

AN ABSTRACT OF THE THESIS OF

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Abstract approved:

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Growing urbanization, shifting water uses, and a focus on ecosystem health in the Deschutes River Basin in Central Oregon led to experimentation with new voluntary market-based approaches to water management in the last decade. To meet groundwater demands while maintaining instream flows and upholding prior water allocations, the Oregon Water Resources Department implemented the Groundwater Mitigation Program (GMP) in 2002. While evaluative reports are due to the Water Resources Commission in 2008 and 2009, no comprehensive review of the GMP has been carried out. As the evaluation requires consultation with Deschutes Basin water users, this research focuses on the experiences of the participants in the program.

The research involves an assessment of the acceptability of the GMP to its participants, using the Institutional Analysis and Development framework (Ostrom, Gardner, and Walker 1994) as a basis for analysis. The study employs nine criteria to examine the acceptability of the program to its participants: 1) economic efficiency, 2) equity, 3) accountability, 4) adaptability, 5) usability, 6) environmental sustainability, 7) utility, 8) collaboration, and 9) information dissemination. Furthermore, in order to contextualize the acceptability of the current program, the research employs two hypothetical alternative institutional arrangements that bound the GMP and serve as comparators: 1) a complete moratorium on all groundwater pumping and 2) no institutional arrangement governing groundwater in the Deschutes Basin. The research incorporates a mixed-method approach. Primary data were collected through interviews and a postal survey that included open- and closed-ended questions. Data were gathered from a total of 111 respondents.

Results indicate that despite many frustrations with the program, including a lack of information dissemination to participants and a lengthy groundwater permitting process, the GMP is more acceptable to participants than the two proposed alternatives because it enables participants to meet their groundwater needs, offsets depletion of instream flows, and allows for economic growth in a manner that may restrict development more than having no institutional arrangement.

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Acceptability of Market-Based Approaches to Water Management: An Analysis of the
Deschutes Groundwater Mitigation Program

by
Eva K. Lieberherr

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Eva K. Lieberherr, Author

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Acceptability of Market-Based Approaches to Water Management: An Analysis of the Deschutes Groundwater Mitigation Program

CHAPTER 1: INTRODUCTION

“We can’t create water or increase the supply. We can only hold back and redistribute what there is” (Stegner 1987).

Surface water in the Deschutes River Basin in Central Oregon has been fully appropriated since the start of the Twentieth Century.¹ Towards the end of that century new demands for water increased with rapid population growth, a changing economy and shifting values. With all surface water rights already fully allocated primarily for agricultural uses, groundwater began being used to meet the new demands. Despite the extensive groundwater system in the Deschutes Basin, the hydrologic connectivity between surface and groundwater combined with state and federal legal requirements for scenic waterways have greatly impacted the ability to allocate water to the rising needs in the basin. In order to meet the growing demands through groundwater supplies while offsetting the effects on instream flows, the state implemented the Groundwater Mitigation Program (GMP) in 2002.

The Deschutes Basin’s situation of shifting water uses from agricultural to urban and instream flow purposes is similar to many basins in the American West (National Research Council 1992; Aylward 2006). In order to offset potential conflict resulting from these water reallocations, there is an emergence of new forms of collaborative management that balance the traditional government-based mechanisms with a more recent market-based approach (Merrett 1997; Lee 1999; Anderson and Snyder 1997; Wahl 1989; National Research Council 1992). Despite the significance of such mechanisms to reallocate water in the West (National Research Council 1992), many water managers, policy makers, water users and the general public feel uneasy with the use of a market mechanism to allocate water (Lee 1999). Therefore the acceptability of market-based approaches becomes a major factor affecting the effectiveness of such emerging management strategies.

¹ As water left instream is assumed as being open to appropriation (Reisner and Bates 1990), a stream becomes over-appropriated when consumptive (out-of-stream diversion-type) water rights are greater than the water instream at a certain time.

In the Deschutes Basin, the GMP serves as an example of an emerging market-based water management institution that employs a combination of regulatory and market-driven mechanisms. The implementation of the GMP can be attributed to a “window of opportunity” where the convergence of state and federal regulations as well as a clear indication of surface and groundwater interaction and the recent political explosion regarding water usage and fish in the Klamath Basin provided a trigger for its creation (Aylward and Newton 2006).

The development of the program began with a stakeholder work group process created by the Oregon Water Resources Department (OWRD). Since the work group never reached consensus, the final GMP rules were implemented somewhat unilaterally by OWRD. Certain stakeholders involved with the initial process believed that key issues under debate remained unresolved and filed a lawsuit that led to a ruling against the GMP in 2005. However, ensuing legislation (HB 3494) reinstated the program that same year, with the conditions that its effectiveness must be evaluated by the Water Resources Commission every five years (the first in 2008 and 2009) and that the program may sunset in 2014.

In order to meet the criteria in the mandated evaluations, it must be shown that the GMP achieves its objectives effectively and that it is a viable program for the Deschutes Basin. Since a primary objective of the GMP is to “sustain existing water uses and accommodate growth through new groundwater development” (OWRD 2003), an important aspect of maintaining the GMP is its ability to meet the needs of the water users in the basin (i.e. program participants and potential participants).² Meeting the participants’ needs may be evaluated by assessing how acceptable the GMP is to them. However, research regarding the GMP participants’ acceptance of the program is lacking.

The focus of this research is on program participants’ perception of how acceptable the GMP is in the Deschutes Basin. The focus is to use acceptability as one indicator of the program’s effectiveness and viability; based on the logic that if a program is acceptable to its participants then it is more effective and viable. Since local non-acceptance of programs is a primary reason for program failures (Thomas 2001), participants’ acceptance of the GMP may play a

² Program participants are defined as groundwater permit applicants with pending applications, permit holders, as well as withdrawn and denied applicants.

major role in the success and subsequent effectiveness of the program. However, it must be taken into account that the objective of the GMP is not only to meet the needs of the water users (i.e. the participants) in the basin; the program serves a larger role of protecting water resources in the basin while allowing for development through new water uses by offsetting the effects of groundwater pumping in order to meet statutory requirements and restore instream flows (OWRD 2003). Yet the objective of this research is *not* to evaluate the effectiveness or the viability of the program as a whole.

Research Problem

No comprehensive documentation of the GMP's acceptance by its participants has been carried out since the program's inception in 2002. While a convening assessment that included a wide range of stakeholders' perspectives and concerns about water management in the Deschutes Basin was conducted by Resolve Inc.³ in 2006 (Nudelman and Odell 2006), it did not focus on the participants of the GMP. In contrast to the Resolve assessment, this research aims to provide insights regarding the program participants' perspectives about the acceptability of the GMP.

Research Criteria, Question & Hypotheses

In order to contextualize participants' perception of the GMP's acceptability, the current program is compared against two hypothetical institutional arrangements that bound the GMP on either side: 1) a rule specifying the closing of the Groundwater Study Area (which includes a major portion of the Upper Deschutes Basin) to further groundwater appropriations beyond the exempt use;⁴ and 2) a return to the pre-1995 institutional arrangement where there are no rules limiting further groundwater appropriations.

The acceptability of the GMP is evaluated in comparison to the two proposed alternatives by using nine criteria that serve as indicators of acceptability. Ostrom (1993) delineates the following evaluative criteria for assessing the alternative institutional arrangements: 1)

³ Resolve is a neutral, private, non-profit group.

⁴ Exempt well use permits the use of up 15,000 gallons per day or up to one-half an acre for irrigation or domestic uses.

economic efficiency, 2) equity, 3) accountability, and 4) adaptability (Ostrom, Schroeder, and Wynne 1993). In order to more thoroughly assess the acceptability of the program, the following criteria are added: 5) usability, 6) environmental sustainability, 7) utility, 8) collaboration and 9) information dissemination. These criteria are assessed based on the perceptions of the participants. For instance, the usability of the GMP is evaluated based on participants' insights and experiences with the program.

Since the purpose of this research is to evaluate the acceptability of the GMP (to its participants) as an institutional arrangement to manage water resources in the upper Deschutes Basin, the main research question asks: Is the GMP more acceptable to its participants than alternative management and regulatory options that could be used to manage water in the basin? In order to address the research question and evaluate the nine criteria, the following hypotheses are tested:

Hypothesis 1: The GMP is perceived by participants as offering higher net benefits than proposed alternatives.

Hypothesis 2: The GMP is perceived as more acceptable to those participants who can more easily afford to pay for it (i.e. wealthier participants) than those who cannot.

Hypothesis 3: The GMP is perceived by participants as more flexible than proposed alternatives.

Hypothesis 4: The GMP is perceived by participants as more equitable than proposed alternatives.

Hypothesis 5: The GMP is perceived by participants as providing more accountability than proposed alternatives.

Hypothesis 6: The GMP is perceived by participants as providing more environmental sustainability than proposed alternatives.

Hypothesis 7: The GMP is perceived by participants as presenting more utility than proposed alternatives.

Hypothesis 8: The GMP is perceived by participants as creating more collaboration within the water community in the Deschutes Basin than proposed alternatives.

Hypothesis 9: The GMP is perceived by participants as offering greater information dissemination than proposed alternatives.

Significance of Research

Evaluative reports on the GMP are due to the Water Resources Commission as well as the State Legislature in 2008 and 2009 respectively. However, information regarding participant perceptions of the GMP is lacking. While the focus of the report due in 2008 is on the physical effectiveness of mitigation projects and credits, the 2009 evaluation requires that OWRD consult with water users and program participants (OWRC 2006).

By gaining firsthand insight about how acceptable the GMP is to program participants, this research may supply useful information that may be employed by OWRD or other entities to improve the GMP and water management in the Deschutes Basin; making the GMP more effective and viable. Furthermore, since the GMP is a pioneering market-based approach for handling emerging water resources needs, it may serve as a model for similar future programs. To this end, it is important that the GMP participants' acceptance and perceptions of the program be documented and made available.

CHAPTER 2: LITERATURE REVIEW

This chapter discusses the literature relating to this research and provides a basis for understanding the GMP. This information should aid in comprehending the findings from the participant interviews and postal surveys presented in Chapter 5. First, the framework underlying the research approach is described. Then the importance of collaborative processes, public involvement, information dissemination and communication between policy officials and the public involved in water management programs are depicted. Next the literature on institutional arrangements regarding water management, groundwater management and the issue of sustainability is reviewed. Then market-based approaches to water management are explored. Finally, in order to contextualize the institutional arrangement of the GMP, water law in the West is discussed.

The Institutional Analysis and Development (IAD) Framework

The conceptual framework for this thesis is driven by political science as well as economic theory. In evaluating programs and institutions, economists usually employ the concept of economic efficiency and political scientists typically include equity as evaluative criteria (Aylward and Gonzalez 1998; Stone 2002). The Institutional Analysis and Development (IAD) framework (Ostrom et al. 1994) is employed as a basis for analysis for this research because it uses both criteria. Furthermore, the IAD provides the flexibility for the incorporation of additional criteria and facilitates in assessing the GMP as an institutional arrangement.⁵ Institutional arrangements establish the structure for regulations governing water resource use and can be defined as: “ordered relationships among people which define their rights, exposure to rights of others, privileges and responsibilities” (Schmid 1972), which can become understood as rules and laws.

Underlying the IAD framework is institutional public choice theory, which is public choice theory applied to institutions; public choice theory assumes that individuals act rationally to

⁵ This framework draws from classic political economy, institutional economics, public choice theory, neoclassical microeconomic theory, transaction-cost economics and non-cooperative game theory (Ostrom et al. 1994) where the individual is regarded as a rational being (Ostrom V 1989).

attain personal preferences and make economically cogent decisions (Ostrom 1989). The institutional public choice theory utilizes assumptions of public choice theory but adds that rational individuals are acting and making decisions in real-world institutional settings (Ostrom et al. 1994). While this theory acknowledges that in simple situations individuals may act rationally, it posits that in complex circumstances individuals lack complete knowledge and wherewithal to act in a fully economically rational manner (Ostrom et al. 1994: 321). In order for institutions (such as the GMP) to function effectively, the institutional public choice theory emphasizes the importance of individuals who are willing to work together under complex circumstances, “extend reciprocity to others and interact with others with similar inclinations” (Ostrom et al. 1994: 329). While economic efficiency is a central tenet of the IAD framework it also addresses fairness; the emphasis is not on economically self-interested individuals but on those capable of working with one another, engaging in mutual exchanges. Furthermore, in order to assist in creating effective institutional arrangements for complex resource allocation problems, the IAD framework recommends dissemination of dependable information by “external authorities” as well as the creation of long-term agreements and enforcement (Ostrom et al. 1994).

Central to the IAD framework is the “action arena” characterized by the physical context, the social context and the institutional arrangements (Ostrom et al. 1994). These three attributes contextualize the action arena where the underlying factors affecting the development of the GMP are addressed. The action arena also includes the action situation within which the actors operate. According to the IAD framework, all action situations include the same seven elements: 1) participants who have specific 2) positions that decide between various 3) actions based on 4) information they have about how the actions are 5) linked to possible 6) outcomes and the ensuing 7) costs and benefits (Ostrom et al. 1994). An actor is defined as an individual who takes action based on personal preferences, knowledge and resources (Ostrom et al. 1994). Since the focal actors in this research are the GMP participants, the research is centered on the perspective of one group of actors involved in the program.

Emerging Collaborations

Water management is prone to conflict when water reallocations are made (Lach 1996), particularly under complex circumstances. In order to mitigate conflict between diverging

values and needs for water, a collaborative and adaptive water management system is important, particularly with the use of new market-based approaches (Aylward 2006). While collaborative water management has a long history in the American West as settlers sacrificed self-interest for the common good of managing water resources collectively (Schneider and Ingram 1998), population growth and scarcity of water resources led to contention between water users. Hence formal allocation of resources occurred when numbers grew and conflicts emerged (Rose 1986). As such allocation and reallocation mechanisms may themselves lead to disputes, increasing emphasis is placed on collaborative processes.

In order for collaborative processes to occur, individuals must be willing to accommodate others' needs so that a shared understanding can be reached (Ostrom et al. 1994); consensus can be built by creating a collaborative environment where all involved parties agree to take responsibility for a problem and strive to solve it (Naiman and Bilby 1998). However, consensus may never be attained if the involved parties fail to recognize each other's differing experiences, knowledge, values, and expectations. An expert argues that while total consensus is not always feasible, public involvement and accountability provide a reasonable alternative (Pagel 2002). While emphasis is placed on arriving at shared understandings, experts also realize that differing worldviews may cause others to see new things. Hence by agreeing to work together, clashing views can lead to innovative solutions as diverging perspectives can complement each other (Schwartz and Thompson 1990).

In order for effective collaborations to occur, tremendous effort is needed to simply create shared understandings and establish a forum to communicate differing perceptions (Blomquist 1992). By communicating preferences it becomes possible to "reach acceptable sharing agreements" (Ostrom et al. 1994: 327) and it is possible to recognize "new realities" (Lach, Ingram, and Rayner 2006). Since such processes are time-consuming and tend not to fit into traditional expectations of water management processes, they are often viewed as cumbersome. Yet researchers argue that a considerable amount of time is needed in order for a shift to occur that leads to effective policies: "You have to slow down long enough to really see what's needed" (Senge et al. 2004: 86). Furthermore, political scientists note that policy development should not be rushed; "a reasonably long period of thinking, discussing, and

debating issues – is good” (Birkland 2005: 44). The length of time needed for this shift to occur is undefined and is unique to each policy situation.

Researchers suggest that “the process of clumsy collaboration may be as important as the designs themselves” (Lach et al. 2006: 239); they enable shared understandings that may create more long-lasting solutions. These “seemingly messy solutions may offer the only viable alternatives for many long-standing and apparently intractable resource problems” (Lach et al. 2006: 239). Furthermore, research shows that often water management programs that require a lengthy process have long-term impacts and are more sustainable than “quick fix” responses to emergencies; policies where the impact is augmented over time are seen as the “best” solutions (Winpenny 1995).

Central to coming to shared understandings is the concept of trust. For the purposes of collaboration, trust means that people must be able to believe in someone or something and have clearly stated expectations about the collaborative process. Mutual trust serves as an important ingredient to create institutions that address resource problems in collaborative ways (Ostrom et al. 1994). In addition to trust, equity is shown to be important in achieving collaborative processes (Lunch 2001). In a study about water management in California a solution was found by putting emphasis on equity, not just on efficiency (Lach et al. 2006). Furthermore, once collaborative processes are established, adaptability of water management also becomes crucial in order for programs to be effective and acceptable: “Managers, users, and advocates need to have the flexibility to imagine and adopt novel solutions to water problems” (National Research Council 2004: 85). Such adaptability that also involves water users and stakeholders with diverging worldviews in water management processes will ultimately lead to increased acceptability of water management mechanisms (Winpenny 1995).

Public Involvement, Information Dissemination & Communication

General consensus in the water resources field holds that incorporating public participation in water management is important for effective management that is acceptable to stakeholders, water users, and the public (Winpenny 1995; Reisner and Bates 1990; National Research Council 1992). Incorporation of water users’ values and ideas (particularly long-term

residents) when making water management decisions is seen as important because they “have generally been in tune with the natural limits of scarce resources” (Winpenny 1995: 20). Furthermore, in order to create effective policies, theorists concur that it is imperative for citizens to take action (Steel 2006). As citizens tend to more actively participate in policy-making when the issues have a direct impact on their lives (Birkland 2005), individuals must realize their role in the situation and know how they fit into the larger system (Senge et al. 2004). Under a market-based approach, such as the GMP, it is particularly important for participants to be involved in order to reduce unexpected consequences (i.e. negative externalities) and to increase compliance (Lee 1999; Winpenny 1995).

Public Participation & Accountability

Public participation is argued as being central to the success of today’s environmental management planning (Jones 1999). An analysis of citizen participation in environmental management shows how public knowledge and participation greatly affect a project’s implementation (Jones 1999; Luz 2000). Without incorporating citizens into the planning and implementation of programs, they may be more likely to fail as local opposition has been found as being a primary factor leading to unsuccessful projects (Thomas 2001). Despite the increasing realization of the importance of public awareness about groundwater management, there is a general lack of public awareness and participation (Beck 1991; Luz 2000). In part, researchers note that this may be due to the difficulty of information dissemination as well as the “challenge of developing an integrated and place-based approach” (Tognetti, Aylward, and Mendoza 2005: 21).

Another aspect of inadequate participation and awareness may be due to the fact that often decision-making authorities are not responsive to the public (Beck 1991). If authorities are not active in providing information to citizens then the citizens are less likely to be involved or to comply with regulations. In addition, experts emphasize the importance of up-to-date, precise and consistent information for creating effective institutional arrangements (Ostrom et al. 1994) that are acceptable to the public. Furthermore, information about policies, their purposes and functions must be available in an easily understandable manner to citizens in order for them to become involved, make decisions, see the utility of programs and hence find them acceptable and comply with them. Citizens may be less likely to participate because the

explanations and information about policies and programs are not construed in a way that is understandable to them (Schneider and Ingram 1993).

A further issue relating to public awareness and compliance is accountability of water management institutions, which involves monitoring and enforcement of water resources, (Winpenny 1995). Not only is accountability critical to attaining sustainability and efficiency of water use but it also increases compliance and makes regulations more acceptable to water users. Enforcement is a component of accountability that affects the acceptability of a program because a program becomes less credible (and hence less acceptable) if enforcement is lacking. Legal scholars say that the state's role should be to supply information and education, monitor groundwater flow and use, develop an institutional framework for managing the resource as well as conduct research (Beck 1991).

Experts postulate that effective enforcement can lead to increased efficiency, which, in turn, should lead to information dissemination (Reisner and Bates 1990; Ostrom et al. 1993). Furthermore, by being accountable to water users, through monitoring and enforcement, compliance among water users should increase. Research shows that programs including a monitoring mechanism benefit from more compliance than those that fail to monitor (Blomquist, 1992: 302). In addition, monitoring of water management programs is crucial for local managers, water users, and communities to accept these new programs (Thomas 2001).

Communication

For effective information dissemination to occur, open and clear communication between program implementers and participants is crucial, which ultimately affects the acceptability of a program (Luz 2000; Burroughs 1999). Studies have found that transparent communication increased public trust, which promoted the acceptability of the new water management programs (Thomas 2001). Other social assessments that monitored the improvement of communication methods between scientists, planners and community members showed that this led to increased acceptance of projects (Luz 2000; Burroughs 1999). Such open communication and information dissemination allows stakeholders and program participants to have an increased understanding about the purpose of a program and ultimately perceive more utility in it and hence view the program as more acceptable.

Creating and maintaining transparent and two-way communication between the public, water users, water managers, state agencies, and other stakeholders early on in the development of a program is crucial for establishing consensus and implementing a successful program (Thomas 2001). Failure to involve citizens in environmental planning projects from the onset of the project can be detrimental to the project's success (Luz 2000). However, water management is often fragmented between different governing bodies that leads to miscommunication and disorganized management that tends not to involve citizens throughout the entire process (Winpenny 1995).

While the state should unify its water management efforts, experts say that local governing entities often create management practices unique to their situation. Such localized management is criticized as leading to a fragmented system that is inefficient (Blomquist 1992), other experts argue that an effective water management strategy must be initiated from the bottom-up – from the community itself (Thomas 2001). It is argued that local water users and stakeholders are more likely to accept groundwater management projects if they are controlled locally (Thomas 2001). For example, in case studies of water management in several basins in California it was found that local self-governing water management systems were adaptable to emerging problems and strove towards innovation. Therefore, it is argued that such bottom-up approaches are preferable to “either a no-action groundwater management system or mere chaos” (Blomquist 1992: 317).

One means to increase public awareness is through legislation and institutions. While rules do not raise consciousness intrinsically, it is argued that any law about water resources will raise awareness about the issue among those who are affected by the regulation (Beck 1991). The logic is that if a part of the public becomes aware and partakes in implementing legislation, the successful or unsuccessful legislation will have the effect of increasing the public's knowledge and participation (Beck 1991).

Institutions, Groundwater Management & Sustainability

“Institutional arrangements are tools with which citizens and officials in the West will address and ease their water resource and use problems” (Blomquist, Schlager, and Heikkila 2004: 135).

Institutions take many forms and have the flexibility of nonconformance with either the traditional market model or the bureaucratic model (Ostrom 1971). At their optimum, institutions “create order and relative certainty for water users, which facilitate the achievement of economic and social goals” (Livingston 1998: 19). On the flip side, institutions can create obstacles for efficient water use due to poor designs that may cause individuals to waste resources in order to compensate (Livingston 1998). Institutions can be pivotal in facilitating collaborative outcomes as they provide the foundations to convene water users and stakeholders (Ostrom 1990). Furthermore, as technical approaches to water management fail to be economically and politically feasible (Livingston 1998), emerging legal thought acknowledges that the institutional aspects, such as economic and social roles of groundwater, must be addressed (Beck 1991).

In the West, where surface water is over-appropriated and mandates from the Safe Drinking Water Act require cleaner water sources, new water demands are increasingly met through groundwater, as is the case in the Deschutes Basin (Aylward and Newton 2006). Groundwater management historically was an accommodating doctrine with unclear laws that catered to unrestricted pumping. Furthermore, groundwater regulations in the past only addressed the physical nature of groundwater in order to capture and supply more water, neglecting the socio-economic aspects of water management (Beck 1991; Winpenny 1995). Today, widespread reliance on groundwater is reaching the point where the current levels of use are unsustainable (Beck 1991). The literature indicates that since the 1970s, there has been growing concern about the potential depletion of groundwater (Reisner and Bates 1990; Glennon 2002). In addition, policy makers increasingly emphasize institutional approaches to attain environmental, economic, and social goals (Livingston 1998). If sustainability can be defined as the juncture of meeting environmental, economic as well as social needs, then the groundwater regime is tending towards sustainability (see Figure 1).

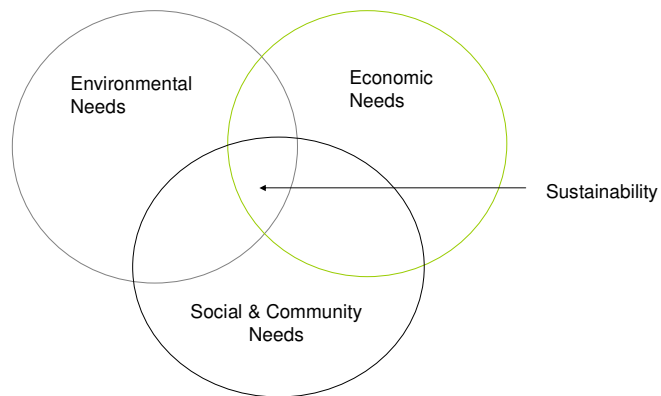


Figure 1: Conceptualization of Sustainability

A distinction must be made between sustainability and sustainable pumping (see Figure 2). While sustainability is a broader term that considers factors such as ecological constraints, water quality issues, and social values, sustainable pumping focuses on technically approximating the amount of water available for utilization without overexploitation of the aquifer. In order to shift from the historically unsustainable groundwater use, sustainable pumping as well as sustainability must be taken into account.

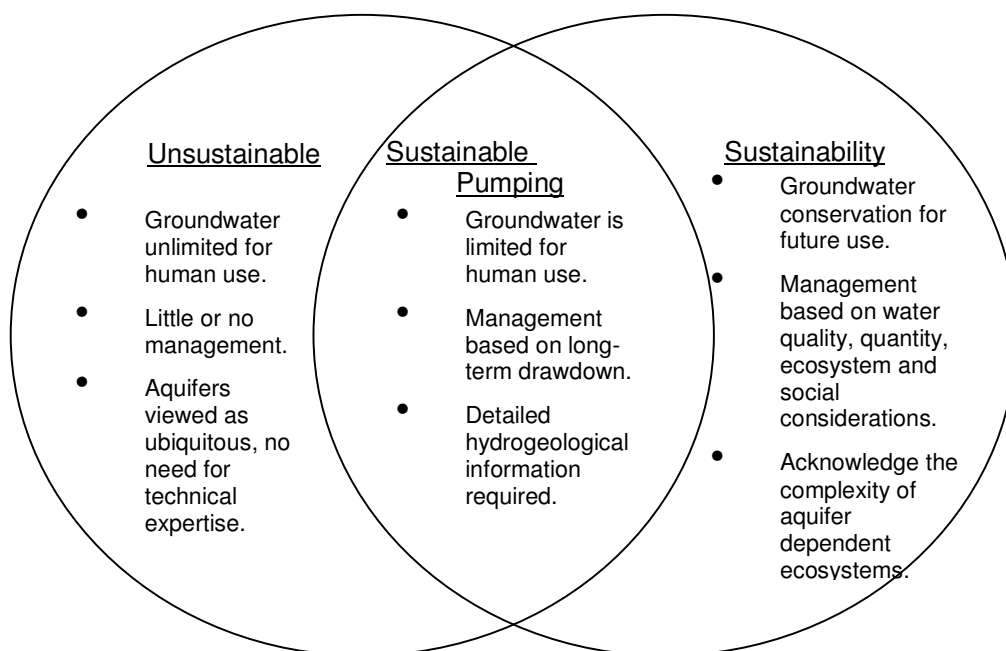


Figure 2: Sustainability of Groundwater Management

In order for sustainable management to occur, researchers say that it must first be realized that “the status quo is simply not sustainable” (Lach et al. 2006: 239). The status quo of western water allocation where irrigated agriculture is sacred, as well as the legacy of federal water policy and water law, are viewed as major impediments to achieving more sustainable water management (Reisner and Bates 1990). While experts encourage an “historic reform” that would alter the status quo of water laws and policies that cater to consumptive uses (Reisner and Bates 1990; Easter, Rosegrant, and Dinar 1998; National Research Council 1992), such a change might be nearly impossible and may come at the cost of increasing the complexity of the already very intricate polices and laws (National Research Council 1992). Therefore, in order to offset such a cost, it is recommended to streamline systems (National Research Council 1992) and to take a more broad-based approach. Scholars indicate that a

comprehensive basin-wide management, where institutions focus on a river basin's environmental, social and economic needs, could serve as a sustainable approach to manage water resources (Lee 1999). Such local-level, basin-wide planning creates the ability to manage water in a way that meets water users' needs while increasing the predictability and cost-effectiveness of water management (National Research Council 1992). However, defining and implementing basin-wide management is cumbersome and has generally failed (Lee 1999).

Conjunctive Management

A central tenet of sustainable groundwater management is conjunctive management, which is the integration of surface and groundwater management (Beck 1991). While surface and groundwater resources were, and in most states still are, managed separately (Winpenny 1995; Reisner and Bates 1990), increasing emphasis is placed on the interdependence of groundwater and surface water (Anderson and Snyder 1997). However, due to the historic differences in managing surface and groundwater, conjunctive management has been difficult to implement. The attributes of the institutional setting (i.e. state and local government relationships or water right laws) affect the type of conjunctive management institutions that are developed (Blomquist et al. 2004); institutional factors can either promote conjunctive management or inhibit their success due to institutional rigidity.

In order for conjunctive management to function as a viable institutional arrangement, several aspects should be in place:

- “sufficient local benefits” (Thomas 2001: 12); monetary or water supply benefits should be offered to local groundwater users;
- local communities should be involved in the entire process – from development to implementation;
- perception of risk must be addressed and mitigated;
 - potential risk factors include:
 - hydrologic risk (reduction of quantity or quality of groundwater);
 - financial risk (increase of mitigation credit costs and energy costs);
 - legal risk (water rights being challenged) (Thomas 2001).

In order for effective conjunctive management to occur, it is important to have adequate data on the hydrogeology and baseline conditions of a region (Thomas 2001). Yet uncertainty is inherent in hydrologic information (National Research Council 2004). Furthermore, hydrogeological information is difficult to obtain and data collection is expensive (Winpenny 1995). Insufficient data on groundwater pumping often leads to concerns about the environmental sustainability of groundwater management.

As the above discussion signifies, the need for new management and planning approaches is generally recognized in the field of water resources management (Winpenny 1995; Beck 1991). One increasingly dominant approach to address the growing concerns about sustainability and shifting the status quo involves market-based mechanisms.

Market-Based Approaches to Water Management

An emerging water management tactic is to treat water as an economic good that can be allocated through a market (National Research Council 1992; Beck 1991). Although many are skeptical about economic efficiency as a goal for water management, market-based approaches are increasingly being supported by water experts, environmentalists, and urban entities alike. Water managers in the West have been turning toward market-based approaches since the 1980s (Lee 1999; Clifford, Landry, and Larsen-Hayden 2004; Winpenny 1995; Merrett 1997; Anderson and Snyder 1997). While the Pacific Northwest is seen as lagging in developing water markets, Oregon has been among the pioneers in this region (Reisner and Bates 1990).

Water markets are incentive driven, decentralized, and flexible institutions (Lee 1999). While various kinds of water markets exist, their shared attribute is that water may be bought and sold through voluntary transfers; the price of water is determined by the voluntary exchange of a water right (Lee 1999) that encourages the highest value of water use (Winpenny 1995). In order for a market to function, clearly defined transferable water rights must be established (Glennon 2005; Freeman and Haveman 1971; Lee 1999; Easter et al. 1998). By legally defining groundwater as a property right, a resource that was free and exploitable becomes “a conservable resource” (Beck 1991: 47). Water markets are only feasible where water rights

are adjudicated (Jaeger 2004) and the fugitive nature of water generally makes absolute rights difficult to establish and enforce (Winpenny 1995).

Historically, water was not viewed as an economic good and therefore was not priced to cover costs of supply (Winpenny 1995). Despite the fact that water demand, in comparison to other resources, is price inelastic, experience demonstrates that water use can decrease with increasing prices (Beck 1991; Winpenny 1995; Anderson and Snyder 1997). Hence water pricing may be used to curb over-use of water, serving as a means for regulating water use; however, prices should remain affordable to those needing the water (Winpenny 1995). Yet since physically regulating water uses is more “real” for many people this is preferred to water pricing as a mechanism for regulating (Beck 1991).

While the market allocates water instead of regulation (Lee 1999; Anderson and Snyder 1997), a mixture of market-based mechanisms as well as state regulatory approaches tends to be employed in order to bridge the inadequacies of both approaches (Beck 1991). Some experts argue that governments are inept to handle market-based management approaches (Anderson and Hill 1983). However other experts realize the limits of markets, which can be compensated by government intervention (Winpenny 1995; Merrett 1997).⁶ Experts note the following reasons for government intervention under market-based mechanisms:

- market approaches often overlook the public good characteristics of water (Colby 1990);
- the public interest needs to be upheld because water is a “subtractable” resource (i.e. one person’s use may influence another’s);
- water lends itself as a “natural monopoly” (Winpenny 1995; Lee 1999; Wahl 1989);
- state and federal laws (mandate that water be “held” or “protected” by the state);

⁶ For instance, during water transfers the state’s instream flow regulations are crucial for curbing negative effects on the environment or economy; protecting the public benefit of instream water, including recreational and aesthetic purposes (Wahl 1989). Furthermore, while markets should provide perfect information (King 2004), in reality people act in a world of uncertainty without perfect information (Anderson and Snyder 1997). Since this invalidates the underlying assumption of markets (that people act rationally with perfect information), government regulation is needed to offset market deficiencies.

- ethical objections of commodifying water and general distrust of water markets;
- people's unwillingness to pay;
- transitional costs (Winpenny 1995; Reisner and Bates 1990; Anderson and Leal 1988);
- water has unique physical, economic and socio-cultural attributes; it is a fugitive resource that evaporates, flows, seeps, and transpires (Lee 1999; Winpenny 1995);
- the social value of water differs; some view it as a means to grow crops while others believe it should flow instream and still others view it as a basic human right that holds certain cultural, social, and religious values distinguishing it from economic goods (Winpenny 1995); markets fail to address the social-community values of water (Ingram and Oggins 1991); and
- markets fail to address equity concerns (Lee 1999), government must oversee the transfer process and set adequate standards to maintain equity and offset negative effects on third parties (Glennon 2005).

Market advocates argue that the role of the government should be decreased and that private organizations and nonprofits play a larger role in water management (Anderson and Snyder 1997). Furthermore, they argue that nonprofits are more willing to experiment with new strategies and provide a “social risk capital in the form of financial, human, technical, and institutional resources to jump-start, leverage, advance, and sustain existing state programs” (King 2004: 11). In addition, nonprofits may channel resistance towards new strategies away from the state; they can improve state programs by merging the public and the private (King 2004).

Connected to the above argument is the entrenched skepticism of the government – with its perceived inefficient bureaucracy – that is prevalent in the U.S. (Goodsell 2004; Lee 1999; Lunch 2001). Many Americans complain that the government is inefficient and infringes on their personal liberties. This viewpoint applies to water resources management as state and federal agencies regulating individual water uses are often inefficient due to under-funding (Winpenny 1995; Lee 1999). The above viewpoint places emphasis on market-based rather than regulatory mechanisms to manage water resources. In contrast, opponents of market-based approaches argue that there is a rift between government's general reputation and its actual

record. It is argued that high expectations of bureaucracy often create contradictory goals and sets bureaucracy up for failure (Goodsell 2004). This perspective holds that government bureaucracies are essential for equitable management and allocation of resources (Goodsell 2004).

Under market-based approaches, reallocation has become the major mechanism for creating sources of “new” water (National Research Council 1992; Stegner 1987), which is seen as leading to economic efficiency (Easter et al. 1998; Wahl 1989) as it allows for shifting water uses without having to expand the water source. Water banks are central to reallocations as they provide a means to transfer rights. Water users seeking a new water right in an over-appropriated basin, like in the Deschutes Basin, must file an application with the state to obtain a “new” water right through a water transfer. Water rights holders who no longer use their water can reallocate their right for a limited time (i.e. lease for a fee), including short- and long-term leases or sell it in perpetuity (Lee 1999; Anderson and Snyder 1997).⁷ New water users seeking water rights, can apply for a permit to obtain water that has been transferred. Since this reallocation process tends to be complex and prone to debates, most applicants hire professionals to assist with the application process (Colby 1990).

Water Banking

Market-based approaches to solving environmental problems can take many forms, such as privatization, water-banking transactions, and leasing.⁸ Water banks characterize one market-based tool for water management that is increasingly employed to meet shifting water needs in the U.S., particularly in the West (Clifford et al. 2004). In a general sense, a water bank is an intermediary that brings buyers and sellers together through an institutionalized process (National Research Council 1992). The central goal of a water bank is to reallocate water to

⁷ The permanent transfers are generally preferred because they are homogenous and they provide security in long-term investment while the time-limited or temporary rights transfers are subject to more uncertainty and rigidity in allocation. However, the latter transfers also provide for more flexibility in potential future water policy changes (Lee 1999).

⁸ Another market mechanism employed is an auction, which was used in the Deschutes basin by the DRC. This method of allocating scarce goods is based on competition. Generally an auction ensures that water is allocated to those who value them the highest and thus increases efficiency (Lee 1999). They also enable a forum for price discovery.

where it is most needed or more readily afforded, which tends to facilitate the transfer of old water uses to new ones and may lead to more efficient and higher economic-value uses as well as increase instream flows (Clifford et al. 2004; Anderson and Snyder 1997).

Banking programs employ temporary leases and/or permanent acquisitions of surface water, groundwater, or stored water. Groundwater banking is a comparatively new form of water banking and only a few exist in the U.S. The purpose of groundwater banking is to provide a means to trade water credits in order to be able to pump groundwater while offsetting effects on surface water (Bakker 2005). Despite the growing emergence of water banks in the West, water banking transactions have not been increasing proportionately. In part this may be due to the nascent nature of water banks and people's lack of awareness (Clifford et al. 2004).

Market Approaches in Oregon

Market approaches in Oregon recently took hold due to the Endangered Species Act (ESA) and increasing concern about over-using water resources (Clifford et al. 2004). Water leasing is becoming a primary mechanism for restoring instream flows in Oregon. The Deschutes River Conservancy (DRC) (discussed in Chapter 4) and the Oregon Water Trust (the first trust for water in the U.S.) have developed effective leasing programs in Oregon. These approaches have created a water market to restore instream flow, where water right holders are compensated for leaving their water instream.

The experience with market-based approaches to restore instream flows in Oregon is seen as being an "efficient approach; playing a major role in future water resources management" (Neuman 2004). While the most extensive leasing program in the state is the U.S. Bureau of Reclamation's program in the Klamath Basin, which protects fish and wildlife habitat, water banking is less feasible in that basin than in the Deschutes because water rights in the latter basin have been adjudicated whereas not all water rights have been adjudicated in the Klamath (see Chapter 4 for more information about adjudication).

Water Law

Of the two dominant legal paradigms underlying water law in the U.S. – the riparian doctrine and prior appropriation (Getches 1997)⁹ – the latter dominates in Oregon but old riparian rights still being recognized (Reisner and Bates 1990). A main tenet of the riparian doctrine that pertains to this research is that the water rights are “appurtenant” (bordering) to the land, which makes this doctrine non-conducive to arid regions where diversions are necessary. Therefore, in order to meet the needs of the early settlers, the doctrine of prior appropriation was developed, which supports water diversions (Getches 1997; National Research Council 1992).

Prior appropriation has become the predominant doctrine for allocating water in the West (Reisner and Bates 1990). This doctrine embodies the “first in time, first in right” principle that gives priority to the senior user. Hence users do not share the costs of water shortages equally; the doctrine fails to address the fair allocation of water. It enables the diversion of limitless amounts of water as long as it is for a “beneficial purpose” (Anderson and Snyder 1997). The concept of “beneficial use” poses problems as people’s viewpoints regarding “good” and “bad” uses vary (Bastach 2006). If a water right user adheres to legal requirements (e.g. continuously using a water right for beneficial uses) then the right is eternal.

Since instream uses were not historically considered as beneficial and water law was developed to protect out-of-stream (agricultural) uses, the prior appropriation system poses challenges for today’s water management institutions that seek to address the growing needs for instream uses (Colby 1990). Despite the growing consensus that “the doctrine no longer provides the best means of allocating water... [the] doctrine is so firmly entrenched in western laws and customs that its abolition is almost unthinkable” (Reisner and Bates 1990: 65). Yet experts are advocating for an historic reform (as noted previously). In contrast, some market advocates argue that because the doctrine enabled transferring water (as water rights are defined and enforceable) prior appropriation made the water rights system adaptable to rising

⁹ In general, eastern states employ the riparian doctrine and the western states prior appropriation; however, ten states (nine are western) use both the riparian and prior appropriation doctrine (King, 2004).

and competing demands (National Research Council 1992)¹⁰ and is seen as a foundation for water markets (Anderson and Snyder 1997). These scholars and experts argue that the problems of western water law are not due to the prior appropriation doctrine but are the result of restrictions put on appropriative water markets (Anderson and Snyder 1997).

Summary

This chapter provided a review of the relevant literature that depicted the significance of collaborative approaches, public involvement and communication among policy experts and citizens involved in water management programs in order to increase the acceptance and viability of such programs. Furthermore, the literature on institutions, groundwater management, sustainability, market-based approaches to water management, and water law was explored. The next chapter delineates the methods through which the data were collected.

¹⁰ However, often “paper” water rights differ from actual water use. Particularly in the West, older water rights tend to be overstated on paper (National Research Council 1992). Furthermore, no consistent body of law regarding water transfers exists.

CHAPTER 3: RESEARCH METHODS

Since data from the key expert interviews are used to provide input into the research setting (Chapter 4), the research methods regarding the data collection are presented prior to the background chapter. This chapter delineates the design, framework, and research methodology that is used to obtain information from key experts as well as to collect data from participants in order to assess how acceptable the GMP is to program participants.

The research approach is descriptive and explanatory as it portrays the story of the development and implementation of the GMP as well as explains participants' acceptance of the program (Robson 2002). This research uses the Deschutes River Basin as a case study of a market-based water management approach in the West.¹¹ The basin's situation of rapid growth and the increasing demands for new water supplies is representative of the American West (National Research Council 1992). Since a case study calls for multiple methods and the IAD framework allows for a mixed-method approach, the research involves both qualitative and quantitative data collection. Primarily qualitative data were collected through interviews and supplemented by quantitative data obtained through interviews and surveys.

While environmental management projects regularly use quantitative methods such as surveys and focus groups in order to obtain information about stakeholders and participants (Wagner, 2005), researchers note that surveys often provide limited information regarding direct attitudes and opinions, and that focus groups can fail to show the variations within the population (Bernhard 2002; Merhoff 1999; Whyte 1991). Given the latter criticisms, researchers often emphasize the importance of qualitative data for social assessments (Bernhard 2002; Wagner 2005). Furthermore, it is argued that qualitative social analyses are usually more beneficial to gain an understanding of stakeholders' perceptions and knowledge (Bernhard 2002; Wagner 2005). However, qualitative research tends to be more expensive and subjective than quantitative methods and are thus used less frequently (Wagner 2005). In order to help offset the trade-offs between qualitative and quantitative methods, it is recommended

¹¹ A case study is a research strategy focusing on a contemporary event in a particular context that incorporates the social and physical setting. This usually involves multiple methods of data collection where qualitative data collection dominates but quantitative can be included (Robson 2002).

to use a mixed-method approach that combines both qualitative and quantitative data, which is seen as a more robust methodology (Bamberger, Rugh, and Mabry 2006). Following the recommendations from the literature, this research involves both qualitative and quantitative data collection.

Within the case study design, the Institutional Analysis and Development (IAD) framework (Ostrom et al. 1994) serves as the structure for analysis and the foundation for the research approach in this thesis. Following the central premise of the IAD, which is the action arena, the physical, socio-cultural and institutional contexts of the GMP are depicted. The IAD framework also includes the action situation with its unifying seven elements as mentioned in Chapter 2 (Ostrom et al. 1994). Following the above seven aspects of the IAD framework, the action situation of the GMP can be delineated as follows: 1) the actors' (i.e. the participants in the GMP who are the focal actors) 2) positions are depicted by the presentation of data collected (through interviews and surveys) on the participants' 3) actions that are based on 4) information about the GMP; the information that participants have is 5) linked to possible 6) outcomes with resulting 7) costs and benefits due to obtaining a groundwater permit.

In order to gain information about participants' personal preferences, knowledge, and perceptions and ultimately assess how acceptable the GMP is to them, the nine evaluative criteria (economic efficiency, adaptability, equity, accountability, usability, utility, environmental sustainability, collaboration, and information dissemination) were employed to drive the interview and survey questions.

Operationalizing the Evaluative Criteria

Since the criteria fail to provide "a simple or determinate rule" (Stone 2002: 37), they must be defined. "Operationalizing" the criteria means delineating how the criteria are being measured in this research.

Economic Efficiency is defined as the perceived net benefits provided by one institutional arrangement in relation to another. While Ostrom et al (1994) define economic efficiency as the "maximization of discounted net present value" (Ostrom et al. 1994: 8), the emphasis of this research is based on whether participants' perceived benefits of the program surpass their

perceived costs (Winpenny 1995). The present value of net benefits (for GMP participants) is compared with the net benefits from the two proposed alternatives.

Adaptability is used synonymously with flexibility in this research and enables assessing whether the program provides elasticity in how it can be used; if it is adaptable in meeting participants' perceived needs as well as addressing the uncertainty of the hydrogeology of the basin. Participants' perception of the GMP's adaptability will be evaluated against the two alternatives.

Equity is used synonymously with fairness and is based on 1) individuals' efforts and their received benefits, and 2) participants' differing ability to pay (Ostrom et al. 1994). In this research equity is determined by assessing whether participants perceive the GMP as an equitable program - that participants get as much out of the program as they invest in it. Whether or not the GMP is equitable will be evaluated based on participants' viewpoints and compared to the two proposed alternative scenarios.

Accountability relates to government officials' (e.g. OWRD staff) ability to administer the GMP as well as other entities' capability to assist in implementing the program. This involves assisting participants through the GMP process as well as monitoring and enforcing water use (the latter should be done by government officials). The accountability of OWRD and other implementers of the program will be analyzed based on responses from participants and is compared against the alternative situations.

Usability is measured by how user-friendly the GMP is. This is assessed through participants' experiences and perspectives about the GMP process, including the permitting process. OWRD data are also used to analyze the length of the permitting process. Participants' experience with the usability of the GMP is contrasted with the two alternatives.

Environmental Sustainability: Recognizing the complexity and ambiguity of the term sustainability (Merrett 1997), the research focuses on how participants' perceive the environmental sustainability of the GMP insofar as it offsets groundwater pumping, restores instream flows and provides an environmentally sustainable and socially acceptable way of

managing water resources; no scientific data on the environmental impacts are assessed.¹² The acceptability of the GMP as an environmentally sustainable water resources management mechanism in the upper Deschutes Basin for the long-term human scale is assessed based on participants' perceptions and is compared to the proposed alternatives.

Utility is used to measure how participants perceive the usefulness of the GMP. Utility in terms of meeting participants' personal needs for groundwater as well as how participants view the program's utility for economic growth and development in Central Oregon, for instream flow and other environmental benefits is assessed. The perceived utility of the GMP is compared against the two alternatives.

Collaboration relates to the GMP's capability of bringing diverse water users in the basin as well as program participants together to work collaboratively and find shared understandings. Collaboration is analyzed through participants' perception of increased collaboration among water users as a result of the GMP and is compared to the proposed alternatives.

Information Dissemination involves educating water users, potential water users and the general public about the purpose of the GMP, how it functions, how someone can obtain a groundwater permit and mitigate for their pumping, as well as the general water situation in the basin. While the administering agency (OWRD) should conduct information dissemination, it may also occur through non-governmental organizations and consultants. Information dissemination will be evaluated based on participants' knowledge about the GMP as well as their viewpoints about being well-informed about the GMP process, which is contrasted by the potential information dissemination under the proposed alternatives.

While *acceptability* is not a criterion (as it is part of the central research question), it must still be delineated. For the purposes of this thesis acceptability is defined as a combination of the above nine criteria and is determined by participants' perception of the following: the program's usability; equity of the program; accountability of organizations and individuals administering and assisting with the implementation of the program (enforcement and

¹² Even in large-scale research, environmental impacts can only be quantified "partially and imperfectly" (Winpenny 1995: 21).

compliance is a part of this); the utility of the program to participants' own needs as well as environmental and economic demands; economic efficiency of the program (i.e. the cost-effectiveness of the program to participants); level of uncertainty and skepticism about the GMP; promotion of collaboration through the GMP; and level and quality of information dissemination as well as public outreach.

Data Collection

The research was conducted in four phases: 1) key expert interviews;¹³ 2) participant interviews; 3) participant postal survey; and 4) analysis and writing. The research proposal underwent an exempt review by OSU's Internal Review Board (IRB). The research proposal as well as all the documents used to correspond with respondents were approved by the IRB. These included the introductory e-mails and cards, the questionnaire and the postal survey documents.

In total, 172 people were contacted and input was received from 111. Of the total number of respondents, 78 are participants, 22 are key experts, and 11 are withdrawn participants (who did not answer the interview or survey questionnaires). Table 1 shows the distribution of the type of data collected.

Table 1: Summary of Data Collection (n = 111)

Type of Data Collection	Responses	Percent of total data collection
Key Expert In-person Interviews	12	11%
Key Expert Phone Interviews	10	9%
Participant In-person Interviews	20	18%
Participant Phone Interviews	27	24%
Participant Postal Survey	29	26%
Participant Phone Survey	2	2%
Withdrawn Participants	11	10%

¹³ Key experts are defined as people closely linked to the GMP's development and/or implementation (consisting mostly policy makers, administrators, lawyers and hydrologists).

Phase 1: Key Expert Interviews

The key expert interviews began in April, 2007 and ended in September, 2007. Telephone and in-person interviews were held with 22 key experts involved with the GMP. The sampling method involved purposive sampling where a sample was built in order to meet the research needs (gaining background knowledge about the GMP) (Robson 2002). Recommendations for further interviews were elicited from key experts, generating a “snow ball” sample (Byman 2001).

Interviews with key experts were held in Corvallis, Salem, and Bend. While the interviews were semi-structured in order to allow for themes to emerge during the interviews, all interviews followed a general structure based on the same themes that focused on gaining background information about the development and early stages of the GMP. The advantage of asking open-ended questions is that it allowed for the scoping of central issues involved in the development and implementation of the program. Key experts interviewed include:

- OWRD staff in Bend and Salem including policy makers, coordinators, analysts, field staff, and hydrologists;
- former OWRD employees;
- DRC staff;
- consultants in the basin;
- lawyers;
- irrigation district managers; and
- a Warm Springs Tribes representative.

Phase 2: Participant Interviews

The participant interviews began in July, 2007 and went until October, 2007. Interviews were held in Bend, Sisters, Redmond, and surrounding areas. This phase involved in-person as well as telephone interviews with program participants including groundwater permit applicant as

well as applicants with pending applications, permit holders, withdrawn¹⁴ and denied applicants. Attempts were made to contact all GMP participants (n=159) and 47 were interviewed either in-person or via telephone.

Participants were contacted by means of e-mails, phone calls, and cards requesting their participation. The cards and e-mails introduced the researcher, stated the nature of the research, requested an interview, and noted that all information provided would be confidential. These initial contacts were followed with phone calls intending to set-up interview times. Most participants were called at least three times. Phone messages were left but most participants did not return calls. Therefore, messages were followed-up with another call. Once a participant stated that they were not interested in participating in the research, they were not contacted again.

The questions for the interviews were based on the main research question and hypotheses. A “Groundwater Mitigation Applicant Interview Form” was drafted in July, 2007 (see Appendix 1). A test interview was conducted in July, which led to a major revision of the questionnaire. The questionnaire includes closed- and open- ended questions and is divided into six sections: 1) water use; 2) application process; 3) economic cost-benefit; 4) awareness; 5) suggestions, scenarios, overall rating; and 6) socio-economic parameters. The master copy was adapted for the different types of users being interviewed (i.e. municipal, irrigation etc). The same questionnaire was used for all participant interviews to provide consistency in the data collection.

Participants were given a choice to either be interviewed over the phone or in-person. Phone interviews were shorter – ranging from 15 minutes to almost an hour. In-person interviews lasted from half an hour to two hours. While the willingness to share information varied greatly among participants, almost all participants said that they were providing their perspectives candidly. While some participants were eager to contribute their perspectives and discuss the GMP at length, others said their time was limited and wanted to be done with the interview as soon as possible. Several participants were very frustrated with the GMP and took the interview as an opportunity to vent their anger. Under such circumstances, the researcher

¹⁴ Since the inception of the GMP, 23 participants have withdrawn.

tried to tactfully guide the participant back to the interview questions. Most participants, when asked if they were interested in obtaining an electronic copy of the final report, expressed interest and supplied the researcher with their e-mail address.

Phase 3: Postal Survey

Since not all participants could be interviewed and because the objective was to obtain input from as wide a population of participants as possible, a survey was proposed for the third phase of data collection. Despite the disadvantages of surveys, particularly postal surveys that take extensive amounts of time and often have low response rates, a postal survey was deemed preferable to interviewing another 73 participants. Furthermore, a benefit of surveys is that they reduce the response bias from the researcher's influence because surveys are mostly self-administered (two were done over the phone because that was the only way participants were willing to provide input).

A web-based survey was not feasible for this population because participants may not have easy access to a computer (e.g. ranchers, farmers and retired participants) (Dillman 2000). Obtaining useful data from surveys can be challenging as questions need to be worded clearly and carefully in order to maintain "internal validity," where valid responses from the respondents are generated (Robson 2002). Due to frequent low response rates, repeated mailings and reminders are required in order to increase response rates in postal surveys. According to Dillman (1978) response rates should be 50% or higher in order to avoid any respondent bias (Dillman 1978).

The survey process began in October, 2007 and ended in January, 2008. Contact information was compiled for the remaining groundwater applicants who were not interviewed and did not state disinterest in partaking in the research (n=73). Creating a shortened and self-explanatory version of the "Groundwater Mitigation Applicant Interview Form," a postal survey for the remaining participants was mailed-out on October 4th, 2007 (see Appendix 2). Since the researcher had experience with many participants' reactions to the questionnaire during the interviews in phase 2, it was decided that the questions for the postal survey could be clearly worded without a pre-test (the survey was proofed by several staff-members at the Deschutes River Conservancy and professors at OSU).

In total, three mailings were sent and one round of phone calls was conducted. The first reminders were mailed on October 24th, 2004. Since this resulted in only a few additional responses, phone calls were made to the participants who had not responded (two weeks later), which led to several more responses. Final reminders, with another survey and self-addressed envelope included, were mailed to 37 participants who had not responded by November 26th. By January 2008, 31 surveys were returned, resulting in a response rate of 42%. While this is lower than the 50% response rate recommended by Dillman (Dillman 1978), extensive efforts were made to increase the response rate (as described above). Furthermore, since the surveys are part of the general participant data collection, the data are supplemented by the interview data as well as additional data collected from withdrawn applicants (as described below), the pool of participant data is larger than 42%. For a summary of the survey response rate see Table 2.

Table 2: Survey Response Rate

Sample Size	Returned, Undeliverable, Ineligible, Unwilling	Total Returned Blank	Total Returned Completed	Response Rate
73	12	2	31	42%

Since it was difficult to obtain information about withdrawn applicants, a trip was made to Salem to retrieve data on the 23 withdrawn applicants. For seven of the 23 withdrawn applicants letters stating the reason for their withdrawal were found. It was also possible to contact four more withdrawn applicants via telephone calls to discover their reason for withdrawal.

Of the 159 participants of the GMP, 70 did not contribute input to the research. The inability to obtain data from these participants was due to: 1) refusal to respond; 2) no listed or disconnected or faulty phone numbers; 3) never returned messages; 4) never picked up the phone (without an answering machine).

Phase 4: Analysis and Writing

Data analysis and writing began in September 2007 and was conducted in Bend, Corvallis, and Switzerland. The responses from the key expert interviews were categorized based on the evaluative criteria (economic efficiency, adaptability, equity, accountability, usability, utility,

environmental sustainability, collaboration and information dissemination) as well as themes from the literature review. Responses that could not be categorized by the evaluative criteria were coded in *in-situ*, i.e. the themes were drawn out from the data. The reasoning for doing *in-situ* coding rather than *a priori* coding is that the objective of the key expert interviews was to obtain background information regarding the GMP.

The data from the participant interviews and surveys were analyzed together and are presented in the same chapter (Chapter 5) because the questions and themes of these two phases of data collection were virtually the same. The qualitative part of the participant interviews and surveys were analyzed using the Miles and Huberman approach (Robson 2002) to assess causal relationships in responses. The data were first entered into a document and organized by question number. Then these responses were coded with *a priori* codes. Similar to the key expert interviews, the evaluative criteria as well as themes delineated in the literature and research questions were used as codes. Each evaluative criterion was given its own document. Within each document, the data were further coded by *in-situ* themes that emerged. Responses were summarized in paragraphs, using quotes to illustrate the respondents' main points and some responses were summarized in tables.

The numerical and pre-coded responses from the interviews and surveys were all entered into excel. The question numbers were placed in the top column, and the responses were entered in the rows. Ones and zeros were used for yes and no responses and simple codes were given to other responses. While there were less survey questions, most of the questions from the survey were the same as the participant interview questions. New columns were made for the few survey questions that were different from the participant interviews. The data were then compared by using pivot tables and charts. A pivot table was made for all questions except for a few questions that proved unconstructive for assessing the hypothesis and research question.

Prior to presenting the findings from the participant interviews and the surveys, background information about the research setting is depicted in the next chapter.

CHAPTER 4: RESEARCH SETTING

This chapter provides background information about the physical, socio-cultural and institutional context within which the GMP emerged; depicting the action arena of the GMP as mandated by the IAD framework. Furthermore, the evolution of the development of the GMP, its implementation and development are discussed in order to contextualize the program. This chapter tells the story of how the GMP evolved, which involved primarily collaborative approaches but also contained a lawsuit. Data from the 22 key expert interviews are used here to supplement the background literature about the research setting as well as the government documents that are used to provide input into this section.

Physical Context

The Deschutes River Basin encompasses 10,484 square miles, making it the second largest in Oregon and a main sub-basin of the Columbia River Basin. The Deschutes River is the fifth largest in Oregon, discharging approximately 4.5 million acre-feet per year (Bastasch 2006). From its headwaters in the Cascades Range, the Deschutes flows 252 miles (or approximately 300 km) north through the arid eastern side of the Cascades to its confluence with the Columbia River (O'Connor and Grant 2003). The two major tributaries that contribute to the flow of the Deschutes are the Metolius and the Crooked Rivers (BOR and OWRD 1997). Other tributaries include the Fall River, Tumalo Creek, Shitike Creek, Trout Creek, the White River, the Warm Springs River and Wychus Creek.

The Deschutes Basin includes Deschutes, Crook, Jefferson, Sherman and Wasco counties. The majority of the upper Deschutes Basin, which is the focal area of this research, lies within Central Oregon that drains approximately 4,500 square miles of north-central Oregon. The upper basin is located above the junction of the Deschutes, Metolius and Crooked Rivers and includes the Deschutes, Jefferson and Crook counties (see Figure 3).



Figure 3: Map of the Deschutes River Basin

(Source: Deschutes River Conservancy)

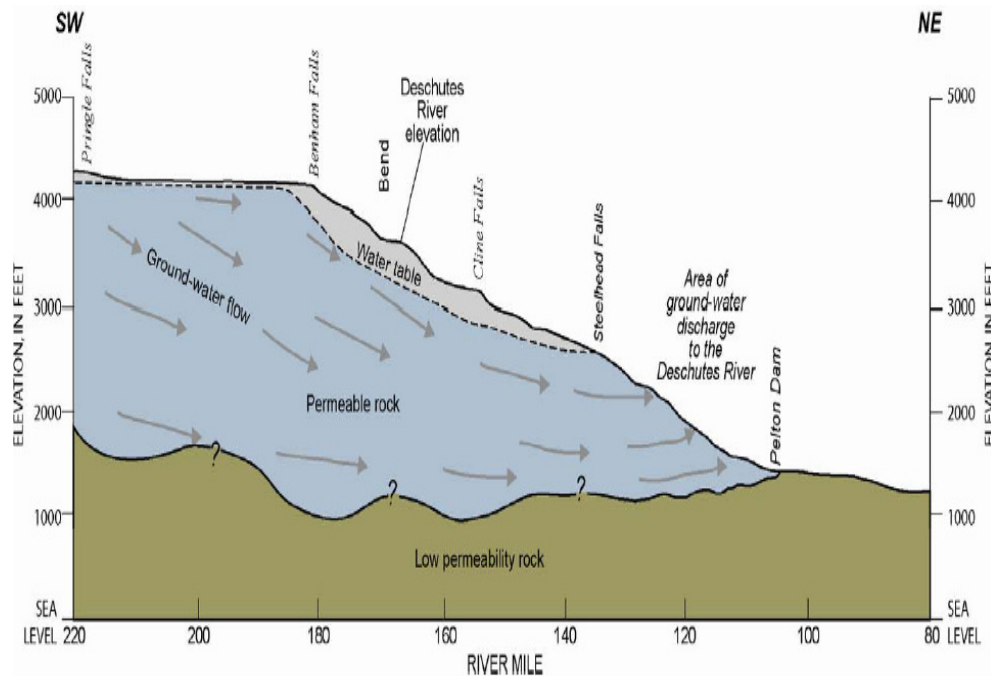
Hydrogeology of the Deschutes River Basin

Primarily due to the large contribution of groundwater to the river, the Deschutes River's flow is extraordinarily uniform given its size (O'Connor and Grant 2003); 80% of the mean annual flow at the mouth of the river is estimated as coming from groundwater (Gannet et al. 2001). Furthermore, the river's steady flow is a result of the unique geology in the upper basin, which is highly permeable young volcanic rock that enables a high rate of groundwater recharge (where water enters the ground).

Water inputs in the Deschutes Basin come from winter precipitation, canal leakage, some inflow from adjacent basins and discharge of groundwater to streams. Most of the

precipitation is supplied by the Cascades Range, averaging close to 200 inches per year in some regions. A large amount of this precipitation percolates into the groundwater system and flows northward from the Cascades toward the confluence of the Deschutes, Crooked and Metolius Rivers (see Figure 3). Almost all the regional groundwater flowing through the permeable Deschutes Formation discharges above the Pelton Dam (Gannet et al. 2001) (see Figure 4). Since the Deschutes Basin is transected by the low permeable John Day formation that blocks groundwater from flowing to the North, the groundwater surfaces above the lower Deschutes River (Gannet et al. 2001). This groundwater discharge from the upper basin supplies over three-quarters of the streamflow for the lower Deschutes River (Gannet et al. 2001). In 2001, a United States Geological Survey (USGS) study confirmed a hydrologic connection between groundwater and surface water in the Deschutes Basin (Gannett et al. 2001), which implies that nearly all groundwater not consumptively¹⁵ used in the upper basin contributes to the flow of the lower Deschutes River (for depiction of upper, middle and lower Deschutes see Figure 5).

¹⁵ Consumptive use meaning that water is used in a way that causes an overall reduction of streamflow; often associated with evaporation or transpiration.



SCHMATIC DIAGRAM SHOWING BASEMENT ROCK CONTROL
ON REGIONAL GROUND-WATER DISCHARGE TO STREAMS

Figure 4: Scea diagram - Flow Patterns

(Source: Marshall Gannett, USGS, via the Deschutes River Conservancy)

Since fluctuations in groundwater levels occur due to climatic changes and attenuation, it is difficult to assess the direct effects of groundwater pumping in the upper basin on streamflow (Gannett et al. 2001). This inability to monitor is due to measurement error as well as the significant natural variance in groundwater discharge. While hydrologic and geologic data demonstrate that groundwater use does affect streamflow (Gannett et al. 2001), long-term streamflow data are lacking. Despite the above uncertainties, the hydrologic connectivity is significant enough that legal mandates protecting the flow of the lower Deschutes River caused OWRD to place an unofficial moratorium on groundwater pumping in the upper basin. OWRD then sought to find a way to offset the pumping in order to maintain flows in the lower basin and created the GMP.

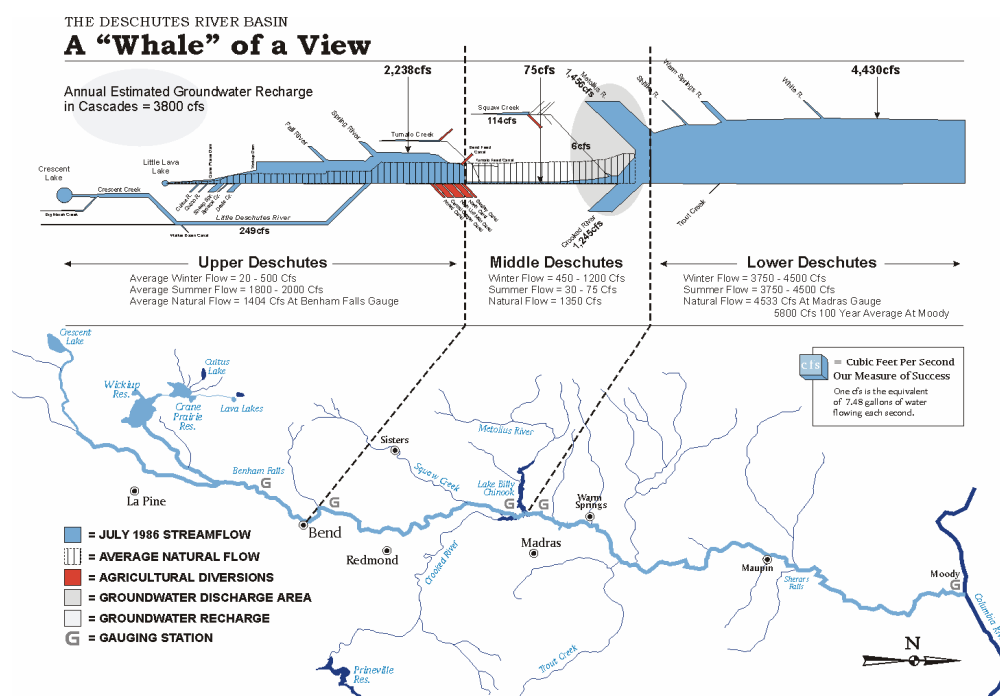


Figure 5: Quantity of flow of the Deschutes River

(Source: Deschutes River Conservancy)

Beyond the hydrogeological factors influencing the flow, the Deschutes River is regulated by reservoirs and irrigation diversions (BOR and OWRD 1997). While overall water uses in the upper basin have been found to affect the seasonal flow of the lower Deschutes River, the most drastic alterations to the flow regime are due to irrigation diversions in the upper basin (Aylward and Newton 2006). Irrigation districts have water rights to pump more water out of the river than sometimes flows instream¹⁶ and such diversions have been diminishing river flows for decades. In part due to these diversions and storage, the basin faces depletion of streamflows (Aylward and Newton 2006).

¹⁶ Irrigation districts realized the low flow problems in the Middle Deschutes River and voluntarily made a gentleman's agreement to leave at least 30 cfs instream during the irrigation season (Yake 2003); yet this flow is not guaranteed.

Socio-cultural Context

Population Growth & Changing Values

Two main social aspects that pertain to the existence of the GMP are the rapidly growing population in the upper Deschutes Basin and the changing values. The upper Deschutes Basin has been faced with rapid population growth since the late 1980s and early 1990s (Yake 2003; Aylward 2006). Deschutes County, which contains a large portion of the upper basin, has been the fastest growing county in the state since 1989 (Yake 2003). Between 2000 and 2006, the percent change in population growth in Deschutes County was 29.3% in comparison to 8.2% in Oregon as a whole; the population in Deschutes County grew from 115,367 to 149,140 (U.S. Census Bureau 2008). This rapid population growth caused municipalities, private water companies and developers to begin using groundwater as a new water resource in the beginning of the 1990s.

While historically irrigated agriculture was the central use and value for water in the Deschutes Basin (BOR and OWRD 1997), values in the basin are shifting from agricultural to recreational and non-commercial uses with the influx of new residents (Aylward 2006; Yake 2003). In contrast to the traditional farming value, the new residents, who mostly come from out-of-state and are often retired and over thirty years-old (BOR and OWRD 1997), envision a picturesque rural life with specialty livestock, green grass, and ponds. These values are changing the division of the land and the use of water as large plots of irrigated land (for commercial crops) are divided into smaller plots with green pastures (BOR and OWRD 1997; Aylward 2006). In fact, analysis of irrigation district water right holdings in Central Oregon, particularly in Deschutes County, reveal that large farms are limited in number and the majority of water use occurs on properties of ten acres or less (Aylward 2006). By the mid 1990s, irrigated land in several irrigation districts was converted to noncommercial, lifestyle or “hobby farm” agriculture (BOR and OWRD 1997).¹⁷

Recent studies confirm that current farming tends to be a lifestyle choice rather than a livelihood need in Central Oregon (Aylward 2006). This shift from commercial to hobby

¹⁷ Hobby farming involves consumptive use of water that incurs large costs with low to no profits (Aylward 2006).

farming is a part of the diverging values in the basin; the new water users tend to view water as a commodity that can be purchased and are willing to pay significantly higher prices than commercial farmers (BOR and OWRD 1997). Not only do many new residents have different values than long-time residents, they also lack understanding of Oregon water law and do not understand how irrigation water provision functions. In addition, new residents are neither acquainted with the history of the area nor with specific watershed issues and concerns (Yake 2003). As the rising population demands more water and surface water is over-appropriated, the new water users turn to groundwater and the GMP.

Beyond a shift in land and water-use, the general economy is changing in the upper Deschutes Basin. Once an agricultural and logging community, the upper basin is now focusing on recreation development where tourism and recreation are increasingly central to the lifestyle, economy and character of the region; the waterways are popular for recreation activities such as rafting and fishing (BOR and OWRD 1997).¹⁸

Shifting Water Uses

The shift in the value of water resources in the Deschutes Basin, from agricultural to urban and instream uses (Aylward 2006), is indicative of a large-scale change occurring at the national level (National Research Council 1992). The national trend in water management focuses on protecting and conserving water resources; valuing its instream benefits and attempting to offset the impacts of previous large-scale infrastructure development and out-of-stream uses (National Research Council 2004; Colby 1998). Despite declining agricultural uses, the predominant consumptive water use in the West is still for irrigation purposes (80 to 90% of consumptive use), which is mostly for low-value crops and watering lawns (Reisner and Bates 1990). In the Deschutes Basin, irrigation continues to consume three times as much water as municipal uses (Gannet et al. 2001). While many residents in the upper basin also depend on private domestic groundwater wells, domestic uses are considered minor in comparison to irrigation and municipal uses; municipalities use a major portion of the groundwater in the upper Deschutes Basin. However, some key experts note that municipal

¹⁸ In fact, the economy is driven by tourism, retail trade, outdoor equipment, aviation, software, high technology and forest products (Oregon Blue Book 2008).

consumption is only “a tiny fraction of the amount of water available and annually recharged by precipitation in the basin” (Testimony on HB 3494 by Martha Pagel 2005: 4).¹⁹

While studies confirm that human uses of water in the upper Deschutes Basin have significantly changed the flow patterns of water, the overall consumptive use is small relative to the available water and the annual flux in groundwater in the Deschutes Basin (Golden and Aylward 2006). Studies on water availability in the basin conclude that it is improbable that water will limit growth and development. In fact, since new water uses for cities and hobby farming consume less water than growing crops, it is projected that as more agricultural land is retired, surplus surface water will become available (Aylward and Newton 2006). However, other key experts are concerned about the water use of the golf-courses and destination resorts and stress the need for addressing sustainable pumping and overall sustainable water management in order to restrict such uses.

As the urban boundary growth spreads onto irrigated agricultural land, irrigation districts are jeopardized because there is less need for irrigation water; such water then becomes surplus (Aylward 2006). While irrigation districts hold senior water rights, they face economic problems because if water is no longer needed for irrigation, they lose their assessment fees (i.e. annual user fees) needed to operate the districts (Aylward 2006). Since an option for irrigation districts in the upper Deschutes Basin is to reallocate irrigation water through leases or sales of water rights, it becomes possible to reallocate surplus irrigation rights to other purposes. Established prior to the GMP, such leasing and selling mechanisms help facilitate the current program as well as sustain irrigation districts by supplying them with revenue. Under the GMP, irrigation water that is leased or transferred instream creates mitigation water that can be used as mitigation credits and purchased by such entities like municipalities that can then use the credits to offset their groundwater pumping. While this shift involves major value trade-offs because it can lead to the drying up of irrigated land (National Research Council 1992), irrigators in the upper Deschutes Basin are increasingly leasing or selling their water in order to obtain revenue.

¹⁹ Furthermore, a large portion of municipal groundwater is returned to the groundwater through sewage disposal systems and leakage (it is assumed that non-consumed water returns to the stream unless usage is transferred from one watershed to another).

Institutional Context

Water users and stakeholders in the Deschutes Basin historically took a cooperative approach to allocating water resources; the institutional capacity for collaborative work in the basin is strong. While the Bureau of Reclamation tagged the upper Deschutes Basin as having the potential for a crisis and conflict by 2025 due to water supply issues (Bastasch 2006: 299) and experts note that shifting values and water uses could lead to conflict in the Deschutes Basin (Aylward 2006), currently the basin is far from such a predicament. The focus in the basin has generally been on alternative, collaborative approaches to solve water resources issues outside the courtroom.

The Deschutes River Conservancy (DRC)

A major contributor to the collaborative tone in the basin is the Confederated Tribes of the Warm Springs Federation (comprised of the Wasco, Warm Springs and Paiute Indians). Adopting an approach centered on negotiation, the tribes have worked to restore flows in the basin collaboratively. In 1996, a discussion between the tribes, the federal government, and a nonprofit group (Environmental Defense) led to the creation of an institution to restore streamflows - the Deschutes River Conservancy (DRC). The DRC is a non-profit organization that works to improve instream flows using market-based approaches.

The DRC was formed with the intention to serve as a unifying mechanism for various groups in the basin and has become a promising institutional model (Yardas 2007). It bridges the gap between two worldviews by allowing for conservation and development simultaneously. However, despite its diverse board of directors as well as its close alignment with the Upper Deschutes Watershed Council,²⁰ the DRC's approach is not universally accepted by environmental organizations and other stakeholders in the basin.

²⁰ In the 1990s, local watershed councils emerged as new mechanisms for basin planning in Oregon. These councils are voluntary, locally based and non-regulatory groups created to enhance watersheds in their region. Based on the available literature, the watershed councils' involvement in the formulation of the GMP rules remains unclear. However, the watershed councils were involved with other groups (i.e. DRC) engaged in the policy process.

The DRC pioneered approaches that now work in conjunction with the GMP. For instance, the DRC implemented the Deschutes Water Exchange (DWE) that leases surface water for instream flow augmentation in the Deschutes Basin (DRC 2007), which now helps support the GMP. Water right holders partaking in the DWE temporarily leave their water instream and are compensated per acre-foot of water left instream; the water is legally protected instream and irrigators who do not need to irrigate can still maintain their water right. Water leasing is mutually beneficial as it provides benefits to instream flows as well as to water right holders because their water right is protected (Aylward 2006).

USGS Study

A collaborative study that is instrumental to the development of the GMP was initiated by OWRD and the United States Geological Survey (USGS), as discussed in the physical context section. In 2001, this joint study confirmed a hydrologic correlation between surface and groundwater in the Deschutes Ground Water Study Area (see Figure 6).²¹ The study area includes the main population hubs in the basin, where groundwater development is most prolific and water resource management questions are most pressing (Gannet et al. 2001). The USGS study was intended to provide resource managers and basin residents with comprehensive information about the regional groundwater system as well as tools to evaluate potential effects of possible groundwater development.

When the preliminary USGS study results were released in 1998 OWRD placed an unofficial moratorium on new groundwater permits because the surface-groundwater connectivity means that pumping groundwater in the upper basin affects the flow of the Lower Deschutes (as discussed above). Therefore, the USGS study created the imperative need to conjunctively manage water resources in the basin.

²¹ The USGS study began in 1993 and was done in conjunction with the Oregon Water Resources Department (OWRD), the cities of Bend, Redmond and Sisters, Jefferson and Deschutes Counties, The Confederated Tribes of the Warm Springs Reservation of Oregon and the U.S. Environmental Protection Agency.

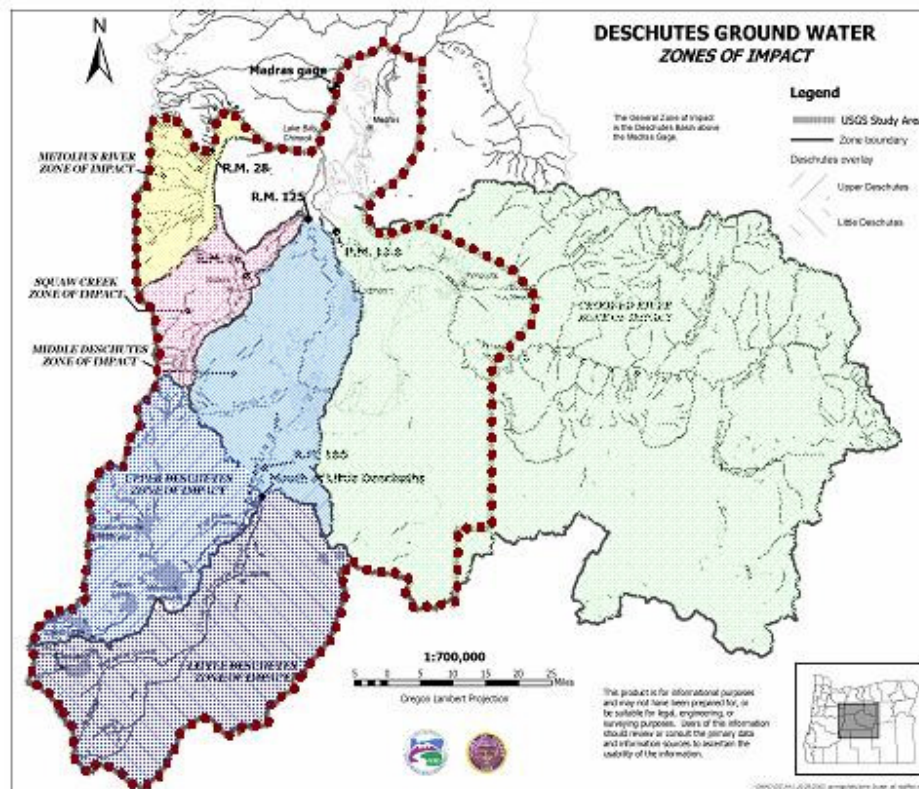


Figure 6: Zones of Impact & USGS Groundwater Study Area

(Source: Deschutes River Conservancy)

Oregon Water Law & the GMP

As noted previously, Oregon water law adheres primarily to the prior appropriation doctrine, which was written into the Oregon Water Code in 1909 (OWRD 2006). In order to incorporate water rights established prior to the inception of the Oregon Water Code, these old rights need to be clearly defined by establishing paper water rights with a permit. The state of Oregon adjudicated water rights by grandfathering in old rights to the legal system (Bastasch 2006). The Deschutes was a priority basin for establishing adjudicated rights. According to a key expert in the basin, the state made a decree for adjudicating rights in the Deschutes Basin in 1928 but it took until the mid 1950s for all water rights (for irrigation districts) to be adjudicated. (For a chronology of historical and legal events in the Deschutes River Basin see Appendix 3).

All water belongs to the public in Oregon and water rights are administered by OWRD. In order to use water, beyond the exempt use that requires no permit (see Table 3), a permit must be obtained from OWRD. Surface water has been fully appropriated in the Deschutes Basin since 1913 when the federal government reserved all remaining water in the main stem of the Deschutes River for future federal use and OWRD closed the upper basin to additional appropriation of surface water (Aylward and Newton 2006). Hence, the only means to obtain new sources of water is through groundwater.

Table 3: Exempt Uses for Groundwater

Type of Use	Limit
Stock watering	None specified
Lawn or noncommercial garden	Up to one-half an acre
Single or group domestic	Up to 15,000 gallons per day
Single industrial or commercial purposes	Up to 5,000 gallons per day
Down-hole heat exchange uses	Up to 10 acres (for schools located within a critical groundwater area)
Watering school grounds	

Source (OWRD 2006)

* Definition: Exempt well use permits the use of up 15,000 gallons per day or up to one-half an acre for irrigation or domestic uses.

The management of groundwater in Oregon is guided by both state and federal laws. The requirement of a permit in order to use groundwater was not mandated (except for in eastern Oregon) until the legislature passed the Groundwater Act in 1955 (Bastasch 2006). While obtaining a groundwater permit involves a similar process as a surface water permit²² the application process is more extensive due to the fact that groundwater is an unseen resource with limited available data (Bastasch 2006); a groundwater permit requires more source data than surface water permits. Furthermore, counter to surface water permits, groundwater permits remain subject to state control and possible effects of groundwater pumping on instream flows must be assessed prior to the issuance of a new groundwater permit (Bastasch 2006), as noted below.²³

²² For all permits, the state bounds a users right by delineating the source, specific purpose and place for use, priority date and the amount allowed to be used.

²³ The court case of *Diack v. City of Portland* led to the mandate that prior to the issuance of a new water right, the state must carefully assess potential scenic waterway impacts (Bastasch 2006).

Oregon water law's protection of instream flows plays an important role in creating the need for the GMP. Through such legislation as the 1955 Minimum Perennial Streamflow Act and the instream water rights legislation in 1987 Oregon water law places emphasis on protecting instream flows. The latter legislation created an instream water right that is held by the OWRD on behalf of Oregonians, to maintain water instream for public use; the instream right is regulated and protected based on the priority date (BOR and OWRD 1997). However, while instream water rights must be held by the state, any entity may change established water rights to instream flows (Anderson and Snyder 1997). This legislation enabled the creation of a market for converting water for instream uses. Oregon also instituted the Allocation of Conserved Water Program in 1988 (OWRD 2005) that encourages water right holders to use water more efficiently.²⁴

Beyond the state's instream legislation, multiple federal and state laws influenced the need for the GMP in the Deschutes Basin (see Figure 7), these include: the State Scenic Waterways Act,²⁵ Instream Water Rights, Endangered Species Act (ESA) and the Federal Clean Water Act (Aylward and Newton 2006). A major institutional factor that contributed to the development of the GMP is Senate Bill 1033 that amended the Scenic Waterway Act by incorporating groundwater regulation into the act and creating the need for conjunctive water management. Implemented in 1995, this amendment specified that OWRD must assess the potential impacts of new groundwater uses on scenic waterways. The statute included the "measurably reduce"²⁶ clause that if an impact of 1% or 1 cubic foot per second (whichever is less) is triggered in instream flow then a groundwater permit would be denied (Ground Water Uses Within Scenic Waterways 1995). Since the lower Deschutes is a scenic

²⁴ Conserved water is also called salvaged water (National Research Council 1992). This includes piping and lining of irrigation canals that will decrease transmission losses (Reisner and Bates 1990). This is a contentious issue among experts in the Deschutes Basin because some argue that while piping and lining eludes that water is being saved, the water supply in the river basin is not being altered (Reisner and Bates 1990; King 2004).

²⁵ The federal Wild and Scenic River Act, passed in 1968, to protect waterways that are exceptionally scenic or have special recreational, historic, cultural, geologic, fish and wildlife or other such features (Bastasch 2006). Oregon's Scenic Waterway Program parallels the federal wild and scenic river program in terms of their goals (Bastasch 2006). Specifically, the Scenic Waterways Act restricts water use or diversions that would impede the free-flow of a scenic river; maintaining enough water instream to support recreation, fish and wildlife.

²⁶ OWRD defines "measurable reduction" as "ground water use [that] will individually or cumulatively reduce surface water flows within the scenic waterway in excess of a combined cumulative total of one percent of the average daily flow or one cubic foot per second, whichever is less" (OWRD 2007: 11).

waterway²⁷ and the hydrologic connection was established in 2001 through the USGS study, it meant that either OWRD would have to place a moratorium on all new groundwater pumping or find a solution that would mitigate impacts, such as the GMP.

Figure 7 is based on information obtained from key expert interviews as well as legal documents and literature indicating the factors contributing to the formation of the GMP.

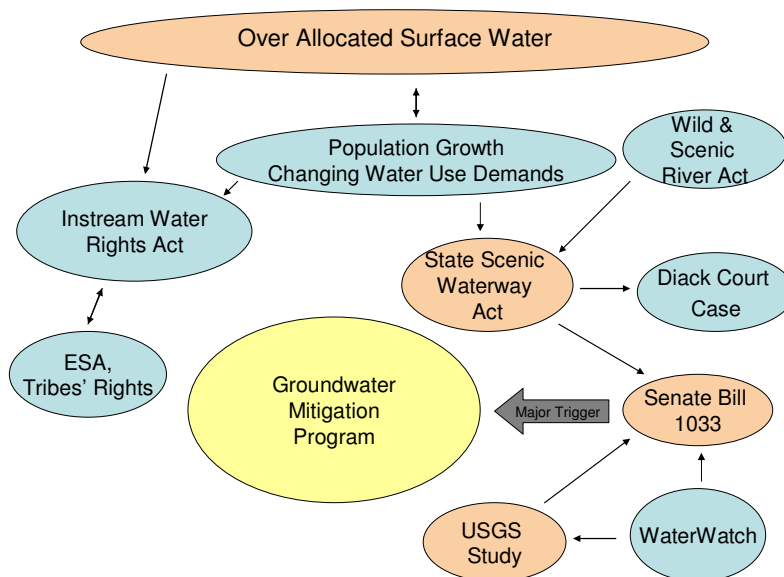


Figure 7: Major Drivers Leading to the GMP
(Factors in red are stronger drivers than factors in blue)

The Work Group

As a result of the legal setting (particularly SB 1033) as well as the USGS study results, OWRD initiated a collaborative stakeholder process to develop what would become the GMP.

²⁷ A portion of the little, upper and middle Deschutes River as well as the entire lower Deschutes River reach are designated scenic waterways; the entire 100-mile length of the lower Deschutes and more than 70 miles of the middle Deschutes River, above Lake Billy Chinook are federally protected under the Wild and Scenic Rivers Act (see figure 1) (Baker Jud 2006). In addition, a portion of Wychus Creek, portions of the Crooked River and almost the entire Metolius River are protected under the State Scenic Waterways and/or Federal Wild and Scenic Rivers Act (Bastach 2006).

The Deschutes Groundwater Work Group (later called the Deschutes Basin Steering Committee) was formed in 1998 to represent the water interests in the basin. OWRD also encouraged groundwater permit applicants to place their applications on-hold and take part developing in a basin-wide solution (Geisen 1999).

The initial objective of the work group was to create a large-scale plan to offset existing and new uses in order to enhance streamflow in the entire basin (Geisen 1999). However, after four years of work, the work group failed to reach consensus and therefore did not draft a mitigation plan.²⁸ Despite the lack of consensus, the work group was able to agree on mitigation credits and mitigation banking, which became a part of the final rules (Pagel 2002). In 2000, when Martha Pagel was succeeded by Paul Cleary as OWRD director, the rule-making was taken out of the field-division (away from the work group) and into the OWRD director's office. The final rules were drafted in the director's office and the GMP rules were passed by the Water Resources Commission in 2002.

Policy Implementation

The Groundwater Mitigation Program (GMP)

The GMP serves as a mechanism to conjunctively manage water resources in a manner that allows for “new” uses by offsetting the impacts of groundwater pumping through the trading of surface water rights in order to adhere to the legal closure of the upper Deschutes Basin to further appropriation of consumptive groundwater use (Aylward and Newton 2006). By requiring that all groundwater applicants provide mitigation water prior to obtaining a permit to pump groundwater, the GMP mitigates potential negative effects of groundwater pumping (on a long-term volumetric basis) in the upper basin on surface water in the middle and lower basin (OWRD 2007). By mandating that the calculated amount of consumptively used water

²⁸ Most people involved with the work group process were frustrated by both the process and the outcome (Nudelman and Odell 2006). The work group experience also “left a negative view about collaboration and a potential reluctance to re-engage in a collaborative process” (Nudelman and Odell 2006: 13). However, most participants agreed with the concept of the work group and said they would partake in another collaborative process “provided sufficient assurances are in place to improve the likelihood of success” (Nudelman and Odell 2006: 13).

must be compensated with an equal amount of water left instream or an other equalizing water transfer, consumptive use is capped in the Upper Deschutes Basin (see Table 4).

Table 4: Groundwater Mitigation Program Terms

Term	Definition
Mitigation	Moderating impacts of groundwater pumping on surface water by obtaining mitigation credits or creating a mitigation project.
Mitigation credit	Means of accounting for mitigation water, “calculated in acre-feet, made available by a mitigation project;” one mitigation credit = one acre foot of mitigation water
Mitigation water	Water legally protected instream; created by a mitigation project (calculated in acre-feet)
Mitigation project	Approved by OWRD and results in mitigation water
Mitigation obligation	Quantity of mitigation water required for new groundwater appropriation (calculated in acre-feet)
Zone of impact	Regions where groundwater pumping may affect surface water; determined by the underlying aquifer zones and potential impact to surface water

Source: Deschutes Basin Program 2007

The purpose of the GMP is to meet OWRD’s statutory requirement to comply with the Scenic Waterway Act and SB 1033 (OWRD 2003). The GMP provides a means to adapt to the shifting needs in the basin: creating a way for cities and farmers to obtain the water they need while not obliterating irrigation districts. The three main objectives of the GMP are to:

- 1) maintain flows for Scenic Waterways and senior water rights, including instream water rights;
- 2) facilitate restoration of flows in the middle reach of the Deschutes River and related tributaries; and
- 3) sustain existing water uses and accommodate growth through new groundwater development (OWRD 2003).

By providing a means for water users to supply mitigation for new groundwater uses, OWRD seeks to address new and growing water supply needs in the Deschutes Basin. Therefore, an important aspect of proving that the GMP is viable in the basin is its ability to meet the needs of the water users in the basin.

The Rules

Based on the rules, the Upper Deschutes Basin (the groundwater study area under the USGS study; see Figure 4) is under a groundwater moratorium *except* for a cumulative total of 200 cfs maximum rate in final orders²⁹ that caps new groundwater permits. Therefore, the objective of the GMP is to provide a framework for OWRD to approve new and pending groundwater applications in the Deschutes Groundwater Study Area that would otherwise be denied. Under the GMP, OWRD assesses every new groundwater permit application to decide if the new use will measurably reduce the instream flow of scenic waterways. If granted, a new permit is in the proximity of the scenic waterway is conditioned in case it is later found that the use does measurably reduce the scenic river flow (OWRD 1998).

In order to obtain a new groundwater permit, participants must go through an extensive application process where they must acquire mitigation credits (see Appendix 4 for a description of the application process).³⁰ Prior to the issuance of a permit, mitigation water must be legally protected instream; it must be committed and maintained for the life of the permit.³¹ As of August, 2007, 53 permits have been issued, 78 permit applications are pending, five have been denied and 23 have been withdrawn (which is the total withdrawn since the program was initiated in 2002). The table below delineates the types of uses permitted by the GMP.

Table 5: Uses allowed under the GMP in the Upper Deschutes Basin

Domestic	Livestock
Municipal	Irrigation
Industrial	Power development not to exceed 7-1/2 theoretical horsepower
Recreation	Irrigation of law or noncommercial garden not exceeding one-half an acre
Wildlife	Fish life uses
Mining	

Source: OWRD 2007

²⁹ A final order is the second to last stage in the permitting process

³⁰ If holders of existing permits (issued after 1995) choose to provide mitigation they will not be subject to future regulation.

³¹ Mitigation is interpreted in the strict sense, where mitigation must be provided for a hundred percent of the consumptive use of the permit application (OWRD 2007).

Mitigation water is created by transferring an existing water right to instream flow as groundwater mitigation (see Table 4). Sellers (i.e. water right holders) who no longer use their water right can sell or trade their water to a groundwater mitigation bank. Buyers in need of a water permit may purchase mitigation credits from the bank or create individual mitigation projects such as transferring a water right to an instream flow use, which is a part of the process for obtaining a permit to pump groundwater under the GMP (OWRD 2007).

The rules mandate that mitigation water be provided within the same zone of impact as the use (for map of zones of impact see Figure 6). OWRD describes that the purpose of zones of impact is to target mitigation in and above stream reaches, on a sub-basin level, where impact on streamflows by groundwater pumping is anticipated to occur (OWRD 2003).

Table 6: Types of Mitigation Projects

Types of Mitigation Projects	Explanation
Allocation of conserved water	Portion of conserved water is legally protected instream
Transfer of existing water right to instream use	Can be temporarily or permanently leased Time-limited transfers can only be done through mitigation banks
Artificial recharge of groundwater	Need a permit to appropriate
Stored water	Need a secondary permit for instream use
Other	Projects resulting in legally protected mitigation water

Source: OWRD 2007

The GMP incorporates the use of temporary and permanent transfers to establish mitigation credits. Temporary mitigation credits are created from instream leases, must be purchased annually, and availability is not guaranteed year-to-year; the 2008 cost is under review to be from \$100-150 a credit (Hubert 2007). Permanent mitigation credits are a one time purchase and apply for the life of the permit or certificate. Any individual may broker permanent credits, which are the result of a permanent instream transfer. To date, permanent mitigation credits have only been created from permanent instream transfers; the 2008 costs for permanent mitigation credits will differ depending on the zone of impact, transfer, acquisition, and bank operation costs; the range estimate is \$1,500 per credit or higher (Hubert 2007). While the costs of permanent mitigation credits are decreasing, the costs of temporary credits are increasing.

The rules require evaluations of the GMP to the Water Resources Commission on five-year intervals.³² Furthermore, by January 2008, or when 150 cfs is reached in final orders, the Commission will evaluate the rules and decide whether the cap should be lifted or changed through other public rulemaking (OWRD 2007). The rules require the Commission to evaluate the effectiveness of mitigation activities as well as the potential to raise the 200 cfs cap (for previous annual OWRD reported outcomes, see summary of OWRD annual reports in Appendix 5). While pending groundwater permit applications surpass the remaining capacity of the 200 cfs cap, only 42% of the cap has been allocated (in final orders and permits). However, while OWRD is currently only processing applications that are within the 200 cfs cap, groundwater requests can be modified to decrease the use, or applications can be withdrawn or denied, which frees up space in the 200 cfs cap “cue.”

Initially OWRD wanted to implement the GMP in a way that would have reduced administrative complexity and costs (through payment-to-provide). However, since this idea was rejected by stakeholders involved in the development of the program, the GMP is implemented under the pre-existing OWRD staff; stretching the staff even thinner than before the GMP. Yet OWRD is not alone in administering this program; mitigation banks, the DRC and consultants in the basin help facilitate the transactions and functions of the GMP.

Water Banks

In 2001 legislation (House Bill 2184) was passed to establish a water bank, enabling the selling and buying of mitigation credits. The rules enable the creation of water banks in the upper Deschutes Basin that should assist in transactions between mitigation credit holders and water users interested in obtaining those credits. While anyone may apply for a mitigation bank charter, it must be identified and established by OWRD (OWRD 2007). Permanent transfers or projects do not require bank authority but the transaction of temporary credits must be done through a state-chartered mitigation bank. Currently only the DRC’s Deschutes Water Exchange groundwater mitigation bank is approved by the state to sell temporary

³² Annual OWRD evaluations and reports on the implementation of the rules must be done in cooperation with Oregon Department of Fish and Wildlife (ODFW), Oregon Parks and Recreation Department (OPRD), Oregon Department of Environmental Quality (DEQ) and Division of State Lands (DSL).

credits. The other state-chartered bank in the basin, John Short's Deschutes Irrigation LLC, is only authorized to sell permanent credits.

Water Management & Enforcement in the Deschutes Basin

While Oregon water law sets high standards to protect groundwater resources and the users, there is a lack of data regarding groundwater resources (Bastasch 2006). In light of such uncertainty, an expert in Oregon notes that the permitting system is the primary source to regulate (in an environmentally sound way) new groundwater uses (Bastasch 2006). In the Deschutes Basin, water management is fragmented and information dissemination is lacking. Water resources management is split between the OWRD head office in Salem and the field office in Bend. Furthermore, lack of adequate information dissemination about water resources management and outreach has been a long-term concern in the Deschutes Basin. A 1997 Bureau of Reclamation study found that sparse to no information is provided to new landowners, which may affect the effectiveness of water management (BOR and OWRD 1997).

When the GMP was implemented some key experts emphasized that "appropriate strategies for community involvement in the problem solving process will be needed" (Pagel 2002: 4). However, experts note that there was no specific strategy to incorporate the community and no outreach or education approaches were carried out. Not only is information and public outreach lacking today but key experts also remark that the current program is too complex for the average citizen to understand.

As noted previously, state agencies often lack the time, staff, and funding to monitor and enforce water use (Sterne 1997). Frequently due to the latter conditions, water rights enforcement in Oregon is passive (i.e. complaint driven), as is the case elsewhere in the Pacific Northwest (Sterne 1997). Water use and water rights are enforced on the ground by a regional watermaster who is employed by OWRD. The watermaster monitors water levels (stream flows) and shuts off junior users' water when necessary (Bastasch 2006). While the watermaster can require users to employ measuring devices and thus monitor individuals' water usage, this is infrequent. The watermaster's duty is to be an unbiased referee who regulates water, yet he is often placed in a difficult situation as he represents both the local

community and the state. As watermasters are frequently pressured by locals, “critics charge that some watermasters have ‘gone native’ and do not provide enforcement needed to protect state interests” (Bastasch 2006: 152). Furthermore, the watermaster’s salary (or part thereof) stems from the water users he is regulating, which makes enforcing illegal uses more challenging (Sterne 1997). The lack of enforcement and monitoring is of major concern as it leads to illegal uses and can also have negative effects on other management aspects such as efficiency and equity. It must be noted that the GMP was implemented without allocating additional funds for the enforcement and monitoring of the new program, as discussed above.

Several key experts express the desire to implement a basin-wide management scheme beyond the GMP that is separate from OWRD. Such a plan would enable the basin to be managed based on “wet” facts (that are real and under local control), rather than on “paper” facts (that are written documents in Salem). These key experts propose an alternative to the GMP that involves looking at the big picture of water management in the Deschutes Basin. While the GMP may be heading in this direction, such a proposal is an immense task that deserves further research.

Policy Development

The Lawsuit

While the GMP is a part of the overall collaborative approach to water management in the Deschutes Basin, the rules were finalized behind the doors of OWRD. Following the implementation of the rules, some stakeholders expressed discontent with the program. Ironically, some of the major parties criticizing the GMP were initially involved with the development of the program. Criticisms include:

- a century of water use in the basin can be hard to detect in the available hydrologic record and therefore some do not see a need for groundwater mitigation;
- the rules provide a means to circumvent traditional water law in order to “allow the transfer of an unused or unwanted water right to a new user rather than force its passing to the next most senior water right holder” (Nudelman and Odell 2006: 5); and
- the final rules fail to address some of the key debates of the work group.

The predominant criticism came from WaterWatch³³ along with a varied group of stakeholders with vested interests in river related businesses, conservation, and general concern regarding the river's well-being. Despite WaterWatch's involvement in the work group, they took a strong stance against the GMP. Severing the trend of non-combative approaches in the Deschutes Basin, WaterWatch and its constituents opted for the traditional litigation route. Due to concerns regarding timing of the impact from groundwater pumping (among other issues) the plaintiffs filed a lawsuit against the GMP in 2002. They stated that the GMP rules violate Oregon's Instream Water Rights Act, the State Scenic Waterway Act, and would reduce instream flow (WaterWatch). They argued that "[u]nfortunately the new rules abandon the state's responsibility to protect the river and instead focus on making it easier to get water rights" (WaterWatch 2007). Furthermore, WaterWatch contested that due to the GMP's lack of timing requirements, mitigation may be ineffective: "the mitigation provider could simply send a slug of water equal to their total use down the river during times mitigation is not needed" (WaterWatch 2007).

WaterWatch and its constituents won the lawsuit in May 2005 when the Court of Appeals ruled against the GMP rules because it found that the rules violate the Scenic Water Waterway Act. However, the 2005 Oregon legislature legally reversed the decision when it passed House Bill 3494. The bill allows the GMP to continue until 2014, when the program may be repealed. In contrast to WaterWatch, proponents of the GMP assert that the program's rules are viable for the environment because there is "more stream flow in the Deschutes River today than before...even though many new ground water rights have been issued" (Testimony on HB 3494 by Martha Pagel 2005: 2).

The Deschutes Water Alliance

Despite the lawsuit, other stakeholders in the basin continued with collaborative processes in the basin. In 2004 four major groups in the basin applied for and received a Bureau of Reclamation Water 2025 grant, which enabled the Deschutes Basin irrigation districts, basin

³³ WaterWatch, a major player in water resources issues in the Deschutes, is a non-profit with the mission to protect and restore river flows and to maintain fish, wildlife and people who depend on them.

cities, the DRC, and the tribes to form the Deschutes Water Alliance (Alliance). While a Deschutes Basin Alliance had existed in the past, it only involved the irrigation districts in Central Oregon (BOR and OWRD 1997). The aim of this new Alliance was to stabilize water use in the basin in order to meet agricultural, municipal, and ecosystem requirements through collaborative efforts among various water users. A focus of the Alliance was to increase knowledge about future water demands by estimating water needs for basin cities as well as the river; drafting a 20-year plan on how to meet future demands.³⁴ The grant also enabled the launching of the Central Oregon Water Bank (COW Bank), which is a component of the GMP. The COW Bank is a virtual, cooperative bank that facilitates short-term, long-term, and permanent transfers of water rights in order to ensure an orderly transition in water use and rights in the basin (Aylward 2006). Furthermore, the COW Bank is a collaborative agreement that should regulate the price of water and allow for flexible movement of water resources.

During the processes of the Alliance, stakeholders in the basin sought other means to achieve collaboration. The DRC and other basin stakeholders sought assistance from the Oregon Consensus Program (OCP) of the Hatfield School of Government at Portland State University in creating a potential collaborative process with a neutral medium for working on water management in the Deschutes Basin; the assessment that was done is summarized below.

The Resolve Assessment

Resolve, a neutral, private, nonprofit group assisting with processes addressing complex environmental and public policy issues, was asked by OCP to undertake an autonomous convening assessment of stakeholders' perceptions of water management issues in the Deschutes Basin (Nudelman and Odell 2006). The goal of the assessment was to evaluate the possibility of a collaborative, consensus-based approach to work through water resources issues in the Deschutes Basin. While this convening assessment included a wide-range of stakeholders' perspectives and concerns about water management in the Deschutes Basin, it focused neither on stakeholders connected directly to the GMP nor on program participants (a

³⁴ The Alliance initiated five planning studies to provide information regarding the costs of a conservation project, the effects of urbanization and land-use change, reservoir management, future demands on groundwater and an assessment of instream flows, which can now be publicly accessed on the DRC's website.

complete Resolve report can be found at http://www.odrc.state.or.us/documents/Final_ConveningReport051606.pdf).

The Resolve convening report found that although stakeholders expressed some apprehension, they were generally willing to engage in a collaborative water resource management process (Nudelman and Odell 2006). Another outcome of the Resolve assessment was a working group of basin stakeholders (called the Deschutes Basin Water Management Work Group) that included many of the parties involved in the Alliance, which began developing a collaborative process. The objective of this work group was to incorporate all stakeholders affected by water resources management issues in the basin in order to design an over-arching “coordinated plan that is supported by all” (Summary of Meeting 2007: 2). However, despite efforts to continue collaborative efforts under the work group, there was not enough incentive or funds for this process to continue. Furthermore, with the re-introduction of anadromous fish, focus among water users (particularly irrigation districts) was placed on how to meet the state and federal requirements to improve the aquatic environment for fish populations.

Summary

Using information obtained from the key expert interviews (during phase one of this research) as well as government documents and background literature, this chapter described the research setting, including the physical context of the hydrogeology of the Deschutes Basin as well as the socio-cultural and institutional setting within which the GMP emerged. The development of the GMP was described as initially occurring through a collaborative work group process but being finalized in OWRD’s director’s office. The purpose and rules of the newly implemented GMP were also discussed. Then the lawsuit filed against the GMP as well as ongoing collaborative processes in the basin were discussed. The next chapter presents the findings from participant interviews and the postal survey.

CHAPTER 5: RESULTS

The findings from the participant interviews and surveys, the second and third phases of this research, are presented in this chapter. The results from these two phases of data collection are presented together because the data stem from the same population – the program participants – and were collected by asking virtually the same questions. When the word “participant” is used it is limited to those individuals who contributed to this research. These results from the participant interviews and surveys are based solely on the participants’ perceptions. Unless specified as being interview or survey data, the results represent data from both methods of collection.

As stated in Chapter 3, data were collected from 78 participants; this chapter focuses on the responses from these participants. While 78 participants were interviewed and surveyed, not all responded to every question. Since the sample size for each question differs, the number of responses for every question is provided (e.g. if 71 participants responded to a question and 36 reported a certain perspective, then something like “36 out of 71 say X” is written). In addition, the percentage for every question was calculated based on the total number of responses to each question.

The main aim of both the participant interviews and surveys is to answer the central research question: Is the GMP more acceptable to its participants than the alternative management or regulatory options discussed in this research? As was reviewed in the Chapter 3, acceptability is a function of a combination of the evaluative criteria. This is defined here as the degree of usability of the program; accountability of organizations and individuals administering or assisting with the implementation of the program (enforcement and compliance is a part of this); equity of the program; environmental sustainability; utility; adaptability; economic efficiency; information dissemination; and collaboration. First the action situation of the GMP and then the demographics of the participants who were interviewed and surveyed are depicted. Next the findings are presented in the order of how significant the results are to the acceptability of the GMP to its participants.

The Action Situation

In order to understand the circumstances within which the participants are operating, the IAD framework calls for delineating the action situation, as discussed in Chapter 2. The seven elements that comprise the action situation can be used to describe the GMP by characterizing the groundwater permit applicants with pending applications, permit holders, as well as withdrawn and denied applicants as program participants who have:

- different positions, financial status, education and occupations;
- made decisions between various actions, such as applying for a permit, putting their permit application on hold, withdrawing their permit application, pumping prior to obtaining a permit, or waiting until a permit is issued;
- undertaken actions based on the information they have about the linkage of their actions and potential outcomes;
 - some participants are worried about breaking the law and want to be compliant; others fear that they will be sued by the state if they use groundwater illegally and some see no negative outcomes if they pump groundwater prior to obtaining a permit;
- carried out actions that are dependent on the perceived ensuing costs and benefits;
 - some withdrew their permit application because they perceived the costs of the program as too high;
 - others perceive the costs as very high but either see no alternative (because based on the information they have, pumping illegally would lead to greater costs than the costs incurred by the GMP); or
 - they believe that in the long-term the costs are worth it as participating in the program provides them with the benefit of increasing their property value; and
 - still others view the GMP as a socially and environmentally sustainable way to proceed; or
 - they want to be compliant with the law.

Demographics & Water Use

Of the 78 participants interviewed and surveyed, the majority were male (76%) with a median age of 50 years. In comparison to the rest of the population in Deschutes County (where most of these participants reside), the participants interviewed and surveyed are very educated: 75% of the participants (53 out of 71) reported having a bachelor's degree or higher while only 25% of the residents who are 25 years or older in Deschutes County have this level of education (U.S. Census Bureau 2008). Figure 8 below shows that participants with college degrees comprise the highest percentage of participants involved in the data collection.

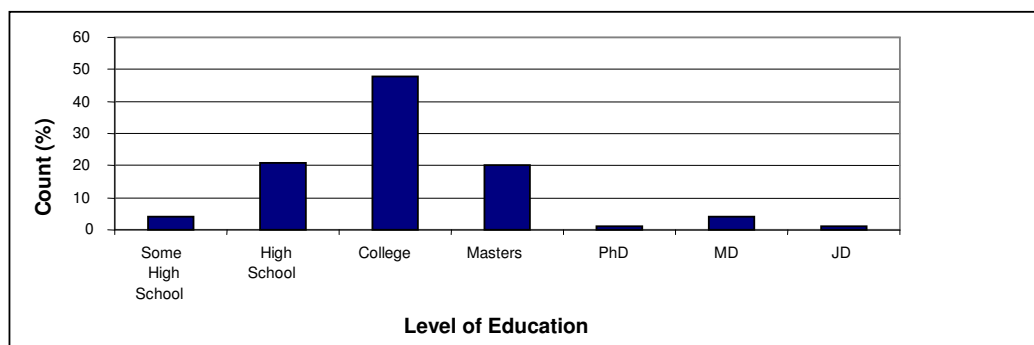


Figure 8: Participants' Highest Academic Degree (n=71)

While participants have a wide variety of occupations (see Table 7), retirement comprises the largest category of participants' occupation and farming/irrigating make up the second largest group.

Table 7: Primary Occupation of Participants (n = 70)

Occupation	Percent	Occupation	Percent
Retired	29%	Land Development	1%
Farmer/Irrigator	10%	Maintenance Director	1%
Other (not specified)	7%	Mortgage Professional	1%
Water Rights, Land Developer	6%	Municipal Water District Employee	1%
Construction	4%	Investor	1%
Engineer	4%	Nurse	1%
Real Estate	4%	Orthopedic Surgeon	1%
Computer Industry	3%	Owner/Manage Alfalfa Store	1%
Attorney	1%	Professional Artist	1%
Business owner	1%	Public Facility	1%
Commercial shipper	1%	Real Estate Developer	1%
Equipment Operator	1%	School District Employee	1%
Golf Course	1%	Service business	1%
Hospitality	1%	State Employee DEQ	1%
Insurance Agent	1%	Thrift Store, Nonprofit	1%

Of the 78 participants involved in the interviews and surveys, 51 (65%) were willing to state their household income; their median annual household income is approximately \$100,000. Comparing this value to the median household income of Deschutes County it is evident that the participants of this program tend to be wealthy: in 2004 the median household income in Deschutes County was \$45,894 (Innovation and Economic Strategies Division 2007). See Figure 9 for the range of household incomes among participants.

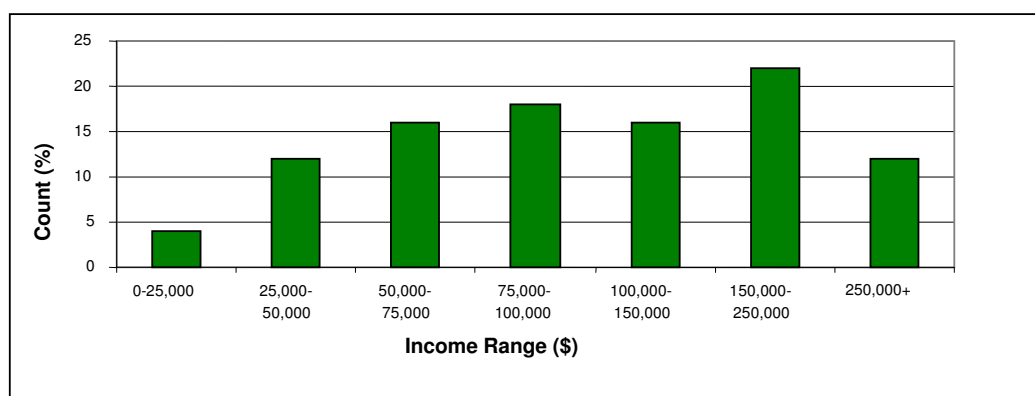


Figure 9: Participants' Household Income (n=51)

Of 64 responses, 48 participants (75%) say they live on the property where they use their groundwater. Furthermore, the majority of participants have owned their property for less than ten years (38 out of 63 responses; 60%). Most wells were drilled prior to 2003 (58%; 38 wells, n=66); 12 participants report beginning to pump prior to 2003. The highest rate of pumping began in 2004 and a surge of well construction occurred in 2003 and 2005 when seven additional wells were drilled in both of those years (with 13 new participants pumping).

Table 8 shows that irrigation permits are the most frequent. While cumulatively irrigation has the highest water use, many of the participants who are irrigators are small water users (consuming less than 10 acre-feet;³⁵ 51 of 78 participants; 65%) while quasi municipal and municipal users consume larger quantities of water. Furthermore, while the median acreage of participants' property (where they use their groundwater) is 20 acres, the median acres to be irrigated is 5 (n=66). In addition, 45% (40 of 88; participants have more than one permit or application) of the groundwater uses are in the general zone of impact (see Figure 6 for zones of impact).

Table 8: Type of Permit Issued versus Total Consumptive Use (n=81)*

Type of Use	Count of permits/applications	Percent of all types of uses	Consumptive Use (acre feet)	Percent** hiring consultants
Irrigation	63	78%	2,120.84	38%
Quasi Municipal	7	9%	1,211.30	5%
Municipal	3	4%	1,570.70	4%
Irrigation Agriculture				1%
Pond Maintenance for Recreation/Domestic/Storage	2	2%	35.8	
Group Domestic	2	2%	297	1%
Commercial	2	2%	46.4	0%
Industrial Mining & Irrigation	1	1%	4.2	1%
Storage & Pond Maintenance	1	1%	1.5	0%

*Some participants had more than one permit or application.

** n=81

³⁵ One acre-foot covers one acre in a foot of water. Consumptive use means that water is used in a way that causes an overall reduction of streamflow; often associated with evaporation or transpiration.

Figure 10 describes the amount of consumptive water uses versus type and number of uses. It suggests that there is a correlation between frequency of use and consumptive use (except for Storage and Pond Maintenance as well as Commercial uses).

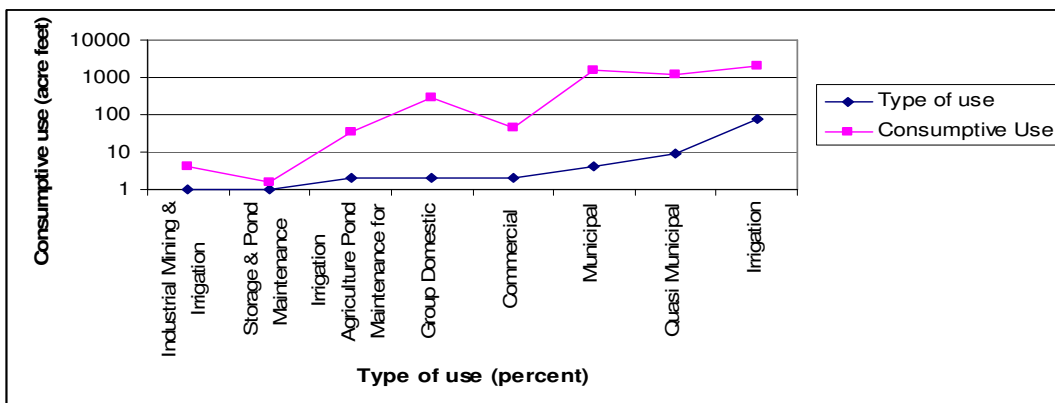


Figure 10: Type of Use/Count of Participants versus Mitigation Obligation

For the majority of participants partaking in the GMP is a lifestyle rather than a livelihood choice. The average response of 59 participants is that the GMP *is* vital to their lifestyle whereas the average response of 51 participants is that the program *is not* vital to their livelihood (see Figure 11). For instance, an interview participant notes that the GMP “is not vital at all to my livelihood; I like having green pastures.”

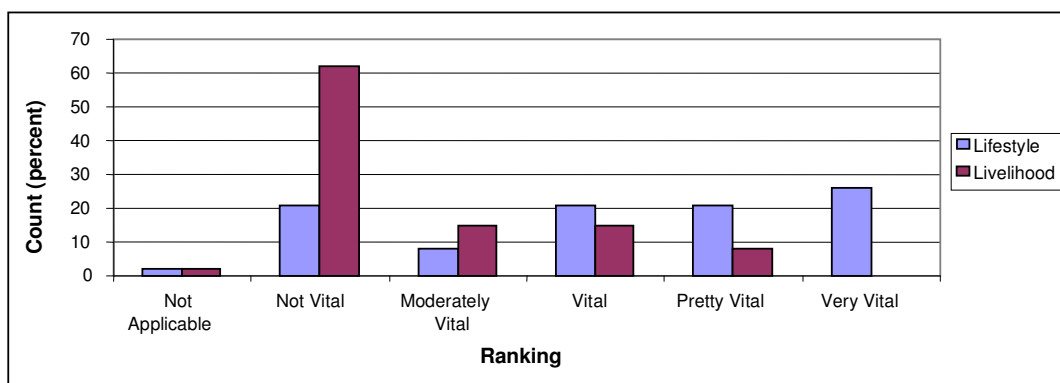


Figure 11: Lifestyle versus Livelihood (n=61 for lifestyle; n=52 for livelihood)

The livelihood participants tend to have a lower annual household income than lifestyle participants: 11 out of 20 livelihood participants (54%) have an annual income that is less than \$100,000 a year versus 17 of 38 lifestyle participants (45%) who have an annual income less than \$100,000. Furthermore, the program is not useful to the majority of participants' livelihood because most are not using the groundwater as a means to make a living; 42 of 67 participants (63%) report that groundwater is for their own consumption, 19 participants (28%; n=67) say it's to produce products for rent or sale to others, and 6 participants (9%; n=67) say it's for both. Many participants use groundwater in order to enjoy a rural lifestyle with a pasture and some livestock. Responses from the survey include the following reasons for needing groundwater: lack of adequate quantity and reliable surface water; cheapest way to obtain clean water; and not being able to obtain surface water. The above results imply that participants tend to be hobby farmers rather than commercial farmers, which is aligned with the background information demonstrating that the majority of irrigators are noncommercial hobby farmers (Aylward 2006).

Table 9 shows in more detail how participants are using or will be using their groundwater permits.

*Table 9: Participants' Type of Groundwater Use (n = 109)**

Type	Percent of Total
Grazing/Pasture	39%
Grass/Landscape	19%
Domestic	12%
Pond	8%
Crop/Alfalfa/Hay	6%
Golf-Course	3%
Garden	3%
Other	3%
Park	2%
Dust and Fire Abatement	2%
Resort	1%
Field Turf	1%
Wildlife	1%

** Participants reported various uses for one permit.*

In sum, the majority of participants can be characterized as irrigators who predominantly use groundwater for grazing, pastures and non-commercial purposes; consume less than ten acre-feet; to support a lifestyle rather than a livelihood choice (33 of 53 participants or 62% say the

GMP is not vital for their livelihood); are above age 50 (median age); attended college; have lived on their property for less than ten years; frequently hire consultants to assist them in the process; and have a median annual income of approximately \$100,000 (n=51).

Acceptability of the GMP

Usability

In order for the GMP to be acceptable to its current as well as potential participants it should be easily usable. Findings from both the interviews and surveys suggest that a primary concern among participants is that the GMP is not user-friendly. The predominant view among many participants is that the permitting process is bureaucratic, confusing, and slow. For instance, an elderly survey participant comments that she is waiting until “OWRD gets around to acting on my application – if I’m alive by then.” A consultant notes that getting a groundwater permit takes longer than land rights, which, he points out, is a major obstacle for development.

The majority of participants are frustrated about the application process due to unrealistic expectations; many *expected* their groundwater application to be processed quickly (41 of 67 or 61% said that they felt uninformed about the length of the process). Some participants admit that once they realized how difficult the process would be, they thought about quitting. For example, an interview participant comments: “It was easy to start, but as the process got more and more expensive, we asked ourselves, why are we doing this?”

In contrast to this general viewpoint, a few participants don’t find the process too difficult or lengthy. It must be noted that most of the latter participants were not concerned about time, or they *expected* their application to be on hold. One such survey participant says that he was not concerned about the time-frame because he was just applying for a permit to be legal.

Data show that the average time to obtain a permit (n=53 permitted participants) is three years (median=2.5, standard deviation=1.7). A consultant states that his fastest permit applications take 15 months and the slowest take about two years. However, hiring a consultant does not necessarily expedite the permitting process; in some instances it has taken longer for participants with consultants than for those without to obtain their permit. Despite the lengthy

process, data indicate that the permitting time-frame is decreasing (see Figure 12). However, it must be noted that some of these applications depicted in Figure 12 are still in process.

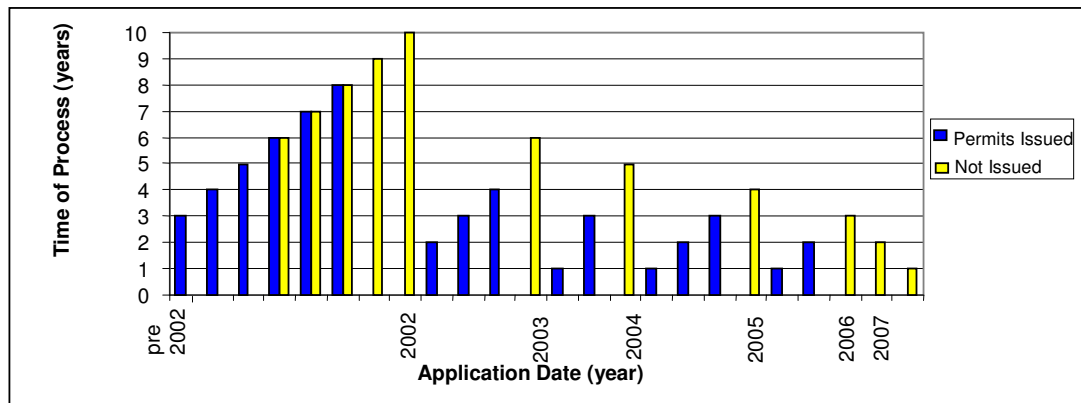


Figure 12: Length of Permitting Process

(n=81) Note: Some permits are still in process; some applicants have more than one permit application

The Application Process

Participants were asked how easy or difficult it was to know the following –

1. the requirement to file an application for a permit to pump groundwater (over the exempt use);
2. how to file the application (fill-out the form and submit the correct paperwork);
3. how to track the application's status;
4. who to contact at OWRD; and
5. where to obtain mitigation credits.

Despite the above responses indicating that the program is difficult to participate in, Figure 13 shows that on average none of the aspects of the process are regarded as very difficult (i.e. ranked as a 1 on a scale of 1 - 5). Yet the averaged responses also indicate that none of the steps in the process listed above are very easy. Many participants emphasize the obstacles in the permitting process. For instance, one interview participant states: “Whenever we turned in paperwork, we got a response telling us how much we did wrong.”

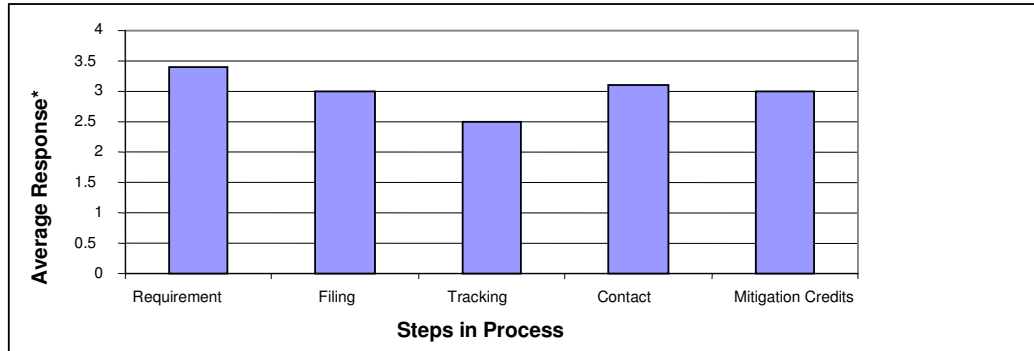


Figure 13: Average Response of Application Process Ratings
(n = 64) *Key: 1=very difficult, 2=difficult, 3=not so hard, 4=easy, 5=very easy

On average, tracking the application status is rated as the most difficult. Knowing where to find mitigation credits, how to file an application, and who to contact at OWRD received average scores depicting them as “not so hard.” Knowing the requirement to file an application is said to be the least difficult of the steps in the permitting process.

Figure 14 provides a more detailed representation of participants’ responses, which shows that knowing about the requirement of a permit was very easy for many participants, yet it was also very difficult for a large number of others.

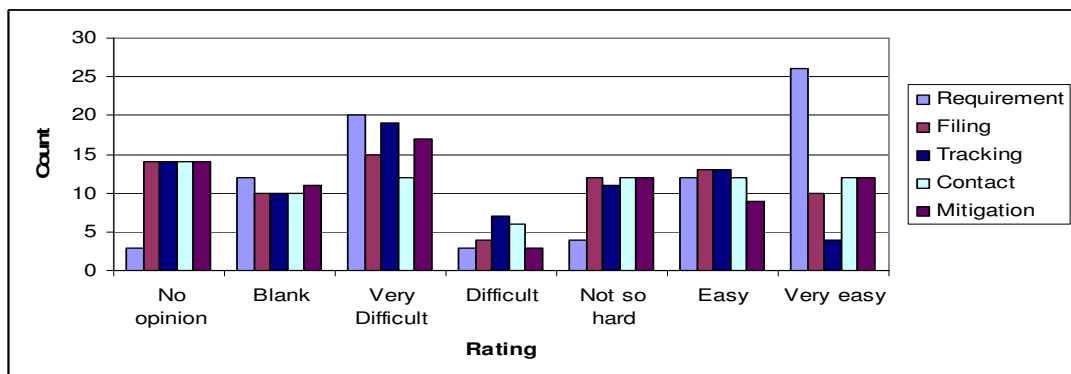


Figure 14: Total Count of Application Process Ratings (n=64)

There seems to be some correlation between level of education and usability of the program as participants with a high school education found several aspects of the application process more difficult than college educated participants. Interestingly, there seems to be a negative correlation between participants who hired consultants and perceived easier usability of the

GMP as those participants who didn't hire consultants found most aspects of the process much easier than those who hired consultants (the tracking step being the exception).

Given the infancy of the GMP, some participants say they understand that the process is difficult because it is new to everyone. Furthermore, a participant representing a basin city notes that the "GMP deserves complexity; it can't be a cake-walk because there's a high level of responsibility and it needs to be a process." Another interview participant, involved with the GMP since its early stages, states that the process is easier today than in the past because now there is more understanding of how the program functions. Some participants also express satisfaction with the GMP process. For instance, an interview participant says: "I am happy with the whole process and would vote to continue the management of water resources."

In contrast to the latter viewpoints, other participants say they are baffled by the program and don't understand why it is so complex. One survey participant, who is elderly, believes that unless people are willing to pay for an expedited process, the GMP is intended to be slow. Many participants say that OWRD should simplify the GMP process and some recommend that the application process be streamlined to drastically reduce the processing schedule and make it less intimidating.

Information Dissemination

As discussed in the literature, in order for a water management program to be successful and acceptable to its users, information dissemination is crucial. The majority of participants express that information dissemination is lacking under the GMP, which is a major concern to them. Many participants say they don't have a general understanding of the GMP, which often leads to confusion and frustration. A general sentiment among participants is that while professional consultants are adequately informed about the mitigation process the typical water user is not.

The lack of information dissemination is particularly troublesome for new residents in the basin. Participants note that out-of-state people moving to the Deschutes Basin have no idea that they need a permit and they just use the water. For instance, an interview participant from

out-of-state says: “It was the worst day of my life when they told me I was pumping illegally [because I had no idea I was doing something illegal].”

Many participants say that information about the GMP is difficult to obtain and explain that they learned about the program in haphazard ways. For example, an interview participant recalls that she learned about mitigation from “the man pouring our concrete.” Others say that they knew about the mitigation program because of articles in the news. One rather educated participant says that there was general awareness about the program, especially in the beginning. Yet some participants did not know what the GMP was at the time of the interview or survey; they thought they were just getting water rights.

While some participants note that initial meetings and outreach were conducted by OWRD during the development of the rules (around 2001 and 2002), they say that once the rules were implemented there was virtually no outreach and education. However, a participant who is a water broker in the basin reflects that “OWRD has done a pretty good job with meetings and getting the public involved,” particularly early on. Others are less satisfied with OWRD’s outreach. For example, an interview participant notes that the early meetings were not representative of the local water users as two-thirds of the attendees were public servants. Others say that despite the meetings that were open to the public, there was no public input to the GMP or they feel that public input was not accepted because comments “fell on deaf ears.” Some participants who attended the early meetings report that:

- they left the meetings totally confused;
- nothing was accomplished;
- still have no idea why water users need to mitigate;
- there were too many meetings;
- the meetings were very inconvenient because they were only held during weekday;
- there were not enough meetings and they were only held after things got delayed; and
- the state was not prepared for the meetings (i.e. “they didn’t know what they were talking about”).

In general, participants in the real-estate industry, municipalities, and quasi-municipalities express more satisfaction with outreach and information dissemination about the GMP than most small water users who are primarily irrigators. The former participants tend to already be educated about the mechanisms of the GMP. For instance, an interview participant who is a real-estate agent says that “I don’t need outreach because [I’m already well informed due to] my industry. I’m pleased with everything they did and gave me.”

As the lack of information provision to water users leads to false expectations and frustrations among participants, most participants stress the need for ongoing information dissemination about the GMP so that they and future participants will no longer feel like it is necessary to hire a professional to assist participants through the permitting process. Educating realtor associations and title companies is recommended as an efficient way to transmit information because property is frequently changing hands and new residents need information.

In addition, in order to improve information dissemination, participants recommend that OWRD should:

- inform groundwater applicants upfront; provide clear information about general expectations (i.e. in terms of cost) and a handbook with guidelines explaining the GMP from A-Z, who to contact, what the next steps are, with a glossary of terms; explanation of GMP (purpose, functions etc);
- use simple language (because “it’s all Greek for anyone who’s a farmer”);
- provide annual reminders, newsletters, status reports, or updates on GMP activities and price changes;
- hold community meetings;
- give more notification about availability of credits and provide education about temporary and permanent credits;
- provide more information about the uncertainty of the GMP and the basin’s hydrology;
- increase general public awareness – outreach to potential users – inform the public that it’s possible to get a permit for “dry” property;

- supply a list of legitimate (state approved) consultants, engineers, and lawyers; and
- provide information about the DRC.

Equity

As discussed in Chapter 2, a program will be less acceptable to its participants if it is perceived as inequitable. A major concern among many participants is that they perceive the GMP process as unfair, dishonest, and inconsistent. Such viewpoints are based on participants' perception that enforcement and monitoring are lacking and that the program is not being uniformly administered. A general sentiment that many participants express is that they feel that it is unfair that they abide by the law and have to pay for their pumping while those not following the law face no consequences. For instance, one interview participant notes that "OWRD should make everyone do it [i.e. participate in the GMP] or make no one do it." Participants also relate differential experiences regarding the permitting process. While some participants say they went through the permitting process and were without water for five years because they were told they would be "severely" fined if they pumped prior to receiving a permit, others say that OWRD told them that they were allowed to use water before permit issuance.

Another equity concern is a general attitude among participants who are small water users that OWRD treats large developments like golf-courses and resorts preferentially because it allows them to use great amounts of water at the same price (per credit) as the smaller users who are consuming less of the resource. Such participants think that these developments are not made to pay enough for their large water usage; they perceive that these developments are not paying a proportionate amount with respect to the impact that they may have on the supply of water resources. Furthermore, these participants complain that small water users are expected to accept restrictions on their small rate of pumping while golf-courses and resorts are permitted to use high rates of water. In addition, several participants believe that some golf-courses and resorts are not required to supply mitigation credits. Participants also note that the resorts and golf-courses would have the money to buy mitigation credits whatever the cost. Therefore, some participants perceive that these developments are or have the capacity to drive up the prices, which makes prices too high for individual, small water users.

Some participants remark that the permitting process is dishonest and unfair because they believe that OWRD is purposely making the GMP complex in order to wear people out or scare them away from pursuing a groundwater permit. Some participants express that OWRD is trying to indirectly decrease new water uses and that it is “obvious that OWRD does not want to process new water rights.” For example, one interview participant says: “I think the intent is to run the process so long until a person gives up – in that sense the state has been successful.” Instead of being strung-on, another interview participant notes that he rather be given a clear answer: “If the real goal is to stop new water uses then they should say that this is the public policy goal.” Furthermore, another interview participant who is an attorney says that OWRD convolutes the nature of a permit and the process is not straight forward. Finally, participants also find it unfair that they need to provide mitigation before they are allowed to pump: “Why do you have to buy mitigation rights and not be able to use them for two years is beyond me;” and “if you can buy mitigation credits then you should be able to use them when paid for.”

Accountability

As discussed previously, in order for a program to be accepted by participants, the organizations and officials implementing it must also be accountable for ensuring that the program is functioning properly; enforcement and compliance are crucial in order for this to occur. Many participants express that there is a lack of accountability under the GMP, which is a major concern to them.

While OWRD is the primary agency administering the GMP, there are multiple entities involved with providing services under the GMP because OWRD does not provide full service. Since the main three entities facilitating the implementation of the GMP are OWRD, the DRC, and consultants, participants’ perspectives about these entities are described below. Then participants’ viewpoints of OWRD’s enforcement and non-compliance to mandates of the GMP (among participants and other water users) are presented.

Oregon Water Resources Department (OWRD)

The majority of participants are dissatisfied with OWRD because they say the department is not sufficiently accountable; OWRD is described as being reactive, inefficient, slow, illogical, and unresponsive. For instance, dissatisfied interview participants say that “if they [OWRD] regulate participants and ask them to have a timeline, then they should have one too!” and OWRD “works at a snail’s pace. If they were a private company they would be bankrupt if they worked like that!” Although the overall responsiveness of OWRD is noted as being poor, some participants provide positive reviews about this state agency. For instance, a few say that OWRD is proactive in contacting them. Furthermore, an interview participant comments that “given that OWRD is a huge bureaucracy, it was pretty responsive.”

While several participants express frustration and difficulty in contacting people at OWRD (Salem) because of the continuously changing staff, some participants say that the assistance provided by certain individuals at OWRD Salem and Bend is good. Many participants confuse OWRD’s field office in Bend and its Salem office but the majority (52 of 69 or 75%) contacted the Salem office. However, many interview participants report that the OWRD Bend office is more helpful than Salem. Others note that there is inconsistency between what the Bend office will say and what Salem will allow. For instance, an interview participant says that he contacted the Bend office and was told that he does not need to mitigate for the small amount he wants to use (even though it is above the exempt use), yet this was not approved by Salem.

Some participants acknowledge that the GMP is a new program and OWRD is simply trying to figure out the process itself. Some also recognize that OWRD is under-staffed and realize that the employees probably do not have time. A few empathetic participants believe that OWRD is attempting to do the right thing but they perceive that there is vagueness at OWRD regarding the staff’s role in implementing the GMP. Yet others critique that the state should not implement a program until it has it fully figured out. Participants recommend that OWRD could increase accountability by:

- contacting (and having regular contact with) current and potential participants;
- monitoring and enforcing water use;

- offering more and clearer communication; and
- providing participants with a main contact at OWRD.

Consultants, Attorney and Engineers

Both interview and survey participants report that they frequently hire consultants, attorneys, and engineers (41 out of 75 or 55% hired consultants, engineers, or lawyers). Many participants feel that hiring a consultant is a requisite to partaking in the program because it is so complex. Some critique that since the GMP is a state run program, hiring a private consultant or engineer should not be necessary. Furthermore, some participants note that not everyone can afford an attorney or consultant. While participants in the lowest income range are least likely to hire consultants, those in the highest income bracket (\$250,000 plus) are *not* the most likely to hire consultants. Participants with an annual income of \$50,000-\$75,000 and \$150,000-\$250,000 as well as those with Masters degrees are found to most commonly hire a consultant.

The predominant reason for hiring a consultant is because participants don't think they could undertake the process alone. For instance, an interview participant says that the application "looked pretty intimidating" so he hired a consultant. The majority of participants hiring consultants express general satisfaction with the services offered. Several participants who feel that OWRD is not accountable say that they are able to gain helpful information and assistance from consultants. For example, a retired interview participant reflects that having someone handle the process is worth the money. Yet some participants are concerned about knowing who is a legitimate water broker. For example, an interview participant explains that he hired a consultant because he lost money by purchasing water from someone who sold it from the wrong aquifer (i.e. the mitigation credits did not match up with the participant's zone of impact).

Of the various professionals hired to assist with the application process, John Short is employed the most frequently (see Table 10). John Short's clients tend to be on the wealthier side: the majority with an annual income of more than \$75,000 (15 of 18 or 83% participants hiring John Short *and* willing to provide their annual income). While John Short is generally

described as providing an excellent service, one participant also expresses dissatisfaction with this consultant.

Table 10: Consultants Hired by Participants (n = 40)

Name	Count	
John Short	22	Many participants who hired a consultant are less frustrated with the process because their consultant handles everything. For instance, one interview participant notes: “After we contacted John Short he took over.” An interview participant comments that “if you don’t have a John Short, then it’s very difficult.” However, as noted earlier in the usability section, participants hiring consultants do not necessarily find the process easier to use than those without consultants.
Adam Sussman/GSI Solutions	3	
Tammy Sailors	3	
Bob Lovlier with Bryant Lovlier and Jarvis	3	
Tom Walker	2	
Fred Ast Jr. & Associates	2	
Anderson Engineering	1	
Newton Consultants	1	
Martha Pagel	1	
Terrescope Inc	1	
HGE IWC	1	

Deschutes River Conservancy (DRC)

While some participants confuse OWRD with the DRC, this nongovernmental organization is generally seen as being more accountable to participants than the state agency. The DRC is viewed as efficient, informative, and helpful by many participants (particularly to interview participants as the majority of them are users of the DRC’s water bank). For instance, interview participants comment that the successful issuance of permits “was entirely the DRC’s efforts; I expect less from the state;” and the “DRC coached me and did everything – took me through the process.” Furthermore, several interview participants view the DRC’s groundwater mitigation bank as making it substantially easier to obtain mitigation credits. A participant who was able to obtain his credits through the auction held by the DRC remarks that this allowed him to immediately buy his credits, which “made the whole process painless.” Further perceptions of the GMP include: the DRC “keeps everything moving;” is “a safe haven;” is “instrumental in the process;” and the “DRC goes out of its way to contact people.” However, many participants not purchasing credits through the DRC’s water bank are unaware of the DRC, have no need to contact the organization, or say it’s hard to find the

DRC. For example, an interview participant says that “their [the DRC’s] name was not put out there...felt like there were some inter-agency issues.”

Generally, the DRC is well accepted by participants in contact with the organization and is seen as promoting cooperation in the basin, restoring instream flows and increasing the acceptability of the GMP. Only a few participants express negative views about the DRC and say that the organization is not proactive. For instance, one interview participants says that although the DRC was helpful they did not contact him and a survey participant remarks that the DRC was not responsive. The DRC received stronger criticism from a long-time water user and former farmer who says that “all the water went to the DRC, which is the middle man [which I] don’t like [because the water is being handled by an intermediary (the DRC) instead of directly by the state]. I feel that OWRD turned to the DRC.” Another retired participant also criticizes the DRC and says that “the DRC is a sneaky little organization.”

Summary of OWRD, Consultants and DRC’s Assistance

Figures 15 and 16 summarize the responses of both interviews and survey participants’ rating of the assistance provided by OWRD, the DRC, and consultants. Figure 15 shows the average ranking of the various entities providing assistance and demonstrates that Salem was ranked the lowest (just below good with a 2.9 on a scale of 1 - 5) and consultants were ranked the highest (just below very good with a 3.9). While the DRC and OWRD Bend are rated as almost the same, the qualitative responses indicate that the assistance provided by the DRC is perceived more positively by most participants than that offered by OWRD Bend.

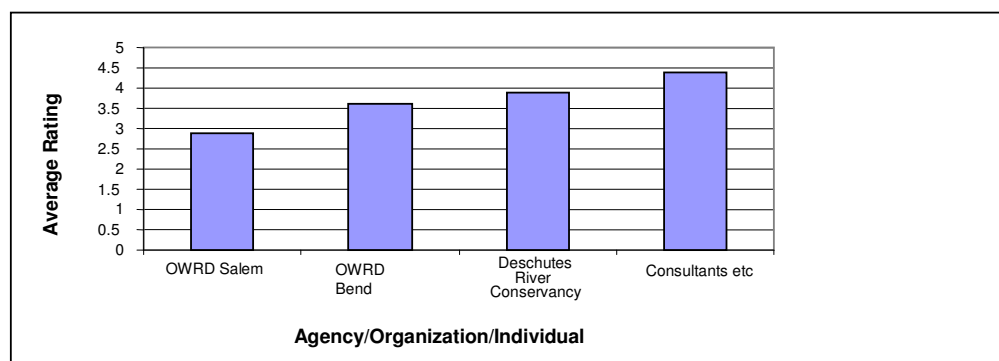


Figure 15: Average Rating of Agencies, Organizations & Consultants (n=66 for OWRD Salem; n=63 for OWRD Bend; n=63 for DRC; and n=37 for consultants, engineers and lawyers; Scale: 1=Poor, 2=Fair, 3=Good, 4=Very Good, 5=Excellent)

Figure 16 provides a more detailed rating of the different entities. While the excellent ratings of the DRC and OWRD Bend are similar, OWRD Bend's poor ratings are a lot higher than that of the DRC. Many participants also express no opinion about the DRC and OWRD Bend, which could imply that they did not have contact with these two organizations. Data show that the rating of OWRD Salem, with which participants had the most contact, is the poorest.

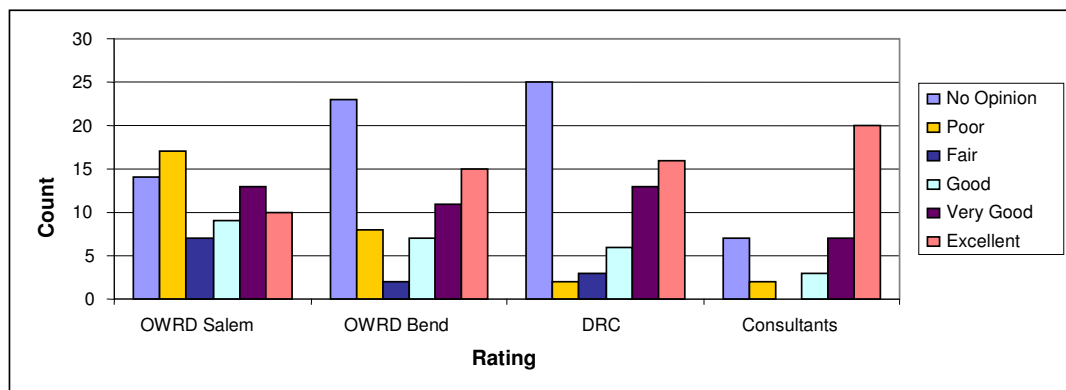


Figure 16: Total Rating of Agencies, Organizations & Consultants (n=66 for OWRD; n=63 for OWRD Bend; n=63 for DRC; and n=37 for consultants, engineers and lawyers)

Enforcement

As noted in Chapter 2, enforcement is a component of accountability that affects the acceptability of a program because a program becomes less credible if enforcement is lacking or perceived to be inequitably applied. The results indicate that many participants are concerned about the lack of enforcement as discussed above. A general sentiment among participants is that if there is going to be a program at all, then it should be enforced; many participants feel that if people are going to take the time and money to apply and obtain a permit, then OWRD should track water use and enforce the law. The general viewpoint of participants is exemplified by this quote: "It's a waste to have a mitigation program if water use is not enforced."

The lack of enforcement frustrates participants because they feel like their effort and money spent on complying with the GMP is pointless because the state ignores illegal uses. Many participants say that OWRD realizes that there are abundant illegal water uses but does nothing about it. These participants believe that OWRD does not keep track of permits and

fails to monitor water use. Furthermore, several participants note that illegal uses may be increasing under the GMP. For instance, an interview participant says that “just because there’s this process, illegal use has not stopped, maybe it made it worse.” However, some participants note that because enforcement is reactive rather than proactive in the Deschutes Basin, often neighbors report illegal water uses, which implements an alternative enforcement system. Several participants admit that they are complying with the GMP only because their neighbors turned them in.

In contrast to many participants’ views, some interview participants who are new to the Deschutes Basin feel that enforcement is strict and consequential. For instance, some say that they were shocked and terrified when they were told they were pumping illegally and that they would be fined. Furthermore, despite the critique of inadequate enforcement, some participants note that enforcement is increasing. An interview participant believes that the increasing enforcement will not be acceptable to many water users in the basin: “In this rural setting people are combative and don’t want regulators on their land.” He believes that “if there will be more enforcement and more monitoring, it’s a question of how to educate people to accept it.” Another interview participant demonstrates this non-acceptance as he says he’s being fined and is incredibly frustrated by it; he says he’s taking the state to court. Echoing this, some participants say they don’t want any state intervention, they feel that there are already too many rules and regulations. The following quote by an interview participant is representative of many participants holding this viewpoint: “I would like the state to leave us alone to run our own show.”

There seems to be a vicious cycle between lack of enforcement and compliance. Some participants note that compliance is an issue that is exacerbated due to lack of enforcement. Several participants note that since consequences are absent (i.e. if people using water illegally get turned in, “they just get a slap on the wrist”) there’s not much incentive to comply. This weakens the credibility of the GMP because it decreases the likelihood that participants (as well as non-participants) take the GMP seriously. For instance, an interview participant remarks that the GMP is “a joke” because 15 new wells were drilled close to his house and people are irrigating without permits. In addition, a few participants note that since the GMP

process is so complex, less people are actually willing to comply, which worsens the problem of illegal use.

Participants' Compliance with Program Mandates

Currently, most participants do not report their annual water use (20 of 31, or 65% of permitted participants are not reporting). Furthermore, despite the fact that installing a water meter is a permit *requirement*, 10 out of 29 (34%) permitted participants lack a water meter. In addition, some participants who have not been issued a permit have already begun pumping; 15 of 40 (38%) un-permitted interview participants reported such activities. One interview participant notes that he pumped prior to obtaining his permit because he found it ridiculous that it was taking so long (over two years) for his permit to be issued and he was already paying for mitigation credits anyways.

Several participants are not complying with the mandates of the GMP because they say they are unaware of the requirements. The following are participants' reasons for not reporting:

- don't receive requests from OWRD to report;
- only sometimes receive requests to report;
- simply don't respond;
- unclear about what needs to be reported;
- reporting is only required when a final certificate is issued;
- only need to report if pumping above the minimum amount; and
- when using a shared well it is not required to report.

Several participants say that they will report their water use if it is required: "if they ask for it we will tell them." A few un-permitted participants assume that they will need to report once they have their permit. Some permitted participants expect that the mandate to report will be implemented: "under the assumption that it will be mandated – wasn't mandated at the time." In contrast to many individual small water users, developers, resorts, and municipalities do report their water use systematically. A consultant representing resorts remarks that "resorts never miss a deadline; they take it seriously and there's open reporting."

Exempt Well Use

A major concern of non-compliance relates to non-participants who are over-using the exempt well use. Most participants say they are aware of this exempt well use (28 out of 33 or 85%, are aware). Furthermore, 37 of 43 interview participants (86%) say that the exempt well use does not influence their decision to partake in the GMP (quasi-municipal and municipal users are mandated to get a permit regardless). However, participants who are small water users note that the exempt use may influence their participation in the GMP because of the increasing prices of temporary credits that may deter them from purchasing these credits in the future. For instance, participants who feel they could get away without having a permit (and slightly over-use their exempt well) may no longer purchase temporary mitigation credits if the prices get too high for them.

Compliance Under the Hypothetical Moratorium

Some participants say that the hypothetical alternative of a moratorium on all new groundwater uses would lead to more illegal uses. For example, one interview participant notes that if there were a moratorium, he would say that he pumps one-half an acre (the exempt use) but in reality would pump as much as needed since there would be “no carrot and stick!” Another interview participant says that he “would shut-up and lay-low; never would be contacted by the state.” However, over-using the exempt well use is a minority view among participants because out of 30 responses, 14 (47%) say they would reduce their groundwater usage to the exempt amount and only three (10%) say that they would over-use their exempt well allowance. Furthermore, 13 participants (43%) say they would search for alternatives. Other survey participants say they would move to a place where they could pump groundwater. Further reactions to a moratorium include:

- leave land dry;
- buy priority rights;
- apply for a well-to-well transfer;
- do whatever OWRD said to do; or
- ask what the reasoning behind a moratorium was.

Utility

In order for a program to be acceptable its participants must see utility in it. Participants from both the interviews and postal surveys were asked about how they perceive the utility of the GMP with respect to the following:

1. their groundwater use and need;
2. benefits to instream flows;
3. other environmental benefits; and
4. economic growth and development in Central Oregon.

Despite the frustrations incurred by the permitting process as well as the equity and accountability concerns, the results indicate that the majority of participants perceive the GMP as meeting their need for groundwater: 48 out of 62 participants (77%) say that the GMP is fulfilling their needs. Participants' predominant personal consumptive use is to "green-up" private properties and to live the "all American dream [of having a green pasture with a few livestock]" (see Table 11).

Table 11: Primary Groundwater Uses Among Participants

Grazing/pasture	Domestic uses
Grass/landscape	Attracting wildlife (birds etc)
Fire protection	Orchard
Garden	Dust abatement

Figure 17 demonstrates the variations in participants' responses about the utility of the GMP. While the rating of meeting personal needs as excellent is high, it also received a substantial number of lower ratings. Participants were less likely to rate the utility of the GMP affecting economic growth as excellent (compared to personal needs) but this utility also received fewer poor or fair ratings.

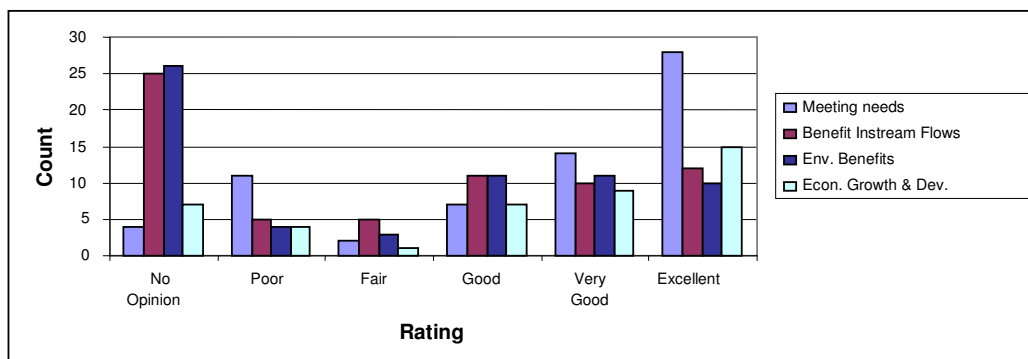


Figure 17: Total Rating of the Perceived Utility of the GMP
(*n=62 for meeting needs; n=64 for Benefit to flows; n=61 for Env. Benefits; n=42 for Econ Growth and Dev*).

An average of participants' rating of the GMP's utility to the four questions listed above indicates that participants perceive the GMP's utility for economic growth and development, personal needs, benefits to instream flows, and other environmental aspects all as good and very good. The overall rating for economic growth and development is slightly higher than that for personal needs (see Figure 18). However, many participants do not view the former utility as positive because participants tend to be wary of the rapid development of golf-courses and destination resorts. For instance, one interview participant notes that the GMP is "good for economic growth, but on the flipside, it's not necessarily good to have development in the long-run." Another interview participant concurs: "the GMP should not be beneficial for economic growth, yet it is." Yet some other participants view this utility as positive and believe that without the GMP, no economic growth in Central Oregon would be possible, particularly if the alternative is no water. In contrast, others say that due to the bureaucratic slowness of the GMP process, the program impedes development.

A few participants perceive that the utility of the GMP is for the state or consultants to make money. While some view this negatively, other participants are neutral or even see a positive side to this presumed money-making. For instance, one interview participant says that "of course the state is making money off of the GMP, which is ok with me; I don't mind paying state because this is my choice of lifestyle." Another interview participant says that the money-making by consultants and the state via the GMP leads to job creation.

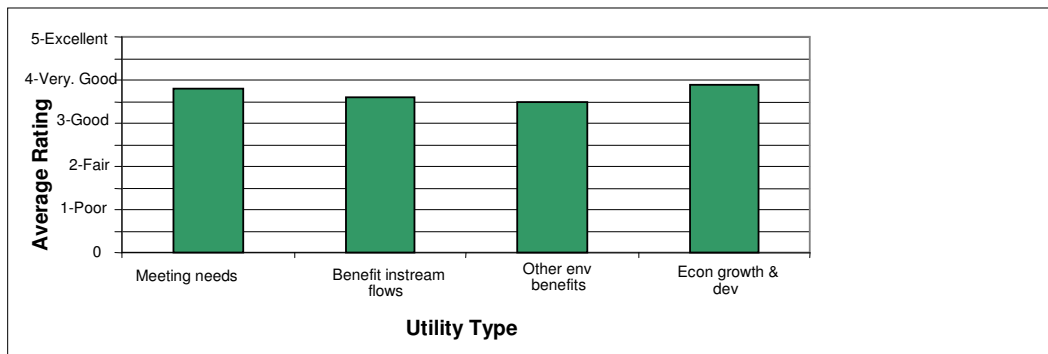


Figure 18: Average Rating of the Perceived Utility of the GMP (n=62 for meeting needs; n=64 for Benefit to flows; n=61 for Env. Benefits; n=42 for Econ Growth and Dev).

Benefits to instream flows and other environmental benefits (such as increasing wildlife habitat) are ranked as the third and fourth highest utility of the GMP by participants. Many participants feel less comfortable about commenting on whether the GMP provides positive benefits for instream flows because of the uncertainty of the effects of mitigation. For example, one interview participant questions: “How would I know if the program benefits instream flows?” Another interview participant says that he does not think anyone knows about the actual benefits to instream flow. Furthermore, several participants express concern as to whether the program is meeting the needs for instream flows and other environmental benefits.

Some participants rationalize that if money generated by the GMP goes towards instream restoration then the program must benefit instream flow. For example, an interview participant notes that “if many people mitigate, there will be a benefit to instream flows.” Furthermore, a few participants note that since many entities are paying for mitigation credits without pumping (because of the requirements to purchase mitigation credits prior to pumping) streamflow must be increasing. For instance, one interview participant explicates that “we’re not pumping groundwater but are putting water instream [through mitigation credits].” Another interview participant says that “if the GMP is doing something, then great, but if it is creating or disguising the real problem [then it is negative].” This participant is “unsure if it’s positive for the environment; in theory it’s great, intent is good... for developing resorts its good.” Another survey participant says that he does not believe that “the ‘mitigation’ program actually will decrease water use. [and hence will not restore flows].” Instead, this participant

believes that “water use will shift to those with the money to pay for credits [i.e. destination resorts and golf-courses].”

While some participants say that instream flows are increasing, they believe that the net increased flows would have happened anyhow, regardless of the GMP. For example, an interview participant notes that water is already being conserved as irrigation has become more efficient (shifting from flood to sprinklers). Furthermore, a consultant in the basin points out that a resort increased river flows by thirty percent prior to the GMP.

No Utility

In contrast to the above perceptions, a number of participants see no utility in the GMP and hence believe that there is no need for the program. For instance, the participants who perceive that there is no utility in the GMP believe that the Deschutes Basin does not “need the GMP – there’s enough water in the basin – it’s just another bureaucracy.” While for some, the primary concern is the opposition of any state intervention with water on *their* land, for others, the GMP simply fails to meet their needs. For example, an interview participant says: “I’m still not able to get enough water.”

Some participants view the GMP as a joke. For example, an interview participant who is a long-time water user and former farmer says that the “whole GMP is a big game... better off without it.” Still others see no utility in the GMP because they view water as a public good that should not be managed through a market mechanism. For example, an interview participant says that “if water belongs to the state of Oregon then there should be no money involved... the state should manage it.” Another interview participant notes that “maybe it would be feasible to have transaction or administrative costs, but not a water market.”

Environmental Sustainability

With the lifestyle in the upper Deschutes Basin shifting from farming and ranching to a recreation and retirement community many participants express concern about the new developments, particularly the abundance of golf-courses, as noted above. They are concerned about the environmental sustainability of the high pumping rates by the new developments because they feel uncertain whether the basin has the capacity for this type of development.

For example, an interview participant notes that the bulk of groundwater is being used by developments and golf-courses that “are depleting the water resources” and drying up the little places (i.e. hobby farms).

Many participants view water uses by developments (golf-courses and resorts) as wasteful and call for the need to control development. These participants believe that OWRD should stand-up against the plethora of new developments. For instance, an interview participant says that “OWRD is allowing way too much water use at a high rate.” A sentiment among several participants calls for the need to know when “enough is enough!” Such participants say that they would be happy to modify and conserve their water use and would like the resorts and golf-courses to adjust their uses as well. For example, an interview participant says that he “would be willing to use less water if more water was needed instream.”

Some participants comment that the visible waste of water use by developments causes them to question the credibility of the GMP. For example, one survey participant says that with the “proliferation of golf-courses, lawns, landscaping, sprinklers, and water running down the street in Bend, either the management of this resource is poorly organized or it is misguided.” Furthermore, it irritates some participants that while they use a watering system that minimizes evaporation, the golf-courses use huge sprinklers; 38 of 76 participants (50%) use underground sprinklers that are more efficient than above ground wheel-line or pivot sprinklers. A few participants also express concern that irrigation districts are using water wastefully. In particular, one interview participant expresses frustration about the wastefulness of the central Oregon irrigation district (COID): “The GMP doesn’t seem to have a lot of hold on COID – they are doing what they feel like.” Another interview participant questions: “COID is just dumping lots of water and won’t let people use it – why? Should utilize what is available (surface water) before going to groundwater – yet this is happening.”

Many participants believe that conservation is a critical issue and think it’s important to control water uses. Despite the ongoing development that is occurring under the GMP some participants perceive that the GMP addresses conservation by offsetting negative effects of groundwater pumping. Furthermore, some participants realize that since they are living in the desert and that water resources are limited, it is not automatic to be able to have a green

pasture: “it is our own benefit to be able to green-up our properties.” For instance, an interview participant says: “it’s smart for all of us to consider how much water we want and need. I don’t need water but like it!” A different interview participant notes that the GMP “sounds like a socially responsible way to proceed [based on information obtained by reading newspapers]” but it is “exponentially getting more difficult because the capacity is finite.” Another interview participant says that he feels comfortable with the GMP because there’s no immediate danger of depleting the aquifers and streams. However, he continues, if things change and there are negative effects on the environment then Central Oregon would have to change its water practices. While some think that the GMP is an attempt to achieve environmental conservation, returning water to the river, there is concern about the objective behind protecting instream flow: “To what degree is the DRC restoring streamflow for recreation or for fish? Basing opinions for nature not for people?”

Economic Efficiency

As noted during the literature review of conjunctive management and market-based approaches, in order for new programs to be acceptable there must be monetary or water supply benefits for the water users (in this case, the program participants). The benefits that participants gain from the GMP should outweigh the costs, that is, the program should be economically efficient for participants. Since many of the costs and benefits, also expressed here as obstacles and incentives, cannot be measured in monetary terms, the monetary and non-monetary values are discussed separately. The monetary-valued costs and benefits expressed by participants are summarized in Table 12. While most interview participants emphasize the obstacles and costs of the program during interviews, they also describe an almost equal number of program benefits.

Table 12: Monetary Values of Benefits and Costs of GMP versus Alternatives

Benefits	Costs
Less cost - groundwater is cheaper than municipal water	Mitigation credits and the whole process is too expensive
Provides water for business; ability to sell water	Huge monetary commitment with no real result
Ability to have livestock and grow hay	Only costs with no benefits or incentives
Self-sufficiency; more control over water and costs; no longer have to pay monthly bill to irrigation district	Did not increase property value
Attaches value to land – permanent groundwater tied to property	“Forced” to hire a consultant
Allows for development	Prospect of losing money

For many participants, the monetary costs that the program incurs is a major impediment as these costs are significant to them; 53 of 66 participants (80%) say costs are significant (see Figure 19). Some participants say that the program creates a market-based pricing mechanism for mitigation credits that makes costs nearly out of our reach for some. Others also note that costs will increase as more golf-courses, resorts, and homes consume available water, making it still less affordable for the small water users. According to some participants, only the rich can afford this program.

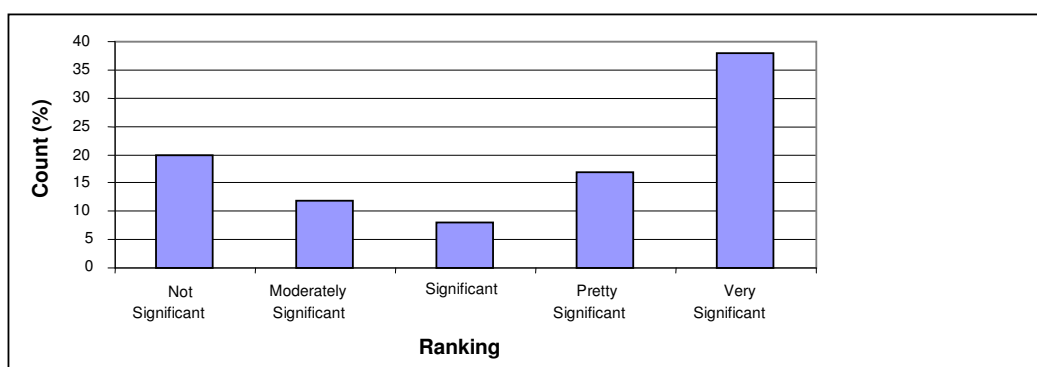


Figure 19: Significance of Cost in Obtaining a Groundwater Permit (n = 66)

As participation in the GMP is a lifestyle, not a livelihood choice for the majority of participants, many see no economic benefits to partaking in the program. Costs are reported as being significant by both those participants who say that the GMP is *not vital* to their livelihood (i.e. lifestyle participants) and to those participants who say the GMP is *vital* to

their livelihood (i.e. livelihood participants): 74% (28 of 38) lifestyle participants say the costs are significant and 60% (12 of 20) livelihood participants say costs are significant. However, a higher percentage of livelihood participants report that costs are very high: 45% (9 of 20) livelihood participants report that the costs are very significant and 34% (12 of 38) lifestyle participants report the same. Therefore, the costs are *very* significant to more livelihood than lifestyle participants.

The costs are viewed as more of a burden by several participants who perceive that the costs are large relative to the outcome. For instance, an interview participant says that the “outcome hasn’t paid-off like I thought it would; I hoped it would increase property value, but it hasn’t.” Others are frustrated with the lack of benefits as they have been paying for temporary credits without being able to irrigate because no permit has been issued. Furthermore, data from participants who withdrew from the program indicate that many withdrew because the costs were too high, making the program economically unviable. For large water users like resorts, the pumping costs rather than the mitigation credit costs pose the greater monetary burden; in comparison to the large pumping costs to pump at a high rate, the mitigation credit costs are almost negligible to these participants.

Some participants do not perceive the costs of the GMP as excessive. For instance, one interview participant reflects that upfront the costs seem huge but in the long-term there should be property benefits. For example, an interview participant says: “I ended up making money off of the GMP, because I sold a property with a permit on it – made the land more valuable.” For others the costs are less of a concern because they think it’s worth paying for the lifestyle they want or they believe that it’s important to pay for conservation. For instance, a wealthy interview participant reflects that if the GMP is trying to conserve water and that this comes at a cost then it is reasonable to have to pay.

Willingness to Pay

Participants express varying attitudes about the amount they are willing to pay in order to pump groundwater. Several participants say they will pay what they have to in order to obtain groundwater, even if they are stretched financially. For instance, an interview participant who is a consultant says that his clients have no choice so they would pay whatever is needed in

order to get mitigation credits. A different interview participant reflects that his willingness to pay depends on what lifestyle he would be seeking. While some say that \$2,500 an acre is too expensive, others say the same price is a good deal (see Table 13 for a sample of what participants are willing to pay).

Table 13: Participants' Willingness to Pay (n=13)

Amount	Type of Participant Willing	Type of Participant Not Willing
\$1,800 per acre or less	Small store owner	
\$2,222 per acre	Thrift store owner; nonprofit housing owner	
\$2,500 per acre	Homeowner association; school district; retired	Small store owner, computer industry
\$3-5,000 per acre	School district; real-estate agents (3), investor ("green developer"); resort; commercial shipping	Accountant; insurance agent; construction; retired

Temporary versus Permanent Mitigation Credits

Several participants note that since temporary credits are cheaper there is more incentive to buy them than permanent credits. For some who are not intending to stay in the basin for a long time, temporary credits are preferable because of the flexibility they offer. Several temporary credit holders express concern about the rising costs of temporary credits. For instance, an interview participant remarks that the credits are barely viable and that "if the price is increased twice as much then I will dump these credits." The rising cost of temporary credits is causing some participants to consider using water illegally, drying up their land or purchasing permanent credits. In fact, despite the higher cost of permanent credits, more participants have permanent than temporary credits. Of 61 participants, 24 (39%) have permanent, 18 (30%) have temporary credits, 6 (10%) have both, 9 (15%) have none, and 4 (7%) say mitigation credits are not applicable yet or they are not sure what they have.

Many participants see benefits in permanent credits because they can retire their mitigation obligation for the life of the permit and permanent credits also provide more certainty than temporary credits. For instance, an interview participant explains that "permanent credits are a lot more consequential." Yet participants comment on several limiting factors in obtaining

permanent credits. The two dominant limiting factors are the lack of availability and the cost. As it is difficult to obtain permanent credits, many participants say that they've placed their names on a waiting list for permanent credits. A few participants note that the open market is very expensive for permanent credits but that there are more affordable ways to acquire these credits (i.e. through the DRC). For example, one interview participant says that "the DRC provided affordable credits- that there are substantial savings to go through the DRC than to go through the open market." The lengthy process of obtaining permanent credits and lack of information are also stated as obstacles in obtaining permanent credits.

Non-Monetary Cost & Benefits

When considering the costs and benefits associated with values that do not necessarily have a monetary value, the list of costs is as long as the list of benefits (see Table 14). However, as noted previously, most participants stress their frustrations about various aspects of the GMP rather than applaud the benefits; only two participants say that there are no obstacles in the GMP process. The bureaucratic application process and time are the primary obstacles listed, as discussed in previous sections. For many, the inefficient, lengthy, and frustrating process is a major cost. For example, an interview participant comments on the cost "of mental anguish, the years of time taken off my life" that the GMP incurred.

Table 14: Non-Monetary Values of Benefits and Costs of GMP

Benefits	Costs
Source of new, high quality, year-round water supply	Inefficiency: OWRD huge bureaucracy; understaffed & too busy
Compliance: being a good citizen; legal protection; appease neighbors; do fair share for the environment	Lengthy: Time-delay to get a permit
Restricts over-use of groundwater	Process: frustrating/scary; not straightforward; mountainous and jargon-filled paperwork
Enhances quality of life/lifestyle; ability to utilize land freely; beautify property; green space; keep things growing; maintains ranching history	Uncertainty: of outcome and of cap; unavailability of credits
Provides multiple ways to obtain "new" sources of water	Information: difficult to obtain; lack of knowledge & public understanding
Fire safety/break; dust abatement	Rigidity: difficult to work through the system; road-blocks; nothing but obstacles

Benefits of the GMP versus Alternatives

A major benefit of the GMP noted by participants is that it provides a means to use groundwater in a way that restricts rampant over-use by large developments. Another benefit that participants note is that there are multiple means to obtain new rights to water. For instance, it is noted that surface water transfers are but one option that can be used under the GMP to create mitigation water. In contrast, under the alternative situation of a moratorium on groundwater pumping, surface water transfers would be the only means available to obtain water. Participants note that transfers are difficult as they are very expensive and tedious. Hence one interview participant comments that “compared to the alternative [surface water transfers] it [the GMP] is excellent.” However, while many participants say that a surface water transfer is more expensive and complicated than groundwater a few remark that surface water is cheaper and easier than groundwater. Furthermore, the GMP is preferable to many participants because groundwater is often their only means to obtain a new source of water: 70% (51 of 73) participants say that they had no alternative but to use groundwater and apply for a groundwater permit.

Adaptability

As discussed in Chapter 2, in order for a program to be acceptable and meet diverging needs for water it must be flexible to adopt new solutions. Through adaptive management as well as the involvement of the water users and stakeholders, new programs can address uncertainties and risks so that participants will have confidence in the program and will be more willing to comply. The results show that many participants feel that the GMP involves many uncertainties. The three major uncertainties noted by participants are:

1. the existence of the program itself (as it may sunset);
2. the need and outcome of mitigating; and
3. the hydrogeologic reasons underlying the program.

For some participants the uncertainties are burdensome and affect how acceptable the GMP is to them. Many participants also feel that there is ambiguity as to why they need to mitigate. A general sentiment holds that “if we don’t need to mitigate then it’s a total waste to have the GMP.” Some participants say that the uncertainty involved with the GMP could reduce

compliance. For instance, an interview participant questions: “Why bother to partake in a program if it could go away?” Another interview participant says that the “uncertainty of the program impacts how I want to put money into it.” The uncertainty of the cap is addressed as a major issue by consultants representing development interests. Since the cap has been reached in applications and applications are only processed if they were filed prior to the cap, consultants perceive the cap as an impediment because it prohibits them from being able to tell their clients that their water right will definitely be issued.

A few participants emphasize that in order for the program to be more acceptable, the certainty of the outcomes should be increased. However, others say they are not influenced by the uncertainty because they trust the program and they are already invested anyways. Furthermore, some participants believe that the GMP is adapting to the shifting values in the Deschutes Basin. In addition, several participants are simply not aware of the uncertainty of the program. One such participant says that “if I had known [about the uncertainty], I would have pondered more [about obtaining a permit].”

While many participants first respond that they do not know why they are required to mitigate, many give reasons for mitigation but say they are “guessing” or “assuming” (a summary of participants’ reasons are given in Table 15). Many participants realize that there is some connection between mitigation credits and offsetting groundwater pumping effects on surface water.

Table 15: Summary of Participants' Perceived Reasons for Mitigation (listed by criteria) (n = 70)

Criteria	Reason
<i>Economic Efficiency</i>	<ul style="list-style-type: none"> • Means for state to make money (6) • Means for consultants/lawyers/engineers to make money • Allows growth
<i>Equity</i>	<ul style="list-style-type: none"> • All available water is put up for bid to the highest bidder
<i>Accountability</i>	<ul style="list-style-type: none"> • State law (3) • Provides an accounting process • Permit requires mitigation • State trying to control - means for state to track water-use • Endangered Species Act – not enough water for fish habitat • Increases compliance
<i>Adaptability</i>	None
<i>Usability</i>	None
<i>Perceived environmental & social sustainability</i>	<ul style="list-style-type: none"> • Offset impacts/improve/restore instream flows (14) • Conservation of available water (11) • Wildlife habitat (9) • Groundwater is a finite resource (6) • Protection of groundwater; avoid waste (3) • Hydrologic connectivity (2) • Offset consumptive use (2) • Keep things in balance • Slow-down water use • Promotion of sustainable living • Need to replace water • Mechanism to offset impact on basin • Improve water temperature
<i>Collaboration</i>	None
<i>Public Outreach</i>	<ul style="list-style-type: none"> • No idea and don't understand (12)

In contrast to the above data indicating that many participants believe that there is a connection between mitigation and offsetting impacts on instream flows, others cannot take the program seriously because they find it incongruous to replace (through mitigation) the water they pump when it goes back in the ground anyways. Also, they see no reason why they should mitigate for their pumping if their wells are at a great distance from the river and pumping could not possibly impact streamflow. A major reason for such skepticism of the GMP lies in the uncertainty of the hydrology underlying the basis for the program. Some participants view the USGS study as uncertain and say that things were “muddled with the USGS study.” Others question the hydrologic connectivity of surface and groundwater as they are not convinced about the science. Furthermore, the more educated participants argue that since groundwater use in the Deschutes Basin is one-tenth of one percent of the annual groundwater recharge, which is immeasurable, there is little need for the GMP. In addition,

another participant notes that the necessity for the GMP is weakened because the water table is strong.

Despite all the uncertainty, some participants have trust in the program and feel that it is adapting to the needs in the basin. They believe that the GMP provides flexibility, particularly with temporary credits that are non-binding. For example, an interview participant representing a basin city believes that despite the difficulty of the process and all the uncertainty, the basin has probably ended up better with the program in place.

Collaboration

In order for a program to manage water resources in a non-conflictive and acceptable manner, collaborative processes are vital. The results indicate that the majority of participants are unaware of increased collaboration in the basin due to the GMP. However, some participants note that while the GMP has increased collaboration among various water users, it has also increased contention between users. For example, one participant notes, the GMP is a double-edged sword: “It creates more antagonism but also created awareness.”

A few participants perceive the GMP as being good for collaboration in the basin – particularly among diverse water users. For instance, an interview participant says that the GMP is a way to get water without fighting with neighbors. Others, however, say that the program has done the reverse because “usually people are turned in by neighbors, [and therefore] the GMP is promoting the opposite of collaboration.” These participants say that the GMP has pitted neighbors against each other because some people are not mitigating. Several participants note that collaboration seems to be impeded due to a lack of trust between neighbors, OWRD, DRC, and consultants. For example, one interview participant states that he doesn’t discuss the GMP with his neighbors because it is a volatile issue. Furthermore, many participants do not trust OWRD and consultants, which can be exemplified by a survey participant’s statement that the staff at OWRD lied to him and consultants gave him faulty information. In addition, another interview participant says that he’s not sure what the DRC’s agenda is and therefore doesn’t trust the organization.

However, the few participants who say that the GMP is promoting collaboration note that different kinds of water users are working together as a result of the GMP. Collaboration between irrigation districts and cities is noted as being particularly strong. A participant working for a resort says that the GMP “brought people to the table – collectively trying to improve flows; improve habitat.” Another participant notes that there is “a lot of cooperative effort: Ten years ago there was not cooperation – farmer-irrigation district mentality – don’t take our water rights. Today, we have a society-beneficial type of mentality; with the Land Trust, the DRC etc.” A participant representing developers in the basin says that “since the GMP, irrigation districts are more educated and cooperative.” Yet some participants reflect that such collaborative efforts cannot be attributed to the GMP because they say that people were trying to get along prior to the program. For instance, a participant representing a quasi-municipality says that “we all try to get along anyway.”

Some participants also reflect that through the GMP, a collaborative process is occurring at the local level and that trust is increasing between water users. For example, an interview participant involved in the GMP since its inception notes that the program is the result of local collaborative efforts “we agreed to work together; can actually make it work.” Another participant representing a basin city says that “we’re building a program because we need each other – because of urbanization of farmland – water is no longer being used for irrigation – there’s a mutual interest.”

Summary

This chapter presented the results from the participant interviews and surveys. The data were organized by the evaluative criteria in order of how pertinent the criteria are to the acceptability of the program. First the usability of the GMP was described as being low because the permitting process is frustrating to many participants. Next information dissemination was depicted as being inadequate. Then equity, accountability, utility, and environmental sustainability were discussed as presenting major concerns to participants; although most participants say that the utility of the GMP for meeting their need for water is high. Finally data pertaining to economic efficiency, adaptability, and collaboration were presented; yet these data are not as strong indicators of the acceptability of the GMP to program participants as the previous criteria and data.

The next chapter discusses the results by addressing each evaluative criterion, testing each hypothesis, and answering the main research question. The findings are discussed in relation to the literature on collaborative approaches, public involvement, environmental sustainability, market-based approaches to water management, and water law.

CHAPTER 6: DISCUSSION

This chapter analyzes the results through the evaluative criteria and tests the hypotheses set forth by this research. The discussion follows the order in which the hypotheses were presented in Chapter 1. After the analysis of each hypothesis and evaluative criterion, the central research question about the acceptability of the GMP to its participants is addressed by using the nine criteria to evaluate acceptability.

Throughout the discussion, the GMP is compared to the two proposed alternative institutional arrangements. In comparing the GMP to these hypothetical arrangements – 1) a moratorium on all new groundwater pumping, and 2) no rules for limiting groundwater appropriations – it must be recognized that both alternatives are extreme cases that impose large costs on some, although not all, participants. The discussion also incorporates the literature and background information about the social context of the Deschutes Basin, collaborative approaches, public involvement, environmental sustainability, market-based approaches to water management, and water law as reviewed in Chapters 2 and 4.

Economic Efficiency

Net Benefits

To address the economic criterion the first and second hypotheses are discussed. The first hypothesis posits that the GMP is perceived by participants as offering higher net benefits than the proposed alternatives. To assess the net benefits of the GMP, participants' perceptions of the benefits and costs under the GMP are compared against the two proposed alternatives (see table 16).

Table 16: Benefits and Costs to Participants

Benefits	GMP	Moratorium	Pre-1995
Cost Savings <i>Financial</i> <i>*financial has monetary consequence</i>	<ul style="list-style-type: none"> Reduction in costs (groundwater is cheaper than surface water, according to some participants) 	<ul style="list-style-type: none"> No costs (but not able to use more than the exempt use) 	<ul style="list-style-type: none"> Minimal costs (largest savings because can simply pump; would still need a permit but no mitigation credits)
Direct Benefits <i>Financial & Economic</i> <i>*economic has monetary and non-monetary impact</i>	<ul style="list-style-type: none"> New and clean water Attaches value to land Aesthetic value Self-sufficiency Ability to develop Livestock value Ranch history Enriches lifestyle Legal protection 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Same as under GMP, except no legal protection
Other Benefits <i>Social</i> <i>*social relates to values</i>	<ul style="list-style-type: none"> Ethically correct Environmentally responsible 	<ul style="list-style-type: none"> Restricts development (perceived as positive by some) 	<ul style="list-style-type: none"> Unrestricted use of groundwater (freedom)
Opportunity Costs <i>Financial</i>	<ul style="list-style-type: none"> Mitigation credits Monetary commitment with no real result or prospect of losing money 	<ul style="list-style-type: none"> Inability to get new groundwater permit 	<ul style="list-style-type: none"> Potential drawdown of aquifer and inability to get a sufficient yield
Transaction Costs <i>Financial, Economic & Social</i>	<ul style="list-style-type: none"> Bureaucratic process/road-blocks Hiring consultants Time (long process) Frustration Uncertainty Unavailability of mitigation credits Lack of knowledge & information about GMP 	<ul style="list-style-type: none"> Limits alternatives for new sources of water; more difficult to obtain new groundwater rights Potential lack of compliance 	<ul style="list-style-type: none"> Potential over-pumping by wealthier water users Uncertainty
Direct Costs <i>Financial</i>	<ul style="list-style-type: none"> Well construction costs Pumping costs 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Same as under GMP
External Impacts <i>Financial & Economic</i>	<ul style="list-style-type: none"> Offsetting impacts on instream flows Allowing for development while placing a cap on the total consumptive use 	<ul style="list-style-type: none"> Potentially no new impacts on instream flow Restricting development 	<ul style="list-style-type: none"> Potential of depletion of aquifer; impact on instream flow Uncontrolled development

Looking at the benefits it is apparent that the pre-1995 alternative creates the largest savings and also offers most of the benefits provided by the GMP. Furthermore, this alternative enables the unrestricted use of groundwater; while there would be no mitigation process, water users would still need to get a groundwater permit. However, the external impacts of unlimited pumping may have long-term negative effects on participants as well as on the environment that may lead to less availability of groundwater to all water users in the basin. Furthermore, if aquifer drawdown occurs and the resources are over-exploited, the state may implement more rigid regulations than those under the GMP. Therefore, given the previous argument as well as the fact that participants express concern about negative environmental impacts, this alternative may be less feasible to participants than the GMP.

In a sense, a moratorium may be preferable to the GMP because it involves neither a process nor monetary costs. However, for those who use groundwater for commercial purposes a moratorium could incur costs as their source of income could be jeopardized. Furthermore, the moratorium also provides no benefits to water users' needs for groundwater. The two major benefits under a moratorium would be the potential outcome of no new impacts on instream flow and uniform restriction on all water users. Since restricting development is perceived as positive by many participants and they are concerned about inequitable use by large developments, the latter two aspects may be viewed as major benefits by some participants.

Yet the restrictions of a moratorium may incur more costs for participants than the benefits can outweigh. For instance, the results show that most participants are using groundwater because they have no alternative. Therefore, the restriction of not being able to obtain a groundwater permit may mean no new water rights and many participants may be without water. However, the results also show that more participants did not seek alternative sources to groundwater than those who did. Hence, in the case of a moratorium, participants might be forced to seek alternatives and they may find that surface water transfers are possible or not as difficult as they expected. Yet those participants who have attempted to undertake surface water transfers say that the transaction costs of such transfers are very high and that obtaining mitigation credits through a water bank incurs less costs than conducting a transfer. Thus the GMP may be favorable because it enables the use of groundwater, which may be cheaper.

Table 16 above shows that the GMP has more costs involved than both of the proposed alternatives. The trade-off between the costs incurred by the GMP, particularly the transaction costs and the benefits it provides, begs the question of whether the time and frustration (that most participants noted) are offset by the benefits. Several participants state that if they had known what they were getting into they may not have participated in the GMP. Many participants note that the transaction costs of tracking an application, being able to contact OWRD, knowing and being able to get mitigation, and the time involved with the entire process are major impediments. Furthermore, many participants complain about the high costs of the program; 80% (53 of 66) participants say costs are significant to them. However, when asked if the GMP is meeting their needs for groundwater 77% (48 out of 62) participants say that it is meeting their needs. In addition, the program provides a balance in terms of restricting pumping as the GMP places more restrictions on development than the pre-1995 alternative (through the cap) but is not as drastic as a moratorium. As many participants are concerned about over-pumping, and some see the need for economic growth, the GMP provides a middle-ground between the two alternatives.

Therefore, if the GMP is meeting many participants' needs for groundwater as well as the simple fact that participants are using and staying with the program, it may be concluded that the benefits of the GMP outweigh the costs. Furthermore, the hypothesis that the GMP offers more net benefits in comparison to the alternatives is supported because the GMP creates a balance that allows for groundwater pumping, which a moratorium would prohibit, while incurring less negative external impacts than the pre-1995 alternative (due to the GMP's restrictions on over-use).

Ability to Pay

The second hypothesis also relates to the economic efficiency criterion as it addresses how participants' ability to pay for the GMP influences their acceptance of the program. The hypothesis posits that the GMP is perceived as being more acceptable to those who can more easily afford to pay for it than those who cannot afford the program as readily.

Participants' ability to pay for the GMP can be determined (in part) by their income as well as their need and value of groundwater. Since the data help confirm that the majority of GMP

users are retired and hobby farmers who use groundwater for personal consumption, groundwater is not vital to most participants' livelihood. As those participants for whom groundwater *is vital* to their livelihood tend to be less wealthy than those for whom it is not, the livelihood participants may be distinguished as being less able to afford the GMP than the lifestyle participants. Furthermore, if acceptability can be determined by how significant the costs are to participants, then the program may be less acceptable to livelihood participants (who are less wealthy). While the costs are noted as significant to both the livelihood and lifestyle participants, a higher percentage of livelihood participants say the costs are *very* significant. Hence, if acceptability can be assessed based on participants' perception of the significance of the costs the program incurs then the hypothesis that the GMP is more acceptable to those who can afford to pay (i.e. the lifestyle participants) than those who cannot (i.e. the livelihood participants) holds true.

When assessing acceptability based on participants' satisfaction regarding how the program is meeting their needs, there does not seem to be a correlation between the ability to pay (i.e. the wealthier lifestyle participants versus the less wealthy livelihood participants) and how acceptable they find the program. This is based on data indicating that participants' income level does not correlate with their rating of how the program is meeting their needs for groundwater. Table 17 below shows that those participants with a lower income tend to be more satisfied with how the GMP is meeting their needs than participants with a higher income.³⁶ Therefore, if one component of acceptability is satisfaction with the program, the hypothesis that the GMP is more acceptable to the wealthier participants is not necessarily tenable. However, as shown in the demographic data, it is evident that the population of program participants is already wealthier than the general population in the region. In fact, \$75,000 is considered to be on the lower side of the household income for program participants (the median is approximated around \$100,000) yet this is well above the median income of Deschutes County (\$45,894). The latter issue must be taken into account throughout this section.

³⁶ It should also be noted that while the one participant with the lowest income (0-\$25,000) reported that the GMP is not meeting his needs, four participants with the second lowest income (\$25,000-\$50,000) said that the GMP is excellent in meeting their needs for groundwater.

Table 17: Average Response of Participants' Needs Being Met by the GMP

Income	Average Response*	Description of Response	n
Lower Income (\$0-75,000)	3.8	Good – Very Good	13
Middle Income (\$75,000-100,000)	4	Very Good	6
Upper Income (\$100,000-250,000+)	3	Good	30

* Scale: 1=Poor, 2=Fair, 3=Good, 4=Very Good, 5=Excellent

If a program can be regarded as more acceptable when the agency administering it is viewed as providing good assistance then the hypothesis stating that the GMP is more acceptable to those with a higher income (and a greater ability to pay) is discredited by the data; Tables 18 and 19 show that those participants with lower income are just as satisfied if not more satisfied as other income groups with the assistance rendered by OWRD Salem and Bend.

Table 18: Average Response of Participants' Rating of OWRD Salem

Income	Average Response*	Description of Response	n
Lower Income (\$0-75,000)	2.8	(Fair) – Good	10
Middle Income (\$75,000-100,000)	2.9	(Fair) – Good	10
Upper Income (\$100,000-250,000+)	2.5	Fair – (Good)	17

* Scale: 1=Poor, 2=Fair, 3=Good, 4=Very Good, 5=Excellent

Table 19: Average Response of Participants' Rating of OWRD Bend

Income	Average Response*	Description of Response	n
Lower Income (\$0-75,000)	3.6	Good – Very Good	8
Middle Income (\$75,000-100,000)	3.1	Good	13
Upper Income (\$100,000-250,000+)	2.5	Fair – (Good)	10

* Scale: 1=Poor, 2=Fair, 3=Good, 4=Very Good, 5=Excellent

If feeling informed about the GMP process can be equated to a higher level of acceptance of the GMP then the hypothesis that the program is more acceptable to wealthier participants is not supported. The results indicate that there is no correlation between income level and participants' perception of being informed about the time-frame of the permitting process. Participants of all income levels feel uninformed about the length of the process (see Table 20). In fact, participants in the upper income range feel slightly less well informed than those of the middle and lower income range.

Table 20: Participants' Perception of Being Informed about Time-Frame

Income	Yes (%)	No (%)	n
Lower Income (\$0-75,000)	31	69	13
Middle Income (\$75,000-100,000)	38	62	8
Upper Income (\$100,000-250,000+)	29	71	21

With respect to the above discussion of the significance of costs and satisfaction with the GMP, the hypothesis that the GMP is more acceptable to those who are wealthier and can more easily afford the costs of the program than those who cannot fails to always hold true. While in the case of the significance of costs, the hypothesis may be upheld, in assessing acceptability with regards to participants' satisfaction of the GMP meeting their needs, OWRD's assistance, and feeling informed about the time-frame, the hypothesis fails. Therefore, it may be concluded that the program is not necessarily more acceptable to those who can more easily afford to pay than those who cannot afford the program as readily.

Adaptability

The adaptability criterion is used to assess the third hypothesis, which states that participants view the GMP as being more flexible than the proposed alternatives. The hypothesis is tested by comparing the adaptability of the GMP with the projected flexibility of a moratorium and the pre-1995 arrangement.

The pre-1995 condition may initially provide flexibility in allowing participants to meet their groundwater needs, as groundwater use would be unrestricted. However, the resources may become depleted, which would potentially lead to inadequate water supplies as well as disputes between water users. If groundwater resources become depleted, or if instream flows decline due to excessive pumping, the environment and legal system will most likely become inflexible to new demands for water. In contrast, a moratorium would prohibit all new groundwater uses beyond the exempt use and would therefore offer participants no flexibility in finding new sources of groundwater. Furthermore, as most participants say that they have no alternative but to pump groundwater, a moratorium may greatly restrict their lifestyle or livelihood. They would have to search for alternative sources (such as a surface water transfer), change their lifestyle or livelihood, or move to another place where they could have access to the water that they want or need.

While many participants perceive the GMP as being the most flexible to the needs of developers, the GMP restricts rampant development, as is noted by the consultants who participated in this research. In particular, the cap creates rigidity that participants in the development industry dislike. The average participant is less concerned about the cap and more concerned about the unyielding and frustrating process. However, as some of the participants filed their application after the 200 cfs cap was already reached in applications, these participants may become more concerned about the cap if they realize that their pending application may not be issued. Their lack of awareness can be seen as another indicator of the lack of information dissemination about the GMP.

Although participants criticize that aspects of the GMP are too rigid, the program may be more flexible than both alternative situations in the long-run. In so far as the GMP allows for the creation of “new” water rights through trading and transferring, it is flexible in meeting the participants’ needs as well as catering to the state and federal requirements to protect instream flows by offsetting pumping impacts and placing restraints on development.

The credibility of the GMP is weakened due to the finding that many participants express uncertainty regarding the existence of the program itself because it may sunset, as well as the vagueness regarding the need and outcome of mitigating, and the hydrogeologic reasons for the program. However, the GMP can adapt to such concerns by educating participants about the program, the outcome of mitigating, and the hydrogeologic reasons as well as addressing the issue of the cap. Since OWRD employs an adaptive management approach by assessing the program every year as well as conducting five-year evaluations (OWRD 2008) it may be possible for the GMP to adapt to the needs of participants as well as the state and federal mandates that protect instream flows; the Water Resources Commission has the ability to increase or lift the cap. In fact, several participants acknowledge that the GMP is adapting to the shifting needs in the basin.

Since the literature notes that institutions guide behavior and “create order and relative certainty for water users” (Livingston 1998: 19), as a water management institution the GMP may provide more certainty than the two alternatives. The pre-1995 alternative would provide

no management institution or regulation and a moratorium would entail regulation but not necessarily a water management program. Furthermore, as key experts note, the Alliance and the ensuing work group are locally motivated groups looking at the future of the program – finding ways to adapt and improve the GMP – hence, the program appears to be adaptable. Finally, as participants continue to partake in the GMP and most say that the uncertainty did not affect their decision to participate, it may be concluded that the GMP is more flexible than the proposed alternatives. Therefore, the data and discussion indicate that the hypothesis stating that the GMP is more flexible than a potential moratorium or a pre-1995 institutional arrangement is supported.

Equity

The equity criterion is discussed with respect to hypothesis four, which states that participants perceive the GMP as being more equitable than the proposed alternatives. The hypothesis is addressed by assessing participants' perceptions of equity under the GMP and comparing this to the moratorium and the pre-1995 arrangement. First it should be noted that many participants seem to place emphasis on equality rather than on efficiency.

Similar to the literature that says that equity and socio-cultural values tend to be neglected under water markets (Ingram and Oggins 1991), participants criticize that various aspects of the GMP are inequitable. These participants express a general sentiment that big water users, especially golf-courses and resorts, are favored by OWRD while the small water users are neglected. Several participants say that the small water users have to wait for a long period of time in order to pump at a minimal rate while the developers are quickly allowed to use large amounts of water. This indicates that participants perceive that OWRD does not adequately ensure fairness. Furthermore, some participants believe that OWRD is purposely making the GMP complex in order to wear people out or scare them away from pursuing a permit, which they view as an unfair way of proceeding.

While participants perceive that the GMP favors economic growth and development in Oregon, the program provides more restrictions on pumping than the 1995-arrangement. The pre-1995 institutional arrangement would allow a free-for-all in terms of groundwater pumping that may lead to major equity concerns as the wealthy, who can afford to pump more

(in terms of pumping costs) may use more groundwater and hence less groundwater may be available to others due to aquifer drawdown. Therefore the latter arrangement may be perceived as less equitable to participants than the current GMP because it would enable unrestricted groundwater use by developers. However, the GMP places fewer restrictions on pumping than a moratorium would because a moratorium would place a restraint on everyone's pumping – including developers; therefore, this may be viewed as a more equitable solution to many participants than the current program (as noted previously).

Based on the results and the above discussion, the hypothesis that the GMP is more equitable than proposed alternatives fails in the case of the moratorium as this alternative may be seen as more equitable because the restriction would be uniform. Yet under the pre-1995 arrangement the hypothesis that the GMP is more equitable than this alternative is supported because the GMP provides restrictions on pumping that the latter alternative would not.

Accountability

Accountability is addressed by discussing the fifth hypothesis, which posits that the GMP is perceived by participants as providing more accountability than the proposed alternatives. The hypothesis is tested by assessing participants' viewpoints of accountability and comparing these to the projected accountability under a moratorium and the pre-1995 arrangement.

As indicated in the literature, enforcement in the Deschutes Basin is reactive. Hence the results indicating that a majority of participants are concerned about the lack of accountability and enforcement by OWRD (because the agency is reactive) are aligned with the literature. Furthermore, many participants criticize that it takes too long for OWRD to get things done, and communication is viewed as often being unclear and illogical. Participants note that other entities in the basin, such as the DRC and consultants, are more accountable and helpful than OWRD, which is also aligned with the literature stating that non-governmental entities, such as nonprofits, can improve and help sustain state programs (King 2004).

There would most likely be less accountability under the pre-1995 alternative than the current GMP as it would be legal to pump groundwater regardless of the situation as long as water users had a permit. Furthermore, there would be neither a regulation nor a program in place.

Under the moratorium alternative, there may be some accountability established in order to enforce the moratorium. Yet since many participants perceive enforcement as already lacking and believe that illegal uses would increase under a moratorium, participants would most likely find accountability to be decreased under the pre-1995 arrangement as there wouldn't be a formalized program like under the GMP.

Despite participants' concerns about the lack of accountability under the GMP, as a state-run program the GMP requires more accountability than the pre-1995 arrangement. Furthermore, participants' perception that the GMP requires the assistance of consultants is aligned with the literature that indicates that most permit applicants hire professionals to assist with their application to obtain a water permit in an over-appropriated basin because the process is often convoluted and contentious (Colby 1990). While there would be no mitigation process under the pre-1995 arrangement, there would still be a permitting process during which water users may want or need extra assistance. It is difficult to say if a moratorium would increase accountability as it would be dependent on the legislation mandating the moratorium; however, given the tendency towards reactive enforcement in the basin, it seems unlikely that enforcement would be increased with a moratorium. Therefore, the fifth hypothesis is generally upheld as it may be concluded that participants would find that the GMP provides more accountability than the pre-1995 arrangement and that it most likely also offers equal if not more accountability than a hypothetical moratorium.

Environmental Sustainability

Participants' perception of the environmental sustainability of the GMP is discussed by testing hypothesis six, which states that the GMP is perceived by participants as offering more environmental sustainability than the proposed alternatives. This hypothesis is tested by assessing participants' perceptions of how environmentally sustainable the GMP is in comparison to the moratorium and pre-1995 arrangement.

As noted previously, many participants tend to place a lot of value on equity as well as conservation. Such participants exhibit concern about depleting water resources through wasteful and inefficient uses and stress the need for groundwater conservation for the future. Since the pre-1995 alternative may lead to rapid development by golf-courses and resorts, this

would be perceived as not environmentally sustainable by many participants as they express a strong sentiment against such rapid growth in the basin. Several participants are not sure whether the basin has the capacity for the new developments' high rate of water usage. Furthermore, such pumping could lead to major environmental detriments, which would also be opposed by many participants who believe that water usage should be modified and controlled in order to meet environmental as well as human needs. Without any regulations on such developments, participants would most likely find a pre-1995 situation less environmentally sustainable than the current GMP.

Since many participants are concerned about the large rates of pumping by golf-courses and developments, the moratorium alternative may be perceived as more environmentally sustainable than the GMP because it would place major restrictions on everyone's pumping, including the developments of golf-courses and resorts. Therefore, given the environmentally conscious viewpoint among many participants, such an alternative may be more acceptable than the current GMP that is perceived as allowing wasteful use by developments.

While some participants say that the GMP is doing a good job with offsetting impacts of pumping and view it as a socially responsible way of proceeding with water management in the Deschutes Basin, others say that the program is not doing enough to control development and find it environmentally unsustainable. Given participants' perspectives on the need to control development, the GMP may be viewed as a more environmentally sustainable way of managing water resources than the pre-1995 institutional arrangement because the GMP seeks to offset impacts of groundwater pumping impact – meeting the needs of the environment as well as the humans (some of whom want the water for consumptive uses and others who want the water instream). However, the GMP is not as restrictive as a moratorium would be; hence a moratorium could be perceived by participants as being more environmentally sustainable than the current GMP.

Following the concept of sustainable groundwater management discussed in Chapter 2, the GMP can be seen as more environmentally sustainable than the pre-1995 arrangement as it aims to conserve water usage through mitigation and it regulates pumping based on the physical characteristics of water (quality and quantity) as well as with respect to ecosystem

and social needs. Given the results and the above discussion, the hypothesis that the GMP offers more environmental sustainability is supported with respect to the pre-1995 arrangement. However, as the moratorium would provide more definite restrictions on development than the GMP, the hypothesis is not supported when compared to this alternative.

Utility

Utility of the program is assessed by testing the seventh hypothesis that states that the GMP is perceived by participants as offering more utility than proposed alternatives. The hypothesis is assessed by comparing participants' rating of the utility of the GMP to the potential utility under the moratorium and the pre-1995 institutional arrangement.

Under the pre-1995 institutional arrangement the utility for participants' personal needs as well as for economic growth and development may be high initially as all the needs for groundwater would be met. However, the resource could be depleted under this free-for-all, which may lead to insufficient groundwater in the future. Furthermore, the utility for instream flow and other environmental benefits may be viewed as less than under the GMP if an exorbitant amount of groundwater is used that creates aquifer drawdown and decreases the instream flow because there would be no mitigation water in exchange for the groundwater pumping.

Since a moratorium would restrict any groundwater pumping beyond the exempt well use and given the results that many participants say that groundwater is the only means for them to obtain "new" water rights, the moratorium situation would hinder participants from being able to fulfill their personal needs for groundwater. While surface water transfers would still be possible, this is noted as being more tedious and expensive than groundwater, or it is simply not possible for some participants to gain access to surface water. Therefore, the utility for meeting participants' personal needs for groundwater would be less under a moratorium than with the GMP.

Furthermore, economic growth would most likely also be restricted by a moratorium as developments would no longer have a means to legally pump large quantities of groundwater; it would become more difficult for golf-courses and resorts to find “new” sources of water. Yet many participants who view the latter entities’ water uses as wasteful would find this impediment useful and beneficial to the environment (i.e. instream flows) as well as to the small-scale water users. The utility for instream flows and other environmental benefits may be increased under a moratorium because less groundwater would be used and hence there would be less potential impact on instream flows. However, if more water users use surface water consumptively, rather than letting it flow instream (as is done under the GMP in order to offset groundwater use), there could be a potential decrease in instream flow (particularly in the Middle Deschutes River). In addition, as several participants say that they use groundwater to attract wildlife and to provide a benefit to the environment, some participants would perceive less utility in the moratorium than the GMP because there may be less verdant land for wildlife if water users are no longer able to water their properties (whether such environmental benefits are sustainable or useful to the flora and fauna of the region is questionable).

Despite the frustrations incurred by the permitting process as well as the equity and sustainability concerns under the current program, the majority of participants express that the GMP is meeting their needs for groundwater. In addition, since the data indicate that participants perceive the GMP’s utility for economic growth and development, personal needs, benefits to instream flows, and other environmental aspects all as “good” to “very good,” it is evident that participants perceive the GMP as useful. While many participants feel uncertain about the GMP’s utility for instream flows or see no utility for flows, some think it does benefit instream flows. Despite the fact that a few participants believe that the GMP is pointless and regard it as a joke, the fact that participants are still participating and finding positive personal utility in the program demonstrates that the program maintains a level of acceptability.

Given the results and the above discussion, the hypothesis that the GMP is perceived by participants as offering more utility than the proposed alternatives is supported because the current program:

- is more useful for meeting participants' personal needs than both alternatives over the long-term;
- enables more economic growth and development than the moratorium and with more limitations than the pre-1995 arrangement; and
- is more useful for instream flows than the pre-1995 arrangement and possibly the moratorium as it offsets groundwater pumping by mandating a certain quantity of surface water to flow instream or through another mitigation mechanism.

Collaboration

The criterion of collaboration is addressed by discussing and testing the eighth hypothesis, which posits that the GMP is perceived by participants as creating more collaboration within the water community in the Deschutes Basin as well as among participants than the proposed alternatives. The hypothesis is assessed by comparing participants' perceptions of the collaboration occurring under the GMP with the projected collaboration under the moratorium and the pre-1995 arrangement.

Under the pre-1995 institutional arrangement there would be no incentive to collaborate and therefore it would be unlikely that water users would work together at all. With a moratorium situation, where no new groundwater pumping would be allowed, the rapport among water users may become tense as neighbors monitor each other to ensure that no one is over-using their exempt use because this could have adverse effects on them (i.e. through aquifer drawdown). Therefore, a moratorium situation could lead to the opposite of collaboration as stringent legal regulation and ensuing illegal uses would most likely lead to conflict between water users; as state enforcement is reactive, neighbors would scrutinize each other's water uses. However, some water users may work together under a moratorium in order to find alternative sources of water (e.g. conduct surface water transfers).

Several participants say the GMP has done the opposite of promoting collaboration among program participants because it has pitted neighbors against each other due to the reactive enforcement system where illegal water uses are often reported by neighbors. In contrast, while many other participants say they are unaware of increased collaboration in the basin due to the GMP, some note that the GMP has brought different parties to the table, particularly

cities and irrigation districts. Furthermore, others see the GMP as a way to get water without fighting with their neighbors because it enables clearly defined water rights that are sanctioned with a permit. In addition, the GMP is noted as promoting a locally-based water management mechanism. By keeping local control, the GMP may create more collaboration among water users in the basin, as is noted in the literature.

Given the results and the above discussion, in comparison to the two hypothetical alternatives, the GMP may be creating more collaboration in the water community in the Deschutes Basin because it requires that water users work together or work through the program, despite the fact that it may pit some neighbors against one another. Hence, regardless of some non-collaborative effects of the GMP, the hypothesis that the GMP is perceived by participants as creating more collaboration than the proposed alternatives tends to be supported in the case of the pre-1995 situation and mostly in the case of a moratorium.

Information Dissemination

The information dissemination criterion is addressed by discussing the ninth hypothesis, which posits that the GMP is perceived by participants as offering a greater amount of information dissemination than proposed alternatives. The hypothesis is tested by comparing participants' perception of information dissemination under the GMP with potential information provision under the pre-1995 arrangement and the moratorium.

In the case of the pre-1995 arrangement, there would most likely be no information dissemination because there would be no regulation in place. The moratorium situation may lead to some information dissemination in order to inform water users about the restriction on pumping and potentially provide them with information about alternative means to obtain water. However, as noted in the literature, generally a water management program offers more information than simply implementing a moratorium. Therefore, a moratorium would most likely offer less information dissemination than the GMP because the moratorium would be a regulation and not a water management institution.

While participants say that some information dissemination and public outreach occurred at the GMP's inception, after the initial pulse of information, many participants note that

information dissemination has been lacking. Yet the literature indicates that a state-run program leads people to *expect* to obtain more information and public outreach because it is a *public* program; since the GMP is a public program, it is expected that more information is available under the GMP than under the two alternatives. Such expectations may lead to increased information dissemination. However, while some participants who took the effort and are computer savvy found some information about the GMP and the USGS study online through OWRD's website, the majority of participants feel insufficiently informed and strongly recommend having more proactive information dissemination about the GMP.

Based on the results and the above discussion, it may be concluded that despite the general lack of information dissemination noted by participants, more information dissemination could be expected with the GMP than with no institutional arrangement such as the pre-1995 scenario. Depending on the legislation of the moratorium situation, there may be public outreach in order to inform water users of the restriction; as less information dissemination is likely under a regulation than with a program, the GMP would most likely be perceived as having more information provision than a moratorium. Thus the hypothesis that the GMP is perceived by participants as offering a greater amount of information dissemination is upheld in the case of the pre-1995 arrangement and most likely also with the moratorium situation.

Assessment of Acceptability

Next the acceptability of the GMP is discussed by addressing the central research question that takes all the criteria into account in order to assess whether the GMP is more acceptable to its participants than the alternative management and regulatory options discussed in this research. The acceptability of the GMP, in comparison to the two alternatives, is addressed by summarizing the results and the above discussion as well as linking the discussion with the literature. Tables 21 and 22 summarize the acceptability of the GMP in comparison to the two alternatives based on the evaluative criteria. Following the tables, the criteria are discussed in order of their importance to the assessment of how acceptable the GMP is to its participants.

Table 21: Acceptability of a Moratorium versus the GMP

Moratorium more Acceptable	Moratorium less Acceptable
<ul style="list-style-type: none"> • Usability • Equity • Utility for instream flows • Environmental sustainability 	<ul style="list-style-type: none"> • Utility for personal needs, economic growth, and environmental benefits • Accountability • Information dissemination • Economic efficiency • Adaptability • Collaboration

Table 22: Acceptability of the Pre-1995 Arrangement versus the GMP

Pre-1995 more Acceptable	Pre-1995 less Acceptable
<ul style="list-style-type: none"> • Usability • Accountability • Utility for personal uses, economic growth, and environmental benefits <i>initially</i> • Economic efficiency <i>initially</i> • Adaptability <i>initially</i> 	<ul style="list-style-type: none"> • Utility for personal needs, for economic growth, and environmental benefits <i>long-term</i> • Utility for instream flows • Equity • Information dissemination • Environmental sustainability • Economic efficiency <i>long-term</i> • Adaptability <i>long-term</i> • Collaboration

Based on the *usability* criterion, the GMP is less acceptable than both alternatives because its process (permitting and mitigation) is most likely more frustrating than any process under the proposed arrangements; the moratorium would not involve a permitting process at all and the pre-1995 institutional arrangement would only involve a regular permitting process (without any mitigation considerations) (see Tables 21 and 22). While participants' frustrations about the bureaucratic slowness appear to be well founded as three years for permit processing is a long time, complaining about bureaucracies seems to be endemic in the U.S., as noted in Chapter 2. A dominant view in the U.S. holds that state-run agencies are inefficient (Winpenny 1995; Lee 1999) and many Americans express skepticism and frustration about government bureaucracies (Goodsell 2004; Lee 1999; Lunch 2001). The participants in the Deschutes Basin are not alone in their frustrations with a state-run program; a recent report about Washington's Department of Ecology (the state agency responsible for water management) says that a major complaint among water users is the agency's slowness (Lovrich and Siemann 2004). As noted previously, the current GMP is being implemented under OWRD's already thinly stretched staff and insufficient funds, which may restrict the number of staff available to work on the GMP process. However, the GMP is also a market-

based approach, which incorporates the DRC and consultants as entities that can provide assistance to the GMP participants. As many participants note that these latter entities made the usability of the GMP easier, this market-based aspect of the GMP may make the program more acceptable than a pure government-run program.

Based on the *information dissemination* criterion the GMP may be more acceptable than both a moratorium and the pre-1995 alternative to its participants because this research suggests that as a state-run program the GMP may offer more information and public outreach than the proposed alternatives (see Tables 21 and 22). While information dissemination is perceived as lacking under the GMP, it must be noted that inadequate information and public outreach about water resources management is endemic in the Deschutes Basin (BOR and OWRD 1997). Furthermore, the lack of information and awareness noted by participants in the Deschutes Basin is indicative of a larger trend in water resources management in the U.S. Experts say that there is a general lack of public awareness about groundwater, despite the increasing realization of the importance of groundwater management (Beck 1991; Luz 2000). Hence lacking information dissemination may be a concern regardless of the institutional arrangement in place.

Based on the *equity* criterion, the current program may be less acceptable than the moratorium situation (where restrictions would be uniform) because many participants perceive the GMP as inequitable (see Table 21). However, the GMP would be viewed as more equitable than the pre-1995 alternative because the current program does provide restrictions on pumping (see Table 22). Participants' concern with equity is aligned with the literature stating that equity is a major issue under market-based approaches (National Research Council 1992), where equity should be addressed by the state.

Based on the *accountability* criterion, the GMP may be more acceptable than a moratorium because as a state-run program it most likely provides more accountability than a regulation mandating a moratorium (see Table 21). While the GMP mandates more accountability than the pre-1995 arrangement, accountability would become less of an issue under this alternative (as participants could simply pump); therefore the pre-1995 arrangement may be more acceptable than the GMP based on the accountability criterion (see Table 22). Participants'

concern about the unaccountability of OWRD is aligned with the literature indicating that authorities managing water resources are often not responsive to the public (Beck 1991), which is due in part to under-staffing and under-funding (Winpenny 1995; Lee 1999) as well as the frequent fragmentation between different governing bodies with resulting miscommunication (Winpenny 1995). The latter points indicate that accountability may be an endemic issue in water management in the U.S. However, market advocates' argument that private organizations and nonprofits are instrumental to government agencies because they are more flexible, creative, and provide a resource base of people, infrastructure, and funding (King 2004) proves to be relevant in the case of the GMP as the program is strengthened by the work of the DRC and consultants who are seen as more accountable than OWRD by many participants.

Based on the *utility* criterion a moratorium would be less acceptable than the current GMP (see Table 21) because most participants say that the program is meeting their personal needs for groundwater, which would most likely not be met under a moratorium (many say that groundwater is their only option for a “new” water source and they would be prohibited from pumping more than the exempt use with a moratorium in place). While a moratorium may supply more utility for instream flows (particularly to the Lower Deschutes River) than the current program (which may provide more flow to the Middle Deschutes River through surface water mitigation but potentially less to the Lower Deschutes), the GMP provides a balance between a completely restrictive moratorium (which would provide little utility for personal needs and economic growth) and a pre-1995 free-for-all (which may lead to rampant development, depletion of water resources, and inadequate utility for personal and economic needs over the long-term); hence, overall, the current program is more acceptable than the proposed alternatives.

Based on the *environmental sustainability* criterion, the GMP may be perceived as less acceptable than the moratorium situation (see Table 21) because the moratorium would more definitively restrict economic growth and development than the GMP. However, the current program may be viewed as more acceptable to participants than the pre-1995 arrangement (see Table 22) because it does address the issue of environmental sustainability and seeks to mitigate impacts of pumping. Relaying this discussion back to the literature, it must be noted

that while historically groundwater laws enabled unrestricted pumping, since the 1970s emphasis has been placed on more restrictive and holistic groundwater management that includes not just the physical side of water management but also social and economic concerns (Beck 1991). The GMP follows this trend as it employs conjunctive management and addresses the socio-economic needs as well as the environmental. Despite data on water availability in the Deschutes Basin indicating that an extensive groundwater system in the Upper Deschutes Basin offers plentiful groundwater, many participants reflect a concern about the sustainability of groundwater use that is aligned with the literature – that widespread reliance on groundwater may lead to levels of unsustainable use (Beck 1991).

Based on the *economic efficiency* criterion the GMP may be more acceptable than a moratorium as the current program provides higher net benefits as it allows groundwater pumping, which a moratorium would prohibit (see Table 21). While the pre-1995 alternative may be perceived as more acceptable based on the economic efficiency criterion than the GMP initially, over the long-term it would be less acceptable because negative impacts on the environment may lead to the inability to obtain sufficient groundwater in order to maintain desired water uses. It must be noted that while a central tenet of the IAD framework is the criterion of economic efficiency, the findings in this research indicate that other criteria play a far greater role in influencing participants' perceptions of the GMP than economic efficiency;³⁷ usability, information dissemination, equity, accountability, utility, and environmental sustainability all take precedence over economic efficiency in terms of how the criteria affect participants' acceptance of the GMP.³⁸

Based on the *adaptability* criterion, the GMP may be more acceptable to participants than the two proposed alternatives due to its higher potential for adaptability than the other institutional arrangements. However, thus far, adaptability under the GMP has not played a major role in raising participants' acceptance of the program. As the GMP rules mandate that OWRD employ an adaptive management approach (OWRD 2008), the program may be able to adjust

³⁷ Since the GMP is predominantly a lifestyle rather than a livelihood choice for participants, economic efficiency is not an influential indicator of the acceptability of the GMP because most participants are not concerned about economic gains from the GMP.

³⁸ However, it must be acknowledged that the IAD framework does take fairness into account, which is shown as playing a major role in how participants perceive the program.

to participants' needs and concerns. Furthermore, the GMP initially involved a locally-based stakeholder group process and continues to evolve through self-governing initiatives like the Alliance, which should make the program adaptable to local needs.

Based on the *collaboration* criterion, the GMP is more acceptable than both alternatives because the current program has more capacity to promote collaboration than the two proposed alternatives; the GMP could serve as a convener for diverse water users to collaborate while the latter arrangements would lack the institutional capacity to bring water users together. However, to date, little collaboration is noted as having occurred among participants through the GMP (more collaboration is noted as occurring between irrigation districts and basin cities). While the literature indicates that collaboration is crucial in order for acceptable water management to occur, the findings in this research demonstrate that this criterion is the least important of the nine criteria employed in assessing participants' acceptability of the GMP.

CHAPTER 7: CONCLUSION

Based on the results and the discussion of the nine criteria used to evaluate the acceptability of the GMP, it is concluded that despite many participants' frustrations about various aspects of the program, overall the GMP is more acceptable to its participants than the two hypothetical arrangements because the program tends to:

1. provide more information dissemination than both alternatives;
2. be more equitable than the pre-1995 arrangement although possibly less equitable than a moratorium;
3. provide greater accountability than both alternatives (although accountability would become a lesser issue under the pre-1995 arrangement);
4. offer more utility for personal needs, economic growth, and environmental benefits than both alternatives over the long-term; provide more utility for instream flows than the pre-1995 arrangement but possibly less than the moratorium;
5. provide more environmental sustainability than the pre-1995 situation but possibly less than the moratorium;
6. be more economically efficient than both alternatives over the long-term;
7. be more adaptable than both alternatives over the long-term; and
8. create more collaboration among water users than both alternatives.

Even though frustrations about the usability of the program are prevalent, the simple fact that participants are using and staying with the GMP is an indicator that it is acceptable; however, it must be taken into account that under the current regulations, the GMP is also the only mechanism through which new groundwater permits may be obtained.

Recommendations

While some participants realize that the GMP is a new program that may involve a tedious and lengthy permitting process, particularly at the outset, and therefore are more accepting of the incurred frustrations, most participants are less understanding and voice the need to improve the program. Participants provide many suggestions for improving the program in ways that

may increase its acceptability. Participants' most frequent recommendations focus on OWRD being more proactive in working with water users. Ideas include:

- more widespread and frequent dissemination of information (in plain English) about the GMP;
- a time-line of the permitting process to help set expectations;
- clarification and simplification of the permitting process;
- updates on GMP activities; and
- increasing public awareness of water issues and water rights in the Deschutes Basin.

Most recommendations focus on improving information dissemination, which indicates that this criterion may be pivotal in affecting the acceptability of the program. Since inadequate information provision about the program affects how participants perceive many aspects of the program such as its complexity, inequity, and lack of enforcement, it seems crucial to address this issue in order to improve the overall acceptability of the GMP. Furthermore, as many participants who are small-scale water users perceive that large-scale water users like resorts and golf-courses deplete the groundwater resources and yet receive preferential treatment by OWRD (as large developments are viewed as being able to obtain a permit for a high rate of water faster than small-scale water users), it may be worthwhile for OWRD to inform participants about the actual regulations governing large-scale developments as well as the basin's capacity for such development. Therefore, providing more and understandable information may assist in alleviating these frustrations incurred by the program. Through increased information dissemination, the GMP may become more acceptable if:

- potential misperceptions about the perceived wasteful uses by large-scale developments and the Upper Basin's perceived incapacity to sustain development are remedied by increased information dissemination about regulations and the groundwater availability in the Upper Basin;
- the program becomes more user-friendly – streamline permitting process;
- participants gain more understanding about OWRD's logic for enforcing and monitoring water use;

- participants know why mitigation is required – information is supplied about the differences of water resource issues in the upper versus the lower basin and participants gain an understanding about the underlying reason for the program – which may
 - make the program seem more equitable;
 - increase the program’s perceived utility; and
 - make it more cost-effective.

By becoming more acceptable to participants through increased information dissemination, the GMP would also become more effective and viable as compliance may increase and water would be pumped in a legal manner. In addition, in order to solve this ongoing issue of lacking information dissemination at a deeper level, OWRD could focus on widespread local-level educational efforts that would provide pertinent and practical information in layperson language, which could become a part of the basin’s water management system. Furthermore, to improve information dissemination as well as the usability and accountability under the GMP, there should be an increase in OWRD staff as well as funding. In addition, while adaptability is viewed as an important criterion for increasing the acceptability of water management programs (National Research Council 2004) adaptability of the GMP has not played a major role in raising participants’ acceptance of the program. Since few participants feel that OWRD is taking an adaptive management approach (as they perceive the agency as unresponsive), despite the GMP rules that provide OWRD with the tools to employ adaptive management, it is recommended that OWRD increase its efforts to adapt to participants’ needs.

Since the GMP is a market-based approach and the literature indicates that equity can play a major role in the acceptability of water management programs particularly under market-based approaches (National Research Council 1992), equity should be a focal concern; hence it is recommended that emphasis be placed on ensuring that the program is implemented in an equitable manner. Since it is suggested that equity concerns be treated outside the market (Lee 1999), the government must oversee the transfer process and set adequate standards to maintain equity (Glennon 2005). Following this logic, the responsibility of ensuring equitable water management in the Deschutes Basin is the responsibility of OWRD. Yet many participants feel that OWRD fails to equitably administer the program, which weakens the

GMP's acceptability to its participants. Either OWRD should focus on equity or it should inform participants and provide evidence that their concerns about equity are misperceptions.

Along the same line of reasoning, another recommendation is the implementation of a progressive payment plan for mitigation credits that takes the quantity of consumptive water use into account. For instance, participants who are using a large quantity of water (i.e. golf-courses and large-scale developments) would be required to pay more than those who use less water (i.e. hobby-farmers). While the nuances of such a plan would have to be finessed, this recommendation may address the equity concern among many small-scale water users as well as make the program appear to be more economically efficient to participants using small quantities of water. Furthermore, such a demand side regulation may also offset many participants' concern that too much groundwater is being used at a high rate because such regulations have reduced the use of water much more than other conservation efforts and any supply side schemes (i.e., diversions, storage, etc.) (Lach et al. 2006).

Another recommendation addresses the lack of trust that participants express as existing amongst water users, OWRD and (for a few) the DRC, which should be addressed in order to make the GMP more acceptable. As was noted in the literature, trust is important in order for a water management program to function effectively. Since many participants distrust their neighbors, OWRD, and to a certain extent the DRC, focusing on building trust in the community could enhance the acceptability of the GMP. OWRD or the DRC could organize meetings for participants, which could be open to the public, where participants would have an opportunity to learn more about the GMP and about each other; such meetings would provide a forum for participants to trust each other, build shared understandings, and to work together, rather than feeling like they are pitted against their neighbors or like the state is out to get them. This emphasis on trust would also address the collaboration criterion and increase general public awareness (if the meetings are open to the public). This recommendation to focus on collaboration and trust building through community meetings is supported by the results indicating that participants want to meet with other participants in order to share ideas, understandings, and build trust.

Currents of the Future

There are a few topics that arose in the course of this research that could not be addressed fully in this work. These are described briefly here with the intention that they may spark future research. One theme that emerged and was mentioned briefly in the background section is a basin-wide management strategy. Several key experts propose this idea and believe that a basin-wide approach, applied at the local level, would create more acceptable water management through increased understanding. Some key experts note that at the time the work group began, water managers, experts, and stakeholders were not ready to deal with watershed management as a whole – on a basin-wide scale – and they wonder whether people are ready for a more holistic approach now.

Another concept that materialized is that of institutional change and how a program like the GMP developed, which was also briefly discussed in the literature review. Since the GMP began with a collaborative stakeholder group process but was not fully developed through this approach (because policy officials lost patience with the work group) some key experts wonder what the outcome would have been if the collaborative process had been completed. Would there have been more profound understandings between water managers, experts, and stakeholders that would have created a more acceptable program to participants and stakeholders? This also leads to the idea of allowing a process to evolve in order for real transformation to occur by recognizing that such processes take a long time. This relates to systems thinking and the concept of *khyros* (or *kairos*) time, which refers to the time needed in order for a profound shift to occur; it is unknown how long it will take to enable a shift but it must be trusted that there will be a shift. While some key experts found the work group a waste of time, others believe that if *khyros* time had been allowed to fully mature, the outcome of the GMP would have been different; there may not have been a lawsuit and the program may be more acceptable than the present GMP.

Community collaboration and the issue of building trust among participants as well as non-participants, OWRD, the DRC, and stakeholders is another issue that could be followed up on. For instance, focus groups with participants and non-participants could be convened where questions regarding trust, collaboration, and other pertinent topics could be addressed. Perhaps the focus groups could serve as a precursor for OWRD-run meetings for participants, non-

participants, the general public, and stakeholders to discuss relevant issues and concerns, which may lead to increased trust in the water community of the Upper Deschutes Basin over the long-term.

Final Thoughts

Given the “action arena” in the Deschutes Basin, with its unique hydrogeology, conjunctive water laws, and shifting values from agricultural to hobby farming as well as to urban and instream uses, the GMP is functioning to meet the diverging needs for water in the basin. This research illustrates that despite the frustrations incurred by the GMP process, it is more acceptable to its participants than a potential moratorium or a pre-1995 institutional arrangement because the program is meeting participants’ needs while accounting for the larger environmental, institutional, and social demands in the basin. Furthermore, the GMP follows the trend of emphasizing a holistic water management and is tending in the direction of a basin-wide approach as it manages water conjunctively and connects actions in the upper with the middle and lower basin. Shifting away from historically unsustainable groundwater uses, the GMP attends to the broader term of environmental sustainability by taking ecological constraints and social values into account. Furthermore, by approximating the amount of water available for utilization without overexploitation of the aquifer or depletion of streamflows (regulating this with the cap), the GMP also addresses the issue of sustainable pumping. However, since the program still receives criticism from both participants and stakeholders, increasing its acceptability (to its participants as well as potential participants) through various strategies such as more information dissemination, is paramount to its viability and effectiveness.

Although the GMP serves as an innovative mechanism to meet the changing demands and values in the Deschutes Basin and is a part of shifting the status quo away from irrigated agriculture, it still works under the constraints of prior appropriation; it is not over-turning the status quo of western water law. While the GMP adapts to the shifting uses of water, making it possible to achieve more sustainable water management by reallocating irrigation water to new demands (Reisner and Bates 1990), the program proves to be complicated and is perceived as frustrating and confusing by many participants. In order to offset complexities induced by new management programs, the literature recommends streamlining programs

(National Research Council 1992). In the case of the GMP, simplifying the permitting process and implementing a system of information dissemination could make the program far less frustrating and hence more acceptable to participants.

While underlying the IAD framework is the assumption that individuals make economically rational decisions in simple situations, the theory behind the framework also takes into account that under more complex situations individuals are less capable of making rational decisions. As the GMP is a complex program for managing an intricate water system (both hydrogeologically as well as legally) and many participants are not acting as rational self-interested individuals, the findings of this research align with the framework's latter assumption. Many participants take part in the GMP due to a lifestyle choice or they are motivated by ethical reasons rather than economic incentives. The IAD framework also emphasizes the importance of individuals who are willing to work together under complex circumstances; the theory's focus is not on economically self-interested individuals but on those capable of working with one another, engaging in mutual exchanges. This research echoes this framework as the literature and the data indicate that in order to improve the acceptability of an institutional arrangement such as the GMP, increased exchanges such as information dissemination and communication between the various actors, such as policy officials and participants, should occur.

Similar to the IAD framework's postulation that the provision of dependable information by authorities (such as OWRD) assists in creating effective institutional arrangements in complex settings, this research also recommends increasing information dissemination and public outreach in order to improve the GMP's acceptability. Such an approach of augmenting the GMP's acceptability through increased information dissemination would be effective because with more understanding about the GMP, participants would perceive many other aspects of the program as less frustrating. By becoming more acceptable to participants through increased information dissemination, the GMP would also become more effective and viable as compliance may increase and water would be pumped in a legal manner. As noted by Wallace Stegner (Stegner 1987), in order to manage water resources in an over-allocated basin, redistribution is central; without the acceptance of the water users, redistribution becomes an even greater challenge.

BIBLIOGRAPHY

- Anderson, T., and P. Hill. 1983. Privatizing the Commons: An Improvement? *Southern Economic Journal* 50 (2):438-450.
- Anderson, T., and D. Leal. 1988. Going with the Flow: Expanding the Water Markets. *Policy Analysis* 104.
- Anderson, T., and P. Snyder. 1997. *Water Markets: Priming the Invisible Pump*. Washington, D.C.: Cato Institute.
- Aylward, B. 2006. Central Oregon Water Bank: Origins, Objectives and Activities: Deschutes River Conservancy.
- . 2006. Growth, Land Use and Irrigated Agriculture in Central Oregon. In *Deschutes Water Alliance Issues Paper*. Bend: Deschutes River Conservancy.
- Aylward, B., and F. Gonzalez. 1998. Institutional Arrangements for Watershed Management: a case study of Arenal, Costa Rica. Review of Reviewed Item. *Working Paper No 21*.
- Aylward, B., and D. Newton. 2006. Long-Range Water Resources Management in Central Oregon: Balancing Supply and Demand in the Deschutes. In *Deschutes Water Alliance Issues Paper*. Bend: Deschutes River Conservancy.
- Baker Jud, S. 2006. Salmon as Lazarus in the Oregon Desert: The Historic Settlement and Relicensing of the Pelton-Round Butte Project. *Natural Resources Journal* 46 (1043).
- Bakker, K. 2005. Neoliberalizing nature? Market environmentalism in water supply in England and Wales. *Annals of the Association of American Geographers* 95 (3):542-565.
- Bamberger, M., J. Rugh, and L. Mabry. 2006. *RealWorld Evaluation: Working Under Budget, Time, Data, and Political Constraints*. Thousand Oaks: Sage Press.
- Bastasch, R. 2006. *The Oregon Water Handbook: a guide to water and water management*. 2nd ed. Corvallis: Oregon State University Press.
- Beck, R. 1991. *Part V - Distribution and Storage, Waters and Water Rights*. Charlottesville: The Mitchie Company Law Publishers.
- Berhnhard, R. 2002. *Research Methods in Anthropology: Qualitative and Quantitative Approaches*. Walnut Creek: Alta Mira Press.
- Birkland, T. 2005. *An Introduction to the Policy Process, 2nd Edition*. New York: M.E. Sharpe.
- Blomquist, W. 1992. *Dividing the Waters: Governing Groundwater in Southern California*. San Francisco: Center for Self-Governance.
- Blomquist, W., E. Schlager, and T. Heikkila. 2004. *Common Waters, Diverging Streams: Linking Institutions to Water Management in Arizona, California, and Colorado*. Washington, D.C.: Resources for the Future.
- BOR and OWRD, Bureau of Reclamation, and Oregon Water Resources Department. 1997. Upper Deschutes River Basin Water Conservation Study: US Department of the Interior.
- Burroughs, R. 1999. When Stakeholders Choose: Process, Knowledge, and Motivation in Water Quality Decisions. *Society and Natural Resources* 12:797-809.
- Byman, A. 2001. *Social Research Methods*. New York: Oxford University Press.
- Clifford, P., C. Landry, and A. Larsen-Hayden. 2004. Analysis of Water Banks in the Western States. In *Publication No. 04-11-011*. Olympia: Washington Department of Ecology and WestWater Research.
- Colby, B. 1990. Transactions Costs and Efficiency in Western Water Allocation. *American*

- Journal of Agricultural Economics*:1184-1192.
- . 1998. Negotiated Transactions as Conflict Resolution Mechanisms: Water Bargaining in the U.S. West. In *Water Markets: Performance and Potential*, edited by W. Easter, Rosegrant, M. and Dinar, A. Boston: Kluwer Academic Publishers.
- Dillman, D. 1978. *Mail and Telephone Surveys: The Total Design Method*. New York: John Wiley and Sons, Inc.
- . 2000. *Mail and Internet Surveys: The Tailored Design Method*. New York: John Wiley and Sons, Inc.
- DRC, Deschutes River Conservancy. *Water Leasing*.
http://www.deschutesriver.org/What_We_Do/Streamflow_Restoration/Water_Leasing/default.aspx 2007 [cited].
- Easter, W., M. Rosegrant, and A. Dinar. 1998. *Markets for Water: potential and performance*. Boston: Kluwer Academic Publishers.
- Freeman, M., and R. Haveman. 1971. Water Pollution Control, River Basin Authorities and Economic Incentives. *Public Policy* 19 (1):53-74.
- Gannet, M., K. Lite, Morgan D., and C. Collins. 2001. Ground-Water Hydrology of the Upper Deschutes Basin, Oregon. In *Water-Resources Investigations Report*. Portland: U.S. Department of the Interior and U.S. Geological Survey.
- Geisen, R. 1999. Deschutes Water Management Plan Update: Oregon Water Resources Commission.
- Getches, D. 1997. *Water Law in a Nutshell*. 3rd ed. St. Paul: West Publishing Co.
- Glennon, R. 2002. *Water Follies: groundwater pumping and the fate of America's fresh waters*. Washington, D.C.: Island Press.
- . 2005. Water Scarcity, Marketing, and Privatization. *Texas Law Review* 84:1873-1902.
- Golden, B., and B. Aylward. 2006. Instream Flow in the Deschutes River Basin: monitoring, status and restoration needs. In *Deschutes Water Alliance Papers*. Bend: Deschutes River Conservancy.
- Goodsell, C. 2004. *The Case for Bureaucracy*. 4th ed. Washington, DC: CQ Press.
- Gorman, K. 2007. Deschutes Basin Ground Water Mitigation Program Annual Implementation and Evaluation Report: Oregon Water Resources Department.
- Senate Bill. 1995. *Ground Water Uses Within Scenic Waterways*. 1033.
- Hubert, G. 2007. Ground Water Application and Mitigation: step-by-step process: Deschutes River Conservancy.
- Ingram, H., and C. Oggins. 1991. Water, the Community, and Markets in the West. *Western Water Policy Project, Natural Resources Law Center, University of Colorado* (Discussion Series Paper No. 6).
- Innovation and Economic Strategies Division. *Median Household Income in Oregon Oregon Economic and Community Development Department* 1/26/2008 2007 [cited].
- Jaeger, W. 2004. *Potential Benefits of Water Banks and Water Transfers*. Vol. Brief #2, *Water allocation in the Klamath Reclamation Project* Corvallis, Or.: Oregon State University Extension Service
- Jones, S. 1999. Participation and Community at the Landscape Scale. *Landscape Journal* 18:65-78.
- King, M.A. 2004. Getting Our Feet Wet: An Introduction to Water Trusts. *Harvard Environmental Law Review* 28 (495).
- Lach, D. 1996. Introduction: Environmental Conflict. *Sociological Perspectives* 39 (2):211-

- 217.
- Lach, D., H. Ingram, and S. Rayner. 2006. You Never Miss the Water 'Till the Well Runs Dry: crisis and creativity in California. In *Clumsy Solutions for a Complex World*, edited by M. Verweij and M. Thompson. Cambridge, United Kingdom: Cambridge University Press.
- Lee, T.R. 1999. *Water Management in the 21st Century: the allocation imperative*, *New Horizons in Environmental Economics Series*. Northampton, MA: Edward Elgar.
- Livingston, M.L. 1998. Institutional Requisites for Efficient Water Markets. In *Water Markets: potential and performance*, edited by W. Easter, M. Rosegrant and A. Dinar. Boston: Kluwer Academic Publishers.
- Lovrich, N, and D. Siemann. 2004. Of Water and Trust: a review of the Washington Water Acquisition Program: Policy Consensus Center: Washington State University and University of Washington.
- Lunch, W. 2001. *Inside the Beltway: the unwritten rules of politics*. Corvallis: Oregon State University: Printing and Mailing Services.
- Luz, F. 2000. Participatory Landscape Ecology: a basis for acceptance and implementation. *Landscape and Urban Planning* 50:157-166.
- Merhoff, W.A. 1999. *Community Design: a team approach to dynamic community systems*. Thousand Oaks: Sage Publications.
- Merrett, S. 1997. *Introduction to the Economics of Water Resources: an international perspective*. Lanham, MD: Rowman and Littlefield Publishers, Inc.
- Naiman, R., and R. Bilby. 1998. *River Ecology and Management*. New York: Springer.
- National Research Council. 1992. *Water Transfers in the West: efficiency, equity and the environment, Committee on Western Water Management, Water Science and Technology Board, Commission on Engineering and Technical Systems*. Washington, DC: National Academy Press.
- . 2004. *Confronting the Nation's Water Problems: the role of research*. Edited by The Committee on Assessment of Water Resources Research, *Water Science and Technology Board Division on Earth and Life Studies*. Washington, DC: The National Academies Press.
- Neuman, J. 2004. The Good, The Bad, and The Ugly: the first ten years of the Oregon Water Trust. *University of Nebraska Law Review*.
- Nudelman, D., and T. Odell. 2006. Deschutes River Basin Water Management Convening Assessment Process. In *Final Convening Report*. Portland: Resolve Inc.
- O'Connor, J., and G. Grant. 2003. *A Peculiar River: geology, geomorphology, and hydrogeology of the Deschutes River, Oregon*. Washington, DC: American Geophysical Union.
- Oregon Blue Book. *Deschutes County*. Oregon State Archives 2008 [cited 1/26/2008]. Available from <http://bluebook.state.or.us/local/counties/counties09.htm>.
- Ostrom, E. 1990. *Governing the Commons: the evolution of institutions for collective action*. New York: Cambridge University Press.
- Ostrom, E., R. Gardner, and J. Walker. 1994. *Rules, Games and Common-Pool Resources*. Michigan: The University of Michigan Press.
- Ostrom, E., L. Schroeder, and S. Wynne. 1993. *Institutional Incentives and Sustainable Development: infrastructure policies in perspective*. Boulder: Westview Press.
- Ostrom V. 1989. *The Intellectual Crisis in American Public Administration, 2nd Edition*. Tuscaloosa: University of Miami Press.
- Ostrom, V. 1971. *Institutional Arrangements for Water Resource Development*. Washington,

- DC: National Water Commission.
- . 1989. *The Intellectual Crisis in American Public Administration*. 2nd ed. Tuscaloosa: University of Miami Press.
- OWRC, Oregon Water Resources Commission. 2006. Deschutes Ground Water Mitigation Rules Reporting Requirements: Oregon Water Resources Department.
- OWRD. 2003. Deschutes Mitigation Program Annual Implementation and Evaluation Report In *Water Resources Commission Work Group Item IV*.
- OWRD, Oregon Water Resources Department. 1998. Water Development Issues in the Deschutes Basin: Oregon Water Resources Department.
- . 2005. Appropriation of Water Generally. In *ORS*.
- . 2006. Water Rights in Oregon: an introduction to Oregon's water laws. Salem
- . 2007. Deschutes Basin Mitigation Bank and Mitigation Credit Rules. In *OAR*, edited by Oregon Water Resources Department.
- . 2007. Deschutes Basin Program. In *OAR*, edited by Oregon Water Resources Department: OAR.
- . 2008. Deschutes Ground Water Mitigation Program Five-Year Program Evaluation Report (draft). Salem.
- Pagel, M. 2002. Creative Programs and Projects to Increase Water Supply Mitigation Banking: strategies for meeting new supply needs in Oregon, Deschutes Basin. *University of Denver Water Law Review* 6 (29).
- Paul, Tom. 2003. Deschutes Mitigation Program Annual Implementation and Evaluation Report: Oregon Water Resources Department.
- Reisner, M., and S. Bates. 1990. *Overtapped Oasis: reform or revolution for western water*. Washington, DC: Island Press.
- Robson, C. 2002. *Real World Research: a resource for social scientists and practitioner-researchers*. 2nd ed. Malden, MA: Blackwell Publishing.
- Rose, C. 1986. The Comedy of the Commons: custom, commerce and inherently public property. *University of Chicago Law Review*.
- Schmid, A. 1972. Analytical Institutional Economics: changing problems in the economics of resources for a new environment. *American Journal of Agricultural Economics* 54 (5):893-901.
- Schneider, A., and H. Ingram. 1993. Social Construction of Target Populations: implications for politics and policy. *The American Political Science Review* 87 (2):334-347.
- . 1998. Science, Democracy, and Water Policy. Review of Reviewed Item. *Universities Council on Water Resources*, http://www.ucowr.siu.edu/updates/pdf/V113_A4.pdf.
- Schwartz, M., and . Thompson. 1990. *Divided We Stand: redefining politics, technology, and social choice*. Philadelphia: University of Pennsylvania Press.
- Senge, P., O. Scharmer, J. Jaworski, and B.S. Flowers. 2004. *Presence: an exploration of profound change in people, organizations, and society*. New York: Currency, Doubleday, Random House Inc.
- Snedaker, L. 2003. Deschutes Mitigation Program Annual Implementation and Evaluation Report: Oregon Water Resources Department.
- . 2005. Deschutes Basin Ground Water Mitigation Program Annual Implementation and Evaluation Report: Oregon Water Resources Department.
- Steel, B. 2006. Saving Wild Salmon: moving from symbolic politics to effective policy. In *Salmon 2100 Project: alternative futures for Pacific salmon*, edited by R. Lackey and D. Lach. Bethesda, MD: American Fisheries Society.
- Stegner, W. 1987. *The American West as Living Space*. Ann Arbor: University of Michigan

- Press.
- Sterne, J. 1997. Instream Rights and Invisible Hands: prospects for private instream water rights in the Northwest. *Environmental Law* 27:203-233.
- Stone, D. 2002. *Policy Paradox*. New York: WW Norton and Company.
- Summary of Meeting. 2007. Paper read at Deschutes Basin Water Management Work Group, at Redmond, OR.
2005. Senate Rules Committee. *Testimony on HB 3494 by Martha Pagel*.
- Thomas, G. 2001. Designing Successful Groundwater Banking Programs in the Central Valley: lessons from experience. Berkeley: The Natural Heritage Institute.
- Tognetti, S., B. Aylward, and G. Mendoza. 2005. Markets for Watershed Services. (http://www.sylviatognetti.org/data/Tognetti_MWS.pdf).
- U.S. Census Bureau. *State & County QuickFacts: Deschutes County Oregon* 2008 [cited 1/26/2008. Available from <http://quickfacts.census.gov/qfd/states/41/41017.html>].
- Wagner, M. 2005. Watershed-Scale Social Assessment. *Journal of Soil and Water Conservation* 60:177-186.
- Wahl, R. 1989. *Markets for Federal Water: subsidies, property rights, and the bureau of reclamation*. Washington, DC: Resources for the Future.
- WaterWatch. Background on the Court Decision Protecting Deschutes River Water Flows: WaterWatch, Oregon.
- . 2007. WaterWatch Homepage: <http://www.waterwatch.org/>.
- Whyte, W. 1991. Participatory Action Research. Newbury Park.
- Winpenny, J. 1995. Reforming Water Resources Policy: a guide to methods, processes and practices. In *FAO Irrigation and Drainage Paper*. Rome: Food and Agriculture Organization of the United Nations.
- Yake, K. 2003. Upper Deschutes Subbasin Assessment. Bend: Upper Deschutes Watershed Council.
- Yardas, D. 2007. Great Basin Land and Water Study: issues and opportunities for acquiring water from willing sellers to increase Walker Lake inflows. *Natural Resource Conservation Service, U.S. Department of Agriculture Grant Agreement No. 68-9327-5-08*.

APPENDICES

Appendix 1: Groundwater Mitigation Applicant Interview Form

Interviewee: _____
 Permit Status (if PI, date): _____
 Zone of Impact: _____
 Type of Use: _____

Date: _____
 Q #: _____
 Application #: _____
 Priority Date: _____

INTRODUCTION

A primary objective of my research is to record the perspectives and opinions of participants in the Deschutes Groundwater Mitigation Program (GMP). My work will result in a Master's thesis. My final written report may also be used by the Deschutes River Conservancy (DRC) and Oregon Water Resources Department (OWRD) in evaluating and improving their programs.

All the information you give me will remain confidential; your real name will not be disclosed and any information made public will not be traceable back to you.

Do you have any questions before we begin?

All italicized questions are NOT for Municipal, Quasi Municipal & Group Domestic Uses

WATER USE

- 1) *I understand that you have a _____ type of groundwater application. What will/are you using it for?*
 - a) *Crop – alfalfa/hay*
 - b) *Crop – grain, seed, nursery etc*
 - c) *Grazing/pasture*
 - d) *Grass/landscape*
 - e) *Pond*
 - f) *Domestic/Household*
 - g) *Other: _____*

- 2) a) Why do you need groundwater as a water source?

- b) Did you consider alternatives? Which?

- c) Do you have access to a surface water ditch or canal?

- 3) *Place of residence:*
 - a) *On property*
 - b) *Off property*

- 4) *How many years have you been on your present property?*
 - a) *2 years or less*
 - b) *3-4 years*
 - c) *5-9 years*
 - d) *10 years or more*

- 5) *What is your primary occupation?*
 - a) *Farming*
 - b) *Other_____*
 - c) *Retired*

- 6) *How many acres is the property where you use/will use your groundwater?*

- 7) *How many acres will you irrigate with groundwater (associated with this permit application)?*

- 8) *Are you using the groundwater for your personal use or to produce products for rent/sale to others?*

- 9) *What type of irrigation system are you using?*
 - a) *Flood*
 - b) *Sprinkler-Hand-line*
 - c) *Sprinkler-Wheel-line*
 - d) *Sprinkler-Pivot*
 - e) *Underground Sprinkler*
 - f) *Drip*
 - g) *Other _____*

- 10) *When was/will your well (be) put in?*

- 11) *Do you have your well log number?*

- 12) *In what year did/will you begin pumping groundwater associated with this permit application?*

- 13) *Do you have a water meter?*

- 14) *How much groundwater do you pump every year? (volume in gallons or acre feet)*

- 15) a) *When in the season do you turn on/off your groundwater?*
 - b) *When in the day/week do you turn on/off your groundwater?*
 - c) *At what rate do you pump groundwater (gpm or cfs)?*

- 16) a) *Do you report your annual water use?*
 - b) *What does OWRD require you to report?*

PROCESS

17) a) Did you hire a consultant/engineer/lawyer/other_____ to assist you through the application process?

b) If yes, what's their name? _____

18)

If you went through the application process alone, on a scale of 1 to 5, with 1 being very difficult and 5 being very easy, how difficult/easy was it to find/know/access the following information about the process?	Very Difficult Very Easy ←----- Not So Hard ----->				
	1	2	3	4	5
<i>a) The need or requirement of applying for a permit N/O</i>					
<i>b) How to file an application N/O</i>					
<i>c) How to track your application status N/O</i>					
<i>d) Who to contact at OWRD N/O</i>					
<i>e) Where to acquire mitigation N/O</i>					

*N/O = No Opinion

19) How long did the application process take?

20) Did you feel sufficiently informed by OWRD about how long it should take for you to go through the application process to obtain your permit?

21) a) At what phase in the application process did you talk to people at OWRD?

b) Did you contact the Salem or Bend office?

ECONOMIC COST/BENEFIT

22)

<i>On a scale of 1 to 5, with 1 being not vital and 5 being very vital, how vital is the groundwater permit to the following?</i>	<i>Not Vital</i> <i>Very</i>				
	<i>Vital</i> <----->				
a) Your lifestyle	1	2	3	4	5
b) Your livelihood	1	2	3	4	5

23) a) *If you put in/upgraded a new well, what did it cost you to put in/upgrade your well?*b) *What are your yearly pumping costs for the new groundwater permit?*c) *Do you have temporary/permanent mitigation credits?*d) *If temporary, what are your yearly mitigation credit costs? (if already have a permit—per acre, total?)*

24)

	<i>Significant</i> <i>Not Significant</i>				
	<----->				
a) <i>On a scale of 1 to 5, with 1 being significant and 5 being not significant how significant/not significant were/are the above costs to you</i>	1	2	3	4	5

25)

	<i>Very Difficult</i> <i>Very Easy</i> <i>Not So Hard</i> <----->				
	1	2	3	4	5
<i>a) Considering the costs you were going to incur and benefits you expected, on a scale of 1 to 5, with 1 being very difficult and 5 being very easy, how difficult or easy was it to make your decision to obtain a groundwater permit</i>					

26) a) Did you consider purchasing permanent credits?

b) If so, why did you choose not to purchase them?

27) How much would you pay for permanent? (Have you thought about a price range that is feasible for you to pay?)

28) Bearing in mind that your response is confidential, if the Central Oregon Water Bank, which is operated by local irrigation districts and the Deschutes River Conservancy, presented you with the opportunity to buy permanent credits for a) \$2,500 per acre, which is \$1,389 a credit, b) \$3,000 per acre which is \$1667 a credit, c) \$3,600 per acre, which is \$2,000 a credit, would you buy them in order to permanently retire your mitigation obligation? *I will randomly split a) b) and c) up among interviewees.*

AWARENESS29) a) *Are you aware of the fact that domestic and irrigation uses of up to ½ an acre (15,000 gallons/day) are exempt?*b) *If yes, does/would this influence your participation in the GMP?*

30) Why are you required to mitigate?

31) How did the uncertainty of the program (WaterWatch's lawsuit, issue of obtaining permanent credits) affect your decision to apply for a groundwater permit?

32) How has the GMP promoted cooperation and collaboration among the water community? (Awareness of DWA? Meetings?)

SUGGESTIONS, SCENARIOS AND OVERALL RATING

33) What are some of the incentives/obstacles to obtain a new groundwater permit? (Enforcement)

34) What public outreach/information dissemination about the GMP could OWRD conduct that would improve the program?

Prompts:

What would you like to know, or what information would have been helpful for you during the application process?

35) Moratorium Scenario:

Take a moment and consider a hypothetical situation where the state is faced with a groundwater study that demonstrates that groundwater pumping affects surface water and thus violates laws regarding scenic river flows (the Scenic Waterway Act), and the state decides to put a moratorium on all new groundwater rights (instead of the GMP that they chose instead) what would you have done differently with regards to your needs for groundwater?

36) Quality of Assistance Rendered of Agencies/Organizations/Individuals

On a scale of 1 to 5, with 1 being poor and 5 being excellent, how would you rate the quality of the assistance provided by the following agencies with respect to the groundwater mitigation program?	Poor Fair Good Very Good Excellent <----->				
	1	2	3	4	5
<i>a) Oregon Water Resources Department Salem N/O</i>					
<i>b) Oregon Water Resources Department Bend N/O</i>					
<i>c) Deschutes River Conservancy N/O</i>					
<i>d) Others you worked with in the process (as noted above)N/O</i>					

* N/O = No Opinion

37) Utility of Program

On a scale of 1 to 5, with 1 being poor and 5 being excellent, how would you rate the utility of the Groundwater Mitigation Program with respect to the following:	Poor Fair Good Very Good Excellent <----->				
	1	2	3	4	5
a) <i>Your groundwater use/need</i> N/O					
b) Benefit to instream flows N/O					
c) Other environmental benefits N/O					
d) Economic Growth & Dev in Central Oregon N/O					
e) Other:					

* N/O = No Opinion

FOR WITHDRAWN APPLICANTS

38) Why did you decide to withdraw?

- a) Due to external factors such as lack of information/assistance from OWRD?
- b) Was the application process too complicated?
- c) Too expensive; unable to purchase credits
- d) Not worthwhile; costs outweighed the benefits
- e) Other: _____

39) Given your reasons for withdrawing, if there had been no groundwater mitigation requirement associated with obtaining a new groundwater permit would you still have withdrawn your application (i.e. would you have proceeded in obtaining your groundwater permit)?

SOCIO-ECONOMIC

40) Gender: male/female

41) What is your age category? (also ask exact age)

- a) Under 25
- b) 25-34
- c) 35-44
- d) 45-54
- e) 55-59
- f) 60-64
- g) 65-69
- h) 70 +

42) *Into which interval does your household income fit?*

- a) \$25,000 - \$50,000
- b) \$50,000 - \$75,000
- c) \$75,000 - \$100,000
- d) \$100,000-\$150,000
- e) \$150,000 - \$250,000
- f) \$250,000 - +

43) What is your highest academic degree?

- a) Attended High School
- b) High School
- c) College
- d) Masters
- e) PhD

Other _____

CLOSURE

44) Do you have any questions for me? Any issues that I didn't address that you'd like to state?

Thank you very much for your time and willingness to share your experience and knowledge.
May I follow-up if new questions arise?

Appendix 2: Groundwater Mitigation Applicant Survey Form

Name: _____

Q #: _____

Application #: _____

INSTRUCTIONS: For multiple choice questions please circle your preferred answer, unless further indicated you should circle one answer. For non-multiple choice questions please write in your answer.

I. WATER USE

1) I understand that you have a _____ type of groundwater application. What are you using (or will you be using) it for? (**CIRCLE ALL THAT APPLY**)

- a. Crop – alfalfa/hay
- b. Crop – grain, seed, nursery etc
- c. Grazing/pasture
- d. Grass/landscape
- e. Pond
- f. Domestic/Household
- g. Other: _____

2) Why do you need groundwater as a water source (as opposed to surface water)? (**CIRCLE ALL THAT APPLY**)

- a. No alternative – no surface water available
- b. Groundwater is cheaper
- c. Groundwater is cleaner
- d. Groundwater is more convenient
- e. Other: _____

3) Take a moment to consider a hypothetical situation where the state is faced with a groundwater study that demonstrates that groundwater pumping affects surface water and the state decides to stop all new groundwater pumping (beyond the exempt use). If this occurred prior to your application for a groundwater permit, what would you have done?

(**CIRCLE ALL THAT APPLY**)

- a. Used exempt use (up to ½ an acre for domestic and irrigation purposes)
- b. Over-used the exempt use
- c. Moved to a place where you could pump groundwater
- d. Not used groundwater – left land dry
- e. Searched for alternatives (surface water transfers)
- f. Other: _____

4) Where is your primary place of residence?

- a. **On** property where you use groundwater associated with this permit/application

- b. **Off** property where you use groundwater associated with this permit/application
- 5) How many years have you been on your present property?
- 2 years or less
 - 3-4 years
 - 5-9 years
 - 10 years or more
- 6) What is your primary occupation?
- Farming/Ranching
 - Retired
 - Other _____
- 7) How many acres is the property where you use/will use your groundwater?

- 8) How many acres will you irrigate with groundwater (associated with this permit/application)? _____
- 9) Are you using the groundwater for your
- Personal use?
 - To produce products for rent/sale to others?
- 10) If irrigating, what type of irrigation system are you (will you be) using?
(CIRCLE ALL THAT APPLY)
- Flood
 - Sprinkler-Hand-line
 - Sprinkler-Wheel-line
 - Sprinkler-Pivot
 - Underground Sprinkler
 - Drip
 - Other _____
- 11) When was/will your well (be) put in? _____
- 12) In what year did you (will you) begin pumping groundwater associated with this permit application? _____
- 13) Do you have a water meter? **YES / NO**
- 14) Do you report your annual water use?
YES / NO
- 15) How much groundwater do you pump every year? (volume in acre-feet or gallons)_____

II. APPLICATION PROCESS

16) a) Did you hire a consultant/engineer/lawyer/other_____ (**CIRCLE ALL THAT APPLY**) to assist you through the application process? **YES / NO**

b) If yes, what's their name or business name?

17) How long did the application process take? (**Specify months or years**) _____

18) Did you feel sufficiently informed by the Oregon Water Resources Department about the following:

- a. Permitting process – i.e. what-to-do-next in the process **YES / NO**
- b. Time-frame to obtain your groundwater permit **YES / NO**
- c. Reason for mitigation requirement **YES / NO**

19) Did you contact the **Salem office** (i.e. Laura Snedaker, Anita Huffman) or **Bend** (i.e. Kyle Gorman, Jeremy Giffin)? (**CIRCLE ALL THAT APPLY**): Salem / Bend

20) Quality of Assistance Rendered of Agencies/Organizations:

On a scale of 1 to 5, with 1 being poor and 5 being excellent, how would you rate the quality of the assistance provided by the following agencies/organizations with respect to the Groundwater Mitigation Program? Please circle one per question, circle N/O for no opinion:	Poor Fair Good Excellent <----->				
	1	2	3	4	5
a) Salem Office N/O					
b) Bend Office N/O					
c) Deschutes River Conservancy (i.e. Gen Hubert, Zach Tillman) N/O					
d) Others you worked with in the process (as noted above) N/O					

21) Do you have any suggestions for how the application process to obtain a groundwater permit could be improved? (**Please explain briefly**):

III. ECONOMIC COST/BENEFIT

22) On a scale of 1 to 5, with 1 being not vital and 5 being very vital, how vital is the groundwater permit to the following? Circle one number per question:	Not Vital Very Vital Vital ----->				
	1	2	3	4	5
<i>a) Your lifestyle</i>					
<i>b) Your livelihood</i>					

- 23) a. If you put in/upgraded a new well, what did it cost you?
 b. What are your yearly pumping costs for the new groundwater permit?
 c. Do you have temporary/permanent mitigation credits?
- 24) What are your yearly mitigation credit costs? (For temporary please write annual total costs, for permanent give cost per credit)._____

25)

On a scale of 1 to 5, with 1 being not significant and 5 being significant how significant/not significant were/are the above the costs of obtaining a new groundwater permit (costs in a, b, d above) to you? CIRCLE ONE	Not Significant Very Significant Significant ----->				
	1	2	3	4	5

- 26) a. Did you consider (or are you considering) purchasing permanent credits?
YES / NO
 b. If you haven't purchased permanent credits-why have you not purchased them? (**Explain briefly**)

27) Usefulness of Program

On a scale of 1 to 5, with 1 being poor and 5 being excellent, how would you rate the usefulness of the Groundwater Mitigation Program with respect to the following: Circle one number for each question; if you have no opinion, circle N/O	Poor Good Excellent				
	<----->				
a) Your groundwater use/need N/O	1	2	3	4	5
b) Benefit to instream flows N/O	1	2	3	4	5
c) Economic Growth & Development in Central Oregon N/O	1	2	3	4	5
d) Other:	1	2	3	4	5

- 28) Which of the following do you think are outcomes of your having to mitigate for your groundwater pumping? (**CIRCLE ALL THAT APPLY**)
- Offset the effects that groundwater pumping may have on surface water
 - Conservation of groundwater
 - Increase wildlife habitat
 - The state makes more money
 - No idea
 - Other:
- 29) Any issues about the Mitigation Program that I didn't address that you'd like to comment on at this time?

IV. SOCIO-ECONOMIC

This section will simply be used to conduct statistical analysis on all the surveys collected.

Please CIRCLE ONE answer for each question:

- 30) Your Gender: male / female (if filling out as a couple circle both)
- 31) What is your age category?
- Under 25
 - 25-34
 - 35-44
 - 45-54
 - 55-59
 - 60-64
 - 65-69
 - 70 +
- 32) Into which interval does your household income fit?
- \$25,000 - \$50,000
 - \$50,000 - \$75,000
 - \$75,000 - \$100,000
 - \$100,000-\$150,000

- e. \$150,000 - \$250,000
- f. \$250,000 - +

33) What is your highest academic degree?

- a. Attended High School
- b. High School
- c. College
- d. Masters
- e. PhD

END OF SURVEY

Would you like me to send you an electronic copy of my report in March, 2008?

YES / NO

I can arrange for you to receive e-mail updates from the Deschutes River Conservancy or Oregon Water Resources Department? Please circle each organization that you **WOULD LIKE TO** receive updates from (no action required if you do not want to receive updates):

a) DRC

b) OWRD

Please provide your e-mail address here if you have answered **yes** to any of these questions:

Thank you very much for your time and willingness to share your experience and knowledge! Please e-mail or call me with any further comments. Thank you.

Appendix 3: Chronology of Events in the Deschutes Basin

1813 – First white settlers arrive in Deschutes River Basin

1860s – Surface water used for irrigated agriculture in Central Oregon

1900s – Surface water rights in Deschutes River Basin have been limited

1955 – Oregon legislature passed a multiple purpose water bill to address instream flow needs

1968 – Wild and Scenic Rivers Act

The events italicized below are viewed as driving factors for Deschutes Groundwater Mitigation Program:

1970 – Oregon Scenic Waterways Act was adopted via ballot initiative. According to the Act the best uses for water in scenic water ways are for “recreation, fish and wildlife uses.” It is the state’s obligation to maintain flows so that the best uses are maintained. Under the Act several parts of the Deschutes River and Basin tributaries, including the Lower Deschutes from the Pelton Dam to its confluence with the Columbia.

1970 – Court decisions providing the Confederated Tribes of Warm Springs with rights to half of the salmon harvest (federal law makes Native American water claims paramount to all others)

1972 – Federal Clean Water Act

1980s – Confederated Tribes of Warm Springs negotiated with state, federal and local government as well as irrigation districts in order to improve instream flow of the Deschutes

1987 – Oregon Instream Flow Law

1987 – Instream Water Rights Act – legal framework to establish instream water rights (OWRD holds rights for the public, which can be purchased, leased or given as gifts)

1988 – In Diack v. City of Portland Oregon Supreme Court interpreted the Scenic Waterway Act to mean that “no diversion of water that otherwise would enter a scenic waterway may be permitted unless the requirements of [the Act] are met.” OWRD needed to assess whether scenic waterway flows will be negatively impacted before a new water right is issued.

1989 – Oregon Groundwater Quality Protection Act

1990 – Municipalities and developers began using groundwater as new water resource

1991 – Scenic waterway flows between 3,500cfs in August to 4,500cfs in winter months became mandated on the lower Deschutes River after a public hearing by the WRC.

1993 – USGS started a comprehensive groundwater study in cooperation with OWRD, local governments, tribes, Bureau of Reclamation and the Environmental Protection Agency. The aim was to supply quantitative understanding of groundwater hydrology in the Upper Deschutes Basin.

1995 – Water Resources Commission placed moratorium on further groundwater permits.

1995 – Oregon Senate Bill 1033 codified as ORS 390.835 added groundwater pumping to the Scenic Waterways program's prohibition of activities that would impair flow of waterways.

1996 – Formation of precursor of Deschutes River Conservancy

1996 – OWRD issued two instream water right certificates on the lower Deschutes River that matched the Scenic Waterway flows established by the Water Resources Commission.

1997 – Oregon legislature repealed state's authority to set additional minimal perennial flows.

1998 – Preliminary results from the USGS/OWRD study show groundwater originating in or flowing through the Upper Deschutes Basin and discharges into the lower reaches of the Deschutes, Metolius and Crooked Rivers above and within Lake Billy Chinook. The conclusions are consistent with previous studies in 1931 and 1968. Based on preliminary results OWRD decided that groundwater usage in the study area has potential to interfere with surface water and that the "measurably reduce" standard from SB 1033 would be triggered. OWRD put all new groundwater applications on hold and convened a diverse group of stakeholders in the basin (as well as beyond the basin) to develop mitigation strategies in order to offset the impacts on the Lower Deschutes and accommodating for new uses and restoring the Middle Deschutes. The committee was first called the Deschutes Work Group and then the Steering Committee continued to meet monthly from early 1999 to early 2001.

2001 – Findings of the USGS/OWRD Study confirmed that aquifer discharge provides a large portion of the surface water to streams in the Deschutes River Basin.

2001 – *House Bill 2184 authorizing a system of mitigation credits and banking arrangements was enacted.*

2001 – *September 2001 and April 2002 – OWRD issued draft Deschutes Groundwater Mitigation rules for public review. Five public hearings were held on the proposed rules and over 160 written comments were submitted to OWRD.*

2002 – Water Resources Commission approved rules for Deschutes Groundwater Mitigation Program.

2002 – WaterWatch filed suit against new Groundwater Mitigation rules.

2004 – 2025 grant from Bureau of Reclamation led to the formation of Deschutes Water Alliance by irrigation districts, cities, DRC and the Confederated Tribes of Warm Springs; creation of Central Oregon Water Bank

2005 – WaterWatch and supporters won lawsuit against new Groundwater Mitigation rules

2005 – House Bill 3494 passed by Oregon Legislature – offset court ruling by validating the groundwater Program's rules

2006 – Deschutes Basin's permit applications surpassed the limit of 200 cfs

Appendix 4: Groundwater Mitigation Program Application Process

In order to understand the application process for groundwater permit applicants, information from the DRC and OWRD are compiled to provide a general outline. First, an applicant must file an application with OWRD (see table below).

Table of Fees

Fee Type	Cost
Base fee	\$500
Fee for first cfs or fraction thereof	\$200
Each additional cfs or fraction thereof	\$100
Each additional use, diversion or well after first	\$200
Permit recording fee	\$300
Certified Water Rights Examiner fee	varies
Temporary Credit 2007	\$70 per credit
Temporary Credit 2008	\$105 per credit
Permanent 2007	Varies depending on zone of impact - \$1,600 or higher
Permanent 2008	Estimated: \$1,800 - \$2,100 per credit or higher

Source: Hubert 2007

The initial review begins once OWRD obtains a new application and it conducts a review to determine a zone of impact and amount of mitigation water required for the proposed use, which generates a mitigation obligation. Next, the applicant must identify a source of groundwater mitigation:

- purchase from DRC's groundwater mitigation bank;
- create own mitigation project; or
- purchase from a private water broker.

A Proposed Final Order (PFO) is issued by OWRD if the application is uncontested during the 30 day public comment period. A well must be completed and water used within three years of the PFO issuance. Then a Final Order is issued by OWRD if the PFO remains uncontested after a 45 day protest period. To move from a Final Order to a permit, the applicant can provide mitigation (but will not necessarily be granted the permit as soon as mitigation is provided). A five year period is allotted as the timeframe for the applicant to provide

mitigation once the Final Order is issued. If the applicant fails to provide mitigation within five years, the Final Order expires. Water use is permitted to start once the applicant provides mitigation and it is approved by OWRD with subsequent issuance of a groundwater permit. Prior to water use, a meter or other measuring device must be installed on the well. Mitigation must be in place for the life of the groundwater use. A certificate can only be obtained by filing a Claim of Beneficial Use or Survey of Beneficial Use with OWRD. Conditions for a certificate include:

- a well must be implemented and put to use (as noted under PFO);
 - a map and report prepared by a certified water rights examiner must be submitted to OWRD within one year of completing the Claim of Beneficial Use; and
 - results from a pump test must be submitted to OWRD
- (Hubert 2007)

Throughout the above process, applicants are allowed to put their application on an administrative hold, which is similar to a time-out; the priority date is not changed.

The rules also delineate the conditions associated with obtaining a groundwater permit:

- OWRD specifies amount and location of mitigation obligation;
 - applicants must submit legally protected instream mitigation water to OWRD;
 - regulation or cancellation occurs if needed mitigation is not upheld;
 - additional mitigation must be supplied if consumptive use has increased; and
 - if long-term mitigation is not maintained then a permit will be regulated and/or cancelled.
- (OWRD 2007)

Slightly different stipulations apply to municipal and quasi-municipal groundwater permit applicants because they can incrementally obtain and provide mitigation to coincide with permit development. Each permit holder must have an incremental development plan on file with OWRD (OWRD 2007).

Appendix 5: Summary of OWRD Reports

OWRD's 2003 Annual Report states that the three main objectives of the GMP are: 1) to maintain flows for Scenic Waterways and senior water rights, including instream water rights; 2) facilitate restoration of flows in the middle reach of the Deschutes River and related tributaries; and 3) sustain existing water uses and accommodate growth through new groundwater development (OWRD 2003).

OWRD's implementation activities include:

- integrating mitigation into the groundwater permitting process, coordinating the review with various departments (i.e. ODFW, DEQ);
- aim to hold workshops and educational outreach in conjunction with DWE;
- staff seek opportunities to improve the review process with increasing mitigation projects and applications;
- staff should provide assistance to groundwater applicants to improve their understanding of the GMP;
- DWE mitigation bank staff are should support OWRD in educating groundwater applicants about the GMP;
- OWRD anticipates that people will choose to mitigate so as to not be subject to future regulation for scenic waterway flows (i.e. for conditioned groundwater permit holders);³⁹
- use of adaptive management and accommodate any new science and mitigation approaches that may emerge over time;
- draft plan to monitor groundwater use, mitigation and streamflows in the basin (focus on tracking whether scenic waterway flows and instream water rights are met on at least equal or more frequent basis in comparison to long-term base flows). The plan includes:
 - streamflow modeling – computer model;
 - database tracking;

³⁹ GMP rules only exempt groundwater users who are mitigating for their pumping from future regulations on scenic waterway flows, not for interference with other rights – the GMP is still the underdog of prior appropriation.

- incorporation of yearly streamflow gauging records.
(Snedaker 2003)

The 2003 report concludes that although OWRD is unable to evaluate the effect of new groundwater pumping and the mitigation activity on streamflow, the GMP is “currently producing positive benefits as more mitigation water has been approved and protected instream than needed for the single ground water permit issued” (Paul 2003). Furthermore, the report states that the implementation of the program is “proceeding smoothly” (Snedaker 2003).

According to OWRD Annual Reports on the GMP in 2004-2005, highlights of activities under the GMP contain:

- construction of a new webpage providing information about the GMP – on mitigation requirements, zones of impact, mitigation projects, mitigation banks, forms, and direct links to mitigation rules;
- objective of electronic submission of instream lease applications;
- continuation of improving review process;
- draft streamflow monitoring plan (same as in 2003 report):
 - computer model “nearing completion;”
 - database (still under development);
 - working system for tracking groundwater use and mitigation activity established;
 - monitoring yearly streamflow gauge records (useful for monitoring in the long-term).
 (Snedaker 2005)

The 2005-2006 OWRD annual report describes new implementation activities under the GMP that include:

- issuance of permits with incremental development plans;
- shift from mainly instream leases through DWE’s mitigation bank to instream transfer (to be supplied as mitigation water);
- more mitigation exists than is required;

- draft streamflow monitoring plan (same as in previous reports):
 - database continues to be under development;
 - computer program (Deschutes Mitigation Model) – developed by OWRD to numerically estimate effects of groundwater pumping and mitigation as well as to calculate changes when instream requirements are met under the conditions of the GMP (the model’s basis is historic stream flow data from 1966 to 1995).

The Deschutes Model demonstrates that “current applications for mitigation activities and groundwater allocations, if permitted, will cause the percent of time the instream requirement is met in the lower river (below Pelton Dam) to decrease slightly in winter months and to increase slightly in summer months” (Gorman 2007). However, on an annual basis, the model demonstrates that as a result of the GMP, the “instream requirements in the lower Deschutes River will be met slightly more often (about 0.5%) than in the past” (Gorman 2007).

According to the 2004-2005 and 2005-2006 OWRD annual reports on the GMP the program is yielding positive results since more mitigation water is approved and protected instream than is required for the groundwater permits issued thus far. Furthermore, active mitigation projects in the General, Wychus Creek, and the Crooked River zones of impact have led to a surplus of mitigation water (credits), which includes the reserve mitigation credit obligation for those permits using temporary mitigation credits (Snedaker 2005; Gorman 2007).

