Barriers to Temporary Inter-District Water Transfers in the Yakima River Basin: Irrigation District Perspective

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Abstract:

Water marketing, or mechanisms to acquire and redistribute water such as temporary water transfers, can represent a valuable response to drought for irrigation districts. The Department of Ecology, the US Bureau of Reclamation, and a workgroup composed of members from various entities collaborated to develop the Yakima River Basin Integrated Water Resource Management Plan (Integrated Plan) to better manage water resources and address ecosystem issues in the Yakima River Basin. The Integrated Plan addresses water marketing but it does not provide specifics on how barriers to inter-district water transfers will be eliminated. This study asks irrigation district managers in the Yakima River basin about the factors they consider when deciding whether to engage in a temporary inter-district water transfer or not. Results show that institutional barriers are the most common barrier to inter-district water transfers. This topic requires further research on fallowing and irrigation district behavior in relation to the other water supply efforts outlined in the Integrated Plan. Finally, the water market in the Yakima basin can benefit from education and outreach to senior water rights holders, shortening the time frame to process expedited transfers, and documentation from irrigation districts reporting denial reasons for temporary inter-district water transfers.

Acknowledgments:

I would like to thank all of the interviewees who took the time to participate in this study. That includes the folks from the irrigation districts as well as the various members from USBR, HDR, and Ecology as well as consultants that provided insight. Due to the confidentiality I promised to uphold, the individuals are not named here. Finally, I would like to thank my research advisors, Dr. Rob Turner and Dr. Eric Salathé, for their guidance.

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GLOSSARY OF TERMS:

Acquavella adjudication: Also known as the Yakima River Basin Surface Water Adjudication. "Water supplies in the Pacific Northwest in 1977 were inadequate to meet the needs in many areas, including the Yakima River basin. The State of Washington, October 12, 1977, filed an adjudication of the Yakima River system in the Superior Court of Yakima County (Case No. 77- 2-0148-5) naming the United States and all persons claiming the right to use the surface water of the Yakima River basin as defendants. Motions were filed to reopen the judgment on the 1945 Consent Decree. However, the District Court held that the Decree was being correctly interpreted by Reclamation. At the same time, the YN filed an action in Federal District Court to determine the priority and quantity of the water rights of the YN under the Treaty of 1855. Later in the same year, the State of Washington filed in State Court for a general adjudication of the Yakima River drainage basin. In March 1985, the Court ruled that this action could be limited to surface waters of the Yakima River basin and that groundwater users need not be included for a general adjudication. The Federal case was deferred to the State's case, and the prior filing by the YN did not proceed. The general adjudication remains open and in progress with orders continuing to be issued on water right claims in the Yakima River and its tributaries." (Reclamation U. B., 2002)

Climate: "The weather of a particular area averaged over many years." (NASA, 2011)

Coase Theorem: The theorem focuses on the conditions that must be met in order to have an efficient market. The two conditions are low transaction costs and clearly defined and secure property rights. (Ruml, 2005)

Consumptive water: Defined as water incorporated into plant, into tissue, plus water lost via evaporation. (Roza Irrigation District, 2016)

Decree: "The District Court of Eastern Washington issued the 1945 Consent Decree (Decree), which established the rules under which Reclamation should operate the project. The Decree determined the quantities of water to which all project users are entitled, and defines a prioritization for water-short years. Users were divided into two classes, non-proratable (those with the most senior rights) and proratable. Non-proratable users would be served first from the total water supply available (TWSA) and proratable users would share equally in the balance of available supply" (Reclamation U. B., INTERIM COMPREHENSIVE BASIN OPERATING PLAN, 2002)

Fallow: Where a farmer does not grow any crops during a growing season, letting the soil rest and rejuvenate.

Infrastructure factors: Physical barriers, capacities or features that enable or limit the conduct of individuals or groups.

Institutional factors: Policies in place, actions taken or lack of actions taken by agencies or even norms, or beliefs that dictate the conduct of other individuals or groups.

Inter-District: In regards to water transfers, this refers to water transfers between irrigation districts.

Irrigation District: "Political subdivisions of the state that supply farmers with irrigation water. Elected governing boards run irrigation districts." (Brewer, Glennon, Ker, Libecap, 2007)

Non-proratable: "Non-proratable entitlements are to be served first from the (see TWSA). The non-proratable entitlements are confirmed by the Decree (see Decree), Article 18. Article 19 established that these entitlements are excepted from proration, and the sum of said amounts are to be deducted from the TWSA prior to determining the entitlements that are subject to proration." (Reclamation U. B., 2002)

Option Contracts: Also known dry year contracts. Options contracts gives buyers the right, but not the obligation, to buy water at a future date (known as exercise date) at a pre-set price (example $100/af). The buyer pays an upfront fee to the seller for this right (example $10/af). The buyer may typically elect to purchase any amount of water up to the full contract limit (referred to as "calling" or "exercising" options) and buyer must decide whether to exercise the option by a certain date agreed to in the contract. Sellers typically will make water available through crop idling. In addition, the option contracts ideally should be signed prior to April where the upfront fee is paid for already ($15/af), and more importantly, so that option contract transaction procedures are already in place in case of drought or water short year. (Tomkins, Weber, Freyberg, Sweeney, & Thompson, 2008)

Perennial crops: "Crops which are alive year-round and are harvested multiple times before dying." (MIT, 2012)

Proratable: All irrigation entitlements determined are established in the Decree (see Decree). When a shortage of water occurs, non-proratable entitlements are fulfilled first. The remaining water is shared equally among the water rights holders determined as proratable water users in the Decree. (Reclamation U. B., 2002)

RCW 90.03.280: *Appropriation procedure—Notice.*
"Upon receipt of a proper application, the Department of Ecology shall instruct the applicant to publish notice thereof in a form and within a time prescribed by the department in a newspaper of general circulation published in the county or counties in which the storage, diversion, and use is to be made, and in such other newspapers as the department may direct, once a week for <u>two consecutive weeks</u>. Upon receipt by the department of an application it shall send notice thereof containing pertinent information to the director of Fish and Wildlife." (Washington State RCW 90.03.280)

RCW 90.03.380(1)(2)(3): "*Right to water attaches to land—Transfer or change in point of diversion—Transfer of rights from one district to another—Priority of water rights applications—Exemption for small irrigation impoundments—Electronic notice of an application for an interbasin water rights transfer. (Effective until June 30, 2019.)*
The point of diversion of water for beneficial use or the purpose of use may be changed, if such change can be made without detriment or injury to existing rights. A change in the place of use, point of diversion, and/or purpose of use of a water right to enable irrigation of additional acreage or the addition of new uses may be permitted if such change results in no increase in the annual consumptive quantity of water used under the water right. For purposes of this section, "annual consumptive quantity" means the estimated or actual annual amount of water diverted pursuant to the water right, reduced by the estimated annual amount of return flows, averaged over the two years of greatest use within the most recent five-year period of continuous beneficial use of the water right. Before any transfer of such right to use water or change of the point of diversion of water or change of purpose of use can be made, any person having an interest in the transfer or change, shall file a written application therefor with the department, and the application shall not be granted until notice of the application is published as provided in RCW 90.03.280. If it shall appear that such transfer or such change may be made without injury or detriment to existing rights, the department shall issue to the applicant a certificate in duplicate granting the right for such transfer or for such change of point of diversion or of use. The certificate so issued shall be filed and be made a record with the department and the duplicate certificate issued to the applicant may be filed with the county auditor in like manner and with the same effect as provided in the original certificate or permit to divert water. The time period that the water right was banked under RCW 90.92.070, in an approved local water plan created under RCW 90.92.090, or the water right was subject to an agreement to not divert under RCW 90.92.050 will not be included in the most recent five-year period of continuous beneficial use for the purpose of determining the annual consumptive quantity under this section. If the water right has not been used during the previous five years but the nonuse of which qualifies for one or more of the statutory good causes or exceptions to relinquishment in RCW 90.14.140 and 90.44.520, the period of nonuse is not included in the most recent five-year period of continuous beneficial use for purposes of determining the annual consumptive quantity of water under this section." (Washington State RCW 90.03.380 (1))
"(2) If an application for change proposes to transfer water rights from one irrigation district to another, the department shall, before publication of notice, receive concurrence from each of the irrigation districts that such transfer or change will not adversely affect the ability to deliver water to other landowners or impair the financial integrity of either of the district."
(Washington State RCW 90.03.380 (2))
"(3) A change in place of use by an individual water user or users of water provided by an irrigation district need only receive approval for the change from the board of directors of the district if the use of water continues within the irrigation district, and when water is provided by an irrigation entity that is a member of a board of joint control created under chapter 87.80 RCW, approval need only be received from the board of joint control if the use of water continues within the area of jurisdiction of the joint board and the change can be made without detriment or injury to existing rights." (Washington State RCW 90.03.380 (3))

Return Flows: "Irrigation return flow is defined as the part of artificially applied water that is not consumed by evapotranspiration and that either drains to the water table or runs off to a surface-water body. Water that drains to the water table will eventually either discharge to a surface-water body, such as a lake, stream, or Puget Sound, or be pumped from a well. The partitioning of aquifer recharge and direct runoff to surface-water bodies depends on the irrigation rates and properties of the irrigated soils." (U.S. Geological Survey, 1999)

Total Water Supply Available (TWSA) Announcement: Announced by USBR. The first estimate of TWSA is provided in early March for the period April through September 30th, and thereafter monthly, biweekly, or weekly as needed. The link below provides an example of a TWSA announcement from August 2015.
http://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=49907

Total Water Supply Available (TWSA) estimate: The "amount of water available in any year from natural flow of the Yakima River, and its tributaries, from storage in the various Government reservoirs on the Yakima watershed and from other sources, to supply the contract obligations of the United States to deliver water and to supply claimed rights to the use of water on the Yakima River and
its tributaries, heretofore recognized by the United States.

TWSA is equal to:

April 1st through July 31st forecast of runoff,
+ August 1st through September 30th projected runoff,
+ April 1st reservoir storage contents,
+ Usable return flow upstream of Parker Gage"

(Reclamation U. B., 2002)

CHAPTER 1 – PURPOSE OF STUDY

The Yakima River feeds water for irrigation, urbanization, wildlife, fisheries, hydropower and more throughout the Yakima Valley (Reclamation U. B., 2002). Specifically related to irrigation, the Yakima River basin contains the largest agricultural economy in the state (Reclamation U. B., 2002). Unfortunately, according a report composed by the Climate Change Impacts Group at the University of Washington, the Yakima River basin is highly sensitive to projected increases in temperatures because of its dependence on a dwindling annual accumulation of snowpack in the Cascades to supply summer-time flows (Vano, et al., 2009). Furthermore, a 2004 case study of the Yakima River Basin found that periodic droughts in the Yakima basin lead to significant reduction in crop yields and "increases in economic risk both in dry years with current climate, and in a future climate with 2°C warming and no change in annual precipitation" (Scott, Vail, Jaksch, Stöckle, & Kemanian, 2004). So even, during a normal precipitation year, the temperature warming will cause the snow pack to melt earlier than is needed for the irrigation season (irrigation season runs from late April to September). The science of forecasting climate temperatures and droughts is far from perfect making it hard to plan for such things like water scarcity. Countless studies show that increase in climate temperatures leads to unpredictable climatic events and more studies predict this will continue into the future. The question then becomes - What can be done in the Yakima River basin to make those that depend on water resilient to climate change and the water scarcity it may cause? One of the responses to this challenge is market-based transactions of water rights (Reclamation & Ecology, 2011).

The Washington State Department of Ecology (Ecology), the US Bureau of Reclamation (USBR) and a workgroup composed of members from various entities like the Yakama Nation, City and County Government, and environmental organizations have collaborated to develop the Yakima River Basin Integrated Water Resource Management Plan (Integrated Plan) (Reclamation & Ecology, 2011a). The purpose of the Integrated Plan is to identify ways to more effectively manage water resources and address ecosystem problems within the Yakima River Basin. Market reallocation is one of seven elements to the Integrated Plan and a specific piece of that element involves irrigation district to irrigation district (or inter-district) temporary water transfers. Irrigation districts are political subdivisions that emerged as a strategy to more efficiently distribute water for agriculture in the western US states. These districts, among many things, manage the water distribution system and have the power to tax landowners within their borders for construction, delivery, and maintenance of the water system (Libecap, 2010). In the Yakima River Basin there are 13 irrigation districts, each led by a five member board of directors. Five of the districts, Kittitas Reclamation District (KRD), Roza Irrigation District (Roza), Yakima Tieton Irrigation District (YTID), Wapato Irrigation Project (WIP) and Sunnyside Valley Irrigation District (SVID) manage about 80% of the water entitlements in the Yakima, Tieton and Naches river watersheds (Reclamation & Ecology, 2011b). The five districts mentioned above will be the most directly impacted by the Integrated Plan and Figure 1 below shows a map of the basin and these irrigation districts.

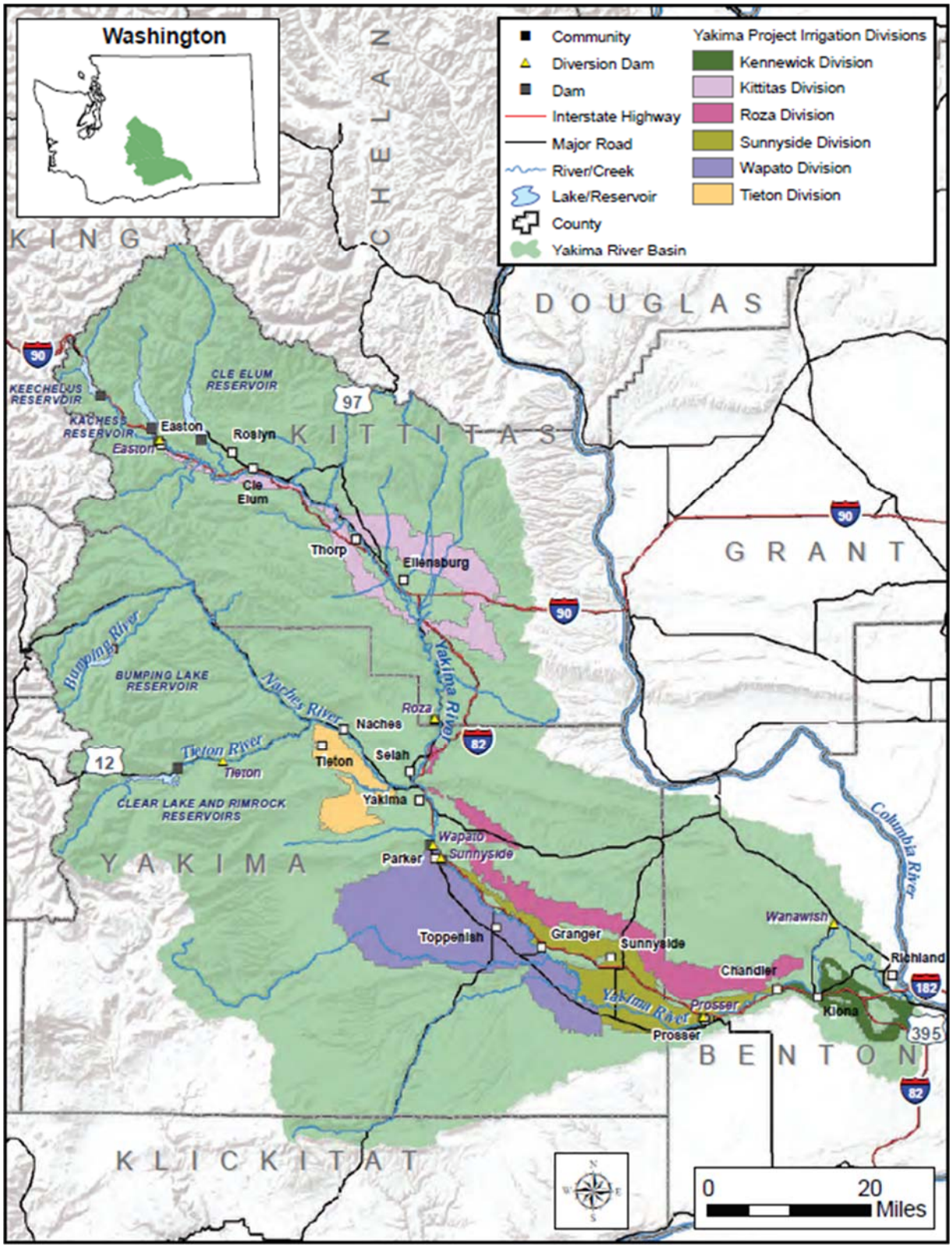

Figure 1 – Map of the Yakima River basin displaying outlines of six irrigation districts and the locations of the primary storage reservoirs. (Reclamation & Ecology, 2012)

Notice as well that the Figure 1 map also points out lakes/reservoirs and diversion points. There are five of reservoirs or storage sites that are part of the Integrated Plan (Bumping Lake, Cle Elum, Kachess, Keechelus, and Rimrock/Tieton Dam) (Reclamation U. B., 2002). These five storage sites have a combined capacity of "one-third of the average annual unregulated flow of the Yakima River basin" (Vano, et al., 2009). Additionally, with the irrigation season beginning in April, the snow pack runoff acts as an additional storage as it typically melts off into June keeping the reservoirs replenished ((Vano, et al., 2009). This may sound like a decent amount of water storage supply but it is not, as evidenced from the quote below:

> *In some low snowpack years, such as 1992-1994, 2001, and 2005, reservoir storage has been insufficient to meet demands, and in these years, water was allocated to junior users based on prorating according to the seniority of their water rights and the TWSA.* (Vano, et al., 2009)

Water rights determine who receives water in times of water scarcity. In the Yakima River basin, allocation of water is based on a seniority system. Individuals who established their water entitlement prior to May 10, 1905 are senior (synonymous with non-proratable) rights holders and their water entitlement will be fulfilled first in times of drought. On May 10, 1905, the Bureau of Reclamation claimed any unappropriated rights for the purposes of developing the Federal Yakima Reclamation Project and those rights are managed by the five irrigation districts mentioned above along with Kennewick Irrigation District. Any water that was claimed on May 10, 1905 is known as proratable because in times of drought that water entitlement will be reduced or prorated based on a hydrological calculation by the US Bureau of Reclamation known as Total Water Supply Available (TWSA). Any post-1905 applications that were granted have Junior priority status and these rights receive no water in times of drought (Reclamation U. B., 2002). Figure 2 provides a visual representation of the different water rights in the Yakima River Basin.

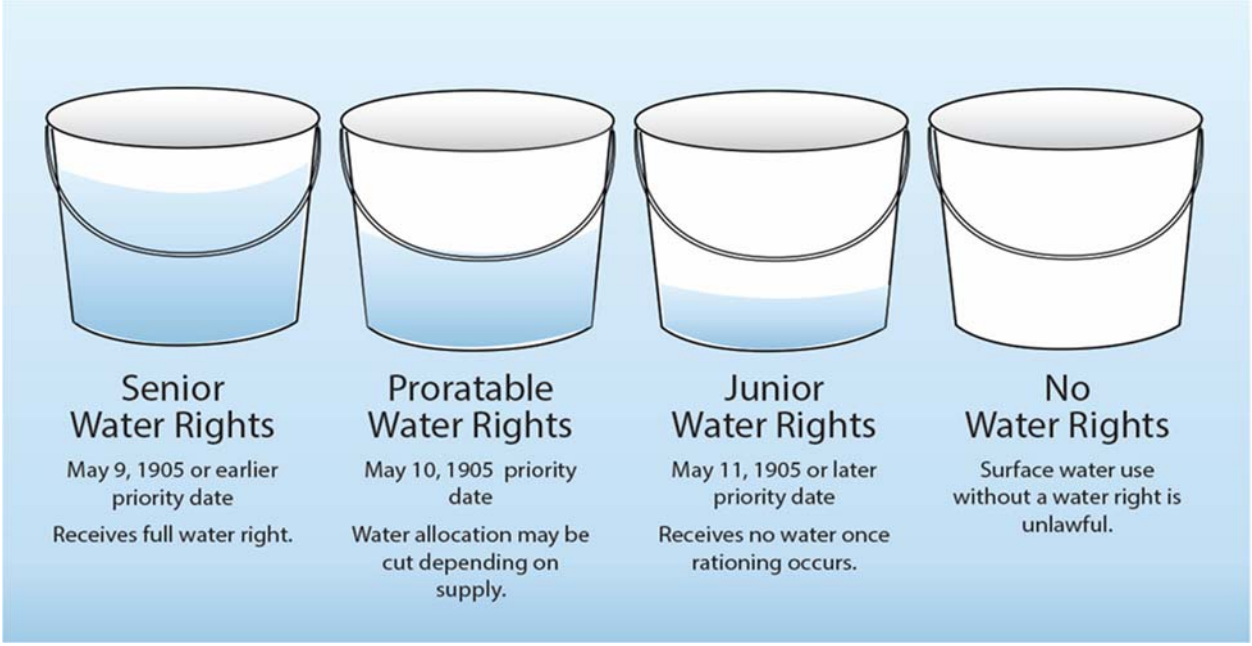

Figure 2 – Graphic displaying the different classes of water rights in WA state. (Roza Irrigation District, 2016)

Water rights in the basin are fully appropriated, meaning there are no additional supplies of water from the basin that can be allocated to new uses. Therefore, the Yakima River Basin's water resource is already operating at capacity. Water rights provide certainty as to who gets water especially when the state is faced with a water short year, but water rights do not ensure that the available water is going where it is needed most or that it will be put to the highest value use. Senior and Proratable water rights entitlements were established more than 100 years ago but water supply and demand in the Yakima River Basin has changed enormously since then.

With the volatility of warming temperatures, the sensitivity of the Yakima basin, the demands on water from agriculture and other users, the structure of water rights, and the fully appropriated water resource, the ability to move water from low value uses to high value uses is essential to make the Yakima River basin community as a whole more resilient. In 2001, the Washington State Department of Ecology (Ecology) established the Yakima River Basin Transfer Program (Clifford, 2004). Figure 3 provides a simplified flow chart of the inter-district water transfer process.

The program or process for an inter-district transfer involves multiple organizations and steps. First, an irrigation district or individual advertises the intent to buy or sell water. A willing seller and willing buyer will come to together to negotiate the terms of the transfer (amount of water, fee, time of transfer, etc). Once the terms of the transfer are agreed to, the application is reviewed by both irrigation districts. Both districts can approve or deny the transfer. If both districts approve, the application is then reviewed by a Water Transfer Work Group (WTWG) that reviews for any externalities to the environment, ensures no injury to other existing rights, and more (See Appendix B for the review checklist). Finally, following the WTWG approval, the application moves to Yakima Superior Court for review. The Yakima Superior Court typically approves any transfers that have been reviewed by the WTWG (Participant 8). Only until this takes place does the transfer of water occur. During a non-drought season the transfer process can take 30-45 days. During drought the quickest a transfer can be processed is 15 days. Due to Washington State regulation, inter-district transfers cannot be processed any quicker because the application requires a 2-week public notice (Washington State RCW 90.03.280). This process is only applicable to inter-district water transfers, not transfers within a district.

This transfer process constitutes a water market mechanism. Ecology defines the water market as "mechanisms used to acquire and redistribute water" (Ecology W. S., 2010). Water markets and markets in general ideally function in accordance with Coase economic theory that states goods will move from low value use to high value use if property rights are clear and there are zero transaction costs (Ruml, 2005).

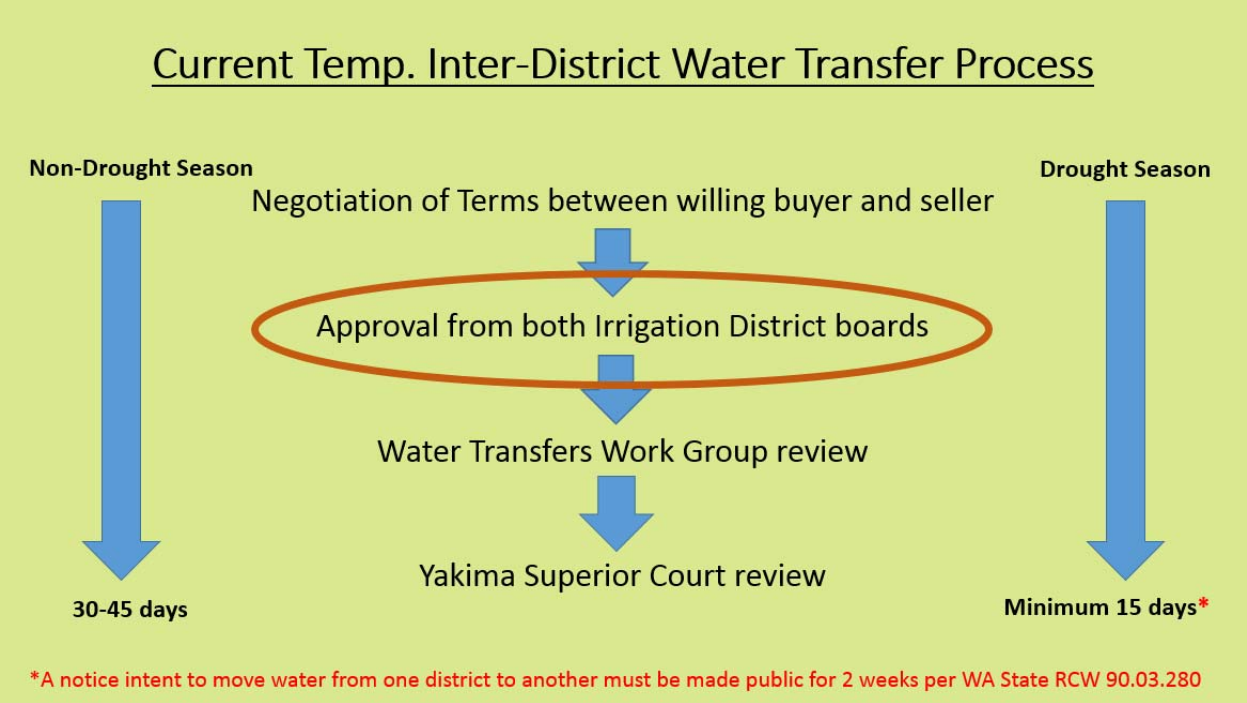

Figure 3 – Process map displaying the steps and time-frame for inter-district water transfer approvals. The role of irrigation districts is highlighted as well as the 2-week public notice requirement. (Meza-Garcia, 2016)

The Integrated Plan's intent to increase the activity of water transfers through the market reallocation element is well justified. One of the interview participants noted that in 2015, the last drought season, their requests to lease water from willing landowners were not approved by Yakima Tieton TID, Selah-Moxee ID, Cascade ID, Ellensburg Water Company and Kittitas Reclamation District. With irrigation districts involved in the inter-district transfer process, they have the legal right to deny a transfer. This is evidence of the clear property rights Coase condition not being met in inter-district transfer situations. For irrigation districts, control of water rights is actually diffused[1] versus owned entirely by an individual. The same participant also expanded to say that in 2015 their irrigation district leased "4,547 acre feet of water from land owners with senior rights for about $1.2 million, and would have readily leased much more water had it been available" (Roza Irrigation District, 2016). Clearly, there is demand for a more robust market for inter-district water transfers.

This study will also focus on temporary water transfers versus permanent water transfers. Research shows that permanent water transfers are associated with higher transaction costs and occur less often than temporary water transfers (Tompkins & Weber, 2009). The objective of this research paper is to identify the primary factors that Irrigation Districts consider when deciding whether or not to participate in temporary inter-district water transfers. This study provides valuable information for the parties involved with the Integrated Plan market reallocation

[1] An irrigation district can legally deny a water transfer outside the district because they wish to use that water for other uses within the districts.

element, as well as anyone interested in maximizing beneficial use and conservation of water in the Yakima River basin.

What This Study Will Contribute:

The environmental, political, and social environment the Yakima River basin water supply functions in is unique. Finding a solution specific to the basin is vital. This study gathers information primarily through phone interviews of irrigation district managers that are knowledgeable of the basin, their respective district operations, and the policies involved with transfers. Their perspective is valuable because they provide recommendations to their board of directors and interact with water rights holders/irrigators as well, which are other parties involved in a temporary inter-district water transfer process. Discovering the barriers that irrigation districts and individual water users face is key to creating customized solutions that can ramp up inter-district water transfers.

CH. 2 ANNOTATED BIBLIOGRAPHY

The following annotated bibliography goes back ten years and presents the government agency publications that were released that studied market reallocation. It also presents peer-reviewed scholarly articles specific to the water market in the Yakima River Basin. The review is presented in chronological order.

2007 December - Technical Report on Market-Based Reallocation of Water Resources Alternative – Yakima River Basin Water Storage Feasibility Study: Washington State Department of Ecology

This report provides a summary of other markets in the Western States of the US, and outlines six requirements of a successful water market.

1- *"Clearly defined, secure, enforceable, and transferable" water rights.*
2- Willing sellers and buyers that are informed and educated where potential sellers are willing to sell their water in a way that meets demands of potential buyers. "Information is key to access to the market or bank and to price setting (Myrum, 2003). Outreach and education conducted by a trusted entity, and widely available information are key to bringing willing buyers and sellers to the transactions. The necessity for trust extends to the entity doing the outreach."
3- Reasonable transaction costs. Transaction costs can include such things as takes too much time or too complicated. The study suggests Ecology can provide information on how transactions work and what the benefits can be for potential buyer/sellers and publicize information on prior transactions so people are more informed about the transfer process.
4- Water transfer processes with built in flexibility, fewer criteria for approving a transaction cost, and less time consuming.
5- Consideration of Third-Party Interests where other water rights are considered as well as environmental concerns, prosperity of local community, and other public values.
6- Trust between the water rights holders and the Department of Ecology.

Based on successful experiences in other areas, the report determines there is a need for an entity or entities, who are non-regulatory and perceived to be neutral, to work in the Yakima basin to do outreach and education to let water right owners know about the potential opportunities they may have to sell, lease, or donate their water right.

The report goes on to consider multiple scenarios for market-based reallocation of water rights. Of particular interest are Alternative 2E and Alternative 2F.

<u>Alternative 2E: Drought Year Transfers Outside of Irrigation Districts</u>

> *This alternative is intended to free up transfers of water outside of an irrigation district during drought years. As discussed above, under current law, Ecology must receive the concurrence of an irrigation district where water is proposed to be transferred outside of the district. RCW 90.03.380(2). Under this alternative, irrigation districts would be*

required to allow transfer of up to 30 percent of the total water supply allotted to the district in years when the state declares a drought under RCW 43.83B.405. A system would be established to allow a member of the district to petition for the temporary transfer of water under their water right to the Bureau of Reclamation to be managed as part of its Total Water Supply Available (TWSA). The member would fallow the acres associated with the transferred water. The member would be paid by Reclamation, Ecology or a water bank established for that purpose, which would in turn be paid by the recipient of the transferred water. Prices would be set by a process, yet to be determined, that may have Reclamation, Ecology or a water bank setting fixed prices or the different parties negotiating prices specific to individual transactions.

Alternative 2F: Irrigation District Bank

Under this alternative, an irrigation district would act as a bank during both good water years and years of drought. The difference from Alternative 2E is that the district would act as the bank rather than Reclamation or Ecology. A district would send out a call for water to their members at a fixed price. Water right holders within the district would decide to fallow all or a portion of their land for all or a portion of the irrigation season and bank their water with the district. The district could pool the banked water and identify blocks of water that they are willing to sell to users within or outside of the district. By selling large blocks the districts would have more pricing power. The districts would take a portion of the selling price and manage water use.

The report concludes with the idea that water markets or water banks should be tailored to fit the needs of the particular area it will function in. Establishing a successful market will require creativity and patience.

2010 May - Climate Change Impacts on Water Management and Irrigated Agriculture in the Yakima River Basin, Washington, USA: Vano, J. et al.

The study argues that junior rights holders are the most vulnerable to climate change impacts. The study incorporates hydrological models that looks at water shortage scenarios out to 2080. The general finding is that the Yakima basin will transition to earlier and reduced spring snowmelt as the century progresses, which will result in decreased water deliveries, especially to junior water rights holders. Also, the study predicts economic losses with lost value of expected annual production in the range of 5% to 16%, with significantly greater probabilities of annual net operating losses for junior water rights holders.

2011 March – Yakima River Basin Study, Market-Based Reallocation of Water Resources Technical Memorandum: prepared by ECONorthwest for USBR

The USBR and Washington State Department of Ecology commissioned a Technical Memorandum to evaluate the economic losses if market reallocation is not promoted and evaluate the savings market reallocation can provide if market reallocation efforts are implemented in the Integrated Plan. The report takes into account the market reallocation effects as a stand-alone project and also considers how the effects will interact with the other six elements of the plan. In addition, the report examined both intra-district transfers (transfers that

take place between landowners within the same district) and inter-district transfers. In order to measure the effects, the authors of the report utilized a model that includes local economic data, drought proration to 40% of full water supply, and crop data specific to the Yakima River basin. The model also makes several assumptions to predict behaviors in the model. One of the main assumptions is that irrigators will trade water freely. The study finds that market-based reallocation, when implemented along with other parts of the Integrated Plan, can offset 100% of the economic losses experienced if no market-reallocation actions are taken. This specific finding is based on the assumption that the other elements of the integrated plan are able to provide 60% of the full water entitlement for irrigators with proratable water rights. It also concludes that the market-based reallocation efforts without the other elements of the integrated can compensate for some but not all of the economic costs caused by severe drought.

2011 April – Yakima River Basin Integrated Water Resources Management Plan vol 1.: USBR and Ecology

The Yakima River Basin Integrated Water Resources Management Plan (Integrated Plan) was composed and published by USBR and Ecology in April 2011. The objectives of the Integrated Plan are to address water resource issues and ecosystem issues that affect fish habitat and passage, and agricultural, municipal, and domestic water supplies in the basin. Even though all the relevant the documents in regards to water supply improvements are not listed on here, it is important to recognize that the USBR and Ecology have been working to combat water supply issues in the basin for decades. For example, in 1979 an enhancement project was undertaken to address fish and wildlife restoration and later in 1994 a continuation of the enhancement project focused on water conservation.

The 2011 Integrated Plan proposes seven elements and one of those is Market Reallocation (see Figure 4). The Market Reallocation element is separated into two phases, both with the end objective of improving water supply and instream flows. One is focused on enhancing water transfer activity involving water users and the Department of Ecology (Trust Water Rights program is an example). The other phase focuses on facilitating water transfers between irrigation districts (inter-district). This Integrated Plan specifically mentions the program would encourage fallowing land inside a district to free up water for leases. In addition, the Integrated Plan outlines how inter-district transfers can be enhanced by improvements to conveyance infrastructure.

Figure 4 – Graphic displaying the 7 major elements of the Yakima River Basin Integrated Water Resource Management Plan (Ecology W. , 2015)

2011 June – Yakima River Basin Study, Water Needs for Out-of-Stream Uses Technical Memorandum: Prepared by HDR for USBR

June of 2011 the USBR and Washington State Department of Ecology published another Technical Memorandum. This report specifically studied water needs for out-of-stream uses in the Yakima River Basin. The objective of this report is to identify and quantify current water needs in water normal years and drought years, and therefore provide information to the YRBWEP Workgroup on current and future water needs as it reviews possible water-resource management actions. The report provides a lot of data on water use for the basin among the six Yakima Project Irrigation Districts (KID, KRD, Roza, SVID, WIP, and YTID).

2011 August – Unlocking water markets: An experimental Approach: Joseph Cook and Sergey Rabotyagov, University of Washington

Professor Joseph Cook and Professor Sergey Rabotyagov of the University of Washington completed a study regarding farmer involvement in the Yakima River Basin water market. The study, Unlocking Water Markets: An Experimental Approach, had actual senior water rights holders from the Yakima Basin participate in mock auction transactions to determine if they had

"preferences for different elements of a water market transaction that are not captured in the relative comparison of their profits from farming and their profits from agreeing to a deal." The study showed with statistical significance that senior rights holders have preferences that they consider aside from just the economic return. These preferences include more willingness to lease water for split season rather than a full season and who the buyer is matters (they prefer to lease water to other irrigators than developers or the Dept. of Ecology). In addition, farmers were more likely than the control group, which were University of Washington undergraduate students who participated in the mock auction, to reject offers even though it would increase their earnings in the experiment. The study highlights the importance of understanding the preferences of farmers in order to design functional policies that will in fact promote water transfer activity. For example, the report is evidence that there is a need to educate and provide outreach services for land owners in regards to their rights and transfers. The report does not highlight any preferences of irrigation districts.

2012 March – Yakima River Basin Integrated Water Resource Management Plan Final Programmatic Environmental Impact Statement: USBR and Ecology

To complement the Integrated Plan published in April 2011, USBR and Ecology commissioned a study of the environmental impacts the Integrated Plan would have. This Final Environmental Impact Statement was published in March 2012. This study evaluates the environmental impacts of a no action alternative compared to the Integrated Plan alternative. Regarding market-reallocation, the report concludes that the impacts the Market Reallocation element will lead to improved stream flows for fish and will have an impact on the land-use decision property owners will make.

2012 October – Yakima River Basin Integrated Water Resource Management Plan Framework for Implementation Report: Prepared by HDR Engineering, Anchor QEA, ECONorthwest, Natural Resource Economics, and ESA for USBR

The purpose of the Framework for Implementation Report is to present additional cost estimates related to the Integrated Plan and present an initial schedule for implementing the Integrated Plan. The report also summarizes a federally required analysis of the Integrated Plan known as Four Accounts analysis (see the summary below) and discusses the financial feasibility of the Integrated Plan. It was estimated that capital cost of the Integrated Plan will be around $4.2 Billion (expressed in 2012 dollars), and once all of the projects and programs are operating, the estimated annual operations and maintenance cost was about $12 million (expressed in 2012 dollars). The report did not mention which costs each party is responsible for but it did note that the State of Washington would partner in funding many of the costs. Nothing specific was mentioned for Market Reallocation.

2012 October - Yakima River Basin Integrated Water Resource Management Plan Four Accounts Analysis of the Integrated Plan: Prepared by ECONorthwest, Natural Resource Economics, and ESA for USBR

The Four Accounts Analysis is a federally mandated report that asks the agencies involved with water and related land resources projects to evaluate the impact the project will have on the national economic output, regional economic output, environment quality, and other social

effects (encompasses anything not included in economic, regional, or environmental accounts). For national economic output and regional economic output, the market-based reallocation element would lead to greater net farm earnings due to the reduction in barriers to water transfers in drought years and non-drought years. The analysis did not mention market-based reallocation for the remaining two accounts of environmental quality or other social effects.

2013 May – Assessing irrigators' preferences for water market attributes with a stated preferences approach: Joseph Cook and Sergey Rabotyagov, University of Washington

This study was composed by the same researchers that put together the 2011 report, Unlocking water markets: An Experimental Approach. For this study the researchers utilize the preferences that resulted from the 2011 report (irrigators are more likely to accept split-season than full-season leases, more likely to reject offers from developers than from the State, and indifferent over bank management) and results from a parallel mail survey to predict market participation rates. The researchers used actual money (participants took home the money earned through the simulations) to simulate a realistic scenario where financial gain is involved. The research study found evidence that irrigators in the study prefer to not lease water rights to developers and found weaker evidence that they prefer to lease to other irrigators rather than the state Department of Ecology. Irrigators preferring split-season to full-season leases was another result.

2014 December – Benefit-Cost Analysis of the Yakima Basin Integrated Plan Projects: Jonathan Yoder, Report to Washington State Legislature

The State of Washington Water Research Center was charged through the 2013 State of Washington Capital Budget to prepare a benefit-cost analysis of each of the projects outlined in the Integrated Plan by first utilizing existing studies and then conducting primary research if necessary. The studies examination of water markets show that an active market may reduce the value of water storage projects but an active market does show potential for economic gains from transfer transactions. The economic gain ranges from $216 million to $1.4 billion to dependent on climate, the extent of market development, and the extent of the development of the Integrated Plan. The study also found that water market transactions can be beneficial for instream flows.

This study considers market constraints and frictions when examining the benefits and costs associated with the market reallocation element. Wapato Irrigation Project (WIP) which is actually a federal agency is not considered a participant in inter-district water transfers because of institutional limitations and Yakima Tieton Irrigation is not considered a participant either because of its location, “crop values,” and the amount and type of water rights they are entitled to. Another friction mentioned is the negative instream flow that can occur from a transaction between a downstream seller and an upstream buyer.

Five “Soft” constraints to water markets are also outlined. A soft constraint is defined as constraints that would lower the impact and value of market-based reallocation.

1- Economic costs (FTE, consultant fees, etc) for agencies involved such as the Superior Court or the Department of Ecology.
2- Water Transfers Working Group reviews of water rights involved in a proposed transfer and this review is made public. In order to not risk losing their right or having it curtailed, water rights holders may be hesitant to participate if they are unsure if their water has been put to beneficial use.
3- The value that growers place on the ability to farm as a livelihood may be modest. Farmers may be hesitant to fallow land in order to sell water if that decision will have an effect on the local farming community.
4- Sellers may not have adequate information on opportunity costs and/or lack information on how well the transaction will be enforced. For example, “irrigators may also be reluctant to sell water for instream flows if they question whether contract enforcement will be effective in securing benefits for fisheries rather than downstream water users.” Another concern for long term leases in particular is the separation of water from land and its appraisal, as well as irrigation districts ability to deny transfers of water to parties outside the district.
5- Multiple counties must be notified of a transfer if county the irrigation district resides in different from the county where the diversion point is located. Washington State regulation requires that the Board of County Commissioners be notified if this is the case and they have the ability to restrict the amount of water transferred.

This study a discloses some of the possible factors that irrigation district managers face when deciding whether or not to participate in a transfers. However, it does not say if one is more significant than the other.

CHAPTER 3: METHODOLOGY

Part of the process prior to conducting any interviews involves a review of the research proposal by the Human Subjects Division of the University of Washington. The review determined this study is exempt from federal regulations but the methods are still required to uphold all ethical principles for the protection of rights and well-being of the interviewees. There is no personally identifiable information disclosed in this report. To further protect the confidentiality of the research participants, aside from disclosing which districts participated in study, the findings of the interviews will be cited using random participant numbers.

Data Collection:

Data to analyze the factors irrigation districts face when they consider a transfer was gathered through structured phone interviews of irrigation district managers. According to information gathered from the Department of Ecology there are 30 major claimants to water in the Yakima River Basin and 13 of those are irrigation districts (Ecology W. S., 2009). The remainder are made up of cities and irrigation companies in the basin. For this study I interviewed managers from 10 irrigation districts, one city and one irrigation company for a total of 12 phone interviews. My original intent was to interview all 30 major claimants. Due to time constraints and the responses to my request for an interview, I decided to focus on irrigation districts. In the results, the data from interviews with the city and irrigation company are not included.[2] The objective was to determine the factors that irrigation districts consider when deciding whether to support inter-district water transfers.

The irrigation districts that agreed to be interviewed include Ahtanum, Cascade, Kennewick, Kiona, Kittitas Reclamation District, Naches-Selah, Roza, Selah-Moxee, Sunnyside Valley, and Yakima Tieton. The names of the participants will remain confidential. In addition, the Wapato Irrigation Project (WIP) is one of the districts with significant water right entitlement. I did not successfully interview a manager of, however, I was able to gather some general insight on their policies from someone who works with the Yakama Nation. The contact at Yakama Nation mentioned that because WIP is a federal agency that must operate under federal regulations, they do "not have the discretion to enter into water transfers or marketing outside of its boundaries. Consequently, there is probably no one you could talk to at WIP" (the contact did make it clear as well that the information provided is just their opinion, they are not speaking for the Yakama Nation or the Bureau of Indian Affairs) (Anonymous, 2016).

I focused on the irrigation districts for this study because they represent a substantial amount of the surface water entitlements in the basin. According to the 2012 Yakima River Basin Integrated Plan, the Yakima Project irrigation districts of WIP, Sunnyside Division, Roza Irrigation District, Kittitas Reclamation District, Yakima-Tieton Irrigation District, and Kennewick Irrigation District are entitled to 80% (1.92 million acre-feet) of the average annual unregulated flow for the Yakima basin measured at Parker gage (pg. 3-18 and CR 121) (Reclamation & Ecology, 2012). Based on

[2] The other major claimants I interviewed were City of Yakima and the Ellensburg Water Company.

these entitlements, the irrigation districts in the basin are in a position where their participation in temporary inter-district water transfers can have significant impacts on water allocation and the economics in the Yakima basin.

The interviews took place between April 4 – May 3, 2016 and the average length of the phone interview was 37 minutes. The phone interviews were recorded using a phone application and the recordings were transcribed. For some participants, follow-up emails were sent asking for a clarification to answers that were provided.

The questions administered in the survey were provided to all participants, however, the order in which they were asked changed and not all participants answered all of the questions. There was a total of seven major questions asked and six of those were open ended questions (See box below). Question 7 asked for demographic data that described characteristics of each participant. For the first couple of interviews I asked the questions in this order. During these interviews I found myself wanting to know some of the demographic information as I was asking the other questions so I decided to ask the 7th question first during the fourth interview. That provided the information I needed where I could ask effective clarification questions right away versus following up at a later time. From the fourth interview on, I asked participants the seventh question first. In addition, a participant pointed out that question 7c could be interpreted in multiple ways. My intention with this question was to figure out the share of the total use going to agricultural use compared to municipal use. The way the question was originally worded asked for the share of municipal water users and the share of agricultural water users. Due to the direction the data analysis took the study I did not go back to the participants and ask them to provide the share of the total use going to agricultural use compared to municipal use. I did not utilize the findings from question 7c as well as 6, 7b, and 7f for reasons explained in the Data Analysis - Coding section below.

Telephone Interview Questions

1. Have you participated in a temporary water transfer with another major claimant to water in the past (will be referring to these types of transactions as inter-district water transfers)? If so, can you explain how that worked? If not, why not?
    a. If the answer to question above was a no, can you briefly summarize how temporary water transfers between major claimants (aka inter-district transfers water) would work in your organization?
2. What is your personal take on inter-district water transfers as an option in times of drought?
3. Is there anything problematic about the current process? What would make it better?
4. What are the most significant barriers to your irrigation district participating in temporary inter-district water transfers? (Please provide your top three)
5. In times of drought, what are your first responses as an organization to meet the water needs of your district?
6. Did you get an opportunity to familiarize yourself with option contracts for temporary transfers? If so, under what circumstances would your organization consider using option contracts for inter-district water transfers?
7. Demographics:
    a. Share of Proratable Vs Non-Proratable water rights?
    b. How many water rights does your ID/agency have in acre-feet (af)?
    c. Share of municipal vs agricultural water users?
    d. What does your crop mix look like?
    e. Do you see your agency in transfers as a buyer, seller or both?
    f. Logistically, which irrigation districts or cities does it make sense to trade with?
    g. Does your irrigation district have a fallowing program?
    h. Does your agency have a reservoir or storage?

Data Analysis - Coding:

The primary mode of data analysis was coding for themes. Aside from the descriptive data gathered through question 7 and explained in the Descriptive Data section below, the remainder of the questions prompt participants to provide qualitative information. The first step in the coding process was associating labels to each of the responses I received. Mainly, I looked for a key idea in their response. The label for most responses was a short phrase like "time of water use and water need" as an in depth response to question 4. This process was completed for all responses to questions 1 (this question had multiple parts so the portions of the answers that contained a summary or explanation were assigned a label), 2, 3, 4, 5, and 6. Once all responses to these questions were given a label, a review of the labels was performed to organize the labels into common themes or categories. This second step is more focused and analytical because it requires the researcher to be more selective. As a result, at this point I decided to discontinue using the information gathered for Question 6, 7b, 7c, and 7f.

The information from Question 6 asked participants how attractive they found option contract or dry year contracts arrangements (see Definitions) for water transfers. Some respondents thought it could be useful but others did not. When I first started the research study I wanted to provide an alternative to the current process for transfers in the basin and on paper option contracts sounded like the best solution. However, I decided to abandon this pursuit during the coding process for two reasons. First, I realized that there are several alternatives for processing temporary water transfers besides option contracts that I am not considering in my study. This study would seem incomplete to analyze just one alternative. Second, my methods for informing the interview participants about options contracts were not ideal. I sent over orientation information on option contracts by email a week in advance of the scheduled phone interview. Unfortunately, I did not follow up before the interview to make sure all participants fully understood how option contracts worked. Therefore, validity of the answers to Question 6 would be highly questionable.

Questions 7b, 7c, or 7f are not included in the analysis because in regards to the research question, the answers to those questions did not add value or context on top of data gathered from the other questions. For example, the data gathered from Question 7b did not provide any additional context that was not provide by 7a - "Share of Proratable Vs. Non-proratable water rights?" None of the participants in the survey mentioned that the amount of water right in acre-feet was something that they consider more than the share of proratable rights. The questions that were not discarded all provided answers, insight, or valuable context to the research objective.

Data Analysis - Memos:

Memos were also conducted to analyze the codes. This technique took place after the coding and the objective of it is to take a holistic look at the labels and categories that were established by writing down extended notes. Mainly, the memos were brief observations. For example, "make note of the tone the respondents answered question #2 and couple that note with the

label." In others the coded information was connected to the annotated bibliography material. For instance, one memo note wrote "How does increased storage really factor into decision making regarding temporary inter-district transfers? The Market-Based Reallocation of Water Resources Technical Memorandum (March 2011) does not provide much detail besides making assumptions on the water supply storage will provide."

Descriptive Data:

Question 7 of the phone interview asked participants to provide demographic information about their respective district or organization. Some participants were not able to provide responses for all of the questions and many participants provided estimates. For this reason, I will be providing summaries of the responses. The objective of these demographic data points is to see how these major claimants differ and to see how the demographics can affect the participation or decision making in regards to temporary inter-district water transfers. An educated estimate from the district managers who are responsible for the operations of district/organization suffices.

Participants responses to question 7e were determined to be the independent variables of the study. The initial coding of the responses to my phone interview naturally prompted the responses to be divided into two categories of buyers and sellers. Question 7e asked if the district managers see their agency as a buyer, seller, or both in a transfer situation. In other words, this question asks if the districts, in a drought season, will be in a position where their district will need water or in a position it may be able to divert water outside the district if the terms are favorable. For a district, being in a position to sell water is very distinct from a position of needing water where one has a much higher sense of security that their water needs will be met. For that reason, the responses to my interview questions are analyzed in these two categories (see Table 1 below).

Question	Buyers	Sellers
1. Participated in a temporary water transfer with another major claimant to water in the past?	2 of 4	3 of 6
7a. Share of Proratable water rights?	87.5%	17.80%
7d. Crop mix	See Appendix A	
7e. Do you see your agency in transfers as a buyer, seller or both?	4	6
7g. Irrigation district has a fallowing program?	3 of 4[3]	2 of 6[4]
7h. Does your agency have a reservoir or storage	2 of 4	3 of 6

Table 1 – Descriptive Data

[3] Two Programs are designed to move water within the district. The third has lands fallowed on a rotating basis that is dictated by water rights.

[4] One program is used to move water within the district. The second has never had to use it because of the strong hop market, and participant did not mention the water from fallowed land would be prioritized to stay within the district.

Validity:

The participants in the interviews conducted (irrigation district managers) are not always the decision makers as to whether a water transfer is approved or not. However, they do manage the operations of irrigation districts, they understand challenges and factors considered in a transfer, and also many times serve as advisors to the board. All transfer proposals are reviewed by the managers with a keen eye to how the transfer will affect the district. Additionally, for irrigation districts the process of approving a transfer includes a vote from the irrigation district board members. It is commonplace for district managers to review a transfer proposal prior to the board and then provide a recommendation for approval/denial of a transfer which the board follows. These participants not only interact with the board members that approve/deny a transfer but they also are engaged with landowners which also are major players in the transfer process. District managers are at the hub of the transfer process and through experience have expert level knowledge on the factors irrigation districts encounter when considering a temporary inter-district water transfer.

CHAPTER 4 – RESULTS AND DISCUSSION

Though water transfers occur in a market based on Coase Theorem principles, the more analytical part of the coding process mentioned in the Methodology chapter drew me away from categorizing data into the themes of "lack of clearly defined property rights" and "transaction costs." These two categories are fitting for the data collected, but they are not the best fit.

As Chapter 1 explained and the results below will show, the Yakima River basin water market functions within a dynamic myriad of policies, physical limitations, climate uncertainties, court systems and more. Categorizing all of these factors on the basis of Coase Theorem criteria over-simplifies the context and concerns of the interview participants. Additionally, there are constraints to the water transfer process that realistically cannot be changed. Coase theorem says constraints must be removed but unfortunately that is not a possibility. An example of a transaction cost is the irrigation districts review process where they have the ability to legally deny a transfer between a willing water rights seller and willing buyer. However, irrigation districts should have a say in this transaction because that water up for sale may be needed to keep the distribution system functioning properly. This legal right of irrigation districts to deny a transfer is necessary but inefficient. The water market in the Yakima River basin is not a perfect market and never will be. My hope is that the following results will highlight the areas that realistically can be changed, in particular the *Institutional* barriers and *Uncertainty* barriers.

Part of the function of a water market is to establish a process that facilitates transactions between willing buyers and sellers (Ecology W. , Technical Report on Market Based Reallocation of Water Resources Alternative, 2007). In order to better analyze barriers to transactions that these irrigation districts face as buyers or sellers, some of the results of the interviews will be categorized and presented separately based on whether the districts saw themselves as a buyer or seller. However, there are also common results between self-identified buyers and sellers and those results will be presented as such.

Buyers v. Sellers

Question 7e prompted participants to determine if their district would be on the receiving end of a temporary water transfer (buyer), if they see their district on the selling end (seller), or both. Of the ten participants, six saw themselves as sellers and those districts were Cascade ID, Kiona ID, Naches Selah ID, Selah-Moxee ID, Sunnyside Valley ID, and Yakima Tieton ID. The remaining four districts of Ahtanum ID, Kennewick ID, Kittitas Reclamation District, and Roza ID all saw themselves as buyers. Questions 7a asked participants about the water right entitlement of the districts. Each of the districts who saw themselves as sellers all had a majority of non-proratable water rights[5] while the four districts who saw themselves as buyers had a majority of their consumptive water right as proratable. Due to the nature of water rights where the type of water right determines whose water need is met first, it can be comfortably assumed that the share of

[5] Kiona ID did not provide a definitive answer to question 7a.

water rights entitlement type (proratable v. non-proratable) determines if the districts will need water in a drought year and therefore sees itself as a buyer.

Sellers

Of the six self-identified sellers, three of the irrigation districts had participated in a temporary water transfer in the past. Two of the three participants who did have experience with transfers only had experience approving transfers of water out to districts that were adjacent to their own. Question 2 of the interview asked the respondents for their personal take on temporary inter-district water transfers as an option in times of drought. Three of the responses were neutral, e.g. "if it works out, where it's a win-win, then there's no problem" (Participant 5) or "transfers are something to consider..." (Participant 2). The remaining three were positive but a couple answers came with a disclaimer. For example, one district mentioned: "Good (referring to temporary inter-district transfers), but policies and timing can be an issue" (Participant 3). As far as barriers are concerned, the six irrigation districts mentioned eighteen barriers that are discussed below.

Buyers

Two of the four self-identified buyers have experience with temporary inter-district water transfers. The personal take of the managers for the two districts without experience did not find transfers helpful due to the nature of the water supply. The water supply for Kennewick Irrigation District (KID) for example is based primarily on return flows (water that runs through the water table and eventually discharges in a body of water like the Yakima River, see Definitions for more detail). This water supply condition makes predicting the water supply available for the district very difficult, and therefore makes planning for buying water even more difficult. To provide context, the other five districts included in the Integrated Plan (Roza, KRD, SVID, YTID, and WIP) have their water supply allocation determined by the Total Water Supply Available (TWSA) estimate. Another district manager mentioned that temporary inter-district transfers are not something they consider because any attempt to move water must be approved by the Yakama Nation. The Yakama Nation has control over water decisions for a specific irrigation district and they have never approved a transfer since the participant has been with that district. The two districts with transfer experience generally find them feasible but challenging. For example, one comment received was "water markets have less to do with moving water from a lower value to a higher value and they have more to with institutional barriers" (Participant 8). In total, buyers mentioned sixteen barriers that limit temporary inter-district water transfers and buyers were exposed to more types of barriers than sellers.

Common Barriers

Buyers and sellers function in the same physical and institutional environment so it makes sense that they have common barriers to contend with. The barriers identified by both groups included things like climate, lack of storage, timing of the total water supply available (TWSA) announcement, and more. Through the data analysis process of coding, the common barriers were divided into four categories of institutional, infrastructure, market forces, and climate.

Institutional

Institutional factors were by far the most common barrier mentioned by participants. For this study, institutional factors are defined as policies in place, actions taken or lack of actions taken by agencies, or even norms, or beliefs that dictate the conduct of other individuals or groups. Almost 45% of all of the barriers mentioned fall under the definition of institutional (8 of 18 barriers for sellers and 7 of 16 barriers for buyers).

One of the primary barriers mentioned by participants is a Washington State water transfer regulation that requires water for transfers to come from fallowed land (Washington State RCW 90.03.380 (1)) and landowners have the right to their land so fallowing is voluntary. Of the sellers, which may have water available to sell because their water rights are more secure in a drought year, only two districts have a fallowing program. However, one of the fallowing programs is really a clearinghouse "blind" market dedicated to facilitating transfers within the district (this program is not used to facilitate inter-district water transfers). In this "blind" market the individual who is voluntarily fallowing land places his unused water into the program pool and from there, individuals within the same district looking to buy water can purchase from that pool (Participant 4). This falls in line with research from J. Brewer showing that transfers of water within an irrigation district are much more prominent than inter-district transfers (Brewer, Glennon, Ker, & Libecap, 2007). The other program was not explained. The participant mentioned that there has never been a need to fallow because the "hop market is very strong" (Participant 3). Without clarification from the participant it is difficult to assume what is actually meant by "need." It is likely that the "need" the participant mentions may actually refer to incentive where there is no incentive to fallow, because the hop market is very strong. Results show that there are no irrigation district programs that incentivize fallowing. Due to the Washington State regulation requiring fallowing of land, this limits the amount of water available to transfer outside of districts.

Another major barrier involved with the current process is the time it takes to complete a transfer. One participant mentioned that on average it takes about 6 weeks from the beginning of the negotiations to until the actual transfer of water completes (Participant 9). The transfer process involves the negotiation of the terms, the approval of the transfer by both districts, a review by the Water Transfer Work Group (which ensures water budget neutrality, instream flows are considered and basically that transfer will not cause any negative externalities) and finally a hearing by the Yakima Superior Court. In a drought year, the court process shortens a mandatory period from 30 days to 15 days providing the public two weeks to contest the transfer if they feel it will negatively impair their water right. So, the transfer process can be completed in 15 days in a drought year, however that is dependent on when the Water Transfer Work Group meets and when the Yakima Superior Court meets for water hearings, which is usually only twice per month in drought seasons. Multiple districts mentioned 15 days is still not quick enough during drought.

Under state law, irrigation district boards have the power to approve or deny any transfer that sends water outside the district. This approval/denial decision from the irrigation boards takes place after the landowners have agreed to the terms of the contract. For one particular

participant, numerous transfers arranged, with willing landowners were denied by the boards of the irrigation districts that the landowner is from. Irrigation districts have valid concerns for keeping water within their district. An example of this is the need to keep water in canals in order to carry water out to the distant reaches of the district. However, one of the seller districts mentioned that some of the apprehensions to approving water transfers, aside from operational needs for keeping water within the district, are the precedent it will set in the district and the uncertainty of the "social and economic impacts for not only the district but the community it serves" (Participant 9). It is reasonable for an irrigation district to fear that an active water market will negatively influence the local community's economy. As the market draws water away from the seller district, the local businesses that supply the local farm that was fallowed will have to look for business somewhere else. In rural farm communities that can be a significant burden.

The objectives of fellow irrigation district themselves can be an obstacle for approving transfers of water to go outside of a district. One participant utilizes transfers more for the benefit of conservation measures because they feel in the long-term, conservation is a more proper response to climate change. This district is preparing to meet its water needs thirty years from now by focusing on ground water and surface water storage (Participant 7). Another participant mentioned that irrigation district delivery systems are designed to function best when they have their full allocation of water (Participant 6). Fulfilling the overall objective of an irrigation district, to efficiently distribute water for agriculture within the district, is affected by the amount of water in the system. Less water in the system can lead to less efficient distribution.

Finally, the district with the most amount of water entitlement in the basin is the Wapato Irrigation Project (WIP). WIP operates under federal laws because they are an agency under the Bureau of Indian Affairs. They did not participate in this survey and from the information gathered it does not look like they have participated in temporary inter-district transfers in the past. From the experience of a couple of the participants, WIPs unclear operational structure and policies prevent water transfers from occurring.

Infrastructure

To categorize barriers in the infrastructure category the following definition was used. Infrastructure barriers are the physical barriers, capacities or features that enable or limit the conduct of individuals or groups. This include things like diversion points, conveyance, storage, and even soil. A common similarity with these features as well would be the time consumption and the high cost required to change. Several irrigation districts, both buyers and sellers, identified location of diversion points in relation to the location of storage reservoirs as a barrier. The positioning of the diversion points and the district involved in the transfer must be considered as well. The positioning of storage, diversion points, and districts can have an effect on the instream flows or can make it difficult to account for the water that is being transfers. A water transfer that negatively impacts the water rights of others will not be approved by the Water Transfer Work Group. Lack of storage is another barrier that multiple districts mentioned in the interviews. The participants mentioned that lack of storage leads to lack of flexibility. Additional storage allows for districts to stock excess water and carry it over from a "wet" year to the next irrigation season or use the excess stock to sell in the market.

Crop mix is important to consider because it can have a direct effect on land owners' decision to fallow. Water made available to transfer is dependent on fallowing, as required by Washington state policy. Participants of the interview stated that land owners who farm perennial crops are less likely to fallow because that decision will have an economic impact for multiple years. In addition, most perennial crops are high value crops. One of the participants in particular mentioned the amount of water that goes to perennial crops in his/her district limits the amount of water that could be made available for transfers (Participant 2).

Market Forces

Specific market forces were seen as a barrier to transfers for both sellers and buyers. A strong agricultural economy can discourage senior rights holders from selling their water if the crop they typically grow are providing strong returns. One district manager identified hops as one of the crops that is particularly doing well. Another participant explained how the expansion of dairy has led to a decrease in farmers willing to fallow. The decrease is due to the fact that forage crops to feed the dairy cows are in high demand so this demand competes against fallowing land in drought years (Participant 8).

Another observation mentioned during interviews was that the water transfer market in the basin is favorable to Sellers. There is a lot of demand for water in the basin with buyer irrigation districts competing with each other as well as the Department of Ecology. The Department of Ecology leases water in the basin in order to offset the impacts of a proposed new use on tributaries. Proposed new uses can be providing water for new development or to increase in-stream flow (Ecology W. S., 2010). With the level of competition in 2015, some landowners were holding out for the best possible bid (Participant 8).

Climate Variability

NASA defines climate as "the weather of a particular area averaged over many years" (NASA, 2011). As the climate temperature increases, according to the Environmental Protection Agency, more frequent droughts and longer heat waves will result (Environmental Protection Agency, 2016). Participants mentioned climate as a barrier because of its unpredictability, which has a direct effect on water supply. One participant mentioned simply that in drought years, there may not be water available to transfer.

Additionally, the timing of the Total Water Supply Available (TWSA) announcement made by the USBR, which is determined by hydrology, complicates the planning process for farmers. The announcement of TWSA is typically made in early April, and according to one of the participants "this is already too late for some individual farm owners... Once they plant a crop it is highly unlikely they will agree to fallow the ground due to the initial investment of planting" (Participant

9). Unfortunately, according to the USBR, forecasts prior to March are not useful for the TWSA estimate[6] (Reclamation U. B., 2002).

The accuracy of the TWSA announcement can have a big impact on irrigation districts looking to engage in temporary inter-district transfers as well. One of the participants mentioned that "if that (TWSA) forecast is overly optimistic, as it was in 2015, it can lead farmers to decide to invest in their crop rather than seek to sell water" (Participant 8). Conversely, for buyers, a forecast with a significantly low proration prompted action. For example, one of the participants in 2015 aggressively entered the market after the proration dropped to 54%. In order to meet the water needs of its landowners, that particular district ended up spending about $36,000 in transfer processing fees alone to acquire water for the district landowners.

Seller Specific Barrier

Uncertainty

Uncertainty was one of the findings that was common only to irrigation districts that self-identified as sellers. One of the uncertainties was in regards to the irrigation district approval/denial decision of a temporary transfer. The participant that mentioned this barrier has not participated in a transfer even though they have been approached. One of the sources mentioned was that the board of directors and the district as a whole are not sure what will result from approving a transfer of water outside the district. The primary concerns were the uncertainty of what the social and economic impacts will be to the district and the community it serves (Participant 2). The second barrier related to uncertainty was specific to perceptions of the water rights holders. The participant believed that the ongoing Acquavella adjudication makes people hesitant to engage in a transfer. The Acquavella Adjudication is the legal process to determine who has legal rights to water in the basin and among other things it requires rights holders to provide evidence that their water had been put to beneficial use. The Department of Ecology is a respondent in the case and the adjudication process has been going for decades (see Glossary for more details). The cause of the hesitancy was the experiences of some rights holders who after their adjudication took place, ended up with an entitlement much less than expected. The participant continued to say that there is a "stigma with people not understanding fully or just worried about their right" (Participant 4).

Buyer Specific Barriers

Miscellaneous Barriers

Washington State law mandates that only consumptive water, defined as water incorporated into plant or into tissue, plus water lost via evaporation, can be transferred. This restricts the amount of water in the basin that is actually available to transfer (Kittitas Reclamation District, 2016). Additionally, a participant has noticed that institutional efforts from Acquavella

[6] In addition, USBR cannot locate a document that prohibits TWSA in January or February, however, USBR does not announce the TWSA prior to late March because in the past (1977) "some erroneous decisions and declarations of water availability were made that cost some folks a lot of money." (Reclamation, 2016)

adjudication and the conservation projects from the Yakima River Basin Water Enhancement Project (YRBWEP) has limited diversions from senior water rights users, and have less water available for their own landowners. Therefore, “there is less water available for transfer during droughts” (Participant 4). Additionally, some Seller districts place a limit on the transfers they are willing to approve in a drought year which in turn limits the available water Buyer districts can lease (Participant 4).

CH. 5 CONCLUSION

Summary

The factors irrigation districts consider when deciding whether or not to participate in temporary inter-district water transfers are numerous, but institutional barriers were the most common barrier. Fifteen of the thirty-four barriers mentioned were institutional with the most common one concerning fallowing. Transfers are contingent on fallowing. That in itself was noted as a barrier, and other barriers have a direct effect on fallowing such as the TWSA announcement which complicates farmers' decision making on whether to fallow or not. A strong agricultural economy was another factor that limits fallowing. As a result, many times the barrier to transfers is not fallowing itself but the policies and external forces that complicate the decision to fallow. The timing of the TWSA announcement, the TWSA estimate itself that can dictate how aggressive buyer districts enter the market, and the time it takes to complete a transfer were all factors that affect the transfer process and decision making of districts as well.

Lack of storage, location of diversion points in relation to storage, and crop mix are all physical features of the district that can impact the ability to transfer water for districts. Storage capacity and the amount of perennial crops for seller districts in particular can limit flexibility in operations. Climate and its volatility create barriers on its own. Climate has a direct effect on supply and that makes it difficult for irrigation districts to plan. For seller districts in particular, uncertainty may affect their decision-making because there is no standard methodology or accessible data sources for assessing what the externalities of selling water will be for the community or individuals.

Buyer districts seem to face more barriers than seller irrigation districts. On average, buyers disclosed four barriers while sellers disclosed three barriers. In addition, buyers face a greater variety of barriers. For example, buyers can only lease water for consumptive use and seller districts sometimes place limits on the amount of water available to transfer in a given season. Buyer districts and the individual users they represent must also compete for water with the Washington State Department of Ecology which is a significant player in the transfer market. These factors are outside the control of buyer districts and are ones that seller districts do not face as barriers.

Implications

Temporary inter-district water transfers are primarily a mechanism that is useful to respond to drought. The economic health and environmental health of the basin can directly benefit from an uncomplicated and active market. The findings of this study show that there are plenty of limitations to the market that either cannot be changed or can only be changed at a high cost, like diversion points or adding conveyance. However, the participants listed off more institutional barriers to trading than anything else. Fallowing is the major bottleneck to transfers. The water resource in the Yakima River basin is over appropriated so fallowing is a must in order

to be environmentally responsible. Nonetheless, it is also a voluntary decision of the land owner/water rights holder whether to fallow or not.

There is encouraging evidence that focused efforts to change behaviors can work. The Conservation projects from the Yakima River Basin Water Enhancement Project has led to senior water users reducing their diversions and making "less water available for their own landowners. Therefore, there is less water available for transfer during droughts. This saved water has been used to increase instream flows" (Participant 8). Although this has been detrimental to the availability of water for transfers, this news is promising because it displays senior water rights holders in the Yakima River basin are coachable and not stuck in their ways. The individuals working on the Integrated Plan market reallocation element can learn from the focused efforts and strategies employed in the Conservation projects to motivate fallowing.

An additional layer of complexity with fallowing is that it is affected by additional barriers like market forces, the timing of TWSA announcement, and the TWSA estimate itself. These other barriers are not easily changed. Market forces can drive the cost of water up but the forces that do that, supply and demand, cannot be changed quickly. Additionally, the TWSA announcement (made in late March or early April) and estimate are both based on climate and hydrology which are inherently variable and thus difficult to predict. The overlap of barriers is important to recognize. This recognition hopefully can highlight what changes can be made so fallowing can be properly encouraged.

Another institutional barrier that has a significant direct effect on the ability of the basin to be resilient to water scarcity is the time it takes for an expedited water transfer (15 days). Multiple participants mentioned 15 days is not quick enough to respond to the water needs. The Yakima Superior Court and the Water Transfer Work Group should be involved in the review of the process because of the possible externalities that can occur. However, does the process need to take 15 days? Primarily the 15-day process takes that long because of the 2-week public notice period required by the *Appropriation Procedure – Notice* regulation (RCW 90.03.280). Is this two week notice period a valid reason for the delay in executing a much needed transfer during drought? As the Technical Report on Market-Based Reallocation of Water Resources Alternative explained in the annotated bibliography, a successful water market will require ingenuity to address a factor like this.

The uncertainty barriers for both irrigation districts and senior water rights holders are significant. For water rights holders that are hesitant to engage in the water market, education and outreach from a neutral third party can address the insecurity surrounding water transfers but more importantly build trust. Ecology is the respondent in the Acquavella adjudication case which ended up reducing many water rights entitlement for many individuals. This has made water rights holders leery of the Department of Ecology. An organization that is not contracted with Ecology or Yakima Superior Court could potentially be more effective in conducting outreach with senior water rights holders and building trust.

Limitations:

According to the market reallocation element of the Yakima River Basin integrated plan (pg. 2-40), market reallocation is expected to result in water exchanges in the range of 30,000-60,000 acre-feet. The interview questions for this study did not ask about the quantity of water in acre-feet involved the transfers. Additionally, this study did not look at how active the market was in 2015[7] (the last official drought year) so it is hard to tell if the market activity was sufficient to meet the water needs of the economy and environment in times of drought.

This study interviewed irrigation district managers, but it leaves out many major decision makers in the process of executing a temporary inter-district water transfer. In particular, the senior water rights holder, farmers, landowners, and irrigation district board members. Additionally, this study only interviews 10 major claimants to water in the Yakima Basin. There are 20 other major claimants that were left out and their experience and their perceptions could be valuable to the analysis.

Future Research:

There are studies that let policy makers know who irrigators prefer to transfer water to and if irrigators prefer to sell water for a split season versus a full season (Cook & Rabotyagov, 2011). Unfortunately, there is no similar research in the basin regarding irrigators and their preferences for fallowing. In particular, research that focuses on non-perennial crop growers from seller districts with a senior water right would be practical. These growers are strong transfer candidates because they do not have multiple year commitments to their current crop and in a drought year they will have the luxury of having their water entitlement fulfilled. Some questions that would be good to ask include the following.

- What is their familiarity with fallowing?
- What are their thoughts on fallowing?
- What information do they think they need in order to know if fallowing is beneficial or not?
- To what degree would they consider the prosperity of the local economy in their decision to fallow or not?

Future research on how the other water supply related elements of the Integrated Plan affect decision making of the senior water rights holders or seller irrigation districts would be valuable. Do the other elements encourage transfers or depress transfers? The Integrated Plan Environmental Impact Statement mentions that model studies predicted benefits to irrigation if all elements of the integrated plan were implemented. I wonder if those models account for

[7] Finding accurate information inter-district temporary water transfer activity for any given year proved challenging. A contact at the court mentioned it could take a full day or more to track down the information. I did not have the time or resources to physically go to Yakima Superior Court office to do the research. The records for these transactions are not posted online.

irrigation district preferences and the various operational priorities that may involve keeping water in storage rather than participate in a transfer in time of drought.

Recommendations:

Provide Education and Outreach on Fallowing, Water Rights, and Transfers to Senior Water Rights Users

This recommendation follows a future research recommendation. The Integrated Plan work group should target senior water rights users and provide them with educational materials on fallowing practices, its benefits, and the financial and agricultural opportunities that water transfers can provide. Additionally, it is vital to get senior water right users to understand how their water right is affected by transfers and how important water transfers can be to the basin's economy and well-being in times of drought. Another beneficial strategy by the Integrated Plan would be to employ an organization independent of the Department of Ecology, as the 2007 Technical Report on Market-Based Reallocation of Water Resources Alternative suggests, to do the outreach work. Ecology's tie to the Acquavella adjudication is cause for concern for many senior water rights holders so Ecology may have trouble establishing trust. Examples of independent organizations that may be a good fit to do the outreach are the following:

- Benton Conservation District (http://bentoncd.org/)
- North Yakima Conservation District (https://northyakimacd.wordpress.com/), and
- Kittitas Conservation District (http://www.kccd.net/)

Shorten the Time-Frame to Process an Expedited Water Transfer

The current time-frame of 15 days is based on the two-week notice requirement (RCW 90.03.280) but it is not quick enough to respond to water scarcity. This is a great opportunity where ingenuity can be employed. Irrigation district water managers should come together and decide what is a quick enough time-frame. The necessary steps could then be taken to change Washington State code that would reduce the two week notice requirement.

Require the Buyer Irrigation District to Pay for Externalities Caused by the Quick Transfer

One idea that may make the shorter review period more politically feasible is requiring the buying district to agree to pay for any externalities a quick transfer (transfers shorter than 15 days) may cause.

Have Irrigation Districts Log and Report the Reasoning Behind Inter-District Transfer Denials

This study provides evidence that seller districts in the Yakima basin have denied transfers for a variety of reasons. Some reasons have been because the seller irrigation district needs the water to keep their canals full, which enables water to be carried (or pushed) out to the furthest reaches of their system, but other reasons mentioned have more to do with the possible effects on the local community. An accounting of the reasons why transfers have been denied and the frequency of those reasons would provide insight for future policy makers. The results of this study could prompt more research on the implication of inter-district water transfers on the local economy and social well-being.

Final Thoughts:

Inter-district water transfers are a frugal response to water scarcity issues in the Yakima River basin. The economy, environment, and wildlife should benefit from an active water market. From the results of this study, increasing inter-district water transfers hinges most on creating incentives and removing barriers for individuals and districts with senior water rights. The recommendations of this study target senior water rights holders and seller districts. Implementation of any or all them should speed up the water transfer process and meet the needs of more users (and the ecosystem) in the basin. The establishment of a viable and agile water market will become increasingly critical as the Yakima River basin is projected to experience:

- increases in population;
- increases in agricultural and municipal water use;
- increases in seasonal mean and maximum temperatures;
- increases in evaporative water loss; and
- decreases in snowpack volumes and summer runoff.

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APPENDIX A

Participant #	Crop mix?
1	Primarily timothy Hay 80%, alfalfa 10%, 5% orchards, 5% other such as beans, potatoes corn
2	90% is orchards (mostly apples, followed by pears and cherries), the remaining 10% is primarily hay, pasture and wine grapes
3	70% hops, remainder is orchards (pears, apples, etc) and pasture
4	80% orchard, rest is hay and misc
5	Mostly orchards, followed by alfalfa (wasn't able to give a percent
6	32% Orchards, 23% hay, 18%pasture and mixed pasture, 10% alfafa, 17% misc
7	Not Provided
8	36% orchards, 15% grapes, 9% hops, 6% Forage, 5% pasture
9	24% pasture (cow grazing), Corn 19%, forge crops (alfalfa, hay) 11%, grapes 10%, fruits 9%, 8% hops, misc 19%
10	Not Provided

WTWG "Box" Checklist	YES	NO

1. Validity

Is there continued beneficial use history sufficient to ensure that the right has not been relinquished or abandoned?		
Is it free of any "cloud" or claim on the title of the water right?		

2. Water Budget Neutrality

Is the transfer water budget neutral?		
Is the transfer TWSA (Total Water Supply Available) neutral?		
Does the transfer of the right result in equal or less consumptive use?		
Can the transfer be made without detriment or injury to existing rights? (RCW 90.03.380(1))		

3. Timing and Availability

Temporary Transfers: If a seasonal transfer, can the transfer be implemented in the time remaining in the season?		
Permanent Transfers: Is there a map of the fallowed land or discontinued use and can it be confirmed?		

4. Impairment of instream flow

Does the transfer cause no adverse change to instream flows?		
Is all the water accounted for at Parker and Prosser (if applicable)?		

5. Operational Considerations

If the transfer relies on space in existing Reclamation storage, is storage capacity available?		
Can the transfer be "bucketed", with different rate and timing, without adverse impacts on other users and fish and other aquatic life?		
Does the transfer have no impermissible impact on Yakima Project operations?		

6. For Transfers Between Surface Water and Ground Water

Can the hydrologic impacts of the transfer be accurately evaluated?		

7. Other considerations

Is the transfer in agreement with public policy?		
Is the transfer free of unacceptable secondary effects – economic, environmental, or cultural?		
Does the transfer not rely on return flow?		