$30,000	$12,000	$90,000	$36,000	$126,000
7	3910 gpm plumbing	2	$20,000	$12,000	$40,000	$24,000	$64,000
8	By-Pass	1	$10,000	$5,000	$10,000	$5,000	$15,000
9	Building and Fence	1	$50,000	$5,000	$50,000	$5,000	$55,000
10	Miscellaneous	1	$40,000		$40,000		$40,000
				Totals:	**$461,000**	**$112,000**	**$573,000**

System 5 Estimated Capital Costs Continued

Estimated Utility Costs

Item	Description	QTY	Unit Cost	Total Cost		
			Lump Sum ($/Qty)	Lump Sum ($)	Install. ($)	Total ($)
1	For Canal Pump Station; New Grant Co. PUD Sub-Station.	1	$1,264,000	$1,264,000		$1,264,000
2	For Canal Pump Station; Build 5 miles of Grant Co. PUD OH Transmission.	5	$152,400	$762,000		$762,000
3	For Canal Pump Station; Build 1 mile of Grant Co. PUD OH Double Circuit Transmission.	1	$195,000	$195,000		$195,000
4	For Pump Stations; Grant Co. PUD Switches.	1	$11,500	$11,500		$11,500
5	Additional Grant Co. PUD Costs.	1	$250,000	$250,000		$250,000
6	For Booster Pump Station 1; Upgrade Big Bend Electric Sub-Station.	1	$1,000,000	$1,000,000		$1,000,000
7	For Booster Pump Station 1; Recondition 5 mile of Big Bend Electric transmission line.	5	$50,000	$250,000		$250,000
8	For Booster Pump Station 1; 1 mile of new Big Bend Electric transmission line.	1	$65,000	$65,000		$65,000
9	For Booster Pump Station 2; 1 mile of new Big Bend Electric transmission line.	1	$65,000	$65,000		$65,000
10	For Booster Pump Station 3; Included in Item 9 Big Bend Electric transmission line.	0	$65,000	$0		$0
11	For Booster Pump Station 4; 2 mile of new Big Bend Electric transmission line.	2	$65,000	$130,000		$130,000
			Totals:	**$3,992,500**		**$3,992,500**
			System 5 Totals:	**$44,075,500**	**$21,048,000**	**$65,123,500**

Pumping Requirements and Estimated Annual Power Usage by System.

System 1. Pumping Requirements

Station	TDH (feet)	Capacity (gpm)	Total BHP (hp)	Full Load Demand (kW)
Canal Pump Station	190	20,600	1,250	1,000
Booster Pump Station 1	85	9,400	250	200
		Totals:	**1,500**	**1,200**

System 1. Estimated Annual Energy Usage

By Pumping Station

Station	TDH (feet)	Station Efficiency (%)	Rate of Usage (kWh/ac-ft)	Area Served (acres)	Volume Pumped (ac-ft)	Energy Usage (kWh)
Canal Pump Station	190	72%	270	4,232	10,580	2,855,000
Booster Pump Station 1	85	72%	121	1,852	4,630	559,000
					Total:	**3,414,000**

By Lands Served

Served Lands	Area Served (acres)	Volume Pumped (ac-ft)	Energy Usage (kWh)	Unit Energy Usage (kWh/ac-ft)
Beyond Booster Pump Station 1	1,852	4,630	1,808,000	390
Between Canal and Booster Pump Station 1	2,380	5,950	1,606,000	270
Totals:	**4,232**	**10,580**	**3,414,000**	**323**

System 3. Pumping Requirements

Station	TDH (feet)	Capacity (gpm)	Total BHP (hp)	Full Load Demand (kW)
Canal Pump Station	210	43,900	3,000	2,400
Booster Pump Station 1	104	18,200	600	500
		Totals:	**3,600**	**2,900**

System 3. Estimated Annual Energy Usage

By Pumping Station

Station	TDH (feet)	Station Efficiency (%)	Rate of Usage (kWh/ac-ft)	Area Served (acres)	Volume Pumped (ac-ft)	Energy Usage (kWh)
Canal Pump Station	210	72%	298	9,757	24,393	7,276,000
Booster Pump Station 1	104	72%	148	3,684	9,210	1,361,000
					Total:	**8,637,000**

By Lands Served

Served Lands	Area Served (acres)	Volume Pumped (ac-ft)	Energy Usage (kWh)	Unit Energy Usage (kWh/ac-ft)
Beyond Booster Pump Station 1	3,684	9,210	4,108,000	446
Between Canal and Booster Pump Station 1	6,073	15,183	4,529,000	298
Totals:	**9,757**	**24,393**	**8,637,000**	**354**

System 4. Pumping Requirements

Station	TDH (feet)	Capacity (gpm)	Total BHP (hp)	Full Load Demand (kW)
Canal Pump Station	220	29,900	2,050	1,700
		Totals:	**2,050**	**1,700**

System 4. Estimated Annual Energy Usage

By Pumping Station

Station	TDH (feet)	Station Efficiency (%)	Rate of Usage (kWh/ac-ft)	Area Served (acres)	Volume Pumped (ac-ft)	Energy Usage (kWh)
Canal Pump Station	220	72%	312	6,117	15,293	4,779,000
					Total:	**4,779,000**

By Lands Served

Served Lands	Area Served (acres)	Volume Pumped (ac-ft)	Energy Usage (kWh)	Unit Energy Usage (kWh/ac-ft)
By Canal Pump Station Only	6,117	15,293	4,779,000	313
Totals:	**6,117**	**15,293**	**4,779,000**	**313**

System 5. Pumping Requirements

Station	TDH (feet)	Capacity (gpm)	Total BHP (hp)	Full Load Demand (kW)
Canal Pump Station	307	97,300	9,400	7,800
Booster Pump Station 1	123	59,800	2,400	1,900
Booster Pump Station 2	164	8,100	425	300
Booster Pump Station 3	165	37,100	2,000	1,600
Booster Pump Station 4	98	31,300	1,000	800
		Totals:	**15,225**	**12,400**

System 5. Estimated Annual Energy Usage

By Pumping Station

Station	TDH (feet)	Station Efficiency (%)	Rate of Usage (kWh/ac-ft)	Area Served (acres)	Volume Pumped (ac-ft)	Energy Usage (kWh)
Canal Pump Station	307	72%	436	19,958	49,895	21,758,000
Booster Pump Station 1	123	72%	175	12,263	30,658	5,356,000
Booster Pump Station 2	164	72%	233	1,652	4,130	962,000
Booster Pump Station 3	165	72%	234	7,600	19,000	4,453,000
Booster Pump Station 4	98	72%	139	6,409	16,023	2,230,000
					Total:	**34,759,000**

By Lands Served

Served Lands	Area Served (acres)	Volume Pumped (ac-ft)	Energy Usage (kWh)	Unit Energy Usage (kWh/ac-ft)
Beyond Booster Pump Station 4	6,409	16,023	15,771,000	984
Between Booster Pump Stations 3 and 4	1,191	2,978	2,516,000	845
Beyond Booster Pump Station 2	1,652	4,130	3,485,000	844
Between Booster Pump Stations 1 and 2 & 3	3,011	7,528	4,598,000	611
Between Canal and Booster Pump Station 1	7,695	19,238	8,389,000	436
Totals:	**19,958**	**49,895**	**34,759,000**	**697**