TECHNICAL MEMORANDUM

SUMMARY OF ADDITIONAL ANALYSIS
ICICLE AND PESHASTIN IRRIGATION DISTRICTS PUMP EXCHANGE

Prepared for

Chelan County Natural Resources Department
316 Washington Street, Suite 401
Wenatchee, Washington 98801

Icicle and Peshastin Irrigation Districts
P.O. Box 371
Cashmere, Washington 98815

Prepared by

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

23 South Wenatchee Avenue, Suite 220
Wenatchee, Washington 98801

March 27, 2015

This technical memorandum was prepared under the supervision of a registered Professional Engineer.

March 27, 2015

ANCHOR QEA

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

TECHNICAL MEMORANDUM

To:	Mike Kaputa, Director Chelan County Natural Resources Department 316 Washington Street, Suite 401 Wenatchee, WA 98801	**Date:**	March 27, 2015
From:	David Rice, P.E., Anchor QEA, LLC Bob Montgomery, P.E., Anchor QEA, LLC	**Project:**	140204-02.01
Cc:	Tony Jantzer, Icicle and Peshastin Irrigation Districts		
Re:	Icicle and Peshastin Irrigation Districts Pump Exchange Summary of Additional Analysis		

The Icicle and Peshastin Irrigation Districts Pump Exchange project proposes to establish an alternate supply of irrigation water for Icicle and Peshastin Irrigation Districts, collectively referred to herein as IPID, through a pump station constructed on the Wenatchee River. The pump station would be used to replace diversions from Icicle Creek and/or Peshastin Creek. A reduction in diversions would improve instream flows, fish passage, and habitat conditions. Several alternatives have been identified and evaluated that would pump water from different locations on the Wenatchee River and deliver water to various locations on the PID and/or IID delivery systems.

This memorandum summarizes additional work done by Anchor QEA, LLC, to evaluate the preferred pump exchange project alternative near Dryden, Washington, and is intended to supplement the analysis that was originally presented in the *Peshastin Irrigation District Pump Exchange Project Appraisal Study* (Anchor QEA 2012). This memorandum also provides a summary of additional alternatives that have been identified to provide a basis for further comparison and consideration by the Icicle Work Group (IWG). The IWG will work with IPID to identify a preferred alternative and determine whether additional funding can be secured to move the project forward through a feasibility level study toward design and implementation.

INTRODUCTION AND PURPOSE

The IPID Pump Exchange project is one of several potential projects currently being evaluated under the direction of the IWG. The IWG was co-convened by the Chelan County Natural Resources Department (CCNRD) and the Washington State Department of Ecology (Ecology) to take a comprehensive look at water resource management in the Icicle Creek Sub-basin. Icicle Creek is one of the primary tributaries to the Wenatchee River and provides critical habitat and a migratory path for anadromous salmonids and bull trout. The IWG consists of federal, state, and local agencies; irrigation districts; the City of Leavenworth; the Leavenworth National Fish Hatchery, non-profit organizations; environmental groups; and other stakeholders. The IWG is working together to identify and evaluate projects that will improve management of water in the Icicle Creek Sub-basin and improve instream flow conditions in lower Icicle Creek.

Projects endorsed by the IWG are collectively intended to meet the following nine Guiding Principles:

1. Streamflow that:
   - Provides passage
   - Provides healthy habitat
   - Serves channel formation function
   - Meets aesthetic and water quality objectives
   - Is resilient to climate change
2. Sustainable hatchery that:
   - Provides healthy fish in adequate numbers
   - Is resource efficient
   - Significantly reduces phosphorus loading
   - Has appropriately screened diversion(s)
   - Does not impede fish passage
3. Tribal Treaty and federally protected fishing/harvest rights are met at all times.
4. Provide additional water to meet municipal and domestic demand.
5. Improve agricultural reliability that:
   - Is operational

- Is flexible
- Decreases risk of drought impacts
- Is economically sustainable

6. Improve ecosystem health including protection and enhancement of aquatic and terrestrial habitat.
7. Comply with state and federal law.
8. Protect Non-Treaty Harvest.
9. Comply with the Wilderness Act of 1964, the Alpine Lakes Wilderness Act of 1976, and the Alpine Lakes Wilderness Management Plan.

The intent of the IPID Pump Exchange Project is to meet multiple prongs of the Guiding Principles. This project has the potential to:

- Augment streamflow in Icicle Creek, below the IID diversion at River Mile (RM) 5.7 (Guiding Principle No. 1). The project also has the potential to augment streamflow in Peshastin Creek below the PID diversion at RM 2.4.
- Improves the reliability of water supply for agriculture (Guiding Principle No. 5)
- Benefit fish passage and habitat (Guiding Principle No. 6) and Treaty and Non-Treaty Harvest (Guiding Principles No. 3 and No. 8)

The work summarized in this memorandum was completed under the direction of CCNRD under a grant (Grant No. G1400161) provided by Ecology's Office of the Columbia River. CCNRD retained Anchor QEA and Aspect Consulting, LLC (Aspect) to further evaluate the preferred pump exchange alternative presented in the *Peshastin Irrigation District Pump Exchange Project Appraisal Study* by completing the following tasks:

- **Evaluation of Pump Station Operations** – This task included additional review of pump station operations and flow rates with IPID. Additional measurement and analysis of canal flow rates was completed. The intent of this task is to more clearly define operating conditions (design flow rates, timing, and duration) for the pump exchange alternative at the preferred location near Dryden.
- **Property Owner Coordination** – As part of this task, the Anchor QEA/Aspect team provided support for initiation of discussions between IPID and the private property

owners that would be impacted by the proposed pump exchange project at the preferred Dryden location.

- **Analysis of Pumping to Icicle Irrigation District Division 3A Canal** – As part of this task, the Anchor QEA/Aspect team worked with IPID to refine the concept for pumping water to the IID Division 3A Canal from the PID Canal. The refined concept includes a re-regulation pond. The cost analysis was updated to reflect the refined concept.
- **Comparison of Alternatives** – CCNRD and IPID requested that the Anchor QEA/Aspect team provide a comparison of various alternatives that have been evaluated to date. Two primary alternatives are likely to be considered for further evaluation: 1) a pump station location on the Wenatchee River at Dryden; and 2) a pump station location on the Wenatchee River near the IID Leavenworth Siphon by Safeway in Leavenworth, Washington.

The following are goals of completing this additional work:

- Identify any "fatal flaws" revealed by the additional work.
- Refine the analysis and compare the opinions of costs for the pump exchange alternatives currently being considered.
- Provide updated information for consideration by IPID and the IWG as they proceed to determine whether additional funding can be made available to carry the project forward through a feasibility level study toward design and implementation.

SUMMARY OF PRIOR AND ONGOING STUDIES

The potential for pumping from the Wenatchee River to mitigate the impact of diversions on late summer low flows in Peshastin Creek was initially identified as part of the *Peshastin Sub-basin Needs and Alternatives Analysis* (Anchor Environmental 2007). This study, prepared under the direction of CCNRD for Ecology, identified a variety of projects aimed at improving water resource management in the Peshastin Creek Sub-basin. Additional studies have since been completed to evaluate this concept in more detail. The following summarizes the most recent studies that have been completed or are in process.

PID Pump Exchange Project Appraisal Study

The *Peshastin Irrigation District Pump Exchange Project Appraisal Study*, completed in 2012 under the direction of CCNRD for Ecology, included an appraisal level evaluation of five pump exchange alternatives that would divert water through a pump station on the right bank (looking downstream) of the Wenatchee River near Dryden, Washington. This study initially focused on delivery of water to the PID Canal to mitigate late summer low flows in Peshastin Creek. Further evaluation was provided for an extension to the IID Canal. The proposed facilities would deliver water pumped from the Wenatchee River to the PID Canal for gravity distribution through the PID Canal system. A portion of the water delivered to the PID Canal would be pumped further up the hill to the IID Division 3A Canal for gravity distribution through the IID Canal system. Facility capacities of 10, 20, and 40 cubic feet per second (cfs) were evaluated to cover a wide range of potential facility sizes.

An instream flow analysis was completed to identify the additional flow needed to improve fish passage and habitat conditions in lower Peshastin Creek. Each pump station location was reviewed and evaluated in the field by a geomorphologist. Each alternative was also reviewed in the field by a geotechnical engineer and an environmental planner in an effort to identify geotechnical challenges, environmental fatal flaws, and likely permitting requirements. A preliminary hydraulic analysis was completed to determine the size of pumping and conveyance facilities. A preliminary cost analysis was completed that included development of an opinion of implementation costs for each alternative; an opinion of probable pumping and operations and maintenance (O&M) costs; and a life cycle cost analysis to estimate replacement fund costs.

An alternatives comparison was presented to PID and a preferred alternative was selected that would include a pump station on the right bank of the Wenatchee River near the Highway 2 Bridge immediately west of Dryden and a delivery pipeline that would extend through private orchards and driveways to the PID and IID canals. A backup alternative was also selected that would include a pump station on the right bank of the Wenatchee River upstream of the Dryden Diversion Dam and a delivery pipeline that would extend in the dam access road, Saunders Road, and Deadman Hill Road to the PID and IID canals.

IID Pump Exchange – Initial Project Assessment

The *Icicle Irrigation District – Initial Project Assessment Memorandum* (Initial Project Assessment; Anchor QEA 2013) was also completed under the direction of CCNRD for Ecology and included a cursory assessment of a potential pump exchange alternative that would divert water through a pump station on the left bank of the Wenatchee River near the IID Leavenworth Siphon and discharge water through the siphon to the IID Division 2, Division 4, and Division 5 canals. The initial assessment included a brief site visit, review of the potential alternative with IID, development of a concept plan illustrating major project elements, and recommendations for additional study. No costs or detailed analysis were provided.

IID Instream Flow Improvement Options Analysis Study

The *Icicle Irrigation District Instream Flow Improvement Options Analysis Study* (Forsgren Associates 2014) was completed under the direction of IWG member Trout Unlimited. The study was performed concurrently with the work outlined in this memorandum and included evaluation of 12 alternatives that would divert water through one of six pump station locations on the Wenatchee River, from Leavenworth to Monitor. The evaluation focused on delivery of water to the IID Canal, which would reduce diversions from Icicle Creek only. The study also includes an appraisal evaluation of the useful storage capacity in Eightmile Lake, where an improvement project is also being evaluated that would increase flow available in lower Icicle Creek. The alternatives were each sized with capacity to meet irrigation needs downstream of the point of discharge to the IID delivery system.

The study identified both pressurized and gravity delivery alternatives. Gravity alternatives would pump water from the Wenatchee River to IID for gravity distribution through the existing canal system. Pressurized alternatives would pump water from the Wenatchee River to a pressurized delivery system that would replace a portion of the IID canal system. Each pump station location was evaluated based on:

- Proximity to IID Canal
- Geology and terrain
- Adequate pool of water in river
- Adequacy of site

A preliminary hydraulic analysis was completed to determine the size of pumping and conveyance facilities. A preliminary cost analysis was completed that included development of an opinion of implementation costs for each alternative and an opinion of probable pumping and O&M costs. A life cycle cost analysis was not included in this study.

PROJECT BACKGROUND

The proposed pump exchange project alternative evaluated for this memorandum would include a pump station on the right bank (looking downstream) of the Wenatchee River near the Highway 2 Bridge immediately west of Dryden, Washington. The project location is shown in Figure 1. The current project concept is illustrated in Figure 2. The project would pump water from the Wenatchee River to the PID Canal. A portion of the PID Canal downstream of the pump station discharge point would be upgraded to increase capacity. A re-regulation pond would be installed in a bend in the PID Canal about 0.5 mile downstream of the pump station discharge point. A pump station at the re-regulation pond would deliver water to the IID Canal for irrigation.

IID currently diverts up to 117 cfs through a surface water diversion on Icicle Creek, approximately 5.7 miles upstream of its confluence with the Wenatchee River. The IID Canal system delivers water for irrigation of properties on both sides of the Wenatchee River from Leavenworth to Monitor. The primary out-of-stream water uses in the Icicle Creek Sub-basin include diversion for irrigation by IPID and Cascade Orchards Irrigation Company, municipal use by the City of Leavenworth, and diversion for fish rearing at the Leavenworth National Fish Hatchery.

The PID delivery system generally runs parallel to the IID Division 3A Canal at a lower elevation, from Peshastin Creek to Cashmere. The PID system provides water for irrigation of properties on the southwest side of the Wenatchee River and is primarily supplied through surface water diversion on Peshastin Creek, approximately 2.4 miles upstream of its confluence with the Wenatchee River. During low flow periods, PID also draws water from a bifurcation at the downstream end of the IID Division 2 Canal. IID and PID share management, water rights for the diversion on Icicle Creek, diversion facilities on Icicle Creek, and the IID Division 1 and Division 2 canals. The IID and PID delivery systems and diversion locations are shown in Figure 1.

The proposed project would deliver water to the PID Canal and the IID Canal from the Wenatchee River during the late summer low flow period, which would allow for reduced diversions at the IID diversion on Icicle Creek and the PID diversion on Peshastin Creek. Icicle Creek and Peshastin Creek both provide critical habitat for Endangered Species Act (ESA)-listed species, including bull trout, spring Chinook salmon, and steelhead. Reducing diversions would increase instream flows in lower Icicle Creek and lower Peshastin Creek during the late summer and would improve habitat and passage conditions for these ESA-listed species.

EVALUATION OF PUMP STATION OPERATIONS

The Anchor QEA/Aspect team met with IPID Manager, Tony Jantzer, to discuss and refine the pump exchange concept presented in this memorandum and review desired pump station operating conditions (design flow rates, timing, and duration). Additional data were collected and reviewed to better understand water supply needs downstream of the proposed points of discharge to the PID and IID canals.

PID Diversions

Table 1 summarizes diversion data for the PID diversions for 2002, 2003, and 2010 through 2013. Data from 2002 and 2003 were obtained from Ecology from diversion records submitted by PID. Records from 2010 through 2013 were obtained directly from PID. Figure 3 includes a chart showing PID's average diversion from Peshastin Creek during this period of record. The chart also shows Peshastin Creek flows during 2003, 2010, and 2011, continuously measured at an Ecology flow monitoring station at Green Bridge Road, which is downstream of the PID diversion. During the most recent 4 years of record (2010 through 2013), the average peak diversion in July has typically been just more than 41 cfs. The data indicate that diversion rates are typically the greatest from early June through the middle of August, when irrigation demand is the highest.

Table 1
PID Surface Water Diversions from Peshastin Creek

Bi-weekly Time Period	2002		2003		2010		2011		2012		2013	
	Average Flow (cfs)	Total Volume (acre-feet)	Average Flow (cfs)	Total Volume (acre-feet)	Average Flow (cfs)	Total Volume (acre-feet)	Average Flow (cfs)	Total Volume (acre-feet)	Average Flow (cfs)	Total Volume (acre-feet)	Average Flow (cfs)	Total Volume (acre-feet)
April 1 – April 15	15.6	185.5	0.0	0.0	2.6	40.7	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]
April 15 – April 30	11.0	326.7	13.0	361.8	10.2	304.8	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]
May 1 – May 15	12.9	383.8	14.5	432.7	18.3	545.4	N/A[1]	N/A[1]	20.7	614.5	N/A[1]	N/A[1]
May 15 – May 30	22.0	699.4	N/A[1]	N/A[1]	19.4	615.9	N/A[1]	N/A[1]	27.4	870.1	32.5	1,032.2
June 1 – June 15	30.1	896.9	29.6	880.3	27.6	820.4	17.7	457.5	34.8	1,036.4	37.1	1,103.0
June 15 – June 30	30.8	917.8	31.3	929.9	33.7	1,003.6	35.1	1,045.6	33.6	999.7	41.0	1,220.6
July 1 – July 15	31.2	928.1	32.0	953.5	39.7	1,180.4	41.6	1,237.4	40.2	1,196.8	40.8	1,212.9
July 15 – July 31	32.5	1,030.2	24.9	791.0	27.6[2]	875.0[2]	41.3	1,311.3	41.7	1,322.2	41.3	1,311.1
August 1 – August 15	26.4	785.7	17.0	506.2	3.5[2]	102.8[2]	39.5	1,176.1	37.5	1,116.0	34.8	1,034.5
August 15 – August 30	17.2	510.6	9.7	289.3	12.3	366.9	36.2	1,078.1	32.5	967.4	24.6	732.6
September 1 – September 15	13.5	214.0	7.6	211.8	8.6	136.3	27.5	436.6	27.4	434.7	20.9	332.1
September 15 – September 30	0.0	0.0	0.0	0.0	8.5	252.6	27.7	823.6	24.3	384.9	18.3	290.8

Notes:
1 N/A indicates periods for which data were not available. The lack of data does not indicate that there were no diversions during that period, but likely indicates that the flow measurement device was not working properly.
2 Data for late July 2010 and early August 2010 indicate that there were several days during this period with average flows of less than 1 cfs. These data either indicate that the measurement device was not working properly or that PID had to shut down the diversion temporarily during this period for maintenance issues.
cfs = cubic feet per second

Diversion rates are affected by flow availability in Peshastin Creek, timing of the fruit harvest, and reductions in water use following the fruit harvest. Diversions are reduced in August when flows in Peshastin Creek cannot sustain peak diversion rates.

Bifurcation Flows

PID diversions are reduced in August when flows in Peshastin Creek cannot sustain peak diversion rates. Because irrigation demands are typically highest during late August, flow in the PID Canal is typically supplemented by flows from a bifurcation structure at the downstream end of the IID Division 2 Canal to meet demands. PID shares ownership and operation of the diversion on Icicle Creek and the IID Division 1 and Division 2 canals with IID. The bifurcation structure distributes flows conveyed at the downstream end of the IID Division 2 Canal to the following:

- A siphon that delivers flow to the IID Division 3A Canal
- A pipeline that supplies the Gibbs Ditch
- A siphon that delivers flow to the PID Canal
- A pipeline that spills excess water to Peshastin Creek

A 6-foot Cipoletti Weir and staff gage measure flows delivered to the IID Division 3A Canal. Another 6-foot Cipoletti Weir and staff gage measure the combined flow delivered to the Gibbs Ditch and PID Canal. A 4-foot Cipoletti Weir and staff gage measures flows delivered to the Gibbs Ditch only. PID personnel visit the structure daily during the irrigation season to read and record water levels in the structure at each staff gage. The Anchor QEA/Aspect team collected and reviewed staff gage readings taken from 2010 through 2013 and calculated corresponding flow rates. Table 2 summarizes the estimated peak flows delivered at the bifurcation structure to the IID Division 3A Canal, the Gibbs Ditch, and the PID Canal. Flows to the PID Canal were estimated by subtracting flows at the Cipoletti Weir to the Gibbs Ditch from flows at the Cipoletti Weir that measures the combined flow to the Gibbs Ditch and PID Canal. The data indicate the following:

- Peak flows typically occur from late July through August.
- Peak flows ranging from 26.2 cfs to 27.9 cfs were delivered to the IID Division 3A Canal.
- Peak flows ranging from 7.1 to 7.9 cfs were conveyed to the Gibbs Ditch.
- Peak flows ranging from 8.3 to 14.1 cfs were conveyed to the PID Canal.

It should be noted that the siphon to the PID Canal includes a valve at Peshastin Creek that can be opened to spill flows to the creek. It is not known when this valve was open or how the estimated flow rates would have been impacted. Typically, the valve is closed during the late summer to maximize deliveries to the canal.

Table 2
Estimated Peak Deliveries at Bifurcation Structure

Year	Peak Delivery to IID Division 3A Canal (cfs)	Peak Delivery to Gibbs Ditch and PID Canal (cfs)	Peak Delivery to Gibbs Ditch (cfs)	Peak Delivery to PID Canal (cfs)
2010	27.2	17.2	7.1	14.1
2011	26.9	13.1	7.1	8.3
2012	27.9	17.2	7.9	9.4
2013	26.2	18.4	7.1	12.2

Flow Measurements

In order to understand water supply requirements downstream of the proposed pump system discharge points on the PID Canal and the IID Canal, the Anchor QEA/Aspect team installed water level transducers with dataloggers in both canals at those locations in August 2014. Three flow measurements were also taken at each location with a Swoffer velocity meter in August and September 2014. The flow measurements and measured canal geometry were used to develop a rating curve for each ditch. The rating curve was then used to convert water levels collected with the water level transducers to flow rates. The rating curves for the PID and IID canals at the point of measurement are shown in Figures 4 and 6. Figures 5 and 7 show the measured flow rates at each location, along with flow rates estimated from the water level data.

It should be noted that the transducers were installed later in the irrigation season, on August 22. The IPID manager indicated that flow rates had peaked 1 to 2 weeks prior to installing the transducers. The data indicate the following:

- Flow rates measured in the PID Canal ranged from nearly 23 cfs in late August, to approximately 13 cfs at the end of the irrigation season.

- Flow rates measured in the IID Canal ranged from nearly 25 cfs in early September, to approximately 18 cfs at the end of the irrigation season.

Design Flow Rates

Based on the data collected and review of the information with IPID, it is recommended that the proposed pump exchange facilities at the Dryden location be designed to deliver the following flow rates:

- Up to 50 cfs from the Wenatchee River to the PID Canal
- Up to 25 cfs from the Re-regulation Pond on the PID Canal to the IID Canal

Based on the data collected, peak water supply needs in the PID system downstream of the proposed discharge point on the PID Canal are in the 23 to 25 cfs range. Peak water supply needs in the IID system downstream of the proposed discharge point on the IID Canal are in the 25 to 27 cfs range. The design flow rates recommended above would allow IPID to meet most of the later summer demand downstream of the pump exchange facilities with water from the Wenatchee River. The benefits to Icicle and Peshastin Creek would be as follows:

- Icicle Creek – Late summer diversions to the IID Canal from Icicle Creek could be reduced by as much as 40 cfs by delivering up to 25 cfs to the IID Division 3A Canal and up to 15 cfs to the PID Canal from the Wenatchee River. The 15 cfs delivered to the PID Canal would eliminate the flow conveyed to PID through the bifurcation at the end of the IID Division 2 Canal. This water could be left in the creek to augment instream flows.
- Peshastin Creek – Late summer diversions, which peak at just more than 40 cfs, could be reduced by the pump exchange facilities. For example, if 40 cfs of pumping was used to offset diversions from Icicle Creek, 10 cfs would be available to offset diversions from Peshastin Creek. This water could be left in the creek to augment instream flows.

The magnitude in reduction of flows would need to be balanced with the needs in each creek. If other projects were implemented to increase instream flows in Icicle Creek, additional flow could be available to offset diversions from Peshastin Creek. One of the

benefits of the proposed pump exchange project at Dryden is that it offers flexibility in operation and potential benefits to instream flows in both Icicle and Peshastin creeks.

Instream flow work outlined in the *Peshastin Irrigation District Pump Exchange Project Appraisal Study* recommended maintaining late summer low flow rates in excess of 20 cfs and improving the worst sections of the lower Peshastin Creek channel to improve fish habitat and passage conditions. A weighted usable area (WUA) analysis performed for that study indicated that the WUA would be four times greater at a flow rate of 22 cfs than at a flow rate of 5 cfs, which is a typical late summer low flow rate downstream of the PID diversion during a dry year. Maintaining 20 cfs during typical late summer low flow conditions would require a reduction in diversions of up to 15 cfs.

PROPOSED PUMP EXCHANGE PROJECT

The current concept for the proposed pump exchange alternative at Dryden is illustrated in Figure 2. The proposed project would include the following:

- A pump station located on the right bank of the Wenatchee River, just southwest (upstream) of U.S. Highway 2, approximately 7,250 feet downstream of the confluence of Peshastin Creek with the Wenatchee River (approximately RM 16.5)
- Four vertical turbine pumps, each designed to deliver approximately 12.5 cfs at a total dynamic head (TDH) of 246 feet (500 horsepower each)
- A 1,240-foot, 42-inch-diameter delivery pipeline that would extend south and east through an existing orchard, and then south and west up a steep hillside to the PID Canal
- A delivery structure at the PID Canal approximately 19,560 feet downstream of the diversion at Peshastin Creek
- Replacement of approximately 2,350 feet of the existing PID Canal downstream of the delivery structure with a 48-inch-diameter gravity pipeline to increase the conveyance capacity of the canal to at least 50 cfs
- Construction of a 15.5 acre-foot re-regulation pond with a high water surface elevation of 1,144 feet at a bend in the PID Canal approximately a 1/2 mile east of the proposed delivery structure

- Construction of a pump station on the east bank of the re-regulation pond to deliver flows to the IID Division 3A Canal
- Two vertical turbine pumps, each designed to deliver approximately 12.5 cfs at a TDH of 195 feet (400 horsepower each)
- A 1,300-foot, 30-inch-diameter delivery pipeline that would extend south and east through an existing orchard and up an existing access road to the IID Division 3A Canal
- A delivery structure at the IID Division 3A Canal approximately 200 feet downstream of the siphon outlet

The pump station on the Wenatchee River would be located along a portion of the river with a relatively steep, high bank. The bank has been prone to erosion and movement, as evidenced by an existing wood structure that is propped up by wood supports over a portion of the bank that has eroded. The geomorphic analysis completed for the *Peshastin Irrigation District Pump Exchange Project Appraisal Study* recommended locating the pump station adjacent to a portion of the riverbank where bedrock is exposed and a scour hole has developed, as shown in Figure 2, creating more consistent depth for pumping. If the recommended pump station location shown will not work due to access or bank stability issues, an alternate pump station location could be considered closer to the U.S. Highway 2 Bridge.

HYDRAULIC ANALYSIS

Table 3 includes a summary of the hydraulic analysis, pipe sizing for the pump station, and the delivery pipelines. Hydraulic calculations are included as Attachment A.

Table 3
Summary of Hydraulic Analysis Results

Design Parameter	Wenatchee River to PID Canal	PID Canal/Re-regulation Pond to IID Canal
Total Design Flow Rate (cfs)	50	25
Pump Sump/Pond Elevation (feet)	923	1,134
Discharge Elevation (feet)	1,146	1,306
Elevation Gain (feet)	223	172
Delivery Pipe Length (feet)	1,240	1,300
Delivery Pipe Size (inches)	42	30
Total Headloss (feet)	23	23
Pumping Head, TDH (feet)	246	195
Number of Pumps	4	2
Flow Rate per Pump (cfs)	12.5	12.5

PROPERTY OWNER COORDINATION

Figure 2 highlights the parcels that would be impacted by the proposed project. The project would directly impact eight parcels owned by five different property owners. The parcel numbers and property owners are shown, as listed in the Chelan County Assessor's data and GIS parcel map. The impacted property owners are also listed in Table 4.

Table 4
Summary of Impacted Properties

Parcel	Owner
Properties Directly Impacted by the Proposed Project	
241827440800	Don Schoening
241827430250	Frederick Johnson
241827430300	Loren Darlington
241834120150	Willow Springs Orchard, Inc.
241834130050	Willow Springs Orchard, Inc.
241834210000	Willow Springs Orchard, Inc.
241834240250	Willow Springs Orchard, Inc.
248134240050	Jeffrey Todd
Nearby Properties Indirectly Impacted by the Proposed Project	
241827440500	Frank Andrews
241827440650	Andrew and Michelle Weaver
241834110150	Frederick Johnson
241834120100	Blanca Hall
241834110100	Remley Orchards Inc.
241834110050	Willow Springs Orchard, Inc.
241834110200	Remley Orchards Inc.

IPID coordination with impacted property owners is ongoing. The IPID manager is leading the coordination and the Anchor QEA/Aspect team is providing supporting information. Additional coordination will occur in the near future to ensure that impacts to private property do not represent a fatal flaw to implementation of the project.

COST ANALYSIS

The preliminary opinions of probable costs for the preferred alternative, presented as Alternative 1 in the *Peshastin Irrigation District Pump Exchange Appraisal Study*, were updated for this memorandum. Opinions of probable costs were completed for both project implementation costs and long-term operating costs.

Project Implementation Costs

Table 5 summarizes the opinion of probable project implementation costs for the project. The opinion of costs includes the following assumptions and allowances:

- A 10% allowance was included for mobilization/demobilization.
- A 30% contingency was included.
- A 20% allowance was included for engineering, permitting, and construction administration.
- The total project cost includes 8.2% sales tax.
- An allowance of $50,000 was included for land acquisition for pump station and pipeline easements.

The total estimated project cost, including the items listed above, is $8.15 million. Of that, $1.48 million has been included as the 30% contingency to account for project elements that are not understood or have not been well defined at this early stage in the planning process. The contingency will be narrowed down as the planning and design progresses. More detailed breakdowns of the opinions of probable cost are included as Attachment B.

Table 5
Opinion of Probable Costs

Item	Alternative 1
Pump Station and Delivery Pipeline – Wenatchee River to PID Canal	
Miscellaneous Site Work	$68,000
Earthwork	$78,600
Pump Station	$2,061,600
Pipeline	$310,000
Outlet Structure	$25,000
Construction Subtotal	**$2,543,000**
Mobilization/Demobilization (10%)	$254,300
Contingency (30%)	$839,190
Engineering and Administration (20%)	$559,460
Tax (8.2%)	$344,068
Land Acquisition	$50,000
Total Project Costs – Wenatchee River to PID Canal	**$4,590,000**
PID Canal Upgrades and Re-regulation Pond	
Miscellaneous Site Work	$53,600
Re-regulation Pond Earthwork	$414,200
Re-regulation Pond Emergency Overflow/Spillway	$50,000
PID Canal Upgrades	$270,300
Control Structure at Re-regulation Pond	$30,000
Construction Subtotal	**$818,000**
Mobilization/Demobilization (10%)	$81,800
Contingency (30%)	$269,940
Engineering and Administration (20%)	$179,960
Tax (8.2%)	$110,675
Land Acquisition	$50,000
Total Project Costs – PID Canal Upgrades and Re-regulation Pond	**$1,510,000**

Item	Alternative 1
Pump Station and Delivery Pipeline – PID Canal to IID Canal	
Miscellaneous Site Work	$38,100
Earthwork	$41,700
Pump Station	$785,000
Pipeline	$239,200
Outlet Structure	$16,000
Construction Subtotal	**$1,120,000**
Mobilization/Demobilization (10%)	$112,000
Contingency (30%)	$369,600
Engineering and Administration (20%)	$246,400
Tax (8.2%)	$151,536
Land Acquisition	$50,000
Total Project Costs – PID Canal to IID Canal	**$2,050,000**
Total – All Components	
Construction Subtotal	**$4,481,000**
Mobilization/Demobilization (10%)	$448,100
Contingency (30%)	$1,478,730
Engineering and Administration (20%)	$985,820
Tax (8.2%)	$606,279
Land Acquisition	$150,000
Total Project Costs – All Components	**$8,150,000**

Notes:
1 Costs are in 2014 dollars. Actual costs may vary based on material and labor costs at time of construction.
2 Subtotals are rounded to the nearest $100. The Construction Subtotals and Total Project Costs are rounded to the nearest $1,000.

Long-term Operating Costs

Opinions of long-term annual operating costs were also developed for each alternative (in based on the following assumptions:

- An allowance for annual O&M was estimated as 0.8% of the pump station and re-regulation pond implementation costs plus 0.2% of the pipeline implementation costs.

- Pumping power costs are based on Chelan Public Utility District (PUD) Rate Schedule 5, for irrigation service.
- Power costs are also based on the estimated horsepower required to deliver the peak design flow rate.
- The energy charge portion of the power cost was estimated for pumping durations of 15 days, 30 days, and 90 days. A pumping duration of 30 days, or 1 month, will be used as a basis for comparing against other pump exchange alternatives.
- The power costs assume that the monthly basic charge and demand charge would only apply during the irrigation season. It is assumed that the power service would be shut down during the off season.

Table 6 provides summary of the opinion of long-term operating costs for the pump exchange project at Dryden. Additional detail is included in Attachment B.

Table 6
Opinion of Probable Operating Costs

Item	Pumping and Delivery – Wenatchee River to PID Canal	PID Canal Upgrades and Re-regulation Pond	Pumping and Delivery – PID Canal to IID Canal	Total
Annual O&M Costs[1]	$31,507	$8,755	$12,721	$52,983
Pump Power Costs[2]				
15-day Annual Pumping Duration	$44,135	-	$17,697	$61,832
30-day Annual Pumping Duration	$52,997	-	$21,242	$74,240
90-day Annual Pumping Duration	$88,447	-	$35,422	$123,870
Total Annual Operating Costs[3]				
15-day Annual Pumping Duration	$75,600	$8,755	$30,400	$114,800
30-day Annual Pumping Duration	$84,500	$8,755	$34,000	$127,300
90-day Annual Pumping Duration	$120,000	$8,755	$48,100	$176,900

Notes:
1 Annual O&M Costs are assumed equal to 0.8% of the pump station project and re-regulation pond costs plus 0.2% of pipeline costs.
2 Pump Power Costs are based on the Chelan PUD Electrical Rate Schedule 5 (Irrigation Service).
3 Total Annual Operating Costs are rounded to the nearest $100.

Life Cycle Replacement Cost Analysis

Replacement costs were evaluated to determine the annual deposit that would need to be made to an account to fund replacement of the facilities at the end of the assumed life cycle for the project. It is likely that components of the project will have longer or shorter design life cycles; however, to simplify the analysis, an overall design life cycle of 50 years was assumed. It is also unlikely that all of the facilities would need to be completely replaced at the end of the assumed life cycle. For this reason, the analysis was performed for three levels of replacement: 25, 50, and 100%. The life cycle replacement cost analysis is also included in Attachment B.

Two methods of annual deposit to a replacement fund were evaluated. The first would be a constant annual deposit through the life of the project. The second would be an increasing annual deposit, escalated at the assumed annual inflation rate of 3%. Table 7 summarizes the total estimated annual replacement fund costs at project years 1, 25, and 50.

Table 7
Estimated Annual Replacement Fund Costs

Year	Level of Replacement	Total for Pump Exchange Alternative at Dryden
1-50	25%	$82,735
	50%	$165,470
	100%	$330,940
1	25%	$43,852
	50%	$87,704
	100%	$175,409
25	25%	$89,143
	50%	$178,285
	100%	$356,570
50	25%	$186,645
	50%	$373,290
	100%	$746,579

Funding for Total Project Costs

The purpose of developing opinions of project costs is to help stakeholders identify potential funding opportunities and costs constraints. IPID has indicated that funding for both project implementation and long-term power and O&M costs would need to be secured to make the project viable. Table 8 summarizes total project costs that would need funding, including the project implementation cost and the present value of estimated annual long-term operating costs through the assumed 50-year life cycle of the project.

Table 8
Total Costs Requiring Funding

Annual Pumping Duration	Total Project Implementation Cost[1]	Present Value of O&M Costs[2]	Present Value of Power Costs[3]	Present Value of Total Project Costs[4]
15 Days	$8,150,000	$2,649,000	$3,092,000	**$13,891,000**
30 Days	$8,150,000	$2,649,000	$3,712,000	**$14,511,000**
90 Days	$8,150,000	$2,649,000	$6,193,000	**$16,992,000**

Notes:
1 Total Project Implementation Cost includes construction, engineering, administration, contingency, and taxes.
2 Present Value of Annual O&M Costs through assumed 50-year project life cycle.
3 Present Value of Annual Power Costs through assumed 50-year project life cycle.
4 Sum of Total Project Cost, Present Value of O&M Costs, and Present Value of Power Costs.

COMPARISON WITH OTHER ALTERNATIVES

As noted previously, several alternatives have been evaluated for a pump exchange project that would deliver water from the Wenatchee River to the PID or IID canals. Table 9 lists and compares the features of each of the alternatives that have been considered for the IPID Pump Exchange Project. The following notes highlight some of the similarities between the various alternatives that have been evaluated:

- Alternative 1 was the preferred alternative evaluated in the *PID Pump Exchange Appraisal Study* and is the alternative currently being evaluated.
- Alternative 1 from the *PID Pump Exchange Appraisal Study* and Option 4 from the *IID Instream Flow Improvement Options Analysis Study* would pump water from roughly the same location, on the right bank of the Wenatchee River upstream of the Highway 2 Bridge near Dryden. Alternative 1 from the *PID Pump Exchange Appraisal Study* would deliver water to both the PID Canal and IID Division 3A

Canal. Option 4 from the *IID Instream Flow Improvement Options Analysis Study* would deliver water to the IID Division 3A Canal only.

- Alternative 5 from the *PID Pump Exchange Appraisal Study* and Option 5-West from the *IID Instream Flow Improvement Options Analysis Study* would pump water from the same location, on the right bank of the Wenatchee River upstream of the Dryden Diversion Dam. Alternative 5 from the *PID Pump Exchange Appraisal Study* would deliver water to both the PID Canal and IID Division 3A Canal. Option 5-West from the *IID Instream Flow Improvement Options Analysis Study* would deliver flow to the IID Division 3A Canal only.
- The alternative identified in *IID Pump Exchange – Initial Project Assessment* is essentially the same as Option 6 from the *IID Instream Flow Improvement Options Analysis Study*. Both studies evaluated a pump station on the Wenatchee River at the IID Leavenworth Siphon. The evaluation of this alternative in the *IID Pump Exchange – Initial Project Assessment* was very cursory. The *IID Instream Flow Improvement Options Analysis Study* evaluated this alternative in more detail and analyzed three different options for delivery.

Table 9
Summary of Alternatives Evaluated

Study	Alternative/ Option	Delivery To	Pump Station Location	Capacity (gpm)	Discharge Location	Discharges To	Delivery Pipe Length (feet)
PID Pump Exchange Appraisal Study	1	PID and IID Canals	Right Bank of Wenatchee River, South of Highway 2 Bridge Near Dryden	10, 20, 40	PID Canal North of Deadman Hill Rd, IID Canal South of Deadman Hill Rd	Gravity Canal Systems	1,240 to PID + 2,250 to IID
	2	PID Canal	Right Bank of Wenatchee River, North of Highway 2 Bridge Near Dryden	10, 20, 40	PID Canal North of Deadman Hill Rd	Gravity Canal System	1,790 to PID
	3	PID Canal	Right Bank of Wenatchee River, South of Highway 2 Bridge further West of Dryden	10, 20, 40	PID Canal at Pipeline Near Transfer Station/Old Landfill	Gravity Canal System	1,490 to PID
	4	PID Canal	Right Bank of Wenatchee River, 0.4 miles Downstream of Dryden Diversion Dam	10, 20, 40	PID Canal Upstream of Pipe Near Transfer Station/Old Landfill	Gravity Canal System	3,240 to PID
	5	PID and IID Canals	Right Bank of Wenatchee River, Upstream of Dryden Diversion Dam	10, 20, 40	PID Canal North of Deadman Hill Rd, IID Canal South of Deadman Hill Rd	Gravity Canal Systems	4,910 to PID + 2,700 to IID
IID Pump Exchange – Initial Project Assessment	1	IID Canal	Left Bank of Wenatchee River, at Leavenworth Siphon	30	Leavenworth Siphon	Pressurized Siphon	Limited – Pump Station to Siphon
IID Instream Flow Improvement Options Analysis Study	1A	IID Canal	Right Bank of Wenatchee River on WDFW Parcel at Monitor Bridge	13.91	Pressurized Delivery in IID Division 3B Canal to Weed Screen Spill	Pressurized Delivery Pipeline	9,042 Transmission + 16,467 Delivery
	1B	IID Canal	Right Bank of Wenatchee River on WDFW Parcel at Monitor Bridge	13.91	Pressurized Delivery System in Monitor near IID Division 3B Canal	Pressurized Delivery System	2,795 Transmission + 26,756 Delivery
	2A	IID Canal	Right Bank of Wenatchee River at South End of City of Cashmere Treatment Plant	13.91	IID Division 3B Canal, Above City of Cashmere Treatment Plant	Gravity Canal System	831 Transmission
	2B	IID Canal	Right Bank of Wenatchee River at South End of City of Cashmere Treatment Plant	22.39	Pressurized Delivery in IID Division 3B Canal to Downstream end of Mission Siphon	Pressurized Delivery Pipeline	831 Transmission + 8,274 Delivery
	3A	IID Canal	Right Bank of Wenatchee River at Cashmere Near Mill Site and Railroad Tracks	22.39	IID Division 3A Canal, Upstream end of Mission Siphon	Gravity Canal System	7,102 Transmission
	3B	IID	Right Bank of Wenatchee River at Cashmere Near Mill Site and Railroad Tracks	29.53	Pressurized Delivery in IID Division 3A Canal to Downstream of Peshastin Siphon	Pressurized Delivery Pipeline	7,102 Transmission + 42,502 Delivery
	4	IID	Right Bank of Wenatchee River, South of Highway 2 Bridge Near Dryden	28.99	IID Canal South of Deadman Hill Rd	Gravity Canal System	3,132 Transmission
	5-West	IID	Right Bank of Wenatchee River, Upstream of Dryden Diversion Dam	29.52	IID Division 3A Canal Downstream of Peshastin Siphon	Gravity Canal System	6,564 Transmission
	5-East	IID	Left Bank of Wenatchee River, Upstream of Dryden Diversion Dam	10.40	IID Division 4 Canal, Above Dryden Diversion Dam	Gravity Canal System	425 Transmission
	6A	IID	Left Bank of Wenatchee River, at Leavenworth Siphon	30.41	Upstream End of IID Division 4 and 5 Canals	Gravity Canal System	5,146 Transmission
	6B	IID	Left Bank of Wenatchee River, at Leavenworth Siphon	62.04	Upstream End of IID Division 4 and 5 Canals, Upstream End of IID Division 2 Canal	Gravity Canal System	6,010 Transmission
	6C	IID	Left Bank of Wenatchee River, at Leavenworth Siphon	117.00	Upstream End of IID Division 4 and 5 Canals, Upstream End of IID Division 2 Canal, Pressure Delivery to IID Division 1 Canal	Pressurized System and Gravity Canal System	6,010 Transmission + Small Delivery to Division 1 Canal Users
Current Evaluation	1	PID and IID	Right Bank of Wenatchee River, South of Highway 2 Bridge Near Dryden	50	PID Canal North of Deadman Hill Rd, IID Canal South of Deadman Hill Rd	Gravity Canal Systems, Re-regulation Pond on IID Canal	1,240 to PID + 1,300 to IID

Key considerations for evaluating the Pump Exchange Project alternatives have included:

- Proximity of pump station location to canal or delivery system
- Access and adequacy of pump station sites and delivery pipeline alignments
- Property owner impacts and feasibility of acquiring easements and property
- Geomorphic and geotechnical feasibility
- Hydraulics
- Environmental impacts and permitting requirements
- Capacity
- Implementation, operating, and replacement costs

None of the alternatives have been evaluated in enough detail to have resolved all potential feasibility issues. The studies have generally evaluated the alternatives in enough detail to identify potential challenges related to the key considerations above and to understand the potential costs and benefits.

Table 10 provides a comparison of the assumptions and approach used in developing the implementation, operating, and replacement costs associated with each alternative. As described in Table 10, the studies used different assumptions to develop opinions of probable project implementation costs. Different contingencies and allowances were included in each. The costs were also developed at different times and are likely based on different information about unit costs.

Pumping power and pumping duration were estimated differently in the studies and it is not clear whether the same power rate schedule was used for the studies. O&M costs were also estimated differently for the studies. A detailed life cycle cost analysis was completed for the *PID Pump Exchange Appraisal Study* to evaluate the cost of a replacement fund needed to replace facilities through the design life cycle of the project and to project O&M costs through the life cycle of the project. This was not done for the *IID Instream Flow Improvement Options Analysis Study*.

Table 10
Comparison of Cost Analysis Approach and Assumptions

Assumption or Parameter	PID Pump Exchange Appraisal Study	IID Pump Exchange Initial Project Assessment	IID Instream Flow Improvement Options Analysis Study	Current Evaluation
Year Costs Developed	2012	2013	2014	2014
Implementation Costs				
Mobilization/Demobilization	10% of Construction Cost	Not Evaluated	Not Listed	10% of Construction Cost
Contingency	30% of Construction Cost	Not Evaluated	20% of Construction Cost	30% of Construction Cost
Engineering/Permitting/Administration	20% of Construction Cost	Not Evaluated	30% of Construction Cost	20% of Construction Cost
Sales Tax	8.0% of Total Cost	Not Evaluated	8.2% of Total Cost	8.2% of Total Cost
Land Acquisition	$50,000 Allowance	Not Evaluated	Not Listed	$50,000 Allowance
Pumping Costs				
Rate Schedule	Chelan PUD Rate Schedule 5	Not Evaluated	Based on Pioneer Ditch	Chelan PUD Rate Schedule 5
Pumping Horsepower	Based on horsepower required to deliver peak capacity over duration	Not Evaluated	Based on annual volume estimated using crop irrigation requirements and assumed efficiencies	Based on horsepower required to deliver peak capacity over duration
Pumping Duration	2-week, 4-week, 6-week, and 8-week duration	Not Evaluated	Full Irrigation Season	15-day, 30-day, and 90-day duration
Operations and Maintenance Costs				
Approach	Estimated salary for ½ full-time equivalent, benefits, transportation, repairs, maintenance, and administration	Not Evaluated	Estimated as 0.8% of pump station capital cost and 0.2% of pipeline capital cost	Estimated as 0.8% of pump station and re-regulation pond capital cost and 0.2% of pipeline capital cost
Life Cycle Replacement Costs				
Approach	Estimated over 50-year design life cycle	Not Evaluated	Not Evaluated	Estimated over 50-year design life cycle

IPID has indicated that the two alternatives that they would most likely consider moving forward include:

- Alternative 1 -– the current version of the preferred pumping alternative at Dryden, as outlined and evaluated in this memorandum
- Option 6B – the pump station alternative at the IID Leavenworth Siphon that would deliver water to both sides of the Wenatchee River

Because the cost analyses of these two alternatives were prepared by the Anchor QEA/Aspect team (Alternative 1) and Forsgren Associates (Option 6B) based on different assumptions, IPID asked that the numbers be reviewed using a similar set of criteria and assumptions so that the alternatives can be more easily compared to one another. Primarily, the method of estimating long-term costs and life cycle replacement costs was reviewed and a common method was applied to both alternatives by the Anchor QEA/Aspect team to provide a better basis for comparison. Table 11 summarizes the assumptions that were used. Table 12 provides a comparison of the two alternatives based on the results.

Table 11
Comparison of Cost Analysis Approach and Assumptions

Assumption or Parameter	Common Assumption/Criteria
Year Costs Developed	2014
Implementation Costs	
Mobilization/Demobilization	10% of Construction Cost
Contingency	30% of Construction Cost
Engineering, Permitting, Administration	20% of Construction Cost
Sales Tax	8.2% of Total Cost
Land Acquisition	$50,000 Allowance
Pumping Costs	
Rate Schedule	Chelan PUD Rate Schedule 5
Pumping Horsepower	Based on horsepower required to deliver peak capacity over duration
Pumping Duration	30-day (1-month)
Operations and Maintenance Costs	
Approach	Estimated as 0.8% of pump station and re-regulation pond capital cost and 0.2% of pipeline capital cost
Life Cycle Replacement Costs	
Approach	Estimated over 50-year design life cycle

Table 12
Comparison Dryden and IID Leavenworth Siphon Alternatives

Characteristic	Dryden	IID Leavenworth Siphon
Study	This Memorandum	IID Instream Flow Improvement Options Analysis Study
Alternative/Option	1	6B
Location	Near Highway 2 Bridge Immediately West of Dryden, Washington	Near IID Siphon Crossing Wenatchee River, near Leavenworth, Washington
Capacity[1]	50 cfs	62 cfs
Opinion of Probable Project Costs[2]	$8,150,000	$8,137,000
Opinion of Probable Annual O&M Costs[3]	$52,983	$58,184
Opinion of Probable Annual Pumping Costs[4]	$74,240	$77,131
Opinion of Probable Annual Replacement Costs[5]	$87,704	$87,849
Key Considerations	• Delivery to Both PID and IID • Good Depth at Pump Station Site, Scour Hole • Steep, Rocky Pump Station Site, Difficult Access • Private Property Impacts • Reliability, Downstream of Worst Section of Canal	• Delivery to IID Only • Larger Area Served, Flow Rate • Access from East Side of River • Good Depth, Conditions at Pump Station Site • Siphon Upgrade/ Replacement

Notes:
1 Represents the peak design capacity of the system.
2 Represents the revised opinion of probable implementation costs developed based on the Common Assumptions listed in Table 11.
3 Represents the revised opinion of annual O&M costs based on the Common Assumptions listed in Table 11.
4 Represents the revised annual pumping costs based on the estimated peak horsepower and other Common Assumptions listed in Table 11. Assumes pumping during a 30-day (1-month) low-flow period only.
5 Represents the annual deposit required in a replacement fund during the first year of funding to fund replacement of 50% of all facilities during the 50-year design life. Assumes deposits will increase through the life cycle at an assumed 3% rate of inflation.

REFERENCES

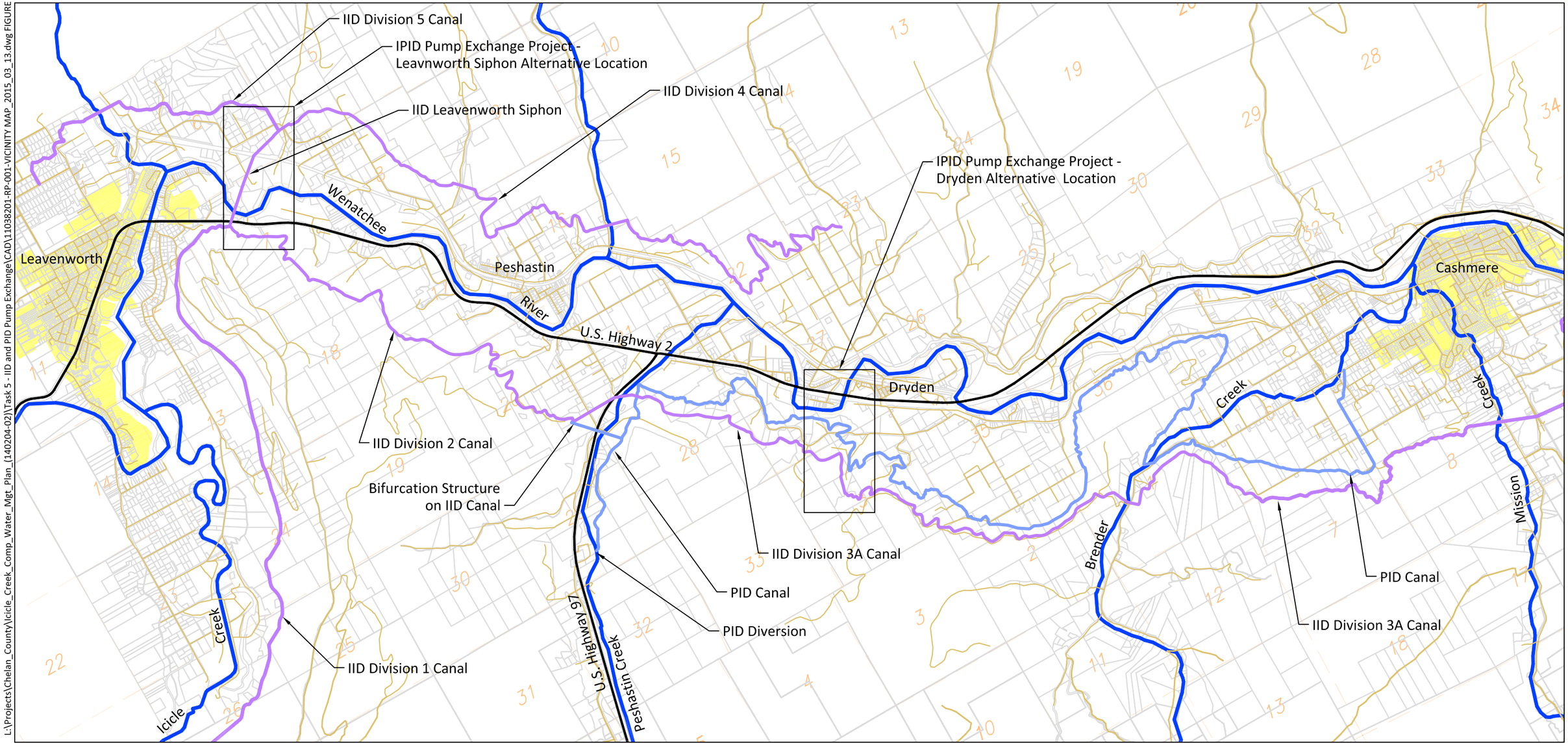
Anchor Environmental (Anchor Environmental, L.L.C.), 2007. *Peshastin Sub-basin Needs and Alternatives Analysis*. Prepared under direction of Chelan County Natural Resources Department for the Washington State Department of Ecology. January 2007.

Anchor QEA (Anchor QEA, LLC), 2012. *Peshastin Irrigation District Pump Exchange Project Appraisal Study*. Prepared under direction of Chelan County Natural Resources Department for the Washington State Department of Ecology. September 2012.

Anchor QEA, 2013. *Icicle Irrigation District – Initial Project Assessment Memorandum.* Prepared under direction of Chelan County Natural Resources Department for the Washington State Department of Ecology. February 2013.

Forsgren Associates, 2014. Draft *Icicle Irrigation District Instream Flow Improvement Options Analysis Study*. Prepared under direction of Trout Unlimited. July 2014.

FIGURES



SOURCE: Basemap with Parcels and Other Data from Chelan County GIS.

HORIZONTAL DATUM: Washington State Plane North, NAD83.

VERTICAL DATUM: NAVD 88.

LEGEND:

- Existing Icicle Irrigation Distirct (IID) Canal
- Existing Peshastin Irrigation District (PID) Canal
- Parcels

0 4,000

Scale in Feet

L:\Projects\Chelan_County\Icicle_Creek_Comp_Water_Mgt_Plan_(140204-02)\Task 5 - IID and PID Pump Exchange\CAD\110382O1-RP-001-VICINITY MAP_2015_03_13.dwg FIGURE 1 - ALT COM

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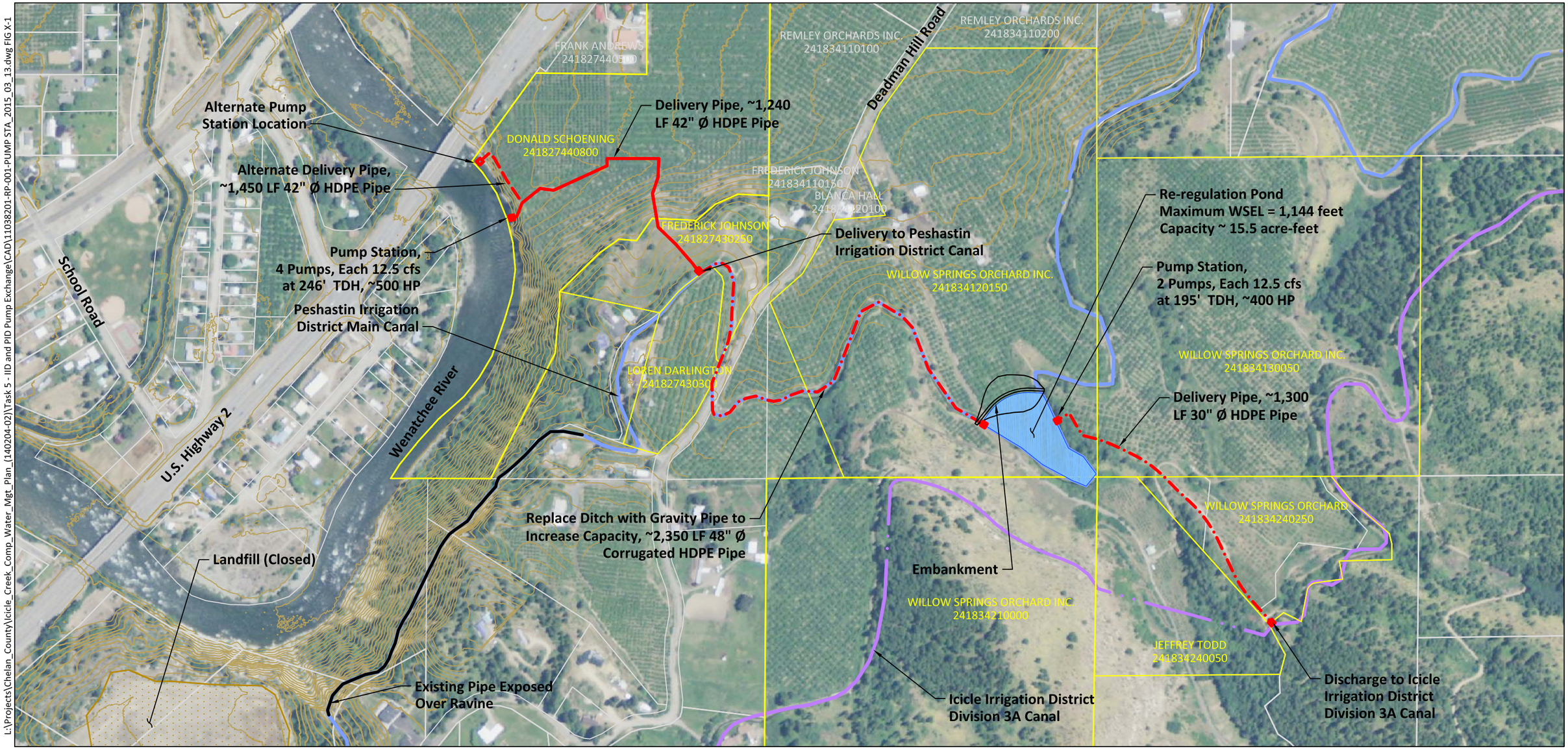
ANCHOR QEA

Figure 1

Icicle and Peshastin Irrigation Districts - VIcinity Map

IPID Pump Exchange

Chelan County Natural Resources Department/Icicle and Peshastin Irrigation Districts



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Mar 13, 2015 1:12pm ahill

SOURCE: Basemap with 2006 NAIP Aerial Photography and 10-foot contours generated from LIDAR.

HORIZONTAL DATUM: Washington State Plane North, NAD83.

VERTICAL DATUM: NAVD 88.

LEGEND:

- Existing PID Canal
- Existing IID Canal
- Existing Pipe
- Contour (10-foot)
- Parcel Boundary
- Parcels Impacted By Project
- Proposed Pump Station or Delivery Structure
- Proposed Pump Station (Alternate Location)
- Proposed Pipeline (to PID)
- Proposed Pipeline (Alternate Location)
- Proposed Pipeline (to IID)
- Proposed Re-regulation Pond
- Proposed Embankment

0 400

Scale in Feet

ANCHOR QEA

Figure 2

Preferred Alternative Concept Plan

IPID Pump Exchange

Chelan County Natural Resources Department/Icicle and Peshastin Irrigation Districts

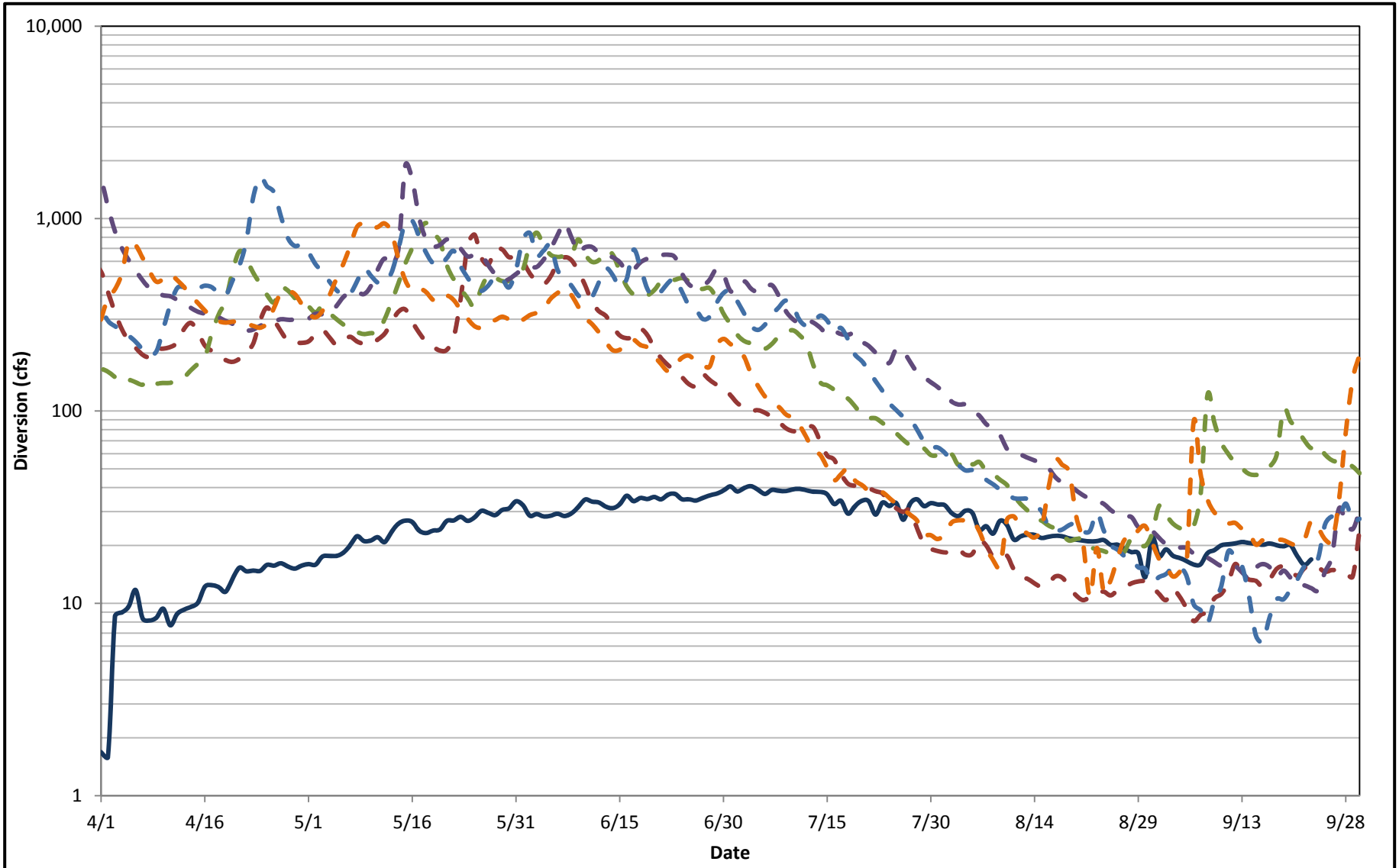

Figure 3
PID Diversions and Peshastin Creek Flows at Green Bridge Road
IPID Pump Exchange

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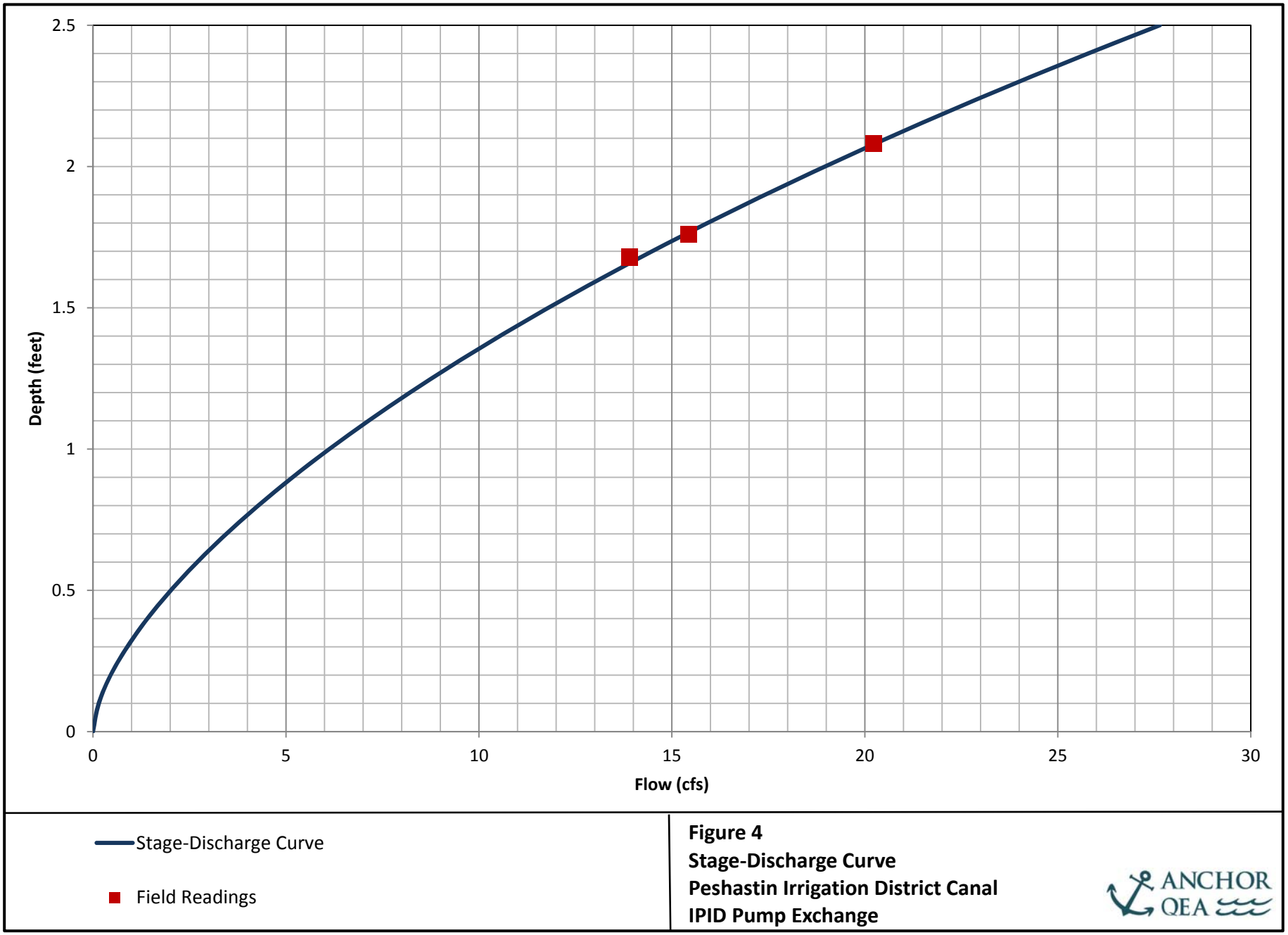

Figure 4
Stage-Discharge Curve
Peshastin Irrigation District Canal
IPID Pump Exchange

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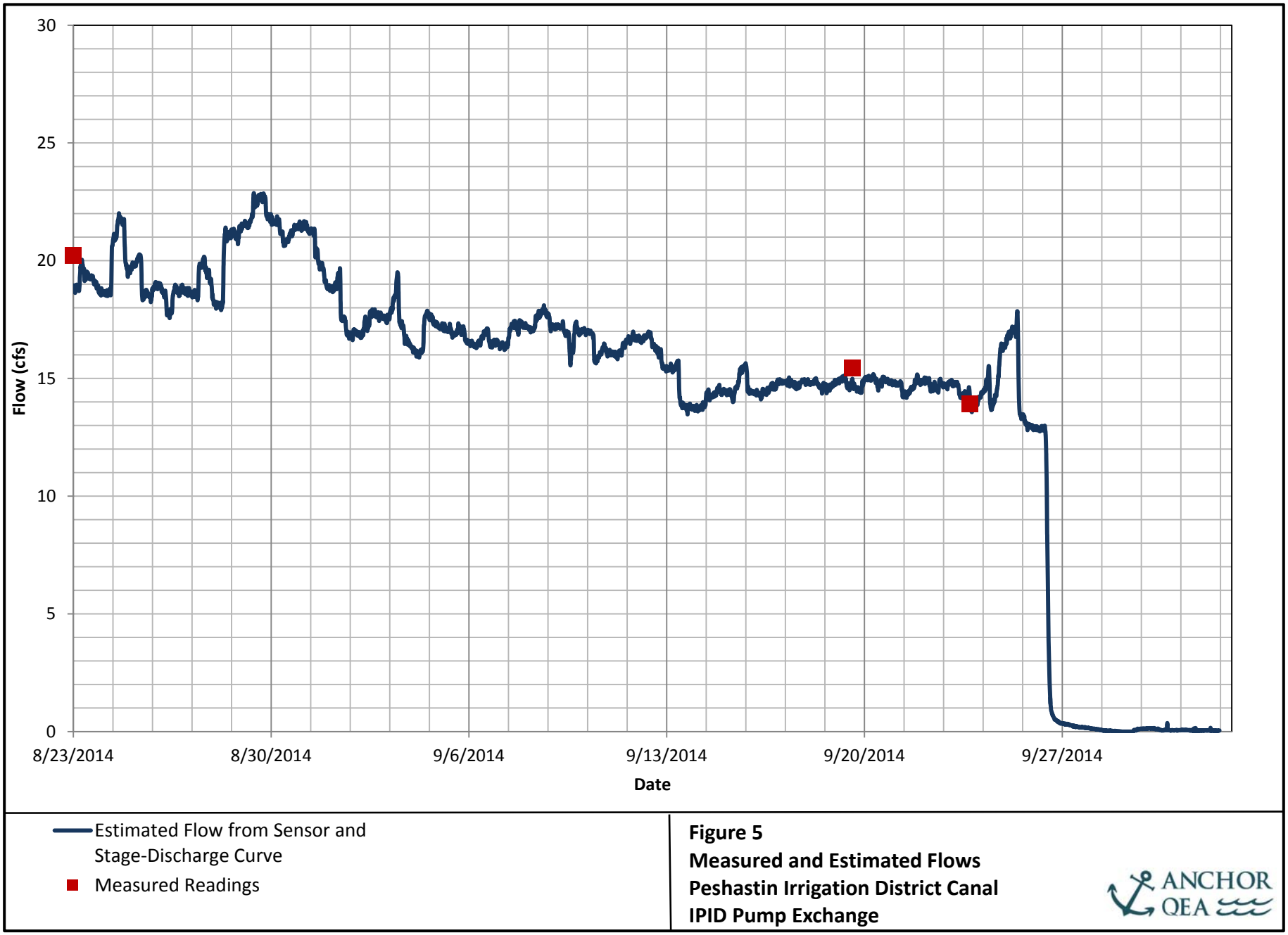

Figure 5
Measured and Estimated Flows
Peshastin Irrigation District Canal
IPID Pump Exchange

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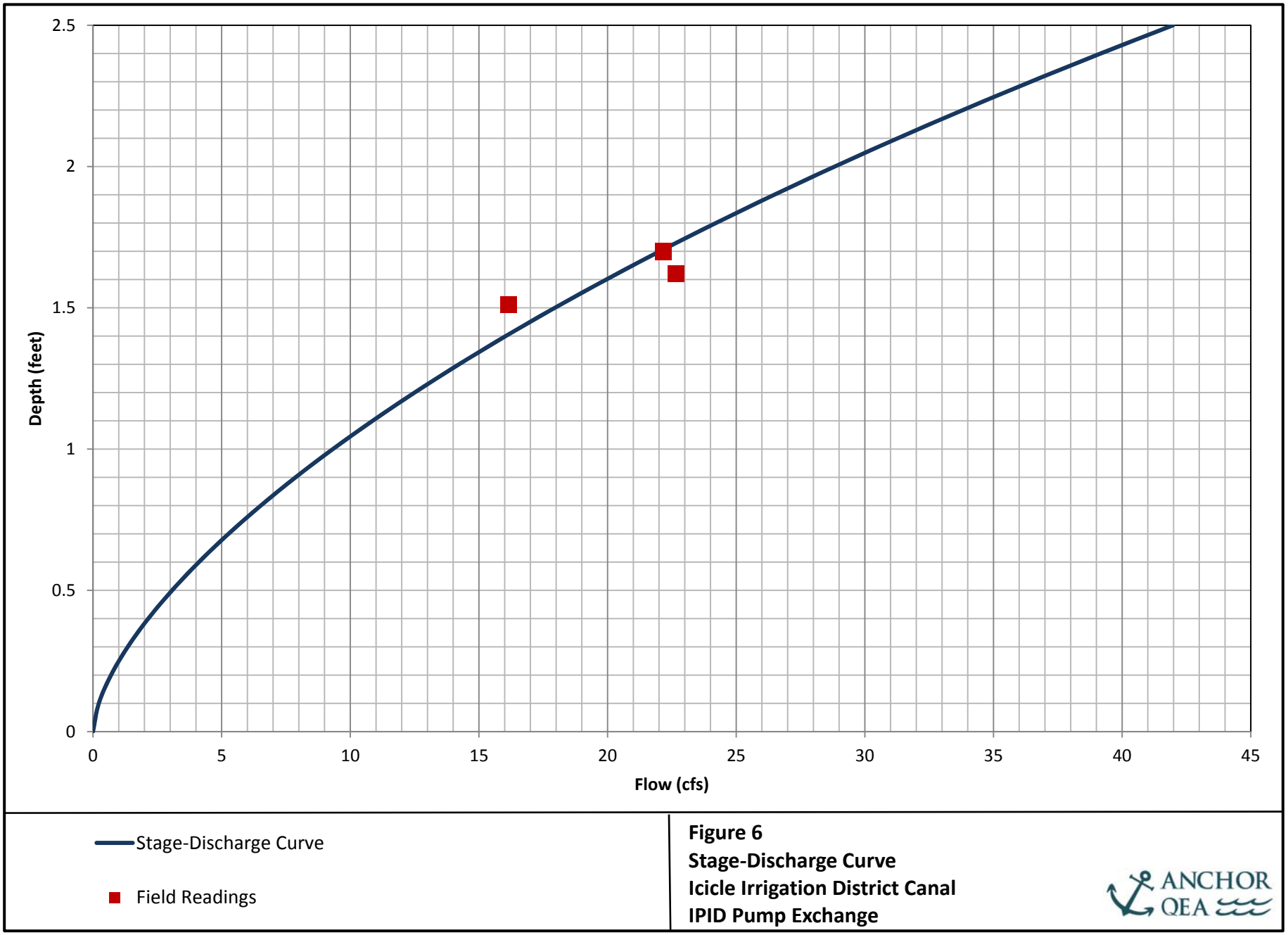

Figure 6
Stage-Discharge Curve
Icicle Irrigation District Canal
IPID Pump Exchange

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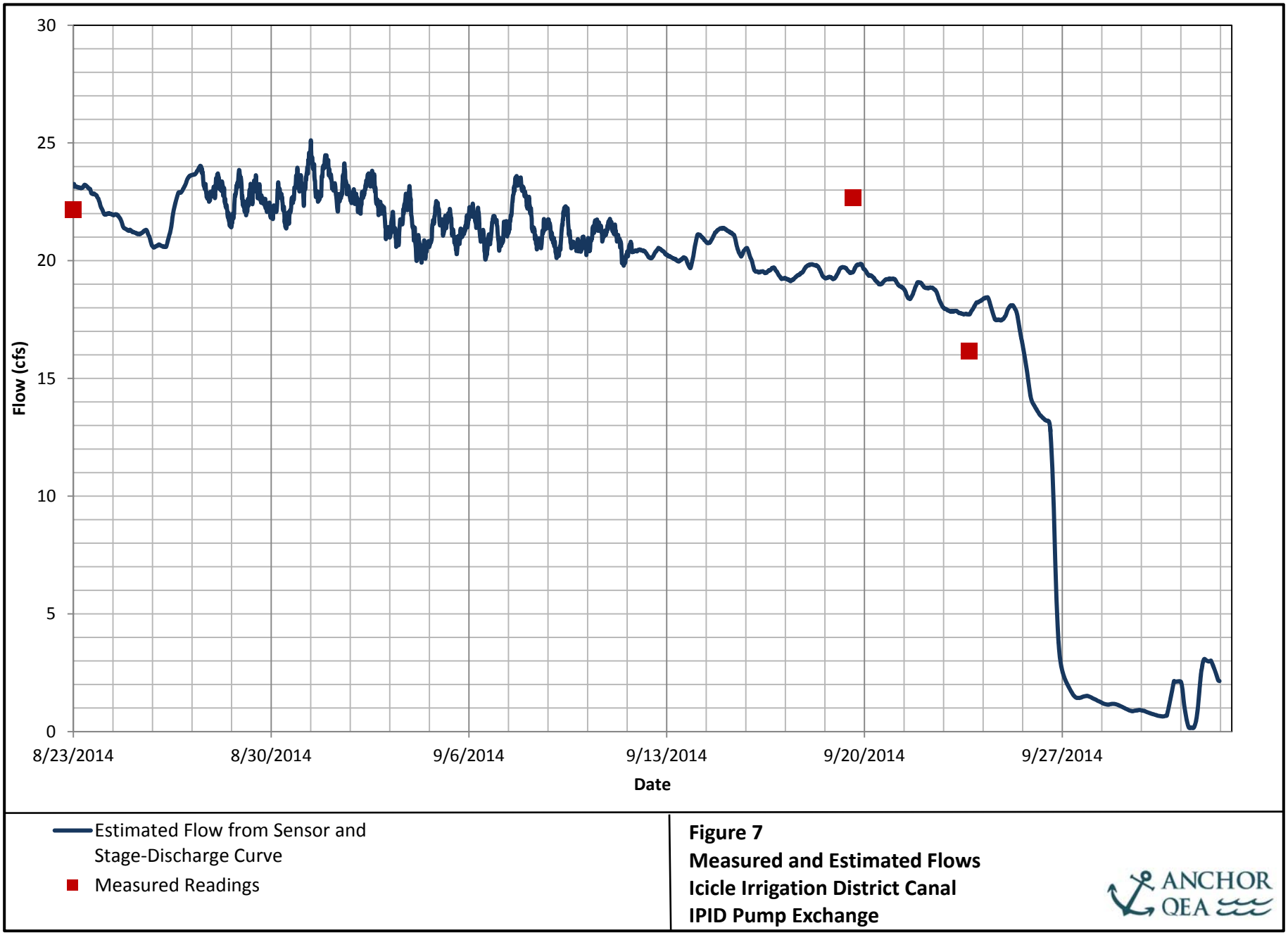

Figure 7
Measured and Estimated Flows
Icicle Irrigation District Canal
IPID Pump Exchange

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ATTACHMENT A
PUMP STATION HYDRAULIC ANALYSIS

Preliminary Water Storage and Volume Calculations
Icicle Irrigation District Reregulation Reservoir

BY: David Rice, PE
DATE: 13-Mar-15

BLACK CELLS ARE INPUT
BLUE CELLS ARE CALCULATED VALUES

Max. Water Surface Elev.:	1,144	Feet
Freeboard:	3	Feet
Top of Embankiment Elev.:	1,147	Feet
Embankment Top Width:	10	Feet
Embankment Side Slopes:	3.0	H:1 V (Upstream)
	2.5	H:1 V (Downstream)

TOTALS:		
WATER STORAGE VOLUME:	**15.5**	**Acre-ft**
CUT VOLUME:	**3,891**	**CY**
FILL VOLUME:	**13,756**	**CY**
CUT-FILL VOLUME:	**(9,864)**	**CY**

			WATER STORAGE				CUT - MAIN DAM			FILL - MAIN DAM		
Location	Elevation (ft)	D Elevation (ft)	Water Surface Area (ft^2)	Water Surface Area (Acres)	Average Area (Acres)	Storage Volume (Acre-ft)	Cut Area (ft^2)	Average Cut Area (ft^2)	Cut Volume (CY)	Fill Area (ft^2)	Average Fill Area (ft^2)	Fill Volume (CY)
	1,118			0.00						0		
		2			**0.00**	**0.0**		**0**	**0**		**1,318**	**98**
	1,120			0.00			0			2,636		
		2			**0.09**	**0.2**		**2,611**	**193**		**7,527**	**558**
	1,122		7,923	0.18			5,221			12,417		
		2			**0.21**	**0.4**		**5,150**	**381**		**14,224**	**1,054**
	1,124		10,805	0.25			5,079			16,030		
		2			**0.29**	**0.6**		**5,254**	**389**		**16,915**	**1,253**
	1,126		14,073	0.32			5,428			17,799		
		2			**0.36**	**0.7**		**5,556**	**412**		**18,184**	**1,347**
	1,128		17,712	0.41			5,683			18,568		
		2			**0.45**	**0.9**		**5,877**	**435**		**18,598**	**1,378**
	1,130		21,774	0.50			6,070			18,627		
		2			**0.55**	**1.1**		**6,014**	**445**		**18,383**	**1,362**
	1,132		26,217	0.60			5,958			18,138		
		2			**0.66**	**1.3**		**5,567**	**412**		**17,700**	**1,311**
	1,134		31,022	0.71			5,176			17,261		
		2			**0.77**	**1.5**		**4,993**	**370**		**16,635**	**1,232**
	1,136		36,192	0.83			4,809			16,009		
		2			**0.89**	**1.8**		**4,475**	**331**		**15,172**	**1,124**
	1,138		41,715	0.96			4,140			14,334		
		2			**1.02**	**2.0**		**3,603**	**267**		**13,332**	**988**
	1,140		47,529	1.09			3,066			12,329		
		2			**1.16**	**2.3**		**2,485**	**184**		**11,176**	**828**
	1,142		53,651	1.23			1,903			10,023		
		2			**1.31**	**2.6**		**952**	**70**		**8,727**	**646**
WSEL	1,144		60,060	1.38			0			7,431		
		3						**0**	**0**		**5,210**	**579**
Top	1,147									2,989		

SYSTEM CURVE CALCULATION

PROJECT: **ICICLE AND PESHASTIN IRRIGATION DISTRICTS (IPID) PUMP EXCHANGE - 2014 SUPPLEMENTAL WORK**

ALTERNATIVE: **PREFERRED DRYDEN ALTERNATIVE - PID CANAL TO IID CANAL - 25 CFS DESIGN FLOW - 2 PUMPS**

BY: David Rice, P.E.

DATE: 13-Mar-15

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	1142.0 feet	Re-regulation Pond
HWL	1144.0 feet	Re-regulation Pond (High WSEL)
LWL	1134.0 feet	Re-regulation Pond (Low WSEL)

DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1305.5 feet	IID Canal Bottom
HIGH	1308.0 feet	IID Canal (High Flow)
LWL	1306.0 feet	IID Canal (Low Flow)

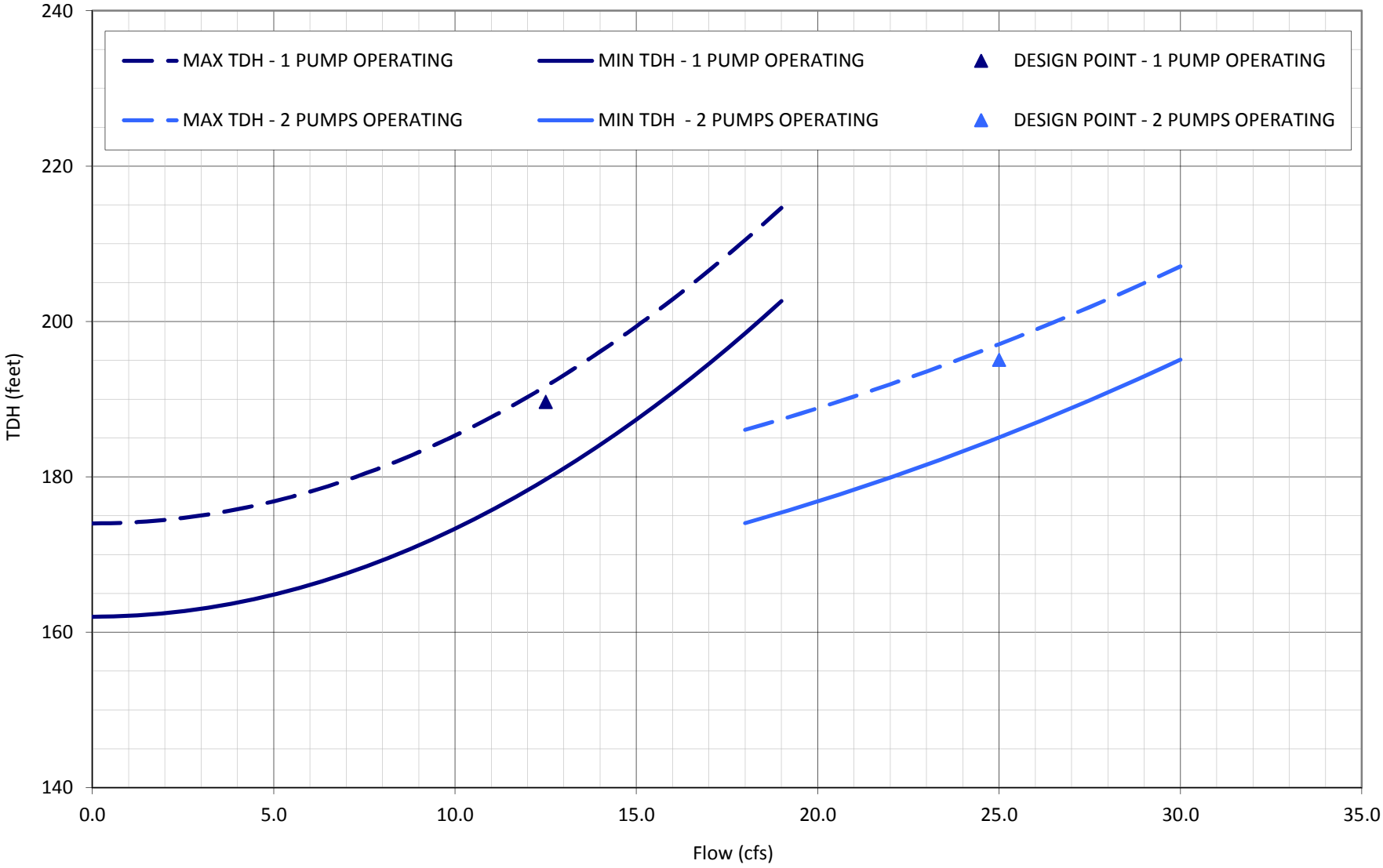
PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					18	18		30
O.D. (in)					18	18		30
I.D. (in)					18	18		30
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	8		1,300
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	5610	12.5	190	384.2
2	11222	25.0	195	790.4
*Assumes	70%	Efficiency		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
(gpm)	(cfs)	18-inch (fps)	18-inch (fps)	-inch (fps)	30-inch (fps)	Minor (feet)	Friction (feet)	Minor (feet)	Friction (feet)	Minor (feet)	Friction (feet)	Minor (feet)	Friction (feet)	Minor (feet)	Friction (feet)	MIN (feet)	MAX (feet)	DESIGN (feet)	MIN (feet)	MAX (feet)	DESIGN (feet)	MIN (feet)	MAX (feet)	DESIGN (feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0			162.0	174.0	172.0	162.0	174.0	172.0			
449	1.0	0.57	0.57		0.20			0.0	0.0	0.1	0.0	0.0	0.0			162.1	174.1	172.1	162.0	174.0	172.0			
898	2.0	1.13	1.13		0.41			0.0	0.0	0.4	0.0	0.1	0.0			162.5	174.5	172.5	162.2	174.2	172.2			
1346	3.0	1.70	1.70		0.61			0.1	0.1	0.9	0.0	0.2	0.0			163.0	175.0	173.0	162.4	174.4	172.4			
1795	4.0	2.26	2.26		0.81			0.1	0.1	1.6	0.0	0.4	0.0			163.8	175.8	173.8	162.6	174.6	172.6			
2244	5.0	2.83	2.83		1.02			0.2	0.2	2.5	0.0	0.6	0.0			164.8	176.8	174.8	163.0	175.0	173.0			
2693	6.0	3.39	3.39		1.22			0.2	0.2	3.6	0.0	0.9	0.0			166.1	178.1	176.1	163.4	175.4	173.4			
3142	7.0	3.96	3.96		1.43			0.3	0.3	4.9	0.1	1.2	0.0			167.6	179.6	177.6	163.9	175.9	173.9			
3590	8.0	4.53	4.53		1.63			0.4	0.4	6.4	0.1	1.6	0.0			169.3	181.3	179.3	164.4	176.4	174.4			
3740	8.3	4.72	4.72		1.70			0.4	0.4	6.9	0.1	1.7	0.0			169.9	181.9	179.9	164.6	176.6	174.6			
4039	9.0	5.09	5.09		1.83			0.5	0.5	8.1	0.1	2.0	0.0			171.2	183.2	181.2	165.1	177.1	175.1			
4488	10.0	5.66	5.66		2.04			0.6	0.6	9.9	0.1	2.5	0.0			173.3	185.3	183.3	165.8	177.8	175.8			
4937	11.0	6.22	6.22		2.24			0.8	0.7	12.0	0.1	3.0	0.0			175.7	187.7	185.7	166.6	178.6	176.6			
5386	12.0	6.79	6.79		2.44			0.9	0.9	14.3	0.2	3.6	0.0			178.3	190.3	188.3	167.4	179.4	177.4			
5610	**12.5**	**7.07**	**7.07**		**2.55**			**1.0**	**0.9**	**15.5**	**0.2**	**3.9**	**0.1**			**179.6**	**191.6**	**189.6**	**167.9**	**179.9**	**177.9**			
5835	13.0	7.36	7.36		2.65			1.1	1.0	16.8	0.2	4.2	0.1			181.1	193.1	191.1	168.3	180.3	178.3			
6284	14.0	7.92	7.92		2.85			1.3	1.1	19.5	0.2	4.9	0.1			184.1	196.1	194.1	169.3	181.3	179.3			
6733	15.0	8.49	8.49		3.06			1.4	1.3	22.4	0.3	5.6	0.1			187.4	199.4	197.4	170.4	182.4	180.4			
7182	16.0	9.05	9.05		3.26			1.6	1.5	25.5	0.3	6.4	0.1			190.9	202.9	200.9	171.5	183.5	181.5			
7480	16.7	9.43	9.43		3.39			1.8	1.6	27.6	0.3	6.9	0.1			193.3	205.3	203.3	172.3	184.3	182.3			
7631	17.0	9.62	9.62		3.46			1.9	1.6	28.7	0.3	7.2	0.1			194.6	206.6	204.6	172.8	184.8	182.8			
8080	18.0	10.19	10.19		3.67			2.1	1.8	32.2	0.4	8.1	0.1			198.5	210.5	208.5	174.1	186.1	184.1			
8528	19.0	10.75	10.75		3.87			2.3	2.0	35.9	0.4	9.0	0.1			202.6	214.6	212.6	175.4	187.4	185.4			
8977	20.0	11.32	11.32		4.07			2.6	2.2	39.8	0.4	9.9	0.1			207.0	219.0	217.0	176.8	188.8	186.8			
9426	21.0	11.88	11.88		4.28			2.8	2.4	43.9	0.5	11.0	0.1			211.6	223.6	221.6	178.3	190.3	188.3			
9875	22.0	12.45	12.45		4.48			3.1	2.6	48.1	0.5	12.0	0.1			216.4	228.4	226.4	179.9	191.9	189.9			
10324	23.0	13.02	13.02		4.69			3.4	2.8	52.6	0.6	13.2	0.2			221.4	233.4	231.4	181.6	193.6	191.6			
10773	24.0	13.58	13.58		4.89			3.7	3.1	57.3	0.6	14.3	0.2			226.7	238.7	236.7	183.3	195.3	193.3			
11222	**25.0**	**14.15**	**14.15**		**5.09**			**4.0**	**3.3**	**62.2**	**0.7**	**15.5**	**0.2**			**232.2**	**244.2**	**242.2**	**185.1**	**197.1**	**195.1**			
11671	26.0	14.71	14.71		5.30			4.4	3.6	67.2	0.7	16.8	0.2			237.9	249.9	247.9	186.9	198.9	196.9			
12119	27.0	15.28	15.28		5.50			4.7	3.8	72.5	0.8	18.1	0.2			243.8	255.8	253.8	188.9	200.9	198.9			
12568	28.0	15.84	15.84		5.70			5.1	4.1	78.0	0.8	19.5	0.2			249.9	261.9	259.9	190.9	202.9	200.9			
13017	29.0	16.41	16.41		5.91			5.4	4.4	83.6	0.9	20.9	0.2			256.3	268.3	266.3	192.9	204.9	202.9			
13466	30.0	16.98	16.98		6.11			5.8	4.6	89.5	0.9	22.4	0.3			262.9	274.9	272.9	195.1	207.1	205.1			

IPID Pump Exchange - Preferred Dryden Alternative - PID Canal to IID Canal - 50 CFS Design Flow - 4 Pumps



SYSTEM CURVE CALCULATION

PROJECT: ICICLE AND PESHASTIN IRRIGATION DISTRICTS (IPID) PUMP EXCHANGE - 2014 SUPPLEMENTAL WORK

ALTERNATIVE: PREFERRED DRYDEN ALTERNATIVE - RIVER TO PID CANAL - 50 CFS DESIGN FLOW - 4 PUMPS

BY: David Rice, P.E.

DATE: 13-Mar-15

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	922.0 feet	Invert at Diversion
HWL	927.0 feet	Wet Well (High River)
LWL	923.0 feet	Wet Well (Low River)

DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1146.0 feet	Canal Bottom
HIGH	1148.5 feet	Canal (High Flow)
LWL	1146.5 feet	Canal (Low Flow)

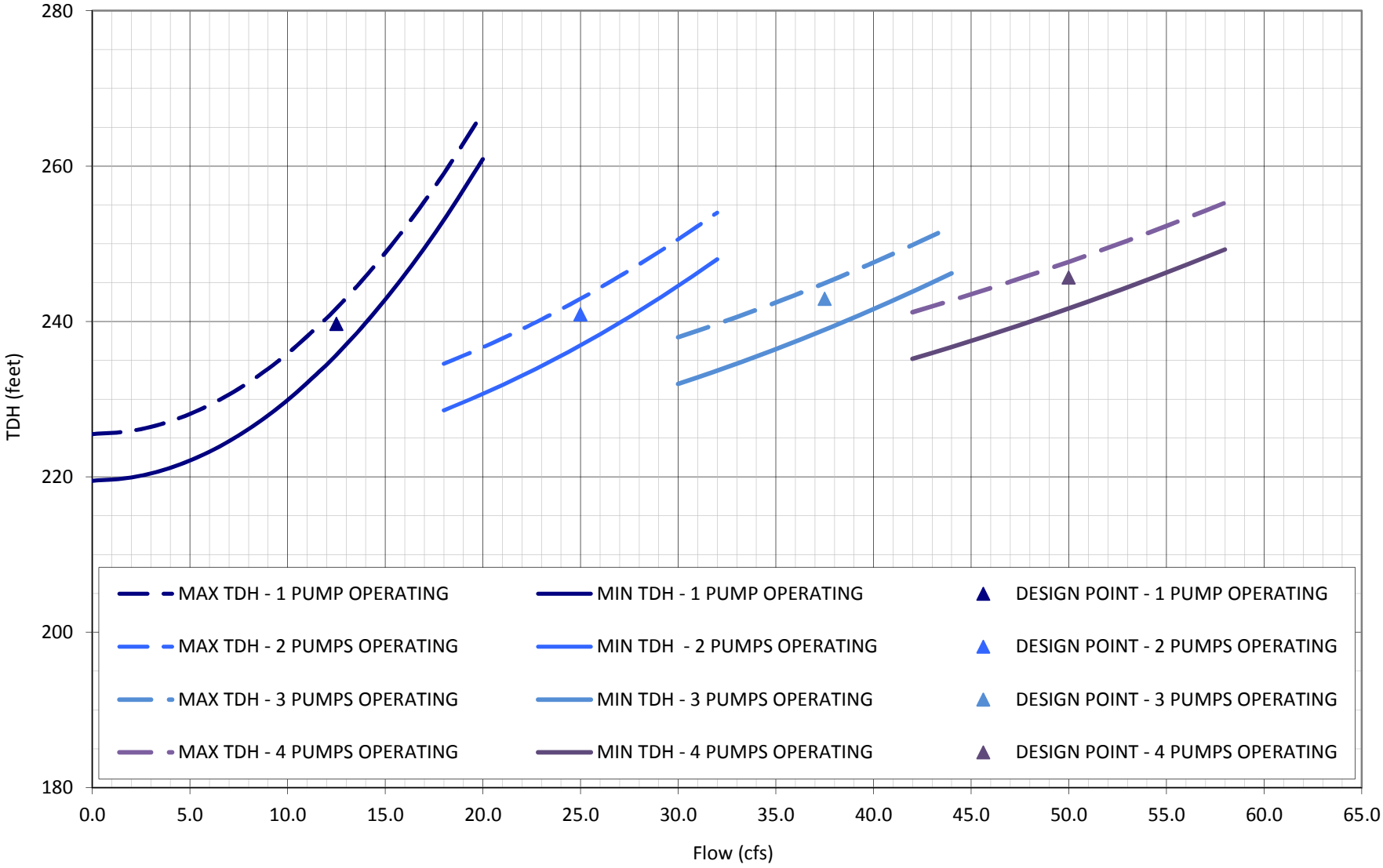
PIPE PROPERTIES	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					18	18		42
O.D. (in)					18	18		42
I.D. (in)					18	18		42
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		1,240
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	5610	12.5	240	485.6
2	11220	25.0	241	976.1
3	16830	37.5	243	1476.3
4	22440	50.0	246	1990.7
*Assumes	70%	Efficiency		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		PS LOSSES - 4 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL D
(gpm)	(cfs)	18-inch (fps)	18-inch (fps)	-inch (fps)	42-inch (fps)	Minor (feet)	Friction (feet)	Minor (feet)	Friction (feet)	Minor (feet)	Friction (feet)	Minor (feet)	Friction (feet)	Minor (feet)	Friction (feet)	Minor (feet)	Friction (feet)	MIN (feet)	MAX (feet)	DESIGN (feet)	MIN (feet)	MAX (feet)	DESIGN (feet)	MIN (feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	219.5	225.5	223.5	219.5	225.5	223.5	219.5
898	2.0	1.13	1.13		0.21			0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	219.9	225.9	223.9	219.6	225.6	223.6	219.6
1,795	4.0	2.26	2.26		0.42			0.0	0.0	1.6	0.0	0.4	0.0	0.2	0.0	0.1	0.0	221.2	227.2	225.2	220.0	226.0	224.0	219.7
2,693	6.0	3.39	3.39		0.62			0.1	0.0	3.6	0.1	0.9	0.0	0.4	0.0	0.2	0.0	223.2	229.2	227.2	220.5	226.5	224.5	220.0
3,590	8.0	4.53	4.53		0.83			0.1	0.1	6.4	0.1	1.6	0.0	0.7	0.0	0.4	0.0	226.1	232.1	230.1	221.3	227.3	225.3	220.4
4,488	10.0	5.66	5.66		1.04			0.2	0.1	9.9	0.2	2.5	0.0	1.1	0.0	0.6	0.0	229.9	235.9	233.9	222.3	228.3	226.3	220.9
5,386	12.0	6.79	6.79		1.25			0.2	0.2	14.3	0.2	3.6	0.1	1.6	0.0	0.9	0.0	234.4	240.4	238.4	223.5	229.5	227.5	221.5
5,610	**12.5**	**7.07**	**7.07**		**1.30**			**0.3**	**0.2**	**15.5**	**0.2**	**3.9**	**0.1**	**1.7**	**0.0**	**1.0**	**0.0**	**235.7**	**241.7**	**239.7**	**223.9**	**229.9**	**227.9**	**221.7**
6,283	14.0	7.92	7.92		1.45			0.3	0.2	19.5	0.3	4.9	0.1	2.2	0.0	1.2	0.0	239.8	245.8	243.8	225.0	231.0	229.0	222.2
7,181	16.0	9.05	9.05		1.66			0.4	0.3	25.5	0.4	6.4	0.1	2.8	0.0	1.6	0.0	246.0	252.0	250.0	226.7	232.7	230.7	223.1
8,078	18.0	10.18	10.18		1.87			0.5	0.3	32.2	0.5	8.1	0.1	3.6	0.1	2.0	0.0	253.0	259.0	257.0	228.6	234.6	232.6	224.0
8,976	20.0	11.32	11.32		2.08			0.7	0.4	39.8	0.6	9.9	0.2	4.4	0.1	2.5	0.0	260.9	266.9	264.9	230.7	236.7	234.7	225.1
9,874	22.0	12.45	12.45		2.29			0.8	0.5	48.1	0.7	12.0	0.2	5.3	0.1	3.0	0.1	269.6	275.6	273.6	233.0	239.0	237.0	226.2
10,771	24.0	13.58	13.58		2.49			1.0	0.6	57.3	0.8	14.3	0.2	6.4	0.1	3.6	0.1	279.1	285.1	283.1	235.6	241.6	239.6	227.5
11,220	**25.0**	**14.15**	**14.15**		**2.60**			**1.0**	**0.6**	**62.1**	**0.8**	**15.5**	**0.2**	**6.9**	**0.1**	**3.9**	**0.1**	**284.1**	**290.1**	**288.1**	**236.9**	**242.9**	**240.9**	**228.2**
11,669	26.0	14.71	14.71		2.70			1.1	0.7	67.2	0.9	16.8	0.2	7.5	0.1	4.2	0.1	289.4	295.4	293.4	238.3	244.3	242.3	228.9
12,566	28.0	15.84	15.84		2.91			1.3	0.8	77.9	1.0	19.5	0.3	8.7	0.1	4.9	0.1	300.6	306.6	304.6	241.3	247.3	245.3	230.4
13,464	30.0	16.97	16.97		3.12			1.5	0.9	89.5	1.2	22.4	0.3	9.9	0.2	5.6	0.1	312.5	318.5	316.5	244.6	250.6	248.6	232.0
14,362	32.0	18.11	18.11		3.33			1.7	1.0	101.8	1.3	25.5	0.4	11.3	0.2	6.4	0.1	325.3	331.3	329.3	248.0	254.0	252.0	233.7
15,259	34.0	19.24	19.24		3.53			1.9	1.1	114.9	1.5	28.7	0.4	12.8	0.2	7.2	0.1	338.9	344.9	342.9	251.7	257.7	255.7	235.5
16,157	36.0	20.37	20.37		3.74			2.2	1.2	128.9	1.6	32.2	0.5	14.3	0.2	8.1	0.1	353.4	359.4	357.4	255.5	261.5	259.5	237.4
16,830	**37.5**	**21.22**	**21.22**		**3.90**			**2.4**	**1.3**	**139.8**	**1.8**	**35.0**	**0.5**	**15.5**	**0.2**	**8.7**	**0.1**	**364.7**	**370.7**	**368.7**	**258.6**	**264.6**	**262.6**	**238.9**
17,054	38.0	21.50	21.50		3.95			2.4	1.3	143.6	1.8	35.9	0.5	16.0	0.2	9.0	0.1	368.6	374.6	372.6	259.7	265.7	263.7	239.4
17,952	40.0	22.63	22.63		4.16			2.7	1.5	159.1	2.0	39.8	0.6	17.7	0.3	9.9	0.2	384.7	390.7	388.7	264.0	270.0	268.0	241.6
18,850	42.0	23.76	23.76		4.36			3.0	1.6	175.4	2.2	43.8	0.6	19.5	0.3	11.0	0.2	401.6	407.6	405.6	268.5	274.5	272.5	243.8
19,747	44.0	24.90	24.90		4.57			3.2	1.7	192.5	2.4	48.1	0.7	21.4	0.3	12.0	0.2	419.4	425.4	423.4	273.3	279.3	277.3	246.2
20,645	46.0	26.03	26.03		4.78			3.5	1.9	210.4	2.6	52.6	0.7	23.4	0.3	13.1	0.2	437.9	443.9	441.9	278.3	284.3	282.3	248.7
21,542	48.0	27.16	27.16		4.99			3.9	2.1	229.1	2.8	57.3	0.8	25.5	0.4	14.3	0.2	457.3	463.3	461.3	283.5	289.5	287.5	251.2
22,440	**50.0**	**28.29**	**28.29**		**5.20**			**4.2**	**2.2**	**248.6**	**3.0**	**62.1**	**0.8**	**27.6**	**0.4**	**15.5**	**0.2**	**477.5**	**483.5**	**481.5**	**288.9**	**294.9**	**292.9**	**253.9**
23,338	52.0	29.42	29.42		5.40			4.5	2.4	268.8	3.2	67.2	0.9	29.9	0.4	16.8	0.2	498.5	504.5	502.5	294.5	300.5	298.5	256.7
24,235	54.0	30.55	30.55		5.61			4.9	2.6	289.9	3.5	72.5	1.0	32.2	0.5	18.1	0.3	520.3	526.3	524.3	300.4	306.4	304.4	259.6
25,133	56.0	31.69	31.69		5.82			5.3	2.7	311.8	3.7	77.9	1.0	34.6	0.5	19.5	0.3	543.0	549.0	547.0	306.5	312.5	310.5	262.6
26,030	58.0	32.82	32.82		6.03			5.6	2.9	334.5	4.0	83.6	1.1	37.2	0.5	20.9	0.3	566.5	572.5	570.5	312.8	318.8	316.8	265.7

IPID Pump Exchange - Preferred Dryden Alternative - River to PID Canal - 50 CFS Design Flow - 4 Pumps



ATTACHMENT B
OPINION OF PROBABLE COSTS

Icicle and Peshastin Irrigation District (IPID) Pump Exchange Project D. Rice
Opinion of Probable Project Costs - Wenatchee River to PID Canal 27-Mar-15
Design Flow Rate = 50 CFS

ITEM	UNIT	UNIT COST	QUANTITY	COST
Micellaneous Site Work				
Diversion and care of water	LS	$30,000	1	$30,000
Temporary & permanent access	LS	$20,000	1	$20,000
Erosion and sediment control	LS	$15,000	1	$15,000
Clearing and grubbing	AC	$3,500	0.9	$2,989
Subtotal - Miscellaneous Site Work				**$68,000**
Earthwork				
Excavation and stockpile, soil	CY	$7.00	1,886	$13,200
Excavation and stockpile, rock	CY	$18.00	1,257	$22,629
Backfill (imported material)	CY	$30.00	732	$21,964
Backfill (native material)	CY	$8.00	975	$7,801
Waste/Disposal of excess material	CY	$6.00	2,168	$13,007
Subtotal - Earthwork				**$78,600**
Pump Station and Intake Facility				
Reinforced Concrete Structure	LS	$170,000	1	$170,000
Steel Supports for Screen	LS	$100,000	1	$100,000
Wedge Wire or Profile Bar Screen	SF	$325	128	$41,600
Air Blast or Other Screen Self-Cleaning System	LS	$200,000	1	$200,000
Vertical Turbine Pumps - ~500 HP, VFD	EA	$250,000	4	$1,000,000
3-Phase Power Extension	LS	$150,000	1	$150,000
Electrical and Controls	LS	$275,000	1	$275,000
Piping, Valves, Meter and Appurtenances	LS	$125,000	1	$125,000
Subtotal - Pump Station and Intake Facility				**$2,061,600**
Delivery Pipeline				
42" DR 13.5 HDPE Pipe	LF	$220.00	1,240	$272,800
Fittings and Appurtenances	LF	$30.00	1,240	$37,200
Subtotal - Delivery Pipeline				**$310,000**
Outlet Structure				
Reinforced Concrete Outlet Structure	LS	$25,000.00	1	$25,000
Subtotal - Outlet Structure				**$25,000**
Construction Subtotal				**$2,543,000**
Mobilization / Demobilization	10.0%			$254,300
Contingency	30.0%			$839,190
Engineering, Permitting and Administration	20.0%			$559,460
Sales Tax	8.2%			$344,068
Allowance for Land Acquisition	LS	$50,000.00	1	$50,000
Total Project Cost				**$4,590,000**

Notes:

1) Costs are in 2014 dollars. Actual costs may vary based on material and labor costs at time of construciton.

2) Subtotals rounded to nearest $100. Construction Subtotal and Total Project Cost rounded to nearest $1,000.

Icicle and Peshastin Irrigation District (IPID) Pump Exchange Project D. Rice
Opinion of Probable Annual Operating Costs - Wenatchee River to PID Canal 27-Mar-15
Design Flow Rate = 50 CFS

ITEM	UNIT	UNIT COST	QTY	COST
Annual Operations and Maintenance Cost[1]				**$31,507**
Pumping Power Costs[2]				
Monthly Basic Charge (3-Phase Power)	/EA/MO	$14.50	1	$14.50
Monthly Demand Charge	/HP/MO	$3.52	2,000	$7,040.00
Energy Charge				
15-day Annual Pumping Duration	kWH	$0.0165	537,120	$8,862.48
30-day Annual Pumping Duration	kWH	$0.0165	1,074,240	$17,724.96
90-day Annual Pumping Duration	kWH	$0.0165	3,222,720	$53,174.88
Total Annual Pumping Costs				
15-day Annual Pumping Duration				$44,135
30-day Annual Pumping Duration				$52,997
90-day Annual Pumping Duration				$88,447
Total Annual Operating Costs[3]				
15-day Annual Pumping Duration				**$75,600**
30-day Annual Pumping Duration				**$84,500**
90-day Annual Pumping Duration				**$120,000**

Notes:
1) Annual Operations and Maintenance Costs assumed equal to 0.8% of pump station project costs + 0.2% of pipeline costs.
2) Pumping power costs are based on Chelan PUD Electrical Rate Schedule 5 (Irrigation Service), in 2014 dollars.
3) Rounded to nearest $100.

Icicle and Peshastin Irrigation District (IPID) Pump Exchange Project D. Rice
Opinion of Probable Project Costs - PID Canal Upgrades and Re-regulation Pond 27-Mar-15
Design Flow Rate = 50 CFS

ITEM	UNIT	UNIT COST	QUANTITY	COST
Micellaneous Site Work				
Diversion and care of water	LS	$5,000	1	$5,000
Temporary & permanent access	LS	$15,000	1	$15,000
Erosion and sediment control	LS	$15,000	1	$15,000
Clearing and grubbing	AC	$3,500	4.4	$15,233
Revegetaiton of Outer Embankment	AC	$4,000	0.9	$3,400
Subtotal - Miscellaneous Site Work				**$53,600**
Re-Regulation Pond Earthwork				
Foundation excavation and stockpile, soil	CY	$7.00	2,323	$16,262
Foundation excavation and stockpile, rock	CY	$18.00	1,549	$27,878
Foundation grouting allowance	SF	$6.00	3,485	$20,909
Cutoff trench excavation and stockpile, soil	CY	$7.00	307	$2,152
Toe and finger drains	LS	$1.00	5,000	$5,000
Reservoir embankment (imported material)	CY	$20.00	8,532	$170,641
Reservoir embankment (fill with cut material)	CY	$8.00	5,224	$41,792
Reservoir pond liner	SY	$15.00	8,639	$129,591
Subtotal - Earthwork				**$414,200**
Re-Regulation Pond Emergency Overflow/Spillway				
Overflow and Spillway Channel/Pipe	LS	$50,000	1	$50,000
Subtotal - Pump Station and Intake Facility				**$50,000**
PID Canal Upgrades				
Trenching/Excavation, soil	CY	$7.00	3,988	$27,914
Backfill (imported material)	CY	$30.00	1,528	$45,841
Backfill (native material)	CY	$8.00	1,323	$10,587
Deadman Road Crossing	LS	$10,000	1	$10,000
48" Corrugated Type S HDPE Pipe	LF	$100.00	2,350	$235,000
Fittings and Appurtenances	LF	$15.00	2,350	$35,250
Subtotal - PID Canal Upgrades				**$270,300**
Control Structure at Re-regulation Pond				
Reinforced Concrete Control Structure	LS	$30,000.00	1	$30,000
Subtotal - Outlet Structure				**$30,000**
Construction Subtotal				**$818,000**
Mobilization / Demobilization	10.0%			$81,800
Contingency	30.0%			$269,940
Engineering, Permitting and Administration	20.0%			$179,960
Sales Tax	8.2%			$110,675
Allowance for Land Acquisition	LS	$50,000.00	1	$50,000
Total Project Cost				**$1,510,000**

Notes:
1) Costs are in 2014 dollars. Actual costs may vary based on material and labor costs at time of construciton.
2) Subtotals rounded to nearest $100. Construction Subtotal and Total Project Cost rounded to nearest $1,000.

Icicle and Peshastin Irrigation District (IPID) Pump Exchange Project D. Rice
Opinion of Probable Annual Operating Costs - PID Canal Upgrades and Re-regulation Pond 27-Mar-15
Design Flow Rate = 50 CFS

ITEM	UNIT	UNIT COST	QTY	COST
Annual Operations and Maintenance Cost[1]				**$8,755**

Notes:
1) Annual Operations and Maintenance Costs assumed equal to 0.8% of re-reg pond costs + 0.2% of pipeline costs.

Icicle and Peshastin Irrigation District (IPID) Pump Exchange Project D. Rice
Opinion of Probable Project Costs - PID Canal to IID Division 3A Canal 27-Mar-15
Design Flow Rate = 25 CFS

ITEM	UNIT	UNIT COST	ALIGNMENT 1 QUANTITY	COST
Micellaneous Site Work				
Diversion and care of water	LS	$5,000	1	$5,000
Temporary & permanent access	LS	$15,000	1	$15,000
Erosion and sediment control	LS	$15,000	1	$15,000
Clearing and grubbing	AC	$3,500	0.9	$3,134
Subtotal - Miscellaneous Site Work				**$38,100**
Earthwork				
Excavation and stockpile, soil	CY	$6.00	965	$5,789
Excavation and stockpile, rock	CY	$15.00	643	$9,649
Backfill (imported material)	CY	$30.00	547	$16,406
Backfill (native material)	CY	$8.00	619	$4,950
Waste/Disposal of excess material	CY	$5.00	989	$4,947
Subtotal - Earthwork				**$41,700**
Pump Station and Intake Facility				
Reinforced Concrete Structure	LS	$80,000	1	$80,000
Vertical Turbine or Centrifugal Pumps - 400 HP, VFD	EA	$220,000	2	$440,000
3-Phase Power Extension	LS	$100,000	1	$100,000
Electrical and Controls	LS	$115,000	1	$115,000
Piping, Valves, Meter and Appurtenances	LS	$50,000	1	$50,000
Subtotal - Pump Station and Intake Facility				**$785,000**
Delivery Pipeline				
30" DR11 HDPE Pipe	LF	$160.00	1,300	$208,000
Fittings and Appurtenances	LF	$24.00	1,300	$31,200
Subtotal - Delivery Pipeline				**$239,200**
Outlet Structure				
Reinforced Concrete Outlet Structure	LS	$16,000.00	1	$16,000
Subtotal - Outlet Structure				**$16,000**
Construction Subtotal				**$1,120,000**
Mobilization / Demobilization	10.0%			$112,000
Contingency	30.0%			$369,600
Engineering, Permitting and Administration	20.0%			$246,400
Sales Tax	8.2%			$151,536
Allowance for Land Acquisition	LS	$50,000.00	1	$50,000
Total Project Cost				**$2,050,000**

Notes:
1) Costs are in 2014 dollars. Actual costs may vary based on material and labor costs at time of construction.
2) Subtotals rounded to nearest $100. Construction Subtotal and Total Project Cost rounded to nearest $1,000.

Icicle and Peshastin Irrigation District (IPID) Pump Exchange Project D. Rice
Opinion of Probable Annual Operating Costs - PID Canal to IID Division 3A Canal 27-Mar-15
Design Flow Rate = 25 CFS

ITEM	UNIT	UNIT COST	QTY	COST
Annual Operations and Maintenance Cost[1]				**$12,721**
Pumping Power Costs[2]				
Monthly Basic Charge (3-Phase Power)	/EA/MO	$14.50	1	$14.50
Monthly Demand Charge	/HP/MO	$3.52	800	$2,816.00
Energy Charge				
15-day Annual Pumping Duration	kWH	$0.0165	214,848	$3,544.99
30-day Annual Pumping Duration	kWH	$0.0165	429,696	$7,089.98
90-day Annual Pumping Duration	kWH	$0.0165	1,289,088	$21,269.95
Total Annual Pumping Costs				
15-day Annual Pumping Duration				$17,697
30-day Annual Pumping Duration				$21,242
90-day Annual Pumping Duration				$35,422
Total Annual Operating Costs[3]				
15-day Annual Pumping Duration				**$20,500**
30-day Annual Pumping Duration				**$24,100**
90-day Annual Pumping Duration				**$48,100**

Notes:
1) Annual Operations and Maintenance Costs assumed equal to 0.8% of pump station project costs + 0.2% of pipeline costs.
2) Pumping power costs are based on Chelan PUD Electrical Rate Schedule 5 (Irrigation Service), in 2014 dollars.
3) Rounded to nearest $100.

Icicle and Peshastin Irrigation District (IPID) Pump Exchange Project
Life Cycle Cost Analysis
Preferred Alternative at Dryden

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$8,150,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:			CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:				
To Replace	25%	After Life of Project		$8,932,209
To Replace	50%	After Life of Project		$17,864,417
To Replace	100%	After Life of Project	$8,150,000	$35,728,834
Disposal and Removal Cost:				
To Replace	25%	After Life of Project		$400,031
To Replace	50%	After Life of Project		$800,063
To Replace	100%	After Life of Project	$365,000	$1,600,126
Total Replacement Cost:				
To Replace	**25%**	**After Life of Project**		**$9,332,240**
To Replace	**50%**	**After Life of Project**		**$18,664,480**
To Replace	**100%**	**After Life of Project**	**$8,515,000**	**$37,328,960**

REPLACEMENT FUND SUMMARY			
Annual Deposit Required (Assume Equal Deposit Made Each Year):			
To Replace	25%	After Life of Project	$82,735
To Replace	50%	After Life of Project	$165,470
To Replace	100%	After Life of Project	$330,940
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):			
To Replace	25%	After Life of Project	$43,852
To Replace	50%	After Life of Project	$87,704
To Replace	100%	After Life of Project	$175,409
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):			
To Replace	25%	After Life of Project	$89,143
To Replace	50%	After Life of Project	$178,285
To Replace	100%	After Life of Project	$356,570
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):			
To Replace	25%	After Life of Project	$186,645
To Replace	50%	After Life of Project	$373,290
To Replace	100%	After Life of Project	$746,579

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 15-Day Annual Operating Duration:				
25% Replacement	$2,128,750	$2,649,130	$3,091,624	**$7,869,503**
50% Replacement	$4,257,500	$2,649,130	$3,091,624	**$9,998,253**
100% Replacement	$8,515,000	$2,649,130	$3,091,624	**$14,255,753**
Assuming the Pumping Power Costs for a 30-Day Annual Operating Duration:				
25% Replacement	$2,128,750	$2,649,130	$3,711,997	**$8,489,877**
50% Replacement	$4,257,500	$2,649,130	$3,711,997	**$10,618,627**
100% Replacement	$8,515,000	$2,649,130	$3,711,997	**$14,876,127**
Assuming the Pumping Power Costs for a 90-Day Annual Operating Duration:				
25% Replacement	$2,128,750	$2,649,130	$6,193,492	**$10,971,371**
50% Replacement	$4,257,500	$2,649,130	$6,193,492	**$13,100,121**
100% Replacement	$8,515,000	$2,649,130	$6,193,492	**$17,357,621**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:	$8,150,000																							
Replacement Fund (For Funding Replacement of 25% of System):																								
Deposits		$43,852	$45,168	$46,523	$47,919	$49,356	$50,837	$52,362	$53,933	$55,551	$57,217	$58,934	$60,702	$62,523	$64,399	$66,330	$68,320	$70,370	$72,481	$74,656	$76,895	$79,202	$81,578	$84,025
Interest		$0	$1,316	$2,710	$4,187	$5,750	$7,403	$9,151	$10,996	$12,944	$14,999	$17,165	$19,448	$21,853	$24,384	$27,047	$29,849	$32,794	$35,889	$39,140	$42,554	$46,137	$49,897	$53,842
End of Year Balance		**$43,852**	**$90,336**	**$139,569**	**$191,674**	**$246,780**	**$305,021**	**$366,533**	**$431,462**	**$499,956**	**$572,172**	**$648,271**	**$728,421**	**$812,797**	**$901,579**	**$994,957**	**$1,093,126**	**$1,196,290**	**$1,304,660**	**$1,418,455**	**$1,537,904**	**$1,663,243**	**$1,794,718**	**$1,932,585**
Replacement Fund (For Funding Replacement of 50% of System):																								
Deposits		$87,704	$90,336	$93,046	$95,837	$98,712	$101,674	$104,724	$107,865	$111,101	$114,434	$117,868	$121,404	$125,046	$128,797	$132,661	$136,641	$140,740	$144,962	$149,311	$153,790	$158,404	$163,156	$168,051
Interest		$0	$2,631	$5,420	$8,374	$11,500	$14,807	$18,301	$21,992	$25,888	$29,997	$34,330	$38,896	$43,705	$48,768	$54,095	$59,697	$65,588	$71,777	$78,280	$85,107	$92,274	$99,795	$107,683
End of Year Balance		**$87,704**	**$180,671**	**$279,137**	**$383,348**	**$493,561**	**$610,041**	**$733,066**	**$862,924**	**$999,913**	**$1,144,345**	**$1,296,543**	**$1,456,842**	**$1,625,593**	**$1,803,158**	**$1,989,914**	**$2,186,252**	**$2,392,580**	**$2,609,319**	**$2,836,910**	**$3,075,807**	**$3,326,486**	**$3,589,437**	**$3,865,171**
Replacement Fund (For Funding Replacement of 100% of System):																								
Deposits		$175,409	$180,671	$186,091	$191,674	$197,424	$203,347	$209,448	$215,731	$222,203	$228,869	$235,735	$242,807	$250,091	$257,594	$265,322	$273,282	$281,480	$289,924	$298,622	$307,581	$316,808	$326,312	$336,102
Interest		$0	$5,262	$10,840	$16,748	$23,001	$29,614	$36,602	$43,984	$51,775	$59,995	$68,661	$77,793	$87,411	$97,536	$108,189	$119,395	$131,175	$143,555	$156,559	$170,215	$184,548	$199,589	$215,366
End of Year Balance		**$175,409**	**$361,343**	**$558,274**	**$766,697**	**$987,122**	**$1,220,083**	**$1,466,133**	**$1,725,848**	**$1,999,826**	**$2,288,690**	**$2,593,085**	**$2,913,685**	**$3,251,187**	**$3,606,316**	**$3,979,828**	**$4,372,504**	**$4,785,159**	**$5,218,638**	**$5,673,820**	**$6,151,615**	**$6,652,971**	**$7,178,873**	**$7,730,341**
Operations and Maintenance Expenses:		**$52,983**	**$54,572**	**$56,209**	**$57,896**	**$59,632**	**$61,421**	**$63,264**	**$65,162**	**$67,117**	**$69,130**	**$71,204**	**$73,340**	**$75,541**	**$77,807**	**$80,141**	**$82,545**	**$85,022**	**$87,572**	**$90,199**	**$92,905**	**$95,692**	**$98,563**	**$101,520**
Pumping Power Costs:																								
15-Day Annual Pumping Duration[8]		**$61,832**	**$63,687**	**$65,598**	**$67,566**	**$69,593**	**$71,681**	**$73,831**	**$76,046**	**$78,328**	**$80,677**	**$83,098**	**$85,591**	**$88,158**	**$90,803**	**$93,527**	**$96,333**	**$99,223**	**$102,200**	**$105,266**	**$108,424**	**$111,676**	**$115,027**	**$118,477**
30-Day Annual Pumping Duration[8]		**$74,240**	**$76,467**	**$78,761**	**$81,124**	**$83,558**	**$86,064**	**$88,646**	**$91,306**	**$94,045**	**$96,866**	**$99,772**	**$102,765**	**$105,848**	**$109,024**	**$112,295**	**$115,663**	**$119,133**	**$122,707**	**$126,389**	**$130,180**	**$134,086**	**$138,108**	**$142,251**
90-Day Annual Pumping Duration[8]		**$123,870**	**$127,586**	**$131,414**	**$135,356**	**$139,417**	**$143,599**	**$147,907**	**$152,344**	**$156,915**	**$161,622**	**$166,471**	**$171,465**	**$176,609**	**$181,907**	**$187,364**	**$192,985**	**$198,775**	**$204,738**	**$210,880**	**$217,207**	**$223,723**	**$230,434**	**$237,347**

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Icicle and Peshastin Irrigation District (IPID) Pump Exchange Project
Life Cycle Cost Analysis (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$86,546	$89,143	$91,817	$94,571	$97,409	$100,331	$103,341	$106,441	$109,634	$112,923	$116,311	$119,800	$123,394	$127,096	$130,909	$134,836	$138,881	$143,048	$147,339	$151,759	$156,312	$161,001	$165,831	$170,806	$175,931	$181,209	$186,645
$57,978	$62,313	$66,857	$71,617	$76,603	$81,823	$87,288	$93,007	$98,990	$105,249	$111,794	$118,637	$125,790	$133,266	$141,077	$149,236	$157,758	$166,658	$175,949	$185,647	$195,769	$206,332	$217,352	$228,847	$240,837	$253,340	$266,377
$2,077,109	**$2,228,565**	**$2,387,239**	**$2,553,427**	**$2,727,439**	**$2,909,593**	**$3,100,221**	**$3,299,669**	**$3,508,293**	**$3,726,465**	**$3,954,570**	**$4,193,007**	**$4,442,191**	**$4,702,553**	**$4,974,538**	**$5,258,611**	**$5,555,250**	**$5,864,956**	**$6,188,243**	**$6,525,650**	**$6,877,732**	**$7,245,065**	**$7,628,248**	**$8,027,902**	**$8,444,670**	**$8,879,219**	**$9,332,240**
$173,092	$178,285	$183,634	$189,143	$194,817	$200,662	$206,681	$212,882	$219,268	$225,846	$232,622	$239,600	$246,788	$254,192	$261,818	$269,672	$277,763	$286,095	$294,678	$303,519	$312,624	$322,003	$331,663	$341,613	$351,861	$362,417	$373,290
$115,955	$124,627	$133,714	$143,234	$153,206	$163,646	$174,576	$186,013	$197,980	$210,498	$223,588	$237,274	$251,580	$266,531	$282,153	$298,472	$315,517	$333,315	$351,897	$371,295	$391,539	$412,664	$434,704	$457,695	$481,674	$506,680	$532,753
$4,154,218	**$4,457,130**	**$4,774,477**	**$5,106,854**	**$5,454,877**	**$5,819,185**	**$6,200,442**	**$6,599,337**	**$7,016,585**	**$7,452,929**	**$7,909,139**	**$8,386,014**	**$8,884,382**	**$9,405,106**	**$9,949,077**	**$10,517,222**	**$11,110,501**	**$11,729,911**	**$12,376,487**	**$13,051,300**	**$13,755,463**	**$14,490,130**	**$15,256,497**	**$16,055,804**	**$16,889,340**	**$17,758,437**	**$18,664,480**
$346,185	$356,570	$367,267	$378,286	$389,634	$401,323	$413,363	$425,764	$438,537	$451,693	$465,243	$479,201	$493,577	$508,384	$523,636	$539,345	$555,525	$572,191	$589,357	$607,037	$625,248	$644,006	$663,326	$683,226	$703,722	$724,834	$746,579
$231,910	$249,253	$267,428	$286,469	$306,411	$327,293	$349,151	$372,027	$395,960	$420,995	$447,176	$474,548	$503,161	$533,063	$564,306	$596,945	$631,033	$666,630	$703,795	$742,589	$783,078	$825,328	$869,408	$915,390	$963,348	$1,013,360	$1,065,506
$8,308,436	**$8,914,260**	**$9,548,955**	**$10,213,709**	**$10,909,754**	**$11,638,370**	**$12,400,884**	**$13,198,674**	**$14,033,171**	**$14,905,859**	**$15,818,278**	**$16,772,027**	**$17,768,765**	**$18,810,212**	**$19,898,154**	**$21,034,443**	**$22,221,001**	**$23,459,822**	**$24,752,973**	**$26,102,600**	**$27,510,926**	**$28,980,260**	**$30,512,993**	**$32,111,609**	**$33,778,680**	**$35,516,874**	**$37,328,960**
$104,566	**$107,703**	**$110,934**	**$114,262**	**$117,690**	**$121,220**	**$124,857**	**$128,603**	**$132,461**	**$136,435**	**$140,528**	**$144,743**	**$149,086**	**$153,558**	**$158,165**	**$162,910**	**$167,797**	**$172,831**	**$178,016**	**$183,357**	**$188,857**	**$194,523**	**$200,359**	**$206,370**	**$212,561**	**$218,937**	**$225,506**
$122,032	**$125,693**	**$129,463**	**$133,347**	**$137,348**	**$141,468**	**$145,712**	**$150,084**	**$154,586**	**$159,224**	**$164,000**	**$168,920**	**$173,988**	**$179,208**	**$184,584**	**$190,121**	**$195,825**	**$201,700**	**$207,751**	**$213,983**	**$220,403**	**$227,015**	**$233,825**	**$240,840**	**$248,065**	**$255,507**	**$263,173**
$146,519	**$150,915**	**$155,442**	**$160,105**	**$164,908**	**$169,856**	**$174,951**	**$180,200**	**$185,606**	**$191,174**	**$196,909**	**$202,816**	**$208,901**	**$215,168**	**$221,623**	**$228,272**	**$235,120**	**$242,174**	**$249,439**	**$256,922**	**$264,630**	**$272,568**	**$280,745**	**$289,168**	**$297,843**	**$306,778**	**$315,981**
$244,468	**$251,802**	**$259,356**	**$267,137**	**$275,151**	**$283,405**	**$291,907**	**$300,665**	**$309,685**	**$318,975**	**$328,544**	**$338,401**	**$348,553**	**$359,009**	**$369,780**	**$380,873**	**$392,299**	**$404,068**	**$416,190**	**$428,676**	**$441,536**	**$454,782**	**$468,426**	**$482,478**	**$496,953**	**$511,861**	**$527,217**

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Summary - Opinion of Costs - Preferred Alternative at Dryden
Design Flow Rate = 50 CFS

Annual Pumping Duration	Total Project Implementation Cost[1]	Present Value - O&M Costs[2]	Present Value - Power Costs[3]	Present Value - Total Costs[4]
15 Days	$8,150,000	$2,649,000	$3,092,000	**$13,891,000**
30 Days	$8,150,000	$2,649,000	$3,712,000	**$14,511,000**
90 Days	$8,150,000	$2,649,000	$6,193,000	**$16,992,000**

Notes:

1) Total project implementation cost includes construction, engineering, admin, contingency, and taxes

2) Present value of annual O&M costs through assumed 50-year project life cycle.

3) Present value of annual power costs through assumed 50-year project life cycle.

4) Sum of total project implementation cost, present value of O&M costs, and present value of power costs.

Icicle and Peshastin Irrigation District (IPID) Pump Exchange Project D. Rice
Opinion of Probable Project Costs - Forsgren Option 6B 27-Mar-15
Design Flow Rate = 62 CFS

From Icicle Irrigation District Instream Flow Improvements Options Analysis Study

ITEM	UNIT	UNIT COST	QTY	COST
Total Construction - Piping				**$617,417**
Congingency	20.0%			$123,483
Legal, Adminstrative, and Engineering	30.0%			$185,225
Sales Tax	8.2%			$60,754
Total Piping Construction Cost				**$986,880**
Total Construction - Pump Station				**$3,884,522**
Congingency	20.0%			$776,904
Legal, Adminstrative, and Engineering	30.0%			$1,165,357
Sales Tax	8.2%			$382,237
Pump Station Construction Cost				**$6,209,000**

Calculated Based on Current Assumptions

ITEM	UNIT	UNIT COST	QTY	COST
Construction Subtotal - Piping				**$617,417**
Mobilization / Demobilization	10.0%			$61,742
Contingency	30.0%			$203,748
Engineering, Permitting and Administration	20.0%			$135,832
Sales Tax	8.2%			$83,537
Allowance for Land Acquisition	LS	$50,000.00	1	$50,000
Total Project Cost				**$1,152,000**
Construction Subtotal - Pump Station				**$3,884,522**
Mobilization / Demobilization	10.0%			$388,452
Contingency	30.0%			$1,281,892
Engineering, Permitting and Administration	20.0%			$854,595
Sales Tax	8.2%			$525,576
Allowance for Land Acquisition	LS	$50,000.00	1	$50,000
Total Project Cost				**$6,985,000**

Icicle and Peshastin Irrigation District (IPID) Pump Exchange Project D. Rice
Opinion of Probable Annual Operating Costs - Forsgren Option 6B 27-Mar-15
Design Flow Rate = 62 CFS

ITEM	UNIT	UNIT COST	QTY	COST
Annual Operations and Maintenance Cost[1]				**$58,184**
Pumping Power Costs[2]				
Monthly Basic Charge (3-Phase Power)	/EA/MO	$14.50	1	$14.50
Monthly Demand Charge	/HP/MO	$3.52	2,912	$10,250.24
Energy Charge				
15-day Annual Pumping Duration	kWH	$0.0165	782,047	$12,903.77
30-day Annual Pumping Duration	kWH	$0.0165	1,564,093	$25,807.54
90-day Annual Pumping Duration	kWH	$0.0165	4,692,280	$77,422.63
Total Annual Pumping Costs				
15-day Annual Pumping Duration				$64,227
30-day Annual Pumping Duration				$77,131
90-day Annual Pumping Duration				$128,746
Total Annual Operating Costs[3]				
15-day Annual Pumping Duration				**$122,400**
30-day Annual Pumping Duration				**$135,300**
90-day Annual Pumping Duration				**$186,900**

Notes:
1) Annual Operations and Maintenance Costs assumed equal to 0.8% of pump station project costs + 0.2% of pipeline costs.
2) Pumping power costs are based on Chelan PUD Electrical Rate Schedule 5 (Irrigation Service), in 2014 dollars.
3) Rounded to nearest $100.

Icicle and Peshastin Irrigation District (IPID) Pump Exchange Project
Opinion of Probable Project Costs - Forsgren Option 6B

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of

ASSUMPTIONS:		
Estimated Capital Cost:	$8,137,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:			CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:				
To Replace	25%	After Life of Project		$8,917,961
To Replace	50%	After Life of Project		$17,835,922
To Replace	100%	After Life of Project	$8,137,000	$35,671,843
Disposal and Removal Cost:				
To Replace	25%	After Life of Project		$429,623
To Replace	50%	After Life of Project		$859,246
To Replace	100%	After Life of Project	$392,000	$1,718,491
Total Replacement Cost:				
To Replace	**25%**	**After Life of Project**		**$9,347,584**
To Replace	**50%**	**After Life of Project**		**$18,695,167**
To Replace	**100%**	**After Life of Project**	**$8,529,000**	**$37,390,334**

REPLACEMENT FUND SUMMARY			
Annual Deposit Required (Assume Equal Deposit Made Each Year):			
To Replace	25%	After Life of Project	$82,871
To Replace	50%	After Life of Project	$165,742
To Replace	100%	After Life of Project	$331,484
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):			
To Replace	25%	After Life of Project	$43,924
To Replace	50%	After Life of Project	$87,849
To Replace	100%	After Life of Project	$175,697
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):			
To Replace	25%	After Life of Project	$89,289
To Replace	50%	After Life of Project	$178,578
To Replace	100%	After Life of Project	$357,157
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):			
To Replace	25%	After Life of Project	$186,952
To Replace	50%	After Life of Project	$373,903
To Replace	100%	After Life of Project	$747,807

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	Replacment Fund	O &M	Power	TOTAL
Assuming the Pumping Power Costs for a 15-Day Annual Operating Duration:				
25% Replacement	$2,132,250	$2,909,200	$3,211,374	**$8,252,824**
50% Replacement	$4,264,500	$2,909,200	$3,211,374	**$10,385,074**
100% Replacement	$8,529,000	$2,909,200	$3,211,374	**$14,649,574**
Assuming the Pumping Power Costs for a 30-Day Annual Operating Duration:				
25% Replacement	$2,132,250	$2,909,200	$3,856,562	**$8,898,012**
50% Replacement	$4,264,500	$2,909,200	$3,856,562	**$11,030,262**
100% Replacement	$8,529,000	$2,909,200	$3,856,562	**$15,294,762**
Assuming the Pumping Power Costs for a 90-Day Annual Operating Duration:				
25% Replacement	$2,132,250	$2,909,200	$6,437,316	**$11,478,766**
50% Replacement	$4,264,500	$2,909,200	$6,437,316	**$13,611,016**
100% Replacement	$8,529,000	$2,909,200	$6,437,316	**$17,875,516**

LIFE CYCLE COSTS:

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Capital Expenses:	$8,137,000																							
Replacement Fund (For Funding Replacement of 25% of System):																								
Deposits		$43,924	$45,242	$46,599	$47,997	$49,437	$50,920	$52,448	$54,021	$55,642	$57,311	$59,031	$60,802	$62,626	$64,504	$66,440	$68,433	$70,486	$72,600	$74,778	$77,022	$79,332	$81,712	$84,164
Interest		$0	$1,318	$2,715	$4,194	$5,760	$7,416	$9,166	$11,014	$12,965	$15,023	$17,193	$19,480	$21,889	$24,424	$27,092	$29,898	$32,848	$35,948	$39,204	$42,624	$46,213	$49,979	$53,930
End of Year Balance		**$43,924**	**$90,484**	**$139,798**	**$191,989**	**$247,186**	**$305,522**	**$367,136**	**$432,171**	**$500,778**	**$573,113**	**$649,337**	**$729,619**	**$814,133**	**$903,061**	**$996,593**	**$1,094,923**	**$1,198,257**	**$1,306,805**	**$1,420,787**	**$1,540,432**	**$1,665,978**	**$1,797,669**	**$1,935,763**
Replacement Fund (For Funding Replacement of 50% of System):																								
Deposits		$87,849	$90,484	$93,199	$95,995	$98,874	$101,841	$104,896	$108,043	$111,284	$114,623	$118,061	$121,603	$125,251	$129,009	$132,879	$136,865	$140,971	$145,201	$149,557	$154,043	$158,665	$163,424	$168,327
Interest		$0	$2,635	$5,429	$8,388	$11,519	$14,831	$18,331	$22,028	$25,930	$30,047	$34,387	$38,960	$43,777	$48,848	$54,184	$59,796	$65,695	$71,895	$78,408	$85,247	$92,426	$99,959	$107,860
End of Year Balance		**$87,849**	**$180,968**	**$279,596**	**$383,979**	**$494,372**	**$611,044**	**$734,272**	**$864,343**	**$1,001,557**	**$1,146,226**	**$1,298,674**	**$1,459,238**	**$1,628,266**	**$1,806,123**	**$1,993,186**	**$2,189,847**	**$2,396,513**	**$2,613,609**	**$2,841,574**	**$3,080,865**	**$3,331,955**	**$3,595,338**	**$3,871,525**
Replacement Fund (For Funding Replacement of 100% of System):																								
Deposits		$175,697	$180,968	$186,397	$191,989	$197,749	$203,681	$209,792	$216,086	$222,568	$229,245	$236,123	$243,206	$250,502	$258,018	$265,758	$273,731	$281,943	$290,401	$299,113	$308,086	$317,329	$326,849	$336,654
Interest		$0	$5,271	$10,858	$16,776	$23,039	$29,662	$36,663	$44,056	$51,861	$60,093	$68,774	$77,920	$87,554	$97,696	$108,367	$119,591	$131,391	$143,791	$156,817	$170,494	$184,852	$199,917	$215,720
End of Year Balance		**$175,697**	**$361,937**	**$559,192**	**$767,957**	**$988,745**	**$1,222,089**	**$1,468,543**	**$1,728,685**	**$2,003,114**	**$2,292,453**	**$2,597,349**	**$2,918,476**	**$3,256,532**	**$3,612,246**	**$3,986,371**	**$4,379,693**	**$4,793,027**	**$5,227,219**	**$5,683,148**	**$6,161,729**	**$6,663,910**	**$7,190,676**	**$7,743,051**
Operations and Maintenance Expenses:		**$58,184**	**$59,930**	**$61,727**	**$63,579**	**$65,487**	**$67,451**	**$69,475**	**$71,559**	**$73,706**	**$75,917**	**$78,194**	**$80,540**	**$82,956**	**$85,445**	**$88,009**	**$90,649**	**$93,368**	**$96,169**	**$99,054**	**$102,026**	**$105,087**	**$108,239**	**$111,487**
Pumping Power Costs:																								
15-Day Annual Pumping Duration[8]		**$64,227**	**$66,154**	**$68,139**	**$70,183**	**$72,289**	**$74,457**	**$76,691**	**$78,992**	**$81,361**	**$83,802**	**$86,316**	**$88,906**	**$91,573**	**$94,320**	**$97,150**	**$100,064**	**$103,066**	**$106,158**	**$109,343**	**$112,623**	**$116,002**	**$119,482**	**$123,066**
30-Day Annual Pumping Duration[8]		**$77,131**	**$79,445**	**$81,829**	**$84,283**	**$86,812**	**$89,416**	**$92,099**	**$94,862**	**$97,708**	**$100,639**	**$103,658**	**$106,768**	**$109,971**	**$113,270**	**$116,668**	**$120,168**	**$123,773**	**$127,486**	**$131,311**	**$135,250**	**$139,308**	**$143,487**	**$147,791**
90-Day Annual Pumping Duration[8]		**$128,746**	**$132,609**	**$136,587**	**$140,685**	**$144,905**	**$149,252**	**$153,730**	**$158,342**	**$163,092**	**$167,985**	**$173,024**	**$178,215**	**$183,561**	**$189,068**	**$194,740**	**$200,583**	**$206,600**	**$212,798**	**$219,182**	**$225,757**	**$232,530**	**$239,506**	**$246,691**

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$86,689	$89,289	$91,968	$94,727	$97,569	$100,496	$103,511	$106,616	$109,814	$113,109	$116,502	$119,997	$123,597	$127,305	$131,124	$135,058	$139,110	$143,283	$147,581	$152,009	$156,569	$161,266	$166,104	$171,087	$176,220	$181,506	$186,952
$58,073	$62,416	$66,967	$71,735	$76,729	$81,958	$87,431	$93,160	$99,153	$105,422	$111,978	$118,832	$125,997	$133,485	$141,309	$149,482	$158,018	$166,932	$176,238	$185,953	$196,091	$206,671	$217,709	$229,224	$241,233	$253,757	$266,815
$2,080,524	**$2,232,229**	**$2,391,164**	**$2,557,625**	**$2,731,923**	**$2,914,376**	**$3,105,318**	**$3,305,094**	**$3,514,061**	**$3,732,592**	**$3,961,071**	**$4,199,901**	**$4,449,495**	**$4,710,285**	**$4,982,717**	**$5,267,257**	**$5,564,384**	**$5,874,598**	**$6,198,418**	**$6,536,379**	**$6,889,040**	**$7,256,977**	**$7,640,790**	**$8,041,101**	**$8,458,554**	**$8,893,817**	**$9,347,584**
$173,377	$178,578	$183,936	$189,454	$195,137	$200,991	$207,021	$213,232	$219,629	$226,218	$233,004	$239,994	$247,194	$254,610	$262,248	$270,116	$278,219	$286,566	$295,163	$304,018	$313,138	$322,532	$332,208	$342,175	$352,440	$363,013	$373,903
$116,146	$124,831	$133,934	$143,470	$153,458	$163,915	$174,863	$186,319	$198,306	$210,844	$223,955	$237,664	$251,994	$266,970	$282,617	$298,963	$316,035	$333,863	$352,476	$371,905	$392,183	$413,342	$435,419	$458,447	$482,466	$507,513	$533,629
$4,161,048	**$4,464,458**	**$4,782,327**	**$5,115,251**	**$5,463,846**	**$5,828,753**	**$6,210,636**	**$6,610,187**	**$7,028,122**	**$7,465,183**	**$7,922,143**	**$8,399,802**	**$8,898,990**	**$9,420,569**	**$9,965,435**	**$10,534,514**	**$11,128,768**	**$11,749,197**	**$12,396,836**	**$13,072,758**	**$13,778,079**	**$14,513,954**	**$15,281,581**	**$16,082,203**	**$16,917,109**	**$17,787,635**	**$18,695,167**
$346,754	$357,157	$367,871	$378,907	$390,275	$401,983	$414,042	$426,464	$439,258	$452,435	$466,008	$479,989	$494,388	$509,220	$524,497	$540,231	$556,438	$573,132	$590,326	$608,035	$626,276	$645,065	$664,417	$684,349	$704,880	$726,026	$747,807
$232,292	$249,663	$267,867	$286,940	$306,915	$327,831	$349,725	$372,638	$396,611	$421,687	$447,911	$475,329	$503,988	$533,939	$565,234	$597,926	$632,071	$667,726	$704,952	$743,810	$784,365	$826,685	$870,837	$916,895	$964,932	$1,015,027	$1,067,258
$8,322,096	**$8,928,916**	**$9,564,655**	**$10,230,502**	**$10,927,692**	**$11,657,505**	**$12,421,273**	**$13,220,375**	**$14,056,244**	**$14,930,366**	**$15,844,286**	**$16,799,603**	**$17,797,979**	**$18,841,139**	**$19,930,869**	**$21,069,027**	**$22,257,536**	**$23,498,394**	**$24,793,671**	**$26,145,517**	**$27,556,158**	**$29,027,908**	**$30,563,162**	**$32,164,406**	**$33,834,217**	**$35,575,270**	**$37,390,334**
$114,831	**$118,276**	**$121,824**	**$125,479**	**$129,243**	**$133,121**	**$137,114**	**$141,228**	**$145,465**	**$149,829**	**$154,323**	**$158,953**	**$163,722**	**$168,633**	**$173,692**	**$178,903**	**$184,270**	**$189,798**	**$195,492**	**$201,357**	**$207,398**	**$213,620**	**$220,028**	**$226,629**	**$233,428**	**$240,431**	**$247,644**
$126,758	**$130,561**	**$134,478**	**$138,512**	**$142,668**	**$146,948**	**$151,356**	**$155,897**	**$160,574**	**$165,391**	**$170,353**	**$175,463**	**$180,727**	**$186,149**	**$191,734**	**$197,486**	**$203,410**	**$209,512**	**$215,798**	**$222,272**	**$228,940**	**$235,808**	**$242,882**	**$250,169**	**$257,674**	**$265,404**	**$273,366**
$152,225	**$156,792**	**$161,496**	**$166,341**	**$171,331**	**$176,471**	**$181,765**	**$187,218**	**$192,834**	**$198,619**	**$204,578**	**$210,715**	**$217,037**	**$223,548**	**$230,254**	**$237,162**	**$244,277**	**$251,605**	**$259,153**	**$266,928**	**$274,936**	**$283,184**	**$291,679**	**$300,430**	**$309,442**	**$318,726**	**$328,287**
$254,092	**$261,715**	**$269,566**	**$277,653**	**$285,983**	**$294,562**	**$303,399**	**$312,501**	**$321,876**	**$331,532**	**$341,478**	**$351,723**	**$362,274**	**$373,143**	**$384,337**	**$395,867**	**$407,743**	**$419,975**	**$432,575**	**$445,552**	**$458,918**	**$472,686**	**$486,867**	**$501,473**	**$516,517**	**$532,012**	**$547,973**

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Summary - Opinion of Probable Project Costs - Forsgren Option 6B
Design Flow Rate = 62 CFS

Annual Pumping Duration	Total Project Implementation Cost[1]	Present Value - O&M Costs[2]	Present Value - Power Costs[3]	Present Value - Total Costs[4]
15 Days	$8,137,000	$2,909,000	$3,211,000	**$14,257,000**
30 Days	$8,137,000	$2,909,000	$3,857,000	**$14,903,000**
90 Days	$8,137,000	$2,909,000	$6,437,000	**$17,483,000**

Notes:

1) Total project implementation cost includes construction, engineering, admin, contingency, and taxes

2) Present value of annual O&M costs through assumed 50-year project life cycle.

3) Present value of annual power costs through assumed 50-year project life cycle.

4) Sum of total project implementation cost, present value of O&M costs, and present value of power costs.