Rapid Scoping for Water Market Readiness

Guidelines and a toolkit for water transfers

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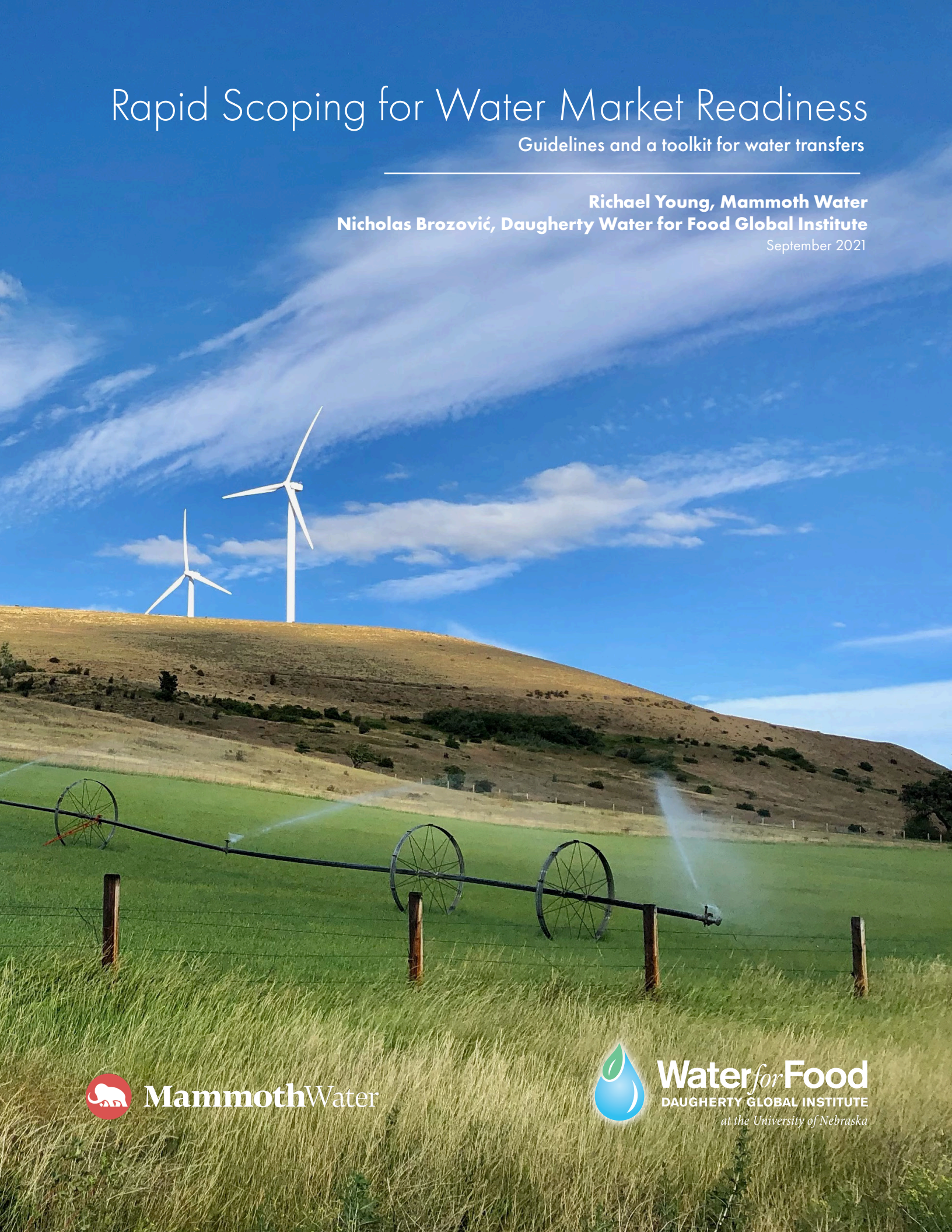

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Executive Summary

There is growing interest in water markets as a tool to mitigate the impacts of water scarcity on agricultural producers. Spikes in the demand for water transfers may be unanticipated. Realizing the full benefits of transfers requires rapid initiation and completion of transactions, including legal and administrative obligations as well as financial ones. In regions with interest in formal water transfers and limited or no experience of such transactions, it is desirable to be able quickly to evaluate readiness to implement a market.

Five key factors must be considered: severity of the water risk; legal readiness; administrative readiness; heterogeneity of water values; and infrastructure readiness. In this report, we demonstrate how scoring a region using these five metrics will give a quick determination of whether market deployment is likely to be successful, and on where future market preparation activities should focus.

An important potential application of the toolkit is in the development of “pop-up” markets. Such markets could be deployed at short notice in response to changing local conditions and the opportunity to generate value for water users.

Background & Motivation

There is growing interest in agricultural producers' use of water markets to mitigate the impacts of water scarcity, including drought, new water regulations, and other water risks. Agricultural water transfers already occur in many regions across the United States and globally. Existing transfers operate in a variety of ways with varying degrees of legal contracting.

Policymakers and practitioners are interested in developing new water markets and formalizing existing ones to improve their effectiveness. A challenge for both these tasks is understanding how to quickly evaluate the potential benefits of water transfers before costly resources have been committed. The timing of crop and water use decisions also complicates planning: by the time drought conditions are evident and water transfers could provide significant economic benefits, it is too late to start a feasibility study or develop the institutions necessary to implement a formal water market.

This report is intended to serve as a guidebook for policymakers and practitioners to rapidly assess whether a region is ready for agricultural water transfer systems. There are many factors that determine a region's readiness for a market; we consider five to be critical:

1. Severity of water risk
2. Legal readiness
3. Administrative readiness
4. Heterogeneity of water values
5. Infrastructure readiness

Our focus is understanding prerequisites for the deployment of water market tools to meet short-term or acute needs for water reallocation. Such needs may be caused by drought or other water curtailment, or supply or demand shocks. In this kind of water risk setting, much of the value of water reallocation is typically realized through lease transfers. Generally, temporary transfers are reviewed and approved at a lower cost, with less time and administrative hurdles than permanent transfers. While the applied focus of this report is on temporary transfers, the same criteria also apply to permanent transfers.

Overall, if regions can be identified as ready for water market activity, it is then conceptually possible to develop pop-up markets for water leases to address unanticipated short-term water reallocation needs. Such pop-up markets would exist only temporarily at locations in time and space where there were opportunities to create value for agricultural producers. Rather than each market being constructed anew over an extended period of time, a pop-market would make use of standardized tools with little or no customization.

The toolkit presented in this report can also be used to help with the deployment of any pilot water markets in communities or regions that have little prior experience with water transfers. Pilot programs allow users to experience markets through a low-risk mechanism that can be tested, refined, and improved before developing a more formal or permanent market institution.

In addition to assessing whether a region is market-ready, the scoring system presented can also help regions that are not market-ready but wish to be. Classifying the ways in which regions are not ready to implement transfers can help policymakers and practitioners identify where to focus efforts to improve market readiness and flexibility of water use over the medium to long term.

Given the paucity of comparable data across regions, assessing readiness is a qualitative exercise. We provide a handful of reference case studies to build an understanding of how assessment works in practice.

1. Severity of Water Risk

The first and most apparent metric involves evaluating the severity of water risk, such as drought, water rights curtailments, and other factors that can lead to water supply shortages. For example, a drought can reduce the amount of water available for water rights diversions and instream flow while simultaneously increasing surface water temperatures, reducing soil moisture, and increasing crop water demands. The combined effect of less available water with increased water demands makes drought one of the most important contributors to agricultural water risk.

When there is not enough water to meet all demands, water rights can be curtailed. Curtailments, which are administered by a regulatory body, can theoretically happen in any year. If a system is heavily over-appropriated, junior water rights may not be fully filled even in average or wet years. Curtailments can happen at an individual or regional level (e.g. irrigation district or ditch/canal company). Water rights curtailments predominantly affect junior water rights users, but can also affect water users with shared priority dates or correlative water rights, as is the case in irrigation districts.

Water supply shortage can occur as the result of drought or water rights curtailment, but can also result from having less water rights than are needed or are physically available in reservoir or aquifer storage. For example, a surface water user might experience water shortage in a year because reservoirs were not refilled the prior year as a result of drought conditions. A reservoir might also be emptied or lowered for construction, emergency, firefighting, or other reasons. Water shortage is possible even in non-drought years, depending on watershed conditions. As another example, a groundwater user may experience water shortage due to reduced well yields resulting from local aquifer depletion, even though surrounding wells are not affected to the same extent.

There are a number of other stressors, or shocks, that increase water risk as a result of decreased supply or increased demand for water. The table below gives examples of water supply and demand shocks.

Examples of Supply and Demand Shocks

Water Supply Shocks	Water Demand Shocks
• Drought (decreased rain, soil moisture, surface flows) • Water rights curtailments • Changes in water regulations • Crop failure or destruction (damaged crops no longer need to be irrigated, making the associated water rights available for sale if crop insurance conditions allow) • Low reservoir levels • Flooding for recharge opportunities	• Drought (higher crop water requirements) • Cold snaps (some crops at risk of freezing, requiring large water application for frost protection) • Crop switching, either to lower- or higher-water use crops • Population growth • Endangered species listing involving streamflow or other aquatic habitat requirements

Legal Readiness

Water risks can be extreme, moderate, or low. The scoring guideline can be used to evaluate the water risk to the region of interest.

Scoring Guideline	
High	A severe shock in the water supply or demand has occurred, such that there is an extreme mismatch between supply and demand of water. Shocks can imply a decrease in water availability (e.g. drought, curtailments) or an increase in water availability (e.g. crop failure, flooding); either shock will create an unanticipated opportunity to transfer water.
Medium	A moderate supply or demand shock has occurred.
Low	A slow, low, or no supply or demand shock has occurred.

2. Legal Readiness

Assessing water market legal readiness requires understanding the existing regulatory framework at an appropriate scale, which depends on the region of interest for the water market. The regulatory or management body that governs water transfers could be a private entity such as a canal company or could be a governmental local (e.g. public water district, county), state (e.g. a state's Department of Water Resources or equivalent), or federal entity (e.g. Bureau of Reclamation). Multiple regulatory agencies may govern or have some oversight of transfers.

There are two parts to legal readiness. First, water rights or allotments must be quantified. Absent some form of water right or restriction, there are no incentives to purchase more of what is an otherwise unrestricted resource. Without some quantification, the lessee (buyer) would have little guarantee of what was being transferred from the lessor (seller).

Second, the regulatory agency must allow for the transfer of water rights or allotments. For a short-term water use risk such as drought or curtailment, allowing the temporary transfer of water rights or allotments will be another important factor in evaluating legal readiness. Coping with drought conditions requires a short-term reallocation of water, such as a single-year lease or a split-season lease. In general, leases offer more flexibility to cope with seasonal drought than permanent transfers, and at lower cost. This requirement is not as stringent as might be thought. Many agencies that oversee agricultural water rights allow the combination of multiple rights into one jointly managed unit, often referred to as a "pool." In areas with pre-existing pooling arrangements, temporary expansion of the definition of a pool to include all water users along a canal, or in a given watershed, would satisfy legal readiness.

Other legal complexities may come into play depending on the nature of the water transfer. For example, surface-to-surface or groundwater-to-groundwater transfers might be relatively simple compared to surface-to-groundwater transfers, groundwater-to-surface water transfers, or transfers that change the purpose of use, such as transferring agricultural water to municipal or environmental uses. The law might also restrict who may hold a water right or might change the reliability of the right after the transfer. For example, Wyoming does not retain the seniority of a water right under agricultural water leasing.

Many surface-to-groundwater transfers to date are permanent, such as for domestic well mitigation. These could be intentionally scaled to increase allocation for existing wells — where there is no need to add more equipment or drill new wells — in order to take advantage of the time lags between groundwater pumping and resulting stream depletion. However, this strategy could create future risks to surface water users, as those lags could reduce baseflow in subsequent years.

Scoring Guideline	
High	There are defined water rights or allotments and the regulator allows their temporary transfer. No legal, regulatory, or policy changes are required to execute the trade.
Medium	There are defined water rights or allotments. The regulator allows reallocation of water rights or allotments to some extent, but there are limitations that would impede transactions (e.g. reallocation is allowed on fields owned or managed by the same entity, but arms-length reallocation is not allowed; permanent but not temporary reallocation is allowed).
Low	There are no defined water rights or allotments and/or the regulatory authority does not allow transfers or reallocation.

3. Administrative Readiness

Water markets and leasing programs depend on a strong and agile administrative body. Monitoring and enforcement, or shepherding, of water rights provides assurance around water transfers to market participants. If water rights were not carefully monitored and enforced, a third party to a transfer might impede it by diverting extra water meant for the buyer/lessee, or the seller/lessor could continue diverting water they had leased, leading to an increase in consumptive use and the injury of other water rights. The transaction costs of monitoring and enforcement may be quite high, or they may be small if relevant practices and technologies are already in place. The tradeoffs around monitoring and enforcement technologies, accuracy, and costs need to be considered as part of the administrative readiness assessment.

Since water leases are time-sensitive and meant to address near-term water risk, the administrative body also must be able to review transfer applications and issue an approval or denial of the transfer quickly. Several regulatory agencies allow transfers but are so backlogged with transfer applications as a result of lengthy review processes and/or insufficient staffing that the process itself inhibits short-term transfers. Finally, the transfer application and review process should not require the hiring of professional staff or administrative fees such that it makes small water transfers very expensive.

Scoring Guideline	
High	Strong monitoring and enforcement; efficient review of transfer applications.
Medium	Efficient review of transfer applications and strong enforcement, but quantification and shepherding remain a challenge.
Low	Weak monitoring and enforcement, expensive review process, and/or large backlog of transfer applications.

4. Heterogeneity of Water Values

The activity in a market and the potential gains from trade are largely influenced by heterogeneity in water values and demands across space and time. Having a variety of water values, including both relatively small and relatively large values, is desirable as a driver of transfer activity. The larger the degree of heterogeneity in incremental water values within a region, the larger the friction that a market can tolerate around transaction costs, including the search costs of finding trading partners and administrative fees. Homogeneity of crops and water values will limit the potential gains from a water market. For example, a water market may be of limited benefit in a region with exclusively high-value and permanent crops. Instead, high heterogeneity in water uses, crop types, soils, and values, particularly in small geographic areas, will define the areas with the highest potential for gains from water trading.

Other factors to consider will include the flexibility of water demands. Hardened demand for water, where there is no flexibility for users to reduce water use, will limit the gains of trade, even if there is heterogeneity in water values. For example, corn growers might have lower net revenue for their water use than orchard growers, but corn growers' binding contracts to supply feed to dairies have impeded drought-year water trading in many regions.

Scoring Guideline	
High	There is high heterogeneity of water values and demands, meaning that there is a wide range of competing water uses (e.g. agricultural and municipal), crops or crop water demand (e.g. annual and perennial), or soil types (e.g. fine and coarse).
Medium	There is moderate heterogeneity in water values or demands.
Low	Water values are homogenous and/or demand is inelastic.

5. Infrastructure Readiness

Ensuring that the appropriate transportation and conveyance system is in place is another important factor for a potential new water market. Constructing new water conveyance systems can take a long time and is generally cost-prohibitive. If transportation between buyers and sellers is not readily available, a short-term or pop-up market is not feasible.

If potential buyers and sellers are connected via a natural river or aquifer system or through existing engineered systems, such as canals, short-term markets may be feasible. Conveying water through federal or state conveyance facilities could require appropriate regulatory review and approval, as well as additional wheeling or administrative fees. These transactions costs should be evaluated as part of the infrastructure readiness.

Scoring Guideline	
High	There are few or no conveyance issues.
Medium	There are some hurdles and costs for securing conveyance on existing infrastructure, but they are reasonable and no new infrastructure is required.
Low	There are steep obstacles and costs to secure conveyance and/or the necessary infrastructure does not yet exist.

In-Depth Feasibility Analysis

Deploying a market is not recommended for a region with even a single “Low” score. The scores are intentionally designed such that a “Low” score equates to a critical failure. One will prevent the successful deployment of a market even if all other metrics score “High.” Further, more than two “Medium” scores will limit the value of a market; the practitioner should either conduct a deeper analysis or proceed with caution and tempered expectations.

There are exceptions where an entity might be willing to assume more risk in a short term or pop-up market than what is recommended above. For example, a single buyer whose intent is to keep water instream for habitat function or downstream human uses might accept relatively low scoring in legal and administrative readiness in the short-term or in times of high need. For example, an environmental nonprofit might choose to develop a water market in a region despite not having quantified water rights and/or the ability to shepherd transferred water downstream. The nonprofit could develop contracts with water users for split-season or full-season water leases, and have provisions for spot-checking the users’ property or requiring new instrumentation that could assist in quantification. There might be losses and inefficiencies, but at scale, enough water could be generated to make it worthwhile for the nonprofit. This is particularly true in cases with high enough water risk or differences in water values. There are several examples across the U.S.: drought-year buyback programs like the Washington State Department of Ecology and Colorado Water Trust reverse auctions; the System Conservation Pilot Program in the Colorado River Basin; and the instream leasing program through the Platte River Recovery and Implementation Program in Nebraska. Such programs might tolerate more risk in the short-term but aim to improve market readiness metrics for the longer-term.

There are several ways to conduct a more quantitative approach to assessing the readiness of a market. Potential tools and resources include the drought index from the U.S. Drought Monitor; streamflow and aquifer levels from the U.S. Geological Survey; reservoir levels from the U.S. Bureau of Reclamation; curtailment information through federal, state, or local water agencies; crop and soil data layers from the U.S. Department of Agriculture; and irrigation data from the U.S. Department of Agriculture National Agricultural Statistics Survey.

Other factors may play an important role, such as buyer liquidity; the ability of buyers to access the funds needed for water transactions quickly; the communication or announcement of the market; and the administration of the market, including matching, handling any necessary paperwork, and transferring funds.

Four case studies representing a variety of settings and levels of market readiness are presented below, together with a template for the water market readiness assessment scorecard.

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Case Studies
Poudre River, Colorado

The Poudre River in Colorado has a mix of water uses, including agriculture, brewing and other industrial uses, municipal and domestic use, and habitat function. The Poudre dries up at various points along its course, disconnecting habitat and impairing water users in those areas. While the State of Colorado has high legal readiness, allowing transfers and governing them through its Water Court, the process in practice is expensive and time-consuming.

Poudre River, Colorado Scorecard		
Metric	Score	Description
Water Risk	Medium	The Poudre River has several dry-up spots that disconnect habitat and impair users in those areas.
Legal Readiness	High	Water rights are quantified under the prior appropriation doctrine and transfers in Colorado are allowed through water court.
Administrative Readiness	High	Transfers take a significant amount of time to be reviewed and approved. In 2020, new legislation (HB 20-1037) was authorized to allow augmentation plans for instream flows in an expedited manner.
Heterogeneity of Water Values	High	A variety of water values exist on the Poudre River, including agriculture, brewing, municipal and domestic uses, and environmental flows.
Infrastructure Readiness	High	None; no new infrastructure required.

Case Studies
California Groundwater Sustainability Agencies

California groundwater users are facing new regulations pursuant to the 2014 Sustainable Groundwater Management Act, which requires local groundwater governance by newly-created Groundwater Sustainability Agencies (GSAs). Groundwater markets are getting significant attention as potential solutions to mitigate the economic impact of new regulations. However, GSAs will first need to define allocations, design trading rules, and implement monitoring and enforcement practices.

California GSAs Scorecard		
Metric	Score	Description
Water Risk	High	New regulations under the Sustainable Groundwater Management Act will reduce the amount of groundwater that users are allowed to pump.
Legal Readiness	Low	Neither groundwater allocations nor the rules or regulations governing transfers have been defined.
Administrative Readiness	Low	GSAs do not yet have the human or financial resources to monitor groundwater pumping, enforce allocations or transfers, or review and approve transfer applications.
Heterogeneity of Water Values	High	A variety of water values exist in most California GSAs, though a finer analysis is required depending on the GSA. Generally speaking, California agriculture is diverse with heterogeneous water values and a mix of demands.
Infrastructure Readiness	High	None; no new infrastructure required for intra-GSA groundwater trading.

Case Studies
Yakima Valley, Washington

The Yakima Valley faces supply and demand shocks during low snowpack and drought years. These shocks lead to curtailment of junior appropriators. The Washington Department of Ecology allows and encourages transfers, but transfers are reviewed on a case-by-case basis and can take a significant amount of time to be reviewed and approved. Washington's laws and statutes currently require strong monitoring and enforcement, but it is expensive to enforce more than 2,500 private water rights diversions. The federal Yakima Project also plays a large and important role in water management and transfers. Should transfers use U.S. Bureau of Reclamation conveyance or storage infrastructure, securing the appropriate wheeling or storage agreement with Reclamation will also be required.

Yakima Valley Scorecard

Metric	Score	Description
Water Risk	Medium	Supply shocks due to curtailment and demand shocks due to drought occur regularly in the Yakima Valley.
Legal Readiness	High	Washington State currently allows the temporary and permanent transfer of water and completed its adjudication of surface water in the Yakima Basin in 2019.
Administrative Readiness	Medium	The transfer application backlog is high at the Department of Ecology. Larger diversions are monitored and enforced while smaller private water rights diverters are not.
Heterogeneity of Water Values	High	A variety of water values and demands exist in the Yakima Valley.
Infrastructure Readiness	High	None; no new infrastructure required.

Case Studies
Treasure Valley, Idaho

The Treasure Valley of Idaho is an agricultural community that has been undergoing rapid urbanization and experiencing shifting demands for water use as a result. The Idaho Water Resource Board has projected demand for domestic, municipal, industrial, and commercial uses to increase severalfold over the next fifty years. This increase will presumably be accomplished through transfers from agriculture (Fereday, 2016).

Reference: Fereday, J., 2016, Opportunities for Surface Water Marketing in Idaho's Rapidly Urbanizing Treasure Valley, report for the Political Economy of Water Markets Project, AMP Insights/ecosystem economics, 35 p.

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Treasure Valley Scorecard

Metric	Score	Description
Water Risk	Medium	While there are high values in moving water to a growing urban population, the needs are for permanent and not temporary water.
Legal Readiness	High	Water rights are quantified and transfers are allowed in Idaho.
Administrative Readiness	Medium	Transfers are efficiently reviewed and there is moderate monitoring and enforcement. However, Idaho's leasing program through its water bank has been encumbered by price-setting and other constraints.
Heterogeneity of Water Values	High	Variety of water values in the Treasure Valley, including agriculture, municipal and domestic use, and environmental flows.
Infrastructure Readiness	High	None; no new infrastructure required.

Pop-up Water Market Readiness Assessment Scorecard

Region of Interest _____

1. How would you rate the **Severity of the Water Risk** of the region?

Low Medium High

Notes: _____

2. How would you rate the **Legal Readiness**?

Low Medium High

Notes: _____

3. How would you rate the **Administrative Readiness**?

Low Medium High

Notes: _____

4. How would you rate the **Heterogeneity of Water Values**?

Low Medium High

Notes: _____

5. How would you rate its **Infrastructure Readiness**?

Low Medium High

Notes: _____

Add each of the above metrics here:

Low _____ Medium _____ High _____


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