

Southern Alberta Resource Economics Centre

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SAREC Report 2011-2

**Changing water value perceptions and water policy
preferences along the rural - urban gradient
in Southern Alberta**

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Southern Alberta Resource Economics Centre Publications

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ABSTRACT

Escalating demand for water resources due to population and economic growth as well as changing environmental values have resulted in increased pressures on existing water resources and represent a challenge for many governments around the world. As currently irrigation accounts for around 80% of total water use within many of the most stressed water resources, there are increased pressures to facilitate water transfers from rural to urban areas to meet the increased demand for water from other sectors of the economy including the environment. This report analyses the values and attitudes that households from four locations in Southern Alberta, not involved in irrigated farming, hold towards water reallocation. In particular, it studies the public's values and attitudes towards the environment, influences on public opinions about water reallocation and the conditions under which people believe reallocation should take place. The report further analyses whether such values and attitudes vary spatially across the four locations and whether residents from the four locations prefer different policy solutions. In total, our study investigated 1,985 responses from Calgary, Strathmore, Lethbridge, and Lethbridge's smaller surrounding towns (Raymond, Taber, Magrath and Sterling (RTMS)), towns which are largely dependent upon irrigation.

The questionnaires collected information on rural and urban status, socio-demographic data and a wide range of value statements and policy statements. If we place the four locations on an urban to rural continuum, their order is Calgary, Lethbridge, Strathmore and RTMS. This order is consistent with the order that respondents from the four regions place the irrigation value of water, from low to high, and generally consistent with the order that respondents place the environmental value of water from high to low. In terms of policy views, Calgary and Lethbridge respondents see a much larger role for the government in water policy, while RTMS respondents agree more strongly with policy statements that assert irrigators' water property rights. Calgary respondents also favour policy orientations that protect the environment's right to water.

Table of Contents

1. Introduction	7
2. Literature Review	10
2.1. Values Associated with Water	10
2.2. Behavioural Intentions and Values	13
2.3. Urban vs. Rural Water Issues	15
2.3.1. The Literature on Urban and Rural Resident Values	19
2.3.2. Water transfer impacts and mitigation	22
2.4. Summary	23
3. Study area, data and methodology	24
4. Findings.....	28
4.1. Findings – Demographics.....	28
4.2. Findings – Value statements	35
4.2.1 All value statements	35
4.2.2 Factor analysis.....	41
4.3. Findings - Policy statements	44
4.3.1 Government Role	44
4.3.2 Environment’s Right	46
4.3.3 Irrigators’ Rights	50
4.4. Value statements vs Policy statements.....	53
5. Discussion	56
6. Conclusion.....	58
References	60

List of figures

Figure 1: Values of Water	11
Figure 2: Theory of Planned Water Behaviour	14

List of tables

Table 1: Number of respondents surveyed according to location.....	28
Table 2: Respondents according to gender.....	28
Table 3: Respondents categorized by location and age	29
Table 4: Respondents categorized by location and household income.....	29
Table 5: Respondents categorized by location of residence and level of education	30
Table 6: Respondents categorized by location of residence and occupation	30
Table 7: Respondents categorized by location and source of water for domestic uses.....	31
Table 8: Respondents categorized by recreational activities	32
Table 9: Residency in Southern Alberta prior to 2001 (percentage)	32
Table 10: Respondents categorized by area (rural or urban) where they had lived most of their lives.....	33
Table 11: Respondents categorized by area (rural or urban) where they were mainly raised.....	33
Table 12: Respondents categorized by area (rural or urban) where they currently reside	33
Table 13: Memberships in WPAC or watershed stewardship group.....	34
Table 14: Membership in an environmental or conservation group.....	34
Table 15: Environmental Water Values	35
Table 16: General Attitudes (water, economic, environment).....	37
Table 17: Human-centred Water Values	38
Table 18: River Livelihood	40
Table 19: River Management Values	41
Table 20: Factor loadings of factor analysis.....	43
Table 21: Average factor scores across four locations	44
Table 22: Government Role	44
Table 23: Average age by Likert scale agreement of the Government role policy statements	45
Table 24: Average household income (in thousands) by Likert scale of the Government role policy statements.....	45
Table 25: Two-way table (row frequency) of education and C1 (The government, rather than market forces, should decide who gets to use Alberta's water).....	46

Table 26: Two-way table (row frequency) of education and C4 (If an irrigation district or municipality is not using all of the water it has been allocated, then the government should be able to take that water for environmental purposes without compensation)	46
Table 27: Two-way table (row frequency) of education and C6 (If water is to be traded among irrigation districts and/or municipalities, the government should set the price)	46
Table 28: Frequency of Environment’s Right	47
Table 29: Average age by Likert scale of the Environment’s Right Policy Statements	48
Table 30: Average household income (in thousands) by Likert scale of the Environment’s Right Policy Statements	49
Table 31: Two-way table (row frequency) of education and C2 (Private individuals and groups should be able to hold water licenses for environmental protection)	49
Table 32: Two-way table (row frequency) of education and C8 (Public funds should be used to improve irrigation systems only if the water that is saved is left in rivers)	50
Table 33: Two-way table (row frequency) of education and C10 (Minimum flows of water should be set for all rivers, and only the water above those minimum flows should be available for economic purposes such as irrigation)	50
Table 34: Frequency of Irrigators’ Water Rights	51
Table 35: Average age by Likert scale of the Irrigators’ Right policy statements	51
Table 36: Average household income (in thousands) by Likert scale of the Irrigators’ Right policy statements	52
Table 37: Two-way table (row frequency) of education and C3 (All water licenses, no matter when they were issued or for what purpose, must be honoured)	52
Table 38: Two-way table (row frequency) of education and C5 (Public funds should be used to help larger water users (irrigators, industries and municipalities) to become more water efficient)	53
Table 39: Two-way table (row frequency) of education and C7 (Water that is saved through improved water use efficiency should be used to increase economic activity)	53
Table 40: Spearman correlation between Government role policy statements and River management values	54
Table 41: Spearman correlation between Environment’s right policy statements and Environment water values	54
Table 42: Spearman correlation between Irrigator’s right policy statements and Human centred water values / River livelihood values	55

1. Introduction

Southern Alberta has experienced increasing water scarcity over the last two decades. This resulted in the emergence of new legislation with the revision of the *Water Act* in 1999 and the *Irrigation District Act* in 2000. In 2001 the government started a process of developing a long-term provincial water management strategy which resulted in the *Water for Life* strategy in 2003. This document confirmed that water resources in the South Saskatchewan River Basin were fully or over committed and that demand for water will continue to increase due to continued economic and population growth. It also recognised the need to leave more water in the streams. The Strategy identified improved efficiency and productivity of water as the most important source of water to meet new demand. It emphasized that existing water licenses will be respected and that new demand should be met by voluntary transfers between existing licence holders and new water users. Such transfers were made possible with the revised *Water Act* in 1999. Finally it states that economic instruments will be used as necessary to achieve policy outcomes.

The largest water users in Alberta are irrigators controlling 75% of all water. Hence, if new demand is going to be met reallocation out of agriculture will necessarily play an important role. The need for such reallocation was emphasized in 2005 when the Minister announced that no further applications for water licenses would be accepted. However, experiences over the last 10 years suggest that water markets have not been very active and are not readily supported by the irrigation sector (Bjornlund et al., 2007). Further, recent conflicts over the first major water transfer from the Western Irrigation District to support a new development of a Mall, casino and race track at Balzac as well as attempts to amend district licenses to enable them to supply water for non-agricultural uses, clearly indicate that there are wide community concern over such arrangements (Bjornlund et al., 2009). Further, there is only a limited understanding of why such opposition occurs.

Water transfers from rural to urban areas is not only an Alberta concern, it presents challenges for many governments around the world. There is the straightforward realisation that water scarcity and the problems related to it can only become more acute in the future, given worldwide population growth projections. As previously mentioned, the main use of water resources in the past was agricultural. However, this has changed over time and contemporary uses include not only irrigation or environmental activities, but also recreational activities related to rivers (Howard 2007). Others recognise that communities are interested in conservation and awareness of water management issues have been increasing over the years (Hatfield-Dodds et al. 2006; 2007).

While the issue of water transfers has become a key research area in some countries, there are other countries which still lag behind. Gleick (1998) notes that some parts of the world, particularly developing countries, have yet to adopt systematic studies of water transfers between rural and urban sectors as they are still struggling to ensure sufficient water access for their basic needs. In Canada the debate over the Balzac transfer and the amendment of Irrigation District Licenses clearly illustrate that water transfers out of irrigation and how such transfers should be conducted are very sensitive issues and evoke emotional debate in the wider community.

A review of the literature reveals that while there is a quite substantive literature on rural to urban water transfer and the potential impacts within the regions exporting the water, there is a need for research answering questions such as: what are the factors that influence policy preferences for rural to urban/environment water transfers? What role do social characteristics, values and attitudes play? Do various groups in society respond differently depending on the level of their dependence on water use?

This report presents an overview of past studies in order to identify key concepts, findings and gaps in the issues surrounding water transfers between rural and urban/environment sectors, with

particular focus on the characteristics of the groups involved. The review covers all disciplines of study. The gaps that emerge from this review suggest possible directions for future research.

This report communicates the overall findings from a survey of rural and urban households not involved in irrigated farming. The survey investigated how these households perceive a number of issues related to water management, the use of water as well as a number of policy statements regarding how water should be managed and shared between irrigation and other needs such as urban, industrial and the environment. It is important to understand that this is not a survey of the population as such, but of households. As such the respondents are not representative of the population living in this area with respect to age and gender, but it is representative of the households living in the area. This report discusses the overall findings with respect to differences between rural and urban residents and also explores how demographic characteristics influence such differences.

2. Literature Review

This literature review looks at some of the values associated with water, how these values can affect people's behaviour regarding water management, and the differences between urban and rural populations in this regard. As the specific literature on water in this area is very limited we have also reviewed the literature with respect to wider environmental, natural resource management and agricultural issues.

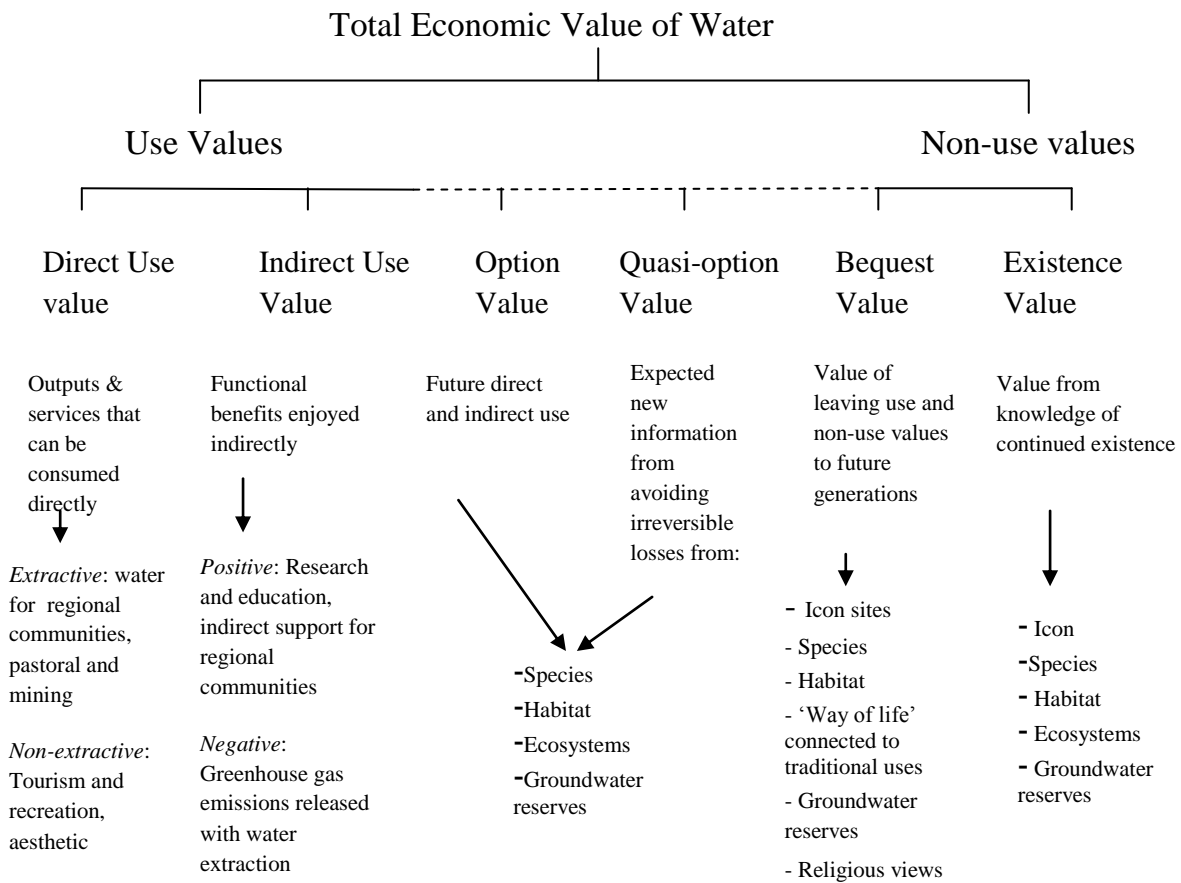
2.1. Values Associated with Water

There are many values associated with water. The total economic value of water is made up of direct and indirect use values, and values accrued on-farm and off-farm. *Direct use values* are benefits that directly accrue to individuals who use the resource. There are different types of direct use, such as consumers directly using water for household purposes and irrigators using water to produce crops, while recreational users may derive benefits from the resource but do not actually consume it. Where there is no direct contact with water, the community may benefit indirectly from the economic activity of irrigators, this is known as *indirect use values*. *Non-use values* to society from water arise either through humans knowing that ample water is there and that there is the potential for future use. Non-use values are divided into *option values*, *quasi option values*, *existence values* and *bequest values*. Option values are values for use in the future, existence values are values for knowledge of their presence and bequest values arise from wanting to preserve the public good for future generations. Non-use values can be derived without any actual current human contact with the resource (Rolfe, 2008).

Figure 1 below illustrates the different concepts of water values and how they make up total economic value of water. Illustrative examples of each type of water value are provided. Although it is beyond the scope of this report, there are a wide range of methodologies that can be used to

estimate water values; these include choice experiments, contingent valuation, hedonic pricing, travel cost method and contingent ranking.

Figure 1: Values of Water



Source: Adapted from Rolfe (2008; p. 18)

The many values and uses of water as illustrated in Figure 1 highlight the management issues that arise if the social, environmental and recreational uses of water are ignored. A variety of studies have discussed these problems (i.e. Syme et al. 2008, Savenije 2002, Batten 2007).

Syme & Nancarrow (2008) developed a visual representation of social aspects in water management. The first three spheres are utilitarian - health, wealth, prestige and social identity. The rest are humanitarian needs - social cohesion, recreation, aesthetics, moral, cultural and spiritual.

Health is directly related to basic water needs and examples of this are drinking, cooking, washing, cleaning and healthcare uses (Syme et al. 2008). It is clear that water for health is a right of every human being and the quality and quantity of water is a critical issue for survival and health. This right is related to other human rights such as food provision, hygiene, right to practice cultural activities (Syme et al. 2008). Water provision is therefore directly related to human well being.

Wealth is a key aspect of economic development and water can be used for generating employment and income in direct and/or indirect ways (Syme et al. 2008). Examples include agriculture, fisheries, aquaculture, tourism, recreational purposes, industrial products, power generation and so on (Wallace et al. 2003). The most fertile land is often situated along watercourses and on flood plains. Other economic activity such as sewerage disposal, transport, research and education are also linked with water (Pollard 2002).

The prestige and social identity aspects of water are familiar to those who deal in real estate. Bourassa et al. (2003) and Askew and McGuirk (2004) note that views of water can increase the price of properties in certain locations (cited by Syme, et al. 2008). Ownership of a boat is a sign of social prestige (Syme et al. 2008) and we often associate marinas with wealth. Howard (2007) observes that property prices are influenced by proximity to rivers due to the lifestyle associated with recreational activities such as fishing, canoeing, water-skiing, etc. These activities are not only associated with leisure but also with the possibility of generating improvements in human health and the harmony of social development (Ewert 2003). Water amenities, whether natural or artificial, are also positively associated with tourism (Howard 2007). People prefer places with water as part of the landscape and the attractiveness of rivers, lakes, waterfalls and fountains is universal (Syme et al. 2008).

Another important aspect is social cohesion, which is related to how the community faces water issues (Pepperdine 2001). This is an important consideration for our analysis, because water scarcity, access and allocation issues can be a major factor behind tensions and conflicts that arise between communities (Syme et al. 2008). Festivals and religious ceremonies where water plays a main role illustrate how communities value water for more than just basic needs. Syme et al. (2008) therefore proposed an integrative assessment which includes significant social variables such as morals and perceptions of spirituality.

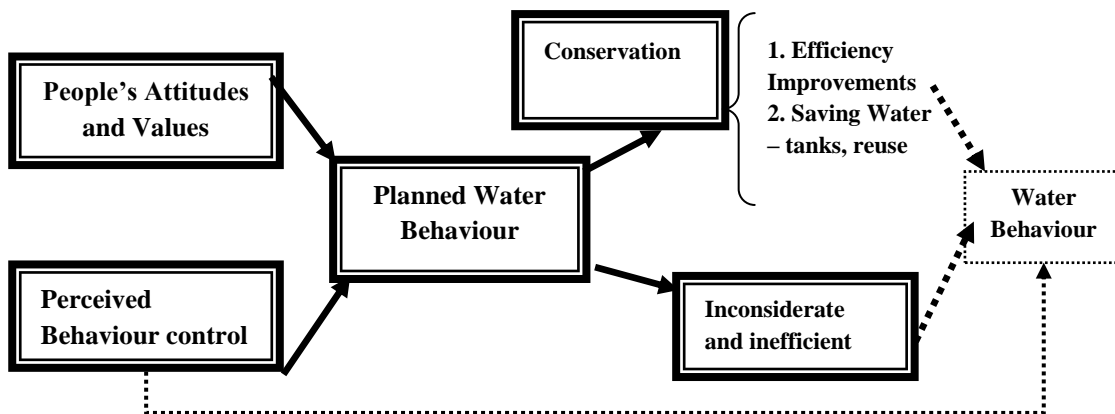
Water therefore has many other dimensions beyond its utilitarian purposes. To effectively manage this resource, we must also consider its humanitarian aspects. In order to do this, the community's beliefs, perceptions and values must be taken into consideration in policy making.

2.2. Behavioural Intentions and Values

An individual's intentions about various types of behaviour can be predicted from their attitudes towards that behaviour; the theory of planned behaviour links a person's values to their beliefs, which in turn heavily influence their attitudes. Along with subjective norms and perceived behavioural control (which refers to a person's perception of how easy or difficult it is to perform a given behaviour), attitudes are a large factor in influencing a person's behavioural intent, which in turn leads that person to perform a certain behaviour (Ajzen 1991). Planned behaviour is the intention to undertake a certain action, though of course this behaviour can only occur if the individual has complete control to perform or not perform the action (Ajzen 1991). While the intention to undertake a certain action is not the same as actually doing it, it is likely to be the best possible indication of the intended path for an individual. There is a considerable literature on what influences the behaviour of individuals. It is generally accepted that values drive attitudes, which in turn influence behavioural intentions and then behaviour (Rokeach 1979, Fishbein and Ajzen 1980, Ajzen 1991, McFarlane and Boxall 2003). Figure 2 incorporates the theory of planned behaviour;

which describes a person’s perceived behavioural control in regards to water and the extent to which their perceptions and confidence influence their decision to undertake certain courses of action, in the context of people’s future plans for water use.

Figure 2: Theory of Planned Water Behaviour



Source: Adapted from Ajzen (1991).

What concepts does the term “value” encompass? De Groot and Steg (2008, p. 331) offer us a four-part description. First, a value “reflects a belief on the desirability of a certain end-state.” Second, they are “rather abstract and transcend specific situations”. Third, they “serve as a guiding principle for selecting or evaluating behaviour, people and events”. Finally, values “are ordered in a system of value priorities”. The authors explain that this implies that when people find themselves in a specific situation where the relevant values may compete with or contradict each other, choices are made based on which values take priority.

It is possible to evaluate, using social values, the fairness of an applied policy and gain a better understanding of how to transfer or allocate water in a manner such that the benefits to society exceeds costs (De Groot and Steg 2008). Values therefore play a significant role in decision making and explaining the similarities and differences between various demographic groups, as well as

between different cultures and nations (Rokeach, 1973). Although they are relatively stable, they do evolve over time (Kennedy 1985).

Syme et al. (2008) call attention to the lack of social analysis in public decision making and cite this as the reason why sustainable natural resource management has yet to be fully realised. They point out the necessity of a framework which considers social aspects such as basic needs, cultural aspects, environmental aspects such as quality and quantity (including human and environmental requirements) and economic aspects such as income and employment generation. Policy makers may initially find it difficult to include the subjective well being that people get from access to water resources in their evaluations, but the authors feel that the inclusion of such variables is critical to the realisation of a sustainable water management approach.

2.3. Urban vs. Rural Water Issues

As noted in the introduction, there are growing disputes over sharing water between urban and rural communities. Demand for water is expected to grow rapidly especially for urban and industrial uses as well as demand to leave more water in the rivers to secure water quality needed for human, environmental and economic uses. These demands will be met increasingly with water transfers out of irrigated agriculture, and in part through new technology applied to irrigation systems and infrastructure. Rosegrant and Ringler (1999, p. 39) underline the importance of water policy when they state that “the management of this reallocation could determine the world’s ability to feed itself.” If the demand side is not properly managed, the prices of agricultural commodities could rise, which will result in more adversity for the poor in low-income countries.

Meinzen-Dick and Appasamy (2002) and Celio et al. (2010) also attribute increased water demand to rapid urban expansion. Worldwide, cities added 2 billion people to their populations from 1950 to 2000 and are expected to add the same amount during the first 25 years of this century. The

provision of water and the treatment of water-borne wastes are the principal challenges, and this will require substantial investments in urban infrastructure for water supply, treatment, and disposal. But demand cannot be left unchecked and must be managed at all levels (Meinzen-Dick & Appasamy 2002).

Other researchers acknowledge that water supply in some parts of the world is inadequate to meet current urban, environmental and agricultural needs (Ramirez et al. 2009). Ducrot et al. (2004, p. 86) points out that rapid urbanisation means that “population densities no longer allow for unlimited access to safe water.” As noted by Showers (2002, p. 645), “urban areas are consuming disproportionate amounts of water and contaminating groundwater, rivers and coasts.” The challenge for water resource managers and policy makers is to find how to assign a scarce resource that has increased demand (Ward 2007). At the same time, the process needs to be inclusive of all stakeholders, communities and groups at both regional and national levels in order to ensure equal access to water for those that need it (Cai 2008).

Molle (2004) and Bastakoti and Shivakovi (2008) point out that increasing water demand from different sectors often generates conflicts. Molle (2004) states that it is necessary to review water rights between stakeholders and government. Conflicts which have arisen between different sectors for water allocation are well documented (Bastakoti & Shivakoti 2008), as are the negative effects that have emerged as a consequence of water transfer between rural and urban sectors and the attempts to mitigate them (Rosegrant & Ringler 1999). In some instances, these transfers have already placed undue stress on communities. Commenting on water transfers between rural and urban areas in Northern China, Cai warns that “some actions are needed right now to avoid serious social instability” and urges the government to prohibit transfers that deplete farmers’ water supply below what is required for their basic needs and to undertake transfers that ensure basic requirements of urban residents during drought periods are met (Cai 2008, p. 24). Deeper analysis

of conflicts and social instability that can arise from water scarcity is, however, beyond the scope of this present study.

A consequence of the wide variety of uses that water serves in the modern world is growth in the number of stakeholders involved in the distribution process. A more integrated and collaborative perspective for water management systems has therefore become necessary. The transfer process has to try and satisfy different sectors, and adaptive systems for effective water management which consider climate and socioeconomic changes are required (Craps et al. 2007).

Levine et al. (2007) notes that water transfers from farmer to farmer and municipality to municipality are a familiar phenomenon. However, they cite others such as Lund, Israel & Kanazawa (1992) who point out that water transfers between rural and urban sectors is a relatively new phenomenon. Levine et al. (2007) summarized three different types of water transfer based on the nature of the transaction: market, quasi- market and fiat. The first scenario is where few buyers and sellers interact, resulting in a non competitive situation resulting in inefficiencies in allocation. The second type involves a competitive buyer side but with a fixed price on the seller side. Finally, the fiat type depends on government power. Levine et al. concluded that a surplus of water through irrigation improvements can facilitate water transfer.

Howe & Goemans (2003) remarked on the importance of water transfer from lower value uses to higher value uses, and also the importance of increasing water market flexibility. Molle et al. (2008) points out that there are some places in the world, e.g. Jordan, which show a mismatch between water required for food production and the contribution to national income.

Ramirez et al. (2009) analysed the relevant characteristics related to the development of policies for water transfers. They find that the price for selling or renting water or water rights is expected to be

different across age ranges. Although it is expected that older farmers set lower prices than younger ones, sometimes this relationship works in an inverse way because of the opportunity cost. These authors also analysed the impact of water restrictions in irrigation sectors on employment and income. They found that many of the people living in farming areas in Jordan have income from farming activities and are generous enough to transfer water to cities for that reason. The price of water is another variable to be considered in the process (Ramirez et al. 2009).

Quiggin (2005) highlights what many Australian urban residents are experiencing - water restrictions due to scarcity. He proposed, as an option, the transfer of water used for irrigation to urban areas. A possible option is the creation of a National Water Market where urban areas can purchase water. But various economists, policy makers and ecologists have put forward arguments both for and against such a market for water transfers. A point in favour of water transfer between rural and urban sectors is economic efficiency in consumption, where a difference of prices between these sectors can benefit both, as water is allocated to those who are willing to pay the asking price. Production efficiency can be raised based on new technology and innovations spurred on by the market. Some of the points against trading are related to the irrigation infrastructure not allowing users to readily transfer water to other sectors. Modifying existing infrastructure may increase the costs to some current users, thus decreasing economic efficiency. Another point against the transfer of water between rural and urban areas involves perceptions of the “wastefulness of some forms of urban water use” (Quiggin 2005, p.11). Quiggin concludes that “in the long run, water should be allocated to its most highly valued use, and the standard way of doing this is through market transactions.”

Hatfield-Dodds et al. (2007, p. 47) find “ample evidence that the community has the capacity to contribute handsomely to the water reform process”. They note that there is growing interest in water conservation among urban residents, but “consistent differences” between various segments

of that community. Awareness of water management models and alternatives within the rural community is far less than what they expected. We can therefore gain considerable insight into a community's preferences regarding rural to urban water transfers by gathering information about their values and perceptions related to the topic. This framework can aid us in explaining the similarities and differences between rural and urban residents' preferences about water transfers.

2.3.1. The Literature on Urban and Rural Resident Values

What has the past literature found in regards to differences between rural and urban values? It may be that there are no major differences between rural and urban attitudes towards water management. For example, Hatfield-Dodds et al. (2007) state that research indicates that when it comes to water culture, disparate groups with different interests actually have more similarities than differences. However, Berenguer et al. (2005, p. 135) found that urban residents are more environmentally concerned than those living in rural areas, but rural residents have a "more well developed sense of moral obligation to care for the environment" and actually "behave more responsibly". They attribute the greater concern regarding environmental issues in urban areas to higher education levels and better access to information compared to rural areas, but it is actually rural residents that behave in ways that are more favourable to the environment. Wachenheim & Rathge (2002) undertook a study on perceptions in twelve states across the North Central region of the United States, with a total usable sample of 594 households. They focused on issues related to the environment and farming. They found differences between rural nonfarm, farm and city residents on their perceptions about existing environmental regulations, farmers, farm consolidation and the role of government aid to the farming sector. Compared to those residing on a farm or in a town or city, rural nonfarm residents were more convinced of farmers' positive impact on the local economy, but were less concerned about the effect of farm consolidation

Pumphrey et al. (2008) conducted a study of urban and rural attitudes about water conservation policies in a semi-arid region of Texas where communities depend on both surface and groundwater sources for their municipal supplies. They tried to test which policies would be most acceptable to these groups, but found no distinct difference between urban and rural attitudes towards any one set of conservation measures among their sample of 829 interviewees. They do, however, acknowledge possible problems with the design of their study that may have led to its results being inconclusive and that there was a need for future research.

Several studies have highlighted the variations between groups with regards to environmental concerns and have attempted to explain these through demographics and other factors such as location of residence (Buttel and Flinn 1974; Van Liere and Dunlap 1980; Sharp and Adua 2009). Van Liere and Dunlap (1980) used demographic variables such as age, social class, residence, political beliefs and gender to explain varying levels of environmental concerns. They find that variables such as being young, well educated, and having liberal beliefs can influence a person's level of environmental concern. They also find correlations with other variables such as private property rights; laissez-faire government and economic growth. They conclude that it is important to analyse demographic and socio-economic variables in order to explain changes in people's environmental concerns; however, they note that their coefficients for these variables were very low, which could explain the limited success of other researchers in establishing links between these variables and environmental concerns.

Jones et al. (1999) found that urban residents are more concerned about environmental matters than rural and a positive relationship exists between certain demographic characteristics and levels of environmental concern. From 1,239 telephone interviews, they found that younger people, those with higher educational levels and liberal political orientations tend to have higher levels. But critically, they found no significant rural-urban differences on several indicators of

environmentalism. Morrissey & Manning (2000, p.21) conducted a similar study on racial identity and location of residence with a sample size of 478 survey respondents, but they state that “relatively few differences in environmental values and ethics were found between African American and white, and rural and urban subgroups.”

Some theories that link differences in environmental concern to residence in a rural or urban area include deprivation theory (Lowe & Pinhey 1982) and extractive-commodity theory (Jones et al. 1999). Deprivation theory states that when people feel deprived of a natural resource of good quality, their environmental concerns are heightened. Based on this theory, Sharp & Adua (2009) reported Tremblay & Dunlap’s (1978) study which theorized that the urban populace will have greater environmental concerns due to the relatively poor quality of their environment (e.g. air, water and noise pollution) compared to rural locations. On the other hand, the extractive-commodity theory states that those employed in industries related to the extraction of natural resources (which are more prevalent in rural areas) tend to be less environmentally concerned than those employed in other sectors.

Van Liere & Dunlap (1980) found that urban residents have higher environmental concerns than people who live in rural areas. However, Lowe & Pinhey (1982) did not find support for environmental degradation theory in urban areas. Moreover, they report that the place of socialization (measured by the type of place respondents were living in when they were at the age of 16) determined how people experienced and viewed different environmental conditions; as the type of place changes from rural to urban and to metropolitan, people’s environmental concern increases. Farmers were slightly less concerned with regards to environmental protection. Therefore, some differences between groups are not completely explained by the aforementioned theories (Lowe & Pinhey 1982).

Other studies looked at differences based on the location of residence. However, this research is scarce and/or inconsistent (Arcury & Christianson 1990). Sharp & Adua (2009, p. 59) find that “the presence or absence of differences may vary according to the nature of the environmental concern as well as contextual attributes of the urban or rural region.”

Sharp and Adua (2009) conducted a study on links between rural-urban location, participation in recreational activities and attitudes towards the environment, particularly regarding environmental concerns related to agriculture. From a sample size of 4,031 completed surveys, they find a strong relationship between location and concern about agriculture and the environment, but this relationship disappears once proximity to agriculture is accounted for. However, they do find a strong relationship between participation in rural recreational activities and levels of concern.

It is therefore difficult to determine whether location or other factors are the main influence on people’s levels of concern about water resource management and the environment. Any study which seeks to investigate links between communities and their views on water management must take into account a number of factors including location, demographics, recreational activities and occupation.

2.3.2 Water transfer impacts and mitigation

The water transfer process can have both positive and negative effects and externalities for the parties involved (Howe et al. 1990). For example, it might result in a reduction of water quality which is a negative externality, while it may increase profits in the importing region which is a positive externality. In conclusion, Howe et al. (1990, p. 1203) suggests that “....states should not fear water transfers: transfers will not wreck basins of origin nor state economies. The results do imply, however, that transitional assistance is warranted to help those parties suffering uncompensated externalities and indirect displacement by transfers”.

From a survey of 317 community leaders in water-trading areas throughout the states of Arizona, New Mexico and Texas in the United States, Charney and Woodard (1990) find that there is a perception that certain groups gain while others lose when water is transferred. The respondents perceived government officials, water utilities, and various experts as gainers, while private well owners, indigenous groups, future generations and small farms were seen as losers. They also point out that transfers do have significant impacts, though they are “not devastating”. However, these impacts tend to be highly concentrated, as purchases tend to be clustered around particular areas where water is available for transfers. Therefore, those areas may need to be compensated in some way.

Rosegrant and Ringler (1999, p. 40) arrive at a similar conclusion when they state that “comprehensive reforms are required to mitigate the potentially adverse impacts of water transfers for local communities.”

2.4 Summary

This literature review focused on water transfers, values, beliefs and behaviours underlying the water transfer process, and water management systems and associated factors. Water resources are not just associated with agriculture or basic needs but have many socio-economic and cultural aspects to their availability and usage. Further research is necessary to find out which demographic and socio-economic factors can lead to people holding different views about water transfers, and how this information can be utilised to form effective sustainable water management policies. These policies can go a long way in preventing future tensions that may arise as a result of competition for scarce water resources, and they can also help to mitigate the negative impacts of water transfers.

3. Study area, data and methodology

The analyses in this report are based on two mail-out surveys. The first survey took place in the southern part of the South Saskatchewan River Basin. It covered the city of Lethbridge as the urban centre and the surrounding small towns as the rural sample. During fall of 2009 Questionnaires were sent to 3,000 residents in Lethbridge, Alberta (urban water consumers) and to 3,000 households in Taber (MD), Magrath, Raymond and Stirling (small towns around Lethbridge largely dependent upon irrigation). Each of the forward sortation areas (FSAs) that served the five sample locations were determined and mailing addresses for the 6,000 surveys were purchased from a list broker (West List Co.). The samples for each of the populations (rural and urban) were chosen by selecting every n^{th} mailing address to ensure that all households within the FSA had an equal opportunity to be sent a questionnaire. Two reminders were sent and incentives were offered (i.e. cash prizes) to encourage respondents to participate. A total of 1,165 valid surveys were returned and 429 were returned due to incorrect addresses, nonqualified responses and other reasons. Therefore, the response rate is 21 percent for our survey which is considered reasonable for a mail-out survey. After removing survey records with incomplete information, particularly for the demographic and socio-economic questions,¹ 1,066 interviews were included with 609 and 457 in the urban and rural areas respectively.

The second survey took place in two locations about 220 km north of Lethbridge: the city of Calgary and the town of Strathmore. During the fall of 2010 questionnaires were sent to 3,000 randomly selected households in Calgary, which has a population of 1,071,515 in 414,185 occupied dwellings (City of Calgary, 2010), and 2,338 questionnaires were mailed to households in Strathmore, with a population of 12,139 in 4483 occupied dwellings (Town of Strathmore, 2010). A systematic random sample was performed on all available address for Calgary, with every n^{th}

¹ The records with incomplete information are also examined and it indicates these records are missing at random. Therefore dropping out these records will not bias our further analysis.

address selected. This ensured all listed addresses had an equal chance of receiving the survey. For the Strathmore sample, all available addresses obtainable through a list broker (West List Co.) were selected. The initial mailing included a cover letter explaining the project and requesting participation, the survey instrument, an entry form for a cash prize incentive and a postage-paid return envelope. This was followed by three timed reminders at three week intervals. The final reminder included a web address at which potential respondents could complete the questionnaire online.

In total, 2,693 surveys were delivered in Calgary with the remainder returned as undeliverable due to incorrect address information provided by the list broker. For the same reason, 2,216 surveys were delivered in Strathmore. Of these, 476 responses were received from Calgary and 347 from Strathmore, resulting in a response rate of 16.8%. After removing surveys with incomplete information as well as respondents who had self-identified as irrigators, 422 completed responses from Calgary and 302 completed responses from Strathmore remained.

Census data was used to check that the respondents were representative of the population. Given that this is a household and not a resident survey, the respondents are not representative of the population, with respect to age and gender.

The four survey regions thus represent four distinct places along the urban to rural gradient and different levels of dependence on water use as the economic engine of the economy. Starting at the most urban end of this gradient, (1) Calgary has little dependence on water use for its economic well being, and the citizens of Calgary would benefit greatly from rural to urban/environment transfer in the form of improved lifestyle. (2) Lethbridge with its population of more than 80,000 people and the presence of major educational and research institutions has an economy independent of irrigation, but it also has a large sector of irrigation based processing, transport and service activities generating jobs and revenues. It therefore represents a second position on the urban to

rural gradient. (3) Strathmore, being an administrative centre for the Western Irrigation district and the host for many irrigation dependent service industries has a larger dependence on irrigation than Lethbridge, but it also has other economic activities and job opportunities due to its proximity to Calgary. It therefore represents a third position along the urban to rural gradient. (4) The small towns around Lethbridge have populations of 3,000 or less and are largely dependent on irrigation as an economic driver and creator of jobs and demand for services. They therefore represent a fourth position on the gradient, disregarding the irrigators themselves.

The questionnaires collected information on rural and urban status, socio-demographic data and a wide range of value statements. The value statements used a one to five Likert rating scale and collected information about family, economics, lifestyle, the environment, water rights, economic issues, and water transfer issues. There were also ten policy questions asked of respondents, to collect their views on government's role in water policy, the market's role and the various rights of the environment/irrigators/public users.

In the findings sections the responses to all questions are discussed under the headings: 1) demographics; 2) value statements; and 3) policy statements. Descriptive statistics are reported and significance tests used to identify differences across the four location samples. The statistical methods used in the findings sections are:

- Kruskal-Wallis rank test: it tests the hypothesis that several samples (from the four locations) are from the same population. For each attitudinal statement, we wish to test for the equality of the Likert scale distribution across the four locations simultaneously. If the test is rejected, we can conclude that the responses from the value statement in question are not from the same population.

- Pearson Chi-square test: it tests the association between two categorical variables or between one categorical and one ordinal variable, such as between gender and residence, between education and residence, between value statement and education, etc.
- Multivariate test on means: This test is applicable when comparing the averages from multiple samples, such as the average age by each level of the Likert scale of the policy statements. This is in the form of an F test.
- Spearman's rank correlation coefficient: This coefficient is used when one or both the variables are ordinal, such as between the value statement and the policy statement.

4. Findings

4.1. Findings – Demographics

For the purposes of descriptive analysis, the respondents were divided into two groups, namely rural and urban, based on the classification of their postal codes.

Table 1: Number of respondents surveyed according to location

Locations	(% of respondents)
RTMS	25
Lethbridge	34
Strathmore	17
Calgary	24
Total	100

Raymond/Taber/Magrath/Sterling (RTMS), Lethbridge, Strathmore and Calgary responses accounted for 25 percent, 34 percent, 17 percent and 24 percent respectively (Table 1). Females accounted for 28 percent, 31 percent, 31 percent and 34 percent of the sample while males comprised 72 percent, 69 percent, 69 percent and 66 percent in RTMS, Lethbridge, Strathmore and Calgary respectively (Table 2). The gender composition in the four regions does not differ statistically.

Table 2: Respondents according to gender

		(% of respondents)				
		Complete	RTMS	Lethbridge	Strathmore	Calgary
Gender	Male	69	72	69	69	66
	Female	31	28	31	31	34
	Total	100	100	100	100	100

Pearson Chi-squared test statistic: 3.9907. p-value=0.262

People aged 50 and above accounted for 72 percent of the entire sample. This is higher in the Lethbridge sample (74 percent) and much lower in the samples of the other three regions. Respondents who were retired or close to retirement age at 60 years or above were 42 percent of the entire sample, 46 percent in Lethbridge and around 20 percent in the other three areas (Table 3). Table 3 also suggests that most of the respondents are between the ages of 40 to 60 except

Lethbridge, where most of the respondents are between the ages of 50 to 70. However, a multivariate test of the mean suggests that the average age is equal across the four locations.

Table 3: Respondents categorized by location and age

		(% of respondents)				
		Complete	RTMS	Lethbridge	Strathmore	Calgary
Age	18 – 19	0	3	0	7	4
	20 – 29	4	6	4	10	12
	30 – 39	9	13	9	15	21
	40 - 49	15	31	13	27	30
	50 - 59	29	26	28	22	18
	60 - 69	23	16	26	17	10
	70 -79	14	5	13	2	5
	80 -89	5	-	7	0	0
	90 +	0	-	1	-	-
Total	100	100	100	100	100	

Multivariate test on means: F-statistic=1.30. p-value = 0.19.

Income distribution varies significantly among the four regions (Table 4). People of RTMS who received \$50,000 or more in household annual income were less than that of the other three regions (59 percent in RTMS compared to 69 percent in Lethbridge, 72 percent in Strathmore and 77 percent in Calgary respectively). It must be noted that this is mostly due to the dominance of residents of Lethbridge, Strathmore and Calgary in the highest income range \$80,000+.

Table 4: Respondents categorized by location and household income

		(% of respondents)				
		Complete	RTMS	Lethbridge	Strathmore	Calgary
Household Annual income	Under \$ 10,000	1	1	1	1	1
	\$ 10,000 - \$ 19,000	3	5	3	2	2
	\$ 20,000 – \$ 29,000	7	10	7	6	6
	\$ 30,000 - \$ 39,000	10	12	11	9	6
	\$ 40,000 - \$ 49,000	10	12	10	10	8
	\$ 50,000 - \$ 59,000	11	11	13	9	9
	\$ 60,000 - \$ 69,000	9	11	10	9	7
	\$ 70,000 - \$ 79,000	8	8	8	8	7
	\$ 80,000 and over	40	28	37	45	54
Total	100	100	100	100	100	

Multivariate test on means: F-statistic=19.85. p-value=0.0000.

Education level varies significantly between the four regions, especially the residents of Calgary have a greater percentage of people with college or university degrees at the Bachelor, Masters and PhD level (51 percent of Calgary compared to around 30 percent in the other three regions).

Table 5: Respondents categorized by location of residence and level of education

		(% of respondents)				
		Complete	RTMS	Lethbridge	Strathmore	Calgary
Level of Education	No certificate, diploma or degree	8	11	8	8	3
	Secondary (high school) diploma or equivalency certificate	21	26	19	24	16
	College, or other non-university certificate or diploma (including apprenticeship or trade)	37	35	41	42	29
	University - Bachelor's Degree	23	18	21	19	34
	University - Master's Degree or doctorate	12	11	11	7	17
Pearson Chi-squared test statistic: 17.72. p-value=0.023.						

Sector of occupation varies significantly between the four regions (Table 6). Although the sector of Social science, education or government has a significantly high share of residents of all four regions, occupations related to Trades, transport or equipment operator have higher shares in the regions of RTMS, Lethbridge and Strathmore, while Calgary residents are employed more in the sectors of Business, Sales and Management.

Table 6: Respondents categorized by location of residence and occupation

	(% of respondents)				
	Complete	RTMS	Lethbridge	Strathmore	Calgary
Management	11	11	9	11	14
Business, finance or administration	13	9	12	13	18
Natural and applied sciences	5	3	6	2	8
Health	9	10	11	8	8
Social science, education or government service	17	18	17	20	16
Sales, service, culture, recreation or sport	12	11	13	10	15
Trades, transport or equipment operator	15	17	15	20	9
Primary industry (forestry, mining, primary processing, manufacturing or utilities)	6	10	4	7	7
other	5	5	7	3	2
homemaker	1	2	1	1	0
Total	100	100	100	100	100
Pearson Chi-squared test statistic: 102.3505. p-value= 0.000.					

The sources of water for domestic use vary for residents of the four locations (Table 7). A slightly higher percentage of residents of Lethbridge, Strathmore and Calgary (98 percent) obtain their water from the municipal water supply compared to the RTMS residents (93 percent). In all other

categories of water sources, the RTMS residents show a higher percentage than other regions. As there are many zero cells in Table 7, a Pearson Chi-squared test of association cannot be reliable.

Table 7: Respondents categorized by location and source of water for domestic uses

		(% of respondents)				
		Complete sample	RTMS	Lethbridge	Strathmore	Calgary
Source of water for domestic uses	Municipal water utility	97	93	98	98	98
	Private well	1	2	0	2	1
	Surface water	1	1	1	0	1
	Storage on-site	1	3	1	0	0
	Other	0	1	0	0	0
	Total	100	100	100	100	100

Many recreational activities are linked, either directly or indirectly, with bodies of water such as lakes and rivers. The activity has the highest percentage of participants in all regions is Viewing/Enjoying scenery, though the percentage is higher in RTMS and Lethbridge compared to Strathmore and Calgary (100 percent in both RTMS and Lethbridge compared to 67 percent and 76 percent in Strathmore and Calgary respectively). A significantly higher proportion of the Strathmore and Calgary residents participate in Walking/Hiking and Camping while the activity of Canoeing/Kayaking has a slight higher percentage of participants in RTMS and Lethbridge. The activities of Bird watching, Motorized water sports and Swimming do not differ significantly between the four regions. In addition, 8 percent of Strathmore residents and 6 percent of Calgary residents indicate that they do not participate in any activity while there is no resident of RTMS and Lethbridge indicate that.

Table 8: Respondents categorized by recreational activities

		(% of respondents)					Pearson Chi-squared statistic
		Complete sample	RTMS	Lethbridge	Strathmore	Calgary	
Recreational activities	Fishing	34	42	31	38	25	34.033***
	Bird watching	18	17	17	19	21	4.1637
	Canoeing/ Kayaking	24	31	27	11	22	48.6025***
	Motorized water sports	11	11	9	11	11	2.0413
	Viewing/ Enjoying scenery	73	100	100	67	76	17.7278***
	Walking/Hi king	39	19	26	53	70	349.1715***
	Hunting	8	12	6	12	6	24.1228***
	Swimming	27	26	28	26	28	1.2882
	Camping	20	1	2	51	43	624.8521***
	None	7	0	0	8	6	1.0438

Note: table shows only positive answers. *** indicates significance at 1 percent confidence level

To get an idea of how long they had been in the region, residents were asked if they had lived in the four regions prior to 2001 (Table 9). The results show significant differences among the four regions, suggesting that compared with Strathmore and Calgary, there are more residents in RTMS and Lethbridge who reside in the two regions prior to 2001 (93 percent of both RTMS and Lethbridge compared to 87 percent of Strathmore and 85 percent of Calgary).

Table 9: Residency in Southern Alberta prior to 2001

		(% of respondents)			
		RTMS	Lethbridge	Strathmore	Calgary
Residency prior to 2001	Yes	93	93	87	85
	No	7	7	13	15
	Total	100	100	100	100

Pearson Chi-squared test statistic: 29.5700. p-value=0.000

Interesting patterns emerge from the responses to the questions of whether they lived their lives mainly in a rural or urban area, where they had been raised, and where they are currently living (Tables 10, 11 and 12). We found that 47 percent of the RTMS sample had mainly lived in urban

areas, which is significantly lower than that of three other regions (85 percent in Lethbridge, 85 percent in Strathmore and 96 percent in Calgary).

Table 10: Respondents categorized by area (rural or urban) where they had lived most of their lives

		(% of respondents)				
		Complete sample	RTMS	Lethbridge	Strathmore	Calgary
Place where most of the life	urban	78	47	85	85	96
	rural	22	53	15	15	4
	Total	100	100	100	100	100
Pearson Chi-squared test statistic: 392. p-value=0.000						

Analysing the question related to where the respondents were raised (Table 11), we found that 38 percent of the RTMS sample had been raised mainly in urban areas, which is also the lowest among the four regions. On the other hand, 80 percent of Calgary sample had been raised in urban areas.

Table 11: Respondents categorized by area (rural or urban) where they were mainly raised

		(% of respondents)				
		Complete sample	RTMS	Lethbridge	Strathmore	Calgary
place where raised	urban	59	38	56	63	80
	rural	41	62	44	37	20
	Total	100	100	100	100	100
Pearson Chi-squared test statistic: 179. p-value=0.000						

The findings related to where the respondents currently reside indicate that, apart from RTMS, most of the respondents from Lethbridge, Strathmore and Calgary are currently reside in urban areas (97% and above).

Table 12: Respondents categorized by area (rural or urban) where they currently reside

		(% of respondents)				
		Complete sample	RTMS	Lethbridge	Strathmore	Calgary
place now	urban	86	51	97	97	99
	rural	14	49	3	3	1
	Total	100	100	100	100	100
Pearson Chi-squared test statistic: 675. p-value=0.000						

While these findings clearly indicate that RTMS residents are significantly more likely to have lived longer in, have been raised in, and currently reside in, rural areas and conversely with residents of Lethbridge, Strathmore and Calgary, the findings strongly suggest that the adult population currently living in RTMS has strong rural ties. Residents of Lethbridge, Strathmore have almost equally strong rural ties while Calgary clearly has the strongest ties to urban areas.

The final two socio-economic questions deal with respondents' memberships in groups involved in water management and environmental or conservation matters. We found that 1 percent of RTMS and Strathmore and 2 percent of Lethbridge and Calgary residents were members of a WPAC or watershed stewardship group (Table 13) while 7 percent of RTMS, Lethbridge and Strathmore respondents were members of an environmental or conservation group (Table 14). There are no significant differences among the four regions with respect to their active involvement in NGOs associated with water management and environmental conservation issues.

Table 13: Memberships in WPAC or watershed stewardship group

Membership in a WPAC or watershed stewardship group	(% of respondents)			
	RTMS	Lethbridge	Strathmore	Calgary
Yes	1	2	1	2
No	99	98	99	98
Total	100	100	100	100
Pearson Chi-squared test statistic: 4.1813. p-value=0.243				

Table 14: Membership in an environmental or conservation group

Membership in an environmental or conservation group	(% of respondents)			
	RTMS	Lethbridge	Strathmore	Calgary
Yes	7	7	7	6
No	93	93	93	94
Total	100	100	100	100
Pearson Chi-squared test statistic: 1.9082. p-value=0.592				

4.2. Findings – Value statements

4.2.1 All value statements

This section compares the answers provided by the rural and urban respondents to the 49² attitudinal questions related to their personal values regarding water.

The values statements were separated into five groups based on their characteristics. The first group is entitled “Environmental Water Values”; it includes all statements related to water and its role in the natural ecosystem (as opposed its role in human activity). Such questions give priority to the environmental needs for water (Table 15).

Table 15: Environmental Water Values

Statements	(% of respondents)																			
	RTMS					Lethbridge					Strathmore					Calgary				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
A1: A healthy, functioning aquatic environment should always take priority over human uses of water***	8	30	18	33	11	4	26	18	39	14	4	27	21	36	12	3	24	18	43	12
A4: Healthy aquatic ecosystems add to the quality of life in the province of Alberta***	0	1	6	63	29	1	1	5	58	36	0	0	3	46	51	1	0	3	38	58
A8: Water in a river has value simply because of all of the benefits and services it gives to us	1	12	8	59	19	3	12	8	53	24	4	12	9	55	20	5	14	11	46	24
A10: Rivers tie communities together***	1	8	23	55	12	1	9	20	57	14	1	9	19	59	12	1	6	17	59	18
A13: New subdivisions should not be allowed in this region if supplying the water they need would cause harm to the environment***	1	12	22	49	16	2	10	16	52	21	2	7	16	53	21	2	11	13	50	24
A20: The environment’s needs for water should be met before water is used for human economic purposes such as industry and agriculture***	5	28	26	33	7	3	21	26	40	10	1	20	27	40	12	1	17	23	45	14
A29: When I think about the potential consequences of water markets the impact on the environment is the first thing that comes to mind	-	-	-	-	-	-	-	-	-	-	2	19	22	41	16	3	17	25	38	17
A33: I want future generations to be able to experience aquatic environments in southern Alberta that are healthier than the ones we have now***	1	7	19	58	16	0	3	17	61	19	0	3	19	52	26	0	3	20	47	30
A45: I am aware that the majority of rivers in southern Alberta are environmentally impacted or degraded	-	-	-	-	-	-	-	-	-	-	2	12	24	49	12	3	13	23	50	12
*** p<0.01, ** p<0.05, * p<0.10: Kruskal-Wallis equality-of-populations rank test																				
^1=strongly disagree, 2 = disagree, 3=neutral, 4=agree, 5=strongly agree.																				

² Since they survey were collected in two rounds, there are 15 questions that were only asked in the second round. Hence only Strathmore and Calgary have the answers to these 15 questions.

Most of the attitudinal statements on environmental water values show significant difference among the four regions, apart from statements A8, suggesting that the four regional samples are not from the same population as far as the environmental water values are concerned. On a closer look, respondents of Lethbridge and Calgary regions are more likely to agree with Statement A1 suggesting that the environment have higher priority than human and consumptive uses when it comes to water allocation and management (55 percent and 53 percent agree and strongly agree in Lethbridge and Calgary respectively while 44 percent and 48 percent agree and strongly agree in RTMS and Strathmore respectively). Question A20 ‘The environment’s needs for water should be met before water is used for human economic purposes such as industry and agriculture’ separates the RTMS most strongly from the three other locations with only 40 percent agreeing or strongly agreeing compared to at least 50 percent agreeing or strongly agreeing in the other three regions.

The statements in the second group related to people’s attitudes towards water, the environment and people’s livelihoods, hence the title “General Attitudes” (Table 16). All of the values show significant difference across the four locations, suggesting people’s general attitudes towards water may depend on the location they are living in. People in Lethbridge and RTMS are clearly more linked to Irrigation than Calgary and Strathmore hence the answers do not follow the same patterns when it comes to this group of value statement where the issue of livelihood is central. Hence for statement A15, we observe that at least 50 percent agree or strongly agree that they are entitled to use as much water as any other resident of the province of Alberta in RTMS and Lethbridge while the percentages for Calgary and Strathmore are much less (38 percent and 41 percent respectively). Similarly for statement A27, respondents in RTMS reported an 87 percent agreeing that irrigated agricultural is beneficial to themselves and their family while in Strathmore and Calgary the percentages are 79 percent and 75 percent respectively. It also appears that more Strathmore and Calgary respondents than RTMS and Lethbridge residents do not believe that they have a better understanding of how water is managed in Southern Alberta than their neighbours. Only 23 percent

of Strathmore and Calgary respondents agree or strongly agree that the aquatic environment in Southern Alberta is healthy while the percentage is at least 30 percent for RTMS and Lethbridge, suggesting Strathmore and Calgary respondents express a higher level of environmental concern.

Table 16: General Attitudes (water, economic, environment)

	<i>(% of respondents)</i>																			
	<i>RTMS</i>					<i>Lethbridge</i>					<i>Strathmore</i>					<i>Calgary</i>				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
A5: I live in a drier environment than most Canadians***	1	5	13	59	21	1	5	10	64	20	2	13	17	55	13	0	12	14	52	22
A7: I'm more concerned about my livelihood than I am about the environment**	11	36	26	25	2	10	43	24	19	3	13	43	24	18	3	12	46	20	20	2
A15: I am entitled to use as much water as any other resident of the province of Alberta***	4	24	21	39	11	8	6	29	23	34	5	31	23	33	8	7	32	23	31	7
A27: Irrigated agriculture produces locally grown, healthy food for me and my family***	0	5	8	68	19	0	6	14	69	11	1	5	15	59	20	0	6	18	64	11
A31: I only use water for domestic purposes such as washing, cooking and cleaning***	4	48	11	29	7	3	45	11	34	7	2	33	8	43	14	4	25	8	44	19
A34: I have a better understanding of how water in southern Alberta is managed than do most of my neighbours***	1	14	52	26	7	0	16	54	21	8	3	21	48	23	5	5	25	46	19	6
A40: I use water more carefully than most of my neighbours***	0	6	47	38	9	0	5	48	36	11	1	8	40	39	12	1	4	33	45	17
A41: The environment is important to me because of its natural beauty*	1	5	8	62	24	1	4	8	60	27	0	4	14	53	29	1	3	11	53	33
A49: The aquatic environment of southern Alberta is healthy***	3	19	38	39	2	3	23	44	28	2	6	35	37	22	1	4	29	44	22	1
*** p<0.01, ** p<0.05. * p<0.10: Kruskal-Wallis equality-of-populations rank test																				
^1=strongly disagree, 2 = disagree, 3=neutral, 4=agree, 5=strongly agree.																				

The third group includes statements related to the use of water for human activities (in contrast to the “Environment Water Values” reported in Table 15) it is therefore named “Human-centred Water Values”. Agreement with these statements means that respondents value the use of water for gardens and public places as well as economic needs higher than environmental uses. Significant differences are seen for most statements, apart from A9, A28, A30 and A36 (Table 17). For Statement A23, residents of Lethbridge are more likely to agree with the statement that water should be made available for economic uses before the environment (10 percent strongly agree in

Lethbridge compared to only 1 percent in all other regions). For A24, 35 percent (the lowest among the four regions) of RTMS residents agree or strongly agree that they use river regularly for recreation while 53 percent (the highest among the four regions) of Calgary residents agree or strongly agree so.

Table 17: Human-centred Water Values

	<i>(% of respondents)</i>																			
	<i>RTMS</i>					<i>Lethbridge</i>					<i>Strathmore</i>					<i>Calgary</i>				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
A6: Using water to create green and lush public spaces adds more to my quality of life than leaving the water in the river**	6	36	25	30	3	9	38	23	28	2	9	28	25	36	2	7	33	26	31	2
A9: I use water for washing my vehicle even if doing so may harm the river where the water comes from	16	50	24	10	0	19	45	20	15	1	22	38	18	20	1	26	36	19	18	1
A16: Domestic uses of water such as washing, cooking and cleaning should take priority over the needs of the healthy aquatic environment**	5	40	23	27	5	6	42	27	22	4	4	32	35	27	3	6	41	26	25	3
A17: Water from rivers should be used to provide benefits to the whole community, not just to those who can afford to buy a water license***	1	1	4	58	35	1	1	4	57	37	1	1	5	49	44	1	2	3	49	46
A18: People have the right to modify the natural environment to meet their economic needs*	11	42	23	23	2	13	48	20	17	2	15	45	20	18	2	18	40	17	22	3
A23: Water should be made available for economic uses before the environment***	11	42	32	13	1	14	52	23	10	1	12	46	30	11	1	18	48	24	10	1
A24: I use rivers and their surrounding areas on a regular basis for recreation***	8	40	18	30	5	8	39	17	29	7	8	29	18	37	8	9	22	16	40	13
A28: I enjoy having a lush green lawn and/or garden even if doing so may cause environmental harm to the river where the water comes from	10	54	24	11	1	14	56	18	11	1	14	55	18	11	2	17	47	22	12	2
A30: The amount of water I use in and around my home would change depending on how much I had to pay for it	3	20	15	53	9	3	24	12	49	11	5	23	15	43	14	5	22	10	48	15
A36: Water for basic human needs should have priority over all other water uses	-	-	-	-	-	-	-	-	-	-	-	11	13	49	27	1	11	17	47	25
*** p<0.01, ** p<0.05. * p<0.10: Kruskal-Wallis equality-of-populations rank test																				
^1=strongly disagree, 2 = disagree, 3=neutral, 4=agree, 5=strongly agree.																				

The fourth group includes statements related to household income generated from activities that utilise water from rivers and is therefore named the “River Livelihood” group (Table 18). There are significant differences for all statements except statement A3 and A12, suggesting that generally the four regional samples are not from the same population as far as the river livelihood are concerned. Agreement with these statements implies that the respondents feel agricultural uses for water should take priority. Our findings suggest that RTMS and Lethbridge residents are significantly more likely to agree with the priority of irrigated agriculture. For example, RTMS and Lethbridge residents are more likely to agree with the Statement A2 (11 percent strongly agree and 12 percent strongly agree in RTMS and Lethbridge respectively compared with 7 percent in Strathmore and 5 percent in Calgary). Take Statement A14 for another example, 15 percent of respondents from RTMS strongly agree with irrigated agriculture is the most economically profitable use of water, which is much higher than that of respondents indicating strongly agree in Strathmore and Calgary (6 and 4 percent respectively). For those statements that only have respondents from Strathmore and Calgary, overall Strathmore respondents are more agreeable to irrigated agriculture as the traditional and profitable economic activity in Alberta than Calgary respondents.

Table 18: River Livelihood

	<i>(% of respondents)</i>																			
	<i>RTMS</i>					<i>Lethbridge</i>					<i>Strathmore</i>					<i>Calgary</i>				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
A2: At least some of my household income depends directly on an activity that uses water from the river***	15	24	17	33	11	15	27	17	29	12	26	27	14	26	7	33	25	13	24	5
A3: I think that water is a commodity that individuals and private groups should be able to buy and sell	41	36	11	11	1	44	37	9	9	1	44	31	10	13	2	40	34	10	13	3
A11: Overall, irrigated agriculture positively contributes to the quality of life in southern Alberta***	-	-	-	-	-	-	-	-	-	-	1	2	10	58	28	0	4	16	60	19
A12: Buyers and sellers of water licences should be the ones who decide the price of water.	31	44	16	8	1	37	41	13	7	2	36	42	12	9	1	36	38	16	9	1
A14: Irrigated agriculture is the most economically profitable use of water in the region***	1	12	26	46	15	3	14	32	44	8	4	11	39	40	6	4	16	46	31	4
A22: I would rather see the region's economy grow through more irrigated agriculture as opposed to having more water in the rivers*	7	37	28	26	3	8	39	32	18	3	6	40	32	19	2 [#]	9	40	30	18	2
A25: Alberta's traditional farming heritage is an important part of the province's identity today***	-	-	-	-	-	-	-	-	-	-	0	4	8	61	28	1	6	10	64	20
A35: The effect on Alberta's irrigators is among the most important things to consider when water markets are discussed*	-	-	-	-	-	-	-	-	-	-	2	19	34	43	3	2	14	45	34	4
A37: Alberta's farmers are good stewards of land and water***	-	-	-	-	-	-	-	-	-	-	4	9	38	41	8	2	14	45	34	4
A38: We should encourage Alberta's transition from an agriculture-based economy to an energy-based economy***	-	-	-	-	-	-	-	-	-	-	11	46	34	8	2	7	43	34	14	2
A39: Alberta's economy will suffer if the province continues to lose farmers***	-	-	-	-	-	-	-	-	-	-	1	7	15	55	22	1	7	22	57	14
*** p<0.01, ** p<0.05, * p<0.10: Kruskal-Wallis equality-of-populations rank test																				
^1=strongly disagree, 2 = disagree, 3=neutral, 4=agree, 5=strongly agree.																				

The fifth group (Table 19) includes statements related to how and who should manage rivers and ensure suitable outcomes, this group is therefore titled “River Management”. Significant difference can be seen from Statements A19, A21, A26, A32, A42 and A48. Statement A19 regarding government’s responsibility of managing rivers shows significant difference between the regions. Compared with those of Calgary, residents of RTMS and Strathmore are more likely to disagree or strongly disagree that government should take river management responsibility while Calgary residents have the highest percentage of strongly agreeing with this statement among the four regions. In addition, significant difference of Statement A21 and A26 suggests that respondents

from RTMS have the lowest concern about the current water management than respondents from other three locations. For those statements with only Strathmore and Calgary respondents, only two of the six show significant differences between the two regions. For these Strathmore respondents are generally more aware of the water management issues than Calgary respondents.

Table 19: River Management Values

	<i>(% of respondents)</i>																			
	<i>RTMS</i>					<i>Lethbridge</i>					<i>Strathmore</i>					<i>Calgary</i>				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
A19: The government should be responsible for ensuring that water quality and quantity are good enough to ensure a healthy environment***	1	3	9	60	27	0	3	6	56	34	1	3	5	53	39	1	1	5	43	51
A21: The way we manage water in our rivers in Alberta is outdated and not in line with society's current values***	2	23	44	26	6	2	14	45	32	7	2	11	49	31	8	2	8	53	28	9
A26: I'm concerned that aquatic habitats in southern Alberta are not receiving enough protection***	2	18	26	41	13	2	12	26	47	14	0	13	20	49	18	0	8	29	46	16
A32: I trust the government to manage water in ways that are best for the environment**	10	28	22	34	6	11	35	17	32	6	9	29	21	35	6	10	27	17	35	10
A42: I am aware that water licenses can be transferred in Alberta***	-	-	-	-	-	-	-	-	-	-	10	23	33	28	5 [#]	14	22	42	18	4
A43: I expect that an increase in water transfers will harm rather than benefit the environment	-	-	-	-	-	-	-	-	-	-	1	6	40	44	10	0	7	38	43	12
A44: I expect that an increase in water transfers will harm rather than benefit Alberta's economy	-	-	-	-	-	-	-	-	-	-	2	12	52	28	6	1	13	53	27	6
A46: Market-based systems provide a good way of reallocating public goods such as water in accordance with the present and future needs of our province	-	-	-	-	-	-	-	-	-	-	9	26	47	15	3	12	27	43	16	1
A47: I expect that an increase in water transfers will harm rather than benefit Alberta's farmers	-	-	-	-	-	-	-	-	-	-	1	8	45	38	8 [#]	1	8	48	36	7
A48: I am aware of the conflict surrounding the amendment of irrigation district water licenses***	-	-	-	-	-	-	-	-	-	-	9	20	49	20	3	14	23	49	13	1
*** p<0.01, ** p<0.05, * p<0.10: Kruskal-Wallis equality-of-populations rank test																				
^1=strongly disagree, 2 = disagree, 3=neutral, 4=agree, 5=strongly agree.																				
#there is one missing observation																				

4.2.2 Factor analysis

The previous section demonstrates residents from the four locations perceive differently for many of the value statements regarding water. It is, however, difficult to generalize the differences as respondents may answer some of the value statements randomly and thus make them contain some noise and inconsistency. In order to eliminate the randomness and the inconsistent value

statements, we used factor analysis to identify those that could best represent the value dimensions people hold towards water.

Principal Components Factor Analysis was carried out. From the initial more than 40 value statements, 12 were used in the final factor analysis model. The Bartlett test of sphericity rejects the null hypothesis that variables are not inter-correlated at the 0.01 significance level and the Kaiser-Meyer-Olkin Measure of Sampling Adequacy for the model is 0.77, which indicates factor analysis of these 12 value statements is appropriate. Four factors with Eigenvalue greater than one are retained, with each explaining 25, 11, 11 and 10 percent of the variance, with a total of 57 percent. Factor loadings of each value statement are presented in Table 20. Factor loadings below 0.30 are not reported as they are considered as both statistically (Stevens, 2002; 294) and practically insignificant (Hair *et al.*, 1998; 111). A careful examination of Table 20 suggests that each construct represents a unique value dimension people hold towards water. For the first factor, the statements all represent the value of water for the environment and community in general; this factor is therefore named *environmental*. The second factor has significant loadings on the statements that relates to domestic use of water; hence this factor is named *domestic*. Statements that make up factor three represent water as a tradable *commodity* and therefore this factor is named commodity. The last statements represent the irrigation value of water that people use for the generation of income; hence *irrigation* is the name of the fourth factor.

Factor scores for each construct are predicted by Thompson's regression method³ (Thomson, 1951). In order to examine whether people from the four locations have different scores for each factor, a multivariate mean equality test is conducted on the factor scores for each factor. Results are presented in Table 21.

³ Each factor score will have a mean of zero and a standard deviation of one for the whole sample.

Table 20: Factor loadings of factor analysis

Statements	Environmental	Domestic	Commodity	Irrigation
A20: The environment's needs for water should be met before water is used for human economic purposes such as industry and agriculture	0.66			
A26: I'm concerned that aquatic habitats in southern Alberta are not receiving enough protection	0.78			
A33: I want future generations to be able to experience aquatic environments in southern Alberta that are healthier than the ones we have now	0.86			
A6: Using water to create green and lush public spaces adds more to my quality of life than leaving the water in the river		0.53		
A9: I use water for washing my vehicle even if doing so may harm the river where the water comes from		0.79		
A28: I enjoy having a lush green lawn and/or garden even if doing so may cause environmental harm to the river where the water comes from		0.78		
A3: I think that water is a commodity that individuals and private groups should be able to buy and sell			0.78	
A12: Buyers and sellers of water licences should be the ones who decide the price of water.			0.81	
A17: Water from rivers should be used to provide benefits to the whole community, not just to those who can afford to buy a water license			0.59	
A14: Irrigated agriculture is the most economically profitable use of water in the region				0.75
A22: I would rather see Alberta's economy grow through more irrigated agriculture as opposed to having more water in the rivers				0.42
A27: Irrigated agriculture produces locally grown, healthy food for me and my family				0.79
Proportion of Variance Explained	25%	11%	11%	10%
Determinant of the correlation matrix	0.165			
Bartlett test of sphericity (Chi2 ; p-value)	3514; 0.000			
Kaiser-Meyer-Olkin Measure of Sampling	0.77			

As Table 21 reveals, for two of the four factors, the means across four locations vary significantly, namely the environmental and irrigation factors. On a closer look, RTMS and Lethbridge residents have negative environmental factor scores while Strathmore and Calgary residents' scores are positive, indicating RTMS and Lethbridge residents regard the environmental value of water higher. For the irrigation factor, two rural township locations, RTMS and Strathmore have positive factor scores while two urban city locations, Lethbridge and Calgary have negative factor score. The ranking of the irrigation factor is also consistent with the urban to rural continuum from Calgary to RTMS.

Table 21: Average factor scores across four locations

	Environmental	Domestic	Commodity	Irrigation
<i>RTMS</i>	-0.212	0.042	0.024	0.210
<i>Strathmore</i>	0.090	0.006	0.048	0.030
<i>Lethbridge</i>	0.003	-0.059	-0.045	-0.059
<i>Calgary</i>	0.158	0.035	0.005	-0.162
<i>MV test (F stat)</i>	12.43***	1.24	0.80	12.51***

4.3. Findings - Policy statements

4.3.1 Government Role

This section compares the responses to the policy statements provided by respondents of four regions and also investigates whether any other demographic variables are associated with policy statements. The first set of policy statements deals with government regulation of water resources (Table 22). Significant difference is seen in all statements. Generally, residents in Lethbridge and Calgary appear to agree with more government involvement in water resource management than residents in the other two locations. All statement indicate that the level of disagreement increased gradually along the urban to rural continuum from 14 percent in Calgary to 19 percent in RTMS for C1, from 25 percent to 38 percent for C4, and from 17 percent to 26 percent for C6.

Table 22: Government Role

	<i>(% of respondents)</i>																			
	<i>RTMS</i>					<i>Lethbridge</i>					<i>Strathmore</i>					<i>Calgary</i>				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
C1: The government, rather than market forces, should decide who gets to use Alberta's water***	3	16	24	45	12	3	13	20	50	14	5	14	24	45	12	3	11	22	49	16
C4: If an irrigation district or municipality is not using all of the water it has been allocated, then the government should be able to take that water for environmental purposes without compensation***	8	30	15	40	8	4	24	19	44	9	6	27	26	34	7	3	22	24	41	10
C6: If water is to be traded among irrigation districts and/or municipalities, the government should set the price***	4	22	30	40	4	3	17	25	49	6	5	17	33	42	2	2	15	33	43	7
*** p<0.01, ** p<0.05. * p<0.10: Kruskal-Wallis equality-of-populations rank test																				
^1=strongly disagree, 2 = disagree, 3=neutral, 4=agree, 5=strongly agree.																				

We further explored whether age and household income are likely to be associated with people's opinions on these policy statements (Tables 23 and 24). Generally people's agreement with the Government role is associated with both age and household income. Older people are both more

likely to either strongly disagree or agree with C1: ‘The government, rather than market forces, should decide who gets to use Alberta's water’ and more likely to strongly disagree with C6: ‘If water is to be traded among irrigation districts and/or municipalities, the government should set the price.’

Table 23: Average age by Likert scale agreement of the Government role policy statements

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
C1: The government, rather than market forces, should decide who gets to use Alberta's water ***	58	55	56	58	58
C4: If an irrigation district or municipality is not using all of the water it has been allocated, then the government should be able to take that water for environmental purposes without compensation**	57	56	57	58	55
C6: If water is to be traded among irrigation districts and/or municipalities, the government should set the price **	59	56	56	58	56
*** p<0.01, ** p<0.05: Multivariate test on equal means					

People with higher incomes are significantly more likely to strongly agree with all three statements, while for C1 and C4 the findings indicate that people on lower incomes are more likely to strongly disagree (Table 24).

Table 24: Average household income (in thousands) by Likert scale of the Government role policy statements

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
C1: The government, rather than market forces, should decide who gets to use Alberta's water ***	58	63	57	61	64
C4: If an irrigation district or municipality is not using all of the water it has been allocated, then the government should be able to take that water for environmental purposes without compensation***	55	59	61	62	65
C6: If water is to be traded among irrigation districts and/or municipalities, the government should set the price	61	62	60	60	64
*** p<0.01: Multivariate test on equal means					

There is evidence that education level is associated with the agreement on the statements related to Environment’s rights (Tables 25, 26 and 27). Higher levels of education are associated with a higher level of agreement with all three policy statements.

Table 25: Two-way table (row frequency) of education and C1 (The government, rather than market forces, should decide who gets to use Alberta's water)

	Strongly Disagree	disagree	Neither Agree or Disagree	Agree	Strongly Agree
No certificate, diploma or degree	5	12	32	39	12
Secondary (high school) diploma or equivalency certificate	4	16	25	47	9
College or other non-university certificate or diploma (including apprenticeship or trade)	4	13	23	48	12
University - Bachelor's degree	3	12	19	49	17
University - Master's degree or doctorate	2	10	17	52	19
Pearson chi2(16) = 43.6503 Pr = 0.000					

Table 26: Two-way table (row frequency) of education and C4 (If an irrigation district or municipality is not using all of the water it has been allocated, then the government should be able to take that water for environmental purposes without compensation)

	Strongly Disagree	disagree	Neither Agree or Disagree	Agree	Strongly Agree
No certificate, diploma or degree	5	34	15	38	7
Secondary (high school) diploma or equivalency certificate	4	27	20	42	8
College or other non-university certificate or diploma (including apprenticeship or trade)	6	27	20	39	8
University - Bachelor's degree	7	23	20	39	11
University - Master's degree or doctorate	2	18	24	48	8
Pearson chi2(16) = 31.8852 Pr = 0.010					

Table 27: Two-way table (row frequency) of education and C6 (If water is to be traded among irrigation districts and/or municipalities, the government should set the price)

	Strongly Disagree	disagree	Neither Agree or Disagree	Agree	Strongly Agree
No certificate, diploma or degree	6	21	32	37	3
Secondary (high school) diploma or equivalency certificate	4	22	30	41	4
College or other non-university certificate or diploma (including apprenticeship or trade)	3	15	31	46	5
University - Bachelor's degree	3	18	29	44	6
University - Master's degree or doctorate	1	14	28	52	5
Pearson chi2(16) = 23.5936 Pr = 0.099					

4.3.2 Environment's Right

Divergence in opinions across the four locations is also seen for the second set of policy statements which are grouped as "Environment's Right", a category which has policies that, if implemented, would increase the supply of water available to the environment (Table 28). In all statements, we find Calgary respondents most likely to agree while RTMS respondents least likely to agree and most likely to disagree. All statement indicate that the level of agreement decreased gradually

along the urban to rural continuum from 49 percent in Calgary to 40 percent in RTMS for C2, from 59 percent to 50 percent for C8, from 41 percent to 31 percent for C9 and from 77 percent to 65 percent for C10. Compared Lethbridge and Strathmore respondents, their agreement or disagreement percentages with these statements are similar although the former appears slightly more disagreeable overall.

Table 28: Frequency of Environment’s Right

	<i>(% of respondents)</i>																			
	<i>RTMS</i>					<i>Lethbridge</i>					<i>Strathmore</i>					<i>Calgary</i>				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
C2: Private individuals and groups should be able to hold water licenses for environmental protection***	8	24	28	35	5	6	24	27	37	5	7	20	30	36	7	4	17	30	38	11
C8: Public funds should be used to improve irrigation systems only if the water that is saved is left in rivers***	4	21	25	44	6	3	20	24	46	8	3	17	24	49	7	2	13	27	51	8
C9: The government should buy water from current water license holders, such as irrigation districts, so that more water can be left in the river for the environment***	6	31	33	29	2	4	25	37	30	4	4	20	40	32	4	3	17	40	35	6
C10: Minimum flows of water should be set for all rivers, and only the water above those minimum flows should be available for economic purposes such as irrigation***	2	13	21	51	14	1	7	16	56	20	2	8	19	52	20	0	4	19	52	25
*** p<0.01, ** p<0.05. * p<0.10: Kruskal-Wallis equality-of-populations rank test																				
^1=strongly disagree, 2 = disagree, 3=neutral, 4=agree, 5=strongly agree.																				

Generally peoples’ level of agreement with environmental policy statements differs significantly depending on age and income (Tables 29 and 30). Younger people are significantly more likely to agree with statement C2: ‘Private individuals and groups should be able to hold water licenses for environmental protection’, C9: ‘The government should buy water from current water license holders, such as irrigation districts, so that more water can be left in the river for the environment’ and C10: ‘Minimum flows of water should be set for all rivers, and only the water above those minimum flows should be available for economic purposes such as irrigation’.

Table 29: Average age by Likert scale of the Environment’s Right Policy Statements

	Strongly Disagree	disagree	Neither Agree or Disagree	Agree	Strongly Agree
C2: Private individuals and groups should be able to hold water licenses for environmental protection ***	59	61	57	56	52
C8: Public funds should be used to improve irrigation systems only if the water that is saved is left in rivers***	59	58	56	58	53
C9: The government should buy water from current water license holders, such as irrigation districts, so that more water can be left in the river for the environment	58	57	57	57	53
C10: Minimum flows of water should be set for all rivers, and only the water above those minimum flows should be available for economic purposes such as irrigation ***	67	59	57	58	54
*** p<0.01: Multivariate test on equal means.					

People with higher income are significantly more likely to agree with policy statement C2: ‘Private individuals and groups should be able to hold water licenses for environmental protection’ and C10: ‘Minimum flows of water should be set for all rivers, and only the water above those minimum flows should be available for economic purposes such as irrigation’. These are the statements related to current water holders and private NGOs funding the environmental rights. On the other hand they are significantly less likely to agree with C9: ‘The government should buy water from current water license holders, such as irrigation districts, so that more water can be left in the river for the environment’. Regarding C8, even though the income levels of the five disagree-agree scales do not differ significantly, the income level of ‘strongly disagree’ is much larger than all the other four scales. This pattern may suggest that higher income households do not favour the idea of taxpayers funding the environmental rights.

Table 30: Average household income (in thousands) by Likert scale of the Environment’s Right Policy Statements

	Strongly Disagree	disagree	Neither Agree or Disagree	Agree	Strongly Agree
C2: Private individuals and groups should be able to hold water licenses for environmental protection***	56	58	60	63	65
C8: Public funds should be used to improve irrigation systems only if the water that is saved is left in rivers	65	61	60	60	61
C9: The government should buy water from current water license holders, such as irrigation districts, so that more water can be left in the river for the environment***	64	63	61	58	61
C10: Minimum flows of water should be set for all rivers, and only the water above those minimum flows should be available for economic purposes such as irrigation***	55	55	57	61	66
*** p<0.01 : Multivariate test on equal means.					

There is also evidence that education level is associated with the agreement on the statements related to Environment’s rights (Tables 31, 32 and 33). Higher levels of education are associated with a higher level of agreement with two of the three policy statements. C2: ‘Private individuals and groups should be able to hold water licenses for environmental protection’ (Table 31) and C10: ‘Minimum flows of water should be set for all rivers, and only the water above those minimum flows should be available for economic purposes such as irrigation’ (Table 33).

Table 31: Two-way table (row frequency) of education and C2 (Private individuals and groups should be able to hold water licenses for environmental protection)

	Strongly Disagree	disagree	Neither Agree or Disagree	Agree	Strongly Agree
No certificate, diploma or degree	9	32	31	27	1
Secondary (high school) diploma or equivalency certificate	7	24	30	34	6
College or other non-university certificate or diploma (including apprenticeship or trade)	7	22	28	37	6
University - Bachelor's degree	6	19	25	39	10
University - Master's degree or doctorate	3	16	32	42	8
Pearson chi2(16) = 43.6629 Pr = 0.000					

Table 32: Two-way table (row frequency) of education and C8 (Public funds should be used to improve irrigation systems only if the water that is saved is left in rivers)

	Strongly Disagree	disagree	Neither Agree or Disagree	Agree	Strongly Agree
No certificate, diploma or degree	4	18	20	52	5
Secondary (high school) diploma or equivalency certificate	3	17	28	49	5
College or other non-university certificate or diploma (including apprenticeship or trade)	3	17	24	49	7
University - Bachelor's degree	3	20	25	42	10
University - Master's degree or doctorate	1	20	28	44	7
Pearson chi2(16) = 25.2768 Pr = 0.065					

Table 33: Two-way table (row frequency) of education and C10 (Minimum flows of water should be set for all rivers, and only the water above those minimum flows should be available for economic purposes such as irrigation)

	Strongly Disagree	disagree	Neither Agree or Disagree	Agree	Strongly Agree
No certificate, diploma or degree	2	8	20	56	14
Secondary (high school) diploma or equivalency certificate	1	9	20	56	15
College or other non-university certificate or diploma (including apprenticeship or trade)	1	9	19	53	17
University - Bachelor's degree	1	5	19	50	24
University - Master's degree or doctorate	1	5	13	52	29
Pearson chi2(16) = 40.6970 Pr = 0.001					

4.3.3 Irrigators' Rights

The third set of policies involves the rights of irrigators to water (Table 34). All statements show significant differences. C3 states that all water licenses must be honoured regardless of the circumstances around their issuance, and C5 indicates that public funds should be invested in improving water efficiency, while B7 states that water saved through more efficient practices should be allocated to economic activity. Calgary respondents are significantly more likely to agree with C5 than respondents from other regions while RTMS respondents are more likely to agree with C3 and C7 than respondents from other regions. Statement C3 and C7 indicate that the level of agreement increased gradually along the urban to rural continuum from 35 percent in Calgary to 49 percent in RTMS for C7 and from 20 percent to 35 percent for C3.

Table 34: Frequency of Irrigators' Water Rights

	<i>(% of respondents)</i>																			
	<i>RTMS</i>					<i>Lethbridge</i>					<i>Strathmore</i>					<i>Calgary</i>				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
C3: All water licences, no matter when they were issued or for what purpose, must be honoured***	4	37	24	30	5	9	44	23	20	4	7	35	32	21	5	7	37	35	16	4
C5: Public funds should be used to help larger water users (irrigators, industries and municipalities) to become more water efficient***	8	32	12	42	6	8	29	15	42	6	6	23	20	44	7	5	20	19	47	8
C7: Water that is saved through improved water use efficiency should be used to increase economic activity***	3	20	27	44	5	3	28	30	35	4	2	23	35	38	3	3	23	40	32	3
*** p<0.01, ** p<0.05, * p<0.10: Kruskal-Wallis equality-of-populations rank test																				
^1=strongly disagree, 2 = disagree, 3=neutral, 4=agree, 5=strongly agree.																				

Generally people's agreement with the statements related to policy options protecting or strengthening Irrigators rights varies significantly with age (Table 35). Older people are more likely to agree with policy statement C3: 'All water licenses, no matter when they were issued or for what purpose, must be honoured' and C7: 'Water that is saved through improved water use efficiency should be used to increase economic activity'. On the other hand, younger people are more likely to agree with C5: 'Public funds should be used to help larger water users to become more water efficient'.

Table 35: Average age by Likert scale of the Irrigators' Right policy statements

	Strongly Disagree	disagree	Neither Agree or Disagree	Agree	Strongly Agree
C3: All water licenses, no matter when they were issued or for what purpose, must be honoured	56	57	56	58	60
C5: Public funds should be used to help larger water users (irrigators, industries and municipalities) to become more water efficient ***	58	58	57	57	52
C7: Water that is saved through improved water use efficiency should be used to increase economic activity ***	55	55	57	60	56
*** p<0.01: Multivariate test on equal means					

Only one of the three statements had significant differences when it comes to income (Table 36). Statement C7 indicating that saved water should be used to expand economic activity. Higher

income people are significantly more likely neither to agree nor disagree while lower income people tend to agree.

Table 36: Average household income (in thousands) by Likert scale of the Irrigators’ Right policy statements

	Strongly Disagree	disagree	Neither Agree or Disagree	Agree	Strongly Agree
C3: All water licenses, no matter when they were issued or for what purpose, must be honoured	64	61	60	60	60
C5: Public funds should be used to help larger water users (irrigators, industries and municipalities) to become more water efficient	57	60	59	62	61
C7: Water that is saved through improved water use efficiency should be used to increase economic activity ***	60	61	63	58	60
*** p<0.01: Multivariate test on equal means					

People’s agreement with the statements related to policies designed to protect Irrigators’ rights varies significantly with education level. People with higher education level are more likely to agree with Statement C5: ‘Public funds should be used to help larger water users (irrigators, industries and municipalities) to become more water efficient’(Table 38). Conversely, Statement C3: ‘All water licenses, no matter when they were issued or for what purpose, must be honoured’ and Statement C7: ‘Water that is saved through improved water use efficiency should be used to increase economic activity’ is statistically associated with a lower educational attainment (Table 37 and Table 39).

Table 37: Two-way table (row frequency) of education and C3 (All water licenses, no matter when they were issued or for what purpose, must be honoured)

	Strongly Disagree	disagree	Neither Agree or Disagree	Agree	Strongly Agree
No certificate, diploma or degree	6	34	25	31	3
Secondary (high school) diploma or equivalency certificate	6	35	32	24	3
College or other non-university certificate or diploma (including apprenticeship or trade)	7	39	26	22	6
University - Bachelor's degree	10	39	27	21	3
University - Master's degree or doctorate	5	46	28	16	4
Pearson chi2(16) = 31.3384 Pr = 0.012					

Table 38: Two-way table (row frequency) of education and C5 (Public funds should be used to help larger water users (irrigators, industries and municipalities) to become more water efficient)

	Strongly Disagree	disagree	Neither Agree or Disagree	Agree	Strongly Agree
No certificate, diploma or degree	8	30	16	38	7
Secondary (high school) diploma or equivalency certificate	7	30	18	40	5
College or other non-university certificate or diploma (including apprenticeship or trade)	8	29	16	39	7
University - Bachelor's degree	5	23	16	49	7
University - Master's degree or doctorate	4	21	15	54	6
Pearson chi2(16) = 32.8713 Pr = 0.008					

Table 39: Two-way table (row frequency) of education and C7 (Water that is saved through improved water use efficiency should be used to increase economic activity)

	Strongly Disagree	disagree	Neither Agree or Disagree	Agree	Strongly Agree
No certificate, diploma or degree	1	17	29	48	5
Secondary (high school) diploma or equivalency certificate	2	24	27	42	5
College or other non-university certificate or diploma (including apprenticeship or trade)	2	22	31	39	5
University - Bachelor's degree	4	27	36	31	3
University - Master's degree or doctorate	4	30	37	26	2
Pearson chi2(16) = 45.3597 Pr = 0.000					

4.4. Value statements vs Policy statements

This section explores how people’s perception of value statements relates to their level of agreement with policy statements. Specifically, we will test correlations between: i) the statements related to the Government role and the River management values (A19 and A32⁴); ii) the statements related to the Environment’s right and the Environment water values (A1, A8, A13, A20, A33 and A43); and iii) the statements related to irrigator’s water right and the Human centred water values (A17, A18 and A23) and the River livelihood values (A3, A12, A14 and A22).

The relationships between each of the Government role statements (C1, C4 and C6) and A19 are statistically significant at the 0.01 level. Regarding A32, it is significantly related to C1 and C6. Hence the correlation between people’s value on river management issues and their opinion on the

⁴ Only the value statements that have relevance for the respective policy are selected for testing.

government's role in managing water is relatively strong. Specifically if people trust the government and believe the government should be responsible for ensuring enough water for a healthy environment, they are also more supportive for the government to decide water allocation and water price.

Table 40: Spearman correlation between Government role policy statements and River management values

	C1: The government, rather than market forces, should decide who gets to use Alberta's water	C4: If an irrigation district or municipality is not using all of the water it has been allocated, then the government should be able to take that water for environmental purposes without compensation	C6: If water is to be traded among irrigation districts and/or municipalities, the government should set the price
A19: The government should be responsible for ensuring that water quality and quantity are good enough to ensure a healthy environment	0.2859***	0.1449***	0.1999***
A32: I trust the government to manage water in ways that are best for the environment	0.0938***	0.019	0.1547***
*** p<0.01			

Similarly, people who value water for its environment and conservation aspects are more agreeable with the policy statement related to Environment's right (Table 41).

Table 41: Spearman correlation between Environment's right policy statements and Environment water values

		C2: Private individuals and groups should be able to hold water licenses for environmental protection	C8: Public funds should be used to improve irrigation systems only if the water that is saved is left in rivers	C9: The government should buy water from current water license holders, such as irrigation districts, so that more water can be left in the river for the environment
Environment water values	A1	0.1198***	0.2255***	0.1721***
	A8	-0.0223	0.0539	0.0449
	A13	0.0995***	0.2341***	0.2148***
	A20	0.1083***	0.2078***	0.1972***
	A33	0.2017***	0.2595***	0.2866***
	A43	0.0311	0.1798***	0.1019***
*** p<0.01				
A1: A healthy, functioning aquatic environment should always take priority over human uses of water. A8: Water in a river has value simply because of all of the benefits and services it gives to us. A13: New subdivisions should not be allowed in this region if supplying the water they need would cause harm to the environment. A20: The environment's needs for water should be met before water is used for human economic purposes such as industry and agriculture. A33: I want future generations to be able to experience aquatic environments in southern Alberta that are healthier than the ones we have now. A43: I expect that an increase in water transfers will harm rather than benefit the environment.				

With two exceptions (between A18 and C5 and between A23 and C5) we can see that people who value water for its use value are also more agreeable with policy statements related to protecting Irrigators' right (Table 42).

Table 42: Spearman correlation between Irrigator's right policy statements and Human centred water values / River livelihood values

		C3: All water licenses, no matter when they were issued or for what purpose, must be honoured	C5: Public funds should be used to help larger water users (irrigators, industries and municipalities) to become more water efficient	C7: Water that is saved through improved water use efficiency should be used to increase economic activity
Human centred water values	A17	-0.1161***	0.0563**	-0.0437*
	A18	0.1622***	0.025	0.2000***
	A23	0.2269***	0.0005	0.3215***
River livelihood values	A3	0.2458***	0.0551**	0.1684***
	A12	0.2494***	0.0468**	0.1517***
	A14	0.1926***	0.0582**	0.2189***
	A22	0.2407***	0.0526**	0.3187***
*** p<0.01, ** p<0.05, * p<0.1.				
A17: Water from rivers should be used to provide benefits to the whole community, not just to those who can afford to buy a water licence. A18: People have the right to modify the natural environment to meet their economic needs. A23: Water should be made available for economic uses before the environment.				
A3: I think that water is a commodity that individuals and private groups should be able to buy and sell. A12: Buyers and sellers of water licenses should be the ones who decide the price of water. A14: Irrigated agriculture is the most economically profitable use of water in southern Alberta. A22: I would rather see Alberta's economy grow through more irrigated agriculture as opposed to having more water in the rivers.				

5. Discussion

The analysis shows that some distinct patterns are emerging with how residents from the four locations view water resources. Five groups of the water attitudinal statements were created: Environmental Water Values; General Water Attitudes; Human-centred Water Values; River Livelihood; and River Management. Responses to these attitudinal statements indicate significant differences across the four locations.

Factor analysis was used to reduce the number of attitudinal statements and identify a set of constructs that represent people's value towards water. Four factors were identified and each represents an important value construct reflecting a unique aspect of the values that residents hold towards water, namely: environment, domestic, commodity, and irrigation. Comparing the factor scores for these values constructs across the four locations, we find that the residents align significantly different in a number of ways: : i) residents in Calgary align most with the environmental value construct s while residents in RTMS align the least; ii) the four locations do not place significantly different values on the domestic use value construct and the commodity value construct,; iii) residents in RTMS align the most with the irrigation value construct while residents in Calgary align the least. The difference between Calgary and RTMS reflects their position on the urban to rural gradient, both in terms of their dependence on irrigation as the economic engine and creator of jobs and their composition of urban and rural residents. Differences between Lethbridge and Strathmore are not obvious although Lethbridge align with both environmental and irrigation value slightly higher than Strathmore.

From our results to policy statements, we see that Lethbridge and Calgary residents tend to agree more strongly on enhanced government regulation of water markets, since all policy statements in the group entitled "Government Role" had higher agreement among Lethbridge and Calgary

respondents. Calgary residents are also more in favour of the environment's right policy orientation. Residents in Strathmore generally are not in favour of policy statements favouring the environment.

Residents in RTMS tend to agree more strongly with two of the policy statements in the "Irrigators Right" group. They feel more strongly than residents in other three locations that all water licenses should be honoured and that water saved through increased efficiency should be directed to economic uses.

Our findings regarding the policy orientations seem to indicate that there is indeed a greater difference among residents in the four locations regarding the use and availability of water for ecosystems; while RTMS residents are more inclined to agree that water should be used for economic purposes and its availability for agriculture and lush, green public spaces supersedes environmental requirements.

6. Conclusion

The report has investigated the differences in attitudes towards water issues across the four locations (Raymond/Taber/Magrath/Sterling (RTMS), Lethbridge, Strathmore and Calgary) in Southern Alberta, Canada. As economic growth and changing community values with respect to water and the environment contribute to escalate demand on water resources, water transfers from rural to urban areas present challenges for many governments around the world. The existing literature has found that differences in perceptions, attitudes, environmental behaviours and demographic characteristics all contribute to a wide variation in attitudes towards water transfers. The total economic value of water is made up of direct and indirect use values, and values accrue on-farm and off-farm. Some literature suggests that although urban residents are more environmentally concerned than those living in rural areas (which has been attributed to education, access to information, income, occupation and ‘deprivation theory’), rural residents may behave more environmentally responsibly. Other literature has found no evidence of differences between urban and rural attitudes towards conservation issues.

Our study investigated 1,985 responses from Calgary, Strathmore, Lethbridge and its surrounding small towns largely dependent upon irrigation. We classified these locations along an urban to rural gradient, namely 1) Calgary; 2) Lethbridge; 3) Strathmore and 4) RTMS. The questionnaires collected information on rural and urban status, socio-demographic data and a wide range of value statements and policy statements. In the demographics of our samples, we found the following statistical differences (at least significant at the ten per cent level) across the four locations: household income; education levels; occupation composition; fishing activities; canoeing/kayaking activities; viewing/enjoying scenery activities; walking/hiking activities; hunting activities; camping activities; proportion of respondents who resided in Southern Alberta; proportional of

respondents who live mostly in urban area, proportion of respondents who were raised in urban area; and proportion of respondents who are currently living in urban area.

In general, respondents in Calgary and Strathmore place a higher value on water for the environment while RTMS and Lethbridge respondents place a lower value. Respondents in Calgary and Lethbridge value water for irrigation less than respondents in RTMS and Strathmore. Regarding water value for domestic use and commodity, interestingly there is no significant difference perceived by respondents from the four locations.

For the views on policy statements, Calgary and Lethbridge respondents see a much larger role for the government in water policy than respondents from RTMS and Strathmore, while RTMS respondents agree more strongly with policy statements that assert irrigators' water rights.

Our findings seem to indicate that there is indeed a greater concern by residents across the four locations regarding the use and availability of water for ecosystems. This is possibly due to the differences in rural and urban composition in the four locations, or other socio-economic profiles of the four locations, such as income, education, occupation, etc. Therefore, further more sophisticated research will be needed to more fully explore the drivers of people's values – this is forthcoming under this research project.

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