1.3 The Ramsar Convention and urban wetlands: an opportunity for wetland education and training

Prof C Max Finlayson[1], **Mike Bartlett**[2], **Prof Nick Davidson**[3] **and Rob McInnes**[4]

[1]Institute for Land, Water & Society, Charles Sturt University, Albury, NSW

[2]Sydney Olympic Park Authority, Sydney Olympic Park, NSW

[3]Ramsar Convention on Wetlands, Gland, Switzerland

[4]RM Wetlands & Environment Ltd., Littleworth, UK

Abstract

The increasing interest in the value of urban wetlands has been recognized through the Ramsar Convention on Wetlands and partners. This has seen the development of guidance for their management, including the identification of key issues and potential solutions. Further analysis has resulted in policy principles and practical steps for management and restoration being suggested. The guidance provided through the Convention could provide a framework for extending the education and training programs that have been conducted through urban-based wetland centres, including the WET program undertaken by the Sydney Olympic Park Authority. A diversity of future courses could be provided taking advantage of the range of differences that exist between wetland centres. Such courses can also be linked to the formal education curriculum for schools. Details of the courses, and links to the formal curriculum, provided by the Authority are provided, as is a description of the key features of other wetland centres.

Introduction

Despite the wise use and conservation of wetlands having received a lot of attention nationally and internationally over the past 3-5 decades the state of wetlands globally has continued to decline (MEA 2005; Finlayson 2012). As with conservation generally there has been an increase in responses to the declining condition of many ecosystems, populations and species, but this effort has not been sufficient to stem the decline (Butchart *et al*. 2010; Armenteras and Finlayson 2012). One response that in recent years has received greater attention is the restoration or creation of wetlands in urban areas. Another is the development of further wetland education and awareness raising exercises.

The former has been propelled by many reasons, such as the increased recognition by civic authorities and local communities that wetlands and other nature-based landscapes can provide many benefits to people (Horwitz *et al*. 2011) and constitute incredibly valuable settings for human wellbeing (Horwitz and Finlayson 2011). The latter has benefitted by dedicated attention being directed towards wetland education and training as part of wider attention being paid to CEPA - Communication, Education, Participation, and Awareness.

The recent emphasis on urban wetlands has been supported by the Ramsar Convention on Wetlands (www.ramsar.org) adopting formal decisions in 2008 and 2012 that complemented other global efforts. A summary of various efforts to address the many management problems that have arisen with urban wetlands has been provided by (McInnes 2013). The Ramsar Convention has also for many years had a focus on CEPA with formal decisions being adopted in 1999 and 2002, and most recently in 2008. These decisions have raised the importance of wetland CEPA as a tool that can be used alongside more traditional management tools. It can also involve all sectors of society from decision-makers, to the general public, wetland users and owners, the media, as well as teachers and schoolchildren. Possibly the best known CEPA activities promoted through the Convention are those associated with World Wetland Day which celebrates the day the text of the Convention was agreed – 2 February 1971 (see www.ramsar.org/cda/en/ramsar-activities-wwds/main/ramsar/1-63-78_4000_0__).

The interest in urban wetlands and CEPA has in many places come together, such as the development of wetland education and training facilities at the urban wetlands in Sydney Olympic Park. Many education agencies and community-based organizations have taken the opportunity of access to urban wetlands to extend their education and training programs in order to create wider awareness of the values of wetlands to urban communities. This has included informal and formal or curriculum-based education and training.

In this paper we provide an outline of the most recent initiatives for urban wetlands supported by the Ramsar Convention as a prelude to describing the education and training initiatives undertaken by the Sydney Olympic Park Authority. This includes a brief description of i) how wetland education is linked to the formal school curriculum, and ii) the range of courses undertaken by the Authority. We include an overview of the main features of a number of wetland centres that provide wetland education and training or awareness raising services, and how these could potentially contribute more directly to promoting a wider education and training agenda for urban wetlands. As an introduction, a description of the Ramsar Convention is provided – this also provides a basis for some concluding comments.

The Ramsar Convention

The Ramsar Convention on Wetlands is the longest-established of the modern global intergovernmental environmental agreements (often know as Multilateral Environmental Agreements). The text of the Convention was opened for signature in the town of Ramsar, I.R. Iran on 2 February 1971. The Convention was developed in the 1960s as a response to concerns about the destruction of wetlands and the impact of this on both people and biodiversity, especially waterbirds. The origins and early history and evolution of the Convention are well described in Matthews (1993).

The Convention's goal is to "stem the progressive encroachment on and loss of wetlands now and in the future", and is "confident that the conservation of wetlands and their flora and fauna can be ensured by combining far-sighted national policies with coordinated international action". The Convention's mission, established in its Strategic Plan (Ramsar Convention 2012a), is the "conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world."

The Strategic Plan recognizes that to achieve this Mission it is essential that the vital ecosystem services, and especially those related to water and those that wetlands provide to people and nature through their natural infrastructure, are fully recognized, maintained, restored and wisely used.

The Convention is implemented through the three 'pillars' of the implementation Goals in the Convention's Strategic Plan (Ramsar Convention 2012a): the wise use of all wetlands; the designation and management of Wetlands of International Importance (Ramsar Sites); and international cooperation – including on shared wetlands and river basins and migratory waterbirds. In 2005 the Convention redefined the wise use of wetlands as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development" (Ramsar Convention 2005; Finlayson *et al.* 2011). In turn, ecological character of wetlands is "the combination of the ecosystem components, processes and benefits/services that characterize the wetland at a given point in time." This definition notes that within this context, ecosystem benefits are defined in accordance with the Millennium Ecosystem Assessment definition of ecosystem services as "the benefits that people receive from ecosystems" (MEA 2003).

The Convention adopted a broad and inclusive definition of wetlands from the mountains to the sea, covering inland wetlands (including lakes and rivers), coastal and nearshore marine wetlands (including estuaries, mangroves, saltmarshes, seagrass beds and coral reefs) and human-made wetlands (including reservoirs, fish-ponds and rice paddy). For the full range of wetland types covered under the Convention see Ramsar Convention (2012b). The Convention's coverage of coastal and marine wetlands extends to those permanently inundated to a depth of six meters.

Since its establishment in 1971 the Convention has progressively grown and now (as at November 2013) has 168 Contracting Parties (member governments). Each Contracting Party commits to the designation of a coherent and comprehensive national network of Ramsar Sites. There are now 2,168 Ramsar Sites covering almost 207 million hectares of wetlands and associated habitats. Information on all Ramsar Sites is publicly available through the Ramsar Sites Information Service (RSIS) on www.ramsar.wetlands.org.

Australia was one of the first signatories to the Ramsar Convention, and designated the first Ramsar Site to be placed on the List of wetlands of International Importance (Cobourg Peninsula in 1974). To date Australia has designated 65 coastal and inland wetlands as Ramsar Sites, covering over 6.8 Million hectares. Amongst these are a number of urban and peri-urban wetlands, including Moreton Bay (Brisbane), Port Philip Bay & Bellarine Peninsula (Melbourne), Western Port (Melbourne), Forrestdale & Thompsons Lakes (Perth), Hunter Estuary Wetlands (Newcastle), and Towra Point (Sydney).

To support and guide governments and others in Convention implementation, since the early 1990s the Convention has progressively adopted a large suite of "wise use guidelines", most prepared through the work of the Convention's Scientific & Technical Review Panel (STRP). All such guidance is published thematically in the 21 volumes of the Ramsar Wise Use Handbooks, the most recent being the 4th edition, which includes all guidance adopted up to and including Ramsar's 10th Conference of Contracting Parties in 2008 (Ramsar Convention Secretariat 2010) (Table 1.3.1). Further guidance adopted in 2012 is available on www.ramsar.org/cda/en/ramsar-documents-cops-cop11-cop11-resolutions/main/ramsar/1-31-58-500%5E25837_4000_0__ and will be published in a 5th edition of the Handbooks.

The Ramsar Convention and urban wetlands

In addition to the suite of guidance on wetlands and water issues, over the last 15 years the Convention has also paid increasing attention to the inter-relationships between wetlands, water and other sectors including urban planning and management. In 2008 the Convention recognized that wetlands in urban and peri-urban areas can provide a range of important ecosystem services (Figure 1.3.1). This led to the adoption of Resolution X.27 on Wetlands and urbanization which, among other things, called on the Convention's Scientific and Technical Review Panel to prepare guidelines for managing urban and peri-urban wetlands in accordance with an ecosystem approach, taking into account issues including climate change, ecosystem services, food production, human health and livelihoods. In response a set of principles for managing such wetlands were prepared, in close collaboration with UN-Habitat, and adopted by the Convention in 2012 through Resolution XI.11 on

Table 1.3.1. The Ramsar Convention 'toolkit' of Handbooks for the conservation and wise use of wetlands, 4th edition, 2010.

Convention pillar 1: Wise Use	
Handbook 1	**Wise use of wetlands** Concepts and approaches for the wise use of wetlands
Handbook 2	**National Wetland Policies** Developing and implementing National Wetland Policies
Handbook 3	**Laws and institutions** Reviewing laws and institutions to promote the conservation and wise use of wetlands
Handbook 4	**Avian influenza and wetlands** Guidance on control of and responses to highly pathogenic avian influenza
Handbook 5	**Partnerships** Key partnerships for implementation of the Ramsar Convention
Handbook 6	**Wetland CEPA** The Convention's Programme on communication, education, participation, and public awareness (CEPA) 2009-2015
Handbook 7	**Participatory skills** Establishing and strengthening local communities' and indigenous people's participation in the management of wetlands
Handbook 8	**Water-related guidance** An Integrated Framework for the Convention's water-related guidance
Handbook 9	**River basin management** Integrating wetland conservation and wise use into river basin management
Handbook 10	**Water allocation and management** Guidelines for the allocation and management of water for maintaining the ecological functions of wetlands
Handbook 11	**Managing groundwater** Managing groundwater to maintain wetland ecological character
Handbook 12	**Coastal management** Wetland issues in Integrated Coastal Zone Management
Handbook 13	**Inventory, assessment, and monitoring** An Integrated Framework for wetland inventory, assessment, and monitoring
Handbook 14	**Data and information needs** A Framework for Ramsar data and information needs
Handbook 15	**Wetland inventory** A Ramsar framework for wetland inventory and ecological character description
Handbook 16	**Impact assessment** Guidelines on biodiversity-inclusive environmental impact assessment and strategic environmental assessment

Table 1.3.1. (cont.) The Ramsar Convention 'toolkit' of Handbooks for the conservation and wise use of wetlands, 4th edition, 2010.

Convention pillar 2: Ramsar sites designation and management	
Handbook 17	**Designating Ramsar Sites** Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance
Handbook 18	**Managing wetlands** Frameworks for managing Ramsar Sites and other wetlands
Handbook 19	**Addressing change in wetland ecological character**
Convention pillar 3: International cooperation	
Handbook 20	**International cooperation** Guidelines and other support for international cooperation under the Ramsar Convention on Wetlands

Principles for the planning and management of urban and peri-urban wetlands (Ramsar Convention 2012b).

This Resolution urged Contracting Parties to continue to promote the conservation and wise use of wetlands in urban and peri-urban environments, as well as of those beyond the urban boundary that are affected by urban activities and developments, and to integrate this activity into efforts to achieve sustainable urban development and adequate shelter for all, as a contribution to achieving the Millennium Development Goals. It also recognized that urban development should be planned and managed in a sustainable way, with particular reference to Resolution XI.9 on an Integrated Framework for avoiding, mitigating and compensating for wetland losses (Ramsar Convention 2012c). The Resolution invited Contracting Parties and other organisations to raise awareness of, and provide guidance on, the importance of wetlands as providers of benefits to urban and peri-urban populations.

The Resolution also recognised that allowing urban wetlands to become polluted and otherwise degraded can have negative consequences for people's health, well-being and livelihoods (Figure 1.3.2).

An appendix to Resolution XI.11 listed the key issues and potential solutions for future sustainable urban and wetland management and planning. The key issues and drivers of wetland loss and degradation within and beyond urban areas are:

- Sectoral conflicts across government departments (both horizontally and vertically) and the scarcity or absence of joined-up planning and coordination often fail to integrate wetlands appropriately in decision-making processes.
- Leaving urban land use and land allocation decisions to market forces or to customary and informal delivery systems is not a sustainable policy option and will result in continued wetland loss and degradation.
- There is widespread lack of awareness about the economic and social value of wetlands and the ecosystem services they provide, both directly and in maintaining water resources upon which urban populations depend.
- Lack of leadership and poor and inequitable governance is a persistent problem.
- There is a general lack of policies and laws to protect wetlands as well as a lack of regulatory mechanisms to enforce them.
- Lack of infrastructure and financial and human resources inhibit the sustainable planning and management of urban and peri-urban wetlands.
- Often there is a weak definition or understanding even of what a "wetland" is. This can be compounded by the lack of a wetland inventory to inform the urban planning process.

Figure 1.3.1. Local climate regulation, recreation, culture and a sense of place - just some of the values of urban wetlands, Xi'an, China. (Photo: R. J. McInnes.)

- Populations and population density are increasing, often driven by rural poverty forcing migration to urban centres.
- Climate change is a direct driver of change but also causes increasing numbers of environmental refugees to migrate to urban centres, compounding population pressures there.
- Poor equity of access to the benefits derived from wetland ecosystem services and endemic urban poverty can result in the over-exploitation of wetlands out of economic necessity.
- Unsustainable development with poorly considered and located formal and informal settlements, illegal buildings and, especially in proximity to the coast, activities such as dumping of waste, contribute to wetland loss and degradation.
- Lack of urban waste water and sewage treatment results in pollution of wetlands directly and impacts to the aquatic environment. In addition, polluted run-off from agro-chemicals and industrial waste can also impact upon wetlands.
- Pressures on water resources for human and industrial consumption can result in water scarcity and security issues both within and beyond urban areas.
- Wetlands are still often associated with diseases such as malaria, sometimes leading to their drainage and infilling, and there must be a greater recognition that healthy wetlands often enhance people's health and livelihoods.
- Inappropriate wetland management has contributed to reducing the resilience of cities to disasters and further reducing their ability to recover from disasters.
- Extraction of geological materials beyond municipal boundaries for both building and development and to support urban populations, such as sand, salt and minerals, must be managed carefully.

Figure 1.3.2. Degraded urban wetlands – a threat to people's health and well-being, Rufisque, Senegal. (Photo: R. J. McInnes.)

- Over-exploitation of wetland resources and the accelerated introduction of alien species, both accidental and deliberate, often cause loss of habitat, decline of indigenous biota, and degradation of ecosystems and the services that they provide.

To overcome these key issues and drivers of wetland loss and degradation within and beyond urban areas, Resolution XI.11 identified a range of potential solutions. These are:

- raising the level of understanding of the broad utility of wetlands, as this is not fully appreciated by a considerable proportion of the planning and other sectors;
- improving awareness of the benefits wetlands deliver at different levels, including teaching programmes at universities, wider public awareness campaigns, and provision of targeted information across government departments;
- achieving more sensitive urban planning policy development, including development frameworks and spatial zonation to protect ecosystem services (especially those of wetlands), and addressing water management issues at the appropriate scale;
- increasing the focus by governments on conserving wetland areas and, if necessary, paying people to move to other, less sensitive areas, e.g., through systems that provide payments for ecosystem services;
- explicitly including wetlands as natural infrastructure in urban planning, including in landscape planning and all aspects of water management, such as storm water management, water resources and water treatment;
- treating wetlands not merely as areas that are important for nature conservation per se but as key elements within urban water management infrastructure and essential components in providing water resources;
- enhancing policy and legal frameworks protecting wetlands, and ensuring that they are enforced and regulated;

- using selected wetlands as natural waste-water treatment systems to mitigate urban pollution and sedimentation, particularly in improving sanitation within the limits imposed by their capacity to provide these services and without significantly compromising their ability to continue providing other ecosystem services and as long as this does not have significant adverse effects on the environment;
- considering the wise use of wetlands both within and beyond urban boundaries and understanding the interconnectivity of catchment/ watershed-scale issues including to guarantee environmental flows to wetlands;
- ensuring appropriate stakeholder participation and empowerment, in both problem setting and problem solving, which can be an essential element in delivering sustainable cities – despite being essential to future successes, such engagement is currently deficient; and
- developing specific programs aimed at benefiting and involving indigenous communities in sustainable wetland management.

To support efforts to address these key issues and to implement the potential solutions for future sustainable urban and wetland management and planning, Resolution XI.11 provided a number of general policy and practical principles. The five policy principles (Additional Information 1) provide headline messages for governments, from national to local, to consider and implement when developing policies that jointly address urban planning and management and the wise use of wetlands. The implementation of the policy principles is expected to catalyze a range of practical measures which together will deliver more sustainable urban development in combination with better maintenance and enhancement of wetlands, through the application of five practical, or best-practice, principles (Additional Information 2).

Contracting Parties to the Convention have recognized that there is a need to ensure that the principles are disseminated and embedded widely in urban and peri-urban planning and management activities, and that the principles must lead to practical implementation in towns and cities across the world if this is to happen. To achieve this, there needs to be ongoing and proactive collaboration among a range of stakeholders and organizations (Additional Information 3).

Additional Information 1: Policy principles for managing urban wetlands

1. Wetlands and the range of services they provide are essential elements of the supporting infrastructure of urban and peri-urban settlements.
2. The wise use of wetlands contributes to socially and environmentally sustainable urban and peri-urban areas.
3. Any further degradation or loss of wetlands as a result of urban development or management should be avoided, and where not possible, any impacts should be mitigated, and any residual effects appropriately compensated for by offsets such as wetland restoration.
4. The full participation of indigenous and local communities, municipalities and government sectors involved in urban and peri-urban spatial planning and wetland management decision making is vital to creating sustainable urban and peri-urban settlements.
5. The threat of natural calamities and human-made disasters and their impacts on urban populations and wetlands requires government priority and convergent actions to enhance resilience to disasters.

Through a series of workshops held in West Africa in 2013, the Ramsar Convention Secretariat, Ramsar National Focal Points, members of Ramsar's Scientific and Technical Review Panel and UN Habitat investigated the practical issues and barriers involved in implementing the principles adopted in Resolution XI.11. The issues identified as needing to be addressed include:

- All departments within a municipality need to take a holistic and systemic approach to understanding the benefits that wetlands can provide and ensure that these benefits are recognised and integrated into both reactive and proactive decision-making.

Additional Information 2: Practical principles for managing urban wetlands

1. Wetland conservation

i. Urban development should avoid, whenever possible, destroying wetlands.

2. Wetland restoration and creation

i. Wetlands should be restored and/or created as elements of urban and especially water management infrastructure in order to maintain or enhance ecological character and optimize ecosystem service delivery.

ii. Opportunities to restore wetlands should be prioritized ahead of the creation of new wetlands. The creation of wetlands should be encouraged according to the regulations of each Contracting Party and established only in cases where other alternatives do not exist and related to economic and social projects, taking ecosystem services into consideration.

3. Understanding the value of wetlands

i. Opportunities to reduce urban poverty through the optimization of sustainably utilised wetland ecosystem services, in accordance with the wise use principles, should be pursued urgently.

ii. Trade-offs in terms of livelihood options and economic benefit-sharing, involving both the market and the state, need to be considered.

iii. Incentive systems such as payment for environmental services should be applied within and beyond urban environments to protect wetlands.

iv. The values of wetlands need to be articulated clearly for urban planners to inform their decision making. The costs of wetland loss and degradation should be made explicit within urban development.

4. Stakeholder engagement

i. Urban development and wetland management should adopt the principles of inclusivity, empowerment, and participation of indigenous and local communities.

ii. Governance of urban development and wetland management should be participatory, with all relevant stakeholders, and decentralized to the lowest appropriate level.

5. Integrated planning

i. Thematic planning should be used as an essential tool to safeguard wetlands and their ecosystem services both within and beyond urban settlements.

ii. The consideration of wetlands within urban planning needs to be integrated fully with wider elements of spatial planning (such as Integrated River Basin Management as adopted under Resolution X.19, water resource management, the development of transport infrastructure, agriculture production, fuel supply, etc.).

iii. Alternative locations need to be identified for planned urban developments (both formal and informal built development) which do not lead to wetlands, or other natural ecosystems, being degraded or lost.

- Decision-making should ensure that wetlands are protected and restored as providers of multi-benefit solutions to urban and peri-urban issues as well as for the important biodiversity they support.
- The many different communities within towns and cities will each require information on the wise use of wetlands to be presented in a variety of formats with different emphasis. Three priority audiences were highlighted in the work conducted in West Africa:

    1. city mayors, senior elected officials and traditional elders, who require information on why the maintenance and restoration of wetlands delivers benefits to urban citizens;

Additional Information 3: Examples of organisations involved in practical implementation in urban and peri-urban planning and management

The **Global Partnership on Cities and Biodiversity** is facilitated by the Secretariat of the Convention on Biological Diversity (CBD) in partnership with a number of UN agencies and international organisations and a Steering Group of Mayors from Curitiba, Montreal, Bonn, Nagoya and Johannesburg, in order to bring together existing initiatives on cities and biodiversity. The aim of the partnership is to engage cities in the flight to reverse the loss of biodiversity, and it assists national and local governments by providing awareness-raising material, organising workshops and training activities, developing tools, and involving cities in international meetings on biodiversity.

The **UN-Habitat Urban Planning and Design Branch** supports spatial planning at the scales of the metropolitan region, city and neighbourhood, as well as through the entry point of climate change. It works at the international scale to mainstream the urban agenda into Multilateral Environmental Agreements and at the local scale to mainstream environmental conservation into urban planning.

Local Action for Biodiversity (LAB) – ICLEI is a global urban biodiversity program coordinated by ICLEI – Local Governments for Sustainability. The LAB Pioneer WrkNet began in 2006 with a select group of local and regional authorities from around the world, representing more than 54 million citizens. Referred to as the "LAB Pioneers" these local authorities are currently international leaders in managing and conserving biodiversity at the local level.

2. heads of municipal departments and their senior technical staff, who require information on why the maintenance and restoration of wetlands delivers benefits to urban citizens and also on how these benefits can be recognised and integrated into spatial and temporal urban planning and management; and
3. wider members of civil society, who need to understand better why the protection and restoration of wetlands delivers benefits to urban citizens but also how day-to-day actions can help deliver the sustainable future that they want.

- Practical guidance needs to be developed for the various audiences, which conveys the policy and practical principles for the wise use of urban and peri-urban wetlands in the appropriate language using the most relevant and accessible media. Developing demonstration sites which people can visit and understand should be encouraged, and social media and video technology used to capture and relay key messages about wetland wise use.
- No two cities or towns are the same. Understanding the unique context of a town or city and recognising different opportunities is critical. Different urban processes or solutions, such as zonation, densification and compactness, should be considered in tandem with the development or protection of natural infrastructure such as wetlands.

Further information and case studies on wetlands and urban planning and management is provided in McInnes (2013). The Ramsar Convention has requested its Scientific & Technical Review Panel to undertake further work on urban and peri-urban wetlands to support implementation of the principles adopted by Resolution XI.11. This includes working to embed the principles on wetlands and urbanization in existing processes, and the development of guidance for different stakeholders to assist in sustainably managing urban and peri-urban wetlands, with information and case studies provided by Parties; and strengthening collaborative initiatives with UN-Habitat and continuing to develop collaboration with Ramsar Regional Initiatives, the Convention on Biological Diversity, Ramsar's International Organiastion Partners (IOPs), ICLEI and other urban stakeholders, in order to

foster projects that develop demonstration sites which both benefit urban local communities and promote the wise use of wetlands.

Sydney Olympic Park and wetlands education

The Sydney Olympic Park Authority is responsible for managing and developing the 640 hectares Sydney Olympic Park. The park is located in the centre of the Sydney basin and is surrounded by the metropolitan area of the largest city in Australia and comprises an extensive complex of parklands, including open space, remnant woodlands, and a variety of urban wetland habitats including saltmarsh, mangroves, swamp forest and waterways. The Authority delivers a suite of over 30 curriculum based outdoor excursion programs to more than 30,000 school students from government and non-government school systems. Whilst programs are offered for Kindergarten to Year 12 students, the peak stages of participation reflect NSW school curriculum emphases on requirements in Years 3-6 HSIE, junior high school Geography and senior high school Science (particularly Biology). The majority of excursion programs pass through the 'Mangrove Classroom' and take full advantage of the 175ha of onsite wetlands which comprise a living laboratory for learning. Changes to wetlands over time are studied using Geographic Information Systems in a computer lab nestled at the end of the Mangrove Boardwalk in Bicentennial Park.

The Authority also provides a unique professional development program for school teachers focussed on enhancing and updating knowledge of wetland ecosystems. This workshop has achieved formal accreditation with the NSW Institute of Teachers as it addresses particular quality teaching standards and related syllabus outcomes. As such, participation provides teachers seeking to maintaining their professional competence and currency with 6.5 professional development hours (in NSW, teachers must undertake 50 Institute Registered professional development hours over 5 years). The program commences with a contextual overview of the Sydney Olympic Park site, past land uses, remediation, current management and future development. Leading wetland scientists then discuss the biology, geomorphology and ecological significance of estuarine wetlands, what puts them at risk and management strategies to protect them. The teacher professional development workshops incorporate wetlands tours and site familiarisation using a 'train the trainer' style approach which has a focus on the use of scientific equipment and fieldwork techniques.

Wetlands education at school level is generally delivered through a mixture of classroom-based units of work/modules complemented by hands-on fieldwork and outdoor activities. In New South Wales (NSW), wetlands have traditionally featured in the Key Learning Areas of Human Society and its Environment (HSIE) and Science and Technology at Primary level and Geography, Science, Biology and Design and Technology at Secondary level (see www.k6.boardofstudies.nsw.edu.au). Wetlands provide ripe case studies for curriculum-based study of biodiversity, conservation and species protection, land and water management, catchments, ecosystems, climate change, food chains, human impact, pollution control, geographic information systems, scientific investigation, data collection and fieldwork techniques. This is particularly so for readily accessible urban wetlands.

The emerging Australian National Curriculum introduces three overarching cross-curriculum priorities which are embedded in all learning areas. The priority with key relevance to wetlands education is that of Sustainability. The Sustainability priority is 'futures-oriented, focusing on protecting environments and creating a more ecologically and socially just world through informed action' (ACARA, 2013). The cross-curricula priority areas hold both negative and positive potential. They may be seen by some teachers as increasing the teaching and learning load generally. Others, particularly those for whom sustainability has long been core business (geography and science teachers for instance) may see this as either a dilution of their subject, or a promotion of its importance.

The implementation of a national curriculum has significant implications for teacher professional development, inter and intra-school collaboration, interagency partnerships and third party education provision. For wetlands educators and managers, these developments have the potential to open up new audiences and program participation from non-traditional areas. Given wetlands education is often case study based, wetlands provide ready application and adaptation for a variety of key learning areas in addition to Science, Geography and HSIE. As an example, the Maths teacher may focus on wetlands for observation, recording and organization of primary and secondary source data, application of spatial reasoning, measurement, estimation, calculation

and costing of sustainable development. For the English teacher, wetlands provide rich and engaging contexts for developing students' abilities in listening, speaking, reading, viewing and writing. Wetlands become a curriculum relevant canvass for movie making, journalism, student advocacy and use of digital technologies.

Wetlands provide opportunity and context for a wide range of curriculum related learning opportunities; however, specific reference to wetlands in the new National Curriculum is rather discreet. In the Australian Primary syllabus, wetlands are noted in:

- Year 1 HSIE 'Places have distinctive features' which builds on the concept of place to introduce classification and observation of features and their changes over time. The inquiry process provides opportunities to explore the environmental features of familiar places through fieldwork and other methods, to record what has been learned and to reflect on the reasons some places are more appealing than others.
- Year 3 HSIE – 'Places are both similar and different' continues to build on the concept of place by investigating and comparing the characteristics of inhabited places. The inquiry process provides opportunities to develop geographical questions, identify patterns and trends in data, and discuss people's connections with places.

In the National Secondary syllabus wetlands are referenced in:

- Year 8 Geography 'Landforms and landscapes' draws on the concepts of change, environment, scale and sustainability to investigate key geomorphological processes and their resulting landforms, geomorphological hazards and soils, threats posed by human activities and proposed future use of environments.
- Year 9 Geography 'Biomes and food security' which draws on the concepts of environment, place, space and sustainability through an investigation of biogeography, agricultural production and associated constraints. This unit involves evaluating the success of methods to partially reverse any adverse environmental impacts of agriculture and 'restoration of wetlands' is a possible case study.
- Unit 1 of the Senior Geography Curriculum 'The changing biophysical cover of the earth' where students examine the ways people seek to reverse the negative effects of land cover change through land management, revegetation, wetland restoration and other rural and urban environmental programs. Wetland restoration is a specific case study option.
- Environmental Management in Years 9 and 10 Design and Technology, where students are asked to critique environments in relation to preferred futures (society, ethics and sustainability practices) like the redesign of a local wetland.

In addition to classroom-based activities, wetland education programs in the school sector typically involve exploration of school grounds and local waterways, field-trips/excursions to wetland areas, 'incursions' (in-school outreach programs by Government, NGOs and private providers), collaborative video conferences and student-driven action learning projects. Program providers in this sector are commonly agencies with place management and/or environmental protection and/or environmental education responsibilities such as Local Government, Statutory Authorities, Catchment Management Authorities, Museums, Environmental Education Centres and a range of non-government and community organisations such as Birdlife Australia and Wetland Care Australia.

Notable Australian sites for teaching and learning resources and curriculum materials are found in Table 1.3.2.

Further educational and curriculum materials have been made available over the past 10 years through Sydney Olympic Park Authority's Wetland Education and Training (WET) workshop series. WET Workshops explore current and future wetland management issues, such as: mangrove or saltmarsh management; aquatic and terrestrial invasive species management; management planning (why and how to prepare the management plans); wetland creation, restoration and management; wetland ecology; and how to apply Geographic Information Systems (GIS) techniques for better wetlands management. A total of 37 hands-on workshops have so far been delivered, all designed to facilitate the sharing of scientific research findings and the successful implementation of research in the management of wetlands throughout Australia. Table 1.3.3 provides a list of the WET workshops organised since 2002.

Nearly 1,500 attendees and tutors have participated in the WET training initiative. Attendees have represented a diverse range of backgrounds and interests, including those directly involved in the repair, rehabilitation and conservation of wetlands, or those in the academic and/or policy arena. A typical workshop includes participants from local, state and federal governments, consulting companies, university staff and students and community organisations. In addition to the rich content delivered and discussed by wetland experts, WET workshops have provided purposeful networking opportunities and spawned wetland 'think-tank' communities of practice. In addition, over the past decade, in excess of 50 Masters and Doctoral research studies have been conducted based on the wetlands at the Park.

In addition, the Sydney Olympic Park Authority participated in an umbrella initiative known as Wetlands.edu that was funded by the Natural Heritage Trust from 2006-2008. This was a national wetland education and management initiative designed to develop the capacity and skills for regional and community investments in wetland assessment, planning and management. It was aimed at regional natural resource management and catchment bodies as well as Landcare and river management groups, local governments and private landholders. The initiative was developed and delivered by a consortium comprising the Hunter Wetlands Centre Australia, Banrock Station Wine and Wetlands Centre, Regional Ecosystem Services as well as the WET Program of Sydney Olympic Park Authority.

Features of wetland education centres in Australia and New Zealand

In addition to the role that the Sydney Olympic Park Authority has played in wetland education and training there are many other wetland centres in Australia and New Zealand that undertake similar activities. The term wetland centre encompasses a range of wetland facilities - from wetlands with paths and interpretive signs, but no formal visitor centre, through to large facilities with a full range of facilities, including a dedicated visitor centre,

Table 1.3.2. Teaching and learning resources and curriculum materials.

Provider	Link
Australian Government (Department of the Environment)	www.environment.gov.au/water/publications/environmental/wetlands/index.html
Sydney Olympic Park Authority	www.sydneyolympicpark.com.au/education_and_learning/resource_centre
NSW Government (Office of Environment & Heritage - Waterwatch)	www.environment.nsw.gov.au/waterwatch/
NSW Government (Primary Industries)	www.dpi.nsw.gov.au/fisheries/habitat/aquatic-habitats/status
Wetland Care Australia	www.wetlandcare.com.au
Queensland Government	www.wetlandinfo.ehp.qld.gov.au/wetlands/resources/education/
Victorian Government	www.dse.vic.gov.au/conservation-and-environment/biodiversity/wetlands/victorian-wetlands-resources-for-teachers-and-students
Hunter Wetlands Centre	www.wetlands.org.au/page4982/Wetlands-Environmental-Education-Centre.aspx
Wetlands International (Oceania)	www.wetlands.org
Australian Wetlands website (University of Technology Sydney, student site)	www.studentwork.hss.uts.edu.au/wetlands/default.html

Table 1.3.3. List of the WET Workshop themes, periods and total participants.

Theme	Year	Total Participants
Water Plants identification and management of constructed wetlands	2003, 2004, 2006, 2007, 2010, 2012	302
Conservation of Saltmarsh and mangrove	2002, 2003, 2004, 2004, 2006	234
Climate Change and Sea Level Rise impacts and adaptation measures	2008, 2010, 2011	144
Wetland ecology and management	2002, 2009, 2012	144
Preparation of Wetland Plan of Management	2005, 2010, 2013	83
Monitoring and assessment of wetlands	2005, 2008	82
GIS as a tool for managing wetlands	2008, 2009	79
Pest mosquito identification and management	2007, 2011	57
Waterbird identification and habitat conservation	2003, 2005	43
Identification and management of Blue-Green Algae	2003	39
Wetland (environmental) legislation	2006	44
Sediment control measures	2012	25
Teachers WET	2007, 2009, 2009, 2010, 2011, 2013	158
TOTAL	**37**	**1,434**

classroom facilities and dedicated curriculum-based education services for primary through to post-graduate students. They are owned/operated by a variety of organisations, including trusts, state governments, federal governments and public-private associations. A survey of such centres was undertaken in 2005 (SGS Economics and Planning 2005) with a further survey undertaken through the Institute for Land, Water & Society, Charles Sturt University in 2010 (Prior unpublished report) after discussion with the members of the Secretariat of the Ramsar Convention on Wetlands and Wetlands Link International.

The results presented below have been summarised from the information provided by 21 wetland centres in Australia and New Zealand. The information provides an overview of the variety of wetland centres and the educational and training work that they undertaken largely, but not only, in urban settings. The data from the survey are shown pictorially in Figures 1.3.3-1.3.5 with a summary provided in Table 1.3.4.

The majority of the centres included in the survey were owned and managed by local government authorities (38%) and state parks or wildlife services (24%). This information indicates that local governments and state conservation services have taken the lead in establishing and supporting wetland centres. Many of the centres were able to cater for visitors through small (38%) or medium to large facilities (33%) although some (19%) did not have a visitor centre. The size of the buildings, including facilities for visitors, varied with about a quarter covering <100 m^2, although some 43% had facilities that covered more than 300 m^2. The facilities generally included an interpretive centre, indoor and outdoor classrooms (48% and 38%

respectively) as well as multi-use rooms (48%), or a lecture theatre (29%), with very few (5%) having none of these.

Visitor numbers varied considerably with almost half (45%) receiving more than 30,000 visitors per year and approximately a third (35%) receiving between 15–30,000, with more than half coming from the local region with individual visitation (49%) and school groups (39%) dominating.

The number of full-time staff at the centres was generally small with many (57%) having three or fewer full-time equivalent paid staff. Volunteer staff were engaged by many centres with some (14%) having more than 100, although many more (29%) did not have any. The differences in facilities and staffing levels are also shown by the annual operating budgets with some (19%) spending more than A$350,000 with a similar number (14%) sending less than A$50,000.

Figure 1.3.3. Features used to characterise the wetland education centres.

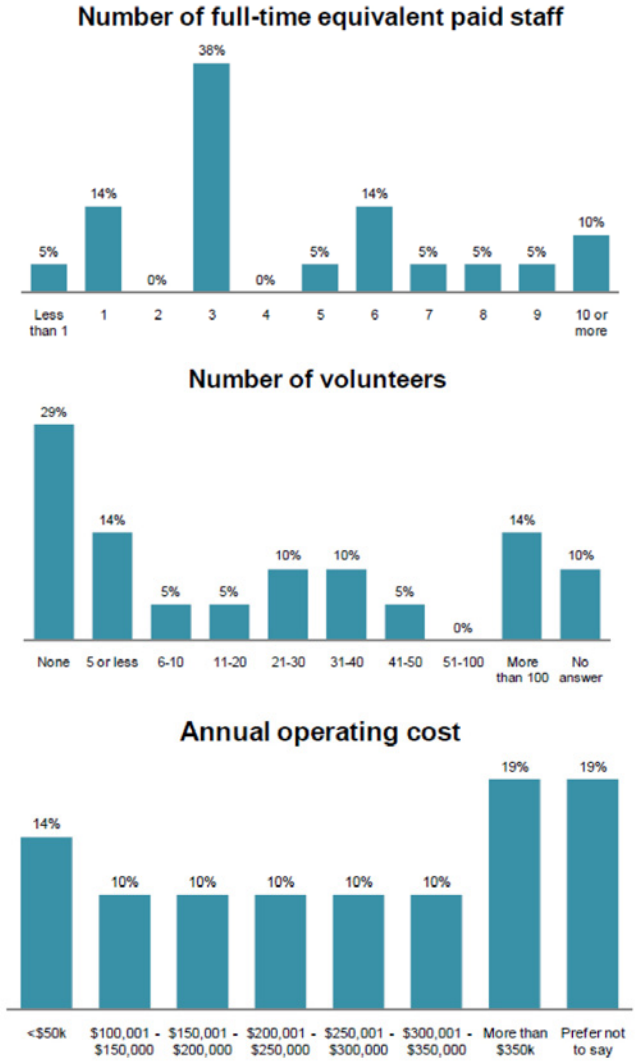

Figure 1.3.4. Staffing levels and annual operating cost in wetland centres included in the survey.

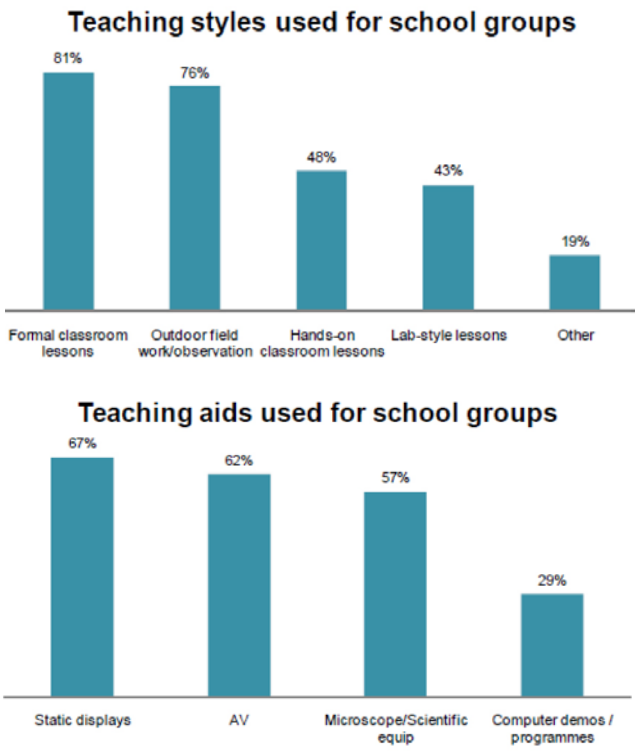

Figure 1.3.5. Teaching styles and teachings aids at wetland centres.

Despite these differences a large proportion of the centres provide curriculum-based education programs with most conducting both outdoor (81%) and class room (76%) activities with hands-on (48%) and laboratory-based (43%) lessons. These lessons made use of a number of teaching aids, including static displays (67%), audio-visual (62%), microscopes (57%) and computers (29%).

While it is difficult to extract a single profile of the features of the wetland centres included in the survey a summary of the most common features is provided in Table 1.3.4. This summarises the information provided in the above text and highlights that while the size, facilities, staffing and budgets of the centres varied there was a commonality in how information was presented to the public, which was largely comprised of individual visitors or visits arranged through schools.

While the above information provides an overview of the type and size of wetland centres, including staffing levels and operating funds, it does not elaborate the specifics of the education and training activities or how they intersected with the available curricula, as described above when considering some of the specifics of the Sydney Olympic Park wetland training program. Nor is there any indication if the wise use and conservation principles and technical guidance developed and supported through the Ramsar Convention have been explicitly included in the education and training that is provided.

Given the development of an explicit focus on urban wetlands through the Convention and other international organisations there is an opportunity to enhance the education and training programs with more explicit information about urban wetlands, including, where appropriate, examples and lessons from international programs and wetland sites. Specifically the practical topics listed in Additional Information 2, and presented in summary form below, as potential courses, could guide the choice of courses made available.

Table 1.3.4. A summary of the main features of the wetland centres included in the survey. The information/data were extracted from that shown in Figures 1.3.3-1.3.5.

Feature	Most common outcome
Ownership/management	Local Councils (38%) State parks or wildlife service (24%)
Type of facilities	Small (33%) to medium-large (38%) visitor facilities Buildings >300 m^2 (43%)
Annual visitation	>30,000 (45%) Local visitors (54%) Individuals (49%) and school groups (39%)
Staffing	Paid staff 1-3 (57%) Volunteers >100 (14%) and none (29%)
Annual operating costs	<$50,000 (14%) and >$350,000 (19%)
Teaching styles	Formal classroom (81%) Outdoor (76%)
Teaching aids	Static displays (67%), audio-visual (62%) and microscopes or other equipment (57%)

Practical courses

1. Wetland conservation
2. Wetland restoration and creation
3. Understanding the value of wetlands
4. Stakeholder engagement
5. Integrated planning

It is not surprising that many of the courses run through the WET workshops (see Table 1.3.3) readily fit within these categories; reference to the categories could inform future choices and planning for further education and training activities.

The abovementioned training topics could be fashioned around the key features of the range of wetland education and training centres that are already being supported through public enterprises, such as local and state governments. The diverse nature of these centres provides an opportunity to tailor a diverse range of courses to the needs of specific audiences. The Sydney Olympic Park Authority provides an example of an urban-based wetland centre that has for many years delivered a range of wetland courses based around perceived needs and feedback from participants. With the information on urban wetlands recently provided by the Ramsar Convention and partners there is more scope to tailor courses around what works for each centre and what is needed for managing, including restoring urban wetlands, and to access a growing information resource on urban wetlands.

The above may also be achieved through interaction with other collaborative arrangements, such as those provided through the Regional Centre of Expertise on Education for Sustainable Development - Greater Western Sydney (RCE-GWS) which brings together institutions and organisations, such as the Sydney Olympic Park Authority, to address the interlinked regional challenges of social, economic and environmental sustainability (www.uws.edu.au/rcegws/rce). Given the location within a large city further opportunities will abound, both locally, such as that provided by the Birdlife Australia Discovery Centre (www.birdlife.org.au/visit-us/discovery-centre) which is located within the Park, as well as with potential partners from further afield.

References

ACARA (2013). Australian Curriculum, Assessment and Reporting Authority. Available at http://www.acara.edu.au.

Armenteras, D., and Finlayson, C. M. (2012). Biodiversity. In 'Keeping Track of Our Changing Environment: From Rio to Rio+20 (1992-2012)'. pp. 133–166. (Division of Early Warning and Assessment (DEWA), United Nations Environment Programme (UNEP), Nairobi.)

Butchart, S. H. M., Walpole, M., Collen, B., van Strien, A., Scharlemann, J. P. W., *et al*. (2010). Global biodiversity: indicators of recent declines. *Science* **328**(5892), 1164–1168.

Finlayson, C. M. (2012). Forty years of wetland conservation and wise use. *Aquatic Conservation: Marine and Freshwater Ecosystems* **22**, 139–143.

Finlayson, C. M., Davidson, N., Pritchard, D., Milton, G. R., and MacKay, H. (2011). The Ramsar Convention and ecosystem-based approaches to the wise use and sustainable development of wetlands. *Journal of International Wildlife Law & Policy* **14**, 176–198.

Horwitz, P., and Finlayson, C. M. (2011). Wetlands as settings: ecosystem services and health impact assessment for wetland and water resource management. *BioScience* **61**, 678–688.

Horwitz, P., Finlayson, C. M., and Weinstein, P. (2011). 'Healthy wetlands, healthy people. A review of wetlands and human health interactions.' Secretariat of the Ramsar Convention on Wetlands and the World Health Organisation. Ramsar technical Report No. 6. Gland, Switzerland. Available at http://www.ramsar.org/pdf/lib/rtr6-health.pdf.

Matthews, G. V. T. (1993). 'The Ramsar Convention on Wetlands: its history and development.' Ramsar Bureau, Gland, Switzerland. pp. 120. Available at http://www.ramsar.org/pdf/lib/Matthews-history.pdf.

McInnes, R. (2013). 'Recognising wetland ecosystem services within urban case studies.' *Marine and Freshwater Research*. Available at http://dx.doi.org/10.1071/MF13006.

Millennium Ecosystem Assessment (2003). 'Ecosystems and Human well-being. A Framework for Assessment.' (Island Press: New York.) Available at http://www.unep.org/maweb/en/Framework.aspx.

Millennium Ecosystem Assessment (2005). 'Ecosystems and human well-being: wetlands and water synthesis.' (World Resources Institute: Washington, DC.)

Ramsar Convention (2005). 'Resolution IX.1 Annex A. A Conceptual Framework for the wise use of wetlands and the maintenance of their ecological character.' Gland, Switzerland. Available at http://www.ramsar.org/pdf/res/key_res_ix_01_annexa_e.pdf.

Ramsar Convention (2012a). 'The Ramsar Strategic Plan 2009-2015, as adopted by Resolution X.1 (2008) and adjusted for the 2013-2015 triennium by Resolution XI.3 (2012).' Gland, Switzerland. Available at http://www.ramsar.org/pdf/strat-plan-2009-e-adj.pdf.

Ramsar Convention (2012b). 'Resolution XI.11. Principles for the planning and management of urban and peri-urban wetlands.' Gland, Switzerland. Available at http://www.ramsar.org/pdf/cop11/res/cop11-res11-e.pdf.

Ramsar Convention (2012c). 'Resolution XI.9. An Integrated Framework for avoiding, mitigating and compensating for wetland losses.' Gland. Switzerland. Available at http://www.ramsar.org/pdf/cop11/res/cop11-res09-e.pdf.

Ramsar Convention Secretariat (2010). 'Ramsar Handbooks for the Wise Use of Wetlands.' 20 volumes. Ramsar Convention Secretariat, Gland, Switzerland. Available at http://www.ramsar.org/cda/en/ramsar-pubs-handbooks-handbooks4-e/main/ramsar/1-30-33%5E21323_4000_0__.

SGS Economics and Planning (2005). Wetlands Centre benchmarking : Edithvale-Seaford wetlands centre – feasibility study. Melbourne Water, Melbourne (unpublished report).