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IS WATER QUALITY REALLY THE ANSWER TO STREAM PROTECTION? INTRODUCING SENSIBLE POLICY

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ABSTRACT

It is becoming increasingly accepted that direct connection of unmitigated stormwater to urban streams tends to degrade stream health. State level water quality targets tend to focus on managing the quality aspects of stormwater only. Improving water quality mitigates stormwater impacts, however, the impacts of additional quantity of stormwater are often ignored.

Proven through extensive modelling, investigations suggest that reducing the quantity of stormwater will almost always meet best practice for water quality improvement. This paper proposes that setting targets for mimicking natural hydrological regimes (stormwater runoff volumes and timings) yields a far better stream ecological outcome than focusing on water quality only. Because it is based on a first principle understanding of streams, it is elegantly simple.

This philosophy has been adopted into draft policy, strategy and technical guidelines for the 13 Councils of The Central West Salinity and Water Quality Alliance (Alliance) strongly supported by the Central West Catchment Management Authority (Central West CMA).

Although the policy was well received by Planners and Engineers within the Alliance Councils, there remains some political resistance from more conservative councils.

For this planning instrument to work effectively with both BASIX and the Building Code, individual Councils need to adopt this policy as part of their Development Control Plan (DCP) with Technical Guidelines in support.

This paper takes the reader on the journey of alternative and innovative stormwater policy development including considerable Council liaison through to strategic marketing and advocacy to garner political acceptance.

The result is a simple policy to understand and implement that also affords the catchment streams and rivers ultimate protection from development.

INTRODUCTION

The Central West Catchment Management Authority (Central West CMA) is committed to improving the condition of catchment waterways, such as the Macquarie and Castlereagh Rivers which drain into the RAMSAR listed Macquarie Marshes, through better management of the lands in the catchment, as outlined in the targets listed in its Catchment Action Plan (CAP). This paper describes one of the collaborative initiatives with Local Government, taken in support of this outcome, which began in 2006 and is briefly described below to provide context.

In NSW, a Memorandum of Understanding exists between the Local Government & Shires Association and the Catchment Management Authorities which recognises that: "Both parties contribute significantly to the sustainable management of natural resources through direct investment, planning, regulation, and implementation of on-ground works. Local Government also has involvement as land managers, local planning authorities, and service providers." The formal

mechanism for this relationship with the 16 catchment councils in the Central West is through the Local Government Reference Group.

BACKGROUND

In 2006 the Central West CMA, on advice from the councils, reviewed its incentive funding for Local Government Partnership programs and determined to increase the amount of funding made available to councils, on the proviso that projects supported catchment targets and were developed by an existing regional alliance. The aim of this was to ensure works were strategic and catchment wide, and included both smaller and larger councils.

This funding initiative gave an opportunity for the Salinity Action Alliance, initially formed in 2002 to address salinity in a whole-of-catchment approach, to become the umbrella group to assist in the development of the projects. Consequently, the group rebranded as the Salinity & Water Quality Alliance (Alliance), as all the issues that councils wished to address were based around water quantity and quality. The 13 councils that finally joined the Alliance and undertook projects over the period 2007-2010 were: Bathurst, Blayney, Bogan, Cabonne, Coonamble, Dubbo, Gilgandra, Mid-Western, Narromine, Orange, Warren, Warrumbungle and Wellington.

Some of the specific issues the group identified and wished to address included: sedimentation, degradation of urban creeks and rivers, stormwater quantity, quality and harvesting, together with lack of staff expertise and skills to overcome many of the identified problems.

Despite many of the councils having stormwater management plans there was little or no recognition that this and Integrated Watercycle Management planning - both requirements in NSW - would require new techniques to implement best management practice. The solutions nominated by the group to form the basis of the projects included stormwater treatment trains - incorporating constructed wetlands, riparian restoration and water re-use. It was recognised that a keystone to implementing the projects was to engage in capacity-building and training events that were organised by the Central West CMA.

The final result was that $3.5 million of on-ground works were undertaken to improve the health of the receiving waters of the catchment, $2 million from the Central West CMA and the remainder from Alliance Councils, both in cash and in-kind contributions.

Whilst the on-ground works were being undertaken it was recognised by the Alliance and the Central West CMA that, to support these works, better stormwater management outcomes were required at the planning stage to guide improved development. The decision was timely, as all the councils are currently reviewing their Local Environment Plans (LEPs) and Development Control Plans (DCPs), under the NSW Planning Reform Process. This created an opportunity to prepare a water sensitive design guideline for inclusion in DCPs that suited inland conditions, including the impacts of climate change.

It was also recognised that such a policy would also significantly contribute to the CentROC (Central Regional Organisation of Councils) Water Security Study that was also in the planning phase.

THE PROCESS

The Alliance and the Central West CMA recognised that implementing change in a traditonally conservative region can be a daunting task. It was clear from the outset that it was going to be a long and challenging road, particularly to achieve consistent stormwater policy across the region. However, through collaboration, the Alliance and the Central West CMA ultimately sought to

achieve their objectives. It was a journey of stormwater management which involved on-ground demonstration works, considerable liaison with all councils, capacity building, provision of tools for council staff and advocacy for adoption of such policy.

In 2007 the journey commenced when the Alliance and the Central West CMA engaged Storm Consulting (Storm) to undertake a scoping exercise. Various projects were identified across the Alliance to demonstrate works that improve waterway health, and as previously noted, the projects selected and scoped were mainly stream and wetland works but also included water sensitive design. The aim of employing an external consultant was to introduce the councils to "new" influences and techniques and ensure the projects were undertaken using best management practice. The works were then designed and constructed with the intention to generate interest and ownership for water quality works in both the Councils and the community.

The next step was to develop policy to drive implementation of water quality works at a planning level. It was proposed to develop a Water Sensitive Design (WSD) Policy with supporting guidelines to assist the practitioners. Liaison was undertaken with each Alliance Council by way of a presentation outlining the vision for the policy and site visits and discussions to identify local issues that may be considered at a catchment scale in preparation of the S_2S – Stormwater to Smartwater - Policy. This culminated in a Scoping Report.

Draft Planning Provisions were then prepared and distributed to a Steering Committee that was established to represent the Alliance Councils. The draft Planning Provisions document described potential policy provisions that would be the essence of the S_2S Policy and guide the preparation of the final document.

It was intended to complete the document, taking into consideration the Steering Committee's comments, and then progress to the advocacy phase to garner Council acceptance. However, this was not the case.

The Unexpected Problem

The draft Planning Provisions were not well received by the Steering Committee. The draft was consistent with typically more advanced WSUD Policies around today so the Central West CMA and Storm were somewhat surprised with the feedback.

It however, proved too ambitious for the project to aim to develop draft planning provisions directly from scoping out the project (Storm Consulting, 2009). The Steering Committee identified their need for more background material plus an explanation of the need for the S_2S Policy that could be communicated to others, before they could begin to assess planning provisions.

The Steering Committee requested that an overall strategy, that tied in the underlying need for the policy, be developed, and that it be named the Water Resource Management Strategy (WRMS) (Storm Consulting, 2009).

Storm prepared this document with the intent that the draft WRMS was to provide all stakeholders with an opportunity to contribute and help develop not only the S_2S Policy but also the way in which the Policy is to be developed (i.e. the strategy documented in the WRMS report), so that it is mutually acceptable and will ultimately be adopted by all stakeholders.

The aim of the draft WRMS was to provide background, justification and explanation for the project in order to garner support from colleagues, councillors and the community (Storm Consulting, 2009). The Steering Committee raised the following questions upon review of the draft Planning

Provisions document:

- Why do we need the policy?
- What are the Policy's aims and objectives?
- Where does it sit in relation to other Council planning policies/instruments?

The WRMS included a revised set of draft planning provisions in a format similar to those that would be found in a typical DCP. These were draft planning provisions which it was hoped the Steering Committee would review once they had gained an appreciation of the WRMS.

Re-thinking the issues/solution

This was a pivotal point in the project where the Alliance and the Central West CMA highlighted the need to differentiate this policy from other typical policies, particularly those derived from the coast. Water Sensitive Design Policies have become increasingly complex, as more is learned and understood about stormwater and a solution to accommodate these variables in the design is sought.

Storm contemplated this - we needed to produce something simple yet very effective.

For quite some years STORM has been working on development that drains to sensitive areas. Receiving water environments are degraded by frequent runoff events combining with increased pollutant loads. This means that there is a need to focus more on the smaller storm events that occur very frequently, rather than the larger events. Therefore, ecologically sustainable development should seek to mimic the pre-development flow regime (or environmental flow regime) with particular focus on the frequency and volume of the smaller storm events (Wiese *et al*, 2006).

Besides water quality we have adopted various measures of flow volume or quantity impact by comparing the pre-development condition (typically pre-colonial) to the post development condition with and without controls. These measures are listed below.

Total volume of runoff	Increasing the imperviousness of a catchment results in additional runoff volume reporting downstream. Traditional stormwater management uses detention as a means of reducing the peak flow leaving a development. However, stormwater detention does not reduce the volume or frequency of runoff and consequently may result in degradation of receiving environments (Wiese *et al*, 2006). Implementing controls in a proposed development can reduce the runoff volume. If the runoff from post development is similar to that of pre development then the risk of harm to the downstream waterway is reduced.
Number of runoff days on average per year	The frequent direct delivery of water and pollutants from impervious surfaces to streams has a detrimental effect on stream health (Ladson, *et al*, 2005). Implementing controls in a proposed development can reduce the runoff frequency occurring on average. If the runoff frequency from post development is similar to that of pre development then the risk of harm to the downstream waterway is reduced. This is probably the simplest measure related to the volume issues for stormwater management.

Runoff Volume Frequency Curve (Wiese *et al*, 2006)

A runoff volume frequency curve provides an easy-to-interpret statistical summary of all of the flows generated from the site. This curve embodies the runoff volumes for all of the rain events that occur. These are summarised in terms of flow percentiles, e.g. the 5 percentile flow is the daily flow volume leaving the catchment which is only exceeded 5% of the time for the given data set.

Certain storm flows correspond to percentile bands, viz.:

- base flows typically occur in the percentile band greater than 10%, i.e. base flows are very frequent flows and the flows are exceeded by runoff generated from most minor storm events
- "freshes" are flows that occur up to the 3-month ARI and which are within the 3-10% percentile band and are not exceeded very often – these flows are critical for maintaining habitat and for flushing creeks
- major storm flows greater than the 3-month ARI occur within the 1-3% percentile band but are infrequent and consequently less important to creek health, though they do play a role in maintaining creek geomorphic processes and the health of floodplains.

Comparison of the differences between pre and post development allows its impact to be determined. The closer the post-development runoff volume frequency curves are to the pre-development runoff volume frequency curve, the closer the subdivision is to mimicking the natural flow regime and therefore reducing environmental degradation.

The Revised Strategy

In the theme of keeping things simple, Storm sought to define the performance through matching runoff days in the average year. There are many variables that influence runoff in a catchment and they are briefly described below. Suffice to say there was extensive number crunching and scratching of the skull, to eventually boil it down to the least number of variables that could be used to define a solution that was simple and effective.

It is acknowledged that reducing the number of variables can introduce errors which may result in some solutions not quite meeting the desired performance, however others will likely over-perform in compensation. Based on our investigations the differences are quite minor and do not warrant increasing the complexity to gain greater optimisation. It is thought that a simplified strategy will be more readily and widely adopted than a complex strategy.

The key, or most sensitive, variables are impervious area and average rainfall depth. The latter was further simplified into areas greater than 800mm and areas less than 800mm annual average rainfall depth.

S_2S - Stormwater to Smartwater - the final plan - was born in August 2010 alive and kicking weighing in at two documents - the policy and supporting technical guidelines.

Concurrently the Central West CMA arranged numerous training sessions for Council staff within the Alliance to generate awareness and hopefully a desire to implement better stormwater management within the catchment. The sessions included Constructed Wetlands, Raingardens Essentials, Music modelling and a WSUD seminar specifically designed for councillors and senior council management. It was in essence a process of arming the staff with the necessary knowledge to contribute and assess such projects.

S_2S – THE PLAN

Description

This policy contains planning controls relating to the management of all aspects of the water cycle in an integrated and consistent manner. The planning controls promote the need for long-term sustainable social, ecological and economic outcomes. Specifically, the planning controls relate to the management of stormwater, roofwater and groundwater while also encouraging the efficient use of every drop of water regardless of its source.

Relationship to other plans

The planning controls apply to all development that requires approval under the Environmental Planning & Assessment Act (the Act). If adopted as a DCP, the planning controls included in this document shall override the minimum requirements stipulated in the NSW Housing Code.

This plan has been designed to complement BASIX and does not have any competing provisions. It is recommended that applicants decide how to best meet BASIX obligations and the requirements of this Policy concurrently. In other words, some solutions (e.g. rainwater tanks) can satisfy both.

S_2S specifically states that the development proponent shall meet all obligations included on their BASIX certificate.

Where compliance with a BASIX certificate requires the proponent to construct a rainwater tank, then the rainwater tank shall comply with the provisions in the supporting S_2S Technical Guidelines.

Objectives

The objectives of S_2S are to:

- Improve the quality & quantity of stormwater discharged to all receiving waters;
- Reduce flooding and drainage impacts within and downstream of any proposed development;
- Maximise the efficient use of every drop of water consumed in the LGA, in a cost-effective manner without competing with BASIX; and
- Minimise the impacts of urban salinity, where applicable.

It is also suggested that Council will apply the principles and performance criteria documented here to all works whether they require approval under the Act or not.

Supporting Technical Guidelines

The planning controls are supported by the S_2S Technical Guidelines. The Technical Guidelines explain how the planning controls have been developed, and they include worked examples showing how to comply with the planning controls.

These planning controls specify the minimum level of performance required from all development. Where an applicant proposes a system that departs from the deemed to comply solutions documented here and within the supporting Technical Guidelines, additional evidence must be supplied with the Development Application (DA) to prove to the satisfaction of Council how the proposed development will achieve the relevant performance criteria.

Development Controls

The planning controls which are relevant to development type are included in Table 1 below.

Table 1 Development Controls

Development Categories	S_2S Development Controls
Residential Development including new development and alterations and additions which require a DA	I. BASIX II. Quality Management During Construction III. Quantity Management During Operation
Residential development in areas of high ground salinity	I. BASIX II. Quality Management During Construction III. Quality Management During Operation IV. Salinity Prevention
Roads in urban areas and car parks (> 5 cars) including new roads on subdivisions and road widening	I. Quality Management During Construction II. Quality Management During Operation III. Salinity Prevention (where applicable)
Commercial, Industrial Developments & Mixed Use Note: Fit outs, refurbishments, internal works which do not disturb the external ground only need to comply with the water conservation S_2S performance target.	I. Quality Management During Construction II. Quality Management During Operation III. Water Conservation IV. Salinity Prevention (where applicable)
All other types of development including Council development that requires approval under the EP&A Act.	I. Quality Management During Construction II. Quality Management During Operation III. Water Conservation IV. Salinity Prevention (where applicable)

Table 1 is to be used by firstly identifying the type of development being undertaken and then selecting, in the second column, which development controls are applicable to that development.

Table 1 is explained further in the following flow chart. The water performance targets are defined in Section 6 of S_2S and reproduced further below.

STEP 1

From the first column in Table 1 work out what type of development your proposal falls into.
For example: It may be residential, commercial, industrial or residential development affected by saline ground conditions.

STEP 2

From column 2 in Table 1 note down your applicable S_2S Performance Targets.
For example: A residential development has the following performance targets that it needs to comply with:

I. BASIX
II. Quality Management During Construction
III. Quantity Management During Operation

STEP 3

All of the S_2S Performance Targets are included in Section 6 of S_2S.
Go to each relevant performance target and note down your obligations.
For example: A residential development will need to comply with BASIX, it will also need to comply with water quality during construction and water quantity during operation.

STEP 4

Once you have worked out your obligations you will need to prepare a submission for DA in accordance with the supporting S_2S Technical guidelines. Most developments will be able to do this without the support of an Engineer. However, larger developments may need to obtain help from a suitably qualified Engineer who will help to work out the most effective way to comply with this plan.

Performance Targets

Quantity Management During Operation

Aims

The Water Quantity Management planning controls aim to ensure that development does not cause a decline in the health of receiving waters.

Performance Targets

The target is to prevent the ecological degradation that happens in receiving waters when there is an increase in the area of impervious surfaces directly connected to the drainage system. For example, this could happen if a new house is built or if a road is widened or a new car park constructed.

Research by Australia's leading hydrologists and ecologists (Figure 1) has shown that the health of a waterway is directly linked to the amount of impervious areas that are directly connected (via drainage systems) to the receiving water.

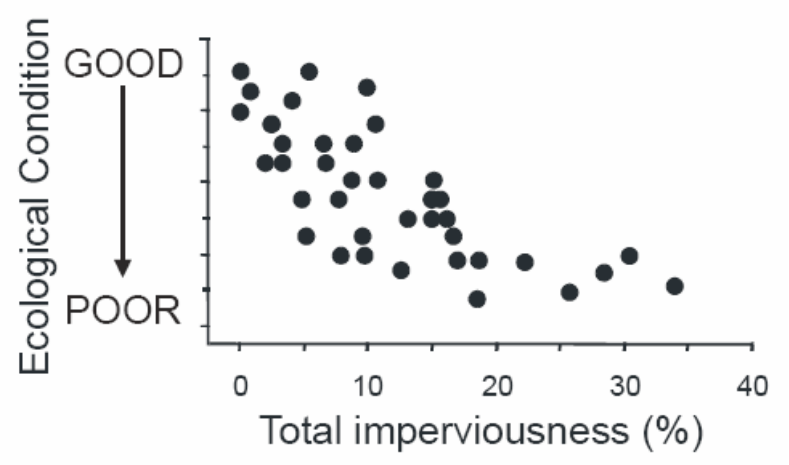

Figure 1. Graph of the ecological condition of a number of receiving waters versus total imperviousness. (Reproduced from Ladson et al, Improving stream health by reducing the connection between impervious surfaces and waterways, WSUD 2004).

Based on the research, it has been determined that the best way to protect receiving waters and to improve the quality of stormwater from the impacts of urban development is to limit the amount of directly connected impervious area. Coincidentally, this approach is also one which is likely to result in other Policy objectives being met, i.e. improving the quality of stormwater discharged to all receiving waters in the LGA as well as reducing flooding and drainage impacts within the development and downstream.

The principal water quantity performance criterion is to ensure that development does not cause an increase in the frequency of surface runoff when compared with the greenfield (pre-development) state.

Investigations have shown that, in the Central West, surface runoff from greenfield or pervious areas in the very dry parts occurs only about 4 or 5 times per year on average, while in the wetter parts, e.g. around Orange, it occurs about 15 times per year.

To make it easier to work out how to comply with the planning controls, a measure called the "rainfall threshold" has been used. The rainfall threshold is the runoff depth (in mm) from impervious surfaces that needs to be retained on site to ensure that runoff frequencies are not exceeded as a result of development.

Exemptions to this part

Where rural residential or farm development cannot be physically connected into any common drainage system, it shall be exempt from complying with this performance target only. Other performance targets, e.g. BASIX, remain applicable.

Development which is located in areas of high ground salinity are also exempt from complying with this part of the planning controls but instead have to comply with the Water Quality performance criteria as shown in Table 1.

How to comply?

Compliance with this performance target can be achieved by:

- Firstly infiltrating runoff which allows the water to soak into the ground and either be taken up by vegetation or lost to groundwater. The applicant will need to check that the development is not located within an area of high ground salinity (see *Exemptions to this part* above).

  There are two ways to comply, with a choice of constructing an:

  I. Infiltration trench; or

  II. Raingarden.

  To make sure that each method of infiltrating runoff does achieve the performance target, the raingarden or infiltration trench will need to be constructed to be able to store a minimum volume of water which is called the "Runoff Storage Volume".

- In addition to infiltration, it is also possible to retain roofwater runoff in a rainwater tank for either outdoor use or both indoor and outdoor use. Where this option is taken up, then credit is given to reduce the storage volume of the infiltration device.

In many instances it will be more cost effective to have a larger rainwater tank and smaller infiltration system; however, applicants will need to work out the most cost effective system for their site. Also note that if this option is chosen, it may result in a rainwater tank choice that is larger than that required under BASIX. It is therefore suggested that the applicant decide how to meet their BASIX obligations and obligations under this plan concurrently.

How does the applicant determine the minimum acceptable size of the raingarden or infiltration trench?

There are several steps needed to work out the minimum size of the raingarden or infiltration trench.

Step 1: Determine the minimum runoff storage volume required

The minimum runoff storage volume (m^3) required is shown in equation 1 and is:

(1) Rainfall threshold depth (m) x proposed impervious area (m^2)

The rainfall threshold applicable to a particular area of the Central West is shown in Table 2 below.

The proposed impervious area is defined as all areas to be developed and which have hard surfaces and which cause rain to runoff from their surfaces nearly every time it rains. Examples are roofs, car parks, garages, sheds, roads and paved areas.

Two rainfall regions have been defined within the Central West catchment to account for the large variation in rainfall. The two regions are based on areas with average annual rainfall of less than 800mm and those areas greater than 800mm per year. Separate rainfall threshold values have been determined for each. In order to work out which region applies to a particular development, the applicant refers initially to Table 2. If a town is not shown, then they refer to the map in Appendix A as a guide.

In areas which are very close to the 800mm rainfall contour (i.e. within 20km of it), the applicant should seek confirmation of the local average rainfall with Council.

Table 2 Shows the threshold depths which need to be retained on site for the two distinct rainfall regions of the Central West.

Average annual rainfall (mm/yr)	< 800mm	> 800mm
Rainfall threshold depth to be retained on site (m)	0.022m	0.016m
Some cities and towns within each rainfall region	Bathurst, Carinda, Coonamble, Coonabarabran, Dubbo, Gilgandra, Mudgee, Narromine, Nyngan, Trangie, Wellington, Warren	Orange, Molong, Oberon, Sofala**

** Sofala is considered to have an annual rainfall close enough to 800mm to be included within this region.

Table 2 shows that for areas with less than 800mm average annual rainfall, 0.022m of runoff from the impervious surfaces needs to be retained for infiltration. For areas with rainfall greater than 800mm average annual rainfall, 0.016m of runoff from the impervious surfaces needs to be retained for infiltration.

Example: A new house is proposed in Oberon with a roof area of 250m^2 and 50m^2 of paved areas including the driveway. From Table 2, the rainfall threshold for Oberon is 0.016m. The runoff storage volume is then determined by multiplying the total proposed development impervious area (250 + 50 = 300) by 0.016m. The infiltration volume required is: 300m^2 x 0.016m = 4.8m^3.

Note that all paved areas which are constructed from permeable paving shall be considered to be permeable for the purposes of applying this policy. Using the example above, if the proponent decided to construct their driveway from permeable pavement then the infiltration volume would be 250m^2 x 0.016m = 4.0m^3.

Step 2 Work out how much a rainwater tank can reduce the infiltration volume

The next step is to work out if a rainwater tank is to be included as part of a configured solution. If it is, then credit will be given and the retention volume can be reduced in accordance with Table 3.

If there is a rainwater tank obligation arising from BASIX, then credit will be given for the tank and the runoff storage volume will be reduced. If the applicant opts to install a larger tank than that required under BASIX, then even more credit may be given.

Table 3 Is divided into the two rainfall regions applicable to the Central West, and gives Credits (reductions in the runoff storage volume) given for various rainwater tank sizes and proposed end uses of the rainwater.

	Reduction in runoff storage volume (m^3) for using a rainwater tank			
Applicable rainfall region	< 800mm/year		> 800mm/year	
Proposed Rainwater Tank size (kL)	Where outdoor use only is proposed	Where both outdoor and internal use including toilets, hot water and laundry is proposed	Where outdoor use only is proposed	Where both outdoor and internal use including toilets, hot water and laundry is proposed
<2.5	0	0	0	0
≥2.5	1	2.0	0.5	1.0
≥5.0	1.25	2.5	0.75	1.5
≥7.5	1.5	3.0	1.0	2.0
≥10.0	1.75	3.5	1.25	2.5

Different amounts of runoff storage volume credit are given depending on the size of the rainwater tank proposed, combined with the uses to which the harvested water is put. For example, if an applicant proposes to have a 2.5kL rainwater tank and they live in Oberon (more than 800mm of rain per year) and they propose to use the rainwater for both indoor and outdoor uses, then they can reduce their runoff storage volume in either their raingarden or infiltration trench by $1m^3$.

Carrying on from the example in Step 1, where it was calculated that the infiltration volume for a proposed $300m^2$ impervious area development in Oberon was $4.8m^3$, if the applicant then chose to use a 2.5kL rainwater tank connected to both indoor and outdoor uses they would be given $1m^3$ credit which would reduce the size of their infiltration volume down to $3.8m^3$.

Step 3 Configure the proposed trench or raingarden

The supporting S_2S Technical Guidelines show how to configure a raingarden or infiltration trench once the applicant has determined the minimum runoff storage volume.

The guidelines take into account the amount of surface storage available and the porosity of the materials that will be used to construct the raingarden or infiltration trench.

Quality Management During Construction

This section refers to the management of all water leaving sites during construction, including surface and piped flows.

Aims

To protect receiving waters from the effects of runoff that flows across construction sites.

Performance Targets

Table 4 identifies soil and erosion control requirements during construction for all Applicants.

Commercial and industrial internal alterations, refits and refurbishments which do not disturb any earth are exempt from complying with this part.

Table 4 Water quality management requirements during construction

Development Scale	Performance Target
Small Scale < 800m^2 of disturbed area	As a minimum, Council requires a hand marked-up plan of proposed works showing sediment and erosion control measures. This plan must be prepared in accordance with the supporting Technical Guidelines.
Medium 800m^2 to 2,500m^2 of disturbed area	An Erosion and Sediment Control Plan (ESCP) must be prepared. The ESCP must be prepared in accordance with Landcom's *Managing Urban Stormwater* (2004), otherwise known as 'The Blue Book' (refer to the supporting S_2S Technical Guidelines).
Large More than 2,500m^2 of disturbed area	A Soil and Water Management Plan (SWMP) must be prepared. The SWMP must be prepared in accordance with Landcom's *Managing Urban Stormwater* (2004), otherwise known as 'The Blue Book' (refer to the supporting S_2S Technical Guidelines).

Quality Management During Operation

Aims

Stormwater controls and treatment measures shall be incorporated in a development in order to avoid polluting receiving waters.

S_2S Performance Targets

This performance target is applicable to:

- New roads in urban areas including new roads in subdivisions and road widening works

- Car parks which have a capacity for more than 5 cars
- Commercial development (excluding internal refurbishment and refits)
- Industrial development (excluding internal refurbishment and refits)
- Any new Council or Special Uses development such as schools, hospitals, etc.

Water quality performance targets are stipulated in Table 5.

Table 5 Post development pollution reduction targets

Pollution Reduction Target
• Total Suspended Solids (TSS) - 85% reduction of the typical annual load
• Total Phosphorus (TP) - 65% reduction of the typical annual load
• Total Nitrogen (TN) - 45% reduction of the typical annual load
• 90% of gross pollutant loads (litter and heavy sediments), oil and grease are retained on site

How to comply?

There are two ways to comply with this performance target. Firstly, by adopting one of two deemed to comply solutions, or, secondly by developing a unique solution supported with scientific evidence which demonstrates that the proposal complies with the performance targets. The supporting technical guidelines document the minimum evidence requirements.

Deemed to comply solutions

There are two deemed to comply solutions which are:

1) The use of a bioretention basin or raingarden (which can also be used to increase public amenity) configured to also promote infiltration where permitted.

   The minimum area of the bioretention basin is to be based on the proposed impervious area. Table 6 defines the minimum requisite areas. The bioretention basin or raingarden is to be designed in accordance with the supporting S_2S Technical Guidelines.

2) The use of a buried infiltration trench. The deemed to comply infiltration trench solution will need to have a minimum volume calculated in accordance with Table 6. The infiltration trench usually receives stormwater flows from the surface in the same manner as raingardens. However, if the trench is receiving sub-surface flows from the stormwater network then the flows will need to be pre-treated with a sediment trap to ensure that sediment is removed from the runoff before it enters the trench. This, in combination with routine maintenance to remove accumulated sediment, will ensure the life of the trench is extended for as long as possible.

Worked examples are included in the S_2S Technical Guidelines.

Table 6 Area of bioretention and volume of infiltration as a proportion of the upstream impervious area

Average annual rainfall (mm/yr)	< 800	> 800
Area of bioretention for roads/car parks expressed as % of the upstream impervious catchment area (based on 100mm depth of surface ponding, 500mm filter media depth and 120mm/hour saturated hydraulic conductivity).	1.0%	1.2%
Minimum volume of storage required inside buried infiltration trench per $100m^2$ of upstream impervious catchment.	$0.5m^3/100m^2$	$0.75m^3/100m^2$

Both the bioretention/raingarden and infiltration trench shall be constructed in accordance with the supporting S_2S Technical Guidelines.

Water Conservation for Non Residential Development

Aims

Maximise efficient use of every drop of water in a cost effective manner without competing with BASIX.

Exemptions

This clause does not apply to residential development.

Performance Targets

New development applicants (other than residential and commercial and industrial refurbishments and refits) shall reduce consumption of potable water by 40% benchmarked against a development which uses only potable water and which has no water-conserving fixtures or fittings.

Commercial and industrial refurbishments and refit applicants shall reduce consumption of potable water by 30% benchmarked against a development which only uses potable water and which does not use water-conserving fixtures and fittings.

How to Comply?

A Water Conservation Report is to be prepared and submitted with the DA which demonstrates how the water consumption on the proposed development will be reduced by 40% when benchmarked against a development which only uses potable water and does not have any water conservation measures. The measures proposed in the Water Conservation Report shall form a statement of commitment and be included on the conditions of consent.

Compliance with the target can be achieved by firstly reducing the demand for water (known as demand management), and secondly by substituting rainwater, stormwater or wastewater sources for town potable water.

With respect to refurbishments and refits, and where consumption is relatively minor, compliance might be achieved simply by implementing demand management measures alone. In all cases evidence must be

provided to Council by way of the Water Conservation Report which defines current demand and demonstrates how future demand will be reduced by the relevant performance target.

Demand Management Measures include the following examples, noting the list is not exhaustive:

- Use of minimum AAA rated fixtures and appliances
- Use of aerators on existing and proposed taps
- Flush arresters on existing toilets
- Selection of plants and landscaping that require little or no watering.

If source substitution such as the use of rainwater tanks, grey water recycling systems or other measures are proposed, then the applicant shall ensure that all water shall be fit for its intended purpose, including:

- Recycled water (treated wastewater or stormwater) may be used for non-potable purposes such as toilet flushing or irrigation and washdown.
- Rainwater may be used for both potable and non potable uses.
- Applicants are encouraged to maintain a town water supply (where available) to top up a rainwater tank when needed.
- Where town water supply is available but not to be installed, agreement on adequate provisions for fire-fighting shall be made with the NSW Fire Brigade, who may permit the use of rainwater for fire-fighting purposes provided it is stored in such a manner that it cannot be drawn down for any other purpose.

Salinity Prevention

Aims

To prevent a decline in the health of receiving waters from development located in areas with high ground salinity.

Performance Target

In areas with high ground salinity or in areas where an elevated saline groundwater table exists, infiltration of runoff shall not be permitted.

Where a Quality Management During Operation performance target exists (such as for residential development in saline affected areas) and, for reasons of high ground salinity, infiltration is not permitted then:

Applicants shall be limited to one deemed to comply solution which is either a bioretention basin or raingarden.

The bioretention basin or raingarden shall be lined to prevent infiltration and otherwise sized in accordance with the performance target for Quantity Management During Operation and constructed in accordance with the supporting S_2S Technical Guidelines.

Wherever feasible, the applicant should explore the adoption of rainwater tanks for stormwater harvesting to reduce the volume of stormwater runoff as far as possible. This is a solution for residential developments, where tanks of even 10 kL in volume will greatly help to reduce water bills and runoff. Commercial developments which use evaporative cooling will also benefit from the use of large rainwater tanks to help reduce runoff and water bills.

In areas which are affected by high ground salinity and which have an elevated saline groundwater table, permeable paving may be used, provided that no additional areas drain onto the pavement, i.e. only the paved area drains through the pavement.

CONCLUSION

Ironically it is easier to introduce complexity rather than introduce simplicity. It is also refreshing to see that this is an initiative from country NSW rather than being a matter of coastal or city technology being adopted.

Perhaps it is time to turn the tables and have the coastal areas and cities consider adopting a similar strategy.

Creation of S_2S - Stormwater to Smartwater - results in arguably the most advanced policy for stormwater management to date. It stands apart from others not due to a comprehensive nature but rather in its simplicity and effectiveness.

There is still some way to go before the policy is adopted and implemented by the Councils but, as with any change management solutions, time and perseverance are the keys.

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