COLUMBIA SNAKE RIVER IRRIGATORS ASSOCIATION

ODESSA SOUTH OF I-90 WASHINGTON

PHASE 4 FEASIBILITY ENGINEERING AND COST REPORT

AUGUST, 2014

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OPTIMIZING WATER RESOURECES THROUGH TECHNOLOGY

Columbia-Snake River Irrigators Association
Technical Memorandum

DATE:	August 13, 2014
TO:	Odessa Subarea S-I-90, System 4 Participants Interested Parties
FROM:	Darryll Olsen, Ph.D., CSRIA Board Representative
SUBJECT:	Odessa Subarea, S-I-90, System 4 Project Preconstruction Engineering and Economics Review

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Enclosed is the CSRIA preconstruction engineering/economics review for the S-I-90, System 4 Project. This review complements CSRIA's previous engineering/economics studies for the Odessa Subarea N-I-90 Projects 1 and 2 (see CSRIA .org).

The review indicates that the System 4 Project is economically feasible, and it will fall within the realistic financial criteria required for project construction and operations.

In summary, the capital costs per acre for the three System 4 zones are approximately $1,400, $1,700, and $2,450; related to a total of about 9,000 acres. Though dependent on specific financial charges and terms, annualized capital costs per acre are estimated to be approximately $110, $130, and $190 for each zone (private sector commercial lending). Additional USBR (and District) annual O&M charges would be included within the costs of System 4 operation.

The CSRIA submits this review to the direct System 4 participants, for consideration with lenders to prepare a Water System Agreement, for private sector financing and Project construction.

Please feel free to contact me with any question of further information needs at 509-783-1623.

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Columbia Snake River Irrigators Association
Odessa South Of I-90 System 4
Engineering & Cost Report

1. Background

IRZ Consulting was tasked by the Columbia Snake River Irrigators Association (CSRIA) with studying the 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 South of I-90. The delivery of this water would be provided through the pumping of water through pressurized pipes. The results of this study will be utilized as the basis to determine the economic viability of moving forward with this project utilizing direct private sector financing from the irrigators.

2. Process

In order to develop a design and the associated cost estimates, several steps were taken to derive the final results. The final conceptual design and costs were based on the best information available. They are based on a pre-construction level approach, and not a construction initiated level approach. Those steps are as follows:

A. Meeting With Water Users

A number of meetings were held with water users that would be served by this proposed project. At those meetings the users provided input into the acres that would be served by the project. Proposed design criteria for the project were established, with an annual water duty of up to 2.5 acre-feet per acre, pivot package rates of 6.5 gpm per acre, and an on-farm system capacity of 75% were agreed to as being reasonable for 2014 operating conditions. Additionally, key delivery points were discussed with the individual users.

B. Initial Tour Of Project Area

After receiving input at the last meeting, a tour of potential pump sites and pipeline routes was taken. Based upon that tour a proposed pipeline route was determined.

C. Office Analysis

Upon completion of the meetings and tour, office work and analysis began. 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 along with land owner input, and digitized. Total acreages were obtained from digitized records. This information was then used to create a base map of the project area, see Odessa Groundwater Replacement Project South of I-90 Map in Appendix A, which shows the considered fields color coded by ownership.

It was determined that acres lying east of the East Low Canal and South of I-90 and North of the Lind Coulee Wasteway would be considered. Additionally, only those acres controlled by land owners interested in participating in this process would be included in

the study. The majority of land owned in the System 3 service area is owned by the Warden Hutterian Brethren. They indicated that they would likely build their own system. As such, System 3 was eliminated from consideration. The three major ownership holders in the System 4 service area determined that they wished to proceed with the project on those lands that could be readily, and economically, served with piped water under this project. The acreage being considered totals approximately 9,000 acres.

Working from the base map, fields to be served were grouped and delivery points located. To serve the identified delivery points, systems were laid out. A map was created, see Odessa Groundwater Replacement Project South of I-90 Map in Appendix A, that shows the considered fields coded by delivery point serving them.

There were several factors evaluated at in determining the location of the main canal pump station in the design. The location of the property to be served lent itself well to the station.

In laying out the pipeline system serving the project, several factors also 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 identified, and the current locations appear to effectively serve the areas. 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. The final construction design will likely be somewhat different then that proposed, based upon more detailed analysis beyond the scope allowed under this project.

At each delivery point, land owners would hook 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 associated with that delivery point. The basic delivery volume was based upon 6.5 gpm per acre and a system delivery factor of 75% 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:

1. The maximum velocity in the pipes would be maintained between 4 and 6 feet per second.
2. PVC pipe would be utilized through 60" diameter.
3. The minimum pressure at each delivery point would be 20 PSI.
4. The minimum pressure at high points, not delivery points would be 10 PSI.
5. Topographic digital information was used to establish the elevations at delivery and high points.
6. The pressure rating of the PVC pipes would be maintained as low as possible.
7. PVC pipes in certain areas were required to have higher pressure ratings.
8. The maximum operating pressure for PVC pipe was considered to be 75% of the pressure rating of the pipe.
9. 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. Odessa Groundwater Replacement Project South of I-90 Map in Appendix A, shows the general layout of the system 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 the ability to closely match pump capacity to demand.

D. Road Crossings & Utilities

Locations of power lines, roads, and any potential obstructions to pipeline installation were reviewed. There were a number of roads identified that would need to be crossed. Adams County has been subsequently contacted, and indicated the roads could be open cut.

There is power located at the main and booster pump station locations. There will be the need to upgrade or construct a new sub-station and power transmission lines to serve those pumps. Big Bend Electric was contacted provided rough estimates of the costs associated with providing power to the proposed pump stations.

E. Final Design & Cost Estimate

With the system layout finalized the costs associated with installing the system was estimated. A summary of those capital costs for the project is provided in Table 1. A summary of the capital costs broken down by zone is presented in Table 2. A summary of the estimated electrical requirements is provided in Table 3. A breakdown of all costs is presented in the Appendix.

Table 1. Estimated Project Capital Costs.

	Materials	Installation	Total
Pipelines	6,457,385	1,320,790	7,796,175
Pump Stations	1,890,000	394,000	2,284,000
Utilities	1,076,721	538,280	1,615,000
Total Construction Costs	**9,430,000**	**2,260,000**	**11,700,000**
Contingency @15%	1,413,616	337,960	1,751,576
Coverage for Wages @ 20%		450,614	450,614
Engineering & Legal @ 5%			584,759
Washington Sales Tax @ 8%			935,614
Total Additional	**1,420,000**	**790,000**	**3,730,000**
Grand Total	**10,850,000**	**3,050,000**	**15,430,000**

In order to assign pro-rated shares of the System 4 costs, 3 Zones have been established. Those 3 Zones are shown on Odessa Groundwater Replacement Project South of I-90 Map in Appendix A. The breakdown of the estimated costs associated with each zone is provided in Table 2.

Table 2. Estimated Costs By Zone.

	Zone 1	Zone 2	Zone 3	Total
Served Area (Acres)	5166	1113	2725	9004
Pipelines	6,173,243	119,070	1,503,862	
Pump Stations	1,596,000	88,000	600,000	
Utilities	1,522,950	29,944	62,106	
Const. Cost	**9,300,000**	**240,000**	**2,170,000**	**11,700,000**
Contingency @15%	1,392,280	35,218	324,078	
Coverage for @ 20%	345,629	10,119	94,865	
Engineering & Legal @ 5%	464,610	11,851	108,298	
Washington Sales Tax @ 8%	744,000	19,200	173,600	
Total Additional	**2,950,000**	**80,000**	**710,000**	**3,730,000**
Total Cost	**12,250,000**	**320,000**	**2,880,000**	**15,430,000**
Estimated Capital Cost ($/ac)	**1,370**	**1,660**	**2,430**	

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 served 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 Table 3.

Table 3. Estimated Energy Usage.

	Zone 1	Zone 2	Zone 3
Area Served (Acres)	5166	1113	2725
TDH (ft)	246	321	346
Est. Energy Use (kWh/ac-ft)	**340**	**440**	**470**

F. Final Water User Meeting

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

3. Conclusion

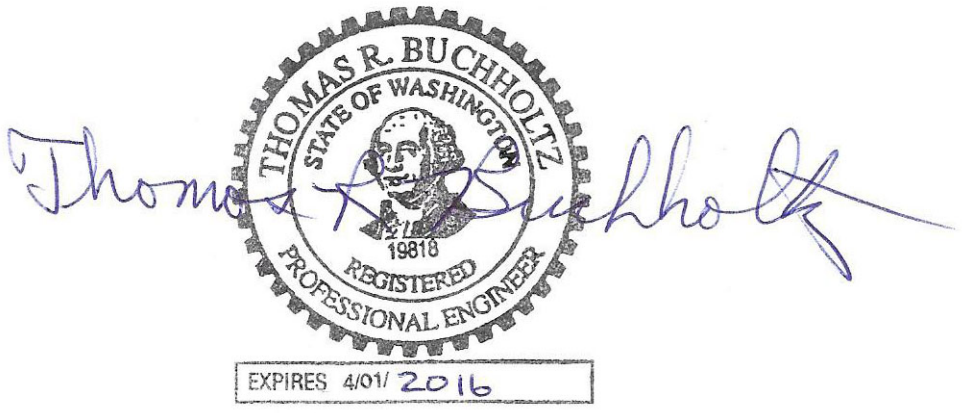
The conceptual level design and associated costs associated with replacing approximately 9,000 acres of deep well irrigated land east of the East Low Canal, and South of I-90 with water from the East Low Canal has been completed. From this analysis it appears that the project is certainly feasible to construct, and the associated costs appear reasonable.

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

A. The main East Low Canal must have its integrity maintained.

B. The widening of the East Low Canal to the Lind Coulee Wasteway must be completed, and the additional gate at the Lind Coulee Wasteway must be installed prior to utilizing the proposed System 4.

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



Appendix

Estimated Pipe Cost

Pipe Location (in)	Description	Qty (feet)	Unit Cost Pipe ($/ft)	Unit Cost Install. ($/ft)	Total Cost Pipe ($)	Total Cost Install. ($)	Total Cost ($)
ML-1.0	60 in C905, 125 psi PVC pipe	3,200	$298	$48	953,600	153,600	1,107,200
ML-1.1	24 in C905, 125 psi PVC pipe	2,560	$42	$7	108,639	18,432	127,071
ML-1.2	24 in C905, 100 psi PVC pipe	2,660	$31	$7	82,460	19,152	101,612
ML-1.3	14 in C905, 100 psi PVC pipe	4,310	$12	$3	50,299	13,792	64,091
ML-1.4	14 in C905, 100 psi PVC pipe	1,060	$12	$3	12,370	3,392	15,762
ML-2.0	48 in C905, 125 psi PVC pipe	5,320	$191	$28	1,016,652	150,556	1,167,208
ML-2.1	18 in C905, 100 psi PVC pipe	5,170	$19	$5	98,331	23,782	122,113
ML-3.0	48 in C905, 125 psi PVC pipe	1,650	$191	$28	315,315	46,695	362,010
ML-3.1	48 in C905, 125 psi PVC pipe	9,150	$191	$28	1,748,565	258,945	2,007,510
ML-4.0	42 in C905, 125 psi PVC pipe	2,360	$137	$21	323,273	49,560	372,833
ML-4.1	42 in C905, 125 psi PVC pipe	2,800	$137	$21	383,544	58,800	442,344
ML-4.2	20 in C905, 125 psi PVC pipe	3,490	$27	$5	94,230	18,846	113,076
ML-5.0	36 in C905, 100 psi PVC pipe	10,680	$75	$15	803,451	162,336	965,787
ML-5.1	20 in C905, 100 psi PVC pipe	2,710	$23	$5	62,730	14,634	77,364
ML-6.0	24 in C905, 100 psi PVC pipe	4,090	$31	$7	126,790	29,448	156,238
ML-6.1	24 in C905, 100 psi PVC pipe	1,240	$31	$7	38,440	8,928	47,368
ML-7.0	20 in C905, 100 psi PVC pipe	5,400	$23	$5	124,997	29,160	154,157
ML-1.0	Pipe Apurtnances Cost					30,720	30,720
ML-1.1	Pipe Apurtnances Cost					3,686	3,686
ML-1.2	Pipe Apurtnances Cost					3,830	3,830
ML-1.3	Pipe Apurtnances Cost					2,758	2,758
ML-1.4	Pipe Apurtnances Cost					678	678
ML-2.0	Pipe Apurtnances Cost					30,111	30,111
ML-2.1	Pipe Apurtnances Cost					4,756	4,756
ML-3.0	Pipe Apurtnances Cost					9,339	9,339
ML-3.1	Pipe Apurtnances Cost					51,789	51,789
ML-4.0	Pipe Apurtnances Cost					9,912	9,912
ML-4.1	Pipe Apurtnances Cost					11,760	11,760
ML-4.2	Pipe Apurtnances Cost					3,769	3,769
ML-5.0	Pipe Apurtnances Cost					32,467	32,467
ML-5.1	Pipe Apurtnances Cost					2,927	2,927
ML-6.0	Pipe Apurtnances Cost					5,890	5,890
ML-6.1	Pipe Apurtnances Cost					1,786	1,786
ML-7.0	Pipe Apurtnances Cost					5,832	5,832
				Total:	**$6,343,685**	**$1,272,070**	**$7,615,755**

Estimated Pipe Crossing Costs

Station	Description	Qty	Unit Cost		Total Cost		
			Material ($/Qty)	Install. ($/Qty)	Material ($)	Install. ($)	Total ($)
4A	ML-1.0 - 60" Howard Road Crossing (Gravel)	60	$277	$192	$16,620	$11,520	$28,140
4Aa	ML- 1.2 - 24" Rolff Rd Crossing (Gravel)	60	$192	$52	$11,520	$3,120	$14,640
4B	ML-3.1 - 48" W Calloway Road Crossing (Gravel)	60	$269	$121	$16,140	$7,260	$23,400
4B-4C	ML-3.1 - 48" Johnson Road Crossing (Gravel)	60	$269	$121	$16,140	$7,260	$23,400
4C	ML-4.0 - 42" Deal Road Crossing (Gravel)	60	$175	$105	$10,500	$6,300	$16,800
4C	ML-4.0.1 - 14" W Calloway Rd Crossing (Gravel)	60	$90	$34	$5,400	$2,040	$7,440
4D	ML-5.0 - 36" N Roxboro Road Crossing (Gravel)	60	$219	$85	$13,140	$5,100	$18,240
Tee	ML-6.0 - 24" W Calloway Road Crossing (Gravel)	60	$214	$52	$12,840	$3,120	$15,960
4G	ML-7.0 - 20" Lind Warden Road Crossing (Paved)	60	$190	$50	$11,400	$3,000	$14,400
	Miscellaneous/ Appurtnances				$0	$0	$18,000
				Total:	**$113,700**	**$48,720**	**$180,420**

Estimated Canal Pump Station Costs

1	Pump & Motor (12,865 gpm @ 246ft) 1000 HP 4160V 1180 RPM	3	$175,000	$8,000	$525,000	$24,000	$549,000
2	1000 HP VFD 4160V	1	$175,000	$4,000	$175,000	$4,000	$179,000
3	1000 HP Soft Start 4160V	2	$65,000	$4,000	$130,000	$8,000	$138,000
4	38,600 gpm plumbing	3	$40,000	$20,000	$120,000	$60,000	$180,000
5	Pump & Motor (3,216 gpm @ 246 ft) 250 HP 480V 1770 RPM	1	$60,000	$2,000	$60,000	$2,000	$62,000
6	255 HP Soft Start 480V	1	$16,000	$4,000	$16,000	$4,000	$20,000
7	3216 gpm plumbing	1	$4,000	$2,000	$4,000	$2,000	$6,000
8	Pump & Motor (1,930 gpm @ 246 ft) 125 HP 480V 1180 RPM	1	$17,000	$1,000	$17,000	$1,000	$18,000
9	125 HP Soft Start 4160V	1	$10,000	$2,000	$10,000	$2,000	$12,000
10	1930 gpm plumbing	1	$2,000	$1,000	$2,000	$1,000	$3,000
11	By-Pass	1	$15,000	$9,000	$15,000	$9,000	$24,000
12	Intake Structure	1	$100,000	$50,000	$100,000	$50,000	$150,000
13	Intake Screens	5	$20,000	$2,000	$100,000	$10,000	$110,000
14	Building and Fence	1	$50,000	$20,000	$50,000	$20,000	$70,000
14	Miscellaneous				$45,000	$30,000	$75,000
				Total:	**$1,369,000**	**$227,000**	**$1,596,000**

Estimated Booster Pump Station 1 Costs

Item	Description	Qty	Unit Cost		Total Cost		
			Material ($/Qty)	Install. ($/Qty)	Material ($)	Install. ($)	Total ($)
	Pump & Motor (2,613 gpm @ 75 ft)						
1	60 HP 480V 1770 RPM	2	15,000	1,000	30,000	2,000	32,000
2	2613 gpm plumbing	2	10,000	2,500	20,000	5,000	25,000
3	60 HP VFD 460V	1	10,000	2,000	10,000	2,000	12,000
4	60 HP Soft Start 460V	1	5,000	2,000	5,000	2,000	7,000
3	Building and Fence	1	2,000	5,000	2,000	5,000	7,000
4	Miscellaneous				$3,000	$2,000	5,000
				Total:	**$70,000**	**$18,000**	**$88,000**

Estimated Booster Pump Station 2 Costs

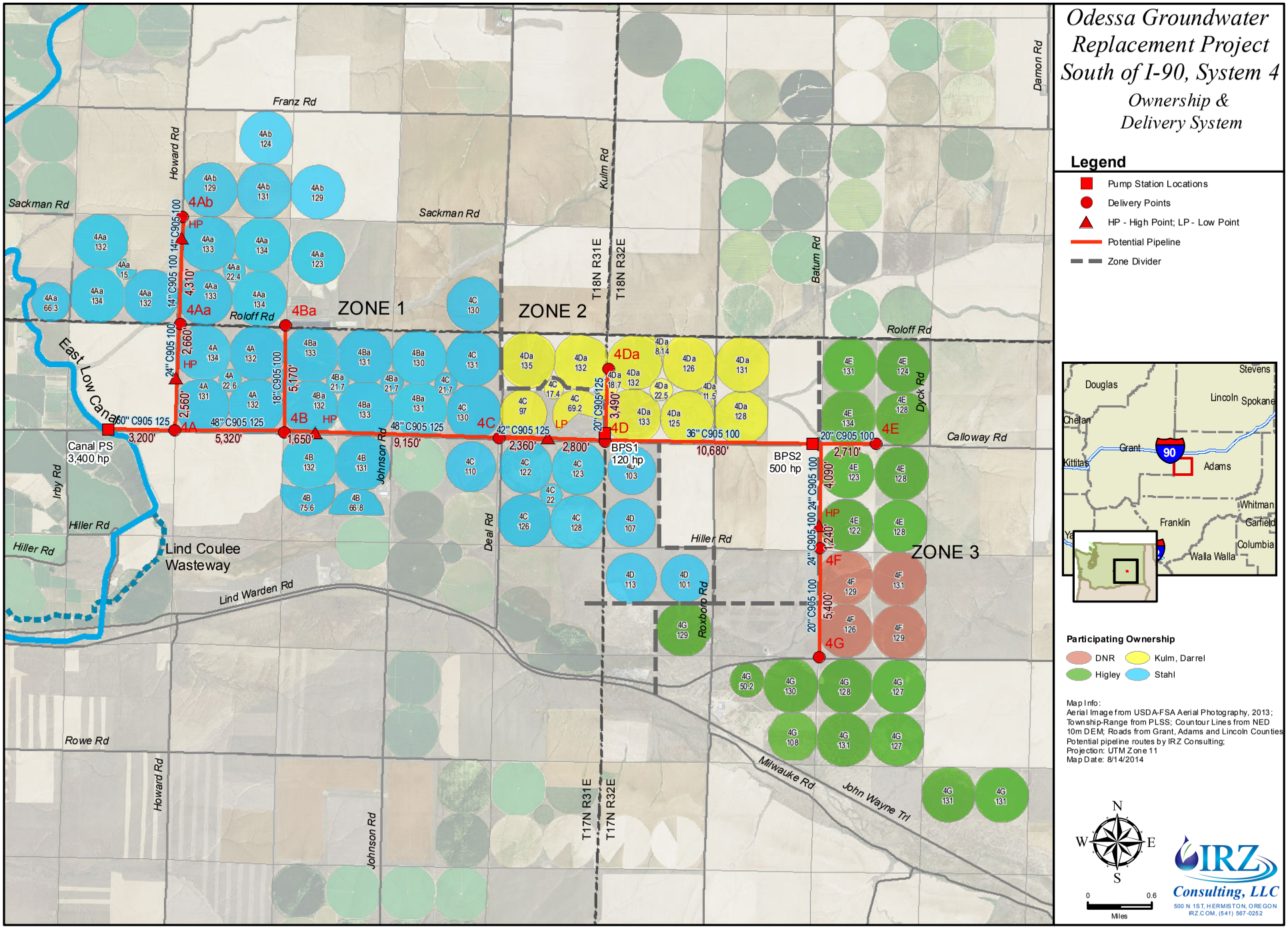
Item	Description	Qty	Unit Cost		Total Cost		
			Material ($/Qty)	Install. ($/Qty)	Material ($)	Install. ($)	Total ($)
1	Pump & Motor (6642 gpm @ 100ft) 250 HP 480V 1780 RPM	2	$60,000	$2,000	$120,000	$4,000	$124,000
2	250 HP VFD 480V	1	$26,000	$4,000	$26,000	$4,000	$30,000
3	250 HP Soft Start 480V	1	$65,000	$12,000	$65,000	$12,000	$77,000
4	6642 gpm plumbing	3	$40,000	$20,000	$120,000	$60,000	$180,000
11	By-Pass	1	$15,000	$9,000	$15,000	$9,000	$24,000
12	Intake Structure	1	$60,000	$30,000	$60,000	$30,000	$90,000
14	Building and Fence	1	$30,000	$20,000	$30,000	$20,000	$50,000
14	Miscellaneous				$15,000	$10,000	$25,000
				Total:	**$451,000**	**$149,000**	**$600,000**

Estimated Utility Costs

Item	Description	Qty	Unit Cost	Total Cost		
			Lump Sum ($/Qty)	Lump Sum ($)	Install. ($)	Total ($)
1	3000 kW Substation			$1,000,050	$499,950	$1,500,000
2	100 kW Power Supply to Booster 1			$16,668	$8,333	$25,000
2	500 kW Power Supply to Booster 2			$33,335	$16,665	$50,000
3	Miscellaneous			$26,668	$13,332	$40,000
			Total:	**$1,076,721**	**$538,280**	**$1,615,000**

APPENDIX A.

Map


Odessa Groundwater Replacement Project
South of I-90, System 4
Ownership & Delivery System
Legend
Pump Station Locations
Delivery Points
HP - High Point; LP - Low Point
Potential Pipeline
Zone Divider
ZONE 1
ZONE 2
ZONE 3
Franz Rd
Sackman Rd
Howard Rd
Kulm Rd
Damon Rd
Batum Rd
Roloff Rd
Dyck Rd
Calloway Rd
East Low Canal
Canal PS
3,400 hp
Irby Rd
Hiller Rd
Lind Coulee
Wasteway
Lind Warden Rd
Johnson Rd
Deal Rd
Roxboro Rd
Rowe Rd
Milwaukee Rd
John Wayne Trl
T18N R31E
T18N R32E
T17N R31E
T17N R32E
BPS1
120 hp
BPS2
500 hp
4Ab
4Aa
4Ba
4A
4B
4C
4D
4E
4F
4G
HP
LP
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5,320'
1,650'
9,150'
2,360'
2,800'
3,490'
10,680'
2,710'
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5,400'
2,560'
2,660'
4,310'
5,170'
Participating Ownership
DNR
Higley
Kulm, Darrel
Stahl
Map Info:
Aerial Image from USDA-FSA Aerial Photography, 2013;
Township-Range from PLSS; Countour Lines from NED
10m DEM; Roads from Grant, Adams and Lincoln Counties
Potential pipeline routes by IRZ Consulting;
Projection: UTM Zone 11
Map Date: 8/14/2014
Douglas
Lincoln
Spokane
Stevens
Chelan
Grant
Kittitas
Adams
Whitman
Franklin
Garfield
Columbia
Walla Walla
90
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Miles
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