An Assessment of the Nebraska Integrated Management Planning Process

December 2015

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This study was funded by the Nebraska Department of Natural Resources.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Locally-driven, decentralized approaches to the management of natural resources are now "state-of-the-art" practices in the field of public administration. The Nebraska Integrated Management Planning (IMP) process for hydrologically-connected surface and groundwater provides a valuable testbed to see how this approach works in urgent areas of water management, because it is centered within the state's unique system of local Natural Resource Districts. We examined the current status of the Integrated Management Planning (IMP) process in two Natural Resource Districts (NRDs) in Nebraska, one mandatory IMP and one voluntary IMP. In order to assess the IMP process, we reviewed the state's Groundwater Management Protection Act, the text of two IMPs and the transcripts of recorded interviews with sixteen decision-makers and stakeholders. By in large, we found that the IMP process is working very well in the NRDs we examined. However, there are significant concerns about the extent of stakeholder involvement, and improvements should be made to better improve cooperative relations, prevent conflict, and strengthen the capacity of this locally-driven decentralized system to address current and future water concerns.

INTRODUCTION

The purpose of this study was to examine how locally-driven decentralized water practices offer benefits and challenges based on the experiences of decision-makers and stakeholders in two NRDs. The Integrated Management Planning process (IMP) in Nebraska is based on a cooperative state and local arrangement that recognizes the hydrological connection between surface and groundwater. It is a decentralized process which allows local Natural Resource Districts (NRDs) to develop planning efforts and objectives on a local level, while adhering to requirements outlined in state law. The specific questions we asked in this study were: 1) Is IMP implementation proceeding well on the local level? 2) Is planning driven by local actors while expanding to include other entities? 3) What are lessons learned to improve the IMP process in future planning?

Locally-driven, decentralized water practices are indicative of a major change in the public management of natural resources, public works, social services and other areas. Top-down, centralized program planning and implementation by federal and state agencies suffers from a number of acknowledged weaknesses. Local networks of public, nonprofit and private organizations have assumed greater responsibility for addressing what the literature calls the "wicked problems" of public health and degradation of natural resources, to name just two crises facing society. There is a new emphasis on valuing local knowledge about conditions specific to a community or geographic area, as well as recognition that complex interrelated problems require collaboration among multiple entities that bring unique perspectives and solutions to decision-making arenas.

The role of federal and state agencies has changed from top-down control to "steering" the work of local networks. Back in the 1960s, the conventional wisdom was that individual users of common pool resources, such as water, fisheries and grazing lands, were unable to cooperate with others, and that the end result was a race for use of those resources leading to unsustainable depletion– a "tragedy of the commons" (Hardin, 1968). Top-down regulation by a central authority was thus deemed necessary to prevent the depletion or degradation of the common pool resource. In the 1980s, however, Elinor Ostrom (1990) and her colleagues found that it was possible for users to solve this dilemma without the need for an external authority.

Field studies of successful locally-driven common pool resource management arrangements reinforced trends in other areas of public administration, namely the growing recognition of the advantages of locally-driven decentralized practices. Evidence showed that individuals were capable of working together at the local level to reduce the likelihood of exhausting the common pool resource, and obtain higher benefits for all. Several of the examples that Ostrom identified were irrigation districts, where local users cooperated in developing effective management approaches for sustainable use of the water commons. Research on local watershed management and sustainable local farming practices also concluded that local, bottom-up planning was more effective than traditional top-down regulation (Morris et al., 2013; Sabatier et al., 2005; Pretty, 2001).

AN OVERVIEW OF THE STUDY

The project team reviewed provisions of Nebraska's Groundwater Management and Protection Act (GWMPA) relevant to the IMP process, as well as the IMPs for two NRDs. We also conducted face-to-face interviews with sixteen decision-makers and stakeholders involved in the development and implementation of IMPs in these two NRDs. We asked about their experiences, and what they saw as the strengths and weaknesses of this unique approach to water planning. Since this was a pilot study designed to generate insights for future research, the project team focused on two NRDs only, the first a mandatory IMP and the second a voluntary IMP, both in the Platte River basin. We have redacted the names of these NRDs in the report.

We chose these NRDs for several reasons. First, the IMP process is different depending on the basin in which the NRD is located and whether the basin is over-appropriated and/or fully appropriated. One of the NRDs met this criteria and the other did not. Second, the dynamics of the IMP process are different if, based on that status, the NRD is mandated to develop an IMP or has voluntarily chosen to develop one. One of the NRDs employed a mandated IMP whereas the other was voluntary. Third, the NRDs lie on either side of the 100th Meridian separating arid and non-arid land. Our findings are thus not representative of IMP processes in other NRDs, but hopefully reflect diverse experiences with the IMP approach in other parts of Nebraska. Further research is needed to more definitively answer these questions.

Nebraska's IMP process addresses the hydrological connection between surface water and groundwater. The GWMPA and the IMP for each NRD address the effects of groundwater pumping on depletions to stream flows, as well as the effects of surface water flow on groundwater recharge, by jointly leveraging the legal powers of the Nebraska Department of Natural Resources (DNR) and NRDs to manage local water supply and use. Each IMP reflects the particular context of the individual district, although there are provisions in the GWMPA for basin-wide IMPs. The process brings together the NRD and the DNR in jointly developing, approving and implementing the IMP.

The GWMPA provides for the DNR and the NRD to consult and/or collaborate with stakeholders that rely on water from the affected basin, including irrigation districts, public power and irrigation districts, municipalities and environmental organizations. The law also identifies other stakeholders, such as recreational interests. Although surface water supplies impact groundwater recharge, the primary focus of the IMP process is to mitigate depletions to stream flow by managing groundwater pumping. Surface water irrigators are consulted in the development of the IMP, but they don't have formal decision-making authority.

The project team encountered both positive and negative perspectives about the process during its field interviews. Reports of these experiences offer valuable insights into the perceptions of decision-makers and stakeholders. To the extent that these insights lead to possible changes in the process allowed by the current law, we have incorporated them into our assessment; however, recommendations for amendments to the GWMPA or changes to the current framework for surface water and groundwater laws in Nebraska are beyond the scope of this report.

The following section presents a summary of our major findings, as well as a comparison between the NRDs with mandatory and voluntary IMPs, in response to our three major questions.

A Summary of Major Findings and Conclusions

Interviews with decision-makers and stakeholders involved in the mandatory and voluntary IMP processes provided insights into positive and negative experiences with locally-driven, decentralized water practices. Similar interview questions were used with individuals in both NRDs (See Field Interview

Guide in Appendix A). Names of interviewees are redacted from this report. Although these findings are not meant to be generalizable to other NRDs, this summary does provide a window into the strengths and weaknesses of the IMP process in two very different contexts, hopefully leading to a more extended assessment in the future.

The overall advantages of local self-regulation in managing hydrologically-connected water are that it allows the NRD to partner with the DNR in addressing issues unique to that area, as well as to engage local users in identifying problems and solutions. The IMP process also allows the DNR and the NRD to establish additional formal arrangements with, e.g., irrigation districts in balancing supplies and uses of surface and groundwater.

THE MANDATORY IMP

The goals and objectives for this IMP, as well as several of the major strategies for addressing depletions to the Platte River, evolved from earlier ideas discussed among the NRD staff, irrigation district board members and municipal officials that became part of the planning document. The manager of the NRD took a strong personal role in developing relationships and building rapport among users at pre-planning stages. These existing relationships, mutual understanding and trust, became very important when it came time for the DNR and the NRD to meet with stakeholders. At this pre-planning stage, local support for the IMP's goals was generated around commonly perceived needs and to avert future restrictions on irrigation:

> Another big selling point to the farmers . . . was to ensure that a reasonable supply of water to agriculture that couldn't be infringed on by government agencies like Fish and Wildlife service and so on and so forth. In order to get that done, we did the IMP. We put that plan or program in place and got everybody signed off, and then at least for the foreseeable future we have a reasonably assured supply of water. . . . If we lost irrigated agriculture in the Platte River Valley you would probably have North Platte, you would have Lexington, probably Kearney… Lexington because it's the county seat, Kearney because it's a college town, well you have some industry users that use a heck of a lot of water, and Grand Island. The rest of the towns will die. The population is not great out here. And basically our sole source of revenue is agricultural products.
>
> ***-Mandatory IMP Interviewee #3***

> We had the reassurance of water going into the future for not only residential growth, but . . . that the NRD would offset any new depletion. So that way if a municipality or if a new industry was coming and was going to need so many acre feet or a hundred thousand gallons a day, the city could recruit them, without having to first go out and try to find water for offset.
>
> ***-Mandatory IMP Interviewee #4***

There is a clearly defined boundary in the IMP which provides clarity to the plan, responsibilities of users, and regulatory mandates. The map of the geographic area covered by the IMP delineates over-appropriated and fully appropriated portions of the IMP, each of which is subject to different requirements. These designated areas predate the 2009 IMP, when the State of Nebraska adopted new legislation (LB 962) and DNR used the definition of hydrologically connected water in the Platte River Recovery Program (PRRIP). A major objective of the PRRIP is to reduce shortages to U.S. Fish and Wildlife Service target flows in the over-appropriated area of the Platte River Basin in Nebraska that crosses several NRDs upstream of Elm Creek. The affected NRDs were obligated to offset "new" depletions dating as far back as 1997 in the over-appropriated area.

> As I recall that was being discussed, that was back in 2008 – 2007. 2008, before the IMPs got really wrote. The COHYST group, which stands for the conjunctive cooperative hydrology study group, which involved Game and Parks, DNR, all the NRDs, the 2 major irrigation districts, CNPPID and NPPD, kind of make up the COHYST study stuff. The Platte River program headwaters group is somewhat involved as well. We were developing the tools and DNR basically requested that we do the study, the COHYST group. So we took the groundwater models to COHYST, and they ran all the models to generate the percent depletion by use.
>
> ***-Mandatory IMP Interviewee #6***

Clearly defined boundaries are an incentive for local decision-makers and stakeholders to cooperate with one another, because they limit water use to those who agree to self-regulate and therefore reduce the chance of "free-riders" exploiting the common pool resource.[1] In this mandatory IMP, the PRRIP adds a further dimension to management of the water commons by reducing regulatory uncertainty under the federal Endangered Species Act in exchange for defined contributions of water by

[1] Clearly defined boundaries, controls on water use relevant to local conditions developed by local decision-makers and stakeholders, local monitoring and mechanisms for local sanctions are among the design principles developed by Ostrom (1990) for effective and long-enduring common pool resource (CPR) institutions.

the State of Nebraska to the Platte. These contributions include projects to store and release excess flows, retire irrigated acres, and increase the base flow of groundwater to the river using canals for recharge. The PRRIP therefore overlays a legal mandate on what, in theory, is a self-regulating IMP process.

Appropriation rules (controls on use) are relevant to local conditions. Strategies to offset depletions to stream flow are part of the local appropriation controls adopted in the plan. In addition to a DNR stay on new surface water appropriations and an NRD moratorium on new wells and/or expanded certified acres, the NRD entered into agreements with local irrigation districts allowing the partners to achieve mutually beneficial outcomes: surface users can switch to groundwater wells and a more certain, less expensive source of irrigation water; and the NRD can apply on behalf of the irrigation district for the right to divert excess river flows during the non-irrigation season into canals for groundwater recharge. The DNR calculates the addition to the base flow from recharge in the area, and counts it as an offset to new depletions.

The DNR-NRD-irrigation district partnership will also allow the partners to forgo their right to call for surface irrigation water during the irrigation season, leasing that water to the PRRIP to help that program meet its objective of reducing shortages to target flows, and sharing the revenues from that lease with the irrigation district.[2] These partnering agreements were strong indicators of cooperative arrangements to address shared concerns. There was a general sense from interviews that member parties viewed these agreements as mutually beneficial:

> I think the nice thing about what they are doing is that they have become partners with the surface water folks, who at the beginning of this process, when we started IMP, they were still not partners. They were still thinking everyone was out to get them.
>
> ***-Mandatory IMP Interviewee #1***

[2] Applications to the DNR to augment stream flow were pending at the time of this study.

> Basically we have an agreement with each of the irrigation districts . . . . We have a lease agreement to put together the water rights, and transfer the water rights. The irrigation district signs them and we send them in. They total up the bills (for canal repairs) and we go half and half. They pay half and we pay half.
>
> ***-Mandatory IMP Interviewee #6***

These agreements developed based on trust after years of discussions; surveys of the land area; and calculations based on a hydrologic model of the interactive effects of surface and groundwater in that area. Overcoming distrust between surface and groundwater users took time and negotiations based on an equitable sharing of the investment costs associated with maintaining the canals for recharge purposes, and future benefits of the revenues from leasing unused surface irrigation water to the PRRIP.

While the agreements between the NRD and local irrigation districts require DNR approval to transfer surface water rights, and involve a lengthy approval process, the IMP facilitates implementation because it allows the DNR to treat transfers as a beneficial use. DNR's role is therefore one of facilitating the strategies developed at the local level by the NRD and irrigation districts. Thus, while the threat of regulatory controls on groundwater irrigation may have been a prime motivator in bringing people together in the IMP process, local cooperation resulted in a proactive approach to controls on appropriations that were unique to local conditions.

However, beyond these agreements, the experiences reported by stakeholders varied widely. One reported that his engagement with the NRD and other stakeholders predated the IMP, and that a great deal of mutual exchange and education among surface water and groundwater users had already occurred. Another reported that those with proposals for trying to surpass the minimum accretions to stream flow required by law were "laughed off the floor". Still another questioned whether the DNR and the NRD actually consulted and collaborated with stakeholders to a meaningful degree, as opposed to simply gathering input and then writing the plan on their own.

The most frequent response from the interviews was that the stakeholder meetings were infrequent compared to the other IMPs in the western part of the state, and that consultation was

perfunctory. Several reported attending and listening, without offering any input. Some stakeholders had specific ideas to propose but had the sense that the NRD was controlling the agenda:

> Collaboration in this sense was basically, "We will meet with you and take your input." We were told many times during the (name of NRD redacted) IMP process that the NRD board would make the decisions. We sent in comments. My recollection was that the NRD drafted the IMP and presented it to the stakeholders. In many cases the department (DNR) responded the same as the stakeholders did. Everyone was feeling their way. *There was no set process*. (Emphasis added)
>
> ***-Mandatory IMP Interviewee #8***

> The statutes say that they are to consult and collaborate with us. Those are two different words. They have two different meanings. And very often what we find is, they come and consult and they say, "We are consulting and collaborating with you now." And we would often ask, "Where is the collaboration? Where is the part where you are asking us to be involved with and participate in finding solutions to this? Because it seems like really what you are doing is consulting only."
>
> ***-Mandatory IMP Interviewee #7***

The lack of active participation by all stakeholders during development of the IMP was apparently due to a number of factors. One reason was that there had already been a number of conversations about specific ideas for offsetting depletions to stream flow from ground water use. A second reason was that the issues were highly technical and some stakeholders found it hard to follow the discussions. As one commented:

> I think the process would have benefited from a much more educational bent. Because not everyone was on the same level of education on how water works and how this whole thing gets put together. There was very little, if I remember it right, very little effort to bring people up to speed with all the stakeholders in fact. And I think I came at it with a fairly decent knowledge, but there was a lot of jargon and acronyms and things like that that probably limited how well people could participate.
>
> ***-Mandatory IMP Interviewee #9***

Monitoring progress involved the NRD gathering data and reporting to the DNR. Monitoring for noncompliance with controls on water use is the role of the NRD, the entity closest to the users. This

approach emphasizes the importance of local monitors who are familiar with local conditions. In the case of the IMP process, monitoring is a more complex challenge because the common pool resource involves a hydrologically-connected water commons.

The DNR and the NRD meet annually to review IMP projects and estimate accretions and depletions to stream flow, and to assess progress toward the overall goal of reducing the gap between an over-appropriated and fully-appropriated condition, or maintaining a fully appropriated status. At the time of this study, decision-makers were finalizing plans to run an updated groundwater (hydrologic) model in order to verify the number of acre feet per year (AFY) that will be needed to offset depletions dating back to 1997.[3] The DNR relies on local (NRD) records for tracking certified acres, including transfers to a water rights holder associated with retired acres and/or transferred groundwater use from one tract of land to another. The NRD also uses aerial photography to insure that irrigators are staying within their certified number of acres.

THE VOLUNTARY IMP

The overall structure of the voluntary IMP includes many of the same requirements as the mandatory process as stipulated by the GWMPA: goals and objectives, a boundary map, controls on water use, and monitoring and reporting requirements. The context is very different, however, because the DNR has not designated the area as being fully appropriated. The voluntary nature of this IMP is evident in the approach taken by the NRD and its board to comprehensive planning. The hydrogeology of the basin is also very different from the middle and upper basins of the Platte, meaning that the source of most water is from induced recharge in or along the river, rather than groundwater from an aquifer:

[3] According to an interview with the NRD, strategies to find offset water have been successful in mitigating depletions dating back to 1997, a requirement of the Platte River Recovery Implementation Program.

> That is really driven from here to the eastern part of the state by geology. The western part of the state is like a huge sandbox. You get here and further east and you have a lot of glaciation. There is a lot of really tight soils, clays from the glaciers 10,000 years ago that confine those hydrologically connected areas, because you will get alluvial deposits in a much tighter formation.
>
> ***-Voluntary IMP Interviewee #2***

The entire NRD is covered by the IMP, although a segment along the Platte is clearly delineated as a hydrologically-connected area, thus establishing a clear boundary linkage. However, many interviewees we talked to expressed concerns that the water balance within the boundaries of the NRD are vulnerable to decisions made upstream that could affect future supplies. Clear boundaries within the voluntary IMP thus fail to reduce the risk of what some perceive as potential exploitation by upstream users. It is important to note at the outset that the complexity of the hydrologically-connected water in the NRD is magnified by these vulnerabilities. Several stakeholders suggested that a local approach fails to serve the interests of downstream water users, and advocated for a more regional or statewide approach to water planning:

> That is one of the things that really frustrate me about the way state water planning goes on in Nebraska. It's based almost always on NRD planning or sub district planning activity, when in fact there are a lot of issues that are significantly beyond the boundaries of those districts, and there needs to be some kind of an oversight state water plan. That doesn't exist. The DNR contends that the NRD planning is enough. And here is a good example of showing that it isn't. You just can't quit at the boundary or the near edge of the boundary and call that a good plan, because it doesn't have the blending if you will of the needs for a broader base of understanding for what is best for the state itself.
>
> ***-Voluntary IMP Interviewee #5***

Controls on use in the voluntary IMP reflect the unique conditions of the area. Groundwater is a comparatively small portion of the total supply. Groundwater wells rely on small aquifers with a minimal hydrologic connection to surface water. Rules and regulations allow the NRD to implement groundwater components of the IMP, such as limiting expansion of certified acres in the hydrologically-connected area, but its authority is confined to irrigation wells. The IMP seeks a comprehensive balance between water

supplies and current/future demands within the entire NRD, but implementation requires the cooperation of independent water systems that rely on induced groundwater recharge from the Platte.

Users actively participated in developing the IMP. The NRD convened a planning retreat among board members, conducted a pre-planning survey among stakeholders to identify salient planning issues, hired a facilitator to develop the public participation plan and to use several engagement approaches, including focus groups, online outreach, and meetings with government agencies. The IMP thus relied on an extensive stakeholder consultation and collaboration process involving a wide variety of interests which helped develop support and transparency. The NRD engaged extensively with members of the public before deciding on goals and objectives. The DNR participated actively in these sessions ranging from collaboration with a stakeholder advisory committee to consultation during public forums:

> We also knew that in our district, you don't do any planning without any broad comprehensive public involvement process. That is what we felt we needed to make sure we were going to be able to engage all the stakeholders and do our best to try and bring them into the process . . . . And then we retained a consultant to do the public process, develop a public process, and guide the planning and development of the IMP under the umbrella of this public involvement process.
>
> ***-Voluntary IMP Interviewee #1***

> You had people who drill wells. You had people that run the water systems: rural and urban. You had ag representation in 2-3 different forms . . . . Yes environmental was there and University Extension . . . . Then there was a pure row crop representation, pivot system irrigation representation. So we spent really that entire first meeting getting a handle on who everybody was, who they represented, and what they saw as issues.
>
> ***-Voluntary IMP Interviewee #3***

In response to the question about engaging with stakeholders, one interviewee offered the nuanced answer that the voluntary nature of the IMP led to a sense of complacency among many participants. Unlike the mandatory IMP, there were fewer irrigators directly impacted by controls on use and there was no legal mandate to offset new depletions. On the other hand, a second interviewee experienced the process as a valuable way for urban and rural water users to educate one another about their unique challenges and interests. Two stakeholder advisory committee members commented that

they would like to stay informed by the NRD about the implementation of the IMP, even though their role had officially ended.

Although the IMP process reserves to the DNR and the NRD final decision-making authority, the NRD interpreted the legal terms consult and collaborate liberally. This investment of time and resources appears to have created "social capital" that has led to cooperation among a wide variety of stakeholders in developing the goals and objectives.[4] The IMP process thus provided a forum that would have otherwise been unavailable for these interests to learn from one another and to find common ground[5]:

> The stakeholder group was a very hard working group. It turned out to be a well selected group. Those meetings were set up for them, very specific agendas. They were meaty issues. They were working on, directly on, the vision, the goals, and having their input into those.
>
> ***-Voluntary IMP Interviewee #1***

> It was a great process. It really was. Lots of people were involved. Lots of data and information was presented. (There were) lots of really nice, thoughtful conversation on the part of different groups and people who were involved. Their comments and suggestions were taken very seriously and incorporated into the final wording of those goals.
>
> ***-Voluntary IMP Interviewee #6***

Another important finding from the interviews is that the role of the DNR was to attend the sessions and provide the participants guidance on legal and technical issues, rather than to signal a top-

[4] Social capital refers to the trust built among participants and decision-makers that reflects an investment of time and resources in the short term in return for cooperative action in the future. See Leuenberger and Reed (2015).
[5] The literature on public involvement underscores the importance of moving beyond consultation (gathering input to proposals from decision-makers) to collaboration (including the public in developing goals and objectives). Collaboration allows stakeholders to reframe public discourse as a way to find common ground, rather than an opportunity to engage in zero-sum conflicts with opposing interests. See Kemmis (1990).

down agenda. The DNR staff could clarify the scope of the IMP process, and what issues fell outside the provisions of the GWMPA, such as water quality:

> DNR's role in that IMP and in most IMPs are to provide a reminder of the statutory boundaries . . . we can say 'well under the statute an IMP really has authorities to do this.' An example of that and I know that it came up in the (NRD name redacted) was water quality. I know that comes up a lot in the eastern IMPs in general. They want to incorporate water quality into it. And it is not under our authority and not under the IMP's authority directly.
>
> ***-Voluntary IMP Interviewee #2***

Since this NRD is in the very early stages of implementation, monitoring for compliance with ground and surface water controls in the IMP is limited in scope. The importance of monitoring is in gathering data to complete a water balance study that is a major goal of the IMP. The DNR relies on information from the NRD on the number of new wells, new residential acres being developed, and expansions of municipal and industrial consumptive uses. Monitoring is therefore essential to annual evaluations of the condition of the area and whether it is approaching a fully appropriated status. As one interviewee stated, "It's about not hitting the line and crashing".

How Is Local Implementation Proceeding?

Implementation is proceeding well at the local level in the two NRDs that were part of this assessment. The mandatory IMP includes creative and proactive cooperative strategies intended to avert the need for restrictions on existing groundwater use. The NRD has established a mechanism to record retirements and transfers of certified irrigated acres. This mechanism allows the NRD to offset new depletions to stream flow in the Platte River, either as a depletion dating back to 1997 or an expansion to an existing use, and therefore helps avert the need to restrict current uses and provides flexibility for future municipal growth and industrial development.

The mandatory IMP also includes provisions for partnering with local irrigation districts so that the NRD can apply on their behalf for rights to divert and store excess non-irrigation flows in the canals for purposes of groundwater recharge. The NRD provides funding for the rehabilitation of these canals,

and in one case has hired the manager of the irrigation district as an NRD employee. These partnerships allow the NRD to count groundwater recharge as an offset to new depletions. In totality, these initiatives appear to have moved the NRD towards its acre feet per year target.

Implementation of the voluntary IMP is also proceeding well. The focus has been a comprehensive inventory of water supply and use in the NRD, since there are gaps in the data base. The area has yet to be designated as fully appropriated, and the planning process has therefore been more forward-looking versus getting back to a fully appropriated condition. The NRD nevertheless faces significant challenges, because its water supply is primarily dependent on the actions of upstream water users. Additionally, there are multiple, independent public water systems throughout the NRD that add to the challenge of managing use and supply in the future in an equitable fashion.

DOES LOCAL PLANNING EXTEND TO OTHER PUBLIC ENTITIES?

The GWMPA establishes an IMP process based on joint decision-making between the NRDs and the DNR. This legal framework drives the IMP process, and situates the NRD as the primary author of the IMP. The advantage of this approach, as shown in field research on local common pool resource arrangements, is that goals, objectives and controls on water use fit conditions unique to the NRD. Moreover, there are greater incentives for users to cooperate, assuming that the boundary around the water resource is clearly delineated; that controls on use are accepted by local users as making sense for their area; that users affected by controls participate in the decision-making process; that monitoring for compliance is the responsibility of local users; that sanctions are imposed by local authorities who know the users and who can exercise discretion in the case of hardship or unusual circumstances; and that conflicts remain and are resolved locally.

Overall, the IMP process adheres to this approach, accounting in large part for its success in the two NRDS examined for this assessment. The boundaries of the hydrologically-connected water within each NRD are clearly delineated, although the size of the area is much larger in the mandatory IMP. Since the mandatory IMP incorporates the Nebraska New Depletions Plan (adopted by the State of Nebraska as

part of the PRRIP agreement among the U.S. Department of Interior, Nebraska, Colorado and Wyoming) the boundary of the hydrologically-connected area makes it clear to the NRD how to determine the volume, location and timing of offsets to depletions for which it is responsible.

Clearly defined boundaries are an incentive for users to cooperate, because they are reasonably certain that "free-riders" who don't invest in maintaining the water supply are excluded from the common pool resource. In the middle and upper basins of the Platte where five NRDs are part of the New Depletions Plan, boundaries are based on intricate modeling of hydrologically-connected areas developed by the DNR and the NRDs. Thus, clearly-defined boundaries allow the NRD to count depletions and accretions to stream flow from its own projects toward its IMP goals and objectives. Clearly-defined boundaries are less important for the voluntary IMP, simply because the area is comparatively smaller. There is frankly more concern about the impact of upstream water development projects on future water supply.

In addition, local users are motivated to accept and comply with controls on use when they make sense to them and are developed by local decision-makers. Local planning has the support of many stakeholder groups in both NRDs. Surface water irrigation project managers, however, appear to have major concerns about the IMP process, because it allows NRDs to offset their depletions to stream flow by converting surface water irrigation to groundwater wells; by using irrigation canals for groundwater recharge; and by storing surface water to meet future shortages.

Federally-regulated irrigation projects are in the "federal nexus" of laws such as the Endangered Species Act; are subject to licensing conditions by the Federal Energy Regulatory Commission; and are responsible for reducing shortages to federal target flows on the Platte over-and-above IMP requirements. Irrigation project sponsors are concerned that they will find it difficult to meet the demands of their users in the future given these other requirements, especially since the GWMPA and IMP process seek to balance surface and groundwater supplies and uses as one common pool resource. Addressing these legitimate concerns in an equitable and procedurally fair consultation and collaboration

process would prevent conflict that generates time and resource costs, and damages relationships and the potential for future cooperation. This concern certainly also applies to smaller surface water irrigators and other surface water interests that have expressed concerns with process and outcome issues.

There is a persistent, unresolved, issue among surface water users that their rights under the prior appropriation doctrine are subsumed under an administrative process aimed primarily at offsetting the impact of groundwater pumping. The GWMPA allows NRDs to reverse those impacts incrementally, preserving existing wells built years after surface water irrigators established rights to appropriate surface water. Uncertainty about future supplies intensifies other concerns, namely that implementation of the IMP process is not adequately engaging stakeholders with meaningful collaboration. Local planning in the mandatory IMP has extended to local irrigation districts, but to date there are no formal partnerships with the larger power and irrigation districts.

The results of this IMP assessment attest to the strengths of locally-driven, decentralized water practices. This assessment has also identified areas of concern that should be addressed to improve the IMP process. What remains to be examined are the experiences of NRDs in other areas. The ultimate test of the IMP process, however, is its potential to extend outward to form coalitions with other NRDs. Future studies should assess the potential for local planning to expand outward to include other NRDs, as well as stakeholders, using more collaborative approaches.

WHAT ARE LESSONS LEARNED?

The major lesson learned from this assessment is that there is great potential to expand outward from the NRD through more extensive stakeholder involvement. There are multiple advantages of locally-driven, decentralized water management practices, and interviews with local decision-makers and stakeholders in the NRDs we examined validate the overall value of the IMP framework. There are, however, significant and valid concerns about the implementation of the process among some surface water irrigators and interests. Consultation appears to be insufficient to overcome this skepticism; while

collaboration requires additional time and resources, it is more likely to increase cooperation among all water users, especially if assisted by an outside facilitator.

The GWMPA contains ambiguous language about the situations in which the DNR and the NRD are required to collaborate. The IMP process is supposed to "consult and collaborate" if the NRD is in an over-appropriated area, but if only part of the NRD is over-appropriated and the entire district is included in the IMP, then the question is what type of participation process to use. More importantly, what exactly does "collaboration" entail? Local planning processes could voluntarily adopt the guidelines of the International Association of Public Participation, as an example, to clearly and transparently provide parameters and expectations for collaboration among stakeholders and decision-makers. Such efforts at the planning stages could have valuable benefits in terms of preventing future conflicts and strengthening foundations for effective local water management arrangements in the future.

IRB # 745-14-EX

APPENDIX A: FIELD STUDY INTERVIEW GUIDE

Name_____

Organizational Title/Affiliation _____

(Identifiers will be confidential)

1. Let's begin with the development of the most recent IMP. What was your overall role in the process? Have you been involved in the development and implementation of the plan? What about the role, if any, of others in your organization?

2. Did you interact with other organizations and government agencies involved in the IMP process? Who was involved from other organizations and government agencies? How often did you meet during the development of the IMP?

3. The IMP process requires a map that delineates the geographic area. Who was involved and what were the considerations that went into the map? What issues or difficulties came up in delineating the area with a hydrological connection?

4. The IMP process also requires ground water and surface water controls. Who was involved and what were the considerations that went into deciding which controls to include in the plan? What issues or difficulties came up in deciding on those controls?

5. The IMP has been in place now for at least two years. Who has been involved in monitoring water supply and use? How would you say compliance with the plan is going? Do water users think that the plan spreads the costs and benefits fairly?

6. Have conflicts between surface and water users emerged during either the development or implementation of the IMP? Have any issues arisen because of requests for new water uses that may require offsets? How are those issues resolved?

7. Let's wrap up by asking you how effective you think the IMP process has been in managing water with a hydrological connection? What has worked especially well in your view? What improvements in the process are needed in your view?

APPENDIX B: MANAGEMENT DESIGN PRINCIPLES

In examining the IMP process as a testbed for locally-driven, decentralized water practices, we relied on a number of reform theories in public administration, including a greater emphasis on collaborative networks of public, nonprofit and private entities. This study primarily relied on an analytic framework that was developed by Ostrom (1990), who studied the principles underlying effective local common pool resource management.

1. Clearly defined boundaries: This principle states that managers should clearly define the boundary of the common pool resource and who has rights to withdraw resources. In the absence of clearly defined boundaries there is little incentive to coordinate, because of the risk that "free riders" will benefit and eventually destroy the resource.
2. Appropriation rules relevant to local conditions: Each common pool resource is unique in its conditions for water use. Incentives to cooperate depend on usage rules that are reasonable and reflect the situation. A "one-size-fits all" approach to managing water supply and use discourages cooperation at the local level.
3. Participation by users: The individuals who directly interact with the common pool resource and with one another on a local level are in the best position to modify operations over time, and therefore they are motivated to participate in decision-making.
4. Monitoring by users: Despite shared norms valuing compliance with cooperative arrangements, most long-enduring cases involve active investments in monitoring by the resource users themselves. Local users are bound by these arrangements to effectively monitor the common pool resource.
5. Graduated sanctions: Punishment for non-compliance by actors in robust self-governing settings occurs in graduated steps, because local monitors are familiar with the individuals and circumstances of the infraction.
6. Accessible conflict resolution: Conflicts are often resolved informally by local leaders in robust common pool resource settings.

APPENDIX C: METHODOLOGY FOR THE IMP ASSESSMENT

Before we interviewed decision-makers and stakeholders, we gathered background information about the GWMPA and the IMP. The GWMPA is a first step in the development of an integrated water management system, but this policy reflects and maintains a divided system of water laws in Nebraska. The DNR administers surface water resources based on the law of prior appropriation; while the NRDs administer groundwater based on a system of reasonable use and correlative rights. Thus, surface water appropriators use a "first in time, first in right" system. Rights to the groundwater supply underlying one's land are determined based on correlative use relative to nearby land owners, and must be a reasonable use (Hoffman and Zellmer, 2013).

The conflicts between users that have arisen in recent years occur when those holding senior surface water rights allege harm due to depletions of stream flow from "junior" (in time) groundwater wells. The courts have yet to make a definitive ruling on how to balance these competing rights. We recognize that this bifurcated system of water laws impacts the GWMPA and IMP process, perpetuating an underlying conflict between surface and groundwater users. NRDs can avert future conflicts through the IMP process by offsetting depletions to stream flows from groundwater pumping. The DNR, in turn, can work jointly with the NRDs to monitor hydrologically-connected uses and supplies, but irrigation districts have no formal decision-making authority. Consequently, our assessment and recommendations are, as discussed previously, limited to what is possible within the IMP process as authorized by the GWMPA.

In order to identify sections of the GWMPA and the IMPs that were most relevant to locally-driven, decentralized water practices, we coded sections of these documents using the design principles in Appendix B as an organizing framework. We coded independently using ATLAS.ti - a qualitative analysis software program, then compared and reconciled their codes. Appendix D presents the results of this background analysis. A similar coding process helped us to synthesize the recorded transcripts of the interview data into the summary of the findings.

APPENDIX D: DESIGN PRINCIPLES IN THE GWMPA AND IMPS

Statutory provisions associated with each of Ostrom's (1990) design principle in relevant sections of the GWMPA are summarized in Table 1. The mandatory and voluntary IMPs are described in narrative form, still using the design principles to organize the material, while not identifying specific sections, so that readers cannot identify the NRDs by comparing relevant sections with IMP documents. The names of the two NRDs are redacted from the narrative.

Table 1.

Framework for Assessing the GWMPA	
Boundaries	§46-715(1)(a), §46-715(1)(b), §46-715(2)(b), §46-718(2)
Appropriations	§46-715(2)(c), §46-715(2)(d), §46-715(4), §46-715(5)(c), §46-716(1)(b), §46-716(1)(c), §46 716(1)(d), §46-716(2), §46-718(2), §46-739
Collective Choice	§46-715(3)(f), §46-715(5)(b), §46-715(5)(d)(ii) , §46-717(2), §46-719(3), §46-719(4)
Monitoring	§46-715(2)(e), §46-715(3)(d), §46-715(5)(d)(ii), §46-715(5)(d)(iii), §46-715(5)(d)(v), §46-715(6)
Sanctions	
Conflict Resolution	§46-715(5)(b), §46-718(3), §46-719(2), §46-719(3), §46-719(4)

CLEARLY DEFINED BOUNDARIES IN THE GWMPA

The GWMPA requires development of integrated management plans through a joint process between the DNR and the NRDs. The IMP process is mandatory in cases where the DNR has designated a basin as over-appropriated or fully appropriated.[6] In all other cases, the NRD may notify the DNR of its intention to jointly develop with the DNR an IMP on a voluntary basis (§46-715[1] [a] [b]). The IMP must contain a map "clearly delineating the geographic area subject to the integrated management plan" (§46-715[2] [b]). Although the emphasis is the management of areas with hydrologically-connected water, the statute allows an NRD to decide to include all water uses within the district (§46-715[2] [e]).

[6] §46-713[3] states that a river basin or sub-basin is fully appropriated if the DNR determines that uses of HC water cause, or will cause in the foreseeable future, the surface water supply to be insufficient to sustain uses for which the DNR granted appropriation rights; stream flow to be insufficient to sustain uses from wells dependent on recharge from surface water; or reduction in stream flow that would cause the state to be in noncompliance with an interstate agreement or compact. The statute relies on an administrative definition of an over-appropriated basin.

After the DNR and an NRD decide to implement a proposed IMP, the NRD adopts by order the boundary of the area subject to ground and surface water use controls in the plan (§46-718[2]). The goals and objectives of an IMP require the DNR and the NRD to jointly assess the interactive effects of the depletions and accretions to surface and groundwater supplies within the clearly defined boundaries of the hydrologically-connected area.

CLEARLY DEFINED BOUNDARIES IN THE IMPS

The basis for the boundary of the hydrologically-connected area is a hydrologic model (COHYST) developed by DNR, NRDs and major water users, and adopted by DNR as an administrative decision.[7] This boundary definition became part of the Platte River Recovery Implementation Program (PRRIP) program document. In the mandatory IMP, the GWMPA has designated the area upstream of Elm Creek as over-appropriated. The over-appropriated stretch of the Platte River crosses five NRD boundaries and constitutes the area for a basin-wide plan as mandated by the GWMPA. The over-appropriated portion includes an area having a hydrological connection between surface and groundwater, and the boundary is clearly defined on a map of the district.[8]

The hydrologically-connected area of the voluntary IMP covers only a small portion of this NRD, and the boundary of the IMP covers the entire jurisdiction. There is a map delineating the hydrologically-connected area; however, there are few hydrological connections between surface and groundwater affecting supplies and uses in most of this NRD.

APPROPRIATION RULES RELEVANT TO LOCAL CONDITIONS IN THE GWMPA

The GWMPA specifies that the elements of an IMP include one or more controls on both surface and groundwater appropriation or use. While statutory authority for these controls occurs in separate

[7] This boundary is referred to as the 28-40 line. A later iteration of this line developed by the DNR through negotiated rule-making is the 10-50 line creating a more inclusive boundary for basins not part of the PRRIP.

[8] The Nebraska New Depletions Plan, approved by the Platte River Recovery Implementation Program Governance Committee, defines the area to be covered by the Plan as located within the North Platte, South Platte or Platte River watershed and so located that if water were intentionally withdrawn for 40 years, the cumulative stream depletion upstream of Chapman, NE, would be greater than 28% of the total groundwater consumed as a result of withdrawals from those wells. This formula for determining the boundary of hydrologically connected water was adopted as part of the mandatory IMP.

sections of the statute (§46-716 and §46-739), the goals and objectives of an IMP are to sustain a balance between hydrologically-connected water uses and supplies so that the "economic viability, social and environmental health, safety, and welfare" of the basin, or sub-basin be achieved and maintained (§46-715 [2] [a]). Appropriation rules (controls on use) for each IMP are therefore structured to fit the unique conditions of hydrologically-connected water in each NRD. IMPs in over-appropriated basins must identify the amount of water necessary to offset the impact of stream flow depletions initiated after 1997[9] (§46-715[5] [c], §46-715[5] [d] [i]).

Appropriation Rules Relevant to Local Conditions in the IMPs

Appropriation rules for the mandatory IMP reflect the status of the Platte River. The fully-appropriated portion is under a moratorium on new well permits and expanded irrigation acres. The NRD is responsible for offsetting new or expanded groundwater irrigation, as well as increases in consumptive municipal use from population growth and commercial/industrial consumptive use, up to limits of 25 million gallons per year. The NRD is also responsible for finding offsets to new or increased non-municipal industrial use up to 25 million gallons per year. The DNR has also placed a moratorium on new surface water appropriations. The over-appropriated portion is under the same moratorium; however, the NRD must also offset "new" depletions dating back to 1997. Appropriation rules allow for continued development through the use of offsets to new or expanded uses.

Despite the lack of hydrologically-connected water in most of the area encompassed within the voluntary IMP, the DNR and the NRD have included proactive steps to manage water supply and control uses. For example, there are requirements for well permits; provisions for adopting a moratorium on new water wells in certain geographic areas where there is a shortage; a requirement for water flow meters on existing and new wells pumping more than 50 gallons per minute; and controls on the certification of irrigated acres. The IMP also limits expansion of historically certified acres in the hydrologically-connected

[9] The year 1997 refers to the signing date of the Cooperative Agreement that created the Platte River Recovery Implementation Program beginning on January 1, 2007. The PRRIP covers the Basin of the Platte River within Colorado, Wyoming and Nebraska. Each state was responsible for developing a plan to mitigate effects of surface and groundwater depletions initiated after 1997. The implications for the IMP process are that NRDs upstream of Chapman, NE, must include strategies to offset post-1997 depletions in their IMPs.

area. Controls on new and expanded uses are contingent on drought and/or reductions in ground and surface water supplies due to consumptive use or to depletions upstream of the NRD. The DNR will issue restrictions on expansion of acres for surface water irrigation in the event of an NRD moratorium on expanded groundwater use.

PARTICIPATION BY USERS IN THE GWMPA

The statute requires consultation with stakeholder groups during development of the IMP for a fully appropriated basin, including irrigation districts, public power and irrigation districts and municipalities (§46-715[3] [f], §46-717[2]). Other provisions require the DNR and the NRD to consult *and collaborate* with stakeholders in over-appropriated basins. The terms consultation and collaboration are unspecified; but, consultation generally means gathering input before making a decision, while collaboration implies greater stakeholder involvement in the development of an IMP (§46-715[5] [b]). The DNR and the NRDs may amend an IMP in an over-appropriated basin based on their annual review, but there are no provisions for involving stakeholder groups (§46-715[5] [d] [ii] in the amendment process.

The GWMPA authorizes the DNR and the NRD as the decision-makers for the original IMP and any subsequent amendments; however it also requires the DNR and NRDs to consult with stakeholders in fully appropriated areas, and to collaborate in over-appropriated portions during the initial development of the plan. The mandatory IMP reflects these statutory provisions, documenting meetings with stakeholders while emphasizing that the DNR and NRD will meet to review annual progress on the IMP, and that any amendments require an agreement between these decision-makers.

PARTICIPATION BY USERS IN THE IMPS

The DNR and NRD can expand their joint planning and management to local irrigation districts subject to local agreements when partnering to negotiate transfers of existing surface water rights to augment instream flow or to make canals available for intentional groundwater recharge. In general, however, participation by stakeholders who may be affected by IMP projects is limited to consultation and/or collaboration at the development stage.

The decision to adopt and amend the voluntary IMP resides with the DNR and the NRD; however, modifications to the goals and objectives trigger collaboration with stakeholders to develop proposed revisions to the IMP. Development of this IMP involved extensive stakeholder participation, including collaboration with a stakeholder advisory committee jointly appointed by the DNR and the NRD. Focus groups, virtual town halls, an open house and social media components provided additional opportunities for input. The DNR and the NRD approved the final IMP, but only after extensive collaboration and consultation with stakeholders. The issues identified encompassed current and future water supplies and uses for development in the NRD.

MONITORING BY USERS IN THE GWMPA

The GWMPA requires that an IMP include provisions to monitor hydrologically-connected water supplies and uses (§46-715[2] [e]). It creates a joint effort between the DNR and the NRD requiring decision-makers to report, consult with each other, and share information on new uses and/or changes in uses (§46-715[3] [d]). There is a joint annual review and technical analysis of actions taken to determine progress toward meeting IMP goals and objectives, as well as an annual forecast of the maximum water volume from stream flow for beneficial use in both the short and long term (§46-715[5] [d] [ii], §46-715[5] [d] iii], §46-715[6]). The joint monitoring of IMPs is external to the users, who may report data on supplies and usage to decision-makers, but who are not monitoring other users.

MONITORING BY USERS IN THE IMPS

Although the mandatory IMP process calls for joint reporting on an annual basis by the DNR and the NRD, it provides that tracking of location, amount and timing of depletions caused by new or expanded water use occur at the local level. The NRD tracks yearly certification of groundwater use, water well construction, and consumptive uses by municipal and non-municipal industrial water systems within its jurisdiction. The NRD tracks the number and location of retired irrigated acres and offsets for new uses, including depletions dating to 1997 in the over-appropriated part of the basin within its jurisdiction. The DNR tracks changes in permits for surface water.

While the voluntary IMP is still in the early stages of implementation, it makes provisions for the DNR and NRD to jointly track depletions as well as accretions to stream flows resulting from changes in water uses. The data on which jointly developed reports rely will come from the DNR and NRD monitoring of surface and groundwater respectively. The IMP refers to the DNR's methodology for assessing hydrologically-connected water supply and use, and proposes to utilize it to monitor the near and long-term balance of water supplies within the NRD. Thus, monitoring data are an important input to the future development of strategies for managing water supply and use.

GRADUATED SANCTIONS IN THE GWMPA

The GWMPA authorizes NRDs to require reporting, meter or decommission wells, issue cease and desist orders, initiate law suits, and take other forms of action to enforce various sections of the statute (e.g. §46-707[1], §46-708[3]). Cease and desist orders may also be issued against public water suppliers, which are to be reviewed by the Attorney General (§46-745[2](a)). Persons who violate cease and desist orders may be subject to costly civil penalties (§46-745[1], §46-746[1]). Specific sanctions' processes are outlined in the administrative rules and regulations of the DNR and NRDs.

Rules and regulations specific to each of the two NRDs and authorized by the GWMPA provide the legal authority to implement groundwater controls, including enforcement of provisions in their respective IMPs.

ACCESSIBLE CONFLICT RESOLUTION IN THE GWMPA

The process for conflict resolution begins during the development of the IMP. In cases where the NRD is in an over-appropriated basin, the law provides for a collaborative approach among decision-makers and stakeholders. If the parties reach agreement on the plan, then the DNR and the NRD adopt it; however the decision-makers can still develop and adopt the plan even if there is disagreement (§46-715[5][b]). The GWMPA does provide for conflict resolution before an Interrelated Water Review Board (IWRB), but only in the case of a dispute between the parties, meaning the DNR and the NRD (§46-718[3], §46-719).

ACCESSIBLE CONFLICT RESOLUTION IN THE IMPS

The only provision for dispute resolution is in the mandatory IMP and applies to the Basin-Wide Plan involving the five NRDs with over-appropriated portions in the IMPs. If a dispute is presented at the annual meeting of the Basin-Wide Plan, and if required by state statute, then the DNR and other affected Basin NRDs, working with the affected water users, develop a management solution to address the issue. In the fully appropriated portion of the IMP, the DNR and NRD determine if a change as proposed by one or more stakeholders will be adopted as an amendment.

APPENDIX E: REFERENCES

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