Renewable Advisory Council Meeting

Project Review

August 14, 2011

The information presented in this review is based on Energy Trust's current understanding of the project and is subject to change.

Project Name:	Klamath Irrigation District, Warm Springs Hydro LLC, C-Drop Project
Staff Evaluator:	Jed Jorgensen
Utility:	PacifiCorp
Power delivery:	QF, standard PPA contract
Capacity:	1.1MW
Generation:	~3,500 MWh annually
Commissioning:	June/July 2012
Total cost:	$2,500,000

Brief Project Description

The C-Drop project is a proposed 1.1MW hydroelectric generating plant located at the convergence several irrigation canals on the Klamath Irrigation District (KID). The site previously supported a 625kW hydroelectric system. The former system burned and was removed from service more than 25 years ago.

The project is being developed by Warm Springs Hydro LLC, an Oregon LLC owned by Dennis Daugherty and Ted Sorenson. Daugherty is the owner of Riverside Inc., a full service construction and electrical firm from Parma, ID. Riverside has been involved in the construction of eight hydropower plants (three where they performed all electrical and mechanical work) and the servicing of another five. Sorenson is a civil engineer who has designed 25 hydro plants from 500kW to 16MW in capacity. He owns and operates nine of those facilities, including one in Oregon. The LLC will construct and operate the plant.

KID is leasing the rights to develop the project to the LLC for 25 years. The lease fee is a royalty based on a percentage of gross revenues. The royalty is structured to provide incentive for the district to provide increased flows to the hydro project. After year 25 the ownership for the project changes to a 50/50 split between the LLC and KID.

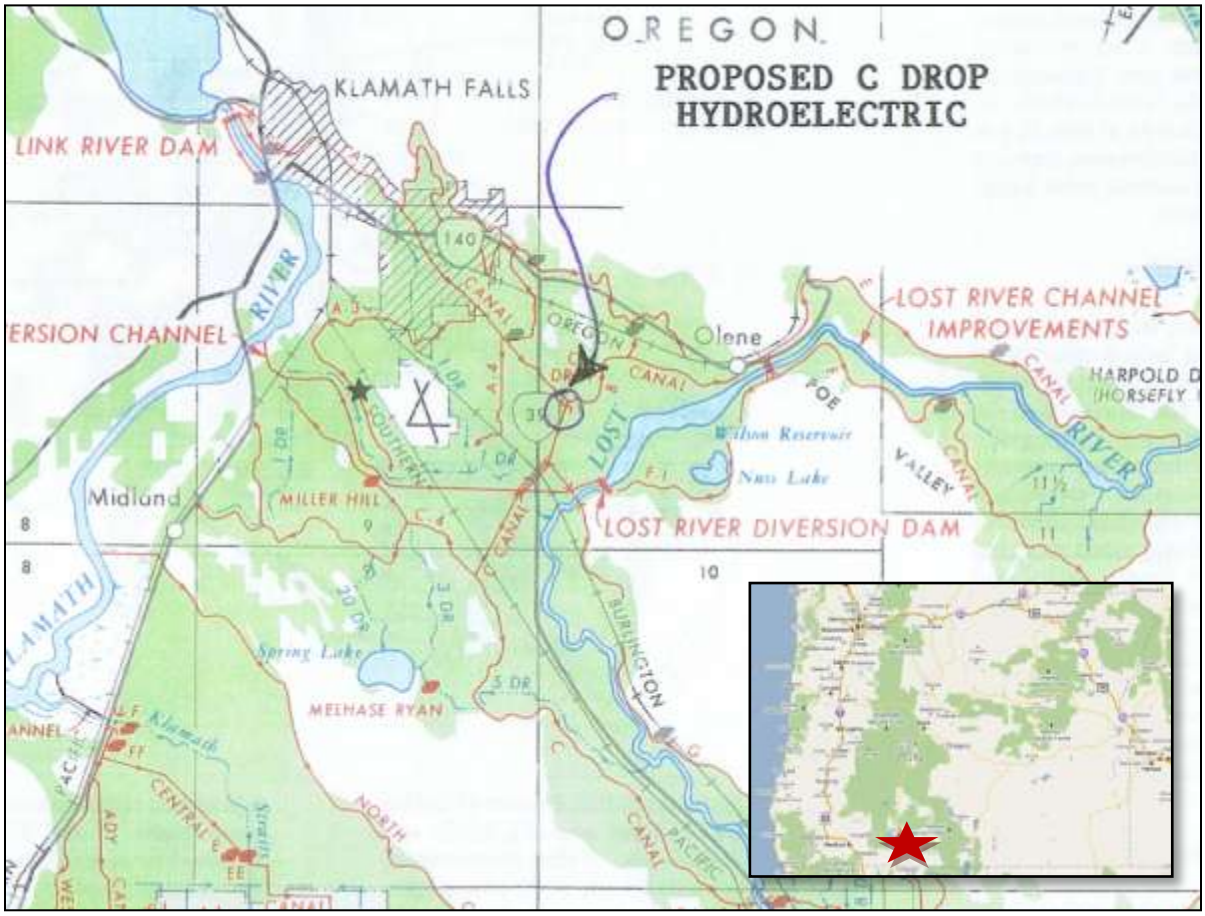
This project differs from other irrigation hydro we have provided incentives for in that there is no significant canal piping involved. Instead, the project utilizes the head available from the existing drop and refurbishes the structures used by the former power plant. The lack of piping lowers project costs significantly.

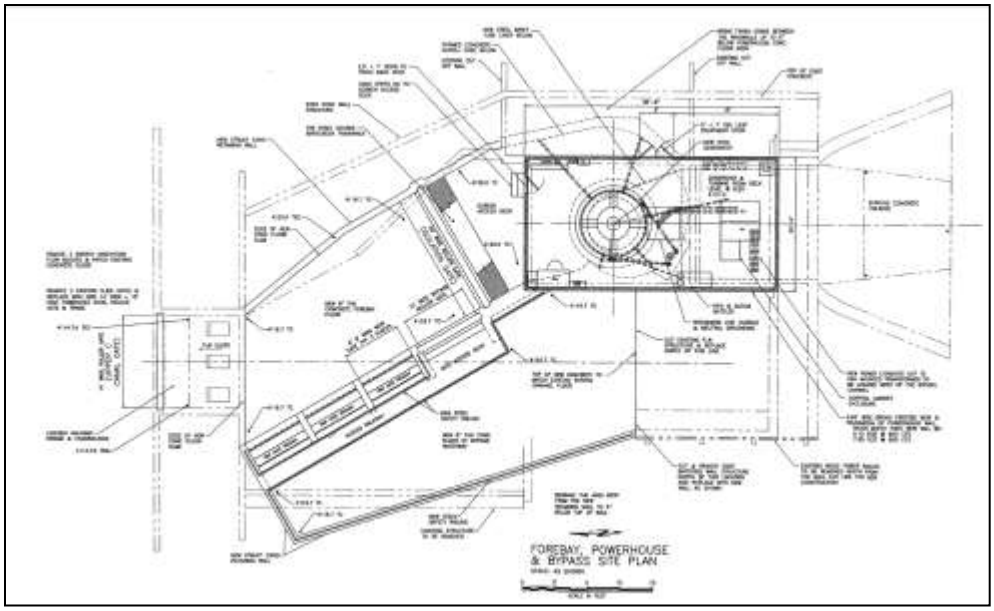
Federal permitting for this project is under the jurisdiction of the Bureau of Reclamation (BOR) instead of the Federal Energy Regulatory Commission (FERC). The BOR process is similar to FERC's in that the goal is to implement the regulations of the National Environmental Policy Act (NEPA). The process differs in that the BOR essentially does all the work and is paid by the developer to do so, while the developer performs all the work under the FERC process.

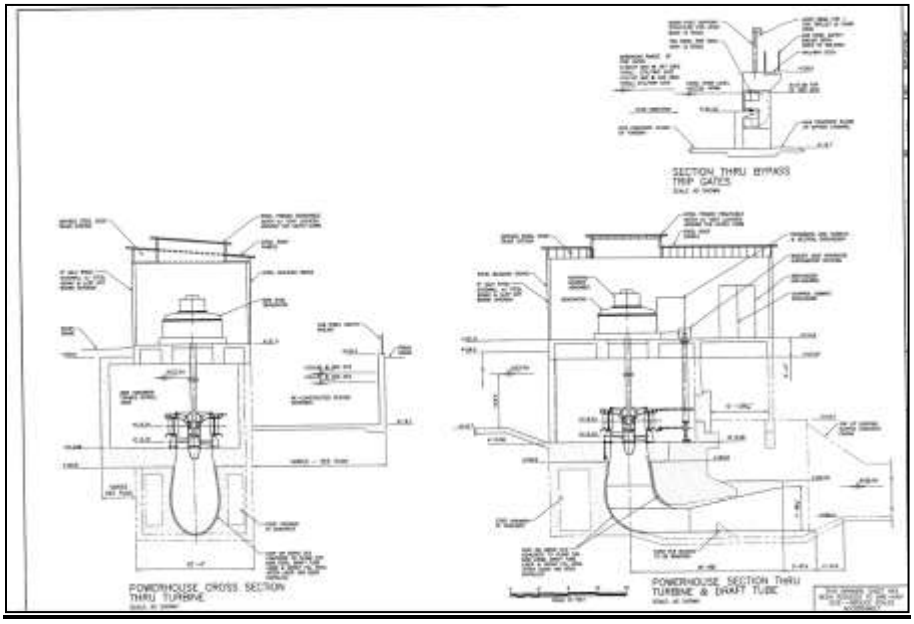
Under the BOR jurisdiction the project is authorized through a "Lease of Power Privilege" (LOPP). The LOPP was awarded to KID and recognizes that the district is in turn leasing the development rights to the LLC. The LOPP comes with some requirements: an annual payment

based on power sales (amounting to ~$4,000/yr) and a $100,000 maintenance reserve fund to be kept in perpetuity.

The images below shows the approximate location of the project at the convergence of multiple canals and preliminary design drawings of the project.







<u>Site Control, Interconnection, PPA, Design, and Permitting</u>
The project is pretty far along in its development.

Site Control: Site control has been secured through the agreement with the district. In addition, the district has been awarded the Lease of Power Privilege from the BOR. The LOPP notes the district's plan to lease the development to a third party.

Permitting: The BOR is moving forward with its NEPA analysis of the project. The BOR process differs from the FERC process in that BOR actively manages environmental permitting instead of the project owner. Energy Trust is providing $40,000 in development assistance to help defer some of the costs of the BOR permitting. The LLC has also applied for the state water rights necessary for the project. The state hydroelectric water right is a layer on top of the

existing water rights for KID, and KID's existing rights serve the water through the project. The state and federal processes move concurrently and are expected to be finished this fall. The LLC has also applied for a conditional use permit from Klamath County and expects it to be granted in September.

Design: The LLC is moving forward with final design of the system. All system designs must be approved by the BOR, at the LLC's expense. 50% design has been submitted and final design is expected to be completed early this fall. The turbine for the project has been ordered.

Interconnection: All interconnection studies have been completed and the project has a signed interconnection agreement with PacifiCorp. Interconnection costs are known, and significantly lower than we have seen for similar projects, mainly due to the existing infrastructure at the project site. PacifiCorp has indicated they have had some trouble on the interconnection time table and may not be able to have the project interconnected until late June 2012.

PPA: The project has a draft PPA with PacifiCorp and is working to see it executed soon as to avoid any changes in the avoided cost schedule that are expected later this year.

Resource Evaluation

A feasibility study for the site was initially performed in 2008 and updated this year to analyze differing flow scenarios. The original study examined 21 years of water flows, from 1986 – 2007, including the 2001 water year in which flows were severely restricted. The 2001 water year is an extreme anomaly and is discussed further later. For the purposes of characterizing the average resource the data from 2001 has been omitted. The remaining flow data represents the historical 'base-case' for the project.

The 2011 addendum to the feasibility study analyzed operational modifications the irrigation district could make to increase water flows at the site of the drop structure. The operational modifications involve re-routing water from various canals and changing pumping regimes. The modifications will cost the project approximately $25,000 up front, but could make a significant difference in the amount of water available to the project. (See Appendix A for KID's explanation of the flow modifications and why the district has confidence in being able to increase water deliveries.) The table below shows the average monthly flows in the base case and an estimate for the flows after the operational modifications are made.

Average flows, CFS	Base Case (standard dev.)	Modified Operations est.	Difference
April	228 (125)	336	32%
May	429 (147)	700	39%
June	520 (112)	700	26%
July	586 (82)	700	16%
August	552 (69)	700	21%
September	388 (99)	499	22%
October	258 (83)	304	15%

Irrigation flows vary every season based on weather and crop needs. As can be seen in the table above, the standard deviation in the monthly flows based on 20 years of data is greatest in the early months of the irrigation season.

The drop structure is able to develop 22.5 feet of head. A Kaplan turbine has been chosen as they are able to efficiently serve projects with low head and highly variable flows. Kaplan turbines look like ship propellers and are able to vary the pitch on their blades to in response to flow conditions.

With the head and flows available the site can support a 900kW turbine under base-case flows, or a 1.1MW turbine with the modified operation flows. Assuming total system efficiencies of 80% (appropriate for hydro when looking at turbine, generator, and transformer efficiencies), the feasibility studies assert that the power plant would generate 2,823 MWh annually under base flows. Looking at year-to-year estimates from 1986-2007, the changing flow regimes lead to a standard deviation in generation of ~300 MWh. Under the modified operations, generation is estimated to reach as much as ~4,150 MWh.

Staff independently analyzed the flow and generation numbers associated with the base-case and modified operations and found them to be reasonable. The tables below show the highlights of staff's analysis:

Generation 1986-2007 base case	**Annual MWh**	
Avg w/ 2001	2,617	
Avg w/o 2001	2,721	
Max Gen	3,264	
Min Gen (w/o 2001)	2,183	
Monthly Generation from avg flows (MWh)	**Base case**	**Modifications**
April	208	307
May	487	794
June	571	768
July	664	794
August	626	794
September	426	548
October	132	156
Total	**3,113**	**4,160**

The district and the LLC intend to follow the modified-operations path as it would be significantly more lucrative for the project. The question is, how successful will the district be in diverting additional flows through the project? The LLC has structured its agreement with the district to reward the district based on increased water flows. That said, the LLC has stated they think the district may not be able to fully divert all the water identified in the operational modifications. The LLC does feel it is likely that flows will be higher than base-case, but perhaps not to the full extent possible.

As with any hydro project, flows will vary from year to year. Staff thinks the best course of action in reviewing the project is to split the difference between the base case generation and the modified operations generation, estimating that 3,495 MWh will be generated annually. The LLC agrees with this approach.

If the district is able to deliver water flows to generate 3,495 MWh annually the lease payments will range from $1,300 in the first two years of the project to $44,000 in the out years.

Water delivery risk, the Klamath Basin Water Crisis, and the 2001 water year: On average, KID delivers water for 192 days per irrigation season (minimum 185, maximum 196). During the crisis in 2001 water was delivered for only 26 days. Much work has been done to avoid another event like 2001, but the risk related to water availability cannot be understated for this project.

KID is a party to and supporter of the Klamath Basin Restoration Agreement (KBRA). The KBRA is the framework for allotting water between environmental and agricultural uses in the basin. The agreement, which was signed in February 2010 by all the parties involved, still requires congressional authorization and appropriation. While funding is hard to come by in the current environment, KID says that some congressional action on parts of the KBRA is already underway. The KBRA has the full support of the BOR and Department of the Interior. KID believes that congress will ultimately support the KBRA in full so as to avoid dealing with any future problems in the basin.

KID believes that it is almost impossible for another 2001 event, even without the KBRA in place, under the assumption that none of the parties involved in the KBRA want that to happen again. If the KBRA is ratified, a similar event will not be able to happen as it ensures a supply of water to KID every year. The supply under the KBRA is less than the historical averages and is determined by the type of water year (dry, wet, etc.). The KBRA also includes funds to pursue activities which will offset potential water losses, such as water banking, land-idling, increased groundwater pumping, on-project and on-farm conservation, and new storage opportunities. KID is already undertaking many efforts to increase their water efficiency. Combined with the operational changes the KID envisions, the district manager does not believe the C-Drop project will experience a drop in water flows: to the contrary, he believes that operational changes will ensure high flows through the hydro project.

In staff's opinion, because the KBRA is not in place there is a risk that the project could suffer the loss of one or more years of irrigation water. However, the project is financially strong, and in modeling these rare events it appears the project should be able survive and service its debt payments with cash on hand and reserves. Staff thinks Energy Trust will have to share in this downside risk to the project, just as we share in its success if the project generates more than expected.

Cost, Expenses, Revenues and Financing

The costs of the C-Drop project appear reasonable and are consistent with costs we have seen for similar projects. It is comparatively cheaper than the other irrigation hydro projects we have supported because of the lack of piping needed. In addition, the project is utilizing a turbine manufactured by China Huadian Engineering Corporation (CHEC), saving approximately $200,000 compared to the 750kW Swalley project. Sorenson has used the same turbine manufacturer on the past five projects he has installed and the turbines have performed well and meet national and international standards.

Upfront costs for the project are approximately $2,500,000 including an ~10% contingency. Annual expenses, before royalties, are estimated at ~$70,000. Expenses are less than COID, but more than the Swalley projects. The LLC appears to be able to leverage its operational expertise to keep expenses low, despite having to pay property taxes.

As the project will be owned by an LLC it can take advantage of the ITC as a grant and depreciation. The ITC as a grant is worth approximately $708,000 to the project.

The majority of the project's up-front costs (93%) can be depreciated on the 15 year MACRS schedule, and another 4% can be depreciated on a 20 year straight-line schedule. In staff's opinion, this level of depreciation appears to be aggressive, but defensible.

In addition, the project has been awarded a BETC worth $328,000 as a pass through.

KID is loaning the project $600,000 at 5% interest for 14 years with no financing fee. This is another value KID sees in the project, and it provides a low-interest source of capital to the LLC.

Capital Costs	
Feasibility, Design, Construction Management	$ 460,000
Site & Civil	$ 441,800
System components	$ 701,000
Electrical / Interconnection (PAC interconnect = ~$240k)	$ 575,500
Construction Interest	$ 70,000
Contingency (~10%)	$ 214,700
Total	**$2,460,000**

Annual expenses	
Maintenance (1.8% of capital – we would expect 1-3%)	$ 45,000
Insurance, Property Tax and other	$ 24,875
Total	**$ 69,875**

Annual Lease Fees

The annual lease fee is a two-tier structure, based on revenues from base case generation and revenues from generation above the base case. If the district is able to successfully supply additional water they see a large increase in their lease payments. As noted above, under the 3,495 MWh generation scenario lease payments range from $1,300 in the first two years to $44,000 in year 20.

	Years 1-5	**Years 6-10**	**Years 11-15**	**Years 16-20**
Lease Payment from revenues from 1st 3,000MWh	0%	5%	7%	12%

	Years 1-2	**Years 3-10**	**Years 11-20**
Lease Payment from revenues from generation above 3,000MWh	5%	15%	20%

Staff's Above Market Cost Analysis

Staff analyzed the project over a 20 year term at a 12% discount rate using the costs, expenses, and financing described above and looked at a range of generation and flow risk scenarios: base case (2,823MWh), mid-range (3,495 MWh), and high-case (4,160 MWh). Each generation scenario was also analyzed to see the impact to the project if no water were to flow in either year 3 or year 10. If the KBRA is enforced, a water shortage in year 10 is less likely than a shortage in the short-term prior to the KBRA coming into effect. The discount rate was chosen as a rate commonly acceptable to privately owned projects, and in this case the developer disclosed an interest in getting a 12% return on their equity.

The table below shows the Above Market Cost across the range of sensitivities to generation and flow risk for the project.

Generation Scenario	Above Market Cost	IRR	Payback Year	DSCR
Base Case (2,823 MWh)	$ (643,483.00)	5.3%	13	>1.36
Base Case + no water in year 3	$ (787,411.00)	4.1%	15	>1.36 except year 3
Base Case + no water in year 10	$ (716,275.00)	4.3%	15	>1.36 except year 10
Mid Case (3,495 MWh)	$ (316,825.00)	8.9%	10	>1.94
Mid Case + no water in year 3	$ (491,228.00)	7.4%	11	>1.94 except year 3
Mid Case + no water in year 10	$ (405,601.00)	7.9%	11	>1.94 except year 10
High Case (4,160 MWh)	$ 3,989.00	12.0%	8	>2.51
High Case + no water in year 3	$ (207,211.00)	10.2%	9	>2.51 except year 3
High Case + no water in year 10	$ (108,107.00)	11.0%	8	>2.51 except year 10

The project has an above market cost in all but the most aggressively optimistic scenarios. The table also shows this is a strong project even under base-case and water shortage conditions. In the event of a water shortage, the project would be forced to rely on reserves and cash-on-hand to cover its debt, but the size of the total amount of debt is small enough to not be too worrisome.

Staff feels that the Mid-Case + no water in year 3 is an appropriately conservative place to base the full evaluation for this project.

Proposed Incentive, RECs, Impact Analysis

Staff made a proposal to the developer using the Mid-Case flow scenario with a water shortage in year three, yielding an Above Market Cost of $491,228.

Staff initially proposed an incentive of $300,000 paid in two payments, which would have yielded close to a 50/50 REC split with the LLC. The developer instead prefers to maximize the incentive amount and sell more RECs to Energy Trust.

The counter offer was for two payments of $245,000 each, for a total of $490,000. The NPV of this incentive is $414,063 or 84% of the Above Market Cost. Energy Trust would ask for 84% of

the project's RECs over a 20 year term, 59,000 RECs total at a levelized cost of $11.47. The project prefers to deliver 100% of its generated RECs to Energy Trust until 59,000 RECs have been delivered, requiring approximately 17 years.

This incentive would give the project an IRR of 11.2% and a payback in year 8.

Assigning a $10 value to the last three years of RECs owned by the project gives the project a final IRR of 12%, which is their target.

Energy Trust would be paying $1.23 million per aMW for the energy, a good value to us.

Recommendation, Action

This is a strong project offered by a sophisticated and experienced developer team. The project is a good value to Energy Trust and would come on line in 2012, providing additional benefit for Energy Trust to meet its goals. Because the project is so far along in its development, much of the risk associated with the development cycle has already been borne by the LLC.

Staff offered the project the proposed incentive and the project accepted the offer.

Internal Review Committee

The project was reviewed on 6/16/2011 by the follow Energy Trust staff:
Phil Degens, Betsy Kauffman, Debbie Menashe, Elaine Prause, Thad Roth.

The internal review committee supported the project and found it to be strong. The committee asked for a sensitivity analysis related to the loss of water in a given year. This analysis was completed and added to the report.

Renewable Energy Advisory Council

The project will be presented to the RAC informationally on August 10, 2011.

Appendix A. Operational Modifications to Increase Flows Through the C-Drop Project

The average flows at the Klamath Irrigation District (KID) upper C canal or the site of the C-Drop hydroelectric project as determined in the original feasibility study are shown in the attached Exhibit A. This original study looked at historic operations without any look at what was the full potential or possible. The design capacity for the Upper C canal is 750 cfs, which splits to the G canal with a design capacity of 400 cfs and the C canal with a design capacity of 330 cfs, with allowances for a few individual deliveries direct from the Upper C.

The G canal has a supplemental pumping station which pumps from Lost River to the G canal with a capacity of 105 cfs. The C canal has a supplemental pumping station which pumps from the #5 Drain to the C canal with a capacity of 25 cfs. The C canal also has a supplemental pumping station Adams near the tail end which supplies laterals from the C from Lost River with a capacity of 63 cfs. Another major lateral of the C, the C-4 has a supplemental pumping station Miller Hill from the Lost River Diversion Channel with a capacity of 105 cfs.

Historically, prior to the expiration of a favorable Power contract with PacifiCorp in 2006, the District paid .6 cents/kwhr for power. In 2013 we will be paying full tariff and have been increasing 50% per year since the expiration of the contract.

When power was cheap the District was quick to use its supplemental pumping capacity as a matter of convenience and to run its Upper C, G & C canals more conservatively as related to their design maximums. Now that power is a greater expense the District will change how it operates and will rely more on gravity flow through its canal systems. This means that we will run our canals at higher than historical averages and will only use supplemental pumping when we cannot meet irrigation demand using the canal design maximums. In addition we have installed Variable Frequency Drives at each of the mentioned supplemental pumping stations so when we cannot meet irrigation demand at design maximums with gravity flows through the canals we can supplement with a smaller volume of water rather than say, turning on a 40 cfs pump for 15 extra cfs of demand and cutting 25 cfs of gravity flow from the canal.

Therefore figuring that we have a total supplemental pumping capacity related to the C-Drop of 293 cfs and we will only pump when necessary to meet irrigation demand over and above the design maximum of the Upper C and associated lateral, a significant portion of the pumping capacity will be transferred to gravity flows through the C-Drop Hydroelectric project.

In addition the Tule Lake Irrigation District (TID) water source is the Lost River at the Malone Dam diversion to the J-Canal. The Lost River picks up the majority of the irrigation return flows and operational spills from KID operations. The return flows are not enough to meet TID irrigation demands and they must supplement their flows to the Lost River from Station 48 which gets its water from the Lost River Diversion Channel (LRDC) which brings water from the Klamath River.

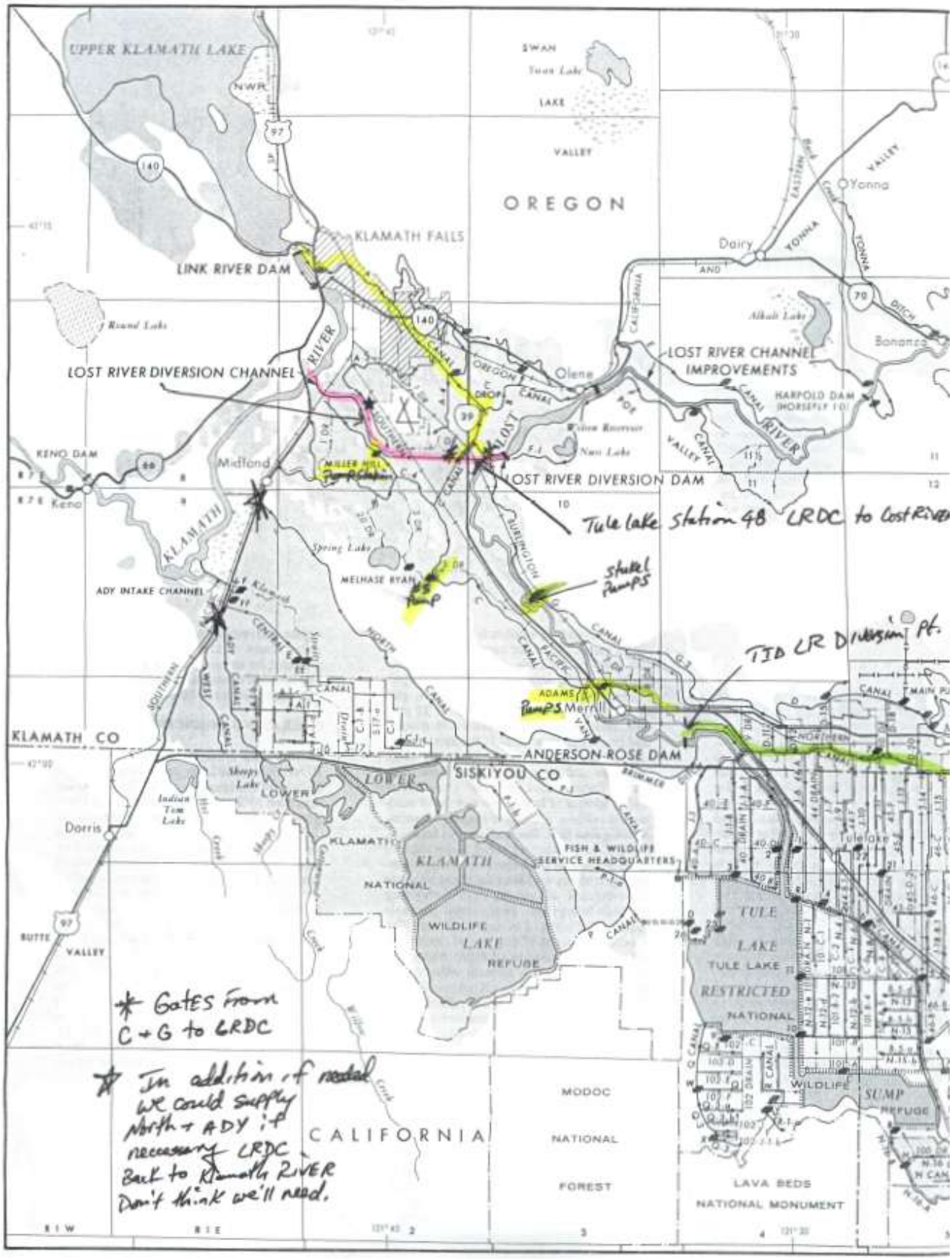
Attached are spreadsheets showing TID demand from station 48 and total demand over 10 year period, average by month. Station 48 demand averages from 82 cfs in April to 267 cfs in June and back down to 35 cfs in October. KID can provide this demand in two ways. 1) indirectly through operational spills to the Lost River which would pass through the C-Drop and supply TID with their demand rather than using Station 48 deliveries. 2) KID has proposed to the Bureau of Reclamation to change operation of the Project to provide TIDs station 48 demand and KIDs C-4 supplemental pumping station with a capacity of 105 cfs by direct delivery to the LRDC from the C and G canals. We have the capability to do so now with existing gate

structures in the C and G canals to the LRDC. All of this water would pass through the C-Drop Hydroelectric project. The Bureau of Reclamation is on board with this proposal and details to implement are being worked on as we speak.

By adding TIDs Station 48 demand, the C-4 supplemental pumping plant demand with direct deliveries to the LRDC and only using other supplemental pumping plants when irrigation demand cannot be met with gravity flow in the C and G canal systems, KID is confident that we can deliver the flows indicated on the spreadsheet titled Warm Springs BETC with water conservation – 700 cfs. If necessary we can provide supplemental pumping data to verify our confidence.

Sincerely,

Mark Stuntebeck
Manager KID


UPPER KLAMATH LAKE
NWR
SWAN
LAKE
VALLEY
OREGON
KLAMATH FALLS
LINK RIVER DAM
Round Lake
LOST RIVER DIVERSION CHANNEL
RIVER
Olene
LOST RIVER CHANNEL IMPROVEMENTS
HAROLD DAM
KENO DAM
Keno
Midland
MILLER HILL
LOST RIVER DIVERSION DAM
Tule lake Station 48 LRDC to Lost River
KLAMATH
Spring Lake
MELHASE RYAN
Stukel Pumps
ADY INTAKE CHANNEL
TID LR Diversion Pt.
ADAMS
Pumps
Merrill
KLAMATH CO
ANDERSON-ROSE DAM
SISKIYOU CO
Sheepy Lake
LOWER
Indian Tom Lake
Dorris
KLAMATH
NATIONAL
WILDLIFE
LAKE
REFUGE
FISH & WILDLIFE SERVICE HEADQUARTERS
TULE
LAKE
TULE LAKE
RESTRICTED
NATIONAL
WILDLIFE
SUMP
REFUGE
BUTTE
VALLEY
Yonna
Dairy
Bonanza
Alkali Lake
Gates From C + G to LRDC
In addition, if needed we could supply North + ADY if necessary LRDC Back to Klamath River Don't think we'll need.
CALIFORNIA
MODOC
NATIONAL
FOREST
LAVA BEDS
NATIONAL MONUMENT