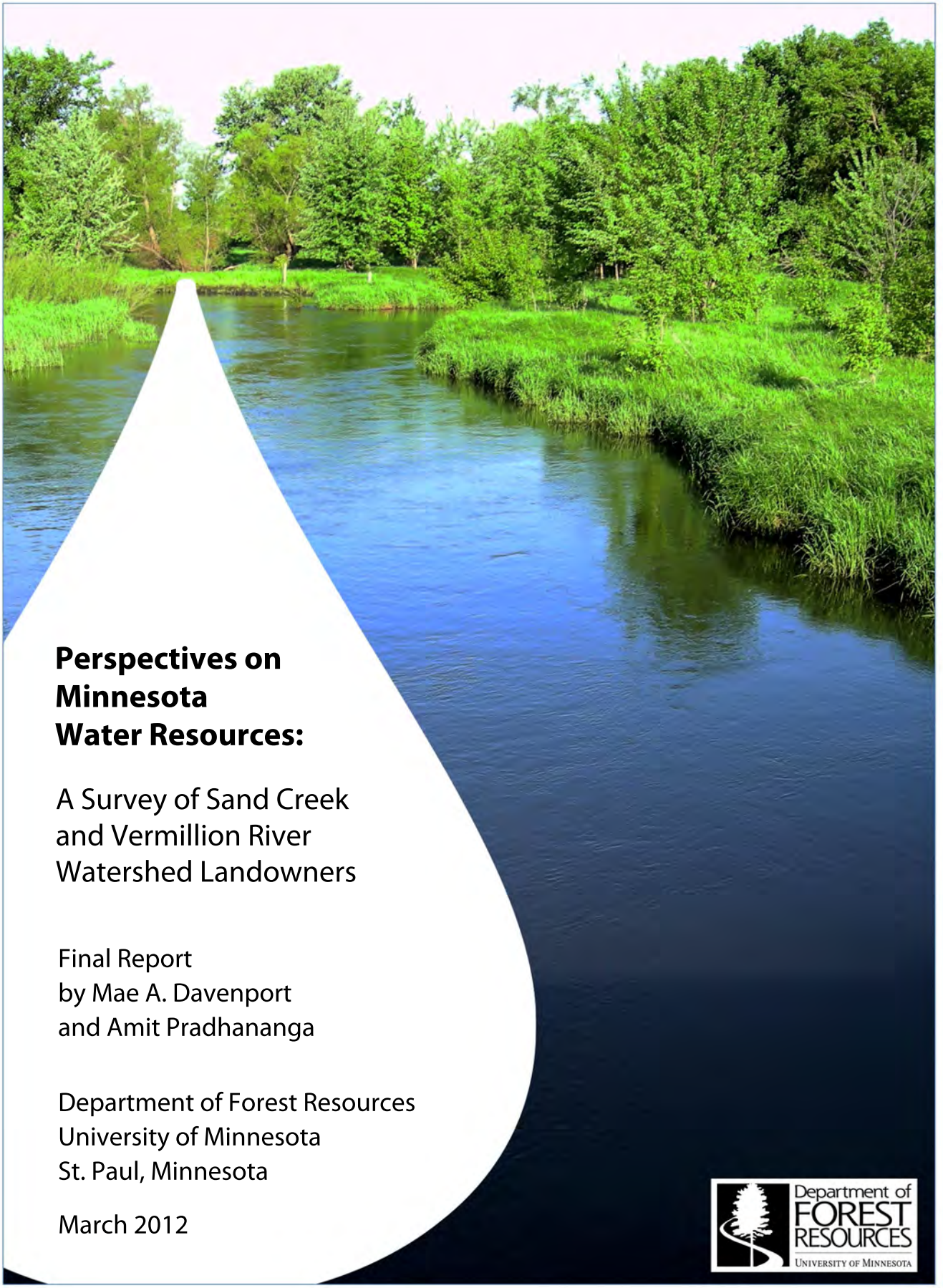

Perspectives on Minnesota Water Resources:

A Survey of Sand Creek and Vermillion River Watershed Landowners

Final Report
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PERSPECTIVES ON MINNESOTA WATER RESOURCES: A SURVEY OF SAND CREEK AND VERMILLION RIVER WATERSHED LANDOWNERS

A final report

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EXECUTIVE SUMMARY

This report describes the findings of a landowner survey administered in the Sand Creek and Vermillion River watersheds, Minnesota. The project was conducted by the Department of Forest Resources at the University of Minnesota in partnership with Scott and Dakota Counties. The purpose of the study is to assist water resource professionals and community decision-makers in better understanding landowners' beliefs, attitudes and behaviors associated with water resources and conservation practices. The survey also inquired in more detail about landowner perspectives on streamside buffers as a conservation practice. Specific study objectives were to assess (1) landowner values and beliefs about their communities, the environment, water quality issues and water resource management; (2) landowner current and future conservation behaviors; and (3) who or what influences landowners' conservation decisions.

Data were collected through a self-administered survey distributed to 2,000 streamside landowners in the Sand Creek and Vermillion River watersheds. Overall, 750 landowners completed and returned the survey for a final response rate of 40% (adjusted for 118 surveys returned undeliverable). The findings of this study are organized in five sub-sections that respond to 16 unique research questions. A brief synopsis of study findings is highlighted below. Full datasets in tabular form are presented in Appendices F and G.

I. Sociodemographic and Property Characteristics

1. Who are respondents and what are their property ownership characteristics?

- The majority of respondents in Sand Creek (78%) and Vermillion River watershed (67%) were male. More than one-third of Sand Creek (35%) and Vermillion River (47%) watershed respondents had attained at least a college degree.
- The median age of Sand Creek and Vermillion River watershed respondents was 55 and 52, respectively.
- The vast majority of the respondents were white (>95%) and not of Hispanic or Latino descent (>98%).
- More than one-third of respondents in Sand Creek and Vermillion River watersheds (>35%) reported an annual household income of at least $100,000.
- Sand Creek respondents reported living 27 years in the community (median), while Vermillion River watershed respondents reported living in the community for 15 years (median).
- A minority of respondents in Sand Creek (39%) and Vermillion River watershed (18%) reported using their land/property for agricultural production. Most respondents in Sand Creek (68%) and Vermillion River (79%) watersheds do not depend on their property for income.
- Most Sand Creek watershed respondents owned 6 or more acres (60%), while most Vermillion River watershed respondents owned less than one acre (53%).
- A majority of respondents (77%) owned and managed their land/property. Most respondents in Sand Creek (87%) and Vermillion River (82%) watershed made their own decisions about how to manage their land/property.
- The majority of Sand Creek respondents (76%) reported owning or renting land with a stream or ditch located on or bordering their property. Slightly fewer than half (45%) of Vermillion River respondents reported that they own or rent land with a stream/ditch located on or bordering their property.

2. How do respondents define their community?

- A large majority of respondents in both watersheds define "their community" as the city or township in which they live (>90%).
- Most respondents (>73%) also define their community as their nearest neighbors.

II. Cultural and Environmental Values and Beliefs about Water Issues

3. What cultural and environmental values are important to respondents?

- Overall, respondents in both watersheds rated cooperating with and helping other members of their community as the most important cultural value.
- On average, respondents in both watersheds rated "respecting the earth" as the most important environmental value. Protecting private property rights also was rated "very important" to "extremely important" by a majority of Sand Creek respondents (75%) and Vermillion River respondents (66%).

4. What are respondents' beliefs about water quality problems and links to land uses?

- In the two watersheds, most respondents (>60%) agreed that the effects of water pollution on public health are worse than we realize.
- A majority of Sand Creek (80%) and Vermillion River (68%) respondents agreed that streamside buffers help to improve water quality. In addition, most respondents in

both groups (>67%) agreed that buffers should be protected because they provide habitat for wildlife.

- When asked about their agreement with the belief that buffers reduce the value of their land, more than one-third of Vermillion River respondents (35%) and Sand Creek respondents (41%) were either neutral or agreed with the statement.
- Respondents were asked to rate the quality of water in the stream or ditch on or adjacent to their property. Less than half of Sand Creek respondents (45%) and less than one-third of Vermillion River respondents (27%) characterized the quality of water in the stream or ditch on or adjacent to their property as good to very good. Almost two-fifths of Vermillion River respondents (39%) and one-fifth of Sand Creek respondents (19%) did not know the quality of the water in their stream or ditch.

5. ***Are respondents concerned about the consequences of water pollution?***
   - An overwhelming majority of respondents in both the watersheds expressed concern about the consequences of water pollution for future generations (>92%), wildlife (>88%) and aquatic life (>87%).
6. ***Who do respondents think should be responsible for responding to water quality issues?***
   - A large majority of the respondents in both watersheds (>86%) agreed that it is their own personal responsibility to help protect water quality.
   - Most respondents in Vermillion River (82%) and Sand Creek (75%) also agreed that the local government should be responsible for protecting water quality.
7. ***Do respondents feel personally obligated to do something about water quality issues?***
   - Most respondents in both the watersheds agreed that they feel a personal obligation to do whatever they can to prevent water pollution (>86%) and to use conservation practices on their land/property (84%). However, fewer respondents feel the same obligation to work with other community members on (<52%) or talk to other community members about conservation practices (<45%).

III. Current and Future Conservation Behaviors

8. ***Do respondents maintain riparian buffers in streams/ditches on or adjacent to their property?***
   - A majority of Sand Creek watershed respondents (54%) reported maintaining buffers on at least some of the streams/ditches on or adjacent to their property.
   - Fewer Vermillion River watershed respondents (30%) reported maintaining buffers on at least some of these waterways.
   - It should be noted that more than half of Vermillion River watershed respondents (53%) reported that they do not have streams/ditches on or adjacent to their property. Less than 30% of Sand Creek watershed respondents reported the same.
9. ***What civic actions have the respondents engaged in the past 12 months related to environmental issues?***
   - Of all the actions listed, the action most commonly engaged in was reading newsletters, magazines or other publications by environmental groups (>45%).
10. ***How likely are respondents to take future conservation actions to protect water resources?***

- A majority of respondents in both watersheds (>83%) reported that they are somewhat to very likely to use conservation practices on their land/property in the future. However, fewer respondents were as likely to work with other community members to protect the environment (<53%) or talk to others about conservation practices (<46%) in the future.
- More Sand Creek respondents (62%) reported being likely to maintain a streamside buffer on their land/property in the future than Vermillion River respondents (51%). Once again, it is important to note that more than half of Vermillion River watershed respondents (53%) reported that they do not have streams/ditches on or adjacent to their property. Less than 30% of Sand Creek watershed respondents reported the same.

IV. Influencing Conservation Behaviors

11. Who influences respondents' conservation practices?

- Overall, respondents in both watersheds rated family as most likely to influence their decisions about conservation practices. Respondents' county Soil and Water Conservation District, MN Department of Natural Resources, the local Water Management Organization and neighbors were also highly rated overall by respondents in both groups as influential in their decision-making.
- Vermillion River respondents were more likely (69% rated at least "somewhat likely") to be influenced by the MN Pollution Control Agency than Sand Creek respondents (57% rated at least "somewhat likely").

12. Do respondents and their communities have the ability to protect water resources?

- Most respondents in both the watersheds (>65%) agreed that their community has the ability to change the way land will be developed in the future to protect water resources.
- Most respondents in both groups (>58%) also agreed that they personally had the knowledge and skills to take care of their land.
- However, a minority of respondents (<24%) agree that their community has the leadership it needs to protect water resources.

13. What would increase the likelihood that respondents would maintain riparian buffers?

- For Sand Creek respondents, having access to financial resources to help them plant and maintain buffers and learning how to maintain buffers for water quality were most likely to increase their riparian buffer maintenance.
- For Vermillion River respondents, learning how to maintain streamside buffers for water quality and knowing more about how to plant and maintain streamside buffers were most likely to increase their riparian buffer maintenance.
- In addition, more than half of respondents in both groups agreed that they would be more likely to maintain streamside buffers if they could learn how to maintain streamside buffers for wildlife benefits and soil conservation.

14. How do respondents who maintain streamside buffers differ from those who do not maintain streamside buffers?

- Respondents who maintain streamside buffers (adopters) and those who do not (non-adopters) shared many qualities including sociodemographics, property

characteristics, values, problem awareness, concern, sense of responsibility, and social influences.

- Highly significant differences between adopters and non-adopters were revealed in their beliefs, sense of personal obligation, perceived ability, future conservation behaviors, and past engagement in civic action. Non-adopters had more negative beliefs than adopters about streamside buffers. They agreed to a lesser extent that they have the ability to change the way they use their land to protect water resources. They feel less of a personal obligation to use conservation practices including streamside buffers on their land. Adopters were more likely to have engaged in various civic actions associated with the environmental issues in the past.

V. Attitudes toward Water Resource Management in Minnesota

15. What do respondents think about management actions to protect the quality of water in Minnesota?

- On average, Sand Creek watershed respondents rated expanding incentive-based programs that offer payments for conservation as most likely to protect the quality of Minnesota's water resources. However, Vermillion River watershed respondents rated enforcing existing land use laws and regulations as most likely to protect Minnesota's water resources.
- The majority of respondents in both watersheds believed that promoting voluntary adoption of conservation practices through education and outreach (>65%), coordinating land use and water planning across communities (>63%), and engaging more citizens in decision-making (>61) will be at least "somewhat likely" to protect the state's water resources.
- A greater proportion of Vermillion River respondents (74%) believed that conducting more water quality research and monitoring will be at least "somewhat likely" protect water quality in the state than Sand Creek respondents (64%).
- On average, the lowest rated management action was increasing regulations that specifically address water resource management. Fewer Sand Creek respondents (44%) rated this action positively (at least "somewhat likely" to protect water resources) than Vermillion River respondents (57%).

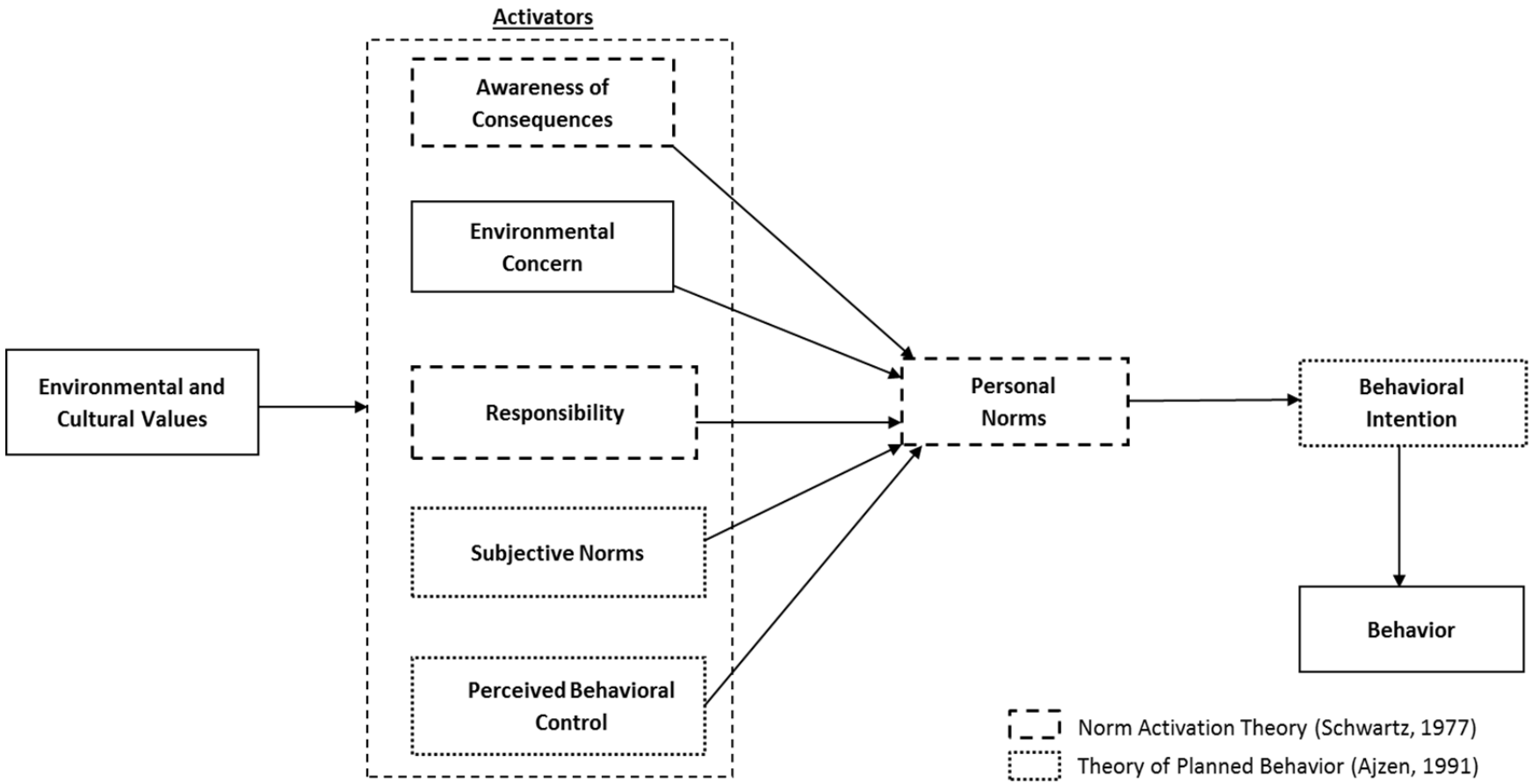
Based on these study findings, a multiple-strategy approach is recommended in conservation programming that raises awareness about local stream conditions and encourages personal commitment to conservation, that fosters community-building around water and promotes a sense of civic responsibility for water resource protection, and that addresses constraints to streamside buffer adoption through landowner-tailored education and incentive programs. Further, this multiple-strategy approach should be presented to landowners in a coordinated and consistent manner across resource management organizations throughout the state.

PROJECT BACKGROUND

This report describes the findings of a landowner survey administered in the Sand Creek and Vermillion River watersheds, Minnesota. The project was conducted by the Department of Forest Resources at the University of Minnesota in collaboration with Scott and Dakota Counties. The purpose of the study is to assist water resource professionals and community decision-makers in better understanding landowners' beliefs, attitudes, and behaviors associated with water resources and conservation practices. The study also focuses in more detail on landowner beliefs about streamside buffers as a conservation practice. Specific study objectives were to assess (1) landowner values and beliefs about their communities, the environment, water quality issues, and water resource management; (2) landowner current and future conservation behaviors; and (3) who or what influences landowners' conservation decisions.

Water resource managers and other professionals are increasingly investing often scarce resources in communication, education, and outreach programs that promote citizen and landowner adoption of conservation practices. However, as environmental practitioners and social scientists have long known, changing human behavior can be a daunting task. To be effective and efficient, programs intended to change behaviors, whether regulatory, incentive-based or voluntary in nature, must respond to the values and beliefs of their targeted audiences. A compounding challenge for water resource professionals is that in the world of water, audiences can be quite diverse with varying socioeconomic backgrounds, land and water connections, environmental and cultural values, and beliefs about environmental problems, consequences, and solutions. Water resource programming aimed at engaging citizens and landowners should be shaped by a baseline understanding of who stakeholders are, how they relate to water, and what influences their decision-making around conservation practices. Programs informed by a combination of social science and local practitioners' expertise are most likely to find success in both responding to stakeholder needs and promoting conservation practices that will protect water resources. This study builds on long-standing theories of behavior and behavior change from the social sciences that converge on the notion that values, beliefs about consequences, concern for consequences, sense of responsibility, personal norms, and social norms drive human behavior (Ajzen, 1999; Schultz, 2011; Schwartz, 1994; Stern, 1999). Importantly, it also is grounded in local resource issues (e.g., riparian buffer maintenance) and practical insight from resource professionals who collaborated with us throughout this project. In designing the survey questionnaire, we adopted a Moral Obligation Model (MOM) (Davenport et al., 2011) as a framework for understanding what drives and constrains conservation behaviors (Figure 1). In this model, basic environmental and cultural values are influenced by five beliefs or activators. The activators trigger feelings of personal moral obligation (i.e., personal norms), which drive performance of environmental behaviors.

The information provided in this report is intended to inform, enhance, and facilitate future community and water resource planning and management initiatives in the two study watersheds and across the state. In particular, study findings will be useful for designing and implementing communication, education, and outreach programs that both respond to landowner needs and promote conservation behaviors that protect and enhance water resources.


Activators
Awareness of Consequences
Environmental Concern
Responsibility
Subjective Norms
Perceived Behavioral Control
Environmental and Cultural Values
Personal Norms
Behavioral Intention
Behavior
Norm Activation Theory (Schwartz, 1977)
Theory of Planned Behavior (Ajzen, 1991)

RESEARCH DESIGN AND METHODS

The study was conducted through a self-administered survey of a stratified, random sample of riparian landowners in the Sand Creek and Vermillion River watersheds. The Sand Creek watershed, a subwatershed of the Minnesota River watershed, stretches across Scott, Le Sueur, and Rice counties (see map in Appendix D, pg. 47). The Vermillion River watershed, a subwatershed of the Lower Mississippi River watershed, stretches across Scott, Dakota, and Goodhue counties (see map in Appendix C, pg. 44). The surveys were administered from March through August 2011.

A list of property owners within the Sand Creek watershed living within 300 feet of a stream or ditch was obtained from the Scott County Watershed Management Organization. The list was based on publicly available property tax records and was restricted to property owners living in Scott County within the Sand Creek watershed. The Sand Creek Watershed Total Maximum Daily Load & Impaired Waters Investigation Stream Inventory (2008), which maps both intermittent and perennial streams and waterways, was used to select streamside landowners in the Sand Creek watershed. A proportionate sample of streamside landowners (approximately 63%) from each of 11 subwatersheds within the Sand Creek watershed and Scott County was randomly selected, yielding a sample of 1,000 streamside landowners. A list of property owners within the Vermillion River watershed and living within 300 feet of a stream or ditch was obtained from Vermillion River Watershed Joint Powers Organization (JPO). This list was also based on publicly available property tax records and includes all landowners within the Vermillion River watershed's hydrologic boundaries. The Wetland and Waterways Inventory and Assessment (Dakota County Soil and Water Conservation District, 2007), which maps both intermittent and perennial streams and waterways, was used to select streamside landowners in the Vermillion River Watershed JPO. A proportionate sample of streamside landowners (approximately 21%) from each of the 11 subwatersheds was randomly selected, yielding a sample of 1,000 streamside landowners. Thus, a total of 2,000 surveys were distributed by U.S. mail.

Survey instruments (Appendix A) were designed based on an extensive literature review and feedback from a pre-test and a pilot test of the instrument. The survey questionnaire included a variety of fixed-choice and scale questions. The Moral Obligation Model was used as a framework for designing the questionnaire. Several questions were adapted from survey instruments used in previous studies of attitudes, beliefs, and values of conservation behaviors (Blasczyk, Your views on local water resources, 2010; Harland et al., 2007; Matsumoto et al., 1997; Prokopy et al., 2009; Seekamp, Davenport, and Brehm, Lower Kaskaskia River Watershed Resident Survey, 2009; Schultz, 2001; Schwartz, 1977; Stern, Dietz and Guagnano, 1998; Stern et al., 1993). Each questionnaire was labeled with a unique identification number (ID) matching the IDs assigned to each name and address in the landowner lists to track responses for subsequent mailings.

An adapted Dillman's (2009) Tailored Design Method was used to increase response rates. The survey was administered in four waves: a pre-notification letter/pre-notice postcard (Appendix

B); the questionnaire (Appendix A) with a cover letter (Appendix C), watershed map, and self-addressed, stamped return envelope; a reminder postcard (Appendix D); and a replacement questionnaire with cover letter (Appendix E) and envelope. Standard protocol recommends a pre-notification letter as the first contact with the sample pool. However, in the Sand Creek watershed study, reminder postcards were delivered ahead of schedule, prior to the pre-notification postcard and questionnaire. Thus, in the Sand Creek watershed survey we adapted the standard Tailored Design Method to achieve a desirable response rate.

After completed questionnaires were returned and logged into the respondent database, questionnaire data were numerically coded and entered into a database using Statistical Package for Social Sciences (SPSS release 17.0). Basic descriptive statistics were conducted to determine frequency distributions and averages of individual variables. Inferential statistics were also conducted to test for significant differences between respondents who reported maintaining streamside buffers and those who reported not maintaining streamside buffers on their property.

STUDY FINDINGS

Overall, 750 landowners completed and returned the survey for a response rate of 40% (adjusted for 118 surveys returned undeliverable). Response rates of 46% and 34% were achieved in the Sand Creek (n=432) and Vermillion (n=318) watersheds, respectively. To address concerns about non-response bias, we compared sociodemographic statistics of our sample respondents to those reported in the 2010 U.S. Census for Dakota and Scott Counties. When compared to county-wide statistics, the survey sample represents some observable differences.

Compared with county-wide statistics, the sample represents a higher proportion of men, white and non-Latino populations, individuals with a bachelor's degree or higher, and individuals with incomes of $100,000 or more. The median age of our respondents is also higher than county-wide statistics demonstrate. While these differences suggest our sample may not be representative of county-wide populations, our study specifically targeted streamside property owners, a subpopulation within the counties. To reduce the effects of non-response bias, we used a probability sampling approach. We also conducted a wave analysis of early and late survey respondents to examine the potential effect of non-response bias (Lankford et al., 1995).

Understanding late respondents provides some insight into the characteristics of populations not represented in the sample (i.e., non-respondents). There were no significant differences between early and late respondents in sociodemographic characteristics, except in age. Early respondents (mean = 55) were slightly older than late respondents (mean = 53). Early respondents also were more likely to report that their land/property borders a stream/ditch or has a stream/ditch running through it. Late respondents agree to a greater extent than early respondents that streamside buffers reduce the value of land. Late respondents agree to a greater extent than early respondents that what they do on their land does not make much difference in overall water quality. Late respondents also agree to a lesser extent than early

respondents that it is their own personal or all landowners' responsibility to protect water quality.

Late respondents are more likely than early respondents to be influenced in their conservation decisions by property rights organizations. Late respondents are not as likely as early respondents to use conservation practices or maintain a streamside buffer on their land/property. Late respondents agree to a lesser extent that they would be more likely to maintain streamside buffers on or adjacent to their property if they could learn how to maintain streamside buffers for water quality. Late respondents agree to a lesser extent that they feel a personal obligation to maintain a streamside buffer on their land/property. Late respondents are less likely to have engaged in civic actions such as discussing water quality issues with community members, or voted for a candidate in part because he or she was in favor of strong environmental protection.

The study findings are organized in 5 sub-sections that respond to 15 unique research questions. Study findings for each watershed are presented separately. Complete statistics for all survey questions are presented in tabular form in Appendices F and G.

I. Sociodemographic and Property Characteristics

1. Who are respondents and what are their property ownership characteristics?

Respondents were asked a series of sociodemographic questions and questions about their land or property characteristics.

Sand Creek watershed:

A majority of the respondents (78%) were male (Appendix F, Table 1). The respondents ranged in age from 20 to 93 with a median age of 55. A vast majority of respondents characterized their race and ethnicity as white (97%) and not Hispanic or Latino (99%). More than one-third of respondents (35%) had attained at least a college degree. More than one-third of respondents (35%) reported an annual household income of $100,000 or more (Appendix F, Table 1), and almost two-thirds of respondents (60%) own 6 or more acres of land (Appendix F, Table 2; Figure 1). Almost 40% use their land/property for agricultural production, and almost one-third of the respondents (32%) depend on their land (or property) for income. A majority of the respondents own and manage their own land/property (77%) and make their own decisions about land management (87%) (Appendix F, Table 2; Figure 2).

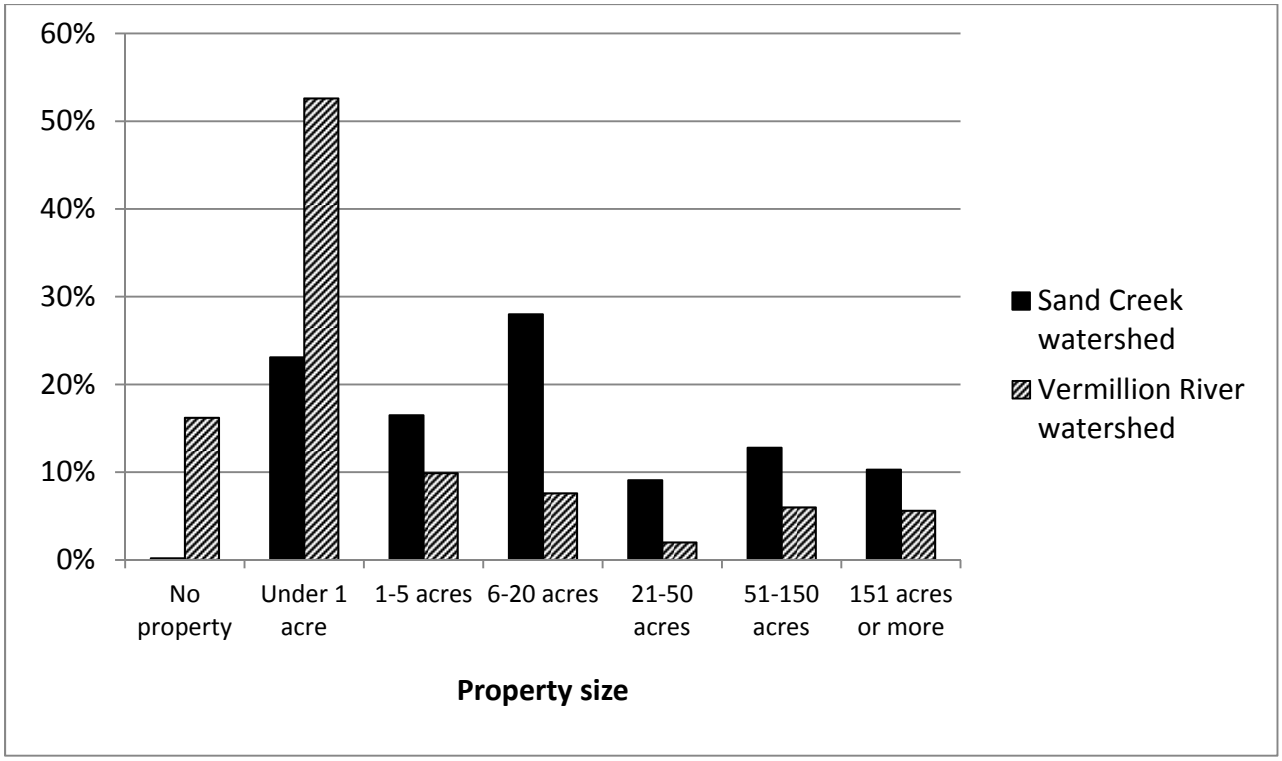


Figure 2. Respondents' reported property sizes in Sand Creek and Vermillion River watersheds (Source: Survey question 22).

Vermillion River watershed:
A majority of the respondents (67%) were male (Appendix G, Table 1). The respondents ranged in age from 18 to 94 with a median age of 52. A vast majority of respondents characterized their race and ethnicity as white (95%) and not Hispanic or Latino (98%). More than one-third (47%) of respondents had attained at least a college degree. More than one-third of respondents (38%) reported an annual household income of $100,000 or more, and more than half of respondents (53%) own less than 1 acre of land (Appendix G, Table 2; Figure 2). Most respondents (79%) reported that they do not depend on their land/property for income. Less than one-fifth of respondents (18%) use their land/property for agricultural production, though slightly more (21%) depend on their land/property for income. A majority of the respondents own and manage their own land/property (77%) and make their own decisions about land/property management (82%) (Appendix G, Table 2).

2. How do respondents define their community?
Many questions in the survey refer to the respondents' communities, thus, respondents were asked to define their community according to social, geographic, political, and hydrologic boundaries. Respondents were asked to rate the extent to which they agreed with seven community descriptors on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Sand Creek watershed:
Respondents' definitions of their community varied (Appendix F, Table 3). Most respondents (>90%) strongly to somewhat agreed that the city or township they live in is their community.

Most respondents (>73%) also perceived their nearest neighbor to be their community. Only 36% of respondents perceived the state of Minnesota to be their community.

Vermillion River watershed:
Most respondents (>90%) strongly to somewhat agreed that the city or township they live in is their community. A majority of respondents (78%) also agreed that their nearest neighbors are their community. Fewer respondents (38%) perceived the state of Minnesota to be their community (Appendix G, Table 3).

II. Cultural and Environmental Values and Beliefs about Water Issues

3. What cultural and environmental values are important to respondents?
Respondents were asked about cultural and environmental values that may serve as guiding principles in their lives. Respondents were asked to rate the importance of seven environmental values and six cultural values on a five-point scale from not at all important (0) to extremely important (5).

Sand Creek watershed:
The values of nurturing or helping and cooperating with other members of their community were the highest rated cultural values overall and were at least moderately important values to 84% of respondents (Appendix F, Table 4).
More than 79% of respondents believed that the environmental value respecting the earth is a very to extremely important guiding principle in their life. At the same time, most respondents (75%) rated the environmental value protecting private property rights as at least very important. Using natural resources for personal income was moderately to extremely important to 32% of respondents (Appendix F, Table 5).

Respondents expressed strong human- and nature-centered environmental values associated with respecting the earth, preserving nature for its own sake, and protecting private property rights.

Vermillion River watershed:
A majority of respondents reported that it was moderately to extremely important to cooperate with members of their community (86%) and to nurture or help other members of the community (82%) (Appendix G, Table 4). Respecting the earth was a very to extremely important environmental value to more than 76% of respondents. In addition, protecting private property rights was viewed as a very to extremely important guiding principle to 66% of respondents. Using natural resources for personal income was moderately to extremely important to 27% of respondents (Appendix G, Table 5).

4. What are respondents' beliefs about water quality problems and links to land uses?
Respondents were asked to rate the extent to which they agreed with a series of nine belief statements about streamside buffers, water pollution, and environmental protection on a five-point scale from strongly disagree (-2) to strongly agree (+2). Respondents also were asked to rate the quality of water in the stream or ditch on or adjacent to their property.

Sand Creek watershed:
More than half of respondents agreed that the effects of water pollution on public health are worse than we realize (60%) and that the balance of nature is delicate and easily upset (68%; Appendix F, Table 6). When asked about local water resource conditions, less than half of Sand Creek respondents (45%) characterized the quality of water in the stream or ditch on or adjacent to their property as good to very good (Appendix F, Table 17). Almost one-fifth of respondents (19%) did not know the quality of the water in their stream or ditch. A large majority of respondents agreed that streamside buffers help to improve water quality for people living downstream (80%; Figure 3) and that buffers should be protected because they provide habitat for wildlife (72%). A majority (59%) of respondents disagreed that protecting the environment will threaten jobs for people like them. When asked about their agreement with the belief that buffers reduce the value of land, more than 40% of respondents expressed neutrality or positive agreement with the statement.

Vermillion River watershed:
More than half of respondents agreed that water pollution poses serious threats to the quality of life in their community (55%), that the effects of water pollution on public health are worse than we realize (62%), and that the balance of nature is delicate and easily upset (71%; Appendix G, Table 6). However, with respect to local water resource conditions, less than one-third of Vermillion River respondents (27%) characterized the quality of water in the stream or ditch on or adjacent to their property as good to very good (Appendix G, Table 17). Almost two-fifths of Vermillion River respondents (39%) did not know the quality of the water in their stream or ditch. A large majority of respondents agreed that buffers help to improve water quality for people living downstream (68%; Figure 3) and that buffers should be protected because they provide habitat for wildlife (67%). A majority of respondents (64%) disagreed that protecting the environment will threaten jobs for people like them. More than one-third of respondents (35%) were either neutral or agreed that buffers reduce the value of their land.

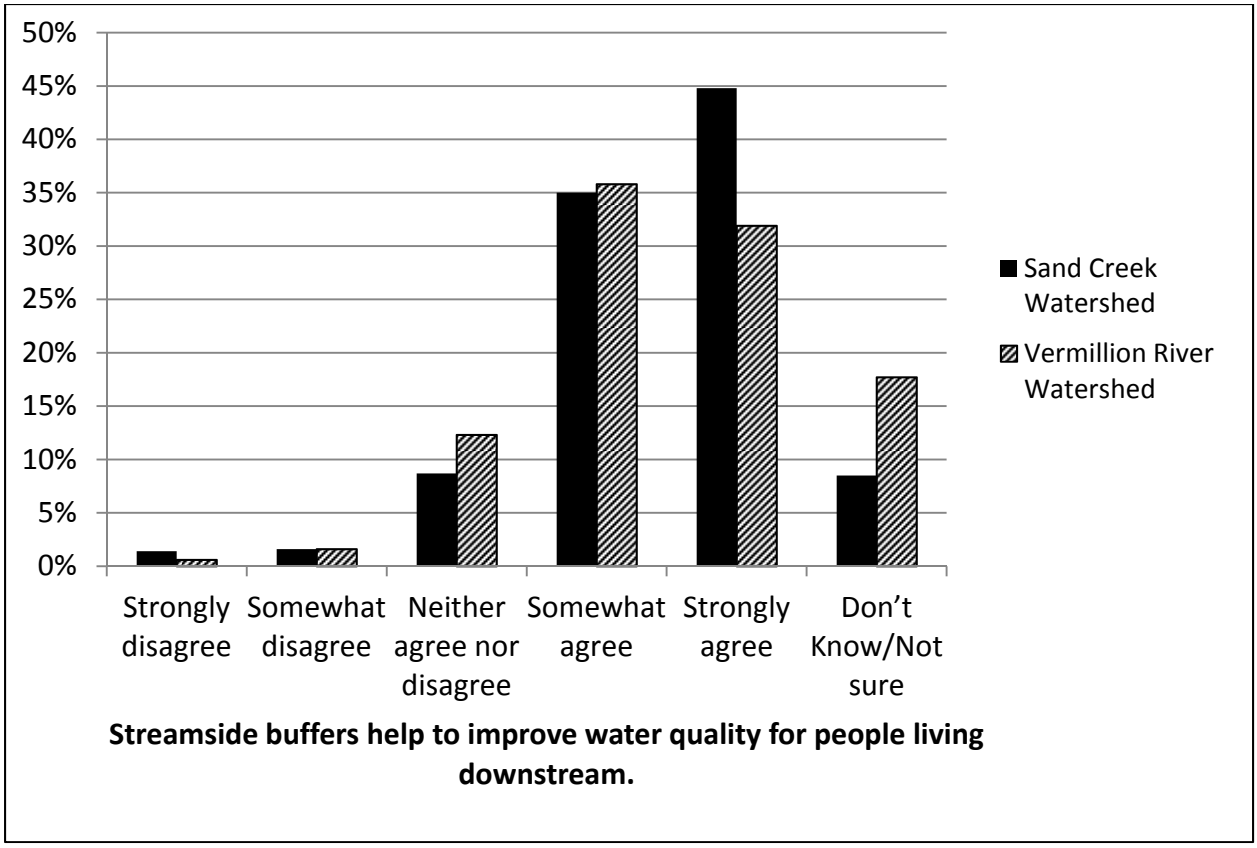


Figure 3. Reported level of agreement or disagreement with the statement "Streamside buffers help to improve water quality for people living downstream" (Source: Survey question 4h).

5. Are respondents concerned about the consequences of water pollution?

The survey also inquired about respondents' concerns about the consequences of water pollution for various uses or purposes. Respondents were asked to rate the extent to which they agreed with the statement "I am concerned about the consequences of water pollution for future generations," as well as the consequences of water pollution on five other object items, on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Sand Creek watershed:

An overwhelming majority (92%) of respondents expressed concern about the consequences of water pollution for future generations (Appendix F, Table 7). Most respondents were also concerned about the consequences of water pollution for wildlife (89%) and aquatic life (88%).

Vermillion River watershed:

Most respondents (92%) expressed concern about the consequences of water pollution for future generations (Appendix G, Table 7). Most respondents were also concerned about the consequences of water pollution for wildlife (89%) and aquatic life (89%).

6. Who do respondents think should be responsible for responding to water quality issues?

Respondents were asked to rate the extent to which they agreed with a series of eight statements identifying parties (e.g., local, state, and federal government) responsible for

protecting water quality on a five-point scale from strongly disagree (-2) to strongly agree (+2). They were also asked a general question about the adequacy of current water resource protection in their community on the same scale.

Sand Creek watershed:
Fewer than half of respondents (42%) believed that water resources in their community are adequately protected (Appendix F, Table 8). A large majority (87%) of the respondents believed that it is their own personal responsibility to help protect water quality. More than 80% of respondents agreed that using a conservation practice contributes to a clean environment. Respondents' perceptions about the role of different levels of government in addressing water quality issues varied. Most respondents believe that the local government (75%) and state government (61%) should be responsible for protecting water quality. Less than half of respondents (49%) believe that the federal government should be responsible for protecting water quality.

Vermillion River watershed:
Fewer than half of respondents (45%) believed that water resources in their community are adequately protected (Appendix F, Table 8). Most respondents (87%) agreed that it is their personal responsibility to help protect water quality. Most respondents also believed that the local government (82%), state government (71%) and federal government (54%) should be responsible for protecting water quality.

Most landowners surveyed believe that it is their own personal responsibility and the responsibility of local government to protect water quality.

7. Do respondents feel personally obligated to do something about water quality issues?
The survey asked respondents if they felt a personal obligation to engage in various actions to address water quality issues. Respondents were asked to rate the extent to which they agreed with a series of six individual and collective action statements on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Sand Creek watershed: A large majority of respondents reported feeling a personal obligation to do whatever they can to prevent water pollution (86%) and to use conservation practices on their land/property (84%; Appendix F, Table 11). However, fewer respondents felt a personal obligation to work with other community members to protect the environment (52%) or talk to others about conservation practices (45%). Most respondents (60%) felt a personal obligation to maintain a streamside buffer on their land/property.

Vermillion River watershed:
The vast majority of respondents reported feeling a personal obligation to do whatever they can to prevent water pollution (90%) and to use conservation practices on their land/property (88%; Appendix G, Table 11). Yet less than half of respondents felt a personal obligation to work with other community members to protect the environment (48%) or to talk to others about conservation practices (45%). More than 47% of respondents felt a personal obligation to maintain streamside buffer on their land/property.

While respondents feel a strong sense of personal obligation around individual conservation actions, they are less likely to feel obligated to engage with other community members in conservation.

III. Current and Future Conservation Behaviors

8. Do respondents maintain riparian buffers in streams/ditches on or adjacent to their property?
Respondents were asked to report whether they maintain streamside buffers on their land/property.

Sand Creek watershed:
More than half of respondents (54%) reported maintaining buffers on at least some streams or ditches on or adjacent to their property (Appendix F, Table 13; Figure 4). Less than one-fifth of respondents (19%) reported that they do not maintain buffers on these streams or ditches. More than one-quarter of respondents (26%) reported that they do not have streams or ditches on or adjacent to their property.

Vermillion River watershed:
In contrast to the Sand Creek watershed, more than half of Vermillion River watershed respondents (53%) reported that they do not have streams or ditches on or adjacent to their property (Appendix G, Table 13; Figure 4). Thus, fewer Vermillion River watershed respondents (30%) reported maintaining buffers on these waterways. Less than one-fifth of respondents (17%) maintain buffers on any of the streams or ditches on their property.

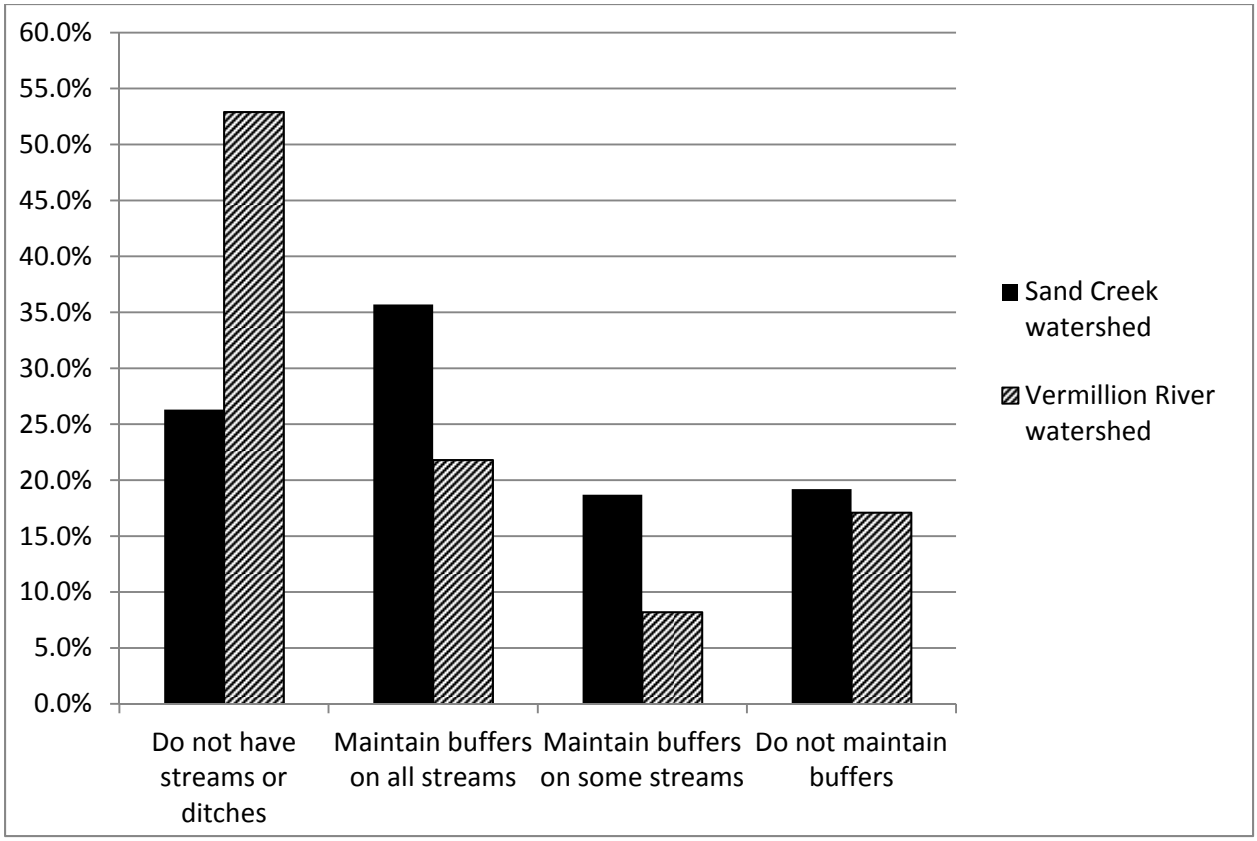


Figure 4. Respondent streamside buffer maintenance behaviors (Source: Survey question 11).

9. What civic actions have the respondents engaged in the past 12 months related to environmental issues?

Respondents were asked if they had engaged in seven various civic actions within the past 12 months.

Sand Creek watershed:

Of all the actions listed, reading newsletters, magazines, or other publications written by environmental groups was the most popular with 50% of respondents engaging in this behavior (Appendix F, Table 15). While 28% of the respondents voted for a candidate in an election at least in part because the candidate was in favor of strong environmental protection, only 14% had attended a meeting, public hearing, or community discussion group about an environmental issue.

Vermillion River watershed:

Reading newsletters, magazines, or other publications written by environmental groups was also the most popular among Vermillion River watershed respondents with 45% engaging in this behavior (Appendix G, Table 15). More than 30% of respondents had voted for a candidate in an election at least in part because the candidate was in favor of strong environmental protection. Only 6% had attended a meeting, public hearing, or community discussion group about an environmental issue.

10. How likely are respondents to take future conservation actions to protect water resources?

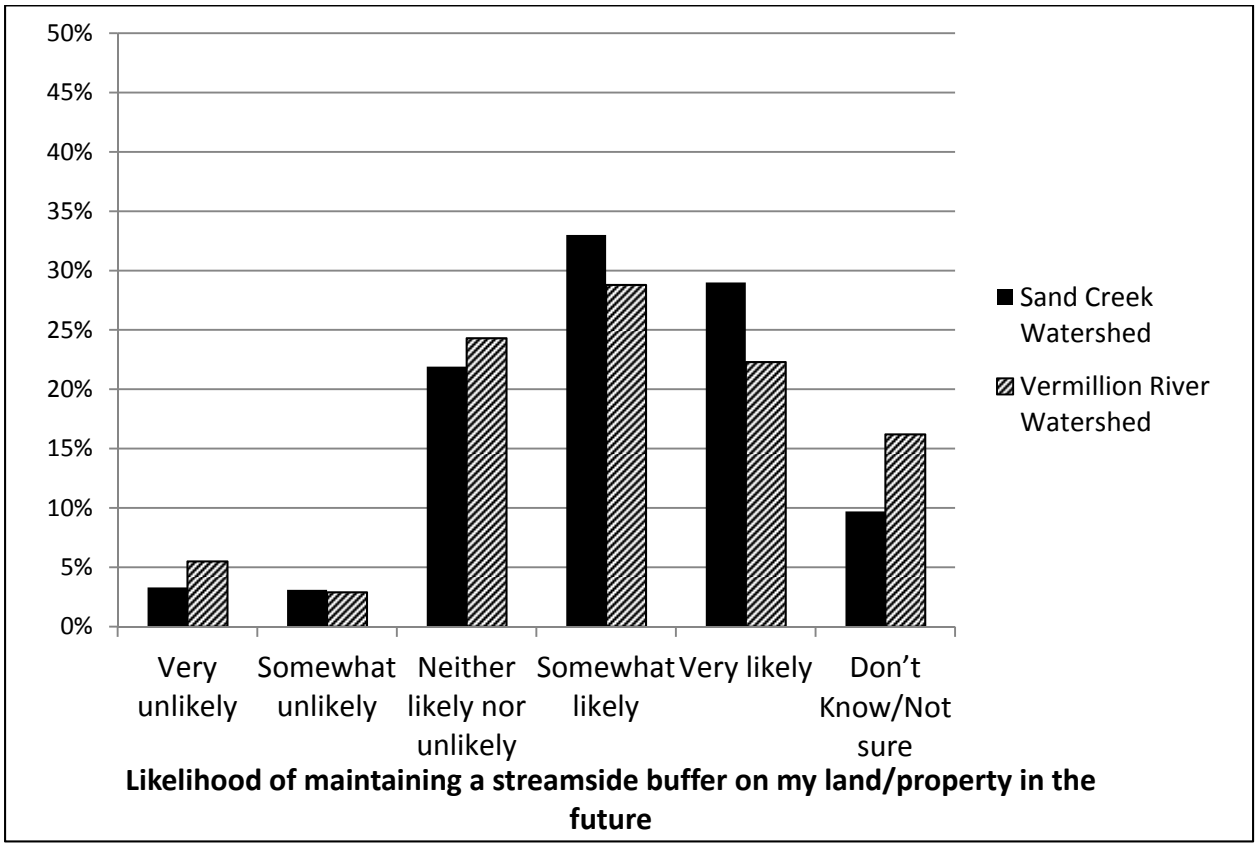
The survey asked respondents about their intentions to engage in six conservation practices in the future, two of which directly addressed water resources. Respondents were asked to rate the action statements on a five-point scale from very unlikely (-2) to very likely (+2).

Sand Creek watershed:

A majority of respondents (88%) reported that they were somewhat to very likely to use conservation practices on their land or property in the future, which was the highest rated action overall (Appendix F, Table 12). Fewer respondents were as likely to work with other community members to protect the environment (52%) or talk to others about conservation practices (46%). Most of the respondents (62%) reported that they were somewhat to very likely to maintain a streamside buffer on their property in the future (Figure 5).

Vermillion River watershed:

More than 83% of respondents reported that they were somewhat to very likely to use conservation practices on their land or property in the future (Appendix G, Table 12). However, fewer respondents were as likely to work with other community members to protect the environment (51%) or talk to others about conservation practices (44%). About half of Vermillion River watershed respondents (51%) reported being likely to maintain a streamside buffer on their property in the future (Figure 5).



Likelihood of maintaining a streamside buffer on my land/property in the future

Figure 5. Likelihood of maintaining a streamside buffer on land/property in the future (Source: Survey question 10d).

IV. Influencing Conservation Behaviors

11. Who influences respondents' conservation practices?

Landowners were asked to indicate who is likely to influence their decisions about conservation practices on a five-point scale from very unlikely (-2) to very likely (+2). A list of 12 individuals, groups, and organizations was provided.

Sand Creek watershed:

Respondents' families, county Soil and Water Conservation District, and the Minnesota Department of Natural Resources (MN DNR) appear to be the most influential overall on their conservation practice decision-making (Appendix F, Table 10). A majority of the respondents reported that it is somewhat to very likely that their decisions would be influenced by their family (76%), county Soil and Water Conservation District (SWCD, 71%), the MN DNR (66%), neighbors (63%), and local Watershed Management Organization (WMO, 61%; Figure 6). Property rights organizations were least likely to influence respondents' decisions about conservation practices.

Vermillion River watershed:

Similar to Sand Creek watershed respondents, Vermillion river watershed respondents' families, county Soil and Water Conservation District, and the MN DNR have the biggest influence on their conservation practices (Appendix G, Table 10). Most respondents report that their conservation practice decisions would be somewhat to very likely influenced by their family (78%), MN DNR (72%), county SWCD (70%), Minnesota Pollution Control Agency (69%), and neighbors (63%). The local WMO was likely to influence about 57% of Vermillion River watershed respondents (Figure 6). Again, property rights organizations were least likely to influence respondents' decisions about conservation practices.

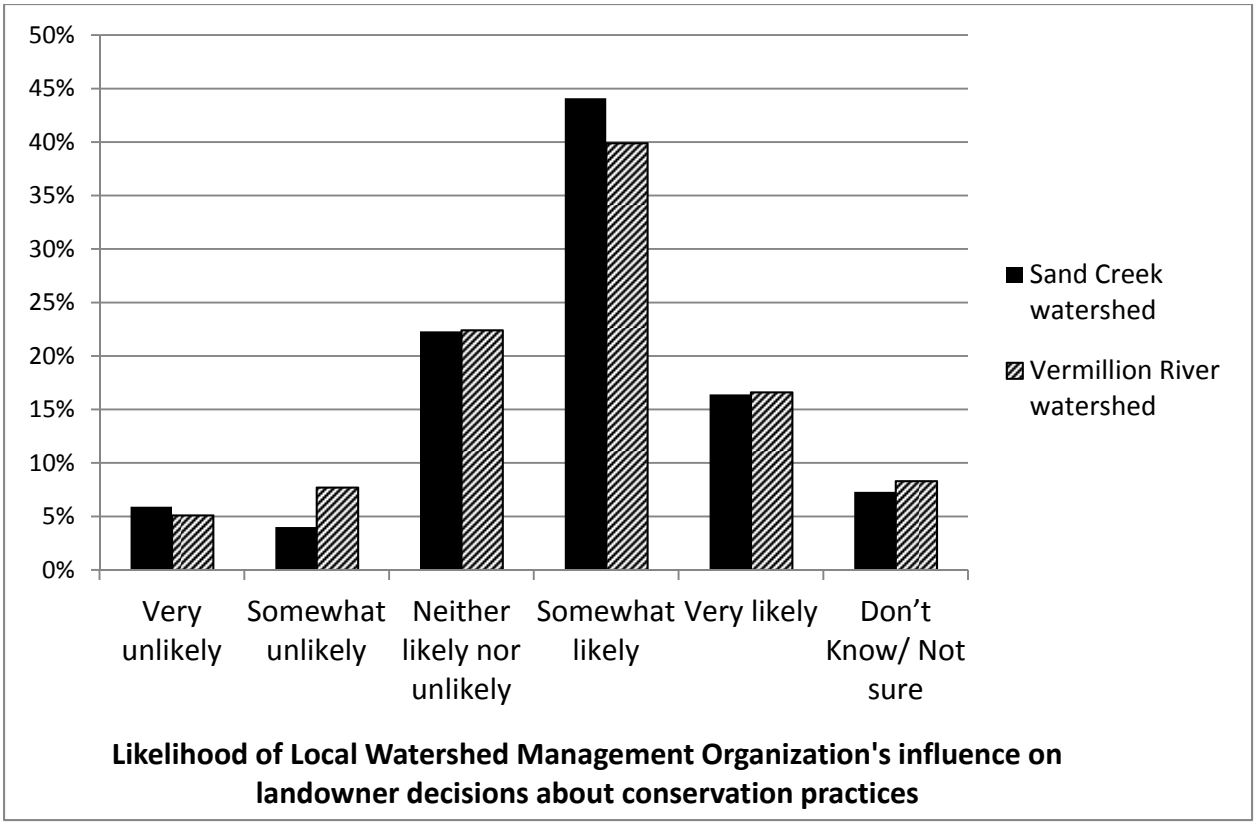


Figure 6. Likelihood of local Watershed Management Organization's influence on conservation practice decisions (Source: Survey question 8j).

12. Do respondents and their communities have the ability to protect water resources?
Respondents were asked to rate the extent to which they agreed with seven statements about their own ability and their community's ability to protect water resources on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Most respondents believe that their community has the ability to change the way land will be developed in the future to protect water resources. However, respondents were less likely to believe that their community has the leadership and financial resources it needs to protect water resources.

Sand Creek watershed:
Most respondents agreed that their community has the ability to change the way land will be developed in the future to protect water resources (66%) and that they personally have the knowledge and skills to take care of their land (60%; Appendix F, Table 9). A small proportion of respondents believed that their community has the leadership (22%) and the financial resources (23%) needed to protect water resources.

Vermillion River watershed:
Most respondents (71%) agreed that their

community has the ability to change the way land will be developed in the future to protect water resources and that they have the knowledge and skills to take care of their land (58%; Appendix G, Table 9). Fewer respondents agreed that their community has the leadership (23%) and the financial resources (32%) needed to protect water resources.

13. What would increase the likelihood that respondents would maintain riparian buffers?
Respondents were asked to rate a series of 11 statements about conditions or actions that might influence their maintenance of streamside buffers on a 5-point scale from strongly disagree (-2) to strongly agree (+2).

Sand Creek watershed:
For Sand Creek respondents, having access to financial resources to help them plant and maintain buffers and learning how to maintain buffers for water quality (Figure 7) were the most likely to increase streamside buffer maintenance (Appendix F, Table 14). Most respondents also agreed that they would be more likely to maintain streamside buffers if they could learn how to maintain streamside buffers for wildlife benefits (52%) and soil conservation (58%). Only 21% of respondents agreed that they would be more likely to maintain a streamside buffer on their land if they could be enrolled in a registry program that recognizes local conservation stewards.

Vermillion River watershed:
For Vermillion River respondents, learning how to maintain streamside buffers for water quality (Figure 7) and knowing more about how to plant and maintain streamside buffers were the most likely to increase their streamside buffer maintenance (Appendix G, Table 14). Most respondents also agreed that they would be more likely to maintain streamside buffers if they could learn how to do so for wildlife benefits (54%) and soil conservation (56%). Only 17% of respondents agreed that they would be more likely to maintain streamside buffers if they could be enrolled in a registry program that recognizes local conservation stewards.

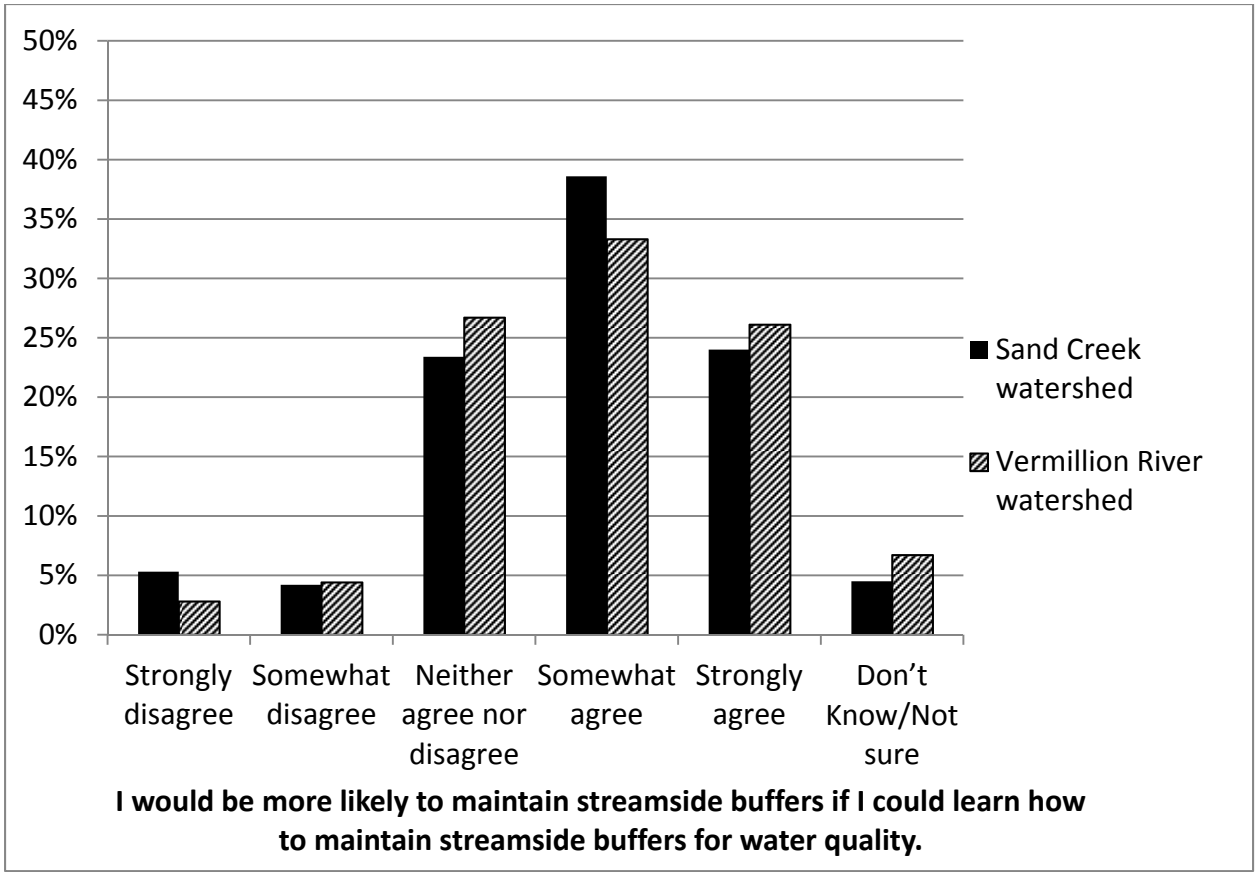


Figure 7. Reported level of agreement or disagreement with the statement "I would be more likely to maintain or continue to maintain streamside buffers on or adjacent to my property if I could learn how to maintain streamside buffers for water quality" (Source: Survey question 12l).

14. How do respondents who maintain streamside buffers differ from those who do not maintain streamside buffers?

To examine differences between respondents who reported maintaining streamside buffers on their property and those who reported not maintaining buffers, we combined the respondent data from the two watersheds and then compared responses of two subgroups: (1) streamside buffer adopters (n=303) and (2) non-adopters (n=126). Respondents who reported that they do not have streams or ditches on or adjacent to their property were excluded from this analysis. We analyzed responses to each survey question. Only items with highly significant differences of at least moderate magnitude are reported here.

The two groups had many similarities across sociodemographic and property characteristics, values, problem awareness, concern, sense of responsibility, and social influences. However, important statistical differences were detected between the subgroups in their beliefs, sense of personal obligation, perceived ability, past engagement in civic action, and future conservation behaviors (Table 1 and Table 2). Streamside buffer adopters agreed to a greater extent than

non-adopters that buffers help to improve water quality for people living downstream. Non-adopters agreed to a greater extent than adopters that buffers reduce the value of land. Non-adopters believed to a lesser extent than adopters that they have the ability to change the way they use their land to protect water resources. Adopters feel a stronger sense of personal obligation than non-adopters to use conservation practices and maintain streamside buffers on their land.

Consistent with their sense of personal obligation, adopters reported being more likely than non-adopters to use conservation practices on their land in the future and, more specifically, to maintain streamside buffers. Finally, adopters were more likely than non-adopters to report that they had discussed water quality issues with community members, attended a meeting about an environmental issue, and read an environment-focused publication.

Table 1. Differences between streamside buffer adopters and non-adopters in their beliefs, perceived ability, sense of personal obligation, and future behaviors.

Item		N	Mean	SD	t[a]	Cohen's d[b]
Beliefs (5-point scale from strongly disagree (-2) to strongly agree (+2))						
Streamside buffers help to improve water quality for people living downstream	Buffers[c]	278	1.42	0.79	5.408	0.62
	No buffers	103	0.90	0.96		
Streamside buffers reduce the value of land	Buffers	268	-0.81	1.08	-4.932	-0.59
	No buffers	95	-0.19	0.99		
Perceived ability (5-point scale from strongly disagree (-2) to strongly agree (+2))						
If I wanted to, I have the ability to change the way I use my land/property to protect water resources	Buffers	272	0.69	1.10	4.728	0.53
	No buffers	115	0.11	1.12		
Sense of personal obligation (5-point scale from strongly disagree (-2) to strongly agree (+2))						
Use conservation practices on my land/property	Buffers	297	1.39	0.70	5.448	0.58
	No buffers	126	0.95	0.90		
Maintain a streamside buffer on my land/property	Buffers	288	1.16	0.89	7.710	0.87
	No buffers	109	0.35	1.03		
Future behaviors (5-point scale from very unlikely (-2) to very likely (+2))						
Use conservation practices on my land/property	Buffers	300	1.38	0.67	6.029	0.64
	No buffers	124	0.91	0.87		
Maintain a streamside buffer on my land/property	Buffers	277	1.27	0.82	9.636	1.09
	No buffers	110	0.30	1.05		

[a]T-test statistic for testing differences in means. Only items with statistical differences at a significance level of $p \leq .001$ (0.1% chance the difference is because of random variability) reported here.

[b]Effect size statistic for measuring the magnitude of the difference between subgroups. Only items with effect size of 0.5 (+/-, interpreted as a moderate effect size) or greater reported here.

[c]Buffers: Respondents who maintain buffers on all or some streams/ditches on or adjacent to their property. No buffers: Respondents who do not maintain buffers on any streams/ditches on or adjacent to their property

Table 2. Differences between streamside buffer adopters and non-adopters in their civic behaviors.

In the past 12 months, have you…[a]		Yes (%)	Chi-square[b] (χ^2)	Phi[c]
Attended a meeting, public hearing or community discussion group about an environmental issue?	Buffers	91	11.626	0.17
	No Buffers	9		
Discussed water quality issues with community members?	Buffers	85	11.528	0.17
	No Buffers	15		
Read any newsletters, magazines or other publication written by environmental groups?	Buffers	83	27.998	0.26
	No Buffers	17		

[a]Response options were yes or no.
[b]Chi-square statistic for testing the significance of differences across groups or variables. Only items with statistical differences at a significance level of p≤.001 (0.1% chance the difference is because of random variability) reported here.
[c]Statistic for measuring the strength of the relationship between variables.

V. Attitudes toward Water Resource Management in Minnesota

15. What do respondents think about management actions to protect the quality of water in Minnesota?

The survey inquired about respondents' attitudes toward water resource management actions. Specifically, respondents were asked to rate the likelihood that each of seven management actions will protect the quality of water resources in Minnesota on a five-point scale from very unlikely (-2) to very likely (+2).

Sand Creek watershed:

Sand Creek watershed respondents rated expanding incentive-based programs that offer payments for conservation as most likely to protect the quality of Minnesota's water resources overall. The majority of respondents also believed that promoting voluntary adoption of conservation practices through education and outreach (65%; Table 3; Figure 8), coordinating land use and water planning across communities (63%), and engaging more citizens in decision-making (61%) will be at least somewhat likely to protect the state's water resources. Most respondents believed that conducting more water quality research and monitoring will be at least "somewhat likely" to protect water quality in the state (64%). The lowest rated management action overall was increasing regulations that specifically address water resource management, though this action still was rated at least somewhat likely to achieve results by 44% of respondents (Appendix F, Table 16).

Vermillion River watershed:

Vermillion River watershed respondents rated enforcing existing land use laws and regulations as most likely to protect Minnesota's water resources overall. The majority of respondents also

believed that promoting voluntary adoption of conservation practices through education and outreach (70%; Figure 8), coordinating land use and water planning across communities (70%), and engaging more citizens in decision-making (65%) will be at least "somewhat likely" to protect the state's water resources. Most respondents believed that conducting more water quality research and monitoring will be at least "somewhat likely" to protect water quality in the state (74%). The lowest rated management action overall was increasing regulations that specifically address water resource management. This action was rated at least somewhat likely to protect water resources by 57% (Appendix G, Table 16).

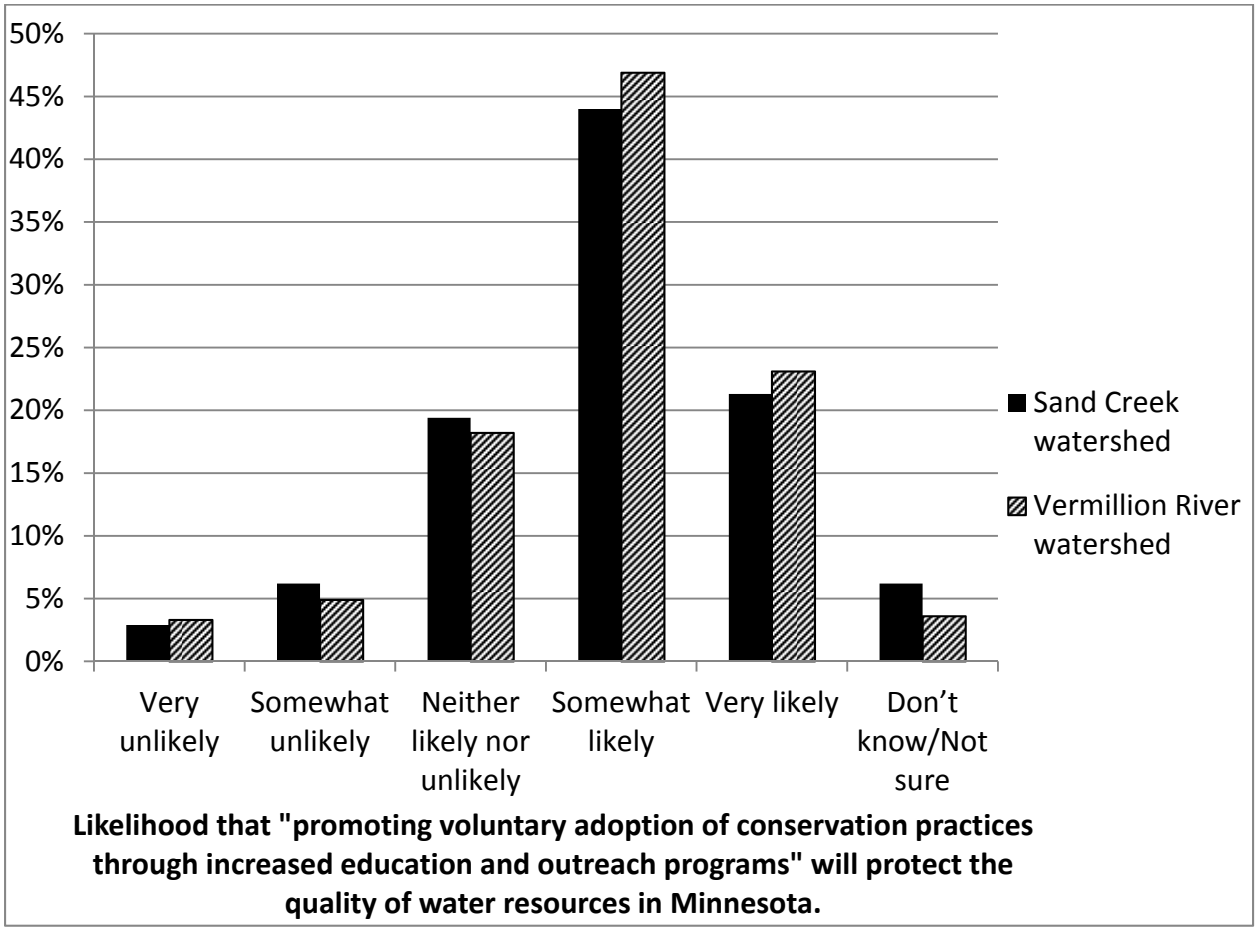


Figure 8. Reported likelihood that "promoting voluntary adoption of conservation practices through increased education and outreach programs" will protect the quality of water resources in Minnesota (Source: Survey question 14e).

DISCUSSION AND IMPLICATIONS

This study has provided much-needed insight on several critical questions identified by local resource managers. These questions include who are streamside landowners, how do they relate to water, and what factors influence their decision-making around conservation practices. Specifically, this study documents streamside landowner values and beliefs about

their communities, the environment, water quality issues, and water resource management; it identifies landowner current and future conservation behaviors; and it establishes who or what influences landowners' conservation decisions and behaviors. This type of social science-based research complements biophysical and geochemical research in helping resource managers identify drivers and consequences of water resource problems grounded in the perspectives of resource users.

We believe the study findings will inform, enhance, and facilitate future community and water resource planning and management initiatives in the two study watersheds and across the state. We encourage resource professionals and community leaders to incorporate the four recommendations highlighted below into the design and implementation of communication, education, and outreach programs.

In sum, a multiple-strategy approach is recommended in conservation programming that encourages personal commitment to conservation, promotes a sense of civic responsibility for water resources, and addresses landowner constraints through tailored education and incentive programs. Further, this multiple-strategy approach should be presented to landowners in a coordinated and consistent manner across resource management organizations.

Recommendation 1: Raise awareness about local stream conditions and encourage personal commitment to conservation.

Study findings suggest that streamside landowners from both watersheds have a high level of general concern about the effects of water pollution on public health, future generations, wildlife, and aquatic life. However, they are less concerned about the consequences of water pollution on people within their community. Findings also indicate either a lack of knowledge or uncertainty among landowners about local water resource conditions, such as the extent to which their community's water resources are adequately protected. Similarly, many landowners do not know the quality of the water in the stream or ditch on their property. Thus, while general concern about water pollution may be high, awareness of problems or certainty about conditions at the local level is relatively low.

To address uncertainty and limited knowledge about local conditions, we recommend landowner-tailored informational strategies aimed at changing perceptions and knowledge. To be effective, the information should be relevant and significant to targeted stakeholders. Thus, communication campaigns should directly articulate local conditions and problems (i.e., impairments in stream reach A or neighborhood B), their potential consequences (i.e., impacts to aquatic life in A or B), and solution alternatives (i.e., streamside buffer installation or wetland restoration near A or B).

Individualized shoreland audits, in which water resource professionals assess stream and shoreland conditions on a landowner's property and provide technical advice about how to plant and maintain buffers for certain benefits (i.e., wildlife or soil conservation) would be most

effective. Individualized, specific, and timely information will make issues more personal to landowners and, when paired with programs aimed at encouraging commitment to conservation practices, are more likely to result in behavior change. Mass media campaigns are believed to be far less effective in changing behavior than personalized approaches (Abrahamse et al., 2005).

Whereas information campaigns alone have had somewhat mixed results, asking for personal commitments, setting goals, and providing feedback has shown more promise (Abrahamse et al., 2005). Personal commitment in the form of a verbal or written pledge to change (or maintain) a behavior establishes personal (if made to oneself) or social (if made public) norms. These promises become even more impactful when matched with a commitment to a particular plan of action (e.g., I promise to install a streamside buffer next spring by planting native grass species and by not mowing along the stream) (Steg & Vlek, 2009).

Goal-setting has also been an effective strategy for promoting behavior change and is frequently used in combination with providing feedback. For example, local resource professionals might set streamside buffer goals of 80% of streamside landowners with buffers or 90% of shoreland miles buffered within a township or municipality. Providing frequent feedback on the extent to which goals are being met to a neighborhood or to a group of landowners living along a stream creates a social norm in favor of buffer adoption and further connects landowners to water resources and to each other. In similar studies of household energy conservation, combinations of strategies including encouraging personal commitments, setting goals, and providing feedback to households or groups has been effective at promoting behavior change (Abrahamse et al., 2007).

Recommendation 2: Foster community-building around water and promote a sense of civic responsibility for water resource protection.

Our study findings indicate that streamside landowners' communal or collective value orientations appear to be strong. Cooperating with community members and nurturing or helping other community members were among the most important cultural values to respondents. This civic-mindedness, however, may not translate well when it comes to conservation practices and water resource protection.

Though a large majority of landowners may feel personally obligated to do whatever they can to prevent water pollution, including using conservation practices on their own land, considerably fewer landowners feel obligated to engage with their community around conservation issues, specifically to work with other community members to protect the environment or to talk to others about conservation practices. Further, as our study revealed, more than three-quarters of respondents admitted they had not discussed water quality issues with other community members in the past 12 months, despite their high concern about water pollution.

As a result, many landowners may not know what their fellow neighbors or community members are thinking or doing with respect to conservation practices on their land. This gap

between individual and collective knowledge and action can stymie the diffusion of knowledge and adoption of innovative solutions (Rogers, 1995). Strategies that build social support for and role modeling of conservation practices through peer-to-peer networks, community events, demonstration areas, and citizen recognition programs build the notion that like-minded landowners have adopted conservation practices and, furthermore, that being a proactive member of the community means doing what one can to protect local water resources.

Landowner commitment to water resource protection can be dramatically influenced by the "citizen effect" or social norms and pressures favoring certain behaviors (Morton, 2011). Information exchange around the successes of conservation practices such as streamside buffers also has the effect of reducing uncertainty and perceptions of risk, often a barrier in behavior change (Rogers, 1995).

While respondents felt individually responsible for the protection of water resources, they also believed it is the responsibility of landowners within the community and local government to protect water resources. Thus, it is clear that landowners recognize that water resource protection requires the collective action of individuals and community leadership. Given prevailing communal value orientations among landowners and their strong sense of personal obligation and responsibility for conservation practices, it would seem that promoting cooperation would have great potential within these watersheds. Cooperation further expands resources available to landowners by pooling knowledge, increasing access to technology and equipment, fostering trust, and building community pride in accomplishments.

The scale of community-engagement strategies is an important consideration. Study findings reveal that when landowners think of "their community," they tend to think of the city or township in which they live and their nearest neighbors, more so than their county or watershed. Thus, coordination on a large scale in watersheds with diverse settlement patterns may prove difficult (O'Neil et al., 2005). Further, traditionally underrepresented or disadvantaged groups may continue to be difficult to engage at a watershed scale. Water resource-focused strategies for building social support and modeling behavior should consider a smaller scale. Neighborhood "block" parties or programs targeted to smaller geographic areas, settlement types, or social groups may be more effective at building social networks and civic engagement than county- or watershed-wide programs (O'Neil et al., 2005). Similarly, recruitment strategies for engaging landowners in programs must be specific and tailored to targeted groups.

Recommendation 3: Address constraints to streamside buffer adoption through landowner-tailored education and incentive programs.

Study findings suggest that many streamside landowners seem to have an understanding of the connection between land use and water quality and that they feel personally responsible for protecting water quality. Yet specific attitudes and resource constraints may prevent adoption of streamside buffers. For example, our study reveals some skepticism exists about the benefits of streamside buffers among landowners in the two watersheds. Among respondents, those with doubts about streamside buffers represent a relatively small minority, yet these beliefs

appear to be a differentiating characteristic between non-adopters and adopters. Specifically, non-adopters held stronger beliefs that buffers reduce the value of land and weaker beliefs that buffers improve water quality than adopters.

Expression of these types of negative attitudes toward conservation practices, that they are likely to have higher risks than rewards, requires interventions that address both real and perceived costs and benefits. Direct types of interventions may encourage or reward (e.g., financial incentives, public recognition) "good" behavior or, alternatively, they may discourage or punish (e.g., fines, public admonition) "bad" behavior. Incentives and rewards are generally favored over sanctions because they tend to promote positive feelings and social support around the desired behavior. However, rewards have their limits. Monetary incentives, in particular, have been shown to have only short-term effects on behavior change because the behavior and outcomes are less likely to be internalized (Abrahamse et al., 2005; Steg & Vek, 2009). A less direct but perhaps more long-lasting strategy for incentivizing conservation behavior is through offering information and assistance that better enable individuals to attain the specific benefits they desire.

Although our study indicates the majority of landowners believe they have the knowledge and skills they need to take care of their land, we also discovered that knowledge and skills may be a constraint to 4 out of every 10 streamside landowners. Furthermore, when asked about information or other incentives that would increase their adoption of streamside buffers, four out of five of the highest ranked items were educational in nature. Findings suggest that the majority of streamside landowners would be more inclined to adopt or maintain existing buffers if they could learn how to maintain buffers for water quality, soil conservation, and wildlife benefits. Most landowners also would be more likely to adopt buffers if they knew more about how to plant and maintain buffers. Thus, it appears that more specific information about streamside buffers and their particular benefits is desired.

At the same time, we learned that perceptions of financial constraints exist. Study findings show that about 5 out of 10 landowners perceive financial resources as a constraint to their ability to take care of their land. Similarly, findings suggest that access to financial resources to help plant and maintain buffers will increase the likelihood of adoption for 5 or 6 out of every 10 streamside landowners.

Given these findings, we recommend that attitudinal and resource constraints be addressed through landowner-tailored education programs, supplemented when possible with short-term opportunities for financial incentives. As discussed above, mass media information campaigns encouraging behavior change are less likely to be effective than informational programs tailored to the specific characteristics and needs of the targeted audience. In the study watersheds, we have learned that streamside landowners want more educational opportunities to learn about maintaining buffers specifically for water quality, soil conservation, and wildlife benefits. Specific knowledge and training around planting and maintaining streamside buffers that is focused on producing these benefits would be well-received.

Recommendation 4: **Coordinate a multiple-strategy approach for water resource protection across the state, and maintain consistent messaging from resource organizations about water resource issues.**

In the context of land use and water resource management, local government and non-governmental organizations play the most intensive role in influencing the day-to-day decisions and behaviors of landowners. Thus, townships, municipalities, and county governments, as well as special resource organizations such as Soil and Water Conservation Districts (SWCDs) and watershed management organizations (WMOs), tend to have the most direct responsibility for implementing programs in their watersheds that ultimately protect water resources throughout the state.

We asked study respondents to weigh in on various management actions intended to protect Minnesota's water resources. Findings indicate that streamside landowners believe a multiple-strategy approach is needed. Based on our study, more than half of streamside landowners believe enforcing existing land use laws and regulations, conducting more water quality research, expanding payment programs for conservation practices, coordinating land use and water planning across communities, promoting voluntary adoption through increased education and outreach, and engaging citizens in decision-making will be likely to protect water quality in Minnesota.

Study findings suggest that streamside landowners' conservation decision-making is most likely to be influenced by family, their county's SWCDs, and the MN Department of Natural Resources. Additionally, in both the study watersheds, about 6 out of every 10 landowners view the local WMOs as influential in their conservation decisions. The majority of respondents reported that they would be at least somewhat likely to be influenced by 7 of the 12 groups listed. These findings indicate that landowners are likely to consult or consider the advice of many individuals and groups when deciding whether to adopt certain conservation practices on their land.

Implications of this finding for resource organizations are twofold. First, many agencies and organizations appear to have the attention of landowners and the legitimacy needed to influence their conservation behaviors. This makes carefully planned and tailored intervention strategies more likely to be successful. Second, given that many agencies and organizations are influential, the need for coordinated and consistent messaging from both government and non-government agencies and across local, state, and federal levels is critical.

LITERATURE CITED

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005). A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology, 25,* 273-291.

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2007). The effect of tailored information, goal setting, and tailored feedback on household energy use, energy-related behaviors and behavior-antecedents. *Journal of Environmental Psychology, 27,* 265-276.

Ajzen, I.(1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision*, *50*, 179-211.

Davenport, M.A., Pradhananga, A. & Sames, A. (2011). The influence of local governance on watershed management in Minnesota: Capacities, constraints, and catalysts of change. *The International Symposium on Society and Resource Management*, June 4-8, 2011, Madison, WI.

Dillman, D.A., Smyth, J.D., & Christian, L.M. (2009). *Internet, mail and mixed-mode surveys: The tailored design method*. Hoboken, NJ: John Wiley & Sons, Inc.

Harland, P., Staats, H., & Wilke, H.A.M. (2007). Situational and personality factors as direct or personal norm mediated predictors of pro-environmental behavior: Questions derived from Norm-activation Theory. *Basic and Applied Social Psychology*, *29*(4), 323-334.

Lankford, S.V., Buxton, B.P., Hetzler, R., & Little, J.R. (1995). Response bias and wave analysis of mailed questionnaires in tourism impact assessments. *Journal of Travel Research, 33,* 8-13.

Matsumoto, D., Weissman, M.D., Preston, K., Brown, B.R. & Kupperbusch, C. (1997).Context-specific measurement of individualism-collectivism on the individual level. *Journal of Cross-Cultural Psychology, 28*(6), 743-767.

Morton, L.W and S.S. Brown (eds) (2011). *Pathways for getting to better water quality: The citizen effect*. New York, NY: Springer Science + Business.

O'Neill, K.M. (2005). Can watershed management unite town and country? *Society and Natural Resources, 18,* 241-253.

Prokopy, L.S., Genskow, K., Asher, J., Baumgart-Getz, A., Bonnell, J., Broussard, S., Curtis, C., Floress, K., McDermaid, K., Power, R., & Wood, D. (2009). Designing a Regional System of Social Indicators to Evaluate Nonpoint Source Water Projects. *Journal of Extension. 47(2)*.

Rogers, E.M. (1995). *Diffusion of innovations*, 4th ed. New York: NY: Free Press.

Schultz, P.W. (2001).The structure of environmental concern: concern for self, other people, and the biosphere. *Journal of Environmental Psychology, 21,* 327-339.

Schwartz, S.H. (1977). *Advances in experimental social psychology*. New York: Academic Press.

Steg, L. & Vlek, C. (2009). Encouraging pro-environmental behavior: An integrative review and research agenda. *Journal of Environmental Psychology, 29,* 309-317.

Stern, P.C., Dietz, T. & Kalof, L. (1993).Value orientations, gender and environmental concern. *Environment and Behavior, 25*(3), 322-348.

Stern, P.C., Dietz, T., & Guagnano, G.A. (1998). A Brief Inventory of Values. *Educational and Psychological Measurement, 58*, 984-1001.

APPENDICES

APPENDIX A: SURVEY INSTRUMENT

ID# _____

Your Perspectives on Local Water Resources

A survey of landowners in Sand Creek and Vermillion River Watersheds

Department of FOREST RESOURCES
University of Minnesota

2011

Thank you for taking the time to answer questions about your community and your watershed.

The purpose of this survey is to understand the perspectives of landowners on their community and water resources. The findings from this study will be used to help resource managers and community leaders understand landowner perspectives on water resources and to facilitate communication and conservation programs.

Your opinions are very valuable to us. This survey is voluntary and completely confidential. Please answer the questions as completely as possible. It should take you about 20 minutes to complete the questionnaire. Please complete the survey, fold it in half, and mail it back in the enclosed self-addressed stamped envelope.

Please keep in mind the following definitions while you are completing this questionnaire.

A watershed is an area of land that drains water and suspended or dissolved materials to a common outlet at some point along a stream or river. The natural watershed drainage area can be altered by engineered drainage networks.

A streamside buffer is an area of land adjacent to streams or ditches that filters water, stabilizes the stream bank, and provides habitat for wildlife. To maintain or establish a streamside buffer, a landowner typically retains or plants native vegetation along a stream edge.

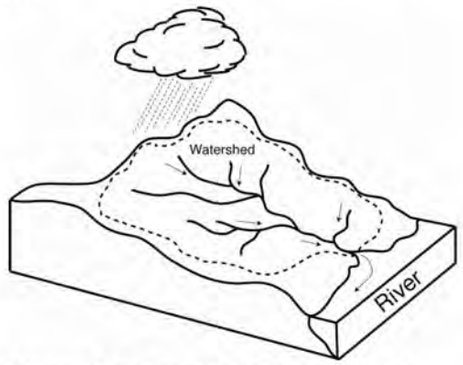


Diagram of the stream systems in a watershed

I. Perspectives on Your Community

First, we would like to know how you define and relate to your community.

1. To what extent do you agree or disagree with the following statements? ***(Please circle one number for each row)***

When I think of my community, I think of...	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't Know/ Not sure
a. My nearest neighbors.	-2	-1	0	1	2	DK
b. People who live within 1-3 miles from my home.	-2	-1	0	1	2	DK
c. The city or township in which I live.	-2	-1	0	1	2	DK
d. The county in which I live.	-2	-1	0	1	2	DK
e. The watershed in which I live.	-2	-1	0	1	2	DK
f. The entire state of Minnesota.	-2	-1	0	1	2	DK
g. Other (please specify):_____	-2	-1	0	1	2	DK

2. How important are each of the following as guiding principles in your life? ***(Please circle one number for each row)***

	Not at all important	Slightly important	Moderately important	Very important	Extremely important	Don't Know/ Not sure
a. To identify myself as a member of my community.	1	2	3	4	5	DK
b. To be different from members of my community.	1	2	3	4	5	DK
c. To cooperate with members of my community.	1	2	3	4	5	DK
d. To pursue my personal goals even if they conflict with broader community goals.	1	2	3	4	5	DK
e. To follow norms of behavior established by my community.	1	2	3	4	5	DK
f. To nurture or help other members of my community.	1	2	3	4	5	DK

II. Perspectives on the Environment

Next, we would like to know your thoughts on the natural environment.

3. How important are each of the following as guiding principles in your life? ***(Please circle one number for each row)***

	Not at all important	Slightly important	Moderately important	Very important	Extremely important	Don't Know/ Not Sure
a. To preserve nature for its own sake.	1	2	3	4	5	DK
b. To conserve natural resources for human use.	1	2	3	4	5	DK
c. To use natural resources for personal income.	1	2	3	4	5	DK
d. To protect nature for human health and well-being.	1	2	3	4	5	DK
e. To maintain unity with nature.	1	2	3	4	5	DK
f. To protect private property rights.	1	2	3	4	5	DK
g. To respect the earth.	1	2	3	4	5	DK
h. To conserve natural resources for my recreational use.	1	2	3	4	5	DK
i. To distribute natural resources fairly.	1	2	3	4	5	DK

4. To what extent do you agree or disagree with the following statements? ***(Please circle one number for each row)***

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't Know/ Not sure
a. Protecting the environment will threaten jobs for people like me.	-2	-1	0	1	2	DK
b. Laws to protect the environment limit my choices and personal freedom.	-2	-1	0	1	2	DK
d. The effects of water pollution on public health are worse than we realize.	-2	-1	0	1	2	DK
e. Water pollution poses serious threats to the quality of life in my community.	-2	-1	0	1	2	DK
f. The balance of nature is delicate and easily upset.	-2	-1	0	1	2	DK
g. Claims that current levels of pollution are changing the earth's climate are exaggerated.	-2	-1	0	1	2	DK
h. Streamside buffers help to improve water quality for people living downstream.	-2	-1	0	1	2	DK
i. Streamside buffers reduce the value of land.	-2	-1	0	1	2	DK
j. Streamside buffers should be protected because they provide habitat for wildlife.	-2	-1	0	1	2	DK

III. Perception of Water Resources

In this section, we ask more specific questions related to your perspectives on water resources.

5. To what extent do you agree or disagree with the following statements? ***(Please circle one number for each row)***

I am concerned about the consequences of water pollution for...	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't Know/ Not sure
a. My health	-2	-1	0	1	2	DK
b. Future generations	-2	-1	0	1	2	DK
c. Wildlife	-2	-1	0	1	2	DK
d. My lifestyle	-2	-1	0	1	2	DK
e. Aquatic life	-2	-1	0	1	2	DK
f. People in my community	-2	-1	0	1	2	DK

6. To what extent do you agree or disagree with the following statements? ***(Please circle one number for each row)***

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't Know/ Not sure
a. Water resources in my community are adequately protected.	-2	-1	0	1	2	DK
b. Someone who uses a conservation practice contributes to a clean environment.	-2	-1	0	1	2	DK
c. What I do on my land doesn't make much difference in overall water quality.	-2	-1	0	1	2	DK
d. It is my personal responsibility to help protect water quality.	-2	-1	0	1	2	DK
e. Landowners/property owners in my community should be responsible for protecting water quality.	-2	-1	0	1	2	DK
f. The federal government should be responsible for protecting water quality.	-2	-1	0	1	2	DK
g. The state government should be responsible for protecting water quality.	-2	-1	0	1	2	DK
h. Local government (i.e. county, city/township) should be responsible for protecting water quality.	-2	-1	0	1	2	DK

7. To what extent do you agree or disagree with the following statements? ***(Please circle one number for each row)***

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't Know/ Not sure
a. If I wanted to, I have the ability to change the way I use my land/property to protect water resources.	-2	-1	0	1	2	DK
b. I have the financial resources I need to take care of my land.	-2	-1	0	1	2	DK
c. I have the knowledge and skills I need to take care of my land.	-2	-1	0	1	2	DK
d. My community has the ability to change the way land is currently used to protect water resources.	-2	-1	0	1	2	DK
e. My community has the ability to change the way land will be developed in the future to protect water resources.	-2	-1	0	1	2	DK
f. My community has the financial resources it needs to protect water resources.	-2	-1	0	1	2	DK
g. My community has the leadership it needs to protect water resources.	-2	-1	0	1	2	DK

IV. Conservation Practices and Civic Engagement

Now, we have a few questions about your conservation practices and civic engagement.

8. How likely or unlikely is it that the following individuals or groups would influence your decisions about conservation practices on your land/property? ***(Please circle one number for each row)***

	Very Unlikely	Somewhat Unlikely	Neither likely nor unlikely	Somewhat likely	Very likely	Don't Know/ Not sure
a. My family	-2	-1	0	1	2	DK
b. My neighbors	-2	-1	0	1	2	DK
c. People in my community	-2	-1	0	1	2	DK
d. My local government	-2	-1	0	1	2	DK
e. Environmental organizations	-2	-1	0	1	2	DK
f. Sportspersons clubs	-2	-1	0	1	2	DK
g. Property rights organizations	-2	-1	0	1	2	DK
h. My county's Soil and Water Conservation District	-2	-1	0	1	2	DK
i. My county's Farm Bureau	-2	-1	0	1	2	DK
j. My local Watershed Management Organization	-2	-1	0	1	2	DK
k. The MN Department of Natural Resources	-2	-1	0	1	2	DK
l. The MN Pollution Control Agency	-2	-1	0	1	2	DK

Next, we would like to know to what extent you feel a *personal obligation* to engage in the following actions.

9. To what extent do you agree or disagree with the following statements? ***(Please circle one number for each row)***

I feel a personal obligation to...	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't Know/ Not sure
a. Do whatever I can to prevent water pollution.	-2	-1	0	1	2	DK
b. Take actions to stop the loss of wildlife habitat.	-2	-1	0	1	2	DK
c. Use conservation practices on my land/property.	-2	-1	0	1	2	DK
d. Maintain a streamside buffer on my land/ property.	-2	-1	0	1	2	DK
e. Talk to others about conservation practices.	-2	-1	0	1	2	DK
f. Work with other community members to protect the environment.	-2	-1	0	1	2	DK

Now, we would like to know *the likelihood that you would* engage in the following actions.

10. How likely or unlikely is it that you would engage in the following actions in the future? ***(Please circle one number for each row)***

	Very unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely	Don't Know/ Not sure
a. Do whatever I can to prevent water pollution.	-2	-1	0	1	2	DK
b. Take actions to stop the loss of wildlife habitat.	-2	-1	0	1	2	DK
c. Use conservation practices on my land/property.	-2	-1	0	1	2	DK
d. Maintain a streamside buffer on my land/ property.	-2	-1	0	1	2	DK
e. Talk to others about conservation practices.	-2	-1	0	1	2	DK
f. Work with other community members to protect the environment.	-2	-1	0	1	2	DK

We want to know about your experiences with and beliefs about streamside buffers **(See definition on inside cover)**

11. To what extent do you maintain streamside buffers on your land/property? ***(Please check one box)***

- ☐ I **do not have** streams/ditches on or adjacent to my property **(Skip to Question 13)**
- ☐ I maintain buffers **on all** streams/ditches on or adjacent to my property.
- ☐ I maintain buffers **on some** streams/ditches on or adjacent to my property.
- ☐ I **do not** maintain buffers on any streams/ditches on or adjacent to my property.

12. To what extent do you agree or disagree with the following statements? ***(Please circle one number for each row)***

I would be more likely to maintain or continue to maintain streamside buffers on or adjacent to my property if...	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't Know/ Not sure
a. I knew more about the benefits of streamside buffers.	-2	-1	0	1	2	DK
b. I knew more about how to plant and maintain streamside buffers.	-2	-1	0	1	2	DK
c. I had help with the physical labor of planting and maintaining streamside buffers.	-2	-1	0	1	2	DK
d. I had access to financial resources to help me plant and maintain streamside buffers.	-2	-1	0	1	2	DK
e. I were compensated for lost crop production because of streamside buffers.	-2	-1	0	1	2	DK
f. I could attend a community workshop or field day on streamside buffers.	-2	-1	0	1	2	DK
g. I could be enrolled in a registry program that recognizes local conservation stewards.	-2	-1	0	1	2	DK
h. My neighbors maintained streamside buffers.	-2	-1	0	1	2	DK
i. I could learn how to maintain streamside buffers for wildlife benefits.	-2	-1	0	1	2	DK
j. I could learn how to maintain streamside buffers for scenic quality.	-2	-1	0	1	2	DK
k. I could learn how to maintain streamside buffers for soil conservation.	-2	-1	0	1	2	DK
l. I could learn how to maintain streamside buffers for water quality.	-2	-1	0	1	2	DK

13. Have you engaged in the following actions in the past 12 months? ***(Please check yes or no for each row)***

In the past 12 months, have you ...	Yes	No	Don't Know/Not Sure
a. Discussed water quality issues with community members?	☐	☐	☐
b. Attended a meeting, public hearing or community discussion group about an environmental issue?	☐	☐	☐
c. Read any newsletters, magazines or other publications written by environmental groups?	☐	☐	☐
d. Given money to an environmental group?	☐	☐	☐
e. Written a letter or called a government official to support strong environmental protection?	☐	☐	☐
f. Joined or been a member of any group whose main aim is to protect the environment?	☐	☐	☐
g. Voted for a candidate in an election at least in part because he or she was in favor of strong environmental protection?	☐	☐	☐

V. Watershed Management in Minnesota

Next, please consider the impact of future management actions on the quality of Minnesota's water resources.

14. In your opinion, how likely is it that the following management actions will protect the quality of water resources in Minnesota? ***(Please circle one number for each row)***

		Very unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely	Don't Know/ Not Sure
a.	Conducting more water quality research and monitoring.	-2	-1	0	1	2	DK
b.	Enforcing existing land use laws and regulations.	-2	-1	0	1	2	DK
c.	Increasing regulations that specifically address water resource management.	-2	-1	0	1	2	DK
d.	Expanding incentive-based programs that offer payments to landowners for conservation practices	-2	-1	0	1	2	DK
e.	Promoting voluntary adoption of conservation practices through increased education and outreach programs.	-2	-1	0	1	2	DK
f.	Coordinating land use and water planning efforts across communities.	-2	-1	0	1	2	DK
g.	Engaging more citizens in local land use and water resource decision making.	-2	-1	0	1	2	DK

VI. Information about You

Finally, we want to know a little bit about you in order to better understand who responded to this survey. Remember, your responses to all of the survey questions are confidential.

15. Approximately how many years have you lived in your community? _____

16. In what year were you born? _____

17. What is your gender?

☐ Male ☐ Female

18. What is the highest level of formal education you have completed? ***(Please check one box)***

☐ Did not finish high school
☐ Completed high school
☐ Some college but no degree
☐ Associate degree or vocational degree
☐ College bachelors degree
☐ Some college graduate work
☐ Completed graduate degree (Masters or Ph.D.)

19. Are you of Hispanic, Latino or Spanish Origin? ***(Please check Yes or No)***

☐ Yes ☐ No

20. How would you describe your race? ***(Please check all that apply)***

☐ White
☐ Black or African American
☐ American Indian or Alaska Native
☐ Asian Indian
☐ Native Hawaiian
☐ Pacific Islander
☐ Chinese
☐ Japanese
☐ Korean
☐ Vietnamese
☐ Filipino
☐ Other Race (Please specify) _____

21. Which of the following best describes your total household income from all sources in 2010 before taxes? ***(Please check one box)***

☐ Under $10,000
☐ $10,000-$24,999
☐ $25,000-$34,999
☐ $35,000-$49,999
☐ $50,000-$74,999
☐ $75,000-$99,999
☐ $100,000-$149,999
☐ $150,000 or more

22. Which of the following best describes the size of your current land/property? ***(Please check one box)***

☐ No property (e.g., apartment, condo)
☐ Under 1 acre
☐ 1-5 acres
☐ 6-20 acres
☐ 21-50 acres
☐ 51-150 acres
☐ 151 acres or more

23. Do you use your land/property for agricultural production? ***(Please check yes or no)***

☐ Yes ☐ No

24. What percent of your income is dependent on your land/property? *(Please check one box)*

- ☐ 0%
- ☐ 1-25%
- ☐ 25-50%
- ☐ More than 50%

25. Which of the following best describes the ownership arrangement of your land/property? *(Please check one box)*

- ☐ I own and manage my own land/property
- ☐ I rent my land/property to another party
- ☐ I rent my land/property from another party
- ☐ Other (please specify):_____

26. Who makes the management decisions on your property? *(Please check one box)*

- ☐ I make my own decisions
- ☐ I leave it up to my renter
- ☐ I leave it up to the landowner/property owner
- ☐ I work together with renter/landowner to make decisions

27. Does the land/property you own or rent border a stream/ditch or have streams/ditches running through it? *(Please check yes or no)*

☐ Yes ☐ No **(Please skip to Question 29)**

28. How would you characterize the quality of water in the stream/ditch? *(Please check one box)*

- ☐ Very poor
- ☐ Poor
- ☐ Good
- ☐ Fair
- ☐ Very good

☐ Don't Know/Not sure

29. Do you have any other comments about your community or water resource management?

Thank you for your help!

Please complete the survey, fold it in half, and mail it back in the enclosed self-addressed stamped envelope.

If you have questions about the survey or the project, please contact Dr. Mae Davenport, Department of Forest Resources, 115 Green Hall, 1530 Cleveland Avenue N., St. Paul, MN 55108. Phone: (612) 624-2721 or Amit Pradhananga by email at prad0047@umn.edu.

Image Credits: Cover Photo: Vermillion River Corridor Plan Draft 2010, Watershed diagram: E. Seekamp

APPENDIX B: PRE-NOTICE POSTCARD

Dear Sand Creek or Vermillion River watershed landowner/property owner,

We are writing to ask you for your help in an important study being conducted by the Department of Forest Resources, University of Minnesota. A few days from now you will receive a request in the mail to complete a questionnaire asking you about your perspectives on your community and water resources management.

We are writing in advance because many people like to know ahead of time that they will be contacted. The study is important because it will help resource managers and community leaders understand landowner perspectives on water resources and will guide communication and conservation programs.

If you have any questions about the study, please feel free to contact me by phone at (612) 624-2721, or by email at mdaven@umn.edu.

Thank you in advance for your help.

Mae Davenport
Assistant Professor

Dear Sand Creek or Vermillion River watershed landowner/property owner,

We are writing to ask you for your help in an important study being conducted by the Department of Forest Resources, University of Minnesota. A few days from now you will receive a request in the mail to complete a questionnaire asking you about your perspectives on your community and water resources management.

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If you have any questions about the study, please feel free to contact me by phone at (612) 624-2721, or by email at mdaven@umn.edu.

Thank you in advance for your help.

Mae Davenport
Assistant Professor

Dear Sand Creek or Vermillion River watershed landowner/property owner,

We are writing to ask you for your help in an important study being conducted by the Department of Forest Resources, University of Minnesota. A few days from now you will receive a request in the mail to fill out a brief questionnaire asking you about your perspectives on your community and water resources.

We are writing in advance because many people like to know ahead of time that they will be contacted. The study is important because it will help resource managers and community leaders understand landowner perspectives on water resources and to facilitate communication and conservation programs.

If you have any questions about the study, please feel free to contact me by phone at (612) 624-2721, or by email at mdaven@umn.edu.

Thank you in advance for your help.

Mae Davenport
Assistant Professor

Department of Forest Resources
University of Minnesota
1530 Cleveland Avenue N
St. Paul, MN 55108

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1530 Cleveland Avenue N
St. Paul, MN 55108

APPENDIX C: COVER LETTER

I. Sand Creek watershed

[Date]

[Full Address]

Information Sheet

Dear [First name Last name],

I am writing to ask for your help in a study about your community and its water resources. The study is being conducted by Mae Davenport, Department of Forest Resources, University of Minnesota and is being funded by grants from the U.S. Geological Survey and the University of Minnesota. I am contacting you because you are a landowner or property owner in the Vermillion River or Sand Creek watershed and we believe you have an important perspective to share on the future of your community and its water resources. The purpose of this survey is to learn more about how local landowners or property owners like you perceive and interact with their community, their environment, and specifically their water resources. The findings from this study will be used to help resource managers and community leaders better understand landowners' views and to facilitate communication and outreach programs in the future. Your input will inform water and land management decisions in the Sand Creek and Vermillion River watersheds. We are only contacting a random sample of landowners in this area, so it is important that we hear from you!

This survey is voluntary and completely confidential. The risks of participating in this study are minimal. There are no direct benefits to you for participating in this study. You are free to withdraw at any time. Completion of this survey indicates your voluntary consent to participate. Your decision to participate will not affect your current or future relationship with the University of Minnesota. The ID # on the front page of your survey is used to help us track mailings and will ensure that your name is never affiliated with your responses. Please answer the questions as completely as possible. It should take you only about 20 minutes to complete the questionnaire. Once you have **completed the questionnaire, fold it in half and mail it back in the enclosed self-addressed, postage-paid envelope.**

We would be happy to answer any questions or listen to any comments you may have about this study. Please feel free to contact me by phone at 612-624-2721, or by email at mdaven@umn.edu. If you have any questions or concerns regarding the study and would like to talk to someone other than the researcher(s), you are encouraged to contact the Fairview Research Helpline at telephone number 612-672-7692 or toll free at 866-508-6961. You may also contact this office in writing or in person at University of Minnesota Medical Center, Fairview Riverside Campus, 2200 Riverside Avenue, Minneapolis, MN 55454.

I hope you enjoy completing the questionnaire and I look forward to receiving your response.

Sincerely,

Mae Davenport
Assistant Professor

II. Vermillion River watershed

[Date]

[Full Address]

Information Sheet

Dear [First name Last name],

I am writing to ask for your help in a study about your community and its water resources. The study is being conducted by Mae Davenport, Department of Forest Resources, University of Minnesota and is being funded by grants from the U.S. Geological Survey and the University of Minnesota. I am contacting you because you are a landowner or property owner in the Vermillion River or Sand Creek watershed and we believe you have an important perspective to share on the future of your community and its water resources. The purpose of this survey is to learn more about how local landowners or property owners like you perceive and interact with their community, their environment, and specifically their water resources. The findings from this study will be used to help resource managers and community leaders better understand landowners' views and to facilitate communication and outreach programs in the future. Your input will inform water and land management decisions in the Sand Creek and Vermillion River watersheds. We are only contacting a random sample of landowners in this area, so it is important that we hear from you! For your reference, a map is enclosed displaying the municipalities and counties that are within the Vermillion River watershed.

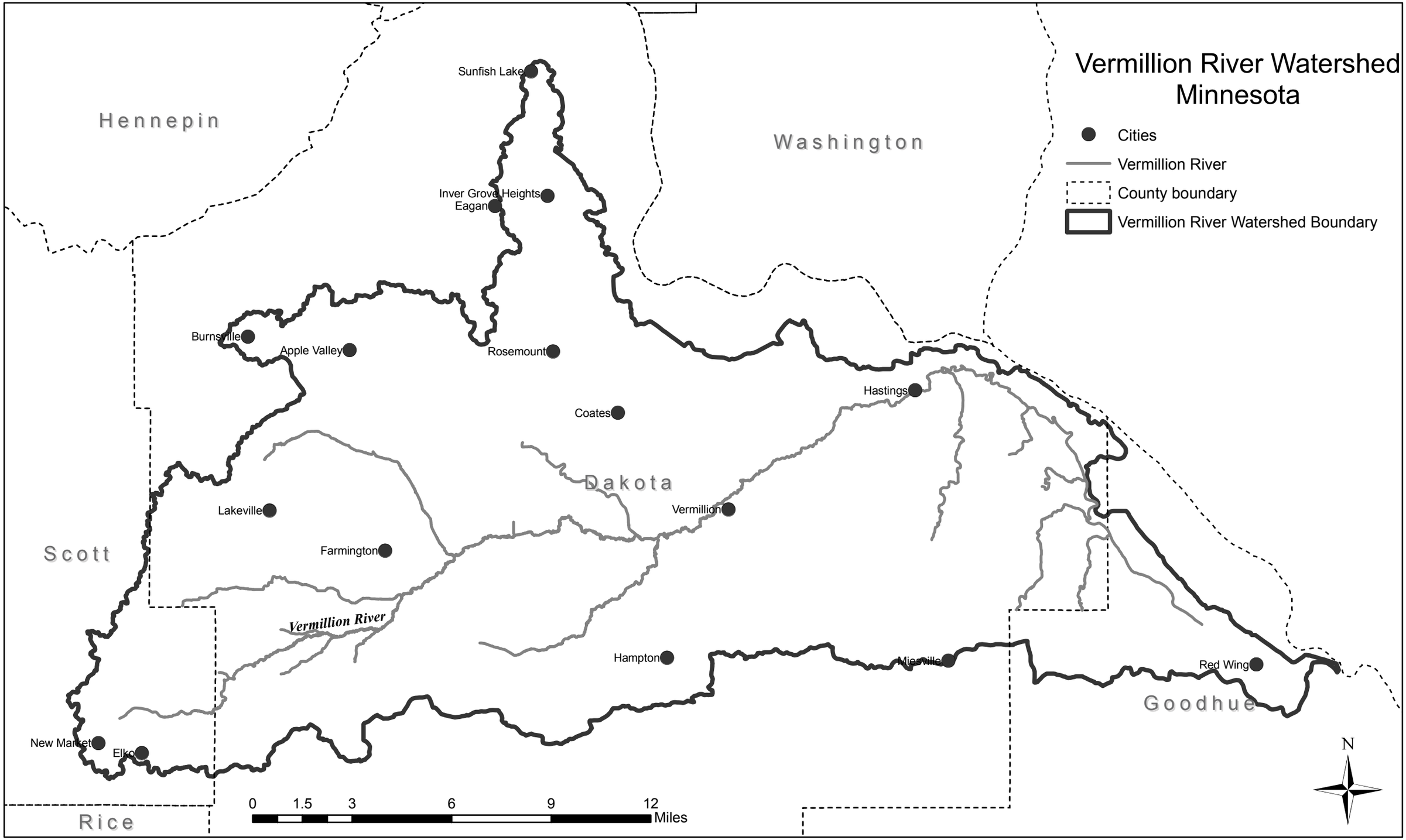
This survey is voluntary and completely confidential. The risks of participating in this study are minimal. There are no direct benefits to you for participating in this study. You are free to withdraw at any time. Completion of this survey indicates your voluntary consent to participate. Your decision to participate will not affect your current or future relationship with the University of Minnesota. The ID # on the front page of your survey is used to help us track mailings and will ensure that your name is never affiliated with your responses. Please answer the questions as completely as possible. It should take you only about 20 minutes to complete the questionnaire. Once you have **completed the questionnaire, fold it in half and mail it back in the enclosed self-addressed, postage-paid envelope.**

We would be happy to answer any questions or listen to any comments you may have about this study. Please feel free to contact me by phone at 612-624-2721, or by email at mdaven@umn.edu. If you have any questions or concerns regarding the study and would like to talk to someone other than the researcher(s), you are encouraged to contact the Fairview Research Helpline at telephone number 612-672-7692 or toll free at 866-508-6961. You may also contact this office in writing or in person at University of Minnesota Medical Center, Fairview Riverside Campus, 2200 Riverside Avenue, Minneapolis, MN 55454.

I hope you enjoy completing the questionnaire and I look forward to receiving your response.

Sincerely,

Mae Davenport
Assistant Professor


Vermillion River Watershed
Minnesota
Cities
Vermillion River
County boundary
Vermillion River Watershed Boundary
Hennepin
Washington
Dakota
Scott
Rice
Goodhue
Sunfish Lake
Inver Grove Heights
Eagan
Burnsville
Apple Valley
Rosemount
Coates
Hastings
Lakeville
Farmington
Vermillion
Vermillion River
Hampton
Miesville
Red Wing
New Market
Elko
0 1.5 3 6 9 12
Miles
N

APPENDIX D: REMINDER LETTER/POSTCARD

I. Sand Creek watershed

[Date]

[First name Last name]

[Address]

Dear [First name Last name],

Several days ago you received a questionnaire inquiring about your perspectives on your community and its water resources. We are surveying landowners and property owners in Sand Creek and Vermillion River watersheds to help inform management decisions and to guide communication and outreach efforts in your area. Our records show that you own land in the Sand Creek watershed (see enclosed map).

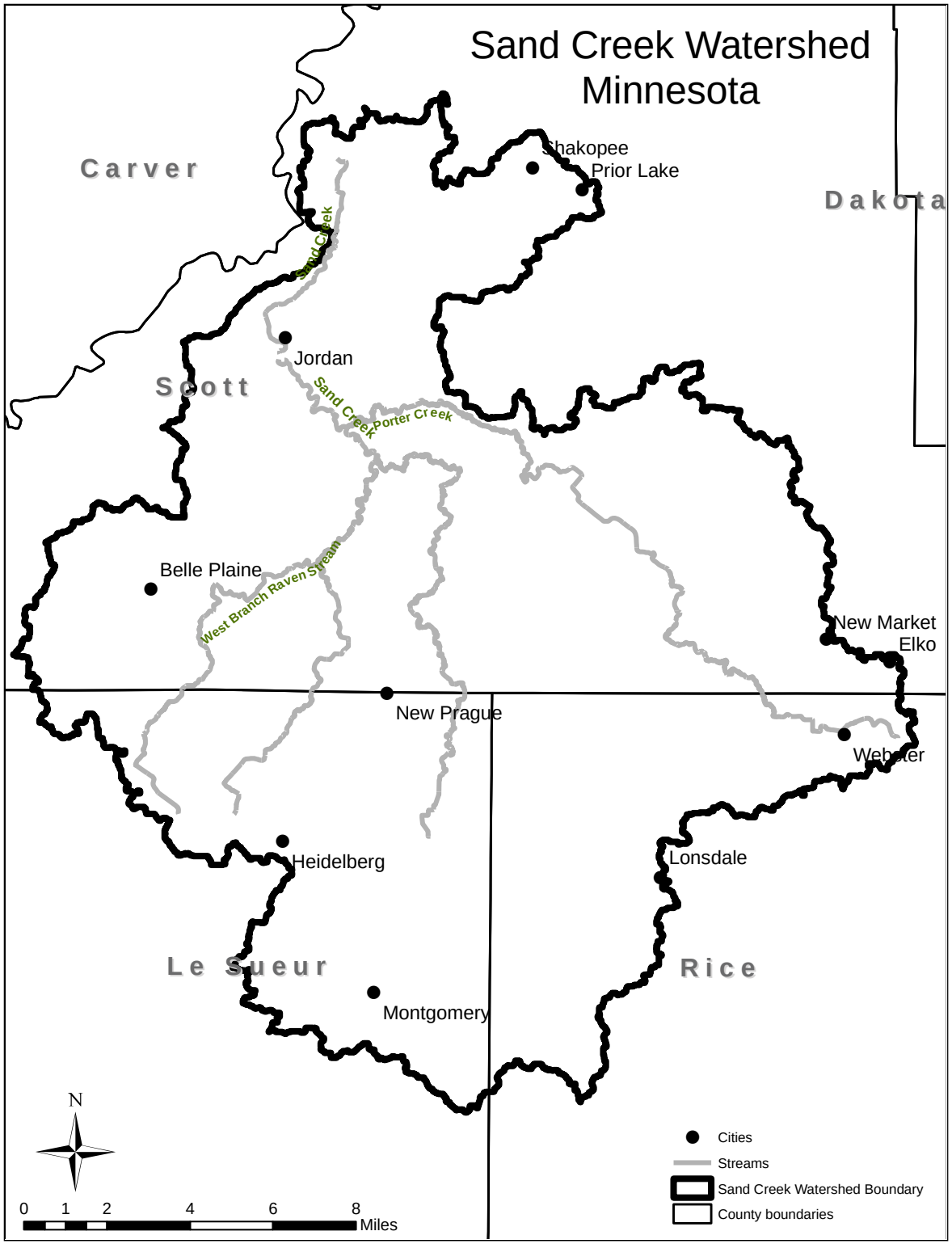
Thus far we have heard from many landowners in your area. However, since we only drew a small random sample of landowners we need to hear from everyone in our sample. **If you have already returned your completed questionnaire, please accept our sincere thanks.** If not, please do so at your earliest convenience using the self-addressed, stamped envelope provided. We need your input!

Some individuals have contacted us to determine whether their land/property is within the Sand Creek Watershed. For your reference, a map is enclosed listing the municipalities and counties that are within the Sand Creek Watershed.

If you have misplaced the questionnaire or have any questions about the study, please contact Mae Davenport at University of Minnesota at (612) 624-2721 or mdaven@umn.edu.

Mae Davenport
Assistant Professor

enclosure



Map of the Sand Creek Watershed

II. Vermillion River watershed

Dear Sand Creek or Vermillion River watershed landowner/property owner,

Several days ago you received a questionnaire inquiring about your perspectives on your community and its water resources. We are surveying landowners in Sand Creek and Vermillion River watersheds to help inform management decisions and to guide communication and outreach efforts in your area.

If you have already returned your completed questionnaire, please accept our sincere thanks. If not, please do so at your earliest convenience using the self-addressed stamped envelope provided. We need your input!

If you have misplaced the questionnaire or have any questions about the study, please contact Mae Davenport at University of Minnesota at (612) 624-2721 or mdaven@umn.edu.

Mae Davenport
Assistant Professor

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Mae Davenport
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APPENDIX E: REPLACEMENT COVER LETTER

Date:

Recipient address:

Dear _____,

A few weeks ago I sent you a questionnaire that asked about your perspectives on your community and its water resources. According to our records, I have not yet received your response.

I am writing again because of the importance your participation has in the success of this study. Your opinions will inform management decisions in your community related to water resources and will guide outreach and education programs. The responses we have already received from other landowners in your watershed show a range of beliefs about water resources and support for watershed management initiatives. We want to ensure that your opinions are represented too! We are only contacting a sample of landowners in your area, so it is important that we hear from you.

The purpose of this survey is to learn more about how local landowners perceive and interact with their community, their environment, and specifically their water resources. The study is being conducted by the Department of Forest Resources, University of Minnesota and is being funded by grants from the U.S. Geological Survey and the University of Minnesota.

This survey is voluntary and completely confidential. The ID # on the front page of your survey is used to help us track mailings and will ensure that your name is never affiliated with your responses. Please answer the questions as completely as possible. It should take you only about 20 minutes to complete the questionnaire. Once you have **completed the questionnaire, fold it in half and mail it back in the enclosed self-addressed postage-paid envelope.**

We would be happy to answer any questions or listen to any comments you may have about this study. Please feel free to contact me by phone at 612-624-2721, or by email at mdaven@umn.edu.

I hope you enjoy completing the questionnaire and look forward to receiving your response.

Sincerely,

_____

Mae Davenport
Assistant Professor

APPENDIX F: SAND CREEK WATERSHED SURVEY RESULTS

Table 1. Respondents' Socio-demographic characteristics

Socio-Demographic Characteristics		N	Percent
Gender	Male	328	78
	Female	93	22
Ethnicity (Hispanic, Latino or Spanish origin)	Yes	5	1.3
	No	392	98.7
Race	White	388	96.8
	Other Race	13	3.2
Age	Median	55	-
	Minimum	20	-
	Maximum	93	-
Years lived in community	Median	27	-
	Maximum	91	-
	Minimum	<1	-
Formal education	Did not finish high school	19	4.7
	Completed high school	108	26.8
	Some college but no degree	70	17.4
	Associate or vocational degree	64	15.9
	College bachelor's degree	84	20.8
	Some college graduate work	15	3.7
	Completed graduate degree (Masters or Ph.D.)	43	10.7
Household income	Under $10,000	7	1.9
	$10,000-$24,999	28	7.8
	$25,000-$34,999	22	6.1
	$35,000-$49,999	56	15.6
	$50,000-$74,999	71	19.7
	$75,000-$99,999	51	14.2
	$100,000-$149,999	66	18.3
	$150,000 or more	59	16.4

Source: Questions 15, 16, 17, 18, 19, 20 and 21; Sand Creek watershed survey

Table 2. Respondents' Property Characteristics

Property Characteristics		N	Percent
Land/property borders a stream/ditch	Yes	310	76.4
	No	96	23.6
Property size	No property	1	0.2
	under 1 acre	94	23.1
	1-5 acres	67	16.5
	6-20 acres	114	28.0
	21-50 acres	37	9.1
	51-150 acres	52	12.8
	151 acres or more	42	10.3
Percent income dependent on land/property	0%	268	67.5
	1-25%	76	19.1
	26-50%	27	6.8
	More than 50%	26	6.5
Property used for agricultural production	Yes	160	39.4
	No	246	60.6
Ownership arrangement	I own and manage my own property	313	77.3
	I rent my land/property to another party	75	18.5
	I rent my land/property from another party	3	0.7
	Other	7	3.5
Management decisions on land/property	I make own decisions	351	86.7
	I leave it up to my renter	18	4.4
	I leave it up to the landowner/property owner	1	0.2
	I work together with renter/landowner to make decisions	35	8.6

Source: Questions 22, 23, 24, 25, 26 and 27; Sand Creek watershed survey

Survey Question: To what extent do you agree or disagree with the following statements?

Table 3. Respondents' perception of their community

When I think of my community I think of…	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
The city or township in which I live	424	1.40	0.81	1.4	2.4	5.2	36.6	54.0	0.5
My nearest neighbors	420	1.02	1.18	6.5	5.3	11.1	30.3	42.8	1.2
People who live within 1-3 miles from my home	419	1.01	1.05	3.6	6.7	12.2	38.7	37.7	1.2
The county in which I live	416	0.59	1.05	5.0	10.3	21.4	44.7	17.1	1.4
The watershed in which I live	417	0.23	1.22	12.7	9.4	31.4	26.9	15.1	4.6
The entire state of Minnesota	416	-0.09	1.29	21.2	12.5	29.1	25.5	10.1	1.7

Source: Question 1; Sand Creek watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2)

Survey question: How important are each of the following as guiding principles in your life?

Table 4. Respondents' cultural value orientations

	N	Mean[a]	SD	Not at all important	Slightly important	Moderately important	Very important	Extremely important	Don't know/Not sure
To nurture or help other members of my community	424	3.46	1.02	4.7	9.9	34.7	34.0	15.1	1.7
To cooperate with members of my community	425	3.45	0.99	3.8	10.8	35.5	34.6	13.9	1.4
To identify myself as a member of my community	425	3.08	1.14	8.5	22.1	35.3	20.2	13.2	0.7
To follow norms of behavior established by my community	425	2.82	1.11	13.9	22.8	33.2	22.1	5.6	2.4
To pursue my personal goals even if they conflict with broader community goals	424	2.39	1.13	25.0	28.5	26.9	11.1	4.5	4.0
To be different from members of my community	426	1.82	1.05	52.6	17.1	18.1	6.3	1.4	4.5

Source: Question 2; Sand Creek watershed survey

[a]Responses based on a five-point scale from not at all important (1) to extremely important (5).

Survey question: How important are each of the following as guiding principles in your life?

Table 5. Respondents' value orientations about the environment

	N	Mean[a]	SD	Not at all important	Slightly important	Moderately important	Very important	Extremely important	Don't know/Not sure
To respect the earth	429	4.16	0.91	1.4	3.0	16.6	35.7	42.9	0.5
To protect private property rights	429	4.08	0.99	0.7	8.6	14.7	32.4	42.4	1.2
To preserve nature for its own sake	428	3.98	0.90	0.5	5.6	21.5	40.4	32.0	0.0
To protect nature for human health and well-being	427	3.95	0.95	1.4	5.6	22.0	37.5	32.8	0.7
To conserve natural resources for human use	424	3.90	0.92	0.9	6.1	23.1	41.1	28.1	0.7
To maintain unity with nature	427	3.64	1.14	5.9	9.4	24.6	32.6	25.5	2.1
To distribute natural resources fairly	428	3.39	1.15	7.5	11.4	30.6	27.8	17.8	4.9
To conserve natural resources for my recreational use	428	3.37	1.15	7.0	14.0	31.8	26.9	18.7	1.6
To use natural resources for personal income	423	2.07	1.12	40.7	24.3	19.4	10.6	2.1	2.8

Source: Question 3; Sand Creek watershed survey

[a]Responses based on a five-point scale from not at all important (1) to extremely important (5).

Survey question: To what extent do you agree or disagree with the following statements?

Table 6. Respondents' beliefs about water quality issues and riparian buffers.

	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
Streamside buffers help to improve water quality for people living downstream.	426	1.31	0.84	1.4	1.6	8.7	35.0	44.8	8.5
Streamside buffers should be protected because they provide habitat for wildlife.	425	1.13	0.91	1.6	2.6	15.3	35.1	36.9	8.5
The balance of nature is delicate and easily upset.	423	0.83	1.10	4.0	9.5	17.0	36.4	31.2	1.9
The effects of water pollution on public health are worse than we realize.	424	0.68	1.17	5.7	10.4	19.3	32.8	26.9	5.0
Water pollution poses serious threats to the quality of life in my community.	425	0.44	1.21	7.1	14.6	24.0	27.5	21.6	5.2
Claims that current levels of pollution are changing the earth's climate are exaggerated.	426	0.12	1.48	20.7	15.7	12.0	26.3	21.1	4.2
Laws to protect the environment limit my choices and personal freedom.	428	-0.24	1.29	21.5	23.1	19.6	25.7	8.4	1.6
Streamside buffers reduce the value of land.	425	-0.60	1.10	22.8	24.7	26.6	11.5	2.8	11.5
Protecting the environment will threaten jobs for people like me.	427	-0.88	1.16	40.0	19.2	25.1	8.2	3.5	4.0

Source: Question 4; Sand Creek watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Survey question: To what extent do you agree or disagree with the following statements?

Table 7. Respondents' concerns about the consequences of water pollution

I am concerned about the consequences of water pollution for…	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
Future generations	429	1.48	0.77	1.4	1.4	4.2	33.8	58.7	0.5
Wildlife	429	1.37	0.83	1.9	1.4	7.2	36.8	52.0	0.7
Aquatic life	429	1.35	0.80	1.2	1.9	7.7	38.5	49.4	1.4
My health	430	1.15	0.99	3.7	2.8	11.2	38.8	42.8	0.7
People in my community	424	1.11	0.95	3.1	2.1	14.9	39.6	38.9	1.4
My lifestyle	430	0.74	0.97	2.8	5.6	29.1	37.7	22.8	2.1

Source: Question 5; Sand Creek watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Survey question: To what extent do you agree or disagree with the following statements?

Table 8. Respondents' perceptions of who should take responsibility for addressing water quality issues

	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
Someone who uses a conservation practice contributes to a clean environment.	428	1.25	0.80	1.4	1.2	8.9	43.5	38.3	6.8
It is my personal responsibility to help protect water quality.	425	1.23	0.81	1.4	2.1	8.9	46.8	40.2	0.5
Landowners/property owners in my community should be responsible for protecting water quality.	429	1.18	0.87	1.4	3.0	11.9	42.0	39.6	2.1
Local government (i.e. county, city/township) should be responsible for protecting water quality.	428	0.94	1.00	3.0	6.3	14.3	44.2	30.4	1.9
The state government should be responsible for protecting water quality.	428	0.58	1.22	9.3	9.1	18.7	37.1	23.8	1.9
Water resources in my community are adequately protected.	428	0.24	1.10	6.3	16.4	17.5	34.8	6.8	18.2
The federal government should be responsible for protecting water quality.	428	0.22	1.33	15.4	14.0	20.1	30.6	18.0	1.9
What I do on my land doesn't make much difference in overall water quality.	427	-0.89	1.13	33.0	41.0	8.2	11.7	4.2	1.9

Source: Question 6; Sand Creek watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Survey question: To what extent do you agree or disagree with the following statements?

Table 9. Respondents' perceptions about their and their community's ability to protect water resources.

	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
My community has the ability to change the way land will be developed in the future to protect water resources.	426	0.82	1.10	4.5	8.2	12.7	39.2	26.5	8.9
I have the knowledge and skills I need to take care of my land.	424	0.62	1.04	4.5	9.4	21.7	42.9	17.2	4.2
If I wanted to, I have the ability to change the way I use my land/property to protect water resources.	424	0.53	1.13	5.9	10.8	21.5	35.4	17.7	8.7
My community has the ability to change the way land is currently used to protect water resources.	422	0.49	1.09	5.0	11.6	19.0	36.0	13.5	14.9
I have the financial resources I need to take care of my land.	423	0.27	1.18	8.3	17.7	22.7	33.1	13.7	4.5
My community has the financial resources it needs to protect water resources.	425	-0.13	1.06	8.5	20.5	27.1	18.8	4.2	20.9
My community has the leadership it needs to protect water resources.	426	-0.22	1.12	13.4	16.7	27.9	18.1	4.0	20.0

Source: Question 7; Sand Creek watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Survey question: How likely or unlikely is it that the following individuals or groups would influence your decisions about conservation practices on your land/property?

Table 10. Individuals or groups that influence landowners' decisions about conservation practices

	N	Mean[a]	SD	Very unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely	Don't know/Not sure
My family	426	1.00	0.96	3.5	2.6	16.0	43.9	32.2	1.9
My county's Soil and Water Conservation District	426	0.86	1.02	4.9	4.0	15.5	46.7	24.4	4.5
MN DNR	427	0.73	1.12	7.3	4.9	18.5	41.5	24.1	3.7
My local Water Management Organization	426	0.66	1.02	5.9	4.0	22.3	44.1	16.4	7.3
My neighbors	426	0.57	0.96	5.2	7.0	23.0	52.1	10.8	1.9
MPCA	427	0.53	1.21	10.3	5.9	21.3	36.8	19.7	6.1
People in my community	426	0.50	0.90	4.0	8.0	27.0	50.7	6.8	3.5
My local government	425	0.44	1.08	8.0	8.0	24.9	43.3	11.3	4.5
Sportspersons club	425	0.30	1.19	10.4	12.7	26.1	32.9	14.6	3.3
Environmental organizations	426	0.29	1.21	11.3	12.7	22.3	36.6	13.1	4.0
My county's Farm Bureau	427	0.12	1.08	10.3	9.4	35.1	27.6	6.3	11.2
Property rights organizations	428	0.01	1.12	12.1	15.2	32.7	27.1	6.5	6.3

Source: Question 8; Sand Creek watershed survey

[a]Responses based on a five-point scale from very unlikely (-2) to very likely (+2).

Survey question: To what extent do you agree or disagree with the following statements?

Table 11. Personal obligation to do something about water quality issues

I feel a personal obligation to…	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
Use conservation practices on my land/property.	426	1.29	0.75	0.7	0.2	12.7	41.1	43.2	2.1
Do whatever I can to prevent water pollution.	428	1.28	0.76	0.5	1.4	11.2	42.8	43.5	0.7
Take actions to stop the loss of wildlife habitat.	429	1.09	0.87	0.9	3.5	17.0	41.3	35.9	1.4
Maintain a streamside buffer on my land/property.	427	0.84	1.01	3.0	4.0	25.3	31.6	27.9	8.2
Work with other community members to protect the environment.	429	0.53	0.99	4.9	5.8	34.5	37.1	14.9	2.8
Talk to others about conservation practices.	426	0.40	1.03	5.6	8.7	38.0	30.3	14.3	3.1

Source: Question 9; Sand Creek watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Survey question: How likely or unlikely is it that you would engage in the following actions in the future?

Table 12. Respondents' likelihood of future to protect water resources

	N	Mean[a]	SD	Very unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely	Don't know/Not sure
Use conservation practices on my land/property.	428	1.24	0.76	0.7	2.3	8.4	48.6	39.0	0.9
Do whatever I can to prevent water pollution.	426	1.09	0.85	0.7	4.0	14.8	45.1	34.0	1.4
Take actions to stop the loss of wildlife habitat.	428	1.00	0.93	2.8	2.3	18.5	42.8	31.5	2.1
Maintain a streamside buffer on my land/property.	421	0.90	1.01	3.3	3.1	21.9	33.0	29.0	9.7
Work with other community members to protect the environment.	425	0.48	1.05	6.4	7.5	31.5	37.2	14.8	2.6
Talk to others about conservation practices.	426	0.40	1.04	6.1	8.7	35.2	32.6	13.1	4.2

Source: Question 10; Sand Creek watershed survey

[a]Responses based on a five-point scale from very unlikely (-2) to very likely (+2).

Survey question: To what extent do you maintain streamside buffers on your land/property?

Table 13. Respondents' use of streamside buffers on their land/property

Response	Frequency	Percent
I do not have streams/ditches on or adjacent to my property	104	26.3
I maintain buffers on all streams/ditches on or adjacent to my property	141	35.7
I maintain buffers on some streams/ditches on or adjacent to my property	74	18.7
I do not maintain buffers on any streams/ditches on or adjacent to my property	76	19.2
Total	395	100.0

Source: Question 11; Sand Creek watershed survey

Survey question: To what extent do you agree or disagree with the following statements?

Table 14. Respondents' views about streamside buffers

I would be more likely to maintain or continue to maintain streamside buffers on or adjacent to my property if...	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
I had access to financial resources to help me plant and maintain streamside buffers.	339	0.75	1.08	5.6	5.0	21.2	38.1	24.2	5.9
I could learn how to maintain streamside buffers for water quality.	337	0.75	1.06	5.3	4.2	23.4	38.6	24.0	4.5
I could learn how to maintain streamside buffers for soil conservation.	338	0.65	1.06	6.2	4.1	26.6	38.2	20.1	4.7
I knew more about how to plant and maintain streamside buffers.	340	0.59	1.03	5.3	4.1	33.5	32.9	18.5	5.6
I could learn how to maintain streamside buffers for wildlife benefits.	337	0.54	1.08	6.2	6.5	30.0	34.1	18.1	5.0
I knew more about the benefits of streamside buffers.	340	0.50	1.02	5.3	6.2	33.8	34.4	14.7	5.9
I could learn how to maintain streamside buffers for scenic quality.	337	0.42	1.10	7.4	7.1	32.6	30.9	15.1	6.8
I had help with the physical labor of planting and maintaining streamside buffers.	338	0.35	1.10	8.0	8.6	34.0	29.9	13.9	5.6
I were compensated for lost crop production because of streamside buffers.	338	0.26	1.15	10.1	7.1	39.1	21.0	15.1	7.7
My neighbors maintained streamside buffers.	339	0.18	1.14	10.6	8.6	35.7	23.9	11.2	10.0
I could attend a community workshop or field day on streamside buffers.	339	0.18	1.13	12.1	6.5	36.3	28.0	9.4	7.7
I could be enrolled in a registry program that recognizes local conservation stewards.	339	-0.16	1.08	15.3	10.6	44.8	15.0	5.6	8.6

Source: Question 12; Sand Creek watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Survey question: Have you engaged in the following actions in the past 12 months?

Table 15. Respondents' civic engagement behavior

	Response		
	Yes	**No**	**Don't know/Not sure**
Read any newsletters, magazines or other publications written by environmental groups?	49.9	48.0	2.1
Voted for a candidate in an election at least in part because he or she was in favor of strong environmental protection?	28.2	64.0	7.8
Discussed water quality issues with community members?	21.6	76.5	1.9
Given money to an environmental group?	16.4	81.7	1.9
Joined or been a member of any group whose main aim is to protect the environment?	15.1	83.1	1.9
Attended a meeting, public hearing or community discussion group about an environmental issue?	14.1	85.0	0.9
Written a letter or called a government official to support strong environmental protection?	6.1	93.4	0.5

Source: Question 13; Sand Creek watershed survey

Survey question: In your opinion, how likely is it that the following management actions will protect the quality of water resources in Minnesota?

Table 16. Respondents' perceptions about management actions to protect water resources

	N	Mean[a]	SD	Very unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely	Don't know/Not sure
Expanding incentive-based programs that offer payments to landowners for conservation practices	418	0.92	1.09	4.5	6.5	13.4	37.3	32.3	6.0
Promoting voluntary adoption of conservation practices through increased education and outreach programs.	418	0.80	0.97	2.9	6.2	19.4	44.0	21.3	6.2
Coordinating land use and water planning efforts across communities.	416	0.77	1.01	4.1	5.3	20.2	41.3	21.9	7.2
Engaging more citizens in local land use and water resource decision making.	416	0.76	1.00	3.1	6.7	21.2	39.4	21.9	7.7
Enforcing existing land use laws and regulations.	416	0.71	1.08	5.5	6.3	19.2	40.6	21.6	6.7
Conducting more water quality research and monitoring.	419	0.70	1.07	5.3	8.4	15.3	44.6	19.8	6.7
Increasing regulations that specifically address water resource management.	414	0.26	1.22	10.6	13.0	23.4	30.2	14.0	8.7

Source: Question 14; Sand Creek watershed survey

[a]Responses based on a five-point scale from very unlikely (-2) to very likely (+2).

Survey question: How would you characterize the quality of water in the stream/ditch?

Table 17. Respondents' perceptions of the quality of water in the stream/ditch that border or run through their land/property

	Frequency	Percent
Very poor	15	4.6
Poor	41	12.6
Fair	91	27.9
Good	91	27.9
Very good	27	8.3
Don't know	61	18.7
	326	100.0

Source: Question 28; Sand Creek watershed survey

APPENDIX G: VERMILLION RIVER WATERSHED SURVEY RESULTS

Table 1. Respondents' Socio-demographic characteristics

Socio-Demographic Characteristics		N	Percent
Gender	Male	208	66.9
	Female	103	33.1
Ethnicity (Hispanic, Latino or Spanish origin)	Yes	5	1.7
	No	292	98.3
Race	White	287	95.3
	Other Race	14	4.7
Age	Median	52	-
	Minimum	18	-
	Maximum	93	-
Years lived in community	Median	15	-
	Maximum	90	-
	Minimum	<1	-
Formal education	Did not finish high school	8	2.7
	Completed high school	33	11.0
	Some college but no degree	66	21.9
	Associate or vocational degree	52	17.3
	College bachelor's degree	73	24.3
	Some college graduate work	19	6.3
	Completed graduate degree (Masters or Ph.D.)	50	16.6
Household income	Under $10,000	4	1.5
	$10,000-$24,999	12	4.4
	$25,000-$34,999	16	5.8
	$35,000-$49,999	33	12.0
	$50,000-$74,999	57	20.8
	$75,000-$99,999	49	17.9
	$100,000-$149,999	60	21.9
	$150,000 or more	43	15.7

Source: Questions 15, 16, 17, 18, 19, 20 and 21; Vermillion River watershed survey

Table 2. Respondents' Property Characteristics

Property Characteristics		N	Percent
Land/property borders a stream/ditch	Yes	135	45.5
	No	162	54.5
Property size	No property	49	16.2
	under 1 acre	159	52.6
	1-5 acres	30	9.9
	6-20 acres	23	7.6
	21-50 acres	6	2.0
	51-150 acres	18	6.0
	151 acres or more	17	5.6
Percent income dependent on land/property	0%	233	79.3
	1-25%	37	12.6
	26-50%	17	5.8
	More than 50%	7	2.4
Property used for agricultural production	Yes	54	17.9
	No	248	82.1
Ownership arrangement	I own and manage my own property	228	77.0
	I rent my land/property to another party	26	8.8
	I rent my land/property from another party	3	1.0
	Other	12	13.2
Management decisions on land/property	I make own decisions	235	82.2%
	I leave it up to my renter	11	3.8%
	I leave it up to the landowner/property owner	16	5.6%
	I work together with renter/landowner to make decisions	24	8.4%

Source: Questions 22, 23, 24, 25, 26 and 27; Vermillion River watershed survey

Survey Question: To what extent do you agree or disagree with the following statements?

Table 3. Respondents' perception of their community

When I think of my community I think of…	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
The city or township in which I live	311	1.49	0.76	1.0	1.3	6.4	30.0	60.7	0.6
My nearest neighbors	306	1.08	1.13	5.5	5.5	9.6	32.8	45.0	1.6
People who live within 1-3 miles	306	0.99	1.02	3.2	5.8	14.8	39.7	35.2	1.3
The county in which I live	309	0.67	1.03	3.2	11.3	21.5	42.8	20.6	0.6
The watershed in which I live	300	0.12	1.24	13.8	11.6	36.3	19.0	15.8	3.5
The entire state of MN	308	0.04	1.30	17.4	15.1	28.3	23.2	15.1	1.0

Source: Question 1; Vermillion River watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2)

Survey question: How important are each of the following as guiding principles in your life?

Table 4. Respondents' cultural value orientations

	N	Mean[a]	SD	Not at all important	Slightly important	Moderately important	Very important	Extremely important	Don't know/Not sure
To cooperate with members of my community.	311	3.49	0.94	2.6	10.9	34.2	38.7	13.1	0.6
To nurture or help other members of my community	307	3.44	0.99	3.2	13.1	32.4	36.2	13.5	1.6
To identify myself as a member of my community	312	2.97	1.07	9.8	20.6	38.1	23.2	7.3	1.0
To follow norms of behavior established by my community.	306	2.97	1.08	10.2	20.1	37.1	23.0	7.3	2.2
To pursue my personal goals even if they conflict with broader community goals	294	2.26	1.12	28.1	30.4	22.4	8.9	4.2	6.1
To be different from members of my community.	300	1.87	1.03	47.1	24.0	17.0	6.4	1.6	3.8

Source: Question 2; Vermillion River watershed survey

[a]Responses based on a five-point scale from not at all important (1) to extremely important (5).

Survey question: How important are each of the following as guiding principles in your life?

Table 5. Respondents' value orientations about the environment

	N	Mean[a]	SD	Not at all important	Slightly important	Moderately important	Very important	Extremely important	Don't know/Not sure
To respect the earth	308	4.09	1.04	2.9	6.1	13.8	32.2	44.1	1.0
To protect nature for human health and well-being.	308	3.97	0.94	1.3	5.5	21.3	37.7	33.5	0.6
To preserve nature for its own sake	308	3.95	0.90	0.3	5.5	23.9	38.7	31.0	0.6
To conserve natural resources for human use	306	3.92	0.88	1.3	4.2	21.7	45.3	26.5	1.0
To protect private property rights.	305	3.92	1.05	2.9	5.8	23.9	29.7	36.1	1.6
To maintain unity with nature	303	3.55	1.19	6.8	11.0	27.2	27.5	25.6	1.9
To distribute natural resources fairly.	295	3.44	1.17	6.8	12.2	28.6	26.7	20.6	5.1
To conserve natural resources for my recreational use	304	3.38	1.18	7.4	16.1	24.4	31.8	18.0	2.3
To use natural resources for personal income.	290	1.95	1.14	45.8	21.4	15.6	8.4	2.9	5.8

Source: Question 3; Vermillion River watershed survey

[a]Responses based on a five-point scale from not at all important (1) to extremely important (5).

Survey question: To what extent do you agree or disagree with the following statements?

Table 6. Respondents' beliefs about water quality issues and riparian buffers.

	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
Streamside buffers help to improve water quality for people living downstream.	255	1.18	0.81	0.6	1.6	12.3	35.8	31.9	17.7
Streamside buffers should be protected because they provide habitat for wildlife.	262	1.07	0.96	2.9	2.3	12.3	35.8	31.3	15.5
The balance of nature is delicate and easily upset.	305	0.87	1.03	2.9	8.7	15.1	42.8	28.6	1.9
The effects of water pollution on public health are worse than we realize.	288	0.82	1.11	3.5	9.3	17.9	31.4	30.1	7.7
Water pollution poses serious threats to the quality of life in my community.	287	0.62	1.17	5.5	11.6	19.9	31.2	24.1	7.7
Claims that current levels of pollution are changing the earth's climate are exaggerated.	287	0.03	1.42	19.3	16.4	15.4	24.1	17.0	7.7
Laws to protect the environment limit my choices and personal freedom.	305	-0.40	1.34	28.0	22.2	17.7	21.2	9.0	1.9
Streamside buffers reduce the value of land.	235	-0.64	1.10	21.3	19.7	22.9	10.0	1.9	24.2
Protecting the environment will threaten jobs for people like me.	303	-0.95	1.17	45.5	18.1	21.3	9.7	3.2	2.3

Source: Question 4; Vermillion River watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Survey question: To what extent do you agree or disagree with the following statements?

Table 7. Respondents' concerns about the consequences of water pollution

I am concerned about the consequences of water pollution for…	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
Future generations	314	1.50	0.78	1.3	1.9	4.5	30.3	62.1	0.0
Wildlife	310	1.42	0.80	1.0	1.9	8.0	32.4	56.1	0.6
Aquatic life	309	1.39	0.81	1.3	1.9	7.1	34.9	53.8	1.0
My health	312	1.30	0.87	1.9	2.2	9.3	36.7	49.5	0.3
People in my community	310	1.12	0.89	1.3	3.5	15.7	40.7	38.1	0.6
My lifestyle	312	0.77	1.02	1.9	9.6	25.3	35.6	27.6	0.0

Source: Question 5; Vermillion River watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Survey question: To what extent do you agree or disagree with the following statements?

Table 8. Respondents' perceptions of who should take responsibility for addressing water quality issues

	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
It is my personal responsibility to help protect water quality.	307	1.24	0.81	1.0	2.9	8.7	45.2	41.3	1.0
Landowners/property owners in my community should be responsible for protecting water quality.	305	1.22	0.84	1.6	2.9	7.7	45.8	40.3	1.6
Someone who uses a conservation practice contributes to a clean environment.	297	1.12	0.80	1.0	2.6	11.6	49.0	31.6	4.2
Local government (i.e. county, city/township) should be responsible for protecting water quality.	304	1.08	0.94	2.9	4.5	8.4	47.9	34.1	2.3
The state government should be responsible for protecting water quality.	301	0.81	1.09	5.5	7.7	12.5	45.0	26.0	3.2
Water resources in my community are adequately protected.	242	0.40	1.10	5.1	13.1	13.7	36.7	8.6	22.7
The federal government should be responsible for protecting water quality.	298	0.38	1.27	12.2	11.2	18.6	35.6	17.9	4.5
What I do on my land doesn't make much difference in overall water quality.	297	-0.87	1.18	33.7	37.5	10.4	8.1	6.5	3.9

Source: Question 6; Vermillion River watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Survey question: To what extent do you agree or disagree with the following statements?

Table 9. Respondents' perceptions about their and their community's ability to protect water resources.

	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
My community has the ability to change the way land will be developed in the future to protect water resources.	281	0.95	0.99	3.2	5.7	9.9	43.9	26.8	10.5
My community has the ability to change the way land is currently used to protect water resources.	266	0.63	1.02	5.4	4.5	19.2	42.8	13.1	15.0
I have the knowledge and skills I need to take care of my land.	297	0.53	1.02	3.5	13.8	19.9	45.3	12.9	4.5
I have the financial resources I need to take care of my land.	294	0.47	1.14	6.1	13.8	21.5	36.0	17.0	5.5
If I wanted to, I have the ability to change the way I use my land/property to protect water resources.	284	0.37	1.20	8.9	11.8	22.3	31.5	15.9	9.6
My community has the financial resources it needs to protect water resources.	227	0.20	1.09	5.8	12.8	21.7	25.6	6.7	27.5
My community has the leadership it needs to protect water resources.	222	-0.09	1.15	10.5	13.4	23.6	18.2	5.1	29.1

Source: Question 7; Vermillion River watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Survey question: How likely or unlikely is it that the following individuals or groups would influence your decisions about conservation practices on your land/property?

Table 10. Individuals or groups that influence landowners' decisions about conservation practices

	N	Mean[a]	SD	Very unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely	Don't know/Not sure
My family	311	1.02	0.98	3.8	3.2	14.3	43.8	33.7	1.3
My county's Soil and Water Conservation District	297	0.82	0.94	3.2	5.1	17.3	49.0	20.5	4.8
MN DNR	305	0.81	1.05	5.4	6.4	13.1	48.4	23.9	2.9
MPCA	301	0.78	1.09	5.8	7.0	14.1	44.7	24.6	3.8
My neighbors	311	0.61	1.00	4.8	8.3	22.6	48.7	14.6	1.0
My local Water Management Organization	287	0.60	1.05	5.1	7.7	22.4	39.9	16.6	8.3
My local government	299	0.56	1.07	5.8	11.5	16.7	47.4	14.4	4.2
People in my community	308	0.55	0.96	3.5	10.2	24.8	47.8	11.8	1.9
Environmental organizations	303	0.42	1.23	11.5	9.6	19.6	39.1	17.3	2.9
My county's Farm Bureau	275	0.20	1.07	7.4	12.6	32.0	28.2	8.7	11.0
Sportspersons club	302	0.01	1.25	15.7	16.3	26.8	26.8	10.9	3.5
Property rights organizations	303	-0.02	1.18	14.6	15.3	33.4	23.9	9.2	3.5

Source: Question 8; Vermillion River watershed survey

[a]Responses based on a five-point scale from very unlikely (-2) to very likely (+2).

Survey question: To what extent do you agree or disagree with the following statements?

Table 11. Personal obligation to do something about water quality issues

I feel a personal obligation to…	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
Do whatever I can to prevent water pollution.	311	1.30	0.79	1.3	1.9	6.7	45.2	44.6	0.3
Use conservation practices on my land/property.	309	1.24	0.83	1.9	2.3	7.1	47.3	40.8	0.6
Take actions to stop the loss of wildlife habitat.	307	1.00	0.90	1.0	4.8	19.3	41.8	31.8	1.3
Maintain a streamside buffer on my land/property.	253	0.72	1.07	3.9	3.9	26.5	24.5	22.9	18.4
Work with other community members to protect the environment.	304	0.45	1.00	4.5	8.7	36.5	33.7	14.1	2.6
Talk to others about conservation practices.	303	0.34	1.05	5.8	12.5	34.3	31.7	12.8	2.9

Source: Question 9; Vermillion River watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Survey question: How likely or unlikely is it that you would engage in the following actions in the future?

Table 12. Respondents' likelihood of future action to protect water resources

	N	Mean[a]	SD	Very unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely	Don't know/Not sure
Use conservation practices on my land/property.	304	1.16	0.80	1.0	2.6	11.3	48.4	34.8	1.9
Do whatever I can to prevent water pollution.	309	1.11	0.89	1.6	3.8	13.1	43.6	36.9	1.0
Take actions to stop the loss of wildlife habitat.	306	0.93	0.91	0.6	7.1	19.3	43.1	28.3	1.6
Maintain a streamside buffer on my land/property.	259	0.71	1.10	5.5	2.9	24.3	28.8	22.3	16.2
Work with other community members to protect the environment.	304	0.44	1.04	6.8	7.4	32.5	37.9	13.2	2.3
Talk to others about conservation practices.	303	0.34	1.07	7.1	10.3	35.7	31.5	12.9	2.6

Source: Question 10; Vermillion River watershed survey

[a]Responses based on a five-point scale from very unlikely (-2) to very likely (+2).

Survey question: To what extent do you maintain streamside buffers on your land/property?

Table 13. Respondents' use of streamside buffers on their land/property

Response	Frequency	Percent
I do not have streams/ditches on or adjacent to my property	155	52.9
I maintain buffers on all streams/ditches on or adjacent to my property	64	21.8
I maintain buffers on some streams/ditches on or adjacent to my property	24	8.2
I do not maintain buffers on any streams/ditches on or adjacent to my property	50	17.1
Total	293	100.0

Source: Question 11; Vermillion River watershed survey

Survey question: To what extent do you agree or disagree with the following statements?

Table 14. Respondents' views about streamside buffers

I would be more likely to maintain or continue to maintain streamside buffers on or adjacent to my property if...	N	Mean[a]	SD	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know/Not sure
I could learn how to maintain streamside buffers for water quality.	168	0.81	1.00	2.8	4.4	26.7	33.3	26.1	6.7
I knew more about how to plant and maintain streamside buffers.	171	0.80	0.94	1.6	6.6	23.1	40.7	22.0	6.0
I could learn how to maintain streamside buffers for soil conservation.	168	0.70	0.95	2.8	4.4	30.6	36.1	19.4	6.7
I had access to financial resources to help me plant and maintain streamside buffers.	171	0.68	1.12	5.0	7.2	27.1	28.7	26.5	5.5
I could learn how to maintain streamside buffers for wildlife benefits.	166	0.67	0.95	2.8	4.4	31.1	35.6	18.3	7.8
I knew more about the benefits of streamside buffers.	170	0.67	0.96	2.7	6.6	26.8	39.3	17.5	7.1
I could learn how to maintain streamside buffers for scenic quality.	167	0.58	1.00	2.8	8.3	31.7	32.2	17.8	7.2
I had help with the physical labor of planting and maintaining streamside buffers.	172	0.55	1.13	4.4	11.5	30.2	24.7	23.6	5.5
My neighbors maintained streamside buffers.	162	0.32	1.00	5.0	9.4	37.8	27.2	10.6	10.0
I could attend a community workshop or field day on streamside buffers.	162	0.18	1.02	6.7	12.2	37.2	26.1	7.8	10.0
I were compensated for lost crop production because of streamside buffers.	152	-0.06	1.17	14.4	7.8	39.4	13.9	8.9	15.6
I could be enrolled in a registry program that recognizes local conservation stewards.	165	-0.22	0.96	11.6	17.1	45.3	14.4	2.8	8.8

Source: Question 12; Vermillion River watershed survey

[a]Responses based on a five-point scale from strongly disagree (-2) to strongly agree (+2).

Survey question: Have you engaged in the following actions in the past 12 months?

Table 15. Respondents' civic engagement behavior

	Response		
	Yes	**No**	**Don't know/Not sure**
Read any newsletters, magazines or other publications written by environmental groups?	45.0	52.7	2.3
Voted for a candidate in an election at least in part because he or she was in favor of strong environmental protection?	30.1	60.8	9.1
Given money to an environmental group?	10.9	89.1	0.0
Discussed water quality issues with community members?	10.6	87.1	2.3
Joined or been a member of any group whose main aim is to protect the environment?	9.0	90.6	0.3
Attended a meeting, public hearing or community discussion group about an environmental issue?	6.1	93.9	0.0
Written a letter or called a government official to support strong environmental protection?	1.9	97.7	0.3

Source: Question 13; Vermillion River watershed survey

Survey question: In your opinion, how likely is it that the following management actions will protect the quality of water resources in Minnesota?

Table 16. Respondents' perceptions about management actions to protect water resources

	N	Mean[a]	SD	Very unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely	Don't know/Not sure
Enforcing existing land use laws and regulations.	290	1.08	0.92	2.6	3.6	10.0	45.6	32.0	6.1
Conducting more water quality research and monitoring.	293	0.91	0.95	2.9	5.8	12.6	48.9	24.6	5.2
Coordinating land use and water planning efforts across communities.	290	0.88	0.93	2.6	4.6	17.6	46.4	23.5	5.2
Promoting voluntary adoption of conservation practices through increased education and outreach programs.	296	0.85	0.96	3.3	4.9	18.2	46.9	23.1	3.6
Engaging more citizens in local land use and water resource decision making.	288	0.81	0.93	2.6	4.6	22.1	43.3	21.2	6.2
Expanding incentive-based programs that offer payments to landowners for conservation practices	290	0.79	1.11	4.5	9.1	15.6	37.3	27.6	5.8
Increasing regulations that specifically address water resource management.	281	0.57	1.16	7.5	8.8	18.6	37.5	19.2	8.5

Source: Question 14; Vermillion River watershed survey

[a]Responses based on a five-point scale from very unlikely (-2) to very likely (+2).

Survey question: How would you characterize the quality of water in the stream/ditch?

Table 17. Respondents' perceptions of the quality of water in the stream/ditch that border or run through their land/property

	Frequency	Percent
Very poor	4	2.4
Poor	23	13.9
Fair	30	18.2
Good	35	21.2
Very good	9	5.5
Don't know	64	38.8
	165	100.0

Source: Question 28; Vermillion River watershed survey