



**The ethnic and cultural correlates of water  
consumption in a pluralistic social context – the  
Sydney Metropolitan Area**

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## **Abstract**

Water resources are subject to increasing stress in many urban areas. Managing water consumption and water supply are key issues for the sustainable development of cities. Despite a growing realisation among water managers and academics that water demand conforms to routines and internalized norms, which are developed within the social and cultural background of consumers, little research attention has been given to the possible impacts that the ethnic and cultural diversity of a population may have on water consumption.

This thesis aimed to explore the ethnic and cultural correlates of water use, bridging the information gap regarding water use in culturally diverse cities. Quantitative and qualitative research techniques were employed to analysis water use and conservation related attitudes and behaviors among three selected ethnic communities (Australian, Chinese and Korean communities) in the Sydney Metropolitan Area. The study identified that disparities and differences exist across the ethnic groups in pro-environmental water attitudes, behaviours and daily water use practices. The influence of ethnic factors on pro-conservational behaviours and water consumption was found to be significant, even greater than socio-demographic factors such as household size and income. The diverse coverage of water issues in English and ethnic media, plus the different habits, routines and considerations relating to water use across ethnic groups, were found to be important in understanding the ethnic effects on water use. The results highlighted the importance of including ethnicity and cultural sensitivity issues into the process of decision making in regards to environmental management.

This research is significant to understand everyday practices of water use by ethnic groups, and has important implications for water planning and management with regards to cultural sensitivity and equal opportunity.

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## Contents

List of Figures .....	IX
List of Tables .....	XI
Appendices.....	XIV
Glossary .....	XV
INTRODUCTION .....	1
CHAPTER 2 LITERATURE REVIEW .....	7
2.1 Introduction .....	7
2.2 Sustainability .....	7
2.2.1 Towards sustainability .....	7
2.2.2 Towards sustainable cities .....	10
2.2.3 Towards sustainable water use and management in urban areas.....	12
2.2.4 Cultural and ethnic sensitivity in water management.....	16
2.3 Environmental citizenship.....	19
2.3.1 What is environmental citizenship .....	19
2.3.2 Environmental citizenship: understanding and prompting the environmental activism of a community .....	21
2.3.3 Ethnicity, environment and environmental citizenship .....	22
2.4 Water use, ethnicity and culture.....	25
2.4.1 Research gap: ethnicity also matters .....	25
2.4.2 Factors determining domestic water consumption .....	29
2.4.3 Ethnic variation in environmental concerns, behaviours and rationales .....	39
2.5 Summary .....	57
CHAPTER 3 RESEARCH DESIGN AND METHODOLOGY .....	60
3.1 Introduction .....	60
3.2 Research objectives and questions .....	60
3.3 Research design and framework .....	61
3.3.1 Study area and target population groups .....	61
3.3.2 Methodology framework .....	66
3.3.3 Primary and secondary data sources.....	68
3.3.4 Sampling strategy .....	68

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3.4 Household questionnaire survey .....	71
3.4.1 Questionnaire design .....	72
3.4.2 Questionnaire survey .....	73
3.4.3 Questionnaire data analysis methods.....	77
3.5 Ethnicity and water consumption.....	82
3.5.1 Data Sources .....	82
3.5.2 Analysis Methods .....	83
3.6. Qualitative study: focus groups, interviews and cultural probes .....	87
3.6.1 Focus groups.....	87
3.6.2 Semi-structured interviews.....	88
3.6.3 Practice observation (cultural probe).....	89
3.6.4 Qualitative data collection and process .....	90
3.7 Media study: the print media coverage of water issues across language divides .....	92
3.7.1 Research purpose of this part of the study.....	92
3.7.2 Print media selection and material collection.....	94
3.7.3 Analysis Methods: .....	96
3.8 Conclusion.....	98
CHAPTER 4      QUANTITATIVE RESULTS .....	99
4.1 Introduction .....	99
4.2 Descriptive analysis of water use behaviour, perceptions, challenges and opportunities.....	99
4.2.1 Familiarity with and perceptions of Sydney’s water issues among ethnic groups .....	99
4.2.2 Incentives and challenges .....	108
4.2.3 Information sources and the influence of language.....	111
4.2.4 Perceptions of conservation strategies, water pricing .....	117
4.3 The influence of ethnicity on water use related knowledge, attitudes and behaviour .....	120
4.3.1 Comparing knowledge, attitudes and self-reported behaviour across ethnicities.....	120
4.3.2 Effects of ethnicity on knowledge, attitude, and pro-conservational behaviour .....	123

---

4.3.3 The magnitude of effects that ethnic backgrounds have on pro-conservational behaviour .....	129
4.3.4 Within group variations – who are more active in pro-conservational behaviour? .....	135
4.3.5 The role of acculturation in reducing ethnic difference .....	136
4.4 Comparing water use practices across ethnic groups.....	141
4.4.1 Dishwashing and dishwasher.....	142
4.4.2 Doing laundry and using a washing machine.....	143
4.4.3 Bathing and Showering .....	144
4.4.4 Watering the garden and other outdoor water-use activities .....	148
4.4.5 Reusing and recycling grey water .....	149
4.5 The effects of ethnic status on per capita water usage .....	150
4.5.1 Results for the summer period.....	150
4.5.2 Results for the winter period .....	153
4.5.3 Ethnic status and between-season water use variation .....	157
4.6 Conclusion.....	158
CHAPTER 5           QUALITATIVE AND MEDIA STUDY RESULTS.....	160
5.1 Introduction.....	160
5.2 Qualitative understanding of diverse water use across ethnic groups.....	160
5.2.1 Diverse water-use practices across ethnicity .....	160
5.2.2 Vernacular sustainable practices- saving water.....	167
5.2.3 Incentives: traditional virtues, education and citizen obligations.....	170
5.2.4 Challenges faced when undertaking water conservation activities .....	171
5.3 Media and ethnicity: the print media coverage of water issues across language divides .....	177
5.3.1 Varied significance of coverage, geographic scope, temporal distribution of coverage and theme coverage.....	178
5.3.2 Diverse frames of water reporting across language divides .....	185
5. 4 Conclusion.....	196
CHAPTER 6       DISCUSSION.....	197
6.1 Introduction .....	197
6.2 Ethnic disparities in attitudes and pro-conservational behaviour.....	197

---

6.2.1 Disparities in knowledge and perceptions of water issues .....	198
6.2.2 Variations between groups' concerns about water and pro-conservational behaviour towards water conservation .....	199
6.2.3 Culturally diverse water use practices/habits .....	202
6.2.4 Ethnic effects of capital water consumption.....	205
6.3 Understanding ethnic differences and disparities in knowledge, perception, attitudes and behaviour.....	206
6.3.1 Understanding the disparities in concerns about water .....	206
6.3.2 Reasons behind the ethnic differences in pro-conservational behaviour ..	222
6.3.3 Understanding the ethnic differences in daily water practices .....	227
6.4 Acculturation and the ethnic differences in water knowledge, attitudes, behaviour and water consumption.....	232
6.4.1 Knowledge, attitudinal and behavioural change in the process of acculturation .....	232
6.4.2 Ethnic disparity change within acculturation .....	233
6.4.3 The influence of acculturation-related factors on water consumption .....	236
CONCLUSION.....	239
7.1 Reviewing the aim and conduction of the study .....	239
7.2 Key findings .....	240
7.3 Potentials, challenges, opportunities and implications to engaging ethnic communities .....	247
7.4 Limitations and Future research.....	255
References.....	259



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## List of Figures

Figure 2. 1 Factors behind domestic water use.....	38
Figure 2. 2 Causal model of values, environmental concerns and behaviour.....	40
Figure 3. 1 Methodology framework.....	67
Figure 3. 2 The geographic locations of selected CCD samples .....	71
Figure 3. 3 Selected months for analysis .....	84
Figure 4. 1 Perceptions of Sydney’s water supply situation in the long run by ethnicity (N=299) Q2 .....	100
Figure 4. 2 Participants’ perceptions of Sydney’s water quality and quantity compared to those of their birth country Q3 .....	101
Figure 4. 3 Respondents’ perceptions of their knowledge about where their drinking water came from, water pricing, and the reuse of grey water Q6.....	102
Figure 4. 4 Perceptions of Sydney’s main drinking water source by ethnicity Q19 .	103
Figure 4. 5 Respondents’ judgement of three water related statements, by ethnicity, Q20 .....	105
Figure 4. 6 Percentage of respondents willing to change their behaviour to reduce water use Q11; and, how much water do they feel they can save q11b.....	106
Figure 4. 7 Responses vis-à-vis which aspects of water use could be further reduced, by ethnicity q11a .....	107
Figure 4. 8 Responses to water-use behaviour change since moving to Sydney, by ethnicity Q9 .....	108
Figure 4. 9 Reasons/ incentives (a) and main reason/incentive (b) for households to undertake water-saving actions, by ethnicity Q10b – q10c.....	110
Figure 4. 10 Challenges (a) and main challenges (b) for undertaking water-saving action, by ethnicity Q10d – q10e.....	112
Figure 4. 11 Sources of information about water issues, by ethnicity (a) and the main information source, by ethnicity (b) Q4 - q4a .....	115
Figure 4. 12 Preferred sources for receiving information about water conservation, by ethnicity q17a .....	116
Figure 4. 13 Language for received information (a) and preferred language for receiving information, by ethnicity (b) Q16b and q17c .....	117
Figure 4. 14 Perceptions of selected water conservation strategies, by ethnic groups Q12 .....	118
Figure 4. 15 Support for government initiatives for securing water supply, by ethnicity Q14 .....	119
Figure 4. 16 Perceptions of whether the current pricing encouraged conservation, by ethnic groups Q13.....	119

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Figure 4. 17 Box plots of the measures of knowledge, attitudes and self-reported behaviour, by ethnicity .....	121
Figure 4. 18 Standardised coefficients between self-reported water-saving behaviour and each of influencing factors.....	131
Figure 4. 19 Box plots presenting the frequency (times per week) of doing laundry using a washing machine across ethnic groups .....	144
Figure 5. 1 The process of washing dishes by hand (developed based on descriptions provided by focus groups, interview participants and the images that were provided by participants in cultural probes) .....	161
Figure 5. 2 Households use of tank water or recycled grey water for watering gardens or other outdoor activities (pictures provided by cultural probe participants, see Chapter 3, Section 3.6.3 for details about the cultural probe research approach). .....	168
Figure 5. 3 Collecting kitchen water to water plants; collecting and storing grey water using a bucket or other big container, and using the grey water to flush the toilet (provided by Chinese cultural probe participants) .....	170
Figure 5. 4 Distribution of water articles by newspaper from December 2011 to December 2012.....	181
Figure 5. 5 Correspondence analysis of themes and newspapers .....	184
Figure 5. 6 Correspondence analysis of frames and newspapers.....	195

---

## List of Tables

Table 3. 1 Questionnaires distributed and received .....	75
Table 3. 2 Coding method for the variable of ethnicity .....	78
Table 3. 3 Qualitative studies participation summary and coding method.....	91
Table 3. 4 Key characteristics of the five selected newspapers .....	95
Table 3. 5 Coding frame used for newspaper analysis .....	97
Table 4. 1 Heard of Sydney Water Q18.....	103
Table 4. 2 Do you know how much water your household uses on average? .....	105
Table 4. 3 Perceptions of household water usage compared to the average of the same type of households in Sydney, by ethnicity .....	106
Table 4. 4 Responses to whether water-saving action was undertaken in the past few years in Sydney, by ethnicity.....	107
Table 4. 5 Willing to know more about how to achieve water conservation, by ethnicity Q17 .....	113
Table 4. 6 Responses to whether they had received any information about water conservation in Sydney, by ethnicity Q16.....	113
Table 4. 7 Responses to awareness of conservation programs in Sydney, by ethnicity Q15 .....	113
Table 4. 8 Knowledge, attitude and self-reported behaviour by ethnicity.....	120
Table 4. 9 Pearson correlation between variables.....	124
Table 4. 10 Ethnic effects of knowledge, attitudes and self-reported behaviour – Results of three model regressions of each selected dependent variable on ethnicity and other influence factors .....	128
Table 4. 11 Comparing the magnitude of effects of ethnic variables self-reported water saving actions with selected socio-economic, housing and location factors and other factors. (Backward multi-regression of self-reported water saving actions on ethnic status).....	130
Table 4. 12 Results of multi-regression analysis of self-reported behaviour on 12 selected variables .....	131
Table 4. 13 Results of regression analysis of self-reported behaviour on ethnicity with each variable controlled individually .....	132
Table 4. 14 Testing the coefficient change of ethnic variables while each selected variable was entered in the regression model .....	134
Table 4. 15 The mediation effect of general knowledge and perception-based dispositional attitude on ethnic effects (tested based on the Product of Coefficient method).....	134

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Table 4. 16 Results of backward multi-regression analysis of self-reported water saving actions on selected socio-economic variables, indicators of housing and location, knowledge, attitudes and perceptions, as well as other variables for survey respondents .....	137
Table 4. 17 The effects of years lived in Sydney and English proficiency on respondents' knowledge, attitudes and behaviour regarding water conservation in each group.....	138
Table 4. 18 Chinese/Australian differences in knowledge, attitudes and behaviour, and the influence of acculturation-related factors on the difference (Regression analysis of knowledge, attitude and behaviour on ethnicity and selected factors) .....	140
Table 4. 19 Korean/Australian differences in knowledge, attitudes and behaviour, and the influence of acculturation-related factors on the difference (Regression analysis of knowledge, attitudes and behaviour on ethnicity and selected factors) .....	141
Table 4. 20 Others/Australian differences in knowledge, attitudes and behaviour (Regression analysis of knowledge, attitudes and behaviour on ethnicity).....	141
Table 4. 21 Percentage of respondents having a dishwasher at home, dishwashing methods, and frequency of using dishwasher, by ethnicity .....	143
Table 4. 22 Percentage of respondents having a washing machine at home, washing methods, and frequency of using washing machine, by ethnicity .....	143
Table 4. 23 Ownership of bath and shower facilities, by ethnicity.....	144
Table 4. 24 Bathing frequency (tubs per week), by ethnicity .....	145
Table 4. 25 Average individual showering frequency .....	146
Table 4. 26 Average time spent for single shower.....	146
Table 4. 27 Average total showering minutes per week per person .....	146
Table 4. 28 Results of multi-model regression analysis of shower time (single shower) and frequency on ethnicity and selected demographic factors .....	147
Table 4. 29 Ownership of gardens, plants on balconies, and watering activities, by ethnicity .....	148
Table 4. 30 Watering time and frequency by ethnicity (summer and winter) .....	149
Table 4. 31 Percentage of respondents who reuse and recycle grey water by ethnicity .....	149
Table 4. 32 Results of regression analysis of summer per capita daily water consumption on ethnic variables .....	150
Table 4. 33 Results of ordinary least square regression and backward regression of per capita daily water consumption in summer periods of selected socio-economic variables.....	151

---

Table 4. 34 Results of Two-model Regression analysis of summer per capita daily water consumption on ethnic status and socio-economic factors.....	152
Table 4. 35 Results of regression analysis of per capita water use for summer period on ethnic variables with each of the selected variables added into the regression .....	153
Table 4. 36. Results of regression analysis of winter per capita daily water consumption on ethnic status.....	154
Table 4. 37 Results of ordinary least square regression and backward regression of per capita daily water consumption in winter periods on selected socio-economic variables.....	155
Table 4. 38 Results of two-model regression analysis of winter per capita daily water consumption on ethnic status and socio-economic factors.....	156
Table 4. 39 Results for regression analysis of per capita water use for winter period on ethnic variables with each of the selected variable added in the regression.....	157
Table 4. 40 Results of backward regression analysis of per capita daily water consumption variation between summer and winter on population and housing variables.....	157
Table 5. 1 Coverage of water articles across five newspapers .....	178
Table 5. 2 Distribution of water articles across scopes within newspaper of each language.....	179
Table 5. 3 Timeline of the main water issues in Sydney and the NSW region, 2011-2012.....	180
Table 5. 4 Coverage of water issues (theme) across five newspapers .....	183
Table 5. 5 Number and ratio of articles with various frames.....	193

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## Appendices

Appendix 1: A summary of selected CCDs for household survey and questionnaire distribution methods

Appendix 2: Household questionnaire sample in three languages (English, Chinese and Korean)

Appendix 3: Household survey envelope sample

Appendix 4: A summary of characteristics of questionnaire respondents

Appendix 5: Principle component analysis on the attitude measurements

Appendix 6: Mediation effects analysis

Appendix 7: Water records obtained from the Sydney Water

Appendix 8: Linking CCDs and SA1s for water data analysis (the relative positional relationship between the 14 CCDs and 35 SA1s)

Appendix 9: Variables derived for analysis of ethnic effects on per capita water usage

Appendix 10: Topics for the semi-structured interview

Appendix 11: Practice observation participant information statement

Appendix 12: Focus group invitation letter

Appendix 13: Interview invitation letter, interview participant information statement

Appendix 14: A copy of water bill for apartment in Sydney

Appendix 15: A copy of water bill for house dwellers in Sydney

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## Glossary

There are a number of key terms are used in this paper. For the purposes of this article, a definition and/or explanation of each key term is provided. This glossary provides an indication of e how these terms are used and interpreted within the paper.

<b>Culture</b>	Culture refers to a way of life underpinned by particular values and traditions.
<b>Cultural probe</b>	Cultural probe is a qualitative data collection method, which contains ‘cultural probes’ tool pack (e.g., camera, photography guidelines, note book and fridge magnet) that was designed by researchers, and distributed to all participants, inviting them to self-record information for a certain period of time.
<b>Environmental citizenship</b>	Environmental citizenship is a new form of citizenship which extends the entitlements and obligations shared by citizens to the environmental context. The rights and responsibilities defined by environmental citizenship transcend generations, national boundaries, as well as public/private spheres.
<b>Ethnic effect</b>	Ethnic effect refers to the effect (coefficient) of ethnicity (being of ‘Australian’, Chinese, Korean or ‘Others’) on each variable examined in regression analyses.
<b>Ethnic group</b>	An ethnic group is defined as a group of people who share a certain common ethnicity
<b>Ethnic minority</b>	Ethnic minorities are of or relating to members of the Australian community who are migrants or the descendants of migrants and whose first language is not English.
<b>Ethnicity</b>	Ethnicity is described as a social classification of people based upon their shared cultural characteristics and heritage.
<b>Virtue of frugality</b>	In terms of natural resources, it refers to the virtue of being frugal, prudent in consumption and avoiding waste of resources (e.g., food, water and energy).
<b>Sustainable development &amp; sustainability</b>	Sustainable development can be understood as a manner of development, in which the economic and social well-being and the protection of environment are balanced. Equity should be achieved in all aspects, including inter-generation, intra-generation, inter-species, trans-frontier and participation, are pursued. Sustainability can be regarded as the ideal situation and condition that this development can achieve.





## INTRODUCTION

Managing water consumption and water supply are key issues for Australian cities, especially the challenge of securing water supplies for the country's increasingly urbanized population. Water resources are subject to increasing stress as a result of the interacting effects of population growth, economic development, erratic precipitation and recurrent extreme weather events, e.g., droughts and floods (Dai, 2011; Trenberth, 2011). Water scarcity problems are projected to increase concomitant with climate change at a global level (Intergovernmental Panel on Climate Change, 2014), a prospect supported by regional scale findings in Australia (Barron et al., 2011; Howe et al., 2005; Water Services Association of Australia, 2012). The high water consumption level of individuals and households adds to the water stress issue in urban areas<sup>1</sup>; to cope with such stress, sustainable water management is required. A range of demand-side management approaches, which focus on enhancing water efficiency and reducing water consumption, have been introduced by scholars and policy makers to achieve sustainable water use.

Domestic water demand management depends on detailed knowledge of the determinants and influence factors behind household water consumption. Policy makers and program designers can use this information as a basis to develop instruments that can both a positive and effective influence on water demand. To this end, many studies have and are investigating, the variance in water consumption and conservation at city, household and individual levels. Factors associated with variances in domestic water use include: socio-demographic considerations, the economic characteristics of households and individuals (e.g., household size, age, gender, and income), knowledge, information access, psychological factors (e.g., attitudes, values, and personal traits), climatic factors (e.g., temperature, rainfall), dwelling and tenure types, the ownership of water appliances/amenities (e.g., swimming pools, gardens), habits/routines, social and cultural contexts of individuals, and the limitations of various forms of infrastructure. These studies supplied a basis of knowledge relating to water planning and management for urban areas. However,

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<sup>1</sup> The water consumption at per capita level in Australia is amongst the highest in the world (Yencken and Wilkinson, 2000).

existing water-related studies rarely address factors related to ethnic diversity, with a very few important exceptions, pertinent to water use and demand (Darr et al., 1975; Medd et al., 2007; Murdock et al., 1991; Smith & Ali, 2006). Despite water managers and academics having realised that water demand conformed to routines and internalized norms (Medd & Shove, 2005) which are developed within the socio-cultural backgrounds of consumers (Smith & Ali, 2006), the influences of ethnicity on water use and management are rarely investigated. As Smith and Ali (2006) claim, excluding ethnicity and its related factors in research that aims to understand domestic water use, would be ‘extremely unwise’, especially in ethnically diverse cities.

Today, many cities in the world are more ethnically diverse than in previous times. In the Australian context, net overseas immigrants have accounted for more than 55 per cent of the total annual population growth since 2005 (ABS, 2012); Sydney, Melbourne and Perth have been the most popular international migration destinations. With regard to Sydney, the ABS 2011 Census showed that 40.1 per cent of residents in the Sydney Metropolitan Area were born overseas, with only 25.7 per cent of people nominating Australian as one of their ancestries (ABS, 2012). The existence of 200 different ethnic cultures in the metropolitan area highlights the fact that Sydney’s water consumer base is substantially characterized by ethnically diverse cultures, in what is often referred to in contemporary parlance as Cultural and Linguistically Diversity (CALD). Thus, acting with sensitivity to cultural diversity is of great importance for sustainable water use and management.

Water is a critical sector for achieving the sustainable development of cities, especially the ones that are experiencing water stress. The percentage of urban population is predicted to increase to 82% in developed countries and 56% in developing countries by 2030 (DESA, 2012). The rapid growth of population has significantly affected water demand. In the Australia context, total urban water consumption is predicted to increase by at least 39% between 2009 and 2026, following a 24% increase of in population between 2007 and 2026. With regard to Sydney, it is projected to have between 8.0 million and 8.9 million residents by 2061 (Australian Bureau of Statistics [ABS], 2013). Driven by population growth, Sydney is predicted to experience a 23% increase in water demand between 2009 and 2026

(WSAA, 2010). Climate change at the global and regional scales would also add to the problem (Dawadi & Ahmad, 2013; Intergovernmental Panel on Climate Change, 2014).

Water supply stress is not new to Sydney. As indicated by Productivity Commission Inquiry Report (Productivity Commission, 2009, p. 47), '[d]roughts are a recurrent and frequent feature of Australia's climate'. Hennessy et al (2008) argued that Australia experienced one of the most notoriously variable climates in the world, which, on a range of timescales, was largely attributed to the El Niño–Southern Oscillation (ENSO) and the Indian Ocean Dipole. There have been more than 10 major periods of drought in Australia since 1864 (Productivity Commission, 2009). Among which three drought periods were particularly severe and prolonged. These are the periods of: 1939-1945 'The Forties Drought' (p. 50), 1982 - 1983 'one of the most intense and widespread droughts on record' (p. 50), and 2002 to 2007 (continued to 2008 in some areas) 'inflows to the Murray-Darling Basin were the lowest on record' (p. 50). Like most cities in Australia, Sydney encountered the severe challenges during the period between 2002 and 2007. During that time, water storage dams dropped significantly (Haertsch, 2005). The Warragamba Dam, which is responsible for approximately 80 per cent of Sydney's drinking water supply, dropped to its lowest level of 32.5 per cent (Sydney Catchment Authority, 2010). Due to the severity, in 2003, Sydney introduced water restrictions for residents, businesses, local councils and government agencies in response to chronic water shortages resulting from the drought (Sydney Water, 2011). The water restriction system is based on a number of levels, ranging from level 1 to level 3 which describe the different stages of water restrictions imposed. In June 2009, Sydney Water replaced the water restrictions with Water Wise Rules, hoping to encourage everybody to use water wisely. However, as argued in the previous paragraph, the ease of the drought in 2009 does not mean an end to water shortages. The Sydney Morning Herald reported, in 2014, that Sydney experienced the driest summer for more than 70 years, with frequently heatwaves.

Ethnicity is one potential way of exploring the effects of cultural diversity on water use (Medd et al., 2007). However, the influence that ethnicity has on domestic water use, as well as the diverse cultural knowledge brought by ethnic minority groups

regarding domestic water use, remains under-explored. Apart from enhancing the extent to which demand management strategies are successfully translated into everyday practices, engaging with cultural diversity also derives from the consideration of equal opportunity and rights over water issues (Medd et al., 2007), a factor which may be examined and emphasized via the concept of environmental citizenship.

Environmental citizenship emphasizes the equal rights, opportunities and just (not necessarily equal) obligation sharing of citizens. The equality and justice aspects address the concern that no one individual should be ‘marginalized’ (Latta, 2007, p: 18); for example, due to ‘racism, sexism, economic inequity, arbitrary state borders, or by not yet being born’. However, in the Australian context, urban water management and planning seem yet to be able to effectively include and engage ethnic minority communities who are usually among the disadvantaged groups due to linguistic, cultural, religious, economic or social reasons (Clarke & Agyeman, 2011; Klocker & Head, 2013). In such circumstances, the notion of environmental citizenship addresses the need to examine the environmental engagement of ethnic minorities, e.g., equal rights to accessing environmental information, having their voices heard in the environmental management process, fair distribution of responsibilities for environmental protection, and especially the ways in which such groups approach and respond to environmental issues.

Water is without doubt essential to human survival. Every person has an equal right to access an adequate amount of water that is of high quality. Equality and justice are pursued when referring to resource management, which emphasizes that any possible inequalities based upon ethnicity, religion, class, or other bases should be eradicated (Walker, 2004). Within an ethnic and culturally diverse society, the interpretation and application of sustainability should be based upon the specific cultures and traditions of diverse ethnic groups. However, the diverse understandings of sustainability and knowledge about the environment brought by the ethnic migrants in an ethnically and culturally diverse society such as Sydney have yet to be fully studied (Klocker & Head, 2013). From this point of view, not only should the water demands of ethnic groups be respected and secured, but understanding their water perceptions, water use patterns and water cultures is also of great significance in managing water resources.

Moreover, investigating the disparities between ethnic groups vis-à-vis water use and conservation can help to search for and identify opportunities and potential for improving water use efficiency and directing the whole community towards sustainable water use. This is especially important given population growth, climate change and variable weather scenarios.

Considering the issues stated above, and looking at previous studies on understanding urban water usage, this research will undertake an empirical study in the Sydney Metropolitan Area to explore the relationship between ethnicity and water use patterns, in the process bridging the information gap regarding water use in culturally diverse societies<sup>2</sup>. The study will undertake a comparative analysis of water use among people from distinct ethnic backgrounds – Australian, Chinese and Korean (with this categorization based on the Australian Standard Classification of Cultural and Ethnic Groups (ASCCEG) Second Edition that was used in the most recent Australian Bureau Statistics [ABS] Census) - domiciled in the Sydney Metropolitan Area<sup>3</sup>. The study aims to examine the influence of ethnicity on residential water use. To achieve this end, the following four specific research questions (plus sub-questions) were developed to guide the research:

- (1) Does ethnicity influence household water use? (a) Do differences or disparities exist across ethnic communities relating to water use and conservation, in terms of perceptions, attitudes and behaviours? (b) If so, what differences exist? (c) To what extent is ethnicity an influence?
- (2) What are the reasons and factors that underpin the ethnic differences and disparities? In other words, how does ethnicity influence households' water use and conservation?
- (3) What is the role of environmental acculturation in engaging persons of ethnic minority in water conservation activities?
- (4) What are the implications of ethnic diversity for water demand management? More specifically, (a) what are the opportunities for engaging ethnic communities in water management while maintaining important cultural values? (b) What are the barriers encountered when engaging ethnic communities in water management? (c)

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<sup>2</sup> See 2.4.1 for definition and interpretation of ethnicity and culture in the context of this study.

<sup>3</sup> See Section 3.3.1 for detailed explanation of the selection of 'Australian, Chinese and Korean' and the potential difficulties with this selection.

How may these barriers be negotiated by water managers seeking to implement sustainable urban water management?

In order to address these four research questions, the thesis begins with a literature review (Chapter 2) which builds up the theoretical framework for this study. Theories and knowledge relevant to this study - sustainability, sustainable cities, sustainable water use and environmental citizenship theories - are reviewed in the chapter. The research gap is clarified, and the study aim and its importance are stated, situated in the context of related theories and existing knowledge. The third chapter presents the research methodology and research design for the study. This research, which was conducted in the Sydney Metropolitan Area, focuses on the water usage patterns of people from three different ethnic backgrounds – Australian, Chinese and Korean. Primary and secondary data (water data from Sydney Water<sup>4</sup>, and housing and population data from the ABS Census) were collected and used for analysis in this study. Quantitative (i.e., a self-reported household questionnaire survey) qualitative (i.e., interviews, focus groups, practice observations) and media study (which is both quantitative and qualitative) approaches were employed. The fourth and fifth chapters present the major findings of the quantitative, qualitative and media studies. The sixth chapter answers the first three research questions by discussing and interpreting the study findings in the context of theories and existing knowledge on this topic. The final chapter, which answers research question four, summarizes the implications and limitations of this research and provides recommendations for future studies.

In summary, managing water demand and promoting sustainable water use is of utmost importance. This study aims to bridge the knowledge gap regarding the relationships between ethnicity and urban water management, including perceptions, beliefs, practices and water usage. By doing so, the research will contribute to constructing transitions to sustainability.

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<sup>4</sup> While the water data was provided by Sydney Water, all analysis has been conducted by and is the responsibility of the University of Sydney and that Sydney water has not endorsed or approved the analysis or conclusions of the thesis. If material from the thesis is to be presented publicly or published in a peer review journal or other public document, Sydney Water would still like to exercise its right of review of the material to be made public as per the original data agreement.

## CHAPTER 2 LITERATURE REVIEW

### 2.1 Introduction

This chapter established a foundation for this study by providing an overview of the theories and knowledge that support the research. It begins by introducing and reviewing sustainability theory and progress in sustainable cities and sustainable water management fields, and then situates this study in the context of the existing work and knowledge in the field. The importance of this study is then, reemphasised under the theory of environmental citizenship. As a whole, this chapter aims to identify the research gap that this study will fill, and to develop a theoretical framework for guiding this research.

Before proceeding, it is necessary to note that in many instances when citing particular studies, the original terminology in such studies is used in this paper. For example, if the term ‘Black-Americans’ was used in the cited original study, then the term was also adopted in this paper when referring to that study, unless it is clearly a racist term or has subsequently been absolutely rejected by the community in question.

### 2.2 Sustainability

#### 2.2.1 *Towards sustainability*

The concept of sustainable development became a central debate in academic, political and social life with the release of the Brundtland Report – *Our Common Future* – by the World Commission on Environment and Development (WCED) in 1987. The Brundtland Report defined ‘sustainable development’ as ‘development which meets the needs of the present without comprising the ability of future generations to meet their own needs’ (World Commission on Environment Development, 1987, p. 43). The two basic concepts encompassed in the definition are the needs of present and future generations and the environment’s limits. The emergence of the term ‘sustainable development’ may be variously traced back to the Habitat Conference in Stockholm in 1972, the 1980 World Conservation Strategy, and other subsequent studies and policy initiatives (Borowy, 2014; McManus, 2005b), although these actions were built on a foundation of environmental thought that had evolved over previous decades.

Brundtland's definition of sustainable development fostered the principle that the development of both economic and social well-being may be reconciled with the protection of the environment and natural resources, meaning that the needs of both the present and future generations can be secured. While some authors have argued that this is not possible (Redclift, 1987; Rees, 1997), this notion has been accepted as the point of departure for both scholars and practitioners concerned with the environment and development dilemmas (Borowy, 2014). Button (2002) suggests that the definition emphasized the temporal dimension more than the spatial dimension, and that this led to difficulties with the geographical implications. In fact, the definition has been the subject of dispute since the popularising of the concept. Attempts to better define and to implement sustainable development have led to numerous explanations of the concept (Borowy, 2014). In their 1989 publication, Pearce, Markandya and Barbier (1989) cited twenty-four definitions of sustainable development, a number subsequently updated to fifty-seven in Susan Murcott's (1997) work and increased in recent years. Efforts to defy a meaningful and precise definition have persisted since Owens and Cowell (2002) summarized different versions of sustainable development from 'weak' to 'strong' concepts. 'Weak' concepts locate environmental issues in a tradeable position in the decision-making against social and economic considerations. 'Strong' concepts, however, argue that despite the inevitable trade-offs between the three elements, priority should be given to the environment, which should not be included in any process of trade-offs. McManus (2005b) argues that the differences between the various concepts of sustainable development may be attributed to how all components are positioned in the pursuit of sustainability, based on either a hierarchical system or model of balance.

The term 'sustainability' is often used interchangeably with the term 'sustainable development'. Diesendorf (2000), however, notes that there are distinctions between the two terms regarding their exact meanings, and subsequently distinguishes sustainable development as a development process, with sustainability being its end goal, to which the policy and research efforts should be directed. McManus (1996) contends that while sustainability emphasises the fundamental change in structures, cultures and politics, sustainable development may be seen as the reformist approach to achieving these changes. Alternatively, sustainable development is viewed as the combination of sustainability and development: sustainability is seen as a core element of sustainable development (Borowy, 2014; Loucks & Gladwell, 1999). UNESCO (1999, p. 9) refers to sustainability as the



‘continuance or maintenance of a certain situation or condition over time’ and views sustainable development as the maintenance of a positive rate of improvement. Similarly, Borowy (2014, p. 2) refers to sustainability as simply a description of the ‘capacity of any given system to exist or reproduce on a long-term basis’; sustainable development is seen as ‘a manner of human living, which can exist and reproduce on a long-term basis while providing good living conditions’.

While many questions surrounding the precise definition of sustainable development or sustainability remain unanswered, efforts to progress towards sustainability need not be delayed. In effect, the rise of the sustainable development or sustainability concept has set in place a pathway for the world to follow. As a conceptual framework, sustainable development has changed how humans perceive their activities, their roles and responsibilities: from emphasis on material wealth to a more holistic and balanced worldview of the social development process (Strange & Bayley, 2008). Sustainable development successfully brings concerns with the environment to socio-economic issues and addresses economic development, social justice and environmental protection as its three basic components (Hopwood et al., 2005). In addition, sustainable development is also a process of change, or improvement through which sustainability objectives may be achieved (Strange & Bayley, 2008). Haughton (1999) outlines the five equity principles that underpin the process of sustainable development as follows: the principle of inter-generation equity, intra-generation equity, trans-frontier responsibility (geological equity), equal participation and inter-species equity. Giddings et al. (2002, p. 194) summarise these principles as ‘futuraity to give regard for the needs of future generations; equity covering social justice regardless of class, gender, race, etc. or where they live and participation so that people are able to shape their own futures’, and as ‘[a] principle recognizing the importance of bio-diversity and ecosystem integrity...’. The principles can serve as a basis for policies and actions pursuing sustainable development (Giddings et al., 2002).

In light of the controversies and difficulties in defining sustainable development and sustainability described so far, the Author proposes the following definitions of sustainable development and sustainability to underpin any references to these terms in this thesis:

Sustainable development can be understood as a manner of development, in which economic, social well-being and the protection of environment are balanced, equity in all aspects, including

inter-generation, intra-generation, inter-species, trans-frontier and participation, are pursued. Sustainability can be regarded as the ideal situation and condition that this development can achieve.

Sustainable development may also be regarded as an end goal towards which society should be moving. It emphasizes the long-term impacts of current actions and requires identifying and fixing the actions performed by present generations that would result in unsustainability, such as unsustainable resource use practices. Apart from a temporal scale, sustainable development also addresses spatial scales (Bulkeley & Betsill, 2003) i.e., the local, regional, national and global levels at which actions are needed to address environmental issues and to contribute to the pursuit of sustainable development. Increasing awareness has also been given to the importance of cities as arenas through which sustainable development should and can be pursued (McManus, 2005b). As McManus (2005b, p. 74) maintains, ‘action at the scale of city and its hinterland is likely to be most achievable and most effective in moving towards sustainability’. With more than half of the world’s population domiciled in urban areas (Department of Economic and Social Affairs, 2012), today cities are shaping the world. Sustainable development will never be achieved without fostering urban sustainable development (Anders, 1991; Yanarella & Levine, 1992).

### ***2.2.2 Towards sustainable cities***

Concomitant with the process of urbanization, an increasing number of people are now living in urban areas. The percentage of the world’s population living in said areas has increased from 36.5 per cent in 1970 to 52.1 per cent in 2010; this figure is estimated to increase to 59.9 per cent by 2030 (Department of Economic and Social Affairs, 2012). As regards the developed regions, the percentage of urban population is much higher. For example, the Oceania region has more than 70 per cent of the population living in urban areas, while the urbanization level for North America is the highest with 82 per cent of the population concentrated in urban areas in 2010 (DESA, 2012). Cities, with their high populations, make intensive demands on natural resources, materials, energy, goods and services both from surrounding areas and the ‘distant elsewhere’. Cities are also degraders of the natural environment, with waste and emissions being discharged into the nature world (Breheny, 1990; Hewitt and Hagan, 2001). According to a United Nations report, cities account for 75 per cent of the world’s total energy consumption and 80 per cent of greenhouse gas emissions (Ash et al., 2008). There is little doubt that many of the world’s environmental problems, both at the local and global levels, are rooted in the consumption activities of the large

population who reside in urban areas and via the activities of industries located in urban areas. This double role of cities, as giant consumers as well as destroyers of the natural environment, has rendered most of them vortex cities, 'sucking in resources for production and consumption and using other parts of the planet to assimilate wastes' (McManus, 2005a, p.1). Therefore, managing cities has become a significant and urgent practical challenge to sustainability (Farreny et al., 2011).

However cities, as places to deal with environmental issues, were usually excluded from the initial approaches of sustainable development, approaches that often seemed to be an extension of the conservation ideal which dominated environmental thought in the nineteenth and twentieth centuries (Wall, 1994). In the conservation ideal, the 'environment' referred to nature and the wilderness, which should be preserved against the culture of cities (McManus, 2005b). In early environmental thought, 'cities are almost inherently undesirable in environmental terms' due to being polluted, degraded places, fostering consumption lifestyles (Haughton & Hunter, 1994, p. 10). With the introduction of the concept of sustainability, the role of cities in addressing environmental issues has been increasingly recognized (Haughton & Hunter, 1994). Two influential publications addressing sustainability, i.e., *The Limits to Growth* (Meadows et al., 1972) and *Our Common Future* (World Commission on Environment Development, 1987), not only emphasised environmental constraints to economic growth, but presented urbanization as a challenge to sustainability (Chang & Sheppard, 2013); that is, the rise of urgent issues in cities such as air pollution, energy use and sewage disposal in urban areas. It was not until the 1992 Rio conference and the 1996 Habitat II Conference that the important role of - and the opportunity brought by - cities in pursuing sustainable development began to be realised (Chang & Sheppard, 2013). Cities are also sources of solutions for environmental problems (Davis, 2010). With their great capacity to be energy-efficient and environmentally-friendly with good design and management (McLaren and Hillman, 1991), cities have been increasingly presented as the hope for sustainable development (Chang & Sheppard, 2013). They 'play an active role in constructing their ecologies and have become proactive contributors to crafting sustainability discourses and practices' (Chang & Sheppard, 2013, p. 59). For this reason, cities are seen as arenas 'through which sustainability could, and should, be pursued' (Bulkeley & Betsill, 2003, p. 22).

With the process of urbanisation, cities have inevitably become arenas in which sustainable development should be applied. Capello et al. (1999) argue that cities can be sustainable if they can prove internally sustainable, and if their impacts on the places on which they rely for natural resources and energy do not exceed the environmental capacity of such places. Ravetz (2000) suggests that cities that have their own eco-cycles are likely to be resilient and/or sustainable. Troy (2000) nominates energy and water consumption and their impacts on the natural flow and natural system, such as levels of greenhouse gas, waste management and recycling, as the main aspects for sustainable development. McManus (2005b) suggests that if cities can reduce their non-renewable resource consumption and waste production, and preserve the natural system they are relying on without trans-frontier environmental costs, they can successfully elude any vortex effects. Addressing the challenges of resource consumption, preserving the natural systems that cities are reliant on, and generating changes in structures, cultural understandings and urban planning and design to move towards sustainability, are important in many sectors. Arguably, none is more important than sustainable water use given that water is fundamental for life.

### ***2.2.3 Towards sustainable water use and management in urban areas***

Water use and management are of critical importance in the pursuance of urban sustainable development (Schaffer & Vollmer, 2010). Water is not just a necessity required to satisfy the biological need for life; it also plays an important role in maintaining ecosystem health, economic development, social well-being and cultural values (Gleick, 1998). Sustainability cannot be achieved without sustainable water resource management supporting its development (Loucks & Gladwell, 1999).

Water is a natural resource which is subject to increasing stress. In 2011, over 50 per cent of the population of the world, approximately 3.63 million people, lived in urban areas (Department of Economic and Social Affairs, 2012). As stated in Chapter 1, Australia's most populous city - Sydney - had a population of 4.3 million in 2014. This number is predicted to climb to between 8.0 million and 8.9 million by 2061 (Australian Bureau of Statistics, 2013). Driven by population growth, the water demand of Sydney is projected to increase 23 per cent between 2009 and 2026 (WSAA, 2010). Climate change at the global and regional scales has added to the problem (Dawadi & Ahmad, 2013; Intergovernmental Panel on Climate Change, 2014): it is expected to affect the total amount as well as spatial and temporal variation of water

resources (Intergovernmental Panel on Climate Change, 2008). In addition, an increase in water usage is also expected as a result of the temperature impacts of climate change. The increased number of days with a temperature above 30 degrees Celsius as a result of climate change undoubtedly increases the water usage in gardens and public green spaces in order to ensure their survival (WSAA, 2010). What is more, traditional urban water management, which greatly relied on technical approaches to fix water problems, e.g., river regulation and re-allocation, has resulted in vulnerable river ecosystems and decreasing availability of water resources (Intergovernmental Panel on Climate Change, 2008; Niemczynowicz, 1999). Thus, given the stress and challenges that cities are facing, sustainable water management is required to meet present and future demands.

The traditional approaches to water management primarily focused on engineering solutions to increase water supply, on building massive infrastructures to meet the increasing water demand, and on confronting extreme drought/flood situations. Taken together, they characterised a large-scale, centralised, technically-facilitated and demand (projection)-orientated system (Brown et al., 2008; Farrelly & Brown, 2011; Gleick, 2003; Sofoulis, 2005). However, such management systems have usually led to substantial costs in ecology and environment (Wang et al., 2011); and they are less likely be able to respond to emerging challenges, for example, climate change (Farrelly & Brown, 2011). With increasing awareness that relying on technological solutions to deal with water issues would not be sustainable in the long run (Farrelly & Brown, 2011; Sofoulis, 2005), a shift from traditional water management to more precautionary approaches, usually referred as ‘sustainable use and management of water’ approaches, has been accepted and promoted in many cities (Marlow et al., 2013; van de Meene et al., 2011).

The notion of sustainable use of resources emerged long before the rise of sustainable development in the 1970s and 1980s, and was usually referred to by terms such as ‘sustained resource use’ or ‘yield management’ in fishing and forestry (Loucks & Gladwell, 1999, p. 6). Foresters were concerned with how to harvest the forest on a sustainable basis (McManus, 1999). The Brundtland Commission Report published in 1987 has made a great contribution by promoting the concept of sustainable development and emphasizing its importance. Though, sustainable development as defined in the Brundtland Commission Report ‘may never be realized, or even adequately quantified’ (Loucks & Gladwell, 1999, p. 6), Herman Daly (1990, p. 2) suggest that Mrs. Brundtland provided ‘a political opening for the proper

concept of sustainable development to evolve'. Herman Daly (1990), who took steps further in the direction of Mrs. Brundtland, emphasised the requirement to respect ecological limits and proposed three criteria. First, the harvest should not exceed the regeneration rate of the environment (sustained yield). Second, the rates of waste emission should not exceed the assimilation capacity of the ecosystems (sustainable waste disposal). Third, for non-renewable resources, the depletion should be accompanied by comparable development of substitutes that are renewable. The scope of the current concept of sustainable development is much broader than the idea of sustained yield management (Bebarta, 2004; Goodbody & Thomas-Hope, 2002; Loucks & Gladwell, 1999; McManus, 2005b; Sophocleous, 2000). Sustainable water resource management is not simply referred to as yield management, but is viewed more as a social goal guiding public value judgements towards water resource use management (McManus, 2005b). Water resource systems should be regarded as integral parts of nature and society; and, their interaction with the society and ecosystems should be considered in their development and management (Giupponi, 2006).

The term 'sustainable water management' refers to a holistic way of planning and managing precise water resources. This involves various political, economic, social, technological and environmental considerations (Brown & Keath, 2008; Mitchell, 2006). 'Sustainable urban water management' usually refers to the holistic and integrated approaches to manage water issues in urban contexts for achieving the sustainable use and management of water resources. Marlow et al. (2013, p. 7151) contend that sustainable urban water management 'reflects a generalised goal to manage the urban water cycle to produce more benefits than traditional approaches have delivered'. As a prudent approach to confronting and coping with the stress and challenges facing cities regarding water (Marlow et al., 2013; van de Meene et al., 2011), sustainable urban water management adopts integrated approaches to water supply, wastewater disposal and stormwater management so as to deliver the most appropriate use of water for human and ecological systems (Brown et al., 2011; Marlow et al., 2013; Milly et al., 2008).

Included in sustainable approaches to urban water management is increasing attention to managing water demand, which is often referred to as either the 'soft' path or demand management (Dawadi & Ahmad, 2013). Rather than focusing on looking for new sources based on technological instruments, an approach adopted in supply-side management, the demand management approach focuses more on demand and consumption aspects. It seeks to

make the available water supply more sustainable and productive, and places emphasis on identifying potential water savings (Gleick, 2003; Savenije & Van Der Zaag, 2002). McManus (2005b, p. 109) claims that although technological solutions have improved cities' capacity to deal with water issues, without complementary approaches focusing on the demand and consumption aspects, the technological solution 'merely enables the perpetuation of a frontier mentality to resource management and is therefore not sustainable'. Actions on reducing water demand for potable water and matching water quality with use purposes is needed in the pursuit of sustainability (McManus, 2005b). By combining with the supply side planning and management, the demand side management makes it possible to meet the present and future needs of human and ecological systems by providing available water (Brooks, 2006; Brooks & Brandes, 2011; Mitchell, 2006).

In terms of residential water usage, demand management refers to approaches that facilitate the reduction of water demand by improving the efficiency of use or water productivity. The instruments may be technical, institutional or economic, such as water conservation, water restrictions, water recycling, economic measures offering incentives to instigate water saving behaviours, promoting alternative sources of supply, access to information, and improving water networks (Kampragou, Lekkas, & Assimacopoulos, 2011; Kanta & Zechman, 2014). In the context of Australia, a number of agencies are involved and contribute to demand management. Various demand management instruments are employed by these agencies, such as the Smart Approved Watermark Labelling Scheme promoted by the COAG; the Water for the Future (2010) policy announcement by Federal government; the building code for new houses with rainwater tanks or grey water systems under the BASIX system by NSW state government; the involvement of local governments in demand management through development approvals and other kinds of education and regulation activities (Reinhardt, W., 2013). In Sydney, the Sydney Water Corporation plays an important role in promoting demand management programs in residential, commercial and industrial aspects. As for the residential aspect, apart from the above regulations mentioned above, indoor programs such as PlumbAssist and WaterFix, outdoor programs such as Love Your Garden and rainwater tank rebates, as well as the Water Wise Rules and recycling programs have been adopted (Sydney Water Corporation, 2015).

Water demand management has shown great economic and environmental benefits through increasing water use efficiency, conservation, and facilitating greater public participation (Brooks, 2006; Brooks & Brandes, 2011). Demand side management helps communities to make judgements regarding what needs and usage can be satisfied by limited water resources. By doing so, it aims to foster pro-environmental water usage among communities, that is required if they are to progress towards sustainability (Medd et al., 2007). Thus, the design of any demand management instruments should be based on the extant knowledge of for what purpose and how water is used by consumers, as well as on the extant influencing factors (Mazzanti & Montini, 2006). Domestic water demand is found to be driven by practices and decisions of consumers and influenced by various factors (Corbella & i Pujol, 2009) including water pricing (Garcia & Reynaud, 2004), socio-demographic factors (Rosenberg, 2009), attitudes, beliefs, and habits (Elizondo & Lofthouse, 2010b; Kallis, 2010), built environments (Randolph & Troy, 2008; Troy et al., 2005), climate factors (Gato et al., 2007; Hoffmann et al., 2006), and regulations, restrictions and facilities (Hardberger, 2008). The potential role of culture and related factors in influencing water usage and demand, as well as their implications for water demand management strategies, is gaining increasing attention among water planners and academics, although there is more work to be done in this area (Elizondo & Lofthouse, 2010b; Klocker & Head, 2013; Medd & Shove, 2005; Medd et al., 2007; Pahl-Wostl et al., 2008; Smith & Ali, 2006).

#### ***2.2.4 Cultural and ethnic sensitivity in water management***

Understanding an individual's water use behaviours and decision-making can assist to develop effective approaches to water demand management (Jorgensen et al., 2009). Households, along with their individual members, have been considered as important scales for examining residential water use and potential opportunities for behavioural change (De Sherbin et al., 2007; Gibson et al., 2011). However, decision-making regarding water usage, as well as the practice of water use itself, is complicated: it involves many influencing factors. Behavioural change for sustainability, i.e., the prescribed top-down approach which includes information-based conventional educational campaigns, has proven only modestly effective (Kollmuss & Agyeman, 2002). Researchers have come to realise that community-based instruments are more effective than traditional ones for sustainability (Elizondo & Lofthouse, 2010a; Kollmuss & Agyeman, 2002; Medd et al., 2007; Randolph & Troy, 2008). These instruments include investigation approaches of identifying and understanding individual or



household behaviours such as ‘behavioural complexity groupings’ and ‘lifestyle types’ (Gilg & Barr, 2006, p. 412), as well as measures that are developed to change or improve said behaviours, such as the design of particular water-saving devices. Not only should diverse water usage behaviour be recognized, but diverse values and opinions within communities should also be taken into account (Bloomfield et al., 1998; Chan et al., 2012; Klocker & Head, 2013; Sofoulis, 2005). This involves three basic elements: a greater understanding of environmental issues among communities; allowing different voices to impact upon decision-making; and the effectiveness of translating sustainability into daily practice (Kollmuss & Agyeman, 2002).

Gibson et al. (2011) suggest that urging households to take greater responsibility through preaching will be less effective unless the consumption behaviour is considered and analysed in larger contexts. They argue that ‘... households must be understood within broader contexts, as they are enrolled in networks (social, industrial, governmental), with consequences for behaviour and resources use and for the extent to which households are actually able to change’ (Gibson et al., 2011, p. 5). These authors propose analysing consumption practices of households by integrating cultural perspectives. People’s decision-making vis-à-vis water consumption, such as purchasing particular home appliances e.g., using a water-efficient washing machine, tend to be economic; but, their decisions are either directly or indirectly attached to preferences and habits which stem from norms and beliefs developed in certain cultural context (Elizondo & Lofthouse, 2010a; Gibson et al., 2011; Medd & Shove, 2005). In other words, the values behind decision-making are ‘fundamentally cultural’ (Gibson et al., 2011, p. 5). Allon and Sofoulis (2006) suggest that culture, as a combination of values, practices and interactions, is also helpful in understanding the importance of daily water-usage related activities, such as daily showers, dishwashing or watering a garden:

We believe an understanding of the cultural domain and the complex world of everyday life experience is crucial for understanding resource consumption, necessary for developing more effective natural resource management strategies, and vital to the adoption of more sustainable urban lifestyles. (Allon & Sofoulis, 2006, p. 46)

From a broader viewpoint, and in terms of environmental culture, Head et al. (2005) argue that ‘all people ‘have culture’ in that they are socialised to think about land and natural

species in particular ways' (p. 252). In the context of migration, for example, diverse cultural knowledge of nature and land is disseminated by migrant groups worldwide (Head et al., 2005). Culture is 'a dynamic mix of symbols, beliefs, languages and practices that people create, not a fixed thing or entity governing humans' (Anderson & Gale, 1992, p. 3). Diverse cultural beliefs and practices are likely to be spread by migrant groups based on their experiences and understandings of nature in both the local area and their places of origin (Head et al., 2005).

Given that water use attitudes and practices are closely related to culture, and that diverse cultural beliefs and practices give rise to diverse cultures of nature, the question is, in terms of water management: how should demand-management strategies deal with cultural diversity and sensitivity (Medd et al., 2007)? Ethnicity has been considered one potential way of approaching cultural diversity and sensitivity (Medd et al., 2007). However, the influence that ethnicity has on domestic water use, as well as the diverse cultural knowledge brought by ethnic minority groups pertinent to domestic water use, remains under-explored. Apart from enhancing the extent to which demand management strategies are successfully translated into everyday practice, engaging with cultural diversity also derives from the consideration of equal opportunity and rights over water issues (Medd et al., 2007), a factor which may be examined via the concept of environmental citizenship.

## 2.3 Environmental citizenship

### 2.3.1 *What is environmental citizenship*

Consideration of ethnic and cultural diversity issues, and their role in sustainable water management, is also based on the notion of environmental citizenship, according to which the rights, entitlements, duties and obligations of individuals and the community are implicit in environmental issues. Environmental citizenship emphasizes the participation of all concerned citizens, regardless of race, class, gender, and nationality, in environmental protection; i.e., moving towards the social objective of environmental sustainability (Dobson & Bell, 2006).

The notion of environmental citizenship, ecological citizenship, or green citizenship in some literatures<sup>5</sup>, is commonly linked with the thought of extending the entitlements and obligations shared by citizens to the environmental context (Latta, 2007). The 1972 Stockholm conference indicated that an acceptable environment might constitute a precondition for the enjoyment of a life of dignity and well-being (Miller, 1998). The Brundtland Report (World Commission on Environment Development, 1987) cited environment quality as a fundamental right of humans. Subsequently, the 1992 Rio Declaration also stressed that individuals should have the right to access information and participate in decision-making processes concerning environmental issues and that relevant authorities should facilitate and encourage this participation (United Nations Conference on Environment and Development, 1992). This right is also accompanied by obligations to protect the environment; it ‘is an obligation entrusted upon everyone and all governments by virtue of the inherent relationship between people and nature, and between citizens and their governments’ (United Nations Environment Programme, 2003, p. 4).

Traditional forms of citizenship, such as civil, political and social citizenship, emphasize the interlocking relations of rights and obligations that define the membership of citizens in a community, in legal and moral systems, and in a variety of social, economic and political spheres (Smith, 1998). Environmental or ecological citizenship<sup>6</sup> is regarded as a new form of

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<sup>5</sup> The term ‘environmental citizenship’ is widely used, whereas, the term ‘ecological citizenship’ is relatively less common Steenbergen (1994), Smith (1998), Dobson (2003), Hayward (2006) and Jagers et al. (2013).

<sup>6</sup> Dobson (2003, p.88-89) draws distinctions between environmental citizenship and ecological citizenship. He defined environmental citizenship as the extension of ‘liberal citizenship’, where the commitment to environmental common good is included as one of the liberal rights, along with other rights, such as civil,

citizenship which ‘will lead the human species into a fundamental reassessment of its capacities for acting upon the environment’ (Smith, 1998, p. 99). Hartley Dean (2001), who explains environmental citizenship as a broader understanding of citizenship under green or ecological thinking, points out that ecological thought affects the understanding of citizenship in several ways, a factor discussed further in Dobson (2003). First, ecological thinking with regard to the relations between society and nature has led to increasing awareness of the environmental rights to which citizens should be entitled. Second, ecological concern on a global level has drawn attention to the need to rethink the geographic scope of citizenship. And third, ecological concerns have promoted talk of the responsibilities of citizenry in the discourse of sustainable development (Dobson, 2003).

While environmental citizenship is a relatively new concept in the environmental research arena, a growing body of studies have given it considerable attention (e.g., Barry, 1999; Dobson, 2003; Dobson, 2007; Hawthorne & Alabaster, 1999; Hayward, 2006; Smith, 1998). In defining environmental citizenship, Dobson (Dobson, 2007, p. 280) states: ‘There is no determinate thing called ‘environmental citizenship’, but in the broadest possible compass such citizenship will/can/may surely have something to do with the relationship between individuals and the common good’. To define it from the perspective of rights, environmental citizenship ‘refers to the attempts to extend the discourse and practice of rights-claiming into the environmental context’ (Dobson, 2003, p. 89). Alternatively, from the perspective of obligations, environmental citizenship urges citizens to ‘try to occupy an appropriate amount of environmental space’ (Dobson, 2007, p. 281), thereby ensuring that their ‘ecological footprints make a sustainable, rather than unsustainable, impact’ (Dobson, 2003, p. 119). In a broader context, Smith (1998) suggests that environmental citizens have obligations to all members of the biotic community, and the responsibility to behave in an extremely cautious manner in order to avoid any adverse impact on nature.

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political and social rights. In contrast, ecological citizenship is argued by Dobson as a ‘post-cosmopolitan citizenship’, where the rights and responsibilities are not confined to the nation, but are in ‘an imagined territory constituted by membership of a common humanity’ (Smith and Pangsapa, 2008, p.76). The environmental citizenship discussed here cuts across the above distinction, it is used in this thesis to describe developing a citizenship that beyond nationality, race, ethnicity and language, in which citizens commit to environmental common good in the territory where they born and/or where they live.

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### ***2.3.2 Environmental citizenship: understanding and prompting the environmental activism of a community***

Public participation was considered a key theme in the 1992 Rio Earth Summit. As noted in the Rio Declaration, Principle 10, ‘environmental issues are best handled with the participation of all concerned citizens, at the relevant level’ (United Nations Conference on Environment and Development, 1992). However, the question is: ‘why should people participate?’ (Macnaghten & Jacobs, 1997). Researchers have suggested the important roles of ‘public identification of sustainable development’ (Macnaghten & Jacobs, 1997, p. 5), ‘trust relations exist between citizens and government’ (Harrison et al., 1996, p 215), civic engagement experiences (such as participation in environmental protests, or donations for environmental reasons) or values/norms (Corner et al., 2014; Steg et al., 2011) in influencing or mediating the individual’s desire or willingness vis-à-vis environmental responsibility and participation. Among the factors that underline public participation, one important aspect is the articulation and practice of ‘citizenship’; more specifically, environmental citizenship. Some people undertake recycling and reduce their energy and water use in the interests of environmental protection voluntarily, even if it means making certain sacrifices.

The notion of citizenship has been emphasized in attempts to encourage environmental activism, or, in a broader context, participation in sustainable development (Clarke & Agyeman, 2011). The latter can only be achieved when individuals are willing to change their unsustainable lifestyles and to commit to the collective good, i.e., sustainable-living (Macnaghten & Jacobs, 1997; Yu & Ahadi, 2010). However, conflict often arises between individual and collective social interests when self-interest goes against environmental protection, an eventuation often called ‘a social dilemma’ (Yamagishi & Yamagishi, 1994). The notion of environmental citizenship offers a solution to this social dilemma: it ‘offers the possibility of checking self-interest against the common good in systematic ways, because this is part of what citizenship – as concept and practice – is about’ (Dobson & Sáiz, 2005, p. 158). Environmental citizenship obligates citizens to work towards a sustainable society: this includes partaking in all of the activities that are believed to be related to environmental well-being. In terms of water, environmental citizenship appeals to citizens to adopt activities such as water conservation, reusing water, rainwater collecting and using water for the common good, in effect, sustainable water usage. In this way, environmental citizenship can be regarded as a crucial route for promoting change and commitment. In the long term it may

even play a powerful role in facilitating attitude change, rather than adopting a financial-incentive approach (Dobson, 2007).

Specifically, environmental citizenship encourages the active participation of citizens in sustainable development in several ways. First, when engaging in sustainable development practices, the general public is expected to take part in at least two ways. While on the one hand, individuals can employ pro-environmental action when doing household activities, e.g., recycling and purchasing green products; on the other, they can participate in the policy decision-making process, protesting against poor policies or supporting environmental policies introduced by their governments (World Conservation Union, 1991). Environmental citizenship encourages this two-sphere action among citizens by recognizing both the private and public spheres as legitimate political arenas (Dobson, 2007). Second, environmental citizenship widens the scope of rights and obligations to include both the international and intergenerational. This reflects the ‘non-territorial nature of environmental sustainability’ (Dobson, 2003, p. 96). Many environmental problems, including global warming, are trans-boundary. In addition, environmental citizens hold an inter-generation obligation for future generations (MacGregor et al., 2005), given that the decisions and actions made by the present generation determine the benefits for or harm to future generations (Dobson, 2003; Dobson, 2007; Smith, 1998). Finally, environmental citizenship offers a strong motive for people to engage in environmental behaviour by asking people to consider their personal behaviour in the contexts of justice and injustice (Dobson, 2007). For example, ‘people drive less in general because they know that car driving contributes to global warming, that global warming affects poor people more than rich ones, and that too much car-driving leaves too big an ecological footprint’ (Dobson, 2007, p. 282). It reflects the requirements of sustainable development; that is, the adoption of certain values and commitment to sustainable living lifestyles. And, in this way, the environmental-citizenship driven behaviour is considered to endure longer than behaviour based on policy or financial incentives (Dobson, 2007, 2010; Jagers et al., 2013).

### ***2.3.3 Ethnicity, environment and environmental citizenship***

Sustainable development is ‘our common future’ (World Commission on Environment Development, 1987): it calls for the ‘widest possible participation’ (United Nations Conference on Environment and Development, 1992, paragraph 8.7) and global

environmental citizenship. Each individual should have the right to access environmental information as well as the opportunity to participate in decision-making. Environmental governance requires great participation and the collaborative work of citizens and institutions. Environmental citizenship emphasises equal rights, opportunities and just (not necessarily equal) obligation sharing of citizens. It is about environmental justice, about no one individual being 'marginalized from the environmental citizenship due to racism, sexism, economic inequity, arbitrary state borders, or by not yet being born' (Latta, 2007, p. 18).

In Western societies, however, environmental management and planning efforts aimed at fostering responsible environmental behaviour among citizens seem not to have successfully engaged ethnic minority groups (Clarke & Agyeman, 2011). This can be seen, for example, in the contrast between the Local Agenda/Action 21 in Britain (Clarke & Agyeman, 2011), and the 2011 Sustainable Population Strategy in Australia (Klocker & Head, 2013). Klocker and Head (2013) note that the diverse knowledge brought by diverse ethnic minority migrants was barely examined in the Sustainable Population Strategy. The notion of environmental citizenship offers opportunities to examine the environmental engagement of ethnic minorities, such as the uptake of environmental rights as well as responsibilities and the ways in which such groups approach and respond to environmental issues.

Scrutiny of the ethnic and cultural dimensions of environmental citizenship may contribute to a more socially inclusive approach to environmental and sustainable research (Clarke & Agyeman, 2011). Environmental citizenship is a notion based upon social justice, equal rights, and fair responsibilities. Apropos of justice, equal rights to accessing environmental information, having their voices heard in the environmental management process and fair distribution of responsibilities for environmental protection of groups and individuals who are either economically or socially disadvantaged, are needed to be recognised and addressed. People from ethnic minority backgrounds are more likely to be among the disadvantaged groups (e.g., due to linguistic barriers). The importance of including people from all groups, regardless of their economic or social status, gender, language or ethnicity, in social debate has been addressed in the sustainable research agenda in the UK (Eames & Adebawale, 2002). Apropos of environmental responsibilities, the notion of environmental citizenship can help to examine whether and how ethnically and culturally diverse communities adopt and negotiate responsibilities in acting towards environmental well-being (Clarke & Agyeman, 2011). Clarke and Agyeman (2011) suggest, in a study aimed to examine the structural and

cultural dynamics of environmental responsibilities among ethnic minorities in Britain, that ethnicity and culture influence how people of ethnic minorities construct their environmental identities and responsibilities (e.g., response to government calls for environmental responsibility, assignment of environmental responsibility between governments and citizens). This is of significance and should be recognised and emphasised in environmental and sustainability policy and planning.

In the US context, this realisation was facilitated by the environmental justice movement (originally about environmental racism) which rose to prominence in the second half of the 1980s. Low-incomes, and language differences, along with cultural barriers, made minority neighbourhoods in the US easy targets for large polluting industrial companies, resulting in the disproportionate locating of pollution plants in minority underprivileged neighbourhoods (Kay, 1992). Growing realization of this phenomenon motivated grassroots groups and ethnically diverse community members to become more active in environmental protection protests and in pursuing social justice (Whittaker et al., 2005). For example, with the help of grassroots organizations such as the Mothers of East Los Angeles, the predominantly Spanish-speaking community of Kettleman City, California, successfully prevented the construction of a toxic waste incinerator in their town in the late 1980s and early 1990s (Kay, 1992; Whittaker et al., 2005). Community members created El Pueblo Para el Aire y Agua Limpio (People for Clean Air and Water) and brought a lawsuit against the permission to construct this incinerator. They claimed that the permitting process excluded monolingual Spanish-speaking residents from the decision-making process, an omission that violated the residents' civil rights protection. A heated Sierra Club<sup>7</sup> policy debate over immigration in the US that occurred in 1997 and 1998 also indirectly raised social inclusion and justice concerns regarding environmental issues. The debate was about whether the growing population, which was driven by immigration, would severely affect the US's environment and ecosystems. Therefore, control of immigration was advocated (Harris, 1998; Pfeffer & Stycos, 2002), and migration-control policies were proposed. In 1994, the proposal was rejected by a vote in the Sierra Club, albeit public attention was drawn to the environmental behaviour of diverse ethnic immigrants as well as to their involvement in environmental politics (Pfeffer &

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<sup>7</sup> The Sierra Club an environmental organisation in the US, was established in 1892. It was one of the first large-scale environmental organisations in the world. The club engages in political advocacy (promoting green policies). It organises outdoor recreation activities, promoting environmental protection consciousness and responsible practice when using the world's ecosystems and resources.



Stycos, 2002).

In Australia, immigration has emerged as a large component of population and environmental debates. Net overseas immigrants have accounted for more than 55 per cent of the total annual population growth since 2005 (Australian Bureau of Statistics, 2011), with blame frequently apportioned to migration for environmental problems (Klocker & Head, 2013). Despite the above, scholars have recognised and highlighted the importance of and need for an inclusive approach to encountering ethnic and cultural diversity in environmental protection and sustainable development ‘by acknowledging [that] immigration and population growth bring both challenges and opportunities’ (Klocker & Head, 2013, p. 44). A growing body of literature has also noted the need to frame a mode of environmental thinking that is open to different (diverse) cultures and values (Goodall, 2008; Head, 2000; Klocker & Head, 2013; Thomas, 2001). The inclusion of ethnicity in environmental research also contributes to the knowledge of whether and how ethnicity and cultural diversity matter in the construction and articulation of environmental responsibility and its implications for environmental governance (Clarke & Agyeman, 2011).

## **2.4 Water use, ethnicity and culture**

### ***2.4.1 Research gap: ethnicity also matters***

Prior to proceeding to the review of related studies, it is important to give some definitional context to the concepts of ethnicity, ethnic group, ethnic minority and culture. As defined in The Dictionary of Human Geography:

Ethnicity is described as ‘A social classification of people based upon their shared cultural characteristics and heritage’ (Castree, Kitchin, & Rogers, 2013, p 138). While the identity of a certain ethnicity is usually based on characteristics of ‘common interests, beliefs, values, language, religion, cultural traditions, historical experiences, and often homeland of a set of individuals’ (Castree et al., 2013, p.138).

An ethnic group is defined as a group of people who share a certain common ethnicity (Castree et al., 2013, p.138).

Macquarie Dictionary (Online Edition 2013) provides definitions in Australian context:

Ethnic minorities are ‘of or relating to members of the Australian community who are migrants or the

descendants of migrants and whose first language is not English’.

The Dictionary of Human Geography defines culture as:

‘a way of life underpinned by particular values and traditions’ (Castree et al., 2013, p. 89).

In this study, ethnicity and culture can be understood as an integrated system, where ‘an ethnic group is recognisable as coming from an identifiable culture’ (Macquarie Dictionary, On Line Edition 2013). In other words, ethnicity describes certain group of people who share a distinct culture. Cultures, including traditions, family and social customs, shape the particular ethnicity. Therefore, when gaining insight into the water use of a certain ethnic group, the influence of the culture that is attached to this ethnic group should not be ignored.

It is important to engage with cultural and ethnic diversity in resource demand management. While ethnicity and faith have been considered as two ways to achieve this aim (Medd et al., 2007), in terms of water demand management, little knowledge of the ethnic and cultural correlates of residential water use is available. This may be because the primary assumption regarding water management and research has been that the population is homogenous and that ethnicity does not make much difference. Furthermore, it was believed that there was little need to study if and how cultural issues impacted on water demand given that in the past, irrespective of whether the water consumer was of indigenous, Anglo, Asian or African origin, the answer was generally a supply-side solution to securing water provision. Nevertheless, time brought the increasing realisation of the importance of water demand management approaches and of the cultural sensitivity issue in designing and implementing demand management measures. In the Sydney context, water management agencies have been made efforts to engage ethnic minorities in various demand management initiatives as introduced in Section 2.2.3, such as providing information brochures in languages other than English, broadcasting water conservation messages within ethnic newspapers or radio programs. The Ethnic Communities Sustainable Living Project has been a good example of engaging multi-cultural and bilingual communities in environmental protection, where sustainable living information is delivered to ethnic minority communities via bilingual educators (Young, G., 2005). However, this process sometimes simply transferal of information. Little is known about the water perceptions among ethnic minority groups and how their ethnic and cultural backgrounds might influence their participation in water

conservation. There is a lack, therefore, of available information for the reference of water managers, planners or educators. An increasing number of studies have focused, and are focusing, on building profound knowledge of the relationships between population and water consumption, especially (see Section 2.4.2), in terms of domestic water use aspects, and the water use patterns of particular households. However, among these study efforts, very few address concerns of ethnicity as a factor in understanding domestic water use variations, with a very few important exceptions (Darr et al., 1975; Murdock et al., 1991; Smith & Ali, 2006) pertinent to water research and management.

Limited studies concerning the relationship between ethnic diversity and water use suggest that ethnicity and religion influence water demand. Darr et al. (1975), in their research analysing the influencing factors of water demand in four urban areas of Israel, found that significant differences existed in water consumption among ethnic groups. They pointed out that the ‘country of origin’ and ‘cultural factors’ that impacted water use preferences, along with other factors, explained a significant portion of the variation in domestic water use (Darr et al., 1975, p. 805). Subsequently, Murdock et al. (1991) examined the magnitude of the effect that ethnic factors had on domestic water use in the US state of Texas. Their results confirmed that ‘ethnic status’ significantly affected water consumption and was ‘often of relatively greater importance than economic, climatic or other physical factors in explaining per capita water use’ (Murdock et al., 1991, p. 235). Additionally, they proposed that if ethnicity was applied in water-use forecasts, it would lead to a dramatic improvement in accuracy (Murdock et al., 1991). Another study conducted in the US context, that of Pfeffer and Stycos (2002), which attempted a comparison between the environmental behaviours of ethnically diverse immigrants and the native-born population, also looked at the water-saving behavioural aspect. In New York, they found disparities between the ethnic immigrants and the native-born population vis-à-vis the likelihood of undertaking water-saving actions. They found that the immigrants were more likely to report water-saving behaviours compared to the native-born population, and this disparity became significant and wider as immigrants’ years of interacting with the host society increased. However, Pfeffer and Stycos’s (2002) study regarded ethnic migrants as one homogenous group, and did not examine the possible differences between various ethnic minority groups. A study undertaken by Smith and Ali (2006) in 17 metropolitan boroughs (local government areas) in the UK, which combined actual water consumption data with the demographic (ethnic and religious) data of communities, provided further information about the impact of cultural and religious water

use. Smith and Ali (2006), who identified diverse water use patterns (not volumes) between the ethnic and religious groups, claimed that the water use patterns were highly shaped by and tightly related to religious and cultural practices (e.g., Wudu practice in Muslim culture and dish-washing under running water among the Hindu community). They argued that ‘it would be extremely unwise to exclude religion or ethnicity as parameters in any further research into understanding domestic water demand’ (Smith & Ali, 2006, p. 209). In the Australian context, in NSW the Department of Environment and Conservation (DEC)<sup>8</sup> conducted research into the differences in attitudes, knowledge, and behaviours of significant ethnic groups regarding environmental issues, and water in particular (Department of Environment and Conservation, 2005; Environment Protection Authority, 1997a). The survey series ‘who cares about the environment’<sup>9</sup> in NSW also examined their findings across the language segments (English speaking vs. non-English speaking background community groups) in their analysis (Department of Environment and Conservation, 2004, 2007; Department of Environment Climate Change and Water, 2010; Environment Protection Authority, 1994, 2001; Office of Environment and Heritage, 2013). The DEC’s (2005) study found that a high percentage (71%) of ethnic populations tended to nominate the environment as a very important priority in their daily lives, a figure substantially higher than the percentage (54% and 53%) found in the community-wide surveys DEC (2004) and DEC (2007). The survey series pointed out that similar to the majority, the ethnic minority communities also care about the environment; however, they tended to be less knowledgeable of, or familiar with, environmental issues in NSW compared to the majority and tended to be less active in some local environmental activities. The ethnic minority participants were less likely to sometimes reduce water consumption compared to their English-speaking background counterparts (25% versus 17%) (Office of Environment and Heritage, 2013).

So, while the above studies all recognized that ethnicity has a significant effect on water use, the mechanism of effect was not explained. Smith and Ali’s (2006) study suggests that water use differences were related to religious matters regarding water use practices; however, the

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<sup>8</sup> The NSW Department of Environment and Conservation was established in 2003, incorporating the staff of the Environment Protection Authority (EPA), National Parks and Wildlife Service, Royal Botanic Gardens and Resource NSW. The NSW Department of Environment and Conservation changed its name to NSW Department of Environment and Climate Change in 2007, and is now within the Office of Environment and Heritage.

<sup>9</sup> The series was initiated in 1994 by the NSW Environment Protection Authority (EPA). The 2003-2009 surveys were commissioned by the Department of Environment and Conservation (the former Department of Environment and Climate Change). And the latest 2012 survey which conducted was commissioned by the NSW Office of Environment and Heritage (OEH).

effect of ethnicity was not delineated in their research. The DEC's (2005) survey findings implied that differences in attitudes and behaviours were linked to ethnic minority groups' cultural backgrounds, environmental experience in their home countries, and to some extent constrained by language and unfamiliarity with the local environment. But, functional relations were not further studied. Corbella and i Pujol (2009) state that migration and multiculturalism are changing the composition of western societies. For this reason, the population and household characteristics of immigrants are considered to be of importance when investigating domestic water use patterns. However, what exactly are the differences, and, what contributes to the differences in water consumption behaviours of ethnic minority groups? Drawing on Medd et al.'s (2007) insights into and suggestions for the sustainable water management research agenda when negotiating cultural diversity, the relationship between practices, values and identities also need to be investigated. A review of the extant environmental research literature concerned with ethnic diversity in environmental issues, water issues in particular, is necessary to establish a theoretical and empirical foundation for exploring the ethnic correlates of water consumption.

#### ***2.4.2 Factors determining domestic water consumption***

Before proceeding to examine the relationship between ethnicity and water consumption, a review of the literature that focuses on domestic water use and debates surrounding urban water and population relations is necessary to understand the factors that shape water consumption, or are involved in the process of water use decision-making.

Generally speaking, the high-consumption lifestyles of households are believed to be the main cause of stress over water resources (Hurlimann, 2006). Growing interest has been expressed in investigating the determinants of urban water demand since the late 1960s. The initial focus was upon the 'requirement concept' of estimating water demand which assumed that water requirements were just a function of population growth and the particular type of urban development (Foster & Beattie, 1979). Research then progressed from this requirement model to economic models in which the roles of economic factors (e.g., water price and consumers' incomes affecting urban demand) were addressed (see Gottlieb, 1963; Primeaux & Hollman, 1973; Wong, 1972). Other demographic factors have also been emphasised, e.g., household size (Independent Pricing and Regulatory Tribunal, 2004; Lux, 2008), age structure (Makki et al., 2013; Murdock et al., 1991), gender (Van Koppen, 2001), and

education (Howarth & Butler, 2004; Sofoulis, 2005). The ownership of water-use related amenities such as washing machines, gardens and swimming pools has also been identified as an important influencing factors regarding domestic water consumption (see Fox et al., 2009; Head & Muir, 2006; Murdock et al., 1991). A range of factors have been recognised, including attitudinal and behavioural factors (see Gilg & Barr, 2006; Randolph & Troy, 2008), cultural factors (Allon & Sofoulis, 2006; Elizondo & Lofthouse, 2010a; Medd & Shove, 2005), religious variables (Smith & Ali, 2006) and urban built environments (Randolph & Troy, 2008; Troy & Randolph, 2006).

Household demands for water include essential needs such as drinking, personal hygiene, cooking, and laundry (Gleick, 1996). They also include usage related to leisure activities or various activities such as garden watering, car washing and swimming (Schleich & Hillenbrand, 2009). In other words, household water consumption is comprised of discretionary and non-discretionary water usage. This division is very important when examining the effects of water use drivers, so that the targeted water-saving potentials implemented by demand management approaches can be satisfactorily achieved through discretionary water use without translating the burden to a household's basic needs for water (Corbella & i Pujol, 2009). Price, which is one important factor influencing domestic water consumption, is also regarded as one of the most effective incentives for achieving water-saving potentials (Garcia & Reynaud, 2004). The basic logic behind the emphasis on pricing is that higher prices result in less water consumption (Shaw, 2005). Price-elasticity tends to be (in absolute terms) greater when dealing with outdoor leisure-related activities than it is for indoor water usage; because indoor water use fulfils more basic needs, there is less price elasticity (Renwick & Green, 2000). However, the price effect varies depending on several other factors, such as the metering approach (common meter or independent meter), the household's acknowledgement of the pricing (Frondel & Messner, 2008; Gaudin, 2006) and the household's economic status (Renwick & Green, 2000). Lack of information about the water price among households is likely to render the pricing instrument less effective (Gaudin, 2006).

Income has been found to be positively related to residential water consumption (Hoffmann et al., 2006). Cole (2004) maintains that increases in income are often accompanied by an improvement in living standards, which suggests an increase in new water-consuming household appliances or amenities such as gardens or swimming pools. Another factor

signalling that income matters is that affluent households are not likely to respond to price incentives as they are not effective enough to induce such a response (Renwick & Green, 2000). Low-income households are more responsive to price.

Demographic and social factors also matter; several were found to be of even greater importance than economic factors in explaining per capita water consumption, e.g., age of householder and household type (Murdock et al., 1991). Household or population dynamics (household size, household composition, age structure, gender and employment status) are the basic elements that facilitate understanding of the domestic consumption (Lux, 2008). As opposed to the economic factors, these socio-demographic factors have more influence on water usage than incentives. With regard to household size, in general, the more members living in a household, the higher the aggregate water consumption (Beal et al., 2011). However, a certain level of economy of scale is found to exist in large households (Arbues & Villanua, 2006; Arbues et al., 2010). The rationale is that water is used more efficiently in large households as members share resources. For example, people tend to take short showers in large households so that others can use the bathroom (Troy & Randolph, 2006). However, Arbues et al. (2010) suggest that small households are better able to adjust and respond to water pricing changes due to reasons of incentive and capacity to control factors.

Age and gender also matter, although they have attracted less study compared to other variables (Corbella & i Pujol, 2009). Studies indicate two opposing arguments on the relations between age and water consumption. One argument proposes that as people age, they use more water (Billings & Day, 1989; Schleich & Hillenbrand, 2009). Schleich & Hillenbrand (2009), who examined per capita water consumption in 600 water supply areas in Germany using regression analysis, found that per capita water consumption increased 1.8 L per day with a one year increase in the average age. This may have been because many retired people spend more time at home and thus have more chance to use water, such as watering their gardens (Billings & Day, 1989). Many elderly people tend to use their bathrooms more often due to health concerns (Schleich & Hillenbrand, 2009). Conversely, some studies suggest age has a negative relation to water consumption (Musolesi & Nosvelli, 2007; Nauges & Thomas, 2000). Many elderly people tend to have innate water-saving attitudes and therefore use water more sparingly. What is more, their generally low incomes may also affect their water usage (Nauges & Thomas, 2000). Makki et al. (2013), who examined the influencing factors of water consumption for showering in Victoria, Australia,

noted that households with children consumed more water in the shower than households without children. The conflict between these empirical findings may be attributable to the different social contexts examined in the studies or to differences in the study periods (winter or summer). In general, the effect of age on water consumption needs further exploration.

Gender is regarded as an important factor in water research and water policy-making due to the substantial variation in water use between genders (Van Koppen, 2001). Females are expected to use more water than males given that they are more likely to undertake water-related activities (often on behalf of the household, including male members). Makki et al. (2013) observe that females are more likely to take long showers than males. Gender differences are also suggested to exist in environmental concerns and pro-environmental behaviour. Research into gender differences in environmental concerns indicated that females are more likely to have a high level of environmental concern, and to be more actively engaged in environmental action (Fink, 2011), particularly household-orientated pro-environmental behaviour (Hunter et al., 2004).

The impacts of household composition on household water consumption mainly reflected the effects of age (children or adults), gender and number of members (Independent Pricing and Regulatory Tribunal, 2004). The Independent Pricing and Regulatory Tribunal (2010), in a survey of residential water use conducted in the Sydney area, indicated that large water consumers tend to include households comprised of couples with children. Another way in which household composition might impact on water use is the tenure status of the dwelling. As indicated by Troy and Randolph's (2006) research, which analyses the relationships between dwelling type and water consumption in Sydney, people who are renting tend to be less active in adopting water-saving actions compared to those who are living in their own dwellings. This phenomenon may be due to the fact that tenants do not pay their water bills; therefore, they tend not to be aware of their water consumption. They feel that it is difficult to respond to calls for water saving (e.g., they are not able to replace aging appliances with efficient ones because they are renting) (Troy & Randolph, 2006).

Thus, ownership of water use appliances and amenities, as well as dwelling type, are believed to affect water consumption (Independent Pricing and Regulatory Tribunal, 2004; Murdock et al., 1991; Randolph & Troy, 2008; Troy & Randolph, 2006). The essential logic is that the higher the number of water use related appliances and amenities, e.g., washing machines,



gardens and swimming pools owned by households, the higher the quantity of water consumed by households. The impact varies, however, depending upon the frequency of usage of the facilities (Murdock et al., 1991) and the water-efficiency of the appliances (Grafton et al., 2011; Makki et al., 2013). Apropos of dwelling type, households living in separate houses, townhouses and semi-detached houses consume more water than those living in units (Independent Pricing and Regulatory Tribunal, 2004; Troy et al., 2005). Water use difference between dwelling types is suggested to reflect the household makeup, household size, or the presence of water use amenities such as lawns and gardens (Independent Pricing and Regulatory Tribunal, 2004; Troy et al., 2005). Troy and Randolph (2006) suggest that differences are also likely to exist in an individual's perceptions and attitudes between types of dwellings. For example, unit-dwellers are less responsive to price incentives because they use a common meter for measuring the water usage in their building block. Other physical factors, such as temperature and rainfall, also matter (Gato et al., 2007; Hoffmann et al., 2006). These climatic factors are expected to impact on outdoor activities, such as garden watering, and the family swimming pool.

Education level is considered to correlate with an individual's water use. The basic logic is that highly educated people are expected not only to have extensive knowledge of environmental issues (Kollmuss & Agyeman, 2002), but also to be more conscious about environmental protection (Syme et al., 2000). They are also more likely to undertake pro-environmental activities. Although, high level of educational attainment may be associated with high income state and, in turn, result in high water consumption. Environmental knowledge can be understood as familiarity, recognition, awareness and basic understanding of the environment and related environmental matters, as well as of information about possible solutions to environmental issues (Cheung et al., 2015). Those with a high level of environmental knowledge are expected to be aware of, and understand, what constitutes environmentally responsible behaviour as well as the importance and benefits of undertaking said behaviour (Frick et al., 2004). However, the effects of environmental education (knowledge) in promoting environmental behaviour may not prove as strong as expected (Kollmuss & Agyeman, 2002). Howarth and Butler (2004) found that by assessing the effectiveness of a water efficiency campaign in a residential area of 8000 properties in the UK, the education campaign produced little effect on water consumption. This may have been due to reasons such as 'the public regard water as low priority compared to other environmental issues' (p. 33). Even though environmental awareness and

behavioural changes are gained through education or knowledge provision, as Lawrence and McManus (2008) found in their study examining the impacts of sustainable lifestyle education programs in Sydney, improved behaviour did not significantly translate into water savings due to the limitations of infrastructure. Nevertheless, knowledge has been considered a prerequisite for pro-environmental behaviour (Pfeffer & Stycos, 2002). Kollmuss and Agyeman (2002, p. 250) argue to the effect that: ‘clearly, people have to have a basic knowledge about environmental issues and the behaviours that cause them in order to act pro-environmentally in a conscious way’. Specific knowledge (e.g., knowledge of action strategies) is also needed to trigger beneficial environmental attitudes and behaviours.

Environmental experience, such as experience of nature during childhood and recent experience of an environmental pollution event, influences people’s environmental sensitivity and involvement (Kollmuss & Agyeman, 2002). Direct experiences (such as seeing dead fish in the river) are regarded to have a stronger influence on behaviour than indirect experiences such as learning from school or media (Rajecki, 1982). Indirect experiences are developed based on secondary information, which may not trigger emotional involvement (Fliegenschnee & Schelakovsky, 1998; Kollmuss & Agyeman, 2002). Moreover, the experiencing of drastic and sudden changes (e.g., drought, flood) in the environment also tend to have a greater impact on pro-environmental behaviours than that of slow and gradual changes (e.g., global warming); (Kollmuss & Agyeman, 2002; Preuss, 1991). Slow changes, especially environmental problems with complex causes, tend to pose a cognitive barrier which prevents people from deeper understanding of the causes and consequences of such phenomenon (Fliegenschnee & Schelakovsky, 1998). This in turn may be not likely to promote environmental awareness and beneficial attitudes.

Attitude and behavioural intentions are regarded as important factors in influencing people’s decision-making vis-à-vis water use and conservation (Gilg & Barr, 2006; Graymore & Wallis, 2010). During water conservation campaigns, positive changes in attitude are usually targeted by providing information about water conservation. The positive changes in attitude gained in such campaigns are expected to transfer to water use behaviour. However, even when people show positive behavioural intentions, these intentions are rarely successfully transferred to their actual behaviour (Jensen, 2008). Hamilton (1985) argued that there is no simple ‘read-off’ between attitudes and actual behaviour, especially in the environmental domain (Sofoulis, 2005). Nevertheless, attitude is still an important factor in facilitating

pro-environmental behaviour (Graymore & Wallis, 2010). In general, environmentally beneficial attitudes are positively associated with the engagement level of water conservation behaviour (Domene & Saurí, 2006; Millock & Nauges, 2010). Domene and Sauri's (2006) study of water consumption in Spain found significant correlations between attitudinal variables and water consumption. Millock and Nauges (2010) noted that people who were actively concerned with the environment were more willing to adopt water efficient appliances at home.

Knowledge, attitudes and behaviour regarding the environment were deemed to have a certain causal relationship between them in the early rationalist models, which simply assumed that more knowledge was aligned with more positive environmental action (Burgess et al., 1998). However, this assumption was proved to be problematic by later environmental psychological studies (Kollmuss & Agyeman, 2002), which showed that the relationships between knowledge, attitudes and actual behaviour are much complicated, being influenced by many other factors (Kollmuss & Agyeman, 2002; Sofoulis, 2005). Hines et al. (1987) argued that the 'locus of control' influenced people's actual environmental behaviour. Reference was to people's perceptions of whether they had the ability to create change. This gave rise to two situations: people believed in their ability and role to make change (internal locus of control); people lacked confidence and felt that what they could do was limited, and perceived that only powerful people or organizations could exercise influence (external locus of control) (Hines et al., 1987). Fietkau and Kessel (as cited in Kollmuss & Agyeman, 2002, p. 246) stated that feedback about environmental behaviour was important. It could provide positive reinforcement for people, e.g., confirm the significance of their efforts or indicate that what they were doing was socially desirable. They also maintained that even though a person was environmentally concerned, her/his actual behaviour was restricted by possibilities to act environmentally (e.g., restricted by economic conditions, infrastructure). Similar to this argument, Blake (1999) suggests that barriers existed between environmental concern and actual environmental behaviour, including individuality (e.g., laziness), responsibility (e.g., no need to take the responsibility) and practicality aspects (e.g., lack of time). Kollmuss and Agyeman (2002) argue that attitudes are embedded in personal values and shaped by environmental knowledge, beliefs, emotional involvement, and personality traits. These factors, taken together, are expected to produce 'pro-environmental consciousness'. Kollmuss and Agyeman (2002) claim that the impact on pro-environmental behaviour may not derive solely from environmental awareness. Other reasons, such as the

value of frugality, can encourage people to consume less without concern for the environment (Fujii, 2006). The transfer of positive signals from the pro-environmental consciousness to behaviour is usually influenced - even restricted - by external factors such as conventional habits, infrastructure, technologies and economic conditions (Graymore & Wallis, 2010; Kollmuss & Agyeman, 2002).

Water consumption is directly determined by water use practices, e.g., washing clothes, taking showers and the watering of gardens. Habits and routines are regarded as important factors in understanding everyday water use practices (Krantz, 2006; Medd & Shove, 2005). Most water-use related activities are usually undertaken on a daily basis in the home as certain habits or as part of daily routines (Elizondo & Lofthouse, 2010b). People observe particular habits or routines to create a safe environment in which they perform their daily household activities unconsciously (Guiddens, 1990). As they become habit or part of people's daily routines, it is difficult to change certain water use behaviours. Moreover, habits and routines largely impact (block) the effect flow from environmental attitudes to environmental behaviours (Graymore & Wallis, 2010; Kollmuss & Agyeman, 2002). Thus, habits (unsustainable water use habits) are usually regarded as barriers to fostering pro-environmental behaviour (Graymore & Wallis, 2010). Notwithstanding, habits can also bring opportunities for promoting environmental behaviour. Changing people's behavioural patterns into more sustainable ones may be regarded as successful only when the newly formed behaviour evolves to become habit or parts of routines which prove more stable and long lasting (Elizondo & Lofthouse, 2010b). Behavioural psychological studies have provided useful knowledge concerning the evolution of water-use habits and routines as well as approaches to de-routinising habits. Pelletier et al. (2008) suggest that there are several stages in the process of changing habits: being aware of the problem and identifying solutions; initiating improved new behaviour; and, making it a stable habit. Sofoulis (2005) proposes that approaches, such as knowledge improvement, conversation and self-experimental-learning, be applied to each stage for de-routinising habits.

The above information and discussion combine to produce a complex picture of how water consumption is determined and influenced by various factors. Individual factors do not have an effect as such; rather, various factors influence water consumption in complex ways through interactions with other factors or processes. For example, the dwelling type affects water consumption not only through the presence of water-use amenities (gardens or

swimming pools), but also through the likely household makeup of dwellers. Moreover, the dwelling form and tenure of dwelling, as well as the profile of dwellers, will greatly influence a household's capacity to save water. This, in turn, will affect a household's attitudes and perceptions (Randolph & Troy, 2008). The determinants of water consumption may vary markedly between different specific social, cultural or other situational contexts (Nauges & Thomas, 2000). All these factors and processes discussed above which influence the residential water consumption are summarised in Figure 2. 1. As recognised in Section 2.4.1, ethnicity was also suggested to matter. Based on the review presented above, I argue that ethnicity might influence water consumption in several ways, interacting with other factors that influence water use as presented in Figure 2. 1. This argument will be developed by a review of environmental psychological, behavioural and culture-related environmental literature in the following section (Section 2.4.3). The review aims to develop a framework for investigating the ethnic and cultural correlates of water use.

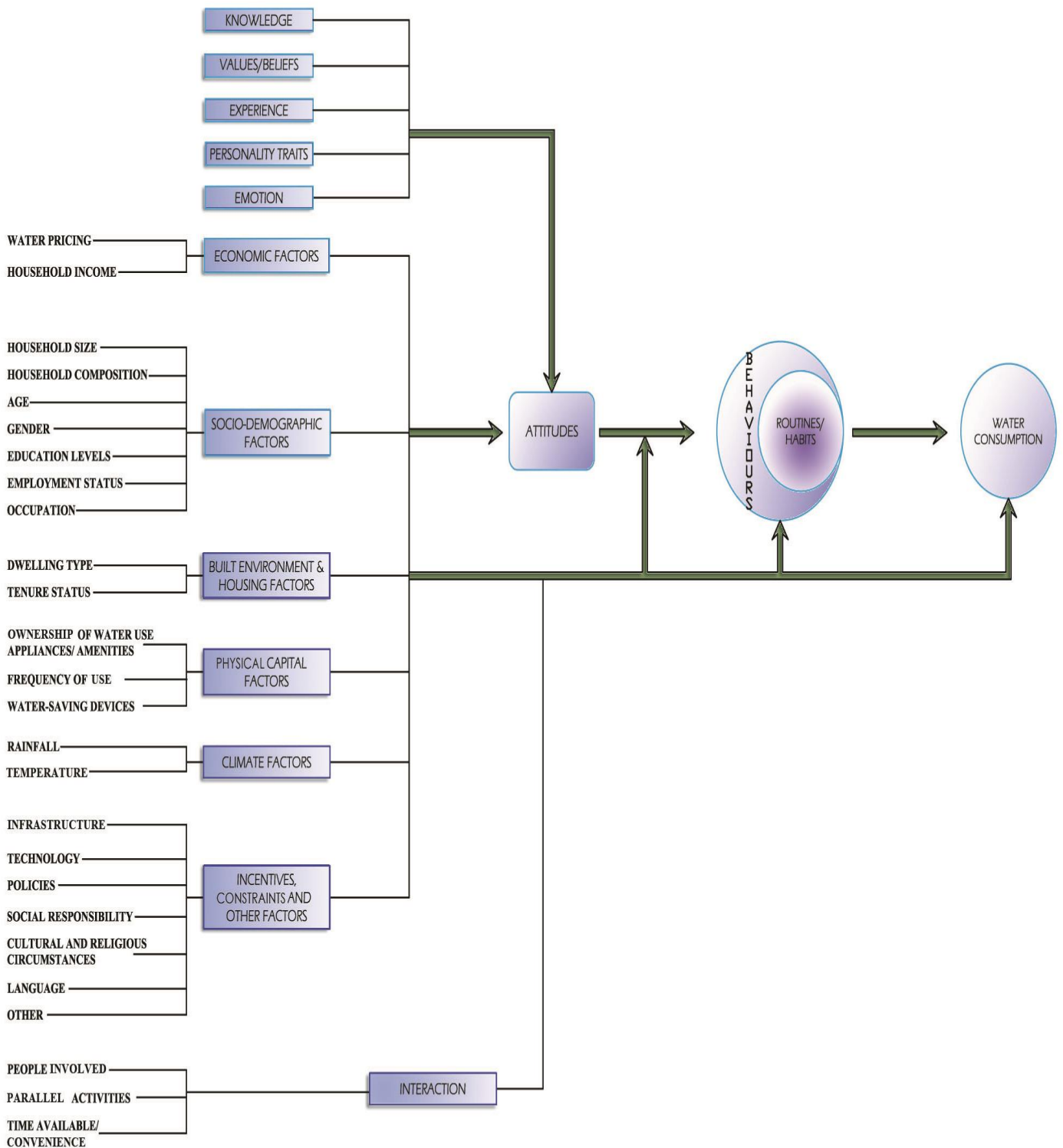


Figure 2. 1 Factors behind domestic water use (author)

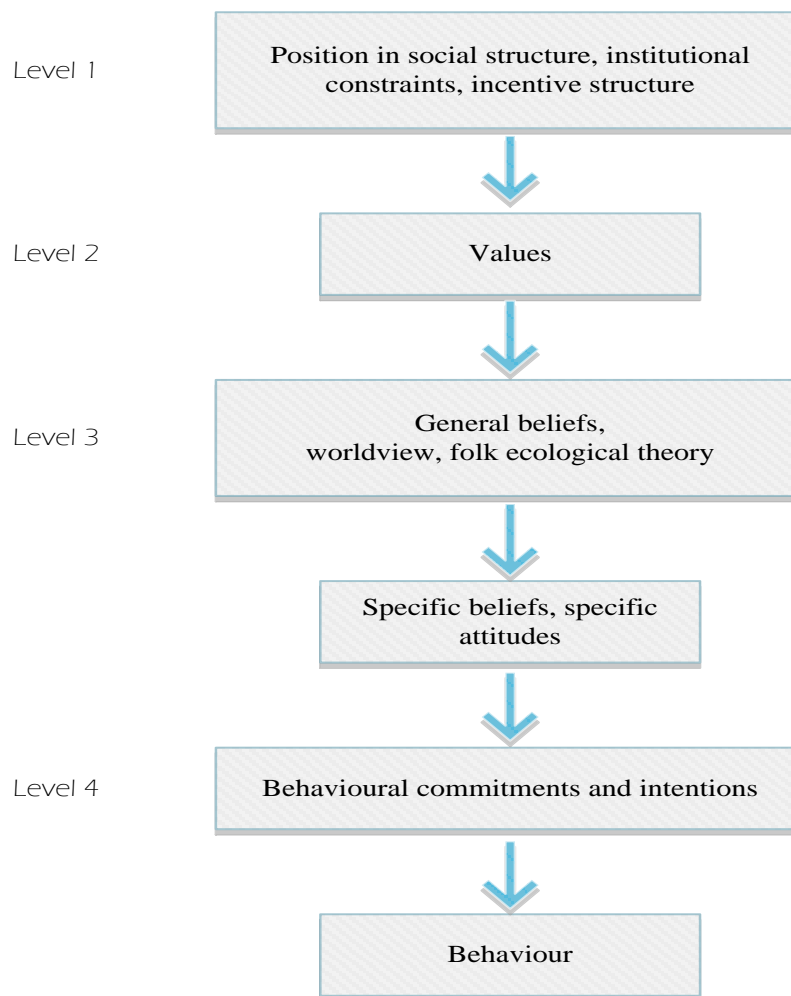
### ***2.4.3 Ethnic variation in environmental concerns, behaviours and rationales***

#### **1) The value-basis theory and ethnic variation**

As suggested in the above section (Section 2.4.2), attitudes play an important role in influencing water use and conservation behaviour (Domene & Saurí, 2006; Millock & Nauges, 2010). Many factors have been recognised as influencing a person's environmental attitudes and concerns, among which people's generalised internal standards (values) are believed to be an essential element (Schultz et al., 2005). A number of behavioural studies, after exploring the links between values and environmental attitudes (value orientation approach), recognised values as underlying determinants of environmental concerns and, by extension, environmental behaviour (e.g., Deng et al., 2006; Johnson et al., 2004; Nordlund & Garvill, 2002; Schultz & Zelezny, 2003). This could prove more useful for predicting environmental concerns than socio-demographic variables such as age, education, and income (Deng et al., 2006). Since values are formed and developed in a certain social and cultural contexts, it is reasonable to expect cultural differences in values (Johnson et al., 2004). Moreover, value differences across ethnicities or cultural groups are in turn expected to be expressed according to the levels, or types, of environmental concern and engagement of environmental behaviour adopted by particular ethnic groups.

The value-orientation approach to analysing and understanding environmental concern proposes that some form of causal relations exist between values, attitude and behaviour towards specific environmental issues (Dietz et al., 1998; Stern et al., 1995); and, ethnicity is expected to operate through this effect flow (Johnson et al., 2004) (Figure 2. 2). As shown in Figure 2. 2, Johnson et al. (2004) propose that, based on Stern et al.'s (1995) and Dietz et al.'s (1998) models, social structural factors constitute precursors of values and general beliefs in a causal relationship. Social structural variables include factors such as ethnicity, age, and gender factors that influence one's general life values, and in turn shape an individual's general beliefs and values towards the environment and nature. These general beliefs and values generate more specific perceptions of the environment (e.g., attitudes about water conservation), which in turn precede behavioural commitments and intentions. Finally, the influence flow ends upon the conduction of actual behaviour. Based on this theory, Johnson et al. (2004) compare the environmental belief (measured by the New Environmental

Paradigm (NEP) scale)<sup>10</sup> and behaviour between the White (European Americans) and four ethnic groups (Blacks, US born Latinos, foreign born Latinos, and Asian Americans) in the United States<sup>11</sup>. They found that the Blacks and foreign-born Latinos scored significantly lower in NEP than Whites, which in effect contributes to the behavioural differences between the Whites and minorities, at least to some extent.



**Figure 2. 2 Causal model of values, environmental concerns and behaviour**

*(adapted from Johnson et al., (2004, p. 160), developed based on Stern et al'. (Stern et al., 1995) and Dietz et al.'s (1998) model)*

Three value orientations, i.e., social-altruistic, biospheric and egoism or self-interest value

<sup>10</sup> The New Environmental Paradigm (NEP) scale was established in 1978 by Dunlap and Van Liere and improved later in 1992 and 2000 by them. The measure scale (including the original 12-item version, the 6-item version, and the 15-item revision) has become widely used in environmental studies for measuring people's generalised environmental beliefs and pro-environmental orientation (Dunlap et al., 1992; Dunlap, 2008; Dunlap & Van Liere, 1978; Dunlap et al., 2000; Hawcroft & Milfont, 2010).

<sup>11</sup> The ethnic terms used here are the exact terms used by Johnson et al. (2004) in their original study.



orientations (Stern et al., 1993), are largely believed to drive and govern environmental beliefs, concerns or attitudes (Deng et al., 2006). Social-altruistic value orientation predisposes people to think and behave with concern for the welfare of the group (such as the community group, or human beings): biospheric value orientation situates people in a position of concern for the welfare of the ecosystems (non-human species and the environment). In contrast, egoism or self-interest values orientate people towards judging environmental issues from a point of self-interest (Stern & Dietz, 1994; Stern et al., 1993). Studies have found that differences exist in the endorsement of the social-altruistic, biospheric and egoistic environmental motive concerns across cultural groups, which in turn influence environmental behaviours (Deng et al., 2006; Milfont et al., 2006).

Cultures influence the types (altruistic, biospheric and egoism) of attitudes regarding the environment that people adopt (Schultz, 2002). Asian cultures have a long history of a biospheric worldview which was largely influenced by Taoism, Confucianism and Buddhism (Jenkins, 2002) and embraces a harmonious relationship between humans and nature. The traditional Asian (Eastern) cultures have a tendency towards collectivist values, emphasising the collective good above individualism (Chan, 2001; Connection, 1987). The traditional Eastern (hu)man-nature and collective value orientations which directly or indirectly influence people's attitudes towards water use and conservation, encourage them to think from the perspective of collective interests and the welfare of the environment (Deng et al., 2006). In contrast, traditional Western cultures have historically been influenced by an anthropocentric worldview, which is rooted in the Judeo-Christian maxim that humans are above nature (Schultz, Zelezny, et al., 2000). In line with this anthropocentric orientation, Western society tended to pursue the maximum economic growth and the enjoyment of material abundance (Deng et al., 2006). The ultimate result was that people became less likely to endorse biospheric values. However, it is important to address the potential influence of Western culture on non-Western societies (Johnson et al., 2004) as well as the value change in both Western and Non-Western cultures. With the diffusion of materialistic values, competition and wealth, the traditional Asian values of (hu)man/nature relationship are decreasing, whereas there is increased environmental awareness in Western societies (Deng et al., 2006).

Another value worthy of mention is frugality. Frugality is not concerned with environmental consequences (such as air pollution), but rather with the resources required for such

behaviour (e.g., energy, money). Frugal behaviours usually yield pro-environmental outcomes, although this might not be the motivating factor. For example, not watching TV leads to a reduction in energy consumption and is money-saving: it also results in a reduction in CO<sub>2</sub> emissions (Fujii, 2006). Fujii's (2006) study conducted in Tokyo and Toyohashi revealed that a strong frugality attitude is positively related to gas and electricity reduction, and that enhancing frugality attitudes would effectively promote pro-environmental behaviour. Hamilton (2003) observes that continued consumption growth has been questioned by people in developed nations. Substantial numbers of people are reconsidering their lifestyle and making changes towards frugal consuming behaviour. In addition to frugality, a disciplined lifestyle, self-cultivation, the prestige of education and sacrifice, represent the basic traditional values stressed in East Asian cultures. The value of frugality was substantially influenced by the Confucian culture in Chinese history (Zhang, 2012). The Master said: 'Extravagance means ostentation, frugality means shabbiness. I would rather be shabby than ostentatious'<sup>12</sup> (Lau, [500 B.C.E] 2008). Moreover, frugality is not merely regarded as a traditional concept in China, but also as a virtue that forms part of its modern culture.<sup>13</sup> In Chairman Mao's era (1949-1976), frugality was depicted as a Communist ideal and promoted by the state (Wang, 2009).

Studies based on the value-orientation approach introduced above have produced mixed results. Schultz (2002), after measuring the environmental concerns of people from the US and seven other countries (Brazil, Colombia, Costa Rica, El Salvador, the Dominican Republic, Paraguay, and Venezuela), based on his Environmental Motives Scales (EMS)<sup>14</sup> found that US participants were more likely to have egoistic concerns, whereas participants from other countries tended more towards endorsing biospheric concerns. In the Canadian

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<sup>12</sup> The original text is 子曰：'奢则不孙，俭则固。与其不孙也，宁固。' In Lau [7:36] (论语述而篇第七章 36.)

<sup>13</sup> Frugality is, argued by some literatures, to be developing as one of the modern socialist virtues, despite of China's rapid economic growth and the rise in consumption among the wealthier Chinese. For example, see Zhang (2012) and Lu (2008); for some insights into why the Chinese continue to prefer savings than consumption even when many Chinese people are getting wealthier.

<sup>14</sup> The Environmental Motives Scales (EMS) is an attitude-measuring scale established based on the three value orientation (altruistic, biospheric and egoism) theory (Schultz, 2002; Schultz et al., 2005; Wesley Schultz, 2001). It looks at the consequences (that result from harming nature) that concern individuals most (e.g., I am concerned about environmental problems because of the consequences for my health is an egoistic orientation).

context, Deng et al. (2006) reveal that while Chinese Canadians were more supportive of social-altruistic values than Anglo-Canadians, they shared the same biospheric values as Anglo-Canadians. In contrast, employing the NEP to measure biospheric concern between Anglo-Australians and Chinese-Australians, Leung and Rice (2002) found divergence in the endorsement of biospheric concerns between the two groups. Anglo-Australians were found, in Leung and Rice's (2002) study, to score higher in biospheric concerns than their Chinese counterparts. Furthermore, the endorsement level of biospheric value was found to be significantly related to the engagement level of pro-environmental behaviour among the Anglo-Australian group, whereas the correlation was not significant in the Chinese Australian group. Studies suggest that different ethnic/cultural groups tend to endorse different value orientations. Milfont et al. (2006) who examined the environmental motivation concerns between European New Zealand students and Asian New Zealand students using the EMS measuring scales, found that whereas European New Zealanders scored significantly higher in biospheric environmental concerns, Asian New Zealanders scored significantly higher in egoistic concerns. No significant difference was found in their altruistic environmental concerns. A further testing of the implications for environmental behaviour in the study indicated that the high biospheric concerns of European New Zealanders significantly predicted environmental behaviour positively, whereas for Asian New Zealanders, biospheric and altruistic concerns both appear to be good predictors of environmental behaviour. Although the findings of the above studies are somewhat inconsistent (e.g., Anglo-Whites were found to have high biospheric concerns in some studies, while in other studies they were found to be more egoistically concerned), studies applying the value-basis theory have empirically identified cultural differences in environmental values orientations, and addressed the effect flow through which ethnicity could influence pro-environmental behaviour.

## **2) Hierarchy of Needs, Environmental Deprivation theories and ethnic variation**

As suggested in Section 2.4.2, besides values, there are many other factors underlining environmental concerns and behaviour. These include knowledge, experience and economic factors. Apart from the value orientation approach, social studies have utilised other perspectives from which to explore ethnic similarities and differences in environmental attitudes and behaviour. Pfeffer and Stycos (2002) propose that the idea of postmaterialist and grassroots environmentalism could provide useful insights for exploring and understanding the uptake of environmental concern and environmentally friendly behaviour among Whites and ethnic migrant groups. Two underlying theoretical hypotheses, Hierarchy of Needs

Theory and Environmental Deprivation Theory, have been used to examine ethnic similarities and differences in environmental attitudes (Whittaker et al., 2005). The Hierarchy of Needs Theory argues that local people, or people from wealthy nations, tend to be more concerned about the environment; conversely, poor or minority people are more likely to be preoccupied with day-to-day pressing needs - such as economic or security issues - rather than with environmental issues (Maslow, 1970; Pfeffer & Stycos, 2002). In contrast, Environmental Deprivation Theory suggests that environmental experience matters considerably, the essential logic being that the more polluted the environment to which people are exposed, the more concerned about the environment these residents will become (Lowe & Pinhey, 1982; Van Liere & Dunlap, 1980). In contrast to environmental deprivation theory, Morrison et al. (1972) proposed a rival theory, the relative deprivation theory, which argued that concerns were more likely to arise among people who used to live in good environments but became exposed to pollution post migration (Morrison et al., 1972).

Empirical studies seeking to correlate people's environmental concerns with their ethnic identity and other socio-economic characteristics by applying and testing the above theories have produced mixed results. Such studies date back to the late 1970s (Whittaker et al., 2005). Prior to 1990, studies, which were mostly based on the hierarchy theoretical hypothesis, argued that environmental concern, indeed environmentalism in general, was only a 'White thing' (Hershey & Hill, 1977-78; Taylor, 1989b). Lahart (1978), for example, found in a pre-adult study that Blacks had less environmental knowledge than Whites. And, Hovart (1974) found that Blacks were less concerned about the environment than Whites. Taylor (1982), who analysed environmental opinions among White and non-White students, found that the latter were less likely to regard environmental issues as top issues and less likely to engage in environmental activities. A general 'concern gap' was suggested to exist between the Whites and non-White groups by most early studies (Taylor, 1989a). However, this White-hypothesis, or concern-gap hypothesis was criticised by later studies (for example, Jones & Carter, 1994; Mohai, 1990; Parker & McDonough, 1999; Uyeki & Holland, 2000). Jones and Carter (1994) argued that many claims relating to the Black/White concern gap were based on inadequate and sometimes misinterpreted evidence. Jones and Carter (1994) examined the environmental concerns of Black Americans and the White Americans through a series of analyses of nationwide, National Opinion Research Centre (NORC) trend data from 1973 to 1990. They found that within the 16 year period, Whites support for environmental protection was only greater than that of the Blacks in 1990, and identical to the

Blacks in 1985. For all other years (14 years), Blacks displayed more support for environmental protection than Whites. This finding was corroborated by Mohai's (2003) study, which found that differences existed between African Americans and White Americans vis-à-vis environmental concerns; however, African Americans, rather than the Whites, were more concerned about environmental issues such as pollution and neighbourhood environmental quality. Mohai suggests that the differences likely reflected the social phenomenon; that is, African minorities were affected disproportionately by environmental hazards.

Van Liere and Dunlap (1980) maintained that any examination of racial or ethnic differences in environmental concerns should break down the subject into different types of environmental issues, rather than taking 'environmental issue' as an umbrella category. In light of this, Mohai and Bryant (1998) examined the differences between African-Americans and White Americans regarding issue-specific environmental concerns. They found that African-Americans were more likely to be concerned about pollution and other neighbourhood environmental issues whereas the Whites were more concerned about global level environmental problems. This is consistent with Clarke and Agyeman's (2011, p. 1795) argument that ethnic groups tend to be more concerned about 'specific' environmental issues' like air pollution while the majority (Whites or Anglo-Europeans) are relatively more concerned about 'remote' or 'global-level' environmental issues. As regards pro-environmental behaviour, Pfeffer and Stycos (2002) found that whereas immigrants in New York, compared to the native-born, were less likely to purchase energy-saving light bulbs and appliances and to engage in environment-related political behaviour, they were more active than the native-born in observing some personal constraints, such as eating less meat and in saving water. As Klocker and Head (2013) argue, the diverse engagement level with particular environmental issues among ethnic minority groups is not necessarily due to lack of concern, but could be ascribed to different environmental priorities, perceptions or personal experiences. Studies indicate that the disparities across ethnic groups may be explained by different perceptions of who (individuals or the government) is responsible for the environment (Kollmuss & Agyeman, 2002; Vavricka, 2013). Vavricka (2013) contends that while African-Americans considered both individuals and the government responsible for environmental issues, other ethnic groups, e.g., native-Americans, Asian-Indians, Chinese, Filipinos, Japanese and Koreans living in America held the government primarily responsible for environmental protection. In comparison, Clark and Agyeman indicated in their study

conducted in Britain that the South-Asian migrants tended to separate the environmental responsibility clearly into two spheres: individual's responsibility for the 'immediate home environment' and the government's responsibility for the 'outside local environment' (Clarke & Agyeman, 2011, p. 1794).

Whittaker et al. (2005) argue that the existing studies in the USA mostly focus only on African-Americans as the minority population of interest, ignoring other sizable ethnic segments of the population. Given that the different minority populations do not constitute a homogenous group (Segura & Bowler, 2005), it is necessary to include other racial or ethnic groups into the studies, rather than simply using White/non-White, or native-born/immigrant binary variables (Klocker & Head, 2013; Whittaker et al., 2005). Based on this consideration, Whittaker et al. (2005), who included Latinos together with African-American and non-Hispanic Whites in their studies, found that both Latinos and African-Americans appeared more sensitive than Whites to some environmental issues, e.g., water pollution and toxic waste. Moreover, they also observed that the White-concern claim was 'overstated and outdated' (Whittaker et al., 2005, p. 445). In addition, they found a significantly increasing concern-trend over a 20-year time period (1980-2000) in Latinos on three environmental issues ('pollution', 'toxic chemicals' and 'support for protecting the environment') (p.445). This suggests that while Latinos may have been somewhat less concerned about those environmental issues than Whites in the past, their increasing awareness has made Latinos more sensitive about parts of the environment than Whites. An increasing concern-trend was also found among African-Americans regarding pollution concerns. Greenberg (2005), who included an Asian-American group (Chinese, Korean and other Asian background respondents) in an environmental study in New Jersey, indicated that Asian-Americans, together with Spanish-speaking Hispanic Americans, were less likely to be concerned about environmental pollution problems than White, Black or English-speaking Hispanic Americans<sup>15</sup>. His study also revealed that demographic predictors for environmental concern calculated within the White and Black respondents did not fit the Asian group. Those among the White and Black respondents who were more concerned about the environment were self-declared political liberals rather than political conservatives, were more formally educated, and tended to be more than 65 years old and female. Whereas those who were more environmentally concerned within the Asian group were not self-declared political liberals,

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<sup>15</sup> The ethnic terms used here are the exact terms used by Greenberg (2005) in his original study.

were not more formally educated, and not female. Greenberg (2005) stresses the importance of examining and understanding the environmental perceptions of Asian Americans. In light of these findings, it is critical to point out that categorising people of Asian descent, as one homogeneous group is problematic, as being of Asian descent encompasses a huge diversity of cultures, languages and literary traditions. Therefore, any analysis of environmental attitudes and behaviours of people of Asian descent would gain more weight if undertaken with reference to particular ethnicities, language or geographic areas.

In sum, social studies focusing on ethnicity and environmental concerns generally agree that there are ethnic disparities in environmental concerns and engagement, and that ethnicity is a useful factor for analysing and understanding the variations in environmental concerns among a designated population. From this perspective, ethnicity is also expected to influence attitudes and concerns regarding water issues, and to affect water use behaviour. The value-basis theory, hierarchy of needs theory or environmental deprivation theory introduced above may help to explore and understand the effects that ethnicity have on water concerns and behaviour. It is important to emphasise that the purpose of this study is not simply to measure which ethnic group is more water-concerned and which is less active in water conservation than others, but to explore the perceptions, understandings and cultural preferences of ethnic communities vis-à-vis water use as well as other diverse factors influencing their water use and conservation. As suggested in Section 2.4.3, the water-use related habits and routines formed and developed in childhood are important elements in understanding people's water consumption (Medd & Shove, 2005), which provide an important basis for investigating the effects of ethnicity.

### **3) Habits, routines and cultural preference in water use practices**

Johnson et al.'s (2004) study, mentioned above, found that the effects of ethnicity on environmental behaviour appeared to be only partly mediated by NEP environmental concerns. This suggests that there are more direct relations between ethnicity and environmental behaviour than through value-based concerns. Johnson et al. (2004) argue that people might engage in certain pro-environmental practices because of convenience or due to factors which are more powerful than attitudes. Culturally, the habits and quotidian practices of an ethnic community could contribute to the ways in which behaviours are more directly shaped. The environmental implication of the habits, routines and practices that are shaped in particular cultural and social contexts has been realised and addressed in cultural

environmental studies, in terms of daily water use (Askew & McGuirk, 2004), dishwashing cultures (Elizondo & Lofthouse, 2010a) and gardening (Head et al., 2004). Medd et al. (2007) argue that rather than being shaped by ethnic and cultural identities directly, water consumption appears to be determined by the conduction of water use practices which are shaped by ethnicity along with other personal identities. And, the performance of those water use practices is completed through individuals' habitual enjoyment of services (Allon & Sofoulis, 2006). Medd et al. (2007, p. 3) note that 'formal religious principles, or particular values or behaviours conventionally aligned with particular ethnicities, have always to be translated and integrated into the complex habits and routines through which we accomplish everyday life'.

The majority of water-use related actions are carried out repeatedly and automatically as habits or part of daily routines (Elizondo & Lofthouse, 2010b). For example, the washing of clothes and dishes is undertaken weekly or daily as part of household chores. Allon and Sofoulis (2006) claimed that people's everyday use of water is not conducted as the use of a certain amount of water; rather, it is performed as their 'habitual enjoyment of services, technologies and experiences that water makes possible' (p. 47). When these activities are carried out repeatedly, people create a personal arrangement with said activities in order to feel in control. Once such habits or routines are established, people perform them continuously without thinking, and create a safe environment by following them (Krantz, 2006). According to Gram-Hanssen (2008) and Medd and Shove (2005), habits and/or routines are developed in certain cultural and social contexts rooted in the individual's childhood. They evolve over time with the interaction of experience, education and other related factors. From this point on, habits and routines are likely to be shaped by cultures and custom. For example, Smith and Ali (2006) found that water use variation was largely related to water-use practices shaped by religious customs. Moreover, although water use activities might vary among individuals, depending on the circumstance, similarities in water use patterns are expected within a group of people from the same cultural and social background. In other words, difference is expected between groups of people from different cultural and social backgrounds. Elizondo and Lofthouse (2010a), in their study comparing patterns of domestic water use in different contexts (Mexico and the UK), address the cultural influence on washing up habits. They found that people from the two nations tend to adopt different dishwashing approaches which were found to be embedded in their cultures. Differences in the amount of water used and in dishwashing frequency were not examined in their study.



Habits and routines evolve over time in tandem with changes of environment, personal experiences, or other circumstances (Medd & Shove, 2005). But, change tends to be slow and needs continuous stimulus (Graymore & Wallis, 2010). Even after people accept and begin to conduct new water use behaviours, old habits are likely to persist over time (Pelletier et al., 2008). Thus habits and routines tend to be regarded as barriers to encouraging the uptake of environmental behaviours (Graymore & Wallis, 2010). Partly due to this interpretation, culturally specific habits and routines are usually regarded as barriers to ethnic migrants' engagement with standard environmental activities, which are acknowledged and valued by the mainstream culture. Ethnic migrants are encouraged to learn the expectations of the mainstream culture and to adhere to standard environmental behaviour. However, this exclusive approach is criticised because it potentially ignores and undermines the vernacular sustainable practices brought by diverse ethnicities (Klocker & Head, 2013). In a study exploring eco-friendly living among the cultural and social diverse population of Stockholm (Sweden), Bradley (2009) state that the notion of eco-friendliness and planning strategies appear to be standardised by Swedish middle-class norms. The habits of the Swedish middle class, such as recycling, using district heating, purchasing organic food and engaging in outdoor activities are regarded as standard eco-friendly living behaviour, whereas other ways of saving resources and eco-friendly living habits (performed by immigrant minority groups) are usually ignored. These findings are consistent with other studies which show that, in general, ethnic minorities are more likely to dwell in flats, to live in large households (Bradley, 2009), grow more food in their backyards (Head et al., 2004), use public transport more often (Chatman & Klein, 2009), eat less meat, and are more likely to save water (Pfeffer & Stycos, 2002).

Attention has been drawn to exploring everyday domestic routines in cultural environmental research, the aim being to capture and understand the types of patterns or routines that people pursue (Klocker & Head, 2013). As some cultural environmental researchers have observed, culture can offer great potential for moving towards sustainability through the diverse vernacular sustainable practices brought by various ethnic communities (Allon & Sofoulis, 2006; Bulkeley & Gregson, 2009; Klocker et al., 2012; Klocker & Head, 2013). Allon and Sofoulis (2006) found in their study that suburban participants with a migration background (whether from rural areas or overseas) were likely to undertake some quotidian self-conducted water recycling practices created based on their knowledge, experience or

cultures of water use. Their experiences in different environments and exposure to different ‘regimes of water’, along with their resources-consumption cultures, provide them with the ability to think about and respond differently to water-use and conservation. Examples of such differences exist in other research themes, such as self-provision gardening practices among migrant background populations in suburban areas (Head et al., 2004) and ethnic minority migrants’ lower usage of private motor vehicles compared to the local-born (Bradley, 2009). Klocker and Head (2013) highlight the importance of acknowledging and maintaining the diverse sustainability actions practiced by ethnic minorities, especially in the first few years following their migration.

The above discussion has addressed the importance of habits, routines and cultural practices in understanding everyday water use practices and other environmental issues. In addition, it has proposed habits, routines and cultural practices as a possible way via which ethnicity and culture, influence water consumption. Again, I want to stress that people’s experiences and socio-economic status are also important variables when examining this ethnicity-habit correlation. The review has also recognised the important observation offered by Klocker and Head (2013) that environmental research into ethnic diversity should not merely focus on the quantitative measurements that attribute the title of most or least environmentally concerned. Rather, it is more important to look beyond the normative to the cultural to explore the diverse environmental capacities and everyday skills that an ethnic minority have brought with them. This argument is consistent with Medd’s et al.’s (2007) conclusion that although much useful knowledge can still be generated through quantitative measuring of the correlations between water usage and the ethnic, socio-demographic profiles of consumers, employing a quantitative approach alone may render it difficult to reach beyond the ‘what’ description of water-use patterns. Qualitative techniques are to supplement the quantitative approach, to provide a profound observation of ‘why’ diverse water practices exist.

#### **4) The notion of intersectionality and contextualising ethnicity in the consideration of broader factors**

Along with habits or routines, significant differences are also expected in the economic and demographic characteristics among ethnic groups in the migration context, e.g., age structure, household size, residential location, and/or education level of the ethnic population (Australia Bureau of Statistics, 2012). Ethnic groups are also distinguished from the majority by religious and linguistic aspects, differences that may be associated with skilled migration

policies, cultural customs, or socio-economic status. For example, Chinese families traditionally tend to be large in size, with children, parents and grandparents living together. In this sense, they differ from 'Western' families. The 2011 census (Australia Bureau of Statistics, 2012) revealed that the percentage of migrant households living in multi-dwellings was approximately twice the figure for Australian-born. The variation again addresses the importance of examining ethnic differences in water use, given the substantial socio-demographic difference between ethnic minorities and majorities. More importantly, as Hamlett et al. (2008) argue, evaluation of the influence of ethnic identities over consumption behaviour should be contextualised 'through a wider consideration of other factors including societal status, gender and age, rather than giving it singular treatment' (p. 91).

Medd et al. (Medd et al., 2007) propose rethinking identity, cultural diversity and difference based on the idea of intersectionality. The notion of 'intersectionality', a sociological theory developed by Kimberlé Williams Crenshaw, which frequently appears in cultural and feminist studies (Crenshaw, 1991), holds that in order to understand the experiences that women face from a systematic viewpoint, it is necessary to examine how biological, social and cultural identities, such as gender, race, and social status, as well as other markers of identities, interact on multiple or simultaneous levels. Rather than just focusing on race or gender dimensions separately, intersectionality proposes looking at a much broader range of factors, such as age and social status, which might also equally substantially impact on Black women's daily experiences (Crenshaw, 1991). In terms of understanding cultural diversity in water consumption, the concept of intersectionality and Medd's et al.'s (2007) notion of rethinking identity highlight the importance of being open to a broad range of factors rather than merely focusing on 'ethnic identity' which was assumed to be particularly relevant when examining ethnic diverse water usage. The broad range of factors includes diverse characteristics, such as habits and routines of water use practices, cultural norms, socio-economic status, and other factors intersecting and interacting with ethnicity and engaging with the formation of identities. In applying the theory of intersectionality in confronting cultural diversity, Medd et al. (2007, p. 9) suggest that it 'allows particular issues to emerge, rather than imposing categories and labels on to research participants'.

The idea of embracing a broad range of variables when investigating the impacts of ethnicity on water use is supported by other studies. Ethnicity is just one of many factors influencing values and attitudes towards the environment. Prior environmental experience,

socio-economic status, and household size were also said to be affecting the decision-making or performance of environmental practices (Chatman & Klein, 2009; Gentin, 2011; Thomas, 2001). Newell and Green (1997), who examined the environmental concerns of African-Americans and the White population and the relevance of income and education factors, found that among low-income respondents, African-Americans were less concerned about the environment compared to their White counterparts; however, as income and education levels of respondents increased, the ethnic differences tended to diminish. Moreover, ethnic minority households' capacity to respond to environmental issues may also be restricted by dwelling conditions. Composting, for example, is less likely to be conducted by minority households due to limited space, living in apartments, or not having a garden (Klocker & Head, 2013). Klocker and Head note:

... Australians from migrant backgrounds are not a coherent group. They are distinguished not only by ethnic differences but also by religious, cultural and linguistic heterogeneity; visa status and duration of residence in Australia. Migrant groups are also internally diverse according to attributes such as age, socio-economic status and gender. Cultural environmental research needs to be attuned to these various axes of difference - between and within broad ethnic groupings. (Klocker and Head, 2013, p. 42)

The inclusion of broad factors when investigating ethnic diversity and water use allows an understanding of the complex ways in which ethnicity and other axes of identities influence water use. As well, it enables a researcher to isolate the direct effect posed by ethnicity on water use from the indirect effect carried over or mediated by other interacting factors; that is, by controlling these other factors. As Medd et al. (2007, p. 9) state, 'it may be that factors other than ethnicity or faith emerge as having equal or greater influence over water consumption, or provide means of intervention to change water use.'

### **5) Within group variations and acculturation**

Variations are also expected to exist within a single ethnic group, between generations, according to birthplace or years of migration, in environmental values, perception, attitudes or engagement (Pfeffer & Stycos, 2002; Thomas, 2001, 2002). Children of migrants are assumed to adopt the values and norms of the mainstream culture in which they growing up (Thomas, 2001, 2002). Similarly, as the number of years of interaction with the host culture and environment increase, immigrants from different ethnic backgrounds learn and adopt the behavioural expectations and expressions of the mainstream culture (Pfeffer & Stycos, 2002).

They also become familiar with the local environment. This acknowledgement and familiarity with local environmental issues, along with compliance with the behavioural expectations of the host community, is in turn expected to contribute to the uptake of pro-environmental behaviours. This process is regarded as environmental acculturation (Pfeffer & Stycos, 2002), which is considered an important determinant of environmental attitudes (Schultz, Zelezny, et al., 2000). Acculturation is considered an important factor for understanding the intergeneration variations in environmental concerns among ethnic minorities (Mukherji, 2005), as well as ethnic similarities and differences vis-à-vis environmental concerns<sup>16</sup> (Deng et al., 2006).

Noe and Snow (1990) found that Hispanics who were more acculturated into the White culture (using economic success as a proxy for indicating the level of acculturation) showed similar environmental attitudes when compared to non-Hispanic Whites. Pfeffer and Stycos (2002) suggest that immigrant/native-born differences in performing environmental behaviours were significantly reduced while ‘years of living in New York’ (a proxy for the degree of acculturation) was controlled in comparison. Apropos of Chinese ethnic groups, Leung and Rice (2002) found that Chinese Australians who had lived in Australia for a long period of time were more likely to endorse NEP values along with the Anglo-Australians. Johnson et al. (2004) claim that the relatively higher level of environmental concern displayed by Asians compared to other minorities (i.e., Latinos and Black Americans), could be attributed to the fact that Asian respondents were more acculturated into the mainstream environmental values and behaviours of the Whites. However, Deng et al. (2006) argue that the Chinese in Canada may have performed a ‘selective acculturation pattern’ (p. 41). Highly acculturated Chinese Canadians who were young, well educated, relatively affluent, and had been residents of Canada for a long period of time tended to be similar to Anglo-Canadians in social-altruistic concerns, whereas those who were less acculturated still maintained the traditional social-altruistic values inherent in Chinese culture. Thus, they were significantly different from Anglo-Canadians when it came to social-altruistic concerns. However,

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<sup>16</sup> In those studies, acculturation was discussed based on the ‘Anglo-conformity’ model, in which the ethnic group’s culture is acculturated into the mainstream Anglo-cultural society (Mukherji, 2005). However, the acculturation process is not simply a result of assimilation. Berry (1980) presented four adaptation models: 1. immigrant loses original culture, gains host culture; 2. retains original, gains host; 3. retains original, does not gain host and 4. loses original, does not gain host. What tends to occur is that, as pointed out by Yinger (1981), cultures interact and are transferred with different speed and success, with changes occurring first in surface aspects (such as language) and changes in values, identifications occurring last (Rudmin & Ahmadzadeh, 2001; Shaul & Gramann, 1998).

acculturation appeared not to impact on the biospheric concerns of the Chinese-Canadians (Deng et al., 2006).

Processes of acculturation, however, might not always promote environmental attitudes and behaviours positively. Some studies find that while the acculturation level does influence environmental attitudes and particular environmental behaviours (recycling), the correlation between acculturation and environmental concern and behaviour is not as positive as conventionally expected (Lynch, 1993; Mukherji, 2005; Schultz, Unipan, et al., 2000). Those studies suggest that the more acculturated an ethnic minority is, the less likely they will be to evince concern for the environment. Their engagement with recycling may reflect this premise, a finding supported by the ‘vernacular sustainability’ arguments in cultural environmental research. These arguments claim that because the vernacular sustainable practices of ethnic migrants were scarcely recognised and poorly supported by environmental policies, these sustainable practices are likely to disappear after years of post-migration (Klocker & Head, 2013). Maller (2011) argues to the effect that rather than acculturating to a high consumption lifestyle, alternative pathways should be found when fostering sustainable living.

Acculturation provides an important perspective from which to examine ethnic similarities and differences in environmental attitudes and behaviours. It helps to understand the detailed and complex ways through which ethnicity may influence water use, and to examine the potential of further reduction in water consumption and opportunities by engaging all ethnic communities – irrespective of whether they are newly immigrated, long-time residents or native-born ethnic members – in water conservation activities. The concern of acculturation suggests that it is important to take variables such as competence in host language (Johnson, 2011), birth place, and/or years of migration or attachment to the local community (Pfeffer & Stycos, 2002) into account when considering cultural diversity issues in water management. Furthermore, it is important to determine whether ethnic difference simply reflects people’s different levels of acculturation.

As their years lived in the host country increase, migrants are expected to gradually become more familiar with local environmental issues; and, to become conscious of local environmental problems. For migrants, especially non-English speaking ethnic minority members, language and information access pose big challenges in this process of

environmental acculturation, which also provides a perspective from which to examine and understand the possible ethnic disparities in perceptions and attitudes regarding water issues.

#### **6) Language preference of ethnic groups and information access**

As suggested in the earlier review (Section 2.4.2), information and knowledge impact upon people's environmental concerns and behaviours. Water-related studies argue that being better informed about water issues is likely to contribute to a rise of positive attitudes and behavioural intentions towards water use and conservation (Dolnicar et al., 2012; Dolnicar et al., 2010; Trumbo & O'Keefe, 2005), and to facilitate supportive attitudes towards water management policies, e.g., water recycling and water desalination (Dolnicar et al., 2011; Dolnicar & Schäfer, 2009). Apropos of information access, a strong preference for languages other than English was found among non-English speaking ethnic minority communities. DEC's (2005) study in New South Wales, Australia, revealed that this preference was not only due to a lack of, or low, English proficiency; bilingual people also indicated that they preferred information provided in their home language alongside English information.

Language difference usually poses a barrier to acculturation and familiarity of local environmental issues (Johnson, 2011). DEC's (2005) study found that while people from various ethnic and linguistic backgrounds were concerned about the environment, due to language differences, they tended to have limited access to information and resources. This, in turn, influenced their perceptions and activities. Zhao (2009) claims that, in his study investigating media use and global warming perceptions, that the frequency of use of media, and the particular media that people use mediates the ethnic difference in perceived knowledge and environmental perception. Scholarly argument raises concern about the influence of English and non-English media (ethnic media) on community perceptions of the environment. Public communication studies also stress that ethnic media is more effective than host media in reaching ethnic minorities (Lebrón, 2002; Yu & Ahadi, 2010).

Ethnic media play an important role in the lives of ethnic communities. Ethnic media was preferred by an ethnic community for several reasons, one of which is that ethnic media addresses the cultural and practical needs of migrant groups who tend to be overlooked by mainstream media (Sun et al., 2011). Ethnic media, while catering for the immediate specific needs of an ethnic community (Adoni et al., 2006), is expected to fulfil several roles, such as bridging ethnic community members with their homelands (Morrissey, 2001; Sun et al., 2011),

integrating an ethnic community in the mainstream society (Morrissey, 2001; Zhou & Cai, 2002) and through to empowering the ethnic community in local debates (Liu, 2012). In the Australian context, Pe-Pua and Morrissey (1994, 1995, 1996), who analysed 14 non-English newspapers in a series of reports between 1994 and 1996, revealed that ‘link to the homeland’, ‘social integration’ and ‘service to the community’ to be three important goals reported by ethnic newspaper editors (Morrissey, 2001, p. 37). Ethnic media provide migrants with a sense of belonging. Migrants targeted media coverage supplies them with ‘a most handy source of practical information on a wide range of services’ (Sun et al., 2011, p. 144). Ethnic media also build a platform for communication, discussion and exchange of information within the ethnic minority community or presents a voice to communicate with the majority community (Deuze, 2006). Zhou and Cai (2002), who studied the role of Chinese media in the US, state that ethnic media provides a roadmap for new immigrants to adapt to local society and facilitate the assimilation process of integrating the ethnic minority into the mainstream culture and society. However, they also point out that the Chinese-language media in the US tend to face financial, institutional and human resource limitations which may limit coverage in media reports (Zhou & Cai, 2002).

The impact of ethnic media on ethnic communities has been well explored; however, studies exploring ethnic media coverage of environmental issues are rare. Media discourse across the language divide is expected to present and articulate environmental issues to its readers differently (Brossard et al., 2004). Two reasons might contribute to these differences: varying environmental values held by different language groups and the existence of diverse media cultures (Dugas & Young, 2012). However, studies comparing media coverage of environmental issues across language divides are limited. Dugas and Young (2012), who compared the coverage of climate change in English language and French language print media in Canada, found that while the English newspapers were more diverse in coverage, reporting was more ‘compartmentalized’ (p. 25). The French coverage was less diverse but more thematically framed and better linked to the ‘spheres of politics, business and morality’ (p. 47).

Media influences public perceptions of environmental issues through its presentation and interpretation of such issues (Hay & Israel, 2001). Since differences are expected to exist between media coverage regarding environmental issues (e.g., water issues) across language divides, which media (e.g., newspapers) people choose to use may influence their information intake and perceptions of said environmental issues. In turn, members of the public influence



media coverage with their interests and concerns, which suggests that people's interests and needs are likely to be reflected in the media coverage they are using. Slater (2007) defines these two interacting aspects (media influencing public perception versus public impact on media) as a pair of reinforcing spirals which highlight the need to examine the construction of environmental issues between mainstream media and ethnic media with significantly different readerships. They highlight the need to explore and understand the diverse perceptions and concerns towards the environment that potentially exist between ethnic communities.

In sum, their selection of information sources - language and media - is expected to influence people's perceptions of environmental issues, which in turn provides a cutting-point through which to understand any possible ethnic variances in water perceptions and concerns<sup>17</sup>.

## **2.5 Summary**

Based on the above discussion, I argue that the ethnic and cultural backgrounds of people may affect their water use and conservation in several ways. In other words, there are several dimensions through which to understand the influence of ethnicity. These dimensions, summarised below, are also employed to serve as a framework in this research for investigating the ethnic correlates of domestic water use.

First, ethnicity, and the cultures particular to the ethnicity, may influence a household's water use via value-attitude-behaviour flows, where values, beliefs and preferences derived from the extant culture and social norms are observed by a certain ethnic group affect both individual and household attitudes towards water use and water conservation. In turn, impacting on water use behaviour. Environmental experiences gained in their countries of origin and the affluent status of their home countries are also expected to influence the relation between ethnicity and environmental behaviour, which can be understood via the hierarchy of needs and environmental deprivation theories.

Second, habits, routines and conventional practices of water use have been found to directly influence domestic water use; and, those shaped by ethnicity and cultures may explain the differences in water use patterns between ethnic groups. Habits and routines may pose

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<sup>17</sup> Media analysis comprised an important part of this study, and literatures on media analysis techniques were reviewed in the media analysis section in the Methodology Chapter (Chapter 3).

barriers to adapting ethnic migrants into certain behaviours which are expected to lead to sustainability. Opportunities (e.g., vernacular sustainable practices) peculiar to diverse habits and routines are also examined in this study.

Third, demographic characteristics, such as family size and other influences including dwelling types, may vary from one ethnic group to another, which in turn mask ethnic differences in water use patterns. Therefore, the effects of ethnicity on water use may be a carryover from these factors, or they may be mediated by particular household and population characteristics. Contextualising ethnic identity in the consideration of broader factors (as reviewed in Section 2.4.2) based on the Intersectionality theory may help to explicate this assumption.

Finally, ethnic minority members' lack of accessible information, or unfamiliarity with the local water issues, may underpin ethnic differences in water use and conservation. Language, ethnic media, and migration status may be the main factors that contribute to the knowledge difference. And, the concept of acculturation may also help to understand the ethnic disparities and variances within an ethnic community.

In order to understand the complexity of impacts that ethnicity has on water use and conservation, it is necessary to combine quantitative and qualitative study approaches to develop original research based on the theories and concepts reviewed above. In particular, the perspectives from both cultural environmental literatures and environmental psychological literatures have been highly influential in framing/contextualising the findings of this thesis. The review recognises that environmental psychological studies were usually criticised by cultural environmental literatures for pitting ethnic minority groups against the majority in the level of environmental concern, which may risk placing the ethnic diversity 'as a threat to the maintenance of particular natural environments' and 'a challenge to be overcome through assimilation' (Klocker & Head, 2013, p.49). As reviewed in Section 2.4.3, the cultural environmental literatures and environmental psychological literatures provide different but both useful perspectives to examine and understand how an ethnically diverse community conceptualises water issues and how they use water in their homes. Therefore, despite of the different emphasis and priorities between the above two body of literature, they are both valuable to this study. To reiterate the importance of this study, it is not merely an attempt to bridge the knowledge gap between the role of ethnicity and cultural diversity in

influencing domestic water consumption, nor simply to bring the variable ‘ethnicity’ to the water research model. More importantly, the study is designed to contribute to the development of an ‘inclusive’ research debate surrounding sustainability, environmental citizenship and sustainable water use which is being promoted by many scholars and organisations (see Department of Environment and Conservation, 2005; Eames & Adebowale, 2002; Klocker & Head, 2013; Medd et al., 2007). As Paul Ehrlich (2002, p. 32) states:

We need to comprehend how cultural evolution produces the vast diversity of human natures – different fundamental attitudes, beliefs, proclivities, preferences... and behaviours. That should help us discover how to reconfigure social, political and economic incentives and cut through barriers of ignorance and denial, allowing society to turn onto a path towards sustainability. Paul Ehrlich (Ehrlich, 2002, p. 32)

## **CHAPTER 3 RESEARCH DESIGN AND METHODOLOGY**

### **3.1 Introduction**

This chapter illustrates the research framework that was adopted to collect and analyse the primary and secondary data for answering the corresponding research questions. It starts by reintroducing the research objectives and research questions outlined in Chapter 1. The main data sources, sampling strategies and the conduct of each research approach, including the questionnaire, interviews, focus groups, cultural probes, water data analysis and media study, are then introduced and explained in this chapter.

### **3.2 Research objectives and questions**

As noted in Chapter 1, the overall study aim was to explore the effect that ethnic and cultural backgrounds have on household water use among ethnic communities. To address this aim, it is necessary to develop profiles of current water consumption for different ethnic groups within the Sydney Metropolitan Region. This contributes to an understanding of the perceptions of water, and to constructing transitions to sustainability. Several specific research questions were formulated to guide the study:

- (1) Does ethnicity influence household water use?
  - (a) Do differences or disparities exist across ethnic communities relating to water use and conservation in terms of perceptions, attitudes and behaviours?
  - (b) If so, what differences exist?
  - (c) To what extent is ethnicity an influence?
- (2) What are the reasons and factors that underpin the ethnic differences and disparities? In other words, how does ethnicity influence households' water use and conservation?
- (3) What is the role of environmental acculturation in engaging persons of ethnic minority in water conservation activities?
- (4) What are the implications of ethnic diversity for water demand management? More specifically,
  - (a) What are the opportunities for engaging ethnic communities in water management while maintaining important cultural values?
  - (b) What are the barriers encountered when engaging ethnic communities in water management?

- (c) How may these barriers be negotiated by water managers seeking to implement sustainable urban water management?

The study helps to bridge the information gap vis-à-vis the relationship between water use patterns and ethnic backgrounds, and suggests ways in which water demand may be reduced. Apropos of government policy, this study will provide a picture of the ethnic correlate of water use in the Sydney Metropolitan Area, which will assist to determine whether the effects of ethnicity should be included in future decision making and if specially designed policies based on ethnicity are needed to achieve sustainable water management. In order to answer the above research questions, a carefully designed research framework has been developed.

### **3.3 Research design and framework**

#### ***3.3.1 Study area and target population groups***

Australia's most populous city, Sydney, is projected to have between 8.0 and 8.9 million residents by 2061 (Australian Bureau of Statistics [ABS], 2013). Driven by population growth and climate change (Hurlimann, 2006), Sydney is predicted to experience a 23% increase in water demand between 2009 and 2026 (WSAA, 2010). Sydney is one of the most culturally diverse cities in the world. According to the ABS 2011 Census, there were approximately two hundred ethnic communities in Sydney, and 40.1 per cent of residents in the Sydney Metropolitan Area were born overseas, with only 25.7 per cent of people nominating Australian as one of their ancestries (ABS, 2012). In ethnically diverse cities such as Sydney that face water stress, understanding the variation in perceptions and attitudes among ethnic groups regarding water use, water conservation and related issues is vital. Two major ethnic minority groups - the Chinese and the Koreans - and the Australian group were chosen for the purpose of this research in Sydney. This categorisation (Australian, Chinese and Korean) was based on cultural and ethnic diversity, as identified in the classification of ABS statistics - Australian Standard Classification of Cultural and Ethnic Groups (ASCCEG) Second Edition, Revision 1.

The selection of the target ethnic communities was based on five important considerations:

- (1) The larger the population of an ethnic community, the bigger the implications or impact that said community may have on water management; for this reason, the population size of the ethnic group was the first criterion.

(2) The residential concentration of the ethnic community was another important criterion. Residentially concentrated areas can provide relatively easy access to an ethnic population and in turn ensure sufficient samples for the study.

(3) In order to understand the expectations, attitudes and cultural norms of particular ethnic communities regarding water use and conservation (which is essential to the study), background knowledge about the ethnic community and its culture is required to ensure the high confidence level of the in-depth research. In the case of this study, given the cultural background of the author<sup>18</sup>, it seemed prudent to focus on ethnic groups with Asian backgrounds.

(4) As indicated in the literature review chapter (Chapter 2), several studies have detected attitudinal differences between Chinese or Asian background ethnic minority groups and the Anglo or European background majority regarding environmental issues. Thus, the Chinese group and Chinese-language newspapers in Australia represented an appropriate arena for this study. Taking into account Greenberg's (2005) and Johnson et al.'s (2004) concerns regarding categorising 'Asian' as an homogenous group, Sydney's Korean community was included in this study<sup>19</sup>. Among the groups from Asian ancestry, Korean is reported, by the 2011 Census, to be the fourth most common language (following Chinese, Indo-Aryan language and Vietnamese) spoken at home in Sydney. A group from a similar cultural background to Chinese allows insights to be gained into whether ethnicity has a significant impact even when cultures are alike.

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<sup>18</sup> The author of this study, who was born in northern China and completed her Master's studies in southern China, has a background in Chinese culture, Mandarin and Cantonese languages. Her cultural backgrounds and language skills allow her to approach and communicate with Chinese background respondents easily, and to get in-depth understanding of the expectations and expressions of Chinese respondents regarding water use and conservation. The knowledge of Korean culture and elementary Korean language skills also assist the author to better approach and undertake studies with Korean background participants (interviews and focus groups with Korean participants were conducted with the help of a Korean translator, and research materials in Korean language were translated by specialists for accuracy purpose, see footnote 32, 36 & 37 for more details). All these conditions are expected to contribute to a high confidence level of the study.

<sup>19</sup> By looking at Chinese and Korean communities within Australia, the aim is not necessarily to examine the attitudinal and/or behavioural variation within the Asian population in Australia as a whole, but rather to try to examine whether differences exist between ethnic groups even if they are from similar cultures and/or same geographic region (Northeast Asia). Refer to Section 2.4.3 for discussion regarding categorisation.

(5) In a series of surveys conducted in 1996 (Environment Protection Authority, 1997a) and 2004 in NSW (Department of Environment and Conservation [DEC], 2005)<sup>20</sup>, which were recognised as significant references for this study, Chinese and Korean-speaking communities were two of the non-English-speaking groups studied. This study series provides valuable insights into the responses of non-English-speaking communities in NSW to environmental issues as well as issues of water use and water conservation.

Background information on the specific ethnic communities, which were chosen for this study based on the above criteria, is presented in the following sections.

#### *Chinese community*

Chinese speakers constitute the largest non-English language speaking group in Sydney (Australia Bureau of Statistics, 2007; 2012). According to the 2006 Census, 234,770 people spoke Chinese (including both Mandarin and Cantonese) at home, accounting for 5.7 per cent of the total population in the Sydney Metropolitan Area. The 2011 Census saw the corresponding figure increase to 283,969; and, the percentage had risen to 6.5 per cent of the population. The 2006 Census found that 146,008 residents were born in China and its Special Administrative Regions (e.g., Hong Kong and Macau), accounting for 3.5 per cent of the total population of Sydney. By 2011 this figure had grown to 185,723 and comprised 4.2 per cent of the population of Sydney. A number of Sydney suburbs are home to sizable Chinese communities: Haymarket, Ashfield, Burwood, Strathfield, Flemington, Lidcombe, Auburn, Parramatta, Carlingford, Eastwood, Epping, Chatswood, Hurstville, Rockdale Cabramatta and Campsie.

#### *Korean community*

According to the 2006 Census, Korean speakers constituted the eighth largest non-English language group in Sydney. Among the 35,943 Korean speakers (0.87% of the total population of Sydney), 32,125 (0.78% of the total population of Sydney) were born in South Korea (ABS, 2007). The corresponding figures reached 46,103 (1.0%) and 40,175 (0.9%) in the 2011 Census (ABS, 2012). Sizeable Korean communities are found in the suburbs of Canada

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<sup>20</sup> NSW Department of Environment and Conservation, the former Environment Protection Authority.

Bay, Burwood and Strathfield. Large Korean populations are also found in Parramatta, Willoughby and the Sydney city centre.

*'Australian' group*

According to the 2006 Census, 1,219,244 people nominated 'Australian' as their ancestries, accounting for 29.4 per cent of the total population in the Sydney Metropolitan Area. By 2011, the figure reduced to 1,130,305 (25.7%). Most of the self-labelled Australian population live in Outer Western Sydney, the Central Coast, St George-Sutherland, Northern Beaches and along the Eastern Suburbs beaches. Very few are found living in Central Western Sydney, Inner Western Sydney and Inner Sydney. There were fewer than 10,000 people in each of above last mentioned subdivision areas.

While recognising the potential for enormous diversity within this sample group, 'Australian' was selected as a control sample. The demographic category of 'Australian' as used by the ABS and defined by the people themselves constitutes more than a quarter of the population of Sydney<sup>21</sup> in 2011 Census. The study adopted the ethnic categories (Australian, Chinese and Korean) that are used by the ABS, thereby enabling a comparison between the Census Collection District (CCD)<sup>22</sup> population and the questionnaire respondents to determine the representativeness of the sample. Despite this, people of all sorts of ethnic backgrounds in Australia can be identified as Australians, the terminology 'Australian' in this research was

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<sup>21</sup> In 2011 ABS census, ancestry was used as an indicator of ethnic origin, to help identify distinct ethnic and cultural groups in Australia. Categories such as Australian, English, Chinese and Korean were adopted based on the Australian Standard Classification of Cultural and Ethnic Groups (ASCCEG) Second Edition, Revision 1. This classification recognises the self-defined and self-reported ancestries of all Australians. The questionnaire survey conducted in this study also adopted this census classification when looking at respondents' ethnic or cultural backgrounds. According to ABS Census, some people of Anglo-European heritage may prefer to define themselves of English or Irish origin rather than 'Australian', therefore, the terminology 'Australian' was not necessary equal to 'Anglo-Australian'. As addressed by ABS, the information gathered based on this cultural and ethnic groups classification 'is essential in developing policies which reflect the needs of our society and for the effective delivery of services to particular ethnic communities'.

<sup>22</sup> Census Collection District (CCD) is the smallest unit used in 2006 Census data collecting and presenting by Australian Bureau of Statistics. For some reason, the ABS substituted Australian Statistical Geography Standard (ASGS) for the Australian Standard Geographical Classification (ASGC) in 2011. Therefore, the new Statistical Areas Level 4 (SA4s) became the smallest geographic unit for presenting 2011 census data.



used as a demographic category rather than nationality<sup>23</sup>. As indicated by ABS, the data gathered based on the Australian Standard Classification of Cultural and Ethnic Groups reflects respondents' own assessment of their cultural and ethnic background. Similar to the category of 'Australian', the Chinese group may also not be homogenous given the 56 ethnic communities across China and migrants who are of Chinese origin but born outside of China. The categorisation of Chinese or Australians as a single group in this study may have its limitations in interpreting research findings<sup>24</sup>. Nevertheless, these categories are currently, the most suitable to describe the ethnic backgrounds of respondents in this study. In the data collection phase of this study, participants were asked to tick an ethnicity category with which they define themselves. Therefore, the identification of 'Australian' as an ethnicity group was not made by the researcher but by the research participants themselves. The term 'Australian group' used in this paper referred to the survey respondents who identify themselves as Australians when considering their ethnicity. Similarly, respondents who defined themselves as of Chinese or Korean origin are grouped as the 'Chinese group' and 'Korean group'.

As stated previously, there are approximately two hundred ethnic communities living in the Sydney Metropolitan Area. It is neither possible nor necessary to include all ethnic groups within the research. This research aims to better conceptualise and understand how ethnic and cultural backgrounds impact on water use in households through an in-depth investigation and analysis of a few specifically selected ethnicities. This was preferable to employing statistically modelling techniques, which require a wider sample across the society. Previous studies (Department of Environment and Conservation, 2004, 2005, 2007; Department of Environment Climate Change and Water, 2010; Environment Protection Authority, 1994, 1997a, 1997b, 2001), which will be used for comparison, only studied a maximum of eight

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<sup>23</sup> In ABS Census, there is a large number of respondents who choose to identify themselves as 'Australian'. In addition, English and Irish are also two major ethnic origins of which respondents define themselves. From this point of view, the 'Australian' is not necessarily equal to 'Anglo-Australian'. Studies which provide insight into the relationship between ethnicity and environmental concerns argued that using general categories such as White/non-White or Anglo-origin/non-Anglo-origin may be problematic or make it difficult to interpret results, given the high-diversity within each group (See Klocker & Head, 2013; Segura & Bowler, 2005, Whittaker et al., 2005. Refer to Section 2.4.3 for more discussion). Under this consideration, referencing to particular ethnicities, language or geographic areas in studies may be prudent choices. Therefore, 'Australian', rather than 'Anglo-Australian', was used in this study.

<sup>24</sup> See Section 6.2.2 for a discussion of the limitations.

non-English speaking communities or only examined the non-English speaking group in general. And those studies were undertaken by government organisations with more resources than afforded a PhD student. The amount of work to be undertaken using the current research approach is significant and commensurate with the requirements of a PhD study.

With ‘Australian’ as the control sample, and ‘Chinese’ and ‘Korean’ as comparable samples, this sampling approach not only enabled exploration of the correlation of ethnicity and water use, but also allowed the researcher to examine the possible barriers posed by language differences and unfamiliarity with water issues, and the role of environmental acculturation in engaging ethnic minority communities in water conservation. By including two ethnic groups from Asian backgrounds, ‘Chinese’ and ‘Korean’, the study is also expected to check any possible disparities in water consumption patterns between communities from similar cultural backgrounds<sup>25</sup>.

### ***3.3.2 Methodology framework***

Quantitative research techniques enabled the researcher to draw links between ethnicity and water use, such as identifying the patterns of use, and the correlations between ethnic status and level of environmental concern and environmental behaviours. Qualitative techniques, however, challenge the investigator to look into the ‘why’ behind the diverse water use patterns (Medd et al., 2007). The employment of a qualitative research approach overcomes the disadvantage of utilising quantitative techniques in order to understand the reasons, consideration and values that influence people’s choices about water use and their everyday practices. As pointed out by Klocker and Head (2013), merely focusing on quantitative testing about which groups (majority/ ethnic minority) are more environmentally concerned or more engaged in environmental behaviours is unlikely to reveal the rich diverse knowledge, values and practice brought by diverse migrant groups. Based on the above considerations, this study employed quantitative and qualitative research techniques, involving both secondary and primary data sources. As shown in Figure 3. 1, a household questionnaire survey was conducted to collect primary data on households’ housing and

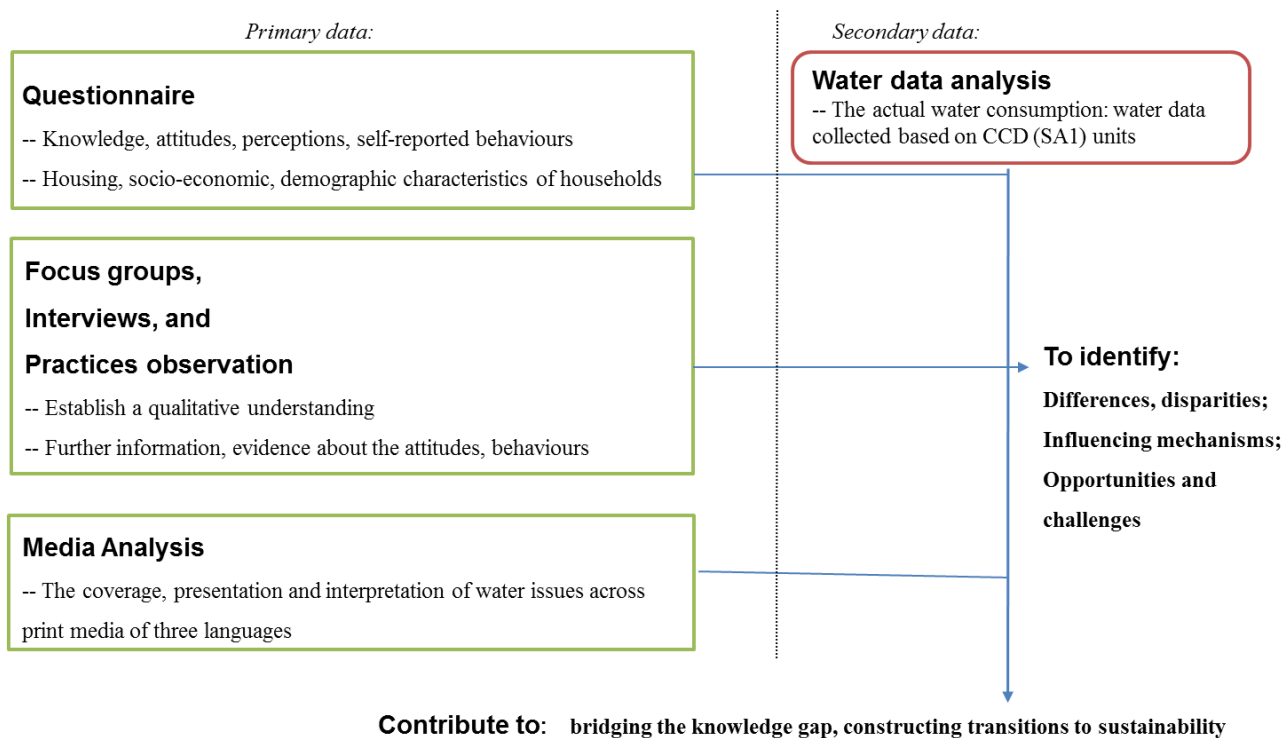
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<sup>25</sup> See Section 2.4.3 for discussions about the differences or similarities in cultures, habits, and socio-demographics among the groups that may affect water consumption.

socio-demographic characteristics, as well as information on attitudes, knowledge and behaviour relative to water use among targeted ethnic groups.

Qualitative study approaches, such as interviews, focus groups and cultural practice observations, were also undertaken following the distribution of a questionnaire survey to deepen information and evidence of individuals' perceptions, knowledge and practices relating to water use. Since the media is one important source of information for individuals about environmental issues, and language matters when people choose information sources (ethnic media versus mainstream media), print media in three languages were analysed to examine water coverage across language divides in Sydney. These findings were combined with those of the household survey. The water consumption analysis, based on water data provided by Sydney Water, enabled the study to examine the influence of ethnic status on per capita water use, and the magnitude of the effect. All of the above contribute to the outlining of the big picture of the ethnic and cultural correlates of water use. More details about each research approach will be presented in the following sections.

**Research Framework:**



**Figure 3. 1 Methodology framework**

### ***3.3.3 Primary and secondary data sources***

A range of secondary and primary data sources were gathered for use in the study, including:

1. The ABS Census of population and housing for 2006<sup>26</sup> and 2011, showing the ethnic, socio-economic profiles of households and individuals domiciled in the Sydney Metropolitan Area.
2. The Sydney Water consumer database<sup>27</sup>, providing water records of selected sample sites for data analysis.
3. Structured survey approaches conducted in sample sites collecting primary data. These approaches included household questionnaires, focus groups and cultural probes for household details as well as attitudes, perceptions and behaviours regarding water use and conservation; and, interviews with households and key people involved in water management and community engagement.
4. Print media in three languages, providing materials for media analysis.

### ***3.3.4 Sampling strategy***

To address the research questions, it was necessary to link ethnic data (ethnic status of population) to water-use related information (attitudes, perceptions, behaviours and actual water consumption). In order to do so, the following two considerations should be borne in mind:

(1) When the study started, the smallest available unit for 2006 Census data was the Census Collection District (CCD). This meant that there was no way to determine which particular households were of Chinese, Korean or ‘Australian’ ethnic backgrounds. An alternative approach was to locate the households of each ethnic community by identifying the CCDs with a high percentage of population from those groups.

(2) For anonymity and confidentiality purposes, water records from Sydney Water are not available at household (property) level, but are accessible at CCD units.

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<sup>26</sup> When the study was first conducted, the 2006 Census data was the latest data available; therefore, sampling was conducted based on 2006 Census data at CCD level.

<sup>27</sup> Water records data was provided at CCD base. In order to link to the population and housing data, the water data was then processed to match the population data at SA1basis by the 2011 Census.

Recruiting questionnaire respondents from three ethnic groups (Australians, Chinese and Koreans) through a metropolitan-area-widely random sampling approach was not feasible, given the large workload and limited time for PhD study. Recruitment among CCDs which had a high concentration of target ethnic communities reduced the workload and potentially increased the response rate. A stratified sampling strategy was employed to conduct the questionnaire survey, and then to recruit qualitative studies participants. The sampling CCDs were also used to obtain water usage data from Sydney Water. Analysis based on the CCD-level water usage data and the CCD-level population and housing data enabled an exploration of the correlates between ethnic factors and per capita water consumption.

A three-step sampling approach, with samples stratified by ethnic categories (ancestries or language spoken at home) and location was adopted. Demographic and housing data of CCDs across the Sydney Metropolitan Area for use in the sampling was obtained from the ABS Census for 2006.<sup>28</sup>

Step 1. All CCDs in the Sydney Metropolitan Area were ranked by percentage of population with origins in the Chinese or Korean communities. ‘Language spoken at home’, used by the ABS to report the demographic characteristics of a population, was adopted for this ranking. The category of ‘Chinese’ included both Cantonese speakers and Mandarin speakers.

CCDs with a high percentage of targeted ethnic minority populations (Chinese and Korean) were first chosen from each Local Government Area within the Sydney Metropolitan area. The thresholds of CCD selection for each ethnic category (Chinese and Korean) were set separately. CCDs where more than 40 per cent of their population is of Chinese origin, and those where no less than 10 per cent of their population is of Korean origin were selected as sample CCDs<sup>29</sup>. This ensured that sufficient samples would be available to include in the questionnaire distribution areas. At this stage, 68 CCDs were selected: 38 CCDs for the

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<sup>28</sup> At the time the sampling was conducted, only 2006 census data was available. Thus, samples for conducting household surveys were generated based on the 2006 census data. However, for accuracy, demographic data was then updated to 2011 census for use in the analysis phase.

<sup>29</sup> As a result of the stratified sampling strategy, the percentage of Korean population of the total CCD population ranges from 0 to about 46 per cent in the selected CCDs, the percentage of Chinese population ranges from nearly 1 per cent to 81 per cent. This variation of population component allows the correlation examination between water use and ethnic status (being of Chinese or Korean) of population in Chapter 4.

Chinese category and 30 CCDs for the Korean.

Prior to the next stage of the selection process, CCDs generated from the first stage were split into four groups by location (region): Northern Sydney Region, Western Sydney Region, Central Region and Southern Sydney Region were covered by particular organisations of councils for the corresponding region. By doing so, the influence caused by locations would be controlled and examined using comparative analysis within and among regions.

Step 2. As regards the ‘Australian’ control sample, the approach was to choose CCDs (a) with large ‘Australian’ populations (based on the ancestries statistics in the 2006 Census) and (b) those that are adjacent to the above selected CCDs which have a high percentage of Chinese or Korean residents. Ten CCDs with large ‘Australian’ populations were chosen respectively for each sub-region in order to address factors relating to geographical location. The number of selected CCDs in each sub-region was set at ten so as to ensure that sufficient CCDs would be available for the next stage of the selection process. Consequently, forty CCDs for the ‘Australian’ category were added to the samples.

Step 3. The third step of the process filtered the samples by using criteria such as average household size, mean household income, dwelling types and locations, to ensure that the choice of CCDs for this study included a range of socio-economic characteristics, housing status of ethnic communities as well as locations across Sydney. This was done to minimise the sampling bias. By means of this process, 46 CCDs (out of 108 CCDs) were chosen.

Step 4. The final stage of the process further filtered the samples based on a 10-20 per cent estimated response rate (Lawrence & McManus, 2008). By doing so, this process made sure that the number of target households of each ethnic group within the selected CCDs was reasonable and applicable for conducting household surveys. As a result, a total of 19 CCDs (out of 46 CCDs) were finally chosen for this study as questionnaire distribution areas. Figure 3. 2 shows the geographical locations of the selected samples.

The selected 19 CCDs were distributed across four subregions. Based on the 2006 Census data, there were approximately 4,338 Chinese speakers, 1,945 Korean speakers and 2,111 ‘Australians’, totalling 7,806 people. There were 5,101 dwelling units in the area, comprising

1,255 separate houses, 534 semi-detached houses, 917 low rise units and 2,377 high rise apartments. Household size in each CCD ranged from 1.9 to 3.5, and the mean household income ranged from \$640 to \$2125 per week (see Appendix 1).

Based on an estimated 10 - 20 per cent questionnaire response rate (Lawrence & McManus, 2008), the selected CCDs were expected to produce a total of 200 to 500 responses and no less than 30 responses for each ethnic group.

The following sections (3.4 to 3.7) will present each specific research approach in detail.

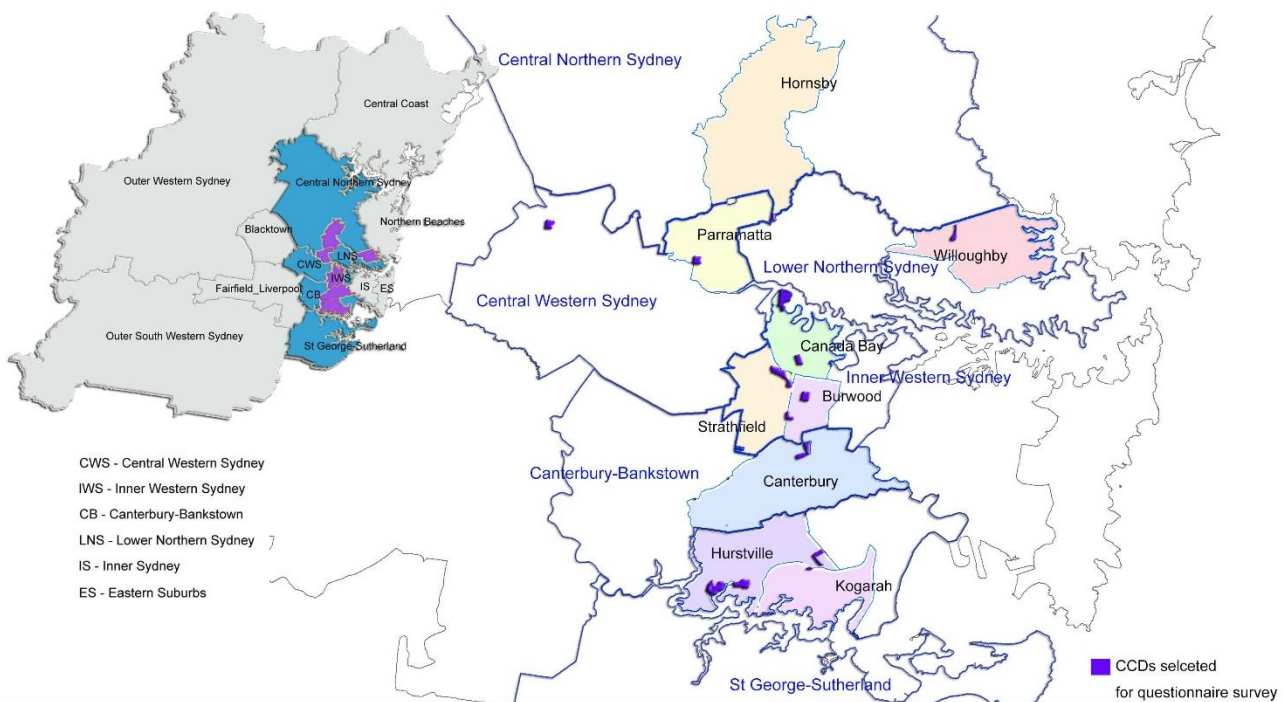


Figure 3. 2 The geographic locations of selected CCD samples

### 3.4 Household questionnaire survey

Primary data for the study was obtained through a questionnaire survey of 4,851 households<sup>30</sup> in a stratified sample of 19 CCDs. An adult representative over 18 years of age who was

<sup>30</sup> According to the 2006 Census, the total number of dwellings in the 19 selected CCDs was 5,101. However, due to several reasons e.g., vacancy, accessibility and the usage of dwellings, the number of questionnaires that were actually distributed was 4,851.

familiar with the water practices of each household was asked to complete the questionnaire during August and September 2012. The questionnaire (Appendix 2) took approximately 15-20 minutes to complete. It included questions about: (1) respondents' knowledge, attitudes and perceptions towards water use, conservation and water pricing; (2) dwelling types, facilities and household water use practices; and, (3) socio-economic, demographic characteristics of respondents and their households. The subjective data (the first part) of the questionnaire was representative of that individual's response, while the objective components (the second and third parts) were representative of the individual or the household.

### ***3.4.1 Questionnaire design***

Several questions used in the questionnaire were adapted from related previous studies (Department of Environment and Conservation, 2004, 2005, 2007; Department of Environment Climate Change and Water, 2010; Environment Protection Authority, 1997b, 2001; Independent Pricing and Regulatory Tribunal, 2004; Lawrence & McManus, 2008; Murdock et al., 1988; Randolph & Troy, 2008), which enabled a comparison between this study and the findings of existing studies. Data on attitudes, knowledge and perceptions were first collected through a list of questions.

First, the respondents' attitudes towards water use and related water issues were measured using a 13-item scale question developed from two previous studies, Murdock et al. (1988) and Lawrence and McManus (2008). Attitudes towards five aspects of water issues – water availability, water management, water consumption, conservation and reuse – were measured. Based on participants' responses to a 5-point Likert scale (1-strongly agree to 5-strongly disagree), the construct of this measure aimed to identify the different constructs of attitudes among households. Additional questions on willingness to learn more about water conservation and to reduce water consumption were also included to explore each respondent's attitude towards engagement in water conservation.

Second, a 3-item question with 5-point scale responses (1-a lot of knowledge to 5-no knowledge at all), two single choice questions and another 3 items with true/false/not sure responses were designed to measure respondents' knowledge about water use and management and their general familiarity with Sydney's water issues.



Third, participants were asked to respond to a number of single and multiple choice questions about their perceptions of Sydney's water supply situation, water demand management strategies, incentives and education programs. As well, they were asked about their perceptions of their own water consumption and situations that challenge their capability to conserve water. Sources from which respondents usually received information about water issues and their preference of particular sources were sought through a series of questions, so as to measure the access of ethnic communities to information and constraints by language.

Households' water use practices were investigated through a list of questions about what households use water for and how water is used, including the number of water-use devices (e.g., washing machines) and amenities connected to dwellings (e.g., swimming pools, gardens), the frequency and duration of water use activities, and the water saving actions household usually undertake at home. This measuring system attempted to explore the ways in which different households use water through every day practices and the level of household engagement with water conservational practices.

As regards the measure of socio-economic, demographic characteristics of households and ethnic-based information, questions and answer categories were designed to be consistent with ABS Census data, so that comparisons were possible. The number of years that the respondents had lived in Sydney<sup>31</sup>, and their English-language ability, were collected as the immigrant status measure; and, home ownership was used as the best available surrogate for a community attachment measure. These variables collectively served as a measure of the stage of environmental acculturation.

### ***3.4.2 Questionnaire survey***

The questionnaire administration mode may affect the participation rate, accuracy and reliability of the responses. Compared to some other administration modes, such as face-to-face interviews or telephone interviews, self-administered questionnaires ensure more privacy for the participants and are particularly suitable for sensitive topics such as income

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<sup>31</sup> Based on the insight of Pfeffer and Stycos (2002), years lived in Sydney rather than years in Australia was used as an acculturation measure in this study, which allows the measurement of acculturation to Sydney local culture for both ethnic immigrants and those (immigrant/native-born) who used to live outside of Sydney.

and showering time (Koponen et al., 2011). Given that the Internet may not be easily accessible for some elderly people, or people who do not have internet connection at home, an electronic questionnaire was ruled out. As the questionnaire should ideally be conducted within the boundary of sample CCDs, a self-administered paper questionnaire was employed for the household survey, specifically by dropping a survey package in the mailbox of every household within the sample CCDs.

### **1) Pilot study**

A pilot study was conducted in March 2012 with 13 adults from households with different ethnic backgrounds to test the reliability of the questionnaire and the time taken to complete it. Although the time that respondents spent on completing the questionnaire in the pilot test ranged widely from 10 to 45 minutes, most (77%) of the time completion was within the reasonable time duration of 15-25 minutes. The respondent who spent 45 minutes made very helpful suggestions and comments on the draft questionnaire when answering the questions. The revision of the questionnaire addressed the structure and wording of the questions. After the revision step was completed, questionnaires were translated from English into simplified Chinese and Korean<sup>32</sup>, the native languages of the two targeted ethnic minority communities.

### **2) Survey package and distribution methods**

Questionnaire household survey packages were distributed in the 19 sample CCDs between June 2012 and September 2012. Questionnaires were accompanied by a copy of the Participant Information Statement introducing the research and participation information to complete ethical requirements. A reply-paid envelope was included for participants to use to return the completed questionnaire. In addition, an invitation letter was attached to the end of questionnaire for recruiting participants for the next stage of the study, i.e., focus groups. People were invited to attend the focus groups by replying to the invitation letter along with the completed questionnaire, using the reply-paid envelopes. All documents were provided in three languages (English, Chinese (simplified) and Korean). Participants could choose based

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<sup>32</sup> The questionnaire related materials (such as participant information statement) were translated into Korean language by a translation specialist, while the Chinese materials were translated by the author whose first language is Chinese. Moreover, in order to make sure the accuracy in translation, all translated materials were reviewed by a Korean native speaker or a Chinese native speaker to certify that the translation is accurate and faithful to the original English (this process was verified and approved by the Human Research Ethics Committee).

on their language proficiency and preference for use. The survey package was distributed to households' mailboxes in an envelope marked 'Household Water Use Survey' in three languages (see Appendix 3).

### 3) Questionnaires distributed and received

A total of 4,851 questionnaires were distributed. Based on the estimated 10 - 20 per cent questionnaire response rate (Lawrence & McManus, 2008), the number of distributed questionnaires were expected to ensure no less than 30 responses from each ethnic group in each correspondent region. A summary of the questionnaires distributed, received and the calculated response rate is presented in **Error! Reference source not found.**

**Table 3. 1 Questionnaires distributed and received**

Region	Distributed	Australian		Chinese		Korean		Others
		Completed (C.)	Response rate* (R.)	C.	R.*	C.	R.*	C.
WSR	644	23	13.3%	19	10.9%	1	2.0%	6
SSR-WEST	1,413	31	13.2%	42	8.7%	—	—	5
SSR-INNER&EAST	1,616	39	19.5%	35	10.5%	25	6.1%	12
NSR	1,178	32	11.4%	14	5.1%	5	3.1%	10
<b>Total</b>	<b>4,851</b>	<b>125</b>	<b>14.2%</b>	<b>110</b>	<b>8.7%</b>	<b>31</b>	<b>4.9%</b>	<b>33</b>

$$* R = \sum_{i=1}^n r_i / \sum_{i=1}^n h_i * p_i$$

R- calculated response rate

r - number of questionnaires completed and returned for each region

h - number of questionnaires distributed in each sample CCD

p - population percentage of each ethnic community in each sample CCD (2006 Census)

n - number of sample CCDs in each region

In all, 299 questionnaires were completed and returned from 19 CCDs, including 125 Australian responses, 110 Chinese responses, 31 Korean responses and 33 responses from households of other ethnic communities. A fourth category 'Others' was created for use in the questionnaire analysis due to the high number of respondents in other ethnic communities, (See Section 4.2.1 and Section 6.2 for further details and discussion). The calculated response rate for Australian was within the expected range, from 11 to 20 per cent for different areas.

The Chinese response rate was lower compared to their Australian counterparts, ranging from 5 to 11 per cent. The response rate among the Korean population was much lower than the other two groups. There may be several reasons accounting for the low response rate among the Korean population, e.g., low awareness or interest in water research issues among Korean people living in the studied area. Another reason may be related to the dwelling and tenure characteristics of the CCDs. There was a higher percentage of apartments in the Korean concentrated CCDs; and, occupiers tended to be young and renting. As is the case with many questionnaires, these people may have been less willing to participate. Moreover, people who rent might have high mobility, people who were reported to live in the targeted areas in 2006 Census might absent (moved to other areas or were away for travelling) when the survey conducted.

#### **4) Summary of questionnaire respondents**

Both Chinese and Korean respondents were more likely to be female, to be aged between 25-44, to live in medium-sized households (3-person households), to live in low/high rise apartments, and to be renting privately. Respondents identifying as Australian were more likely to be aged between 45-64, to live in small sized households (1-2 persons), and to be living in fully-owned separate houses. Chinese respondents were more likely to live in share housing and to work full time, while Korean respondents were more likely to be a one parent household, and to work in part-time or casual jobs. The Australian respondents were more likely to be single persons or couples with children. They were more likely to be retired. A significant proportion of Chinese (60.9%,) and Korean (41.9%) respondents claimed that they could speak and read English well, although the proportion was much higher (19%) among the Chinese respondents (see Appendix 4 for a summary of the characteristics of questionnaire respondents).

In some spheres, e.g., education, age structure, and household structure, the samples collected in 19 CCDs across the Sydney Metropolitan Area were found to be slightly different from those pertaining to the general population within the Sydney Metropolitan Area in the 2006 Census. While the sample was expected to be representative of the whole population, it was designed to be representative of the two ethnic minorities (Chinese and Korean) as well as the 'Australian' group living in the same or adjacent areas. As samples were collected based on a stratified sampling approach, which was expected to represent particular ethnic

subpopulations throughout the Sydney Metropolitan Area, the results can be seen to represent more than the areas in which the questionnaire was conducted. The samples were regarded as reliable for undertaking cross-ethnic comparative research. In order to control the influence of demographical variance across ethnicity, specific analysis techniques were employed, as explained below.

### ***3.4.3 Questionnaire data analysis methods***

Data gathered by the questionnaire survey was processed using SPSS software and was prepared for use in the quantities analysis. Non-parametric statistical analysis methods such as cross-tabulation and graphs, along with regression analysis techniques, were employed to analyse the data and to identify patterns and relationships. A set of variables was derived from the data for use in the statistics and regression analysis.

#### **1) Measurement of Variables**

##### *Individual and household characteristic variables*

Variables were derived from the results of the questionnaires (Appendix 2). Variables of years lived in Sydney and household size were used with their raw data, while age, education level, household income and English proficiency variables were used in their category form with ordinal measurements. Dichotomous nominal variables were used for gender (Male-0, Female-1), whether respondents have ever received water conservation information (Yes-1, No -0), ever heard of a water conservation program (Yes-1, No -0), and whether the respondents pay a water bill (Yes-1, No -0). Other variables for measuring work status, dwelling type and housing type were applied in multi-nominal form (for example, in the case of housing type, owned fully was referred to as 1, paying off as 2, renting-private as 3 and renting-public as 4). The variable of ethnicity was originally coded as Australian -1, Chinese-2, Korean-3, and Others-4. This nominal variable was then recoded to a set of dummy variables for use in the regression analysis (see **Error! Reference source not found.**).

##### *Knowledge factors*

Two variables measuring knowledge levels in regards to water issues were derived from the results of four questions (Q 6, 18, 19 and 20). One refers to the general knowledge of or familiarity with a variety of water issues in Sydney, such as main drinking water source and

water actors based on three questions (one 3-item scale, two standard questions). Respondents were asked to tick true/false or not sure to three statements (see question 20, Appendix 2), and each item was measured dichotomously (correct answer-1, wrong answer/not sure-0). Two other standard questions asked respondents if they had ever heard of the Sydney Water Corporation and what was the main source for drinking water in Sydney? Results were measured in dichotomous form (yes=1, no=0; Dams=1, others=0). As a result, a single score was assigned to each respondent by simply adding up his/her scores for three questions, with higher scores indicating a higher level of knowledge or familiarity with water issues. This variable was named ‘general knowledge’ and distinguished from the second variable.

**Table 3. 2 Coding method for the variable of ethnicity**

	<b>Ethnicity: Australian</b>	<b>Ethnicity: Chinese</b>	<b>Ethnicity: Korean</b>	<b>Ethnicity: Others</b>
<b>Ethnicity: Australian</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Ethnicity: Chinese</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>
<b>Ethnicity: Korean</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>
<b>Ethnicity: Others</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>

The second variable, which was defined as self-assessed-knowledge, was based on a 3-item scale question (Q6) indicating how much the respondents thought they knew about water issues, such as ‘where does your household water come from’, ‘the water pricing system’ and ‘the reuse of grey water at home’. Each item was measured using the Likert-scale, ranging from 1 (no knowledge at all) to 5 (a lot of knowledge). A single score was then assigned to the variable showing the mean value of three items for each respondent.

#### *Attitudinal factors*

The deriving of attitudinal factors was based on a 13-item scale question (Q5). The 13-item scales, which were developed from two former studies by Murdock et al. (1988) and Lawrence and McManus (2008), referring to several water topics, e.g., water availability, water management, water consumption, conservation and reuse. Each item was measured along a 5-point scale (ranging from 1-strongly agree to 5-strongly disagree, with reverse coding used for some items). In order to examine the underlying constructs of the reported scales of attitudes and, by extension, to choose or create the suit indicator for attitudes, a

factor analysis (Principal components analysis) with varimax rotation was conducted. As a result, three attitudinal factors were derived: value-based affective attitude, perception-based dispositional attitude and the general attitude (see Appendix 5).

### *Pro-conservational water behaviours*

The engagement level of respondents with certain pro-conservational water use behaviours was measured using a series of questions (Q 10-10a) which asked the respondents to report if they had taken action to save water in Sydney over the past few years and how often they undertook such action. These actions included reducing water use in indoor and outdoor activities, such as ‘reduce frequency toilet flush’, ‘adopting efficient garden watering facilities’ and ‘taking short showers’<sup>33</sup>.

Each action was measured along the scale from no-0, yes: occasionally-1, sometimes-2, to usually-3. Responses indicating actions not applicable were regarded as missing. The reliability of the 11-item scale was high (Cronbach’s alpha=.985, M=2.5). An indicator was created based on the composition of all 11 items, and measuring each respondent’s average level of water saving behaviour for use in the statistical analysis.

## **2) Statistic analysis techniques**

Descriptive analysis (cross-tabular and graphics) and multiple-regression analysis techniques were employed to perform the statistical analysis. Descriptive analysis was used to present the results in an easily understood, direct manner while regression analysis was used to examine the magnitude of correlations between variables. Ordered logistic and multi-linear-regressions analyses (depending on the data form of the dependent variables, i.e., ordinal form: the general knowledge variable, or continuous form: self-assessed knowledge variable) were used to examine the correlations between the dependent and independent

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<sup>33</sup> The water conservational actions included in the questionnaire were adapted from related previous studies as mentioned earlier (Department of Environment and Conservation, 2004, 2005, 2007; Department of Environment Climate Change and Water, 2010; Environment Protection Authority, 1997b, 2001; Independent Pricing and Regulatory Tribunal, 2004; Lawrence & McManus, 2008; Murdock et al., 1988; Randolph & Troy, 2008). It is critical to note that some water-saving activities that are popular among certain ethnic minority groups may not be recognised yet, and therefore, were not investigated in the survey. Nevertheless, this variable can assist to explore whether differences exist in the engagement level of these examined water-saving activities among studied groups. It is also worth to note that water conservation can also be undertaken via activities outside people’s home, though it is not within the scope of this study.

variables. Employing both analysis techniques enabled the discerning of relationships between ethnicity and knowledge, attitude, self-reported behaviour of respondents, as well as the interaction effects of factors such as individual and household characteristics (age, household size, dwelling type), migration-related factors (years lived in Sydney, birth country) and other factors (location of residence, payment of water bill).

Statistical analysis was completed in the following steps:

(1) Descriptive analysis approaches were employed to examine the basic features of data. This simply summarised the contingency or diversity of the samples. These included cross-tabulate analysis and graphic analysis (box plots). The response differences among ethnic groups were examined by cross-tabulating ethnicity and various variables (or responses to each question), such as perceptions and knowledge. Box plot, a graphic analysis approach, was used during the analysis to examine the overall pattern of knowledge levels, attitudinal scores, and engagement in self-reported water saving action.

(2) To provide a brief account of the possible relationships between variables, correlations between variables of ethnicity, actual knowledge, self-assessed knowledge, affective attitude and dispositional attitude were computed using Pearson correlations (see results in Section 4.3.2, Chapter 4).

(3) A series of regression tests were conducted in order to examine the ethnic differences in, or total effects on, knowledge, attitudes and self-reported behaviour. These tests also investigated the interaction of other factors, such as individual characteristics (e.g., age) and housing factors (e.g., housing types). For example, as presented in Section 4.3.2, Chapter 4, the series of regression analysis comprised three models. Model 1 looked at the total ethnic effects on knowledge, attitudes, and self-reported behaviour, with ethnicity as the sole predictor for individual regression. Models 2 and 3 examined the effects of ethnicity on knowledge, attitudes, and self-reported behaviour while other variables - the individual characteristics (age, gender, education and income) and housing-related factors (housing type and dwelling ownership) – were holding constant. Similarly, a set of baseline and control model regressions were tested to examine the variance of ethnic effects on pro-conservational behaviour while a range of other variables (e.g., migration status, knowledge, information and other related factors) were included in the regressions (see Section 4.3.3, Chapter 4).



(4) Analysis was also conducted to explore the within-group differences in the patterns of self-reported behaviours. Separate backward multi-regressions with the variable of pro-conservational behaviours as the outcome (dependent variable) were conducted for each ethnic group respectively, to determine which factors significantly influenced the likelihood of performing pro-conservational water saving actions for each ethnic group (see Section 4.3.4, Chapter 4).

(5) Multi-regressions were computed with the total survey samples to identify factors accounting for the variance of self-reported behaviour among respondents, and the magnitude of the effects of ethnic status. A backward multi-regression of self-reported behaviour on variables of individual and household characteristics, housing status and location of residence, knowledge, attitudinal indicators and other factors was employed. This model included all variables in the predictor, which enabled examination of the magnitude of ethnic effects compared with those of other predictors, such as income and dwelling type (see Section 4.3.3, Chapter 4).

(6) This step explored the influence of acculturation on ethnic effects, with factors such as language proficiency and years lived in Sydney included in the analysis. In Section 4.3.5, a baseline model was computed with the ethnic variable as the sole predictor. Then, each and both selected variables (years lived in Sydney and English proficiency) were entered individually into the control model.

(7) Mediation analysis was then conducted to examine the indirect ethnic effects on self-reported behaviour that was potentially mediated by the knowledge and attitudes of the respondents. Mediation can be seen as a form of effect transmitted by a hypothesized causal chain in which one variable affects a second variable and then, in turn, affects a third variable. In the case of analysing the relationship between ethnicity, knowledge, attitude and behaviour, knowledge may be regarded as the mediator between ethnicity and attitude or the mediator between ethnicity and behaviour. The mediation effect (indirect effect) is, therefore, the effect carried over by knowledge to attitude or to behaviour (see Appendix 6 for details about the method of testing mediation effects)(see Section 4.3.3, Chapter 4).

### **3.5 Ethnicity and water consumption**

This part of the study aimed to examine whether ethnic status affects per capita water use, and the magnitude of the affect. The examination was performed based on actual water consumption data collected from Sydney Water and population and housing data from the 2011 ABS Census.

#### ***3.5.1 Data sources***

Water consumption records for selected census collection districts were obtained from Sydney Water, while demographic, economic, ethnic, and housing data were derived from the ABS Census for use in the secondary analysis.

Personnel from Sydney Water provided data on the monthly average water consumption for single dwellings, for multi-dwellings in 100 per cent of residential developments and for multi-dwellings consisting of a mix of residential and non-residential units/flats for 14 Census Collection Districts for each month from July 2008 to March 2013<sup>34</sup> (see Appendix 7). Due to anonymity and confidentiality issues, water use data for an individual property could not be accessed; instead, data on average water consumption for single dwellings and for multi-dwellings in each CCD was provided. The 14 CCDs were contained in those in which the questionnaire survey was conducted. The adjustment of water use data to represent the specific CCDs required extensive efforts; therefore, data was requested for only 14 CCDs which had relatively higher residential concentrations of the three ethnic groups among those used for the questionnaire.

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<sup>34</sup> Detached and semi-detached houses, as well as terraces and townhouses if held under a single title, are categorised as a single dwelling by Sydney Water; while strata units, flats, mixed flats and dual occupancies are defined as multi-dwellings. Single dwellings have their own separate meters, while multi-dwellings use a common meter which records only the consumption for the building block as a whole. To calculate the consumption of a multi-dwelling, the consumption on the common meter is divided by the total number of units in the block.

Some strata units are in a mixed strata development which includes non-residential units, for example, and a number of shops on the ground floor of the development. In such cases, the consumption for a residential unit is the consumption recorded on the common meter divided by the total number of units, i.e., residential plus non-residential units. In order to mark the difference, two sets of water data were provided for the multi-dwellings; multi-dwellings with 100% residential units and multi-dwellings with mixed residential and non-residential dwellings.

At the time the research was designed and the preliminary analysis on ethnic population distribution was performed, census data on population and housing was available only up to 2006. Therefore, CCD was employed as the basic unit for conducting the household survey and collecting water data. CCD was the smallest unit in the Australian Standard Geographical Classification (ASGC) used for the 2006 census data release. However, a new statistical geographic standard was employed for the 2011 census statistics, and all census data was released in this new framework- Australian Statistical Geography Standard (ASGS) in which SA1 is the smallest geographic unit. The change in their statistical geographic standard made it difficult to combine the water data with the population and housing census data in the research. Further discussion of this issue and a solution combining CCD water data, SA1 population and housing data is provided in the following section.

### **3.5.2 Analysis methods**

Regression analysis techniques were employed to examine the ethnic correlation of actual water consumption, with per capita daily residential water consumption for the summer period and that for the winter period derived from the water records provided by Sydney Water as dependent variables.

#### **1) Deriving dependent variables**

Two dependent variables (per capita daily residential water consumption for the summer period and the winter period for each study unit) were derived from water data and census data through the following two steps.

##### *Step1. Defining analysis period*

At the time the analysis was conducted, census data on population and housing characteristics was available for 2011. Therefore, 2011 was considered a benchmark year for developing the average daily water consumption variable. As a result, two years average daily water consumption for three summer months (December, January and February, 2011 and 2012) and three winter months (June, July and August, 2010 and 2011) were calculated for the regression analysis (see Figure 3. 3). Average daily water consumption was computed by dividing the monthly data provided by Sydney Water by the number of days in each month.

The analysis period precedes and covers the household survey period enabling comparison of the results with the questionnaire data analysis results. By dividing the water consumption into two parts-summer water consumption and winter water consumption - the influence of climatic differences can be minimised.

Year	2008				2009				2010				2011				2012																
Month	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3

**Figure 3. 3 Selected months for analysis**

*Summer period:*

*Average daily per dwelling consumption for SD = sum (average monthly consumption for SD for Dec 2009, Jan., Feb. & Dec. 2011, Jan. & Feb., 2012)/180 days*

*Average daily per dwelling consumption for MD = sum (average monthly consumption for MD for Dec 2009, Jan., Feb. & Dec. 2011, Jan. & Feb., 2012)/180 days*

*Winter period:*

*Average daily per dwelling consumption for SD = sum (average monthly consumption for SD for Jun., Jul. & Aug., 2010 & 2011)/182 days*

*Average daily per dwelling consumption for MD = sum (average monthly consumption for MD for Jun., Jul. & Aug., 2010 & 2011)/182 days*

### *Step 2. Combining CCD water data and SA1 population and housing data*

As suggested earlier, water records were available for the average consumption for single dwellings and multi-dwellings in each selected CCD. The number of single dwellings and the number of multi-dwelling blocks were also provided, along with the water data for each CCD. However, the number of units or flats in multi-dwelling blocks or residential population size was not provided; so, it was impossible to calculate the total daily water consumption and, in turn, the average per capita daily water consumption for each CCD. Alternatively, the number of dwellings and the number of people (single dwelling and multi-dwelling units) can be obtained from the 2011 Census data, which means that the average per capita water consumption can be computed by matching the CCD water consumption data with the SA1 population and housing data.

An examination of the spatial relationship between the CCD geographic units and SA1 geographic units was conducted using ArcGIS computer software. The SA1 units, which were spatially contained in, containing or intersecting with the 14 CCDs, were selected using

the spatial selection tool. As a result, 36 SA1 units were identified. The relative positional relationship between the 14 CCDs and 36 SA1 units appears in Appendix 8. Most of the CCDs appear to contain, albeit not entirely contain, one or more SA1 units. Only two CCDs had a boundary that was entirely matched by two-SA1-unit combined areas. Satellite images obtained from Google Maps were used to examine the difference between CCDs and SA1 unit areas. Despite the fact that the boundaries of the selected CCDs and SA1s were not matching; it was still possible to link the water data, population and housing data. This was achieved by regarding the average per dwelling daily water consumption for single dwellings and for 100 per cent residential multi-dwelling in each CCD to be the estimated average daily consumption level for single dwellings and multi-dwellings for all SA1s which contained or were partially overlapped by that CCD<sup>35</sup>. To minimise the deviation caused by this approach, each SA1 unit with less than 1/3 of its area contained in the correspondent CCD was removed. As a result, 28 SA1 unit areas were selected. In this way, total residential water consumption for each SA1 could be calculated by summarising water usage for all dwelling types in each SA1. In turn, per capita daily water consumption could be computed by dividing the total water consumption by the total number of people living in the area. The equations were as follows:

*Summer average daily per capita consumption = (Summer average daily per dwelling consumption for SD \* total number of occupied SDs in the SA1 + Summer average daily per dwelling consumption for MD \* total number of occupied MDs in the SA1) / total number of persons in the SA1*

*Winter average daily per capita consumption = (Winter average daily per dwelling consumption for SD \* total number of occupied SDs in the SA1 + Winter average daily per dwelling consumption for MD \* total number of occupied MDs in the SA1) / total number of persons in the SA1*

## 2) Independent variables

A variety of variables were developed from 2011 Census data, including three broad categories: socio-demographic characteristics, economic and housing factors.

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<sup>35</sup> This analysis only investigated the correlation of ethnicity and residential water use; therefore, the average water consumption for 100 per cent residential multi-dwellings in each CCD was adopted to represent the average water consumption level for all multi-dwellings in the SA1 areas, irrespective of whether they were 100 per cent residential or mixed residential and commercial multi-dwellings. This approach avoided any possible error due to the presence of mixed residential and non-residential dwellings. For this reason, the number of total dwellings in each SA1 area which was used for calculating the per capita water use data, used the total number of occupied dwellings rather than the total number of dwellings.

These three categories were selected for the following reasons. Ethnic variables were the main focus/emphasis of this study. Socio-demographic factors and economic factors, such as age, education attainment, household size, work status and household income, have been identified in an extensive body of research as affecting household water use (Corbella & i Pujol, 2009) and have been widely employed for water usage research and planning. Housing factors such as dwelling type and ownership, are also suggested to influence households' water use or peoples' capacity to respond to water conservation (Troy & Randolph, 2006). Inclusion of these two categories of factors in regression analysis enabled a comparison of the importance of ethnicity in explaining the variation in per capita residential water use with that of other factors. By controlling those variables in regression models, any possible effects of ethnicity on regional water consumption which might be found in the analysis can be tested to confirm if it was a direct effect or just a carry-over effect due to demographic differential between ethnic populations, such as difference in household size or age. A list of variables derived from the Census data and employed for regression analysis is presented in Appendix 9.

Regression analysis was employed to examine the correlations between independent variables and dependent variables, specifically:

(1) The correlation between percentages of population for each ethnic community and per capita daily water consumption for the summer period and winter period was first examined using Pearson correlation coefficients.

(2) Then, a set of ordinary least squares regression analysis and backward regression analysis of per capita daily water consumption (for the summer and winter respectively) was conducted on all independent variables along with the percentage of ethnic population, to identify useful variables for explaining variation in per capita water consumption. In this process, the magnitude of the effects of ethnic status on per capita water usage was also explored.

(3) In this step, a two-model regression analysis was performed for per capita water consumption for the summer and winter periods respectively, to further test the relationships

between per capita water consumption and percentage of ethnic population. Percentage of ethnic population (Chinese, Korean and Australian) was the sole set of variables in model 1. For model 2, the variables which were found important in explaining the per capita water use variation in step 2, were then added into the regressions. The two-model regression analysis made it possible to test if the relationships between the ethnic status of the population and per capita water use were caused by variables other than ethnicity itself.

### **3.6. Qualitative study: focus groups, interviews and cultural probes**

Additional information was obtained through qualitative research. A series of focus groups and interviews were conducted between October 2012 and March 2013. Qualitative research explored the attitudinal and behavioural aspects of water use among three ethnic communities as well as constraints and opportunities for community engagement in water management. Qualitative studies complemented the quantitative analysis by clarifying ambiguous or unexpected findings, and supplemented it with in-depth insights into the perceptions and attitudes of households towards their use of water, water conservation programs and water pricing, their vernacular water-saving practices, their achievements in saving water at home, the challenges they encountered as well as their ideas and opinions on the cultural interaction on water use attitudes and practices.

#### **3.6.1 Focus groups**

Focus groups are often used following quantitative surveys for interpreting quantitative results and adding depth to the surveys (Hennink, 2013; Stewart & Shamdsani, 1990). In this study, focus groups were employed to better understand the results of the questionnaire survey as well as to generate ideas and concepts which were missed in the questionnaire study.

Participants were recruited at the end of questionnaire survey by attaching a focus group invitation letter. They were grouped by ethnicity (language) and location (suburbs). Three focus groups were conducted with a total of eight people attending. Discussion focused on a range of topics including perceptions of daily water use, awareness of and attitudes towards water conservation, incentives and challenges for saving water, plus changes in attitudes, behaviour and feelings over time (the Chinese and Korean groups were asked about changes after they moved to Sydney), information access and awareness of conservation programs

and policies.

### ***3.6.2 Semi-structured Interviews***

Interviews were conducted with individual members of two groups, i.e., the community members and key people involved in water management and environmental communication. For those willing to become further involved in the research, but not able to attend the focus groups, semi-structured interviews were conducted. Discussions followed the topics designed for focus groups.

Understanding domestic water consumption and water management involves understanding the agencies, institutes and groups involved in water management and community engagement, the policies, plans, programmes and measures employed, and the challenges and motivations for water management and engagement. To this end, interviews attempted to explore the experiences, views and opinions of key people involved in water management and community engagement vis-à-vis issues, including how ethnicity and cultural diversity is represented and reflected in environmental management issues and the associated successes and challenges. The interviews also explored the barriers in communication between Councils and ethnic minority groups with regard to environmental issues, especially water conservation promotion.

Interviews were conducted using a semi-structured format. The interview sample was drawn from managers, professionals or educators of government agencies, environmental groups, and ethnic community organisations within the study areas. A purposive sampling method, it was based on the identification of key people involved in water management and in promoting household sustainability. Potential interviewees were sent letters of invitation by both email and post. Copies of the Participant Information Statement (PIS) and Consent Form were attached for perusal by potential participants.

Topics were designed carefully to elicit information regarding several factors: access of ethnic communities to information; engagement levels of ethnic communities with water conservation practices, incentives and opportunities, shifts in policy and perceptions over time, potential and barriers to change, and further plans or proposals relating particularly to ethnic groups (Appendix 10).



### ***3.6.3 Practice observation (cultural probe)***

An innovative aspect of this research was participant observation of household practices of water use. Rather than the researcher being physically present in the dwelling to observe a participant's actions, residents were asked to send pictures, videos or other relevant materials via their mobile phones or emails, depicting their water use activities in home e.g., watering plants and washing dishes. to explore anecdotal evidence which suggests that particular cultural practices result in different levels of water use between ethnic communities. This is similar to Elizondo and Lofthouse's (Elizondo & Lofthouse, 2010a) use of 'cultural probe' in their study exploring patterns of conservation and domestic water use in different cultures. The cultural probe, first introduced by Gaver et al. (1999), is a qualitative data collection method. A 'cultural probe' tool pack (e.g., camera, photography guidelines, note book and fridge magnet) was designed by researchers, and distributed to all participants, inviting them to record information for a certain period of time, upon the completion of which all materials are sent to the researcher. It is particularly effective when investigating activities that are undertaken in households (Kjeldskov et al., 2005). For example, people may not be willing to let researchers to enter their house and collect data for a period of time, however, interactively, they may be willing to collect information themselves and hand it to the researcher. In this study, the approach is used to encourage volunteer households to collect photos or videos of their water use practices. This 'cultural probe' data collection approach provided good complementary information to the questionnaires and group discussions as it supported self-reflection and self-documentation. This aspect of the research was voluntary and participants had total control over what they chose to send to the researcher. A non-invasive research method, it ensures the safety of the researcher while, importantly for research where language challenges exist, it enables participants to demonstrate their activity rather than describing it in writing or verbally.

For the purposes of this study, participants were recruited at the end of focus groups and interviews to participate in the activity between October and December 2012. Instructions were explained to the participants during the recruiting stage. Photograph, video and drawing samples were shown to help them obtain a general idea of what could be included. Details were explained in the PIS (Appendix 11).

When taking photographs or videos, participants were advised to focus on the water rather than on their faces if they did not want to be identified. It was not necessary for their faces to be included in the images. Suggestions for maintaining anonymity included taking a photograph from behind so that the face was invisible, or producing a video showing only the hands and tap if relevant.

### ***3.6.4 Qualitative data collection and process***

In sum, 19 respondents from the questionnaire survey indicated their willingness to participate in the interviews or focus groups. This was signalled by the return of the *Focus Group Invitation Letter* (Appendix 12) along with the questionnaire. These respondents were then contacted for scheduling of the focus groups or interviews<sup>36</sup>. Focus groups were established by location, and for areas where only one respondent opted to participate, interviews were arranged. In order to reach as many participants as possible from among the 19 potential participants, respondents who were not able to attend the focus groups due to scheduling or personal issues were then offered an interview at their convenience. However, due to changes of mind, unexpected occurrences or inconvenience, eventually three focus groups and three interviews were conducted using this pool of potential participants.

Apropos of interviews with environmental and community communication experts, potential interviewees were approached using three possible ways. First, interview invitation letters were sent by post and/ or by email to nine Local Government Councils and the Ethnic Communities' Council of NSW (Appendix 13). However, this resulted in only four potential interviewees. Following communication via email or phone, three interviews were undertaken with three bilingual environmental educators. Second, for those councils that failed to respond, a follow-up approach was adopted. In addition, efforts were made to find potential interviewees: these included meeting people in seminars, campaigns or by introduction. As a result, five interviews were conducted with bilingual educators, an environmental manager and an ethnic communication team leader.

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<sup>36</sup> At the recruitment stage, potential participants were informed that they can chose the language (English, Mandarin, Cantonese or Korean) that they prefer to use when participate in further research activities: Focus Groups and Interviews. A translator was hired where necessary to help with conducting focus groups and interviews.

As regards practice observation (cultural probe), although all ten participants enlisted for the interviews and focus groups expressed enthusiasm for participation and signed the consent form, only five – one or two from each target ethnic group – of these people provided pictures and videos. A summary of the participants for the three qualitative studies appears in Table 3. 3.

**Table 3. 3 Qualitative studies participation summary and coding method**

Research Approach	Location	Number of Participants	Ethnicity	Gender	Role	ID
<b>Focus Group</b>	Hornsby	2	Australian	1 male 1female	Community member	FA_1, FA_2
		4	Korean	4 females	Community member	FK_1, FK_2, FK_3, FK_4,
		2	Chinese	1 male 1female	Community member	FC_1; FC_2
<b>Interview_ Community Member</b>		1	Australian	male	Community member	IA_1
	Hornsby	1	Chinese	male	Community member	IC_1
		1	Chinese	male	Community member	IC_2
<b>Interview_ Manager &amp; Experts</b>	--	1	Chinese		Bilingual Educator	IME_E1
	--	1	Chinese		Bilingual Educator	IME_E2
	--	1	Korean		Bilingual Educator	IME_E3
	*	1	--		Environmental manager from local council	IME_M4
	*	1	--		Ethnic communication team leader from local council	IME_M5
<b>Practice Observation /Cultural Probe</b>	Hornsby	2	Australian	Female	Community member	CPA_1, CPA_2
	Parramatta	2	Chinese	Female	Community member	CPC_1, CPC_2
	Strathfield	1	Korean	Female	Community member	CPK_1
<b>Total</b>	3 Focus groups (8 participants), 8 interviews (3 community members; 5 management or education roles), 5 cultural probe participants. Overall, 16 people participated in the qualitative studies, with 5 people participating in two research activities.					

*Note: \* As requested by the participants, the location of council or specific position of participants cannot be disclosed.*

Verbatim transcription was conducted for interviews and focus groups. This task was completed by listening carefully to the recordings and reading the notes which were taken at the interviews and focus groups. Transcription materials were then printed and prepared for use in the analysis. Three out of eight interview participants declined consent to have the conversation recorded. Therefore, the transcription of three interviews was conducted without the aid of the recording device. Materials collected in interviews and focus groups were used mainly to supplement with the questionnaire data, by providing evidence to, explain or question the questionnaire results. The coding method for qualitative data was displayed in Table 3.3. Photographs collected in the cultural probes were used to support or present the findings of focus groups and interviews in a visual way.

### **3.7 Media study: the print media coverage of water issues across language divides**

#### ***3.7.1 Research purpose of this part of the study***

The mass media serves as an important information source for the public on environmental issues. It influences attitudes and behaviours through its construction of social norms (Ching, 2010). Media is expected to integrate ethnic minority migrants into the mainstream culture, facilitate engagement among them vis-à-vis environmental issues, and reduce ethnic differences. However, the Literature Review (Section 2.4.3, Chapter 2) revealed a strong preference for information provided in languages other than English among non-English speaking ethnic minorities. This included bilingual people who often preferred to receive information in their home language alongside English information (Department of Environment and Conservation, 2005; Environment Protection Authority, 1997a). This raises the concern of whether differences exist about which particular environmental issues are reported, and how they are presented by the host and ethnic media. Examining media discourse and perception construction across language divides is of great importance, especially in ethnically diverse societies. This part of the study investigates how water-related issues have been presented and handled in print media across language divides in Sydney, with applicability elsewhere.

Media provides environmental information through which it impacts public debate and public opinion (Ching, 2010; Soroka, 2002). In terms of water, better information may be insufficient to promote behavioural change (Nerlich et al., 2010); but being better informed about water

issues could encourage positive attitudes and behavioural intentions towards water use and conservation (Dolnicar et al., 2010; Trumbo & O'Keefe, 2005). The media's selection of stories and emphasis can shape policy agendas, public conceptions and create public consciousness towards certain issues (Leiserowitz, 2005; Soroka, 2002). In agenda-setting theory, the greater the volume of reporting given to a certain issue translates into perceptions of the higher importance of this issue which, by extension, draws more public attention (Marks et al., 2007; McCombs & Ghanem, 2001). While good coverage empowers people and advances public debate, poor coverage may fail to draw public attention or mislead readers (Antilla, 2010). Hurlimann and Dolnicar (2012) stress that the lack of inclusive representation of a range of stakeholders, high levels of hedging, and limited scientific evidence in the presenting and interpreting of water issues in seven large newspapers across Australia was likely to undermine people's confidence in water management. In addition, it could result in negative opinions about public participation. In contrast, Haertsch (2005), who analysed water reporting in seven newspapers in Sydney between 2003 and 2005, found that prominent coverage was given to water storage and water supply issues, moreover, when the water situation became extreme, news reporting shifted from 'short-term' concerns to 'long-term' considerations (Haertsch, 2005, p. 6). It is not only through agenda setting that media shapes public conceptions and consciousness in regards to environmental issues, but also through the framing of reports (Antilla, 2010; Hurlimann & Dolnicar, 2012). Framing involves narrative techniques used to present and interpret an issue from a particular perspective, or to address a particular argument (Maesele & Schuttrman, 2008; Young & Dugas, 2012). By using different frames, media reports on the same topic can be presented in several ways, placing emphasis on certain points of view and marginalising others (Hornig, 1993).

Media influences public perceptions of environmental issues through their presentation and interpretation of such issues (Hay & Israel, 2001). In turn, the public influence media coverage with their interests and concerns. Slater (2007) defines these two interacting aspects as a pair of reinforcing spirals. These mutual effects between media and individual perception highlight the need to examine the construction of environmental issues by mainstream media and ethnic media; that is, to explore and understand the ethnic disparities in water perception and attitudes revealed in both quantitative and qualitative studies. To this end, this part of the study aims to compare the reporting (coverage and framing) of environmental issues in media across

language divides in two main dimensions, i.e., reporting coverage and framing, through analysing five English and non-English print newspapers in Sydney. Specifically, it looked at:

- (1) What water-related issues were reported in the English and Non-English language newspapers in Sydney between December 2011 and December 2012?
- (2) How were these water issues framed in various newspapers?
- (3) Did the extent of coverage and the framing of water issues differ across English and Non-English language newspapers?
- (4) If differences were found to exist, what are the reasons explaining these differences and what are the possible impacts that the disparities have on perceptions towards water use and management among the English-speaking majority and the Non-English-speaking ethnic minorities?
- (5) What are the implications of the differences in the ethnic and English-language media reporting of water?

### **3.7.2 Print media selection and material collection**

In cities such as Sydney that are simultaneously facing water stress and hosting diverse ethnicity and cultures, gaining an understanding of the variation in perceptions and attitudes among ethnic groups regarding water use, water conservation and related issues is vital. Media analysis of English and Non-English language media can contribute to this understanding. Therefore, five newspapers printed in three languages – English, Chinese and Korean – were selected for this study (see Table 3. 4). A twelve-month period from December 2011 to December 2012, which was consistent with the household survey period, was used for article collection. The two main English-language daily newspapers in the Sydney region, The *Sydney Morning Herald* (SMH) and the tabloid *The Daily Telegraph* (TDT) were chosen. The largest circulation Chinese newspaper in Australia, *Australian Chinese Daily* (ACD), and the first simplified Chinese daily newspaper in Australia, *Australian New Express Daily* (ANED), were also selected. The only Korean daily newspaper published in Australia, the tabloid *The Korean Daily Hoju Dong-A* (KDHDA) was also included in the study.

**Table 3. 4 Key characteristics of the five selected newspapers**

Newspaper	Language	Format	Coverage	Frequency	Circulation	Publisher	Readership
<i>The Sydney Morning Herald</i>	English	Broad-sheet	Sydney and NSW	Daily (Mon-Sat)	161,169 (M-F)/ 265,457 (SAT) <sup>a</sup>	Fairfax Media	Two of the most-read publications in Australia.
<i>The Daily Telegraph</i>	English	Tabloid	Sydney and NSW	Daily (Mon-Sat)	341,583 (M-F)/ 318,092 (SAT) <sup>a</sup>	Nation-wide News	
<i>Australian Chinese Daily</i> ( <i>澳洲新报</i> ) <sup>c</sup>	Traditional Chinese	Broad-sheet	Sydney and NSW, metro, Vic, WA, SA and Canberra	Daily (Mon-Sat)	17,000 -25,000	Australian Chinese Newspapers Pty Ltd	Favoured by the Traditional-Chinese speaking migrants from Taiwan, Hong Kong and Macau, and overseas Chinese communities.
<i>Australian New Express Daily</i> ( <i>澳洲新快报</i> ) <sup>c</sup>	Simplified Chinese	Tabloid	Sydney, NSW, Canberra, WA and SA	Daily (Mon-Sat)	Not available	Kingold Media	Favoured by the Simplified-Chinese speaking community who are mainly from mainland China, Singapore and Malaysia.
<i>The Korean Daily Hoju Dong-A</i> ( <i>호주동아일보</i> ) <sup>d</sup>	Korean	Tabloid	Sydney	Daily (Tue-Sat) <sup>e</sup>	8,000 <sup>b</sup>	The Korean Daily Hoju Dong-A Pty Ltd.	The only Korean daily newspaper published in Australia.

*a: Weekly circulation July-Sept 2012*

*b: Estimated, no accurate data record*

*c: News in the two Chinese-language newspapers is mainly reprinted or edited news from local media or media in China. For example, the news items relating to China in the ANED are mainly reprints from the New Express Daily Guangzhou, China.*

*d: The KDHDA consists of local stories translated from the local media, a few original news stories edited by its journalists, plus Korea-related stories that are reprinted, edited from the Dong-A ilbao (one of the major newspapers in South Korea).*

*e: KDHDA publishing is usually suspended during holiday breaks.*

Sources: NewsSpace 2013, Audit Bureau of Circulations, 2012; *Australian New Express Daily* website, <http://www.xkb.com.au>; *Australian Chinese Daily* website, <http://www.australianchinesedaily.com.au>; The Hoju Dong-a website, <http://www.hojudonga.com>

ProQuest Newsstand Database was used for searching water-related items in the two English-language newspapers. For the Chinese-language newspapers and the Korean-language newspaper, articles were collected by searching the microfilm collections in the NSW State Library<sup>37</sup>. Articles not specifically relevant to water issues were removed, and all remaining articles were printed and organised in chronological order for later analysis. As a result of two collection approaches, four hundred and sixty-two water articles were collected: 144 articles in *the Sydney Morning Herald* (SMH), 99 articles in *Australian New Express Daily* (ANED), 92 articles from *The Daily Telegraph* (TDT) and 34 articles from the *Korean Daily Hoju Dong-A* (KDHDA) (further details were displayed in Section 5.3).

### **3.7.3 Analysis methods:**

#### **1) Content analysis**

Content analysis method (Manganello & Blake, 2010) was employed to study water coverage in the selected newspapers. A coding system was developed based on previous studies (Dugas & Young, 2012; McManus & Montoya, 2012; McManus, 2000). As shown in Table 3.5, the entire text of each article was examined and analysed to identify the geographic scope or focus of coverage, the coverage distribution along a timeline, and the water issues (topics) discussed across newspapers. A method adapted from McManus (2000) was employed to measure the significance of coverage. Each article scored points based on article size (length), location of article, photo/picture used, headline size and primacy of water theme. Given the large sample size, an ordinal score system was used with articles given one, two, or three points respectively if they were small (no more than 1/8 of the newspaper page), medium (larger than 1/8 but equal or smaller than 1/4) and large (larger than 1/4). This score was then multiplied by five if it was located on the front page, by four if it continued from the front page or had a headline on the front page, by three if it was printed on page two or three, and by two if it was printed on page four or five or on the front page of a subsection of a newspaper. Fifteen points were awarded to each article accompanied by a photo. Ten or five points were given to each article depending on the relative size of their respective headlines. Points calculated based on the above processes were then multiplied by 0.5 or one, depending on whether water was a subtheme in that article or the main theme of said article.

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<sup>37</sup> The data collection of Korean newspapers was conducted with the assistance of a specialist who is capable of translating and interpreting Korean materials to English.



**Table 3. 5 Coding frame used for newspaper analysis**

Coding Field	Focus/Example
1. Theme	Content of article, types of issues discussed (water supply, water pollution, water conservation, etc.)
2. Primacy of water theme	Main theme/ sub theme
3. Type of article	News, feature <sup>a</sup> , editorial <sup>b</sup> , letter
4. Significance of Coverage	Page number, photo/picture used, article length, headline size
5. Geographic focus	The scope of water issues discussed, e.g., Australia related water issue (local, state, national), China-related, Korea-related water issue or water issues associated with other countries

*a: 'Features' refers to a story or article that is not closely tied to a recent news event but is of human interest. It often goes into great detail regarding to the issue, people, places or events discussed.*

*b: Editorial refers to opinion pieces written by the senior editorial staff or publisher of a newspaper, for example, in the Sydney Morning Herald, editorials are classified in the 'opinion' section.*

These methods of counting the number of articles, the size, location and geographic focus of each story revealed the different levels of coverage across newspapers. Analysis of geographic scope, type of articles, and themes enabled one to understand what water issues were reported and how they were presented across English- and Non-English-Language newspapers. Correspondence analysis was used to gain a more direct, graphical view of the differences in the coverage of themes across newspapers, by mapping their correlations in a two-dimensional map.

## 2) Framing Analysis

Framing (deriving media frames), an important content analysis technique looking at the ways in which media shape and interpret issues, was also employed. Drawing on studies which explored methods of framing (Matthes & Kohring, 2008; Zhou & Moy, 2007) and empirical studies built on such methods (Dugas & Young, 2012; McManus & Montoya, 2012), this part of the research identified media frames across five newspapers through carefully reading each item. Seventeen media frames were identified by recognising the theme and tone of each item collected from the five newspapers (see Table 5.5 for a list of frames and Section 5.3.2 for further details). Note that multiple frames exist in some articles. In such instances, more than one frame might be identified for one article. Attention was given to how each frame characterised the importance of water security and water conservation, opinions regarding government management of water issues, information about the community's engagement, and water issues in controversy across newspapers (the results

are presented in Section 5.3 in Chapter 5). Statistical analysis approaches, such as summary graphs and correspondence analysis, were used to assist presentation of the frequency and coverage of frames across newspapers.

### **3) Correspondence analysis**

Correspondence analysis approach was employed to examine how theme coverage and frames varied across newspapers (shown in Figures 5.5 and 5.6 in Chapter 5). Correspondence analysis, a statistical analysis technique introduced by Hirschfeld and developed by Jean-Paul Benzécri, was adopted to examine the associations between categorical data, (see Greenacre, 1994, 2010; Hirschfeld, 1935; Nenadic & Greenacre, 2007). This is a method factoring categorical variables. It measures the distance between any two points (categorical values), maps their associations in two or more dimensions, and displays plots points (categories) along the computed factor axes on the correspondence map. The analysis technique determines which categories are close together (correlated): this is reflected in the distance between points (categories). For example, in terms of analysis of the correlation between theme and language type of newspapers, correspondence analysis tests which themes are closely related to a certain type of newspaper, the distance between points (point for the theme and point for the newspaper type) and indicates how related they are. In other words, it estimates which themes are frequently reported in a certain type of newspaper and how frequently they are reported.

## **3.8 Conclusion**

This chapter has presented the research design and methods employed in this study. It started by reintroducing the research aim and research questions which guide this study, then verified the research area, target communities, and the stratified sampling strategy employed. It then explained why quantitative and qualitative techniques were used for data collection and analysis, and described the implementation and analysis of the questionnaire, semi-structured interviews, focus groups, practice observation, water data analysis and media analysis in detail. The next chapter will present the results derived from the implementation of these research techniques.

## CHAPTER 4      QUANTITATIVE RESULTS

### 4.1 Introduction

This chapter presents the quantitative findings of the study. It starts by addressing the results of the household questionnaire survey, which provide insights into the perceptions, knowledge and post-migration behavioural changes of ethnically diverse groups, as well as incentives and challenges that shape people's engagement with water conservation. It then displays the results of the correlation analysis of the primary data (questionnaire data) and secondary data (census population data), which quantitatively examine the impacts of ethnic backgrounds on attitudes and behaviour pertinent to water use and per capita water consumption. Section 4.4 presents the results of the questionnaire exploring indoor and outdoor water-use activities across ethnic groups. The last section displays the results of the quantitative examination of ethnic effects on per capita water usage.

### 4.2 Descriptive analysis of water use behaviour, perceptions, challenges and opportunities

#### *4.2.1 Familiarity with and perceptions of Sydney's water issues among ethnic groups*

##### 1) Perceptions of Sydney's water situation

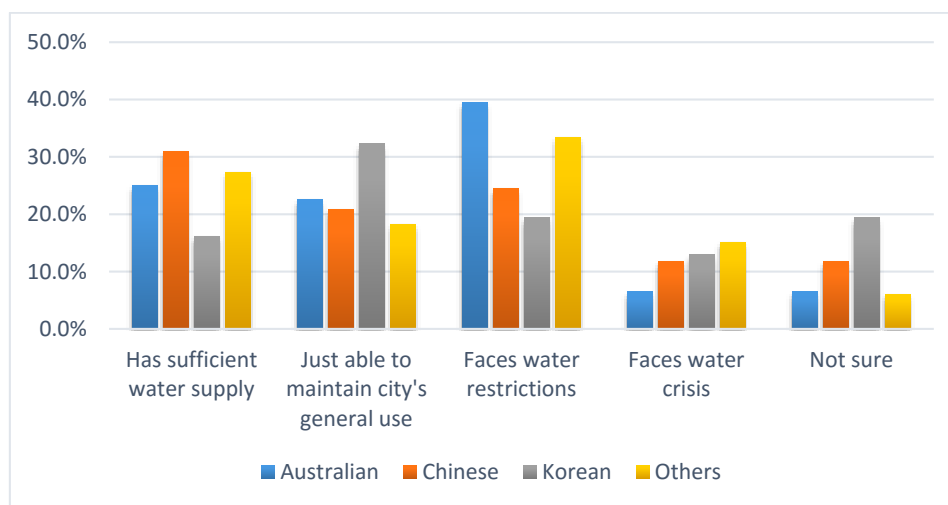
Environmental knowledge is regarded as a prerequisite for environmental awareness (Pfeffer & Stycos, 2002); and, individuals' perceptions influence their water-use behaviour (Adams et al., 2013). Therefore, it is important to examine the variance across ethnic groups regarding how familiar or informed households are with water issues in Sydney.

The questionnaire sought to determine participants' perceptions of Sydney's water supply situation in the long term (Q2). A comparison of responses across four<sup>38</sup> ethnic groups (Australian, Chinese, Korean, Others) revealed significant differences in respondents' perceptions (Figure 4. 1). Australian households and 'Other' ethnic community households

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<sup>38</sup> Given the high number of 'other' responses in the questionnaire survey, a fourth group, i.e., 'Others' was created and used in the quantitative analysis as a reference group. 'Others' included a large proportion of English respondents (defined by themselves), who were not necessarily representative of the diversity of 'other ethnic communities' outside the Australian, Chinese and Korean populations of Sydney. See Chapter 3, Section 3.4.2.

were more likely to believe that inevitably Sydney would face water restrictions (39 and 33 per cent respectively, compared to 25 and 19 per cent among Chinese and Korean respondents respectively). Korean households tended to believe that Sydney's water resources were only just able to meet the city's general use (32 compared to less than 22 per cent among Australian and Chinese groups). In comparison, Chinese respondents were more inclined to think that Sydney has a sufficient water supply (31 compared to 25 per cent of Australians and 16 per cent of Koreans).



**Figure 4. 1 Perceptions of Sydney's water supply situation in the long run by ethnicity (N=299) Q2**

The respondents' perceptions of Sydney's water supply compared to those of their birth countries may have influenced their perceptions and judgement of water issues, which in turn would influence people's attitudes towards water conservation and water use behaviour. To this end, questions were asked regarding what the participants thought about Sydney's water quality and quantity compared to water conditions in their home countries (Q3). As shown in Figure 4.2, The three ethnic groups outside of Australians all tended to think that Sydney had a good, or very good water supply in terms of quality. However, regarding the quantity of water supply, the Korean group's responses appeared slightly different, with a considerable percentage (27.6) perceiving Sydney's water supply quantity as average. Nevertheless, overall, the respondents were optimistic, with only a small percentage of respondents in each group (or no Chinese respondents) stating that Sydney had a poor or very poor water supply.



**Figure 4. 2** Participants' perceptions of Sydney's water quality and quantity compared to those of their birth country Q3

## 2) Self-reported levels of knowledge

The questionnaire also tested respondents' personal perceptions; that is, how knowledgeable they were about water issues including drinking water sources, grey water reuse, and water pricing. As shown in Figure 4.3, the results indicate that the Chinese respondents tended to claim that they knew little or even nothing about those water issues compared to their counterparts in other groups. Specifically, 38 per cent of Chinese respondents admitted that they knew little about where their drinking water came from compared to only 20 per cent and 9 per cent of Koreans and Australians. The Korean respondents seemed relatively more confident about their knowledge compared to their Chinese counterparts, although more than half of the Korean respondents reported having little or no knowledge about water pricing and grey water use. A considerable proportion (34 per cent) of respondents indicated that they had moderate knowledge of drinking water sources. Compared to both the Chinese and Korean groups, the Australians were more likely to claim that they had moderate or quite a bit of knowledge about those water issues. Forty-one per cent of Australian respondents reported to have moderate knowledge about water pricing compared to 31 per cent and 20 per cent of Chinese and Koreans respondents respectively. It is noticeable that respondents in the group of 'Others' seemed more confident about their knowledge of the drinking water sources, compared to that of Australians. Approximately 64 per cent of respondents in the category of 'Others' claimed they had quite a bit or a lot of knowledge compared to 57 per cent of the Australian group. The varied level of self-reported knowledge seemed consistent with that of the actual knowledge measured by the questionnaire.

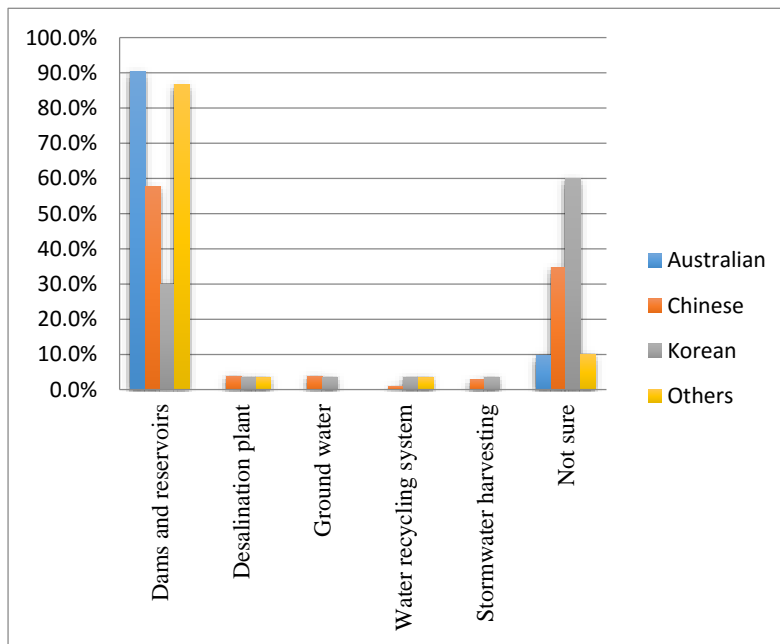


**Figure 4. 3 Respondents' perceptions of their knowledge about where their drinking water came from, water pricing, and the reuse of grey water Q6**

### 3) The actual knowledge level

The actual knowledge of respondents was measured using a series of questions (Q18-20), including whether they were aware of their drinking water provider (Sydney Water), the main sources of domestic drinking water, and their judgement of the three water-related statements (Q20).

As shown in Figure 4. 4, it appeared that most of the Australian respondents and respondents from the group of 'Others' were familiar with the main domestic water sources; ninety per cent of Australian respondents and 88 per cent of 'Others' provided the right answer. Not surprisingly, Chinese and Korean respondents were relatively less informed about this issue compared to their Australians counterparts, with only 58 and 30 per cent of respondents in these groups, respectively, providing the right answer. Approximately 60 per cent of Korean respondents indicated they had no idea about where their drinking water comes from, which was substantially higher than the percentage of Korean respondents who self-claimed to have no knowledge about water sources as indicated in Figure 4.3. This suggested that many Korean respondents might have been less knowledgeable about water issues than they thought they were.



**Figure 4. 4 Perceptions of Sydney's main drinking water source by ethnicity Q19**

Further examination of whether participants had heard of Sydney Water (Q18) and their judgements regarding the three statements (Q 20) about water issues found that the Chinese and Korean respondents were relatively less informed or familiar with those issues compared to the Australian and Others groups (Table 4. 1). When asked if they had heard of Sydney Water, 36.4 per cent of Chinese respondents and 46.7 per cent of Korean respondents claimed that they had never heard of Sydney Water, compared with merely 8.2 per cent of respondents in the Australian group and 19.4 per cent of respondents in the 'Others' group.

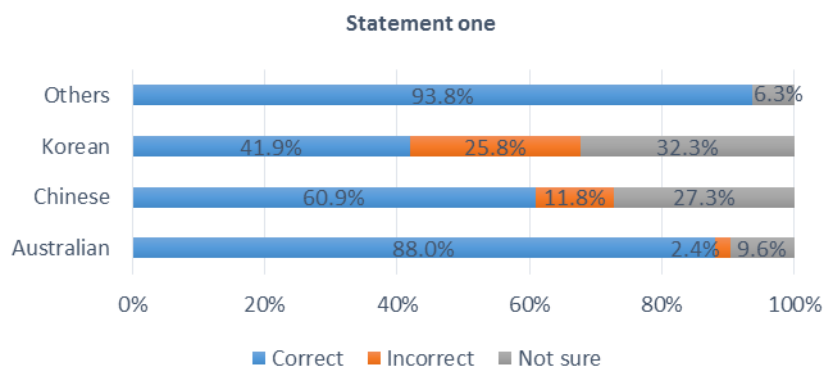
**Table 4. 1 Heard of Sydney Water Q18**

	Australian	Chinese	Korean	Others
<b>No</b>	8.2%	36.4%	46.7%	19.4%
<b>Yes</b>	91.8%	63.6%	53.3%	80.6%

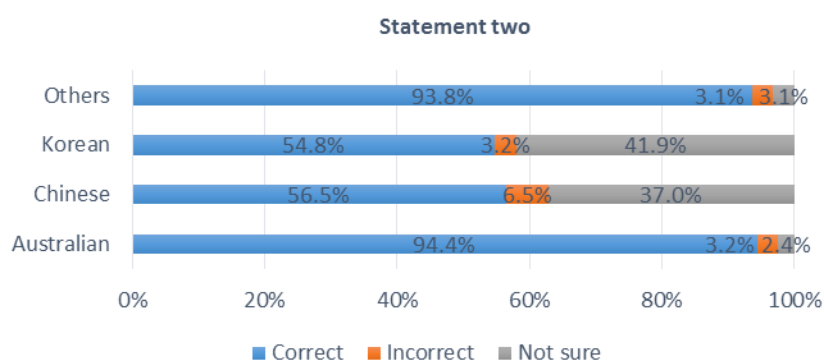
Similarly, as shown in Figure 4. 5, Chinese and Korean respondents were also more likely to indicate that they were not sure about the water-related issues examined in question 20 and were thus unable to make judgement about the statements. Apropos of statement one, which examined their basic knowledge of water resources, Korean respondents were most likely to respond with an incorrect answer (25.8%) or to indicate that they were not sure (32.3%). Following was the Chinese group, with 11.8 and 27.3 per cent of them giving an incorrect answer or finding it difficult to answer based on their knowledge. Compared to the Chinese

and Korean groups, the Australian respondents were more likely to provide the correct answer, with 88 per cent compared to 41.9 and 60.9 per cent in the Korean and Chinese groups respectively.

Uncertainty vis-à-vis statements two and three was even greater among the Korean and Chinese respondents; 41.9 per cent of Korean respondents and 37 per cent of Chinese respondents found it difficult to make a judgement about grey water use based on their knowledge, compared to merely 2.4 per cent of Australian respondents who indicated so. Similarly, 32.2 per cent of Koreans and 35.5 per cent of Chinese respondents claimed that they were not sure whether Sydney had ever experienced compulsory water restrictions. In comparison, only 9.6 per cent of Australian respondents indicated lack of certainty. More importantly, approximately 20 per cent of Korean and Chinese respondents answered incorrectly when asked if Sydney had ever experienced any compulsory water restrictions. Surprisingly, 19.4 per cent of respondents from the group of ‘Others’ also held this perception.

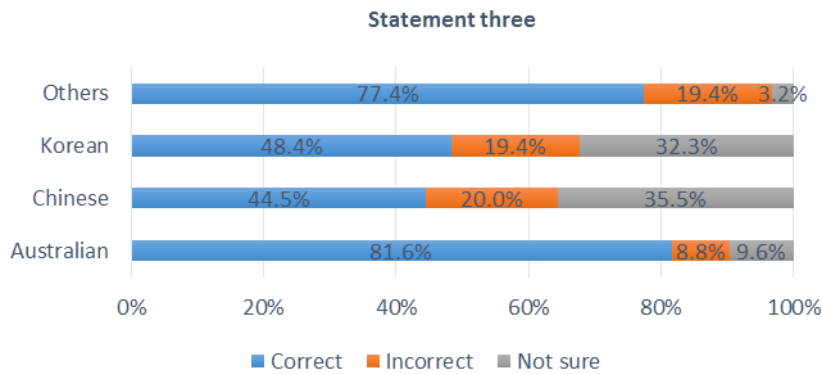


(1)  
Respondents' judgement of statement one:  
'Most stormwater drains run directly into waterways or oceans'.



(2)  
Respondents' judgement of statement two:  
'Grey water is leftover water from baths, showers, hand basins and washing machine'.





(3)  
 Respondents' judgement of statement three: 'Sydney has never experienced compulsory household water use restrictions'.

**Figure 4.5 Respondents' judgement of three water related statements, by ethnicity, Q20**

#### 4) Awareness, potentials and opportunities

In order to ensure water conservation at home, households need to be aware of how much water they use, how much water they save, and how to achieve savings. The questionnaire analysis found that Australian respondents were more likely to be aware of the amount of water their households used: 66.9 per cent of Australian respondents claimed that they knew about their water usage. However, the Chinese and Korean respondents seemed less likely to know about their actual water usage, with only 30.6 per cent of Chinese and 36.7 per cent of Korean respondents claiming knowledge (Table 4. 2).

**Table 4. 2 Do you know how much water your household uses on average?**

	Australian	Chinese	Korean	Others
<b>Yes</b>	66.9%	30.6%	36.7%	50.0%
<b>No</b>	33.1%	69.4%	63.3%	50.0%

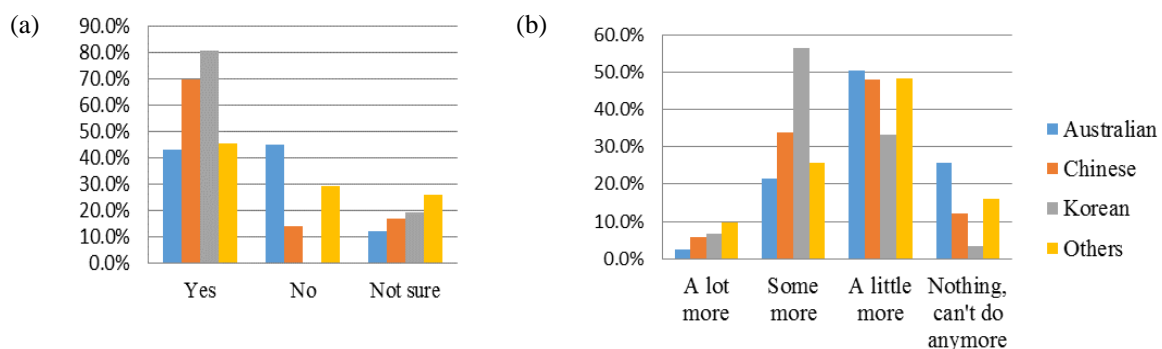
Their judgements of whether their household water usage was high or low among the same type of households would also influence householders' awareness of conservation. As shown in Table 4. 3, somewhat surprisingly, the respondents from all four groups all tended to believe that their water usage was below or approximately equal to the average. Very few respondents considered their household usage to be above the average in water consumption. Between-group comparison indicated that Australian respondents and respondents from the category of 'Others' were most likely to identify as small water consumers, with more than half (52.8%) of Australians and 54.5 per cent of 'Others' perceiving that their household water consumption was below the average. Korean respondents also tended to believe their water consumption was below the average; however, the percentage (45.2%) of respondents who claimed so was slightly lower than that of the Australian (52.8%) and 'Others' (54.5%). In comparison, Chinese respondents (43.9%) were more likely to believe their household

water consumption was approximately equal to the average. A considerable percentage of Chinese (15%) and Korean (12.9%) respondents indicated that they were not sure about their water usage compared to other households of the same type.

**Table 4. 3 Perceptions of household water usage compared to the average of the same type of households in Sydney, by ethnicity**

	Australian	Chinese	Korean	Others
Above average	8.0%	5.6%	3.2%	6.1%
Approximately equal to the average	34.4%	43.9%	38.7%	30.3%
Below average	52.8%	35.5%	45.2%	54.5%
Not sure	4.8%	15.0%	12.9%	9.1%

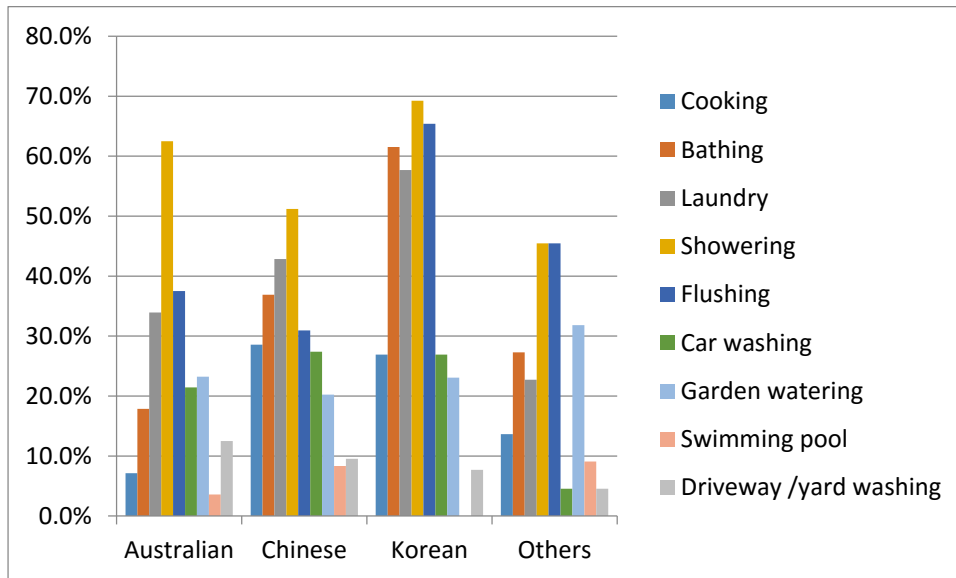
Respondents in the Korean and Chinese groups were more likely to indicate willingness to reduce water use (Figure 4. 6a), with 81 per cent and 69 per cent in the respective groups compared to 42 and 43 per cent in the Australian and ‘Others’ group. Responses varied between groups in regards to the scope for reducing water use (Figure 4. 6b).. As shown in Figure 4. 6b, the Korean respondents were more likely to indicate that they could save some more, i.e., 58 per cent compared to 21 and 34 per cent of Australian and Chinese respondents who indicated likewise. Respondents from the other three groups tended to claim that their households could only save a little more. More than 25 per cent of Australian households believed that they could not do anymore, compared to only about 12 per cent of Chinese respondents, 4 per cent of Korean respondents and 16 per cent of respondents in the ‘Others’ group. It seemed that based on their self-reporting of willingness and potential, there was greater potential to reduce water use among the Korean and Chinese households than there was among Australians.



**Figure 4. 6 Percentage of respondents willing to change their behaviour to reduce water use Q11; and, how much water do they feel they can save Q11b**

Given that the willingness and potential to save water across ethnic groups has been examined, a further important factor is to identify which aspects of household water use can

potentially be reduced. Accordingly, respondents were asked which aspects of water use their households could reduce (Q11a). As shown in Figure 4. 7, the most common response in all groups was showering (Australian=62.5%, Chinese=51.2%, Korean=69.2% and Others=45.5%). Bathing, toilet flushing and laundry were also relatively more reported by the Korean respondents, with more than 57 per cent indicating that they could save water during the above activities compared to less than 45 per cent in the other three groups.



**Figure 4. 7 Responses vis-à-vis which aspects of water use could be further reduced, by ethnicity Q11a**

### 5) Water-saving behaviour and behavioural change after migrants moved to Sydney

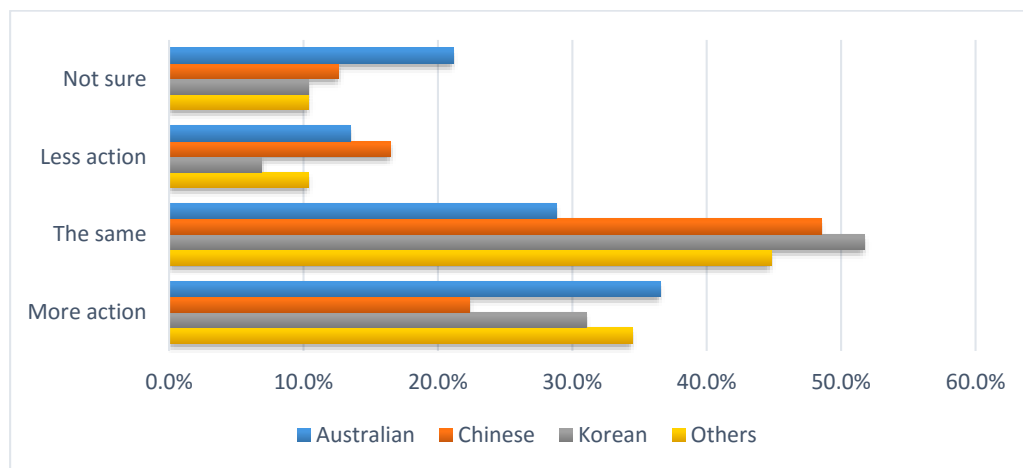
A high percentage of respondents in each group indicated that they had undertaken water-saving action at home in Sydney (Table 4. 4). Among them, the Australian group, with 90.3 per cent, ranked top, followed by ‘Others’ (87.9%). The Chinese and Korean groups had relatively lower response rates compared to Australians and ‘Others’, with 72.2 and 74.2 per cent of respondents respectively claiming that they had conducted water-saving activities in the past few years in Sydney.

**Table 4. 4 Responses to whether water-saving action was undertaken in the past few years in Sydney, by ethnicity**

	Australian	Chinese	Korean	Others
Yes	90.3%	72.2%	74.2%	87.9%
No	9.7%	27.8%	25.8%	12.1%

Questionnaire respondents were also asked to compare their water-saving behaviour with their behaviour before migration (Q9). The results, shown in Figure 4. 8, indicate that Korean

and Chinese respondents, as well as those from the ‘Others’ group were more likely to respond that they used water the same way as before they came to Sydney. Australian respondents now living in Sydney who had previously lived outside of Sydney were more likely to indicate that they were increasingly taking more water-saving action than before. Specifically, 51.7 per cent of Korean respondents, 48.5 per cent of Chinese respondents and 44.8 per cent of respondents from other ethnic communities indicated that they used water the same way as before. In contrast, 36.5 per cent of Australians claimed that nowadays they undertake more water-saving action than they did previously, compared to 22.3 per cent of Chinese and 31 per cent of Korean respondents who indicated so. A noticeable percentage (16.5 %) of Chinese respondents reported that they tended to be less engaged in water-saving activities than in their original place of residence.



**Figure 4. 8 Responses to water-use behaviour change since moving to Sydney, by ethnicity Q9**

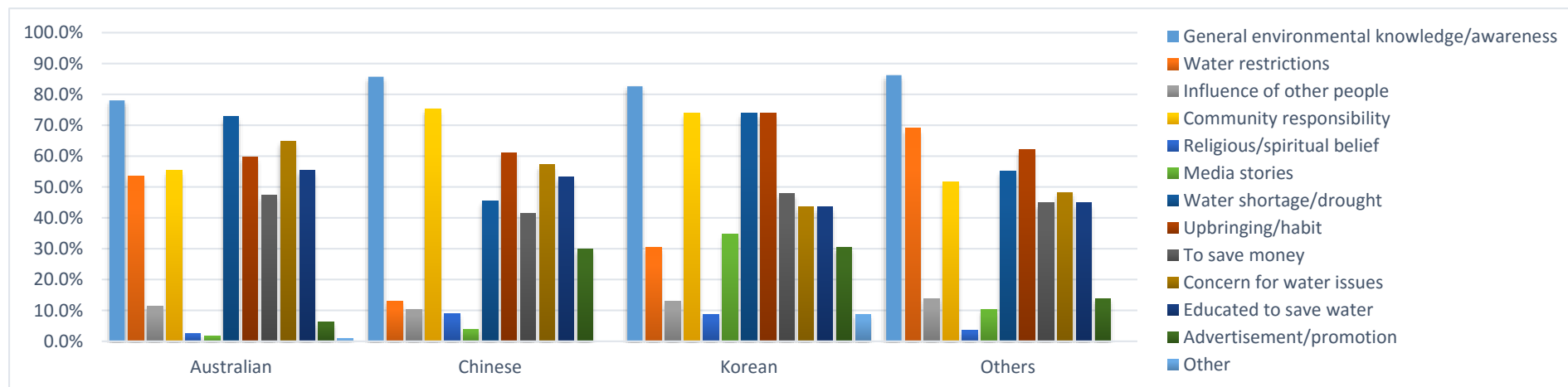
## 4.2.2 Incentives and challenges

### 1) Incentives

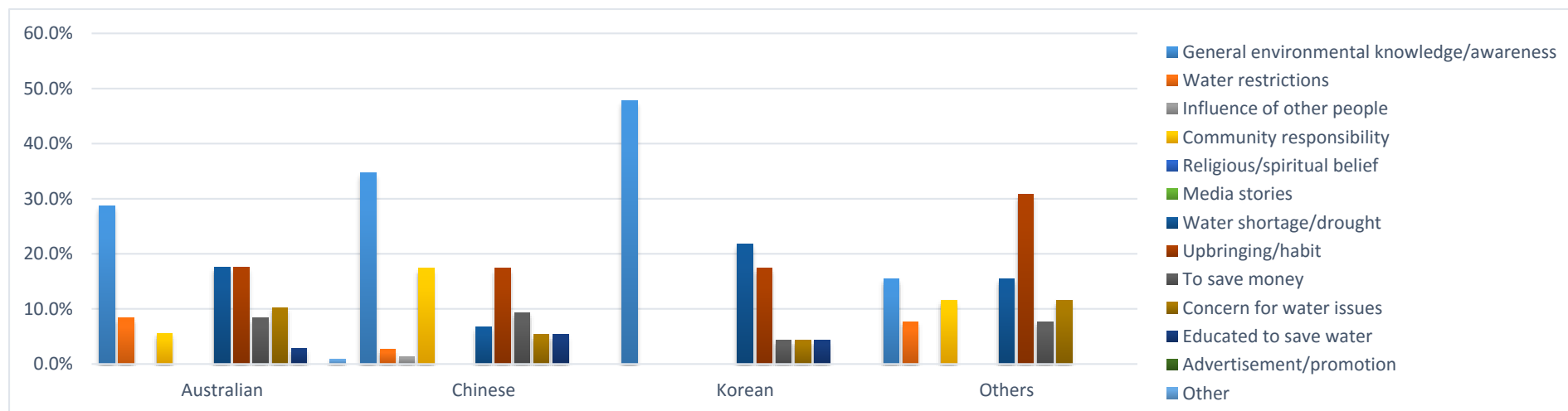
Identification of the incentives and challenges that households are confronting can potentially assist in designing a water management strategy to promote water conservation. In the questionnaire survey, respondents were asked what incentives and challenges their households faced when reducing water use (Q10b-10e). Summarised in Figure 4. 9 are the important reasons/incentives (multiple choices) and main reason/incentive (single choice) for households to undertake water-saving activities, as reported by respondents in the questionnaire.

As shown in Figure 4. 9a, ‘general environmental knowledge and awareness’ was the most common answer in all groups, with 85.7 per cent of Chinese, 82.6 per cent of Korean and 86.2 of ‘Other’ respondents nominating it as an important reason for them to save water. The percentage in the Australian group was slightly smaller, with 78.1 per cent of Australian respondents nominating this incentive. ‘Upbringing/habits’ were also commonly reported by all groups, especially the Korean group (73.9%). Chinese and Korean respondents were more likely to indicate ‘community responsibility’ as an important reason for water conservation, with 75.3 and 73.9 per cent respectively compared to 55.3 and 51.7 per cent in the Australian and ‘Others’ groups. ‘Water shortage/drought’ was also a common answer among Australian and Korean respondents (72.8% and 73.9%); however, it was relatively less mentioned by the Chinese and ‘Other’ groups (45.5% and 55.2%). Another considerable difference between the groups was the response to ‘water restrictions’: 53.5 per cent of Australians and 69 per cent of ‘Other’ respondents regarded ‘water restrictions’ as an important reason for saving water. However, this factor was rarely mentioned by the Chinese and Korean respondents (13% and 30.4% respectively). More than half of the Australian and Chinese respondents also reported ‘concern for water issues’ and ‘educated to save water’ as important incentives for them to conserve water.

As regards the main incentive (Figure 4. 9b), consistent with the pattern presented above, ‘general environmental knowledge/awareness’ was still the most common answer provided by all groups. ‘Upbringing/habits’ was also an outstanding incentive across all four groups, although the proportion of respondents who nominated this factor was substantially lower than that for ‘general environmental knowledge/awareness’. There were also other noticeable incentives, such as ‘community responsibility’ to the Chinese group, and water shortage and drought to the Australian and Korean groups.



(a)



(b)

**Figure 4. 9 Reasons/ incentives (a) and main reason/incentive (b) for households to undertake water-saving actions, by ethnicity Q10b – Q10c**

## **2) Challenges**

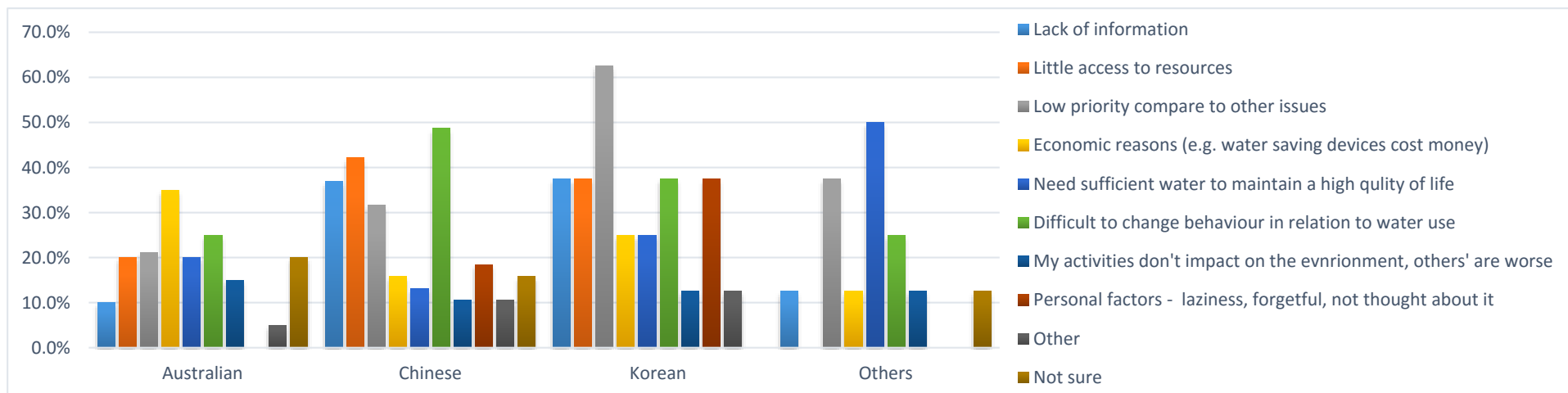
Figure 4. 10 summarises the important challenges (1) and the most important challenge (2) for households to conduct water-saving behaviour, as reported by questionnaire respondents (Q10d-10e). It appears that responses to the important challenges varied substantially across ethnic groups. As shown in Figure 4. 10 (a), the most common response provided by the Australian group was ‘economic reasons’ (35%), whereas the most commonly nominated challenge for the Chinese group was ‘difficult to change behaviour’ (48.6%). In contrast, Korean respondents were more likely to answer ‘low priority compared to other issues’ (62.5% compared to 21.1, 31.6 and 37.5 per cent in the Australian, Chinese and ‘Other’ groups respectively), while ‘Others’ tended to nominate ‘need sufficient water to maintain the high quality of life’. It was noted that a ‘lack of information’ was also relatively more reported among Chinese and Korean respondents, with more than 36 per cent of respondents in these two groups nominating this factor, it was rarely mentioned by Australian (10%) and ‘Other’ (12.5%) respondents. Similar patterns also existed in the responses to ‘little access to resources’, with 42.1 per cent of the Chinese and 37.5 per cent of the Koreans compared to only 20 per cent in the Australian group. No respondent nominated this factor in the ‘Others’ group.

When asked to identify the most important challenge, there was a difference from the findings of the multiple-choice question stated above in that the responses appeared to be less varied across groups (see Figure 4. 10 (b)). ‘Difficult to change behaviour’ was the most common response from all groups with the exception of the Chinese group. Slightly more Chinese respondents indicated ‘lack of information’ as the most important challenge rather than ‘hard to change behaviour’, 26.3 per cent compared to 23.7 per cent respectively.

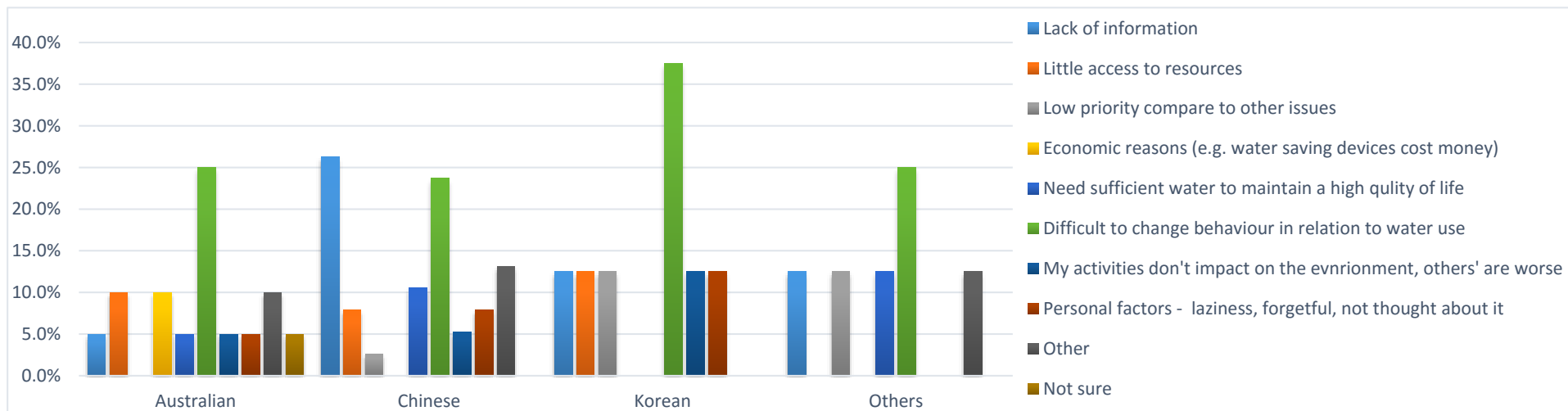
### ***4.2.3 Information sources and the influence of language***

#### **1) Willingness to know more about water conservation**

The questionnaire found that a high percentage of respondents in each ethnic group claimed that they were willing to learn more about water conservation (Table 4. 5), especially the two ethnic minority groups – the Chinese (84%) and the Koreans (86.9%). However, in relation to the Australian group, the ethnic minority groups tended to be less informed about water conservation issues in Sydney (see Table 4. 6). Only 46.6 per cent of Chinese and 29 per cent of Korean respondents indicated they had ever received information about water conservation in Sydney.



(a)



(b)

**Figure 4. 10 Challenges (a) and main challenges (b) for undertaking water-saving action, by ethnicity Q10d – Q10e**



Likewise, as shown in Table 4. 7, 34.5 per cent of respondents in the ‘Others’ group, and only 20.6 per cent of Chinese and merely 12.9 per cent of Korean respondents, reported they were aware of water conservation programs in Sydney.

**Table 4. 5 Willing to know more about how to achieve water conservation, by ethnicity Q17**

	Australian	Chinese	Korean	Others
Yes	76.3%	84.0%	86.7%	75.0%
No	23.7%	16.0%	13.3%	25.0%

**Table 4. 6 Responses to whether they had received any information about water conservation in Sydney, by ethnicity Q16**

	Australian	Chinese	Korean	Others
Yes	78.9%	46.4%	29.0%	61.3%
No	21.1%	53.6%	71.0%	38.7%

**Table 4. 7 Responses to awareness of conservation programs in Sydney, by ethnicity Q15**

	Australian	Chinese	Korean	Others
Yes	40.5%	20.6%	12.9%	34.5%
No	59.5%	79.4%	87.1%	65.5%

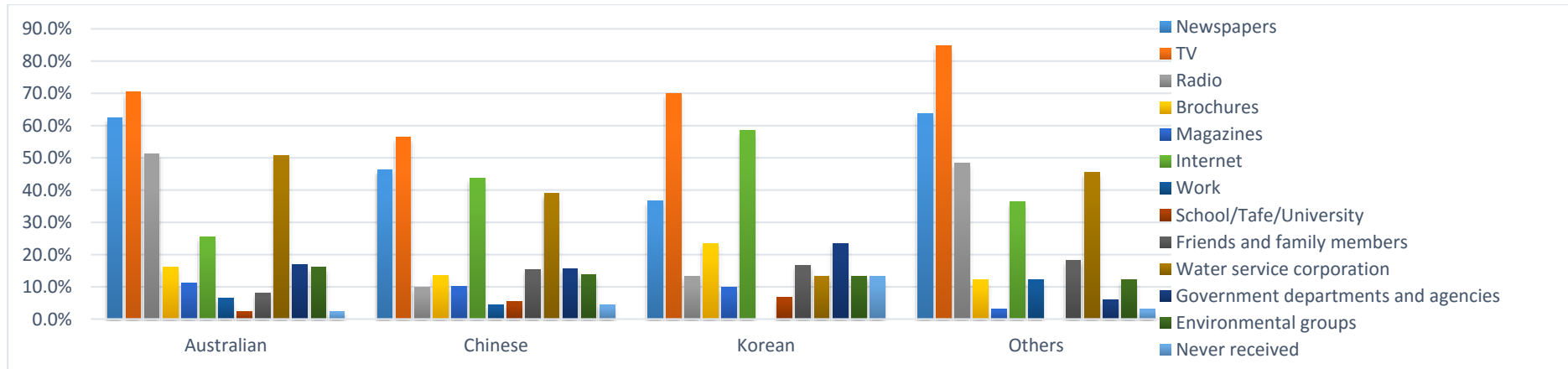
After the community members expressed their intention of getting involved in water conservation, it was important to identify effective ways through which to communicate with them. To this end, questionnaire respondents were asked what their information sources were, as well as through what sources they preferred to receive information about water issues Q4 and Q17a.

## 2) Information sources

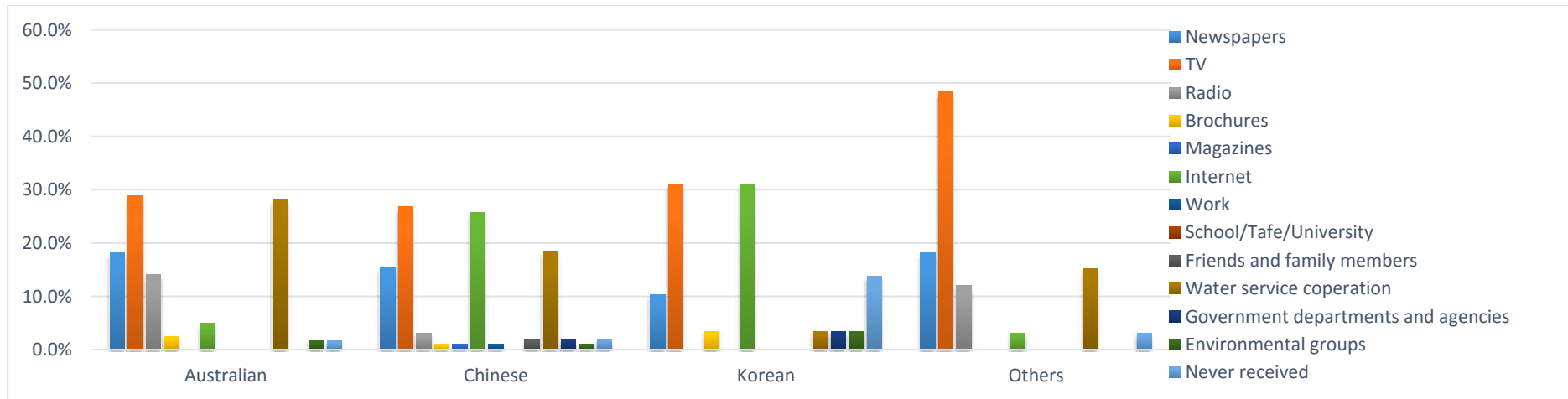
Figure 4. 11a presents the sources through which respondents usually receive information about water issues (multiple choice question Q4). Figure 4. 11b summarises the main information source reported by respondents (single choice question Q4a). Overall, as shown in Figure 4. 11a, Australian respondents were likely to have more sources of information than the other groups. Half or more of Australian respondents reported usually receiving information about water issues from four information sources: television, newspapers, radio, and the water service corporation (Sydney Water). In contrast, only two information sources were reported by more than half of the respondents in each of the other three groups. Sources of information tended to vary according to groups. Specifically, television was the most reported information source by all groups: 70.4 per cent by the Australian group, 70 per

cent by the Korean group, 84.4 per cent by the 'Others' group, and a slightly smaller percentage (56.4 per cent) in the Chinese group. Newspapers were the second most reported sources of information for water issues in the Australian (62.4%) and 'Others' (63.6%) groups. In comparison, the Chinese and Korean groups were relatively more likely to nominate the 'Internet' as an important source following television; with 43.6 per cent and 58.6 per cent respectively compared to 25.6 per cent and 36.4 per cent in the Australian and the 'Others' group. Moreover, 50.8 per cent of Australian, 45.5 per cent of 'Others' and 39.1 per cent of Chinese respondents specified the water service corporation as one of the important information sources. In contrast, only a few Korean respondents (13.3%) supported this claim.

The pattern of responses for the main (most important) information source was similar to that for important information sources. Generally speaking, the Chinese and Korean respondents were more alike and tended to specify television (Chinese=26.8%, Korean=31.0%) and the Internet (Chinese=25.8%, Korean=31%) as the main sources for them to receive information about water issues. The Australian respondents were more likely to nominate television (28.9%) and the water corporation (28.1%) as the most important sources of information. Responses seemed to be less varied among respondents in the 'Others' group, with almost half (48.5%) of this group indicating television as the most important source of information about water issues.



(a)



(b)

Figure 4. 11 Sources of information about water issues, by ethnicity (a) and the main information source, by ethnicity (b) Q4 - Q4a

### 3) Preferred information source

Questionnaire respondents were then asked from which sources they would prefer to receive information about water conservation in the future (Q 17a). As shown in Figure 4. 12, with the exception of the Korean group, television was still the most reported preferred source of information among all groups (Australian =26%, Chinese =34.9% and ‘Others’ =39.4%). Although a considerable percentage (26.7%) of Korean respondents reported television as their preferred information source, this percentage was substantially lower than the 40 per cent of Korean respondents who chose brochures. The Chinese respondents also liked brochures more than the Australian and ‘Others’ respondents. Meanwhile, the Chinese (31.1%), Korean (23.3%) and ‘Others’ (30.3%) were more likely to claim they preferred to receive information through the Internet compared to the Australian respondents (11.4%). The Chinese respondents also tended to nominate newspapers more than the other groups. Approximately 20 to 28 per cent of respondents in each group indicated that information provided through all sources was acceptable. Nevertheless, sources such as water bills and seminars, which were stated options, were barely nominated by any group.

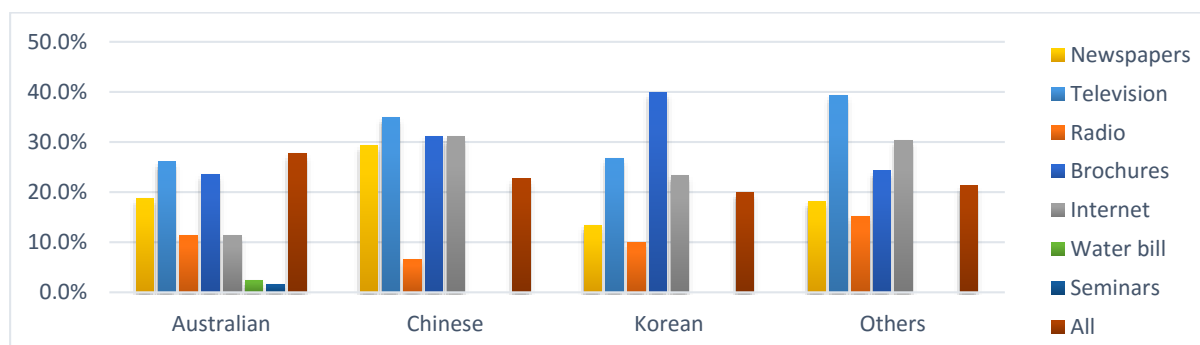
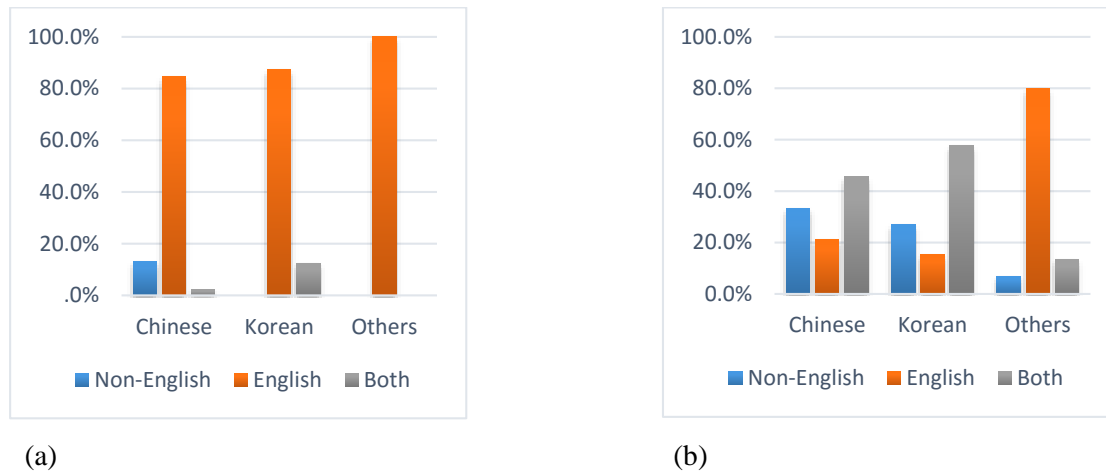


Figure 4. 12 Preferred sources for receiving information about water conservation, by ethnicity Q17a

### 4) Language preference for receiving information

Respondents were asked about which languages were used in the information they usually received (Q16b). The most common answer was English (see Figure 4. 13a). More than 80 per cent of respondents in each group indicated that the information they received about water conservation was in English. However, as shown in Figure 4. 13b, when asked about their preference for language used in water related information, the common answer was both English and non-English (Chinese=45.6%, Korean=57.7%), with the exception of the ‘Others’ group (80% of whom preferred information provided in English). More Chinese and Koreans

preferred non-English over English (33.3% compared to 21.1% among Chinese respondents; and 26.9% compared to 15.4% in the Korean group).



**Figure 4.13** Language for received information (a) and preferred language for receiving information, by ethnicity (b) Q16b and Q17c

#### 4.2.4 Perceptions of conservation strategies, water pricing

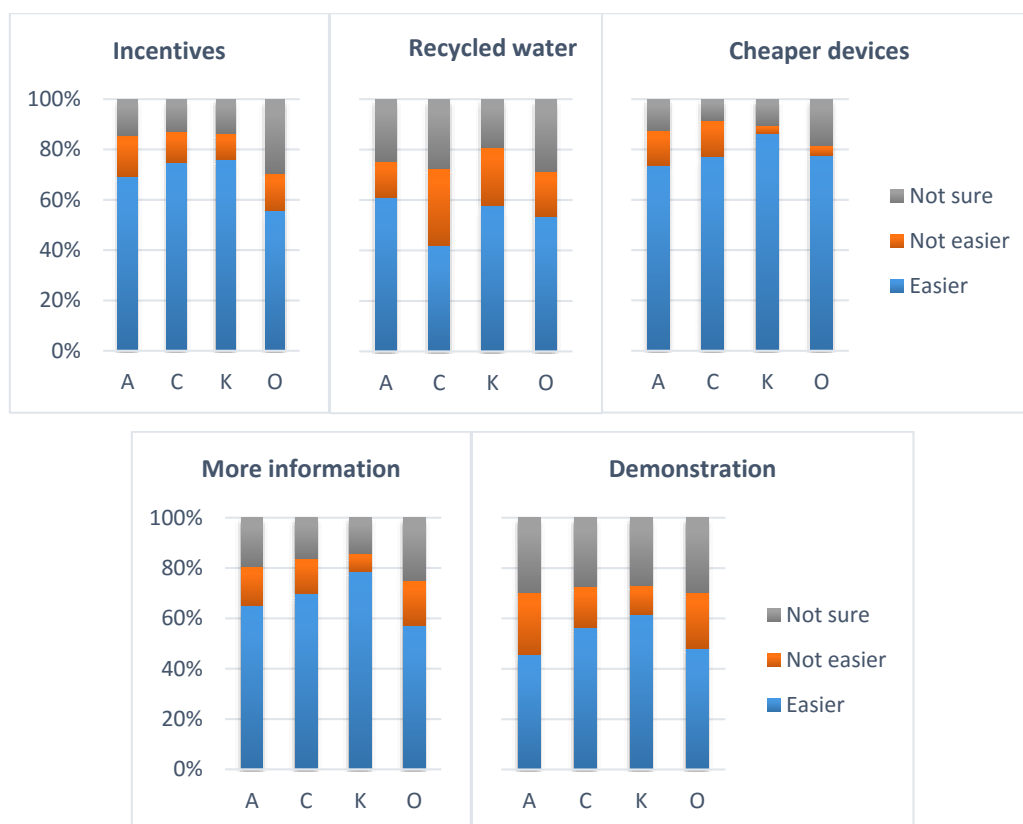
Understanding the degree of support by respondents in each ethnic group for water conservation strategies can assist in decision-making and policy design. Accordingly, respondents were asked about their attitudes towards water conservation strategies, i.e., ‘incentives to save water (eg. financial incentives)’, ‘assurance that recycled water is safe’, ‘cheaper water saving devices’, ‘more information about ways to save water’ and ‘public demonstrations of water saving techniques’ (Q12). As well as if they supported the listed government initiatives for securing water supplies, e.g., ‘recycling / stormwater use’, ‘building dams’ and ‘upgraded Infrastructures including pipelines, tanks’(Q14).

##### 1) Perceptions of conservation strategies

As shown in Figure 4.14, in general, the most supported strategy to save water across the four ethnic groups was providing cheaper water saving devices; with 86.2, 73.8, 77.1 and 77.8 per cent for the Korean, Australian, Chinese and ‘Others’ groups respectively. In comparison, the strategy of ensuring that recycled water was safe to use and public demonstration of water saving techniques were the least supported strategies across the four groups, with 60 per cent and fewer respondents in each group claiming that it made water saving easier. However, there was high uncertainty among the Chinese respondents regarding the strategy of water recycling. Only 42.1 per cent indicated that providing ‘assurance that recycled water is safe’ would make water conservation easier compared to 60.9, 57.7, and 53.6 per cent of the Australian, Korean and ‘Others’ groups respectively. Moreover, 30.5 per

cent of Chinese respondents claimed that the strategy of water recycling had not made water conservation any easier. Rather the Chinese respondents preferred to concentrate on incentives (75%) and the provision of cheaper water saving devices (77.1%).

Korean respondents were less likely to claim that water recycling (57.7%) made water-saving easier. Instead, they were more supportive of the strategy of providing cheaper devices (86.2%) and information (78.6%). Australian respondents were less likely to claim public demonstration (45.5%) as an efficacy strategy for water conservation. They were more likely, to think that the provision of cheaper water saving devices (73.8%) would make water-saving easier.



**Figure 4. 14 Perceptions of selected water conservation strategies, by ethnic groups Q12**  
(Note: A-Australian, C-Chinese, K-Korean, O-Others)

## 2) Perceptions of government initiatives

As shown in Figure 4. 15, when asked what initiatives the government should take to secure the water supply, the most common answer from all groups was recycling/storm water use (Australian=87.1%, Chinese=80.9%, Korean=67.7% and Others=87.9%). Australian (66.9%) and Korean (61.3%) respondents were more likely to see infrastructure upgrades as helpful in securing water supplies compared to 50 per cent of the Chinese group and 54.5 per cent of

‘Others’. Apart from these two initiatives mentioned above, 64.5 per cent of Korean respondents also nominated reducing water consumption as an initiative that the government should carry out. But there was relatively less support in other groups for adoption of this approach. Approximately, 40 per cent of respondents in each group thought a water pricing strategy was worth trying. In contrast, building a desalination plant or building dams gained relatively less support than other initiatives from respondents in all groups.

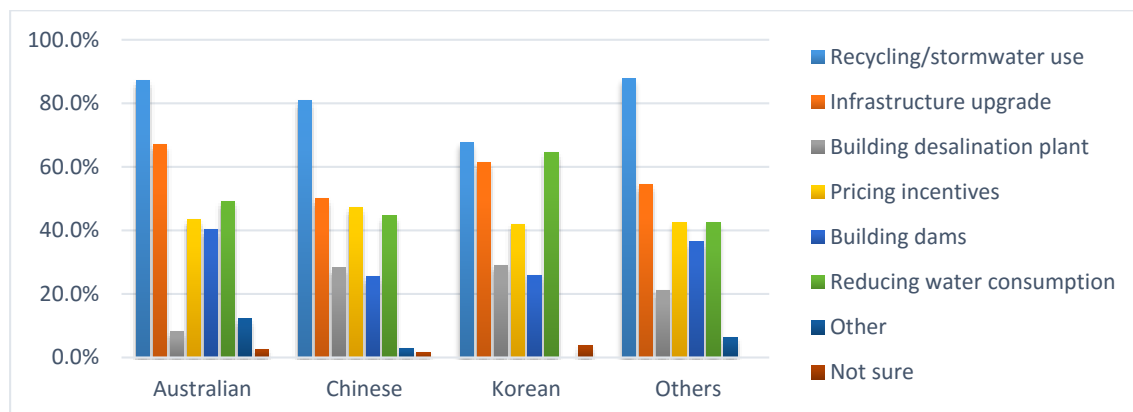


Figure 4.15 Support for government initiatives for securing water supply, by ethnicity Q14

### 3) Perceptions of water pricing

A considerable percentage of respondents (as shown in Figure 4.15) regarded a water pricing approach to be an initiative that the government should carry out to secure the region’s water supply. Perceptions regarding the prospect of the current water pricing encouraging water conservation varied between the ethnic groups. As shown in Figure 4.16, Australian respondents (36.4%) were more likely to think that the current water pricing would not encourage water conservation, whereas respondents in the other three ethnic groups were more likely to believe that the current water pricing would encourage conservation to some degree (64.5% Chinese, 45.0% Korean and 33.9% Others, compared to 24.2% of Australian respondents).

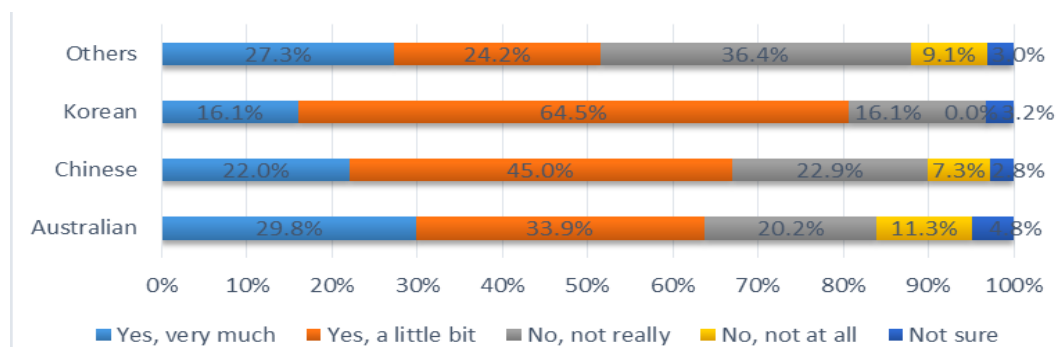


Figure 4.16 Perceptions of whether the current pricing encouraged conservation, by ethnic groups Q13

### 4.3 The influence of ethnicity on water use related knowledge, attitudes and behaviour

#### 4.3.1 Comparing knowledge, attitudes and self-reported behaviour across ethnicities

Table 4. 8 and Figure 4. 17 compared scores of knowledge, attitudes and self-reported behaviour in terms of mean, standard deviation and the overall patterns of responses across ethnic groups. While mean and standard deviation simply provided the average and extent of variance of sample data, box plots provided further details of the distribution patterns - the full range of variation (from minimum to maximum), the likely range of variation, and a typical value-median - by dividing respondents into four quartiles according to their scores<sup>39</sup>. Each respondent was given a score according to their knowledge of water issues. The score ranged from 0 to 5, the bigger the score indicating a higher level of knowledge on the part of the respondent. The box plot sorted the respondents from the smallest score to the greatest score. Results were presented for five variables which were derived from the questionnaires. Two indicators were used to measure the respondents' knowledge levels (see Section 3.4.3, Chapter). The first, self-assessed knowledge, referred to how knowledgeable respondents thought they were about water issues. The second was the actual knowledge levels of the respondents measured by a series of testing questions in the questionnaire. Apropos of the attitudes, three indicators were used – general attitude, value-based affective attitude and perception-based dispositional attitude which were derived from Principal Component Analysis (see Section 3.4.3, Chapter 3 and Appendix 5 for further explanation).

**Table 4. 8 Knowledge, attitude and self-reported behaviour by ethnicity**

Variable	Australian (N=125)		Chinese (N=110)		Korean (N=31)		Others (N=33)		One-way ANOVA Between group
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F (sig.)
General knowledge (0-5)	4.51	0.75	2.85	1.40	2.26	1.39	4.26	0.96	60.7*
Self-assessed knowledge (1-5)	3.03	0.89	2.15	0.74	2.39	1.14	2.94	0.99	21.8*
General attitude (1-5)	3.74	0.46	3.51	0.37	3.56	0.34	3.82	0.43	8.87*
Value-based affective attitude (1-5)	3.91	0.54	4.09	0.41	4.28	0.41	4.02	0.49	5.96*
Perception-based dispositional attitude (1-5)	3.75	0.56	3.09	0.51	3.06	0.47	3.73	0.52	39.07*
Self-reported behaviour (0-3)	1.90	0.88	1.22	0.94	1.29	1.09	1.85	0.87	12.2*

\* The result of between group difference is statistically significant, when sig <.01

<sup>39</sup> The Upper whisker, lower whisker, upper box, lower box, and a segment inside the rectangle box are referred to as the five summaries-the maximum, minimum, the third and fourth quartiles as well as the median. The unfilled circles represent the uncommonly surprisingly maximum or surprisingly minimum data sets which are called outliers.



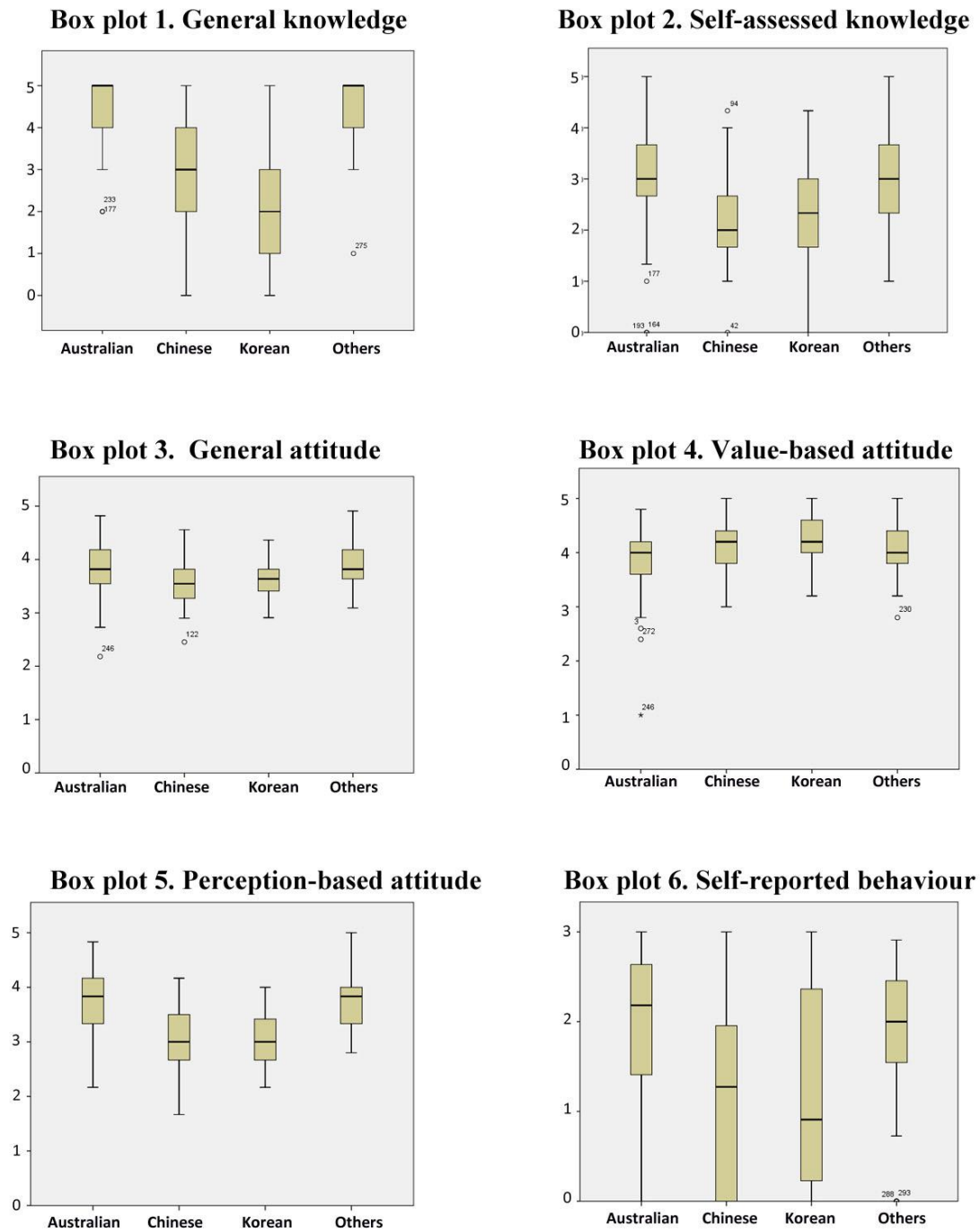


Figure 4. 17 Box plots of the measures of knowledge, attitudes and self-reported behaviour, by ethnicity

As shown in Table 4. 8 and Figure 4. 17, significant differences existed across ethnic groups in knowledge, attitudes and pro-conservational behaviour. The between-group differences were greater in actual knowledge, self-assessed knowledge and dispositional attitude (with the one-way ANOVA test (F) at 60.7, 21.8 and 39.07 respectively) than in general attitude, value-based affective attitude and self-reported behaviour (8.87, 5.96 and 12.2 respectively).

As regards to the general knowledge measured based on the questionnaire data, the Australian respondents scored the highest in the level of knowledge (mean=4.51). Approximately 75 per cent of Australian respondents achieved scores equal to or higher than 4, followed by the Chinese (mean=2.85), 75 per cent of whom achieved a score no less than 2. The Korean group had the lowest mean score (2.26), with 50 per cent having a score equal to or smaller than 2. The knowledge patterns for the group of 'Others' were smaller than those of the Australians. The SD values in Table 7 and the whiskers in the box plots in Figure 21, both indicated that the Chinese (SD=1.40) and Korean (SD=1.39) groups' knowledge levels were more varied compared to those of the Australians (SD=0.75) and 'Others' (SD=0.96).

Regarding the self-assessed knowledge, the Australians and 'Others' were more likely to claim to have high knowledge of water issues (with the mean of 3.03 and 2.94 respectively) compared to their Chinese (mean=2.15) and Korean (mean=2.39) counterparts. As shown in Figure 4. 17, more Australian (41%) and 'Others' respondents (45%) reported having 'quite a bit of knowledge' (scored 4) or 'a lot of knowledge' (scored 5), compared to the 9 per cent of Chinese and 22 per cent of Korean respondents who indicated similarly.

The results for attitudes revealed two opposing patterns. Regarding the general attitude measured by the 13-item scale (Section 3.4.3 in Chapter 3), similar to the pattern of knowledge variables presented above, the Australian and 'Other' respondents scored highest among the four groups (Australian mean=3.74, 'Others' mean=3.82), followed by the Korean group (mean=3.56). The Chinese group had the lowest mean score (mean=3.51). The results for value-based dispositional attitude showed a similar pattern to that of general attitude, with the Australian and 'Other' respondents achieving higher scores (3.75 and 3.73) compared to their Chinese (3.09) and Korean (3.06) counterparts. However, the overall pattern for perception-based affective attitude seemed significantly different from the above patterns. As shown in box plot 4, Figure 4. 17, the Chinese and Koreans achieved slightly higher dispositional attitudinal scores than their Australian and 'Other' counterparts. Specifically,

Korean respondents had the highest mean score (4.28) followed by the Chinese with a mean of 4.09. Australians and 'Others' had relatively lower mean scores (3.91 and 4.02), albeit the deviations within each group were similar.

Differences were also found in the self-reported water saving actions, similar to dispositional attitude. In general, and based on self-reporting, the Australian respondents were reported to undertake the highest level of water saving action amongst the four groups (with the highest mean score of 1.9), followed by the 'Others' group (mean =1.85). More than 75 per cent of Australian respondents undertook water-saving actions sometimes or usually, compared to slightly more than 50 per cent of Chinese respondents. More than 50 per cent of Koreans claimed that they undertook water-saving actions very occasionally or did not take any action. In addition, while the responses from the Australian group and the 'Others' group were highly consistent (Australian SD=0.88, 'Others' SD=0.87), the Chinese and Korean groups' responses were more varied (SD at 0.94 and 1.09 respectively). It is necessary to remember that this is self-reported behaviour, and that there can be differences between reporting and actual behaviour (see Lawrence & McManus, 2008).

### ***4.3.2 Effects of ethnicity on knowledge, attitude, and pro-conservational behaviour***

#### **1) Correlations between Variables**

The correlations between variables were tested by the Pearson correlation, which outlined the big picture of the relationships between ethnicity and knowledge, attitudes and self-reported pro-conservational behaviour (Table 4. 9).

As shown in Table 4. 9, the ethnic category of 'Australian' was found to be, significantly, positively related to general knowledge, self-assessed knowledge, general attitudes, perception-based dispositional attitudes and self-reported behaviours, and negatively related to value-based affective attitudes. This indicated that the Australian respondents were more likely to have, and claim to have significant knowledge of water issues, positive dispositional attitudes towards water management and water conservation, and to report frequently conducting water-saving behaviour at home. They were, however, less likely to have positive value-based affective attitudes.

**Table 4. 9 Pearson correlation between variables**

	Ethnic status (A) <sup>a</sup>	Ethnic status (C) <sup>a</sup>	Ethnic status (K) <sup>a</sup>	Ethnic status (O) <sup>a</sup>	General knowledge	Self-assessed knowledge	General attitude	Value-based affective attitude	Perception-based dispositional attitude
Ethnic status (A) <sup>a</sup>	1								
Ethnic status (C) <sup>a</sup>	/	1							
Ethnic status (K) <sup>a</sup>	/	/	1						
Ethnic status (O) <sup>a</sup>	/	/	/	1					
General knowledge	***	**	**	***	1				
Self-assessed knowledge	***	**	-	+	***	1			
General attitude	***	**	-	+	***	***	1		
Value-based affective attitude	**	+	***	-	-	-	***	1	
Perception-based dispositional attitude	***	**	**	+	***	***	***	***	1
Self-reported behaviours	***	**	-	+	***	***	+	-	***

*a: A-Australian, C- Chinese, K- Korean, O- Others. \*\*: Correlation is significant at the 0.01 level (2-tailed). \*: Correlation is significant at the 0.05 level (2-tailed).*

Conversely, the ethnic status of being Chinese and Korean was found to be significantly, negatively associated with general knowledge, self-assessed knowledge, general attitudes, dispositional attitudes and self-reported behaviour, but positively associated with affective attitudes. In other words, the Chinese and Korean respondents tended to have lower levels of knowledge, were less likely to think that they had high water-related knowledge, were likely to have less positive general attitudes or dispositional attitudes, and were less likely to report themselves as being engaged in water-saving behaviour compared to their counterparts in other groups. Nevertheless, the Chinese and Koreans were more likely to adopt positive affective attitudes towards water management and conservation. In the case of the ‘Others’, only three correlations were found to be significant; being a member of the ‘Others’ group increased their likelihood of having a high general knowledge level, a general attitude, and a positive affective attitude.

The correlation between general knowledge and self-assessed knowledge was found to be significantly positive (coefficient is 0.432), which suggested that the two measures were consistent in measuring respondents’ knowledge. In effect, most respondents who claimed to have a low level of knowledge about water issues were found to have scored lower in the measures of actual knowledge than other respondents. The results also indicated that high knowledge levels were significantly positively related to benefit attitudes and high frequency

of engagement of self-reported water-saving action. The significantly positive coefficients between knowledge and attitude indicated that respondents who knew more about water issues were more likely to engage in frequent water-saving actions.

## **2) Effects of ethnicity on knowledge, attitudes and self-reported behaviours and the influence of other factors**

The Pearson correlations presented above have outlined the relationships between the relevant factors in general. Further regression analysis would help to depict details of the relationships involved. As well, it would also assist in determining whether the differences were accounted for by ethnicity, or whether ethnicity was masking the variance of other factors, e.g., age, education attainment, gender or household income. In a bid to answer this question, multi-model regression analysis was conducted for each of the knowledge, attitudes and self-reported behaviour variables on ethnicity and other selected demographic factors. As shown in Table 4. 10, the first model (Model 1) allowed testing for the effects of ethnic status on knowledge, attitudes, and self-reported behaviour. Model 2 enabled an examination of the changes of ethnic effects after holding constant other social structural variables; and, Model 3 examined the impacts of housing factors and effects of ethnicity on self-reported behaviours.

The columns demonstrate the individual coefficient between each tested dependent variable (such as general knowledge) and independent variables (such as ethnic variable - Chinese, age, years lived in Sydney). Asterisks (\*) marked results which were statistically significant at the 95% and/or at the 99% level. The first two columns displayed results for two multi-model ordered logistic regression analyses. The likely estimated coefficients were in an ordered log-odds unit. The remaining columns presented the results for three separate multi-model multiple regression analyses, with B referring to the un-standardised coefficient and  $\beta$  referring to the standardised coefficient. The regression coefficients showed the relationship between the independent variables and the dependent variable, or can be interpreted as the changes (increase or decrease) in general knowledge (in logit scale), self-assessed knowledge (in logit scale), affective attitudes, dispositional attitudes or self-reported behaviour respectively if the explanatory variables change by one unit (increase or decrease). For a binary variable (Gender\_female) and a set of dummy variables (Chinese, Korean and 'Others'), the coefficients indicated change in dependent variables if, for example, the gender was female instead of male, or if ethnicity was Chinese instead of Australian.

Model 1 is the baseline model, with ethnic status as the sole predictor. It presents the effect of ethnic status on each dependent variable, including general knowledge, self-assessed knowledge, general, affective and dispositional attitude and self-reported behaviour. Specifically, and with regard to general knowledge (the first column of data), the results for Model 1 indicated that the ethnic status of being Chinese and Korean were both significantly negatively related to the level of general knowledge. This was consistent with the results of the box plots (Figure 4. 17) displayed earlier. In this case, the coefficients were -2.69 and -3.47. In other words, being a Chinese or Korean respondent instead of Australian resulted in 2.69 and 3.47 units decrease in the ordered log odds of knowledge score. Consistent with the results tabled in Figure 4. 17, the ethnic status of being Chinese or Korean rather than Australian was found to be significantly negatively correlated to self-assessed knowledge (coefficients were -1.84 and -1.34), general attitude (-0.24 and -0.19), dispositional attitude (-0.52 and -0.49) and self-reported behaviour (-0.68 and -0.61), and to be significantly, positively related to affective attitude (0.14 and 0.21).

Then, demographic factors (age, gender and education) were added into the equation as predictors, together with the ethnic variables, in Model 2. It was found that older respondents and respondents with high education attainment were more likely than young and less educated respondents to have high knowledge of water issues, with the coefficient at 0.26 and 0.60 (while other factors were controlled). Given that the Korean and Chinese respondents were more likely to be female and young compared to the Australian respondents, questions arose as to whether the ethnic correlates of general knowledge were accounted for by the positive correlations between demographic factors and general knowledge. The answer was negative: the statistics for the Chinese and Koreans were found to remain significant in Model 2 while keeping the demographic factors constant. Similar results were found for self-assessed knowledge, general attitude, dispositional attitude and self-reported behaviour. Age was found to be significantly and positively associated with self-assessed knowledge, as high education attainment was associated with high affective attitude, and, older people and females were found to be more likely to report a level of pro-conservational behaviour. Even when those demographic variables were controlled, the ethnic effects (of being part of the ethnic minority) were still significant. In other words, ethnic status (being Chinese or Korean) were found still to be statistically significantly influencing general knowledge, self-assessed

knowledge, dispositional attitude and self-reported behaviour when age, gender, and household income of respondents were controlled in Model 2.

It is worthy of note that in Model 2, while the selected socio-demographic variables were included in the regression of affective attitude, the effects of ethnicity became not significant, whereas education was found to be significantly related to affective attitude while all other factors were controlled. No significant result was found vis-à-vis the variable of ethnic status being 'Others'.

In Model 3, housing type and dwelling ownership variables were added into the regression individually. It was found that respondents who lived in low-rise and high-rise units rather than houses were less likely to report pro-conservational behaviours. Respondents who lived in privately rented dwellings (ie. not public or community housing), were less likely to report themselves as engaged in pro-conservational behaviour than those who owned a dwelling. When the dwelling types and dwelling ownerships were held constant, the coefficients between ethnic status (being Chinese or Korean) and self-reported pro-conservational behaviour were reduced but remained statistically significant with coefficients at -0.34, -0.71 and -0.31 respectively.

**Table 4. 10 Effects of ethnicity on water related knowledge, attitudes and self-reported behaviour – Results of three model regressions of each selected dependent variable on ethnicity and other influence factors**

		General knowledge	Self-assessed knowledge	General attitude		Value-based affective attitude		Perception-based dispositional attitude		Self-reported behaviour	
Parameter		Likely estimated	Likely estimated	B	$\beta$	B	$\beta$	B	$\beta$	B	$\beta$
<b>Model 1</b>	Chinese	-2.69**	-1.84**	-.24**	-.27**	0.14*	.13*	-.52**	-.40**	-0.68**	-0.33**
	Korean	-3.47**	-1.34**	-.19**	-.13**	0.21*	.12*	-.49**	-.23**	-0.61**	-0.19**
	Others	-0.54	-0.16	0.08	0.06	0.09	.05	.10	0.05	-0.05	-0.02
	<i>Explained variance: R<sup>2</sup></i>			0.08		0.020		0.177		0.112	
<b>Model 2</b>	Chinese	-2.51**	-1.72**	-.29**	-.33**	.02	.03	-.49**	-.36**	-0.55**	-0.27**
	Korean	-3.59**	-1.58**	-.22**	-.17**	.08	.05	-.46**	-.22**	-0.67**	-0.22**
	Others	-0.37	0.08	0.14	0.10	.07	.04	.22	.10	0.18	0.06
	Age	0.26**	0.18*	-.002	-.01	-.02	.06	.01	.03	0.14**	0.21**
	Education	0.60*	0.37	0.09	0.09	.08**	.07**	.11	.08	0.11	0.05
	Gender: Female	-0.41	-0.42	0.10*	0.12*	.19	.19	.13	.10	0.31**	0.16**
	Household income	/	/	0.003	0.01	-.02	-.07	.03	.08	-0.05	-0.09
<i>Explained variance: R<sup>2</sup></i>			0.15		0.067		0.198		0.207		
<b>Model 3</b>	Chinese	/	/	/	/	/	/	/	/	-.33**	-.16**
	Korean	/	/	/	/	/	/	/	/	-.14	-.04
	Others	/	/	/	/	/	/	/	/	.08	.03
	Dwelling type (house):										
	Semi-detached <sup>(ns)</sup>	/	/	/	/	/	/	/	/	.06	.03
	Low-rise unit <sup>(s)</sup>	/	/	/	/	/	/	/	/	-.34*	-.12*
	High-rise unit <sup>(s)</sup>	/	/	/	/	/	/	/	/	-.71**	-.34**
	Dwelling ownership (fully owned):										
	Buying <sup>(ns)</sup>	/	/	/	/	/	/	/	/	-.22*	-.10*
	Renting-private <sup>(s)</sup>	/	/	/	/	/	/	/	/	-.31*	-.14*
Renting-public <sup>(ns)</sup>	/	/	/	/	/	/	/	/	.14	.02	
<i>Explained variance: R<sup>2</sup></i>										0.234	

\*\**. Correlation is significant at the 0.01 level (2-tailed).*

\**. Correlation is significant at the 0.05 level (2-tailed).*



### ***4.3.3 The magnitude of effects that ethnic backgrounds have on pro-conservational behaviour***

#### **1) Relative importance of ethnic variables in explaining self-reported pro-conservational behaviour**

A backward regression analysis of self-reported behaviour on all variables was used to discern the magnitude of the relationships between each of the independent variables and self-reported behaviour. Variables were selected by omitting the variable which had the largest sig-value but little contribution to the variance explained. The final result contained only variables which, if omitted, would significantly reduce the R square (model fit or proportion of variation explained by independent variables) (see Table 4. 11).

As shown in Table 4. 11, ethnic status, together with age, gender, household income, household structure, dwelling ownership, dwelling type, region of residence, and whether the respondent pays the water bills were found to be statistically significant in affecting the engagement level of self-reported water saving behaviour, explaining 33 per cent of variance in self-reported behaviour. Specifically, people who were members of the ‘Others’ ethnic grouping, old and female were more likely to exercise high self-reported water-saving behaviour. People from a Chinese background, from a one-parent household rather than a single-person household, and those living in low rise and high rise apartments, were less likely to self-report water-saving behaviour.

Results for a regression on all variables identified in Table 4. 11, with the exception of the variable of ethnic status, are presented in Table 4. 12. It was observed that those variables explained 27 per cent of variance in self-reported behaviour. By including the variable of ethnic status into the regression model, the explained variance increased 6 per cent (33% - 27%).

**Table 4. 11 Comparing the magnitude of effects of ethnic variables self-reported water saving actions with selected socio-economic, housing and location factors and other factors.** (Backward multi-regression of self-reported water saving actions on ethnic status)

Variable	Unstandardized	Standardized	Sig.*
	Coefficients	Coefficients	
	B	$\beta$	
Ethnicity (-Australian):			
Chinese	-.33**	-.16**	0.02
Korean	--	--	--
Others	.32*	.10*	0.09
<b><u>Socio-economic variables</u></b>			
Age	.09*	.13*	0.06
Gender: Female	.29**	.15**	0.01
Education	--	--	--
Work status (don't work):			
Full-time	--	--	--
Part-time/casual	--	--	--
Retired	--	--	--
Household size	--	--	--
Household income	-.06	-.09	0.11
Household structure (single person):			
One parent	-.39*	-.12*	0.05
Couple no child	--	--	--
Couple with child(ren)	-.20	-.09	.15
A family with tenant(s)	--	--	--
Sharing housing	--	--	--
Other	--	--	--
<b><u>Housing status and location</u></b>			
Dwelling ownership (fully owned):			
Buying	--	--	--
Renting private	--	--	--
Renting public	.57	.07	.25
Dwelling type (house):			
Semi-detached	--	--	--
Low-rise unit	-.31*	-.12*	.09
High-rise unit	-.69**	-.34**	.000
Region (WSR):			
SSR-WEST	--	--	--
SSR-INNER&EAST	-.19	-.09	.12
NSR	--	--	--
<b><u>Other variables</u></b>			
Pay water bill_yes	.19	.09	.20

$R=.573$ ,  $R\text{ Square}=.33$

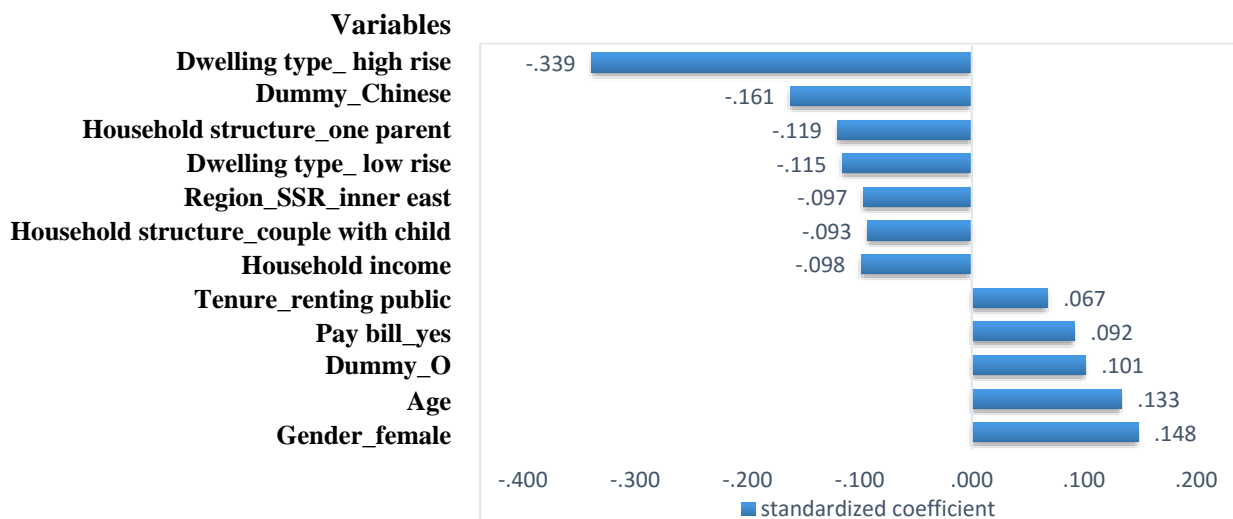
\*\* Correlation is significant at the 0.05 level (2-tailed).

\* Correlation is significant at the 0.1 level (2-tailed).

**Table 4. 12 Results of multi-regression analysis of self-reported behaviour on 12 selected variables**

Model	Unstandardized	Standardized	Sig.*
	Coefficients	Coefficients	
	B	Beta	
(Constant)	1.393		.000
Age	.114	.176	.011
Gender_female	.278	.143	.015
Household income	-.053	-.088	.149
Pay bill_yes	.159	.076	.295
Household structure_one parent	-.319	-.096	.106
Household structure_couple with	-.102	-.047	.466
Tenure_renting public	.690	.080	.172
Region_SSR_inner east	-.188	-.093	.126
Dwelling type_low rise	-.404	-.146	.030
Dwelling type_high rise	-.745	-.368	.000
R=.52, R square= .27			

When comparing the standardised coefficient of self-reported behaviour with each independent variable (Figure 4. 18), it was observed that the variable of ethnic status (being Chinese) appeared to have greater importance than some other demographic and economic factors such as gender, household income, and dwelling tenure status, when explaining the variation of pro-conservational behaviour.



**Figure 4. 18 Standardised coefficients between self-reported water-saving behaviour and each of influencing factors**

## 2) The interaction and influence of migration-related factors and other factors to the effects of ethnicity

The effects of migration status, knowledge and attitudinal variables on the relationship between ethnicity and self-reported water saving action were examined by running both a baseline model, with a set of ethnic dummy variables as the sole predictor, and a series of

control models with ethnic status and each of other predictor variables alone as predictors. In doing so, the research focused on explaining how, and to what extent, each of the other variables influenced the ethnic differences in the level of self-reported water-saving behaviour. The results are presented in Table 4. 13.

**Table 4. 13 Results of regression analysis of self-reported behaviour on ethnicity with each variable controlled individually**

	Variable			R square	Adjusted R square
	Ethnic: Chinese	Korean	Others		
	B	B	B		
<b>Baseline model <sup>a</sup></b>					
<i>No control</i>	-0.68**	-0.61**	-0.05	.112	.103
<b>Control model</b>					
<i>Variable controlled <sup>b</sup>:</i>					
<b><u>Migration status</u></b>					
Years lived in Sydney (s)	-.18	-.14	.16	.071	.049
English proficiency (ns)	-.68**	-.62**	-.03	.107	.094
<b><u>Knowledge and attitudinal factors</u></b>					
General knowledge (s)	-.45**	-.28*	.07	.148	.136
Self-assessed knowledge (s)	-.51**	-.49**	-.03	.141	.129
General attitude (s)	-.62**	-.56**	-.07	.123	.111
Value-based affective attitude (s)	-.73**	-.72**	-.08	.130	.118
Dispositional attitude (s)	-.59**	-.53**	-.05	.116	.104
<b><u>Other factors</u></b>					
Received information about water conservation (s)	-.57**	-.45*	.08	.149	.137
Know or notice water Conservation programs (ns)	-.68**	-.60**	-.02	.110	.097

*a: Baseline models only contain a set of dummy variable: ethnical variables (ethnicity: Chinese, ethnicity: Korean and ethnicity: Others; (with Ethnic: Australian coded as 0)) as the predictor, with self-reported behaviour as the outcome.*

*b: Control models were run by adding each influencing factors into the regression model individually.*

*\*:  $p < .05$ , the coefficient (relationship) is statistically significant at 0.05 level.*

*\*\* :  $p < .01$ , the coefficient (relationship) is statistically significant at 0.01 level.*

*(s) - indicating that the added variable was significant while holding the variables of ethnicity constant*

*(ns) - indicating that the added variable was not significant while holding the variables of ethnicity constant*

The results showed that variables of Chinese and Korean became not significant when ‘years lived in Sydney’ was controlled. This finding suggested that controlling years lived in Sydney for Chinese and Korean respondents may contribute to eliminating ethnic difference in the self-reported behaviour. Moreover, controlling knowledge, attitude (dispositional attitude) or the information access could substantially reduce the ethnic disparities in self-reported pro-conservational behaviour albeit not enough to make the disparities disappear. However,

English proficiency and whether the respondents believed that they were informed about any water programmes seemed to have little impact on the correlation between ethnic status and self-reported behaviour.

### **3) Mediation effects of knowledge and attitude on the relationship between ethnicity and pro-conservational behaviour**

Causal relations were suggested to exist among variables of ethnic status, knowledge, attitude and self-reported behaviour by former analysis (see Tables 4.9 and 4.10). In other words, attitude seemed to have mediational effects on the relationship between ethnic status and self-reported behaviour. Mediation testing was conducted on those variables. Mediation can be seen as a form of effect transmitted by a hypothesised causal chain in which one variable X affects a second variable M and then, in turn, affects a third variable Y. If the effect of X on Y is zero when M is included, it is regarded as a full mediation. If the effect of X on Y is reduced when M is included in the equation, then it is a partial mediation effect (see Section 3.4.3, Chapter 3).

Primary testing of the coefficient changes of ethnic variables was completed before and after each of the selected variables was entered into the regression model. The results (presented in Table 4.14) Table 4. 14 showed that the regression coefficients for ethnic variables were reduced. For example, the coefficient for Chinese decreased from 0.517 to 0.445 and the Korean coefficient reduced from 0.491 to 0.411 when general knowledge was entered into the regression of dispositional attitude individually (Model 2, Table 4. 14). Likewise, coefficients between ethnicity and self-reported behaviour reduced when general knowledge and dispositional attitude were controlled (Model 3, Table 4. 14). This suggested that general knowledge was likely to have a mediation influence on the ethnic effects on dispositional attitude; similarly, general knowledge and dispositional attitude appeared to mediate the ethnic effects on self-reported behaviour. In order to test the possible mediation effects of general knowledge and dispositional attitude, the product of coefficient approach (Sobel, 1982) was employed. The results are detailed in Table 4.15 (refer to Appendix 6 for details and process of the analysis).

**Table 4. 14 Testing the coefficient change of ethnic variables while each selected variable was entered in the regression model**

Model	Outcome	Bc & Bc'		
<b>Model 1</b>	Value-based affective attitude	Ethnicity: Chinese	Ethnicity: Korean	Ethnicity: Others
<i>No control</i>		0.136	0.206	0.085
<i>Variable Controlled:</i>				
General knowledge		0.138	0.213	0.088
<b>Model 2</b>	Perception-based Dispositional attitude			
<i>No control</i>		-0.517	-0.491	0.103
<i>Variable Controlled:</i>				
General knowledge		-0.445	-0.411	0.126
<b>Model 3</b>	Self-reported behaviour			
<i>No control</i>		-0.677	-0.611	-0.048
<i>Variable Controlled:</i>				
General knowledge		-0.456	-0.279	0.069
Value-based affective attitude		-0.734	-0.669	-0.068
Dispositional attitude		-0.556	-0.439	-0.009

**Table 4. 15 The mediation effect of general knowledge and perception-based dispositional attitude on the effects of ethnicity (tested based on the Product of Coefficient method)**

	Predictor	Outcome	Total effect (Bc)	Mediating factor	Mediated effect (Ba*Bb)	Significance p value*
<b>Test 1</b>	Ethnic status_Chinese	Perception-based Dispositional attitude	-.517	General knowledge	-0.06	0.275 (ns)
	Ethnic status_Korean		-.491		-0.08	0.276 (ns)
	Ethnic status_Others		0.103		0.01	0.436 (ns)
<b>Test 2</b>	Ethnic status_Chinese	Self-reported behaviour	-.677	General knowledge	-0.24	0.004 (s)
	Ethnic status_Korean		-.611		-0.33	0.004 (s)
	Ethnic status_Others		-.048		-0.04	0.29 (ns)
<b>Test 3</b>	Ethnic status_Chinese	Self-reported behaviour	-.677	Perception-based dispositional attitude	-0.12	0.023 (s)
	Ethnic status_Korean		-.611		-0.11	0.038 (s)
	Ethnic status_Others		-.048		0.02	0.411 (ns)

\* Coefficient is regarded as 95% significant when  $p < 0.05$ , and 99% significant when  $p < 0.01$ , s – significant, ns – not significant.

As shown in test 2 in Table 4.15, the ethnic correlates of pro-conservational behaviour were significantly mediated by the level of general knowledge. More specifically, the estimate of mediated effect was -0.24 and -0.33 (for the Chinese and Korean variables respectively) at 99 per cent confidence, suggesting that 35 per cent (-0.024/-0.677) and 54 per cent (-0.033/0.69) of the ethnic effects on self-reported behaviour may have been mediated by changes in the level

of general knowledge of the respondents. Likewise, test 3 found that 18 per cent (-0.12/-0.677) and 17 per cent (-0.11/-0.611) of the ethnic effects on self-reported behaviour were carried over by ethnic difference in the level of perception-based dispositional attitude, which had 95 per cent confidence. Given that the results for the ethnic variable of 'Others' were not significant for both mediation tests; it was not appropriate to summarise any effect of 'Others' on outcomes mediated by general knowledge. As regards the analysis, which focused on the mediation effect of perception-based dispositional attitude on self-reported behaviour across ethnicities, the statistics were found not to be significant.

#### ***4.3.4 Within group variations – who are more active in pro-conservational behaviour?***

Analysis was conducted to examine the within group variations in self-reported pro-conservational behaviour and to identify the explanatory factors for the variation in each group. In other words, analysis was conducted to find out which respondents were more likely to claim themselves to be frequently engaged in pro-conservational behaviour. The results are presented in Table 4. 16.

It was observed within the Australian group that older, female respondents from households of couples with a child(ren), from households of shared housing, semi-detached dwellers, respondents with a positive perception-based dispositional attitude, and respondents who claimed to have never received information about water conservation were significantly more likely to report themselves as frequently engaged in water-saving behaviour compared to their counterparts. Alternatively, respondents who lived in high-rise dwellings were less likely than those who lived in houses to claim themselves to undertake water-saving practices frequently.

With regard to the Chinese group, variables of education attainment, self-assessed knowledge and paying their water bills were found to have a significant positive correlation to the self-reported frequency of water-saving engagement. Variables such as household size, households of couples with a child(ren), paying off a housing mortgage, living in a high-rise unit, living in the north Sydney region and being aware of water conservation programs were found to have a significant negative affect on the engagement level of water-saving activities.

Results for the Korean group showed that respondents who displayed competence in the English language, lived in a large household, in households comprising family and tenants, had a high score in general knowledge of water issues, positive perception-based dispositional attitudes and who believed that Sydney's water situation was facing crisis, were significantly more engaged in water-saving action than their counterparts. In contrast, respondents from households comprised of couples with a child(ren), or living in high-rise or low-rise apartments, were significantly less likely to undertake water-saving practices.

Apropos of the group of 'Others', variables of female gender, high education attainment, full-time work status, living in Sydney for a longer time, larger numbers of occupants in households, and couple without child households were found to significantly decrease the self-reported engagement level of water-saving actions. Variables such as high self-assessed knowledge level and positive value-based affective attitude significantly increased their engagement level.

The results of each of the four ethnic groups suggested that factors that contributed to the variation of pro-conservational behaviour were different across ethnic groups. An awareness of these factors and the disparities between ethnic groups is useful in conservation programme designing and would assist in finding the best way to encourage water conserving behaviours among people from different ethnic backgrounds.

#### ***4.3.5 The role of acculturation in reducing ethnic difference***

##### **1) The influence of migration status on migrants' knowledge, attitudes and self-reported behaviour**

Within the process of acculturation, migrants may gradually become familiar with local water issues and learn the behavioural expectations of the mainstream culture; therefore, attitudinal and behavioural changes are expected among migrants proportional to the years lived in Sydney increasing and English proficiency improvement. Analysis was conducted to examine the influence of these two factors on ethnic effects.



**Table 4. 16 Results of backward multi-regression analysis of self-reported water saving actions on selected socio-economic variables, indicators of housing and location, knowledge, attitudes and perceptions, as well as other variables for survey respondents**

Variable	Unstandardised Coefficients			
	Within Australian group	Within Chinese group	Within Korean group	Within 'Others' group
<b><u>Socio-economic variables</u></b>				
Age	0.35**	--	--	--
Gender: Female	0.39**	--	--	-1.06*
Education	--	0.59**	2.03	-1.44
Work status (don't work):				
Full-time	-0.26	0.34	--	-2.80**
Part-time/casual	--	--	0.53	--
Retired	--	--	--	--
English proficiency	/	--	1.56**	--
Years lived in Sydney	/	--	--	-0.08*
Household size	--	-0.21**	0.65*	--
Household income	--	--	-0.37	-0.29
Household structure (single person):				
One parent	--	0.61	--	--
Couple no child	--	--	--	-1.75*
Couple with child(ren)	.44*	-0.79**	-2.38**	--
Family with tenant(s)	--	--	2.97**	--
Sharing housing	1.00*	--	-1.3	--
<b><u>Housing characteristics and location</u></b>				
Dwelling ownership (fully owned):				
Buying	--	-0.57**	--	--
Renting private	--	--	--	--
Renting public	--	--	--	--
dwelling type (house):				
Semi-detached	0.65*	-0.82	--	--
Low rise unit	--	--	-6.27*	--
High rise unit	-0.78**	-0.72**	-3.57*	--
Region (WSR):				
SSR-WEST	--	-0.72	--	--
SSR-INNER&EAST	--	-1.09*	--	--
NSR	-0.25	-0.79	--	--
<b><u>Knowledge, attitudes and perceptions</u></b>				
General knowledge	0.15	--	0.58**	--
Knowledge self-assessed	0.12	0.38**	--	1.02**
Value-based affective attitude	--	--	--	3.30*
Perception-based Dispositional attitude	0.37*	--	1.32*	-1.08
Perception of water situation (sufficient to crisis)	--	--	0.78*	--
<b><u>Other variables</u></b>				
Pay water bill	--	0.79**	--	--
Received info about water conservation	0.41*	--	--	--
Awareness of water conservation programs	-0.25	-0.49*	--	--
<b>R square</b>	<b>0.528</b>	<b>0.547</b>	<b>0.734</b>	<b>0.755</b>

\* Coefficient is regarded as 95% significant when  $p < 0.05$ ,

As shown in Table 4. 17, within the Chinese group, while years lived in Sydney were both positively correlated to general knowledge and negatively related to the dispositional attitude, by a significant degree. In other words, Chinese respondents who had lived in Sydney for a

long time tended to have higher general knowledge of water issues but a lower value-based affective attitude towards water use and conservation than those who had lived in Sydney for a short time. The influence of English proficiency on an individual's knowledge, attitude and behaviour was slightly different from that of years lived in Sydney. Respondents with high English proficiency were more likely to have higher knowledge and value-based affective attitudes towards water conservation than those who had poor English language skills.

Regarding the Korean respondents, years lived in Sydney was found to be significantly directly associated with general knowledge of water issues, general attitude, and self-reported pro-conservational behaviour towards water use and conservation. This means that as their years lived in Sydney increased, Korean respondents were more likely to be knowledgeable about water issues, and more likely to have beneficial attitudes, and more likely to undertake water conservation behaviours. Moreover, Korean respondents with improved English proficiency tended to have higher general knowledge about local water issues and higher perception-based dispositional attitudes than those with poor English skills.

Within the 'Others' group, years lived in Sydney was found to be significantly negatively related to value-based affective attitude but significantly positively associated with self-reported behaviour. While, English proficiency was only found to be significantly positively related to general knowledge.

**Table 4. 17 The effects of years lived in Sydney and English proficiency on respondents' knowledge, attitudes and behaviour regarding water conservation in each group**

Tested group	Independent variable		Dependent variable				
			General knowledge	General attitude	Value-based affective attitude	Perception-based Dispositional attitude	Self-reported behaviour
			B	B	B	B	B
Chinese	Years lived in Sydney		.04*	-.003	-.01*	-.05	.001
	English proficiency		.39*	.06	-.03	.28*	-.10
Korean	Years lived in Sydney		.05*	.012*	.012*	.011	.03*
	English proficiency		.56*	.14*	.09	.20*	.27
Others	Years lived in Sydney		.006	-.001	-.01*	.004	.019*
	English proficiency		.68*	.13	.02	.19	.09

\* Coefficient is regarded as 95% significant when  $p < 0.05$

## 2) The role of migration status in reducing ethnic difference in knowledge, attitude and behaviour

The roles of years lived in Sydney and English proficiency in reducing the disparities between the Australian and each ethnic minority group in knowledge, attitudes and self-reported behaviour was then examined. The results are presented in Table 4.18 to Table 4.20. As shown in Table 4.18 to Table 4.20, Model 1 is the baseline model with ethnic status as the sole independent variable (differences were compared between Australian and each one of the ethnic minority groups, rather than drawing comparisons across all groups). In Model 2, years lived in Sydney and English proficiency entered the regression separately, while in Model 3, the two variables were included in the regression together.

As shown in Model 1 in Table 4.18, being Chinese rather than of Australian ethnicity was negatively related to the level of general knowledge, general attitude, perception-based dispositional attitudes and self-reported behaviour, to a significant degree, yet positively associated with value-based affective attitudes. In Model 2, when years lived in Sydney was controlled, the Chinese/Australian differences in knowledge, perception-based dispositional attitude and self-reported behaviour were still significant, suggesting that ethnic (Chinese/Australian) differences exist irrespective of whether the persons had just moved to Sydney or had lived in Sydney for a long time. It was noted that the absolute value of coefficients for ethnic status and self-reported behaviour reduced from 0.67 to 0.40, which means that years lived in Sydney can help to reduce the Chinese/Australian differences in the engagement level of the examined pro-conservational behaviour<sup>40</sup>. However, increasing length of residence in Australia is not strong enough to eliminate the disparity. Likewise, when English proficiency was controlled, the Chinese/Australian differences in knowledge and dispositional attitudes were reduced but remained significant (the absolute value of the coefficient for Knowledge reduced from 1.66 to 1.09, while that for perception-based dispositional attitude decreased from 0.66 to 0.37). English proficiency seemed to have little

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<sup>40</sup> Environmental acculturation is suggested to reduce the Chinese/Australian differences in the engagement level of water-saving activities that were investigated in the questionnaire survey. However, this does not mean that the 'Australian' is the norm that other groups should conform to, given the diverse water-saving skills brought by ethnic minority groups. Instead, the analysis implies that migrants may learn the behavioural expectation of the mainstream culture and tend to more frequently undertake water-saving activities that the mainstream society fostered and promoted (while they may still keep their old water saving activities as reported in Section 5.2), Chinese/Australian differences seemingly reduced.

impact on the ethnic effects of value-based affective attitude and self-reported behaviour. When both variables were held constant in Model 3, while the Chinese/Australian differences were reduced, they were still significant in knowledge, perception-based dispositional attitudes and self-reported behaviour.

**Table 4. 18 Chinese/Australian differences in knowledge, attitudes and behaviour, and the influence of acculturation-related factors on the difference** (Regression analysis of knowledge, attitude and behaviour on ethnicity and selected factors)

Model	Variable controlled	Ethnic coefficients of knowledge, attitudes and self-reported behaviour							
		Knowledge		Value-based affective attitude		Perception-based dispositional attitude		self-reported behaviour	
		B	b	B	b	B	b	B	b
<i>Baseline model</i>	Ethnic status: Chinese (Chinese-1, Australian-0)	-1.66*	-0.60*	0.18*	0.19*	-0.66*	-0.52*	-0.67*	-0.34*
<i>Control model 1</i>	Ethnic status: Chinese (Chinese-1, Australian-0)	-1.42*	-0.51*	0.10	0.11	-0.74*	-0.58*	-0.40*	-0.20*
	Years lived in Sydney	.007	.122	-.002	-0.11	-0.002	-.056	0.01*	0.17*
<i>Control model 2</i>	Ethnic status: Chinese (Chinese-1, Australian-0)	-1.09*	-0.39*	0.18*	0.19*	-0.37*	-0.29*	-0.82*	-0.42*
	English proficiency	0.43*	0.27*	-0.01	-0.01	0.22*	0.30*	-.12	-.10
<i>Control model 3</i>	Ethnic status: Chinese (Chinese-1, Australian-0)	-0.83*	-0.29*	0.09	0.10	-0.44*	-0.34*	-0.55*	-0.28*
	Years lived in Sydney	0.01*	0.13*	-.003	-.125	-.001	-.050	.01	.16
	English proficiency	0.44*	0.27*	-.01	-.017	0.22*	0.31*	-.12	-.10

\* Coefficient is regarded as 95% significant when  $p < 0.05$

Table 4. 19 presents the results for Korean/Australian differences before and after years lived in Sydney and with English proficiency is controlled. As shown in Model 1, being of Korean rather than Australian ethnicity was also found to be significantly negatively correlated to knowledge, general attitudes, perception-based dispositional attitudes and self-reported behaviour, and significantly positively related to value-based affective attitudes. When years lived in Sydney were controlled in Model 2, the Korean/Australian differences in knowledge, affective and perception-based dispositional attitudes and self-reported behaviour were still significant. When English proficiency was held constant, Korean/Australian differences in perception-based dispositional attitude became not significant, while the Korean/Australian difference in knowledge reduced from 2.25 to 1.29, but was still significant. English proficiency seemed not to significantly affect the Korean/Australian disparity in affective attitude and self-reported behaviour. Similar results were found in Model 3, i.e., that

controlling both variables can assist in reducing the Korean/Australian significant disparity in self-reported behaviour, and help to reduce the differences in knowledge. However, once again this reduction was not enough to make the disparity disappear.

**Table 4. 19 Korean/Australian differences in knowledge, attitudes and behaviour, and the influence of acculturation-related factors on the difference** (Regression analysis of knowledge, attitudes and behaviour on ethnicity and selected factors)

Model	Variable controlled	Ethnic coefficients of knowledge, attitude and self-reported behaviour							
		Knowledge		Value-based affective attitude		Perception-based dispositional attitude		self-reported behaviour	
		B	b	B	b	B	b	B	b
<i>Baseline model</i>	Ethnic status: Korean (Korean-1, Australian-0)	-2.25*	-0.71*	0.36*	0.27*	-0.68*	-0.45*	-0.61*	-0.25*
<i>Control model 1</i>	Ethnic status: Korean (Korean-1, Australian-0)	-2.24*	-0.69*	0.34*	0.26*	-0.79*	-0.52*	-.067	-.031
	Years lived in Sydney	0.003	0.04	-.001	-.002	-.001	-0.05	0.01	0.30
<i>Control model 2</i>	Ethnic status: Korean (Korean-1, Australian-0)	-1.29*	-0.40*	0.54*	0.41*	-0.29	-0.19	-0.41	-0.177
	English proficiency	0.62*	0.37*	0.11	0.15	0.26*	0.33*	0.11	0.09
<i>Control model 3</i>	Ethnic status: Korean (Korean-1, Australian-0)	-1.39*	-0.43*	0.51*	0.39*	-0.39	-0.26	0.13	0.06
	Years lived in Sydney	0.56*	0.34*	.11	.16	-0.002	-0.07	0.01	0.22
	English proficiency	0.002	0.04	-.001	-.04	0.26*	0.34*	0.21	0.19

\* Coefficient is regarded as 95% significant when  $p < 0.05$

Since no significant difference was found between ‘Others’ and Australian, as shown in Table 4. 20, there was no need to examine the influence of years lived in Sydney and English proficiency on ethnic effects.

**Table 4. 20 Others/Australian differences in knowledge, attitudes and behaviour** (Regression analysis of knowledge, attitudes and behaviour on ethnicity)

Independent variable	Knowledge		Value-based affective attitude		Perception-based dispositional attitude		Self-reported behaviour	
	B	b	B	b	B	b	B	b
	Ethnic status: Others (Others-1 Australian-0)	-.250	-.126	.108	.084	-.013	-.010	-.048

\* Coefficient is regarded as 95% significant when  $p < 0.05$

#### 4.4 Comparing water use practices across ethnic groups

Among the key determinants of water usage may be the use of various indoor appliances and outdoor amenities, and the performing of certain types of water-use behaviour (Corbella & i

Pujol, 2009). To this end, examinations were carried out to check the ownership of appliances and preferences for certain forms of water-using behaviour across ethnic groups based on the questionnaire data. Cross tabulate analysis and one-way analysis of variance were used to summarise and discern the similarities and differences between the concerned ethnic groups. Box-plots were also employed where necessary to graphically depict the variance among samples. The tables displayed in the following sections show the results of cross tabulate analyses of the household ownership of various kinds of water appliances and water use behaviour by ethnicity. The statistical significance of the relationships, as measured by Pearson Chi-square, and the results of one-way analysis of variance are also displayed in the Tables.

#### ***4.4.1 Dishwashing and dishwasher***

Questionnaire respondents were asked how their households did the dishwashing, whether they had a dishwasher at home and how frequently they used it (Q 28). Their responses revealed that a high percentage of respondents in each group had a dishwasher at home, especially the Korean group with 92 per cent compared to 69.7 per cent in the Australian group, 70.5 per cent in the Chinese group, and 78.6 per cent in the 'Others' group (Table 4. 21). Despite the high ownership of dishwashers, most respondents in the Chinese and Korean groups seemed to prefer washing by hand, with merely 8 per cent of Chinese and 10.7 per cent of Korean respondents indicating that their households actually used the dishwasher. In comparison, the Australians and 'Others' were more likely to use their dishwashers compared to their Chinese and Korean counterparts, with nearly half (48.3%) of Australian respondents and 63.3 per cent of respondents in the group of 'Others' usually using their dishwashers. A substantial percentage of Australian respondents also washed their dishes by hand; however, they tended to wash dishes in a plugged sink compared to the Chinese and Korean respondents (58.6% compared to 38.6% and 17.9% respectively). A very high percentage (78.6%) of Korean respondents usually washed their dishes under running water. For those who use a dishwasher, significant differences were also identified between groups in the frequency of use of the dishwasher. Specifically, the Chinese group were likely to use a dishwasher less frequently (Mean=0.3) than their counterparts in the other three groups (where in each case the Mean was higher than 3 times per week)<sup>41</sup>.

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<sup>41</sup> Differences were identified between groups in dishwashing manners. However, which way is better in terms of saving water was not clear here since, regrettably, the water actually used for dishwashing in the homes was not measured in this study. Refer to Section 6.2.3 for further discussion.

**Table 4. 21 Percentage of respondents having a dishwasher at home, dishwashing methods, and frequency of using dishwasher, by ethnicity**

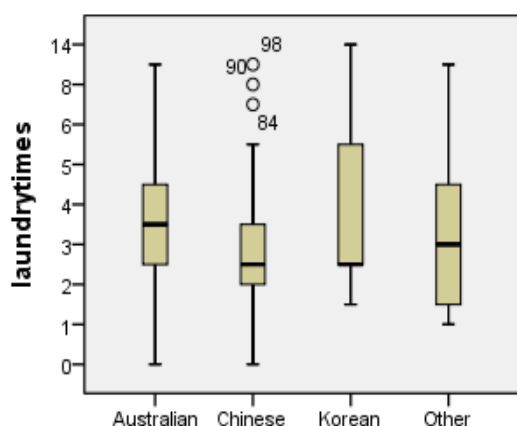
	Ownership		Washing method			Dishwasher use frequency /week	
	Dishwasher	By hand		Use dishwasher	Mean	Std. Deviation	
		Running water	Plugged sink				
Australian	69.7%	8.6%	58.6%	48.3%	3.5	2.49	
Chinese	70.5%	56.8%	38.6%	8.0%	0.3	1.39	
Korean	92.0%	78.6%	17.9%	10.7%	3.8	3.49	
Others	78.6%	16.7%	40.0%	63.3%	3.8	2.61	
Pearson Chi-square, Asymp. Sig. (two sided)	0.115		0.000		One -way ANOVA F-value (between group differences)	23.0*	

#### 4.4.2 Doing laundry and using a washing machine

The ownership of a washing machine and how often people did their household laundry was compared across ethnic groups (Q 28). As shown in Table 4. 22, there was high ownership of a washing machine in all groups and no significant difference (Chi-square=0.15) was found in the methods of doing laundry. However, significant differences were identified in the frequency of using a washing machine across groups (Figure 4. 19). With Chinese respondents likely to use their washing machines less frequently compared to their Australian, Korean and ‘Others’ counterparts (the Mean of the Chinese group was 2.4 compared to 3.3 for the Australian, 3.5 for the Korean and 3.2 for the ‘Others’ group).

**Table 4. 22 Percentage of respondents having a washing machine at home, washing methods, and frequency of using washing machine, by ethnicity**

	Ownership		Washing method			Washing machine use frequency /week	
	Washing machine	By hand		Washing machine	Mean	Std. Deviation	
		Running water	Basin/container				
Australian	96.5%	0.0%	2.5%	94.1%	3.3	2.1%	
Chinese	98.1%	0.0%	12.3%	96.2%	2.4	1.5%	
Korean	100.0%	0.0%	6.7%	100.0%	3.5	2.8%	
Others	100.0%	0.0%	6.3%	93.8%	3.2	2.5%	
Pearson Chi-square, Asymp. Sig. (two sided)	0.804		0.145		4.16*		



**Figure 4. 19** Box plots presenting the frequency (times per week) of doing laundry using a washing machine across ethnic groups

#### 4.4.3 Bathing and showering

##### 1) Differences between ethnic groups

Water use for showering and bathing forms an important part of household water consumption. Therefore, specific analysis was carried out on this topic (Q 28, 29).

Ownership of shower and bath facilities was compared across ethnic groups. As shown in Table 4. 23, in each of the four ethnic groups, there was a high percentage of households having one or more bath tubs, ranging from 75% to 95.6%. Although the percentage in the Chinese and Korean groups seemed higher than in the Australian and ‘Others’, the statistical significance test suggested that the between-group difference was not statistically significant. No significant difference was found in the ownership of showers either. Alternatively, statistically significant differences were revealed in the use of efficient showerheads by households among ethnic groups. More Australian (77.5%) and ‘Others’ (90%) respondents reported one or more water efficient shower heads being used in their households, while only 48.5 % of Chinese respondents and 50% Korean respondents claimed so. It was noticeable that a high percentage of respondents had no idea if the showerheads being used in their households were efficient or not.

**Table 4. 23** Ownership of bath and shower facilities, by ethnicity

Ethnicity	Bath		Shower			Efficient shower head	
	1	2	1	2	3	Have 1 or more	Don't know
Australian	78.7%	7.4%	47.4%	38.8%	13.8%	77.5%	8.3%
Chinese	91.0%	2.6%	38.8%	57.3%	3.9%	48.5%	40.6%
Korean	91.3%	4.3%	41.4%	55.2%	3.4%	50.0%	38.5%
Others	70.8%	4.2%	22.6%	74.2%	3.2%	90.0%	3.3%
<i>Pearson Chi-square, Asymp. Sig. (two sided)</i>	ns		ns			*	

*ns – not significant*

*\* The statistic is significant at 0.05 level*



Although a high percentage of households in all groups had both bathtubs and showers, people tended to take showers rather than bathe. The average number of tubs of baths per person per week for each of the four groups was very small, ranging from 0.13 to 0.43 across ethnic groups (Table 4. 24). No statistically significant difference was found across groups.

**Table 4. 24 Bathing frequency (tubs per week), by ethnicity**

<b>Ethnic status</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>One-way ANOVA between-group difference F (sig.)</b>
Australian	0.43	1.25	
Chinese	0.14	0.83	4.39
Korean	0.13	0.40	
Other	0.27	1.22	

\* Coefficient is regarded as 95% significant when  $p < 0.05$

The results of one-way ANOVA indicated that significant differences were found in showering frequency (Table 4. 25), single shower time (Table 4. 26), and total shower time per week (Table 4. 27) across the four ethnic categories. The average showering frequency for Chinese respondents was 7.0 showers per week which was the highest among the four groups. For the group of Australians, it was 6.4, and for that of ‘Others’ it was 6.3. Korean respondents reported the least shower frequency among the four groups, the average frequency being 5.9.

The pattern for a single shower time was slightly different from that of shower frequency. On average, Chinese respondents reported the longest shower time, the mean of which was 11.3 minutes, followed by the Korean and ‘Others’ categories with mean minutes of 10.2 and 8.5 respectively. Respondents in the Australian category claimed to take a shorter average single shower than those of the three other ethnic categories: the mean value was 7.0 minutes.

Total shower time per week of each respondent was calculated from the single shower time multiplied by the number of showers reported by respondents. The statistics of total shower time per week of respondents indicated that the Chinese group, on average, had the longest time for showering per week among the four ethnic groups (over an hour - 79.1 minutes), followed by the Korean and ‘Others’ groups (the average shower time was 59.3 and 55 minutes respectively). Australian respondents were found to have the shortest shower time

per week among the four ethnic groups. Based on the self-reported data, the average time for showering per week by Australian respondents was 50.9 minutes.

**Table 4. 25 Average individual showering frequency**

<b>Ethnicity</b>	<b>Australian</b>	<b>Chinese</b>	<b>Korean</b>	<b>Others</b>
<b>Mean</b>	6.4	7.0	5.9	6.3
<b>Std. Deviation</b>	2.9	3.1	2.2	2.1
<b>One -way ANOVA</b>				
<b>F-value (between group differences)</b>		4.2*		

**Table 4. 26 Average time spent for single shower**

<b>Ethnicity</b>	<b>Australian</b>	<b>Chinese</b>	<b>Korean</b>	<b>Others</b>
<b>Mean</b>	7.0	11.3	10.2	8.5
<b>Std. Deviation</b>	4.5	7.4	4.6	6.4
<b>One -way ANOVA</b>				
<b>F-value (between group differences)</b>		26.3*		

**Table 4. 27 Average total showering minutes per week per person**

<b>Ethnicity</b>	<b>Australian</b>	<b>Chinese</b>	<b>Korean</b>	<b>Others</b>
<b>Mean</b>	50.9	79.1	59.3	55.0
<b>Std. Deviation</b>	38.7	66.6	28.7	36.4
<b>One -way ANOVA</b>				
<b>F-value (between group differences)</b>		15.2*		

\* Coefficient is regarded as 95% significant when  $p < 0.05$

## 2) Influence factors behind the diversity in showering practices

As indicated in Appendix 4, Chinese and Korean respondents were more likely to be female, young and living in large households, compared to the Australian and ‘Others’ respondents. This may contribute to, or explain, the relatively long and more frequent shower patterns among Chinese and Korean respondents. In order to discern whether the between group difference was masking the demographic differences between groups, selected factors such as gender and age were controlled in the regression analysis of shower time and frequency by ethnicity. As indicated in the Literature Review (Section 2.4.2, Chapter 2), household size was perceived to influence shower patterns. Members of large households tended to take short showers so that others in the household could also use the bathroom.

As shown in Table 4. 28a, ethnic effects were still significant when household size and gender were controlled. In other words, the ethnic differences in single shower time were not likely to mask the demographic differences between groups. As regards shower frequency (Table 4. 28b), when gender was held constant, the ethnic difference was still significant. However, when age was controlled, the ethnic correlates of shower frequency became ‘not significant’, suggesting that age had a greater impact on shower frequency than ethnicity. Older people tended to shower less frequently (with the coefficient between age and shower frequency at -.032). When household size was controlled, the Chinese respondents remained significantly different from the other groups in shower frequency, whereas the Korean respondents became not significantly varied from other three groups if comparisons were made between respondents from the same household size. This suggested that household size had a greater impact on shower frequency than ethnicity, i.e., being Korean.

**Table 4. 28 Results of multi-model regression analysis of shower time (single shower) and frequency on ethnicity and selected demographic factors**

**(a) Single shower length**

Model	Variable	Ethnic status_ Chinese	Ethnic status_ Korean	Ethnic status_ Others
<i>Baseline model</i>	No control	4.34*	3.25*	1.47
<i>Control model with each variable entered individually</i>	Household size (s)	4.22*	3.27*	1.51*
	Gender (ns)	4.07*	2.99*	1.33
	Age (s)	3.04*	2.24*	0.00

*Note: s- statistic test is significant, ns-not significant*

**(b) Shower frequency (per week)**

Model	Variable	Ethnic status_ Chinese	Ethnic status_ Korean	Ethnic status_ Others
<i>Baseline model</i>	No control	0.56*	-.572*	-.132
<i>Control model with each variable entered individually</i>	Household size (s) (-.33*)	0.65*	-.56	-.18
	Gender (ns)	0.69*	-0.85*	-.127
	Age (s) (-.32*)	-.260	-.750	-.232

*Note: s- statistic test is significant, ns - not significant*  
\* Coefficient is regarded as 95% significant when  $p < 0.05$

#### 4.4.4 Watering the garden and other outdoor water-use activities

Outdoor water use practices were also compared across ethnic groups. As shown in Table 4. 29, a relatively higher percentage (76.6%) of Australian respondents had garden/yards attached to their properties, compared to 62.5 per cent of respondents in the ‘Others’ group, 26.9 per cent Chinese and 34.5 per cent Korean respondent households. Moreover, Australian and ‘Others’ respondents were found to be more likely to have plants on their balconies, compared to their Chinese and Korean counterparts (Australian=44.4%, Others=59.4%, Chinese=26.9% and Korean=34.5%). Further examination found that among those who had a garden or yard, the Australian respondents were more likely to report that their households watered the garden or lawn, with 85.9 per cent compared to 65.5 per cent in the Chinese group and 60.0 per cent in the ‘Others’ group. The Korean group were least likely to water their gardens (30%).

**Table 4. 29 Ownership of gardens, plants on balconies, and watering activities, by ethnicity**

Ownership of outdoor amenities, by ethnicity			Watering of gardens by ethnicity (for those who had gardens)	
Ethnicity	Having garden/yard	Having plants on balconies	Watering of gardens	
			Australian	76.6%
Chinese	26.9%	26.9%	Chinese	65.5%
Korean	34.5%	34.5%	Korean	30.0%
Others	62.5%	59.4%	Others	60.0%
Pearson Chi-square, Asymp. Sig. (two sided)	*	*	Pearson Chi-square, Asymp. Sig. (two sided)	*

\* Coefficient is regarded as 95% significant when  $p < 0.05$

Significant differences were also found in the frequency of watering gardens across ethnic groups (Table 4. 30). Chinese and Korean respondents tended to water their gardens less frequently and to water for a shorter time in the summer period, with 1.2 and 1.3 times, and 2.3 and 5.5 minutes per week respectively compared to more than 2 times per week and more than 15 minutes per week among Australian and ‘Others’ respondents. In the winter period, the disparities between ethnic groups were smaller than in the summer period. No significant differences were found in the frequency of watering in winter across ethnicities, whereas groups were slightly different from each other in the total watering minutes per week. As shown in Table 4. 30, the average time that Australian respondents took to water their

gardens was the longest (6.8 minutes per week), followed by the Koreans (4.9 minutes) and ‘Others’ (4.6 minutes). In contrast, the Chinese respondents spent an average time of merely 2 minutes.

**Table 4. 30 Watering time and frequency by ethnicity (summer and winter)**

Period	Item	Australian	Chinese	Korean	Others	One-way ANOVA test F (sig.)
		Mean	Mean	Mean	Mean	
Summer period	Frequency of watering (times per week)	2.1	1.2	1.3	2.4	5.81*
	Total watering minutes (minutes per week)	18.8	2.3	5.5	15.5	16.29*
Winter period	Frequency of watering (times per week)	0.8	0.7	0.7	1.0	.620
	Total watering minutes (minutes per week)	6.8	2.0	4.9	4.6	5.58*

\* Coefficient is regarded as 95% significant when  $p < 0.05$

The questionnaire survey also identified disparities between ethnic groups in other outdoor activities. More Australian respondents (55.4%) and respondents from ‘others’ group (42.2%) than Chinese (28.2%) and Korean (32.3%) respondents claimed they washed their cars at home.

#### 4.4.5 Reusing and recycling grey water

As shown in Table 4. 31, more Chinese and Australian respondents reported reusing grey water at home (52 per cent and 44.5 per cent respectively) compared to 34.4 and 23.3 per cent in the ‘Others’ and Korean groups. Use of grey water for watering the garden was common among Australian, Korean and ‘Others’ respondents, while as shown in Table 4. 31, Chinese respondents were far more likely to reuse grey water for flushing toilets. However, the approaches of reusing grey water between respondents of ethnic groups were found to be diverse in the qualitative studies (physically collect the grey water using a bucket etc., for flushing, or connect a hose from the sink/bath, etc., to the garden) (see Section 5.2.2, Chapter 5).

**Table 4. 31 Percentage of respondents who reuse and recycle grey water, by ethnicity**

Performance	Ethnicity			
	Australian	Chinese	Korean	Others
Reuse grey water*	44.5%	52.0%	23.3%	34.4%
For flushing toilets*	6.7%	37.6%	6.9%	3.1%
For watering gardens*	41.2%	21.8%	17.2%	37.5%
For cleaning the house (floor)	0.0%	4.9%	10.1%	0.0%

\* Coefficient is regarded as 95% significant when  $p < 0.05$

## 4.5 The effects of ethnic status on per capita water usage

This section presents the results of the analysis of the correlation between ethnic status and per capita water usage in Sydney. Independent and dependent variables (see Appendix 9 for a list of derived variables) were derived from two sets of data, actual water usage record (with CCD as the basic unit) from the Sydney Water and the ABS 2011 Census data on housing and population characteristics (with SA1 as the basic unit). A correlation analysis was also conducted on ethnic status, per capita water usage (summer period and winter period) and selected demographic and migration related factors (see Section 3.5, Chapter 3 for details of the study methods).

### 4.5.1 Results for the summer period

#### 1) The correlation between ethnic status and per capita water consumption in summer

As shown in Table 4. 32, the percentage of the population that were Chinese and the percentage that were Korean were both significantly positively related to daily per capita water usage, indicating that areas (SA1) with a high percentage of Chinese or Korean dwellers were likely to have higher per capita water usage. Specifically, in the summer period, a one-unit increase in the percentage of the population who were Chinese or Korean in a certain area (SA1) was associated with a 0.06 or 0.25 units rise in the per capita water consumption rates<sup>42</sup>.

**Table 4. 32 Results of regression analysis of summer per capita daily water consumption on ethnic variables**

Independent variable	Unstandardized Coefficients	Standardized Coefficients	R Square
	B	Beta	
(Constant)	0.18**		
Chinese population (percentage)	0.06**	0.32**	
Korean population (percentage)	0.25**	0.68**	.510

\* correlation is significant at the 0.01 level (2-tailed)  
 \*\* correlation is significant at the 0.05 level (2-tailed)

#### 2) The importance of ethnic effects on per capita water use (summer) compared to other explanatory factors

The examination started with a backward regression of all socio-demographic, economic and housing variables (with the exception of the variables for ethnicity). This was undertaken in

<sup>42</sup> Water consumption data is in kilolitres. The coefficient indicates that a CCD where 50 per cent (0.5) of their population are of Chinese ethnicity, would on average, have 0.03 kilolitres  $((0.5-0) * 0.06)$  more daily per capita water consumption than those with a zero per cent Chinese population.

order to identify the important variables in explaining the variation in per capita water use. Table 4. 33 presents the results for ordinary least squares regression with all variables entered in the model (columns 2 and 3) and the procedure and results of the backward regression (column 4). All of the variables examined in the regression are displayed in column 1. The results of the backward regression show that six factors proved useful variables, accounting for 78.9 per cent of the total variations in per capita water use. These are the location, the percentage of dwellings that are high-rise units/flats, the percentage of population with tertiary education, the percentage of population living in public rental dwellings, the percentage of population not in the labour force (including students), median age and median personal incomes of the area (SA1). A comparison of the above variables and ethnic variables will facilitate determination of the relative importance of ethnic variables when exploring water use variation (Table 4. 34).

**Table 4. 33 Results of ordinary least square regression and backward regression of per capita daily water consumption in summer periods of selected socio-economic variables**

Variable	Ordinary least-square regression		Backward regression
	Unstandardized coefficients	Standardised coefficients	Unstandardied coefficients
	B	Beta	B
(Constant)	0.73		
region	0.03**	0.68**	.02**
Dwelling: semi-detached	-0.07	-0.11	Removed at step 5
Dwelling: low-rise flat	-0.04	-0.10	Removed at step 4
Dwelling: high-rise flat	0.14*	1.26*	.15**
Education: <year12	-0.26	-0.32	Removed at step 8
Education: tertiary	-0.38	-0.51	-.21*
Household structure: non-family	-0.14	-0.34	Removed at step 6
Tenure: mortgage	-0.32	-0.67	Removed at step10
Tenure: rent private	-0.16	-0.79	Removed at step 9
Tenure: rent public	2.63	0.27	2.15*
Work: unemployed	1.09	0.40	Removed at step 7
Work: not in labour force	-0.78*	-0.66*	-.42*
Gender: female	-0.04	-0.02	Removed at step 2
Median age	0.01*	1.06*	0.01**
Median personal income	-0.01	-0.55	-.001*
Median household size	-0.01	-0.06	Removed at step 3

*R Square Backward Regression model is .789*

*\* correlation is significant at the 0.05 level (2-tailed)*

*\*\* correlation is significant at the 0.01 level (2-tailed)*

Table 4. 34 presents the results of a two-model regression analysis, with the percentage of population for each ethnic community as the sole set of variables in Model 1. A set of socio-demographic, economic and housing variables, which were identified in Table 4. 33, were then added in to the regression in Model 2. As shown in Model 2, the coefficient for the ethnic variable – Korean – decreased from 0.25 to 0.19 but was still significant when a set of variable population characteristics were held constant in the model. This suggested that ethnic status was also an important factor in predicting per capita water consumption. Ethnic status and other demographic and housing variables together explained 83.8 per cent of the variation in per capita water usage. A comparison of standardised coefficients across all variables in Model 2 found that ethnic status (Korean) might have a relatively greater effect on per capita water use than most variables, except the percentage of high-rise flats and median age.

**Table 4. 34 Results of Two-model Regression analysis of summer per capita daily water consumption on ethnic status and socio-economic factors**

Models		Unstandardised	Standardised	R Square
		Coefficients B	Coefficients Beta	
<b>Model 1</b>	(Constant)	0.18**		.510
	Chinese population (per.)	0.06**	0.32**	
	Korean population (per.)	0.25**	0.68**	
<b>Model 2</b>	(Constant)	0.03		.838
	Chinese population (per.)	0.08	0.46	
	Korean population (per.)	0.19*	0.53*	
	Region	0.02**	0.52**	
	Dwelling: high-rise flat (per.)	0.08	0.75	
	Education: tertiary	-0.08	-0.10	
	Work: not in Labour Force	-0.34	-0.28	
	Tenure: rent public	1.72	0.17	
	Median age	0.01**	1.16**	
	Median personal income	-0.01	-0.29	

\* correlation is significant at the 0.01 level (2-tailed)

\*\* correlation is significant at the 0.05 level (2-tailed)

### 3) The influence of migration status on ethnic effects

This research indicates that migration status was likely to influence the relationship between ethnic status of population and per capita water usage in the summer period to some degree. Specifically, as shown in Table 4. 35, Model 2 found that the percentage of migrants who had lived in Sydney for less than 6 years was significantly negatively correlated with the daily per capita water usage. In other words, areas with a large percentage of new migrants were likely



to have lower per capita water consumption compared to those with a large percentage of migrants who had lived in Sydney for more than 6 years. However, when years of migration was controlled, the ethnic effects on per capita water consumption remained significant; in other words, the year of migration seemed unable to eliminate the ethnic difference in per capita water consumption. In contrast, English proficiency was found to be significantly positively related to per capita water usage in the summer period, suggesting that migrants with lower English proficiency tended to be higher water consumers. When English proficiency was held constant (Model 3), the ethnicity-Chinese became not significant whereas ethnicity-Korean was still significant. The coefficient between ethnicity-Korean and per capita water usage decreased slightly from 0.25 to 0.20, which indicated that migrants' English proficiency may help to reduce the Australian/Korean difference in water use, albeit not enough to make the difference disappear.

**Table 4. 35 Results of regression analysis of per capita water use for summer period on ethnic variables with each of the selected variables added into the regression**

	Variable	Baseline model		Model 1		Model 2		Model 3	
		B	Beta	B	Beta	B	Beta	B	Beta
Ethnic status variable	Chinese population	0.06**	0.32**	0.14*	0.83*	0.11**	0.62**	-0.01	0.04
	Korean population	0.25**	0.68**	0.38**	1.03**	0.34**	0.92**	0.20**	0.05*
Variables controlled (one variable entered the model at a time)	Birthplace: born overseas	--	--	-0.11	-0.63	--	--	--	--
	Years immigrated to Sydney: < 6	--	--	--	--	-0.12*	-0.47*	--	--
	English proficiency: not high	--	--	--	--	--	--	0.22*	0.42*

The Pearson Correlation for Chinese population (percentage) and English proficiency: not high (percentage) is 0.77\*\*; the Pearson Correlation for Korean population (percentage) and English proficiency: not high (percentage) is 0.23.

\* correlation is significant at the 0.01 level (2-tailed)

\*\* correlation is significant at the 0.05 level (2-tailed)

#### 4.5.2 Results for the winter period

##### 1) The correlation between ethnic status and per capita water consumption in winter

Similar to the results for the summer period, shown in Table 4. 36, the percentage of the population who were Chinese and the percentage who were Korean, were both significantly

positively related to the daily per capita water usage; however, the ethnic effects on per capita water consumption in the winter period seemed greater than in summer, with a coefficient at 0.11 and 0.30 for the Chinese and Korean groups respectively. In other words, a one-unit increase in the per cent of population who were Chinese or Korean in a certain area (SA1) was associated with a 0.11 or 0.30 units increase in the per capita water consumption in the winter period.

**Table 4. 36. Results of regression analysis of winter per capita daily water consumption on ethnic status**

Model		Unstandardised	Standardised	R Square
		Coefficients	Coefficients	
		B	Beta	
Model 1	(Constant)	0.15**		
	Chinese population (percentage)	0.11**	0.52**	.639
	Korean population (percentage)	0.30**	0.67**	

\* correlation is significant at the 0.01 level (2-tailed)

\*\* correlation is significant at the 0.05 level (2-tailed)

## 2) The importance of ethnic effects on per capita water use (winter) compared to other explanatory factors

The result of the backward regression analysis suggested that variables which best explain the variation in per capita water use in winter seasons were similar to those for the summer period. As shown in Table 4. 37, the percentage of high-rise dwellings, the percentage of the population living in public rental dwellings, the percentage of population not in the labour force (including students), median age and median personal income were also found to be significant in predicting per capita water consumption during the winter. The percentage of the population with tertiary education significantly predicted per capita water consumption in the summer period; however, this indicator seemed not to matter much vis-à-vis water use in the lower consumption (winter) period. Instead, a housing-related variable - the percentage of the population who lived in a dwelling with a mortgage - was found to be a useful factor for explaining the variation of per capita water consumption in winter. A 79.6 per cent of variation in per capita water use was explained by all variables identified. Again, comparison between the effects of these variables and that of ethnical variables can assist to determine the relative importance of ethnic variables for exploring water-use variation in the winter (Table 4. 37).

**Table 4. 37 Results of ordinary least square regression and backward regression of per capita daily water consumption in winter periods on selected socio-economic variables**

Variable	Ordinary Least-Squares Regression		Backward Regression
	Unstandardized Coefficients	Standardised Coefficients	Unstandardised Coefficients
	B	Beta	B
(Constant)	.633		
Region	0.03**	0.61**	0.03**
Dwelling: semi-detached	-0.02	-0.02	Removed at step 2
Dwelling: flat-low-rise	0.02	0.06	Removed at step 4
Dwelling: flat high-rise	0.17*	1.22*	0.12**
Education: year12	-0.30	-0.30	Removed at step 7
Education: tertiary	-0.31	-0.34	Removed at step 8
Household structure: non-family	-0.05	-0.10	Removed at step 6
Tenure: mortgage	-0.39	-0.66	-0.15
Tenure: rent private	-0.23	-0.95	Removed at step 10
Tenure: rent public	2.91	0.25	2.18
Work: unemployed	1.49	0.44	Removed at step 9
Work: not in labour force	-0.89*	-0.61*	-0.46*
Gender: female	0.10	0.04	Removed at step 5
Median age	0.01	0.80	0.01**
Median personal income	0.00	-0.43	-0.001**
Median household size	0.01	0.07	Removed at step 3

*R Square Backward Regression model is .796*

*\* correlation is significant at the 0.05 level (2-tailed)*

*\*\* correlation is significant at the 0.01 level (2-tailed)*

As shown in Table 4. 38, when the identified demographic and housing variables were added in Model 2, the ethnic variable ethnicity-Korean, remained significant. This was consistent with that for the summer period. Moreover, the ethnic variable Chinese was also still significantly related to per capita water use, when the demographic and housing variables were held constant. This suggested that the percentage of population who were Chinese or Korean, together with demographic and housing variables, are important explanatory factors for understanding domestic water use in the winter period. More importantly, comparison of the standardised coefficients indicated that ethnic status had a greater impact on per capita water consumption than most demographic and housing factors, except for the median age.

**Table 4. 38 Results of two-model regression analysis of winter per capita daily water consumption on ethnic status and socio-economic factors**

Model		Unstandardised Coefficients	Standardised Coefficients	R Square
		B	Beta	
<b>Model 1</b>	(Constant)	0.15**		0.639
	Chinese population	0.11**	0.52**	
	Korean population	0.30**	0.67**	
<b>Model 2</b>	(Constant)	.086		0.847
	Chinese population	0.12*	0.56*	
	Korean population	0.22*	0.50*	
	Region	0.03**	0.50**	
	Dwelling: high-rise flat	0.06	0.47	
	Tenure: mortgage	-0.07	-0.12	
	Tenure: rent public	1.59	0.13	
	Work: not in labour force	-0.44*	-0.30*	
	Median age	0.01**	0.83**	
	Median personal income	-0.001	-0.23	

\* correlation is significant at the 0.01 level (2-tailed)

\*\* correlation is significant at the 0.05 level (2-tailed)

### 3) The influence of migration status on ethnic effects (winter)

As shown in

	Variable	Baseline model		Model 1		Model 2		Model 3	
		B	Beta	B	Beta	B	Beta	B	Beta
Ethnic status variable	Chinese population	0.11**	0.52**	0.17*	0.8*	0.15**	0.69**	0.06	0.30
	Korean population	0.30**	0.67**	0.39**	0.87**	0.37**	0.82**	0.26**	0.58**
Variables controlled (one variable enters the model at a time)	Birth place: born overseas	--	--	-0.07	-0.35	--	--	--	--
	Years immigrated to Sydney: < 6	--	--	--	--	-0.09	-0.28	--	--
	English proficiency: not good	--	--	--	--	--	--	0.18	0.28

\* correlation is significant at the 0.01 level (2-tailed)

\*\* correlation is significant at the 0.05 level (2-tailed)

, unlike the results for the summer period, no significant results were found for the influence of migration status on the ethnic effects of per capita water consumption in the winter. In other words, neither variables of birth place, years since migration nor English proficiency significantly affected the ethnic correlates of per capita water rates in winter.

**Table 4. 39 Results of regression analysis of per capita water use for winter period on ethnic variables with each of the selected variables added into the regression**

	Variable	Baseline model		Model 1		Model 2		Model 3	
		B	Beta	B	Beta	B	Beta	B	Beta
Ethnic status variable	Chinese population	0.11**	0.52**	0.17*	0.8*	0.15**	0.69**	0.06	0.30
	Korean population	0.30**	0.67**	0.39**	0.87**	0.37**	0.82**	0.26**	0.58**
Variables controlled (one variable enters the model at a time)	Birth place: born overseas	--	--	-0.07	-0.35	--	--	--	--
	Years immigrated to Sydney: < 6	--	--	--	--	-0.09	-0.28	--	--
	English proficiency: not good	--	--	--	--	--	--	0.18	0.28

\* correlation is significant at the 0.01 level (2-tailed)

\*\* correlation is significant at the 0.05 level (2-tailed)

#### 4.5.3 Ethnic status and between-season water use variation

The percentage of population that is Chinese proved more useful for explaining water use variation in winter than in summer, thus; the percentage of Chinese might be useful for understanding the between-season variation of water use. A further examination was conducted for effects of the percentage of population for each ethnic community on water use variation between the summer and winter seasons. Results are shown in Table 4. 40 and, as expected, the percentage for Chinese was inversely significantly related to summer-winter seasonal variation in per capita water use. An inverse and significant relationship was also found between the percentage of households that were non-family and between-season variation of water use. This finding suggests that SA1s with a higher percentage of Chinese residents, non-family households and households who live in low-rise apartments tend to have a smaller variation between their summer and winter water use when compared with SA1s that have a high ethnically Australian and family household makeup.

**Table 4. 40 Results of backward regression analysis of per capita daily water consumption variation between summer and winter on population and housing variables**

	Unstandardized Coefficients		Standardized Coefficients	
	B		Beta	
(Constant)	.288			
Chinese population (percentage)	-0.15**		-0.45**	
Korean population (percentage)	-0.15		-0.22	
Dwelling: flat low-rise	-0.11*		-0.17*	
Household composition: non-family	-0.53**		-0.66**	
Working status: not in labour force	0.36		0.16	
Median household size	-0.09		-0.32	

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*R Square Backward Regression model is 0.823*

*\*\* correlation is significant at the 0.01 level (2-tailed)*

## **4.6 Conclusion**

This chapter summarised the findings of the quantitative analysis based on questionnaire data and secondary water data. Section 4.2, which drew on the self-reported questionnaire data, found that disparities existed in knowledge and perceptions of water issues across ethnic groups, especially between the Australian and the two ethnic minority groups. Chinese and Korean respondents were found to be less familiar with, or knowledgeable about, local water issues compared to their Australian counterparts; moreover, the considerations, incentives and challenges associated with the undertaking of water conservation behaviour were also diverse across groups. Despite the low familiarity with and varied perceptions towards water issues and water policy, the Chinese and Korean respondents all showed a high willingness to become involved in water conservation and management.

Section 4.3, which is based on the questionnaire data, examined the ethnic correlates of knowledge, attitudes and pro-conservation behaviours of water use, and confirmed the ethnic effects. Ethnic differences exist in knowledge, attitudes and behaviour; and, even when the other demographic factors were controlled, the ethnic effects were still significant. The Chinese and Korean respondents were likely to have lower knowledge levels, less positive perception-based dispositional attitudes and were less active in pro-conservational behaviour compared to their Australian counterparts. Although the Chinese and Korean respondents were more similar to each other than to the Australian respondents, disparities still existed. Moreover, acculturation-related factors were found to have impacts on the ethnic effects.

Section 4.4 considered the various indoor and outdoor water use practices across the daily lives of the ethnic groups. Disparities were found to exist across ethnicities. Respondents from different ethnic and cultural backgrounds were found to be likely to follow divergent water use habits. Ethnic differences were identified in dishwashing, doing laundry, showering, watering the garden, washing cars and reusing grey water in the home.

Section 4.5, which considered the relationship between ethnic status and actual domestic water consumption based on water data obtained from the Sydney Water, found that ethnic status significantly correlated with per capita water usage. Being of Chinese or Korean ethnicity was found to be significantly positively associated with the various per capita water use rates.

Ethnicity had greater importance than some economic and demographic factors in explaining the variations in per capita water usage among the populations.

This study combines both quantitative research methods (discussed in Chapter Three, with the results presented in this chapter) and qualitative research methods. The results drawn from the qualitative analysis (focus groups, interviews and practice observations) and the media analysis component of this study are presented in the next chapter (Chapter 5).

## CHAPTER 5 QUALITATIVE AND MEDIA STUDY RESULTS

### 5.1 Introduction

This chapter presents the results of the qualitative analysis and media analysis undertaken in this study. It starts by detailing the findings of the qualitative studies – interviews, focus groups and practice observations – thereby contributing to a better understanding of the elements behind the phenomenon and patterns revealed in the quantitative study. It then presents the findings of print media analysis, highlighting the differences and similarities in water coverage and framing across newspapers which contribute to understanding the diverse construct of perceptions of water issues.

### 5.2 Qualitative understanding of diverse water use across ethnic groups

Household activities vary; and, it is difficult to draw similarities or differences within or between groups of people given the limited samples in qualitative studies. Nevertheless, the discussion and investigation conducted did identify some differences in water use practices and perceptions of water use and conservation which were linked to ethnic and cultural backgrounds. Furthermore, the findings of the qualitative study also provide a detailed understanding of the ethnic differences in water use which were identified in the questionnaire. The following section looks at three main household water practices in which significant differences were found to exist between three ethnic groups (Australian, Chinese and Korean)<sup>43</sup> in this study. These practices are washing dishes, showering/bathing and brushing teeth.

#### 5.2.1 Diverse water-use practices across ethnicity

##### 1) Dishwashing practices

###### *Diverse dishwashing techniques*

All of the participants, with the exception of FA\_2, irrespective of ethnicity, reported that they had a dishwasher at home. However, only the Australian participants claimed that they

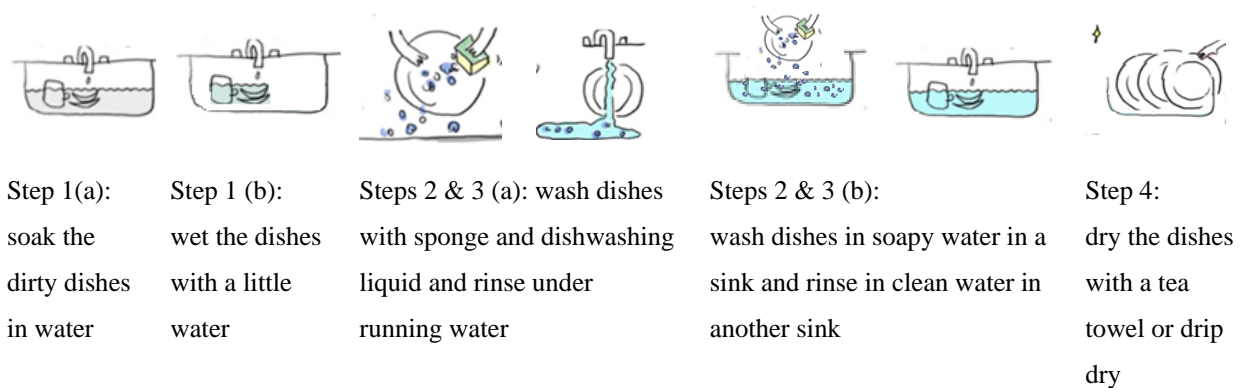
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<sup>43</sup> Three ethnic groups are included in the qualitative studies: Australian, Chinese and Korean. This is different from the quantitative analysis in which four ethnic groups (the Australian, Chinese, Korean and the 'Others') were examined (the fourth group, 'Others', was created as a reference group given the high number of others responses to the questionnaire survey).



actually use the dishwasher regularly (every day or every other day). The Chinese and Korean participants claimed that they rarely, or never, used the dishwasher despite having one at home. They all pointed out that washing dishes by hand is common among all people of their ethnicity. The Australian participants also said that they sometimes washed by hand if there were not many dishes. However, as shown in Figure 5. 1, the method of washing dishes by hand among Australians differs slightly from that of the Chinese and Korean respondents.

According to the information provided by all respondents, there are four steps in washing dishes by hand; and, the difference in hand-washing between cultures mainly lies in the third step. The dirty dishes were soaked in water or wet with a small amount of water, then washed with dishwashing liquid, sponged and rinsed. The wash-and-rinse method seemed diverse between cultures, with the Chinese and Korean respondents all consistently indicating that after washing with a sponge and washing liquid, they usually rinsed the dishes under running water, as shown in steps 2&3 (a). The Australian respondents claimed that they usually washed their dishes in soapy water in a sink and then rinsed them in another sink with clean water (steps 2&3 (b)). When asked about their reasons for rinsing under running water, a Korean respondent stated that ‘it is cleaner that way’ FK\_3. The last step is drip drying the dishes on a rack or drying them using a tea towel. FA\_2 pointed out that this method may be relevant to the case that, prior to the 1970s, houses had only one sink in their kitchens. The situation may be different now, nevertheless, these practices seemingly continue.



**Figure 5. 1 The process of washing dishes by hand** (developed based on descriptions provided by focus groups, interview participants and the images that were provided by participants in cultural probes)

### *Dishwasher versus hand washing*

It seemed hard for the Australian participants to understand why the Chinese and Korean households never use their dishwashers, just as the Chinese and Korean participants had difficulty understanding why Australian households like to use their dishwashers. In Sydney,

newly-built dwellings usually have a dishwasher as a standard part of the new home. For the Australian respondents, the dishwasher was considered 'efficient' and 'convenient', and was regarded as 'normal' for washing dishes. Australian respondents indicated they usually used the dishwasher when it was full loaded. One Australian respondent indicated that although she usually washed dishes by hand since she lived alone, using dishwasher was still a good option to her. She would use dishwasher once a week with full load.

It is common, most people do this (FA\_1) (referring to using a dishwasher).

I use the dishwashing machine, it depends when it is full, probably every second day. Why not? It's efficient. (IA\_1)

However, for the Chinese and Korean participants, the existence of a dishwasher in the kitchen was likely to be considered a waste of space, as indicated by the following participants:

Most Chinese households never use the dishwasher and just leave it as a display, and some even use the dishwasher for storage. (IME\_E2)

As I know, most Korean families do not use dishwasher in Korea, it is the same after they moved to Australia. (IME\_E3)

Qualitative studies provided several reasons explaining why the dishwasher has been rejected by Chinese and Korean community, including:

**(a) Not used to using a dishwasher**

The Korean and Chinese participants' common response was they were 'not used to' using a dishwasher, 'due to habits' or 'no reason to'. Washing by hand is generally regarded as the conventional way to do the dishwashing: it was taught to respondents during their childhoods by their parents in the Chinese and Korean cultures. For example, in China, children were requested to wash their own dishes and those of the whole family once they reached a certain age. Since most families in China did/do not have a dishwasher, washing by hand is the only way to wash their dishes. Over time, it has become a habit or part of the daily routine. After they migrated to Australia, the existence of a dishwasher in the home meant little to them.

Hand washing dishes under running water, in the consideration of hygiene and convenience. Besides, it is also a habit developed when I was in China.<sup>44</sup> (IC\_1)

Participants also pointed that there was no reason to use the dishwasher. To most Chinese and Korean people, a dishwasher is a machine which seems energy-consuming and water-wasting (depending on its size). If washing can be done in a small sink by hand within a short time, there is no reason to use a machine that is not economical. Elderly people who find it difficult to operate the machine are not keen to learn something which seems non-beneficial.

I heard washing by dishwasher can save water, but I just don't like to use it. (FK\_2)

### **(b) Not convenient, not trustable**

Not only was a dishwasher inconvenient, the Chinese and Korean participants lacked trust in it based on their or their friends' single experience of using a dishwasher. Because it usually took more than one day to accumulate enough dishes to constitute a load, the dirty dishes needed to be stored until washing. Apart from being considered unhygienic, it was very inconvenient when certain kinds (certain shapes) of dishes were needed for the next meal. Dishes washed by a dishwasher were also considered, by the Chinese and Korean respondents, to be 'not clean' or sometimes 'not dry'; therefore, extra work was needed to clean or dry them.

It's troublesome (to clean or towel dry the dishes after dishwashing). (FK\_4)

## **2) Showering, bathing, facilities and cultures**

### *Taking a bath*

Taking a shower, rather than a bath, is regarded as a daily practice for the majority of participants from the three ethnic groups (Australian, Chinese and Korean). However, a few participants said they take baths only occasionally. There was no sign of distinction between the ethnic groups in the conduction of this practice (taking a bath occasionally), however, motivational reasons varied between the Australian and Chinese respondents. The Australian participants indicated that the common reason for Australian people to take a bath was 'to relax' whereas one of the Chinese participants regarded it as a hot-water therapy for sickness.

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<sup>44</sup> The original words: '洗碗是手洗, 洗的时候也是用流动的水, 有卫生啊, 方便啊, 两方面的考虑, 还是一种习惯吧, 以前 (在中国的时候) 就是这样做的'.

Soaking their feet in hot water helped them to recover from cold or fatigue. Feet-bathing is a form of foot therapy in Traditional Chinese Medicine (TCM); and, on most occasions, Chinese traditional herbs are added to the water. In China, feet-bathing is usually conducted using a bucket or similar container whereas according to some interview participants, in Australia it is sometimes done in the bath tub for convenience. Another reason for taking a bath at home was to wash children, which was the case for all three ethnic groups.

#### *Showering preferences in different cultures*

When talking about the long showering tendency among the Chinese and Koreans participants, a Korean bilingual educator pointed out that this might be related to the Korea's Jjimjilbang bath culture. Jjimjilbang (찜질방) is a Korean style public bathhouse or sauna; however, it is not the same as a bathhouse or sauna. It is open 24-hours-a-day, visitors can take a bath and a sauna, and there is an array of therapeutic hot rooms and ice rooms. Other facilities provided include the food court, video and Internet rooms, play areas and sleeping areas. Koreans like visiting the Jjimjilbang, and most stay there all day enjoying the therapeutic bathing and sauna or the entertainment devices in the common area (Choe, 2008; Junker). As one interviewee indicated, the habit of spending a long time in the water at Jjimjilbang appeared to translate into spending a long time in the shower at home in Sydney, since no Jjimjilbang service is available in Sydney.

I am not sure whether Korean people tend to take longer shower, but if so, I think it might have something to do with the Korean style bathing, the Jjimjilbang,... we take our time over bathing, and somehow, I tend to spend more time in [the]shower at home as well. (IME\_E3)

Public bathhouses are also commonly found in some cities in north China, especially in boarding schools and universities. The public bathhouse culture in China may also underpin the long-shower tendency among Chinese respondents. However, rather than the public bathhouse culture, the Chinese focus groups and interviewees claimed that climatic factors and the convenient showering facilities were more important considerations influencing their showering habits. Chinese participants indicated that their showering habits were formed when they were young and they had barely changed after moving to Australia. People born in northern China said they were used to taking long showers in China in the cold months but not so frequently (maybe only around 3-5 times a week). In Sydney, despite the warmer winter, they retain their long-shower habit. A Chinese respondent who used to live in

southern China said that people there tended to take short but frequent showers (every day, sometimes two showers a day on weekends) due to the hot, humid weather. After they moved to Sydney, the long but not frequent showering habits among people from northern China and the frequent but short showering preferences among people from southern China appeared likely to have shifted to a long and frequent showering tendency, since the showering facility at home (with both cold and hot water provided) is more convenient in Sydney.

I think the water use manners are relevant to cultural conventions and habits. In China (northern China) people may take two to three showers a week, in comparison, in Australia, people [may] have been used to take showers in the morning and the evening which may probably [be] due to the convenient hot water supply... Migrants (Chinese) may tend to use more water [for showering] after their migration to Australia... Hot water is available from the taps and temperature of water can be adjusted easily. Therefore, I believe the convenient water supply facilities contributes to the increase in water use [showering and dishwashing] at home.<sup>45</sup> (FC\_1)

In regards to showering, Chinese people may take [a] longer time [compared to Australians], especially females. When I asked them how much time they usually spend in shower, the answer was 15 minutes, 20 minutes, even half hour. Females' long hair might be a reason. Besides, we might have been used to the public bathhouse culture in China in the old days, and would not rush to finish a shower.<sup>46</sup> (IME\_E1)

Regarding the Australian respondents, the reasons behind their showering practices seemed also related to climate issues and habits. Australian respondents frequently mentioned the '3-minute shower', 'conserve water' and the 'drought conditions' in Australia, in interviews and focus groups. One Australian respondent said that having a short shower is a habit or kind of rule for him. He could finish his shower in three to five minutes so there was no need to spend more time showering. Respondents also mentioned that some Australians may like to take a shower in the morning instead, or sometimes two showers a day - in the morning and evening. Females were believed among respondents to have longer showers than males, although the reason for this was not clear.

<sup>45</sup> The original words: '我觉得用水方式跟文化习俗习惯有关系。像在中国以前大家都是一周洗两、三次澡（冬天的北方），在这边澳洲人都习惯早晚两次，这可能也跟在热水很方便有关..... 到了澳洲之后会洗更多的澡..... 一打开水龙头就有热水，可以随意调节到适合的温度。可以说，我觉得澳洲更便利的提供热水的条件，导致了用水(洗澡、洗碗用水)的增加'.

<sup>46</sup> The original words: '好像, Shower(洗澡)方面, 中国人花的时间会比较长, 因为中国的尤其是 lady(女士), 我有问过一些你们洗澡大概多长时间, 他们都说 15 分钟啊, 20 分钟啊, 有些半个小时, 因为是长头发嘛, 而且在因为我们在中国澡堂里洗习惯了, 大家都是在澡堂里泡一下啊, 不会着急(rush)'.

I take showers, never have a bath, me in the morning and my partner in the night. I take showers in the morning to wake up, I feel it takes a long time to wake up and be ready to talk, and showers helps that. I think it's a habit like my whole life. (IA\_1)

Short shower in the morning, about, probably, ten minutes. But [if I] have it in late night, for whatever reason, sometimes the shower [is] longer. My partner takes shower in the evening, probably 20 minutes, a quite long shower. I think she just likes long showers. (IA\_1)

It's usually once every day (showering), I rarely, very occasionally might have two showers if I am going out, or something. (FA\_1)

I have a shower in the morning...usually once a day, but if it's hot outside or something, working in the garden, I might have two. (FA\_2)

### **3) Brushing teeth and doing laundry – perceptions and preference**

It was interesting to note the different ways of brushing teeth revealed in the study. The difference lay in the ways of using water for rinsing the mouth. It is the Chinese and Korean way to fill a cup with water and use this water to rinse the teeth during and after brushing. In contrast, the Australian way is to catch running water in the hand from the tap to rinse the teeth. The tap might be on during the whole process; or it only open when necessary and, it is turned off quickly after there is enough water for rinsing.

The Australian way:

Is it common among Australian (sic) to brush without a cup? (FA\_1)

Ah, [brushing under tap] that's classic [for Australians]. (FA\_2)

The Chinese and Korean approach:

Of course with a cup, that's what I was taught too, and I do so all the time. (IC\_1)

In the workshop, I used to tell participants 'don't keep the tap water running while brush the teeth', they responded with the confusing face 'why keep the water running, I use tooth-brushing cup to get water' (sic). (IME\_E2)

However, the way of brushing using water in a cup appeared to be easy to change. One Chinese participant said that she used to brush with a cup but after she came to Australia for study she learned to brush under the running tap, using her hand to catch water for rinsing. The reason for this change is that she lives in a shared apartment and everyone has limited

time for occupying the bathroom in the morning. So teeth-brushing should be very quick and brushing under a running tap was duly undertaken and developed into a habit.

I know many young people turned to brush in this way (brush under running tap),... , the cup was then just used for placing the toothbrush. (FC\_2)

Apropos of the practices of doing laundry and using a washing machine, most participants indicated that they, normally, wash clothes using a washing machine on weekends or when they were available. The washing machine might be full loaded or not, which really depends on their actual circumstances (i.e., household size, working status and availability). Differences were observed in people's perceptions and preference towards doing laundry. A bilingual educator interviewee (IME\_E1) suggested that she had observed that whereas most Chinese people only separate clothes by colour when washing, Australians or other ethnic community members might also opt to separate clothes by a particular material (wool, cotton), colour (dyes), kid/adult clothes, or clean/dirty clothes. One Chinese respondent (FC\_2) said that her family members usually washed their underwear and babies' clothes by hand rather than using the washing machine. They believed that it was hygienic in that way.

### ***5.2.2 Vernacular sustainable practices- saving water***

Participants were asked about the water-saving actions they conducted at home as well as the traditional techniques they practiced in their cultures. Diverse and inventive water-saving skills were found among the two ethnic minority groups and the Australian group. Rather than listing all of the water-saving measures reported by the participants, the findings below focus on the diverse techniques between groups.

#### **1) Australian households: do-it-yourself water collecting and recycling practices**

Apropos of Australian participants, the most reported actions included installing a water tank to collect rain water for outdoor use or for flushing the toilet(s), recycling grey water by piping the water collected from the laundry for watering the garden (see **Error! Reference source not found.**), fitting water efficient shower heads and water-saving toilets, using a carwash service, and purchasing water-efficient appliances. Even though, indicated by two respondents, installing a water tank or other facilities required time and financial input, they were still willing to consider these options; and, the investment could be made up for by benefits in long term.

We got a water kit from water kit programming from Sydney water. When we purchased the house, the plumber come around and put in the water saving shower head, and changed the washing room, we got new toilets which are very water efficient. And the washing machine is water efficient, when we buy the machine, there is information like power rate, water rate. (IA\_1)

I don't have a rainwater tank, I thought I might, should get a rainwater tank,... it's convenient to the toilet, it would be, I thought I should to get a tank to water the garden, but it's just one of the projects [I] need to do, [with] my time and my finances. (FA\_1)

For me, it's the same too, the water tank or solar panels, I think I could afford it, or may be [I need] financing. (FA\_2)



**Figure 5. 2 Households use of tank water or recycled grey water for watering gardens or other outdoor activities** (pictures provided by cultural probe participants, see Chapter 3, Section 3.6.3 for details about the cultural probe research approach).

Ideas for capturing water and recycling through re-plumbing were mostly implemented by house dwellers based on their awareness of water restrictions and their intention to pursue free use of water. Unit or apartment dwellers were less likely to report the implementation of these kinds of actions due to structural restrictions such as space and ownership; nevertheless, they indicated their intention to undertake such measures if they bought a house.

If we got a new house, we probably will look at the water chain and use grey water for the garden or something like that. (IA\_1)

Now, everyone has a rainwater tank, but nothing about the having a tank [can] recycle or drains away the grey water from the washing machine. With the rainwater and grey water mixed together would be okay to use. Maybe they (government) need to be pushed towards funding recycled water at the



laundry. (FA\_2)

The study found that actions of collecting and reusing water, using portable devices in the process of preparing food, washing or showering were rarely undertaken among Australian respondents. ‘Not convenient’, ‘never thought about it’ and does ‘not seem to matter’ were considered by respondents to be the main concerns for not participating in this water reuse practice. We don’t reuse water, when we cook [and] there is some water you can reuse it, but we generally don’t reuse it. The water in the washing machine just goes down the drain, it’s not catchable, you can’t put a bucket or something, probably possible but not convenient. (IA\_1)

In contrast, these practices were commonly undertaken among the Chinese and Korean respondents as explained in the following section.

## 2) Chinese and Korean households: tips for frugal (green) living

Rather than engaging in big water-saving activities, such as installing rainwater tanks or home water-recycling systems, the Chinese and Korean participants were more likely to utilise their everyday water-saving skills on activities that were easy to conduct and did not require financial investment. These skills included:

- Collecting water from the kitchen sink and using it for washing vegetables or rice, watering plants in the garden, or pot plants on the balcony (see Figure 5. 3);
- Capturing water in the bathroom or kitchen sink for flushing the toilet using a bucket (see Figure 5. 3);
- Reserving water from washing vegetables by plugging the sink so that it can be used for dishwashing –soaking dishes (the first step of the dishwashing process);
- Using a little water to wet the dishes before washing rather than soaking them in water in the sink;
- Brushing teeth and rinsing the mouth with water that is stored in a cup; and
- Turning off the shower when soaping

I usually wash vegetables in a sink, and plug the sink [to reserve water]<sup>47</sup> (IC\_3)

It takes a few minutes for water to be heated to the suitable temperature. It is a waste to just let the

<sup>47</sup> The original words: ‘我通常在水槽里洗菜，拿塞子塞住[来储水]’.

water flow away during.<sup>48</sup> (IC\_1)

Every people (Chinese migrants) have many ways to save water, especially the elderly.<sup>49</sup> (IME\_E1)

They (the elderly from Chinese community) are very conscious about water [use]. They usually collect water that is used for washing vegetables and rice to water flowers.<sup>50</sup> (IME\_E1)

Some elderly female [Koreans] wash [their] hair with a basin and a bucket rather than under the shower head. (FK\_2)



**Figure 5. 3** Collecting kitchen water to water plants; collecting and storing grey water using a bucket or other big container, and using the grey water to flush the toilet (provided by Chinese cultural probe participants)

### 5.2.3 Incentives: traditional virtues, education and citizen obligations

When asked about their reasons for undertaking water-saving action, the Chinese participants were more likely to regard it as a kind of traditional virtue: being frugal. This traditional virtue was inherited from their grandparents and parents through learning in daily life or through the primary education system. Participants considered saving money as an incentive for being frugal; but, when financial benefits were not obvious, the factor supporting water-saving behaviour might be the awareness of waste in its own right. Chinese participants also emphasised the importance of their prior environmental experiences in China, i.e., promoting awareness of water conservation. Korean respondents, however, were more likely to claim that they conserved water because they cared about the future, especially about securing their children's futures.

<sup>48</sup> The original words: '洗澡放水等水加热的需要好几分钟, 这期间流掉的水感觉很浪费'.

<sup>49</sup> The original words: '每个人(华人)都有很多节水的方法, 特别是老人'.

<sup>50</sup> The original words: '他们(华人老年人)非常 conscious about water [use](谨慎的用水), 都是用洗菜的水, 洗米的水来浇花.'

This (saving water) is a traditional habit that [is] handed down through generations.<sup>51</sup> (IME\_E2)

Frugality is a tradition virtue of Chinese people. We are opposing extravagance and advocating thrift. I followed the same rule even living in Australia.<sup>52</sup> (IC\_3)

It's also related to my experience, when I was a child, my family need[ed] to pay money to get water, so I am worried that situation happens again. (FK\_2)

It also because we care about the water, concern for the future. (FK\_3)

In contrast, Australian participants tended to mention the recent drought, water restrictions, and citizen responsibilities as their incentives for undertaking water-saving action. In other words, the Australian participants were concerned about more locality-related factors.

When we had the last drought, I think it's relatively recently, maybe a couple years ago, I remember, on the TV news, they always said how much water in the Warragamba in the end of day. So you can't be unconscious about it, saving water, because there is a limit to reach, people talk about it. You feel you have the responsibility to save water. (IA\_1)

I think it (saving water) isn't against the price to save a couple dollars, I think it's a moral thing, you know, moral or obligations to save water after the 10 years' drought. (FA\_1)

Although half of the Chinese and Korean participants indicated their awareness of the recent drought, their vague sense of drought was not strong enough to trigger particular water-saving actions. In this way, Chinese and Korean migrants were less likely to be thinking in the local context.

#### ***5.2.4 Challenges faced when undertaking water conservation activities***

##### **1) Perceptions of water pricing and its influence**

There was no difference between ethnic groups in their perceptions of the price of water; the only difference was between dwellers of houses and those of multi-dwellings. The majority of participants claimed they had no knowledge of the pricing of water. Some were generally oblivious to the unit-price of water on their water bills, while some others said that there was no such information on their water bills at all. Participants living in units or apartments said

<sup>51</sup> The original words: '这(节约用水)[是]种老一辈的传统习惯, 一代代传承下来的。'

<sup>52</sup> The original words: '中国人本身有个节俭的传统, 本身没有奢侈的用水习惯, 就算是环境变化了, 我还是这样的生活。'

that their water cost per quarter was a fixed charge, which left them no way of knowing how much water they actually used or the pricing of water from the bill (Appendix 14). For participants who lived in houses, the actual amount of water used and the cost of the usage appeared on the bill (Appendix 15), however, as they indicated, what they usually noted was the overall cost they needed to pay. The comparative average usage graph over time, and/or the graph comparing their usage to Sydney's variously sized households' average usage was not noted. Unit- and apartment dwellers opined that the fixed charge did not really encourage water saving, because no matter how much they tried to save water, there was no single difference on the bill, and therefore, most importantly, their efforts were neither recognised nor appreciated.

The water charge is fixed, so the water price has little influence to my water use.<sup>53</sup> (IC\_1)

However, the water pricing approach for multi-dwellings could have greater impacts on ethnic minorities. An interviewed bilingual educator stated in regard to the experience of some recently-arrived Chinese migrants who lived in apartments that the pricing was regarded not merely as ineffective when encouraging saving water but, moreover, it sometimes hindered them from saving water. People who were very cautious about water use in China, who had saved water by undertaking various easy-to-conduct methods (such as using grey water collected from the kitchen to flush the toilet or clean the floor), persisted with these water-saving practices after they moved to Sydney. However, unlike in China, their efforts were not reflected in the bill. For some people, saving money might not be an incentive for saving water. But, it was indeed regarded as recognition or encouragement, something which can be seen and is therefore more realistic than 'saving for the environment'.

They (Chinese background migrants) are not familiar with the local water issues, and they think water is cheap. Besides, no matter how much water they use (more or less), they couldn't see any difference in water charge when looking at their water bills. Therefore, they tend to think it is not necessary to save water at home.<sup>54</sup> (IME\_E2)

Even when some people went away and spend a long time in China for holidays, they still need to pay

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<sup>53</sup> The original words: '我是固定水费，所以水价对我来讲没有什么区别'.

<sup>54</sup> The original words: '不了解澳大利亚的水资源的情况，以为澳大利亚的水很便宜，拿到水单一看，多用点水或者少用点水，钱都是一样的，所以认为没有必要去节水'.

the same amount of money for the water bill...it was frustrating, then some of them just quit or not keen to continue the water-saving practices (sic). (IME\_E1)

## 2) Challenges for Australian respondents

Economic factors might not be an effective incentive for saving water. But, they were considered a large obstacle when adopting a water saving action which cost money, e.g., installing water tanks, a grey water recycling system, or fixing leaking taps or toilets.

Although the Australian participants showed enthusiasm for having water tanks or getting their properties re-plumbed, the financial cost (the cost of purchasing a tank, hiring a plumber and the costs of re-plumbing) was usually a big challenge for them. Other difficulties involved technical problems: not able to (because they lived in units), no reliable information, or considered not feasible in terms of cost-benefit after considering the pricing policy.

I can't get a tank to use grey water to flush toilet, it'd just be costing a fortune to do that.

Also I don't quite know, I look all the brochures, I don't know [if] I should get a big one here, or a small one? I need sort of someone to coming and say, look, this is what we do, this is the plan, this is how much. (FA\_2)

Nevertheless, when speaking of fixing a toilet or replacing the toilet with an efficient one, using Sydney Water or government rebates, the Australian participants all said that it was much easier to make the decision even though it meant spending extra money, unless it was beyond out of their control, such as if they were renting.

For the Chinese participants, besides the financial cost and the structural difficulties, there were other misgivings. The Chinese respondents tended to have misgivings about the potential cost-benefit, convenience, appearance, environment change, and impacts on their daily lives. The Chinese interviewees opted for a steady life style and routines that they wanted to maintain. Changes could only be contemplated when misgivings were dispelled.

For something new, [when] I am not familiar with or know little of it, I am not willing to try or accept [it] as I am not sure how efficient it would be and how much it would improve my living condition,

even if there is a rebate<sup>55</sup>. (IC\_2)

This also reflected the problem encountered by many ethnic minority persons, which is the lack of specific information. This lack of information usually fuelled misgivings.

Information should show what actual benefit could be achieved by adopting the promoted water-saving actions or facilities. How much they actually save, if you see it, it is easy to do it. (FK\_4)

### **3) Challenges for Chinese and Koreans: lack of information**

Participants were asked how knowledgeable they were about water issues in Sydney, and about their access to information related to water issues. The Australian participants all said that they knew a lot about Sydney's water issues; for example, the recent drought, Warragamba Dam, water restrictions, the desalination plant, and local water/river activities. Regarding some specific issues, however, they were only vaguely aware of them; for example, how helpful the desalination plant was to Sydney's water supply and whether the water restrictions had been lifted. In addition to the mass media, e.g., TV, newspapers and radio, the Australian respondents all nominated Sydney Water as an important and useful source of water-related information. They were generally aware of the various rebates, offers and water-saving tips available on, or through, Sydney Water's website. Two Australian community participants reported that they had used the rebate services provided by Sydney Water, such as fixing the shower hose or replacing the toilet. One other Australian participant said that although he had not used any of the rebates, he was aware of the types of services available and where to find them.

I know information and resources are there, I can find them when I need, it's just a few clicks away. (IA\_1)

I think everyone knows that, I think different generations have varied sources of information. You can hear it from the TV news, if you are on the radio you can hear it. (FA\_1)

However, the scenario for the Chinese and Korean participants was different. Only one Chinese participant indicated his familiarity with water issues in Sydney due to his

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<sup>55</sup> The original words: '我现在生活在一个可以接受的环境下, 那么, 做了改进以后是未知的, 我不确定它会 improve (改善)我的生活, 我甚至不能保重它能达到我现在的的状态, 所以我不愿意去花钱, 去冒这个风险'.

occupation; and, only one Korean participant claimed to be actively searching for water-saving tips on the Internet or other media, based on the consideration of ‘wise-living’. As suggested in Section 5.2.4, all of the other Chinese and Korean participants said that they had never received water-related information from the government in their mail boxes or, they were not aware of any such information.

I heard that Sydney has a shortage of fresh water sources. However, I have no concept how serious the shortage is. And I know little about where our drinking water comes from, the purification and recycling, as well as what I should do and how to respond<sup>56</sup>. (IC\_3)

I know very little about water situation in Sydney, not much. (FK\_1)

With regards to the information provided with the water bill, one Chinese participant indicated that she did not pay her water bill as she lived in a shared apartment. And, she was not knowledgeable about ‘Sydney Water’. It seemed that the information provided with the water bill did not work well for those participants, even though a telephone or website was provided with Chinese and Korean translations saying ‘we speak your language’. Some participants indicated that they knew about Sydney Water, and they knew that there might be useful information on the Sydney Water website, however, none of them had ever visited the website. A bilingual environmental educator (IME\_E1) said that some people called for information about water services; however, they were less likely to ask about water conservation information over the phone. This was echoed in the statement of an environmental manager (IME\_M4) of a local council. He spoke of the range of water programs and activities organised by the local council; however, he said, recruiting and encouraging non-English speaking community members to participate in their programs had proven a big challenge for them.

I put an advertisement about a certain local water activity in a Chinese newspaper. It was in a good size and in a proper position in the newspaper. It was written ‘please call this number for more information’, however, no one called (sic). (IME\_M4)

Chinese and Korean participants who had been living in Australia for a long time (10 years or more) said that they were aware of some water issues, for example, the drought, the

<sup>56</sup> The original words: ‘我听说悉尼是个水源性的缺水，但是这个水从哪里来，怎么处理(净化)，怎么再生利用，这些我都不知道，所以就算他说缺水，我也没什么概念，也不知道应该怎么做’.

desalination plant, or the water restrictions. This knowledge came from several sources including newspapers (mainly ethnic newspapers, sometimes from an English language newspaper), television, the Internet, friends, some community societies or groups such as a church group (most mentioned by Korean participants), local seniors groups, or an overseas ethnic community association. Although all of the Chinese and Korean participants said that it did not matter in which language they received information about water in the print media, they suggested that information provided in their native languages might be more eye-catching. Although none of the Korean participants nominated language difference as a barrier impeding them from accessing relevant water information, the information provided by the Korean media might be more effective. The Korean participants, as well as the bilingual educator, all suggested publicising efficient ways of saving water in Korean magazines<sup>57</sup>, which are published and circulated weekly in the Sydney area and are free of charge.

As I knew, Chinese background migrants had limited access to information and resources. All materials are in English language, therefore, most Chinese migrants might not be aware of the available resources, such as the rebate programs or services provided by the governments (regarding water conservation)<sup>58</sup>. (IME\_E2)

I was aware of the water issues broadcasted on the TV, though [I] did not quite follow verbally. I might [have] receive[d] some flyers along with the water bill before, but there seemed nothing important [in them], I just threw them away. (FK\_1)

I think the best source for [the] Korean community to get information about water conservation is Korean magazine. (FK\_4)

#### **4) Chinese and Koreans: less active in water activities**

As suggested above, the Chinese and Korean respondents were actively conducting do-it-yourself water-saving practices at home, both indoors and outdoors; however, in contrast, they were found to be less active in participating in water-related issues outside of

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<sup>57</sup> The free weekly Korean-language magazines alluded to by the Korean participants are not associated with the daily Korean language newspaper but are separate publications. However, no water issues-related information was found in any of those published magazines. Therefore, they were not included in the print media studies.

<sup>58</sup> The original words: ‘我觉得华人在这边能得到的资源还是比较 limit(局限的),所有的资料都是 in English (用英文展示的) ... 像是政府有些什么服务或者是补贴政策, 大多数华人都不知道的’.



their homes. Chinese participants said that they seldom participated in water activities in Sydney, one reason being that they claimed to be busy or to have other priorities. Another reason might be that they tend to be reserved and experience discomfort with public engagement, especially communicating with the government. When participating in local activities, they indicated that they, being the minority groups among the participants, tend to feel somewhat excluded from the mainstream. This may be the reason why ethnic minorities prefer to participate in environmental activities conducted by an ethnic social group rather than those organised directly by the local council.

Another important reason might be their perceptions of who is responsible for dealing with water problems. Nearly all of the Chinese respondents considered it to be the government's responsibility to protect water resources and secure the water supply. The individual's role is to cooperate with government policy and management within the scope of the household, and to monitor the government's performance in the public sphere. Most of them believed that it was up to the government to find effective ways of solving the water problems. They saw the contribution of an individual's water-saving practices as minimal, similar to trying to 'quench the fire of a cartload of firewood with one cup of water'<sup>59</sup> (*IC\_1*). Korean participants also tended to believe that their ability to help solve water problems was limited, and that the government should, and can, secure the water supply. Engineering approaches, such as accessing alternative water sources, creating a neighbourhood-based decentralised water recycling system or using an efficient water use appliance were believed by some Chinese participants to be the efficient solution to water problems. Beliefs about responsibility for, and possible solutions to, urban water management issues were influenced by the presence or absence of these issues in the media. I now turn to the important findings of the media studies work which consider how water issues were presented in English-language and Non-English print media in Sydney.

### **5.3 Media and ethnicity: the print media coverage of water issues across language divides**

This section presents the results of a media study which examined water coverage and framing in five English and Non-English (ethnic) print media (see Section 3.7, Chapter 3).

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<sup>59</sup> The original words in Chinese are '杯水车薪 (bei shui che xin)'

Similarities and differences were identified in the media coverage of water issues across language divides; more importantly, it provided insights into the diverse construct of water perceptions among ethnic communities.

### ***5.3.1 Varied significance of coverage, geographic scope, temporal distribution of coverage and theme coverage***

Four hundred and sixty-two water articles were collected. The distribution of articles across newspapers is shown in Table 5. 1. *The Sydney Morning Herald* (SMH) published 144 articles, accounting for 31.2 per cent of the total samples. Among those articles, news items comprised 50.7%. The Chinese-language newspaper – *Australian New Express Daily* (ANED) contained 99 water articles, mainly news items (78.8%). *The Daily Telegraph* (TDT) and *Australian Chinese Daily* (ACD) accounted for 19.9 per cent and 20.1 per cent of total samples respectively. The composition of article types in the TDT resembled the SMH, with 54.4 per cent news. The *Korean Daily Hoju Dong-A* (KDHDA) had the least coverage of water issues, with only 34 articles, of which 58.8 per cent were in news form. The prominence (points scored) of water coverage across newspapers is shown in Table 5. 1. The SMH scored highest and the KDHDA was least prominent in reporting water issues.

**Table 5. 1 Coverage of water articles across five newspapers**

Newspaper	Number of articles (% of total sample)	Points scored	Number of articles of each type and percentage within the newspaper			
			news	features/opinion	letter	Other
The Sydney Morning Herald	144 31.2%	1229	73 50.7%	40 27.8%	25 17.4%	6 4.2%
The Daily Telegraph	92 19.9%	880	50 54.4%	23 25.0%	19 20.7%	0 0
Australian Chinese Daily	93 20.1%	806	86 92.5%	1 1.1%	/ <sup>a</sup>	6 6.5%
Australian New Express Daily	99 21.4%	1006	78 78.8%	10 10.1%	2 2.02%	9 9.1%
The Korean Daily Hoju Dong-A	34 7.4%	337	20 58.8%	7 20.6%	0 0	7 20.6%
<b>Total</b>	462 100%	4258	307 66.5%	71 17.5%	46 10.0 %	28 6.0%

*a: No letters published in the Australian Chinese Daily*

#### **1) Geographic scope of water coverage**

The results of the geographic scope of water issues discussed by various newspapers, exploring how Chinese and Korean newspapers balance the coverage of Australian and the

homelands' water issues, are shown in Table 5.2. The two English newspapers mainly covered local (Sydney) water issues plus a range of state and national water issues. The two Chinese-language newspapers and the Korean-language newspaper varied from the English-language newspapers in their geographical scope of coverage. Both Chinese newspapers showed more interest in reporting homeland relevant water issues, with 52.7 per cent of ACD's and 56.6 percent of ANED's water coverage focusing on homelands. There was also significant homeland water reporting (35.3%) in the KDHDA, although its Australian focused reporting was 47 per cent of the total water coverage.

**Table 5. 2 Distribution of water articles across scopes within newspaper of each language**

Newspaper	Number of water articles of each scope and percentage within the correspondent newspaper								
	Local	State	National (MDB) <sup>a</sup>	Other city/state	China	Taiwan	Hong Kong	South Korea	Global/overseas
The Sydney Morning Herald	66 45.8%	19 13.2%	26 (25) 18.1%	1 0.69%	/	/	/	/	7 4.9%
The Daily Telegraph	60 65.2%	8 8.7%	12(8) 13.0%	0 0	/	/	/	/	4 4.4%
Australian Chinese Daily	14 15.1%	6 6.5%	3(0) 3.2%	17 18.3%	42 45.2%	0 0.0%	7 7.5%	/	4 4.3%
Australian New Express Daily	10 10.1%	7 7.1%	9(0) 9.1%	11 11.1%	49 49.5%	6 6.1%	1 1.0%	/	6 6.1%
The Korean Daily Hoju Dong-A	9 26.5%	6 8.82%	3(0) 8.8%	1 2.9%	/	/	/	12 35.3%	3 8.9%
<b>Total</b>	159 34.42%	47 10.17%	53(32) 11.47%	30 6.49%	91 19.7%	6 1.30%	8 1.73%	12 2.60%	24 5.19%

a: MDB refers to the Murray-Darling Basin

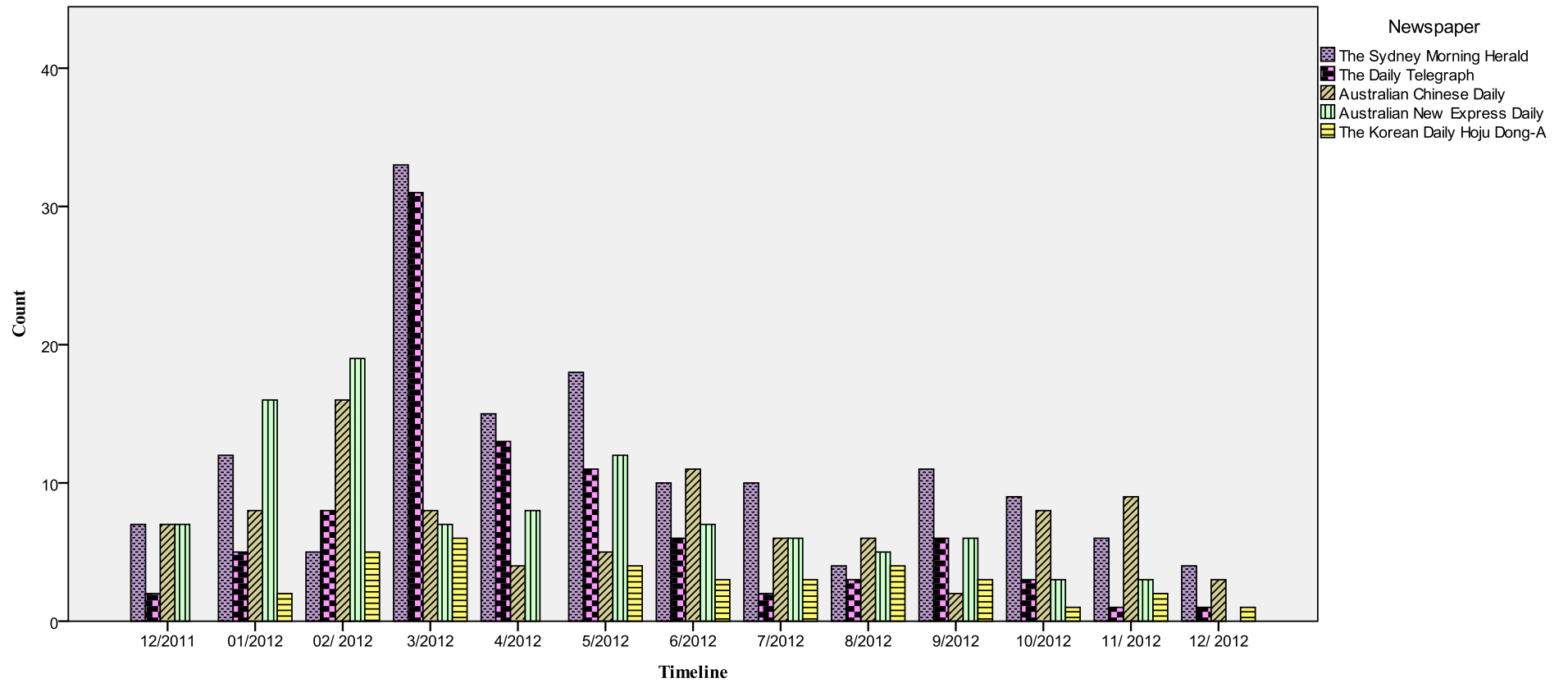
## 2) Water coverage distribution across the study period

Differences and similarities across newspapers were identified in the distribution of water coverage over time (see Figure 5. 4). Table 5. 3 outlines the main water issues in Sydney and NSW discussed during the study period. Water issues were reported in both English-language newspapers most frequently in March 2012, with substantial coverage in the following two months. The issues were rainy weather and the desalination plant. The Murray-Darling Basin Plan and the consideration of using recycled water for drinking were prominent in the SMH between March and May. Compared to the SMH, TDT more intensively reported and facilitated a debate on the wet weather, the desalination plant, and the climate change

arguments. Thirty-two water articles were published between March and May; however, the Murray-Darling Basin Plan and ‘drinking recycled water’ were either absent from or relatively less covered in TDT.

**Table 5.3 Timeline of the main water issues in Sydney and the NSW region, 2011-2012**

Date	Event/issue
Jan 2012	Heavy rain across January; and Wentworth Group of Concerned Scientists rejects the draft Murray-Darling Basin Plan
27 Feb 2012	Sydney Water plans to raise water prices and cut down the number of its staff
29 Feb 2012	Warragamba dam 88 per cent full, and experts call for desalination plant closure
Mar 2012	Warragamba dam spills for the first time in 14 years; and the operators of the desalination plant announce that it will halve its output to 45 million litres a day; and IPART releases its draft report of the review of Sydney Water's prices
3 Apr 2012	New doubts on Murray-Darling plan, the NSW government rejects draft Murray-Darling Basin Plan
Apr 2012	Warragamba dam spills for the second time; and the Federal Government announces Australia officially drought-free for the first time in more than 10 years
7 May 2012	Review of Metropolitan Water Plan to secure water supplies beyond 2025, purified wastewater for drinking is again considered after 5 years
May 2012	NSW government sold the desalination plant's 50-year lease to a consortium of Hastings Fund Management and Ontario Teachers' Pension Plan for \$2.3 billion; the federal government's Climate Commission indicated extremes in weather more likely as the climate changes
20 Jun 2012	IPART release its final report on Sydney Water's price, water price increases from 1 Jul 2012
4 Jul 2012	Weather experts warns a possible return of El Nino
1 Sep 2012	Weather experts predict a trend towards El Nino
22 Nov 2012	Murray-Darling Basin Plan finally signed into law



**Figure 5. 4 Distribution of water articles by newspaper from December 2011 to December 2012**

Water issues were covered intensively in February in the two Chinese-language newspapers, reported frequently in May in the ANED, and in June and November in the ACD. The coverage in February, which was mainly China focused, included continued news reports about river pollution in China and drought conditions in some provinces of western China. The sub peak of water coverage in June in the ACD was found to be associated with water price increases in Sydney and Melbourne, which were of less concern to the English-language newspapers) and the drought conditions in China. Likewise, the high coverage in November in the ACD was related to water charges and water quality reports in Melbourne (Victoria, Australia) and China. In comparison, the water reports in the KDHDA were more evenly distributed across the time period, with slightly more coverage (six articles) in March, and with no issue dominating.

### **3) Coverage of water topics across newspapers**

The themes of the water-related articles were examined and the results are shown in Table 5. 4. It was possible that multiple topics were discussed in each article. Twenty-four major topics were identified, among which, generally speaking, river/beach pollution and improvement was the most frequently discussed topic (14.5%), followed by rainfall/ wet weather (10.8%).

Water plan/ water right/ river health (18.75%) were the most frequently covered topic in the SMH; but, coverage was virtually missing in the three ethnic newspapers. The TDT was more interested in reporting rainfall/wet weather (28.3%) and desalination plant (15.2%) stories. The KDHDA covered river/dam, rainfall/wet weather, drought and water infrastructure issues more frequently, albeit there were fewer articles than in the other newspapers. The two Chinese-language newspapers had a common interest in water pollution, mostly in China, with coverage at 24.7 per cent and 20.2 per cent respectively. They also both appeared interested in water pricing issues (17.2% and 15.2%), drinking water quality and drinking water pollution (19.4% and 16.2%). This coverage was substantially higher than the corresponding coverage in the English-language newspapers and the Korean-language newspaper.

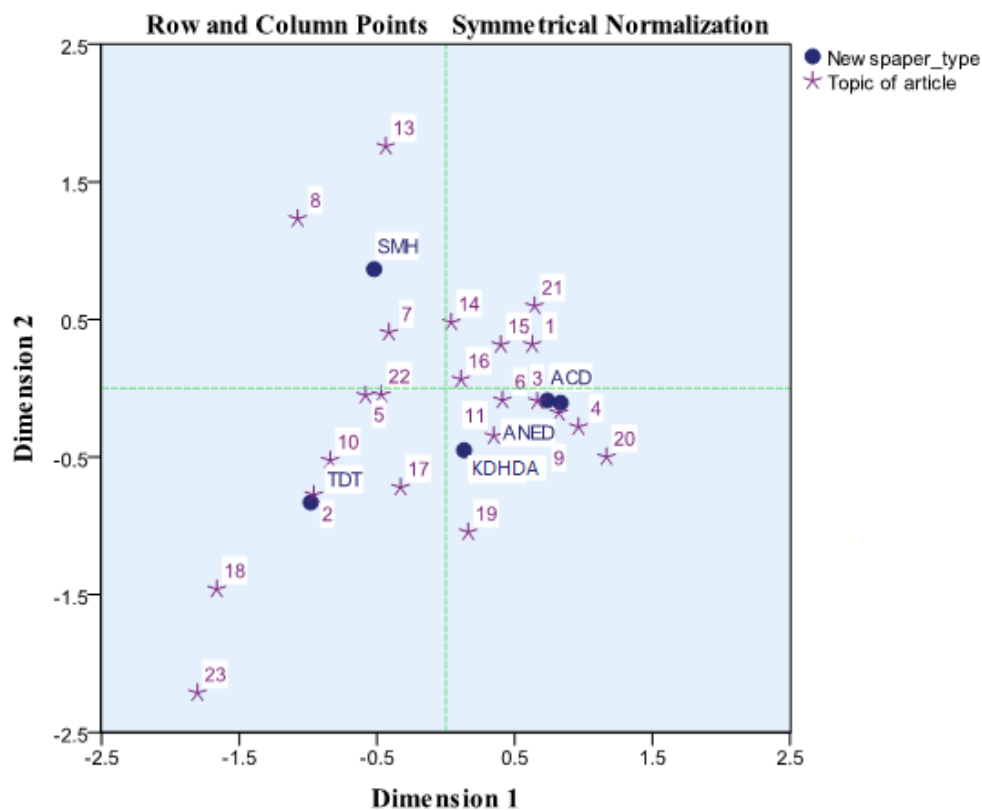
Other issues, with high coverage in both English language newspapers, were water conservation/ water saving/ efficient water use, and river/dam (especially the Warragamba Dam which supplies over 80 per cent of Sydney's water). These issues were covered less

frequently by the two Chinese-newspapers. Recycled water for drinking was an important local issue during the period; however, surprisingly it was barely mentioned outside of the SMH (7.6 % of its total coverage). Likewise, storm water/grey water collection and reuse, which are important alternative water sources in Sydney, were generally missing in the three ethnic newspapers.

**Table 5. 4 Coverage of water issues (theme) across five newspapers**

ID	Theme	The Sydney Morning Herald		The Daily Telegraph		Australian Chinese Daily Total (Australia focused)		Australian New Express Daily Total (Australia focused)		The Korean Daily Hoju Dong-A Total (Australia focused)		Total
		Count	p.	count	p.	count	p.	count	p.	count	p.	
1	River/beach pollution and improvement	18	12.50%	2	2.20%	23(3)	24.70%	20(3)	20.20%	0	11.80%	14.5%
2	Rainfall/ wet weather	12	8.30%	26	28.30%	4(4)	4.30%	5(5)	5.10%	5 (2)	14.70%	11.4%
3	Water price/ water charge	7	4.90%	5	5.40%	16(14)	17.20%	15(11)	15.20%	1(1)	2.90%	9.5%
4	Drinking water quality/ pollution, ground water pollution	3	2.10%	3	3.30%	18(5)	19.40%	16(6)	16.20%	3(1)	8.80%	9.3%
5	River/ dam	16	11.10%	13	14.10%	5(3)	7.5%	3(2)	1.00%	7(1)	20.60%	9.5%
6	Water supply/ water security/ water shortage	8	5.60%	7	7.60%	7(1)	7.60%	16(1)	16.20%	2(1)	5.90%	8.7%
7	Water conservation/ water saving/ efficient water use	17	11.80%	8	8.70%	6(6)	6.50%	4(2)	4.00%	3(3)	8.80%	8.2%
8	Water plan/ water right/ river health	27	18.75%	8	8.70%	0	0.00%	1(0)	1.01%	0	0.00%	7.6%
9	Drought	4	2.80%	1	1.10%	6(1)	6.50%	14(7)	14.10%	6(2)	17.60%	6.7%
10	Desalination plant	8	5.60%	14	15.20%	5(3)	5.40%	1(1)	1.00%	1(0)	2.90%	6.3%
11	Water infrastructure/ facility	4	2.80%	4	4.30%	6(2)	6.50%	7(0)	7.10%	5(2)	14.70%	5.6%
12	Flooding	5	3.50%	1	1.10%	2(2)	2.20%	3(1)	3.00%	1(1)	8.80%	3.0%
13	Recycled water/recycled water for drinking	11	7.60%	0	0.00%	1(1)	1.10%	2(0)	2.00%	0	0.00%	3.0%
14	Water program/ campaign	4	2.80%	1	1.10%	2(2)	2.20%	2(2)	2.00%	1(1)	2.90%	2.2%
15	Water service/ management/ water authority	3	2.10%	1	1.10%	3(3)	3.20%	3(2)	3.00%	0	0.00%	2.2%
16	Water consumption	2	1.40%	1	1.10%	2(0)	2.20%	1(1)	1.00%	1(1)	2.90%	1.5%
17	Water storage	1	0.70%	3	3.30%	3(3)	3.20%	0	0.00%	0	0.00%	1.5%
18	Storm water/grey water collection and reuse	1	0.70%	5	5.40%	0	0.00%	0	0.00%	0	0.00%	1.3%
19	Sewage treatment	0	0.00%	2	2.20%	1(0)	1.10%	2(0)	2.00%	0	0.00%	1.1%
20	Water waste	0	0.00%	1	1.10%	1(0)	1.10%	2(1)	2.00%	0	0.00%	0.87%
21	Water policy in general	1	0.70%	0	0.00%	1(1)	1.10%	1(1)	1.00%	0	0.00%	0.65%
22	Water use restrictions	1	0.70%	1	1.10%	1(1)	1.10%	0	0.00%	0	0.00%	0.65%
23	Water tanks	0	0.00%	2	2.20%	0	0.00%	0	0.00%	0	0.00%	0.43%
24	Other	4	2.80%	3	3.30%	5(4)	5.40%	5(4)	5.10%	0	0.00%	3.70%

Further examination of topic coverage across the five newspapers was conducted using correspondence analysis techniques (see Section 3.7.3, Chapter 3). While correspondence analysis (presented in Table 5.4) graphically illustrates the newspaper-topic correlations, the main purpose of employing this approach was to outline the relative positions of the newspapers in terms of topic coverage. In order to make the map clearer, ID-numbers were used to represent each theme (see the first two columns in Table 5.4 to match ID numbers with a specific theme). As shown in Figure 5.5, the Chinese-language newspapers were located on the right side of the vertical origin line and were very close to each other, indicating similarity in topic coverage. The two English-language newspapers located on the left side of the vertical original line were significantly different from the Chinese-language newspapers in topic coverage, and were also significantly different from each other. The SMH is located in the II quadrant and TDT is located in the III quadrant. In contrast, the Korean-language newspaper differed in its selection of water topics from both the English- and Chinese-language newspapers.



**Figure 5.5 Correspondence analysis of themes and newspapers<sup>a b</sup>**

*Note: a. The correspondent topic for each number marked next to the star in the Figure can be found in the ID and Theme columns in Table 6. b. A total of 462 cases (samples) were entered in the correspondence analysis. Dimension 1 and dimension 2 accounted for 84% variance of data (56.9% and 27.0%, respectively).*



### ***5.3.2 Diverse frames of water reporting across language divides***

Seventeen media frames were identified by recognising the theme and tone through careful reading of each item collected from the five newspapers. Note that multiple frames exist in some articles. In such instances, more than one frame might be identified for one article. Attention was given to how each frame characterised the importance of water security and water conservation, questions pertaining to government management of water issues, information about community engagement, and controversial water issues. In the next section, 17 frames are explained, and at least one example is provided for each frame to demonstrate the essence of the frame.

#### **1) Frames**

##### **(1) Attention to water security**

This frame focuses on water security issues at the local, national, overseas or global scope. It constructs the impression of the importance of water security by demonstrating water scarcity, water shortage, water stress problems due to increasing population, drought conditions, unpredictable weather patterns, climate changes, or unsustainable water use.

Examples of this frame include:

广西逾20万人饮水难 (Translation: over 200 thousand people in Guangxi suffering from a drinking water shortage) -- Australian New Express Daily (Anon, 7 May 2012, p. 15).

##### **(2) Lack of trust/ questioning management**

This frame focuses on two sets of actors: government departments or agencies, especially government water authorities, and private water utilities. Lack of trust or questioning relates to poor management or to the unsatisfactory performance of government departments and water authorities when dealing with various water issues.

A range of water issues were discussed or reported in this frame. For example, managing actors were variously questioned or blamed for ‘putting an end’ to the River Watch program, ‘removing’ public health experts from the water quality authority, for their poor performance in protecting river or drinking water sources from pollution, or for wasting taxpayers’ money by keeping the desalination plant in full operation while water was flowing over Warragamba Dam.

These documents show clearly that the O'Farrell government<sup>60</sup> has little commitment to protecting the environment and is only concerned about window-dressing. – Sydney Morning Herald (Chubby, 12 Dec 2012, p. 8)

THE agency set up in response to the city's worst drinking water crisis, the Sydney Catchment Authority, has been left without a public health expert on its board for the first time in its history, prompting concerns about the oversight of its operations. – Sydney Morning Herald (Nicholls, 10 Dec 2012, p.5)

Yes, our cities need drought-proofing. But politicians rushed to build the most expensive option to fit their green agendas. – The Daily Telegraph (Bolt, 11 Oct 2012, p. 13)

The O'Farrell government has cut \$54 million from Sydney Water's infrastructure budget which will mean poorer service, less maintenance and longer and more unplanned water interruptions- and now they want to charge families more for less. – Sydney Morning Herald (Patty, 20 Jun 2012, p.5)

### (3) Government's commitment to/efforts for water security

This frame, which reverses the frame 'Lack of trust/questioning management', refers to the positive performance or achievement of governments or other water management bodies. It includes policies, plans, financial investment, or other relevant initiatives adopted to secure water supply or to deal with other water-related problems.

6市聯手護母親河 水質一年比一年好 (Translation: Six city governments work together in protecting the mother river; water quality has got better and better over the years) – Australian Chinese Daily (Anon, 4 Aug 2012, p. a13)

### (4) Community engagement/ camaraderie

This frame focuses on the importance of community members engaging in water programs, individuals adopting water conservation practices, community support for/assistance with water initiatives, volunteers, and environmental groups working together on water issues.

Little fish in a big pond save power –and the planet... Derek Spielam would think how it would be much better if it was full of turtles. Now his own backyard swimming pool is one of 50 on Sydney's north shore that have been turned into ponds, saving thousands of dollars on power and water bills. – Sydney Morning Herald (Power, 19 Nov 2012, p.3)

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<sup>60</sup> It refers to the 93rd ministry of the Government of New South Wales, which was led by Barry O'Farrell between 2011 and 2014

The community in general was mentioned in this frame; but, no specific claim was given to an ethnic community in most Australian-focused news. Only two articles in this frame related specifically to ethnic community members. In order to note the difference, the following sub-frame was identified, ‘emphasis on ethnic community engagement’ for use in further analysis.

“中部海岸亚洲式餐馆节省用水计划”，于日前在富丽宫酒楼推出，富丽宫酒楼已安装了“省水”蒸笼。(Translation: A Central Coast Saving Water in Asian Restaurants Project was carried out recently at the Marigold Chinese Restaurant; and, the Marigold Chinese Restaurant has installed waterless wok stoves in its restaurant – Australian New Express Daily (Anon, 2 Apr 2012, p. 6)

#### (5) Waste

This frame was often employed, focusing on wastage of water, e.g., losing an opportunity for efficient use of water, allowing water to flow from the storage dam, stormwater running into the sea, waste of money, waste of facilities, and the waste of resources associated with particular water issues.

Four [desalination plants]- worth more than \$10 billion - are already mothballed. - The Daily Telegraph (Bolt, 11 Oct 2012, p. 13)

...價值上千萬元的飲用水，從大壩中溢出，流入大海中。(Translation: Drinking water worth tens of millions of dollars spilled from the dam<sup>61</sup> and ran to the sea) – Australian Chinese Daily (Wen, 1 Mar 2012, p.1)

#### (6) Emphasis on water consumption

This frame emphasises the consumption of water or the unsustainable manner of water use at the individual/household or city/country levels. The frame draws attention to the phenomena of high water consumption, the severity of the possible consequences, and concern about this issue.

按國際水協2010年報告，港人耗水量排世界第10位...當中以淋浴耗水量最多。(Translation: According to the International Water Association 2012 Report, per capita water consumption in Hong

<sup>61</sup> Warragamba dam – Sydney’s primary water supply dam.

Kong ranked 10<sup>th</sup> in the world ... among which showers are the largest water user) – Australian Chinese Daily (Anon, 4 Jun 2012, p. 23)

#### (7) Promoting efficient water use/water conservation

This frame focuses on the importance, necessity, urgency or benefit of improving water use efficiency, or of conducting water conservation. The claim was often associated with financial aspects at the household level, or with sustainability at the city/country levels.

如果每周只洗两次澡，一个人一周可以节水超过100立升，一年节水5吨。(Translation: If a person only takes two showers a week, that person can save over 100 litres of water a week, five tons a year) - Australian New Express Daily (Anon, 1 Feb 2012, p.45)

#### (8) Opportunity/ towards sustainability

The impression of opportunities was constructed by presenting innovative approaches or technological solutions to help deal with water issues in a number of articles. Examples of this frame include articles on the acceptance of recycled water for drinking, and water-efficient or water-sensitive designed residential buildings. Another component of this frame is progress towards sustainability of water use and management.

This is the first time the technology has been applied on such a large scale ... ‘a water-sensitive urban-designed precinct’. – Sydney Morning Herald (Boyd, 01 Dec 2012, p. 39)

A few environmentally sensitive commercial developments in the central business district have installed recycling systems and use grey water in toilets,... In Central Park, each unit will have its own meter, giving residents the same incentive as house owners to save water. – Sydney Morning Herald (Moore, 28 May 2012, p. 5)

#### (9) Difficulty/ Conflict/ Cost

This frame contains three elements: difficulty, conflict and cost. Difficulties, at the household level, refer to the sacrifice of households due to water restrictions or an increase in the price of water. Difficulties were often claimed to be associated with living standards, inconvenience or financial aspects. Difficulties, at the city/country level, refer to hardships in securing water supply, water quality, promoting water conservation or water environment protection, such as dated water infrastructure and a shortage of finance.

Another component of this frame refers to the conflict among stakeholders vis-à-vis a water plan, water rights, or controversial arguments arising from climate change-induced drought claims. Costs, the third component of this frame, emphasises financial costs, resources or energy consumption when securing water supplies the cost of updating supply facilities, or the increase in the price of water caused by the desalination plant.

水电气价也看涨 消费者负担加重。尽管悉尼消费者的用水量减少了1%，但水费也涨了17%。  
(Translation: Water, electricity and gas prices rise, increasing customers' economic burden. Although Sydney customers' water consumption reduced 1 per cent, their water bills increased 17 per cent.) — Chinese New Express Daily (Wen, 29 Nov 2012, p. 4)

Most of the sewer lines in the older parts of Sydney leak because they are old, cracked earthenware or bricks and mortar. So during heavy rain, rainwater leaks in, under both public and private land, and exceeds the capacity of the sewer mains to carry the water-sewage mixture... This is a classic example of “out of sight, out of mind”. – The Sydney Morning Herald (Court, 7 Jan 2012, p. 12)

The plan has become a political football, kicked over one state boundary to the next. – The Daily Telegraph (Townsend, 29 May 2012, p.211).

#### (10) Inequity

Inequity, a minor frame, is usually associated with water pricing or water plan themes. This frame refers to the unevenly apportioned benefits for or burdens on households living in different types of dwellings, or experiencing different financial conditions. With regard to the water plan issues, the inequity frame emphasises unequal representation of related interest parties.

Apartment residents to be hit hardest by rising water prices – Sydney Morning Herald (Patty, 20 Jun 2012, p.5)

#### (11) Concerns about / Preparation for future drought

This frame emphasises concerns about future droughts, or the importance/urgency of preparing for future droughts. It is different from the frame of ‘Commitment/effort for water security’ and ‘Community engagement/ camaraderie’, in that it draws attention to ‘future drought’, and is often accompanied by weather/rainfall/climate outlooks, and past drought experience themes and notions for ‘drought proofing’.

THE relaxation of water restrictions has removed the incentive for many householders to save water, but it's just a matter of time until we hit another dry spell, a sustainability expert warns. — Sydney Morning Herald (Boyd, 1 Dec 2012, p. 39)

It's a land of drought and flooding rains. Just because we've had a few wet years doesn't mean the problem is solved. — The Daily Telegraph (Jones and Lentini, 15May 2012, p. 8)

평균적으로 NSW 전체는 더욱 건조해져 가뭄이 강기화하고 악화될 위험이 증가해 산불 위험도 높아질 예정이지만 (Translation: The NSW state, on average, is expected to become drier, increasing the risk of longer, harsher droughts and of bushfires) – The Korean Daily Hoju Dong-A (Jin, 15 May 2012, p. 1)

#### (12) Optimistic outlook for water situation

This frame which refers to the optimistic outlook for water storage, rainfall pattern or water security in general, conveys a positive impression about current or future water conditions.

Ecology-wise, Sydney is now virtually drought-proof. If it stopped raining right now – which it won't – our water supply is good for another four years without any rainfall at all. — The Daily Telegraph (Blair, 4 Jun 2012, p. 13)

#### (13) Counter-drought argument

This frame is similar to the 'optimistic outlook for water situation' frame in that it conveys a positive message regarding rainfall and water conditions. But negative attitudes towards government actions and/or some key roles evolved. Concomitant with the recent increase in rainfall, more voices were heard questioning or opposing climate-change driven drought claims. Actions performed based on this claim were questioned.

How wonderful that Warragamba Dam is nearly at 100 per cent capacity. But hang on -- weren't we told over and over by so-called climate-change experts (aka alarmists) that Sydney would run out of water in five years? —The Daily Telegraph (Harrison, 1 Mar 2012, p. 32)

#### (14) Attention to water pollution problems / security and health concerns

This frame refers to health or security concerns arising from wastewater recycling, water environment pollution and drinking water contamination. This frame was found to be present in different themes in different language newspapers; therefore, the frame was split into two

sub frames for use in further analysis: ‘Attention to water pollution problems /health concerns regarding drinking water pollution’ and ‘Attention to water pollution problems /health concerns regarding river water pollution’.

原本干净的河水突然变成了触目惊心的血红色 (Translation: The originally clean river suddenly became shockingly blood red) – Australian New Express Daily (Anon, 17 Dec 2011, p. 13)

新州中部海岸部分地区的自来水供水系统发现含大肠杆菌 (Translation: Escherichia coli was found in drinking water system in some areas of Central Coast, New South Wales) – Australian New Express Daily (Jiang, 8 Feb 2012, p. 5)

自来水危机, 合格率仅50%, 无城市实现直饮 (Translation: Drinking water crisis, merely 50% reached the quality standard) – Australian New Express Daily (Anon, 9 May 2012, p. 19)

#### (15) Information about water conservation

Different from the frame ‘Promoting efficient water use/water conservation’, this frame focuses on providing households with useful tips and practical information on how to save water at home, and highlights the resources that are available from local government or environmental groups, such as seminars, education programs or rebates.

Michael Smit, national programs manager with water conservation organisation The Savewater! Alliance, says re-using water from the rinse cycle will save money. For about \$20, people can run a hose from the machine to the garden and re-use rinse water on the lawn and flowers, saving money on their water bills. – The Daily Telegraph (Larkin, 4 Mar 2012, p. 31)

澳洲慈濟分會環保展覽會。期待...能啟發大家一起...從生活習慣開始, 省水, 省電及資源回收。(Translation: Australia Tzu Chi<sup>62</sup> environmental protection exhibition. Expecting to inspire everyone to save water, save electricity and to recycle in daily life.) – Australian Chinese Daily (Anon, 6 Mar 2012, p. 6)

유비무환의 정신으로 각 가정에서 물을 지혜롭게 이용하는 방법을 알아보자. 생활 습관부터 바꿔라! 가정에서 물을 가장 자주 그리고 많이 사용하는 곳은 욕실, 주방,

<sup>62</sup> Australia Tzu Chi is one of the sub-organizations of Tzu Chi Foundation, which is an international non-government organisation (NGO) with a network of volunteers and employees.

세탁실이다. (Translation: Learn how to use water wisely in daily life at home in the spirit of yubimuhwan (be prepared and you won't have a crisis). Start from lifestyle change, from bathroom, kitchen and laundry where water is used most often in the home) – The Korean Daily Hoju Dong-A (Young, 3 Aug 2012, p. 14)

#### (16) Safety

This minor frame was related to the release of water from a dam. It appeared with flood issues and the operation of the dam gate. Warragamba Dam, Sydney's major water storage dam, it is claimed, is vital for Sydney's water security and should not be used for flood mitigation purposes.

It has been known for well over 100 years that the Hawkesbury Valley<sup>63</sup> is subject to floods. Why have people been building there?

A water supply dam yet again being called into service as a flood mitigation dam. It can't be both. For water supply it must be kept full: for flood mitigation it must be kept empty.

—Sydney Morning Herald (Lynch, 27 Mar 2012, p. 10)

#### (17) Water Pricing

This frame refers to the introduction or explanation of new water pricing policies, or relevant debate on water pricing and water charge issues in general. Concerns about water price increases were present in this frame, but were not necessarily associated with the influence of price increases on the water use practices of households.

WATER bills could rise under a new arrangement which will see Sydney's desalination plant pass on its electricity-trading losses and gains. – The Daily Telegraph (Anon, 3 Mar 2012, p. 10)

## 2) The coverage of frames across newspapers

The relative frequency of these frames across newspapers is displayed in Table 5. 5. Both similarities and differences were observed across newspapers. As shown in Table 5. 5, in general, the English and Chinese-language newspapers tended to question the performance of, or note a lack of trust in how governments or related water authorities deal with water issues. There was a total of 84 articles in this frame: 20.1 per cent of the water-related articles in the SMH, 14.1 per cent in the TDT, 23.7 per cent in the ACD and 17.2 per cent in the ANED. The two Chinese-language newspapers also published many articles using the 'government's

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<sup>63</sup> Hawkesbury Valley is located at the western end of the Hawkesbury River, which surrounds the Sydney Metropolitan area on the north.



commitment/effort for water security’ frame; 15.1 per cent in the ACD, and 25.3 per cent in the ANED. There was relatively less usage in the two English-language newspapers (3.5% and 8.7% in the SMH and TDT respectively).

**Table 5. 5 Number and ratio of articles with various frames**

Frame	The Sydney Morning Herald		The Daily Telegraph		Australian Chinese Daily Total (Australia focused)		Australian New Express Daily Total (Australia focused)		The Korean Daily Hoju Dong-A Total (Australia focused)		Total
	count	r.	count	r.	count	r.	count	r.	count	r.	
	(2) Lack of trust/ questioning management	29	20.1%	13	14.1%	22(13)	23.7% (11.3%)	17(9)	17.2% (7.1%)	3(1)	
(3) Government’s commitment/effort for water security	5	3.5%	8	8.7%	14(5)	15.1% (4.3%)	25(8)	25.3% (6.3%)	4(1)	10.5% (2.6%)	56
(9) Difficulty/ Conflict/Cost	23	16.0%	10	10.9%	6(5)	6.5% (4.3%)	12(6)	12.1% 9(4.7%)	2(1)	5.3% (2.6%)	53
(14a) Attention to water pollution problems / security and health concerns (drinking water)	6	4.2%	2	2.2%	16(5)	17.2% (4.3%)	22(4)	22.2% (3.1%)	1(0)	2.6% (0)	47
(14b) Attention to water pollution problems / security and health concerns (rivers, groundwater or water in general)	12	8.3%	2	2.2%	15(2)	16.1% (1.7%)	11(3)	11.1% (2.4%)	1(1)	2.6% (2.6%)	41
(1) Attention to water security in general	8	5.6%	7	7.6%	6(1)	6.5% (0.9%)	15(4)	15.2% (3.1%)	4(2)	10.5% (5.3%)	40
(8) Opportunities/ towards sustainability	17	11.8%	8	8.7%	3(3)	3.2% (2.6%)	2(1)	2% (0.8%)	2(1)	5.3% (2.6%)	32
(5) Waste	8	5.6%	12	13.0%	5(2)	5.4% (1.7%)	3(2)	3% (1.6%)	0	0.0% (0.0%)	28
(11) Concerns about / preparations for future drought	10	6.9%	7	7.6%	5(0)	5.4% (0)	3(3)	3% (2.4%)	3(3)	7.9% (7.9%)	28
(12) Optimistic outlook for water situation	6	4.2%	14	15.2%	3(2)	3.2% (1.7%)	3(3)	3% (2.4%)	0	0.0% (0.0%)	26
(16) Safety	6	4.2%	4	4.3%	4(2)	4.3% (1%)	1(1)	1% (0.8%)	7(5)	18.4% (13.2%)	22
(4a) Community engagement/ camaraderie	12	8.3%	4	4.3%	1(1)	1.1% (0.9%)	1(0)	1% (0)	0	0.0% (0.0%)	18
(4b) Ethnic Community engagement/ camaraderie	0	0	0	0	1(1)	1.1% (0.9%)	2(2)	2% (1.6%)	2(2)	5.3% (5.3%)	5
(13) Counter-drought argument	1	0.7%	16	17.4%	0	0(0)	0	0 (0)	0	0 (0)	17
(17) Water Pricing	3	2.1%	2	2.2%	6(4)	6.5% (3.5%)	4(2)	4% (1.6%)	0	0 (0)	15
(7) Promoting efficient water use/water	3	2.1%	3	3.3%	3(3)	3.2% (2.6%)	2(1)	2% (0.8%)	1(1)	2.6% (2.6%)	12
(15) Information about water conservation	3	2.1%	4	4.3%	2(2)	2.2% (1.7%)	1(1)	1% (0.8%)	2(1)	5.3% (2.6%)	12
(10) Inequity	2	1.4%	2	2.2%	1(1)	1.1% (0.9%)	1(0)	1% (0)	2(1)	5.3% (2.6%)	8
(6) Emphasis on water consumption	4	2.8%	0	0.0%	1(0)	1.1% (0)	0	0 (0)	0	0 (0)	5
(18) Other	2	1.4%	1	1.1%	1(1)	1.1% (0.9%)	2(1)	2% (0.8%)	4(0)	10.5% (0)	10

Apart from the ‘questioning’ and ‘commitment/effort’ frames, two Chinese-language newspapers – the ACD and the ANED - also frequently framed stories by drawing public attention to water pollution problems and drinking-related health concerns (17.2% in the ACD and 22.2% in the ANED) and river/beach issues (16.1% and 11.1% respectively). The ANED also featured high usage of the ‘attention to water security in general’ frame (15.2%). In contrast, the two English newspapers’ water reports appeared more often in other frames used by the English newspapers. Specifically, the SMH framed a significant number of articles in either ‘difficulty/conflict/cost’ (16%) or ‘opportunity/towards sustainability’ (11.8%) frames, while the TDT tended to publish stories in the ‘counter-drought argument’ (17.4%), ‘optimistic outlooks for weather pattern and water supply situation’ (15.2%) and ‘waste’ (13%) frames. As evident in Table 5. 5, these frames appeared less frequently in both the Chinese newspapers and the Korean newspaper. At most, two or three articles used the ‘optimistic outlook for weather pattern and water supply situation’, ‘counter-drought argument’ or ‘opportunity/towards sustainability’ frames in both of the Chinese-language newspapers. Despite the fact that a total number of 12 articles in the ANED used the ‘difficulty/conflict/cost’ frame, only six were focused on Australia. Apropos of the KDHDA’s framing, within its limited array of water articles, a sizable proportion were found only in the ‘attention to water security in general’ and ‘safety’ frames, with four articles accounting for 11.8 per cent of its total samples and seven articles accounting for 20.6 per cent respectively. Other frames either appeared less frequently, or were absent from the KDHDA.

As shown in Table 5. 5, only a small percentage of articles were framed by either ‘promoting efficient water use/ water conservation’ or ‘information for water conservation’ in all newspapers. This put little emphasis on the importance of water conservation and offered the readers limited access to practical water saving information. And while ‘community engagement/camaraderie’ was emphasised in the SMH in a considerable number of articles (8.3%), it was rarely used by the other four newspapers. Regarding the frame of ‘community engagement/camaraderie with ethnic community specifically focused’, this frame was only found in one or two articles in each of the two Chinese-language newspapers and the Korean-language newspaper. Somewhat surprisingly, only a small percentage of articles were framed by either ‘promoting efficient water use/ water conservation’ or ‘information about water conservation’ in all newspapers (at most 4 articles in each of the newspapers).

A further examination of the coverage of frames across five newspapers was conducted using correspondence analysis techniques (Figure 5. 6). The main purpose for employing this approach was to outline the relative relationship between frames and newspapers graphically (see Section 3.7.3, Chapter 3 for details of the correspondence analysis technique). In order to make the map clearer, ID-numbers were used to represent each frame (see the first two columns in Table 5. 5 to match ID numbers with a specific frame).

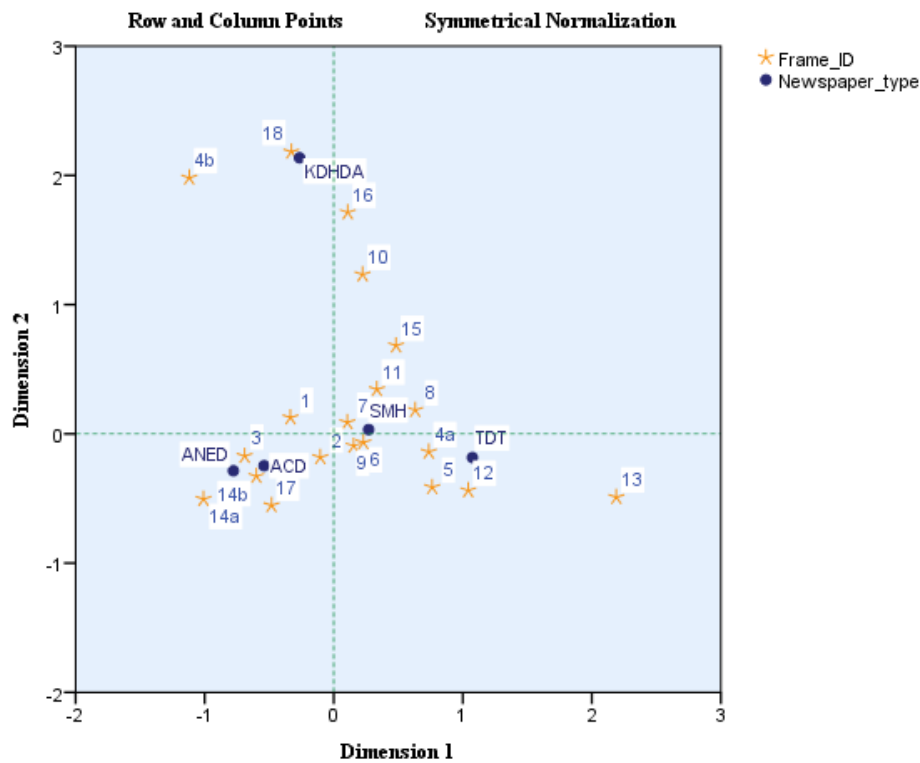


Figure 5. 6 Correspondence analysis of frames and newspapers

As shown in Figure 5. 6, newspapers printed in different languages showed significant divergence in their usage of frames while newspapers published in the same language were similar to each other. This finding is pertinent to the framing of stories and was somewhat similar to the finding regarding themes covered by the newspapers (Figure 5.5), although the Korean-language newspaper differed from all of the other newspapers in its framing of stories. The KDHDA tended to frame stories in terms of safety; and to a lesser extent in terms of ethnic community engagement. The two Chinese-language newspapers, which were located on the left side of the vertical origin line, were very close to each other, indicating similarity in the framing reports between them. Their framing tended to favour the government's commitment to addressing water issues (Frame 3), water pricing, and the framing of stories as water pollution. The two English-language newspapers were located on the opposite side of the Chinese newspapers (the right side of vertical original line),

indicating that they were significantly different from the Chinese-language newspapers in frame coverage. And whereas the SMH tended to present stories through frames of conflict and consumption, the TDT framed stories in terms of waste (Frame 5) however, it was also optimistic about the water situation outlook (Frame 12) and was the closest publication to presenting a counter-drought argument (Frame 13) by highlighting the water levels of the Warragamba Dam.

## **5.4 Conclusion**

This chapter and the previous chapter have considered water perceptions and water usage patterns across ethnic communities, and how the ethnic and cultural backgrounds of individuals influence their household water usage. Each of the sections corresponds to one or more of the research approaches presented in Chapter 3, the findings of which, taken together, contribute to answering the research questions introduced in Chapter 1.

Section 5.2 presented the results of the qualitative studies, further explored diverse water use practices and considerations across the ethnic groups identified in Chapter Four. It found that diverse dishwashing methods, teeth brushing habits, and the considerations and perceptions of water use were closely related to people's cultures and the social contexts in which they grew up.

Section 5.3 presented the results of media studies, which explored the coverage and framing of water issues across five Sydney newspapers published in three different languages. This section found that water issues were reported and presented divergently in print media across the language divides, specifically, the significance of coverage, geographical focus, coverage of topics, and frames employed. The analysis of these findings will facilitate an understanding of the construction of diverse perceptions among ethnic communities and the relationships between perceptions, knowledge and behaviour.

The next chapter will analyse the empirical results presented in this chapter in the light of existing research, and develop answers to each of the research questions posed in this thesis.

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## CHAPTER 6 DISCUSSION

### 6.1 Introduction

The overall aim of this study is set out in Chapter 1 wherein it sought to examine the influence of ethnicity and culture on domestic water use. Specific research questions were introduced in Chapter 3 (See Section 3.2, Chapter 3 for details). Specifically, the study aims to identify (1) whether ethnicity influences household water use, and if so, (2) what are the reasons and factors that underpin the ethnic differences and disparities? In other words, how does ethnicity influence households' water use and conservation? (3) What is the role of environmental acculturation in engaging persons of ethnic minority in water conservation activities? (4) What are the implications of ethnic diversity for water demand management? The major findings derived from each research approach were summarised in Chapters 4 and 5. This chapter will answer each research question (with the exception of Question 4 – 'opportunities and challenges' which will be answered in Chapter 7) by interpreting the findings and explaining how the results extend the existing knowledge of the topic. It is necessary to note again that in many instances, when citing particular studies, the original terminology in said studies was used in this thesis<sup>64</sup>.

### 6.2 Ethnic disparities in attitudes and pro-conservational behaviour

Apropos of the first question, the results reported in Chapters 4 and 5 indicate that ethnicity does influence residential water use. Specifically, ethnic differences exist in perceptions, knowledge, attitudes, pro-conservational behaviour and daily water use practices; and, in turn, ethnicity is likely to influence per capita water consumption (estimated based on the CCD-level water records obtained from Sydney Water). Ethnicity as a factor was found to statistically, significantly affect respondents' knowledge and attitudes regarding water issues. The influence of ethnic factors on pro-conservational behaviours and water consumption was also found to be significant, even greater than socio-demographic factors such as household size and income.

Before continuing, it is important to note that in the statistical analysis of knowledge,

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<sup>64</sup> For example, if the term 'Black-Americans' was used in the cited original study, the term was also adopted in this paper when referring to that study, unless it is clearly a racist term or has subsequently been rejected by the community in question.

attitudes and behaviour in this study, the coefficient tests on the ‘Others’ variable were barely significant (see Tables 4.9 and 4.10), suggesting that respondents in the ‘Others’ group were not significantly different from the Australian group in the above tested aspects. However, this is not necessarily indicative of a similar concern or activism among Australians and ethnic minorities outside of the Chinese and Korean communities regarding water use and conservation. As suggested in Section 3.4.2, Chapter 3, the ‘Others’ group included a large proportion of English respondents (defined by themselves), so this particular group is not necessarily representative of the diversity of other ethnic communities outside of Sydney’s Australian, Chinese and Korean populations. ‘Others’ group respondents were more likely to have been born in Australia, were likely to have higher English proficiency, and were considered to be more acculturated into the main-stream culture of Australia. Therefore, they were more likely to resemble Australians in spheres of knowledge, attitudes and behaviour. Although many respondents may have realised that the Australian, Chinese and Korean groups were subjects of the survey, judging by the fact that the questionnaire was printed in three languages, they were happy to participate in the survey. This may imply that ‘Others’ respondents were concerned about water issues, willing to support research into water management, and seemed eager to convey a voice by participating in the research. In effect, they expressed deeper concern for water issues than the other migrant groups.

This study has aimed to explore perceived effects of ethnicity on water use and conservation through the cross-cultural analysis of Australian, Chinese and Korean respondents; therefore, the discussion below focuses on these three ethnic groups. The category of ‘Others’ was used for comparison purposes only where necessary<sup>65</sup>. The disparities and differences among the studied ethnic communities will be explained and discussed in detail in the following sections.

### ***6.2.1 Disparities in knowledge and perceptions of water issues***

Knowledge measurements based on the self-reported questionnaires indicated that the Chinese and Korean respondents had lower levels of knowledge about water issues than their Australian counterparts (Table 4.8, Figure 4.17). Moreover, whereas the Chinese and Korean

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<sup>65</sup> Australian, Chinese and Korean communities were the main focus of this study. A fourth category ‘Others’ was created and used in the questionnaire data analysis due to the high number of ‘other’ responses in the questionnaire survey. See Section 3.4.2, Chapter 3.

respondents were less likely to think that they had good water knowledge, their Australian counterparts were relatively more confident about their knowledge, believing themselves to have quite a bit or substantial knowledge of water issues (Table 4.8, Figure 4.17, also see Section 5.2.4, Chapter 5). Fewer Chinese and Korean respondents reported that they knew about Sydney's main water source, had heard of Sydney Water, or knew of the recent drought event (Figures 4.4 and 4.5, Table 4.1).

The Chinese and Korean respondents tended to think that Sydney has little or no water supply problems compared to their home country (Figure 4.2). Specifically speaking, while the Australian respondents were likely to express concerns about Sydney's water supply, in the belief that they were facing either water supply restrictions or a crisis, the Korean respondents were more likely to think that Sydney's water resources would be 'able to maintain the city's general use'. Similarly, the Chinese respondents were more likely to believe that Sydney had sufficient water resources.

The findings were, generally, consistent with those of the DEC's (2005) survey series, which revealed that non-English speaking ethnic minority members seemed less familiar with and/or knowledgeable about local environmental issues. Researchers may argue that residents of a city with environmental problems should have enough experience and awareness to care about the environment, regardless of ethnicity and culture (Johnson, 2002; Vaughan, 1995). However, due to language constraints, non-English speaking communities may feel excluded from environmental communication (DEC, 2005). Lack of communication could prevent them from being sufficiently concerned about, or active in, environmental protection. It seemed that the Chinese and Korean migrants might be left out of communication about water issues (further discussion of the reasons behind this knowledge-disparity is presented in Section 6.3.1).

### ***6.2.2 Variations between groups' concerns about water and pro-conservational behaviour towards water conservation***

As expected, the findings showed that differences existed among ethnic groups in relation to concerns about water use and conservation activities. More specifically, the Chinese respondents were found to have less positive pro-conservational attitudes and to be less active in water-saving than the Australians (yet various effective water-saving actions were taken by

the Chinese respondents although these actions were not replicated by other ethnic groups that participated in this study). Similarly, the Korean respondents also scored lower in both water concern and pro-conservational water use behaviour compared to their Australian counterparts. As shown in Table 4.8, the between-group difference in general attitude and the self-reported behaviour were both significant at 0.01 level. This was consistent with the general argument of social and psychological studies (see Greenberg, 2004; Greenberg, 2005; Hershey & Hill, 1977-78; Johnson et al., 2004; Jones & Carter, 1994; Taylor, 1982), that disparities exist between the majority (Anglo-white) and the ethnic minorities' concerns and behaviour towards both the environment (environmental protection in general) and specific environmental issues (such as pollution, recycling and nature protection). This study, in line with that of Smith and Ali (2006), argues that such differences also exist in water use related concerns and activities between ethnic and cultural groups.

However, rather than simply alluding to a 'concern gap' or 'action gap' between the majority and the ethnic minority (as indicated in some studies, see Taylor (1982; 1989b), Mohai (2003), Pfeffer and Stycos (2002)), my analysis revealed 'ethnic variations' in environmental concerns and behaviour<sup>66</sup>. While the Australian group ranked first and the Chinese ranked third in the measurements of attitudes and pro-environmental behaviour, the Korean group appeared to take a middle position (although their responses were more like those of the Chinese participants than the Australians' responses). Consistent with the arguments presented by Johnson et al (2004) and Segura and Bowler (2005), who argued that while the white-majority/ ethnic-minority difference is prominent, environmental perceptions held by ethnic minorities were not necessarily homogenous. This study has found that ethnic communities from the same geographic region (i.e., Northeast Asia) and with similar cultural backgrounds were not necessarily homogenous vis-à-vis concern about water and pro-environmental behaviour. Disparities were also found to exist between the Chinese and Korean respondents' daily water use practices (e.g., showering practices (Section 6.2.3)).

This finding provides further support for the argument articulated by Johnson et al. (2004) that the single categorisations (such as geographical based categorisation: Asians, Europeans, and Africans, or race based categorisation: e.g., Latinos) adopted in most related studies

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<sup>66</sup> It highlighted the different level and forms of concerns and action that have water-saving outcomes, even if they are undertaken for other reasons, e.g., frugality, habit, community responsibility.



might prove problematic. As Johnson et al. (2004) suggest, in their study of Asian Americans, categorising them as homogenous added to the difficulty of interpreting why they were more pro-environmental compared to the other ethnic minorities. The Chinese and Korean migrants share similar cultures and came from the same continent. However, cultural values appertaining to the environment, which were developed subject to diverse climatic and environmental conditions, languages, traditions and histories in their original places of residence, are unlikely to be the same. Other factors, for example information access and media reporting, are also likely to matter (Section 6.3.1- (3) and (4)). Further discussion focused on understanding the reasons behind ethnic variation in environmental concerns and behaviour is provided in Sections 6.3.1 and 6.3.2.

The categorisation of Chinese or Australians as a single group in this study also had its limitations. There is great cultural diversity across China, not only among the officially recognised 55 ethnic minorities, but within the mainstream Chinese population. Respondents who identified their ethnicity as Chinese may have migrated from countries outside of China, e.g., Singapore, Vietnam, and Malaysia. The non-ignorable variations within the Chinese group (and even the Australian group), may make it difficult to interpret the between-group differences that were identified in the study (for example, their showering practices). Categorisation enabled the study to summarise the differences that derived from ethnicity, which can serve as a foundation for future studies of within-group variations (e.g. considering factors such as rural/urban origin, and country of origin) and how they determine water use.

Given the ethnic variations in environmental concerns and behaviour, it would be extremely unwise for environmental managers, decision-makers and scholars to consider the ethnically and culturally diverse public as a homogenous community sensitive to environmental engagement. In terms of water management, as addressed by Medd et al. (2010), recognising and understanding variations in water perceptions and behaviour among ethnic and cultural groups is essential for dealing with cultural sensitivity towards water demand management. Moreover, because environmental perceptions and behaviour appear to vary by ethnicity, it would also be unwise to merely focus on the white-majority and ethnic-minority binary (Segura & Bowler, 2005), or the majority and one particular ethnic group binary (Klocker & Head, 2013) in environmental studies or environmental management.

### ***6.2.3 Culturally diverse water use practices/habits***

Water is consumed as part of an individual performing various practices in her/his daily life (Allon & Sofoulis, 2006; Medd et al., 2007). In other words, water usage is determined by peoples' daily water-use related practices such as dishwashing, doing laundry, showering/bathing, and the brushing of teeth. A comparison of water use related practices among ethnic groups indicated the existence of ethnic differences in daily water use practices (Section 4.4, Chapter 4).

Disparities were revealed in the three respondent groups' dishwashing methods, washing machine use frequency, showering frequency and length, methods of teeth-brushing, along with some outdoor water-using activities. The Chinese and Korean groups were found to be more likely to wash dishes by hand, while the Australian respondents were more likely to use their dishwashers (Table 4.21). The Koreans and Chinese' hand-washing preferences may help to explain Troy and Randolph's (2006) finding that approximately 11 per cent of respondents (based on a generalised sample regardless of ethnicity in Sydney) reported that they never use the dishwasher, despite having one at home. The figure rises to 26 per cent for high-rise dwelling occupants, which may be linked to Chinese and Korean migrants' proclivity to live in multi-dwelling properties. According to the 2011 ABS Census, the percentage of migrant households that lived in multi-dwellings (15.2%), e.g., high-rise, low-rise apartments, is nearly twice of the percentage of local-born Australians (8.7%) (Australia Bureau of Statistics, 2012). In my questionnaire survey, the Chinese and Korean respondents reported their tendency to wash dishes under running water compared to the Australians' use of their dishwashers (Table 4.21). This may provide an explanation for Troy and Randolph's (2006) finding that a considerable number of respondents in their study claimed that they rinse under running water, and the percentage for flat occupants was almost twice that of those who lived in houses. The Chinese respondents were likely to use their washing machines less frequently than the Australian and Korean respondents (Table 4.22). This finding may again help to understand why a considerable percentage (40%) of the respondents in Troy and Randolph's (2006) study had only used the washing machines two or three times, which is far below the average level of total respondents in their study.

The Chinese respondents tended to take more frequent and longer showers, while the Korean respondents tended to take longer showers but to do so less frequently compared to the Australian respondents (Table 4.25 to Table 4.27). The Chinese and Korean respondents

tended to brush their teeth using a cup of water for rinsing, whereas the Australian respondents seemed to prefer brushing their teeth using running water directly from the tap (Section 5.2.1-(3), Chapter 5). As regards outdoor water use activities, Australian respondents who had a garden tended to water the garden more often than their Chinese and Korean counterparts (Table 4.30). Australian and Chinese respondents were found to be more likely to use grey water at home compared to Korean respondents (Table 4.31). The diverse habits and routines developed in childhood in a migrant's place of origin, are important in explaining these diverse water related practices. Other factors such as climate, the convenience of modern technology and an individual's perceptions of convenience and hygiene also matter (See further discussion in Section 6.3.3).

It is important to note that this part of the study relied on a self-reported questionnaire survey, semi-structured interviews, and focus groups. Thus, these findings may not reflect the actual scenarios. For example, people may actually spend a longer or shorter period of time in the shower than they think they do, or do laundry more often or less often than they estimate. Nevertheless, the results are believed to be reliable regarding the general patterns of water use practices among ethnic groups. However, the differences in practices did not necessarily indicate that a certain group tended to use more water in certain scenarios (e.g., showering, dishwashing) than other groups. Regrettably, no actual measurement of household end-use data was undertaken. Australian respondents were found likely to use a washing machine more often than the Chinese respondents; however, this was not indicative of Australian respondents using more water than their Chinese counterparts, since the water level for each washing, the setting selected on the machine, the capacity and the water efficiency rate were all unknown. Similarly, Chinese and Korean respondents were reported to take longer and more frequent showers than the Australians; however, again, whether the showerhead was efficient, the rate of flow and whether the interviewees turned off the tap for soaping is not known. Therefore, this research cannot confirm that the Chinese and Korean respondents consume more water when showering compared to their Australian counterparts (although it is probable). Regarding dishwashing differences, although washing using a full-loaded dishwasher is argued to consume less water than washing by hand (Stamminger et al., 2004), the actual result is subject to other variables, e.g., the water efficiency rating of the machine and the number of items washed at any given time. The Australian 'classic way' of brushing teeth under running water is usually perceived to consume more water than the Chinese and Korean way of brushing using a cup. However, whether the tap is turned off after catching

water or if the water is kept running during the whole process varied, and this would change the total amount of water consumed when undertaking this activity.

The research indicated that people from different ethnic and cultural backgrounds are likely to follow distinct patterns when they undertake water-use related practices in their daily lives. This finding is consistent with the studies of Elizondo and Lofthouse (2010a) and Smith and Ali (2006), which argue that water-use practices are shaped by an individual's culture or religious custom. These practices have become part of people's habits and daily routines, with years of development within their specific social and cultural contexts (Gram-Hanssen, 2008; Medd & Shove, 2005). It appears that even after people move to a new social context, they still tend to follow the same habits and routines when performing water-use practices. This is further evident in the findings of the questionnaire survey. Approximately 49 per cent of Chinese and 52 of per cent Korean respondents confirmed no behavioural changes after they moved to Sydney. Approximately 10 per cent of Chinese and Korean respondents were not sure whether there had been any changes. Adding to the argument made in the last section, these findings further suggest that ethnic differences not only exist in knowledge, attitudes and pro-environmental behaviour, but also in the performance of daily water-use practices. As Medd et al. (2007) state, ethnicity and culture are likely to influence water consumption through the conduction of everyday water-use practices.

Rather than asserting which water-use behaviour is more sustainable, it is more important to recognise the implications of ethnic disparities in daily water-use practices for policy making and water demand management. As Gilg and Barr (2006, p. 412) observe, policies with a view on 'behavioural complexity groupings' and 'lifestyle types' would be of great effect in encouraging water conservation or other environmental conservation activities. Failure to recognise the differences in water use practices may result in little response among ethnic communities to certain policies or incentives. In effect, a 'simple one-policy-fits-all approach' for water conservation is not appropriate (Randolph & Troy, 2008, p. 453), given the different water-use practices among ethnically diverse communities. Similar to Randolph and Troy's (2008, p. 453) argument about making water conservation policies accord with the circumstances of 'different housing marketing and population segments', the findings of this study suggest that water conservation and other environmental conservation policies also need to be tailored for different ethnic communities.

It is difficult to generate change in water-use habits, but it is not impossible. The provision of practical demonstrations and specific practical advice has been suggested as an effective approach to facilitate behavioural changes by some authors (Medd et al., 2007), although practical demonstrations were not valued highly by the Chinese and Korean respondents in the questionnaire (Section 4.2.4, Chapter 4). Perhaps this is because the ‘practical demonstrations’ are not practical for people of particular cultures because the activities shown bear little relationship to their values and current practices. The disparities in daily water use practices among ethnic groups suggest that practical demonstrations and advice should be specifically designed based on cultural practices, rather than contradicting cultural preferences. Moreover, rather than merely focusing on enhancing water conservation through practice change, alternatively, as Elizondo and Lofthouse (2010a) propose, innovative design of water-using facilities based on the insights of ethnical and cultural impacts on water use practices, can better contribute to more sustainable use of water.

Given that ethnic disparities were found to exist in attitudes, perceptions, pro-conservational behaviours and daily water-use practices, a major concern is whether differences also exist in actual water consumption.

#### ***6.2.4 Ethnic effects of capital water consumption***

The results of the regression analysis of per capita water use indicated that the ethnic status (the percentage of population that is, of the Chinese or Korean ethnicity) along with other socio-economic factors, significantly predict per capita water consumption in the summer and winter periods (Tables 4.32 and 4.36). Further comparison indicates that the effects of ethnic status are even greater than those of particular socio-economic variables, e.g., the characteristics of the population’s housing and tenure status, locality of residence, and median income (Tables 4.34 and 4.38). These findings are consistent with those of Darr et al. (1975) and Murdock et al. (1991), who found that ethnic status is one of the important factors in explaining the variation in per capita water rates, proving more useful than economic or other socio-demographic factors.

The regression results indicated that the per capita water use rate is positively related to ethnic status (being Chinese or Korean rather than Australian). In other words, CCDs (SA1s) with larger Chinese or Korean ethnic minority populations are likely to have higher per capita water-use rates than areas with the same percentage of Australian population. This finding

echoes Murdock's et al. (1991) study which has shown a direct correlation between per capita water consumption and the percentage of populations who are of certain ethnic background (Hispanic or Black). It also appears to be consistent with ethnic difference in the spheres of knowledge, attitudes, pro-conservational behaviour and some water-use practices. Wherein Chinese and Korean respondents were found to be less knowledgeable about local water issues, to have less positive attitudes, to be less active in undertaking water-saving action and more likely to take long showers and to wash dishes under running water. Due to confidentiality issues, water records at the household level were not available; thus, only water data at the CCD level was collected and analysed in this study. My analysis based on the CCD level water data was not conclusive enough to stipulate any correlations between attitudinal and behavioural difference and per capita water consumption disparities. It was not established whether the Chinese and Korean respondents who evinced positive water attitudes and high levels of activism tended to consume more water than the Australians. Nevertheless, given the negative correlation between attitude, pro-environmental behaviour and per capita water use suggested by extant water studies (see Murdock et al. 1991), the results of this study suggest that attitudinal and behavioural differences between ethnicities which were identified in the questionnaire surveys are likely to contribute to the disparities in per capita water consumption. Further research based on household level data (water records and attitudinal and behavioural data) needs to be carried out to determine whether there is a casual chain between them.

### **6.3 Understanding ethnic differences and disparities in knowledge, perception, attitudes and behaviour**

As differences were found to exist among the ethnic groups in several dimensions, it is important to understand these differences, to explore the 'why' behind the differences identified, and to explain the findings within the existing knowledge. This will assist the answering of the second research question.

#### ***6.3.1 Understanding the disparities in concerns about water***

As indicated in Table 4.8 and Figure 4.17, the Australian respondents were generally found to have the most positive attitudes towards water conservation, followed by the Korean group. In contrast, the Chinese group, in general, were found to be least positive regarding water attitudes. The ethnic differences remained statistically significant after controlling the

socio-demographic factors (Table 4.10), which revealed that the differences in attitudes did not mask the variations in demographic characteristics between ethnic groups but were a result of the influence of ethnicity. As stated in the literature review (Chapter 2), two theories have been commonly used to understand the effects of ethnicity on environmental concerns and behaviour: the Hierarchy of Needs Theory and Environmental Deprivation Theory. So, which theory can be used to explain the ethnic disparities revealed in this study? Are there dimensions to understanding the differences? Answering these questions will assist in understanding the reasons behind the disparities in water concerns revealed in this study.

### **1) Hierarchy of Needs Theory or Environmental Deprivation Theory?**

According to the Hierarchy of Needs Theory, ethnic or poor people preoccupied with day-to-day pressing needs such as economic issues are generally less concerned with environmental issues (Maslow, 1970). If this proved true for the Chinese and Korean respondents, significant differences would be observable between poor Chinese, Korean and Australian respondents; and, with an increase in income, the disparities would be reduced or even non-existent (Newell & Green, 1997). However, the analysis in Table 4.10 indicates that the effects of ethnicity on water attitudes seemed not to be influenced by household incomes. In effect, it suggests that the Hierarchy of Needs Theory does not account for the differences between the Australian, Chinese and Korean respondents in respect to water concerns. Furthermore, given that Australia's Chinese and Korean immigrants are mainly middle-class, high-income, well-educated elites, a result of Australia's preference for skilled and investment immigration (Klocker & Head, 2013), the Hierarchy of Needs Theory may not effectively explain the Australian, Chinese and Korean disparities. Rising levels of income, which is a surrogate variable for meeting needs, does not explain the differences between middle-class Chinese, Korean and Australian respondents. It may be that other possible explanations such as Environmental Deprivation Theory need to be explored.

Studies that draw on Environmental Deprivation Theory or grassroots environmentalism indicate that ethnic minorities who were more likely to have been exposed to severe environmental pollution prior to migration, or are vulnerable to or actually being exposed to environmental problems after migration, were more likely to be concerned about the environment than the majority of the population (Burger et al., 2004; Johnson, 2002; Mohai, 2003; Schultz, Zelezny, et al., 2000; Whittaker et al., 2005). In other words, concern regarding certain environmental issues (such as pollution) is associated with an ethnic

minority's environmental experiences of being affected by said environmental problems such as scarcity or hazards. However, the situations of the 'Australians' and two ethnic minority groups - Chinese and Koreans - were very different from those of the participants in the above studies. Although drought and water shortage are important issues, the urgency or severity of these problems in the urban areas of China and Korea is lower than is the case in Sydney, which suffered a severe drought between 2002 and 2007<sup>67</sup>. Considering the severe water pollution problems and the relatively low per capita water consumption rates in China and Korea, the attention in these countries may be more focused on river restoration (e.g., improve the water quality in the river), or techniques to secure suitable quality water supply than on water demand management (Finlayson et al., 2013). As a result, their awareness of water conservation shaped by their homeland experiences (among the Chinese and Korean migrants) may not be as high as among Australians who have recently experienced severe drought and water restrictions. Exposure to a water shortage problem may serve as an explanation for the Australians' higher concerns about water consumption and water conservation. In terms of vulnerability, Australian respondents were more likely to live in houses, and have large backyards and gardens to maintain compared to the Chinese and Korean respondents. Thus, they were more affected by drought and water restrictions, and this further contributed to their higher positive water-saving attitudes. This argument is supported by Troy's (2005) qualitative study which found that house-dwellers in Sydney were more aware of, and more likely to respond to, water restrictions than multi-dwelling dwellers, mainly because they tend to be high water users (given the larger households and bigger outdoor areas).

It could be argued that Sydney's Chinese and Korean communities were also exposed to the same water shortage and restriction problem as the 'Australian' group. However, the findings of this study indicate that the actual circumstances of the Chinese and Korean communities seemed to differ from this assumption. As found in this study, the Chinese and Korean respondents were less impacted by Sydney's water shortage problem and restrictions because they were either less likely to water outside areas than the Australians, or less likely to be

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<sup>67</sup>Due to the severity, Sydney introduced water restrictions in 2003 in response to chronic water shortages resulting from the drought (Sydney Water, 2011). Refer to Chapter 1 for more details.



aware of their outdoor water usage due to housing type<sup>68</sup> (see further discussion in Section 6.3.3). The Chinese and Korean respondents were less knowledgeable about Sydney's water issues, and even less likely to be aware of the previous drought event and water restrictions in Sydney because some had only recently migrated to Sydney. They may have had limited information access due to language preference and/or ability to understand English. In addition, media is a crucial factor. As found in the media analysis, Chinese and Korean language newspapers were less likely to report host-country (Australia) water droughts and restrictions compared to the English language newspapers (Section 5.3.1, Chapter 5). The overwhelming reporting of home-country water problems in the Korean and Chinese language newspapers also led to the issue of identification, that is, the frequent reporting of drought and water shortage problems in the home-country (Table 5.4) is likely to give readers the feeling that, in comparison, Sydney's water supply situation seems good. Moreover, the emphasis placed on water pollution issues in the ethnic newspapers (Table 5.4) may distract their readers' attention from the drought and water restrictions. Evidence for the above arguments can be found in questionnaire findings (Section 4.2.1) that the Chinese and Korean respondents tended to think Sydney has a good water supply situation (around both quality, quantity and in the long run). The above factors probably all contribute to reduce any desire for demand management. While potentially acting as an influence on everyday water use practices at the individual and household levels among the Chinese and Koreans. The following two sections - information access and media coverage spheres - will extend the discussion.

## **2) Knowledge and Familiarity**

As indicated in Table 4.9, level of knowledge was significantly positively associated with general attitudes towards water use and conservation. This suggests that respondents with higher knowledge of local water issues were more likely to develop positive water attitudes. In other words, the lower the level of knowledge and familiarity with local water issues among the Chinese and Korean respondents, the less positive their attitudes towards water conservation. The Chinese and Korean respondents considered lack of information access and limited access to resources the main reasons for low water knowledge.

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<sup>68</sup> The outdoor areas of strata units are maintained by the strata company and water charges for watering outdoor landscapes are incorporated in strata fees rather than on tenants' water bills.

Given that the Chinese and Koreans respondents were mainly first generation migrants; it could be expected that they would be relatively less familiar with Sydney's water issues compared to the 'Australian' group. The results of the interviews and focus groups suggested that the Chinese and Koreans had limited access to information about water issues, irrespective of whether it was passively received information or positively sought. By contrast, most of the Australian interviewees claimed to be able to access a whole range of information sources whenever needed; they also knew where to find them (Section 5.2.4). The questionnaire survey found that the Chinese and Korean respondents were more likely to indicate that lack of access to information and resources were big challenges for them when attempting to implement water-saving action (Figure 4.10). The Korean and Chinese respondents were more likely to claim that they have not received information about how to save water, or had not heard of water conservation programs, compared to the Australian respondents (Tables 4.6 and 4.7).

A comparison of the sources of water issue-related information reported by the questionnaire survey indicated that responses varied significantly across the three communities (Figure 4.11). In general, the majority of Australian respondents nominated a wide range of information sources (specifically, more than 50 per cent of Australian respondents used TV, newspapers, radio and the water service corporation when seeking information about water issues). Whereas the majority of the two ethnically diverse community respondents claimed, their access to water-related information was limited to a few sources (TV, Internet and newspapers). TV was the only source nominated by more than half of the Chinese respondents. While the majority of the Korean respondents nominated only two sources: TV and the Internet. Newspapers were also one of the most nominated information sources among the two ethnic minority groups, however, it seemed that they were relatively less likely been used by the Chinese (46%) and Korean (37%) respondents as a source for water-related information compared to their Australian counterparts (62%). This trend among the Korean respondents was consistent with the DEC (2005) survey finding that 39 per cent of their Korean-speaking respondents used newspapers for information about environmental issues. This may be related to the fact that there are limited Korean-language newspapers available in Sydney: there is only one daily newspaper and a few weekly newspapers printed

in the Korean language and circulated in the Sydney region<sup>69</sup>. However, the relatively lower number of Chinese respondents who nominated newspapers as an important resource seemed contrary to the DEC's (2005) finding (46% versus 64%) that newspapers ranked above all other media (e.g., TV) as a source of information about environmental issues. This may be related to the technological changes implemented between 2005 and 2013, which have resulted in an increasing number of Chinese community members using Internet media (such as Weibo (微博 weibo)). As shown in Figure 4.11(2), more of the Chinese respondents reported the Internet rather than newspapers as their main information source. It was noticed that the Chinese and Korean respondents made less use of the radio (10% and 13% respectively) compared to the Australian group (50%), which is again consistent with the DEC's (2005) findings. This may be related to the limited number of radio programs broadcast in the Chinese and/or Korean languages in Sydney. The Koreans rarely nominated Sydney Water as a source of information about water issues. This may have been due to the fact that very few people knew about Sydney Water (see Table 4.1). This finding is important for water education programs, not just because it highlights the different trends across ethnicities, but because it also indicates possible ways via which educators can communicate with ethnic minorities about water conservation and water-related issues.

The above findings are important for designing water education and communication programs. Consistent with Randolph and Troy's (2008, p. 453) argument that a 'simple one-policy-fits-all approach' in water conservation is not appropriate, environmental communication programs should be designed based on the particular circumstances of each ethnic community. The low tendency to use the water service corporation as an information source regarding water issues suggested that water conservation-related information (e.g. water saving tips, recycling information and water rebates) that Sydney Water has publicised may not be reaching the Chinese and Korean communities. Given that the Chinese and Korean groups nominated the Internet as an important information source, as well as one of the preferred sources (Figure 4.12) for receiving water-related information, the Internet would be an important medium for promoting water conservation education among these two communities. Another opportunity to improve the water knowledge of the two ethnic

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<sup>69</sup> The *Korean Daily Hoju Dong-a* is the only Korean-language daily newspaper circulated in the Sydney region. Established in 1990, it has five issues per week. See Table 3.5 for detailed information about this newspaper. There are also a few weekly Korean-language newspapers available in Sydney, e.g., the *Sydney Korean Herald* and *The Weekly Korean Town*.

communities is via brochures. As indicated in Figure 4.12, brochures were ranked top of the preferred information sources by the Korean respondents and second by the Chinese respondents. However, combining the result of preferred sources (Figure 4.12) with that of the actual sources (4.11), it was found that the demand for information delivered in brochures was higher than the volume currently being delivered. In other words, the current amount of information delivered through brochures might be lower than the demands or expectations of the ethnic minority community. The findings could have significant implications for water education designing. The usage of brochures and the internet as means to approach ethnic minority communities should be combined with the language preference as well as culturally sensitive practical dimensions on how to save water (as addressed in Section 6.2.3). This may be done 'live' or it could be filmed and placed on the internet, or photographed and included in a culturally sensitive brochure translated into the mother tongue of targeted ethnically diverse communities.

As suggested above, the tendency to have limited information sources among ethnic communities compared to the Australian group may be related to the language-other-than-English (LOTE) preference and the relatively limited ethnic media resources in Sydney (although, the ethnic resources for ethnic communities in Sydney are enormous compared to regional areas outside Sydney.). This suggests that although there is a wide range of information and resources available, language preference (or barrier) may narrow down options (or access). As found in the questionnaire survey, the Chinese and Korean respondents expressed a strong preference for media in LOTE. The percentage of respondents who preferred to receive information only in their native language was obviously higher than for those who claimed they preferred information to be provided in English (Figure 4.13). This was consistent with the findings of the DEC's (2005) study in which non-English speaking ethnic minority members in NSW Australia were found to prefer information provided in their original languages over English, especially, newspapers, radio and/or brochures (p. 53). The results of the interviews and focus groups also suggested that language does matter in information access. The ability to read English is still a challenge for some Chinese and Korean immigrants, especially for some elderly people. They may be aware of the water issues portrayed on television judging by the images displayed; however, information provided in English from other sources may be out of their reach due to their difficulty in reading English. Apropos of the DEC's (2005) argument that strong preference is not merely due to language proficiency, bilingual people tend to prefer information provided

in their native languages alongside English. The qualitative findings indicate that although the Chinese and Korean interviewees tended to claim that they accept information provided in both English and their native languages, flyers printed in their respective mother tongues were more ‘catchy’ for them.

The questionnaire survey respondents nominated newspapers as one of the important information sources (although they were relatively less used by the Chinese and Korean respondents compared to their Australian counterparts). Newspapers ranked second for the Chinese group, and third in the Korean group (Figure 4.11a). Several ethnic newspapers were nominated by the Chinese and Korean respondents when asked about their preferred source of information about water issues. These newspapers included those studied in Section 5.3, e.g., the *Australian Chinese Daily* and the *Korean Daily Hoju Dong-A*. In addition to language preference, there are several other reasons why ethnic minority members choose ethnic media over mainstream media. As Sun, et al. (2011) suggest, ethnic media addresses the cultural and practical needs of ethnic minority groups who are generally disregarded by the mainstream media. In addition, culturally structured media reporting provides them with a sense of belonging. Migrant-focused media coverage provides them with ‘a most handy source of practical information on a wide range of services’ (Sun, et al., 2011. p. 144). Ethnic media build a platform for communication, discussion and exchange of information within the ethnic minority community, allowing the voice of a minority community to communicate with the majority (Deuze, 2006). The research component that focused on the coverage of water issues in newspapers printed in the Chinese, Korean and English languages indicated that water issues were covered and presented divergently across language divides. This was likely to influence the ethnic communities’ knowledge of local water issues and the construction of perceptions towards water issues among ethnic groups.

### **3) Disparities in media coverage of water issues across language divides**

As stipulated in Section 5.3, water issues were reported and presented divergently across language divides in print media in terms of the significance of coverage, geographic scope, coverage of topics and framing. In general, the studied Chinese and Korean language newspapers scored lower than the English-language papers in significance of coverage (see Section 3.7.3, Chapter 3 for details about the method for measuring the significance of coverage). The two Chinese and the Korean newspapers were also found to be more interested in reporting their homeland’s water issues, with little coverage focusing on the

water issues in Sydney. Moreover, relatively fewer water topics and frames were covered in the Chinese and Korean newspapers compared to the English papers.

The findings of the media analysis indicate that, as shown in Tables 5.3 and 5.4, a range of water issues were reported and discussed in the newspapers analysed for this research. These issues included water pollution, rainfall and wet/dry weather, the Warragamba dam and drinking water quality. As regards the second question, this research shows that comparisons between the newspapers that highlighted the coverage of water issues indeed differed across the language divides in several dimensions: significance of coverage, distribution across time, theme coverage and geographical scope. This was consistent with the findings of Dugas and Young (2012), Brossard, Shanahan and McComas (2004), and Ching (2010), i.e., that media in distinct cultures tend to construct environmental issues differently.

In general, water issues received relatively more attention in English and Chinese-language newspapers than in Korean newspapers. As table 5.1 shows, there were no significant differences in the number of articles or significance of coverage between the English and Chinese-language newspapers; suggesting that water is also an important issue in Chinese-language media. There was, however, significantly less coverage of Sydney water issues in the Chinese-language newspapers compared to their English-language counterparts. The Korean-language newspaper had the least number of articles and points of significance. This may in part be because the KDHDA publishes only five issues a week, while the other newspapers all publish six days per week. In addition, publication is usually suspended during important holidays, including a two-week break over the New Year holiday. Even allowing for these factors, it appears that the coverage of water issues in the KDHDA is less than that of the other newspapers studied.

According to agenda-setting theory, the volume of reporting and salience given to certain issues contributes to the importance of such issues (McCombs & Ghanem, 2001). From this perspective, the low coverage of water issues in the Korean-language newspaper suggests that it has little potential to positively draw the Korean community's attention towards water issues. Alternatively, considering the degree of interaction between media and audience perceptions (Slater, 2007; Zhao, 2009), the low coverage may be interpreted as reflecting the relatively low priority accorded to water-related issues by the Korean community.

Apropos of the distribution of water-related reports over time, there were distinct distribution patterns across the language divides (Figure 5.4). Close examination suggested that the divergent patterns between newspaper distributions may have been a reflection of diverse interests in water topics and the geographical focus. This points to another two important findings of this study; varied geographic scope, and varied theme coverage across media.

*Divergence in geographic scope: Sydney versus ethnic homelands*

The two English-language newspapers were found to present a wide range of local, regional, national and international water issues. Focus was predominantly on local water issues (Table 5.2). In contrast, the Chinese-language newspapers appeared to include a higher coverage of the homeland's water issues than Australian-relevant water issues, with only a small proportion of articles focusing on local (Sydney) water issues. While the two Chinese newspapers are produced in Sydney, they are national<sup>70</sup> in focus and circulation. Therefore, national coverage of water issues, especially other capital cities, reduces the space for reporting local (Sydney) water issues. The Australia/homelands divide in Chinese- and Korean-language coverage of water reports reflects the ethnic newspapers' nature: catering to the immigrants' need for both home and host country information (Morrissey, 2001; Zhou & Cai, 2002). Ethnic media not only need to integrate or incorporate migrants into the local society by providing local information and guidance (Adoni et al., 2006; Zhou & Cai, 2002), but should also aim to connect readers with their homelands by updating and educating them about their native country issues (Sun et al., 2011).

It appears that in terms of water issues, the two Chinese-language newspapers did well playing the bridging role (i.e. bridging the Chinese migrants with their homeland news), given their significant coverage of homelands' water issues. However, in regard to integration, this study partly contradicts Zhou and Cai (2002) who argue that ethnic media facilitate the assimilation of ethnic minority members into the host society. In the case of social aspects, e.g., purchasing a home, establishing a business and/or building a career, ethnic media serve as a guide map for newly-arrived migrants (Zhou & Cai, 2002). However, in terms of environmental aspects, ethnic media seem not to guide migrants by educating them in the expected values and behaviour of the mainstream culture. Moreover, considering that the

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<sup>70</sup> The use of 'national' here refers to the Metropolitan Areas in New South Wales, Victoria, Western Australia and the Australian Capital Territory areas, in which a significant number of Chinese people reside.

degree of emphasis on certain issues influences the relative importance that media consumers assign to such issues (Marks et al., 2007), the relatively higher level of coverage on homeland rather than Australia-focused water issues in the ethnic newspapers is likely to suggest that Sydney's water problem is less severe compared to the homelands' water problems. This finding has important implications for environmental management, considering that the DEC (2005) stresses that ethnic migrants tend to base their judgement of Australia's environmental situation on a comparison with their homeland situations.

### *Disparities in theme coverage*

In general, the two English-language newspapers reflected a wide range of water topics in contrast to the relatively selective coverage by the ethnic newspapers (Table 5.4, Figure 5.5). The difference between the two English-language newspapers in topic coverage may be explained by the fact that newspapers need to brand themselves to distinguish their coverage from a whole range of similar publications by providing unique perspectives to readers. However, the divergence in theme coverage revealed across language divides is unlikely to signal ethnic media's standing out from the English-language ones, rather, in line with Dugas and Young's (2012) observation, the particular coverage by ethnic media is likely to closely reflect the ethnic minority community's specific interests and concerns vis-à-vis certain topics and their environmental cultures and values. Drought and climate change both challenge water security in China; water pollution and poor management are perceived to be the biggest threats to most cities (see Finlayson et al., 2013). Somewhat unsurprisingly, water pollution ranked top among water topics in Chinese-language newspapers. South Korea also faces great water stress, due to its monsoon climate that brings high precipitation for three months of the year, followed by a long period of low precipitation or severe drought conditions. For the Korean community, it seems that storing more water during the wet season is an easier way to secure water supply than reducing water use in the dry season. River restoration is also a subject of heated public debate in South Korea (Jun & Kim, 2011). These considerations may help to explain why the Korean-language print media shows more interest in dam, river and drought issues.

Given the mutual relationship between media use and public perceptions (Slater, 2007; Zhao, 2009), the divergent media emphasis on topics identified in the study not only reflects particular concern for certain issues, but will likely continue to shape and reinforce audiences' concerns and cognitions regarding these issues. In this case, the divergent coverage of topics



across the language divides may imply that Chinese, Korean and English-speaking readers might be concerned about different water issues. This consideration is consistent with arguments in social and behavioural studies (Clarke & Agyeman, 2011; Mohai & Bryant, 1998), that is, people from different ethnic and cultural backgrounds tend to be concerned about different aspects of the environment. Following this logic, this study suggests that ethnic groups may also be concerned about particular issues of water management.

Another influence of the limited topic coverage by ethnic media is that little information about some local (Australia focused) issues, such as climate change/rainfall patterns, rivers/dams and water plans/ water rights, is provided to non-English speaking readers. This failure to provide information may mean that the non-English speaking audience remain unaware of these important 'local' water issues; hence, they are unable to engage in public debate. Scholars (Hurlimann & Dolnicar, 2012; Soroka, 2002) suggest that media tend to impact on public opinion when issues are domestically relevant. The relative absence of local-focused water issues, such as the Warragamba dam, the desalination plant, stormwater and grey water reuse and recycled water for drinking, may indicate that the Chinese and Korean communities tend to be less informed about Sydney's water problems and their possible solutions. This view was evident in the questionnaire findings. A significantly lower level of knowledge about Sydney's water issues, such as 'main water source' (Figure 4.4), and 'water restrictions' (Figure 4.5) was found among the Chinese and Korean respondents compared to the Australians, confirming the DEC's (2005) finding that non-English speaking migrants are likely to be less knowledgeable about the local environment. The disparities in knowledge and understandings of water issues were not only caused by the differences in media coverage of topics between ethnic and English language newspapers, but were also affected by how those newspapers framed their reports.

#### *Frame - Function as a forum for diverse opinions and debates*

The media not only impacts on readers' concerns regarding certain issues through lending salience to such issues by a certain degree of volume and prominence of coverage (McCombs & Ghanem, 2001), but also through framing the discussion around said issues (Hurlimann & Dolnicar, 2012). Through frames, the media places emphasis on certain points of view and marginalise others (Hornig, 1993). In the two English-language newspapers, the presentation and discussion of water issues were relatively more diversely framed compared to the Chinese-language media (Table 5.4). The English-language newspapers also tended to use

both negative and positive frames when reporting (e.g., water management or water conservation relevant difficulties/challenges, opportunity/towards sustainability; concerns about/preparation for future periods of drought, and optimistic outlook for water situation). By using both negative and positive frames when reporting, the English newspapers conveyed a sense of warning as well as of hope to their readers. The diverse frames provided by English-language coverage allow readers to think and understand water issues through multiple angles, which can more successfully facilitate public debate of water issues.

In contrast, the Chinese-language coverage appeared to frame discussion in less varied ways, especially the ACD, wherein discussion is often framed to question or blame governments' failure, acclaim governments' achievements, or draw attention to drinking water/ river pollution and health concerns. Similarly, only the 'safety' frame was frequently used by the KDHDA. The less varied frames used in Chinese and Korean-language reporting seemed to simplify the nature of the water issues. Rather than merely transmitting simple information to readers, ethnic media are expected to play a local surveillance role, to reveal hardships and difficulties, warn of threats and responsibilities, and empower people with rights and opportunities (Liu, 2012)(Alia, 2005; Liu, 2010). However, the findings suggest that the three ethnic newspapers under scrutiny appeared not to have successfully achieved the local surveillance role in terms of water issues; that is, to be 'functioning as a forum for individual opinions of ethnic communities' (Liu, 2010, p. 256).

The lack of a community engagement/camaraderie frame, especially an ethnic community engagement/camaraderie frame, may underpin the insufficient positive feedback critical to the Chinese and Korean communities vis-à-vis their role in water conservation. The high usage of the 'government commitment/effort to water security' frame signalled that the ethnic newspapers transmit a feeling that despite their poor management in the past, their governments are committed to or have made efforts towards making the situation better, thereby leaving the community (readers) as outsiders. In other words, the ethnic newspapers' coverage may give the Chinese and Korean community readers the impression that their governments are, and should be, responsible for water issues. This assignment of responsibility for environmental well-being, however, does nothing to encourage the development of environmental citizens (Clarke & Agyeman, 2011) and the pro-environmental behaviour which is facilitated through environmental citizenship (Dobson, 2010). This perceived environmental responsibility assignment contests the individualisation of

responsibility in Western society (Clarke & Agyeman, 2011; Dobson, 2007; Dobson & Sáiz, 2005), where individuals are required not only to take the responsibility for their own welfare, but also for the well-being of the society and environment in which they live. Clarke and Agyeman (2011) stress that it is important to explore the context in which the ‘different mindset’ – differently perceived environmental responsibility – emerges. Based upon the above analysis, the high coverage of the government-role frame and the low coverage of community-member-role frame in the ethnic newspapers may reflect, or serve as a context for, the different mindsets of the Chinese and Korean respondents as revealed in the qualitative analysis (Section 5.2.4, Chapter 5; see Section 6.3.1 (3) for further discussion). This also has important implications for local environmental initiatives and campaigns, since the perceived cultural difference in the apportioning of who is responsible for environmental protection may be related to the perceived lack of environmental activism among some ethnic minority communities (Clarke & Agyeman, 2011; Klocker & Head, 2013).

Only a small percentage of articles in the English, Chinese and Korean coverage were framed using ‘information for water conservation’; by extension, offering their readers limited access to practical water saving information. Kollmuss and Agyeman (2002) suggest that financial incentives (e.g., water price) and awareness (e.g., concern about water shortages) have proven important for reducing water use. Therefore, reporting framed to emphasis the ‘difficulty/cost’ regarding water price, to draw attention to water security and concerns about/preparing for future drought in newspapers would be useful for promoting environmentally beneficial attitudes and behaviour. However, if limited practical water-saving information persists, it may have little effect.

This study has highlighted the importance of studying media across language divides as a way of understanding diverse perceptions and attitudes towards environmental issues among ethnically diverse populations. In essence, it has contributed to the debate surrounding ethnic diversity and environmental awareness/behaviour. Zhao (2009) observes that the effects of ethnicity on perceived knowledge of, and concern for, global warming were mediated by the level of media use and related to the type of media used (web, newspapers and/or TV). The ethnic/mainstream media differences revealed in this current study have significant implications for water management and environmental education. Ethnic media is perceived as an effective means through which to approach ethnic minority members (Yu & Ahadi, 2010), and to promote engagement among non-English speaking minorities. However, it is

less likely to contribute effectively to inclusive education until such time as ethnic/mainstream media differences are recognised and engaged.

#### **4) Diverse concerns: value-based or perception-based**

Rather than simply indicating a lack of water concern, Chinese and Korean respondents' concerns about water might be shaped and expressed differently from their Australian counterparts. Principle component analysis of 13 attitudinal measurement items (Section 3.4.3, Chapter 3) identified two underlying components: value-based affective attitude and perception-based dispositional attitude. Chinese and Korean respondents were found to have higher affective attitudes towards water conservation than their Australian counterparts, while Australian respondents scored higher in dispositional attitudes than the Chinese and Korean respondents (Table 4.8).

As pointed out in the Literature Review, studies have revealed that values drive and govern people's environmental beliefs, concerns and attitudes (Section 2.4.3, Chapter 3). The high value-based affective water attitudes among Chinese and Korean respondents revealed in this study might be understood from the perspective of altruistic (concern for the group interests) and biospheric (concern for the welfare of the ecosystems) value orientations. The questionnaire survey and qualitative studies found that Chinese and Korean respondents, compared to their Australian counterparts, were more likely to claim 'community (citizen) responsibility' as an important reason for undertaking water-saving action (Figure 4.9, Section 5.2.3). The Chinese and Korean respondents tended to put themselves in a position to think and behave with concern for the welfare of the community – collective values (Chan, 2001). This finding is partially consistent with the finding of Deng et al. (2006) that Chinese migrants were more inclined to endorse social-altruistic values compared to the Anglo majority community in Canada. The questionnaire survey also found that the Chinese and Korean respondents were more likely to show concern for the welfare of the environment and resources, believing that their over-usage could deplete water resources, and that conservational action will benefit the environment (Appendix 5). This is consistent with the dominant philosophy of 'ecocentric or biospheric' promoted by the traditional Chinese culture (Chan, 2001; Deng et al., 2006). However, this finding seemed contrary to Leung and Rice (2002) and Milfont et al.'s (2006) studies, which found that Chinese-Australians and/or Asian New Zealander students had higher biospheric environmental concerns than their Anglo and/or European counterparts. This contradiction may be because Leung and Rice

(2002) and Milfont et al. (2006) were measuring environmental concerns in general, while this study's focus is on water. The target population in Milfont et al. (2006) were students who might be less likely to maintain their traditional Chinese traits (Deng et al., 2006).

In comparison, the high dispositional attitudes among Australian respondents were experience-based or specific-knowledge based. That is, Australians' attitudes and beliefs regarding water conservation were directly related to local experiences such as water restrictions and drinking recycled water. Since non-immediate or remote environmental problems tend to escape community awareness, local directly experienced and dramatic issues are more able to trigger environmental awareness (Fliegenschnee & Schelakovsky, 1998; Kollmuss & Agyeman, 2002; Rajecki, 1982). Australian respondents were more emotionally involved and showed a greater positive disposition towards water conservation, even if it meant self-sacrifice (Appendix 5). For example, once a person has experienced a severe drought or serious water restrictions, it becomes much easier to make judgements about whether it is better to keep the lawn green or to save water for basic needs (Appendix 5). This phenomenon became further evident in the findings pertinent to perception measurements in the questionnaire study and qualitative analysis (Figure 4.9, Section 5.2.3), that is, the Chinese and Korean respondents tended to link their positive water attitudes and behaviours to their education ('educated to save water') and environmental experiences prior to migration. They were less likely to link their positivity with the context of local water issues ('water restrictions') compared to their Australian counterparts. Moreover, the Chinese and Korean respondents also tended to attribute their pro-conservational behaviours to one traditional Asian virtue - frugality. Accordingly to the Literature Review, frugality, one of the basic traditional values or virtues in Asian cultures, is being promoted in contemporary Asian societies, especially in China (Lu, 2008; Zhang, 2012). It seems that this virtue was inherited and practiced by Chinese and Korean respondents in Sydney after their migration. As Kollmuss and Agyeman (2002) argue, cultural values can drive people to act environmentally, irrespective of whether they are environmentally conscious or not. In line with that argument, this study suggests that rather than as a result of environmentalism, the Chinese and Korean respondents' environmentally friendly behaviour may have formed partly as a result of their frugal perceptions and frugal consumer habits. This is also consistent with Fujii's (2006) finding that people's frugal attitudes are positively related to a reduction in resource consumption and would effectively promote the conduction of pro-environmental behaviour. In contrast, for Australian respondents, water conservation was normally regarded as an

instrument to defend society against drought, one closely related to water restrictions and water shortages (Figure 4.9).

### ***6.3.2 Reasons behind the ethnic differences in pro-conservational behaviour***

#### **1) Do ethnic differences regarding pro-conservational water-use behaviour mask socio-demographic or housing factors? To what extent does ethnicity influence pro-conservational behaviour?**

As suggested in Section 2.4.2, Chapter 2, a range of factors determined household water consumption and pro-conservational behaviours: gender, education attainment, household structure, dwelling type and tenure type. According to Gentin (2011), Medd et al. (2007) and Thomas (2001) ethnicity could be just one of many factors influencing environmental concern and water-oriented behaviour. According to Intersectionality Theory (Section 2.4.3 (4), Chapter 2), socio-demographic factors and other factors are likely to intersect and interact with ethnicity, in the process influencing environmental behaviours. Given the diverse demographic characteristics of population among community groups, it may be assumed that ethnic differences of pro-conservational behaviour may reflect the socio-demographic variations among said populations; for example, the Chinese and Korean respondents tended to be young and middle-class.

Apropos of the above assumption, a set of regression analyses of pro-conservational behaviour on ethnicity were conducted. The results (Table 4.10) indicated that the effects of ethnic status (being Chinese, or Korean, rather than Australian) remained statistically significant when factors such as household income, age, gender and education were controlled. This suggests that the ethnic differences in pro-environmental behaviour observed in this study are likely to, after all other variables have been considered (such as values, knowledge, habits), actually result from ethnicity, rather than ethnicity masking other important variables such as age and education levels.

As highlighted in the Literature Review, housing variables, including dwelling type and tenure status, were found to influence a household's water use and a household's capacity to respond to water conservation (Independent Pricing and Regulatory Tribunal, 2004, 2010; Troy & Randolph, 2006). Therefore, it was argued that ethnic differences in pro-conservational behaviour revealed in this study might be a reflection of the housing

differences among ethnic groups. In order to isolate the effects of ethnicity from those of housing on pro-conservational behaviour, dwelling type and tenure status were controlled in the regression analysis (Table 4.10). The results indicated that respondents who lived in low-rise units and high-rise apartments were less likely to undertake water-saving behaviour compared to those who lived in houses and semi-detached houses. This was consistent with Troy and Randolph's (2006) view that flat dwellers are likely to be restricted by facilities and dwelling structures. Respondents who are buying (with a mortgage) or renting were also less likely to conduct pro-conservational behaviour compared to others living in fully-owned dwellings. However, the effects of ethnicity on pro-conservational behaviour remained statistically significant when housing variables were held constant, suggesting that ethnic effect was not a result of the varied housing status between ethnic groups.

Results from a backward multi-regression of self-reported water saving action on all factors (except knowledge and attitudinal factors) proved ethnicity to be an important factor for explaining the engagement level of pro-conservational behaviour (Table 4.11). Ethnic status, together with other socio-demographic and housing variables, accounted for 33 per cent of variance in the self-reported behaviour. A comparison of the standardised coefficients indicated that the effects of ethnic status on pro-conservational behaviour were even greater than factors such as housing status, income and household size (Figure 4.18).

## **2) Mediation effects of knowledge, and attitudes on the relationship between ethnicity and pro-conservational behaviour**

As indicated in the Literature Review, knowledge of environmental issues can motivate people to think and behave in an environmentally conscious way. Moreover, environmental knowledge and attitudes can directly or indirectly affect people's pro-environmental behaviour. Although the relationships between the three elements is complicated due to the interaction between many factors, incentives and barriers in the signal path (Fietkau & Kessel, 1981; Frick et al., 2004; Kollmuss & Agyeman, 2002), low level engagement of certain groups with water-conservation activities may be attributed to a corresponding low level of knowledge and less positive attitudes towards water use and water conservation among community members. The correlation tests on knowledge, attitudes (affective and dispositional attitudes) and self-reported pro-conservational behaviour in this study also indicated that those factors were significantly positively related to each other (Table 4.9).

Having established that the Chinese and Korean respondents had significantly lower levels of knowledge of local water issues and less positive attitudes towards water conservation than their Australian counterparts (Table 4.8), it was argued that these disparities may have carry-over effects vis-à-vis the respondents' pro-conservational behaviour. This concern related to the question as to whether the ethnic differences in pro-conservational behaviour were accounted for by knowledge and attitudinal disparities among ethnic groups.

The results of the regression analysis testing the influence of knowledge on ethnic correlates of attitudes and pro-conservational behaviour found that controlling knowledge reduces the effects of ethnic status on dispositional attitudes; and that when knowledge and dispositional attitudes were held constant, ethnic effects on pro-conservational behaviour were also reduced (Table 4.14). This suggests that improving the knowledge level pertinent to local water issues could help to reduce the ethnic differences in dispositional attitudes. Moreover, improving knowledge and fostering positive water attitudes among the Chinese and Korean communities could help to reduce the disparities between the Australians' and those two ethnic minority communities' pro-conservational behaviour. However, the ethnic differences were still statistically significant when knowledge or attitudes were controlled, suggesting that improving knowledge and attitudes may help to reduce the disparities in pro-conservational behaviour, albeit it may be insufficient to make the disparities disappear. Further examinations of the indirect effect on self-reported pro-conservational behaviour (see Table 4.15) indicated that the effects of ethnicity were mediated by knowledge difference and attitudinal disparities. With 35 per cent and 18 per cent of the Chinese effects on pro-conservational behaviour, and 54 per cent and 17 per cent of Korean effects, being accounted for by these two factors respectively. In this case, in answer to the above question, the differences in water-saving behaviour patterns among Australians and the two ethnic minorities (Chinese and Korean), were only partly mediated by, rather than fully accounted for, by disparities in knowledge and attitudes among the two groups.

As Kollmuss and Agyeman (2002) state, knowledge and attitude (along with other factors such as values and emotional involvement) together constitute the internal factors which affect people's pro-environmental behaviour. The DEC (2005) study affirmed that lack of knowledge or lack of awareness about certain environmental issues can act as a significant barrier to the uptake of environmental-friendly behaviours among the non-English speaking groups. Pfeffer and Stycos (2002) indicated that foreign born migrants with high



environmental knowledge, who had learned the behavioural expectations of mainstream society, tended to emulate the local born population in pro-environmental behaviour, while those less knowledgeable and less aware of the environmental issues were significantly different from the local born population in the engagement of pro-environmental behaviours. In line with those above arguments, this study further argues that divergent knowledge levels and attitudes towards certain environmental issues between groups of people may result in a diverse engagement level of pro-environmental behaviours among them.

Analysis suggests that the effect of knowledge was more pronounced than that of attitudinal effect for reducing ethnic differences in water-saving behaviour (the mediation effects of knowledge were 35% and 54% compared to those of attitudes at 18% and 17%). This can be deduced from Hines et al.'s (1986) model of environmental behaviour in which knowledge of environmental issues and knowledge of action strategies are two main predictors of pro-environmental behaviour. The role of attitudes in promoting environmentally responsible behaviour is perceived to be weaker in their model (Hines et al, 1986). Simply adopting a beneficial attitude towards environmental issues is not enough; people need to know how to deal with such issues practically. The findings of the mediation effect analysis have important implications for conservation education. In order to promote high levels of engagement with water conservation among Sydney's Chinese and Korean communities, providing information about local water issues together with targeted attitude approaches may achieve greater success than merely focusing on fostering conservation awareness. However, as indicated in the media analysis, the information relating to local water issues provided by ethnic newspapers was limited (see Section 6.3.2).

As discussed above, the ethnic differences in the engagement level of pro-conservational behaviours proved to be attributed to, but not fully accounted for by, the varied levels of knowledge and attitudes among community groups. Other reasons may exist, such as perceptions of the allocation of responsibility for the environment.

### **3) Perceptions of who is responsible for the environment**

As revealed in the above sections, the ethnic disparities in the adoption of pro-conservational water behaviour may in part be due to the divergent knowledge and attitudes among ethnic groups. Other socio-demographic factors, e.g., household size, tenure type and income, were found to be either independent or to have small interaction with the effects of ethnicity in this

study. Therefore, other explanations may exist. The qualitative analysis of this study found ethnic differences in the perceptions of who is responsible for the environment (Section 5.2.4). Clarke and Agyeman (2011) argue that cultural differences in the perception of ascription of liability may underpin the differential in environmental activism. More specifically, while the Chinese and Korean respondents held that individuals have a moral obligation to save water, at the same time they tended to believe that governments should be responsible for fixing water supply problems. In contrast, the Australian respondents were more likely to nominate both households and their governments as important agencies in dealing with water issues. This finding was consistent with that of Vavricka (2013), who observed that Chinese and Korean Americans, along with some other ethnic minorities in America, held the governments primarily responsible for environmental protection, because they believe that governments have sufficient resources and will be more efficient and more effective. As my qualitative analysis revealed, one Chinese respondent suggested that government scale instruments such as building a decentralised water recycling system are much more efficacious than household scale water conservation activities. In comparison, the Australians' perceptions of the role of the household in mitigating water stress may be influenced by the media attention to household consumption and conservation activities. As the media analysis (Section 5.3) revealed, there was relatively high coverage of household and community level water conservation framing (Table 5.5) in the English-language media. The Australians' experiences of water restrictions may also influence their perceptions and their uptake of household water conservation behaviours. As Clarke and Agyeman (2011) indicated, ethnicity and culture shape ethnic minorities' perceptions to the assignment of responsibility for environmental well-being, and influence their response to government calls for citizen responsibility. In line with the argument of Clarke and Agyeman (2011) that ethnic minorities were not open and responsive to persuasion and participation as assumed, the Chinese and Korean respondents tended to distance themselves from responsibilities and shift responsibility onto the government when negotiating with their respondents to act towards environmental (water) well-being. The revealed difference in culturally perceived environmental responsibility between the ethnic minority groups and the majority in my study is important for the construction of environmental citizenship across the Sydney Metropolitan Area. Troy and Randolph (2006) stated that Sydney residents not only see household water conservation activities as a social responsibility for mitigating water stress, but also consider it a means of eliminating constraints on water usage under the water restrictions.

The revealed ethnic differences in pro-conservational behaviour can also be understood from the ‘locus of control’ element in the pro-environmental-behaviour model discussed in Kollmuss and Agyeman’s (2002) study. That is, people with a perceived strong internal locus of control are more confident about their ability to make change, while those with a perceived strong external locus of control are less confident about their behaviour. The latter prefer to believe in people or agencies with power. Under this consideration, in my study, the Australian respondents appeared to believe in their water saving actions and were more confident about their roles in resolving water shortage problems. Whereas the Chinese and Korean respondents appeared to have an external locus of control belief (government responsibility) and tended to be relatively less confident that their water-saving behaviour would make much difference. This implied a lack of feedback about the behaviour of the Chinese and Korean households, an opinion supported by the media study, which showed that limited community engagement frames were presented in two Chinese and one Korean language newspapers (Table 5.5). The perceived ascription of liability and confidence revealed among the Chinese and Korean respondents may also help explain the DEC’s (2005) finding that non-English speaking ethnic minorities were less active in local environmental activities.

### ***6.3.3 Understanding the ethnic differences in daily water practices***

The questionnaires and qualitative studies revealed that household water-use related to daily practices, e.g., dishwashing, doing laundry, showering, teeth-brushing and garden-watering, varied significantly across respondent groups (Sections 4.4 and 5.2.1). Examination focused on the ownership of water use appliances (e.g., dishwasher, showerheads) revealed that variance in household water-use practices was not accounted for by the ownership difference of water use appliances among respondent groups. This suggests that other explanations are required.

#### **1) Were the differences in water use practices a reflection of other socio-demographic variations between groups?**

As suggested in the Literature Review (Section 2.4.2, Chapter 2), several socio-demographic factors influence people’s water-use practices. For example, household size influences household water consumption. In general the larger the household, the higher the aggregate water consumption, although a certain level of economy of scale existed in large households

(Arbués et al., 2003; Arbues et al., 2010; Independent Pricing and Regulatory Tribunal, 2010). Age and gender are also associated with water-use attitudes and behaviour (Makki et al., 2013; Schleich & Hillenbrand, 2009; Van Koppen, 2001). Elderly people tend to adopt water-saving attitudes and are therefore more prudent with water consumption than the young (Nauges & Thomas, 2000). Females tend to take longer showers than males (Makki et al., 2013). Among the samples of questionnaire respondents, the Chinese and Korean respondents tended to be young, female, and living in large households (Appendix 4). The lower frequency of dishwasher and washing machine use among Chinese households, compared to Australian group, was not likely to be associated with household size, since Chinese respondents tended to be from large households. However, it may be argued whether socio-demographic differences account for ethnic disparities in showering practices.

The results of the regression analysis of shower length and frequency, which aimed to answer the above questions (Table 4.28), indicated that the ethnic differences in shower length were significant regardless of gender, age or household size. However, when household size was controlled, while the Chinese group remained statistically significantly varied from the other groups in shower frequency, being Korean became insignificant when explaining shower frequency variations. Moreover, when the variable of age was held constant, ethnic status became insignificant when explaining shower frequency variation. These results suggest that age appeared to have greater impact on the shower frequency of the respondents than the ethnic status (being Chinese and/or Korean rather than Australian), and the Korean/Australian differences in shower frequency seem to be relevant to the age and household size structure differential between the two groups. However, in contrast, the shower length of respondents was significantly affected by their ethnic status regardless of the gender, age or household size.

Since ethnic disparities in shower length were proved not to be a result of demographic variation among groups (e.g., age, gender or household size), other explanations are needed for understanding variance in shower practice as well as other water-use practices.

## **2) What lies behind the diverse water use practices?**

As indicated in the Literature Review (Section 2.4.3 in Chapter 2), water use practices such as showering are actively constructed and shaped by people's habits, daily routines and interacted by their perceptions and preferences. The results of the qualitative studies (Section

5.2.1) indicated that cultural preferences, experiences and climatic factors are also important perspectives for understanding diverse water-use practices among ethnic groups.

The diverse dishwashing approaches adopted by the Australian, Chinese and Korean respondents, were regarded as a result of cultural preferences by qualitative study respondents; that is, while Australian respondents were more likely to use the dishwasher, the Chinese and Korean respondents were more likely to wash by hand. This was consistent with Elizondo and Lofthouse's (2010a) argument that the different washing-up techniques practiced in different nations were embedded in their respective cultures. Behind these diverse cultural preferences, two elements were revealed to be important. The first refers to the habits of the people. As suggested in Section 5.2.1, the practice of washing by hand was claimed to be formed in childhood in the countries of origin of the Chinese and Korean respondents, where it was regarded as the conventional way of washing dishes. Even after they moved to Sydney, they retained this habit. 'Not used to' and 'due to habits' were commonly mentioned as their reason for not using a dishwasher. Another element was the respondents' perceptions, including their concept of the dishwasher, and perceptions of cleanness and convenience. The dishwasher was more likely to be portrayed by the Chinese and Korean respondents, as 'energy-consuming' and 'water-wasting', which appeared contrary to the frugality virtue encouraged by the traditional Chinese and Korean cultures. The Chinese and Korean respondents also tended to claim that the dishes washed by the dishwasher were usually 'not clean' or 'not dry' which made the dishwasher not trustable. As (Medd et al., 2007, p. 3) suggest, the particular values and behavioural patterns that conventionally align with particular cultures 'have always to be translated and integrated into the complex habits and routines' through which the daily water-use practices were accomplished. It seemed that the hand-washing conventions in the original cultures, the frugality values and the individuals' perceptions (i.e., hygiene and convenience) together constructed the hand-washing preference among the Chinese and Korean respondents. Moreover, their concepts of the dishwasher portrayed dishwashing as being non-beneficial (e.g., energy-wasting, not clean), which gave no reason for changing their dish-washing habits after moving to Sydney. Their preference to wash dishes under running water rather than in a plugged sink may correspond to Smith and Ali's (2006) finding that for hygienic reasons, they believe it cleaner than rinsing in a sink.

Apropos of washing machine-use practices, the differences among the respondent groups

might be understood through people's perceptions and preference. The approach of separating clothes by colour, material or other elements might vary between Chinese and Australians (Point 3, Section 5.2.1), which may relate to their attitudes towards dirt (Randolph & Troy, 2008) or other considerations. Washing underwear and/or babies' clothes by hand rather than using the washing machine, an action reported by a Chinese interviewee, might be understood by people's perceptions of convenience (Elizondo & Lofthouse, 2010b). This finding may serve as an explanation for the finding in questionnaire analysis that while all of the respondents purported to have a washing machine at home, more than 10 per cent of the Chinese respondents reported hand washing as one washing method (Table 4.22). It may also provide an explanation to Randolph and Troy's (2008) observation that a considerable number of respondents claimed they wash by hand.

With regard to showering practices, qualitative studies provided several factors for understanding the long shower proclivity among the Chinese and Korean respondents<sup>71</sup>, including public bathhouse cultures, climatic factors and the convenience of shower appliances in Sydney (Section 5.2.1). The qualitative studies revealed that the public bathhouse culture - Jjimjilbang<sup>72</sup> - might have something to do with the long shower tendency among the Korean respondents in Sydney. As regards the public bathhouse culture in China, the Chinese respondents were more likely to claim that climatic factors and infrastructure differences between Sydney and their homeland influenced their showering practices. These findings can be understood through Medd et al.'s (2007) notion (developed from Hand et. al. (2005)) that three elements constructed and shaped an individual's water use practices: a specific arrangement of materials (technology and infrastructure), an individual's perceptions (such as concepts of the body), and routines. The Jjimjilbang culture may not only influence the Korean respondents' cleanness perception, it was likely to affect their showering routines (shower length). The Jjimjilbang culture is also likely to impact on the Korean respondents' arrangement of materials. Because Jjimjilbang facilities are not available in Sydney, the respondents may transfer their long-showering habits formed in Jjimjilbang to their daily showering practices at home. While the Chinese migrants from

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<sup>71</sup> The frequency differences between the Chinese, Korean and Australian respondents were attributed to the variance in age or (and) household size among respondents in the previous section (Section 6.3.3 (1)); therefore, the observed showering frequency differences is not further discussed here.

<sup>72</sup> The original words in Korean language is 찜질방.

Northern China might keep their long shower habits in Sydney, the transition of the Chinese respondents' short but frequent shower habits formed in Southern China into long shower performance in Sydney may be regarded as the result of a change in showering technology. The convenient hot/cold water services in Sydney have made it convenient and possible to enjoy frequent and long showers. The fixed water bills may also add to this phenomenon. This is supported by the argument that perception, lifestyle and the introduction of appropriate infrastructure drive the evolution of routines (Elizondo & Lofthouse, 2010b) albeit not necessarily towards a sustainable way.

The different teeth-brushing approaches among the Australian, Chinese and Korean respondents may be regarded as a conventional behaviour embedded in their particular cultures. Using a cup all the time when brushing the teeth is what Chinese and Korean respondents learned when they were young, either from their families or in boarding school. Kids in Australia are taught to brush under a running tap. This conventional behaviour developed into habits as they grew up. The brushing-using-a-cup behaviour also reflects the frugal aspect promoted by Chinese and Korean cultures, which has been integrated into people's daily practices (Medd et al., 2007). However, this environmentally friendly approach to the brushing of teeth among the respondents seems unstable and tends to evolve with the change of environment, for example, changing brushing habit to brushing under a running tap after living in a shared apartment in Sydney (Point 3, Section 5.2.1). As Elizondo and Lofthouse (2010b) claim, convenience is one of the important factors influencing people's choices regarding water-use actions. The change of brushing habit is likely to reflect the trade-off between habits and convenience.

The garden watering practices (frequency and duration) are attached to many factors, such as the type of garden beds, size of garden, the use of outdoor spaces, climate factors, water restrictions and people's perceptions (Troy & Randolph, 2006). As observed in this study, the Chinese and Korean respondents were found to be less likely to water a garden, and those who water their gardens also tend to water less frequently and for a shorter period than the Australians (Section 4.4.4). This phenomenon might be because the Chinese and Korean respondents tended to live in semi-detached and multi-dwellings and have gardens of a small size (if they have gardens), and/or related to the preference of a simple and time-saving landscape (e.g., turf) among the Chinese and Korean respondents. The DEC (2005) study also indicated that the Korean speaking participants were less likely to grow vegetables, fruit,

herbs or native plants. And the Chinese speaking respondents were less likely to use their outdoor space, they preferred ‘large, spacious, clean and modern homes as key aspect of the enjoyment they gain from their home, rather than their backyard’ (DEC, 2005, p. 48), which may in turn explain the short time spent in maintaining outdoor areas. In the qualitative studies (Point 2, Section 5.2.2), the Chinese and Korean participants also claimed that they tended to collect used water from their kitchen to water plants, using a bucket or small container rather than using a sprinkler or hose.

## **6.4 Acculturation and the ethnic differences in water knowledge, attitudes, behaviour and water consumption**

### ***6.4.1 Knowledge, attitudinal and behavioural change in the process of acculturation***

As suggested in the Literature Review, migrants are expected to become familiar with local environmental issues, and to learn the behavioural expectations of the mainstream society. Therefore, questions arise vis-à-vis whether the Chinese and Korean migrants have acquired more knowledge about local water issues while interacting with the mainstream culture? In addition, have their attitudes and behaviour towards water conservation changed during their years lived in Sydney and as their English proficiency has improved?

As shown in Section 4.3.5, Chapter 4, ‘Years lived in Sydney’ and ‘English proficiency’ have been used to analyse the influence of acculturation on water knowledge, attitudes and pro-conservational behaviour among Chinese and Koreans. Due to the limited number of Korean and Chinese respondents born in Australia in the questionnaire survey, the influence of ‘birth place’ was not examined. Analysis of the other variables revealed that environmental acculturation did in fact matter.

As regards the Koreans, as their years lived in Sydney increased, there was a statistically significant increase in their levels of knowledge, attitudes and engagement of pro-conservational behaviour (Table 4.17). Improvement in English proficiency was also found to be associated with a statistically significant increase in knowledge and attitudes. Likewise, in the case of the Chinese respondents, their years lived in Sydney or English proficiency were also significantly positively associated with an increase in their levels of knowledge of, and dispositional attitudes towards, water conservation. These findings are consistent with the general argument of studies that focus on the correlation of acculturation



and environmental concern. They have found that an immigrant's acculturation level influences his or her familiarity (Johnson, 2011; Pfeffer & Stycos, 2002), perceptions (Leung & Rice, 2002), attitudes (Caro & Ewert, 1995; Schultz, Unipan, et al., 2000; Segev & Pinto, 2011) and behaviour (Johnson et al., 2004; Leung & Rice, 2002) towards environmental issues (e.g., the environment, water, air pollution).

However, it was noted that neither an increase in the years lived in Sydney nor an improvement in English language proficiency was accompanied by an increase in self-reported water-saving behaviour among the Chinese respondents (Table 4.17). This seems to potentially challenge Leung and Rice's (2002) argument that Chinese-Australians who have resided in Australia for a long period are more positive in environmental behaviour. These divergent findings may be explained by the fact that the two studies examined different aspects of environmental behaviour (environmental behaviour in general versus water saving behaviour in particular). Or by the possibility that depending on who the migrants were (younger workers or people who arrived as part of a family reunion, for example), their levels of acculturation were influenced by factors other than time.

In line with Deng et al.'s (2006) argument relating to ethnic migrants' selective patterns of acculturation (see Section 2.4.3, Chapter 2), the findings of this study may reflect the different speed and success of acculturation, rather than refuting the influence of acculturation on water conservation behaviour among Chinese migrants. As Yinger (1981) argued, in the process of acculturation, change first happens in surface aspects and then in deeper aspects. This current study suggests that within the process of environmental acculturation, while the more acculturated Chinese respondents may have learned the attitudinal expectations, they are yet to learn the behavioural expectations and expressions.

#### ***6.4.2 Ethnic disparity change within acculturation***

Further regression analysis indicated that when years lived in Sydney and English proficiency were both controlled, the Chinese/Australian differences in knowledge and dispositional attitude were reduced; but they were still statistically significant (Table 4.18). In contrast, while the Korean/Australian differences in knowledge also decreased, the differences in dispositional attitude were no longer statistically significant (Table 4.19). It seems that with years lived in Sydney increasing and their English language proficiency improving, Chinese

and Korean respondents have become more knowledgeable about local water issues, and, the disparities between them and the Australian respondents have become smaller, albeit disparities still exist. The process of acculturation has seen the Korean respondents increasingly resemble their Australian counterparts in dispositional attitudes; however, the disparities between the Chinese and Australian respondents have not yet disappeared. This outcome partly challenges Caro and Ewert's (1995) argument that the effect of acculturation is stronger than that of ethnicity on water concern. The different findings within the Korean and Chinese groups can be understood from the view of different speed and success of environmental acculturation. This is partially consistent with Johnson et al. (2004) who argue that Asian-Americans may have become relatively more acculturated to the mainstream American environmental culture than other minority groups (for example, Latino- and Black-Americans). Taking this a step further, it appears that in this study, the Korean respondents were relatively more acculturated in the Australian mainstream environmental culture than their Chinese counterparts. This may have been because the Korean respondents were more likely to have higher level of education compared to the Chinese respondents (see Appendix 4).

The magnitude of 'English proficiency' was found to be greater than 'years lived in Sydney' in predicting the positive changes associated with acculturation in knowledge, attitudes for both the Chinese and Korean participants, and water-saving behaviour among the Korean respondents (Table 4.17). Under these circumstances, one may argue that the quicker these newer residents learn English, the quicker they will acculturate and adopt water conservation practices and values. This may be true, but it also implies that those who are not proficient in English are likely to be left out of environmental communications, a notion consistent with the DEC's (1997; 2005) concerns. The Chinese and Korean respondents were found to prefer to obtain information in their home languages rather than English or to like information provided in their home language together with English (Figure 4.13). In other words, it would be easier to approach non-English speaking communities through non-English media. Ethnic media has an important role to play in maintaining the 'traditional' values of the homeland, validating helpful practices, and bridging the knowledge and belief systems between the homeland and the host country (Zhou & Cai, 2002).

Environmental management approaches promoting material in languages other than English would achieve greater success in environmental communication than merely waiting for

non-English speaking community members to improve their levels of English. The media analysis discussion (Section 6.3.1) indicated that while the ethnic media may have performed an integrating role in relation to some social and economic issues, the Chinese and Korean print media investigated in this research did not play a bridging role in terms of providing information and promoting awareness of water issues.

An interesting finding was that as the Chinese respondents' years lived in Sydney increased, there was a decrease in their value-based attitudes (Table 4.17). In contrast, as their English proficiency improved, there was an increasing tendency in dispositional attitudes. According to the findings of the quantitative analysis (Table 4.8), the Chinese respondents were more likely to have value-based attitudes towards water issues whereas the Australians tended to adopt perception-based attitudes. This suggests that there are two tendencies happening in the process of acculturation. First, as the number of years after the Chinese respondents move to Sydney increase, they tend to lose the original water concerns which they brought with them from their homelands. Viewed from this perspective, the findings seem partially consistent with Mukherji's (2005) study in which he found that more acculturated American migrants were less likely to have positive attitudes towards environmental protection due to the perceived less salience of environmental problems in America compared to their homelands. The 'perceived less salience of environmental problems' argument was supported by the findings of the perception analysis in my study, i.e., that the Chinese respondents tended to consider Sydney's water condition better than conditions in their homelands (Figure 4.2). Second, a growing trend was observed in dispositional attitude among the Chinese respondents as their English proficiency improved (Table 4.17). Losing the original water concern they formed in their home cultures does not mean that migrants care less about water issues; rather, they tend to express their concern from the perspective of the mainstream culture, to be more like the Australians in water attitudes and be concerned about water in the local context.

This two-tendency change may be understood through the acculturation model presented by Berry (1980) (see Section 2.4.3, Chapter 2) which is rooted in the theories of assimilation. One of the possibilities described in Berry's four adaptation models is that, in the process of acculturation, migrants tended to lose their original culture and gain that of the host. In terms of this study, Chinese migrants seemed to lose the attitudes they had formed based on their original cultural values as they learned the attitudes held by Australians. Although the process

mentioned above is very complex and dynamic in that people may simultaneously lose and acquire cultures, create a new form of hybrid culture, or carry forward their original cultures into an atmosphere of increasing multiculturalism and celebration of diversity, the notion highlighted here is to avoid losing any opportunities for engaging with ethnic minority communities. Klocker and Head (2013) warn of the danger of the vernacular sustainable practices of ethnic minorities being scarcely recognised and ultimately poorly supported by environmental policies, which could result in the diverse sustainabilities brought by ethnic cultures disappearing after years of post-migration. Therefore, it is important to recognise and utilise the environmentally beneficial attitudes and behaviour that align with migrants' cultural values rather than simply attempt to adapt them to the way of thinking and behaving in Western cultures.

Since the Chinese and Korean respondents are becoming more knowledgeable about local water issues, positive in water attitudes, and more active in pro-conservational water use behaviour (observed only among the Korean respondents), as their years lived in Sydney increased, and/or their English proficiency improved, one could ponder whether this positive change is also reflected in their actual water consumption. In other words, how do acculturation-related factors (years of migration, English proficiency) influence the relationships between ethnic status and the per capita water consumption in the studied areas?

#### ***6.4.3 The influence of acculturation-related factors on water consumption***

My analysis of per capita water usage in the summer period found that areas with a high percentage of people whose English language skills were not good, or who had lived in Sydney for more than six years tended to have a higher per capita water use rate (Table 4.35). Birthplace (the percentage of people who were born overseas) appeared not to be significantly correlated with water consumption when the ethnic status variables were held constant. This suggested that birthplace is not as useful as ethnic status for understanding per capita water consumption variance.

My analysis revealed that areas with a higher percentage of people who had lived in Sydney for less than six years tended to have lower per capita water usage. When the percentage of the population who were relatively newly-arrived migrants (migrated less than 6 years ago) was controlled, the ethnic status (percentage of Chinese or Korean people) remained

statistically significantly correlated with per capita water usage. It appeared that ethnic status and years of post-migration domicile in Sydney were both useful for understanding per capita water usage. Moreover, the results also suggested that areas with a high percentage of Chinese people who had lived in Sydney longer than six years were likely to have higher per capita water usage than those with a high percentage of Chinese people who had migrated within six years. The percentage of people whose English was not good was also found to be significantly positively related to per capita water consumption (based on the ABS data for the SAIs, income might be an influence since those people were likely to live in areas with low median household income). Moreover, when English proficiency (percentage of people whose English is not good) was held constant, ethnic status – the percentage of people who were Chinese – became non-significant, whereas the percentage of people who were Korean remained significant. The results conveyed two important concepts. First, the results suggested that English proficiency and the percentage of Korean population were both important variables in understanding per capita water usage; moreover, areas with a higher percentage of Korean people whose English was not good were likely to have higher per capita water consumption. Second, the high correlation between ethnicity (being Chinese) and water consumption may have been due to the fact that the Chinese migrants' English skill were less likely to be self-reported as fluent. Or that they tended to live in certain areas where most of the residents lacked English proficiency (as shown in Table 4.35, the Pearson Correlation between the population percentage for Chinese and that for English-not-good was significant at 0.77).

The findings suggest that acculturation did affect, to some extent, household water consumption. For example, high English proficiency may help the Chinese and Korean respondents to reduce their water consumption. This has important implications for water demand management, especially for conservation education. An approach targeting Chinese migrants whose English is not good could prove a good start to reducing the area's water consumption. However, it may not prove effective to wait for the Chinese and Korean migrants to reduce their water consumption as they acculturate into the mainstream culture. Years of domicile in Sydney seem not to be effective, given that the earlier migration generation were likely to consume more water than the new migration generation. The findings of my study imply that the early-arrived Chinese and Korean migrants might tend to use more water than those who have lived in Sydney for a short period. This argument is consistent with the finding of earlier studies (Lynch, 1993; Mukherji, 2005; Schultz, Unipan,

et al., 2000) (refer to Section 2.4.3 for a review of studies) that the process of acculturation might not always impact migrants' environmental performance as positively as conventionally expected in some aspects. This can be understood in relation to the following factors. According to the water consumption data provided by the water studies conducted in China and Korea (ABS, 2005; Lee et al., 2012; Lu, 2007), the average daily per capita water consumption in Australia (Sydney) is much higher than that in China and Korea (210 litres compared to 104 litres and 165.8 litres respectively). Chinese and Korean migrants may gradually have adopted a new lifestyle in Sydney, for example, watering gardens. They may be unaware of changes that have taken place, such as having longer showers (Tables 4.25 - 4.27) while enjoying the convenience of Sydney's hot/cold water service. The relatively low English proficiency of the migrants may add to this phenomenon: it may be that they are less likely to be aware of Sydney's water problems. Nevertheless, opportunities exist and the findings of this study can assist to develop effective water management strategies (see Section 7.3).

## **Conclusion**

Through a careful examination and discussion based on the results obtained from the quantitative, qualitative and media studies and the existing knowledge reviewed in the Literature Review, this chapter has explored and explained how ethnicity influences residential water use and answered each research question (with the exception of Question 4) set out at the beginning of this thesis (Chapter 1). It has shown that ethnicity is an important factor in understanding residential water use and that the influences of ethnicity on individuals and households' water use can be understood from several dimensions, such as knowledge, perceptions, cultural values/traditions, environmental experiences, attitudes, pro-conservational behaviours, daily practices (habits/routines) and acculturation. The next chapter will summarise the important findings of the study, providing an overview of the information discovered, the significance and the implications of this study. The Question 4 - 'opportunities and challenges' will also be answered in the concluding chapter, which will also provide information on the limitations of the study and potential future research directions.

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## CONCLUSION

Urban population growth and people's high-consumption lifestyles have put the environment under severe pressure throughout the world. Sustainable development offers cities a guide map to address the crisis they face. Water is a basic element of urban sustainable development; and, water demand management is an important approach to sustainable water use. Today, many cities are more ethnically diverse than ever before. In such cities, challenges include how to negotiate ethnic/cultural sensitivity, engage with culturally and linguistically diverse communities and equal rights. Addressing these challenges is of both great importance and urgency. A review of the existing literature indicates, however, that the relationship between ethnicity and residential water usage is not only unclear, but also rarely studied. In an ethnically diverse city such as Sydney, it is important to understand the water use patterns of peoples from different ethnic cultural backgrounds, and to explore the influences of ethnicity on residential water usage and conservation. This current research contributes to an understanding of the perceptions of water among ethnically diverse communities, and constructs potential transitions to sustainability.

### 7.1 Reviewing the aim and conduction of the study

#### *1) Research aim*

The overall aim of this thesis has been to identify the effects of ethnic and cultural factors on household water consumption. This was pursued through an empirical study of three communities - Australian, Chinese and Korean - living in the Sydney Metropolitan Area. The research was guided by the four following research questions, with sub-questions in some instances:

- (1) Does ethnicity influence household water use? (a) Do differences or disparities exist across ethnic communities relative to water use and conservation, in terms of perceptions, attitudes and behaviour? (b) If so, what differences exist? (c) To what extent is ethnicity an influence?
- (2) What are the reasons and factors that underpin these ethnic differences and disparities? In other words, how does ethnicity influence households' water use and conservation?
- (3) What is the role of environmental acculturation in engaging persons of ethnic minority in water conservation activities?
- (4) What are the implications of ethnic diversity for water demand management? More specifically: (a) What are the opportunities for engaging ethnic communities in water

management while maintaining important cultural values? (b) What are the barriers impeding ethnic communities' engagement in water management? (c) How may these barriers be negotiated by water managers seeking to implement sustainable urban water management?

## **2) Conduct of research**

Five research techniques were employed: a household questionnaire survey, focus groups, interviews, practices observation (cultural probes), and media analysis. Actual water usage data (at CCD units) was also obtained from Sydney Water for use in the analysis. These research techniques combine to identify the differences in how ethnicity influences water use, as well as opportunities and the challenges facing water demand management. The fieldwork was carried out in 2012 and 2013. A total of 4,851 copies of the household questionnaire survey were distributed, with 299 completed and returned. In addition, 8 interviews and 3 focus groups were conducted with community members and people in environmental management and education roles. Photographs were collected from 5 cultural probe participants. Sydney Water provided water usage records at the CCD level. Media analysis was conducted on 462 water-related articles published in five newspapers in English, Chinese and Korean languages in Sydney. Analysis of the data collected from all these sources helped to answer the four research questions.

## **7.2 Key findings**

### **1) Differences exist between the ethnic groups**

When answering question one, the results reported in Chapters 4 and 5 found that ethnicity does affect residential water use. Specifically, based on the self-reported survey data, ethnic differences influence respondents' perceptions, knowledge, attitudes, and pro-conservational behaviour regarding water use and daily water use practices. And, in turn, ethnicity strongly influenced the average per capita water consumption in the study areas.

As regards the disparities in perceptions across ethnic groups, based on the self-reported survey data, Australian respondents were more likely to believe that it is prudent to conserve water in Sydney, while the Chinese and Korean respondents were relatively more optimistic about Sydney's water situation. The latter groups tended to believe that Sydney has sufficient water supplies or that the supplies are able to maintain the city's general use in its current form. The study further revealed that the ethnic minority respondents were relatively less knowledgeable



about Sydney's water issues (such as where the drinking water came from, and water pricing practices). On average, the Chinese and Korean respondents scored lower in the level of general knowledge than their Australian counterparts. Similar patterns were also identified in the self-assessed knowledge, attitudes and self-reported water saving behaviour. In other words, the Chinese and Korean respondents self-claimed to be less familiar with local water issues. They were also found to have less positive dispositional attitudes towards water conservation, and engaged less frequently in the examined water-saving behaviour at home compared to the Australian respondents<sup>73</sup>. Notwithstanding, the Korean and Chinese respondents scored higher than the Australian respondents in value-based affective attitudes. Disparities were also identified in the conduction of daily water use practices, such as showering length, dishwashing methods, laundry frequency, teeth-brushing preferences, and garden-watering frequency. For example, despite the high percentage of respondents who claimed that they had a dishwasher at home across all the ethnic groups, the Chinese and Korean respondents were found to be more likely to wash dishes by hand while the Australian respondents were more likely to use a dishwasher. Showering was another activity in which ethnic disparities existed. The Chinese respondents on average claimed generally to have more frequent and long showers, while the Korean respondents were reported to have long but less frequent showers compared to the Australian respondents.

Statistical analysis revealed that ethnicity significantly influenced respondents' pro-conservational water-use behaviour with the effect of ethnicity being greater than factors such as housing status, income and household size. Moreover, the study further revealed that ethnicity was an important variable in explaining the variations in per capita water consumption across the study areas. Areas with larger Chinese or Korean ethnic minority populations were likely to have higher per capita water use rates than areas with the same percentage of Australian population. This likely higher water consumption among two ethnic minority groups may be associated with the revealed lower level of knowledge, less positive perception-based attitudes, the lower engagement level of water-saving action, as well as certain habits and cultural preferences vis-à-vis daily water use practices (such as the long showers) among the Chinese and Korean respondents. However, due to data limitations, the

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<sup>73</sup> It is important to note that, Chinese and Korean respondents were found to less frequently undertake the water-saving activities that were listed in the questionnaire. However, this does not necessarily indicate that they were less engaged in water conservation activities, since some other form of water-saving actions may be taken among their ethnic communities (see Section 5.2.2 for further discussion).

correlations between consumption and the revealed ethnic disparities were not examined. Nevertheless, similar to the effects on pro-conservational behaviour, ethnic status was considered important to understanding the variations in residential water consumption. The analysis indicated that the magnitude of ethnic status in explaining average per capita water usage was even greater than some other socio-demographic factors, such as household income and dwelling type.

## ***2) Understanding ethnic influences***

Apropos of question two, the study provided several dimensions through which to understand how ethnicity and associated cultures influence households' water use and conservation.

### **Environmental Deprivation Theory and the Hierarchy of Needs Theory perspective**

The study indicated that Hierarchy of Needs Theory seemed not applicable when explaining the Australian, Chinese and Korean disparities, especially considering that the ethnic groups studied were generally middle-class, high-income, well-educated Chinese and Korean migrants, whose acceptance into Australia resulted from the country's preference for skilled and investment immigration (Klocker and Head, 2013). Alternatively, the study suggested that any ethnic disparities may be understood from the perspective of Environmental Deprivation Theory. On one hand, their exposure to the recent severe water shortages and restriction problems may serve as an explanation for the Australians' higher concerns about water consumption and water conservation. Moreover, the lifestyle of having large backyards and gardens to maintain may also add to high water concerns. On the other hand, despite drought and water shortages being important issues in China and Korea, water pollution problems and low per capita water consumption rates in those areas may originally have focused the concerns of Chinese and Koreans migrants more on water quality than on the quantity of water in reserves. In Sydney, the Chinese and Korean respondents were less impacted by water shortage problems and restrictions since they were less likely to water outside areas compared to Australians; or, they were not aware of the volume of water required to maintain outdoor areas (which are usually maintained by the strata company) as they were more likely to live in flats. They also less likely to be aware of recent drought events and water restrictions due to their short period of migration and limited access to information.

### **Language and Information access**

Apropos of understanding the disparities in knowledge and attitudes, little access to

information about water issues, and a lack of access to resources pertinent to water conservation were among the Chinese and Korean respondents' main reasons for lower levels of knowledge. While the Australian respondents recognised that there were various information sources available to them, the Chinese and Korean respondents indicated that they had little access to information. This became a big challenge for them when they attempted to participate in conservation. The analysis shows that limited information and resources access might be attributable to their language preferences for receiving information. For the ethnic groups, information provided in their mother tongue was preferred to provision in the English language. Although both languages (home language/ English) seem to work well for bilingual migrants, the information provided in their home language may be catchy and more suitable for them, since the ethnic media would be tailored to their specific needs. This raises an important question studied in this research; namely, did the divergent coverage of water issues in ethnic and mainstream media result in differently constructed perceptions and attitudes to water use?

### **Divergent media coverage may influence people's perceptions**

Comparison of the coverage of water issues between the five English and Non-English-language print media published in Sydney revealed that water issues were reported differently in Chinese- and Korean-language newspapers from their English-language counterparts in extent of coverage, article type, temporal distribution, theme, and geographical focus. Newspapers printed in the same language may differ from each other; but, between-language disparities are more prominent than differences in same-language publications. English-language newspapers tended to reflect a wide range of local water issues, while the ethnic newspapers were more selective regarding the topics they reported, with relatively more interest in reporting homeland water issues. While this low degree of coverage can be regarded as contributing little to enhancing public debate or promoting water awareness among readers, varied coverage of theme and geographic focus is likely to result in different water conceptions among English- and Non-English-language newspaper readers. Limited water-topic coverage may have contributed to the Chinese and Korean-language speaking readers being less informed about, or in some cases unaware of, many local issues, for example recycled water for drinking or about the Murray Darling Basin Plan. The higher coverage of homelands' water issues may also produce the impression that Sydney's water problem is less severe compared to the homelands' water problems. The varied coverage of topics and diverse priority given to water issues may contribute to the English-newspaper readers and Non-English-newspaper audiences being concerned with different water aspects. This is

likely given the different levels of knowledge, the sources of information (and particularly the main sources of information) about water issues, and the differences in the coverage of water issues identified in this thesis. However, drawing a causal link between these phenomena should be done with caution.

### **Cultural preferences, habits/routines and diverse perceptions**

The diverse habits and routines that developed during childhood in a migrant's place of origin, partially explain their diverse water-related practices in activities such as dishwashing, brushing teeth and showering. In addition, the participant's water-related practices (washing methods) were portrayed as a cultural preference, or as embedded in their culture. Clearly, their habits had evolved as a part of their cultures. The study also found that people's perceptions and the availability of infrastructures were also important dimensions to understanding the ethnic disparities in water use practices. Specifically, the preference for washing dishes under running water vs. using a dishwasher, and hand-washing clothes vs. using a washing machine among the Chinese respondents, may reflect the varied perceptions of hygiene between cultures. The long showering tendency among Chinese respondents may be related to their habits and the convenient hot/cold water services in Sydney. While being careful to avoid environmental determinism, the influence of these cultural factors cannot be ignored.

### **Attitudes and behaviours shaped and expressed differently**

Rather than simply indicating that Chinese and Korean respondents were less concerned about water than their Australian counterparts, findings of the study argue that the concerns among the Chinese and Korean respondents were likely to be constructed differently from those of the Australian participants. The Chinese and Korean respondents had developed higher affective attitudes towards water use and conservation based on the values of collective value orientation and being frugal. In contrast, the high dispositional attitudes towards water use and conservation among the Australian respondents were reported to be closely related to the local water situation and their experience. Australian respondents tended to regard their positive attitudes and initiatives as an expression of environmentalism.

Regarding pro-conservational behaviour, the study confirmed that ethnic differences did not mask the socio-demographic variations among the respondents. Nevertheless, specific socio-demographic characteristics (such as the tendency among the Chinese and Korean communities to live in flats/apartments) should be given attention by water demand

management. Further examinations revealed that the ethnic differences in the engagement level of pro-conservational behaviour were partly attributable to the varied level of knowledge and attitudes among ethnic groups. Additional examination suggested that the lower engagement level of household water-saving behaviour among the Chinese and Korean groups compared to the Australian group may also be related to disparities in perceptions about 'who is responsible for dealing with water shortage and supply issues'. The study found that the Australian respondents tended to think that the government and community share a joint responsibility for securing Sydney's water supply and believed that their actions could make a big difference. The Chinese and Korean respondents, however, tended to think it was the government's responsibility to deal with water shortage problems, and they had less confidence in their personal role in water conservation compared to their Australian counterparts.

Crucially, rather than simply indicating a lack of activism among the Chinese and Korean population in Australia vis-à-vis water-saving, it is important to recognise and utilise the diverse forms of sustainable actions brought by these two ethnic minority communities.

### **Attitudinal and behavioural differentials and the effects of ethnicity on water consumption**

The positive correlation between ethnic status and average per capita water consumption seems consistent with the ethnic differences in knowledge, attitudes, pro-conservational behaviours and some water use practices. In effect, the Chinese and Korean respondents were found to be less knowledgeable about local water issues, had less positive attitudes, were less active in undertaking water saving action, and were more likely to take long showers compared to their Australian counterparts (based on reported shower times). The areas with high Chinese and Korean populations were likely to be associated with higher per capita water usage. However, due to data limitations, it was hard to draw a causal correlation between the ethnic disparities in attitudes, behaviours and practices and the ethnic influences on water consumption. The results of this study only suggest that the revealed attitudinal and behavioural differences by ethnicity can assist to explain the disparities in per capita water consumption.

### ***3) The influence of acculturation on engaging ethnic communities in water conservation***

With regard to the third question, this study found that acculturation does affect ethnic migrants'

(the studied Chinese and Korean communities) knowledge, attitudes and behaviours towards water use. However, rather than directly saying that the acculturation has a positive or negative influence on the performance of Chinese or Korean respondents towards water use and conservation, the discussion argued that acculturation leads to complex scenarios.

Similar to the findings of most environmental acculturation studies, the results of this study imply that as years lived in Sydney increase and English proficiency is improved, the Chinese and Korean respondents were likely to be more knowledgeable about local water issues and have more positive attitudes towards water use and conservation. In the process of acculturation, it was observed that the Chinese group tended to lose the original water concerns formed in their home cultures (e.g., biospheric and collective values). However, this does not mean that migrants care less about water issues. Rather, they tend to contextualise their concern in the local social and water context, similar to Australians, deriving concerns from the water restrictions, drought conditions and environmentalism.

However, with regard to pro-conservational water use behaviours, acculturation did not seem to matter much among Chinese respondents. As argued above, this might be explained by the different speed and success of acculturation, or related to the stable and steady nature of habits and routines of water use practices. In contrast, looking at the actual water consumption of study areas implies that Chinese and Korean migrants who had migrated for a longer time might have a higher per capita water consumption than those who recently migrated. It seemed acculturation had a negative effect on household water consumption. As discussed in Section 6.4.3, several reasons might contribute to this problem, such as the relatively higher water consumption lifestyle in Sydney (compared to cities in China and Korea), the convenient water supply facilities, and the low possibility of increasing water-saving actions in the process of acculturation. This implied that, as years lived in Sydney increase, Chinese and Korean respondents might tend to develop a lifestyle that could result in higher water consumption. The finding has important implications to water demand management. It addresses the importance to check on migrants' water consumption trends during the period of living in Sydney. Highlighting that in the process of acculturation, proper guidance needed to prevent migrants from developing a high-water-consuming lifestyle.

By answering the first three questions, the study confirmed the existence of ethnic disparities in water use and conservation, and identified the reasons and factors that can facilitate an

understanding of the influence of ethnicity. The study also addresses the significant implications of these results for sustainable water management, as detailed in the next section.

### **7.3 Potentials, challenges, opportunities and implications to engaging ethnic communities**

Apropos of the final question, this study has application in the wider context of research or practice in many other (ethnically diverse) cities. The findings of this study will both bridge and enhance our knowledge of water use and management in pluralistic societies. Moreover, the study has important implications for water demand side management, where understanding fundamental differences derived from ethnicity, cultural usage of water, and conservation are critical to decision-making in water demand management strategies, especially in the design of conservation education programs. The study has also highlighted water use reduction potential among the two ethnic communities, the barriers to and possible means through which to approach ethnic communities.

Having established the ethnic disparities in knowledge, concern, behaviour and practices appertaining to water use and conservation, it would be extremely unwise for environmental managers, decision-makers and scholars to consider ethnically and culturally diverse publics as a homogenous community for environmental engagement. Moreover, the disparities (e.g., incentives/challenges for adopting water-saving behaviour) between the Chinese and Korean groups further suggest that water research and management should not merely focus on the White-majority and ethnic-minority binary, or the native-born and migrant binary, but strive to understand the water perceptions of each ethnic community group as well as the particular circumstances and context.

The study shows that information access, language preference, habits/routines, cultural preferences, experiences in the home and host countries, cultural/traditional values, socio-demographic and housing characteristics, and acculturation all help to understand ethnic disparities in water concerns and behaviour. To this end, water management that aims to effectively engage ethnically-diverse societies in water conservation needs to adopt integrated approaches rather than concentrate on one dimension. Conversely, the several dimensions revealed in this study provide various opportunities and means for potentially approaching and engaging ethnic communities in water management.

### **1) Potentials**

Since the Chinese and Korean communities were revealed to have relatively lower levels of knowledge, less beneficial dispositional attitudes, and a lower engagement level of pro-conservational behaviour (as conventionally understood) compared to the Australian respondents, there is much that water managers and educators can do to encourage water conservation. Despite the above differences, the study reported substantially higher willingness and potential to reduce water usage among the two ethnic minority groups reported compared to their Australian counterparts (Figure 4.6). Moreover, a higher percentage of respondents in the Chinese and Korean groups claimed to have an intention to know more about how to achieve water conservation compared to that of the Australian group. If this stated willingness can be translated into action, this finding further suggests that there may be greater potential among the ethnic minority groups for reducing household water usage than within the population in general.

The study indicated a potential to reduce water use among ethnic minority groups by targeting aspects of water use. Showering was the most nominated activity that had further water reduction potential among the Chinese and Koreans. The latter also tended to nominate laundry as another area wherein they could save water. Showering accounted for the largest water usage indoors; and, it was not surprising that it was nominated by all ethnic groups as the first target activity for saving water in the future. Given that long shower tendencies were revealed among the Chinese and Koreans, it seems there is greater water-saving potential among those groups if their long (and frequent) showers habits can be changed. Apropos of the outdoor water usage, since the Chinese and Korean communities tended to be apartment dwellers and few have gardens, there may be little potential to save further water via targeting outdoor water use activities.

Since the potential and willingness for a reduction in the use of water are recognised, it is important to identify how ethnic minorities can be approached and how their potential can be achieved. Water demand management strategies and educational campaigns that aim to effectively reduce water consumption based on ethnicity and cultures should pay particular attention to the barriers and challenges that emerge when engaging ethnic communities.



## **2) Barriers to overcome**

The research identified a number of important barriers that need to be overcome in order to reduce urban water usage among various ethnic communities in Sydney, with implications for other ethnically diverse cities. The critical barriers included:

(a) Lack of information and limited access to information and resources were revealed as important challenges for both the Chinese and Korean communities. It is important to note that Sydney Water (and other agencies) have already provided much of this information about water use and conservation; but, the clear response from the Chinese and Korean communities is that the information is either not provided, or is not in a form that they can or prefer to, access. The problem of limited information access may result in migrants not being aware of Sydney's local water issues, especially the debates and programs promoted by the government to encourage water conservation. Moreover, the misunderstanding among the Chinese and Korean communities that Sydney has a good water situation may further reduce any desire for water conservation. While, it has the potential to influence the everyday water use practices of Chinese and Korean's, both at the individual and household level.

(b) Hard to change behaviour patterns were nominated as another important challenge by the Chinese and Korean communities. The study found that the Chinese and Korean respondents tend to claim certain water use practices as habits, part of routines or a cultural preference, which formed since their childhood and was difficult for them to change. Consequently, they were unlikely to change practices, for example, such as washing dishes under running water.

(c) The Chinese and Korean communities might tend to think that it is the government's responsibility to deal with water problems. They were also less confident about their ability to make changes regarding water conservation, compared to their Australian counterparts. Moreover, the cultural differences that underpinned the apportioning of who is responsible for handling water issues were likely to contribute to the low pro-conservational behaviour; and, to the perceived lack of environmental activism (Clarke & Agyeman, 2011; Department of Environment and Conservation, 2005; Klocker & Head, 2013).

(d) Chinese and Korean respondents, who are renting and/or living in high-rise apartments, were revealed to be less likely to undertake pro-conservational behaviour in this study. Several

reasons may explain this phenomenon, e.g., restricted by space and facilities, and not able to make big changes due to tenancy. Also worthy of note is the influence of fixed water charges on flat dwellers' water perceptions. No matter how hard they tried to save water, the charge was the same, and thus reduced their desire to persevere with water-saving practices.

### ***3) Approaching ethnic minority members and overcoming the barriers/challenges***

How to approach ethnic community members has proven a problem for water managers and local government. As suggested by one environmental expert in local government, there are large numbers of ethnic Chinese living in a particular area, and the government had a range of water programs, however, the only problem was how to approach the ethnic communities and encourage them to become involved in the programs. A number of important points to consider when involving ethnic communities in water conservation programs are presented below.

#### **Providing information to ethnic communities through their preferred particular information sources and the importance of ethnic media**

The Chinese and Korean participants' levels of knowledge and familiarity with local water issues can be improved through information provision and education campaigns. Environmental communication should be achieved through preferred information sources and media. TV, newspapers and the Internet are the important information sources that the Chinese respondents are currently using for water related information. The Korean respondents claimed that TV and the Internet were their main information sources. TV was the most preferred information source for water information, even among the Chinese and Korean respondents with limited English proficiency. The Internet provides the easiest way to search for the information that people needed. However, the adoption of this approach may be restricted by the limited English-reading ability of some people. Further examination of their preferred information sources highlighted another important source – brochures. It seems that both the Chinese and Korean respondents tended to prefer information provided in brochures: the easy and practical water-saving tips they advertise could be useful for households to follow. Brochures printed in their mother tongue would be more eye-catching and helpful for them, but publications with long texts could prove too boring to read. The study also indicated that the current information delivery through brochures might not meet the current expectations of the ethnic minorities studies in this thesis. Newspapers were nominated less frequently as a preferred information source among the Koreans, which may have been because there were

few Korean-language newspapers in Sydney available to them. The low tendency to use the water service corporation as an information source among the Chinese and Korean respondents suggests that the leaflets attached to the water bills may not catch the attention of these households.

Chinese and Korean respondents were found to prefer to receive information provided in their native languages. Therefore, environmental management approaches promoting material in languages other than English would achieve greater success in environmental communication than waiting for non-English speaking community members to improve their levels of English. However, the divide between local/home-country coverage, limited reporting, and theme coverage of local water issues in ethnic newspapers could be resolved and in turn sharpen their readers' awareness and perceptions of Sydney's water issues. The media study revealed that water issues were reported differently in Chinese and Korean language newspapers from their English language counterparts in the extent of coverage, article type, temporal distribution, theme and geographical focus. Moreover, the media study (Section 6.3.1) indicated that the Chinese and Korean print media investigated in this research seemed not to play a bridging role in terms of providing information about and promoting awareness of local water issues. By ignoring or minimally reporting local water issues, the ethnic newspapers failed to inform their readers about important local water issues. Many ethnic community members who rely on, or prefer, ethnic newspapers as a source of information were probably unaware of those local issues and showed little concern for them. This implies that ethnic print media may need to give greater coverage to local water issues rather than the overwhelming emphasis on homeland issues. The issues revealed above should be recognised and addressed if water conservation programs are to consider an approach which involves ethnic minorities through print media.

### **Utilising culturally diverse water-use habits, recognizing and promoting the vernacular sustainabilities**

Rather than asserting which water use behaviours are more sustainable, it is more important to recognise the implications of ethnic disparities in daily water use practices for policy making and water demand management. As Gilg and Barr (2006, p. 412) observe, policies with a view on 'behavioural complexity groupings' and 'lifestyle types' would be of great effect in encouraging water conservation or other environmental conservation activities. This study suggests that the latter needs to be tailored to accord with particular ethnic communities. Rather

than attempting to facilitate changes in water use practices among ethnic communities to correspond with an assumed way of being sustainable, it may be more effective to utilise their habits and cultural preferences. Practical demonstrations and advice specifically based on people's cultural practices, and the innovative design of water-using facilities based on culturally diverse water-use habits and preferences, can better contribute to a more sustainable use of water.

This study addresses the importance of thinking beyond the normative, and recognising the diverse household sustainabilities peculiar to ethnically diverse communities. These vernacular, environmentally sustainable practices are usually undertaken unintentionally. This was found in the current research. Qualitative studies have illuminated how Chinese and Korean people use a cup to hold water while brushing their teeth, turn off the tap when soaping in the shower, and collect and store grey water in buckets for toilet flushing or watering flowers. These alternative means of saving water among the two ethnic groups should be recognised and promoted rather than simply attempting to adapt them to normative, western assumed 'green' behaviour.

### **Promoting sustainable water governance via the development of environmental citizenship**

The study suggests that while it is necessary to promote environmental awareness through education and information provision, it would also be effective to utilise water-use related traditional cultural values to assist water conservation. These values include the altruistic and biospheric value orientations influenced by collectivism, Taoism, Confucianism and Buddhism, and the frugality value that is implicit in Asian traditional cultures. As this study has revealed, while the Australian respondents were more likely to consider their water attitudes and behaviour as linked to environmentalism, the Chinese and Korean respondents tended to attribute their pro-conservational behaviours to the traditional virtue of frugality. Compared to their Australian counterparts, the Chinese and Korean respondents were more likely to claim 'community responsibility' as an important reason for undertaking water-saving action. Therefore, the above cultural values would be important elements through which to encourage voluntary pro-conservational behaviour and, for a further step, to develop environmental citizenship, especially when some other incentives (such as those based on water pricing or saving money) are of little effectiveness when reducing water consumption.

The research findings support the recent trend in environmental governance of promoting community participation in sustainable development via establishing and emphasising environmental citizenship. The importance of environmental citizenship needs to be addressed in multicultural societies, like Sydney, residents of which are from diverse ethnic backgrounds, speaking different languages at home and with different nationalities. In terms of the traditional concept of citizenship, it is difficult to involve cultural and ethnically diverse communities (especially those without Australia nationalities) in environmental activities, through the rights and obligations of citizenship. As a result, it is particularly difficult to engage cultural and ethnically diverse communities in the public sphere (for example, as indicated in the study, participating in local water activities). Environmental citizenship offers a solution to this issue. The rights and obligations defined by environmental citizenship are not confined to any nation; instead they are concerned with the common good of humanity. Under this consideration, in terms of this study, no matter if a person is Australia born or from a Chinese or Korean background, speaks English, Chinese or Korean, and no matter what visa or nationality of passport he/she is holding, he/she is entitled to the rights and responsibilities regarding to the welling-being of environment and the future of the societies he/she is from and living in.

The study also contributes to the understanding of applying the notion of environmental citizenship to sustainable water governance in some respects. In the context of environmental citizenship, individuals are willing to examine and change their unsustainable water use manners and commit to the collective good of society and environment. This commitment is considered to be more steady and powerful than incentives such as financial benefits, however, how to facilitate such commitment is a key issue. Besides education, the study offers a further opportunity that can be used to establish environmental citizenship. The study observed that ‘community responsibility’ and the ‘traditional virtue of frugality’ were commonly claimed among Chinese and Korean respondents to be important reasons to engage in water conservation. This implies that the observed respondents have norms and values influencing their practices rather than merely looking at the available incentives (such as pricing and rebates). These norms could be further strengthened and form a basis to develop environmental citizenship. However, the particular values of Chinese and Korean communities are not necessary applicable to all ethnic communities. For Australians, the development of environmental citizenship could be promoted with environmentalism or emphasising the combined rights (water consumption) and obligations (water saving and restrictive water usage) to water resources.

The study recognised that the apportioning of responsibility to the governments among the Chinese and Korean respondents influenced respondents' engagement in water-saving activities and might be a potential obstacle to encouraging environmental citizenship. Environmental citizenship encourages voluntary environmental behaviours both in the private and public spheres. In terms of water use, participation in conservation activities in the public sphere requires people to realise their individual roles and be confident about their participation. However, assigning the responsibilities to the governments indicates a lack of confidence among the Chinese and Korean respondents regarding their abilities and the effectiveness of their behaviour. In other words, they may be less likely to have a sense of involvement and empowerment. The lack of information and little access to resources also added to this problem. As a result of this situation, improving community connections, better environmental communication (ethnic media) and greater opportunities for people to take part in local environmental decision making would assist to overcome this obstacle. In addition, water conservation education programs designed for particular ethnic communities should clearly emphasise the role of households in water management and provide them with feedback on their behaviour, to acknowledge, encourage and reinforce their efforts.

### **Identifying the potential target population groups**

This study found that the variables which were revealed to significantly predict pro-conservational behaviour patterns differ across ethnic groups. An awareness of the diverse demographic predictors for pro-conservational behaviour across the ethnic groups is useful for designing a specific water conservation program. It would assist to identify the potential target population group, people who are relatively less active in water conservation and who should be paid more attention in water conservation education programs that target particular user groups. For example, those among the Chinese respondents who were living in high rise apartments, renting, or not pay water bills should be given particular tuition in water management strategies which aim to facilitate pro-conservation behaviour. In contrast, Korean people living in households comprised of couples with child(ren), in flats (high-rise apartments and low-rise units) and who lack good English language skills, would be the specific groups to approach and engage.

## 7.4 Limitations and Future research

This study has explored the influence of ethnicity on water use by focusing on three ethnic community groups (Australian, Chinese and Korean) using qualitative, quantitative and media study approaches. Ethnicity was found to matter in residential water use. While the findings have largely bridged the knowledge gap in ethnicity and water use, and provided significant implications for water demand management, the study was not without limitations and further research to extend this topic is needed:

(a) It is important to note that the research methods were limited in a few regards. The low response rate of the questionnaire survey resulted in a relatively small sample, which obviously limited the scope of analysis in examining trends and patterns in water attitudes, perceptions and behaviours. In addition, the low response rate among the Korean group indicated that the samples studied were not likely to be representative of the whole Korean community in Sydney. This also caused difficulties in finding significant relationships from the statistical analysis. As discussed in Section 3.4.2, several factors might contribute to the low response rate, such as low awareness, interest or high mobility of residents. Besides, the low-response-rate of the self-administrated questionnaire survey, (the estimated response rate for Korean group is as low as 5%), there are other limitations regarding the questionnaire survey method. The respondents of the questionnaire survey might be more likely to be those who are more aware of, or more interested in water issues. In addition, since the questionnaire is self-administrated, the self-reported perceptions, attitudes, knowledge and behaviours towards water use and conservation might not be consistent with the actual scenarios. Therefore, the results observed based on the samples might have a certain bias; especially the results obtained based on 30 Korean respondents. Despite the limitations, results of the questionnaire study provide critical knowledge that was used to answer the research questions. Significant correlations were found between ethnicity and water knowledge, attitudes and self-reported behaviours, based on the information collected through the questionnaire survey. The congruency between the results of the questionnaire study and that of the water data analysis also added a certain degree of confidence in the generalisability of the findings. Nevertheless, future studies with a broader range of samples would build higher confidence in these conclusions. An extension of this study could be conducted by taking measurements of actual home water use and its relationship to self-reported behaviours and water consumption.

(b) Qualitative research techniques were employed to supplement the quantitative analysis. It was expected that qualitative methods would deepen the information obtained from questionnaire survey. Although several communication methods were used to recruit participants, only a limited number of people, as detailed in Section 3.6.4, attended the focus groups and interviews due to anonymity and confidentiality concerns, availability, low interest, change of mind, denial of access to organisation. The relatively small sample size limited the scope of in-depth analysis to a certain extent. For example, Jjimjilbang tradition was raised by one Korean bilingual environmental educator in interview to be a possible explanation for the long shower tendency that was observed in the quantitative study among Korean participants, however, being not able to confirm this reason with further respondents, there is not enough evidence to draw conclusions on this possibility. The cultural probe was an innovative approach to this study, which was expected to help understand the specific water use practices that respondents mentioned in interviews or focus groups. However, due to the low response rate, the information collected through this technique was limited. Focus group and interview respondents were invited to participate in the cultural probe at the end of talks. Obviously, this recruitment procedure contributed, to a certain extent, to the low rate response of cultural probe. Future research that intends to use the same data collection method could gain a large sample via a better designed recruitment process.

(c) The results of this study suggest that attitudinal and behavioural differences by ethnicity are likely to contribute to the disparities in per capita water consumption. However, due to privacy requirements about the use of data, direct correlations between the above two elements were not analysed. In other words, it was not clear whether the Chinese and Korean respondents who evinced positive water attitudes and high levels of activism tended to consume more or less water than the Australians. Therefore, further studies combining water consumption data with survey data (ethnicity, migration status, socio-demographic, housing and attitudinal data) at the household level are needed.

(d) This study suggested that greater water reduction potential could be achieved by engaging with ethnic minority communities. Several aspects of water use were identified as good places to target. However, further studies based on actual water usage as measured in households are needed to confirm how much water households with particular ethnic backgrounds actually use for each water practice, and how much water can be potentially saved. More importantly, it is



necessary to understand how water usage can be reduced by targeting the particular daily water-use practices that prevail in certain cultures. This could involve practical demonstrations, advice, and the promotion of innovative water saving facilities based on particular cultural preferences.

(e) The study suggested that the Chinese and Korean migrants might tend to have higher water consumption as the years lived in Sydney increase. The possibility of this trend and how this might be prevented is critical to water demand management. However, regrettably, this argument was not further tested since the actual water consumption data for individual households was not collected in this study. Future studies with more detailed data could better gain insight into this issue.

(f) The media analysis part of this study highlights the importance of ethnic media to water management, and the need to understand what is produced, how it is produced and how it is received in terms of water issues. Some people do not read newspapers; but, there are other information sources. While media disparities may contribute to ethnically diverse public perceptions of water use, the existence of a causal chain, and its significance for those two aspects, requires further investigation. In other words, one should ascertain whether the differences in knowledge, perceptions and attitudes are accounted for, or mediated by, media disparities. In addition, apart from print media, TV and internet have been nominated as two important sources of information by the questionnaire respondents. Regrettably, how water issues were presented and interpreted by the mainstream and ethnic TV/internet media was not investigated in this study, further research is needed to obtain insights into this topic.

(g) This study enhances our knowledge on ethnicity and water use. The differences and disparities pertinent to water usage and conservation among the Chinese, Korean and Australian communities were explored, and opportunities to engage with the Chinese and Korean communities were analysed. However, more work is required to engage with other large and/or growing ethnic/non-English-speaking communities (e.g., the Indian, Vietnamese or Spanish communities among others). Similar research is also required in cities other than Sydney, cities in which the population is ethnically, culturally and linguistically diverse, and the water supply is under stress. The lessons learned from this study also have implications for studies and management of other environmental issues. For example, ethnicity may impact on a households' energy consumption and willingness to support environmental protection. For

this reason, further research is required to explore the effect of ethnicity on other environmental issues, and to increase our knowledge of this important phenomenon.

As has been established in this study, ethnicity and diverse cultures are important elements influencing people's water use and conservation. It is vital that researchers, water managers and policy-makers include ethnic factors in water research, management and decision-making, especially in ethnically diverse cities like Sydney. Moreover, there is a need to learn and understand ethnic differences and disparities, and to move towards sustainability based on a mutual respect of cultures. This research is significant because it provides an understanding of everyday practices of water use by ethnic groups. It has important implications for water planning and management and for cultural sensitivity and equal opportunity. People from different ethnicities have developed different habits, followed varying routines, and have culturally particular considerations when they make decisions. These differences lead to diverse water-use patterns and to people responding differently to water policies and management approaches. This highlights the importance of including ethnicity and cultural sensitivity issues in the processes of decision-making and environmental management. The lessons drawn from this research are applicable to many other cities, and to a myriad of environmental issues. There is an urgent need to act on these lessons, given the threats posed by population growth, increased consumption, climate change and the lack of easily available water sources. Fortunately, as a result of this research that builds on other studies of ethnicity and environmental issues, readers now know a little more about how to include ethnicity in the promotion of sustainable urban water use.

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## **Appendix 1**

**A summary of selected CCDs for household survey and questionnaire distribution methods**

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**A summary of selected CCDs for household survey and questionnaire distribution methods**

CODE			SOCIO-DEMOGRAPHIC AND HOUSING CHARACTERITICS																		QUES_ALLOCATE_METHD		ESTI_QUE_RETURN (calculated based on 20%)			
CODE	CD_CODE06	SLA_CODE06	SUB-REGION	SLA_NAME06	P_CHIN	P_KOR	P_AUSSIE	CHN	CHIN	KR	KOR	AUSSIE	MEAN_INC	HH_SZ	TOTAL_DWE	SEP_H	DETA_H	FLAT	LOW_RISE	HIGH_RISE	TOTAL_PP	POTENTIAL RESPONSE_RATE	ESTIMATED NO. of QUES.	CHIN	KOR	AUSSIE
1	1250814	105604004	NSR	Hornsby (A)	8.54%	1.52%	80.79%	6	0	4	0	265	2,125	3.3	97	97	0	0	0	0	328	10~20%	97	0	0	16
2	1251211	105604004	NSR	Hornsby (A) - South	51.17%	6.81%	8.17%	212	263	31	35	42	863	2.3	214	0	0	214	214	0	514	10~20%	214	22	3	3
3	1251513	105604004	NSR	Hornsby (A) - South	12.79%	15.55%	15.55%	88	134	152	163	163	1,177	2.3	441	0	0	441	0	441	1,048	10~20%	441	11	14	14
4	1330209	105406253	WSR	Parramatta (C)	1.60%	1.60%	51.20%	0	4	0	4	128	1,214	2.7	91	91	0	0	0	0	250	10~20%	91	0	0	9
5	1331212	105406252	WSR	Parramatta (C) - North-East	46.67%	14.81%	8.32%	411	561	131	178	100	1,161	3.3	355	30	325	0	0	0	1,202	10~20%	355	0	11	6
6	1350903	105201550	SSR-WEST	Canterbury (C)	33.03%	14.55%	3.46%	224	286	105	126	30	661	2.4	335	40	34	256	218	38	866	10~20%	335	17	10	2
7	1350910	105201550	SSR-WEST	Canterbury (C)	40.58%	14.76%	5.63%	308	418	135	152	58	729	2.6	366	22	17	317	208	109	1,030	10~20%	366	26	11	4
8	1360705	105154150	SSR-WEST	Hurstville (C)	59.13%	1.32%	6.59%	423	583	9	13	65	892	3.0	318	95	42	181	74	107	986	10~20%	318	21	1	4
9	1361006	105154150	SSR-WEST	Hurstville (C)	3.87%	0.00%	47.74%	18	24	0	0	296	1,512	3.0	204	204	0	0	0	0	620	10~20%	204	0	0	19
10	1361104	105154150	SSR-WEST	Hurstville (C)	2.38%	0.00%	46.29%	14	17	0	0	331	1,527	2.9	242	242	0	0	0	0	715	10~20%	242	0	0	22
11	1361208	105154450	SSR-WEST	Kogarah (A)	80.84%	2.24%	2.66%	480	578	15	16	19	791	2.6	267	0	0	267	10	257	715	10~20%	267	43	1	1
12	1382306	105558250	NSR	Willoughby (C)	27.69%	16.94%	5.51%	144	201	120	123	40	1,061	2.1	261	0	0	261	0	261	726	10~20%	261	14	9	3
13	1382317	105558250	NSR	Willoughby (C)	43.37%	16.20%	3.57%	255	340	135	127	28	1,420	2.4	311	0	0	311	22	289	784	10~20%	311	27	10	2
14	1410120	105351521	SSR-INNER & EAST	Canada Bay (A)	5.40%	3.19%	32.13%	28	39	20	23	232	1,392	2.7	241	157	77	7	7	0	722	10~20%	241	0	2	15
15	1410308	105351521	SSR-INNER & EAST	Canada Bay (A)	3.90%	3.47%	31.67%	11	18	15	16	146	1,569	2.9	160	153	7	0	0	0	461	10~20%	160	0	1	10
16	1410413	105357100	SSR-INNER & EAST	Strathfield (A)	11.89%	27.33%	4.56%	82	107	197	246	41	1,112	2.6	282	4	4	271	32	239	900	10~20%	282	6	15	3
17	1410511	105357100	SSR-INNER & EAST	Strathfield (A)	17.33%	46.34%	4.29%	158	206	512	551	51	782	2.5	433	0	0	433	0	433	1,189	10~20%	433	15	40	4
18	1410901	105351300	SSR-INNER & EAST	Burwood (A)	9.43%	19.95%	7.55%	19	35	54	74	28	1,031	2.6	136	70	11	55	55	0	371	10~20%	136	1	5	2
19	1411001	105351300	SSR-INNER & EAST	Burwood (A)	51.78%	9.68%	4.74%	429	524	102	98	48	803	2.7	347	50	17	280	77	203	1,012	10~20%	347	29	7	3
<b>Total</b>								<b>3,310</b>	<b>4,338</b>	<b>1,737</b>	<b>1,945</b>	<b>2,111</b>	<b>21,821</b>	<b>51</b>	<b>5,101</b>	<b>1,255</b>	<b>534</b>	<b>3,294</b>	<b>917</b>	<b>2,377</b>	<b>14,439</b>		<b>5101</b>	<b>233</b>	<b>140</b>	<b>144</b>

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## **Appendix 2**

### **Questionnaire (English, Chinese and Korean)**

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## HOUSEHOLD WATER USE QUESTIONNAIRE (English Version)

Project: The Ethnical and Cultural Correlates of Water Use in a Pluralistic Social Context

SCHOOL OF GEOSCIENCES, UNIVERSITY OF SYDNEY

*This questionnaire is being conducted to collect data for an academic research project at the University of Sydney concerning residential water use in Sydney. The research attempts to better understand residential water use in households with different ethnic and cultural backgrounds and is expected to contribute to sustainable water management. The information gathered will be used to identify water use patterns and help to understand the relationships between household characteristics, attitudes, behaviours and water use.*

*This questionnaire takes about 15-20 minutes to complete. While the general data-analysis results of the questionnaire will be used to generate research publications, all the specific information you provide will be treated **anonymously** and **confidentially**. For any questions, please contact Liping YAN on 0449940405 or liping.yan@sydney.edu.au*

**An adult** (over 18 years of age) who is **familiar with the water use** in the household **is invited to complete this questionnaire**. Please **return** the completed questionnaire using the **prepaid** envelope provided for you together with this questionnaire, by **1<sup>st</sup>, November, 2012(Monday)**.

### 1. Please tick with which ethnic community do you identify yourself?

- Australian     Chinese     Korean     English     Irish     Scottish  
 Italian     Lebanese     Greek     Indian     German     Vietnamese  
 Filipino     Other, please say which one(s) \_\_\_\_\_

### PART 1: ATTITUDES, KNOWLEDGE AND PERCEPTIONS

### 2. What do you think about Sydney's water supply situation for the long run? Please tick the description that best describes your opinion.

—————  —————  —————  —————

Has sufficient water supply    Just able to maintain city's general use    Faces water restrictions    Faces water crisis    Not sure

### 3. If you were born overseas, what do you think about the water supply quality and quantity in Sydney in comparison to your home country? Please tick the term that best describe your opinion. If you are born in Australia, please go directly to question 4.

Quality:  —————  —————  —————  —————  —————

Very good    Good    Average    Poor    Very Poor    Not sure

Quantity:  —————  —————  —————  —————  —————

Very good    Good    Average    Poor    Very Poor    Not sure

### 4. Please tick the sources from which you usually receive information about water issues (You can tick more than one box)

- |                                     |   |   |
|-------------------------------------|---|---|
| <input type="checkbox"/> Newspaper  | <input type="checkbox"/> Internet                   | <input type="checkbox"/> Government departments and agencies    |
| <input type="checkbox"/> Television | <input type="checkbox"/> Work                       | <input type="checkbox"/> Environmental and conservation groups  |
| <input type="checkbox"/> Radio      | <input type="checkbox"/> School/TAFE/University     | <input type="checkbox"/> Other, specify _____                   |
| <input type="checkbox"/> Brochures  | <input type="checkbox"/> Friends and family members | _____   |
| <input type="checkbox"/> Magazines  | <input type="checkbox"/> Water service corporation  | <input type="checkbox"/> Never receive this kind of information |

### 4a. Which one of the above sources is the main source of information you usually receive about water issues? \_\_\_\_\_

**5. For the following statements, please tick if you strongly agree, agree, neutral, disagree or strongly disagree.**

STATEMENTS	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
People should have the right to use as much water as they wish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Most households use more water than they need	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The government should place restrictions on how much water a household can use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The water supply in Sydney is sufficient to meet the needs of the community for many years to come	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is important that lawns be kept green and healthy, even if it means using a lot of water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If an area has a water shortage problem, mandatory rationing should be enforced	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It costs more to fix a leaky faucet than it is worth in water savings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It would be easy to reduce the amount of water used in your household	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that over-use of water depletes the resources available for use by other people	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have a personal responsibility to conserve water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that my actions can benefit the environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Waste water can be effectively treated to a standard so that it is safe for flushing toilets, watering gardens, washing cars and other outdoor uses.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Waste water can be effectively treated to a high standard so that it is safe for drinking.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**6. How much do you believe you know about the following issues?**

WATER ISSUES	A lot of knowledge	Quite a bit of knowledge	Moderate knowledge	Little knowledge	No knowledge at all
Where your household water comes from	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The water pricing system in Sydney	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The reuse of grey water at home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**7. Do you know how much water your household usually use?**

Yes      No

**8. What do you think about your water consumption compared to the average of the same type of households in Sydney region?**

- Above the average
- Approximately equal to the average
- Below the average
- Not sure

**9. If you were born overseas or used to live in other places outside the Sydney region for some period, what do you feel about your water consumption practices in Sydney in comparison to that outside Sydney?**

- I tend to take more water saving actions in Sydney
- I use water the same way as before came to Sydney
- I tend to take less water saving actions in Sydney
- I am not sure

**10. Have you taken actions to reduce your water consumption in Sydney in the past few years?**

- Yes (go to 10a, 10b and 10c, and skip 10d and 10e)
- No (go to 10d and 10e)

-----If YES, see question 10a, 10b and 10c-----

**10a. If yes, please tick what actions you have taken and then tick how frequently (usually, sometimes, or occasionally) you undertook that action(s) to reduce water consumption?**

ACTIONS	FREQUENCY		
	Usually	Sometimes	Occasionally
<input type="checkbox"/> Reduce frequency toilet flushed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Reduce driveway washing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Reduce water for garden/ adopt efficient garden watering facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Reduce car washing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Turn off tap for teeth brushing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Have short showers and /or do not fill the bath tub	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Fix leaking taps, leaking toilets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Use sink/basin plug more often	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Use dishwasher and /or wash machine only when there is a full load	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Reuse kitchen water (for flower watering, toilet flushing)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Replace old appliances with water-saving appliances	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Other, specify _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**10b. If yes, please tick what led you to use less water? (You can tick more than one box)**

- |   |  |
|---|--|
| <input type="checkbox"/> ① General environmental knowledge/awareness              | <input type="checkbox"/> ⑧ Water shortage/drought                  |
| <input type="checkbox"/> ② Water restriction                                      | <input type="checkbox"/> ⑨ Upbringing/habit/common sense           |
| <input type="checkbox"/> ③ Influence of other people e.g. children/friends/family | <input type="checkbox"/> ⑩ To save money                           |
| <input type="checkbox"/> ④ Community responsibility                               | <input type="checkbox"/> ⑪ Concern for water issues, like scarcity |
| <input type="checkbox"/> ⑤ Religious/ spiritual belief                            | <input type="checkbox"/> ⑫ Educated about saving water             |
| <input type="checkbox"/> ⑥ A media story  | <input type="checkbox"/> ⑬ An advertisement/promotion              |
| <input type="checkbox"/> ⑦ Not sure   | <input type="checkbox"/> ⑭ Other, specify _____.                   |

**10c. Of the above reasons, which one is the main reason for you undertaking water-saving actions? (Write down the number of the factor that you select) \_\_\_\_\_**

-----If NO, see question 10d and 10e-----

**10d. If not, what do you think are the challenges for you to reduce water use? (You can tick more than one)**

- ① Lack of information about ways to conserve water
- ② Little access to water saving devices
- ③ Low priority compared to other issues
- ④ Economic reasons (like water saving equipments cost money)
- ⑤ Need sufficient water to maintain high quality of life
- ⑥ Difficult to change behaviours in relation to water use that developed over time
- ⑦ My activities don't impact the environment, others are worse
- ⑧ Personal factors – laziness, forgetful, not thought about it
- ⑨ Other, specify \_\_\_\_\_
- ⑩ Not sure

**10e. Among the above factors, which do you think is the most difficult challenge for you to reduce water use? (Write down the number of the factor that you select) \_\_\_\_\_**

**11. Are you willing to change your water use practices in the next 12 months to reduce water use?**

- Yes                       No, can't do any more                       Not sure

**11a. If yes, what aspects of water usage do you think you can reduce?**

- Cooking     Showering
- Bathing     Flushing toilets
- Laundry     Car washing, *if you wash car at home*
- Flower watering, *if you have a garden or keep plants on your balcony and you water them*
- Water in swimming pool, *if you have a swimming pool connected to your dwelling*
- Driveway washing, *if you have yard and water it*
- Other, specify \_\_\_\_\_.

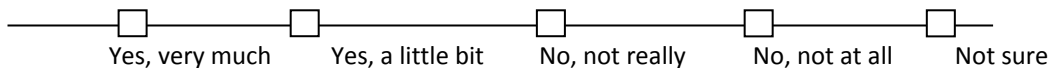
**11b. Thinking about how your household uses water, how much do you feel that your household could do to save water?**

- A lot more                       Some more                       A little bit more                       Nothing, can't do any more

**12. Do you think the following strategies would make it easier for you to save water, or not make it any easier?**

STRATEGIES	EASIER	NOT EASIER	NOT SURE
Incentives to save water (eg. financial incentives)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Assurance that recycled water is safe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cheaper water saving devices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
More information about ways to save water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Public demonstrations of water saving techniques	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**13. Do you think water pricing encourages conservation?**





**14. What specific initiatives do you think the government should take in order to deal with water supply issues?**  
 ( You can tick more than one box)

- Recycling / stormwater use
- Upgraded Infrastructures including pipelines, tanks
- Building desalination plant
- Pricing /incentives
- Not sure
- Building dams
- Regulation /restrictions
- Addressing reducing water use/consumption
- Other, specify \_\_\_\_\_

**15. Have you noticed any conservation programs performed by government/ organisations in Australia?**

- Yes, what (kind of) program(s)? \_\_\_\_\_
- No

**16. Did you ever receive any information about how to conserve water at home in Sydney?**

- Yes
- No

**16a. If yes, from which source?** \_\_\_\_\_

**16b. Was the information in your**  First language or in  English?

**17. Are you willing to know more about how to achieve water conservation?**

- Yes (go to 17a, 17b and 17c)
- No (go to 18)

-----If YES, see question 17a, 17b and 17c-----

**17a. If yes, where would you most like to receive information about water conservation?(Tick one box only)**

- Television
- Radio
- Internet
- Newspaper
- Brochures
- All kinds of media
- Other, specify \_\_\_\_\_.

**17b. If you prefer to receive information about water conservation through television, which television station do you watch the most?** \_\_\_\_\_.

**If through radio, which radio channel do you mostly listen to?** \_\_\_\_\_.

**If through newspaper, what newspaper do you read the most?** \_\_\_\_\_.

**17c. If you speak another language other than English at home, In which language do you prefer to receive the information?**

- Your first language
- English
- Both

**18. Have you heard of Sydney Water Corporation?**

- Yes
- No

**19. Do you know where Sydney’s drinking water is mainly sourced from today? (Tick one box only)**

- Desalination plant
- Dams and reservoirs
- Grounds water
- Water recycling system
- Stormwater harvest
- Not sure

**20. Please tick whether you think the following statements are true or false, or not sure.**

STATEMENTS	TRUE	FALSE	NOT SURE
Most stormwater drains run directly into waterways or oceans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Grey water is leftover water from baths, showers, hand basins and washing machine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sydney has never experienced compulsory household water use restrictions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**PART 2: HOUSING STATUS AND WATER USE BEHAVIOUR**

**21. Please tick what type of dwelling your household lives in?**

- Separate house  Semi-detached and town house  
 Low-rise units (less than 4 storeys)  High-rise apartment

**22. If your household live in a house, please tick the approximate land size of your property.**

- Less than 300 square metres  More than 900 square metres  
 300-500 square metres  Don't know  
 500-900 square metres

**23. Please tick the ownership of your dwelling?**

- Owned fully  Buying/ paying off  
 Renting-private  Renting- public/ with housing commission

**24. Do you pay the water bill?**

- Yes (go to question 24a)  No (go to question 25)

**24a. Do you pay by the amount of water actually used or is it a fixed charge?**

- By the actual amount used  Fixed  Other, specify \_\_\_\_\_.

**25. Do you have any of the following amenities connected to your dwelling?**

- Garden/ yard  Flowers / plants on the balcony  
 Spa  Swimming pool (private owned)  
 Swimming pool (shared with other dwellers in the building)  None

**26. Do you undertake any outdoor activities that consume water at home? Please tick all activities you usually do.**

- Washing car  Watering garden/ yard  
 Watering plants on the balcony  Watering paved road  
 Other, specify \_\_\_\_\_  None

**26a. Do you reuse water (reusable water from hand wash basin, bath, kitchen and cloth washing machine) for any indoor and outdoor activities?**

- Washing car  Watering garden/yard, plants on the balcony  
 Watering paved road  Other, specify \_\_\_\_\_  
 Flushing toilet  Do not re-use water at home

**27. If you have a garden or keep plants on the balcony please answer the following questions 27a to 27c.**

**27a. How often do you water the garden or balcony flowers in warmer months?**

- \_\_\_\_\_ times per week. About how many minutes per week do you water? \_\_\_\_\_ minutes  
 Not sure  
 Never water plants

**27b. How often do you water the garden or balcony flowers in colder months?**

- \_\_\_\_\_ times per week. About how many minutes per week do you water? \_\_\_\_\_ minutes  
 Not sure  
 Never water plants

**27c. What method(s) do the household use for watering garden/balcony plants?**

- Portable sprinkler  Hand held hose  
 Automatic sprinkler with timer  Automatic sprinkler without timer  
 Other, specify \_\_\_\_\_.

28. Please have a look at the table below and then write down the number of dishwasher/washing machine/bath/shower/ toilets you have in your household.

APPLIANCE	NUMBER of APPLIANCES in the household	RELATED INFORMATION
Dishwasher	_____	<b>The household usually wash dishes:</b> <input type="checkbox"/> by hand, under running water <input type="checkbox"/> by hand, in a plugged sink or other kind of container <input type="checkbox"/> using dishwasher, _____ times per <u>week</u>
Washing machine	_____	<b>The household usually do laundry:</b> <input type="checkbox"/> by hand, under running water <input type="checkbox"/> by hand, in a basin or other kind of container <input type="checkbox"/> using washing machine at home, _____ times per <u>week</u> <input type="checkbox"/> go to a laundry or use a laundry service
Single flush toilet	_____	_____ times per <u>day</u>
Dual flush toilet	_____	_____ times per <u>day</u>
Bath	_____	
Shower	_____	<b>How many of the showers are water efficient shower heads?</b> _____ of them are water efficient shower heads <input type="checkbox"/> Don't know

29. Please estimate how many showers people take in your household each week and the length of each shower, or how many tub of baths each week?

PERSON	GENDER (M-male/ F-female)	FREQUENCY and LENGTH for <u>SHOWERING</u>	How many <u>TUB of BATHs</u> per WEEK
Yourself		_____ Times <b>per week</b> , _____ minutes <b>each time</b>	_____ tub baths <b>per week</b>
2 <sup>nd</sup> Person		_____ Times, _____ minutes	_____ tub baths <b>per week</b>
3 <sup>rd</sup> Person		_____ Times, _____ minutes	_____ tub baths <b>per week</b>
4 <sup>th</sup> Person		_____ Times, _____ minutes	_____ tub baths <b>per week</b>
5 <sup>th</sup> Person		_____ Times, _____ minutes	_____ tub baths <b>per week</b>
6 <sup>th</sup> Person		_____ Times, _____ minutes	_____ tub baths <b>per week</b>
7 <sup>th</sup> Person		_____ Times, _____ minutes	_____ tub baths <b>per week</b>

30. If you wash your car at home, please write down how many times per month you wash your car at home: \_\_\_\_\_ times per month \_\_\_\_\_ minutes each time.

**PART 3: SOCIO-ECONOMIC AND DEMOGRAPHIC DATA**

31. How many people normally live in your dwelling, counting yourself? \_\_\_\_\_.

32. Using the following categories, please tick which best describes your household structure.

- Single person
- One parent family
- A couple no children
- A couple with children
- A family with tenant(s)
- Share housing
- Other, please describe \_\_\_\_\_

33. Please estimate the usual weekly household total income (income for all people who live in the household, including wages/salaries, government benefits, pensions, allowances and other income) before tax, and tick the appropriate income category.

- |  |   |
|--|---|
| <input type="checkbox"/> Less than \$599 | <input type="checkbox"/> \$1400-\$1999    |
| <input type="checkbox"/> \$600-\$999     | <input type="checkbox"/> \$2000-\$2999    |
| <input type="checkbox"/> \$1000-\$1399   | <input type="checkbox"/> More than \$3000 |

34. What is the main language spoken in the household? \_\_\_\_\_ .

35. If you have a religion, what is it? \_\_\_\_\_ .

36. How competent are you in English?

- |   |  |
|---|--|
| <input type="checkbox"/> Cannot speak, read or write in English           | <input type="checkbox"/> Can speak, read and write well in English |
| <input type="checkbox"/> Can speak, but not read or write well in English | <input type="checkbox"/> I am an English native speaker            |

37. Please look at the table below, and tick the boxes that best describe your age, education and work status:

<b>Age:</b>		
<input type="checkbox"/> Less than 18,	<input type="checkbox"/> 35 ≤ age <44,	<input type="checkbox"/> Over 65
<input type="checkbox"/> 18 ≤ age <24,	<input type="checkbox"/> 45 ≤ age <54,	
<input type="checkbox"/> 25 ≤ age <34	<input type="checkbox"/> 55 ≤ age <64,	
<b>Education:</b>		
<input type="checkbox"/> No formal schooling or primary school,		
<input type="checkbox"/> Secondary school,		
<input type="checkbox"/> University or diploma and / or other tertiary education		
<b>Work status:</b>		
<input type="checkbox"/> Student	<input type="checkbox"/> Full-time work	<input type="checkbox"/> Part-time/ casual work
<input type="checkbox"/> Don't work	<input type="checkbox"/> Retired	

38. In which country were you born? \_\_\_\_\_ .

38a. If you were born in Australia, please indicate the birth country of your parents:

Father \_\_\_\_\_ Mother \_\_\_\_\_

38b. If you were born overseas, how long have you been living in Australia? \_\_\_\_\_ years.

39. How long have you been living in Sydney? \_\_\_\_\_ years.

And how long since you moved to this city/suburb? \_\_\_\_\_ years.

40. Do you have any further comments? Please add them here:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(If the space is not enough, please attach a separate page.)

**(End of questions)**

Thank you for taking time to help with this research. Your help and effort is much appreciated!

Please place the completed questionnaire in the prepaid envelope provided and if possible send it back to us by 1<sup>st</sup> October, 2012 (Monday). In case of losing the envelope, please return the completed questionnaire to the address below:

PhD Candidate Liping YAN  
Madsen Building (F09), The University of Sydney, NSW 2006, AUSTRALIA

## 家庭用水调查问卷 (中文版)

研究项目: 在多元化社会背景下家庭用水与民族和文化的关联性  
悉尼大学 地球科学院

该调查问卷是为悉尼大学的一项关于悉尼居民用水的学术研究收集相关数据。该研究项目旨在深入了解处于不同民族和文化背景下的家庭其用水状况，并期望为水资源的可持续利用和管理做出贡献。所收集的数据将主要用于识别不同的家庭用水模式以及探讨各家庭特征与用水状况，用水态度和用水行为之间的相互关系。

完成 该调查问卷大约花费您 15-20 分钟的时间。尽管数据分析的总体结果会用于发表研究出版物， 但您提供的所有的具体信息会做严格的匿名化和保密处理。 如有任何疑问请通过手机 (0449940405) 或者电子邮件 ([liping.yan@sydney.edu.au](mailto:liping.yan@sydney.edu.au)) 联系研究人员 Liping YAN。

请年满 18 岁，且对家庭用水情况比较熟悉的家庭成员来负责填写该项问卷。 请您使用我们所提供的已付费的信封将完成的调查问卷在 2012 年 11 月 1 日 (星期一)前寄回给我们， 感谢您的合作。

### 1. 请选择您的民族背景:

- |  |   |  |  |
|--|---|--|--|
| <input type="checkbox"/> 澳大利亚族群 Australian | <input type="checkbox"/> 华人 Chinese           | <input type="checkbox"/> 韩国族群 Korean   | <input type="checkbox"/> 英格兰族群 English   |
| <input type="checkbox"/> 爱尔兰族群 Irish       | <input type="checkbox"/> 苏格兰族群 Scottish       | <input type="checkbox"/> 意大利族群 Italian | <input type="checkbox"/> 黎巴嫩族群 Lebanese  |
| <input type="checkbox"/> 希腊族群 Greek        | <input type="checkbox"/> 印度族群 Indian          | <input type="checkbox"/> 德国族群 German   | <input type="checkbox"/> 越南族群 Vietnamese |
| <input type="checkbox"/> 菲律宾族群 Filipino    | <input type="checkbox"/> 其他, 请说明是哪个 (些) _____ |  |  |

## 第一部分: 态度, 认识和理解

### 2. 从长远来看, 您认为悉尼的水资源供给状况如何? 请选择最合适您观点的那一项

—————  —————  —————  —————

充足的水资源供给      仅能维持城市一般      面临用水限制      面临水资源危机      不确定

### 3. 如果您在澳大利亚以外的地区出生, 请问与您的出生国家相比, 悉尼在水资源供应的质和量这两方面如何? 请选择与您的观点最贴切的选项。 如果您出生于澳大利亚, 请直接跳到问题 4.

质:      —  —  —  —  —  —  —

非常好      好      一般      较差      很差      不确定

量:      —  —  —  —  —  —  —

非常好      好      一般      较差      很差      不确定

### 4. 请选择您平常接触水资源相关信息的渠道? (可以选择多个选项)

- |                              |   |   |
|------------------------------|---|---|
| <input type="checkbox"/> 报纸  | <input type="checkbox"/> 网络                 | <input type="checkbox"/> 政府部门和机构            |
| <input type="checkbox"/> 电视  | <input type="checkbox"/> 工作                 | <input type="checkbox"/> 环保组织/团体            |
| <input type="checkbox"/> 电台  | <input type="checkbox"/> 学校/职业技术学院(TAFE)/大学 | <input type="checkbox"/> 其他, 请说明 (列举) _____ |
| <input type="checkbox"/> 宣传册 | <input type="checkbox"/> 朋友和家人              | _____                                       |
| <input type="checkbox"/> 杂志  | <input type="checkbox"/> 自来水服务公司            | <input type="checkbox"/> 从未收到 (接触) 过此类信息    |

4a. 以上哪一项是您接触该类信息的主要渠道? \_\_\_\_\_

5.关于下面的各项陈述，请选择您是否非常赞成、赞成、中立、反对或者极其反对

陈述	非常赞成	赞成	中立	反对	极其反对
人们应该有权使用任何自己所期望的水量	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
大多数家庭用水都超过了自己所需的水量	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
政府应限制各家庭的用水量	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
悉尼的水资源供给足够满足整个社会未来多年的需求	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
保持草坪的绿色和健康是很重要的，即使这意味着消费大量的水资源	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
如果一个地区面临水资源短缺，那么应执行强制性（定量）配给	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
用于修理漏水的水龙头的代价（费用）要高于以此达到的节约用水的价值	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
减少家庭的用水量是件容易的事情	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
我相信过量的用水会耗尽别人可获得（使用）的水资源	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
我有节约用水的个人责任	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
我相信我个人的节水行为会有益于环境（的保护）	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
污水经过有效的净化处理达到一定的标准，可以安全地用于冲马桶、浇灌花园、洗车以及其他室外用水活动	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
污水经过有效的净化处理达到一定的高标准，可用于饮用	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. 您认为您对下面事项有多少了解？

水资源相关事项	很了解	比较了解	一般了解	不太了解	完全不了解
您住所的自来水来源于哪里	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
悉尼的自来水收费体系	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
家庭灰色水的再利用	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7.您知道您住所平常的用水量吗？

Yes 知道      No 不知道

8. 与悉尼地区相同类型家庭（住所）的平均用水量相比，您如何看待您的住所用水量？

- 高于平均水平
- 约等于平均水平
- 少于平均水平
- 不确定

9. 如果您出生于澳大利亚以外的地区或者曾经有一段时间居住于悉尼以外的地区，与在海外或悉尼以外时相比，您感觉现在的用水行为有何变化？

- 更多的节水措施，在悉尼
- 用水与来悉尼之前没有什么变化
- 更少的节水措施，在悉尼
- 不确定

10. 在过去几年中，您是否采取了措施减少您在悉尼的用水量吗？

- 是（继续回答问题 10a, 10b and 10c, 然后跳过 10d and 10e）
- 否（跳到问题 10d and 10e）

-----如果 10 题回答‘是’，请继续回答 10a, 10b 和 10c-----

10a. 如果‘是’，请在下面左边一栏勾选您采取了哪些措施，并在右边一栏勾选该措施实行的频率（经常，有时，或者偶尔）

措 施	频 率		
	经常	有时	偶尔
<input type="checkbox"/> 减少冲厕所的次数	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 减少人行道、车道冲洗次数	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 减少花园浇灌/采用高效率的灌溉设备	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 减少洗车	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 刷牙时关掉水龙头	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 缩短洗澡时间/不灌满浴缸	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 修理漏水的水龙头、漏水的马桶	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 增加使用水槽塞子的次数，用以蓄水	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 等洗碗机和/或者洗衣机装满后才使用	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 厨房污水再利用（用于浇花、冲厕所）	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 用节水型装置替换旧的用具、装置	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 其他措施，请说明_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10b. 如果‘是’，请选择是哪些原因让你减少用水？（可以选择多个选项）

- ① 环保常识/环保意识
- ② 用水限制（管制）
- ③ 受他人影响，如儿女/朋友/家人
- ④ 社会责任感
- ⑤ 宗教/精神信仰
- ⑥ 一项新闻报道
- ⑦ 不确定
- ⑧ 水资源短缺/干旱
- ⑨ 从小养成/习惯/常识
- ⑩ 为了省钱
- ⑪ 关心水资源问题，如水缺乏
- ⑫ 节约用水的教育
- ⑬ 节约用水的广告/宣传
- ⑭ 其他，请说明\_\_\_\_\_

10c. 在以上原因中，哪一项是促使您实行节约用水的最主要原因？（请将您选择的选项前的编号写在横线上） \_\_\_\_\_





**14. 您认为政府应该采取那些优先措施来因对水资源供给问题？（可选择多个选项）**

- |  |                                      |
|--|--------------------------------------|
| <input type="checkbox"/> 循环水/雨水利用        | <input type="checkbox"/> 建造水坝        |
| <input type="checkbox"/> 升级基础设施，包括管道、储水槽 | <input type="checkbox"/> 调控/管制       |
| <input type="checkbox"/> 建造海水淡化厂         | <input type="checkbox"/> 强调减少用水/节约用水 |
| <input type="checkbox"/> 收费系统/激励因素       | <input type="checkbox"/> 其他，请说明_____ |
| <input type="checkbox"/> 不确定             | _____                                |

**15. 您在澳大利亚是否有注意到政府或团体/组织的任何节约用水方面的活动？**

- 有，是什么（样的）活动？\_\_\_\_\_
- 没有

**16. 您在悉尼是否曾经收到过任何关于如何节约用水的信息？**

- 有             没有

**16a. 如果‘有’，请问是从哪个渠道？** \_\_\_\_\_

**16b. 您收到的信息是**  您的母语 **还是**  英语？

**17. 您是否愿意多了解如何实现节约用水？**

- 是（继续回答问题 17a,17b 和 17c）                       否（直接跳到问题 18）

-----如果‘是’，请回答问题 17a,17b 和 17c-----

**17a. 如果‘是’，您最喜欢通过哪种渠道？（仅选择一项）**

- |                             |                              |                                      |
|-----------------------------|------------------------------|--------------------------------------|
| <input type="checkbox"/> 电视 | <input type="checkbox"/> 报纸  | <input type="checkbox"/> 所有媒体        |
| <input type="checkbox"/> 电台 | <input type="checkbox"/> 宣传册 | <input type="checkbox"/> 其他，请说明_____ |
| <input type="checkbox"/> 网络 |                              | _____                                |

**17b. 如果您喜欢通过电视接收有关节约用水的信息，请问哪个电视频道您最常收看？** \_\_\_\_\_

如果是通过电台，哪个电台频道您最常收听？ \_\_\_\_\_

如果是通过报纸，哪份报纸您最常看？ \_\_\_\_\_

**17c. 如果您在家讲英语以外的语言，请问您更喜欢哪一种语言形式的节水信息？**

- 母语                       英语                       两者都可以

**18. 您有听说悉尼水务局（Sydney Water Corporation）吗？**

- 有                       没有

**19. 您知道目前悉尼的饮用水主要来源于哪里吗？（仅选择一项）**

- |                                |                                  |
|--------------------------------|----------------------------------|
| <input type="checkbox"/> 海水淡化厂 | <input type="checkbox"/> 水循环利用系统 |
| <input type="checkbox"/> 水坝和水库 | <input type="checkbox"/> 雨水收集系统  |
| <input type="checkbox"/> 地下水   | <input type="checkbox"/> 不确定     |

**20. 请您选择以下陈述是否正确**

陈述	正确	错误	不确定
大部分雨水排水沟直接将雨水排入水道或者大海	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
灰色水是浴缸、淋浴室、洗手槽和洗衣机使用剩下的污水	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
悉尼从来没经历过强制性的家庭用水限制	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 第二部分：家庭和用水状况

### 21. 请选择您的住宅类型：

- 独立房屋 (Separate house)                       半独立/联排式房屋 (Semi-detached and town house)  
 少于 4 层的低层公寓 (Low-rise units)                       高层公寓 (High-rise apartment)

### 22. 如果您的住所是独立房屋，请选择您住所大概的总占地面积：

- 少于 300 平米                       多于 900 平米  
 300-500 平米                       不知道  
 500-900 平米

### 23. 请选择您住所的拥有权形式？

- 完全私有                       还款中  
 租赁私房                       租赁公房/有住房补贴

### 24. 您平常是否支付用水收费单 (water bill)？

- 是 (继续回答问题 24a)                       否 (跳到问题 25)

#### 24a. 水费是根据实际用水量来支付还是是固定的金额？

- 按照实际的用水量                       固定的金额                       其他，请说明 \_\_\_\_\_

### 25. 您的住所是否有以下用水设施？

- 花园/院子                       阳台种植植物  
 水浴/温泉 (spa)                       游泳池 (私有)  
 游泳池 (与其他住户共用)                       没有

### 26. 您平常在家是否进行以下用水的室外活动？

- 洗车                       浇灌花园/庭院  
 浇灌阳台植物                       喷洒路面  
 其他，请说明 \_\_\_\_\_                       没有

#### 26a. 您在家重复利用污水 (可再利用的污水，包括在洗手槽、浴室、厨房和洗衣机使用剩下的污水) 进行以下室内和室外活动吗？

- 洗车                       浇灌花园/庭院，阳台的植物  
 喷洒路面                       其他，请说明 \_\_\_\_\_  
 冲厕所                       不重复利用 '可再利用' 污水

### 27. 如果你有花园或者在阳台种植植物，请回答以下问题 27a 和 27c

#### 27a. 在较温暖的月份，您多久浇一次花园？

- \_\_\_\_\_ 次每周。每次浇灌时间大约多长？ \_\_\_\_\_ 分钟  
 不确定  
 从不浇灌

#### 27b. 在较冷的月份，您多久浇一次花园？

- \_\_\_\_\_ 次每周。每次浇灌时间大约多长？ \_\_\_\_\_ 分钟  
 不确定  
 从不浇灌

#### 27c. 您用什么方法浇灌花园、阳台植物？

- 手提喷淋装置                       手提水管  
 有定时装置的自动喷灌系统                       无定时装置的自动喷灌系统  
 其他，请说明 \_\_\_\_\_

28. 请阅读以下表格的信息，并在相应的位置填写您住所里用水装置的数量，以及您洗碗、洗澡等的相关信息

装置	住所里用水装置的数量	相关信息
洗碗机	_____台	您住所内平常如何清洗餐具： <input type="checkbox"/> 手洗，在开着的水龙头下 <input type="checkbox"/> 手洗，在出水槽或其他容器中 <input type="checkbox"/> 使用洗碗机，_____次每周
洗衣机	_____台	您住所内平常如何清洗衣物： <input type="checkbox"/> 手洗，在开着的水龙头下 <input type="checkbox"/> 手洗，在洗衣盆或者其他容器中 <input type="checkbox"/> 在家中用洗衣机洗衣物，_____次每周 <input type="checkbox"/> 去洗衣店或者使用其他清洁服务
单冲厕所	_____个	_____次每天
双冲厕所	_____个	_____次每天
浴缸	_____个	
淋浴	_____个	住所有多少淋浴喷头是节水型的？ _____个是节水型的 <input type="checkbox"/> 不知道

29. 请估算一下您住所内所有成员每周洗澡（淋浴或者泡浴）的次数和时长：

所有成员	性别 (M-男性/F-女性)	淋浴的频率和时长	泡浴的浴缸数
你自己		____次每周，____分钟每次	____浴缸每周
成员 2		____次每周，____分钟每次	____浴缸每周
成员 3		____次每周，____分钟每次	____浴缸每周
成员 4		____次每周，____分钟每次	____浴缸每周
成员 5		____次每周，____分钟每次	____浴缸每周
成员 6		____次每周，____分钟每次	____浴缸每周
成员 7		____次每周，____分钟每次	____浴缸每周

30. 如果您在家洗车，请问您每月洗车的次数和每次的时长是多少？ \_\_\_\_\_次每月， \_\_\_\_\_分钟每次。

### 第三部分：家庭社会、经济和人口数据

31. 包括你自己在内，您的住所平常有多少人居住？ \_\_\_\_\_

32. 在下面的选项中，那一项最能描述您住所内的居住人口构成？

- |                                 |   |
|---------------------------------|---|
| <input type="checkbox"/> 单身住户   | <input type="checkbox"/> 一个家庭和租客              |
| <input type="checkbox"/> 单亲家庭住户 | <input type="checkbox"/> 合租住户 (Share housing) |
| <input type="checkbox"/> 夫妇有小孩  | <input type="checkbox"/> 其他，请说明 _____         |
| <input type="checkbox"/> 夫妇没有小孩 | _____   |



## 가정용 물 사용 관행 설문조사 (한국어)

연구프로젝트: 다문화 사회에서 민족과 문화적 요인이 물 사용관행에 미치는 영향  
시드니대학 지구과학원

본 설문조사는 시드니 주민의 물 사용 관행에 관한 시드니 대학의 학술연구 자료를 수집하기 위한 것입니다. 본 연구는 다양한 민족적 문화적 배경을 가진 주민들의 물 사용 관행을 이해하고, 지속가능한 수자원 관리 방법을 모색하고자 합니다. 수집된 정보는 물 사용 패턴을 확인하고, 가구별 특성, 태도, 행동 등이 물 사용 패턴과 어떤 관계가 있는지 파악하는 데 사용될 것입니다.

본 설문조사는 약 15 내지 20 분 정도가 소요됩니다. 일반적인 자료 분석 결과는 연구자료 발행에 사용되겠지만 귀하가 제공하는 상세한 정보는 엄격한 기밀로 처리될 것입니다. 만약 조사와 관련된 질문이 있으신 경우 핸드폰(0449940405) 혹은 이메일 ([liping.yan@sydney.edu.au](mailto:liping.yan@sydney.edu.au)) 로 Liping YAN 에게 연락해 주십시오.

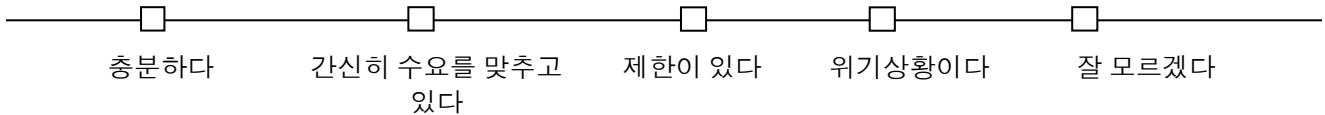
만 18 세 이상의 성인 중 가정 내 물 사용 현황을 잘 알고 있는 가족 구성원이 이 설문조사지를 작성해주시기 바라며, 완성된 조사지는 동봉한 반송용 봉투를 사용하시어 01/11/2012 (월요일)까지 보내주시면 됩니다.

### 1. 귀하의 민족적 배경을 선택하십시오.

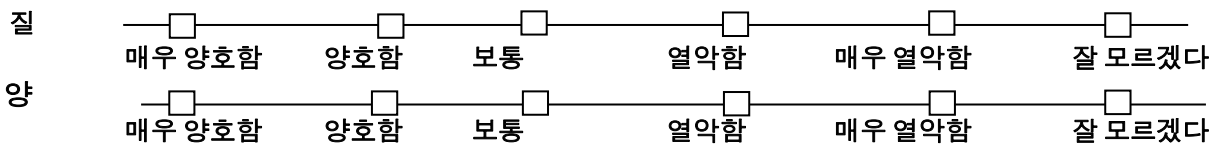
- |  |   |                                       |   |
|--|---|---------------------------------------|---|
| <input type="checkbox"/> 호주 Australian | <input type="checkbox"/> 중국 Chinese           | <input type="checkbox"/> 한국 Korean    | <input type="checkbox"/> 잉글랜드 English   |
| <input type="checkbox"/> 아일랜드 Irish    | <input type="checkbox"/> 스코틀랜드 Scottish       | <input type="checkbox"/> 이탈리아 Italian | <input type="checkbox"/> 레바논 Lebanese   |
| <input type="checkbox"/> 그리스 Greek     | <input type="checkbox"/> 인도 Indian            | <input type="checkbox"/> 독일 German    | <input type="checkbox"/> 베트남 Vietnamese |
| <input type="checkbox"/> 필리핀 Filipino  | <input type="checkbox"/> 기타, 직접 작성하십시오. _____ |                                       |   |

## 제 1 부분 태도, 인식과 이해

### 2. 장기적인 관점에서 귀하가 생각하는 시드니의 수자원 공급 상황은 어떻습니까? 아래 보기 중 본인의 의견을 가장 잘 표현한 것을 선택하십시오.



### 3. 만약 귀하가 호주 이외의 국가에서 출생했다면 귀하의 출생국가와 비교했을 때 시드니 수자원 공급의 질과 양을 어떻게 평가하십니까? 아래 보기 중 본인의 의견을 가장 잘 표현한 것을 선택하십시오. 만약 호주에서 출생하셨다면 질문 4 로 이동하십시오.



### 4. 귀하가 평소 물과 관련된 정보를 수집하는 방식을 모두 선택하십시오. (모두 선택하십시오)

- |                               |   |                                    |
|-------------------------------|---|------------------------------------|
| <input type="checkbox"/> 신문   | <input type="checkbox"/> 인터넷                | <input type="checkbox"/> 정부 발행 문서  |
| <input type="checkbox"/> 텔레비전 | <input type="checkbox"/> 업무                 | <input type="checkbox"/> 환경단체      |
| <input type="checkbox"/> 라디오  | <input type="checkbox"/> 학교/ 기술교육원(TAFE)/대학 | <input type="checkbox"/> 기타 _____  |
| <input type="checkbox"/> 홍보책자 | <input type="checkbox"/> 친구 가족              | _____                              |
| <input type="checkbox"/> 잡지   | <input type="checkbox"/> 수도회사               | <input type="checkbox"/> 정보를 얻지 못함 |

### 4a. 위 내용중 귀하가 정보를 얻는주요 방식은 어느 항목입니까? (한가지만 선택) \_\_\_\_\_

5. 아래 설명중 님의 견해를 선택하십시오.아주 찬성합니다,찬성합니다,중립,반대 혹은 극력 반대합니다.

설명	매우동의함	동의함	보통	동의하지 않음	매우동의하 지 않음
주민은 자신이 원하는 만큼 물을 사용할 권리가 있다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
대다수 가정은 꼭 필요한 양보다 물을 더 사용한다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
정부는 각 가구의 물사용 양을 제한해야 한다	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
시드니의 수자원 공급량은 향후 다년간 수요를 충분히 만족할만큼 충분하다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
다량의 물 사용을 필요로 하지만 잔디가 건강하게 자라는 것이 중요하다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
만약 특정 지역에 물공급이 부족하다면 사용량의 강제 제한이 불가피하다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
수도꼭지 누수를 수리하는데 드는 비용이 수리 후 절약할 수 있는 비용보다 비싸다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
가정에서 물을 절약하는 것은 쉽다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
물을 낭비하는 것은 다른 사람이 사용할수 있는 물의 양을 감소시킨다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
나에게는 물을 절약해야할 책임이 있다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
나의 물 절약 습관은 환경에 도움을 준다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
오수는 효율적인 정화 과정을 거쳐 번기, 정원에 물주기, 세차 혹은 다른 실외 활동에 사용할 수 있다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
오수는 효율적인 정화 과정을 거쳐 음용수로 사용할수 있습니다	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. 아래 항목들에 대해 얼마나 자세히 알고 계십니까?

	매우 잘 알고 있음	잘 알고 있음	보통	잘 모른다	모른다
상수도 공급원	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
시드니의 상수도 비용 시스템	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
한번 사용한 수돗물의 재활용	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. 귀하의 가구가 사용하는 물의 양이 보통 어느 정도 인지 알고 계십니까?

네 모름니다

8. 시드니 지역 내다른 가구의 평균 물사용량 과 비교하여 본인 가구의 사용량에 대해서는 어떻게 생각하십니까?

평균 수준보다 높습니다.  
평균 수준과 비슷합니다

평균 수준보다 낮습니다  
잘 모르겠습니다

9. 만약 귀하가 호주이외의 지역에서 출생하였거나 혹은 시드니 이외 지역에서 일정한 시일동안 거주하였다면 시드니 외에 거주할 때와 시드니에서 거주할 때 본인의 물 사용 습관에 변화가 있습니까?

- 시드니에서 물을 더 절약합니다
- 차이가 없습니다
- 시드니에서 물을 덜 절약합니다
- 잘 모르겠습니다

10. 과거 시드니에서 물을 절약하기 위한 행동을 취하신 적이 있습니까?

- 네(질문 10a, 10b and 10c 을 작성하시고 10d and 10e 는 작성하지 않으셔도 됩니다)
- 아니오(질문 10d 과 10e 을 작성하십시오)

-----만약 <<네>>로 질문 10 을 답변하였다면 계속하여 10a, 10b 과 10c 를 작성해주십시오-----

10a. 만약 <<네>>로 답변하였다면 아래 좌측의 선택 사항중 어떤 조치를 취했는지 표기하시고 우측의 선택사항중 빈도를 선택하십시오.

조치	빈도		
	자주	간혹	이따금
<input type="checkbox"/> 변기에 물 내리는 횟수를 줄였습니다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 주차장 앞 진입로에 물청소하는 횟수를 줄였습니다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 정원에 물주는 횟수를 줄였거나, 물절약에 효과적인 관수(灌水)시설을 설치했습니다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 세차 횟수를 줄였습니다	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 양치질할때 수도꼭지를 잠갔습니다	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 샤워시간을 줄였고/ 혹은 욕조에 물을 채우지 않았습니다	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 누수 하는 수도꼭지와 변기를 수리하였습니다	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 싱크대와 세면대 마개를 더 자주 사용하였습니다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 식기 세척기혹은 세탁기는 풀 로드후 사용하였습니다	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 주방 오수를 화분에 물을 줄 때나 변기에 사용하였습니다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 오래된 장비들을 물 절약 장비로 교체했습니다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 기타 (직접 서술하십시오)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10b. 만약 <<네>>로 답변하셨다면, 귀하가 물을 절약하게 된 원인이 무엇인지 선택하십시오. (모두 선택하십시오)

- ① 환경보호 상식/환경보호 의식
- ② 물사용 제한(관리제도)
- ③ 타인의 영향을 받아 (자녀,친구,가족)
- ④ 사회적인 책임감
- ⑤ 종교/정신적인 신앙
- ⑥ 뉴스보도
- ⑦ 잘 모르겠습니다
- ⑧ 수자원 부족 /가뭄
- ⑨ 가정 교육/습관/상식
- ⑩ 돈을 절약하기 위하여
- ⑪ 수자원 문제에 관심 있어. 예를 들어:수자원 부족
- ⑫ 수자원 절약과 관련된 교육
- ⑬ 수자원 절약 홍보/선전
- ⑭ 기타는설명부탁드립니다. \_\_\_\_\_

10c. 선택한 항목 중 가장 주요한 원인은 무엇입니까? (선택한 항목의 번호를 적어주십시오) \_\_\_\_\_

-----<<아닙니다>>로 답변하였다면 질문 10d 과 10e 를 작성해주시오-----

10d. 만약<<아닙니다>>로 답변하셨다면, 아래 중 어떤 항목이 귀하가 물을 절약하는데 가장 큰 어려움을 주고 있습니까? (모두 선택하십시오)

- ① 물 절약 방법에 대한 정보가 부족합니다.
- ② 물 절약형 장비들을 구하기 힘듭니다 (비용이나 많이 들거나 어디서 파는지 잘 모르는 경우).
- ③ 다른 이슈들에 비해 물절약 대한 관심이 부족합니다.
- ④ 경제적 원인 (예를 들어, 물절약 장비를 구매하려면 많은 비용이 듭니다)
- ⑤ 높은 삶의 질을 유지하려면 충분한 물이 필요합니다
- ⑥ 일단 한번 만들어진 물사용 습관은 바꾸기 어렵습니다.
- ⑦ 저의 물사용 습관은 환경에 영향주지 않았고, 다른 사람들이 저보다 잘하고 있다고 생각하지 않습니다.
- ⑧ 개인적인 원인- 귀찮음, 깜빡함, 무신경함.
- ⑨ 기타 (직접 서술하십시오) \_\_\_\_\_
- ⑩ 잘 모르겠습니다.

10e. 선택한 항목 중 가장 주요한 원인은 무엇입니까? (선택한 항목의 번호를 적어주시오)

\_\_\_\_\_

11. 향후 12 개월 내 물사용 습관을 개선하여 물을 절약할 의사가 있으십니까?

- 네  아니요  잘 모르겠습니다

11a. 만약<<네>>로 답변하시었다면 어떤 방법을 사용하시겠습니까? (모두 선택하십시오)

- 요리  샤워
- 욕조 목욕  변기에 물내리기
- 세탁  세차, 만약 집에서 세차하실 경우
- 화분에 물주기, 만약 집에 정원이 있거나 혹은 베란다에 식물을 키우고 계신 경우
- 수영장 물사용, 만약 집에 수영장이 있는 경우
- 진입로에 물 뿌리기, 만약 집에 진입로가 있어 물 뿌리시는 경우
- 기타, 설명 부탁드립니다 \_\_\_\_\_

11b. 현재 귀하가구의 물 사용현황을 고려할 때 앞으로 얼마나 더 절약할 수 있다고 생각하십니까?

- 아주 더 많이  어느 정도 더  아주 조금 더  더 절약할수 없습니다.

12. 아래 중 어떤 방법이 귀하가 물을 더 쉽게 절약하는데 도움을 준다고 생각하십니까?

조치	도움이 됨	도움이 되지 않음	잘모르겠습니다
물 절약에 따른 인센티브 제공 (재정적인 우대)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
재활용된 물이 안전하다는 보증	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
저렴한 물 절약형 도구/장치/가정용 전기 제품	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
물절약 방법과 관련된 더 많은 정보	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
물 절약 방법에 대한 대중적인 시연	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

13. 수도요금에 물을 절약하는데 관련이 있다고 생각하십니까?

- \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_
- 매우 많이      어느 정도      별로관련없음      전혀관련 없음      잘 모르겠음



14. 정부는 어떤 조치를 우선적으로 취하여 수자원 공급문제를 해결해야 합니까? (모두 선택하십시오)

- 오수 재활용/빗물 사용
- 제방 건축
- 기반시설(수송 도관, 물저장 탱크)개선
- 통제/관리제도
- 바다물 담수 공장 건축
- 물절약 소비 강조
- 요금제/인센티브 이용
- 기타, 설명부탁드립니다. \_\_\_\_\_
- 잘 모르겠습니다

15. 호주 정부 혹은 민간단체/조직의 물절약 캠페인 등 활동을 알고 계십니까?

- 네, 구체적으로 어떤 활동입니까? \_\_\_\_\_
- 아니오

16. 시드니에 거주하시면서 물 절약하는 방법과 관련된 정보를 받으신적 있습니까?

- 네, 있습니다
- 아니오, 없습니다.

16a. 만약 <<있습니다>>라면 어떤 방법입니까? \_\_\_\_\_

16b. 그 정보는  모국어 혹은  영어로 제공되었습니까?

17. 물 절약 방법을 더 많이 알고 싶습니까?

- 네 (계속 질문 답변 17a, 17b and 17c)
- 아니오 (18 를 답변 하시오.)

-----만약 <<네>>이면 문제 17a, 17b 와 17c 를 작성해주십시오.-----

17a. 만약 <<네>>이면 아래 중 어떤 방법을 가장 선호하십니까? (하나만 표기하십시오.)

- 텔레비전
- 신문
- 모든 매체
- 라디오
- 홍보책자
- 기타, 설명부탁드립니다.
- 인터넷

17b. 만약 텔레비전을 통해 정보 얻는 방법을 선호하신다면, 어떤 채널을 가장 자주 보십니까?

라디오를 선호하신다면, 어떤 라디오 채널을 가장 자주 들으십니까? \_\_\_\_\_

신문을 선호하신다면, 어떤 신문을 가장 자주 읽으십니까? \_\_\_\_\_

17c. 귀하가 집에서 영어 이외의 언어를 사용하고 계신 경우, 어떤 언어로 된 물 절약 정보를 선호하십니까?

- 모국어
- 영어
- 두가지 다 괜찮습니다

18. 시드니 수도국 (Sydney Water Corporation) 을 들어본적 있습니까?

- 네
- 아니오

19. 시드니 음용수가 어디서부터 공급되고 있는지 알고 계십니까? (하나만 표기하십시오)

- 바닷물 담수화공장
- 재활용물
- 물 제방과 저수지
- 빗물 수집 시스템
- 지하수
- 잘 모르겠습니다

20. 아래 설명이 정확합니까?

설명	예	아니오	잘 모름
대부분의 빗물 배수구는 수로 혹은 바다로 직접 연결된다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
욕조, 샤워실, 세면대 혹은 세탁기가 사용후 남은 오수는 재활용이 가능합니다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
시드니는 강제적으로 가정용 물 사용 양을 제한한 적이 없다.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 제 2 부분: 주거 유형과 물사용 현황

### 21. 현거주지의 주거 유형은

- 독립적인 건물(Separate house)                       반독립/서로 연결된 건물 (Semi-detached and town house)  
 4 층 이하의 낮은 아파트(Low-rise units)                       고층 아파트 (High-rise apartment)

### 22. 만약 독립적인 건물이라면, 그 건물이 차지한 총 바닥 면적은

- 300 m<sup>2</sup> 미만     900 m<sup>2</sup> 이상  
 300 m<sup>2</sup> 이상 500 m<sup>2</sup> 미만     모릅니다  
 500 m<sup>2</sup> 이상 900 m<sup>2</sup> 미만

### 23. 현 거주지의 소유 형식은?

- 완전 사유입니다.     대출금 지불 중입니다.  
 임차한 개인주택입니다.     임차한 공공주택입니다/주택 수당이 있습니다.

### 24. 수도요금 (water bill) 을 지불합니까?

- 네, 지불합니다. (24a 을 답변 하시오)     지불하지 않습니다 (25 를 답변 하시오)

#### 24a. 수도요금은 실제 물사용양에 근거해 지불하십니까, 아니면 고정적인 금액을 지불하십니까?

- 실제적인 물사용양에 따라     고정적인 금액     기타, 설명 부탁드립니다. \_\_\_\_\_

### 25. 거주지 내아래와 같은 물사용 시설이 있습니까?

- 정원/뜰     베란다에 화초를 키웁니다  
 스파     (개인소유) 수영장  
 (기타 주민과 공동으로 사용하는) 수영장     없습니다

### 26. 다음과 같은 실외 활동을 하고 계십니까? (모두 선택하십시오)

- 세차     정원에 물 주기  
 베란다에 있는 화초에 물주기     사유 도로에 물 뿌리기  
 하지 않습니다     기타, 설명 부탁드립니다. \_\_\_\_\_

#### 26a. 다음과 같은 용도로 생활 오수 (재활용 가능한 오수 : 세면대, 욕실, 주방, 세탁기에서 쓰다 남은 물) 를 재활용하십니까?

- 세차     정원에 물 주기. 화초에 물주기  
 도로에 물 뿌리기     기타, 설명 부탁드립니다. \_\_\_\_\_  
 변기물 내리기     생활오수를 재활용하지 않습니다

### 27. 만약 정원이나 베란다에서 화초를 키우고 계시다면 27a, 27c 을 작성해주십시오

#### 27a. 비교적 따뜻한 계절에 가든에 물주는 빈도는?

- 매주 \_\_\_\_\_ 회. 대략 얼마나 걸립니까? \_\_\_\_\_ 분.  
 잘 모르겠습니다  
 물을 주지 않습니다

#### 27b. 추운 계절에 가든에 물주는 빈도는?

- 매주 \_\_\_\_\_ 회. 대략 얼마나 걸립니까? \_\_\_\_\_ 분.  
 잘 모르겠습니다  
 물을 주지 않습니다

#### 27c. 어떤 방법을 사용하여 정원, 베란다에 물을 공급합니까?

- 휴대용 살포 장치     휴대용 물 파이프  
 정시장치가 있는 자동 스프링 시스템     정시장치가 없는 자동 스프링 시스템  
 기타, 설명해 주십시오 \_\_\_\_\_





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## **Appendix 3**

### **Household survey envelope sample**

School of Geosciences  
Madsen Building F09  
The University of Sydney NSW 2006 Australia

## Household Water Use Survey

家庭用水调查 | 가정용 물 사용 관행 설문조사

The University of Sydney Academic Research Project: Ethnical and Cultural Correlates of Household Water Use

悉尼大学学术研究项目：家庭用水与民族、文化背景的关联性

시드니대학 연구프로젝트: 다문화 사회에서 민족과 문화적 요인이 물 사용관행에 미치는 영향

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## **Appendix 4**

**A summary of questionnaire respondents' characteristics**

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#### Appendix 4 A summary of questionnaire respondents characteristics

		Australian (N=125)		Chinese (N=110)		Korean (N=31)		Other (N=33)		Total Respondent (N=299)		Sydney population 2011 (N=4391673)	
<b><u>Gender</u></b>	Male	59	52.2%	36	41.4%	11	44.4%	16	53.3%	122	47.9%	2162221	49.2%
	Female	54	47.8%	51	58.6%	15	55.6%	14	46.7%	134	52.1%	2229452	50.8%
<b><u>Age</u></b>	18-24	1	0.8%	8	7.3%	2	6.5%	0	0.0%	11	3.7%	418839	7.0%
	25-34	5	4.1%	28	25.5%	6	19.4%	8	24.2%	47	15.9%	676894	15.4%
	35-44	13	10.6%	28	25.5%	9	32.3%	5	15.2%	55	18.6%	653490	14.9%
	45-54	30	24.4%	19	17.3%	4	12.9%	5	15.2%	58	19.6%	594978	13.5%
	55-64	33	26.8%	17	15.5%	6	19.4%	6	18.2%	62	20.9%	475608	10.8%
	over 65	41	33.3%	10	9.1%	3	9.7%	9	27.3%	63	21.3%	564445	12.9%
<b><u>Education</u></b>	no formal schooling or primary school	1	0.8%	4	3.6%	0	0.0%	0	0.0%	5	1.7%	1712238	39.0%
	secondary school	30	24.4%	19	17.3%	1	3.2%	6	18.8%	56	18.9%	2895630	65.9%
	university or diploma and/or other tertiary education	92	74.8%	87	79.1%	29	96.8%	26	81.3%	234	79.4%	209741	4.8%
<b><u>Household size</u></b>	One person	28	24.3%	9	8.6%	2	6.7%	8	24.2%	47	16.7%	343810	22.6%
	Two person	42	36.5%	28	26.7%	9	30.0%	8	24.2%	87	31.0%	467724	30.7%
	Three person	18	15.7%	40	38.1%	8	26.7%	7	21.2%	73	26.0%	261649	17.2%
	Four person	21	18.3%	18	17.1%	9	33.3%	6	18.2%	54	19.6%	266476	17.5%
	Five person	4	3.5%	8	7.6%	1	3.3%	1	3.0%	14	5.0%	118569	7.8%
	Six or more person	2	1.8%	2	1.9%	0	0.0%	1	3.0%	5	1.8%	63169	4.2%
<b><u>Household structure</u></b>	Single person	32	25.6%	12	10.9%	4	12.9%	8	24.2%	56	18.8%	1037860	68.2%
	One parent family	7	5.6%	7	6.4%	12	41.9%	0	0.0%	26	9.1%	343807	22.6%
	A couple no children	38	30.4%	34	30.9%	2	6.5%	10	30.3%	84	28.2%	181216	15.7%
	A couple with children	41	32.8%	19	17.3%	4	12.9%	12	36.4%	76	25.5%	189292	16.4%
	A family with tenant(s)	4	3.2%	6	5.5%	4	12.9%	2	6.1%	16	5.4%	374595	32.5%
	Share housing	2	1.6%	27	24.5%	4	12.9%	1	3.0%	34	11.4%	36434	2.4%
	Couple with an adult child	0	0.0%	2	1.8%	0	0.0%	0	0.0%	2	0.7%	103289	6.8%
	Elderly and kids	0	0.0%	1	0.9%	0	0.0%	0	0.0%	1	0.3%		
	couple kids and elderly	1	0.8%	1	0.9%	0	0.0%	0	0.0%	2	0.7%	1521397	100.0%
<b><u>Work status</u></b>	Student	2	1.6%	6	5.5%	3	10.3%	2	14.3%	13	4.4%		



	Full-time work	52	41.6%	67	60.9%	11	41.4%	14	42.4%	144	49.5%		
	Part-time/casual work	23	18.4%	15	13.6%	8	27.6%	4	28.6%	50	17.4%		
	Don't work	3	2.4%	10	9.1%	4	13.8%	4	28.6%	21	7.2%		
	Retired	41	32.8%	12	10.9%	2	6.9%	8	57.1%	63	21.5%		
<b><u>Household income</u></b>	less than \$599	12	11.2%	15	14.3%	3	9.7%	8	27.6%	38	14.0%	110822	7.3%
	\$600-\$999	18	16.8%	23	21.9%	8	25.8%	5	17.2%	54	19.9%	103674	6.8%
	\$1000-\$1399	25	23.4%	17	16.2%	5	16.1%	2	6.9%	49	18.1%	172068	11.3%
	\$1400-\$1999	13	12.1%	28	26.7%	7	25.8%	4	13.8%	52	19.2%	273688	18.0%
	\$2000-\$2999	20	18.7%	12	11.4%	6	19.4%	5	17.2%	43	15.9%	215022	14.1%
	more than \$3000	19	17.8%	10	9.5%	1	3.2%	5	17.2%	35	12.9%	119970	7.9%
<b><u>Dwelling type</u></b>	separate house	84	67.7%	5	4.5%	3	9.7%	14	42.4%	106	35.7%		
	low-rise units	8	6.5%	28	25.5%	5	16.1%	3	9.1%	44	14.8%	926062	56.5%
	semi-detached and town house	12	9.7%	27	24.5%	2	6.5%	6	18.2%	47	15.8%	233502	14.2%
	high-rise apartment	20	16.1%	50	45.5%	20	67.7%	10	30.3%	100	33.7%	194169	11.8%
<b><u>Housing tenure</u></b>	Owned fully	71	58.2%	32	29.1%	6	19.4%	16	50.0%	125	42.5%	462150	30.4%
	Renting-private	15	12.3%	42	38.2%	11	38.7%	11	34.4%	79	26.9%	192154	12.6%
	Buying/paying off	36	29.5%	34	30.9%	10	32.3%	5	15.6%	85	28.9%	529907	34.8%
	Renting-public/ with housing commission	0	0.0%	2	1.8%	3	9.7%	0	0.0%	5	1.7%	27191	1.8%
<b><u>Engproficiency36</u></b>	cannot speak, read or write in English	0	0.0%	13	11.8%	5	16.1%	0	0.0%	18	6.1%		
	Can speak, but not read or write well in English	0	0.0%	25	22.7%	11	35.5%	0	0.0%	36	12.2%		
	Can speak, read and write well in English	0	0.0%	67	60.9%	12	41.9%	13	39.4%	92	31.3%		
	I am an English native speaker	121	100.0%	5	4.5%	2	6.5%	20	60.6%	148	50.3%		
<b><u>Ethnicity</u></b>	Australian	125	41.4%									1138043	25.9%
	Chinese	110	36.4%									358063	8.2%
	Korean	31	10.3%									49735	1.1%
	Other	33	10.9%									3665530	83.5%
<b><u>Country of birth</u></b>	Australia	104	83.2%	6	5.5%	0	0.0%	7	21.2%	117	39.3%	2632544	0.5994

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## **Appendix 5**

### **Principle component analysis on the attitude measurements**

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## Principle component analysis on the attitude measurements

The deriving of attitudinal variables was conducted based on a 13-item scale question (Q5) in the questionnaire. The 13 items were developed from two previous studies, Lawrence and McManus (2008) and Murdock et al. (1988) including aspects of water availability, water management, water consumption, conservation and reuse. Each item was measured along a 5 point scale (ranging from 1-strongly agree to 5-strongly disagree, with reverse coding used for some items). In order to examine the underlying constructs of the reported scales of attitudes, and to choose or create the suit indicator for attitudes, a factor analysis - Principal Components Analysis (PCA)<sup>1</sup> – with varimax rotation was conducted.

### Result of the Principal Components Analysis

	Rotated Component Matrix <sup>a,b</sup>		
	Component		
	1	2	3
1.Right to use much water	.005	<b>.787</b>	.088
2.Households use more	.173	.251	<b>.605</b>
3.Restriction on water use	.127	.338	<b>.644</b>
4.Water supply is sufficient	.234	<b>.415</b>	-.032
5.Important lawn green	-.054	<b>.719</b>	-.101
6. Rationing enforced	.153	<b>.516</b>	.252
7.Costs more to fix leaking	.087	<b>.507</b>	-.486
8.Easy to reduce water use	.062	-.184	<b>.542</b>
9.Personal responsibility	<b>.612</b>	.243	.059
10.Overuse depletes resources	<b>.842</b>	.059	.110
11.My action benefits the environment	<b>.881</b>	.004	.103
12.Waste water reuse	<b>.679</b>	.103	.091
13.Waste water treated for drinking	.198	<b>.415</b>	.123

Extraction method: Principal Component Analysis.  
Rotation method: Varimax with Kaiser Normalization.

a. Rotation converged in 4 iterations.  
b. Refer to question 5 in Appendix 2 for details of each statement.

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Three constructs were revealed by the PCA. As shown in the second Table, the first factor referred to concerns based on general beliefs and values regarding the environment; e.g., ‘I

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<sup>1</sup> Principal Component Analysis (PCA) is a data analysis approach which allows one to examine the systematic patterns of variations in the data. In this study, the PCA was used to summarize the underlying constructs of variations in the variables. See O'Rourke et al. (2013) for more information.

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have a personal responsibility to conserve water’ and ‘I believe that over-use of water depletes the resources available for use by other people’. This construct can be understood through affective dimension of environmental concerns (Lafuente & Sánchez, 2010): people express supportive attitudes towards the environment and specific environmental issues based on their primitive beliefs and values. Scores for these scales varied from 0.612 to 0.881 with a reliable internal consistency (Cronbach’s  $\alpha^2 = 0.760$  ).

**Result of Principal Component Analysis (with varimax rotation) on attitudinal items**

Item	Factor loading	Cronbach’s alpha
Factor 1:		.760
10. Personal_responsibility	.612	
9. Overuse_depletes_resources	.842	
11. My_actions_benefit_environment	.881	
12. Waste_water_reuse	.679	
Factor 2:		.610
1. Right_to_use_much_water	.787	
5. Important_lawn_green	.719	.687
6. Rationing_enforced	.516	
7. Costs_more_to_fix_leaking	.507	
4. Water_supply_is_sufficient	.415	
13. Waste_water_treated_for_drinking	.415	
Factor 3:		.385
2. Households_use_more	.605	
3. Restriction_on_water_use	.644	
8. Easy_to_reduce_water_use	.542	

The second factor (construct) indicated the respondent’s attitude towards specific issues and actions that were closely related to personal experiences, costs, health and quality of life, all of which can be understood through the perception-based dispositional dimension of environmental concerns (Lafuente & Sánchez, 2010). Items included were, for example, ‘it is important that lawns be kept green and healthy, even if it means using a lot of water’ and ‘if an area has a water shortage problem, mandatory rationing should be enforced’. The scores for these scales ranged from 0.415 to 0.787 with a reasonable reliability (Cronbach’s  $\alpha = 0.610$ ).

Factor 3 which described attitudes towards water use and management at the household level, included ‘most households use more water than they need’, ‘it would be easy to reduce the

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<sup>2</sup> Cronbach's alpha is a statistic which is generally used to measure the internal consistency or reliability (underlying construct) of a set of variables or items. See O'Rourke et al. (2013) for more information.

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amount of water used in your household' and 'the government should place restrictions on how much water a household can use'. Alpha for these scales was relatively low (Cronbach's  $\alpha=0.385$ ).

As a result, 3 variables were constructed in total for measuring attitudes. Two variables, namely value-based, affective attitude and perception-based, dispositional attitude, were constructed on the basis of the first two factors in PCA by computing the mean of items with a factor loading of 0.4 or higher (as shown in the second Table). Another variable, namely general-attitude, was constructed based on all Likert-scales, by calculating the general means of 13 items for each respondent. No variable was set up based on the third factor, as the alpha was below 0.590, which is considered not reliable.

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## **Appendix 6**

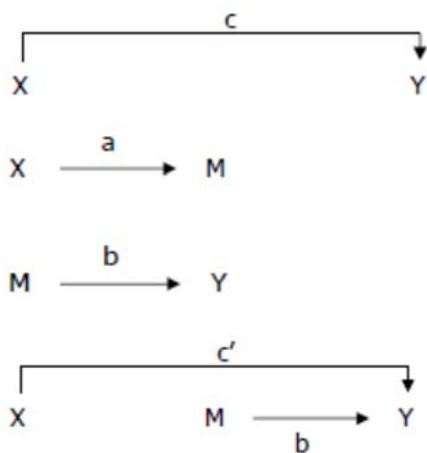
### **Testing the mediation effects of knowledge and attitudes**

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## Testing the Mediation Effects of Knowledge and Attitudes

The mediation can be seen as a form of effect transmitted by a hypothesized causal chain in which one variable affects a second variable and then, in turn, affects a third variable (MacKinnon, 2008). The figure below gives a visual depiction of these relationships.  $c$  refers to the total effect of  $X$  on  $Y$ ,  $a$  indicates the direct effect of  $X$  on  $M$ ,  $b$  represents the direct effect from  $M$  to  $Y$  while  $X$  being controlled, and  $c'$  refers to the direct effect from  $X$  to  $Y$  while the mediator  $M$  being taken into account. Mediation effect is the indirect effect of one variable on outcome carried over through mediator (MacKinnon, 2008; MacKinnon et al., 2007). In the case of analysing the relationship between ethnicity, knowledge, attitude and behaviour, knowledge may be regarded as the mediator between ethnicity and attitude or the mediator between ethnicity and behaviour, the mediation effect (indirect effect) is, therefore, the effect carried over by knowledge to attitude or to behaviour



### Effect flow of the mediation effects

If the effect of  $X$  on  $Y$  is zero ( $c'=0$ ) when  $M$  is included, it is regarded as a full mediation. If the effect of  $X$  on  $Y$  reduced when  $M$  ( $c'<c$ ) is included in the equation, then it is a partial mediation effect.

To test the mediation effect, a widely used approach is to calculate the indirect effect (coefficient) and then test it for significance (MacKinnon, 2008). The regression coefficient can be interpreted as the change in  $Y$  caused by every unit change in  $X$  that is mediated by the mediator. Two approaches are usually used for calculating the indirect effect (MacKinnon & Dwyer, 1993).

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*Calculating the mediation (indirect) effect*

In this study, the product of coefficients approach was employed to calculate the indirect effect (coefficient). Function was shown as below :

Regression analysis model	Equation
Model1	$Y=B_cX +e_1$
Model2	$M=B_aX+e_2$
Model3	$Y=B_{c'}X+B_bM +e_3$

The mediation effect coefficient is  $B_{\text{mediation}} = B_a * B_b$

*Statistical tests of the mediation (indirect) effect*

Once the coefficient for the mediation effect is computed, statistic tests need to be done for testing the significance of the coefficient. There are many approaches developed by researchers to do the statistic tests (MacKinnon, 2008), here, an approach proposed by MacKinnon (MacKinnon, 2008; MacKinnon & Dwyer, 1993) was used for the analysis, p value (sig.) and z-score statistics, also see MacKinnon's webpage on mediation analysis (McKinnon, 2013).

The statistic test for mediation effects is dividing the mediated effect ( $B_a * B_b$ ) by its' standard error (MacKinnon, 2008; MacKinnon & Dwyer, 1993).

$$Z_{ms} = (B_a * B_b) / SE_{BaBb}$$

$$SE_{BaBb} = \sqrt{B_a^2 * SE_{Bb}^2 + B_b^2 * SE_{Ba}^2}$$

The result is a z-score. Use the z-score to look up the matching p-value in the table of normal distribution.  $B_a$ ,  $B_b$ ,  $B_{c'}$ ,  $SE_{Ba}$ ,  $SE_{Bb}$  and  $SE_{B_{c'}}$  can be calculated from the regression model1, 2 and 3 as shown in the above table.

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## **Appendix 7**

### **Water data provided by Sydney Water**

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## Water data provided by Sydney Water

### Data provided

The following data was provided:

- Number of single dwellings
- Average consumption by single dwellings
- Number of multi dwellings
- Average consumption by multi dwellings
- Number of multi dwellings in developments that are 100% residential
- Average consumption of multi dwellings in 100% residential developments
- Number of multi dwellings in mixed residential/non-residential developments
- Average consumption of multi dwellings in mixed developments.

Data was provided on a monthly basis for every month between and including July 2008 to March 2012 for the 14 selected CCDs. Data provided including the following items:

- CCD\_2006: CCD code as per 2006 Census
- MONTH
- SD: Number of single dwellings
- MEAN\_CONS\_SD: Average consumption of single dwellings
- MD: Number of multi dwellings
- MEAN\_CONS\_MD: Average consumption of multi-dwellings
- MD\_RES: The number of multi-residential dwellings in developments that consist of residential units/flats only (“100% residential”)
- MEAN\_CONS\_MD\_RES: The average consumption of multi-dwellings in 100% residential developments
- MD\_MIXED: The number of multi-residential dwellings in developments that consist of a mix of residential and non-residential units/flats
- MEAN\_CONS\_MD\_MIXED: The average consumption of multi-residential dwellings in mixed developments.

### Measure of consumption

The measure of consumption provided is the so called apportioned monthly consumption. It is derived from quarterly meter readings. The average daily consumption was calculated as the

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metered consumption divided by the number of days since the previous meter read. The apportioned monthly consumption is the average daily consumption multiplied by the number of days in that month.

### **Property types**

Data is provided for single dwellings and multi-dwellings. The single dwellings category includes detached and semi-detached houses as well as terraces and townhouses if they are held under a single title. All of these dwelling types are categorised as single dwelling by Sydney Water.

The multi-dwellings group includes four different property type categories:

- strata units
- flats
- mixed flats
- Dual occupancies.

Strata units are units held under strata title. As a rule, strata units do not have their own meter. Instead, there is a single meter, called the common meter, which records the consumption for the block as a whole only. To calculate the consumption of a strata unit, the consumption on the common meter is divided by the total number of units in the block.

### **Data available for selected CCDs**

1250601, 1250814, 1251211, 1330209, 1360705, 1360709, 1361006, 1361104, 1361208, 1382306, 1410413, 1410511, 1410901, 1411001

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## **Appendix 8**

**Linking CCDs (2006 Census) and SA1s (2011 Census) for water data analysis (the relative positional relationship between the CCDs and SA1s)**

**--Table**

**-- Images**

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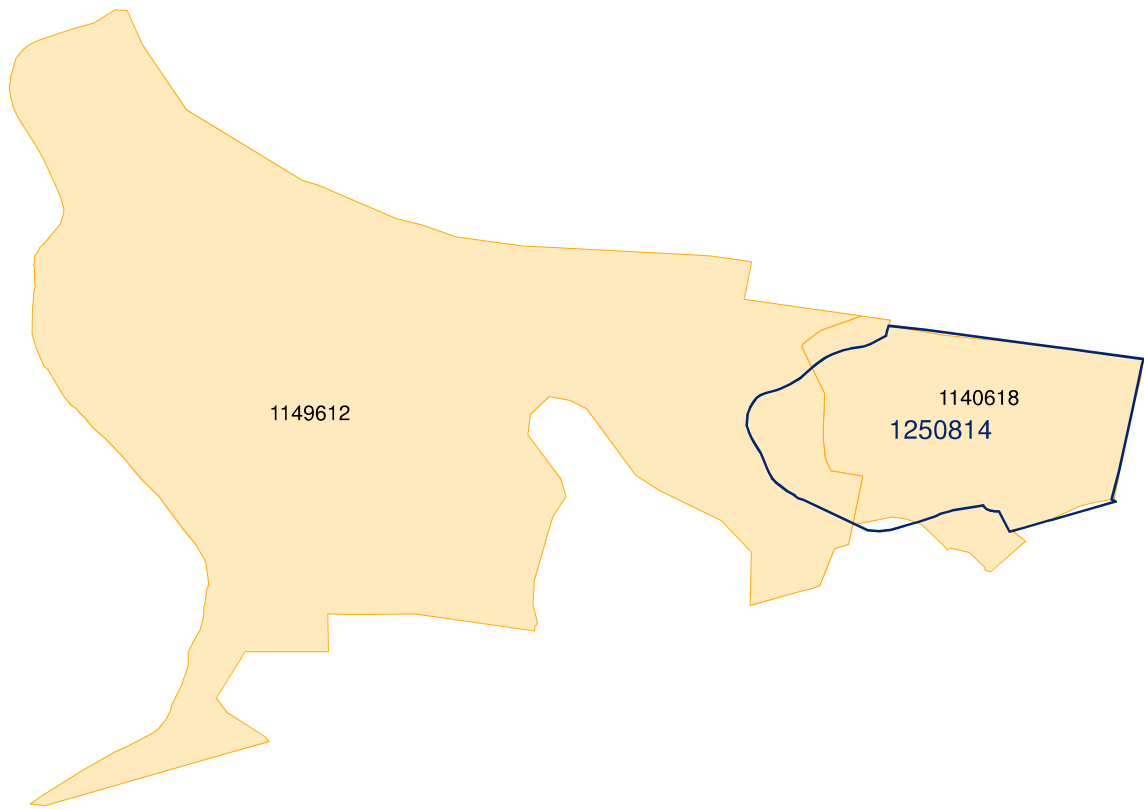
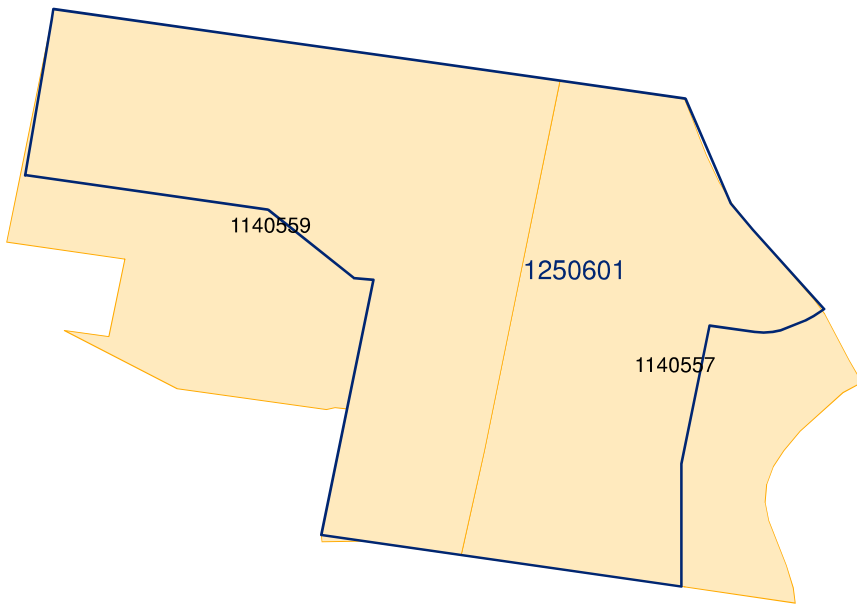
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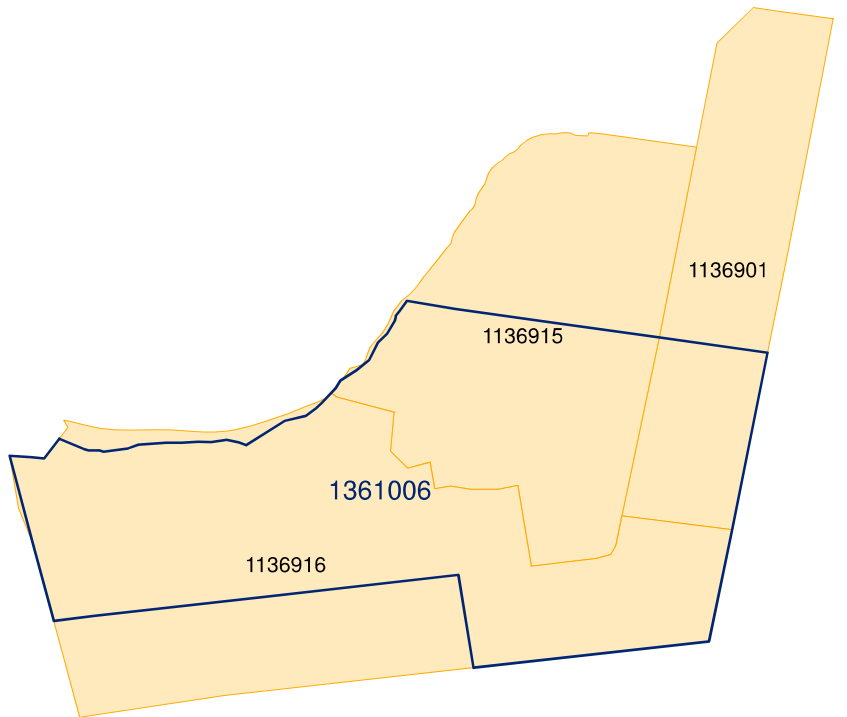
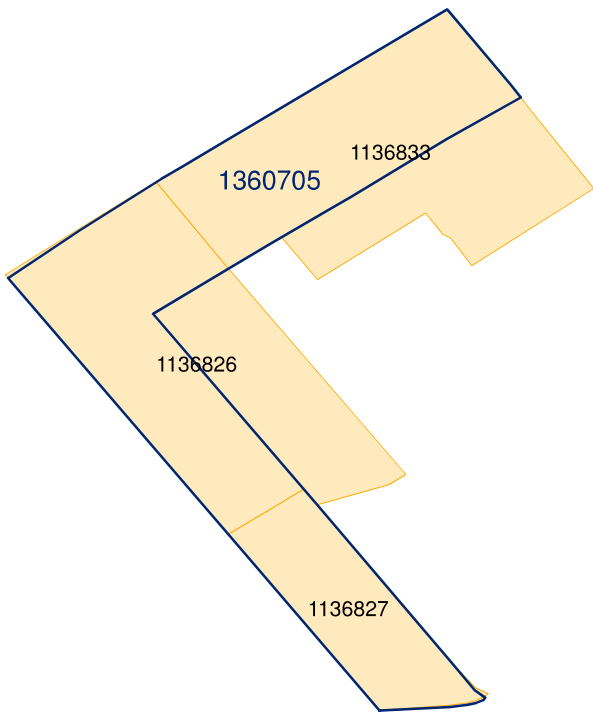
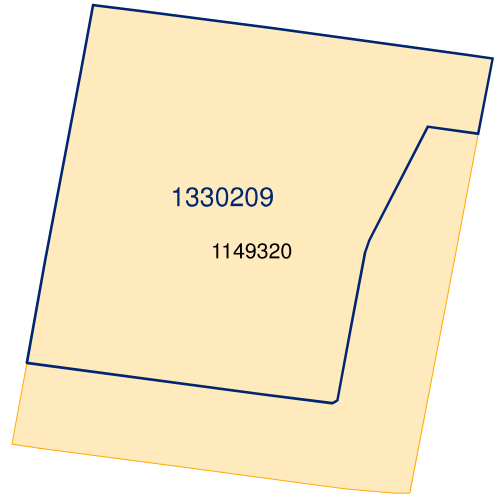
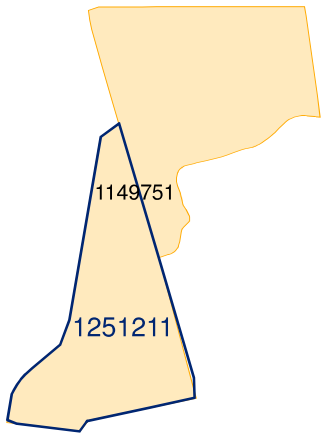
**Linking CCDs (2006 Census) and SA1s (2011 Census) for water data analysis (the relative positional relationship between the CCDs and SA1s)**

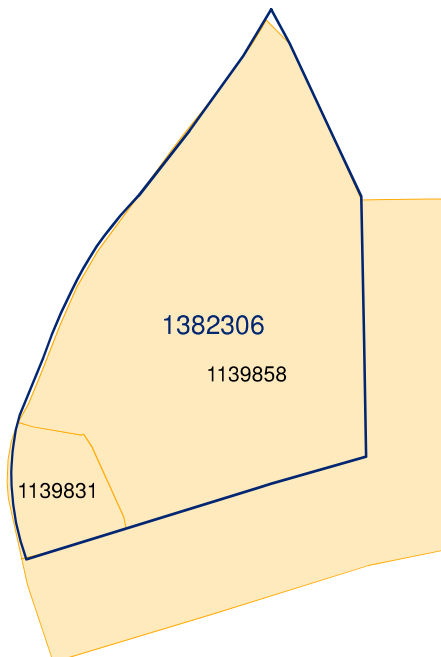
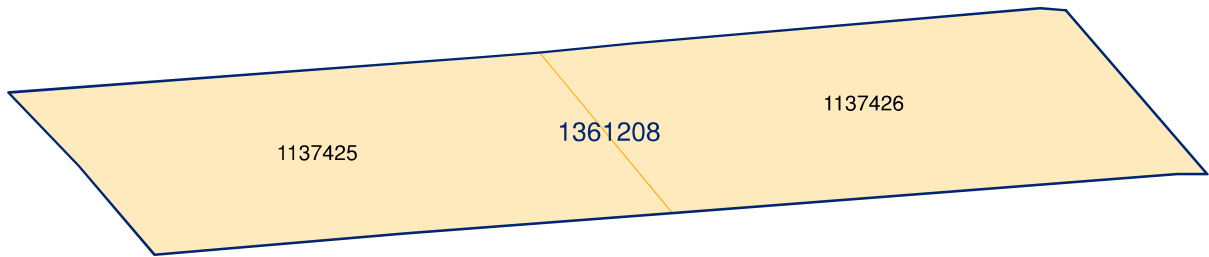
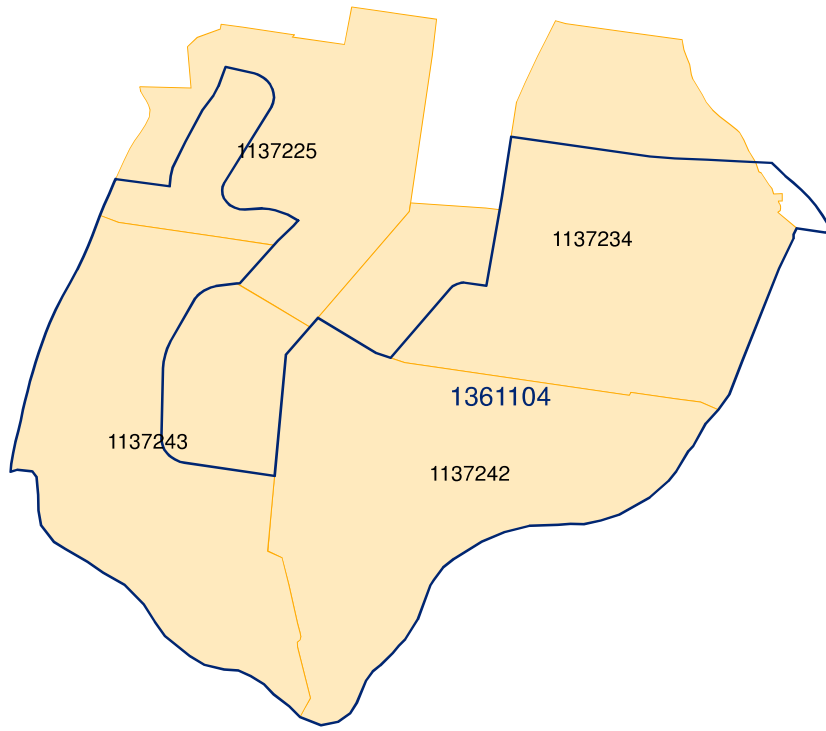
---

<b>ID</b>	<b>sa1_2011</b>	<b>ccd_2006</b>	<b>summer_per_capita_daily_cons_litres</b>	<b>winter_per_capita_daily_cons_litres</b>
1	1140557	1250601	160.73	154.36
2	1140559	1250601	176.12	169.13
3	1140618	1250814	176.19	155.80
4	1149612	1250814	/	/
5	1149751	1251211	194.04	212.73
6	1149320	1330209	206.59	176.87
7	1136826	1360705	219.10	212.47
8	1136827	1360705	238.86	242.49
9	1136833	1360705	196.22	181.70
10	1136817	1360709	236.09	267.75
11	1136843	1360709	211.82	227.06
12	1136831	1360709	/	/
13	1136915	1361006	187.60	172.60
14	1136916	1361006	178.02	163.79
15	1136901	1361006	/	/
16	1137234	1361104	208.09	172.83
17	1137242	1361104	219.48	182.29
18	1137243	1361104	207.42	172.27
19	1137225	1361104	/	/
20	1137425	1361208	253.56	264.92
21	1137426	1361208	273.52	285.77
22	1139831	1382306	171.78	171.84
23	1139858	1382306	168.30	168.36
24	1139604	1410413	233.75	232.33
25	1139609	1410413	236.20	229.67
26	1139612	1410413	/	/
27	1139728	1410413	/	/
28	1139624	1410413	/	/
29	1139726	1410511	371.69	386.14
30	1139727	1410511	337.68	350.80
31	1139321	1410901	181.92	173.75
32	1139323	1410901	191.46	167.77
33	1139106	1411001	224.50	250.37
34	1139109	1411001	229.84	258.19
35	1139149	1411001	236.79	254.52
36	1139131	1411001	/	/

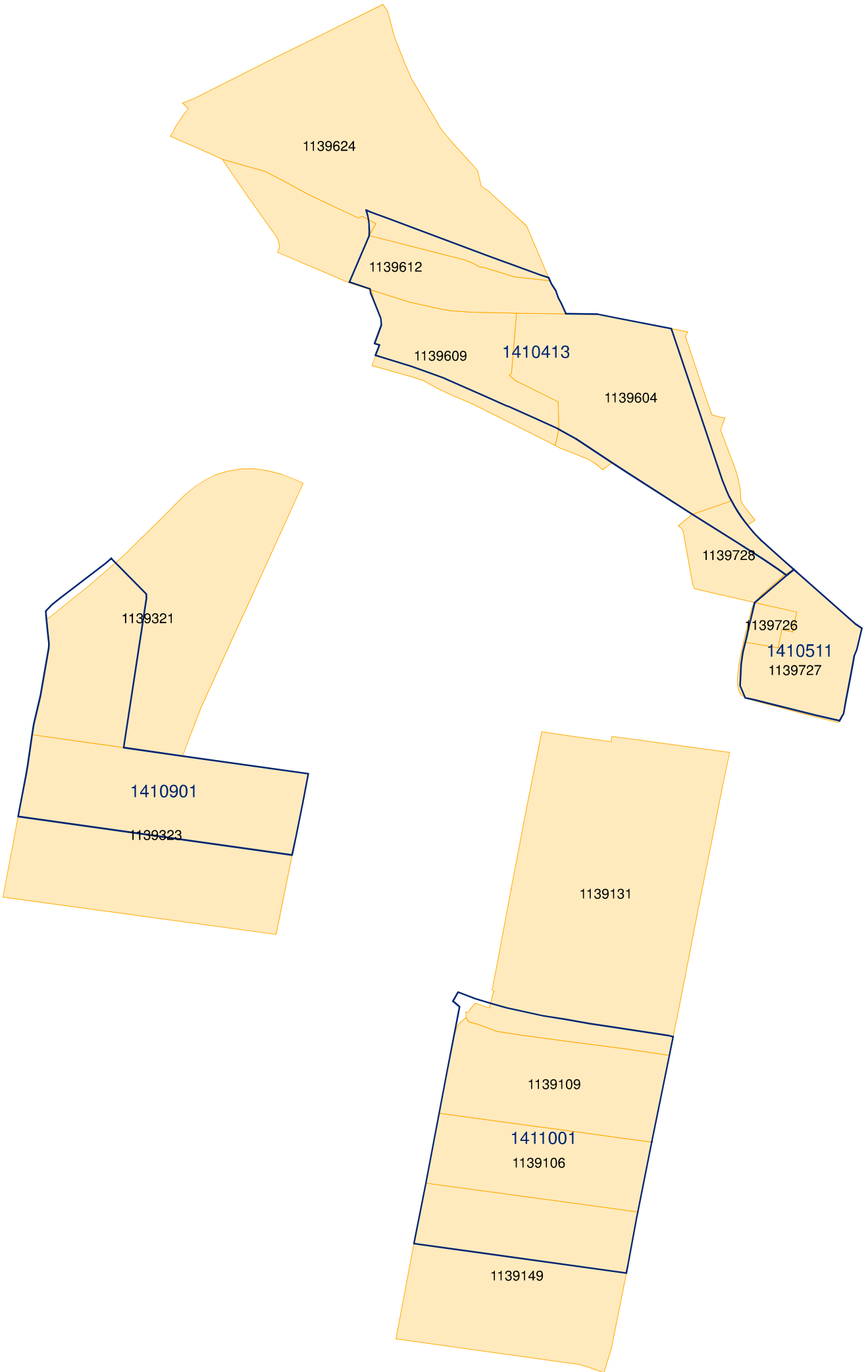
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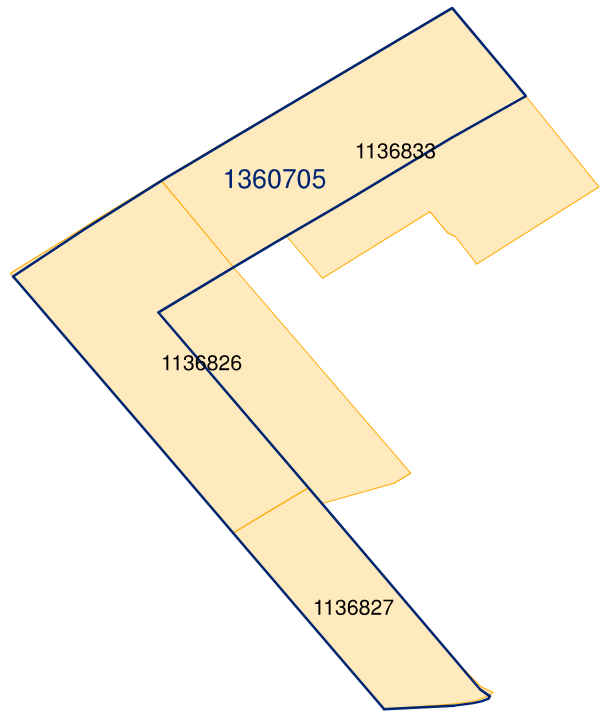
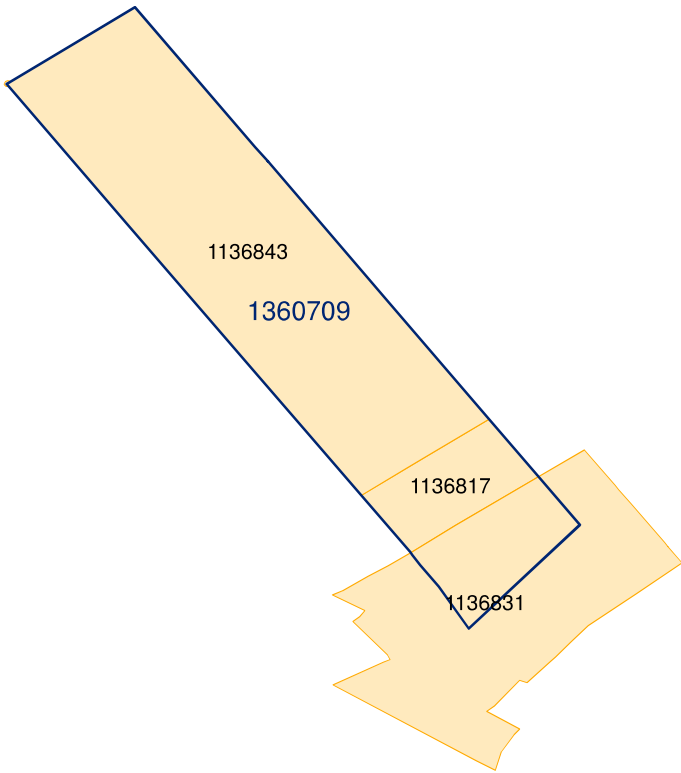












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## **Appendix 9**

**A list of variables used in the secondary analysis**

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## A list of variables used in the secondary analysis

Category	Proposed Variables
<b>Ethnic factors:</b>	
Ethnic status:	<ul style="list-style-type: none"><li>- percentage of Australian population</li><li>- percentage of Chinese origin</li><li>- percentage of Korean origin</li><li>- percentage of other minorities origin</li></ul>
Country of birth:	<ul style="list-style-type: none"><li>- percentage of population born outside of Australia</li><li>- percentage of population born in Australia</li></ul>
Years of domicile in Australia:	<ul style="list-style-type: none"><li>- percentage of population migrated less than six years</li><li>- percentage of population migrated more than six years</li></ul>
<b>Demographic factors:</b>	
Age:	<ul style="list-style-type: none"><li>- median age</li></ul>
Education:	<ul style="list-style-type: none"><li>-percentage of population(over age of 25) with tertiary education attainment</li><li>-percentage of population(over age of 25) not completed high school</li></ul>
Household size	<ul style="list-style-type: none"><li>- average size of household</li></ul>
Household structure	<ul style="list-style-type: none"><li>- percentage of households= single person</li><li>- percentage of households= couple with children</li><li>- percentage of households= couple no child</li><li>- percentage of households= unrelated individuals with sharing housing</li><li>- percentage of households= other</li></ul>
<b>Socio-Economic factors:</b>	
household Income	<ul style="list-style-type: none"><li>- median households' weekly income</li></ul>
Work status:	<ul style="list-style-type: none"><li>- percentage of population employed</li><li>- percentage of population unemployed</li><li>- percentage of population not in labour force</li></ul>
<b>Housing factors:</b>	
Dwelling type	<ul style="list-style-type: none"><li>- percentage of dwellings=houses</li><li>- percentage of dwellings=semi-detached houses (townhouse, terrace)</li><li>- percentage of dwellings=low-rise units</li><li>- percentage of dwellings=high-rise apartments</li></ul>
Dwelling ownership	<ul style="list-style-type: none"><li>- percentage of dwellings fully owned</li><li>- percentage of dwellings paying off</li><li>- percentage of dwellings renting-private</li><li>- percentage of dwellings renting-public</li></ul>
Region:	<ul style="list-style-type: none"><li>- WSR</li><li>- SSR-WEST</li><li>- SSR-INNER&amp;EAST</li><li>- NSR</li></ul>

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## **Appendix 10**

### **Topics used in semi-structured interview**

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## **Topics used in semi-structured interview**

A list of indicative topics is presented below:

### **For community members**

- Water use practices at home (frequency, methods and why certain kind of practices are performed), such as in the kitchen, bathroom, or outdoors.
- Water use in Sydney compared to that in their homeland, any noticed differences between themselves and people from other ethnic communities
- Perceptions of water conservation
- Water-saving action at home (what actions, frequency and methods)
- Reasons, incentives, challenges and difficulties faced when undertaking water-saving action
- Familiarity (level of knowledge) with Sydney's water issues, information sources, difficulties in seeking water relevant information
- Awareness of water conservation programs, water rebates
- Perceptions and considerations of some government water initiatives, and public engagement with environmental activities.

### **For environmental educators, environmental managers**

- Water management and ethnic diversity in local government areas (water supply and demand situations, demographic and housing status of ethnic communities, water consumption level)
  - Water conservation programs (projects, policies, rebates and restrictions, resources and tools, outcomes and success)
  - Education programs targeting ethnic communities (incentives and prompting approaches for different ethnic communities: Chinese, Korean and Australian, outcomes and success)
  - Resources for ethnic communities (available resources, languages, access of ethnic groups)
  - Ethnic communities' engagement (engagement levels of different ethnic groups, changes over time, barriers and potentials)
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## **Appendix 11**

### **Practice observation participant information statement (English, Chinese and Korean)**

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## **Practices Observation**

**(Research Project: The Ethnical and Cultural Correlates of Water Use in a Pluralistic Social Context)**

### **PARTICIPANT INFORMATION STATEMENT**

**(1) What is the study about?**

You are invited to participate in an academic research study concerning residential water use in Sydney. The project is researching water use in households of different ethnic groups in the Sydney metropolitan area. It aims to explore the influence of ethnical and cultural backgrounds on household water use.

**(2) Who is carrying out the study?**

The study is being conducted by PhD candidate Liping YAN and will form the basis for the degree of Doctor of Philosophy PhD at The University of Sydney under the supervision of Associate Professor/ Dr. Phil McManus.

**(3) What does the study involve?**

To participate, you will be asked to take pictures and/ or videos of how water related practices are undertaken in your household, such as the way you do dishwashing, garden/balcony flower watering, or other relevant water related activities after the completion of focus groups. Images and/ or videos you took can be sent to the researcher via mobile phone, email or some instant communication tools at your preference before 06/11/2012. More detailed information will be provided at the end of the focus groups. Participation in this stage of study is completely voluntary.

**(4) How much time will the study take?**

There is no fixed time for undertaking this activity. It is a self-administrated approach. You have total control over when and how many photos or videos you choose to take at your convenience, as long as you think they are sufficient to demonstrate the particular water use practices.

**(5) Can I withdraw from the study?**

Being in this study is completely voluntary and you are not under any obligation to consent. Submitting images or videos is an indication of your consent to participate in the study. You can withdraw any time prior to submitting any image or video without affecting your relationship with The University of Sydney. Once you have submitted your images or videos anonymously, your responses cannot be withdrawn.



**(6) Will anyone else know the results?**

All aspects of the study, including results, will be strictly confidential and only the researchers will have access to information on participants. A report of the study may be submitted for publication, but individual participants will not be identifiable in such a report.

When sending photographs or videos it is advisable that if you do not want to be identified, please focus on the water rather than your face. It is not necessary for your face to be included in the images. Suggestions to maintain anonymity include taking a photograph from behind so that the face is invisible, or producing a video showing only the hands and tap if this is relevant.

**(7) Will the study benefit me?**

There will be no direct benefit to you by participating in this study. However, your participation will influence the research results.

**(8) Can I tell other people about the study?**

Yes. Please feel free to tell others about this study.

**(9) What if I require further information about the study or my involvement in it?**

When you have read this information, Liping YAN will discuss it with you further and answer any questions you may have. If you would like to know more at any stage, please feel free to contact Liping YAN, PhD Candidate, School of Geosciences on [liping.yan@sydney.edu.au](mailto:liping.yan@sydney.edu.au), +61 2 9351 6444 or +61 449940405.

**(10) What if I have a complaint or any concerns?**

Any person with concerns or complaints about the conduct of a research study can contact The Manager, Human Ethics Administration, University of Sydney on +61 2 8627 8176 (Telephone); +61 2 8627 8177 (Facsimile) or [ro.humanethics@sydney.edu.au](mailto:ro.humanethics@sydney.edu.au) (Email).

*This information sheet is for you to keep*

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## 用水习惯观察

研究项目: 在多元化社会背景下家庭用水与民族和文化的关联性

### 参与信息说明

#### (1) 此研究是关于什么?

我们邀请您参与一项有关悉尼居民用水的学术研究。该项目是研究悉尼大都市地区不同民族背景下的家庭的用水情况, 其目的在于探索民族和文化背景对家庭用水的影响

#### (2) 谁在开展此项研究?

此项研究是在导师Phil McManus (悉尼大学地球科学院副教授) 的指导下, 由Liping YAN (悉尼大学地球科学院博士生) 开展和实施的, 并在此基础上研修其博士学位。

#### (3) 此项调查包括什么内容?

参与该项研究, 您只需要在“专题小组讨论”结束之后, 在您家中自行拍摄一些有关您家庭用水习惯的照片或者影像, 例如洗涤餐具, 浇灌花园、阳台植物, 或者其他任何用水的活动。您可以通过手机、邮件或者即时聊天工具等您喜欢的方式, 将这些宝贵的图像资料在30/11/2012之前发给我们。详细的信息会在专题小组结束时提供给您。该研究阶段的参与是完全自愿的。

#### (4) 完成调查需要多长时间?

这是一种完全由参与者自主执行的参与方式, 没有固定的时间要求。采用哪种记录方式——“照片”或者“影像”, 以及照片的张数或者影像的拍摄时间, 全部由拍摄者“您”来控制 and 把握, 只要您认为提供的图像资料足以描述您住所的某一项或者某些用水行为和习惯就可以。

#### (5) 我可以从调查中退出吗?

参与该研究基于完全自愿的原则, 您并无任何义务同意参与该研究。提交图像资料将被视为您同意参与, 因此您可以在提交图像资料之前的任何时间退出, 且退出并不会影响您和悉尼大学的关系; 但是一旦您以匿名的方式提交了图像材料, 您的提交将无法被撤销。

#### (6) 别人会知道调查结果吗?

该研究获得的所有信息, 包括调查结果, 将被严格保密, 只有调查者有权获得该信息。由该研究生成的报告可能会提交出版, 但报告内容将不会涉及任何参与者的任何个人信息。

在您拍摄照片或者影像时, 如果不想身份被识别, 最好的方法是镜头对准用水操作而非您的面部。没有必要将您的面部暴露在图像内。我们给您的建议是从背后拍摄、或者仅拍摄手部以及水龙头在内范围。

**(7) 我会在调查中受益吗?**

在此调查中，您并没有获得直接利益，但是您的参与将会影响研究结果。

**(8) 我可以告诉其他人这项调查吗?**

是的，您可随意告诉其他人。

**(9) 我怎样获得关于调查和参与的更多的信息?**

当读完以上信息，您仍有疑问，请联系Liping YAN，她会跟您进一步讨论，并将回答您的所有疑问。如您想了解该研究更多的信息，请随时联系环境科学院在读博士生Liping YAN，邮件至liping.yan@sydney.edu.au，或致电+61 2 9351 6444 或+61 449940405。

**(10) 如果我有不满或受到困扰怎么办?**

对此研究有不满或受到困扰，可联系悉尼大学人文研究伦理管理部主任：电话+61 2 8627 8176；传真+61 2 8627 8177；电子邮件地址ro.humanethics@sydney.edu.au。

此信息页由您保留

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**물 사용 관행 관찰**

**(연구프로젝트: 다문화 사회에서 민족과 문화적 요인이 물 사용 관행에 미치는 영향)  
참여 정보 설명서**

**(1) 본 연구는 무엇과 관련된것입니까?**

저희는 귀하께 시드니 주민의 물 사용 관행과 관련된 학술연구에 참여할 것을 요청 드립니다. 이 프로젝트는 시드니 내 다양한 민족적 배경을 가진 가구들의 물 사용 현황을 관찰하여, 민족과 문화적 요인이 물 사용 관행에 끼치는 영향을 밝히고자 합니다.

**(2) 누가 이 연구를 전개하고 있습니까?**

이 프로젝트는 Phil McManus(시드니대학 지구과학원 부교수님)의 지도 하에 Liping YAN(시드니대학 지구과학원 박사님)이 진행하고 있습니다. 이 프로젝트는 Liping YAN의 박사학위 취득을 위해 사용될 것입니다.

**(3) 이 조사는 무슨 내용을 포함합니까?**

귀하는 <<포커스 그룹 토론>> 참가 후, 귀하의 가구에서 물이 어떻게 사용되고 있는지 증명할 수 있는 사진이나 동영상을 찍어주시면 됩니다. 이는, 예를 들어 설거지, 정원이나 화분에 물주기 등 물 사용과 관련된 모든 활동을 포함합니다. 촬영 후 핸드폰, 이메일 혹은 또는 문자 메시지 등 귀하가 편리하다고 생각하시는 방법으로 xx/xx/2012까지 발송 해 주시길 부탁드립니다. 상세한 정보는 <<포커스 그룹 토론>> 진행 시 말씀 드리겠습니다. 이 단계의 연구에 참여하시는 것은 여러분의 자발적 선택에 달려있습니다.

**(4) 본 조사를 완료하는데 소요되는 시간은 얼마입니까?**

본 조사는 참여자 스스로 진행하시는 것이라 고정된 시간은 없습니다. 언제, 얼마나 많은 사진이나 동영상을 찍을 것인지는 귀하가 본인 가구의 물 사용 관행을 충분히 보여줄 수 있다고 생각하시는 수준에서 결정하면 됩니다.

**(5) 조사 참여를 중단할 수 있습니까?**

귀하가 이 연구에 참여하는 것은 귀하의 자유로운 선택에 달려있고, 따라서 반드시 참여해야 할 의무는 없습니다. 귀하가 사진이나 동영상을 제출하면 조사 참여에 동의하시는 것으로 인정하겠습니다. 영상자료를 제출하시기 전까지는 언제든지 참여를 중단할 수 있고 이는 귀하와 시드니 대학 사이 관계에 영향을 끼치지 않습니다. 단 귀하가 익명으로 사진이나 동영상을 제출하신 후에는 이를 되돌릴 수 없습니다.

**(6) 다른 사람은 본 조사 결과를 알수 있습니까?**

조사 결과를 포함하여 이 연구에서 얻은 모든 정보는 철저히 보호될 것이며, 담당 조사자만 이 정보에 접근할 권한이 있습니다. 연구 보고서는 출판을 위해 사용될 수 있지만, 그 내용에 참여자의 개인 정보는 포함되지 않습니다.

사진 혹은 동영상 촬영 시 본인의 신원이 노출되기 원치 않으시면, 인물이 아닌 물에 초점을 두어 촬영하십시오. 본인의 초상이 사진에 포함될 필요는 없습니다. 얼굴이 보이지 않도록 인물 뒤에서 촬영을 하시거나 꼭 필요한 경우에는 손과 수도꼭지를 촬영해 주십시오.

**(7) 저는 본 조사에 참여함으로써 보상을 받을수 있습니까?**

귀하에게 직접적인 보상이 제공되지는 않지만, 귀하의 참여는 본 연구에 귀한 자료로 사용될 것입니다.

**(8) 제가 이 조사에 대해 다른 사람에게 알려도 됩니까?**

네, 다른 사람에게 알려도 됩니다.

**(9) 저는 어떤 방식으로 조사와 참여에 관련된 정보를 얻을수 있습니까?**

위 내용을 읽으신 후 문의사항은 Liping YAN에게 연락해주시기 부탁 드립니다. 조사 참여 중에도 언제든지 Liping YAN에게 연락하시면 친절히 답변해드리겠습니다. 연락처는 다음과 같습니다: 이메일liping.yan@sydney.edu.au, 전화번호 +61 2 9351 6444 또는 +61 449940405.

**(10) 제가 불만이나 혹은 고민이 있다면 어떻게 처리합니까?**

본 연구와 관련 불만이나 혹은 고민이 있다면 시드니대학 인문연구논리관리부주임과 연락하십시오. 직통번호:+61 2 8627 8176

팩스번호 : +61 2 8627 8177

이메일주소 : ro.humanethics@sydney.edu.au

*이 설명서는 귀하가 보관합니다.*

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## **Appendix 12**

**Focus group invitation letter (English, Chinese and Korean)**

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**Liping YAN** | *PhD Candidate*  
Room 405  
Madsen Building F09  
The University of Sydney  
NSW 2006 AUSTRALIA  
Telephone: +61 2 9351 6444  
Email: liping.yan@sydney.edu.au  
Web: <http://www.sydney.edu.au/>

**Phil McManus** | *Assoc. Prof*  
Room 435  
Madsen Building F09  
The University of Sydney  
NSW 2006 AUSTRALIA  
Telephone: +61 2 (02) 9351 4242  
Email: phil.mcmanus@sydney.edu.au  
Web: <http://www.sydney.edu.au/>

## FOCUS GROUP INVITATION LETTER

(**Research Project:** The Ethnical and Cultural Correlates of Water Use in a Pluralistic Social Context)

Again, thank you for taking time to complete the questionnaire and help with the research. This research also involves conducting focus group discussions within a few ethnic groups (Australian, Chinese and Korean) which attempt to elicit insights into the constraints and opportunities towards water conservation in households among ethnic groups.

If you identify yourself as being of **Australian, Chinese or Korean** ethnicity, **we sincerely invite you to participate in our focus group discussions**. It will be small groups (5-8 people), and we can discuss your perceptions of water use, your experiences or stories about water in your first language (separate groups for Cantonese and Mandarin), and you can also choose to receive follow up information about this study.

We hope you will join us, but participation is voluntary. All information about you and anything you say during the focus group discussion will be confidential or anonymous. Your name will not be used in any presentation or publication and we will not release any information that can be linked to you.

If you interested to participate in the focus group discussion, please provide **your preferred way(s) for us to contact you** so we can provide further information (such as the date, time and location) about the focus groups.

### **Please provide contact details:**

**Name:** \_\_\_\_\_

**E-Mail:** \_\_\_\_\_

**Telephone:** \_\_\_\_\_

**Mailing Address:** \_\_\_\_\_

*(Your contact information will be strictly confidential. When this letter and the completed questionnaire are returned to the university, the letter will be separated from the questionnaire before any research process so that your completed questionnaire will be anonymous.)*

Please **send** this paper **back to us** in the **same envelope with the completed questionnaire** by 1<sup>st</sup>, November, 2012.

In case of losing the envelope, please return the completed questionnaire to the address below:

PhD Candidate Liping YAN  
Madsen Building (F09), the University of Sydney, NSW 2006, AUSTRALIA

Thank you!



## 专题小组讨论邀请函

(研究项目: 在多元化社会背景下家庭用水与民族和文化的关联性)

再次感谢您参与该研究, 并抽出宝贵的时间完成该调查问卷。该研究项目还包括采用“专题小组讨论”的研究方法, 即邀请来自不同民族背景(包括澳大利亚人、华人和韩民族)的居民参与“小组讨论”, 来进一步探讨不同民族背景下的家庭在节约用水方面所面对的限制与机会。

如果您是澳大利亚人、华人或者韩民族的一员, 我们真诚地邀请您参与我们的“专题小组讨论”。每个小组会有 5 到 8 个成员, 且讨论的全过程会以参加者的母语(普通话, 粤语, 韩语或者英文)来进行。欢迎您与我们分享您对用水的看法、您的亲生经历以及关于用水的故事。同时, 您也可以接收关于该项研究的更多信息。

我们真挚地希望您能来参加, 但参与过程是自愿的, 且在讨论中您所提供的所有信息都将会被严格保密或匿名处理。您的姓名等个人信息将不会在任何出版物或报告中被提及, 任何可能会连系到您本人的信息都不会被公布。

如果您有兴趣参加我们的“专题小组讨论”, 请提供您首选的(任何)联系方式, 以便于我们为您提供详细的参与信息(如日期, 时间和地点)

**请提供您的联系方式:**

姓名: \_\_\_\_\_ 电子邮箱: \_\_\_\_\_

电话/手机: \_\_\_\_\_ 邮寄地址: \_\_\_\_\_

(您提供联系信息会受到严格保密。并且, 在该页信息与您完成的调查问卷一同寄回悉尼大学时, 为了保证调查问卷的匿名性, 在进行数据分析之前, 该页信息会与调查问卷分开存放。)

请在 2012, 11 月 1 日之前, 将该页联系信息与完成的调查问卷一并邮寄给我们(请使用我们提供的已付费的信封邮寄)。如万一您丢失了有邮件地址的信封, 请将该信息页和调查问卷一并邮寄到一下地址:

PhD Candidate Liping YAN  
Madsen Building (F09), the University of Sydney, NSW 2006, AUSTRALIA

衷心感谢您的参与!

## 포커스그룹 참여 요청서

(연구프로젝트: 다문화 사회에서 민족과 문화적 요인이 물 사용 관행에 미치는 영향)

귀한 시간을 내어 설문지를 작성해 주시고, 본 연구에 협조에 주신데 대해 다시 한번 감사 드립니다.

이 연구프로젝트는 설문조사 이외에 포커스그룹이라는 연구방법을 사용하여 한국, 중국, 호주 계 주민들을 초청하여 물을 사용하는 데 있어서 평소 느끼시던 한계점이나 기회를 듣고자 합니다.

만약 귀하가 한국, 중국, 호주라는 민족적 집단의 구성원이라면, 저희는 귀하가 포커스그룹에 참여할 것을 진심으로 요청합니다. 각 그룹은 5-8 명의 소 그룹으로 구성될 것이며, 여러분은 평소 물 사용에 대한 의견, 경험 등을 모국어(현대중국어표준어, 광둥어, 한국어, 영어)로 편하게 말씀하시면 됩니다. 원하실 경우 귀하는 본 연구 진행과정과 결과에 대한 상세한 정보를 얻으실 수 있습니다.

저희는 귀하의 참여를 진심으로 기대하지만, 이는 여러분의 자발적인 선택에 달려 있습니다. 귀하의 개인정보와 토론 중 말씀하신 내용은 기밀사항과 익명으로 처리됩니다. 귀하의 이름은 어떤 발표 자료나 출판물에 포함되지 않으며 귀하와 연관 지을 수 있는 어떠한 정보도 유출되지 않을 것입니다.

만약 귀하께서 포커스그룹에 참여할 의향이 있으면 선호하시는 연락방법을 택하셔서 제출해주시십시오. 저희들이 상세한 정보(날짜, 시간, 장소 등)를 알려드리겠습니다.

**연락방법**

이름: \_\_\_\_\_ 이메일: \_\_\_\_\_

핸드폰번호: \_\_\_\_\_ 주소: \_\_\_\_\_

(귀하의 연락처 등 개인정보는 엄격한 기밀이 보장됩니다. 완성하신 설문지와 이 편지가 저희 측에 도착하면, 이 둘은 서로 분리되어 설문지의 경우 실제 연구과정에서 익명으로 처리될 것입니다.)

01 /11 /2012 까지 포커스그룹 참여 요청서와 완성하신 설문지를 저희에게 보내주시십시오(동봉한 우편봉투를 이용하십시오) 저희 주소가 적힌 봉투를 분실하신 경우 아래 주소로 보내주시면 됩니다.

PhD Candidate Liping YAN  
Madsen Building (F09), The University of Sydney, NSW 2006, AUSTRALIA

감사합니다!



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## **Appendix 13**

**Interview invitation letter**

**Interview participant information statement**

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ABN 15 211 513 464

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**Liping YAN | *PhD Candidate***

Room 405  
Madsen Building F09  
The University of Sydney  
NSW 2006 AUSTRALIA  
Telephone: +61 2 9351 6444  
Email: [liping.yan@sydney.edu.au](mailto:liping.yan@sydney.edu.au)  
Web: <http://www.sydney.edu.au/>

**Phil McManus | *Assoc. Prof***

Room 435  
Madsen Building F09  
The University of Sydney  
NSW 2006 AUSTRALIA  
Telephone: +61 2 (02) 9351 4242  
Email: [phil.mcmanus@sydney.edu.au](mailto:phil.mcmanus@sydney.edu.au)  
Web: <http://www.sydney.edu.au/>

<Title > <First Name> <Surname>  
<Position>  
<Organisation>  
<Suburb> <State> <Postcode>

<Date>

Dear <Title> <Surname>

I am a PhD student at the University of Sydney, supervised by Associate Professor Phil McManus in the School of Geosciences. I am conducting research to explore the influence of ethnic and cultural backgrounds on household water consumption which aims to bridge the research gap regarding ethnic diversity and water use. To this end, I am employing a mix of research instruments: questionnaires and focus groups with households of different ethnic and cultural backgrounds, and interviews with managers and other key persons. The purpose of interviews is to establish a qualitative understanding of the topics in relation to water management and ethnic communities in Sydney.

I am writing to you in your capacity as <Position> at <Organisation > to invite you to participate in an interview for this research. Interviews will be conducted in a semi-structured manner. I am particularly interested in hearing your views and experiences on the relationship between the environment (especially water) and ethnic communities and how to better engage all ethnic communities in water conservation.

It is anticipated that the interview would last approximately one hour. The research has been approved by the Human Research Ethics Committee of the University of Sydney and is funded by the Richard Claude Mankin Scholarship.

Please find attached a copy of the Participant Information Statement and Consent Form for this research. If you are willing to participate in this research, please sign the Consent Form and return it to me at the above address. For your convenience, please provide your preferred contact details, preferred interview time and a suitable place so I can arrange the interview with you.

Thank you for your consideration of this request for an interview. If you require further information, please do not hesitate to contact me by email [liping.yan@sydney.edu.au](mailto:liping.yan@sydney.edu.au).

Yours Sincerely

Liping YAN  
PhD Student, The University of Sydney

**Liping YAN | *PhD Candidate***

Room 405  
Madsen Building F09  
The University of Sydney  
NSW 2006 AUSTRALIA  
Telephone: +61 2 9351 6444  
Email: [liping.yan@sydney.edu.au](mailto:liping.yan@sydney.edu.au)  
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**Phil McManus | *Assoc. Prof***

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Telephone: +61 2 (02) 9351 4242  
Email: [phil.mcmanus@sydney.edu.au](mailto:phil.mcmanus@sydney.edu.au)  
Web: <http://www.sydney.edu.au/>

## Interviews

(Research Project: The Ethnical and Cultural Correlates of Water Use in a Pluralistic Social Context)

### PARTICIPANT INFORMATION STATEMENT

**(1) What is the study about?**

You are invited to participate in an interview which will collect primary data for an academic research project concerning residential water use in Sydney. The research project attempts to better conceptualize the influence of ethnical and cultural backgrounds on household water use. It is also expected to contribute to understanding perceptions of water and to constructing the way of transition to sustainability.

**(2) Who is carrying out the study?**

The study is being conducted by PhD candidate Liping YAN and will form the basis for the degree of Doctor of Philosophy PhD at The University of Sydney under the supervision of Associate Professor/ Dr. Phil McManus.

**(3) What does the study involve?**

It involves interview with people who involved in water management and/or familiar with the status of ethnic communities in Sydney. The interview will be conducted in a semi-structured way with a broad range of topics relating to domestic water use. Interviews may be undertaken at your office or in a public place convenient to you. An audio recorder will be used only with your permission to record conversations for the purpose of obtaining an accurate transcription.

**(4) How much time will the study take?**

There is no fixed time for each interview. As a general rule, each interview may take about 1 hour, but the duration will depend on the depth of conversation and the time you have available.

**(5) Can I withdraw from the study?**

You may stop the interview at any time if you do not wish to continue, the audio recording will be erased and the information provided will not be included in the study.

**(6) Will anyone else know the results?**

All aspects of the study, including results, will be strictly confidential and only the researchers will have access to information on participants

A report of the study may be submitted for publication, but individual participants will not be identifiable in such a report.

**(7) Will the study benefit me?**

There will be no direct benefit to you by participating in this study. However, your participation will influence the research results that emerge in the PhD thesis and academic publications. Individual participants will not be identified in any publication.

**(8) Can I tell other people about the study?**

Yes. Please feel free to tell others about this study.

**(9) What if I require further information about the study or my involvement in it?**

When you have read this information, Liping YAN will discuss it with you further and answer any questions you may have. If you would like to know more at any stage, please feel free to contact Liping YAN, PhD Candidate, School of Geosciences on [liping.yan@sydney.edu.au](mailto:liping.yan@sydney.edu.au), +61 2 9351 6444 or +61 449940405.

**(10) What if I have a complaint or any concerns?**

Any person with concerns or complaints about the conduct of a research study can contact The Manager, Human Ethics Administration, University of Sydney on +61 2 8627 8176 (Telephone); +61 2 8627 8177 (Facsimile) or [ro.humanethics@sydney.edu.au](mailto:ro.humanethics@sydney.edu.au) (Email).

*This information sheet is for you to keep*

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## **Appendix 14**

### **Water bill sample for single dwellings**

# A copy of water bill for apartment in Sydney

(Source: website of the Sydney Water)



Telephone Payments ☎ (See below)  
Account Balance ☎ **1300 362 093**  
Website: sydneywater.com.au

General Enquiries ☎ **13 20 92**  
8.30am to 5.30pm (Mon-Fri)  
Faults and Leaks ☎ **13 20 90**  
24 hours

Last bill	Payments	Balance	This bill	Total amount due
\$189.50	\$190.00	\$0.00	\$225.30	<b>\$225.30</b>



MR J CITIZEN  
MRS A CITIZEN  
67 SMITH RD  
SYDNEY NSW 2000

76589840-26106

Please pay by

**10/12/12**

①

Account number

**7658 984**

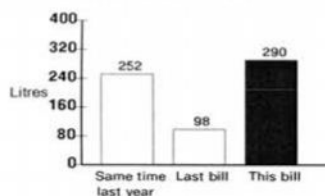
## Account for residential property

67 Smith Rd Sydney

<b>Fixed charges - GST free</b>	1 Oct 12 - 31 Dec 12			\$
Water service			②	33.78
Wastewater (sewerage) service				138.77
<b>Usage charges - GST free</b>	25 Aug 12 - 19 Nov 12			
Water	25/08 - 19/11	25 kL at \$2.1300 a kL	③	53.25
		<i>See over for details</i>		
<b>Other charges and credits</b>				
Miscellaneous credit			④	-0.50

## Your average daily usage

**Total amount due \$225.30**



1000 litres  
=  
1 kilolitre

How much water did you use?

SYDNEY WATER CORPORATION ABN 49 776 225 038

TAX INVOICE

Continued overleaf  
Date of issue 19 November 2012



Account for 67 Smith Rd Sydney



\*242 7658 984 0002

POSTbillpay: Use cash, cheque or debit card at any Australia Post Office.

**Credit card limit:**  
\$1,000 per bill



BPAY: Internet or phone banking.  
Bill code: 45435 Ref no.: 7658 984 0002



Mail payments: Return slip and cheque payable to Sydney Water (no staples).

⑤

Payment number  
**7658 984 0002**



Telephone payments: Mastercard or Visa.  
Call **1300 12 34 58** (24 hour service)

Send to:  
Sydney Water  
PO Box 339  
Silverwater NSW 2128

Please pay by  
**10/12/12**



Direct debit payments: For more information, please call 13 20 92 or visit sydneywater.com.au



Internet payments: Mastercard or Visa:  
sydneywater.com.au

Total amount due

**\$225.30**

TRAN CODE USER CODE CUSTOMER REFERENCE NUMBER  
831 066859 00007658 984 0002

<0000022530> <066859> <000076589840002> >

- ① **Account number:** This number is unique to your property.
- ② **Service charges:** These are the fixed quarterly charges for having connections to our water and wastewater mains.
- ③ **Usage charges:** This is the charge for the amount of water used at your property.
- ④ **Other charges and credits:** If you have overpaid, have an overdue amount or receive a concession from us, it will be shown here.
- ⑤ **Payment number:** Your unique reference number you use to pay your bill.

**Account for residential property****67 Smith Rd Sydney****Water meter details****Meter Reading Period:** 25 Aug 12 - 19 Nov 12

Meter No.	This Reading	Last Reading	Consumption (kL)
BDJK4511	604	579	25

Total water used in 86 days was 25 kilolitres

**Customer information**

- \* We may give a concession to pensioners with a Pensioner Concession Card, a Department of Veterans' Affairs Gold Card (TPI/TTI, War Widow/Widower or EDA) or who receive a Department of Veteran's Affairs intermediate rate pension.
- \* Visit [sydneywater.com.au](http://sydneywater.com.au) to view the Quarterly Drinking Water Quality report.
- \* Visit [sydneywater.com.au](http://sydneywater.com.au) to view the Sydney Water Customer Contract in Brief.
- \* Interest may be charged on overdue amounts at the current rate of 7.00% a year.
- \* For customers in financial difficulty, Sydney Water may provide payment assistance including deferred payment, instalment options and hardship relief. Conditions apply. Call **13 20 92** for details.
- \* Hearing impaired customers can phone via NRS for a TTY service on **13 36 77**, quoting **13 20 90**.
- \* We may exchange contact information with local councils to ensure your bills get to you.

**Faults and Leaks (available 24 hours)**

Please ring 13 20 90 in cases of service difficulty and emergency.

Payment number      Total amount due

**7658 984 0002****\$225.30****Changing your mailing address?**

For changes to your mailing address, please ring general enquiries or visit [sydneywater.com.au/AskSydneyWater/](http://sydneywater.com.au/AskSydneyWater/) to change your address online.



**Centrelink payments:** call Centrelink to arrange regular Centrelink deductions.  
Centrelink Reference No.: 555 052 086C

**Interpreter Service 13 14 50****Arabic • Chinese • Greek • Italian • Korean • Vietnamese**

إذا كنت تحتاج إلى مترجم، يرجى الاتصال بالرقم أعلاه.

如果您需要傳譯員的協助，請致電以上的號碼。

Αν χρειάζεστε διερμηνέα, τηλεφωνήστε στον παραπάνω αριθμό.

Se vi serve un interprete, telefonate al numero indicato sopra.

통역사가 필요하시면 위의 번호로 전화하십시오.

Nếu quý vị cần thông dịch viên, hãy gọi đến số trên đây.

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## **Appendix 15**

### **Water bill sample for strata units**





## Account for strata unit

### Customer information

- The Independent Pricing and Regulatory Tribunal (IPART) has determined changes in service and usage charges from 1 July 2015.
- We may give a concession to pensioners with a Pensioner Concession Card, a Department of Veterans' Affairs Gold Card (TPI/TTI, War Widow/Widower or EDA) or who receive a Department of Veteran's Affairs intermediate rate pension.
- If you are having difficulty paying your bill, we can help. We have flexible payment options to help you plan your payments. We may offer payment extensions, a regular payment arrangement, the Payment Assistance Scheme (PAS) and the BillAssist customer assistance program. **Call us on 13 20 92.**
- Interest may be charged on overdue amounts at the current rate of 6.25% a year.
- Hearing impaired customers can phone via NRS for a TTY service on **13 36 77**, quoting **13 20 90**.
- We may exchange contact information with local councils to ensure your bills get to you.

### Faults and Leaks (available 24 hours)

Please ring 13 20 90 in cases of service difficulty and emergency.

099101/M06856/S006887/1013774

Payment number	Total amount due
5462 703 0007	\$171.00

#### Changing your mailing address?

For changes to your mailing address, please ring general enquiries or visit [sydneywater.com.au/SW/accounts-billing/](http://sydneywater.com.au/SW/accounts-billing/) to change your address online.



**Centrepay payments:** call Centrelink to arrange regular Centrepay deductions. Centrepay Reference No.: 555 052 086C

#### Interpreter Service 13 14 50

**Arabic • Chinese • Greek • Italian • Korean • Vietnamese**

إذا كنت تحتاج إلى مترجم، يرجى الاتصال بالرقم أعلاه.

如果您需要傳譯員的協助，請致電以上的號碼。

Αν χρειάζεστε διερμηνέα, τηλεφωνήστε στον παραπάνω αριθμό.

Se vi serve un interprete, telefonate al numero indicato sopra.

통역사가 필요하시면 위의 번호로 전화하십시오.

Nếu quý vị cần thông dịch viên, hãy gọi đến số trên đây.