

URBAN WATER RESTRICTIONS IN AUSTRALIA: ACCOUNTING FOR BEHAVIOURAL DIFFERENCES

1.0 INTRODUCTION

An extended and severe drought in southern Australia accompanied by policy failures in the allocation of water resources has created a difficult environment for urban water managers. Mandated restrictions over the use of water are now common place and substantial attention is focussed on the efficacy of different approaches to deal with water shortages (see, for example, ABC News 2009a).

The welfare costs of urban water restrictions are well recognised by economists, if not yet quantified with precision (see, for example, Edwards 2008). Mandatory restrictions can be time consuming, costly to enforce and require a significant investment in education and marketing (White, Robinson, Cordell, Jha and Milne 2003). Notwithstanding these costs, governments appear reluctant to abandon them altogether, at least until additional infrastructure is in place to shore up supplies. In addition, there is at least some evidence that political leaders and some sections of the community see value in restriction regimes in their own right, in part, due to the sense of shared hardship and the ‘community building’ response this purportedly invokes (see, for instance, Gadd 2009). Water restrictions are claimed to be a means of changing behaviour, a vehicle for encouraging greater awareness of water use or even a mechanism for promoting greater environmental consciousness generally (see, for example, Water Corporation 2010; Goulburn Valley Water 2010). Consequently, some form of behavioural constraint over the use of water is now applied in almost every

major urban centre in Australia, regardless of their merits, and often in the absence of any debate about the compliance regimes that accompany them.

The apparent enthusiasm for urban water restrictions in some spheres raises important questions about how water consumers view the attenuation of their rights to use water. It also raises broader concerns about the mechanisms for gaining compliance with regimes that *prima facie* impinge on individual liberties.

In this report, individual preferences towards urban water regulations are more closely examined to provide tentative answers to some of these questions. The aim is to develop empirical models of householders' preferences that take into account both economic and psychographic variables. This can improve our understanding of consumers' perceptions of compliance and the motivations that sit behind acquiescent behaviour. Such models might also shed light on the costs of the status quo and the preparedness of individual consumers to bring about change. Collectively, this should facilitate the formulation of improved urban water policy. An additional central objective is to establish welfare estimates regarding avoiding urban water restrictions entirely. Whilst the context of the report is urban water use, the results provide useful insights to broader questions of political economy. In addition, broader water policy concerns will be touched on, such as the efficacy of restricting urban water use for the sake of it.

The report is comprised of five main parts. A brief overview of the urban water sector in New South Wales and Victoria is given in section two. Section three provides an overview of the literature pertaining to the motivations underlying individuals'

compliance behaviour, which will act as a foundation for considering those factors that may affect individuals' preferences in relation to water restrictions. In section four, the design and results of this particular choice experiment are presented. More specifically, the empirical estimates of respondents' willingness to pay (WTP) for identified attributes of a compliance regime are reported. An illustration of the application of the contingent valuation methodology to the challenge of determining a welfare estimate associated with avoiding water restrictions is presented in section five. Policy implications stemming from the findings obtained in sections four and five are discussed in part six before offering some brief concluding remarks in the final section.

2.0 URBAN WATER RESTRICTIONS: NSW AND VICTORIA

Almost universal water shortages in the capital cities of Australia have provoked unprecedented interest in water resource management policies in Australia (Cruse and Dollery 2006). Drought was once of only marginal interest in the capital cities of Australia; during 2006 it became front page news and continues to have regular media attention (ABC News 2009b). In general, urban water consumers have accepted the bureaucratic regulation of their water usage as evidenced by their common compliance with restriction regimes. However, the compliance of urban water users should not be taken to imply that there is no justification for reform or that it is appropriate to apply a bureaucratic approach to water management in preference to markets.

Substantial differences exist in the regulatory regimes in place for the management of urban water resources in NSW and Victoria. The provision of urban water in NSW outside of the state capital (Sydney) is primarily a function of local government. In Victoria, the responsibility for water provision lies with corporations that report directly

to the State Minister. The legislative frameworks governing water restrictions differ not only across Victoria and NSW, but also between water authorities within the states. Different levels of enforcement and penalties are employed across various Councils and Water Authorities. Regardless of these variations, householders' preferences regarding the most appropriate methods of bringing compliance are largely unknown. Thus, the extent to which enforcement is aligned with preference (and indeed the impacts of enforcement on preferences) could be empirically pursued in the context of urban water restrictions. In the context of compliance capacity, the literature on NIE can be particularly instructive.

3.0 INSTITUTIONS AND COMPLIANCE CAPACITY

Institutions can be regarded as “the rules of the game in society or, more formally are the humanly devised constraints that shape human interaction” (North 1990, p.3). Superior institutions can be distinguished by the extent to which the informal ‘rules of the game’, for instance in the form of social norms and mores, are consistent with the formal rules developed to govern behaviour (Challen 2000; North 1990). This is not to suggest that the informal institutions can substitute for formal institutions in every case (Dovers 2001). However, Dover (2001) suggests that greater alignment of formal institutions with the underlying rules of social networks will give rise to lower costs and therefore superior institutions generally.

This observation has particular relevance in the current context. Very little is known about the preferences of water users and the formal restrictions as previously highlighted. In essence, restriction regimes targeting specific outdoor water uses have arisen from historical engineering notions about water security. Arguably, attempts

have subsequently been made to convince urban water users that these constitute the preferred and socially desirable behaviour (i.e. the informal institutions). The extent to which this is actually the case requires empirical data on the actual preferences of water users and their preferred means of limiting water consumption during times of scarcity.

An alternative interpretation of these theoretical insights in the context of the current problem is that political players have adjudged that using market rules to ration urban water is too far removed from existing informal institutions and would thus give rise to severe costs, ultimately felt at the ballot box. This also has implications for the cost of any policy adjustment in this sphere.

Compliance capacity

Enforcement and the ability to bring compliance to rules has been identified as one of the core features of good institutions generally (North 2000) and for institutions dealing with water allocation and sharing in particular (Ostrom 1993). There are two basic types of compliance mechanisms: self-enforced and third-party enforced. Notably, there are significant differences in the costs that attend different compliance regimes. The effectiveness of different compliance regimes will also vary across locations and segments to communities.

Regardless of these important differences very little is understood about the cost of securing compliance with urban water restrictions. This stands in stark contrast to the hefty public investment in crafting water legislation (formal institutions) and efforts to persuade the public about the preferred social responsibly water-using behaviour (informal rules). More specifically, there is no empirical evidence attesting to the

preferred compliance regimes that would best suit water users. This is important for at least two reasons. First, it seems likely that formal institutions (including those pertaining strictly to compliance) that better match the underlying motivations of individual behaviour will achieve more success and cost less. Second, the extent to which self-enforcement can occur has ramifications for the public purse. Put simply, if consumers self-enforce water restrictions then state-owned water utilities stand to make savings on the cost of securing compliance.

3.1 Theory of compliance

Enforcement is an important element of regulatory policy design (Cohen 1998) and institutional design generally (Pagan 2009). There has been a trend in regulatory research where focus has shifted from investigating the enforcement procedures of regulatory bodies to the motivations underpinning individual compliance with regulations (see, for instance, Cohen 1998; d’Astous, Clobert and Montpetit 2005). It seems that the fundamental question underpinning effective development of regulatory policy is ‘Why do individuals comply with the law?’ Notwithstanding the research interest in this field, it is often not considered and applied when stipulating regulatory policy. Those factors that motivate an individual to comply with formal water regulations are of particular focus.

Calculative motivations

Calculated motivations underpin the most established theory regarding regulatory compliance. In Becker’s (1968) seminal work he suggests that the regulated will comply with a particular rule when they perceive the benefits of compliance, including avoidance of fines and penalties, surpass the associated costs (see also Ehrlich 1972;

Stigler 1970). The Beckerian perspective is not without its critics (Wenzel 2005), and a range of alternative motivations are also identified.

Intrinsic motivations

A sense of moral obligation, i.e. the need to ‘do the right thing’, is a common driver behind members of society complying, even when the illegal gains exceed the anticipated penalties (Sutinen and Kuperan 1999). Contemporary economics generally fails to recognise that moral aspects have an affect on economic behaviour (Hausman and McPherson 1993, 1996).¹ Thus, the adequacy of regulatory policy developed by economists could be challenged.

Moral development

Researchers propose that there is a positive relationship between the moral development of an individual and their propensity to comply with regulations (Sutinen and Kuperan 1999). Kohlberg (1969, 1984) suggests that there are three evident levels of moral development: pre-conventional, conventional, and post-conventional. Pre-conventionalists usually form their rationale on fear of punishment whereas conventionalists generally rationalize on the basis of social conformity and stability (Sutinen and Kuperan 1999). Post-conventionalists are inclined to reason on the basis of moral principles that are independent of social order (Sutinen and Kuperan 1999). Kohlberg (1969, 1984) contends that the violation of regulations are likely to diminish at higher levels of moral development and this has been supported by empirical research in numerous contexts (see, for example, Kuperan and Sutinen 1994).

¹ This dimension of motivation has been given various labels from different authors. For instance, “normative commitment” (Burby and Paterson 1993); “moral or ideological compliance” (Levi 1988, 1997; McGraw and Scholz 1991); commitment based on civic duty (Scholz and Pinney 1995; Scholz and Lubell 1998); an apparent obligation to follow the law which comprises a form of legitimacy (Tyler 1990).

Social motivations

The concept of social motivation has also been recognized as an impetus for compliance; that is, “the desire of the regulated to earn the approval and respect of significant people with whom they interact” (Grasmick and Bursik 1990 in Winter and May 2001, p.3). This is consistent with the conventionalist perspective as specified by Kohlberg (1969). The degree to which individuals desire to receive the respect of society is relevant in the context of water using behaviour. Those who are conscious of how they are perceived by others will strive to behave consistently with the social norms surrounding water use and regulations in order to uphold their reputation, notwithstanding that the setting would appear critical.

In addition to these three fundamental motivations for compliance (i.e. calculative, moral and social motivations), some researchers also factor in the ability and capacity of the regulated to comply (see, for instance, Winter and May 2001). An additional consideration is that moral drivers could be undermined by economic drivers. More specifically, paying a fine as a result of not complying with a regulation may lead an offender to feel excused for their actions (Levitt and Dubner 2005). That is, paying a fine may justify their misbehaviour and in effect “buy off their guilt” (Levitt and Dubner 2005, p.23).

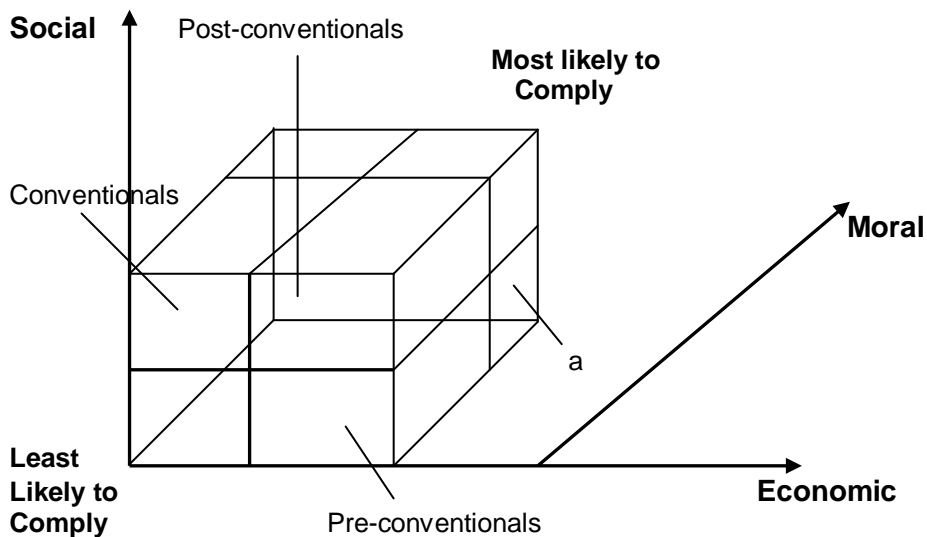
In sum, the literature recognises a number of variables as playing a part in shaping compliance behaviour: severity and certainty of sanctions, potential illegal gain, an individual’s standard of personal morality and their moral development, and social environmental influences. The concept of compliance is multifaceted and the literature surrounding this concept is extensive.

3.2 Compliance framework

A framework that captures the pertinent concepts of compliance motivations would be useful to reduce the complexity of the preceding literature. The following proposed a framework that enables individuals to be classified according to the type of motivations that drive them to comply with regulations. It has incorporated the categories of pre-conventionals, conventionals and post-conventionals into the framework.

A framework, which attempts to capture the compliance literature is presented visually in Figure 1.

Figure 1 Compliance cube



This 'compliance cube' is used to capture the three key motivational dimensions of compliance - economic, social and moral. This framework facilitates the segmentation of individuals according to those motivations that drive them to comply. For instance,

individuals that are solely driven by; economic motivations fall into the pre-conventionals segment; social motivations are classified as the conventionals segment; and moral motivations fall into the post-conventionals segment. Individuals who are driven by more than one dimension fall between these extremes. For instance, segment 'a' would include those individuals that are driven by both moral and economic motivations.

Drawing from the moral development literature discussed earlier in the report, the framework can be employed to identify which segments of the citizenry are least likely to comply and which are most likely to comply. This framework should prove useful for contemplating the challenge of designing effective compliance strategies. For instance, a policy maker that segments a regulated market according to motivations to comply might be able to develop enforcement mechanisms that are more closely aligned with individuals' motivations. Therefore, a potentially more cost effective approach to achieve compliance can be developed. A way forward would involve exploring these components empirically.

4.0 CHOICE MODELLING

In order to shed light on the preferences for a water restriction regime and likely compliance we turn to the choice modelling technique. Choice modelling is a type of multivariate technique which is employed to comprehend the manner in which respondents form preferences for the attributes of products, services, or ideas (Hair et al. 1998). This technique allows estimation of separate marginal values for each attribute or total values for any particular collection of attribute levels and it can also estimate the marginal rates of substitution between any two attributes. The theoretical underpinning

of choice modelling is random utility model (RUM) (McFadden 1974). In this case, an advanced RUM model is employed, where we relax the assumption that the coefficients are the same for all individuals. We will refer to the models within this approach as Mixed Logit (ML) models² (see, for example, Train 2003; Hensher and Greene 2003; Hensher et al. 2005).

4.1 Data collection

This research generally followed the overall experimental design process used by Lockwood and Carberry (1998), involving focus interviews, focus groups and survey pre-testing. It was anticipated that this process would reveal the attributes of the ‘product’, an urban water restrictions compliance regime and relevant attribute levels. Six cities were selected to draw the sample for conducting the main survey, which was distributed on-line to a random sample of households.³ These cities provided scope for analysis on several dimensions, including comparisons between water rich and water poor cities; Victorian and NSW cities; and regional and metropolitan cities. Some relevant characteristics of the pre-defined study locations are presented in Table 1.

² Numerous names have been employed in the literature, i.e. random coefficient logit, random parameters logit, mixed multinomial logit, error components logit, probit with a logit kernel, and mixed logit. These names describe the same underlying model.

³

Table 1 Characteristics of study locations

City	State	Rural or Metropolitan Centre	Population	Average annual residential water supplied for the period 2006-2008 (kL/property) ^ā
Melbourne	Victoria	Metropolitan	3.9 million [†]	161
Wodonga	Victoria	Rural	34 504 [*]	235.5
Bendigo	Victoria	Rural	96 741 [*]	158.5
Goulburn	NSW	Rural	27 277 [*]	146.5
Albury	NSW	Rural	48 629 [*]	234.5
Sydney	NSW	Metropolitan	4.4 million [†]	190.5

[†]Source: ABS (2009)

^{*}Source: ABS (2008a-d)

^āThis indicator is derived from dividing the total volume of residential water supplied with the number of connected residential water properties (Source: NWC 2008).

Complete and valid information was gathered from 512 respondents (Wodonga: 54; Albury: 94; Melbourne: 106; Sydney: 102; Goulburn: 51; Bendigo: 105). The questionnaire consisted of four parts. The first part contained questions regarding respondents' attitude toward water restrictions. The choice-experiment was presented in the second section and questions regarding the respondents' socio-economic status were presented in part three. The final section was used to probe respondents about their WTP to avoid water restrictions⁴.

4.2 Choice model design

Concurrent with a move within the literature toward the use of efficient (and often non-orthogonal) designs, this study employs a D-efficient design (see, for instance, Sandor and Wedel 2001), where parameter estimates were obtained from a pilot study (see, for instance, Hensher and Greene 2003; Hensher et al. 2005). Each sampled respondent evaluated 12 stated choice sets, where each choice set comprised three alternatives and

⁴ See section five for a review of the contingent valuation analysis conducted with this data.

the third alternative was always the status quo⁵. Whilst the specified attributes were common across all options, the levels differed from one option to another, according to the experimental design.

In this case, the product was identified as a ‘compliance regime’ for urban water restrictions⁶, which was comprised of the following four generic attributes: the price respondents were WTP per annum to have the compliance regime invoked in their city; the number of water inspectors per household to patrol householders outdoor water usage; an attribute to act as a proxy for the educating and informing aspect of a compliance regime was included in the form of ‘frequency of exposure’ to informative media advertisements regarding water restrictions; the ability to report neighbours via a hotline to a team who would process the complaint.

4.3 Coding of variables and the status quo

To develop models of buyer behaviour in the current context, choice attributes and socio-economic variables were coded for regression⁷. In this instance, the status quo or base option implied that the respondent would prefer the present situation to either of the alternatives. Obviously, if the respondent chose neither option, they make no additional payments, but do not receive the ‘benefits’ of the compliance regime; say by being able to report their neighbours’ breach to authorities.

⁵ See Appendix A for a sample of the choice sets presented to respondents.

⁶ In an attempt to address the potential challenge of adverse behaviour, that is, respondents who breach water restrictions deliberately selecting compliance regime alternatives that will minimize the likelihood that they will get caught, a series of statements were included before the choice experiment. These statements highlighted the possible and generally undesirable outcomes of people not complying with water restrictions (e.g. reduced water reliability in the immediate term, more severe water restrictions in the future, an increase in the need to source alternative water supplies).

⁷ Refer to the Appendix B for a complete report of attribute and variable coding.

4.4 Results: ML model

The ML model exhibited an adequate fit of the data with a Rho 2 of 0.38 (see, for instance, Hensher et al. 2005). The COST and INSPECTORS parameters are negative and significant at the 1 percent level. Alternatively, the INFORMING and REPORT parameters are positive and significant at the 1 percent level. The influence of the socio-economic, situational and psychographic variables of respondents on preferences for a compliance regime has been explored in the ML model by interacting these types of variables with the attributes. Appendix C presents the results of this ML model. The results reveal significant sources of preference heterogeneity. The policy implications of this will be discussed in section six.

5.0 CONTINGENT VALUATION

In addition to investigating householders' preferences for a water restriction regime, data were collected to uncover the preference for avoiding restrictions entirely. These data are considered in the context of the contingent valuation methodology.

5.1 Bid design

In a contingent valuation method study, respondents are asked questions to elicit their maximum WTP or minimum willingness to accept compensation for a predetermined change (Carson et al. 1995; Carson 2001). In this study, the MBDC format required respondents to indicate their voting certainty on a proposed policy referendum at each of the possible dollar values specified on the payment card (bids) by choosing from “definitely no”, “probably no”, “not sure”, “probably yes”, and “definitely yes” response alternatives (Loomis and Ekstrand 1997; Cameron et al. 2002; Roach et al. 2002; Alberini et al. 2003; Evans et al. 2003; Vossler et al. 2003).

There are a number of ways that have been proposed to retrieve the WTP from this form of data. Here we applied an ordered probit model⁸ (see, for instance, Cameron et al. 2002; Horna et al. 2007).

5.2 Contingent valuation findings

A scaled ordered probit model was estimated for all respondents. In Appendix D the results of this model (Model 2) are summarised, where significant socioeconomic and attitude items have been included in an attempt to improve model fit.⁹ Model 2 indicates that a number of household characteristics are significant determinants of WTP to avoid restrictions. The LAWN, FAIR, and INCOME coefficients are positive and significant at the 1 percent level. The WATER, REASONABLE, EDUCATION and NUMBER OF RESIDENTS are also significant and positive, but at the 5 percent level. Alternatively, the COMPLY coefficient is negative and significant at the 1 percent level. Analysis of Model 2 (Appendix D) also reveals that a number of psychographic variables are significant determinants of WTP. The policy implications of this will be discussed in section six. In this context, it is possible that some individuals are philosophically opposed to removing water restrictions, even if there were no cost to themselves. In fact, some 20% of the sample always select the ‘definitely no’ response (this group is referred to as Class 1).

5.4 WTP to avoid water restrictions

The median WTP range for all respondents (assuming that the expected value of the individual specific random effect is zero), and for those in Class 2 are reported in Table 2. Class 2 comprises the group who are responsive to payments, and these give

⁸ The ordered probit model was estimated using the data collected from the main survey instrument, which was described in section 4.1.

⁹ Refer to Appendix B for a description and the coding of variables used in the model.

significant upper and lower bounds on median WTP. As one might expect, the range across all individuals is high, with the lower level not significantly different from zero. This is because this sample includes those who have an objection to accepting the policy, even at zero bid value.

Table 2 Median WTP per annum

	All Respondents	Class 2
Lower bound (Conservative)	-\$8	\$141***
Upper bound (Liberal)	\$103***	\$252***

*** indicates significance at the 1 percent level.

Figure 2 and 3 illustrates the predicted probabilities for each outcome (definitely no; probably no; unsure; probably yes; definitely yes) for each of the bid amounts, conditional upon being in Class 1 and Class 2 respectively.

Figure 2 Predicted probabilities: Class 1

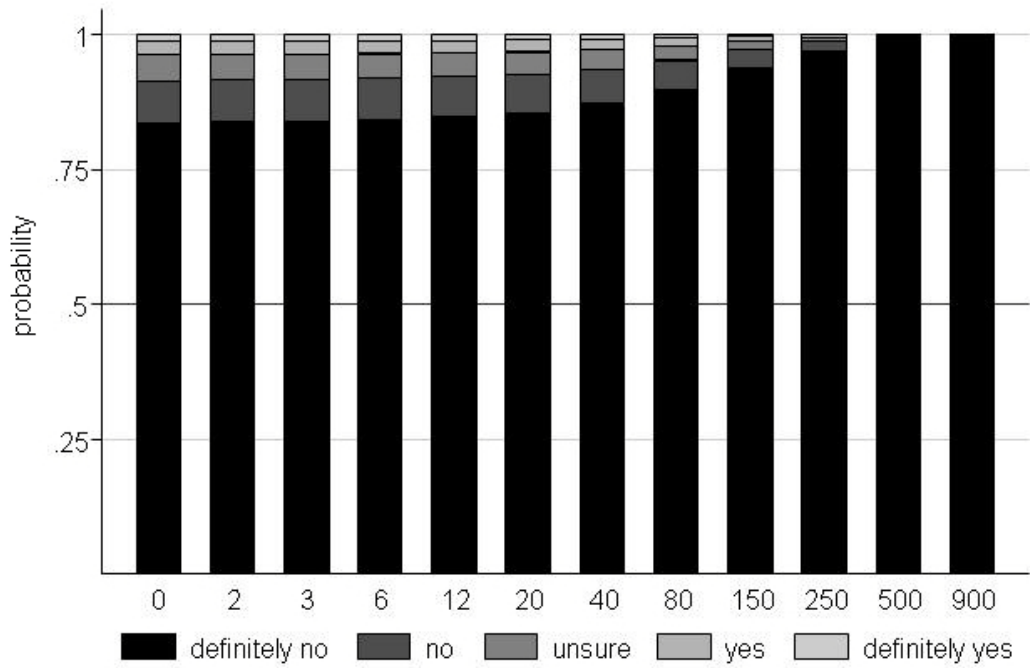
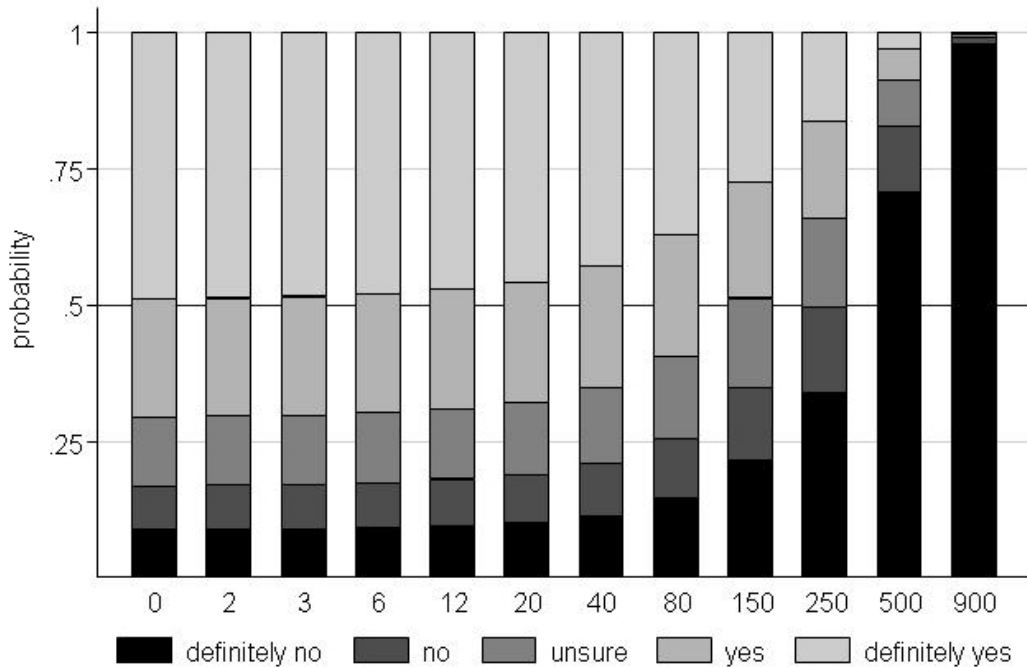


Figure 3 Predicted probabilities: Class 2



A number of unconditional median WTP values were estimated along situational dimensions in order to make meaningful comparisons within the sample data. Table 3 presents the range for the unconditional Median WTP across three dimensions for Class 2 (those who are responsive to payment). More specifically, the WTP range is compared between: (1) respondents who have a lawn and those who do not; (2) respondents from water rich cities and water poor cities; and (3) respondents with ‘lower’ household income compared to those with a ‘higher’ income. As you would expect, the medians remain negative for class 1 regardless of particular situational variables, thus these are not discussed further.

Table 3 Unconditional median WTP ranges: Class 2

	Lawn			
	Yes	t-ratio	No	t-ratio
Lower bound	\$152.00	7.94***	\$98.00	4.52***
Upper bound	\$263.00	13.51***	\$208.00	9.55***
	Water			
	Water Rich	t-ratio	Water Poor	t-ratio
Lower bound	\$158.00	7.84***	\$137.00	7.07***
Upper bound	\$269.00	13.13***	\$247.00	12.60***
	Income			
	Low	t-ratio	High	t-ratio
Lower bound	\$106.00	5.38***	\$181.00	9.24***
Upper bound	\$216.00	10.90***	\$291.00	14.60***

*** indicates significance at the 1 percent level.

Note: All other exogenous variables held constant at mean levels.

6.0 POLICY IMPLICATIONS

Early in this report, it was noted that, despite criticisms, urban water restrictions have become the norm in many Australian cities and this seems set to remain the case for the foreseeable future. It is against this background that the interest in compliance, the structure of compliance regimes, and the attitudes of the citizenry in this field was developed.

6.1 Choice Modelling: Implications

Whilst there is the temptation to speculate about underlying factors driving the observed heterogeneity in the choice models, it is better to restrict discussion to those areas where policy adjustment or modifications are feasible. These data also provide useful insights into the likely cost of some policy changes.

Policy formulation often occurs in an environment which presupposes perfect compliance achieved at no cost. As acknowledged earlier, when problems arise with a policy, enforcement is commonly deemed to be responsible for the policy failure, with the outcome being the demand for improved enforcement (Sutinen and Kuperan 1999). Establishing people's preferences for compliance regimes is an important element to developing effective policy. Moreover, identifying people's preferences for a compliance regime may enhance social welfare and will likely be attended by lower political costs, particularly if we accept that water restrictions are likely to be a medium to long term component of urban water management.

Clearly, the average respondent values modifying the compliance regime surrounding water restrictions. If respondents, on average, are WTP for a compliance regime (i.e.

more inspectors and being able to report others) then it would seem there is a preference for mandatory enforcement.

The four attributes that comprised the compliance regime proved to significantly influence respondents' choice. This has a number of implications for policy in the context of water restrictions.

Inspector attribute

The results of the choice model reveal that, on average, respondents are WTP to increase the presence of water inspectors. This suggests that the average citizen values formal deterrence mechanisms when water use is being regulated. In addition, this suggests that the average respondent values increasing the probability of detecting those who opt for recalcitrant behaviour. Nevertheless, and as observed by Winter (2008), an increase in inspectors does not necessarily mean an increase in compliance. Alternatively, this type of incentive may have a negative impact on social cohesion and thus, undermine moral and social incentives to comply with water restrictions (Winter 2008).

The findings (see Model 1) also identify three significant sources of heterogeneity relative to respondents' preferences for more water inspectors. Firstly, home ownership was identified as a source of preference heterogeneity. Although, on average, respondents prefer a higher presence of water patrol inspectors, those who own their home have the strongest preference for this. Arguably, home owners are the segment of the sample who carry a disproportionate burden of water restrictions. The accelerated depreciation of garden assets brought by water restrictions and/or the cost of converting

to a low-water garden are more immediately visited upon home owners. This may explain the relative enthusiasm of this group for more vigilant inspection regimes.

Secondly, the respondents' state of residence (i.e. NSW or Victoria) is a significant source of preference heterogeneity, with those living in NSW having a stronger preference for an increase in water patrol inspectors in their city. Ironically, NSW already has a greater presence of water patrol inspectors than Victoria. This raises important questions about the way the population (or at least the population of these two jurisdictions) reacts to the visible presence of authority generally. For instance, does some visible presence of authority prompt a desire for an even greater presence?

Thirdly, the environmental values variable proved to be a significant source of heterogeneity. This implied that respondents who claimed to have stronger environmental values expressed a stronger preference for water patrol officers. Potable water is ostensibly a private good, however governments often portray its use as having significant environmental consequences. Accordingly, water consumption is commonly seen as having a direct impact on environmental health and future generations (Our Water, Our Future 2007). Against this background, non-compliance with water restrictions is commonly perceived as having a negative impact on environmental health. Therefore, a stronger preference for an increase in enforcement by those respondents who have strong environmental values is perhaps not expected.

At a practical political level, these results need to be considered cautiously. Whilst, on average, there would appear to be support for more authoritative and vigilant water inspection officers, this view is hardly universal. Such an approach, at least on the basis

of these data, may not be welcomed by those living in rented accommodation and those who claim less ardent environmental views. Moreover, invoking such a policy would appear to generate more controversy amongst Victorians than those in NSW. In simple terms, a national policy modification of this form might require additional measures to engage broader support.

Informing attribute

The estimates generated by the preferred choice model also reveal that respondents, on average, are WTP to decrease the frequency of exposure to information about water restrictions. Paying to receive less of a product's attribute may, in the first instance, appear to be behaviourally implausible. However, given the nature of this attribute it is reasonable to suggest that respondent's utility may, in fact, be increased when they are not inundated with some forms of information. Knowledge of the requirements to conform with regulations is a fundamental component of compliance behaviour (May 2005). However, the findings of this study show some evidence of 'habituation' and 'advertising wear-out', which occur when consumers are overexposed to particular stimuli (see, for instance, Blackwell et al. 2006, p.439). In the context of water restrictions in Australia, Watson (2008) has also bemoaned the negative impacts of the 'save every last drop' dogma often promoted by governments. These results also cast some doubt over the persistent call for 'educating the community' (see, for instance, Victorian Women's Trust 2005), and suggest that there is a fine line between educating the public and unwarranted indoctrination.

Situational variables had a significant influence on respondents' preferences for information in the media. Firstly, those respondents that live in Victoria had a stronger

preference for reduced exposure. Interestingly, the state government of Victoria has consistently invested in education and awareness campaigns over recent years to encourage water conservation inside and outside of the home (see, for example, Victorian Government 2003). For instance, a number of programs have been implemented under the *Our Water, Our Future* plan (2007) such as the ‘Waterwatch Program’, ‘Water-Learn it! Live it!’, making water bills more informative and the public reporting of water authority’s progress in meeting water-saving targets. Victorians may well be justified for exhibiting symptoms of advertising wear-out.

Secondly, those respondents that live in metropolitan centres had a stronger preference for lessening exposure to information. This may, in part, be a function of the generally more intensive media campaigns in metropolitan areas compared to residents of rural centres.

Thirdly, the average respondent that does not have a lawn and/or garden that requires watering also had a stronger preference for a reduction in the frequency of reminders and information about water restrictions. The underlying logic of this result may simply be that water restrictions are not as relevant for householders that do not have a lawn and/or garden compared to those who do. Reminders would likely be less relevant and potentially more utility decreasing for the latter.

Consistent with environmental paradigms (see, for instance, Fulton et al. 1996), environmental values proved to have a significant impact on behavioural preferences. More specifically, respondents who claim to have low environmental values had a stronger preference for reduced information. As highlighted earlier, individuals have

been encouraged to believe that there is a verifiable link between complying with water restriction and improving the environment. Therefore, it is not unexpected that respondents with lower environmental values had a stronger preference for being less frequently exposed to reminders about water restrictions.

One of the prominent policies implemented in NSW and Victoria to meet the requirements of the National Water Initiative was public education and awareness programs promoting water conservation and efficiency. There is some support within these data that greater attention should be given to the costs of education and awareness campaigns versus the wider gains. Given that preferences for the frequency of exposure are not homogenous, a more targeted approach may produce gains.¹⁰

Report attribute

The notion that respondents, on average, are WTP to have a service that enables them to report others for what is perceived as ‘water abuse’ carries with it a number of implications. Firstly, this may suggest that the element of spite is prominent across respondents, or at least the average respondent. Put differently, the average respondent is WTP for the ‘privilege’ of ‘dobbing-in’ their neighbours and this implies that the average respondents’ utility is decreasing as a result of others’ water use benefits, *ceteris paribus*. Alternatively, this act may be motivated by altruism. That is, the average respondent may feel that financially supporting a service that facilitates reporting those who breach water restrictions is contributing to a benefit for the community overall and thus utility adding for the individual.

¹⁰ Alternatively, although respondents, on average, want to decrease their frequency of exposure to water restriction campaigns, it does not necessarily mean that they are not having an impact on water use behaviour. Put differently, even if people would rather not hear about water restrictions, the campaigns could still be having a significant impact on behaviour.

Secondly, this may infer that respondents hold the perception that there is merit in complying with water restrictions and therefore, believe that others should be complying. This is consistent with the predominant view that there is value associated with ‘saving water’, regardless of whether such ‘savings’ are real (see, for instance, Crase and O’Keefe 2009).

Thirdly, respondents may opt to have a ‘reporting mechanism’ available in order to avoid private confrontation and private punishment of those breaching water restrictions. The common adverse consequences of private confrontation and the numerous incidences of threats, vandalism and physical harm over alleged non-compliance with water restrictions may make a ‘reporting mechanism’ an attractive service. Notably, the existence of a service to report does not necessarily imply that this will eliminate private confrontation; in fact, it may have the reverse effect if those being reported suspect that their neighbours have been spying on them. Regardless of the underlying motivations that led to the results, this generally does not bode well for those supporting more stringent regimes on the basis that water restrictions are akin to a ‘community strengthening exercise’ prompted by rallying to overcome a common problem (see, for instance, ABC News 2008; ACTEW 2010; Gadd 2009).

The findings of the reported ML model support the notion that contextual variables have a significant influence on respondents’ preferences for having a reporting service available. Firstly, respondents living in regional centres have a stronger preference than those who live in metropolitan centres for having a reporting mechanism. Arguably, this calls into question the extent to which regional/rural communities are more socially

cohesive than larger urban metropolises. Romanticised images of the ‘rural idyll’ – a small-scale, naturally bonded, cohesive and caring community – are strong in Australia’s national mythology (Allen 2003; Hogg and Carrington 1998; Macklin 1995). However, this kind of one-dimensional imagery is clearly at odds with the results of this choice experiment i.e. the average regional respondent has a stronger preference to be able to report others.

Secondly, the findings suggest that the preference for reporting others is stronger for respondents who live in areas not subjected to severe water restrictions for a long period of time (i.e. water rich cities) relative to other respondents (i.e. water poor cities). This outcome may, in part, be explained by the concept of ‘water restrictions fatigue’. This concept became apparent during interviews with residents from cities that had been on severe water restrictions for an extended period of time (i.e. Bendigo, Goulburn). A number of interview participants revealed a diminishing enthusiasm for water restrictions over time. Those in ‘water poor’ cities may be more likely to be experiencing water restriction fatigue compared to those in ‘water rich’ cities and thus less likely to be as enthusiastic about reporting non-compliance compared with those in water rich cities. In addition, if widespread non-compliance emerges as the norm, there are likely to be confronting social pressures not to inform authorities when witnessing delinquent behaviour.

Finally, the findings of Model 1 support the notion that respondents who claimed to have strong environmental values had a stronger preference for having a service available to report others for non-compliance. As stated earlier, non-compliance with water restrictions is commonly perceived as having a negative impact on environmental

health. Thus, it might be expected that respondents with high environmental values had a stronger preference for being able to report non-compliance.

6.2 Compliance cube

The findings from the choice model (ML model 1) gives a clear indication of the extent of heterogeneity around this topic. Again, policy makers looking for a one-size-fits all response might find some discomfort in these results. The key dimensions of compliance behaviour were illustrated in the ‘compliance cube’ framework presented in Figure 1. This framework could be used to categorise segments of the citizenry and better target regulatory responses. This would enable the application of compliance mechanisms that are more closely aligned with motivations, and thus more likely to be effective.

6.3 WTP

As was initially observed in section four, choice modelling allows for the estimation of WTP values for the average respondent. For the ML model (Model 1) the estimated mean WTP for the average respondent was: about \$37 per annum to be able to report their neighbour to authorities for non-compliance; around \$0.40 per annum to have one less day of exposure to information about water restrictions (i.e. the average respondents is WTP about \$0.40 per annum to have one more day between reminders); and \$0.00026 per annum to have one less household per water patrol inspector (i.e. a more vigilant inspection regime). Hypothetically at least, these values can be employed to construct more meaningful scenarios. From a policy perspective, this enables preferences to be quantified and compared in a meaningful way. Some illustrative potential scenarios are summarized in Table 4.

Table 4 Hypothetical scenarios: Compliance regime

	WTP per annum (once off payment)
SCENARIO ONE	
REPORT: YES (service to report others)	\$37.70
INFORMING: 1 week between reminders	\$2.80
INSPECTORS (inspectors per household) 1 per 50 000 to 1 per 10 000	\$10.40
Total WTP	\$50.90
SCENATIO TWO	
REPORT: YES (service to report others)	\$37.70
INFORMING 2 weeks between reminders	\$5.60
INSPECTORS (inspectors per household) 1 per 50 000 to 1 per 20 000	\$7.80
Total WTP	\$51.10
SCENARIO THREE	
REPORT: NO (no service to report others)	\$0.00
INFORMING 1 week between reminders	\$2.80
INSPECTORS (inspectors per household) 1 per 50 000 to 1 per 40 000	\$2.60
Total WTP	\$5.40

In sum, identifying people's preferences for compliance regimes is an important element to developing effective policy. Given the likelihood that urban water restrictions will persist for some time and the political consequences that attend

changing perceptions about water restrictions, there is value in understanding householder's attitudes.

The policy implications of this choice experiment are significant. Presently, state jurisdictions impose a range of constraints to limit household water use. Clearly, many would appear to be in favour of a more rigorous application of those constraints in one form or another. However, these results are hardly consistent with the near-daily reports in the popular media promoting water restrictions as a positive force for social cohesion and as an effective vehicle to achieve behaviour modification (see, for example, ABC News 2008). The results from this work should be used to seriously challenge proponents of water restriction regimes and raise questions about the longer term social impacts of their deployment. Put simply, it is hard to reconcile these results with the view that water restrictions make for a more cohesive society striving to overcome an inconvenient hydrology whilst simultaneously becoming more informed and educated about environmental matters generally.

The findings also have useful implications relative to the media campaigns circumscribing water restrictions. More specifically, it appears that an increase in the frequency of informing consumers, on average, has a negative impact on utility and this is more evident for particular groups within the population i.e. Victorian residents. For policy makers this should signal the need to re-evaluate public investment in awareness campaigns.

Finally, the observed heterogeneity in these data should be a caution to policy makers and advisers. There is strong evidence that segments of the community have disparate

views about the appropriateness of different compliance measures. Thus, universal changes in one direction or the other need to be contemplated with caution.

6.4 Some implications from the contingent valuation findings

People's sensitivity to water restrictions across a number of dimensions appears to differ between groups within the population. Being able to identify the segments within the population and identifying those who are most enthusiastic about paying to avoid water restrictions is an important element to developing effective policy.

Contrary to the implied value of 'saving water' that dominates popular thinking, these data suggest that particular segments within society actually value not being subject to water restrictions. Attitudinal variables (e.g. attitudes toward water restrictions) and particular value sets (e.g. environmental values) were shown to play some part in influencing an individual's WTP to avoid water restrictions. Similarly, respondents that differ across socio-demographic variables such as income and education also appear to receive differing levels of utility from avoiding water restrictions. In addition, exogenous factors such as the severity and duration of water restrictions and whether the respondent had a lawn were shown to have an influence on the WTP to avoid water restrictions.

The findings reveal that a substantial portion of the sample (approximately 80%) support being able to buy their way out of water restrictions. Thus, the impact of water restrictions on human welfare is self evident. Alternatively, there is a group of respondents who do not *prima facie* gain utility from avoiding water restrictions. Notwithstanding the variation in preference for avoiding water restrictions, subjecting

all water users to the same water restrictions is consistent with the Rawlsian view (Rawls 1971), which advocates equality, even if it is equality of suffering.

The results also show that when respondents received additional information in the survey regarding national water allocation by sector it significantly reduced the predictability of their responses. Further investigation into the influence of educating householders about national water consumption trends on decision-making appears to be warranted. Put differently, the data support the view that objective, factual data on water consumption significantly changes the probabilistic distribution of the choices (for any bid level) in this context, at least relative to those who are exposed to the present information on water saving that is typical in most jurisdictions.

The policy implications of these findings are useful in terms of effectively differentiating the market according to variables that influence WTP. For instance, there appears to be merit in differentiating the price of discretionary water use for householders that have a lawn and a higher income compared to householders that do not have a lawn and a lower income. Moreover, state jurisdictions presently impose a range of constraints to limit household water use with little account for individual preferences or use. Clearly, this approach is not unanimously supported by the population, although many would appear to support more rigorous application of enforcement across the populous simply for the sake of it (as shown in section four). By way of contrast, the contingent valuation data show that particular household segments have a greater inclination to pay to avoid restrictions.

As with the heterogeneity embodied in the choice modelling data, there are similar messages for policy makers in the contingent valuation results. Economists find it

difficult to support on-going behavioural restrictions on water use (see, for instance, Edwards 2006). Moreover, there continues to be calls for deployment of markets but around 20 percent of this sample stridently resists markets in this domain. Resistance of this magnitude across the electorate will potentially make it more costly to achieve this policy change.

7.0 CONCLUDING REMARKS

Part of this report uses the results from a choice experiment to investigate the interplay between different components of a water restriction regime. Foremost amongst the predictor variables in the preferred choice model were the product attributes of COST, INSPECTORS, INFORMING and REPORT. These factors exhibited important influences on householders' decisions to purchase a modification in the water restrictions compliance regime. Put simply, respondents are more likely to opt away from the status quo: the higher the number of INSPECTORS, the lower the COST, the less frequent INFORMING about water restrictions, and the existence of a service for REPORTING others for non-compliance. The findings of the choice experiment also reveal significant sources of preference heterogeneity relative to the product attributes. They imply that socio-economic, situational, and psychographic variables play a significant part in preference formation for a compliance regime.

State devised attenuation of urban water use means that these findings have a number of important implications for policy. The impact and acceptability of differing approaches to enforcement is particularly significant. Increased understanding of these intricacies takes us a step closer to improving the confidence with which compliance incentives can be recommended. The underlying rationale is that a regime that is perceived as

acceptable will generate less severe welfare losses as opposed to one that is not consistent with individual preferences. Moreover, understanding the acceptability of restrictions also potentially offers useful insights into the broader implications of a public policy approach based on regimes of this form.

However, while the idea to adopt a compliance regime that is preferred by citizens may be sound in theory, it appears that it may suffer from several pragmatic problems. Put differently, a socially preferred policy may have unacceptable implications on other fronts and may not be politically feasible to implement. In this instance, a preference for an increase in the presence of inspectors and a service to report non-compliance does not appear to be pragmatic and achievable. However, there may be immediate scope for re-evaluating the benefits of ‘educating’ and ‘informing’ the population. These results are obviously in stark contrast to prevailing views that focus on the community benefits from ‘shared pain’. Moreover, results point to the significance of components such as ‘dobbing-in’, deterrence and spite as elements of politically-attractive enforcement regimes.

The contingent valuation analysis also provided a number of important implications for policy. Current bureaucratic regulation of urban water use tends to regard individuals as largely homogenous and does not consider variables that drive behaviour or preferences for water usage. Alternatively, the contingent valuation findings reveal that people’s preferences are markedly heterogeneous across the sample. Put differently, people’s sensitivity to water restrictions across a number of dimensions appears to differ between groups within the population. From a policy perspective, it is useful to understand that the population is comprised of a portion of people who are strictly opposed to paying to

avoid water restrictions and a portion of people who are willing to buy their way out of water restrictions.

In addition, the apparent variation in respondents WTP across particular dimensions provides a useful basis for differentiating the urban water market. This suggests there is scope to develop pricing structures that reflect more closely the value particular segments place on discretionary water use. All these topics are worthy of greater scrutiny in a policy context and provide a useful basis for future applied work of this type.

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Appendix A: Example of a choice set presented to respondents

Which enforcement & education package would you choose?		Price of the Enforcement Package 	Number of Inspectors 	Information 	Able to report your neighbour 
Package 1		\$5 per year	1 per 8 000 households	Every 14 days	Yes
Package 2		\$50 per year	1 per 5 000 households	Every 7 days	No
Neither		\$0 per year	1 per 10 000 households	Every 90 days	No

Appendix B: Coding and description of socio-economics variables

ATTRIBUTES/ VARIABLES	DESCRIPTOR	LEVELS/CODING
INSPECTORS	ratio: number of water inspectors per household	1: 1000 = 1000 1; 2000 = 2000 1: 5000 = 5000 1: 8000 = 8000 1: 50 000 = 50 000 1: 200 000 = 200 000
INFORMING	Frequency of household exposure (days)	Everyday = 1 Every 7 days = 7 Every 14 days = 14 Every 31 days = 31
COST	Increase in water bill (\$ WTP Per annum)	\$2 = 2 \$5 = 5 \$10 = 10 \$20 = 20 \$50 = 50 \$100 = 100
REPORT	Able to report your neighbour	Yes = 1 No = 0
WATER	Do respondents live in a water poor or water rich city	Water poor=1 Water rich=0
NSW	The state the respondent lives in	NSW=1 Victoria=0
LAWN	Do respondents have a lawn/garden that requires watering	Yes=1 No= 0
HOME	Do respondents own their home	Yes=1 No=0
METROPOLITAN	Do respondents live in a metropolitan or regional centre	Metropolitan=1 Regional=0
E-VALUES	Respondents' perception of their own environmental values	Factor score derived from 5 scale items
AGE	4 stage scale	18 to 24=1; 25 to 54=2; 55 to 64=3; 65+ =4
FACTS	Did respondents receive facts outlining national water usage on their survey	Yes=1 No=0
INCOME	Total household income per week	<\$200=1 \$200-\$299=2 \$300-\$399=3 \$400-\$499=4 \$500-\$599=5 \$600-\$699=6 \$700-\$799=7 \$800-\$999=8 \$1,000-\$1,499=9 \$1,500+ =10
EDUCATION	Highest level of education completed	Year 10 at secondary college=1 Year 12 at secondary college=2 Diploma or certificate=3 Tertiary degree=4
NUMBER OF CHILDREN	The number of children in their household	None=0 1 or 2=1 3 or 4=2 5+ =3
POOL	Do respondents have a pool	Yes=1 No= 0

Appendix B Continued

ATTITUDE VARIABLE	DESCRIPTOR	EXAMPLE QUESTION	CODING
INTENTION	Intention to comply with water restrictions: where increased intention implies greater intention to comply with water restrictions.	"I intend to follow water restrictions in the future"	Factor Score: 4 intention questions (5 stage Likert scale) were reduced to a single INTENTION variable.
ATTITUDE	Attitude toward water restrictions: where an increase in this variable implies a more favourable attitude toward complying with water restrictions.	"I think it is a good idea to comply with water restrictions"	Factor score: 11 Attitude questions (5 stage Likert scale) were reduced to 2 variables- ATTITUDE and SOCIAL NORMS Factor score (5 scale items).
SOCIAL NORMS	Respondents attitude toward social norms: where increased social norms implies a greater concern for behaving 'appropriately' according to society's norms.	"Most members of my family think I should comply with water restrictions" x "Generally speaking, I want to do what most members of my family think I should do"	
VALUES	Environmental values: where increased environmental values implies stronger values for the environment.	"It makes me sad to see natural environments destroyed"	Factor score: 8 Attitude questions (5 stage Likert scale) were reduced to 2 variables- VALUES and COMPLIANCE VALUES 3 items
COMPLIANCE VALUES*	Compliance Values in general: where increased compliance values implies stronger values for complying with the law in general.	"Generally, I feel that I have a duty to comply with the law"	
PBC	Perceived behavioural control over the national water situation: where higher PBC implies higher perceived control.	"It won't make any difference if my household does not comply with water restrictions"	Factor Score: 7 intention questions (5 stage Likert scale) were reduced to a single PBC variable.

Appendix C: ML with interactions (Model 1)

	Model 1: ML with heterogeneity interactions
Random parameters	
INSPECTORS	-0.1308 E-04*** (-14.592)
INFORMING	0.0162*** (4.891)
REPORT	1.4427*** (12.648)
Nonrandom parameters	
ASC ₁	1.5656*** (8.778)
COST	-0.0382*** (-32.827)
Heterogeneity around mean	
INSPECTORS:HOME	-0.2311 E-05*** (-4.842)
INSPECTORS:NSW	-0.2186 E-05** (-2.327)
INSPECTORS:E-VALUES	-0.3371 E-05*** (-6.942)
INFORMING:NSW	-0.0106*** (-5.476)
INFORMING:METROPOLITAN	0.0149*** (6.871)
INFORMING:E-VALUES	-0.0084*** (-7.656)
INFORMING:LAWN	-0.0099*** (-4.240)
REPORT:METROPOLITAN	-0.4507*** (-3.076)
REPORT:WATER	-0.6998*** (-4.602)
REPORT:E-VALUES	0.2271*** (3.450)
Derived standard deviation	
INSPECTORS	0.8042 E-05*** (12.261)
INFORMING	0.0416*** (29.960)
REPORT	1.1363*** (18.716)
Model statistics	
Log likelihood	-4178.377
Rho 2 (ρ^2)	0.381
AIC	1.366
BIC	1.385
Observations	6144
Chi-square	5142.99

Wald-statistics in parentheses

*** indicates significance at the 1 percent level

** indicates significance at the 5 percent level

Appendix D: Ordered probit model (Model 2)

	Coefficient	Z statistic
BID	-0.435 ***	29.33
LAWN	0.237 ***	4.27
WATER	0.093**	2.03
FAIR	0.060 ***	2.66
REASONABLE	0.046**	2.55
EDUCATION	0.121 **	2.46
NUMBER OF RESIDENTS	0.071 **	2.36
INCOME	0.374 ***	7.71
E-VALUES	0.137 ***	3.45
INTENTION	0.162 ***	3.34
ATTITUDE	-0.281 ***	4.36
COMPLY	-0.075 ***	2.54
Cut points		
μ_1	-0.412 ***	2.55
μ_2	0.046	0.29
μ_3	0.528 ***	3.26
μ_4	1.174 ***	7.17
Scale equation (log standard deviation)		
EXTINFO	0.038***	3.34
FACTS	0.116***	3.56
Log odds parameters (class 1)		
EXTINFO	0.209**	2.41
PBC	0.531***	3.54
SOCIAL NORMS	-0.263*	1.89
FAIR	-0.209*	1.77
constant	-1.191***	7.83
Random effects		
	Class 1	Class 2
location	-2.14	0.65
Prior probability	0.23	0.77
Log Likelihood	-5950.1452	

*** indicates significance at the 1 percent level.

** indicates significance at the 5 percent level.

* indicates significance at the 10 percent level.