

# Barriers to voluntary improvement of residential fertiliser practices in the Peel-Harvey Catchment\*

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**ABSTRACT:** *The adoption of best practices in residential lawn and garden fertiliser use has been identified as a cost effective means to reduce urban nutrient inputs to waterways. This article examines the barriers to such voluntary change in urban sub-catchments of the Peel-Harvey Estuary system in Western Australia. The implications for the design and successful implementation of a voluntary community-based behavioural change program targeting residential fertiliser practices are discussed.*

**KEYWORDS:** Catchment; nutrients; Peel-Harvey; residential; fertiliser; voluntary; behavioural change.

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## 1 INTRODUCTION

Residential fertiliser use is a significant source of phosphorous and nitrogen inputs to the Peel-Harvey Estuary (a.k.a. the Peel Inlet-Harvey Estuarine system) located in southwestern Western Australia. This estuary has long suffered from large-scale eutrophication problems (EPA, 2008). The adoption of best practices in lawn and garden fertiliser use has been identified as a cost effective means to reduce urban nutrient inputs to the estuary. In 2011, the South West Catchments Council (SWCC) funded a preliminary study of the potential barriers to voluntary change in residential fertiliser practices in urbanised areas of the catchment. The findings of that study and their implications for the design and implementation of a voluntary community-based behavioural change program targeting residential fertiliser practices in urbanised sub-catchments are discussed as follows.

## 2 PEEL-HARVEY WATER QUALITY IMPROVEMENT PLAN

The Peel-Harvey Estuary consists of two broad shallow lagoons, the Peel Inlet and Harvey Estuary. The estuary has a large catchment (11,930 km<sup>2</sup>) and receives seasonal flows from the Murray, Serpentine and Harvey Rivers and many drains. The catchment's population of around 330,000 includes the rapidly growing municipality of Mandurah. Situated about 75 km south of Perth, Western Australia, the estuary and its catchment provide significant ecological, recreational, commercial and scientific values and forms part of the Ramsar-listed Peel-Yalgorup System.

Since the 1960s, the estuary has suffered from large-scale eutrophication problems, due excessive nutrients predominantly exported from diffuse rural and urban sources (Zammit et al, 2006). During the 1980s and early 1990s, the system experienced large blooms of toxic blue-green microalga (*Nodularia spumigena*) and large accumulations of macroalgae. This created not just an environmental problem but a political problem for the state government (Bradby, 1997).

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In 1992 a statutory Environmental Protection (Peel Inlet-Harvey Estuary) Policy (EPP) set the environmental quality objectives for the system. This included an annual median load (mass) of phosphorus flowing into the estuary of less than 75 tonnes. It is a statutory water quality target that has never been met. In 2006, the phosphorus load to the estuary was about twice the EPP load target (EPA, 2008).

Opened in April 1994, the 2.5 km Dawesville Channel or "Cut" was constructed to increase tidal exchange between the estuary and marine waters to flush the system. The Cut significantly improved water quality in some parts of the system (Paling et al, 1999), but nutrient loads in other parts (eg. rivers and lakes) remain problematic (EPA, 2008).

In 2003 the system was identified as a water quality management priority hotspot under the Australian Government's Coastal Catchments Initiative. This led to the preparation of the *Water Quality Improvement Plan (WQIP) for the Rivers and Estuary of the Peel-Harvey System – Phosphorus Management*. Finalised in 2008, the WQIP aims to improve water quality by reducing phosphorus discharges from the catchment through changes to agricultural and urban practices and land use planning (EPA, 2008).

The WQIP is a long-term plan. As a result of decades of nutrient input, large stores of phosphorus in the soils and sediments of the coastal portion of the Peel-Harvey catchment will take many years to leach out of the soil. Highlighting the seriousness of the management challenge, the EPA has predicted that, on a small scale, improvements could be detected in nutrient loads within a 10-year time scale but significant improvements could take 20-50 years (EPA, 2008). It should be noted that although nitrogen discharges are also a major problem, the WQIP focuses its efforts on the management of phosphorous discharges.

### 3 RESIDENTIAL FERTILISER PRACTICES

The current land use that delivers the majority of the nutrients to the estuary is grazing (39%) following by residential uses (17%). Although urban areas account for only 6% of the catchment's land use by area, they contribute more than 20% of the phosphorus inputs (EPA, 2008). The unit area Phosphorus export rates from medium and large urban residential lots exceeds that of some rural land uses including beef grazing and mixed grazing (Kelsey et al, 2010). Over the next 20 years, residential contributions could increase significantly as portions of the catchment transition from rural to urban through implementation of the South Metropolitan and Peel Sub-regional Structure Plan (WAPC, 2009).

There is growing interest in engaging citizens to voluntarily achieve sustained behavioural change.

Fuelled by the surge in popularity of social marketing (Kotler et al, 2002) and the emergence of community-based social marketing (McKenzie-Mohr & Smith, 1999), environmental change agents (ie. those seeking to modify the environmental behaviours of others) are increasingly looking to voluntary behavioural change programs to help tackle environmental problems that are either too difficult or too costly to tackle through other means (Stern, 2000).

In preparing the WQIP, a range of catchment management scenarios, including various mixes of voluntary and regulatory best management practices (BMPs,) were assessed to identify the best mix of actions to meet the water quality target (Zammit et al, 2006). Urban fertiliser management was identified as one of the most successful BMPs in term of load and concentration reduction and cost effectiveness (Neville, 2005).

The WQIP (EPA, 2008) recommended the following actions to achieve urban fertiliser management:

- Use low water soluble fertilisers.
- Apply these fertilisers sparingly to gardens and turf.
- Fertilise only when symptoms of nutrient deficiency occur (eg. yellowing).
- Minimise lawn areas or plant an alternative lawn (ie. non-grass).
- If fertiliser is needed use a complete lawn fertiliser containing a nitrogen, phosphorus and potassium.
- Establish a public education program on environmentally responsible gardening, including the use of native plants, reduced lawn, low water use, and mulching.

Following the release of the WQIP, the state government took the significant step of passing the *Environmental Protection (Packaged Fertiliser) Regulations 2010*. As of 1 January 2013, the maximum amount of phosphorus in garden fertiliser sold in Western Australia must not exceed 2% by weight and 1% by weight for lawn fertilisers.

The regulations apply to fertilisers manufactured for domestic use but does not apply to garden fertiliser that is either controlled release fertiliser or processed organic fertiliser. This is a significant limitation as garden fertilising, including organic fertilisers such as manures and many mulches, is a major source of nutrient export from urban areas (Kelsey et al, 2010).

Despite the introduction of the new regulations, further improvements in residential fertiliser practices are needed in order to achieve the water quality targets.

### 4 PRELIMINARY STUDY

As part of the implementation of the WQIP, in 2011, the SWCC funded a preliminary study of the potential

barriers to voluntary change in residential fertiliser practices in urbanised areas of the catchment.

#### 4.1 Study area

The City of Mandurah suburb of Meadow Springs was chosen as the study area. It is a middle class residential estate of approximately 2000 single detached homes on medium sized lots. It was selected because:

- it is located within a coastal urbanised sub-catchment of the system (ie. 7 km north of the Peel Inlet)
- it was part of the 2006 Department of Water (DoW) urban nutrient survey (Kelsey et al, 2010)
- medium-sized residential lots (601-730 m<sup>2</sup>) have greater nutrient exports (kg/ha) than smaller or larger lots (Kelsey et al, 2010).

#### 4.2 Data sources

The sources of data used in the study included:

- a review of academic articles, technical reports and grey literature pertaining to residential fertiliser practices and behavioural change
- advice from DoW project officers regarding potential fertiliser management strategies
- semi-structured interviews with 12 key stakeholders including representatives of relevant state and local government agencies, change agents, local turf managers (eg. golf course) and SWCC officers
- face-to-face interviews with a sample of Meadow Springs’ residents
- a review of fertiliser packaging messages.

#### 4.3 Literature review

The literature review was used to identify factors to be included in the resident survey and key stakeholder interviews. These factors were drawn from two sources:

1. behavioural change theories and models (eg. Ajzen, 1991; Bandura, 1986; Prochaska & DiClemente, 1983; Rogers, 1975; Rimal, 2008; Stern, 2000)
2. residential fertiliser behavioural change case studies.

#### 4.4 Resident survey

Using a property data base provided by the local government, a personalised letter was sent to each household informing them that SWCC interviewers would be door knocking their neighbourhood and seeking their participation in an interview about residential fertiliser use. Homes situated within retirement villages were excluded from the sample as they have minimal lawns and gardens. In an effort

to improve participation rates, an incentive of a \$40 voucher for fertilise-wise or water-wise products was offered to those who completed the questionnaire.

A pre-tested questionnaire was used to guide the interviews and ensure consistency in data collection. The questionnaire included a question that screened out households that did not use fertilisers. A team of five trained interviewers door knocked over 500 Meadow Springs households over a weekend.

Due to time and funding constraints and the exploratory nature of the study, a target of 50 interviews was set for the Meadow Springs resident survey. Thus the survey employed a convenience sample strategy as opposed to seeking a statistically representative sample. The Meadow Springs survey yielded 54 useable questionnaires. More than half of the survey respondents were male (57.4%). All respondents lived in detached single dwellings with an average lot size of 633 m<sup>2</sup>.

A full description of the methods and results is available in a technical study report (Beckwith Environmental Planning, 2012) on SWCC’s website <http://swccnrm.org.au/>.

## 5 RESIDENT PERCEPTIONS

### 5.1 Problem awareness

While problem awareness will not in itself generate behavioural change, it is a critical foundation component of a behavioural change process. Citizens are unlikely to voluntarily adopt a new behaviour if they are unaware of the problem issue or do not perceive it to be a problem requiring action. Furthermore, they must believe that the current situation threatens environmental resources they value and believe their actions can help alleviate the threat and restore the values (Stern, 2000). Without these pre-conditions citizens are unlikely to experience a sense of moral obligation to change their behaviour (Grob, 1995; Norlund & Garvill, 2003).

Residents were asked the following question: “Is the health of the Peel Inlet-Harvey Estuarine System is important to you?” On a scale from 1 (strongly disagree) to 5 (strongly agree), a large majority either “strongly agreed” (59.3%) or “agreed” (35.2%) with the statement. This is an indication that residents do value having a healthy system.

They were also asked an open-ended question as to why state agencies and NRM groups, like the EPA and SWCC, are concerned about fertiliser use in urban areas. Three-quarters (75.9%) indicated it was related to runoff into waterways, groundwater or wetlands. This suggests some understanding of the relationship between fertiliser use and water quality.

The state’s EPA has repeatedly stated that the Peel-Harvey system could face another ecological collapse including more fish deaths, algal blooms and

continued deterioration unless urgent, coordinated and sustained action is taken (EPA, 2007). The surveyed residents do not share that view. Asked to rate the current condition or health of the Peel Inlet-Harvey Estuarine System on a scale from 1 (very poor) to 5 (excellent), the majority rated it as either "average" (35.2%) or "good" (27.8%), with a significant number selecting "don't know" (18.5%). Surprising few rated the system's condition as either "very poor" (3.7%) or "poor" (14.8%).

People often rely on their senses to evaluate threats to environmental quality (eg. bad odours, stagnant water) (Canter et al, 1993). Residents were asked: "How do you know the water quality is [their rating]?". The dominant response was the presence or absence of algae (25.9%). Other sensory cues identified were "whether looks good" (16.7%) and colour or clarity (13%). This indicates that some residents apply sensory cues in making their judgements of system health.

It is easier to raise problem awareness if there are complementary sensory cues. Such cues were obvious in the 1980s and 1990s when large toxic algal blooms and fish kills generated significant media coverage. The Cut dramatically reduced the potential for such events within the Inlet and Estuary although smaller events still occur in the contributing rivers. Although the system's water quality problems have not gone away, to a large extent the sensory cues to the problem are no longer present.

Overall, although residents understand that fertiliser use is viewed by the experts as a threat to water quality, they do not view the estuarine system as unhealthy. In part this may be due to a decline in sensory cues that would signal that the system is struggling.

## 5.2 Personal behaviour

People are more likely to take action if they believe their behaviour is a significant part of the problem (Prochaska & DiClemente, 1983) and that by changing their behaviour they could make a difference (Maddux & Rogers, 1983). Two questions were used to assess whether residents view their behaviours as part of the problem. Using a scale from 1 (strongly disagree) to 5 (strongly agree), less than a third of residents either "agreed" (25.9%) or "strongly agreed" (3.7%) with the statement: "Much of the fertiliser I use on my property eventually ends up on local waterways and estuaries". They were also asked which statement in table 1 best described their fertiliser use. Most indicated they either use the proper amount (42.6%) or less than they need to (27.8%). Only 13% indicated they use more than required.

Residents were asked if they agreed with the statement: "Changing my fertilising practices would have little impact on the health of the Peel Inlet-Harvey Estuarine System." A third either "agreed" (22.2%) or "strongly agreed" (9.3%), while a quarter (25.9%) "neither agreed nor disagreed". Only a third indicated that they either "strongly disagreed" (7.4%) or "disagreed" (29.6%) with the statement. This suggests that residents do not believe that changing their behaviour would make a significant contribution to solving the water quality problems.

People are less likely to change their behaviour if they believe other sectors of the community are the main sources of the problem. Using a scale of 1 (no positive impact) to 5 (major positive impact), residents were asked to rate the degree of impact various actions would have on nutrient levels in the Peel Inlet-Harvey Estuarine System (table 2). Residents indicated that

**Table 1:** Perception of personal fertilising behaviour.

Response	Percentage (%)
I apply more fertiliser than I need to	13.0
I apply less fertiliser than the garden and lawn need	27.8
I apply a proper amount of fertiliser to my lawn and gardens	42.6
I don't know if I apply the correct amount of fertiliser	16.7
Total	100.0

**Table 2:** Perceived impact of actions on nutrient levels in the Peel Inlet-Harvey Estuarine System (Q27).

Statement	Mean rating
Reducing discharges from industrial sources	4.31
Reducing the amount of fertiliser applied to agricultural properties	4.27
Encouraging residents to plant native gardens	4.06
Reducing the amount of fertiliser applied to public open space (eg. parks, ovals)	3.71
Limiting fertiliser applications to autumn and spring	3.65
Reducing the amount of fertiliser applied to residential properties	3.51
Changing the design of residential subdivisions	3.19

reducing discharges from industrial sources (mean = 4.31) would have the greatest positive impact followed by reducing the amount of agricultural fertiliser use (mean = 4.27). Reducing residential fertiliser use (mean = 3.51) and limiting applications to spring and summer (mean = 3.65) received among the lowest mean ratings, although use of native gardens rated well (mean = 4.06).

This suggests that residents view industry and farmers as more responsible for the problem. While it is true that farming practices are the largest contributors, residential contributions far outweigh the contribution from industry.

In general, surveyed residents view residential fertiliser use as a small contributor to the problem relative to other land uses (ie. industry and farming). They neither believe their actions are significantly contributing to the problem nor that changing their behaviour would impact the system’s health.

### 5.3 Social norms and benefits

Social norms are rules that are understood and acted upon by group members without the force of laws (Cialdini et al, 1995). They form a key component of many behavioural change models (eg. Ajzen, 1991; Stern, 2000). In any behavioural change context there will be a number of norms at play. Variation exists in the prevalence, importance, and stability of normative standards in different settings and social contexts. Some norms will exert a stronger influence

**Table 3:** Having an attractive garden is an important part of being a good neighbour.

Rating	Percentage (%)
Strongly disagree	5.6
Disagree	14.8
Neither agree or disagree	18.5
Agree	38.9
Strongly agree	22.2
Total (n = 54)	100.0

**Table 4:** Perceived necessity of fertilising.

Rating	It is impossible without using fertiliser to have an attractive ...	
	Garden (%)	Lawn (%)
Strongly disagree	9.3	7.4
Disagree	20.4	11.1
Neither agree or disagree	18.5	14.8
Agree	33.3	35.2
Strongly agree	18.5	29.6
Don’t know	0.0	1.9
Total (n = 54)	100.0	100.0

on behaviour than others in some contexts (Kuentzel et al, 2008). Existing behaviours that are consistent with strong social norms are harder to modify than those not associated with strong norms.

On a 5-point scale, residents were asked the degree to which they agreed with the statement: “Having an attractive garden is an important part of being a good neighbour.” Over 60% of those surveyed either “agreed” or “strongly agreed” with the statement (table 3). This result is consistent with other studies that found that maintaining one’s lawn is a strong social norm in many communities and for many it is part and parcel of being a good neighbour (Kaufman & Lohr, 2002).

In deciding whether or not to change their behaviour, an individual will consider trade-offs and outcome expectations (Bandura, 1986). If a person thinks the new behaviour requires sacrifices that are not outweighed by benefits (monetary or non-monetary), they are less likely to voluntarily change their behaviour (Janz & Becker, 1984). People tend to be more sensitive to the threat of losing something of value than the prospect of a gain (Tversky & Kahneman, 1992). People value their green lawns and gardens for their aesthetics, psychological benefits and the strong social norm to be a good neighbour (Kaufman & Lohr, 2002).

The surveyed residents not only value their lawns but believe that they need to fertilise in order to have an attractive lawn. The majority of residents either “agreed” (35.2%) or “strongly agreed” (29.6%) with the statement: It is impossible to have an attractive lawn without using fertiliser (table 4). There would likely be resistance if residents were asked to reduce their fertiliser usage as that would be viewed as threatening an existing benefit (ie. green garden and lawn) that is supported by a strong social norm (ie. being a good neighbour).

### 5.4 Self-efficacy

Self-efficacy is the confidence that one can perform a specific behaviour. Individuals who have a stronger sense of self-efficacy are more likely to successfully change their behaviour (eg. Bandura, 1986; Ajzen,

1991; Prochaska & DiClemente, 1983). In this case, most surveyed residents displayed a strong sense of self-efficacy in terms of their ability to change their fertilising practices, if they chose to do so. Most either "disagreed" (40.7%) or "strongly disagreed" (38.9%) with the statement: "It would be difficult for me to change my fertilising habits" (table 5). Asked if they would change how they fertilise if they learned it was harmful to the environment, most either "agreed" (42.6%) or "strongly agreed" (40.7%) with the statement.

Residents expressed confidence in their ability to appropriately apply their fertilisers (table 6). The majority of participants (70.4%) indicated that they read and follow the package instructions on how to calculate the proper amount of fertiliser to apply. A quarter of residents ignored the instructions in favour of their own judgements. These individuals typically expressed great confidence in their own judgement.

When asked how they would know if they were applying too much fertiliser, the dominant response was that the lawn or plants would get burnt (38.9%) or die (16.7%). Almost a quarter of residents (22.2%) stated that they did not know how to determine if they were applying excessive amounts of fertiliser. Unfortunately using a burned lawn or garden as a cue to excessive application is unreliable. With the improved "no burn" fertilisers, a person could easily exceed the proper application rates but still see no damage to their lawn or garden.

### 5.5 Trusted sources

Change agents seek to use persuasive communication to influence attitudes and behaviours. In general, messengers viewed by message receivers as highly

credible are more persuasive. The position advocated in a message may be accepted if the message comes from a highly credible source but rejected if the source is perceived to lack credibility. The actual merits of the arguments contained in the message may not be considered at all if message receivers rely on a source credibility heuristic (ie. If I trust the source, I trust the message) (Chaiken, 1980).

Credibility refers to the perceived expertise and trustworthiness of the communicator (ie. change agent). When asked to identify the two most trustworthy sources of information about proper fertiliser use, residents identified the local garden centre (ie. Bunnings) (42.6%), followed by TV programs (31.5%), and friends and family (27.8%). Among government agencies the Department of Agriculture and Food WA (DAFWA) fared best (25.9%). The trustworthiness of a source is in part a function of familiarity. Catchment groups (5.6%) and the Great Gardens program (3.7%) were rarely identified as trusted sources of information about fertilisers. This likely reflects their relatively low profiles with these residents.

Partnering with organisations viewed by the target adopters as trusted sources with respect to the target behaviour can assist change agents in making their messages more persuasive. In this case, a partnership with local garden centres and DAFWA could be beneficial to the SWCC. It would also benefit its efforts if SWCC raised its public profile with target adopters.

## 6 RESIDENT FERTILISER PRACTICES

### 6.1 Timing of fertiliser use

It is recommended that lawn fertilisers are applied only in autumn and spring, when grass grows rapidly

**Table 5:** Perceived self-efficacy.

Rating	It would be difficult for me to change my fertilising habits (%)	I would change how I fertilise if it was harmful to the environment (%)
Strongly disagree	38.9	0.0
Disagree	40.7	7.4
Neither agree or disagree	1.9	9.3
Agree	11.1	42.6
Strongly agree	7.4	40.7
Total	100.0	100.0

**Table 6:** Use of fertiliser instructions.

Response	%
I read and follow the instructions on how to correctly apply the fertiliser	70.4
I don't really bother reading the instructions; I use my own judgement	25.9
I would like to follow the instructions but they are too difficult	1.9
Other (fertiliser does not have instructions)	1.9
Total	100.0

(Department of Agriculture WA, 2006). Residents indicated they apply fertilisers mainly in spring (77.8%) or autumn (29.6%), while a quarter fertilise in summer (25.9%) and 13% in winter. On average residents fertilised their lawns twice a year (mean = 1.93 times/year) and their gardens somewhat less (mean = 1.63 times/year). Three quarters (74.1%) fertilised both their lawn and garden. While there is some room for improvement, most Meadow Springs residents appear to be already doing the correct behaviour in terms of the timing of their applications.

## 6.2 Application advice

Inconsistent and contrary messages are barriers to behavioural change. Both DAFWA's and the South East Regional Centre for Urban Landcare's (SERCUL) Fertilise Wise program (SERCUL, 2011) recommend applying fertiliser only in spring and autumn. DAFWA also advises that residents only apply fertiliser when symptoms of nutrient deficiency occur (eg. yellowing). For established lawns both recommend applying a complete maintenance lawn fertiliser at a maximum use a maximum application rate of 25 g/m<sup>2</sup>. The recommended nitrogen (N) to phosphorus (P) to potassium (K) ratios are almost the same with SERCUL recommending a ratio of 10:1:6 and DAFWA a ratio of 10% to 12% N, 1% to 2% P, and 6% to 10% K. Both sets of recommendations are specifically tailored for soils commonly found on the Swan Coastal Plain.

Unfortunately, residents are more likely to turn to fertiliser packaging for guidance. The directions on commercial inorganic fertiliser packaging found in home garden centres often offer contrary advice, especially regarding frequency of application. Some products recommend use every three months, others every six weeks, or simply "as needed". While most recommended not applying their products in winter, many did not comment on summer use.

The confidence expressed by residents in their ability to properly apply fertilisers to their lawns and gardens is not shared by the authors. It is likely that residents do read the instructions but for the reasons discussed below it is far less likely that they fully follow them. Most inorganic granular fertilisers recommend an application rate of 25 g/m<sup>2</sup> but the consumer is left to figure out how to achieve this application rate. Some fertiliser packaging provides guidance on how to estimate what 25 g looks like (eg. an adult male hand holds approximately 50 g). However, the resident still needs to know the area of their lawn. In our experience, most people do not know the area of their lawn or garden. Thus even though residents are confident in their abilities (table 1), there is little evidence that this perception is correct.

Some consumers like the convenience of liquid fertiliser products such as weed and feed products.

Simply hook the hose to the container and it will apply the appropriate amount. At least that is the assumption. Some liquid lawn food packaging indicates that they contain phosphorous but do not indicate the concentration or the application rate. In terms of frequency of application, some products state only that for best results the consumer should not fertilise again within the next seven days.

The situation is even more problematic with regard to organic fertilisers. It is a common consumer misconception that products labelled "natural" or "organic" are environmentally sensitive (Hughes et al. 2009). This can lead to well-intended actions having unintended consequences such as residents favouring organic fertilisers in the mistaken belief they are innocuous because they are "natural". Among surveyed Meadow Springs' residents, mulch (33.3%) was the most common fertiliser type (inorganic or organic) and 13% applied sheep manure.

More often than not organic fertilisers come in plain packaging or no packaging (eg. trailer loads) and thus provide no advice regarding their content or proper application rates. Even the Fertilise Wise advice for fertilising gardens is vague in comparison to that offered for lawns. It advises gardeners to use a high quality, coarse mulch in garden beds to reduce watering and minimise nutrient loss and to take care using raw animal manures that break down readily. No specific advice is provided in terms of application rates.

## 6.3 Purchasing habits

Wandering the rows and stacks of fertiliser products in a home garden centre can be a confusing experience. On what basis does a consumer choose one product over another? In response to an open-ended question, residents indicated that they purchased their garden and lawn fertilisers on the basis of "past experience or habit" (garden 29.6%; lawn 25.9%), suitability for the purpose (16.7% for both), price (lawn 18.5%; garden 11.1%) and on the basis of recommendations by others (lawn 16.7%; garden 9.3%). Whether a product was "environmentally friendly" or phosphate-free was a significant factor for only 5.6% when choosing their lawn or garden fertilisers.

Even if they wanted to select an environmentally friendly product, it is easier said than done. Green labelling of fertiliser products is becoming increasingly popular but some are green in name only. Consumers lack the ability to easily identify and purchase environmentally sensitive fertiliser in the store (Hughes et al, 2009). Despite eco-labelling on a number of fertiliser products, within the study area only one local fertiliser producer had attained certification status through the Fertilise Wise program. Its limited range of products is only sold in one home garden centre chain and it is not Bunnings. Thus the 83.3% of residents who

exclusively purchase their fertiliser at Bunnings do not have access to these products.

It appears that resident fertiliser purchasing is largely guided by habit. Once a person finds a fertiliser product that works well, they are likely to stick with it regardless of whether or not it is environmentally friendly. Research has shown that habitual behaviours are more difficult to change than behaviours that are not habitual (Verplanken & Aarts, 1999; Møller, 2002).

#### 6.4 Native gardens

Private gardens in Western Australia are composed mainly of exotic rather than native plant species. A shift to native species gardens would significantly reduce residential phosphorous inputs as native gardens do not require fertilising. The DoW has estimated that if all residences replaced their exotic gardens with native gardens and applied SERCUL recommended lawn fertiliser application guidelines, a phosphorous export target of 4.5 kg/ha/a could be met (Kelsey et al, 2011). However, existing trends suggest this would be very difficult if not impossible to achieve voluntarily over the next 10 years.

For well over a decade the installation of native gardens has been widely promoted in the State's south-west as a water conservation measure. This has included media campaigns, workshops, native garden competitions, demonstration gardens and verge makeovers. Yet 40% of private gardens on the Swan Coastal Plain consist of only 10% or less of native plant species. Less than 20% of gardens consist of at least 80% native species (Kelsey et al, 2010). Disappointingly, residences less than 10 years in age are more likely not to have any native plants in their gardens than older dwellings (Kelsey et al, 2010).

For most residents, a request that they rip up their existing garden and replace it with a native garden is too big an ask from a cost perspective and because many people are very attached to their existing gardens and uncertain if they would be equally satisfied with a native garden (eg. aesthetic stereotypes). It may be more productive to encourage residents to instead take baby steps initially such as replacing plants that die with native plants so that they become comfortable with the idea. Providing households with a free native plant to add to their garden could also help lower resistant to the idea of a garden dominated by native species. The greatest potential to have residents install complete native gardens at one time is in new subdivisions. Research has shown that people are more likely to change their behaviour during a time of transition.

### 7 MONITORING CHANGE

Although ongoing monitoring and evaluation is a key component of any behavioural change

program, it often proves to be a weak link (Taylor & Wong, 2002). It is the intention of the WQIP to measure attainment of water quality improvement and efficacy of specific best management actions. However, the existing water quality monitoring network does not permit small scale measurements to identify the efficiency of BMPs such as changes to residential fertiliser practices (EPA, 2008).

In the absence of this type of monitoring data, the program would need to rely on surrogate indicators of program impact. The most commonly applied surrogates for actual behavioural change are behavioural intentions and self-reported behaviours. However, the gap between both intentions and actual behaviour (Armitage & Connor, 2001; Webb & Sheeran, 2006) and self-reported and actual behaviours (Rundle-Thiele, 2009; Jenner et al, 2006) can be large, making them far from ideal indicators.

The WQIP states that attitudinal surveys at 1, 5 or 10 years will provide a source of data for the adaptive management strategy. This would be used to report on the percentage of farmers and urban land holders changing their attitudes and recognising that they are part of the water quality problem and solution (EPA, 2008). While such surveys could provide information on problem awareness, it should not be used to infer actual behaviour.

Just as the WQIP is a long-term plan, change agents need to maintain behavioural change programs for many years in order to maximise gains and minimise residents slipping into older behaviours (Prochaska & DiClemente, 1983). Too many voluntary behavioural change programs are abandoned after only one year, either due to unrealistic expectations or lack of ongoing funding. Unfortunately many environmental change agents (eg. NRM groups) operate on short funding cycles. In order to compete for funding, change agents can feel under pressure to set unrealistic behavioural change targets and to quickly demonstrate significant results in order to justify renewed funding. In addition, funding agencies (eg. state and federal government agencies) have the unfortunate habit of shifting their investment priorities every few years.

### 8 CHANGE POTENTIAL

Under the fertiliser management scenarios in the WQIP, most urban households would need to adopt best practice fertilising behaviours (eg. native gardens, improved fertiliser application rates and timing). Based on case studies with a similar behavioural focus and the barriers identified in this study, such a high level of voluntary behavioural change seems unlikely.

Taylor & Wong's (2002) review of US case studies of education and intensive training programs involving lawn and garden care practices probably



offers the best insights as to the *maximum* magnitude of behavioural change that can be expected over the short term (1 year). They found that public media campaigns can produce an 8% to 48% (with an average of the most reliable data around 12%) increase in the number of people undertaking specific desirable behaviours. Participation in intensive training programs (eg. workshops on lawn and garden care practices) produced a 10% to 75% (with an average of the most reliable data around 29%) increase in the number of people undertaking a specific desirable behaviour and a 40% increase in the number of desirable practices adopted.

Overall, media campaigns are more cost-effective in raising broad community awareness, while intensive training is more effective at changing behaviour, although it typically reaches only a small segment of the community. Taylor and Wong considered these figures to be maximum estimates of change because many of the reviewed case studies relied on self-reported behaviours and thus are likely overestimates of actual behaviour.

In terms of native garden adoption rates, it is likely that those most receptive to a request to change their garden type have already done so in response to ongoing water conservation campaigns conducted by the Water Corporation and local governments (Rogers, 2003). While it is worthwhile to continue to promote native gardens, especially as it is consistent with existing social norms about water conservation, large voluntary gains in the short to medium term appear unlikely. An educated guess would be a 5-10% gain over the next 5 years.

## 9 CONCLUSIONS

SWCC will use the results of the preliminary study to decide if or how it will proceed to the design and implementation of a voluntary behavioural change program focussed on residential fertiliser practices. This study identified a number of resident perceptions that are barriers to behavioural change, including that:

- many residents do not believe the Peel-Harvey system is in poor health
- they do not believe their actions are contributing to the problem and believe that others (eg. industry) are more responsible
- residents view having a green lawn and garden as part of being a good neighbour (ie. strong social norm)
- they believe they need to use fertilisers to achieve their lawn and garden goals
- they have confidence in their existing fertiliser practices which are largely based on habit
- environmental considerations are not a driving force in their fertilising purchasing decisions.

Resident perceptions are not the only barriers to improved fertiliser management practices. Other barriers that need to be lowered include the:

- conflicting messages on packaging regarding proper application rates, timing of fertiliser use and the eco-friendliness of products
- lack of specific guidance available on how to use organic fertilisers
- need to know the size of one’s lawn area in order to apply the proper amount of fertiliser
- inability to directly monitor the nutrient savings from improved residential practices
- short-term funding cycle of change agents versus the long term investment required to achieve and maintained voluntary behavioural change.

While a voluntary behavioural change program has the potential to significantly change residential fertiliser practices on the Peel-Harvey catchment, it is unlikely to achieve the scale of gains sought in the WQIP. This is not to suggest it is an unworthy exercise. Far from it, but environmental managers need to consider the adoption potential of such programs when evaluating their potential contribution to addressing environmental problems such as excessive nutrient loads.

It should also be kept in mind that even if voluntary behavioural change programs do not generate high levels of change, they can play a valuable role in changing social norms and thereby making it more acceptable to subsequently adopt other types of measures (eg. regulation).

Given the catchment’s large size and population, it is recommended that SWCC and its partners focus on a broad based education campaign including mass media, supplemented by intensive training programmes in those urban sub-catchments where improvements in behaviour would have the most impact in achieving water quality targets. It is also recommended that the behavioural change program be pilot tested (McKenzie-Mohr & Smith, 1999) in order to refine both the program methodology and adoption expectations. Ideally the pilot test should include direct monitoring of the impact of the behavioural change (ie. water quality monitoring) to enable better impact predictions.

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