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THE CHANGING VALUE OF WATER: THE CONUNDRUM FOR FUTURE WATER MANAGERS

By

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ABSTRACT

THE CHANGING VALUE OF WATER: THE CONUNDRUM FOR FUTURE WATER MANAGERS

By

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Governance of water resources that supports the ecological and social resilience of the system often requires the involvement of individuals outside of the policy making community. In order to develop policies that meet the multiple needs of groundwater users, state lawmakers in Michigan appointed an advisory council (the Council) which consisted of eleven individuals meant to represent eleven different interest groups around the state. I used thirty semi-structured interviews with the Council and their colleagues to understand how these individuals represent the variety of concerns related to groundwater use and relate to each other. The interviews measured individuals' backgrounds, values, attitudes and policy preferences related to groundwater withdrawal. The participants were most different in terms of their profession and education. There was no relationship between an individual's background and their subsequent values, attitudes and policy preferences for groundwater. Four groups were identified which shared common values, attitudes and policy preferences. These groups were least different their values, and most different in the level at which they preferred decisions about groundwater withdrawals be made, particularly as related to the local, state or Great Lakes basin level. These findings can assist in improving and continuing the collaborative policy process in Michigan, as well as other water rich states wishing to increase the resilience of their water resource systems.

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Introduction

Water development and management will change more during the next twenty years than it has during the past 2000 years (Salman 1999). Groundwater is the world's primary source of drinking water and irrigation. In many places around the world, increasing population pressures and pollution from land use practices are causing major declines in groundwater aquifer levels (Shah et al 2000). Developing groundwater governance institutions that optimize social and ecological resilience is crucial in water-rich states such as Michigan if they are to anticipate and prepare for water resource challenges of the future. Governance refers to the structures and processes by which societies share power and shape individual and collective actions (Young 2002a). Governance is not a function solely of the state but includes the interaction of many others including the private sector and non-governmental organizations when making decisions (Lebel et al 2006). Resilience is a measure of the amount of change a system (ecological or social) can undergo and still retain the same abilities of structure and function (Carpenter et al 2001). This is a very useful measure when thinking about how to develop groundwater governance institutions that are able to meet the challenges of the future with the involvement of stakeholders and addressing current small-scale conflicts within the context of the multiple political and ecological influences at work.

The diverse nature of groundwater resources, users, and scales of governance in Michigan would suggest that developing acceptable policy and effective institutions for governing groundwater withdrawals in Michigan needs to include a diversity of individuals (Young 2002a). Michigan's groundwater resources are plentiful not only in terms of quantity but also in terms of the number and types of sectors that depend on their

use; the political and geophysical scales at which it is governed; and the new governance issues that citizens and decision makers will face in the future. However, participatory strategies do not guarantee outcomes that protect the desired social and political characteristics of the resource or the corresponding institutions (Cooke and Kothari 2004), nor is there readily available information on how to best incorporate such a process in the absence of major conflict or scarcity. Evaluating the ability of institutions to involve stakeholders in a way that increases the capacity for resilience may be a useful tool for determining the quality of groundwater governance in water-rich areas.

This project evaluates the process in Michigan and its outcomes in the context of policy change resulting from the deliberation and participation of a group of stakeholders and advisors, and the effects of timing and scale on the development of governance institutions for its groundwater resources. With its diversity of users, multiple levels of governance and future challenges, Michigan has recently (February, 2006) enacted legislation addressing large-scale (greater than 100,000 gallons per day) groundwater withdrawals. This was partially accomplished through the creation of an advisory council whose legal mandate was to address issues of groundwater quantity in the state and make policy recommendations. This group was established in a way that attempted to represent the various groundwater user groups in Michigan. However, their final report was submitted by consensus.

In the remainder of this section I will first describe the context of Michigan's groundwater resources and governance structures at all levels, focusing on the recent creation of the Groundwater Conservation Advisory Council. I will then examine how best to determine the diversity of these individuals, and their colleagues, and the way they

think about groundwater use issues in Michigan. Finally, I describe the specific goals and objectives for this project.

Michigan's Groundwater Resources and Governance

The natural rainfall recharge of Michigan's groundwater aquifers is estimated at 27 billion gallons per day, of which only 2.6 percent is used consumptively, i.e., not returned to the watershed (Michigan Groundwater Conservation Advisory Council 2006). Almost every sector of Michigan's economy uses groundwater, including public supply municipal systems (40.6%), individual households (22.6%), industry (20.6%), agriculture (13.3%), commercial entities (1.9%), mining (0.8%), and thermoelectric power generation (0.3%) (National Groundwater Association 2004). About one third of the population in the Laurentian Great Lakes region receives its domestic water supplies from groundwater (USGS 2000). Michigan's lakes, streams, and wetland ecosystems also depend on groundwater inflows in order to maintain their structure and function, as well as supply society with the ecosystem goods and services (e.g., flood protection, fish and fish habitat, recreation opportunities) that Michigan's citizens depend on and enjoy (USGS 2000; Postel and Carpenter 1997).

The governance of Michigan's groundwater occurs on multiple political and geophysical scales. Located within the Laurentian Great Lakes watershed, Michigan is party to international agreements with Canadian provinces regarding water use, such as the Great Lakes Charter (Charter, 1985) and the Great Lakes Charter Annex (Annex 2001). As applicable to groundwater resources, the Charter's proposed Basin Water Resources Management Program includes an inventory of the groundwater resources, identification and assessment of existing and future demands for diversions, withdrawals

and consumptive uses, and calls for cooperative policies and practices to minimize consumptive use of groundwater. The Annex focuses even more closely on states coordinating the management and monitoring of groundwater withdrawals, including state and province level development of a decision making standard to be used for reviewing proposals for new or increased surface and groundwater withdrawals within the basin. Michigan was one of the last states to implement such measures, which occurred in 2006. International advisory bodies, such as the Great Lakes Council of Governors, Great Lakes Sustainable Water Resources Roundtable and the International Joint Commission, also help guide Michigan's management and monitoring of groundwater use.

Like many states, Michigan's groundwater use laws historically have not recognized the interconnectedness of groundwater and surface water systems (Gould and Grant, 2000), but follow the reasonable use test which allows withdrawals to be made by property owners so long as they do not harm other landowners right to use the groundwater (Barr, no date). As a publicly held resource, groundwater use is monitored by the Michigan Department of Environmental Quality (DEQ). Prior to 2006, the DEQ monitored "major water uses in Michigan" through the Michigan Water Use Reporting Program (WURP).[1] This program was established through legislation to meet provisions in the Great Lakes Charter and requires "power generation plants, self-supplied industries, and golf course irrigators to register with the Michigan Department of Environmental Quality if they have the *capacity* to withdraw over 100,000 gallons of water per day over any 30-day period." Users also had to pay a $100 fee and report their annual withdrawal quantities. This information is processed by the DEQ at the county,

[1] www.deq.state.mi.us/documents/deq-wd-wurp-overview.htm

township and watershed level. Smaller users and municipal users do not report through this program, and no users needed a state-issued permit to withdraw groundwater. As of 2002 agricultural users in Michigan were required to register with the Michigan Department of Agriculture, avoiding the $100.00 fee, and these individual withdrawals are aggregately reported at the township level to the DEQ. Prior to 2002 agricultural users were not required to report groundwater use because of a strong legislative lobby.

In addition to formal government bodies and agencies, there are a wide variety of non-governmental organizations (NGO's) that focus their advocacy and activism on water use issues in Michigan and provide an opportunity for local users organize. These include groups with origins at the watershed level, (e.g., Muskegon River Watershed Council, Clinton River Watershed Council); state level (e.g., Michigan Citizens for Water Conservation, Michigan Environmental Council, Michigan United Conservation Clubs); regional level (e.g., Lake Michigan Federation); and national level (e.g., National Wildlife Federation, Sierra Club, Trout Unlimited). A group of nine of these joined forces to generate the "Great Lakes, Great Michigan Campaign" in 2005, which established legislative and regulatory goals for the state of Michigan.[2] Attention to water management and policy in Michigan has also been an academic focus through Michigan State University's (MSU) Water Fellows Program which aimed to "discuss science needs identified by Michigan citizens as critical for making informed water policy decisions (Rose and Dreelin 2006)." Additionally MSU's Institute for Water Research's Great Lakes Protection Fund Project is using a two-year grant to study the feasibility of implementing conservation credits in Michigan.[3]

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[2] http://www.mecprotects.org/sumwup.pdf
[3] http://www.egr.msu.edu/~lishug/research%20web/GLPF.htm

As stated previously, Michigan citizens and decision makers also face a unique diversity of decisions about the future governance of its groundwater aquifers. New uses, such as bottled water and the possibility of large scale diversions out of the basin, require careful planning and balancing of the multiple sectors, laws, regulations, and interest groups described above that are involved in groundwater policy in Michigan. For example, reports from the Michigan Land Use Institute (Schneider 2002), the Public Interest Research Group in Michigan (2005) and the DEQ (2002) all mention the (real or perceived) threat of dry western states that hope to gain access to Great Lakes water.

Perhaps symbolic of this threat was the recent location of a water bottling plant owned by Nestle Waters North America in Michigan's Mecosta County in 2000. In 2002 a citizens' lawsuit (*Michigan Citizens for Water Conservation v. Nestle Waters North America*) challenged both the right of groundwater users to interfere with surface water riparian rights and to sell bottled water as a commodity (Schneider 2002). It also heightened awareness of discrepancies and inconsistencies in Michigan's withdrawal policies, prompting the legislature to act.

In 2003, Michigan's legislature passed Public Act 148, establishing the Groundwater Conservation Advisory Council (the Council). The ten Council members were to be appointed by the Speaker of the House, the Senate Majority Leader, and the Director of the Department of Environmental Quality; three nonvoting members were appointed by the Directors of the Department of Natural Resources, the Department of Agriculture, and the DEQ, respectively. The voting members of the Council represent the following sectors:

- Business and manufacturing
- Utilities

- Conservation organizations
- Local units of government
- Agricultural irrigators
- Well drilling contractors
- Environmental organization
- General public
- Aggregate industry
- Nonagricultural irrigators

The Council was asked to meet for two years beginning in January of 2004 and was charged with three tasks:

1. Study the sustainability of the state's groundwater use and whether the state should provide additional oversight of groundwater withdrawals,

2. Monitor Annex 2001 implementation efforts and make recommendations on Michigan's statutory conformance with Annex 2001, including whether groundwater withdrawals should be subject to best management practices or certification requirements and whether groundwater withdrawals impact water-dependent natural features, and

3. Study the implementation of and the results from the groundwater dispute resolution program created by Public Act 177 of 2003.

As mandated, the Council would, "submit a report on its findings by January 2006 and make recommendations to the Senate Majority Leader, the Speaker of the House, and the standing committees with jurisdictions primarily related to natural resources and the environment (Michigan Department of Environmental Quality, 2003)."

During this time, Judge Root of Mecosta County ruled in favor of MCWC and ordered the Nestle-owned bottling operation to be shut down. However, the Governor overrode this decision in December of 2003, allowing the pumping to continue while further information was found and deliberation was undertaken. In March of 2004 legislation was proposed to the legislature by the Governor. This original "Water Legacy

Act" would have required those who proposed a new or increased groundwater withdrawal within the basin greater than 2 million gallons per day to acquire a permit from the DEQ. According to the Michigan Land Use Institute, "the legislation would require permit applicants to identify the location, amount and purpose of their proposed water projects, outline a conservation plan, and anticipate the effects of the venture on the environment and nearby water users (Guy, 2004)." However, the legislation was never passed, and a seeming impasse developed between the state government, environmentalists, and business.

In February of 2006 the Council submitted its final report[4], outlining their suggestions for improving Michigan's groundwater withdrawal policy framework in a way that will encourage sustainability, minimize conflict between users, and help to align Michigan with the goals of the Great Lakes Charter Annex 2001 (GWCAC 2006). Within a month of the final report being released the Michigan legislature passed a group of bills that created a system of permitting and reporting for groundwater withdrawals, including how they impact surface water ecosystems. The legislation defined an adverse resource impact as, "impairing the lake or stream's ability to support its characteristic fish population," attempting to link groundwater use to surface water ecosystem functioning. Until February 2008 this will only apply to trout streams and after this date the definition will apply to all streams and lakes.

In addition the legislation:

1. Established a definition for large quantity withdrawals as 100,000 gallons per day.
2. Requires registration for all large quantity withdrawals, minus agricultural use.

[4] http://www.michigan.gov/documents/act148reportlegislature_157533_7.pdf

3. Established an annual reporting system.

4. Established a permitting system for all new or increased withdrawal greater than two million gallons per day. These permits will only be given if the withdrawal will not cause an adverse resource impact.

The Council was further charged with developing a "water withdrawal assessment tool" that will be capable of determining such impacts from groundwater withdrawals. The legislation also encouraged voluntary water user committees and best practices among water-user sectors.

The Council has obviously had a tremendous impact on the ability of the legislature to design policy and implementation procedures for groundwater withdrawals that provide clear definitions, improve monitoring and reporting, and link groundwater use to surface water ecosystems. The Council presented its consensus findings and recommendations. However, the interests represented on the Council are quite diverse, from agriculture to industry, and the impacts of the legislation on these groups have the potential to be equally as diverse. These differences will likely influence how present and future groundwater debates are constructed and which policy solutions are deemed acceptable to various sectors and decision makers. Also, if the Council continues to be successful in helping to develop such relatively broadly acceptable water policy options and an assessment tool that acknowledge sustainability and conservation goals, this could serve as an important model for others involved in contentious policy debates. Therefore, understanding who these people are--their backgrounds and personal understanding of and tendency toward acceptable policy outcomes--is very important.

Goal and Objectives

The first goal of this project was to examine the differences among the Council and their colleagues (termed advisors). Specifically my objectives were to ascertain the:

1. Diversity among the advisors' backgrounds (age, gender, ethnicity, education, political identity, and profession),

2. Range of values, attitudes and policy preferences held related to the governance of groundwater withdrawals,

3. Presence (or absence) of groups that may be present or have developed among the advisors based on shared values, attitudes and policy preferences.

These variables were chosen as measurements of differences among the advisors based on the empirical literature surrounding environmental conflict, social psychology, and water and public policy. I propose that personal background factors will influence values, attitudes and policy preferences (Figure 1).

The second goal was to determine how these differences among advisors affected the policy process and outcomes, and the value of enacting legislation in the absence of large conflicts or scarcity. This will be done using criteria developed by Lebel et al (2006) for evaluating the capacity to manage resilience.

Personal Background Factors

Research has identified personal background factors, such as age, education, gender, and socio-economic status as important determinants of an individual's propensity for environmental concern. In a review of common background factors, Dietz et al (1998) found that an individual's age and education had the most consistent relationship with environmental concern; age was most significant, with younger groups having a more pro-environmental orientation than older ones. Education levels also have

been shown to correlate with concern for the environment, with those who are highly educated being more likely to express concern (Dietz et al 2002). Gender differences in values related to the environment have also been particularly well-studied, and women have consistently been found to have greater concern for the environment and to actively pursue outcomes favorable toward the environment (Borden and Francis 1976; Stern et al 1995; Zelezny et al 2000). Historically in the United States different ethnic and socio-economic groups have brought a diversity of environmental values to the forefront of environmental policy debates, such as urban ecosystem health, toxic pollution, and topsoil erosion (Taylor, 1997).

There are, however, many discrepancies and exceptions to the consistency of these relationships, and it is unclear if they are truly independent of one another. This may be a consequence of the difficulty of developing accurate measuring techniques (Dietz et al 1998). Even less consistent is the relationship between other personal background factors, such as political identity, ethnicity, and occupation. These can still be measured as potential influencers of individuals' values, attitudes, and subsequent policy preferences but the direct relationship within the empirical literature is unclear.

Values

Values are highly resistant to change as they are an "enduring belief that a specific mode of conduct is personally or socially preferable to an opposite or converse mode of conduct or end state of existence (Rokeach 1973, 5)." The potential for people's values to conflict over environmental or water use decisions is partly due to the fact that, fundamentally, natural resource use and environmental quality are about more than simple efficiency; they affect our quality of life and livelihoods, and can invoke moral

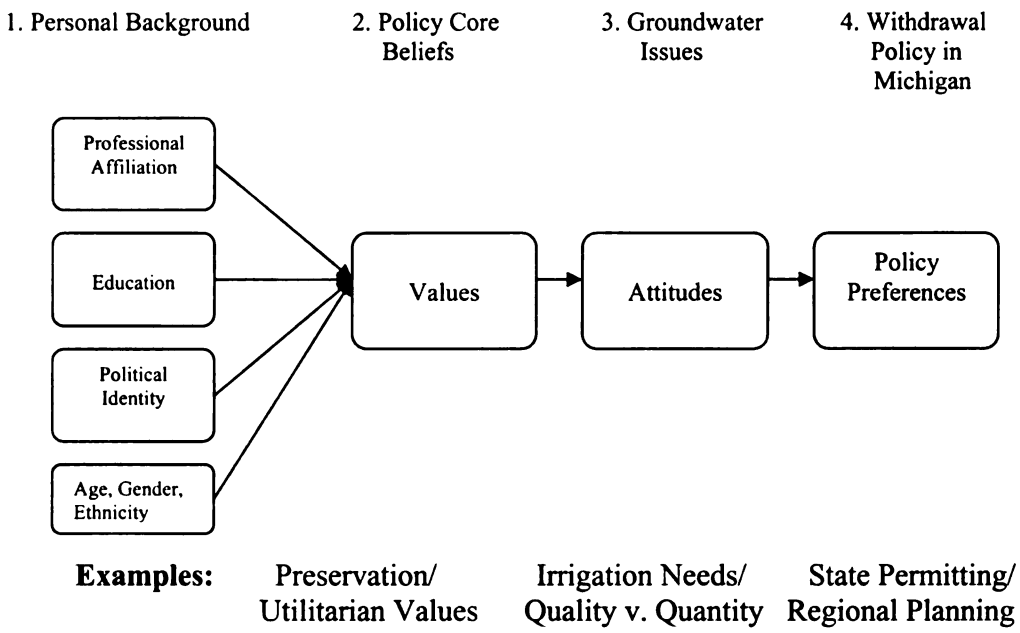
considerations for future generations and non-human entities (O'Neill and Spash 2000). A common example is environmental conflicts that center on preservation versus use values for resources (Stern and Dietz 1994). Values, and their differences, are inherent in how individuals perceive the natural world and help define the ways they interact and the benefits they hope to receive from it. Environmental policy conflicts often arise due to differences in individual values or the values of the organization or profession with which an individual is associated (Vaske and Donnelly 1998; Dietz et al 2005).

Values influence how environmental decisions are made (Dietz et al 2005). Chess et al. (1998) show that a group's differences in values will influence the amount of deliberation and discussion that will be necessary for a decision to be reached. For example, in an environmental decision making situation in which the level of value agreement is low and the level of knowledge is low (as could be seen in Michigan's groundwater use), integrated deliberation between scientists and stakeholders would be required. Values also act as an input into the decision making process, influencing individuals' preferences for participatory or top-down approaches. For example, in a survey of stakeholders involved in a marine protected area decision making process in California, Weible et al (2004) found that an individual's values helped determined whether or not he or she preferred collaborative as opposed to top-down decision making.

The Advocacy Coalition Framework (ACF) is one way of measuring basic value orientations that is useful for studying environmental policy. The ACF focuses on the individual's role in policy change (rather than formal organizations or institutions) and identifies a person's "deep core policy beliefs" in a way that parallels the common understanding of values. Deep core policy beliefs are "fundamental normative and

ontological axioms that remain constant over a period of a decade or more and across all policy issues (Jenkins-Smith and Sabatier 1993, 5);" for example, valuing public participation in policy making processes. They are not likely to change, and if they do it is often the result of high impact events, such as a disaster or revolution ("akin to a religious conversion," (Sabatier and Jenkins-Smith 1993, 221)).

Figure 1: Hypothesized flow diagram of the policy making process



Attitudes

An attitude has been defined as a mental state that must refer to some object, such as surface or groundwater, and can range from strongly to weakly developed (Eagly and Chaiken 1993; Bright and Manfredo 1995). Unlike values, these are issue-specific and less likely to remain consistent across issue areas and can change with learning and experience. For policy making, this means that an individual's attitude toward a specific issue, such as groundwater withdrawal policy, may be different from his or her attitude toward other issues, such as land use or minimum wage increases, depending on the amount of information available on the topic or previous experience. Vaske and Donnelly explain that, "the more general value orientations affect attitudes regarding specific

objects and situations, and that attitudes, in turn, influence behavior (1999)." This suggests the importance of understanding how attitudes are distributed among stakeholders, in an issue-specific context such as groundwater withdrawal, in order for policies to be acceptable and relevant at a given time with a given group of stakeholders and policy makers as well as to predict how individuals will act in policy situations.

Policy Preferences

In environmental decision making an individual's preference for policy outcomes is what is ultimately expressed to others. The range of policy preferences among a group of collaborators may serve to set the boundaries of the debate by establishing potential scenarios and acceptable outcomes. Preference for a given policy alternative may reflect the value an individual places on the perceived outcomes and his or her understanding of the effects of different actions on valued resources (Stern et al 1995). Preferences can be seen as part of a social process, influenced by increasing scientific understanding and changing levels of individual and public awareness (Stern et al 1995). A growing body of research is attempting to link values with policy preferences (Dietz et al 2005). Examples can be found in studies of the policy preferences of individuals playing an active role in environmental decision making and research, such as risk professionals in Washington, D.C. (Dietz and Rycroft 1987); climate change experts (Morgan et al 2001); and scientists and stakeholders involved in the creation of Marine Protected Areas in California (Weible et al 2004).

Groups

Water policy decisions are often contentious and complicated: they require knowledge of a resource's physical and biological characteristics, the social and economic benefits society hopes to gain from the resource, and the kinds of value placed on its use and conservation (Gleick 1993; d'Estree and Colby 2004; Adaman and Madra 2003; Conca 2005). As a potential means of overcoming these challenges related to quality of information and understanding that decision makers have available, individuals outside of the government are becoming increasingly involved in the environmental decision and policy making process (Bierle 2000; Fischer 2005). There has been widespread recognition over the last decade that this move toward individuals outside of the government being more directly involved in environmental policy making can result in decisions that are more acceptable and effective at levels ranging from local to global (NRC 1996; Chess et al., 1998; Stern et al., 2002; Dietz et al., 2003; Ribot 2003).

In order to capitalize on this trend this move toward greater participation has been initiated by those outside of government as well as those within: interest groups along the entire continuum of values related to the environment have gained momentum at local, state, national and international levels (Sabatier et al 2005; Conca 2005; Van de Wetering 2006). For example, citizens of the Great Lakes region formed Great Lakes United in 1981 to act as a binational, watershed wide means of helping citizens actively participate and help shape policy based on their goals and needs (Jackson 2005). Individuals who have access to the policy making process have been referred to as "policy activists" (Sabatier and Zafonte 1994), "experts" (Fischer 2004; Morgan et al 2001) and "policy elites" (Rothman and Lichter 1987; Foyle 1997).

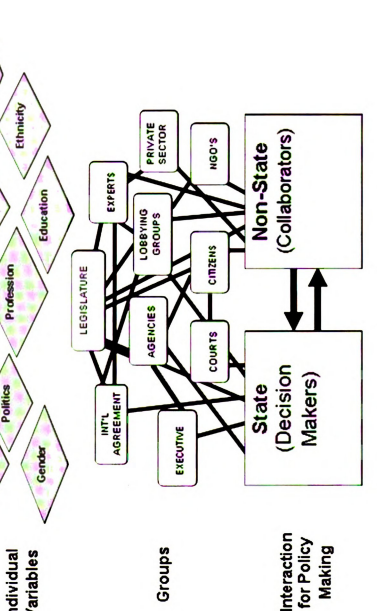
Even with the use of these collaborators there is often little agreement surrounding environmental policy issues. While outside "experts" are receiving greater responsibility and credibility within the environmental policy arena (Fischer 2004), such input is rarely singular in its objectives, nor are "experts" always unified in their perception of optimal solutions. Their power partly resides in groups' and individuals' ability to politically construct knowledge and to profligate a particular system of values (Conca 2005). This creates an opportunity for multiple perspectives and as many valid solutions. Often these interests and perspectives result in the formation of groups or coalitions surrounding a policy issue or resource. Dietz et al. (1989) describe how even the definition of the problem can be socially constructed to reflect the interests of and resources available to particular groups. We are all chameleons; however ideological consistency among groups is possible to achieve and maintain without the corresponding ideological nature of the individuals who make up the group (Feld and Grofman 1988).

At the international level, "epistemic communities" can and do use technical expertise to create networks of influence that guide national government leaders (Haas 1992). An epistemic community is "a network of professionals with recognized expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain or issue-area (Haas 1992)." These could be groups composed of environmentalists, scientists, or corporate interests, for example. Research using and developing the advocacy coalition framework (ACF) has shown that ideologically linked groups have decades-long staying power and influence (Sabatier and Jenkins-Smith 1999). These "advocacy coalitions" are connected mainly by their deep core policy beliefs related to a particular policy topic, such as water management in the

Lake Tahoe watershed (Sabatier 1993) or the Sacramento Valley (Munro 1993). As an example, a study of water policy activists in the San Francisco Bay/Delta region found that scientists who were involved tended to have similar core policy beliefs to environmentalists, and seek to influence policy consistent with these beliefs (Sabatier and Zafonte 1994).

The presence of such groups in relation to a water policy issue may help to predict both the interests of non-state stakeholders and actions that will be taken to satisfy these. Accounting for and evaluating these as they affect groundwater withdrawal policy change and the state will thus be of value to decision makers and the groups themselves, should they exist. Together with personal background factors, values, attitudes and policy preferences, these will provide a fuller understanding of the collaborators, their interactions, and subsequent policy recommendations (Figure 2).

Figure 2: Interaction hierarchy of individual variables, group formation and collaboration in policy making



Methods

In order to determine the diversity and differences among groundwater withdrawal policy collaborators (the Council and their colleagues) in Michigan I conducted thirty semi-structured interviews. The interview tool used fixed answer and open-ended questions that targeted each individual's values, attitudes, policy preferences, personal background factors, and thoughts for the future (Appendix A).

Study Site: Identifying the Target Population

In order to identify a group of individuals large enough to permit analysis and pattern recognition using quantitative and qualitative analyses, I used the Council as the beginning of a snowball sampling methodology (Dietz and Rycroft 1987). This method allows the participants to recommend other individuals they deem appropriate and valuable to the study which maintains a sampling frame of colleagues and allows access to the informal network. All thirteen Council members were contacted via email and asked to voluntarily participate in the study. Eleven of the thirteen members agreed, for a response rate of 85%; the remaining two did not respond to email or phone requests for an interview. At the end of each interview I asked the participant for the names of five people who he or she thought would be important for me to include in my study. Specifically I asked:

> "For this project, I would like to interview people whose professional activities are centered on groundwater resources and/or policy in Michigan. I am interested in influential individuals from both the private and public sectors. Could you suggest five individuals I might want to interview?"

Responses to this question often resulted in offers of telephone numbers and email addresses. Participants would often preface their recommendations with a description of the person's experience and policy preferences, which were at times quite different from those of the participant. Each time an individual was recommended the name would be written on to a card, which was then placed in a file box. I drew names from the box every two weeks at random, and contacted the person via email to invite him or her to participate in this research project. Thus, a person's inclusion in the study was directly proportional to how often the individual was recommended and therefore relatively well known in the groundwater policy and research community in Michigan. I continued this

process until I had interviewed a total of thirty individuals. The overall response rate was 83.3%.

There is the possibility that those individuals whose views and/or experience were not respected would not be recommended for inclusion in the study. However, the occurrence of people recommending individuals different from themselves in their views on groundwater issues seems to indicate this was not a significant factor in nomination to the potential pool of participants.

Each interview typically lasted for one hour, and was scheduled within two to four weeks of the original email. Twenty-four of the thirty interviews were conducted at the participant's office or office building; four were on the Michigan State University campus and two took place in coffee shops at the participant's request.

The Interviews

In order to identify the issues surrounding groundwater extraction policy being discussed in Michigan, I completed a thorough review of print (brochures, press releases, and news articles) and online materials (websites, electronic news articles) available from active non-governmental organizations in Michigan. The targeted organizations were identified using the following criteria: 1) had a representative at legislative meetings regarding ground water legislation; 2) had available material on groundwater policy on their website or in their newsletter; and/or 3) had participated in the Michigan State University's Water Resources Institute working group on conservation trading and water markets in Michigan. By attending these meetings myself I was also able to supplement my knowledge of the main issues being debated by each organization in regards to groundwater use in Michigan as well as current trends in policy solutions. All print and online materials located were searched for reference to groundwater extraction, groundwater quantity, water management and policy, and water diversions in Michigan.

To assess participant's values related to groundwater extraction issues, I used the ACF's measure of "deep core" policy beliefs. While not labeled values per se, the definition of deep core policy beliefs closely matches that of values, in that they are long lasting, difficult to change, and transfer across a range of issues. To measure these I adapted a scale developed by Sabatier and Zafonte (1994) for a study of stakeholder

perceptions of Delta smelt population declines and potential listing as an endangered species. I selected the following ten questions that addressed water management and development issues:

1. In environmental quality disputes the burden should be on users to prove that their use will not harm human health or wildlife habitat.
2. Decisions about development are best left to the economic market.
3. More emphasis should be placed on society's environmental rights and less placed on the individual's rights.
4. Groundwater should be managed primarily for human benefit.
5. Individual ownership of groundwater rights should be replaced by public control.
6. Public and environmental groups should have a greater role in the groundwater policy decision making process.
7. Ecological values should be given as much consideration as economic growth values.
8. Improved technology is an appropriate tool for solving environmental problems.
9. The needs of future generations should be considered in groundwater management decisions.
10. Humans have a responsibility to be stewards of the environment

Participants were asked to state the degree to which they agreed with a series of statements related to water development, water rights, and humans' relationship with the environment. I used a five point Likert-type scale (1=highly agree, 2=agree, 3=neutral, 4=disagree, 5=highly disagree) with an option to not respond or have no opinion. Because agreeing or disagreeing with different statements differentially reflects more conservative or liberal core beliefs, the answers were later standardized so that a high score had the same value implication. These ten questions were then aggregated to generate an average core belief score for each participant between 1 and 5.

Attitudes typically range from positive to negative evaluations (Fishbein and Ajzen 1975). To measure attitudes of participants toward the management of groundwater resources in Michigan, I used a variety of techniques related to some of the issues surrounding groundwater extraction. The following questions were posed for participants:

- What is the most important topic related to groundwater in Michigan?
- How important is groundwater to Michigan's agricultural vitality?
- How important is groundwater to Michigan's industrial vitality?
- How important is groundwater to recreation and tourism in Michigan?

When possible, the answers to these were recorded as a scale from positive to negative (1=very important, 5=very unimportant). Otherwise they were categorized within a normative scale; for example, responses to the question, "What is the most important topic related to groundwater in Michigan," could be categorized as "quantity," "quality," "current policies."

Participants were asked to rank 1) groundwater user groups according to the importance of their access to groundwater, and 2) potential policy solutions according to their usefulness to Michigan, using a methodology developed for risk ranking among risk professionals by Morgan et al (2001). For ranking user groups participants were given eight choices on individual index cards, each of which had a sector of society that uses groundwater written on it. Participants were then asked to place the cards in the order with which they would allocate groundwater given unrestrained power to do so. The cards read as follows:

- Agriculture
- Ecosystem Health
- Industry/Manufacturing/Commercial
- International agreements
- Municipalities
- Needs of future generations
- Non-agricultural irrigation
- Recreation and Tourism

Answers were recorded with a score of 1 through 8, with eight being that user group ranked first.

To measure policy outcome preferences a similar ranking exercise as well as open-ended questions were used during the interview process. The ranking exercise was composed using examples of differing groundwater policy from five other states, namely California, Wisconsin, Washington, Florida, and New Mexico (see Appendix C). These gave participants a broad range of alternatives, from local-based and decentralized management (California and Florida) to state-centered permitting (Wisconsin) to surface-water based decision making (Washington and New Mexico). I first described each of the policies to the participants, then asked them to rank each option in the order in which they thought Michigan could benefit from adopting a similar approach, using the choice cards.

The open-ended questions used during the interview related to each participant's policy preferences were as follows:

- Is it necessary for Michigan to change its current policies related to groundwater withdrawals? How?
- Do you think market based mechanisms for allocating groundwater are something Michigan could benefit from?
- At what level of governance (local, county, state, regional, federal) should groundwater extraction decisions be made?

Demographic information on participants' personal background factors was assessed during the interview using the following questions:

- How old are you?
- Which ethnic group do you identify with?
- What is your education background?
- How would you describe yourself politically?
- What is your position and what are your duties?
- Gender (determined visually)

Open-ended questions were used to qualitatively characterize participants' vision for Michigan's groundwater withdrawal policy future. These questions include:

- In your opinion, if additional legislation on permitting groundwater withdrawals were to be passed, would some sectors of society benefit?
- Do you think market based mechanisms, such as water markets, would improve or harm current groundwater management in Michigan?
- Do you think that groundwater extraction for agricultural irrigation is acceptable?
- Do you think that groundwater extraction for commercial sale is acceptable?
- In your opinion, is it necessary for Michigan to change its policies regarding groundwater withdrawals?

Data Management and Analysis

Immediately after each interview I filled out a summary sheet outlining the context of the interview and any insights about the individual's knowledge and concerns related to groundwater gained from the interview (Appendix B). This, together with the notes from the interview and any supplemental material (i.e., business card, brochure, reports) the participant may have voluntarily given to me, was placed in a folder and kept in a locked filing cabinet as per University rules and regulations regarding study of human subjects (IRB #05-292). A database tracking the number of completed interviews,

contact information, and interview transcripts was kept in my computer with access available only to the principle investigator. Participants' names are not on the interview notes, nor in the transcribed interviews. All interviews were recorded on a Sony digital voice recorder, with the participants' consent, and subsequently transcribed into word documents. The quantifiable results from the interviews were maintained in an Excel database as well as translated into an SPSS format for analysis of significant relationships and groups. Microsoft Excel was used to generate averages and sums of participants' responses and characteristics.

To determine which of the six background factors were responsible for the most variation among participants I used a factor analysis. The three components with Eigen values greater than 1 were extracted and rotated using a vari-max rotation. This allowed the components to be identified with variables they were most significantly related to (SPSS help guide). In order to evaluate the relationship among these personal background factors, values, attitudes and policy preferences a Spearman's bivariate, two-tailed correlation analysis was used. Pairs of variables with a correlation significance level of 0.05 or lower were recorded as related to one as related to one another.

To determine whether there are groups of individuals in this study who share similar values, attitudes and preferences toward groundwater and surrounding policy, I used the Ward's method hierarchical cluster analysis. This method uses Euclidean sums of squares distances to aggregate individuals, which helps to reduce error and increase accuracy (Everitt 1974). Three clustering variables were used to represent values, attitudes and beliefs:

1. Average policy core belief scale (from 1-5; from liberal to conservative)
2. Attitude toward groundwater's economic importance to Michigan (from 1-5; very important to very unimportant)
3. Scale at which groundwater policy should be made (from 1-5; representing scales from instream flow to Great Lakes basin)

The resulting clusters were then evaluated using both a cross-tabs analysis and a one-way analysis of variance (ANOVA) to confirm the presence of significant differences between the groups.

Results

Quantitative Analyses

Personal Background Factors

All of the thirty participants identified as White/Caucasian. Twenty-seven of the thirty are male (90%), and three are female (10%). As described by the participants, fourteen of the participants have jobs that primarily involve advocating and affecting policy decisions (such as lobbying state government, developing policy platforms, and networking among interest groups). These individuals were classified as 'policy' in the profession category. Nine participants have jobs that primarily involve conducting or supervising scientific research related to groundwater. These individuals were classified as 'research.' Seven participants have jobs that involve nearly equal involvement in both policy and research. These individuals were classified as 'both' (Figure 3). Of the thirty participants, nine were between the ages of thirty-one and forty; ten were between the ages of forty-one and fifty; nine were between the ages of fifty-one and sixty; four were over sixty years old (Figure 4). The average age of the participants is forty-five years old.

The most common political identity was as a moderate or neutral. Of the twenty-eight participants who chose to respond to this question, seven identified themselves politically as conservative; twelve identified as either moderate or neutral; five identified as liberal; four identified as independent (Figure 5).

Participants in this survey were relatively highly educated with six participants having doctoral or law degrees, fourteen having completed a Master's degree, six having a Bachelor's degree and one having completed high school (Figure 4). Three of the participants did not disclose educational status.

The average participant in this project was a Caucasian male between the age of forty-one and fifty, possessing moderate political views, a Master's degree, and is professionally involved in advocating for and affecting policy decisions related to groundwater.

I tested the relationship among these background factors using a two-tailed, bivariate Pearson's correlation analysis. This showed no significant correlations among these six personal background factor variables, allowing them to be used as independent variables when conducting further analyses. However, a primary components factor analysis showed that the majority (76%) of the variance among the participants' background can be explained by profession, education, and political identity (Tables 2 and 3); age and gender only accounted for twenty-five percent of the variation. The profession of participants explained the most variation (30%). Ethnicity was not included because it has zero variance because all of the participants were Caucasian. Thus, profession, education, and political identity were used to describe the groups of people that were interviewed in this study and to examine the relationship between an individual's background and his or her values, attitudes and policy preferences.

Figure 3: Profession of participants (N=30)

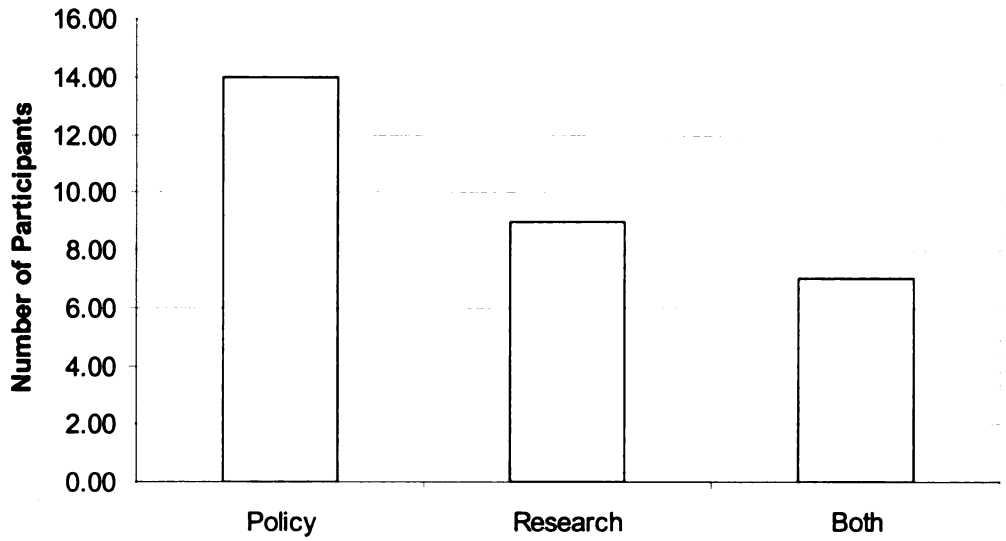


Figure 4: Age of participants (N=30)

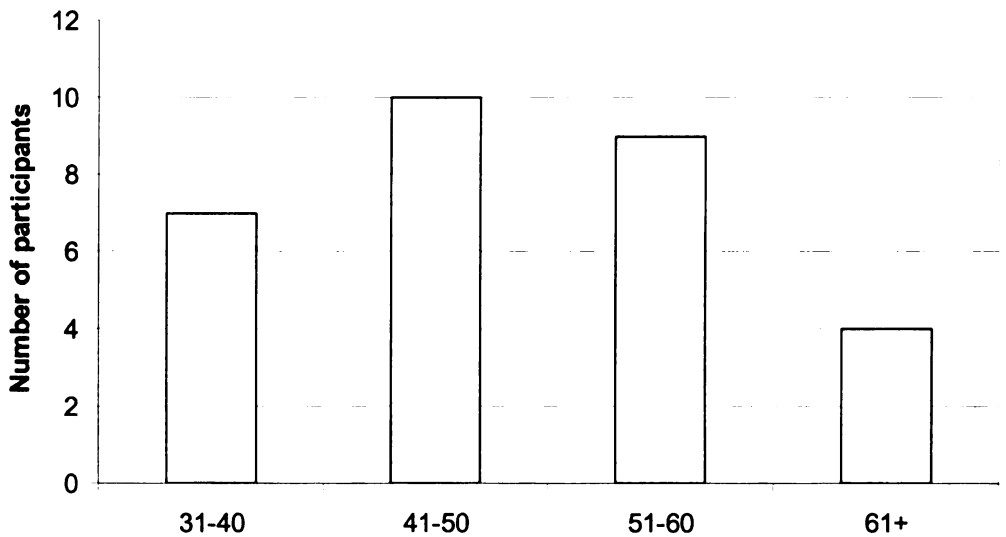


Figure 5: Political identity of participants (N=28)

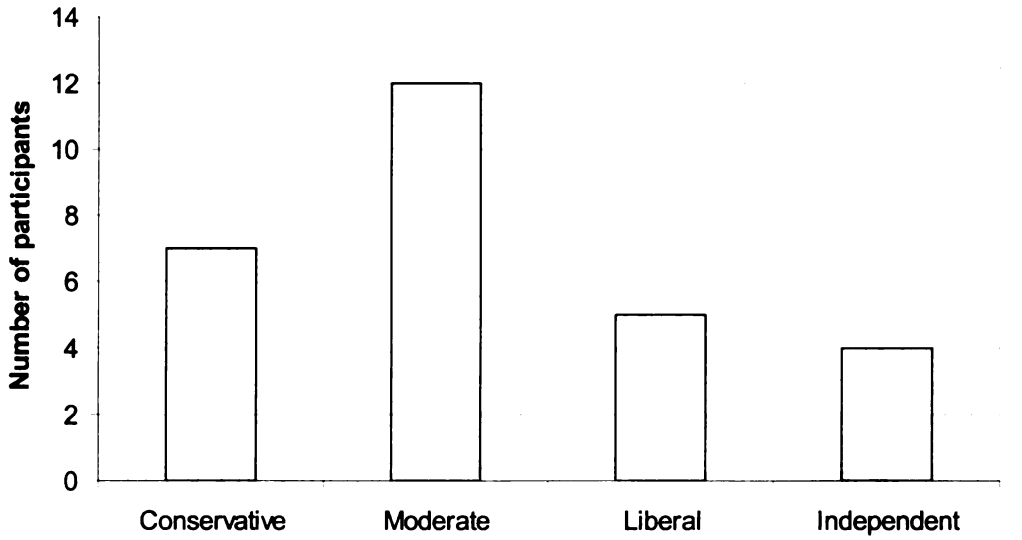
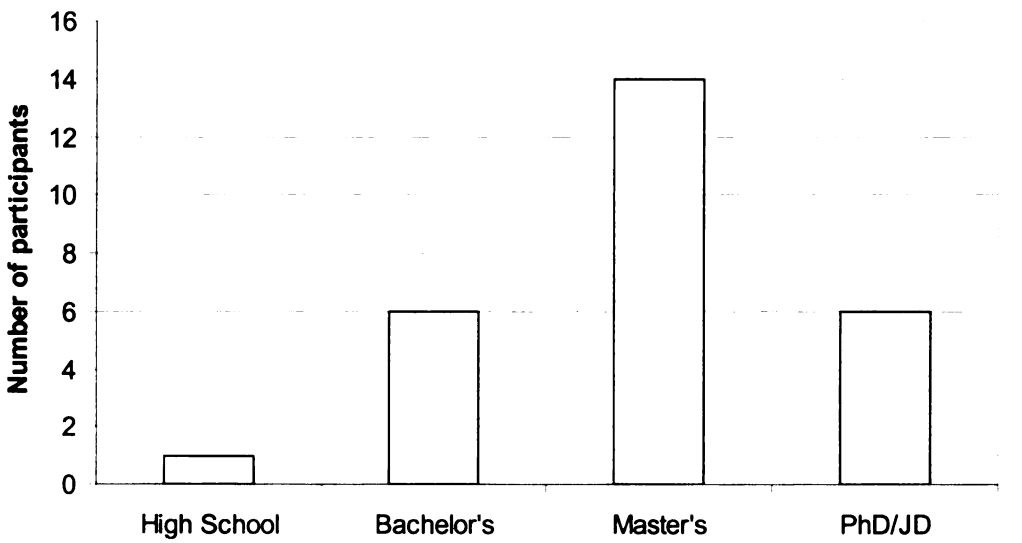


Figure 6: Highest education level of participants (N=27)



Almost all of the participants self-identified as being familiar with Michigan's groundwater withdrawal policies. Twenty-two of the thirty participants (73.3%) were very familiar with Michigan's groundwater extraction policies and six were familiar (20%) for a total of 93.3% being at least familiar. One person (3%) was neutral, or unsure of his or her familiarity and one person (3%) was unfamiliar with the policies.

All of the participants thought the connection of groundwater and surface water is important. Twenty-four (80%) of the thirty participants thought the surface water-groundwater connection was very important and six (20%) thought it was important.

Values

Most participants had moderate values (Figure 7). As measured using the modified policy core beliefs scale, the group's average was 2.7 on a five-point scale, just on the conservative side of the middle. The highest scores (most conservative) tended to be from individuals from business and agricultural interests, and only one of the five highest were among the appointed GWCAC members. The lowest scores (least conservative) tended to be from individuals from environmental or public interest groups and two of the five were voting members of the GWCAC. However, the Cronbach's alpha reliability score for this variable was 0.595, just below the standard accepted minimum value of 0.6. This is a close enough reliability score that the results can be used to understand the range of values held by these individuals.

Attitudes

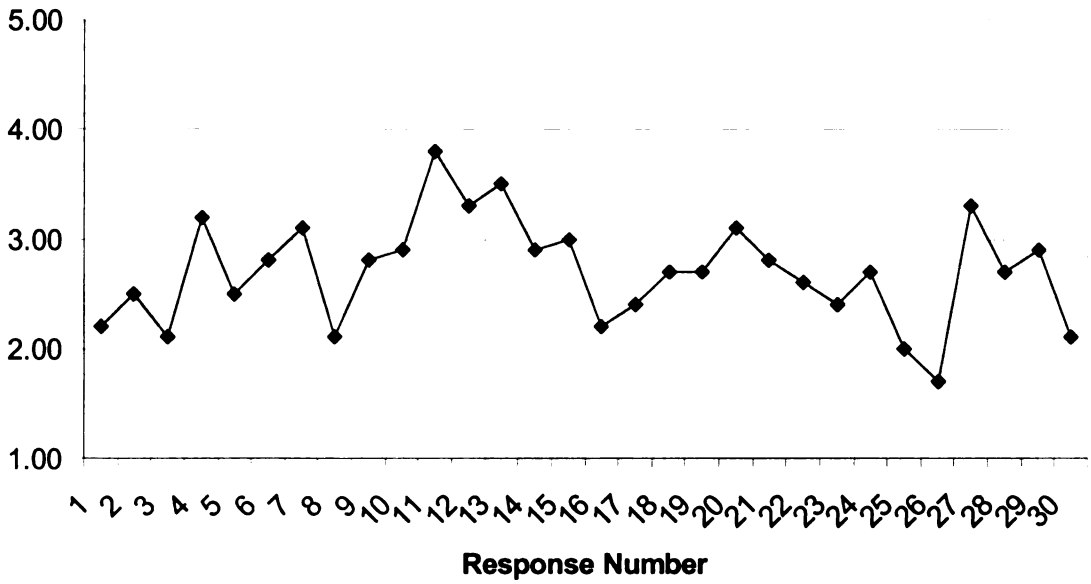
Most participants (70%) rated groundwater's economic role in Michigan as very important. Ten people (30%) rated groundwater as important to Michigan's economy. All of the participants rated groundwater as either important or very important to ecosystem health.

When asked to identify the most important issue related to groundwater in Michigan, eleven of the thirty participants (36.6%) thought that water quality issues were the most important challenges. Nine (30%) thought the most important problem was inadequate state-level policy surrounding groundwater withdrawals. Eight (26.6%) thought the most important problem was a lack of information available to decision makers and stakeholders about groundwater resources in Michigan. Two participants (6.6%) thought the problems were a result of public perception; i.e., the public mistakenly perceived problems surrounding groundwater withdrawals.

Policy Preferences

When asked at what level of impact decisions about groundwater extraction should be made, thirteen out of twenty-six participants (50%) preferred them to be made at the level of instream flow impacts; six (23%) preferred decisions to be made at the watershed impacts level; and six (23%) preferred decisions to be made at the level of Great Lakes impacts; one (4%) preferred them to be made at the groundwater aquifer level; no participants preferred them to be made at the state level.

Figure 7: Average value score for each participant (1=most liberal, 5=most conservative)



Correlating Personal Background Factors and Values, Attitudes, and Preferences

A two-tailed, bivariate correlation analysis using Pearson's formula was used to determine if personal background factors were correlated to an individual's values, beliefs and preferences in relation to groundwater withdrawal and environmental policy in general. The variable "economic value of groundwater" was used as a belief measure; the variable "scale of governance" was used as a preference measure; and the variable "values" indicates the scale developed to measure core policy beliefs in relation to environmental issues. These were used because they were either ordinal or scale variables, in that there is a meaningful order to the responses. The analysis shows that these three variables are not significantly correlated with one another.

There were, however, significant correlations between some of these measures and an individual's personal background factors (Table 1). Level of education was significantly correlated with the measure for values and beliefs. "Education" was shown

to be positively correlated with the variable "economic value of groundwater," indicating that as an individual's education increases, the importance placed on groundwater's economic value in Michigan decreases.

"Education" was also significantly correlated with "values," with those individuals having a higher level of education generally expressing more liberal policy values. "Political identity" was negatively correlated with "values," meaning that individuals who identified themselves as more politically liberal generally have liberal values as well. This demonstrates the consistency between the scale measure of core policy beliefs and an individual's own political identity.

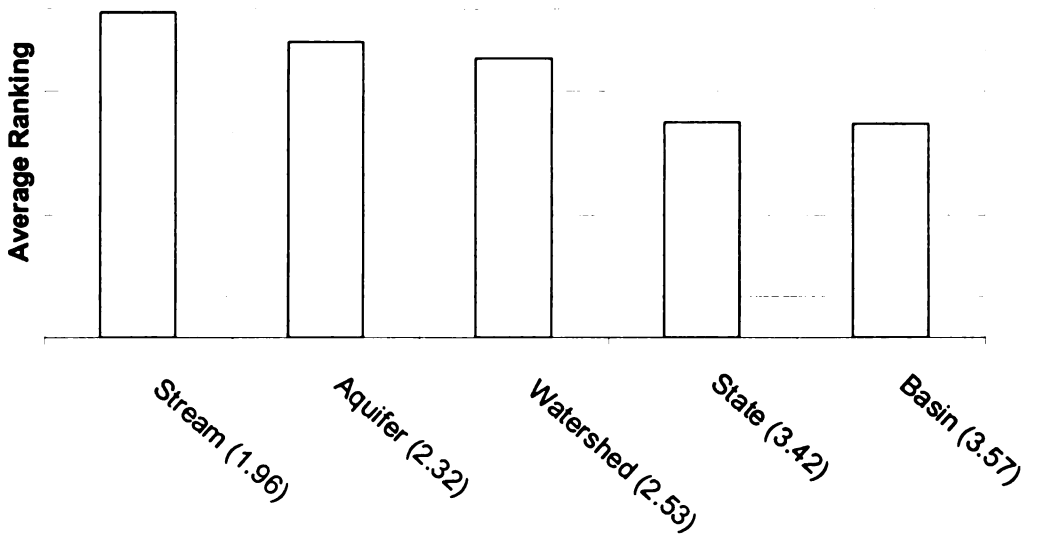
Table 1: Pearson's two-tailed bivariate correlation analysis for personal background factors and values, beliefs, and preferences

		Scale of policy and research	Education	Political Identity	Economic value of gw	Scale of governance	Values
Scale of policy and research	Pearson Correlation	1	-.016	.108	-.292	.151	.016
	Sig. (2-tailed)	.	.937	.586	.117	.462	.932
	N	30	27	28	30	26	30
Education	Pearson Correlation	-.016	1	.208	.423(*)	.064	-.400(*)
	Sig. (2-tailed)	.937	.	.298	.028	.770	.039
	N	27	27	27	27	23	27
Political Identity	Pearson Correlation	.108	.208	1	.182	-.201	-.375(*)
	Sig. (2-tailed)	.586	.298	.	.355	.345	.049
	N	28	27	28	28	24	28
Economic value of gw	Pearson Correlation	-.292	.423(*)	.182	1	.077	-.199
	Sig. (2-tailed)	.117	.028	.355	.	.707	.292
	N	30	27	28	30	26	30
Scale of governance	Pearson Correlation	.151	.064	-.201	.077	1	-.204
	Sig. (2-tailed)	.462	.770	.345	.707	.	.317
	N	26	23	24	26	26	26
Values	Pearson Correlation	.016	-.400(*)	-.375(*)	-.199	-.204	1
	Sig. (2-tailed)	.932	.039	.049	.292	.317	.
	N	30	27	28	30	26	30

Ranking Uses, Scales of Decision Making, and Policy Alternatives

Most participants thought that decisions about groundwater withdrawals could best be made based at the level of stream characteristics. Eighteen out of thirty (60%) participants ranked stream level flows as the best level of governance at which to make decisions about groundwater withdrawals, while eleven (37%) participants ranked the Great Lakes basin as the least desirable level at which to make decisions about groundwater withdrawals (Figure 8).

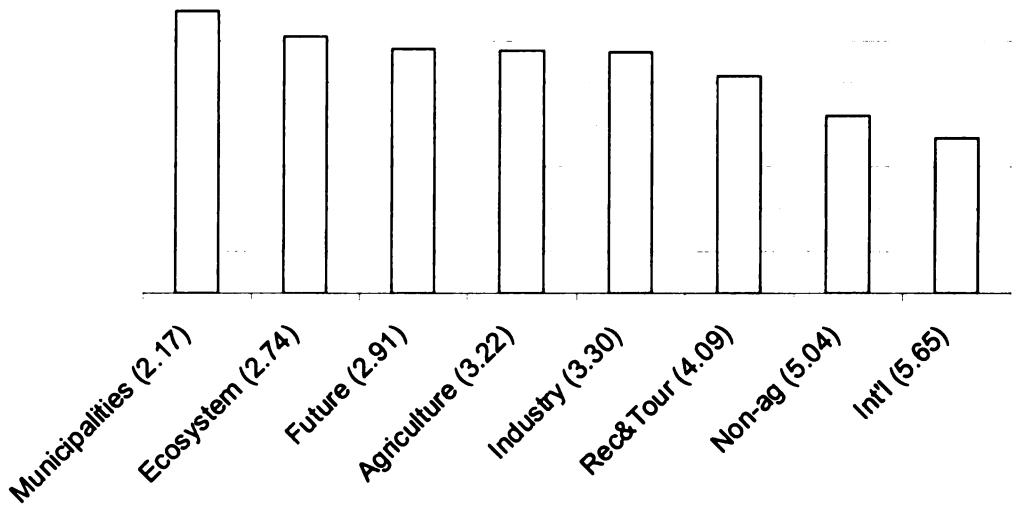
Figure 8: Average rank of physical levels of decision making for groundwater withdrawals; a value of 1 indicates the level was ranked first, and 5 would be last. The height of the bar indicates the strength of preference held for that level.



When asked to rank the eight general groundwater user groups in Michigan in terms of how they would personally prioritized usage given the opportunity participants listed municipal use as most important and fulfilling international agreements as least important (Figure 9). Ecosystem needs and those of future generations were also very highly ranked. Many times international agreements were ranked last because

participants felt that if we met the needs of Michigan in a sustainable way we would naturally meet our international obligations. However, some expressed concern at the prospect that placing a high priority on Great Lakes basin agreements would undermine Michigan's autonomy in relation to the governance of its water resources.

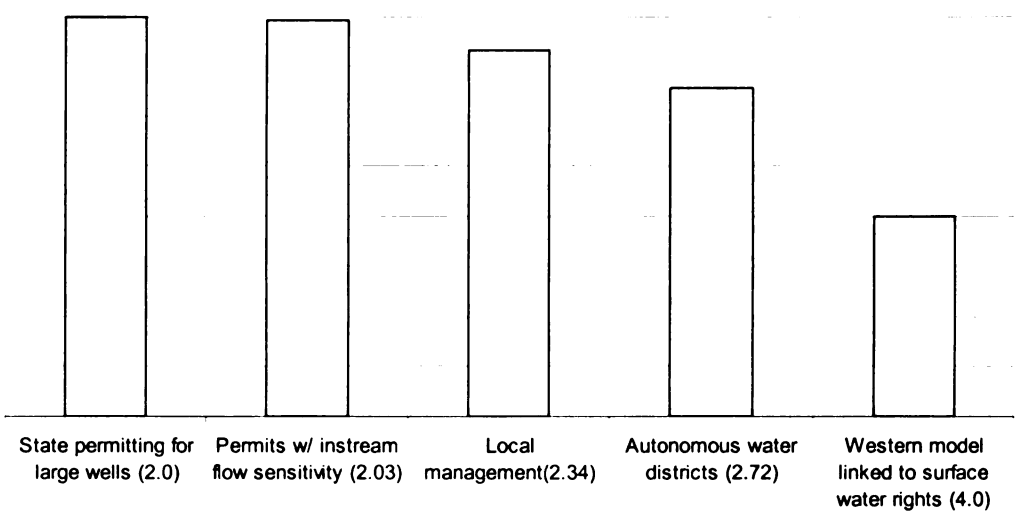
Figure 9: Average ranking of groundwater user groups in Michigan; a value of 1 indicates the use was ranked first, and 8 would be last. The height of the bar indicates the strength of preference held for meeting the needs of each group.



When participants were asked to rank alternative groundwater governance policy solutions developed in other states in the U.S. in terms of whether participants thought Michigan could benefit from implementing such a policy, two of the alternatives--a system of state-level permitting, and permits based on instream flow impacts—ranked highest (Figure 10). Twelve out of the twenty-nine who participated in this exercise (41%) ranked state permitting highest and ten out of twenty-nine (35%) ranked permits with sensitivity to instream flow impacts highest. However, neither of these were ranked

higher than second (2.0), on average, and as such there does not seem to be a clear consensus as to what would be optimal for Michigan. An evaluation of just these two options shows an almost even split, with twelve (41%) participants favoring the instream flow model, fourteen (48%) favoring state permits, and three (10%) ranking them equally valuable to Michigan's groundwater management. The western U.S.-style policy model of groundwater permits issued based on surface water rights was ranked least useful to Michigan by participants with sixteen (55%) participants ranking it last.

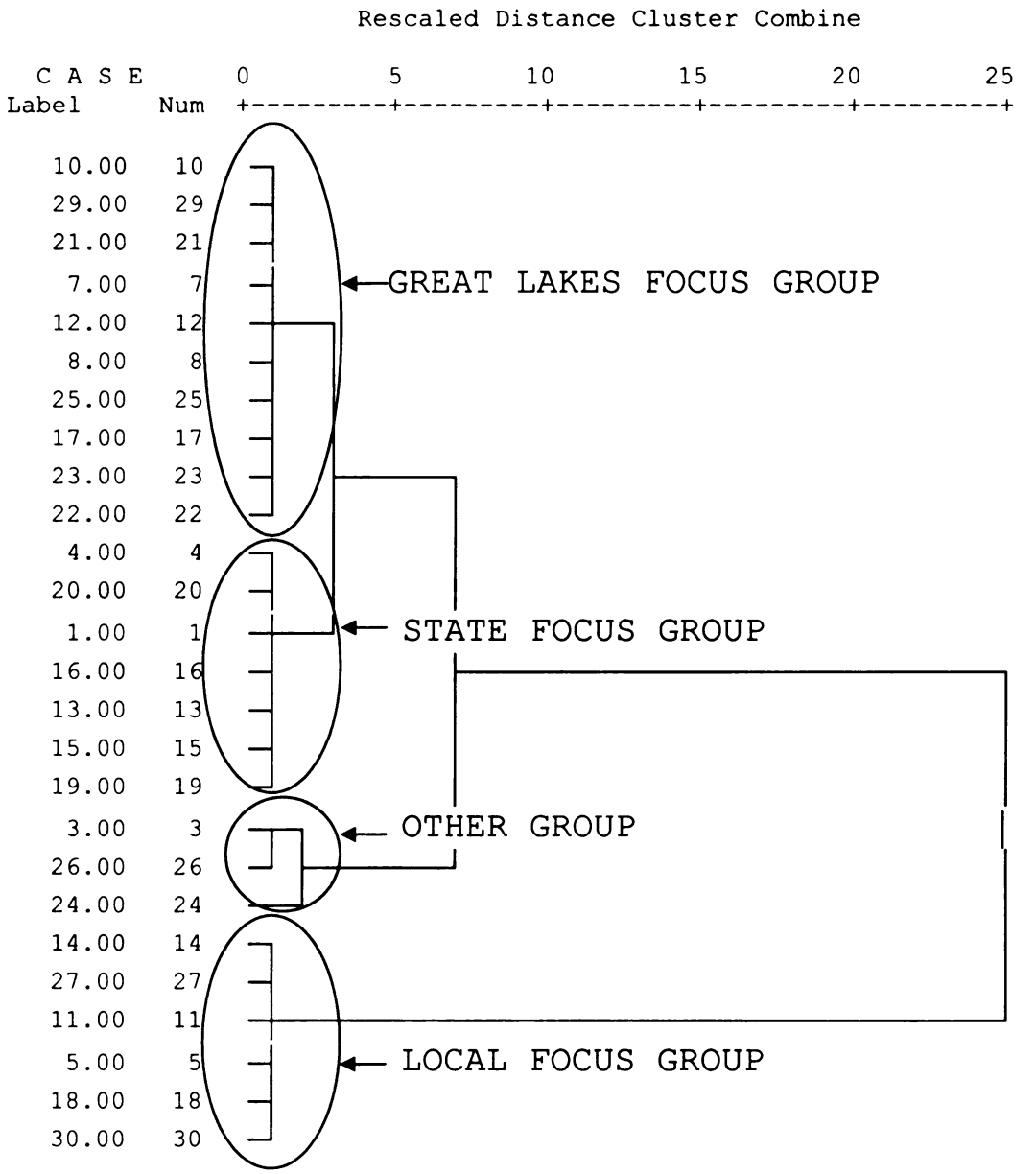
Figure 10: Average ranking of alternative policy models; a value of 1 indicates the policy was ranked first, and 5 would be last. The height of the bar indicates the preference held for the policy's ability to be successful in Michigan.



Looking for Groups

The Ward's method hierarchical cluster analysis method depicted four distinct groupings of individuals. These groups share common sets of beliefs, values, and preferences as related to the environment in general and groundwater use in particular (Figure 11).

Figure 11: Dendrogram showing Ward's method hierarchical cluster analysis results



The values of individuals are more similar between groups and most dissimilar in terms of the attitudes and preferences. To test the significance of these groupings, I used a cross-tab analysis of each of the three variables against the cluster membership. This showed a significant difference in the groups related to their attitudes and preferences, but not for values. Therefore, the differences among individuals seem to come primarily

from their different attitudes toward the use of groundwater and their policy preferences for its management. Each group has at least one Council member in it.

The first group that appears is the "Great Lakes Focus" Group (Table 2). This group had ten members, who were professionally a mix of individuals involved in policy and research, and had an average education level of a Bachelor's degree. They identified as politically conservative and unanimously found groundwater to be important to Michigan's economy. They thought the biggest problem related to groundwater in Michigan was the water's quality. One defining feature of this group is that, paradoxically, this group was the only one that identified as politically conservative, yet all ten members believed that groundwater decisions should be made at the Great Lakes basin level which is not typical of a conservative ideology. The group is named the "Great Lakes Focus" group because of their unanimous preference for policy decisions to be made at the Great Lakes level.

The second group is the "State Focus" Group (Table 3). This group has seven members who are a professional mix of individuals involved in policy and research. The average education level is a Master's degree and they identified politically as moderate. They believed groundwater is important to Michigan's economy and unanimously preferred that decisions about withdrawals be made at the state level. While the other three groups placed water quality as the first priority issue for Michigan groundwater, the defining feature of this group is that they thought the biggest problem related to Michigan's groundwater resources is an inadequate policy framework at the state level.

The third group is the "Other" Group (Table 4). This group only has three individuals, and they are all professionally involved primarily in policy issues. The

average education level is a Master's degree and they identified as politically moderate. They thought decisions should be made either at the state or Great Lakes basin level, and did not think groundwater is important to Michigan's economy. Some defining features of this group are that they thought the most important problem facing Michigan in terms of groundwater is water quality issues, and they are the only group with a liberal value score. However, there was no clear policy focus for the group.

The fourth group is the "Local Focus" Group (Table 5). This group has six members and they are primarily professionally involved in policy. The average education level is between a Bachelor's and a Master's degree, and they identify as politically moderate. They believe groundwater is important to Michigan's economy, and that the biggest issue for Michigan's groundwater is water quality. The defining feature of this group is that they all ranked governing at the level of in-stream impacts as most desirable. These individuals thought that decisions about groundwater withdrawals should be made based on the lowest scale of impact measurement that is available.

Table 2: The "Great Lakes Focus" Group

Number of Members	**10**
Profession	Both Policy and Research
Education	Bachelor's
Political ID	Conservative
Economic Value	Important (all)
Level of Gov't	Great Lakes (all)
Values	2.7/5.0
Problem	Water Quality
Defining Feature	*Unanimously preferred withdrawal decisions to be evaluated at the level of the Great Lakes basin*

Table 3: The "State Focus" Group

Number of Members	**7**
Profession	Both Policy and Research
Education	Master's
Political ID	Moderate
Economic Value	Important
Level of Gov't	State (all)
Values	2.8/5.0
Problem	Policy
Defining Feature	*Most concerned with the state's groundwater policy framework*

Table 4: The "Other" Group

Number of Members	**3**
Profession	Policy (all)
Education	Master's
Political ID	Moderate
Economic Value	Not Important
Level of Gov't	State/Great Lakes basin
Values	2.2/5.0
Problem	Water Quality
Defining Feature	*No clear policy focus*

Table 5: The "Local Focus" Group

Number of Members	**6**
Profession	Policy
Education	Bachelor's-Master's
Political ID	Moderate
Economic Value	Important
Level of Gov't	**In-stream Impacts (all)**
Values	2.8/5.0
Problem	Water Quality
Defining Feature	*Unanimously preferred withdrawal decisions to be evaluated at the level of in-stream impacts*

Summary

The interview results show that while there are some background similarities among those who are actively participating in the policy making process, there are far more differences. The participants were most similar in terms of their gender, ethnicity and age. The differences between the participants were mainly found in their political identity, education, and profession, variables that are far more socially contextual and changeable. While not very diverse demographically, the group was quite diverse in regard to other background variables: political identities included strong conservative to strong liberal, as well as independents and moderates; education levels ranged from high school to doctoral degrees; and professions ranged from highly scientific, research-based positions to specialized political lobbyists to little experience at all with groundwater issues. Of course, due to personal and political factors some individuals will have more influence and power than others; but this shows the range of interests that groundwater affects and the broad reach that decisions about its use can have.

There were some similarities among the group of participants as a whole. A full 76% of the participants favored a state-level permitting system of some kind as a useful solution for Michigan. This may be because this type of system had already been discussed in legislative meetings in 2004 and 2005, and is a common means of governing groundwater withdrawals in other Midwestern states (i.e., Wisconsin Public Act 301, 2004). The difference between the groups' values was very low, ranging from 2.2 to 2.8 on a five point scale, but there were larger differences in terms of their attitudes and policy preferences. This means that while there are shared values among this group of

stakeholders as a whole, the differences are due to the specific ways decisions about groundwater are made, rather than the nature of people's relationship to the resource.

The cluster analysis showed that there are four distinct groups of people that are similar in their values, attitudes and preferences. The focus of these groups in terms of groundwater included making decisions in the Great Lakes basin as a whole; improving Michignan's policy framework; conserving groundwater resources for ecological uses; and evaluating impacts at very local scales. The greatest level of unanimity within a group was in the Great Lakes Focus group, which was also the group that consistently interacted in other arenas such as MSU's Great Lakes Protection Fund and Senator Birkholz's policy development meetings.

Qualitative Analysis

The individuals involved in this study play a key role in determining the future of Michigan's groundwater resources, whether through their participation in the GWCAC, actively lobbying legislators, or developing the science base for decisions to be made on. Their roles and means of influence are quite variable: some have had repeated interactions with one another through legislative hearings, committee and council membership; some communicate their message mainly through media outlets, policy platforms and membership campaigns; still others hold politically appointed positions. The length of time that individuals have spent on water policy issues in Michigan and the background they bring with them also varies: some were involved in similar policy reviews from twenty or more years ago while others arrived on the water policy scene only recently. These differences and others were acknowledged by many of the advisors that I interviewed and are illustrated by some of the following statements from the interviews:

> "...all of us on the commission, we all are a very diverse group, I mean it's the whole political spectrum from right to left, and everybody in between, so we're all at the table too to represent not only our own interest but also the guy or gal who appointed us." ---Advisor 4

> "...the Council doesn't have really good representation from the municipal users Let's see, who else is not at that table. That room doesn't really have big-time industrial users there, so talking to...these are some of my opposition and they'll give you totally opposite answers." ---Advisor 3

> "These are good questions, you'll get different answers." ---Advisor 1

Some were also aware of what value, skill or knowledge they contributed to the discussion, and the challenges this can present, as illustrated by the following statements:

> "It's that I worked for a long time as a research biologist, and I worked on connecting landscapes and hydrology and river habitats and fish distribution and abundance." ---Advisor 1

"Now my role on there (the Council) is to represent local government. So, to do that I try to solicit advice and ideas from other folks in cities, villages and county government, but it's not easy, frankly. I thought I would get a lot more input and advice from folks but it's been pretty sporadic. I've found I've had to do more of my own asking rather than people coming to me...I have a pretty good track record at regional cooperation, and working with neighboring communities." ---Advisor 4

"My own personal interest is in water and waste water treatment." ---Advisor 7

"I am different than most of them on there (the Council) because I'm not representing necessarily any single group, generally the people of Michigan, which is ridiculous, but that's who I'm representing." ---Advisor 8

"I try to keep on top of what is going on with policy, legislation for Michigan and the whole Great Lakes." ---Advisor 17

Because of the differences among individuals there are also a range of ideas related to how people perceive problems and solutions for groundwater extraction in Michigan. However, there are many similarities as well. Here I use the text of the thirty interviews I conducted with advisors in Michigan to illustrate these differences and similarities.

Most of the individuals felt that a change in Michigan's groundwater withdrawal policies is inevitable, if not welcome and necessary. For some this was due to international pressures to comply with reporting standards in the Great Lakes Charter, for others this was necessary for industry to thrive in Michigan as a consistent framework for decision making increases predictability for new and existing users; some felt that a change would help to better protect ecosystems that depend on groundwater. Examples of statements made about whether policy change is necessary in Michigan include:

"So, the reason I think it's (policy change) very necessary is that typically the environmental components, the ecosystem components, are not always understood or considered when people are making social, political, and industrial decisions. So, the thing that needs to change the most in my mind is awareness of how things are linked. Part of my hesitation was, I'm not sure we need a million laws, but we do need to recognize how the systems work, and how our decisions will have ramifications on an

ecosystem, that I think a lot of people do value. So, I just want good choices to be made with good information." --Advisor 1

"What I think needs to change is not so much a lot of new regulations, or necessarily very onerous types of permitting and all that kind of stuff, even though in some cases that may be warranted. I think what the state needs to do is kind of get their act together at the state level, and coordinate departments, and make sure that everybody else knows what everybody is doing, because groundwater crosses a number of different departments at the state level in terms of involvement. I think that they need to "incentivize" or encourage local governments to work together to address groundwater protection and I would say that would be both: number one would be quality, and number two would be quantity."
---Advisor 8

"I think we need to tweak some of the things that are happening, but we're on the right track." ---Advisor 5

"Any policy/laws/regulation that don't recognize impacts on what is going on with surface water need to be changed." ---Advisor 17

"We're on the threshold of coming to grips with that whole conundrum of changing: are we going to change?" ---Advisor 6

A common approach to managing groundwater withdrawals in other states is through implementing a permitting system at the state level. When asked whether they believed such a system would harm or benefit different sectors in Michigan, based on their own thoughts and experience, the group of advisors who participated in this study had mixed feelings on the subject. Some thought that new rules, new legislation, would necessarily generate both harm and benefits as the natural course of outcomes; some thought that properly crafted legislation is able to avoid inflicting harm on any sector; some thought that new rules and additional regulations mean only harm without benefits. These mixed sentiments are illustrated in the following statements made during the interviews:

"There's always winners and losers, that's the way things are generated. Until we see exactly what the legislation looks like we won't know who the winners and losers will be, but that's inevitable." ---Advisor 2

"I think in the long term, all sectors benefit from it. I think some of the positions you're seeing from some of the sectors at this point are rather short term in nature. Their opposition I think takes a very short term view of what this does for them, and I think the key is to make sure that we're balancing the uses so that everyone who wants to put water to use in Michigan is going to get kind of an opportunity to do it, but not in a way that is going to limit future generations." ---Advisor 3

"Well, I would hope that there would not be winners and losers...I think we have to strike a balance between the environment and the many people in Michigan that depend on groundwater for a variety of reasons." ---Advisor 4

"I think additional regulation, everybody loses." ---Advisor 5

"To the extent that somebody feels harmed that had a right that they thought they could exercise in the future and that is now extinguished, or that they have to ask permission to exercise what they thought was their unbounded right, that is a harm...None of us really want to go ask dad if we can take the car out. Especially if we thought the car was ours." ---Advisor 9

"Obviously it depends on what the legislation is. But most types of legislation that would be considered by and large I think industry will get a little bit of a benefit from it because it will create increased predictability whatever regulatory costs go into it. By and large I think actually most of the permitting being tossed around are going to be fairly neutral." ---Advisor 24

"I would think the goal of the policy would be to ensure that there weren't losers." ---Advisor 30

"It depends on the way the bill is written. I think there is a way to write a bill that every sector is treated equally and that is the way it ought to go." ---Advisor 25

The group overwhelmingly agreed that market-based mechanisms for managing groundwater withdrawals, such as water trading, are not tools that Michigan should be looking to adopt at this point. The following statements illustrate these views:

"You don't really have a scarcity of groundwater right now to justify a market system." ---Advisor 24

"Over the long run yes, but not now. There needs to be a limit on the amount of total water that can be taken from each catchment basin, defined by the impact on that stream. Once you get to that limit, yes, it is appropriate to think about trading within than context." ---Advisor 25

"I think it's (water markets) fodder for research, it's fodder for investigation. It may lead to new truths. But I don't see it as a fundamental aspect at the core of permitting or a management structure." ---Advisor 9

"We have talked about it, we're aware of it. It's very difficult though to have this concept of trade-offs. Michigan has tried that with wetlands-some people think it's great, some people think it's a horrible idea...but I've seen cases where that works ok, and I've seen cases where I don't think it makes sense." ---Advisor 4

The participants were asked about appropriate uses of groundwater, specifically, if they thought that extracting groundwater for commercial sale (often interpreted as sold as bottled water) and for agricultural irrigation are acceptable uses of groundwater resources. The majority said that these are appropriate uses. However, there were some who did not feel these are appropriate. The opposition to withdrawals for agricultural irrigation was mainly due to a view that irrigation water rights are sometimes abused or over-used. There were some who felt that allowing withdrawals for commercial sale set a precedent in Michigan they did not feel was appropriate, or that withdrawing for commercial sale is just wrong. These ideas are represented in the following statements:

"I think in principle it's a valid use, I'm not against agriculture, and I think it ought to be very careful, I don't want to waste any water...So I'm concerned that once a farmer buys an irrigation system they're using it. They buy it in drought cycles and then they use it all the time. And they'll argue, no, no, no, we use it perfectly to match the soils, but I don't know if I buy it." ---Advisor 1

"I'd probably say if people want to buy it, as long as it's not affecting the environment, then that's fine." ---Advisor 2

"Ag is still Michigan's second largest industry. And I think without groundwater withdrawals they would be sunk. I think they are also in many cases, not all, but I think most of your ag users are among your better conservationists because they have everything to lose if they run out of water." ---Advisor 4

"Groundwater use for commercial sale, yes, because we sell milk, it has water in it. Potatoes have water in it, beans have water in it. So yes, we're doing it every day. And we can go as far as to say should we be selling bottled groundwater. Well, I think some decisions are going to be made on that." ---Advisor 5

"If we start down the slippery slope of using our water as a commodity then we may not be able to protect the resource." ---Advisor 24

In addition to direct responses to questions there are common themes and topics that emerged during the interviews, without prompting, related to the future of groundwater withdrawal policy in Michigan. One was the idea of sustainability. Though rarely defined, sustainability was often invoked as a guiding principle for making decisions about groundwater withdrawals in Michigan. The following statements help to illustrate the advisors' perception of sustainability and how it might relate to the topic of groundwater policy:

> "...but, it's the whole issue of sustainability, what's the scope of our groundwater resources, where is it threatened, where is there no threat, and what do we need to do to keep it going for future use." ---Advisor 4

> "I would say sustainability is definitely important...also the sustainability issue. In other words, if they're pumping so much groundwater out of an area that they only do it for twenty years and then it's depleted." ---Advisor 8

> "...it's not about total (withdrawal), there's sort of a sustainability element or a balance between withdrawal, transmissivity, and storativity aspects...If the system stays healthy then there's a sustainability to it. There's a concern for future generations." ---Advisor 9

> "If you collect information based on aquifers then you can deal with groundwater-surface water interaction and the long term sustainability with respect to getting water out for human uses. And really the tool for that is the groundwater flow model." ---Advisor 17

> "I think it's very important for Michigan to find some kind of balance between its economic development and its environmental protection to be able to promote development, the use and the enjoyment, of its groundwater resource, in a way that's sustainable; in a way that let's us do it essentially on and on and on for future generations." ---Advisor 30

The second topic that emerged from the interviews is the threat, real or perceived, of western states gaining access to water resources in the Great Lakes basin and Michigan in particular. This is a topic that many incorporated into their answers regarding withdrawal policy and the future of the resource in Michigan; at times disregarding the

threat and at times judging it as worthy of protective measures. The following statements illustrate some of these thoughts:

> "So it seems to me that it's more powerful to think about the Great Lakes basin as a whole...but if we did the whole nation this way, then the other argument is then Arizona would say, well we want the water from the Great Lakes since we're all one big team here." ---Advisor 1

> "A lot of people are afraid we're going to run out of it, or people are going to steal it, Arizona. I think it's all nonsense...and I certainly don't want to ship our water to Arizona. They can't afford to buy it anyway." ---Advisor 7

> "This issue we're dealing with of diversions under Annex 2001 and all that is, I suppose that in future years if the Southwest states that are drier started getting in worse shape, there's going to be more and more pressure to divert water from the Great Lakes...for freshwater supply. And so we do need policies to manage and control that, but I see that more as an issue that's coming at us in the future, rather than something we're dealing with." ---Advisor 8

> "We've been shipping water out of this state forever and should because that's our natural economic advantage over places like Arizona...Do I think we should have a pipeline that goes to Arizona or even to southern Illinois? I think not." ---Advisor 13

Overall, there were a variety of opinions on the state of the debate in Michigan and the future of policies for managing groundwater withdrawals. There were some who recognized the value of having the debate before a major crisis occurs; some were hopeful that Michigan can capitalize on its water resources to its economic advantage; some see the debate as a fundamental decision regarding the nature of groundwater resources in the realm of governance; one advisor even mentioned the potential impact of global warming on future decisions that will be made. Regardless of their opinion, people tended to look toward the future. The following statements illustrate this:

> "We have had some small kind of crises, but I see these discussions as actually being proactive, before we have a big crisis, which is a real healthy time to talk about it, so I think the big issue, sorry, opportunity we have is to lay a framework for the future that will help us." ---Advisor 1

> "But if we take a look at Michigan's economy today, being relatively slack, and we look at being a groundwater rich state, I think we have a real obligation to go to work to try to

get some of these industries in that can effectively use groundwater, at least in a manageable and a conservation way." ---Advisor 5

"(It) really comes down more to the question of is the groundwater of the state a public trust resource or is it a private mineral right." ---Advisor 6

"The problem with that question is the fact that we may start, through global warming or other events, we may not have as much rainfall in the future, and that would impact obviously on groundwater. So the two may come at us at the same time, and in that case if you don't have rainfall you need the groundwater to irrigate, and if you don't have the groundwater to irrigate, you're pretty sunk." ---Advisor 8

"Human use is not going away. We are not going back to a pre-settlement use, and we are not going to legislate people...back in time in terms of their overall consumption. We're just not headed down that path and I think the public will hopefully push back on that." ---Advisor 9

"There is a lot of discussion in the legislature about regulating groundwater in the state. I think it's much more important to understand the realities of groundwater: how much there is, how much is available, and how much we use." ---Advisor 13

"It's interesting, hopefully from your perspective, when you look at a resource that really is relatively abundant, it would be very simple if we were in a real arid environment with very limited resources, then everybody recognizes the need for conservation and efficient use of the water. But here, where it's plentiful, people get complacent or they ignore the problem because they have other problems, and trying to get ahead of the problem takes a lot of energy, it takes a lot of courage, and some vision, all of those aspects and humans are crisis oriented so if we're not in a crisis it's difficult to act ahead of the curve and that's what we're trying to do here." ---Advisor 2

Summary

This group's outlook for the future of Michigan's groundwater resources came out of the interviews in a much more qualitative way, and often involved topics not included in the interview tool. There was an overall consensus that Michigan as a state does not (yet) face a crisis situation related to groundwater. Many participants were much more concerned with issues of groundwater quality than quantity, although the two are related. Most participants saw preparing for future situations and circumstances related to governance as a top priority, whether in terms of gathering more information about Michigan's groundwater resources, enacting legal protections from out of basin transfers, or determining a sustainable level of use to meet the needs of various sectors without

depleting the resource. This idea of sustainability was discussed by several participants and may be a result of the mandate to examine the sustainability of the state's groundwater resources as laid out in PA 148. Most thought that allowing the commercial sale of groundwater (i.e., bottled water) is a way for Michigan to capitalize on this valuable resource, if done in an ecologically sensitive manner.

While not all participants agreed on the desirability of a state-level permitting system, this was the most referred to method of governing the resource. Many cited local level decision making as desirable but questioned whether adequate scientific understanding would be available, and how the multiplicity of regulations that could result would be economically desirable. On the other end of the scale, many supported the idea of regional governance but were reluctant to create a situation in which Michigan's economic future would be dependant or under the control of an outside entity, including western states rumored to desire Great Lakes water. It may be these fears that outweighed any hesitation regarding state-level permitting.

Discussion

The results show there are significant differences among individual backgrounds, values, attitudes and policy preferences related to groundwater. Additionally there are significantly different groups who share a similar set of values, attitudes and policy preferences. In the context of these differences and their deliberate inclusion in the groundwater policy making process, Michigan has enacted legislation that tightens monitoring and control of groundwater withdrawals in the state. While there have been isolated conflicts in Michigan, as a water rich state there has yet to be a condition of scarcity or emergency that would have required the state to act quickly. Rather, there were values expressed by the stakeholders through workgroups and the media that stressed the ways Michigan could benefit from planning now for future concerns such as the sustainability of water resources, enhancing the state's economy, and establishing a legal framework that prevents large scale out-of-basin withdrawals.

The water-related policy making and enforcing institutions in Michigan, as in other water-rich areas, have not typically needed to address many of the stresses on water resources faced by water scarce areas and thus have a need to develop processes now that will help them to meet future challenges. The development of an advisory institution to help meet these goals, the Groundwater Conservation Advisory Council, is a valuable model of groundwater governance not only for Michigan as it continues to develop monitoring devices and further involve its stakeholders, but also for other water-rich areas. Making decisions related to groundwater use and its future should be politically debated and contested to decide what outcomes are desired and which criteria are most important, therefore the answer for each region, state or community will be different. For

example, Michigan decided that characteristic trout populations will be the measure of acceptability used for groundwater withdrawals. However, in order for a governance system that allows for this type of deliberation to persist and maintain effectiveness it must be resilient to external forces upon its component social and ecological systems.

Increasing a system's capacity for resilience happens in the present, and can account for damage of the past, but really is about planning for an uncertain future. Governance that increases the resilience of social and ecological systems is particularly important in water rich states because of changes in the economy and environment, such as climate change, globalization, and population increases, whose impacts on ecological and social systems in many ways are yet to be felt. The ability to detect hard-to-reverse thresholds in a timely manner could allow societies to take measures to prevent ecosystems and social systems from transferring to an undesirable condition (Lebel et al 2006). By preparing institutions now, and defining the critical thresholds that stakeholders are not willing to cross, the resources of water-rich areas can be governed in a way that will allow for maximum adaptability and, ultimately, success in preserving those attributes of our social and ecological systems that have been deemed important and desirable.

Lebel et al (2006) hypothesized there are three criteria that are necessary for regional institutions to successfully gvern for resilience. These were tested on several case studies and the same will be done here for the case of governing Michigan's groundwater. The criteria for these institutions are: that they include participation and deliberation; they are polycentric and multi-layered; they are and accountable and just. The authors found a consistent connection between these three criteria and the ability to

govern in a way that increases social and ecological systems' resilience. The characteristics of Michigan's existing and newly emerging groundwater withdrawal institutions fit many but not all of these. As such, this serves as an opportunity for Michigan and other water rich states to learn and improve.

Governance for Resilience Includes Participation and Deliberation

The first criterion of governing for resilience is including participation and deliberation. Participation implies the involvement of a diversity of actors and an ability to create transparency when discussing issues. Bierle and Cayford (2002) define participation as "any of several 'mechanisms' intentionally instituted to involve the lay public or their representatives in administrative decision making (6)." Thus not only is participation involve those not typically part of decision making, but it is also intentional. Michigan's Groundwater Conservation Advisory Council intentionally represented a diverse array of groundwater stakeholders and provided them a means of influencing both the evaluation of present policy conditions but also for recommending a future path for Michigan. Additionally, the Council's meetings were open to the public and often included presentations from other groups.

The results of this study also support the representation and diversity of the people who participated in changing Michigan's groundwater governance framework in terms of how they view groundwater problems and solutions. The differences in the perceived economic role of groundwater in Michigan, the challenges Michigan faces, and the background each member brought was highlighted in the qualitative responses. For example, some saw groundwater as critical to the economy, and as a source of future

development for the state; others saw groundwater as an insignificant factor in Michigan's economy.

Governance models that include participation have often been hypothesized to produce more acceptable, equitable and effective environmental and policy outcomes (Adaman and Madra 2003; Ostrom 1990). The Council's recommendations were quickly followed by legislation that reflected many of the diverse opinions held by its members. The legislation also charged the Council with additional responsibilities, further institutionalizing its presence. However, the effectiveness of the legislation is yet to be determined. One criticism of the legislation's equity would be the singling out of water bottling operations as needing to meet higher environmental standards than other industries. Water bottlers are required to mitigate any environmental impacts, while other industries need only be concerned with their impacts on characteristic fish populations. However, it can be assumed that this provision is meant to protect the interests of riparian rights, and the citizens group (MCWC) who fought for these in Circuit court.

According to Lebel et al (2006) deliberation is characterized by repeated interactions that allow stakeholders to build trust and develop a shared understanding and social learning. They argue that deliberation allows for differences in interests and perceptions to be explored among individuals, and the trust and shared understanding that develop form the foundation for mobilizing around new issues. Also, deliberation can be an important alternative or complement to representational democracy.

Michigan's Council held meetings at least monthly for two years, and often organized into smaller subcommittees to address specific issues. This allowed for repeated and concentrated interaction. However, these were not the only interactions, and

not the only people, that influenced policy outcomes in Michigan. The groups that emerged among the participants in this study reflect the way deliberation may influence shared perceptions and preferences. While each group had a member of the Council in it, the group labeled "Great Lakes focus" was composed of the most individuals who had participated in other stakeholder group projects, and was also the group that expressed the most unanimity. It could be that those who held the most similar views were more comfortable to interact, it is likely the case that these individuals have been in deliberative situations repeatedly and have had the opportunity to share ideas on problems and solutions, and to evaluate what about groundwater use and management is important and what valued system attributes should be maintained. Additionally, the similar values shared by all participants may have allowed them to communicate and compromise despite the greater difference in attitudes and policy preferences. It may be that the repeated interaction allowed these shared values to be recognized, increasing trust and facilitating compromise.

However, while institutions that foster resilience may be characterized by their capacity for participation and deliberation, there is not necessarily a guarantee that by including participation and deliberation that optimal policy will result (Cooke and Kothari 2004). In order for participation to work, the structure must match the knowledge and value context of the issue at hand (Chess et al 1998; Cleaver 2004). In Michigan's case the fact that there were only local conflicts, no conditions of scarcity and a broad concern for future challenges, the inclusion of representatives from various stakeholder groups and their ability to work closely with decision makers seems to have been appropriate. Should this model be transferred to a higher conflict area it may be necessary

to broaden the method of participation to include more laypeople and involve greater educational and awareness efforts.

Governance for Resilience Involves Polycentric and Multi-layered Institutions

The fit, interplay and scale of environmental institutions play an important role in linking these institutions to the ecological and social systems they govern (Young 2002b; Ostrom 2005). Polycentric institutions have multiple loci of authority and allow for the ability of local problems to be dealt with in a local context (Lebel et al 2006). The groundwater policy process in Michigan has highlighted multiple locations of control in decision making, as well as what can happen when these are not coordinated. The disconnect between state policies and local impacts is what originally prompted action toward creating new withdrawal policies. By forming a citizen's organization (Michigan Citizens for Water Conservation) this affected group was able to put the question of small scale impacts on the state's agenda. The views of many of the participants in this study support local control and the evaluation of local impacts. This is reflected in the legislation in the form of sector-based best management practices and the encouragement of watershed councils. However, it is unclear how much authority these groups will have and how much flexibility to adapt to changing conditions they will be given.

"Multi-layered institutional arrangements can be important for handling scale-dependent governance challenges as well as cross-scale interactions (Lebel et al 2006)." Governing groundwater requires Michigan to coordinate its policy activities at every level from local to international and soon it will likely require a global awareness as demand for water continues to increase. The values, attitudes and preferences of individuals in this study reflect this awareness. Local level impacts and conflict were a

top priority for many, and their evaluation was part of the Council's mandate. Additionally, by preparing a legal framework that complied with international agreements with Canada and regional agreements within the United States Michigan stakeholders hoped to avoid future challenges to remove large quantities from the Great Lakes. Simultaneously there as a majority who believed this could best be accomplished by state level regulation and monitoring. As a model of governance, the Council provided an additional institutional layer that adds to existing agency and non-governmental networks and can provide coordination among these as Council members interact in other work groups or with their coworkers and advocacy partners.

This model of governance has succeeded in linking institutional characteristics with valued ecological systems. The policy that resulted in Michigan links decision making for groundwater withdrawals to their impacts on characteristic fish populations. These were determined to be not only indicators of ecological health but economically and culturally valued resources in the state. It also resulted in increasing the synergy between groundwater and surface water policy, a gap that many other water management areas also struggle to fill.

The suggestions that can be made in terms of polycentric and multi-layered institutions include formalizing local authority and continuing to link local, state, and regional decision making institutions and finding ways to facilitate communication between them, whether through the Council or other mechanisms.

Governance for Resilience is Accountable and Just

The final criterion for governing for resilience is decision makers that are accountable and just. As posed by Lebel et al (2006), the question is not only the

resilience of what to what, but for whom? Who should be accountable and will they be? Will minority interests be protected?

These are much more difficult to evaluate in Michigan's case than the previous two because of the relatively recent legislation. As the Council pointed out in their final report, even the conflict resolution bill from 2003 (PA 177) has yet to be tested. Much of the responsibility for enforcement of permitting and registering groundwater withdrawals lies with the DEQ, but there are also provisions in the legislation that encourage water sectors to develop best management practices. It is unclear how or whether these groups be held accountable. An important addition, however, was a requirement for the Governor to publicly announce any intention to veto a large out-of-basin diversion so that citizens may have a chance to put forth their opinions on the issue, which increases the accountability of the state in terms of international basin-scale issues.

While the individuals in this study were quite diverse in terms of their education, profession, values, etc., there is still an under-representation of women, minorities, and potentially urban and municipal interests. This may not affect the equity of the resultant legislation, but it may be that the perception of equity is as important as its reality when determining whether a system of governance is just. However, as the Council is a politically appointed group with no women or minorities as members, there is room for such changes and the institutional mechanisms to be deliberate in their choosing.

Monitoring and evaluating the impacts of the legislation on various user groups and the ability of Michigan citizens to hold agencies and decision makers accountable will be very important in the coming years. The policy path Michigan has chosen has yet to be tested for enforcement potential. This will play an important role in determining

how this governance model will foster resilience in Michigan's groundwater institutions as economic and environmental conditions change in the future.

Appendix A: Interview Instrument

Interview # _____

As my email mentioned, I am conducting a study of the individuals in Michigan involved with groundwater withdrawal policy. The interview contains questions about your work, your background and your views. It includes both open-ended and closed-ended questions, as well as exercises designed to gain a better understanding of your views. These sheets include the text of some of the closed-ended questions; they should help us get through those parts of the interview more quickly. Please feel free to make any comments you care to at any point. As the email noted, your responses will be kept strictly confidential.

This interview is completely voluntary--if we come to any questions which you do not want to answer, just let me know and we will go on to the next question.

[AT THIS POINT, READ AND SIGN CONSENT FORM AND BEGIN RECORDING]

1. I'd like to ask about your work. What exactly is your position, and what are your duties?

Probe: If you had to categorize your work, would you say the majority of your time is spent in:
_____ conducting research
_____ supervising research
_____ developing policy from research
_____ management
_____ translating and interpreting scientific information
_____ working directly on policy issues
_____ Other (specify) _____

[Let's talk about groundwater now]

3. In your opinion, what is the most important topic related to groundwater in Michigan?

4. How familiar with Michigan's groundwater withdrawal policy system do you consider yourself?

_____ 1. Very familiar

_____ 2. Familiar

_____ 3. Neutral

_____ 4. Unfamiliar

_____ 5. Very unfamiliar

_____ 9. D.K., N.R

[I'd like to know how important you think the following considerations are. You may answer: very important, important, neutral, unimportant, very unimportant, or say you don't know or would prefer not to answer]

5. In your opinion, how important are the needs of *future generations* when making decisions about groundwater in Michigan?

_____ 1. Very important

_____ 2. Important

_____ 3. Neutral

_____ 4. Unimportant

_____ 5. Very unimportant

_____ 9. D.K., N.R

6. In your opinion, how important is Michigan's compliance with *international agreements,* such as the Great Lakes Charter?

_____ 1. Very important

_____ 2. Important

_____ 3. Neutral

_____ 4. Unimportant

_____ 5. Very unimportant

_____ 9. D.K., N.R

7. In your opinion, how important is groundwater for *economic growth* in Michigan?

_____ 1. Very important

_____ 2. Important

_____ 3. Neutral

_____ 4. Unimportant

_____ 5. Very unimportant

_____ 9. D.K., N.R

8. In your opinion, how important is groundwater for *industrial vitality* in Michigan?

_____ 1. Very important

_____ 2. Important

_____ 3. Neutral

_____ 4. Unimportant

_____ 5. Very unimportant

_____ 9. D.K., N.R.

9. In your opinion, how important is groundwater for *agricultural vitality* in Michigan?

_____ 1. Very important

_____ 2. Important

_____ 3. Neutral

_____ 4. Unimportant

_____ 5. Very unimportant

_____ 9. D.K., N.R.

10. In your opinion, how important is groundwater for *recreation and tourism* in Michigan?

_____ 1. Very important

_____ 2. Important

_____ 3. Neutral

_____ 4. Unimportant

_____ 5. Very unimportant

_____ 9. D.K., N.R.

11. In your opinion, how important is groundwater for *ecosystem health* in Michigan?

_____ 1. Very important

_____ 2. Important

_____ 3. Neutral

_____ 4. Unimportant

_____ 5. Very unimportant

_____ 9. D.K., N.R.

12. In your opinion, how important is the surface water and groundwater connection?

_____ 1. Very important

_____ 2. Important

_____ 3. Neutral

_____ 4. Unimportant

_____ 5. Very unimportant

_____ 9. D.K., N.R.

12. In your opinion, is it necessary for Michigan to change its policies regarding groundwater withdrawals?

If yes: What are the most important changes Michigan needs to make?

-More liberal?

-More restrictive?

If yes: Why is change necessary? How?

If no: Why not?

QUANTITATIVE TRADEOFFS, ENVIRONMENTAL CRITERIA

13. The following cards contain factors that have to be given priorities in new groundwater legislation and attendant regulations. Please place the cards in the order of priority you believe such a new law should give to each of them.
(Each card will have one of the following variables and interviewer has an explanation ready)

- Maintaining an ecologically minimum instream flow _____
- Total water withdrawal from the state _____
- Total water withdrawal from a watershed _____
- Total water withdrawal from an aquifer _____
- Total water withdrawal from the Great Lakes basin _____

QUALITATIVE TRADEOFFS, SOCIAL POLITICAL ECONOMIC CRITERIA

14. The following cards contain development concerns associated with groundwater withdrawal that have to be given priorities in new groundwater legislation and attendant regulations. Please hand me the cards in the order of priority you believe such a new law should give to each of them.

(Each card will have one of the following variables and interviewer has explanation)

- Agriculture _____
- Recreation and Tourism _____
- Ecosystem Goods and Services _____
- Industry/Manufacturing/Commercial use _____
- Non-agricultural irrigation _____
- Compliance with international agreements _____
- Concern for needs of future generations _____
- Municipalities _____

[Now I'd like to know how much you agree or disagree with the following statements. They are to get an idea of how you think about issues of environmental policy in a general sense. You may answer: highly agree, agree, neutral, disagree, highly disagree, or say that you don't know or would prefer not to answer]

15. In environmental quality disputes the burden should be on users to prove that their use will not harm human health or wildlife habitat.

_____ 1. Highly agree

_____ 2. Agree

_____ 3. Neutral

_____ 4. Disagree

_____ 5. Highly Disagree

_____ 9. D.K., N.R.

16. Decisions about development are best left to the economic market.

_____ 1. Highly agree

_____ 2. Agree

_____ 3. Neutral

_____ 4. Disagree

_____ 5. Highly Disagree

_____ 9. D.K., N.R.

17. More emphasis should be placed on society's environmental rights and less placed on the individual's rights.

_____ 1. Highly agree

_____ 2. Agree

_____ 3. Neutral

_____ 4. Disagree

_____ 5. Highly Disagree

_____ 9. D.K., N.R.

18. Groundwater should be managed primarily for human benefit.

_____ 1. Highly agree

_____ 2. Agree

_____ 3. Neutral

_____ 4. Disagree

_____ 5. Highly Disagree

_____ 9. D.K., N.R.

19. Individual ownership of groundwater rights should be replaced by public control.

_____ 1. Highly agree

_____ 2. Agree

_____ 3. Neutral

_____ 4. Disagree

_____ 5. Highly Disagree

_____ 9. D.K., N.R.

20. Public and environmental groups should have a greater role in the groundwater policy decision making process.

_____ 1. Highly agree

_____ 2. Agree

_____ 3. Neutral

_____ 4. Disagree

_____ 5. Highly Disagree

_____ 9. D.K., N.R.

21. Ecological values should be given as much consideration as economic growth values.

_____ 1. Highly agree

_____ 2. Agree

_____ 3. Neutral

_____ 4. Disagree

_____ 5. Highly Disagree

_____ 9. D.K., N.R.

22. Improved technology is an appropriate tool for solving environmental problems.

_____ 1. Highly agree

_____ 2. Agree

_____ 3. Neutral

_____ 4. Disagree

_____ 5. Highly Disagree

_____ 9. D.K., N.R.

23. The needs of future generations should be considered in groundwater management decisions.

_____ 1. Highly agree

_____ 2. Agree

_____ 3. Neutral

_____ 4. Disagree

_____ 5. Highly Disagree

_____ 9. D.K., N.R.

24. Humans have a responsibility to be stewards of the environment.

_____ 1. Highly agree

_____ 2. Agree

_____ 3. Neutral

_____ 4. Disagree

_____ 5. Highly Disagree

_____ 9. D.K., N.R.

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25. In your opinion, at what level of governance should groundwater extraction decisions be made?

Probe: For example, federal, regional, state, county, local, watershed...

26. In your opinion, if additional legislation on permitting groundwater withdrawals were to be passed, would some sectors of society benefit?

Would sectors of society be harmed?

27. Do you think market based mechanisms, such as water markets, would improve or harm current groundwater management in Michigan?

28. Do you think that groundwater extraction for agricultural irrigation is acceptable?

Why or why not?

29. Do you think that groundwater extraction for commercial sale is acceptable?

Why or why not?

Why would some people say it's not?

[Now, I'd like to talk with you about some of the ways other states have decided to manage groundwater withdrawals. I'd like to know if you think these would or would not work in Michigan and why]

30. The first method has to do with delegating management authority for groundwater withdrawals. In this state, five water management districts were formed, encompassing the entire state. Each district covers one or more important water basins. Each district is controlled by a governing board of nine members who reside within the district. The members are appointed by the governor and confirmed by the state senate to serve four-year terms. The water management districts are required to implement regulatory programs for well construction, consumptive water use, and for alterations to the hydrologic regime. Taxes are important source of funding for the districts. In your opinion, what would be the challenges and opportunities for the implementation of Water Management Districts such as these in Michigan?

31. The second scenario involves a system of permitting for withdrawing groundwater that is hydraulically connected to surface water bodies. If the state agency finds that there is significant hydraulic continuity between the surface water and the groundwater, any effect on the river during the period it is below the minimum instream flow level is cause for the permit to be revoked. This includes situations in which the groundwater withdrawal causes the river to fall below its minimum instream flow level. The state agency is able to authorize conditional groundwater withdrawal permits, and revoke these if harm is seen to be done to surface water flow conditions. The state agency is responsible for monitoring.

In your opinion, what would be the challenges and opportunities for Michigan in establishing a conditional permitting system based on the connection of the groundwater to surface water, and maintenance of minimum instream flow?

32. The third example also involves permitting for groundwater withdrawals that are hydraulically connected to surface water bodies. In this situation, the state agency responsible for issuing permits limits new groundwater diversions to the amount of valid surface water rights held by the applicant, plus the amount of water the applicant returns directly to the river. The surface water rights held by the groundwater permit applicant are not immediately needed to offset groundwater pumping impacts because stream depletion may not occur until many years after pumping begins. The groundwater applicant is required to monitor the surface water level decline and submit data to the state agency.

In your opinion, what would be the challenges and opportunities of establishing a permitting system based on groundwater extractors obtaining equal amounts of surface water rights to counteract the impacts their pumping may have on instream flow levels?

33. The fourth example deals with expanding regulation of high capacity wells to include an environmental review by the state agency at the time of application. As an example, for the proposed construction of a public water utility well, the agency would weigh the public health and safety benefits of the proposed well against the well's environmental impact. Some of the criteria that might be used for this "balance test" include provisions for water conservation, appropriate use (drinking water vs. lawn watering or car washing), and long range water supply planning.

In your opinion, what would be the challenges and opportunities of such a policy of environmental review by the state agency for newly proposed high capacity wells (i.e., those wells able to withdraw more than 100,000 gallons per day)?

34. In the fifth, and final, example of groundwater policies from other states, local groundwater management entities are responsible for drafting groundwater management plans. In general, it is expected that detailed objectives for basin management, within the broad goal of meeting the estimated average annual sustainable basin yield, will be developed from a combination of physical basin conditions, timing and quantity of available groundwater, and desires of local entities and other participants in the basin. It is recognized that management programs may vary significantly due to regional differences, other factors that define management objectives, and desired local management objectives. In that light, examples of objectives include: determine long-term pumping goals in relation to sustainable yield, protect and enhance groundwater quality, coordinate groundwater use among local entities, employ conjunctive water management to improve supply reliability, preserve interconnected surface water resources, and agree on other water conservation goals to ensure water resources sustainability in the basin.

In your opinion, what would be the challenges and opportunities of establishing local-level groundwater management plans to meet specific groundwater needs of communities in Michigan?

35. Using these cards, would you please rank the five example groundwater management policies based on their applicability to groundwater management efforts in Michigan. Please hand them to me in their order of importance.

36. For this project, I would like to interview people whose professional activities are centered on groundwater resources and/or policy in Michigan. I am interested in individuals in both the private and public sectors. Could you suggest five individuals I might want to interview?

Name	Organization	Phone #

[I have some demographic questions. Again, you don't need to answer any question you are not comfortable with]

37. Which do you identify with?:

1. Asian American _____
2. Black _____
3. White _____
4. Other _____
9. Can't classify _____

38. What is your education background?

School	Dates	Degree	Major

39. What is your previous employment history?

Employer	Dates	Job Responsibilities

40. To what professional organizations do you belong?

_____

_____

_____

_____

41. How would you describe yourself politically?

42. Age:

_____ 1. Under 21

_____ 2. 21-30

_____ 3. 31-40

_____ 4. 41-50

_____ 5. 51-60

_____ 6. Over 60

Appendix B: Summary Sheet

Interview Number _____
Date of Interview _____
Time of Interview _____
Location of Interview _____

Impressions of physical location:

Impressions of participant's state of awareness, enthusiasm, interest, etc.:

Issues of interest to the participant:

Issues of concern for the participant:

Areas of incomplete knowledge for the participant:

Major source of information, data gathering, interactions in the community:

Other Comments:

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