

Water Sensitive Urban Design: Basic Procedures for 'Source Control' of Stormwater A Handbook for Australian Practice

Edited by John Argue, University of South Australia

Published in 2004

John Argue of Adelaide, Australia has specialised in the field of urban hydraulics and hydrology since 1976. His book "Storm drainage design in small urban catchments - a handbook for Australian practice" published in 1986 is still widely used by municipal engineers and consultants across the nation. The recently published Handbook on source controls incorporates theory development and practical lessons learned by Urban Water Resources Centre staff at the University of South Australia through research for, design and monitoring of over 30 successful stormwater management field installations in South Australia and New South Wales.

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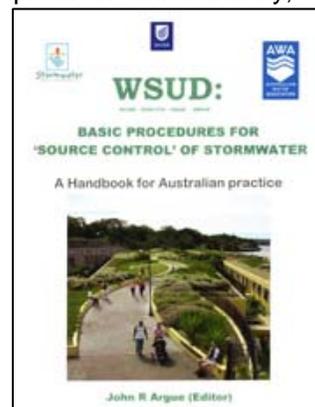
Bert van Duin of Calgary, Alberta provided John Argue with this peer review of the Handbook. Bert is an urban drainage 'specialist' and provides consulting services in stormwater and watershed management to the land development industry, municipal governments, and the Alberta provincial government. Bert is a founding member of the Alberta Low Impact Development Partnership. He is currently drafting a *Best Management Practices and Source Control Manual* and conducting several BMP and enhanced sedimentation pilot projects for the City of Calgary.

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Water Sensitive Urban Design (WSUD) is a term that was first coined by a group of environmental planners, engineers and landscape architects in Perth, Western Australia to describe their thinking about **total water management in the urban landscape**, i.e., covering water supply, wastewater collection and treatment, and stormwater collection and treatment. Similar concepts are known as **Sustainable Urban Drainage Systems (SUDS)** in the United Kingdom or **Low Impact Development (LID)** in North America.

After gaining wide recognition across Australia in the 1990s with the construction of numerous experimental projects, the need was identified to develop simple tools, albeit based on sound theory and practice, to support the adoption of the concepts on a wider basis. This Handbook is a compilation of basic approaches that aim at solving everyday problems of small-scale, i.e., not basin-wide, stormwater management. The document is a collaboration of the Australian Water Association, the Stormwater Industry Association and the University of South Australia. The materials have been tested in undergraduate and graduate design courses at the Urban Water Resources Centre of the University of South Australia for over six years.

Upon first glance two things stood out in the Handbook, the first being a beautiful picture of roof gardens on apartment buildings in Woolloomooloo, New South Wales, and the second one being the names of the principal contributors. This beautiful picture on the title page was in fact the only colour photograph in the document. While the Handbook contains numerous diagrams, it is not about pretty pictures. Unfortunately, too often advocates of



WSUD practices are still portrayed as well-intentioned souls that manage to paint pretty pictures that somehow will be magically sustained over the years without consideration of the science for these systems to remain effective. This

Handbook is an attempt, and a very valuable one at that, of addressing the hydrologic tenets to ensure that these seemingly 'revolutionary' approaches are designed properly and will continue to operate as intended.

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As to the contributors, most are likely well-known in Australia and several internationally as well. An interesting detail is the contribution by Professor Wolfgang Geiger of the University of Essen in Germany. Professor Geiger and Germany have been on the leading edge in the application of stormwater infiltration techniques and green roof systems for the last two decades. As such, this Handbook has a distinct international flavour, not only reflecting the latest insights in Australia.

While the book of course targets Australian practice and therefore contains numerous design graphics specifically derived for the various regions of Australia, nothing stops the discerning reader from developing similar graphics for other, similar regions of the world. Indeed, this reviewer has already commenced doing so for the Canadian prairies. Although appropriate adjustments may be necessary for cold climate applications, it does not take away from the fact that the approaches are in principle universal.

The 250 page Handbook is divided in nine chapters. The first four introductory chapters cover the basic concepts and theories, and discuss at length the characteristics of the various soil types, geology and stormwater planning within a larger basin-wide context. The following four chapters provide a total of ten design procedures of source control installations from the perspective of flood control, pollution control, stormwater harvesting and a combination thereof. These ten design procedures are explained in numerous fully worked-out and illustrated design examples. One of these chapters also provides detailed information on Australian water quality criteria relating to stormwater. The last chapter presents concluding discussions.

It is interesting to note that while flood control is largely introduced and discussed from a peak flow control perspective, the proposed measures aim at volume control. Catchment-wide objectives are translated into three basic scenarios, i.e., a 'yield-maximum' strategy, a

'regime-in-balance' strategy and a 'yield-minimum' strategy, which essentially cover the full realm of how one can deal with the increase in runoff volumes that is associated with urbanization.

The computational methods that are utilized in the discussion of the ten design procedures are a combination of continuous simulation techniques and single event analyses, in conjunction with emptying time criteria. The Handbook also offers thought provoking discussions of the merits and disadvantages of distributed versus centralized storage, and of detention versus retention. In addition, it presents an in-depth discussion of local versus global or basin-wide impacts, specifically as it might affect the selection of appropriate values for the time of concentration that is used in the design procedures.

Unfortunately, because its sole focus is on the hydrologic design aspects of source control techniques, the Handbook can provide only little information about costs or the structural composition of the proposed source-control techniques, or the administrative needs to implement these measures. Addressing these issues would likely double or triple its size. Instead, the reader is referred to an extensive bibliography.

Purists might have some reservations because the Handbook does not explicitly mention groundwater mounding. It is however implicitly mentioned in extensive sections about soils permeability and water-reactivity and "do's and don'ts" of on-site retention technology. While the Handbook provides guidance on how to 'properly' measure the hydraulic conductivity in soils, a more extensive discussion of the necessary hydro-geotechnical analyses as to scope, extent and timing within the overall planning and design process should be considered in future editions. At the same time, the Handbook does not shy away from addressing potentially contentious issues such as infiltration type source controls in expansive clays. It provides guidance on clearance

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distances from buildings for the various soil types. It also provides procedures to compute the emptying time of the infiltration measures. In the case of relatively tight soils, options for enhanced infiltration are presented consisting of either deep aquifer infiltration or slow drainage by sub-drains. In addition, the Handbook provides valuable information on the 'lifespan' of infiltration measures in view of potential clogging due to fine sediments or surface blockage, based on extensive testing at the University of South Australia. Throughout the Handbook several modification factors are introduced that relate the results of the design procedures to the performance of the experimental sites, thus addressing the reservations of purists that the procedures are merely theoretical.

The Handbook offers numerous tidbits of information that are thought provoking. For instance, while mumbling under his breath that the Handbook did not address the concept of trying to match complete hydrographs as being advocated in certain parts of North America for the preservation of fisheries habitat, this reviewer suddenly found it discussed in a few paragraphs. While the Handbook may not have recommended the implementation of this concept, it is comprehensive in discussing it. The reader will find numerous similar nuggets of information that will make one want to re-read the Handbook on several occasions to get the most out of it, because it contains so much information that one inevitably misses something along the way.

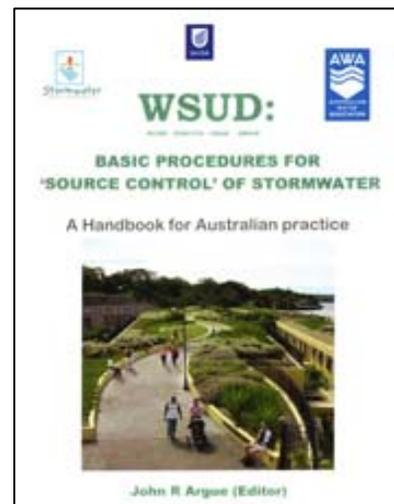
The reviewer fully expects that the source-control design procedures will be automated in due time, for instance by incorporation into some of the popular urban drainage models. This will allow the representation of more complex systems such as treatment trains, actual water quality enhancement or continuous simulation within a larger context. Nevertheless, a document such as the Handbook is very much needed to verify the output of these urban drainage models and to instil an appreciation of the basics of these source-control applications,

both of which are often sorely lacking in urban drainage practice.

Although every attempt was made to make the Handbook comprehensive, the authors very much appear to appreciate that this Handbook cannot cover each and every permutation, or answer each and every question. The reader is therefore invited to actively provide feed-back and engage in an ongoing exchange of opinions and information. The authors desire that the Handbook will become a living document with the readers being updated via a newsletter about new insights.

How to Purchase the Handbook:

The cost of the Handbook is Aus \$ 165.00, which in mid January 2005 was equal to about US \$127, Can \$154 or Euro €97.



The Handbook can be obtained from Diane Wiesner at the Australian Water Association Bookshop at

AWA Bookshop
PO Box 388, Artarmon NSW 1570
Australia
Telephone +61 (02) 9413 1288
E-mail: bookshop@awa.asn.au

or from the Urban Water Resources Centre at the University of South Australia by contacting Ms. Carolyn Bellamy at carolyn.bellamy@unisa.edu.au