Independent Inquiry into the Georges River - Botany Bay System

FINAL REPORT
September 2001

Healthy Rivers Commission
of New South Wales

Level 18, 15 Castlereagh Street

SYDNEY NSW 2000

Telephone: 02 9231 2977
1800 818 369 (freecall – outside Sydney)
Facsimile: 02 9232 5973
E-mail: rivercom@hrc.nsw.gov.au
Website: www.hrc.nsw.gov.au

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Foreword

In finalising this Georges River - Botany Bay Inquiry, the Commission has completed the picture of river and bay health for the three river systems (the Hawkesbury Nepean, Shoalhaven and Woronora), that provide water to the Sydney metropolitan area. The Commission has found that the health of each of these rivers is affected, to varying degrees, by water extraction, sewage and stormwater discharge, urban and rural development.

It has become clear that if river health is to be *optimised* whilst preserving the many uses that the catchment communities expect of their watercourses, the three river systems *cannot* be managed in isolation from each other. Likewise, key elements of the water cycle must be managed *across* the metropolitan area in an integrated way. Stormwater and sewage effluent must no longer be thought of as 'wastewater' but as a valuable resource and part of the total water cycle available to improve river health and ameliorate demand on supply for the wider Sydney region. The Commission has devised strategies and recommendations to improve river health, taking into account the expectations and needs of the diverse and growing community.

In that context, in the Georges River - Botany Bay Inquiry, the Commission has found that there are three critical issues which must be addressed as a matter of priority if we are to secure a healthy river and bay environment. The most significant of these is the future management of the water cycle *across the three river systems*. In all Inquiries to date, the Commission has advocated that rivers should be managed as 'whole systems': in this instance, the 'system' incorporates those three rivers, interconnected by the operation of the metropolitan water, sewage and stormwater systems.

The Government's commitment to providing environmental flows in these rivers, coupled with its recent decision to defer construction of Welcome Reef Dam, means that demand for water must be reduced and alternate sources of supply must be harnessed if the current security of the metropolitan water supply is not to be placed at risk. In that context, future decisions about the urban water cycle must be made in an integrated manner, considering water requirements of all users, provision of environmental flows, options to reduce demand, *and* options for the reuse of stormwater and sewage effluent. The Commission proposes a mechanism to allow such decision-making.

Recommendations include better integration of stormwater management, not just in the Georges River - Botany Bay catchment, but *across* the metropolitan area, *and* with other water, wastewater and reuse strategies. To provide that better integration, using existing institutions, the Commission recommends that Sydney Water take on greater strategic responsibility for stormwater management, while local councils manage local systems, focussing on promotion of water sensitive urban design principles. Establishment of long-term sustainable funding and partnerships between Sydney Water and local government will ensure the most cost-effective outcomes for the metropolitan area are achieved.

The management of Botany Bay is the second issue that requires urgent attention. The bay is a very complex system, in terms of the terrestrial and aquatic ecosystems and also the political and administrative arrangements. There is a clear need for an integrated decision-making framework for the bay to deal with this complexity and devise strategies to sustain the competing interests of industry, commercial activity, national and international

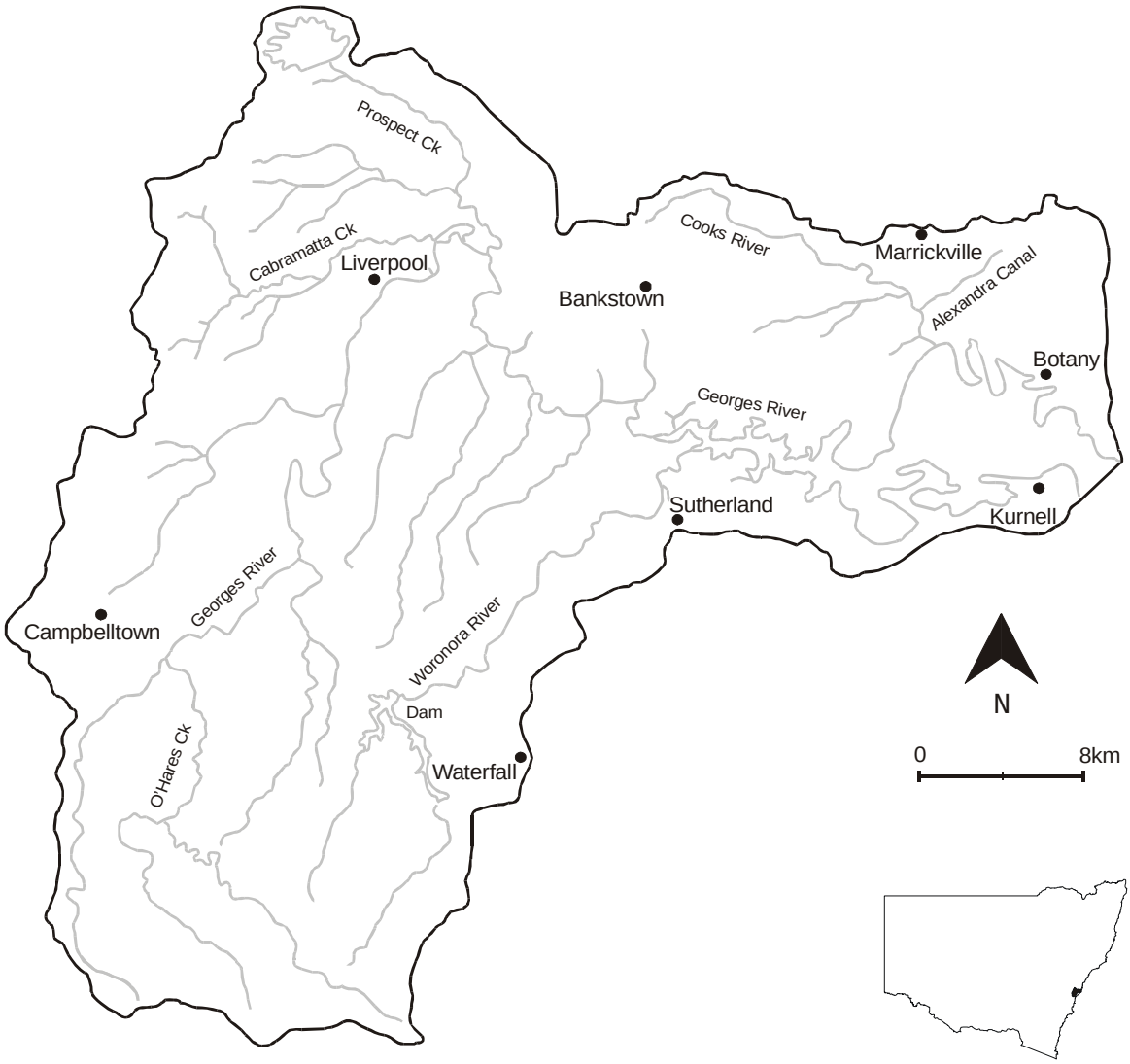
transport, residents *and* the environment. The Commission recommends that the State establish an integrating framework with unambiguous support from the three levels of government and key stakeholders. That should facilitate the development of a strategic plan for Botany Bay which would identify agreed goals, strategies to achieve them, and the context against which new development is assessed.

The third critical issue in the Georges River - Botany Bay system is the continued protection of remaining natural areas within the catchment that contribute to river health in terms of aquatic and terrestrial habitat, water quality and visual and recreational amenity at both the local and catchment scale. The Commission recommends mechanisms to protect these areas in future.

I thank all of those citizens, council officers, agency staff, and independent experts who have participated in the Inquiry process, contributed to the Commission's appreciation of the complexity of the issues, and assisted in devising strategies to harness the many opportunities to improve river and bay health.

Peter J Crawford
Commissioner

The Georges River - Botany Bay catchment



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PART A

Context

Introduction

The Healthy Rivers Commission's independent and public Inquiry into the Georges River - Botany Bay system is part of the NSW Government's *Water Reform Program*[1]. As in its previous Inquiries, the Commission's role in this catchment is to assist the community to identify appropriate long-term river[2] and bay health goals and the management strategies required to achieve them.

In a highly urbanised catchment such as this, river and bay ecosystems are significantly modified. The Commission's definition of river and bay health encompasses socio-economic factors as well as ecological ones - a healthy river is one that can support its ecological functions *and* those uses to which its community aspires. In this case, community goes beyond the people living and working in the Georges River - Botany Bay catchment. As the 'birthplace of modern Australia', as the major sea and air port, as the site of significant defence holdings, and as an area where almost half the people of metropolitan Sydney live, Botany Bay and its catchment span the interests of the city, and in some respects, the state and the nation. The challenge therefore, is to improve river and bay ecological health, whilst maintaining essential economic and social services to the catchment and wider community.

This Final Report is based on the findings and draft recommendations of the Commission's Georges River - Botany Bay Draft Report (HRC 2000a), the earlier Woronora River Draft Report (HRC 1999c), and comments received on each. Both of those reports and associated background papers remain current and are referenced throughout this Final Report, together with references to the set of management principles outlined in the Commission's strategic report *Securing Healthy Coastal Rivers: A Strategic Perspective* (HRC 2000b), which summarises common findings from all of the coastal rivers subject of its Inquiries to date[3].

This report therefore focuses on the Commission's final recommendations to Government. It sets out the lead and other key agencies nominated for implementation action, and provides a summarised rationale for each recommendation (the fuller text of the Commission's findings is in the Draft Report, HRC 2000a). In devising its final recommendations, the Commission has had regard to the many comments received on the Draft Report and new issues that have emerged since that report was released.

The appendices provide details of the Inquiry process, since release of the findings and draft recommendations, including a list of those who made submissions.

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[1] For details, see HRC (2000a, p. 110). Throughout this report, unless otherwise stated, the term 'government' refers to the NSW Government.

[2] In the context of this Inquiry, the Commission uses the term 'river' to encompass the main stem and all tributaries of the Georges and Cooks rivers including their estuarine reaches (areas subject to tidal fluctuations), which, in the case of the Georges River, extend to Liverpool weir.

[3] Copies of all Commission reports are available on request and are also posted on the Commission's website.

Key outcomes

Throughout the Inquiry, the community has referred many matters to the Commission for consideration and resolution. The Commission has focused on those matters where it believes it can add value to current management approaches and where issues *must be addressed if the environmental values and river and bay health objectives are to be achieved.* The recommendations therefore focus on four key areas:

1. **Improved management of the metropolitan water supply system and associated river flows, in ways that recognise the need for whole system management including the interrelationships among the following:**

    - provision of environmental flows downstream of the storages in each of the three catchments from which water supply is drawn (Hawkesbury Nepean, Shoalhaven and Woronora);
    - maintenance of the security of potable water supplies, in the light of decisions to defer indefinitely the construction of Welcome Reef Dam; this would include water sharing strategies for all users and drought management strategies that may necessitate adjustments to environmental flows and water reuse while taking account of the implications for river health;
    - demand management strategies that link containment of river extractions from each catchment (involving a mix of supply, re-use, efficiency and pricing policies) to the integrated effort required from the Sydney Catchment Authority, as the bulk supplier, the Sydney Water Corporation, as the reticulation and wastewater manager, and Department of Land and Water Conservation as a key regulating authority involved in determining offsets.

2. **Improved institutional arrangements for stormwater management which include:**

    - provision for long-term, self-sustained funding (not dependent on grants) through existing institutions and mechanisms, under which prices necessary for long-term cost recovery are set by the Independent Pricing and Regulatory Tribunal (IPART);
    - defined accountability for outcomes at both the local and metropolitan levels;
    - partnership arrangements with and among councils to provide for coordination of those priority works, necessary to achieve the most cost-effective outcomes for the metropolitan area, regardless of location;
    - integration with other wastewater strategies, including those for dry and wet weather sewage overflows, *and* with reuse strategies for both stormwater and treated effluent;
    - provision for water sensitive urban design principles to be incorporated in all planning, development and redevelopment proposals and to be promoted through a mix of local government incentives and requirements;
    - integration *within* councils of local stormwater management across all relevant council departments.

3. **An integrated decision-making framework for Botany Bay that provides the context against which decisions of the three levels of governments are made.** While there are various ways in which the framework may be developed and refined, at a minimum it must:

   - include stakeholder participation from *all* interest sectors: environmental, transport, commercial and recreational;
   - create a longer-term strategic context for both planning and ongoing management;
   - be backed by an ongoing scientific program that treats the bay as a whole biophysical system, recognising its highly dynamic nature and identifying causal linkages between the system and the impacts of proposals. (Existing hydrodynamic modelling should be included in that program and expanded to include biological parameters.)

In recent years, the catchment/subcatchments have received much attention, whereas the bay, *as an entity*, has been largely neglected. More traditional land use planning approaches and coordination mechanisms between public bodies do not deal adequately either with such a physically dynamic and important environment or with such a commercially important location.

4. **Protection of remaining natural areas, in particular riparian and foreshore areas, whether in public or private ownership.** This would involve a number of mechanisms but should include at a minimum:

   - mechanisms to protect all tributary water courses through the planning and development control process, *as well as* through the ongoing stormwater management process;
   - mechanisms to maximise all opportunities to improve modified channels[4];
   - mechanisms to ensure that, when developments are determined to be essential by a public process, appropriate offsets[5] for any potential adverse environmental effects are identified at the outset of the planning process, and put in place *prior* to the development occurring.

[4] For example, when rusting sheet piling on the Cooks River requires replacement, alternative, more environmentally sensitive bank stabilisation measures should be installed. Fairfield Council has some excellent prototypes that could be used as models.

[5] The notion of 'offsets' is discussed in Recommendation NA 5.

Implications of Government decisions on related Inquiries

Recent Government decisions on other Commission Inquiries, especially those on the Hawkesbury Nepean and Shoalhaven River systems, have direct implications for the Georges River – Botany Bay catchment, in part as a consequence of the interlinkages created by the metropolitan water supply system. Decisions on the Hawkesbury Nepean catchment are also highly relevant to the Georges River - Botany Bay catchment because, together, the catchments comprise much of the highly urbanised metropolitan area. Many of the same challenges arise in terms of local environmental management, stormwater management, containment of mining impacts and other development pressures on urban streams. This Report completes the picture for the metropolitan area. Recommendations here dovetail with ones made in the two earlier Inquiries and depend on Government decisions already taken or principles already entrenched. For example, the Commission's recent report, *Securing Healthy Coastal Rivers: A Strategic Perspective* (HRC 2000b), currently before Government, identifies those critical principles that underpin all of the Commission's recommendations for river and bay health.

Implementation mechanisms

Since its inception, the Commission has sought a strong, publicly accountable mechanism for the implementation of Government decisions in response to Inquiry recommendations. The Commission is pleased to report therefore that Government decisions on the recommendations from Commission Inquiries, supported where relevant by findings and explanatory material from Commission reports, have been consolidated into Statements of Intent. These public Statements represent the Government's way of integrating its responses to the Inquiries. They clearly identify specific actions, timeframes and responsible agencies[6]. Through that mechanism, the Government has publicly committed its state agencies to certain courses of action in the carriage of their functions, and to the provision of support for local government to facilitate complementary action. Such action by local government is, in most cases, crucial to the achievement of desired outcomes.

Progress in meeting the accountability required by the Statements will be monitored through agencies providing six monthly progress reports on implementation to an interagency committee of Chief Executive Officers of the major natural resource agencies. The Government has further determined that the Healthy Rivers Commission will 'audit' and publicly report on implementation two years after the release of each Statement. It is expected that a similar mechanism will be developed for implementation of the Government-endorsed recommendations from the Georges River – Botany Bay Inquiry.

[6]The Statements relating to implementation of Government endorsed recommendations for the Hawkesbury Nepean and Shoalhaven Inquiries are available on the Commission website, or from the Commission on request.

A State Riverine Corridor Policy

The Government has decided, on the basis of the Commission's Final Report on its Hawkesbury Nepean Inquiry, to develop a State Riverine Corridor Policy. An interagency Committee, which also includes local government interests, has been established to oversight this work. The Committee, chaired by the Department of Urban Affairs and Planning, has begun its consideration of the many planning, regulatory and incentive mechanisms available to protect the state's river corridors. In this catchment, the Policy should be linked to the existing Georges River Regional Environmental Plan to provide effective protection of foreshore lands, including land currently owned by the Commonwealth. The Commission has addressed the Committee outlining important considerations that should be included in the Policy in respect of rural and semi-rural areas as well as in the urban context (pursuant to Recommended RC 1 of this report). Appendix A3 provides a summary of the Commission's recommended approach to policy development in this area.

Environmental management by councils

In managing their local domains, councils undertake many planning, regulatory, management, construction and maintenance functions, all of which have direct or indirect bearings on river health.

In its Hawkesbury Nepean Inquiry, the Commission recommended, and Government subsequently decided, that state agencies are to work with councils to assist them with developing an environmental management component of their Council Management Plan. The Commission's strategic report (HRC 2000b) recommends that requirement be extended to all coastal catchments. This extension is especially important in the Georges River - Botany Bay system and the remaining metropolitan area, of which the Hawkesbury Nepean system forms over one third. The Commission is actively pursuing the development and refinement of this approach with the Department of Local Government.

The Commission recommended that those environmental management components link, prioritise and maximise the synergies between councils' activities that are currently identified as 'environmental works', environment protection measures and other activity that may impact on river health. Stormwater and urban stream management, sewerage, 'engineering works' (such as parks/gardens/road maintenance), vegetation management and Bushcare, monitoring *and* the exercise of planning and development controls all have 'environmental management' aspects that are not always recognised as such. They are thus often not integrated in priority setting, management or funding allocation processes. A dedicated environmental component of the Management Plan would bring the budgeting and planning for all of those related environmental functions together to assist councils to prioritise, plan, fund and coordinate action across council departments in an integrated manner with a complementary set of goals for each council department.

In the Georges River – Botany Bay catchment, the Commission has once again found that environmental management at the local level is critical, and that a major impediment continues to involve situations where different council departments do not work sufficiently in concert with each other. Accordingly, the Commission expects that distinct environmental benefits will flow from the Government's decision on environmental management plans, as well as improved planning and management. This should give rise to improved efficiencies and effectiveness.

Management of river flows and water supply

With the finalisation of its Georges River – Botany Bay Inquiry, the Commission will have completed inquiries on the three river systems that supply metropolitan Sydney with water.

The three river catchments are, in effect, connected by the Sydney Catchment Authority's water storages, pipe and canal system and the Sydney Water Corporation's reticulated water supply and sewerage networks. Government decisions on the earlier Commission Inquiries require that all of the storages owned and operated by the Sydney Catchment Authority be managed in agreed and transparent ways as components of a whole water supply system.[7] Environmental flows provided by releases from any one part of the system are not to be offset, or compensated for (in operational terms), by increasing inter-valley transfers that could compromise the health of another part of the system. This means that there will necessarily be a greater reliance on demand management, if the security of the water supply system is to be maintained without creating the need to augment storages.

Since those earlier decisions were made, four matters have come to light that heighten the implications of those decisions *and* of the more recent decision to defer indefinitely the construction of Welcome Reef Dam in the upper Shoalhaven system. The matters are as follows.

1. Revised climate/streamflow data. Since undertaking modelling for the Commission (Sydney Catchment Authority 2000), the Sydney Catchment Authority has added data from the period 1995 - 1998 (which includes a significant drought event) to its historical data record used for modelling. Results from new modelling indicate that the bulk water supply system will have to be augmented sooner than predicted based on earlier data[8] unless demand management and reuse strategies are made more effective.
2. Likely increases in water demands. Continuation of significant housing development in Sydney (partly as a result of low interest rates and first-home-owner rebates) could increase total demand for water, especially if development is on the drier urban fringe, *unless* that demand is managed effectively and water reuse becomes more widespread. That could include increased use of on-site storage such as rainwater tanks and greater use of water-efficient devices.

3. Completion of the Penrith Lakes Scheme could also significantly[9] increase the demand for water from the Hawkesbury Nepean system *unless* the integrated effluent management scheme is established according to the Government decision from that river Inquiry[10].

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[7] Appendix A2 provides some detail about Government decisions on the Commission's Hawkesbury Nepean and Shoalhaven Inquiries as they affect the water supply system to the Sydney metropolitan area, Wollongong, Blue Mountains and Shoalhaven regions.

[8] Original modelling was based on historical streamflow data from 1909 – 1994. Inclusion of data from 1995 – 1998 covers a period of drought.

[9] Extraction is proposed to be 26,000 ML/year on average, with most being returned to the river further downstream. HRC (1998, p.85) provides details.

[10] That decision required an investigation of options for effluent reuse to: offset environmental flows from Warragamba Dam; provide a water supply to existing users (especially those pumping from weir pools in order to also facilitate removal of weirs); establish a variable flow regime in South Creek; *and* contribute to the water needs of the Penrith Lakes Scheme (NSW Government, 2001b).

4. Establishment of the Sydney Catchment Authority. In the past it was somewhat easier to focus on management of the total water cycle. The establishment of the Authority has involved separation of bulk water supply and catchment management functions from the reticulation of potable supply, sewage treatment and effluent disposal functions (held by Sydney Water).

Together, these have significant implications for the security of metropolitan water supplies *unless* Sydney Water, in conjunction with the Sydney Catchment Authority, is able to achieve its demand management targets.[11] In turn, that will depend on achieving water efficiencies through a variety of means, as pricing mechanisms alone have been shown to have only a limited effect on water demand (IPART 2000)[12]. Importantly, achievement of demand management targets will depend heavily on establishment of alternative sources (such as reuse of appropriately treated stormwater/sewage effluent to offset demand for potable water and for make-up of environmental flows). That will require a review of current legislative and policy arrangements regarding reuse of treated sewage. For example, current legislative requirements provide for even highly treated effluent discharges to the Hawkesbury Nepean River system to be phased out and for that treated water to be used to meet 'new' water demands, rather than *to replace the current demands* existing users place on the system. While both existing and new demands need to be contained, there may be additional benefits to river health from a greater emphasis on management of existing water uses. For example, early proposals to re-use water from the West Camden STP indicate a preference for the establishment of a new woodlot, rather than exploring options to supply existing irrigators who currently pump from weir pools. A more strategic and integrated approach is required which would assist in giving effect to the Government decision on the Commission's Hawkesbury Nepean Inquiry about weir removal, subject to making alternative water supplies available to existing irrigators. (Without removal of the weirs, the value in providing environmental flows from the upper Nepean storages is significantly reduced.)

The government decisions, new data and new operating environment therefore create a new context in which agencies of the state must integrate their management of key elements of the water cycle in the metropolitan area. Various agencies[13] have responsibilities and associated powers relating to:

- rules governing water extraction (for a variety of purposes) from the three catchments;
- provision of environmental flows from major storages;
- weirs on the upper Nepean River;
- management of the Penrith Lakes Scheme;

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[11] The water supply system modelling undertaken by the Sydney Catchment Authority on behalf of the Commission indicates that achievement of demand management targets is required, if environmental flow requirements are to be met and current security and reliability of the water supply system are to be retained. The Sydney Catchment Authority and the Sydney Water Corporation have demand management obligations incorporated into their Operating Licences. Sydney Water's targets are to reduce consumption to 364 litres/capita/day by 2004-5 and 329 litres/capita/day by 2010-11. (Consumption in 1999-2000 was 414 litres/capita/day.)

[12] For example, the Sydney Water Corporation is currently investigating the use of minimum performance standards for water using appliances and fittings (such as washing machines and shower heads).

[13] Relevant agencies are the Sydney Catchment Authority, the Sydney Water Corporation, Department of Land and Water Conservation, IPART, NSW Fisheries, the Department of Urban Affairs and Planning, the Environment Protection Authority and NSW Health.

- incentives for urban water efficiency;
- licensing, location and pattern of discharges to the river systems;
- management of stormwater runoff; and
- promotion and regulation of water re-use.

All those agencies and authorities therefore have the potential to influence the total demands (in terms of water availability and quality) placed on the entire water supply and riverine systems, and thus their sustainability over time.

Government decisions on Commission Inquiries mean that those many powers of all relevant Government bodies must be applied in complementary ways to achieve an optimal set of outcomes for river and bay health *and* the security of metropolitan water supplies. This must be addressed by each agency individually and by all collectively. Key elements of the water cycle in the metropolitan area must be managed in an integrated way, and the multiple regulatory instruments *must* be applied in ways that are mutually reinforcing.

The commitment of water to environmental flows (from the total system, and within each component) should be specified by Government in accordance with the principles in the *Water Management Act* 2000 (which recognise that the environment has a prior right to water). The provision of those environmental flows will, effectively, create a 'boundary' on water available for extraction. That, in turn, must influence demand management targets if current security of supply is also to be maintained. Government decisions on actual volumes[14] of environmental flows have been deferred pending further advice from the Government's community-based Hawkesbury Nepean Water Management Forum and the Shoalhaven Illawarra Water Management Committee. The Sydney Catchment Authority's Operating Licence provides for the establishment of an independent expert panel to also inform Government. Such a panel has been appointed by the Minister for the Environment in consultation with the Minister for Land and Water Conservation and the Healthy Rivers Commission[15].

However, given the lead-time required to develop alternative sources of supply, quantification of those environmental flows is now urgent. Government decisions require those two bodies to provide integrated advice across the two catchments. The Commission believes that such advice must *also* be informed and influenced by the decisions about the provision of alternative sources of supply. Government decisions about future stormwater management in the metropolitan area *and* options for reuse of sewage discharge must be considered *together* with the quantification of environmental flows and the need to maintain security of supply. Recommendations in this Report related to water supply management (RF 1) and stormwater / sewage management (WM 1) address this now urgent requirement.

The recent Sydney Water Corporation decision to review and update *WaterPlan 21* presents a useful vehicle with which to explore in detail many of these matters and to contribute further to giving effect to those recommendations. Sydney Water advises that the review will aim to enhance the existing strategy, and to incorporate water, stormwater and sewage management provisions into a comprehensive planning process. It would therefore allow

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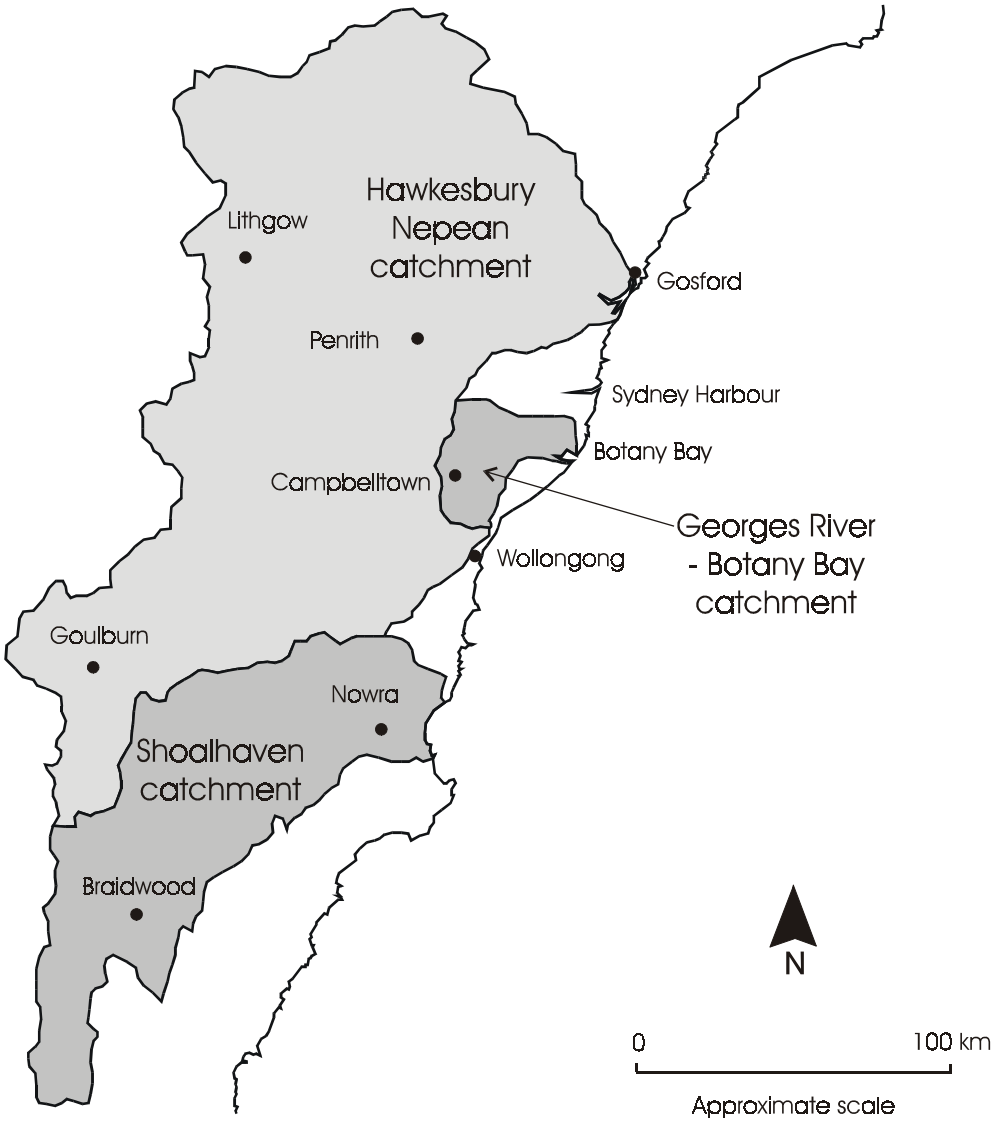
[14] As an *interim* measure, an environmental release equivalent to the 95th percentile flow has been imposed on the Sydney Catchment Authority's storages on the Hawkesbury Nepean system.

[15] The expert panel is being chaired by Mr Robert Wilson.

consideration of trade-offs amongst investment options, for example, between sewage treatment plant upgrades and installation of water efficient devices. The Commission endorses such an approach, and advocates that it be linked to consideration of all water users, including those that draw water directly from the river systems.

As noted, it will be essential for the many relevant agencies with disparate powers and responsibilities to work closely together at both the operational and strategic level. The challenges in this regard will be significant. The Commission believes that a strategic level Task Force, reporting to the Government through the Premier or a designated Minister, is needed to ensure the necessary degree of integration and appropriate attention to *system*-based planning and implementation strategies. That Task Force should comprise the Chief Executive Officers of the Sydney Water Corporation, Sydney Catchment Authority, Department of Land and Water Conservation, Environment Protection Authority, NSW Health and Department of Urban Affairs and Planning. The Taskforce would also guide the implementation of the Commission's Recommendations RF 1 and WM 1 subject to Government endorsement.

River catchments connected by the water supply system



PART B

Recommendations

River flows and water supply

RF 1 Water management in the Sydney metropolitan area

Lead Agency: ***Department of Land and Water Conservation***
Key Others: ***Sydney Catchment Authority, Sydney Water Corporation, Environment Protection Authority, NSW Fisheries, NSW Health, Department of Urban Affairs and Planning.***

Key elements of the water cycle in the metropolitan area, including water supply, stormwater and sewage, should be managed in an integrated way. Environmental flow releases from all Sydney Catchment Authority storages on the Woronora, Hawkesbury Nepean, and Shoalhaven rivers should be designed to *optimise* river health benefits across the three catchments. *At the same time* complementary demand management measures should be strengthened to maintain the adequacy and security of water supplies to the metropolitan area and other users.

This will require:

a. early determination of environmental flow releases from water supply storages;

b. criteria for the management of prolonged droughts, including protocols for the sharing of water and possible adjustments of environmental flow releases;

c. stronger demand management, including adoption of water efficiency devices and alternative supply options; and

d. stormwater and sewage effluent to be managed in a way that would facilitate their use as supplementary supplies for make-up of environmental flows and *existing* users (in the first instance for non-potable purposes), pursuant to Recommendation WM 1.

Securing effective demand management, reuse and adequate environmental flows should be made the *common* goals of the Sydney Catchment Authority, Sydney Water Corporation, Department of Land and Water Conservation and Environment Protection Authority. A strategic level Task Force, comprising relevant CEOs should be established to give effect to those common goals. All relevant licences and review processes (including those done by IPART, and the update of *WaterPlan 21*) should facilitate the achievement of those goals (including the need to take account of decisions by Government in respect of the weirs on the Nepean and effluent re-use in the Penrith Lakes). In particular, the water management licence of the Sydney Catchment Authority and the Operating Licence of the Sydney Water Corporation should specify the relevant requirements and provide for adaptation as feedback dictates.

Rationale for recommendation RF 1

The Commission has found that ecological river health downstream of all major storages is affected, to varying degrees, by flow reduction. Storages have especially affected the low to medium flows, which are particularly important to river health. However, it is also in these dry periods when the supply authority receives the greatest demand for water from metropolitan users, supplied through the Sydney Water Corporation's distribution system.

Accordingly, to maintain current security of supply[16] while providing for an appropriate environmental flow regime, all demand management strategies[17], including adoption of alternative supply options, must be more stringently applied.

Since, as previously noted, the provision of environmental flows must strongly influence demand management, it is critical that appropriate environment flows from *all* the major storages supplying the metropolitan area be quantified without delay. As in earlier Inquiries involving major storages, the Commission has recommended an adaptive management approach for the Woronora River, which would allow an initial flow regime to be set, followed by appropriate environmental monitoring. Flow rules would be adapted over time in response to the results of that monitoring and to an evaluation of impact on security of supplies. (Recommendation RF 2 refers). So long as such an adaptive approach is accepted, initial flow determinations could, and in the Commission's judgement should, be made quickly, without the need for full scientific certainty. The current community-based committee structure will require significant advice and assistance if it is to address adequately all the many aspects of water cycle management (as set out in the following) that must be determined in concert with decisions about environmental flows.

Water sharing criteria and operational protocols need to be made explicit and take into consideration equity issues for *all* water users, including riparian users, irrigators, town water supply and the environment[18]. The need for a drought management plan is obvious and criteria under which there might be an adjustment of environmental flow releases during a prolonged drought need to be developed in agreed and transparent ways across all components of the water supply system.

The aim of optimising river health benefits across the system means that in determining drought management criteria, there must be consideration of where the greatest ecological benefit per volume of release might accrue. For example, benefits to the Woronora River are likely to be high and realisable because the freshwater part of that river downstream of the storage is particularly flow-deprived. Flow deprivation is also the *only* major adverse impact on this section of river, where water quality is good and where there is a fully vegetated riparian zone and minimal catchment development[19]. By comparison, in the Shoalhaven,

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[16] The Commission is taking the current level of reliability and security of supply as given. That does not mean that it would be adverse to an increase in the frequency of water restrictions.

[17] Including, for example, extension of the Government's decisions on dual flush toilets to other water using appliances, and enhancing Sydney Water's retrofit program for private premises.

[18] This principle is consistent with the different classes of licensed water use approved in rural areas. It could reasonably be argued, for example, that environmental flow releases should not be reduced unless restrictions on outside water use (for parks and gardens) were also in place.

[19] That situation changes downstream of the Heathcote Creek junction, where inflows are affected by residential development and sewerage overflows.

regardless of environmental releases, significant volumes of water are continuously released from Tallowa Dam for later extraction by Shoalhaven City Council at the tidal limit, some 26km downstream, so provision of additional environmental flows is less crucial to river health[20]. In the Hawkesbury Nepean catchment, river reaches downstream of the storages are subjected to many other stressors, including the presence of many weirs[21], significant channel enlargement through dredging, loss of riverine vegetation, significant bank erosion and pollution from stormwater, stock access and sewerage discharges. Any one of these could limit the value of environmental releases from potable water supplies in such periods.

Increasingly, there will be a need for alternative supply options, including water tanks and reuse of 'wastewater'. For example, a system-wide assessment of all sources of supply to meet the environmental flow targets would evaluate opportunities for utilising treated effluent from West Camden STP for irrigation in the upper Nepean as an alternative source of irrigation water to pumping from weir pools. (Government decisions already require consideration of reuse of effluent currently discharging to South Creek to be used in the Penrith Lakes Scheme.) The Commission notes that the Sydney Water Corporation is considering options for reuse of effluent from sewage treatment plants at Glenfield, Liverpool and Cronulla for reuse in industrial areas at Botany and Kurnell. Such opportunities need to be seized across the greater metropolitan area.

The limited capacity of the river systems to meet all of the demands placed on them should influence long-term planning for the metropolitan area. This should examine how appropriate siting of new development may help to contain growth in water demands. For example, new low density housing at the urban fringe in drier parts of the Sydney Basin is likely to stimulate more demand for water for gardens etc, than medium to high density housing associated with redevelopment proposals closer to the coast. The Commission considers that such 'macro' considerations are just as important as water sensitive urban design criteria that tend to target development at the local level. (Recommendation WM 2 refers.) Both will be required in order to offset high water use, thereby providing for environmental flows and maintenance of the Government's commitment to defer indefinitely the construction of Welcome Reef dam.

The urgency with which alternative supply options will need to be developed make it paramount that stormwater and sewage effluent are managed in tandem with the provision of environmental flows and metropolitan water supplies. (Recommendation WM 1 refers.) It is therefore critical that *all* relevant state agencies be required to use their legislative, planning and regulatory powers in complementary and mutually reinforcing ways to achieve the river health goals aspired to by the community and committed to by the Government's water reform program.

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[20] The more important impact on river health in that river is the obstruction of fish passage to some 80% of the catchment by the dam structure itself.

[21] The Government's decision on the Hawkesbury Nepean Inquiry requires a review of those weirs: the goal being to *"remove the maximum number of weirs consistent with providing alternate, secure water supply to existing users, and to ensure that any remaining weirs provide for fish passage."* (NSW Government 2001b)

RF 2 Environmental flow releases from Woronora Dam

Lead Agency: ***Department of Land and Water Conservation***
Key Others: ***Sydney Catchment Authority, Sydney Water Corporation,***

For Woronora Dam, an adaptive regime for management of environmental flows should commence with the releases shown in Table 2.1. Requirements for flow releases should be incorporated into the water management licence issued to the Sydney Catchment Authority by the Department of Land and Water Conservation. Releases should commence as soon as practicable but no later than 1 January 2003.

The licence should create a management regime, with specific requirements that:

- **an appropriate environmental monitoring program be implemented, as soon as possible, but no later than December 2001 (to provide 12 months of pre-release data);**
- **the results of the monitoring program be reported both to the Department of Land and Water Conservation as part of the Annual Monitoring and Compliance report, and to the public through the Sydney Catchment Authority's Annual Report;**
- **the hydrologic data base for the Woronora River be improved, to allow better estimation of the daily flow duration curve, by using a combination of existing data, measurement of inflows on the major storage tributary and hydrologic modelling;**
- **in conjunction with the Sydney Water Corporation and the Department of Land and Water Conservation, the Sydney Catchment Authority develop a drought management plan, which links any proposed reductions in environmental flow releases across its supply storages to restrictions being put in place for other users;**
- **environmental flow provisions from Woronora Dam and all other storages within the water supply system be reviewed on a five yearly basis and adjusted as necessary in response to monitoring results. Such review should provide for community input.**

Table 2.1 Recommended initial environmental flow rules for Woronora Dam

Flow Condition	Environmental Flow Requirement
When inflows are less than 5 ML/d	Release full inflow.
When inflows are between 5 & 30 ML/d	Release 5 ML/d plus 50% of the remaining inflow.
When inflows are greater than 30 ML/d (when dam is not spilling)	Vary the release at least weekly, between 10 and 50 ML/d, so that the average release over a year is 18 ML/d.
Once per year (July to June), at the time of the first spill after October 1, or by February 1 at the latest	Release 800 ML/d for 3 days (unless the spill exceeds this amount, in which case no such release is required in that year). Section A2.2.2 provides details.
If the storage is drawn down to a predetermined level	Environmental flow releases may be reduced or not required.
The ecological considerations reflected in the above flow regime are based on the expert panel's views of the particular characteristics of the Woronora River ecosystem. The volumetric flows should therefore not be translated into percentiles for application downstream of other storages.	

Rationale for recommendation RF 2

In its Draft Report on this Inquiry (HRC 2000a, pp. 59-62) the Commission recommended an adaptive approach to determining and managing the environmental flow releases required from Woronora Dam[22]. The initial pattern of flows proposed by the Commission was based on ecological objectives recommended by an independent expert panel, appointed as part of the Commission's Woronora River Inquiry (HRC 1999c, pp. 16-22 and 79-81), and on the existing infrastructure available for making releases from the dam. In response to the Commission's draft recommendations (HRC 2000a) the Sydney Catchment Authority undertook system modelling so that the Commission could also assess the socio-economic impact of providing environmental flow options, as reflected in system security, reliability of supply and need for augmentation. The Authority also provided the recommended calibration releases from the dam, under observation of the expert panel[23] and Commission officers. Investigations associated with that work have since been reported to the Commission, and the expert panel has provided its independent advice on the outcomes. (Appendix A2 provides a summary.)

After considering the results of all those investigations, the Commission has concluded that its recommended environmental flow regime should be established for Woronora Dam *without delay*[24]. Ecological benefits of such flows are likely to be high because disruption of flows is presently the main impact on river health downstream of the dam, and the *only* adverse impact between the dam and the confluence with Heathcote Creek (a distance of 12 kilometres). The economic impacts of those releases are judged, based on available information, to be tolerable in terms of system security and continued deferment of augmentation, *so long as demand management targets are met*. (HRC 2000a, pp. 116-118 provides a more detailed summary of the modelling.) The social impacts of environmental flow releases largely arise in times of prolonged drought when competing interests are exacerbated due to scarcity of supply. The interests of *all* water users must be considered at such times and restrictions need to be addressed on an equitable basis[25], pursuant to Recommendation RF 1. As part of the recommended drought management plan, and following further modelling by the Sydney Catchment Authority, the Commission advocates a minimum level below which environmental flow releases may need to be modified to provide for essential water supplies in the event of prolonged drought.

Environmental impacts of the recommended flow regime will require ongoing monitoring. A scientifically valid environmental monitoring program should be established as soon as possible and *no later than December 2001*, to ensure that there is at least 12 months of pre-release data available for future adaptive management purposes.[26] The way the process is managed must be able to adapt, within defined limits, to new information. That is because

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[22] That approach is consistent with the Commission's recommendations, endorsed by Government, for storages on the Hawkesbury Nepean and Shoalhaven rivers.

[23] Not all panel members were the same as in the initial round of investigations in HRC (1999c).

[24] This was strongly recommended by the expert panel, who stressed that releases of environmental flows should not be delayed pending any further investigation. Actual volumes and patterns of flow can be adjusted over time in response to monitoring.

[25] For example, the Commission considers it would be inequitable for water use in Sydney to continue unabated if other users are placed on significant restrictions. HRC (1999b, pp. 123-126) provides detail.

[26] The Commission understands that the Sydney Catchment Authority engaged the Cooperative Research Centre for Fresh Water Ecology to develop such a monitoring program.

the recommended environmental flow regime is based on a combination of environmental, social and economic considerations, which have been informed by limited available data.

The Commission considered:

- the expert panel's conclusions in relation to ecosystem needs;
- the security of supply as defined using the Sydney Catchment Authority's current criteria for reliability of supplies; and
- a preliminary judgment that the required flows could be released without major infrastructure changes to the dam, as advised by the Sydney Catchment Authority based on its preliminary assessments.

Accordingly, that flow regime must be able to be adjusted over time based on the results of the monitoring program and any further assessment of socio-economic impact that may be undertaken. In addition, the current hydrologic data base for the Woronora River is poor and needs to be improved in order to develop a daily flow model to better inform decision-making.

Once the environmental flow regime has commenced in the Woronora River the existing limits on extraction from the Woronora reservoir[27] may be able to be removed. The Commission believes that the recommended environmental flow regime is likely to fulfil the intent of that protocol. However, the Commission has not been able to determine the specific effects of the removal of the protocol and suggests that this be modelled by the Sydney Catchment Authority and reviewed by the Department of Land and Water Conservation as part of ongoing adaptive management.

Submissions on the Draft Report (HRC 2000a) called for increased community involvement and dissemination of information about the flow releases. They signalled the need for a "*greater degree of conservation group stakeholder involvement in discussing, developing and endorsing specific flow objectives and developing transparent monitoring and compliance protocols*". The Commission supports this view and has incorporated public reporting of the environmental flow process and community input into the regime designed to provide adaptive management, outlined in Recommendation RF2.

Prospect Reservoir

A few submissions on the Draft Report (HRC 2000a) have called for provision of environment flows from Prospect Reservoir. In that regard, the Commission found that for approximately two years prior to September 2000, Prospect Reservoir was spilling on a regular basis. Those flows were 'artificial' in that they consisted of inter-basin transfers from the Nepean storages[28]. Since that time, the reservoir has been maintained below full supply level in order to prevent spills. The Commission has decided against recommending environmental flow releases for two reasons. Firstly, the 5km^2 catchment is too small to contribute any significant flow - even in very wet weather, natural inflows are so small they roughly equate to evaporation rates. Secondly, the loss (from natural conditions) of that flow

[27] These limits were imposed when the Woronora Filtration Plant was commissioned, as a mechanism to limit daily extraction in an effort to prevent adverse effects on the downstream aquatic ecology through decreased frequency of spills from the dam.

[28] Some of the suburbs supplied by the Woronora Dam can also be supplied from Prospect Reservoir.

would be more than compensated for by the increased flows that would be expected from the now significantly urbanised areas of the Prospect Creek catchment downstream of the reservoir.

Although the Commission does not see a need, based on current information, for environmental flow releases to be made from the reservoir, it recommends the identification of ways in which the Sydney Catchment Authority and/or Sydney Water could contribute to environmental improvement programs downstream of the reservoir. Such contributions should be seen as 'offsets' for impacts the reservoir may be having on instream needs and community amenity.

RF 3 Provision of fish passage

Lead Agency: ***NSW Fisheries***
Key Others: ***Department of Land and Water Conservation***

The effectiveness of the concrete and vertical slot fish ladder at Liverpool Weir should be evaluated as part of an ongoing maintenance program in order to inform future decisions about the cost-effectiveness of such structures. In the event that the weir fails in future, it should not be rebuilt unless there are compelling socio-economic reasons to do so and then only if the adverse ecological effects can be adequately managed at reasonable cost.

Rationale for recommendation RF 3

The Commission is concerned about the high cost of this fishway, both in terms of initial cost and cost of repairs after floods. The effectiveness of the fishway should be evaluated and the results compared to those found in evaluation of other design types, including the rock ramp styles on the nearby Nepean River[29]. The Commission is also concerned about the dubious value of the weir itself and recommends that it be assessed as part of the state-wide weir review being undertaken by the Department of Land and Water Conservation and NSW Fisheries. The impact on fish passage of other minor structures described in Section 6.2 of HRC (2000a) should also be investigated. However, in the light of submissions received, the Commission judges that they are not of sufficient importance to warrant a separate recommendation[30].

[29] A study by NSW Fisheries (Gehrke et al, in prep) found that several species of freshwater fish present below the weir are absent above the weir. Other migratory species are present above *and* below the weir. This indicates that species recovery has been mixed since the fishway was constructed and its effectiveness to date is therefore uncertain.

[30] In the case of a structure on Commonwealth land in Williams Creek (reported in HRC 2000), the Department of Defence has advised that it is in fact a temporary structure, installed as part of a broader project to address problems of sedimentation in Williams Creek resulting from erosion of tracks in the area. A staged removal of the gabion weirs to reintroduce the tidal regime to the creek is part of the project.

WM 1 Improved institutional arrangements for wastewater management

Lead Agency: ***Stormwater Trust***
Key Others: ***Environment Protection Authority, Sydney Water Corporation, Ministry of Energy and Utilities, Department of Local Government, IPART, Department of Urban Affairs and Planning, Department of Land and Water Conservation.***

More strategic and clearly defined institutional arrangements should be introduced to integrate key elements of water cycle management involving stormwater, sewerage and water supply services and to provide a metropolitan-wide approach. There are several ways in which this might be accomplished, but the most obvious option would be for the Government to assign the Sydney Water Corporation clear responsibility *and accountability* for assuring integrated stormwater management across the metropolitan area. That would require Sydney Water to manage and maintain the trunk drainage system and to lead in providing system-wide integration.

Such an arrangement would continue the momentum created by the state-wide stormwater improvement program led by the EPA. There would continue to be a heavy reliance on the responsibilities of local councils, although some stormwater assets presently owned by local councils, but integral to the trunk drainage system, could be transferred to Sydney Water.

A 'mid-term' review should be carried out by the Stormwater Trust, in close consultation with the Environment Protection Authority, Sydney Water, IPART, Ministry for Energy and Utilities and local councils. This should adopt, as its starting point, that the institutional arrangements must provide for:

- **clear accountability for outcomes across the metropolitan area and achievement of synergies among programs dealing with key elements of the water cycle;**
- **improved capacity to use more of the 'wastewater' stream (appropriately treated sewage and stormwater) to augment supply options for at least non-potable uses, pursuant to Recommendation RF 1;**
- **sustainable long-term funding as, for example, *via* Sydney Water's existing collection mechanism, with pricing to be determined by IPART for long-term cost recovery;**
- **effective (contractual) partnership arrangements with and among councils so that coordinated stormwater management projects can be mounted in cost-effective ways for the catchment/metropolitan area;**
- **independent and public audit of 'trunk' stormwater management, including the effectiveness of local government partnership agreements, through the established IPART mechanism;**
- **continued overview of local council stormwater planning and implementation by the Environment Protection Authority.**

Rationale for recommendation WM 1

The Commission commends the current program to improve stormwater management, including planning, education and seed funding initiatives that is being led by the Environment Protection Authority. It equally commends the enthusiasm with which many local councils have embraced improved stormwater planning. However, evidence from this Inquiry suggests there is still much progress to be made in the following three areas.

- Integration of the management of key elements of the water cycle. Stormwater, sewerage and water supply service delivery must be managed holistically in ways that are both cost effective and equitable, and which sustain and improve river health[31].

- Establishment of a long-term sustainable source of funding, not dependent on Government grants.

- Removal of impediments to effective stormwater outcomes. These include fragmented ownership, planning and management, which lead to poor coordination and lack of accountability for outcomes. Because there is no accountability for whole-system goals across the entire stormwater system of metropolitan Sydney, the projects of strategic importance *across* that area are unlikely to be implemented. (The Commission has heard that very few councils, if any, would be committed to spending rate-payer funds in another council's domain to secure a better overall result. Any proposal to raise revenue locally would therefore not be sufficient in its own right.)

Accordingly, the Commission's recommendations are, in effect, a proposal for a *further stage* of the stormwater improvement in Sydney and surrounds, and are entirely consistent with the recommendations of the Stormwater Trust review of the first three years of that program (Stormwater Trust 2000). The proposals are not alternatives to, and would not undermine, what has occurred in the current three year planning cycle and what may occur in the second stage approved by Government. The Commission recognises that councils, Sydney Water and the Roads and Traffic and Authority have committed to current works programs as outlined in stormwater management plans and is in no way suggesting that this work be ignored or undone. Details of the Commission's findings are in HRC (2000a, pp. 68-81).

After many discussions with key stakeholders[32], and review of stormwater management elsewhere, the Commission has concluded that the Sydney Water Corporation is best placed

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[31] Many submissions on the Draft Report expressed strong support for improved stormwater management and more effective integration of stormwater and sewage overflow management. One submission suggests that, "i*nstitutional arrangements for stormwater management across the metropolitan area will need to be reviewed but they should not be changed until councils and stormwater managers have had an opportunity to implement the recently completed stormwater management plans."*

[32] For example, Sydney Water and the Stormwater Industry Association have expressed strong support for the Commission's approach (SIA (2000) provides such support in the lead article.) A recent survey (SWC 2000) found that 63% of respondents favoured Sydney Water taking responsibility for managing stormwater across the metropolitan area (22% opposed and 15% did not know). Discussion with the Ministry for Energy and Utilities suggests that the preliminary findings of its review of stormwater management are complementary to those of the Commission. IPART (2000b) recommends that, "*Sydney Water should undertake stormwater projects to improve the effectiveness of the capital expenditure program on sewer overflows."* Both IPART and the Waterways Advisory Panel have called for a change to institutional arrangements to overcome the fragmented ownership and management of stormwater across Sydney. The independent Stormwater Trust evaluation of the stormwater program to date noted support for incorporating stormwater planning into total water cycle management.

to integrate stormwater, sewerage and water supply delivery across the metropolitan area[33]. In the Commission's judgement, this would represent *the most efficient use of existing arrangements*, and would provide the best avenue for integration of management of various services that, together, impact on river health and system integrity. Sydney Water also has an established charging mechanism by which it could rate all contributors for major, system-wide improvements in the stormwater system[34].

That stormwater management fee would form part of ongoing and sustainable metropolitan stormwater funds to be used by Sydney Water directly, as well as being used to fund effective partnerships with councils as a mechanism to secure major systemic improvements and integrated management. As a minimum, those partnership arrangements should target priority areas for source control and co-fund strategic stormwater projects reflecting metropolitan-wide priorities. They should also provide incentives in key areas to secure water sensitive urban design through planning and development approval processes. Pricing would be determined through the existing IPART mechanism and be related to long term cost recovery. Detailed issues related to asset transfer (such as the identification of assets for transfer and any re-distribution of financial obligations and impacts) would also be included in the IPART determination process.

Accountability at the local level would clearly remain with councils as they are the main determining authorities in the development process and managers of their local domains. However, in addition, Sydney Water would be accountable for its own, expanded infrastructure plus overall system performance through the above partnership agreements. That accountability would be incorporated into Sydney Water's Operating Licence, whereby a review of its stormwater management would become part of the independent and annual audit of its performance carried out under IPART's direction.

An additional advantage of the recommended system is that it would provide the basis for more effective negotiations to be carried out with the multiple regulators in setting performance standards for integrated management across key elements of the water cycle. There are other related areas where better integration is also needed. For example, there is a need to link the Environment Protection Authority's stormwater management directions and sewer overflow licensing.

Some have argued that the suggested stormwater model would weaken the important linkages, which exist currently, between councils as stormwater managers and the

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[33] The suggestion that this role could be undertaken by the Sydney Catchment Authority is not supported by the Commission as that body does not have responsibility for providing reticulated sewerage and water supply, nor for any stormwater management, in the metropolitan area. Its focus is on safeguarding the quality of water in its storages through catchment protection strategies *upstream* of those storages in order to provide *bulk* water to the Sydney Water Corporation.

[34] Very preliminary cost estimates for stormwater improvement across the metropolitan area equate to some $45 per household per year over 50 years or some $60 per household per year over 20 years to improve water quality. If those works are coupled with works to restore urban streams and thus benefit aquatic ecosystems and urban amenity, those costs might increase to about $90 and $160 respectively. Details are provided in HRC (2000a, pp. 119-121). One submission on the Draft Report notes that such cost estimates are too high as they do not consider existing expenditure. The Commission did not intend for those costs to represent only *additional* expenditure and recognises that some of the necessary work is already being undertaken. The figures represent a broad estimate of *overall* costs. In addition, the Commission advocates that improvements to urban streams and stormwater systems be undertaken on a priority basis guided by the Management Goals in Table 7.2. Some submissions also note that s94 contributions should be reviewed in order that they could be used for addressing stormwater impacts remote from the actual development site from which they are raised.

community and/or between councils' stormwater management and land-use planning processes. The Commission does not agree with that view - rather, it considers that under the proposed arrangement councils would be *more* able to focus their effort and resources on local system management and planning.

In reviewing the responses to its Draft Report, the Commission has carefully considered the various concerns raised about its proposed arrangements for stormwater management. It remains confident that the risks associated with those concerns are well outweighed by the potential benefits of the approach proposed in Recommendation WM 1. Those benefits include the potential to address the community's concerns about situations where flooding of major stormwater and sewerage systems occurs and leads to surcharges of sewage into residential properties and riverine and bay environments, with consequent public health risks. The Commission believes that the approach in Recommendation WM 1, *together* with the approach in Recommendation RF 1, makes best use of existing institutional arrangements and provides the most effective means for the integrated management of water supply, sewage *and* stormwater in order to achieve the most cost-effective, overall outcome. It therefore recommends that this proposal *should serve as the benchmark against which any other options might be considered.*

The Commission's proposal would provide some opportunity for recent stormwater and other planning initiatives to gain further momentum and avoid any risks of their dislocation associated with what must represent the next critical stage in integrated stormwater management for metropolitan Sydney. Importantly, it would facilitate the integrated management of key elements of the water cycle pursuant to Recommendation RF 1.

WM 2 Integrated stormwater management at the local level

Lead Agency*: *Department of Local Government
Key Others:* *Local councils, Sydney Water Corporation, Environment Protection Authority, Department of Urban Affairs and Planning, Department of Land and Water Conservation

Local councils should retain responsibility for local stormwater systems. Management of these systems should form an integral part of councils' overall environmental management strategy, including the application of planning controls, flood controls, maintenance of urban streams and undertaking of engineering works. Water sensitive urban design principles should be given effect through that integrated management. Funding should be generated, as now, by rating revenue, but should be augmented if necessary by special rates aimed at improving environmental management, and through partnership agreements with the Sydney Water Corporation, pursuant to Recommendation WM 1.

Councils should ensure that costs of ongoing stormwater and urban stream management are included as costs of development and redevelopment from the outset. The costs involved in identifying cumulative impacts on water bodies, installing and maintaining detention basins and sedimentation ponds, and in undertaking appropriate monitoring, should be *s*hared amongst *all* developers in a particular subcatchment area, and should not be borne only by those responsible for large-scale developments.

Rationale for Recommendation WM 2

The Commission has acknowledged the many environmental management responsibilities that increasingly have been assigned or devolved to councils, and commends council attempts to meet those challenges. However, it remains convinced that councils' stormwater management plans must be integrated with plans relating to other council functions - a principle endorsed by Government in its decisions on the Commission's Hawkesbury Nepean Report (HRC 1998).

The Commission believes strongly that substantial river health and economic gains would be made if councils managed their environmental domain across all their departments. That is especially the case in the area of stormwater management, which is well placed to sustain urban streams through decisions that are well integrated with those for landuse planning. For example:

- in 'greenfield' sites, integrating the provision of open space with the maintenance of natural channels would provide benefits for river health, the community and developers alike;
- in redevelopment proposals, maximising opportunities for the improvement of stormwater and instream habitats would also provide improved river health and urban amenity at least cost to councils and their communities[35];
- in councils' ongoing maintenance activities, making works programs complementary with stormwater management goals and the maintenance of ecological functions in urban streams should provide for more cost-effective outcomes.

Management of stormwater at the local level must therefore not be isolated from other related council management functions. Such functions may all need to be better funded, but just as importantly, they need to be better *integrated*, and funding them as separate and discrete activities is seldom the best way of achieving that.

The Commission reiterates its view, expressed in its Hawkesbury Nepean Inquiry and endorsed by Government, that councils should be permitted to raise special rates for all their environmental management functions. (Budgeting and prioritising for those functions would form part of the environmental component of the council management plan, also endorsed through the Government's decision on the Commission's Hawkesbury Nepean Inquiry.)

Under the Commission's proposal for strengthening the institutional arrangements for stormwater management, pursuant to Recommendation WM 1, councils would also be provided with assistance through the establishment of partnership agreements with Sydney Water. Amongst other things, those funds would assist councils to facilitate introduction of source control measures across the metropolitan area (with any necessary 'end-of-pipe' solutions also being adequately funded on an equitable basis).

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[35] In its recent evaluation of the current stormwater program, the Stormwater Trust noted that, "*the design and construction of new urban developments – both 'greenfield' subdivisions and redevelopment of existing urban areas – provides an opportunity to cost-effectively mitigate the impacts of urban stormwater upon the environment.*" (Stormwater Trust 2000, p. 38).

WM 3 Stormwater management by public land owners

Lead Agency: ***Environment Protection Authority***
Key Others: ***Sydney Water Corporation, Roads and Traffic Authority, Rail Infrastructure Corporation***

Stormwater management programs throughout the metropolitan region should address more directly the significant contributions to stormwater pollution generated by vehicles and runoff from roads, as well as by litter and weed propagation from rail corridors.

Managers of relevant entities, such as the Roads and Traffic Authority and the Rail Infrastructure Corporation should be required to manage stormwater pollution from those lands far more effectively than at present, and their performance obligations should reflect that requirement. Funding arrangements for stormwater management should reflect the varying sources of costs, including those from public lands. Cost-sharing arrangements with managers of those lands should reflect their increased obligations.

Under the arrangements pursuant to Recommendation WM 1, Sydney Water, as the entity with responsibility for integrated management of stormwater across the metropolitan region, should be entitled to raise funds through charges to such entities, with IPART oversight to ensure appropriate cost recovery.

Rationale for Recommendation WM 3

The Commission's proposals are based on the belief that funding arrangements for stormwater management should reflect both 'user-polluter' and 'beneficiary-pays' principles[36]. A concept of 'beneficiary-pays' underlies requirements for households to contribute to metropolitan-wide improvements, and for councils to manage local environments through ratepayer funds (where rates are not closely tied to stormwater contributions). The Commission believes that 'polluter-pays' should apply in those instances where the relevant contributions could be assessed with some confidence, as is the case for the contributions of road and rail users.

Thus it proposes that these contributors should also bear an appropriate proportion of the total stormwater management costs, through the charges levied by the managers of those public lands[37]. At present, road user charges administered by the Roads and Traffic Authority are generally used to mitigate vehicular impacts on roads. The Commission believes that this should be expanded to address the impact of vehicles on the stormwater system and ultimately the riverine environment[38]. The options through which road users could contribute to stormwater funding according to their road usage should be further

[36] The Commission advocates a user-pays system that would allow full cost recovery, be transparent, be based on catchment management principles, and be consistent with the COAG framework.

[37] This view is supported by IPART (1998), which recommended that the owners of roads that discharge to the SWC stormwater system should be required to contribute stormwater charges.

[38] The EPA and RTA should consider the opportunities to link such a system to the program being developed to address air quality impact of emissions from vehicles, thereby exploiting inherent synergies that may exist between the two programs.

explored[39]. Alternatively the RTA should provide 'bulk' funding from its overall road maintenance budget, either to local stormwater managers[40] or to a metropolitan-wide system manager (as proposed in Recommendation WM 1) commensurate with the amount and impact of pollutants emanating from roads[41].

The Commission has found that rail corridors are also significant contributors to the load placed on the stormwater system in terms of litter and weed propagation and thus believes that the 'polluter-pays' principle should apply also to funding contributions from the Rail Infrastructure Corporation. HRC (1999c, pp. 40-41 & 50-51), and HRC (2000a, p. 78) provide details.

[39] For example, if each motor vehicle registered in Sydney (RTA 1999), excluding motor cycles, contributed just $4 per year, it would provide $7.5 million each year for improvements to stormwater runoff from roads. Using figures from HRC (2000a, p. 121), that could fund construction of 140 GPTs per year plus ongoing maintenance.

[40] The Commission remains unconvinced that the current methodology used by the Roads and Traffic Authority to determine its contribution to local stormwater management is commensurate with such responsibility.

[41] A detailed study of the Cooks River catchment (Hatfield 1997) showed that even in that highly industrialised catchment, streets and gutters accounted for some 30% of impacts from all pollution sources.

BM 1 Integrated management framework for Botany Bay

Lead Agency: ***Department of Urban Affairs and Planning***
Key Others: ***Commonwealth, state and local government and their agencies that are involved in bay management. (HRC 2000a, pp. 158 –164 provides a full list.)***

State planning strategies for the region encompassing Botany Bay should contain a component specifically directed towards the management of the bay as a discrete entity with dynamic geomorphological and biological characteristics, and complex economic and administrative attributes which, together, provide a set of unique management challenges.

A new participative framework should be established for the making of planning and management decisions that will critically impact on the bay and its surrounds. The framework should provide for the early development of common goals *for the bay*, and for the progressive development of a set of strategies to achieve them, consistent with the NSW Coastal Policy. There should be explicit links between that Botany Bay planning framework and the wider planning initiatives within which regional goals will be specified and trade-offs amongst them considered and determined.

The framework for the bay should be established, as an early pilot, in the implementation stages of the State Government's *PlanFirst* initiative. However, in light of its special characteristics, the planning and management framework for the bay must provide for the following, some of which go beyond the present proposals for *PlanFirst*.

- **A stakeholder committee comprising officers from the three levels of government, together with key business and transport interests, environmental and recreational sectors, to develop a strategic plan. The plan must provide a strong conflict resolution mechanism for decisions about competing objectives for bay use and management, including the facilitation of any major trade-offs. It should incorporate an adaptive management approach, including mechanisms for early identification of any need to modify actions being undertaken.**
- **A process to bring political leaders at the three levels of government together to sign off on the strategic plan and to commit to its implementation.**
- **Subsequent collaborative effort, involving the integrated application of relevant powers by NSW government entities and councils (as represented on the above committee) to implement recommendations of the HRC that are endorsed by government, and to implement future government decisions relating to the bay.**
- **Independent science that treats the bay as a whole biophysical system, recognising its dynamic nature, and that identifies causal linkages. Such science should inform the development of a well-accredited predictive model that links the bay's physical behaviour (sand movement, waves and tidal currents) to biological responses, thus providing a firm basis for the identification and management of cumulative impacts.**

Rationale for recommendation BM 1

Botany Bay presents a particular challenge for integrated management due to the high degree of urbanisation, its status as the nation's premier gateway, in terms of sea and air ports, and the many competing interests[42] including:

- Commonwealth, State and Local Government jurisdictions;
- local, national and international transport (including some conflicting requirements);
- major commercial activity, residential, industrial and recreational pursuits;
- significant natural areas, subject to international treaties; and
- terrestrial and aquatic ecosystem requirements and their interface management.

In addition, there is continued pressure to build hard structures, including significant expansion of the port facilities, on what is essentially a highly dynamic sandy system, largely defined by sediment movement from ocean tides / waves and river currents. The pattern of those forces, in turn, is modified by the structures and by various episodes of dredging[43].

The Commission has found that Botany Bay currently has no planning or decision-making framework suited to such a complex system. It believes that the need for a defined, bay-specific framework has become even more important since the release of its Draft Report. This is because Botany Bay is now the only estuary on the NSW coast where no overarching environmental policy underpins management decisions. (The Government has recently extended the NSW Coastal Policy to include the Sydney metropolitan area *except for Sydney Harbour and Botany Bay*. In the case of the harbour, the Commission notes that the Deputy Premier oversights the efforts to integrate policy and actions by the Office of the Sydney Harbour Manager. In the case of Botany Bay, there is no bay-specific arrangement in place.) The very complexity of managing the competing pressures and interests in Botany Bay demands urgent action. It is now critical that Government consideration of this Report leads to new and appropriate arrangements for strategic planning and management for Botany Bay and surrounds, in ways that are consistent with outcomes sought by the NSW Coastal Policy.

The Commission has identified a number of critical success factors that ***any*** integrated management arrangement must meet (HRC 2000a, pp. 169-170 provides detail). In summary, these are as follows.

1. Political commitment and public sign-off on strategic direction and implementation of major projects
2. Public accountability for implementation
3. Independent and credible scientific input to aid decision-making
4. Comprehensive stakeholder participation
5. Defined conflict resolution mechanisms
6. Defined leadership and champion roles

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[42] HRC (2000a, pp. 42-52) provides detail.

[43] Technical details are provided in a background paper (Cowell & Kannane 2000) and summarised in HRC (2000a, pp. 145-157).

7. Integration of environmental / economic / social outcomes across sectors
8. Links between bay, waterways and catchment
9. Funding from private and public sectors

There are several multi-agency bodies established to provide coordination and exchange of information for matters related to Botany Bay and its catchment, including the recently established Southern Sydney Catchment Management Board (whose geographical area coincides with that of this Inquiry). However, in the Commission's judgement, *none* of the existing bodies meets all or most of the above critical success factors for future planning and management[44].

Accordingly, in its Draft Report (HRC 2000a, pp. 49-55) the Commission proposed a particular model for the integrated management of Botany Bay. Submissions on that Report expressed widespread agreement about the *need* for an effective integrated management arrangement, for example, "*to coordinate conservation, resource and activity management in the Bay*". However, there were varying degrees of support for the actual model presented. Some parts of the Commonwealth and State Government expressed support, as did local councils around the bay. Some community groups felt it may be too bureaucratic, whilst some State agencies expressed a degree of opposition, often for differing reasons.

This has led the Commission to stand back from any specific model. The Commission continues to hold strongly that an arrangement that provides for integrated management of Botany Bay *must* be put in place. Its final recommendation focuses on what a successful framework for Botany Bay would have to achieve, rather than proposing any one detailed or specific model. The State *owns* the bed of the bay and most of its surrounds, and is the main determining authority for major development *within* the bay. The Commission therefore remains convinced that the State must take a lead role in entrenching more satisfactory integrated planning and management arrangements and the framework within which that is to occur. The Commission has proposed that the Department of Urban Affairs and Planning should lead the refinement and implementation of the framework, building on the key elements and principles the Commission has identified here.

Recent and proposed changes to legislation and policy present unique opportunities to overcome the obvious shortcomings of current institutional arrangements. Those include the review of the *Environmental Planning and Assessment Act* 1979 with the subsequent proposals for *PlanFirst* regional planning forums/strategies, the new *Water Management Act* 2000, and the review of the *Ports Corporatisation and Waterways Management Act* 1995. The Commission has referred to those new and proposed instruments in refining its recommendations BM 1 to BM 7. In particular, the Commission proposes that Botany Bay and its environs be used as a sub-regional pilot under the *PlanFirst* proposal, to agree on common directions and reduce conflict between state agencies, and to negotiate common strategies with local and Commonwealth interests.

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[44] For example, although the Catchment Management Board has been charged with developing a strategic plan, it has no powers to implement, and no resources with which to fund works, studies or independent advice. Some have asserted that the Board does not even have the facilities for custodianship of catchment data. The Board has no widely recognised champion, and is not inclusive of many stakeholders, especially those with a special interest in the bay, whether that interest be oriented towards the commercial, transport or environment sectors.

The framework proposed in Recommendation BM 1 would involve the development of a strategic plan for the bay that would set out agreed goals and progressively develop strategies to achieve them. The Commission stresses the following key attributes of the proposed framework.

- It would inform decisions and courses of actions, set common goals and create momentum towards agreed strategies. The aim is that, over time, agreement and concerted action would become more commonplace and the processes underpinning the instrument would engender mutual trust.
- It would improve decision-making and *create a context* within which powers are exercised predictably and consistently. Actions would increasingly become convergent and complementary and would create far fewer surprises.
- It would recognise the need to sustain commerce, citizens and their lives as well as the ecology. It would therefore identify any necessary trade-offs and provide an appropriate context in which proposals for developments are properly assessed and major necessary change in management and restoration strategies are carried through.
- It would recognise the disparate roles and varying interests of the many agencies and councils involved, but would link them in ways designed to encourage improved whole-system management and better community interaction with the public sector.

The challenge will be to establish that framework, secure public sign-off by key stakeholders and secure the confidence of the local community. A widely accepted mechanism is required to resolve conflicts arising from the varying interests in the determination of common goals. In that regard, the prospect of securing agreement would be enhanced by access to credible and independent science, capable of informing decision-making whilst accommodating the uncertainties surrounding physical and biological processes operating in the bay, as well as future planning and management priorities. An *adaptive* management framework will be essential.

Once the framework is in place, all relevant stakeholders with decision-making powers and operational roles, should be required to use their powers in accordance with the strategic plan. For example, when the Department of Land and Water Conservation considers issuing approvals to the Sydney Ports Corporation or the Waterways Authority for 'controlled activities' within the bay, pursuant to the *Water Management Act* 2000, it would do so in the context of the determined goals and strategies of that plan. Likewise, when agencies make decisions about commercial shipping and recreational boating, they would do so in ways consistent with the goals of the plan and the needs of the wider system.

It would be critical that decisions about major projects in and around the bay are within this broader planning and management context, subject to Government endorsement. In particular, the assessment for, and decision on, major projects such as port expansion should be undertaken within the whole-of-bay context advocated in Recommendation BM 1 and pursuant to Recommendations BM 2 and BM 3. Government decisions on this Inquiry should therefore *precede* decisions on the commencement of such major projects.

The Commission notes that the Sydney Ports Corporation would benefit (in terms of public acceptance of results) from independent whole-of-bay science informing its future planning and management processes. It would thus benefit considerably by contributing to funding an independent centre of excellence for bay studies, as would other major commercial bay stakeholders, including the Commonwealth.

BM 2 Accountability for 'resource management' within Botany Bay

Lead Agency: ***Department of Transport***
Key Others: ***Waterways Authority, Sydney Ports Corporation, Department of Land and Water Conservation***

The arrangements for natural resource and environmental management, including marine policy, in Botany Bay and surrounds should be clarified and strengthened. This is particularly important in relation to the exercise of operational, transport and commercial responsibilities.

A new context for management and planning has been created in the State by the new *Water Management Act* 2000, the proposed *PlanFirst* initiatives and the significant changes in the way Government and citizens expect agencies and corporations to manage natural systems and resources. In that regard, the existing arrangements for Botany Bay should be reviewed to identify the best ways:

- **to make the responsibilities of the Sydney Ports Corporation and the Waterways Authority related to environmental management more consistent with contemporary community expectations;**
- **to specify the responsibility for marine/coastal policy, and establish arrangements so that efforts between agencies and corporations are better integrated in a common thrust to achieve more comprehensive environmental management;**
- **to revise existing legislation so that necessary changes in role and modes of operation are clearly established at law, provide for separation of operator-regulator roles and include provision for independent validation of performance (the Commission notes, for example, the requirements placed on other public utilities such as Sydney Water);**
- **to augment funding available for environmental improvement works/studies/controls within Botany Bay (that could include the introduction of an environmental management component in the port shipping and other user charges);**
- **to develop a formal "Waterways Management Policy for Botany Bay and its Tributaries" similar to that developed for Sydney Harbour and its tributaries, in the context of the integrated management framework of recommendation BM 1.**

Rationale for recommendation BM 2

The Commission found that administrative and ownership arrangements within the bay essentially meant that no one agency could be identified as the 'resource manager' for the bay (HRC 2000a, pp. 50-51 provides details). Activities such as dredging and reclamation in the bay have required the approval of NSW Waterways under the *Rivers and Foreshores Improvement Act* 1948. In turn, that agency relied heavily on engineering assessments contracted out to the Sydney Ports Corporation, which had inherited expertise from the previous Maritime Services Board. During the Inquiry, some citizens expressed concern that such arrangements were unsatisfactory because the approval and assessment procedures did not appear to be separated adequately from user interests. There was therefore some lack of public confidence in the results. The Commission, in its Draft Report, stressed that the body

of expertise and knowledge held by key officers distributed across the Waterways Authority, the Sydney Ports Corporation and the Department of Transport should be recognised and valued. Linkages should be formalised and better integrated if the bay is to be protected and well managed into the future. However, it also recommended that user interests should be clearly separated from the assessment procedure.

Since release of the Commission's Draft Report, the new *Water Management Act* 2000 has been passed. That legislation assigns clear responsibility for all state waters, including coastal and marine, to the Department of Land and Water Conservation. The Act requires that all water sources be managed *"in a way that achieves their protection, conservation and ecologically sustainable development"*. The Commission welcomes such formal objectives in relation to Botany Bay, and believes that careful application of the principles contained in the legislation will help to distance assessment procedures from user interests.

The Commission has been advised that any future dredging and reclamation works will require an approval for 'controlled activities' pursuant to the *Water Management Act* 2000 from that department. The environmental responsibilities of NSW Waterways and the Sydney Ports Corporation should be more clearly articulated and strengthened under their legislation, in part, to complement the strengthened resource management role of the Department of Land and Water Conservation.

BM 3 Assessment procedures for activities within Botany Bay and surrounds

Lead Agency: ***Department of Urban Affairs and Planning***
Key Others: ***Department of Land and Water Conservation, Waterways Authority, Sydney Ports Corporation, National Parks and Wildlife Service, NSW Fisheries***

Comprehensive assessment of the impact of specific proposals on the whole Botany Bay system, including assessment of cumulative impact, must be a pre-condition for any approvals for significant activities within the bay and surrounds (including those pursuant to the *Water Management Act* 2000).

Such assessments are essential to ensure that aquatic ecosystem protection (including geomorphological response) are fully considered when decisions are being made on specific development proposals. They should address the impact of proposals on sediment transfers around the entire bay system, including the secondary impact of any changes in sediment transfers on aquatic flora and fauna, migratory bird habitat and feeding requirements.

Resulting decision-making should be undertaken within the management framework recommended in BM 1.

Rationale for recommendation BM 3

The Inquiry has highlighted that Botany Bay is a highly dynamic and complex physical system which forms the substrate for an equally complex biological system, ranging from tiny organisms and seagrasses that live in the sediment to fish and shell fish, which form part of the human food chain. The physical features of the bay have evolved in response to natural, long and short-term processes, and will continue to do so. The consequences of this natural evolution will continue to appear as changes in shoreline configuration. The natural pattern of evolution and bay behaviour have been significantly influenced by large-scale engineering works, including major episodes of dredging, reclamation and construction. Changes in water movement, sand distribution and shoreline have resulted. In some cases, these engineering-induced changes have been expected; in others, they have not.

The most important issue that future management must address is that Botany Bay behaves as one single geomorphic and biological *system*, and the processes that move water and sand and change the physical characteristics of foreshore areas *interact throughout the entire bay*. Proper understanding of changes in the geomorphology of the bay, brought about by natural or human-induced processes or by the interaction of both, must be based on consideration of the bay in its entirety. This whole-system perspective must determine future management, including the design of engineering works, if adverse impacts are to be minimised[45].

In the absence of such a broader perspective, adequate assessment of individual proposals is difficult if not impossible. The Commission's findings (in HRC 2000a, pp. 43-47 and Appendix 6 of that report, pp. 145-157) provide detail that should be incorporated into any assessment process[46].

To ensure that appropriate and timely decisions are made, biophysical assessments must also be undertaken within an institutional framework that allows due consideration of socio-economic impacts and benefits, and involves the three levels of government with operational responsibilities in the bay, together with industry and the community. (Recommendation BM 1 refers.)

[45] The Commission also notes that any activities in the bay that may affect the RAMSAR site on the southern shores, or any listed migratory species such as the Little Tern, would automatically trigger the provisions of the Commonwealth's *Environment Protection and Biodiversity Conservation Act* 2000. That legislation also has third party review rights, which could lead to review by the Federal Court.

[46] A background technical paper is also available from the Commission (Cowell and Kannane 2000).

BM 4 Protection of lands on the Kurnell Peninsula

Lead Agency: ***Department of Urban Affairs and Planning***
Key Others: ***Sutherland Shire Council, Department of Land and Water Conservation, National Parks and Wildlife Service, Environment Australia***

Remaining natural areas on the Kurnell Peninsula (including the Towra Point Nature Reserve and lands subject of International Agreements) should be preserved and the impact of present and future coastal hazards mitigated through specification of compatible and preferred end land uses and environmental safeguards for existing activities.

Appropriate protection/mitigation measures should be identified for the remaining natural lands in private ownership, and lands affected by mobile sand dunes and/or sand extraction. Reviews of those lands to determine necessary measures for protection, restoration or limited development should be considered in the context of the integrated management framework in Recommendation BM 1.

Rationale for recommendation BM 4

The history of sand extraction and other land use proposals on the Kurnell Peninsula has been fraught with conflict, leading to public inquiries and reviews, and to provisions being incorporated into a Regional Environmental Plan (No. 17). All seem to have failed to give effect to the desired outcomes. (HRC 2000a, pp. 165-166 provides details.) The Kurnell Peninsula is a unique part of a special bay system. Coined *"The Birthplace of Modern Australia"*, it continues to enjoy a close association with the traditional owners. Yet, significant land use conflicts remain unresolved. Some citizens value parts of the remaining dunescape, the remaining wetlands that are home to the endangered green and golden bell frog, and the adjacent aquatic reserves, national parks, nature reserves and Bate Bay beaches. Others value the construction facilitated by the sand resource. Yet others value the long-term development potential of these highly amenable sites.

The bay management framework in Recommendation BM 1 could be applied to facilitate the resolution of such conflicts. However, this Inquiry has led the Commission to conclude that there is now an *urgent and immediate* need for the State to take a lead role and assist the local council to address this land use planning issue immediately. Close consultation with the community will be essential. The highest priority is to review the status of lands zoned 7(b) in the Kurnell REP and adjacent areas affected by mobile dunes. In particular, there must be an early review of extractive industries, which are currently being undertaken without adequate environmental safeguards or assessment, even where they may have "continuing or existing" use rights. These reviews are even more important in light of decisions to exclude Botany Bay from the ambit of the NSW Coastal Policy, including the proposed Comprehensive Coastal Assessment.

The Commission believes that in dynamic areas such as these coastal dune systems, an assessment of the overall impact on the geomorphic stability of the area is required. Such assessment would also help to define coastal hazards, which may impact on end land uses,

especially in the light of changing climatic conditions[47]. After all, the state and local government and the wider community, as well as the individual landowners and operators, all should have an interest in the stability of the peninsula. In that regard, the Commission recommends an assessment that seeks to include the entire sand body separating Bate and Botany bays, rather than individual examinations on a site-by-site basis.

The assessment should lead to firm recommendations about preferred end land uses. The process should also identify, unambiguously, the status of current approvals and the requirements for all extractive operations. The latter would assist the identification of achievable environmental outcomes, and should be undertaken with reference to the provisions of State Environmental Planning Policy 37 – *Continued Mines and Extractive Industries* (SEPP 37), gazetted in 1992[48]. (Preliminary investigations suggest that SEPP 37 should have resolved the 'existing use rights' issues on privately owned lands, subject of sand extraction, on Kurnell Peninsula.) The Commission recommends that the Department of Urban Affairs and Planning provide advice on the implications of SEPP 37 to inform Council's review of 7(b) lands at Kurnell.

In its recently released Coastal Lakes Inquiry Draft Paper (HRC 2001) the Commission recommends assessment of the social, economic and ecological risks that are likely to result from a rise in sea level and predicted change in storm events for coastal areas. Management responses will be required to adapt to such changes, including a common standard for a predicted sea level rise in all relevant planning and management activities related to coastal areas.

Future management decisions for Botany Bay would benefit from the bay being included in the Comprehensive Coastal Assessment proposed under the NSW Coastal Policy. However, because Botany Bay has been excluded from that Policy, it will not be subject to that broader assessment. Accordingly, the common standards adopted by the NSW Coastal Policy and its proposed Comprehensive Coastal Assessment should be incorporated into the Botany Bay framework (pursuant to Recommendation BM 1) and into relevant regional and local planning instruments, including those covering the Kurnell Peninsula.

[47] The Department of Land and Water Conservation has expertise on such matters.

[48] The purposes of SEPP 37 include "*to promote and safeguard the orderly and economic use of land for the purpose of mines and extractive industries in recognition of the importance of mines and extractive industries…",* and *"to enable certain existing mines and extractive industries to continue to operate subject to appropriate environmental assessment and to specify the circumstances in which development consent for them may be obtained."* (Emphasis added.)

BM 5 Protection and management of the southern shores

Lead Agency: ***NSW Fisheries***
Key Others: ***National Parks and Wildlife Service, Environment Australia***

Management of terrestrial and aquatic ecosystems within the remaining natural areas of the southern shores should be better integrated. A number of mechanisms should be explored, such as an estuarine extension to the national park estate or inclusion into a Marine National Park. Regardless of the chosen mechanism, the revised management arrangement should result in more cost effective management and lead to the resolution of any conflicting objectives and divergences in management approaches at the tidal interface.

In addition, there should be assessment of the merits of expanding the Towra Point Aquatic Reserve to incorporate the intertidal area of Woodlands Bay to provide protection for the Taren Point Shorebird Community, which is listed as an endangered ecological community under the *Threatened Species Conservation Act* 1995.

The final management arrangements would be guided by the priorities identified under the integrated management framework in Recommendation BM 1.

Rationale for recommendation BM 5

The southern shores of Botany Bay comprise mobile sands, seagrass beds, mangroves associated with finer silts and mud, and one of the largest remaining salt marsh areas in Sydney. The southern headlands make up the rocky shores of the Botany Bay National Park at Kurnell. Together they comprise important aquatic and terrestrial ecosystems, highly valued for their recreational uses and as habitat to migratory birds and juvenile fish. They are mostly in public ownership as aquatic reserve, nature reserve and national park, with a few isolated (but mostly undeveloped) pockets in private ownership. The community, including the local council, place a high priority on the acquisition of those isolated pockets to maintain continuity of habitat and to preclude any possibility of inappropriate development.

Management of public lands along the southern shores is divided between NSW Fisheries, which manages below the mean high water mark, and National Parks and Wildlife Service, which manages above that mark. There have been occasions when the two agencies have had conflicting objectives[49]. The Commission believes there would be advantages in formal integration of the management of these important and interdependent aquatic and terrestrial ecosystems. This could be done in a number of ways, including as an estuarine extension of the National Park or Nature Reserve under the control and management of the National Parks and Wildlife Service, or as a Marine National Park under the control of the Marine Parks Authority.

Detailed investigation of the latter would form part of the systematic assessment for the identification of areas to be included in the National Representative System of Marine Protected Areas (NRSMPA), which is currently being undertaken by NSW Fisheries for each

[49] For example, small-scale dredging proposals by the National Parks and Wildlife Service to provide safe nesting grounds for the Little Tern have conflicted with the NSW Fisheries goal of protecting seagrass beds.

of the five bioregions in NSW. The Hawkesbury Shelf bioregion, which includes Botany Bay, is scheduled for assessment in 2002-2003. The scientific approach used for such assessments may or may not identify Botany Bay as best representing the biodiversity of that region and the Commission is not proposing a change to the assessment procedures in general. However, in the case of the southern shores of Botany Bay, the Commission believes that there are sufficient factors complementary to those in the bioregional assessment process that warrant special consideration. Those factors include the following:

- the economies of scale that could be secured through integrated management to achieve conservation outcomes,
- the significance of the area has already been established, by virtue of part of it being declared as aquatic reserve (under the *Fisheries Management* Act), a large part being designated as a terrestrial nature reserve (under the *National Parks and Wildlife* Act) and the proximity of the entire area to the Botany Bay National Park;
- the area's listing in a number of international agreements together with the identified threatened species;
- the dynamic geomorphological processes of scientific interest, and the 'scarcity' of such complex biophysical environments in proximity to urban areas; and
- the area's significant historical value as the 'birth place of modern Australia' as well as its significant Aboriginal heritage value and ongoing connection with local Aboriginal communities.

In addition, submissions to the Inquiry have stressed the importance of the intertidal flats in Woodlands Bay. It appears that the particular sedimentary features of that area provide different habitat than found elsewhere in the Towra Point Aquatic Reserve and support the Taren Point Shorebird Community, which is listed as an endangered ecological community under the *Threatened Species Conservation Act* 1995. On this basis, the Commission believes that consideration of expanding the aquatic reserve to incorporate this area is warranted.

BM 6 Preservation of wetlands, western shores

Lead Agency: ***Department of Urban Affairs and Planning***
Key Others: ***Local councils, Department of Land and Water Conservation, Environment Protection Authority, NSW Fisheries, Roads and Traffic Authority***

Wetland protection should be a strongly held policy objective in all future development planning. Behind the western shore, there should be no further net loss of wetlands in the remaining Rockdale wetland corridor. In particular, the interconnectivity of the wetlands, including their connection with the bay, must be maintained. Should future Government decisions about infrastructure necessitate unavoidable damage to any part of the existing wetlands, there should be explicit offsetting action elsewhere to ensure no net loss of the ecological function of wetlands.

Such offsets should be determined within the management framework in Recommendation BM 1 and within the frame of reference developed pursuant to Recommendation NA 5. They should be established prior to development proceeding.

Rationale for recommendation BM 6

Behind the western shore of Botany Bay is a corridor of wetlands collectively known as the Rockdale wetlands[50]. These are remnants of an inter-barrier depression that separated the dunes, which used to exist behind Lady Robinsons Beach, from the higher lands beyond West Botany Street. Several submissions on the Draft Report suggest that greater emphasis needs to be placed on protection of the wetland corridor as it is an important habitat for a number of bird species and as a fish nursery. The area is considered particularly important habitat due to the loss of other wetland areas on the north-western side of the bay. The Commission notes that the Sydney Coastal Councils have made strong statements about the importance of protecting remaining wetlands,[51] however this wetland corridor is under particular threats due to its current status as a road reserve.

The Rockdale wetland corridor has been highly degraded by weed invasion, nutrient enrichment from market gardens, parks, municipal and residential gardens, and various pollutants from stormwater runoff and leachate from old landfill. Parts have also been infilled and reclaimed for various purposes, including for part of the M5 East extension. The fact the wetland corridor exists at all is due to its reservation as part of an easement for the potential F6 roadway corridor, mostly owned by the Roads and Traffic Authority and managed by Rockdale Council and the Sydney Water Corporation. Whilst such reservation has saved the wetlands from total destruction, it has also discouraged their effective management and rehabilitation. This is because Council is understandably reluctant to expend significant resources on an area that may one day be turned into a freeway. Nevertheless, Rockdale Council has undertaken a comprehensive assessment of the wetland corridor and identified its significant natural values, including as a fish nursery[52].

The Roads and Traffic Authority agreed to provide compensatory habitat for damage to part of the corridor at Eve Street from construction of the M5 roadway. This involved rehabilitation of an abandoned sand extraction pit on the southern shores of Woolooware Bay, work that has been completed since release of the Draft Report. Whilst the rehabilitated area has provided some habitat for shore birds, the Commission has received commentary to the effect that the offset arrangement does not provide habitat commensurate with that which was lost. The Commission is not in a position to evaluate the merits of the constructed wetland, however, it recommends that any future offset wetlands be designed, constructed and operational in advance of decisions to modify / remove areas of existing wetlands.

The issue of 'offsets' requires further consideration pursuant to Recommendation NA 5.

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[50] The 'Rockdale wetland corridor' includes Eve Street wetland, Spring Street wetland, Landing Lights wetland, Kings wetland, Patmore Swamp and Scarborough Park wetland. Eve Street wetland is listed on the Directory of Important Wetlands (ANCA 1996), while Kings wetland, Patmore Swamp and Scarborough lakes are listed on the Rockdale City Council Heritage Register.

[51] Sydney Coastal Councils Group (2001).

[52] A study by Gibbs et al (1999) found that Scarborough Park, is important habitat for fish species. Surprisingly, fish utilise (as their only access) the Florence Street stormwater drain, which connects the wetland corridor with Botany Bay.

BM 7 Management of Botany Aquifer, northern shores

Lead Agency: ***Department of Land and Water Conservation***
Key Others: ***Environment Protection Authority, Department of Urban Affairs and Planning, local councils***

An Interim Management Plan for the northern zone of the Botany Sands Aquifer, *based on current knowledge,* should be finalised promptly. It should form the basis for adaptive management of the aquifer and be used as a precursor to the development of a full Management Plan, which is likely to take some years to complete. The Interim Plan should stress the protection of groundwater dependent ecosystems, and should be used to inform local landowners and groundwater users of the *potential* risk if groundwater reaches the surface. It should guide monitoring programs and risk management strategies, and ensure that industry and the public accord higher values to protection and use of the aquifer.

The Interim Plan should define 'groundwater risk zones', showing areas where there is the potential for groundwater contamination or the likelihood that excavation works will intercept the groundwater table. Such zones should be mapped based on current knowledge of former potentially contaminating activities, current potential pollution sources, known aquifer water quality and approximate depth to groundwater.

Rationale for recommendation BM 7

Submissions on the Draft Report (HRC 2000a) indicated a significant degree of public interest and concern about management of the Botany Aquifer, especially in its contaminated northern zone. The Commission did not present a draft recommendation as it believed that the matter was being adequately addressed by an interagency and industry working group, which had been developing a management plan. The Commission was also informed that South Sydney Council had an active contaminated sites program and had taken a proactive approach towards individual site management.

The Commission endorses that work. However, following further investigations, the Commission has concluded that progress towards a management plan is very slow, being dependent, at least in part, on the collection of further scientific and hydraulic data. From a recent report (Bish *et al* 2000), and its other investigations, the Commission notes that:

- there are 733 licensed extraction points and a considerable number of unlicensed points, thought to be primarily spearpoints for *domestic* purposes;
- over 60% of the licences are in perpetuity and have no requirements specifying allocation;
- the aquifer is extremely vulnerable to contamination with some areas of it *known* to be seriously polluted (various parts of the aquifer have been contaminated by a long previous history of industrial pollution);

- details of some point sources of contamination are known[53], others suspected, and the potential for others can be deduced from an examination of past polluting activities;[54]
- release of that contaminated water to the surface (through pumping, interception or natural flow) may create a potential threat to environmental and human health[55];
- large areas of good quality water remain within the aquifer, suitable for most purposes, except potable supply; and
- the Department of Land and Water Conservation, with the Environment Protection Authority and local councils, has identified action required to prepare a comprehensive groundwater management plan, which is likely to take some years to complete.

Given the importance of protecting the aquifer, the need to rehabilitate it where practicable *and* the potential for environmental and human health risks to groundwater users, the Commission believes that urgent action is needed in the interim. It therefore agrees that: *"As a preliminary management tool, a map that outlines areas of known and potential contamination should be prepared. …..* [It] *should highlight areas…that need further investigation to fill the knowledge gap."* (Bish *et al* 2000). At a minimum, the recommended interim plan should:

- define broad scale 'groundwater pollution risk zones'[56] which, when implemented, would preclude extraction from some areas and provide warnings on risks to groundwater users in other areas; and
- provide an approximate groundwater contour map, to establish where there may be risks that excavation could intersect the water table. (This would assist councils and landowners and users in their assessments of building and development proposals.)

The Commission believes that such an interim plan is an appropriate and necessary response to existing information about known contamination of the aquifer[57]. The plan would provide a basis for addressing any significant risks of harm to groundwater users, including the development of strategies that would minimise further contamination. It would also be a valuable tool to raise public awareness in a focused way.

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[53] For example, Orica is working closely with the Environment Protection Authority to ameliorate groundwater contamination from the previously ICI-owned site.

[54] For example, findings reported by the Botany Aquifer Working Group (1996 p14) include: "*EPA data indicates approximately 70 identified contaminated sites …However, EPA information is incomplete and other land has almost certainly been contaminated but not yet identified nor its potential to contaminate the aquifer assessed*". EPA has advised this Inquiry that it is *"actively regulating more than 10 sites in the area … and is assessing several more to determine whether they pose a significant risk of harm."*

[55] For example, some sites have apparently intercepted the stormwater system and the local council has placed signs on the shores of Penrhyn Estuary warning about the dangers to health of swimming or eating sea food from the area because of the levels of contamination reaching the estuary *via* that system.

[56] The Department of Land and Water Conservation uses the term "beneficial use zones" to emphasise that there are many parts of the aquifer that do not pose a risk in use. However, the Commission is concerned that there *may be* environmental and health risks if contaminated groundwater reaches the surface through means other than by pumping, including through intersection of the groundwater by excavations, stormwater channels or low lying ground.

[57] The Commission has been informed that much of the work towards such a plan has already been undertaken.

RC 1 Protection of urban streams

Lead Agency: ***Department of Urban Affairs and Planning***
Key Others: ***Department of Land and Water Conservation, NSW Fisheries, Department of Local Government, Local Government and Shires Association, Regional Organisations of Councils and individual councils***

A policy objective of net improvement of natural channels and riverside vegetation should be incorporated within the State Riverine Corridor Policy, currently being developed by an interdepartmental committee chaired by DUAP. That policy should include a component specifically directed towards urban stream management. It should require that where development, which has been approved by a public process, would unavoidably impact on natural channels and/or riverside vegetation, those impacts should be offset by appropriate trade-offs that would result in a net improvement to local waterways. (The nature of such trade-offs should be identified within the frame of reference that would be developed under Recommendation NA 5.) The policy should further require that all development and redevelopment proposals identify and take advantage of opportunities to improve the connectivity of natural channels and to improve ecosystem function so that, over time, there will be a net *increase* in those values.

The objectives of the State Riverine Corridor Policy, as outlined in Appendix 3, must be given effect through all relevant State and Local Government regulatory and planning instruments including regional environmental plans, local environmental plans, development control plans, s94 contribution plans and stormwater management plans. In particular, a mechanism should be established to afford protection to riverine vegetation in urban areas. That is because the protection afforded by earlier legislation to so called 'prescribed streams' and 'protected land' no longer applies to some urban areas since that legislation was replaced by the *Native Vegetation Conservation Act* 1997.

Rationale for Recommendation RC 1

Submissions to this Inquiry have clearly indicated that all riverine corridors and foreshore areas are highly valued by the catchment and wider community (HRC 2000a, p. 84 provides details)[58]. In each of its Inquiries to date, the Commission has sought independent expert advice in relation to the instream flows required to improve river health. In each case, experts have stressed the critical importance of natural river channels and healthy riverside vegetation as determinants of river health, including the health of aquatic ecosystems.

In urban areas, riverine corridors can provide multiple environmental and human health benefits. This applies both to the near pristine parts of the system such as the upper Georges

[58] The terrestrial biodiversity study being undertaken as a component of the Georges River REP identifies these as significant areas for biodiversity (DUAP in prep.).

River, and also to the highly modified parts of its tributaries, such as Clear Paddock Creek. The challenge in urban areas is to ensure that the full costs of development, including the need to protect riverine corridors, are included at the outset. Sufficient area must be provided on each side of drainage lines to maintain tributaries in healthy, if modified, condition (HRC 2000a, pp. 85-87 provides detail). In the Georges River - Botany Bay catchment, 'greenfield' sites for development are becoming increasingly scarce. It is critical that the remaining tributary streams are valued and protected on such sites. Streams should no longer be channelised or piped, and they must be protected from indirect impacts, such as increased nutrients, runoff, weed propagation and silt loads. Most importantly, remaining riverbank vegetation must be protected. For example, it may be necessary to address the fact that the *Native Vegetation Conservation Act* 1997 has had the effect of removing state protection along 'prescribed streams' in urban areas, including the Georges River and its tributaries[59].

The State Riverine Corridor Policy, being developed as part of the Government response to the Commission's Hawkesbury Nepean Inquiry, will guide the realignment of agency actions and assist councils to develop appropriate and complementary development controls. The primary intention of the relevant recommendation by the Commission was to establish decision-making processes that would ensure that rivers and their tributary streams can fulfil their full range of ecological functions. That is, at all levels, decisions governing development should address explicitly the need for protection of riverine corridors. The committee is to consider those changes to planning processes that may be necessary to give effect to that intention. Awareness of existing mechanisms for protection of the riverine corridor is to be raised, existing programs are to be reviewed, and potential zoning options investigated. This should address concerns raised in submissions on the Draft Report that existing powers to protect riverine areas are not effectively enforced: "*more needs to be done to ensure compliance with development consent conditions and planning instruments, which is currently a weak point in the land-use planning system*". Details of the principles the Commission holds to be critical in development of the policy are presented in Appendix A3[60].

The recommended urban stream component should aim to ensure that:

- rehabilitation and management of urban streams focuses on protection of the residual natural stream ecosystem (this should be undertaken in the context of local council stormwater management and priorities determined within the context of the Management Goals listed in Table 7.2);
- planning and design of urban rejuvenation or redevelopment proposals incorporate an appropriate mix of regulation, incentives and partnership arrangements to achieve improved environmental and visual amenity of waterways;

[59] The Commission understands that the reason for excluding urban areas from that state legislation was that local councils have development control and planning powers with which to provide such protection. However, the Commission has been made aware of at least one instance where local councillors are attempting to change current local tree preservation provisions, even in riverine zones, in order to provide water views. From a river health perspective this is unacceptable. From a management perspective, it indicates that state legislation may continue to be required to overcome local pressures.

[60] The Commission met with the interdepartmental committee with a view to ensuring that the strategic intentions of its recommendations are incorporated in the policy being developed.

- planning and design of *new* urban developments / subdivisions maintain, to the greatest possible extent, the natural values of urban streams and downstream rivers and estuaries[61]; and
- channel management or flood mitigation works within existing urban developments incorporate measures to protect the ecological, geomorphological and hydrological values of the stream.[62]

The Commission stresses that the relevance of these objectives extends well beyond the Georges River - Botany Bay catchment. They should be adopted in state and local government policies and be applied across the entire metropolitan area and to all urban areas in the state. In the meantime, all *existing* state and local legislation and planning instruments that are designed to protect riverine corridors and their vegetation should be used to the fullest extent possible to achieve similar results[63]. For example, in redevelopment sites, where many of the tributaries have been highly modified, or even piped, improvements to the natural drainage system can form part of the development consent and / or be funded through section 94 contributions. As one council submission on the Draft Report commented, the development and planning framework needs to be reviewed to "*ensure councils have the maximum opportunity to promote and support those redevelopments that would assist the restoration of degraded foreshore areas*". Unless existing provisions are better utilised, the pessimism expressed in another submission on the Draft Report is likely to prove correct: *"given the rapid rate of foreshore bushland depletion,* [the policy's] *arrival is likely to be too late for the Georges River* [and its tributaries]*"*. The Commission emphasises that the State Riverine Corridor Policy must ensure that riverine corridor management is planned into developments rather than added afterwards[64]. In this way, councils, the development industry and the community would have *"clear indications that riverine corridors need to be protected and thus require a different approach to their treatment than land zoned for residential* [or other] *use."*

The links with urban stormwater management pursuant to Recommendations WM 1 to WM 3 are obvious, as urban stream management has largely been seen as the responsibility of local councils, in relation to their management of stormwater. The past focus was on effective drainage and flood mitigation which, as noted in HRC (2000a, pp. 68-69), led to many streams being channelised. More recently, councils have been required also to consider the water quality aspects of stormwater management. The Commission supports this shift in emphasis and believes it should be incorporated into an even broader land and

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[61] For example, one response on the Draft Report indicated that some councils do not allow riverine corridors to be included in open space provisions. This creates a disincentive to stream protection. It could be addressed through environment protection zoning that allows uses compatible with ecological protection such as passive recreation, including walking and cycling trails where appropriate. The Commission has found that where such multiple use zones have been created, the riverine corridors have been highly valued by the new residents and contribute much to the local urban amenity. Cabramatta Creek is one example.

[62] These principles are reflected in 'interim' internal guidelines developed by a predecessor of the Department of Land and Water Conservation (DWR 1994). It is understood that the policy will build on those guidelines, which are endorsed by the Commission.

[63] These include council Tree Preservation Orders and the provisions of the *Rivers and Foreshores Improvement Act* 1948, or the *Water Management Act* 2000 when gazetted, and the *Native Vegetation Conservation Act* 1997, which should be extended to include riparian vegetation in urban areas. They also include existing planning and management initiatives described in HRC (2000a, pp. 138-142).

[64] An example from the Inquiry is the impact of the East Hills Railway augmentation on Wolli Creek. Assessment of that impact did not occur as part of the initial overall planning, making it virtually impossible for regulatory agencies to stop artificial embankments from being constructed on the creek bank to support an access road.

water planning and management framework, which would promote opportunities for restoring the *ecological functions* of streams as part of the stormwater management program. As one submission on the Draft Report noted, we should recognise the "*importance of parts of the existing stormwater system for ecological connectivity in some areas of the catchment*".

That view has wide support, both here and overseas. Urban communities are increasingly demanding that ecological functions be restored in urban waterways. As one submission on this Inquiry put it, in order to *"establish corridors of green along corridors of blue"* across the metropolitan area. Obviously this would be a long-term goal. It should be guided by the management goals shown in Table 7.2 and discussed in HRC (2000a, pp. 32-33).

NA 1 Protection of remaining natural lands, including those currently under Commonwealth ownership and management

Lead Agency: ***Department of Urban Affairs and Planning***
Key Others: ***Department of Land and Water Conservation, Sydney Catchment Authority, National Parks and Wildlife Service, Department of Mineral Resources, local councils,***

All remaining natural lands in the Georges River - Botany Bay catchment should be afforded the highest possible protection, through integrated action harnessing all available planning and management mechanisms. Particular focus should be given to ensuring effective protection of large areas of contiguous bushland, riverine corridors and upland swamps.

The State Government, in collaboration with relevant areas of the Commonwealth Government, including Environment Australia, should initiate *early* action to ensure that the mid-catchment lands owned by the Commonwealth, for Army and other purposes, enjoy continued protection of their natural values. This would be especially important if the Commonwealth were to divest itself of ownership.

In particular, means must be found to prevent further alienation of foreshore lands, including those along the Georges River between Harris and Mill Creeks, and riverside lands along tributaries to that section of river. (In this context, 'foreshores' are of rivers, creeks, and/or wetlands.) Conditions of any sale of adjacent lands should include provision for appropriate zoning to protect the foreshore areas.

In the O'Hares Creek subcatchment, undisturbed pockets of Crown land with ecologically important upland swamps should be incorporated into the adjoining National Parks estate and protected from any uses not compatible with the maintenance of their biodiversity and ecological functions. Remaining lands in this important subcatchment should continue to receive the protection afforded by their National Parks estate status. Surface mining should be prohibited. Particular attention should be given to protecting the integrity and values of instream habitats and groundwater-dependent ecosystems from the impacts of subsurface mining pursuant to Recommendation NA 2.

Rationale for Recommendation NA 1

Although the Georges River – Botany Bay catchment is arguably the most populous in the state, with over 1.2 million residents, it also has significant tracts of land that are largely in a natural state. These are very important contributors to river health in terms of aquatic and terrestrial habitat, water quality and visual and recreational amenity at both the local and catchment scale. HRC (2000a, pp. 94-100) provides detail about the need to protect these remaining natural lands as well as the need to improve the way they are managed.

The large areas of contiguous bushland in the western and southern parts of the catchment are particularly important, and have well documented[65] intrinsic value in terms of native fauna and flora, geological formations, and cultural heritage. Those large areas owned by the Commonwealth for Army and other purposes are afforded a high level of protection as a consequence of their present status and the associated restrictions on access and use. This makes an important contribution to river health and biodiversity, including koala habitat. Those Commonwealth lands are surrounded by, and are contiguous with, the Heathcote National Park, the Sydney Catchment Authority's drinking water catchments (including O'Hares Creek), the Woronora River estuary corridor lands, the Georges River Regional Open Space and Scenic Protection Corridor and the Georges River State Recreation Area. Together they compensate to some degree for the loss of habitats in other parts of the catchment and contribute significantly to river and bay health, being described as "the kidneys of the Georges" (SWC 1995). The Department of Urban Affairs and Planning, in its submission on the Draft Report, noted that *"the possibility of release of those* [Commonwealth] *lands presents an unparalleled opportunity for the State Government to consolidate foreshore open space and areas of natural and cultural heritage significance, and thereby a range of ecosystem system services."*[66]

Other submissions also expressed strong support for continued protection of the Army lands. The NSW National Parks Association has long advocated that those lands be protected together as a "mega park". The Association has suggested that *"all vegetated defence lands not needed for defence purposes should be transferred without cost to the NSW National Parks and Wildlife Service for nature conservation purposes … even if future human recreational use is not indicated on safety grounds."* A further typical suggestion to the Inquiry is that they should be identified as "'*future Nature Reserve' if vacated and managed by Environment Australia with the support of the Army in a transparent way, with public Draft Plans of Management as if it were a Nature Reserve now*".

The Commission concurs with such views and notes that the suggested action would be consistent with the goals and objectives of the Federal *Environment Protection and Biodiversity Conservation Act* 2000.

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[65] See, for example, Australian Heritage Commission (1999) for the army range lands, SCA and NPWS (1999) for O'Hares Creek, Keith (1994) for upland swamps, NPWS (1999) for Towra Point, DUAP (in prep) for biodiversity etc. The Cubbitch Barta National Estate Area includes 18000 hectares at Holsworthy, the Georges River Wetlands and the Kurnell Peninsula at Towra Point (Register of the National Estate).

[66] The Department also advised that those lands coincide with the transition zone between the Woronora Plateau and the Cumberland Plain and the riparian corridor, and as such support significant biodiversity values. The ongoing protection and management of these lands should therefore be a matter of priority for the catchment.

Regardless of ownership, the State Government should seek Commonwealth assurance that the Holsworthy army rangelands, and other Commonwealth lands along the Georges River, will continue to be managed in ways that recognise their relationship to contiguous lands and their special biodiversity values. The relevant State and Commonwealth agencies should explore ways in which those lands and their ecological values can continue to enjoy protection by the strongest mechanism available. For example, the Commission has been advised that riverside lands currently owned by the Commonwealth, especially east of Heathcote Road, are 'surplus to requirements' and may be sold. The Commission has sought assurance from Environment Australia that the significant environmental values of such lands would be protected from development in such an event.

It is unclear whether the sale of the land is an 'action' that would trigger the provisions of the *Environment Protection Biodiversity Conservation Act* 1999[67]. However, once the sale is effected and ownership passes from the Commonwealth, development proposals would be subject to assessment under State planning laws whether or not such assessment occurs at the time of sale. Commonwealth laws would apply to the extent they may affect values of national environmental significance. Nevertheless, there are concerns about the sale process and the potential for that process to raise expectations about future development prospects of those lands without adequate recognition being given to their regional significance. This, in turn, could put pressures on the approval process.

It is therefore important that there be certainty about the development potential of these lands, to pre-empt any process leading to misunderstandings or possible misrepresentations about the development potential. There may be less scope after any sale occurs to assess proposals within the context of a broader and detailed planning regime, as provided by State environmental law and, in particular, the Georges River Regional Environmental Plan and Strategy. It would be especially unfortunate if a technical issue, such as a change in the applicable laws, from the Commonwealth to the State, could be exploited to jeopardise the future management of these lands. The required certainty could be provided by the Commonwealth agreeing to manage those lands in accordance with the principles and objects of the relevant State environmental laws.

It will be critical therefore for the ongoing conservation of the foreshore lands and their related ecosystems that the State engage in early dialogue with relevant agencies of the Commonwealth to secure that protection through the recognised application of its laws, *prior* to the sale of other lands for development.

In addition, the Department of Urban Affairs and Planning should include, in its current Georges River catchment regional planning processes, an examination of the extent to which mechanisms developed to protect the Sydney Harbour foreshores owned by the Commonwealth may be applicable for the Georges River. Since release of the Draft Report (HRC 2000a), that regional environmental planning process for the Georges River catchment has progressed significantly. Stage 2 of the process addresses the need to preserve biodiversity in the catchment and a draft plan is soon to be exhibited. The Commission supports that initiative and believes it will be a key tool to formalise protection of many natural areas throughout the catchment, including the high conservation status O'Hares Creek subcatchment.

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[67] The issue depends on whether such a sale comes within the meaning of 'undertaking' and thereby an 'action' for the purposes of the Act. The Act regulates actions of Commonwealth agencies that have, or are likely to have, a significant impact on the environment.

The Commission is convinced that to maintain the ongoing health of the upper Georges River system[68], the O'Hares Creek subcatchment requires permanent protection. The most effective legal mechanism should be applied. However, the Commission notes with concern that the existing protective legislation may be inadequate in this instance. This is because the 'water catchment zoning' precludes almost all land uses *except* mining and extractive industries. These latter are activities that frequently affect natural areas and river health adversely. The rationale for Recommendations NA 2 and NA 3 refer.

[68] It is also important to the health of the adjacent water supply catchments of Woronora and Cataract reservoirs, for which the O'Hares catchment provides a buffer. (The three catchments together form an area of contiguous bushland important to both terrestrial and aquatic biodiversity.)

NA 2 Management of longwall coal mining

Lead Agency: ***Department of Mineral Resources***
Key Others: ***Department of Land and Water Conservation, Department of Urban Affairs and Planning, Local councils***

The context within which longwall mining (second workings) applications are assessed should be significantly broadened.

In cases where the impacts of longwall coal mining under rivers have not previously been assessed under the *Environmental Planning and Assessment* Act 1979, a completely new and *public* planning and regulatory process for the approval of longwall coal mining in existing mines is recommended. This would require changes to the *Coal Mines Regulation Act* 1982 and/or the *Mining Act* 1992. The recommended assessment process, in relation to the riverine context, should establish requirements commensurate with those of an environmental impact statement and should involve independent review aimed at identifying methods of extraction that minimise environmental harm whilst optimising resource extraction.

Where the assessment process shows likelihood that subsidence would cause adverse impacts to river health and public safety, new or continued longwall mining should *not* be permitted by mining legislation *unless*:

- **the impacts can be addressed to the satisfaction of the Department of Land and Water Conservation;**
- **sufficient securities are held for effective restoration of natural surface features *across the entire area of impact*; and**
- **the securities are held for a period sufficient to allow for subsidence impacts to become manifest and be repaired.**

If procedures for further approvals related to *existing* longwall mines are retained while new legislation is developed and implemented, as an *interim* measure the 'section 138' review process should be refined to incorporate the above extended security requirements and, additionally, to require:

- **the conduct of reviews in a more open way that facilitates public involvement, particularly in relation to the environmental-commercial trade-offs, the damage to river health and the timing and effectiveness of restoration;**
- **the introduction of strictly enforceable conditions aimed at avoiding, mitigating, monitoring and, where necessary, restoring the integrity of riverbeds and associated surface flows, with significant punitive damages if restoration action is not successful.**

Rationale for Recommendation NA 2

Longwall coal mining under streams in the upper Georges River catchment has caused cracking of riverbeds, loss of surface flow and water quality decline[69]. These problems became apparent just after release of the Draft Report (HRC 2000a). Subsequent submissions called for the Commission to address the issue, which is receiving increasing attention from local residents as well as from wider environmental interests. For example, *"…downstream of Appin, the Georges River flows through spectacular sandstone gorges that have environmental, tourism and Aboriginal heritage values, all of which may be threatened by future mining if adequate controls are not enforced."*

There is a growing awareness and understanding of the impacts of longwall mining. In the course of its Hawkesbury Nepean Inquiry the Commission was advised that the particular geological characteristics of the Cataract River gorge meant that the incidence of riverbed cracking was unlikely to be repeated elsewhere. This has not proven to be the case, and it is now evident that the impacts of longwall mining are significantly broader than was then advised. Government decisions on that Inquiry endorsed the need to consider more fully the environmental aspects of second workings (longwall mining) in existing coal mines.

On the evidence of recent damage to the Georges River (and the Cataract River before that), the Commission has concluded that regulatory provisions to date have *not* been effective in protecting river health. It notes that the Department of Mineral Resources is undertaking a review of the environmental aspects of its section 138 approval process, and a review of the environmental provisions of the Mining Act 1992. At the time of writing, the Commission has not had opportunity to assess the material emanating from those reviews. However, it is concerned that the review of approval processes for longwall mining *will not create the appropriate context* within which sufficient recognition and weight can be given to standards of environmental stewardship, implementation of the Government's water reform program or community views about the wider public interest.

The current machinery of the State is out of date and inadequate to deal with an activity that has been proven to cause significant environmental impacts. Section 138 of the *Coal Mines Regulation Act* 1982, which is used to regulate the relevant operations, was designed to ensure occupational health and safety of mine workers. It was never designed properly to assess and mitigate potential and likely environmental impacts, nor to give interested and affected citizens a good opportunity to participate in the decision-making process. Therefore, in the Commission's judgement, a review of section 138 *cannot* provide the appropriate context to address those needs. It believes that the issue has proved to be too important to be addressed by modest additions to this section of the legislation. A new, *public* planning and regulatory process, with new objectives, is required.

[69] This is a similar scenario to that observed in the Cataract River from 1997 to the present day.

Longwall mining *must* be better managed to maintain the socio-economic benefits associated with the coal industry whilst mitigating adverse impacts, providing opportunities for citizen involvement and incorporating sizeable securities over the entire area of impact.[70]

The inappropriateness of the existing context is of less concern in the case of new longwall mining proposals that have been through a public and detailed environmental impact assessment process under the *Environmental Planning and Assessment Act* 1979. However, even in those cases, the impacts of the *second* workings must be assessed and *any relevant development approval conditions incorporated into the Mining Lease and subsequent s138 approval'*[71]. For mines that have not been through such a public assessment process, the intrinsic weakness of this context is of serious concern. This is demonstrated by a current longwall mining proposal being considered under the existing section 138 process, in the absence of broad public consultation even though it is predicted to extend the impacts of subsidence to another 4 km of near-pristine river[72], including the popular local swimming area, known as Marhnyes Hole[73].

The Commission has therefore gone beyond the recommendations of its Hawkesbury Nepean Inquiry and is now recommending a significant broadening of the context for the approval process for longwall mining.

Obviously the decision about whether to permit continued longwall mining under the upper Georges River and its tributaries will need to take into consideration the *significant* economic and social benefits of the coal resource to the state and the local community[74]. However, the objective of maximising extraction of the coal resource should not be pursued at the expense of riverine resources. The Commission strongly advocates that *any environmental cost should be internalised within the commercial activity* so that investment decisions by the industry sector are made on a 'full cost' basis. Furthermore, such investment decisions by industry should not be finalised pending the outcome of the assessment process by Government[75].

In the context of the current proposal for an extension of longwall mining in the Appin lease, operated by BHP Billiton, the Commission recognises the sizeable investment already

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[70] There is concern that securities currently only apply to the 'lease area', which comprises the subsurface mine and any area of the surface used for actual works. The remaining surface area *above* the workings and/or impacted *by* the workings is not covered. This anomaly must be addressed if future generations of tax/rate payers are not to be left with a significant, and possibly ongoing, restoration cost for impacts that include:

- cracking of bedrock streams with subsequent reduction in low flows;
- reduction in aquifer levels with subsequent impact on water users;
- changes to drainage patterns that adversely affect water dependent flora and fauna; and
- threats to public safety associated with subsidence destabilising steep slopes and rock overhangs in recreational rock climbing and bush walking areas.

[71] The Commission has been advised that under current arrangements, development consent conditions are not necessarily incorporated into mining leases and s138 approvals. This is unfortunate as those are the primary *ongoing* regulatory mechanisms.

[72] There are also numerous small tributary streams likely to be affected in the same way.

[73] BHP has given a verbal assurance to the Commission that it would maintain water in Marhnyes Hole even if it had to undertake multiple episodes of restoration. This however, would need to be specified in any future approval issued by the Department of Mineral Resources.

[74] The Department of Mineral Resources has advised the Commission that the three operating collieries in the catchment directly employed some 547 people and produced coal with a value of approximately $185 million in 1999/2000. The recoverable reserves within the Bulli seam have been valued at $4.7 billion.

[75] In the case of the Appin lease, much investment, in the form of underground roadways and access, has been made *prior to application* for a section 138 approval, thereby adding complexity to the decision-making process.

undertaken, the significant socio-economic benefits from the mine and the large degree of expectation created by previous approvals. The Commission has had extensive discussions and correspondence on this matter with relevant Ministers and agencies and with BHP. It understands that since its Cataract River experience, BHP Billiton has undertaken extensive surveys of the upper Georges River to provide effective assessment of the potential impacts of longwall mining operations[76]. (The information will be submitted as part of the company's application for approval to extend its longwall operations under another 4km of the Georges River.) BHP Billiton has advised the Commission that the assessment predicts continued cracking of the river bed. Such confirmation gives greater weight to the concerns expressed by the community as well as the main regulatory agencies.[77]

The Department of Mineral Resources has recognised the likely impacts and advises that it is facilitating consultation with the Department of Land and Water Conservation in order to identify works necessary to mitigate the impact on the river. The views of other relevant agencies are also being incorporated. However, the Commission notes that all such decision making is still within Government and that the community has little direct input to the process. It also notes that there appears to be little, if any, *independent* assessment of mining methods that may reduce the risk of subsidence (such as for example, reducing the width of the longwall panels or exploring mechanisms for backfilling the voids to minimise subsidence). Given the level of likely impact and the degree of concern expressed, including through local and state media, the Commission believes that both these shortcomings must be addressed.

NA 3 Clay mining in upland swamps

Lead Agency: ***Department of Mineral Resources***
Key Others: ***Department of Land and Water Conservation, Department of Urban Affairs and Planning, National Parks and Wildlife Service, Sydney Catchment Authority, Local councils***

Clay mining and other extractive industry pose a serious threat to the high environmental values of the remaining natural areas of the upper Georges River catchment. By definition, *surface* mining in upland swamps involves total destruction of on-site ecosystems and reduces downstream flows in dry weather. New activities proposed on undisturbed areas of upland swamp should be prohibited and the Crown land involved transferred to the national parks estate pursuant to Recommendation NA 1.

[76] That work includes longitudinal and cross section profiles, water quality testing and photographic records of the river bed and rock outcrops.

[77] A recent study by the Department of Mineral Resources (DMR 2000) notes that "*Cracking of deeply incised river beds due to mining is not uncommon. Loss of water may result in such cases, which may be temporary or permanent*." Monitoring undertaken by the Department of Land and Water Conservation in the Cataract River, since grouting was undertaken in 1999, indicates that water loss is continuing. The grout curtain appears to have reduced the loss of surface flow by about 50% (DLWC 2000).

Rationale for Recommendation NA 3

Parts of the O'Hares Creek catchment near Appin Road, are in Crown ownership but are not afforded any formal protection zoning (HRC 2000a, pp. 96-97 provides detail). Some of those Crown lands comprise 'upland swamps', which are of particularly high conservation value due to their significant biodiversity and due to their role in maintaining low flows to downstream creeks under dry conditions. The swamps are attributable to the presence of clay-shale lenses in the sandstone. Those lenses form both the basis of the swamps existence, and also the basis for the greatest threat to their *continued* existence, being subject to existing and proposed clay mining[78].

The Commission believes that any further disturbance of these lands is extremely undesirable. It is particularly concerned about the mining of the upland swamps because it believes the fabric of the swamps (and their ecological functions) would be destroyed forever, notwithstanding any management and rehabilitation effort that might accompany mining activity[79]. Many submissions on the Draft Report express support for the protection of these areas with one noting that *"…protection of the upper catchment from further vegetation clearing and mining is essential if the outstanding biodiversity, hydrological and landscape values of this area are to be maintained. This should be a principal priority for management of the Georges River - Botany Bay system"*.

The Commission recognises that some economic value attaches to the clay resource, and that its realisation would bring a different set of benefits directly to the private mining interests and indirectly to the community through royalty and tax payments[80]. Notwithstanding those latter benefits, the Commission believes that should the clay mining proceed, the cost to environmental amenity and ecosystem function would be, in this instance, extraordinarily high, and sufficiently so to warrant prohibition of clay mining from any undisturbed parts of the upland swamps[81]. The Commission itself has not attempted to identify alternative, ecologically sustainable sources of the material, or cost-effective substitutes for it, but believes that should be a matter for consideration by the Department of Mineral Resources.

The Commission strongly recommends that the relevant Crown lands containing upland swamps be designated for environment protection zonings under the Regional Environmental Plan. The relevant lands, with their high ecological values, are *already* in public ownership, and their associated socio-economic benefits already accrue, and should continue to accrue, to the community generally.

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[78] Sandstone quarrying and a proposed rifle range also pose threats to the upland swamps.

[79] The removal of this clay layer amounts to changing the shape and nature of the substrate responsible for maintaining the perched water table (Whittow 1984). Loss of the perched water table would mean *permanent* loss of the upland swamp habitat and its function in supplying continuous clean water. There is *no feasible way to rehabilitate the area* to restore the perched water table if the fundamental geomorphology, responsible for its existence, is altered. Revegetation efforts would be hampered by the fact that the original distribution of plant species is closely tied to the clay / peat lithology, the surface topography and the resultant hydrology and nutrient availability (Keith & Myerscough 1993). It is unlikely, if not impossible, that such a combination of characteristics could be re-established post-mining.

[80] The benefits to the regional economy are likely to be minor as the clay resource is not classified as 'regionally significant' by the Department of Mineral Resources.

[81] As part of this Inquiry process, the Commission prepared two technical background papers assessing the ecological value of these upland swamps (Holman 2000) and preliminary estimates of the economic value of the clay resource subject of a mining application (Gillespie Economics 2000). Both are available on request from the Commission. HRC (2000a, p. 118) provides a summary of estimated economic benefits.

NA 4 Management of Crown land on urban fringe, including that reverting to Aboriginal ownership that was degraded under prior Crown ownership

Lead Agency: ***Department of Land and Water Conservation***
Key Others: ***Department of Urban Affairs and Planning, National Parks and Wildlife Service, Department of Aboriginal Affairs, Local councils***

Crown land on the urban fringe should be managed by the State to levels commensurate with those required of private landholders and local councils. Priority should be given to areas on the urban fringe that are under the greatest pressure from illegal activities. A review of current management practices and an estimation of funds required to address degradation of Crown land in such areas should be undertaken.

There should be State assistance for the restoration of land reverting to Aboriginal ownership in circumstances where, under Crown ownership and management, that land had become degraded. Priority should be given to restoration in those aspects of land degradation that are incompatible with the maintenance of river health.

Traditional owners should be assisted in identifying areas that warrant permanent protection (including because of river health considerations) and uses of adjacent areas that would be compatible with those values.

Rationale for Recommendation NA 4

Under the *Crown Lands Act* 1989, the management of Crown land in NSW is the responsibility of the Department of Land and Water Conservation. Evidence to this Inquiry suggests that management has not been highly effective in large parts of the Georges River - Botany Bay catchment. The Draft Report (HRC 2000a, pp. 99-100) provides detail.

The Commission understands that the resources required to manage large tracts of bushland are considerable. Equally, the Commission believes that the State has an obligation to manage Crown land to a standard *at least* equivalent to that required of local government and private landholders. This issue has state-wide implications in terms of the problems, the questions of equity and the scale of resources required to undertake such management. Crown land on the urban fringe is subject to additional pressure related to high population densities in terms of illegal dumping, weed invasion and off-road vehicle access. Because of the very real impact that such activities have on many areas of Crown land in urban fringe areas, the Commission believes mechanisms for improved management of such areas *must* be established as a matter of priority. This view is supported by many submissions on the Draft Report which also identify a lack of effective management and/or funding as resulting in degradation of natural areas under Crown ownership (including lands comprising the Georges River Regional Open Space Corridor). Some suggest that "*the lack of management for the regional open space lands … is impacting on water quality*".

At the very least, there should be a review of current management practices and an estimation of the funding that would be required to mitigate the impacts on bushland and river health, from the above activities, which commonly occur at the urban fringe. The review should also explore sources of funding to support better management. For example,

in the Draft Report (HRC 2000a, p. 99) the Commission suggested funds could be sought from additional Treasury allocation to the relevant state agency, and / or from monies raised by limited development opportunities and lease arrangements *so long as any such use is compatible with protecting the land's natural values.*

The Commission continues to believe that where adequate funds can be raised, principles of 'accountable government' require that a proportion of the funds so raised should be dedicated to management of the Crown lands estate. Despite past practice and policy, the Commission believes it is not appropriate for all such revenue to be subsumed into general funds.

Recently, large tracts of formerly Crown land have been the subject of successful Local Aboriginal Land Council (LALC) claims by the Dharawal and Gandangara peoples (Appin and West Menai respectively). The Aboriginal Land Councils involved have submitted to this Inquiry that it is unfair to expect them to restore such degraded lands, entirely at *their* expense, when the degradation was allowed to occur under *state* ownership and stewardship. In the case of the Gandangara lands at West Menai, the Commission notes the extensive efforts that have been made by the traditional owners not only to clean up and commence restoration of the site, but also to gain the support and cooperation of the local council, agencies, and recreational users[82]. The Commission endorses these efforts and encourages state agencies to continue to support them. In particular, it supports attempts by the Environment Protection Authority to improve runoff to Mill Creek from the Lucas Heights Waste Management Centre and urges more concerted effort on the part of that Centre to augment on-site detention of sediment-laden stormwater.

The Commission has been informed that Land Councils are encouraged to apply for alternative sources of funding for environmental restoration available to groups within the community[83], and that they can also apply for a Commonwealth Government grant under a scheme exclusively for indigenous groups. Nevertheless, in the Commission's judgement, the State Government should also recognise responsibility for assisting such claimants to restore areas of land that were previously degraded as a consequence of continuing illegal access and use when in the hands of the Crown. That is *regardless* of whether the claimants were informed of the degraded condition of those lands prior to the claim being processed. The Department of Urban Affairs and Planning is supportive of this approach and believes that *"such assistance would be consistent with regional objectives for environmental improvement and would help to establish partnerships with the managers of a significant portion of the remaining natural areas in the catchment."*

The claims have changed the status of sizeable catchment areas from 'Crown land' to 'freehold'. The traditional owners now are seeking to ascribe residential and other zonings to some of those lands that have been severely degraded by off-road vehicles in order to pay for the conservation, enhancement and management of the remainder. The Commission supports this approach in principle, and notes that the Gandangara peoples intend to maintain large tracts of land which have not been degraded, including steep and sensitive

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[82] The Gandangara LALC has advised the Commission that it has undertaken a range of rehabilitation activities including removal of dumped car and rubbish, fencing to control unauthorised access, weed removal and land management planning. It also proposes to build a new 'town' on degraded areas in the north west corner of the land.

[83] That includes the Georges River Foreshore Improvement Program, to which the Commission understands a successful application has been made by the Gandangara peoples.

lands along Mill Creek and minor tributaries, as regional open space for passive recreation. This could amount to a 'win-win' situation and a pragmatic trade-off[84]. However, rezoning proposals should be conditional on such intentions being formalised, and sensitive areas duly identified by an open and participatory process[85]. It will be critical that state agencies such as the Department of Aboriginal Affairs, National Parks and Wildlife Service, the Department of Land and Water Conservation and the Department of Urban Affairs and Planning assist the traditional owners and the local council in this regard.

NA 5 Provision of 'offsets' and 'trade-offs'

Lead Agency: ***Department of Urban Affairs and Planning***
Key Others: ***Environment Protection Authority, Department of Land and Water Conservation, National Parks and Wildlife Service, local councils***

A consistent frame of reference should be established by the State, in consultation with local government, for the identification and application of the concept of 'offsets' and 'trade-offs' as they apply to developments that affect natural areas with important ecological value, including remaining waterways. These should be applied only in situations where development has been approved by a *public* process for its social and/or economic benefits and where that development may have *unavoidable* adverse impacts on remaining natural areas or ecosystem functions. The concept of 'no net loss of ecosystem function' should be applied to such situations.

The frame of reference should be incorporated into a relevant State Policy associated with the implementation of the proposed *PlanFirst* initiative, and thereby become incorporated into regional and local planning instruments.

Rationale for Recommendation NA 5

In its Draft Report (HRC 2000a) the Commission advocated the concept of 'no net loss', for example, of wetlands and/or natural streams, with a goal of a net increase over time. Application of this concept could mean that where an approved development would have unavoidable impacts, those impacts should be offset by environmental improvements elsewhere *before* development proceeds. A number of councils and agencies are already applying these concepts in the Georges River – Botany Bay catchment but without the application of the recommended qualifications. Examples include:

- installation of stormwater management controls as a ‘trade-off’ for floor space in redevelopment proposals at Green Square;
- rehabilitation of an old sand extraction site at Woolooware Bay as an 'offset' for damage to the Eve Street Wetland during construction of the M5 East extension; and

[84] The Commission has been advised that a recent development application made on behalf of the Gandangara LALC proposes best management practices for stormwater (including tertiary treatment of runoff), energy efficient housing and ongoing environmental management.

[85] The Gandangara peoples have already commenced this process in a voluntary capacity.

- proposed hand-over to public ownership of natural lands on the Kurnell Peninsula, as a 'trade-off' for development rights on other, degraded parts of the peninsula.

In citing these examples, the Commission is simply noting that they have been seen as legitimate parts of the development approval process by relevant decision-makers. The Commission is not offering comment on their individual merits.

Understandably, this has proved to be a sensitive issue. Several submissions from individuals and councils have questioned the theory of 'no net loss' and have sought additional information as to what is considered 'essential' development and examples of what might be considered appropriate offsets and trade-offs. Other submissions accused the Commission of 'giving the green light' to any future development. That is certainly *not* the Commission's intention. The Commission maintains that *avoidance* of environmental damage is the preferred approach. However, it recognises that *in practice* this may be difficult to achieve in all cases. Therefore, the Commission's intention is to ensure that in cases where a development is determined (by a public assessment process) to have critical benefits to society but might involve unavoidable damage to the original values (habitat/species, whatever it happens to be), compensation or 'offset' provisions must be imposed. *If no compensation or offsets can be formulated, then the development should not proceed.*

The Commission is aware that scientists urge caution not least because the effectiveness of creating 'compensation habitat' is limited by technical capability. In addition, the concept is problematic in urban areas where alternate sites are limited, and some other type of habitat may need to be sacrificed (as opposed to situations where degraded habitats can be restored). Longer term responsibility for maintenance and/or handover of the offset work must also be considered. Despite these limitations, the Commission believes that the concept has merit, and has now adopted the term of 'no net loss of ecosystem function'[86], which addresses the problem of the relative ecological simplicity of created habitats, compared to natural ones (a criticism levelled at 'compensatory wetlands').

In a highly urbanised environment, there inevitably will be situations where economic and environmental objectives conflict, and where ecologically sustainable development *on the subject site* is not possible. Historically, such occasions have resulted in adverse impacts on the environment, with no compensatory action elsewhere, as the economic imperative prevailed. Contemporary expectations suggest that such an approach is no longer acceptable. Increasingly, development approvals for such proposals have required some type of environmental offset or trade-off. The concept is not new, it has been used in NSW as part of regulatory controls for some time including:

- development approvals that provide a 'neutral or beneficial effect' on water quality;
- development approvals that require more trees to be planted than are destroyed;
- pollution control and the 'bubble licence' concept; and
- salinity trading schemes.

What has been missing to date is a frame of reference in which such decisions can be made in a consistent and transparent manner and with appropriate public input. Guidelines are

[86] See for example, Government of Canada 1991. *The Federal Policy on Wetland Conservation.* Available from the Canadian Wildlife Service, Environment Canada, Ottawa.

required to identify what are appropriate or commensurate offsets and trade-offs. The Commission understands that several state agencies are currently considering offset schemes in the context of specific natural resource issues. For example, the Environment Protection Authority is currently undertaking pilot projects in South Creek and in the Sydney drinking water catchments to look at ways of offsetting impacts on water quality (NSW Government 2001a). [87] The Department of Land and Water Conservation recently released a discussion paper considering the use of offsets in the management of native vegetation and salinity (DLWC 2001).

The Commission commends this work and recommends the development of a state-wide frame of reference to support it.

[87] For example, the Environment Protection Authority is currently developing a 'green offset scheme' to support the Sustaining the Catchments Regional Environmental Plan. The REP provides that, for a development to be approved, it must be shown to have a neutral or beneficial effect on water quality. The Department of Urban Affairs and Planning is developing specifics for a 'neutral or beneficial effect' test, expected to be completed by end 2001. Developments that cannot meet the test may be granted approval if they can demonstrate a net benefit by the use of offsets.

River and bay health objectives

The preceding recommendations are all designed to improve various aspects of river and bay health. The Commission is confident that together they would lead towards achievement of the objectives in this section. Submissions from agencies and the community have shown widespread support for these river and bay health objectives. The NSW Government has demonstrated its intent to improve river and bay health by its initiation of, and continuing commitment to, its water reform program. It has also signalled its commitment to improving the health of Botany Bay by expanding the Commission's Inquiry to include the bay and its entire catchment.

Accordingly, the following recommended objectives address the need to:

- protect river corridors (their natural structure and vegetation);
- provide adequate river flows for instream needs;
- improve water quality for protection of aquatic ecosystems and other uses; and
- collect sufficient and appropriate data to enable implementation of an adaptive approach to improving river and bay health cost effectively.

Evidence from this Inquiry has confirmed the need to address those river and bay health objectives while recognising wider environmental values and management goals. HRC (2000a, pp. 28-32) provides detail.

RHO 1 Environmental values

Lead Agency: ***Environment Protection Authority***
Key Others: ***Local councils, Department of Urban Affairs and Planning, Department of Land and Water Conservation***

The Environmental Values shown in Table 7.1 and the management goals shown in Table 7.2 should be endorsed as the long term targets to which management programs of state and local government entities are directed.

Achievement of those values will depend upon the success of relevant programs in achieving the river corridor, river flow, and water quality objectives recommended in this Final Report. Accordingly, all decision-making related to those programs should be guided by these environmental values and associated goals.

Table 7.1. Environmental values for the Georges River - Botany Bay system.

Environmental value	Catchment division (as shown in Figure 7.1)					
	Natural	Mixed use rural	Georges estuary	Cooks estuary	Botany Bay	Urban (other)
Protection of visual character (a)	✔	✔	✔	✔	✔	✔
Protection of aquatic and riparian ecosystems (b)	✔	✔	✔	✔	✔	✔
Protection of farmstead water (c)	✔	✔ (d)				
Protection of urban water supply drinking water (e)	✔					
Protection of irrigation water	✔	✔ (d)				
Protection of livestock water	✔	✔ (d)				
Protection of human consumers of cooked fish, shellfish and crustaceans (f)	✔	(g)	✔	(g)	✔	(g)
Protection of primary contact recreation	✔ (j)	✔	✔	(h)	✔	
Protection of secondary contact recreation	✔	✔	✔	✔	✔	✔

Notes to Table 7.1

(a) The Commission is using 'protection of visual character' in a wider sense than it has previously been used in, for example, the National Water Quality Management Strategy. It includes preservation of the *character* of the landscape immediately surrounding the waterways (for example, rock outcrops in the lower Georges estuary or the green corridor along the Cooks River) as well as the appearance of the water itself. In recognising this aspiration, the Commission also recognises that it may not be achievable in some urban waterways where channels have been highly modified or piped.

(b) The Commission is also using 'protection of aquatic and riparian ecosystems' in a wider sense than has been previously used. There are many links between aquatic ecosystems and the adjacent riparian (or riverside) ecosystems. For example, riparian trees may shade riverbank habitat, helping to control water temperatures; provide woody debris, leaf litter and insects, which fall from native riparian vegetation and make important contributions to the aquatic ecosystem. In turn, birds and insects that form part of the riparian ecosystem may feed on fish or other aquatic life. A healthy river requires both of these strongly interrelated ecosystems to be in a healthy state. The Commission notes that the community generally wants all waterways, including those in urban areas, to support living (albeit modified) ecosystems. In recognising this aspiration, the Commission also recognises that it may not be achievable in some urban waterways for many years,

and certainly not until engineered channels or banks are substantially removed or modified (priorities should be guided by the management goals in Table 7.2).

(c) The Commission has been informed that there are a number of rural dwellings, which are not connected to the Sydney Water Corporation reticulation network, and which draw water from streams for domestic use. Wherever rural citizens draw water directly from the river for drinking or cooking, appropriate treatment will be required so that, after treatment, water at the point of consumption will comply with the NHMRC/ARMCANZ (1996) guidelines for drinking water. Numerical values for raw water quality in these circumstances will depend on the extent and type of treatment. NSW Health also recommends disinfection of all river water to be used for showering and bathing. Note (i) also applies.

(d) Of all streams in this catchment division, the Commission considers that only a few in the upper catchment are suitable for these water supply uses unless water is subjected to a high level of treatment.

(e) The protection of drinking water for use in urban water supply is treated as a separate issue from the protection of homestead water supplies because of the likely greater scale and extent of treatment of the former. The Commission's endorsement of this environmental value means, in effect, that it endorses a standard for raw (river) water that, with 'conventional treatment technology', would be converted to drinking water of NHMRC/ARMCANZ standards at the point of consumption. The corresponding raw water quality objective will depend on the extent and type of treatment, but will in any case be equivalent or less stringent than the objective for protection of farmstead water supplies (because of the generally greater extent of treatment in urban water supply systems). Note (i) also applies.

(f) The Commission's endorsement of this value does not imply that fish, shellfish and crustaceans would necessarily be safe for human consumption, especially if eaten raw. The Environment Protection Authority and NSW Health advocate that all such foods be cooked (other than those commercially grown, subjected to a quality assurance program and depurated prior to point of sale). Local councils and other appropriate authorities should take measures to make citizens aware of any health risks involved in eating such foods, whether cooked or raw.

(g) Despite the possibility that fish or crustaceans may be found in some streams in these catchment divisions, the Commission considers that it is unlikely that this value can be achieved in these catchment divisions for many years.

(h) The Commission considers that it is unlikely that primary contact recreation will be safe in this catchment division for many years, but does not intend that it be precluded for all time. It should be retained as a longer term goal.

(i) Despite the availability of water treatment, it is strongly recommended that catchment management be used to ensure that the raw water is of as high a quality as possible, to facilitate treatment and reduce the risk of drinking water not meeting guidelines at point of consumption.

(j) Public access is not permitted within the catchment of Woronora Dam and entry is regulated under the *Sydney Water Catchment Management (General) Regulation* 2000.

As such, a classification of 'primary contact recreation' in natural areas of the catchment should not be interpreted as permitting activities such as swimming in the catchment of the Woronora Dam.

Table 7.2 Management Goals for Georges River - Botany Bay subcatchments.

Catchments	Environment condition	Desired outcomes	Management goal
O'Hares, Punchbowl, Williams, Deadmans & Harris Creeks and upper Woronora River.	Substantially unmodified	Preserve natural geomorphic, hydrologic and ecological processes and biodiversity.	Protect current condition
Upper Georges River. Towra wetlands & Woolooware Bay	Slightly modified	Restore natural processes and biodiversity as much as practicable.	Restore natural condition
Georges River estuary and southern Botany Bay.	Moderately modified	Retain or restore important natural processes/ biodiversity and protect desired public uses.	Maintain or restore healthy modified conditions
Most urban streams, Cooks River, Alexandra Canal, Chipping Norton Lake, Botany & Rockdale wetlands, Centennial Park ponds, northern Botany Bay.	Highly modified	Restore ability to sustain chosen values/uses.	Rehabilitate key elements

Table 7.3 Georges River - Botany Bay Catchment Divisions used in relation to the recommended environmental values in Table 7.1 and illustrated in Figure 7.1 below.

Catchment division	Brief description
Natural	Wooded upper catchment areas, largely undeveloped, in military reserve, National Park and Sydney Catchment Authority Special Areas and non-tidal Woronora River
Mixed use rural	Cleared land, often urban fringe, used for various types of farming
Georges and Woronora estuary	Tidal section of the Georges River, between Liverpool weir and Captain Cook bridge and Woronora River up to the Needles
Cooks estuary	The tidal section of the Cooks River and Alexandra Canal
Botany Bay	Botany Bay and foreshores, including Woolooware Bay and Towra Point.
Urban (other)	Other urban areas in the Sydney metropolitan area

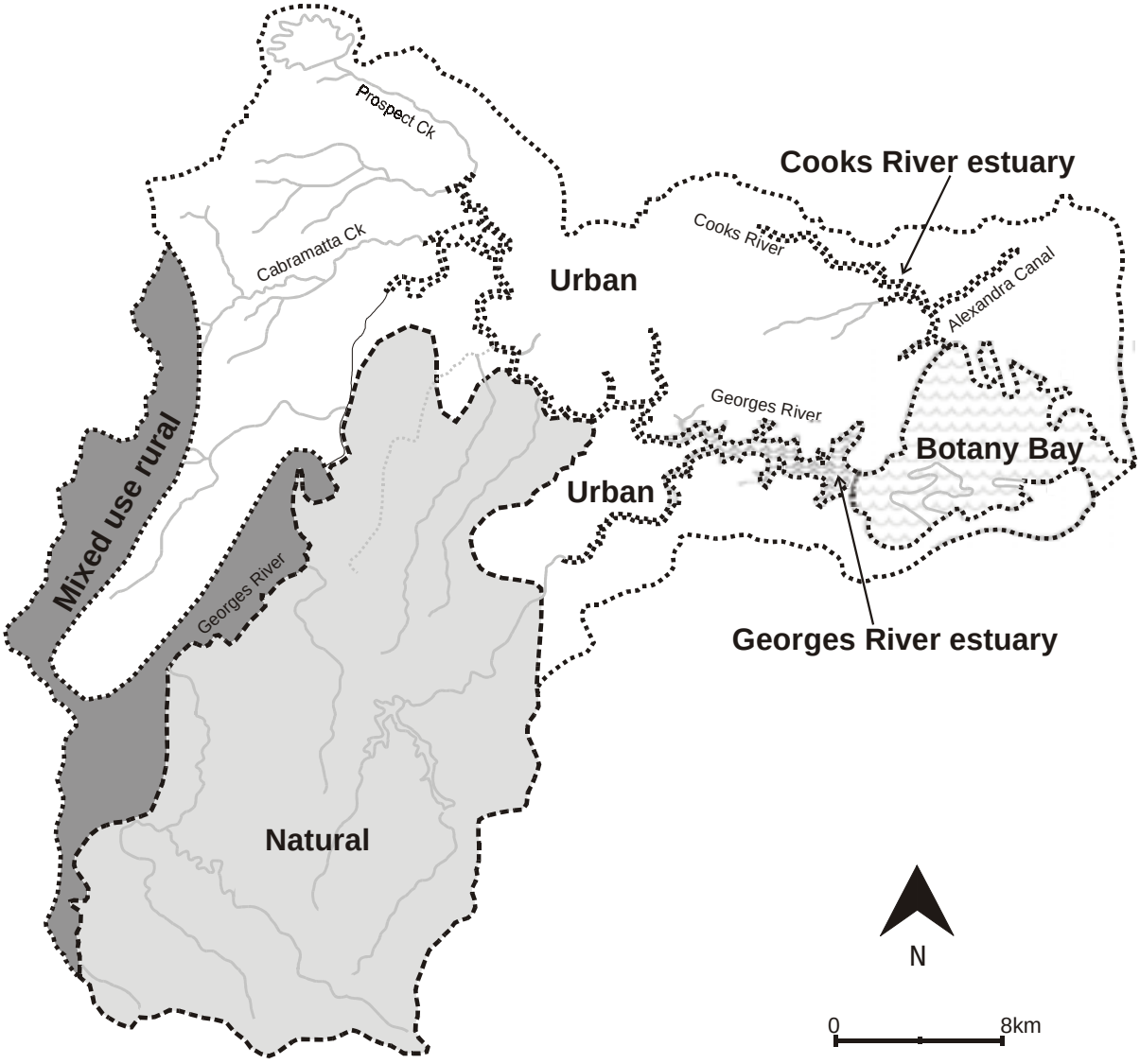

Figure 7.1. Georges River - Botany Bay catchment divisions

Rationale for recommendation RHO 1

The Commission uses the term *'environmental values',* as in its previous Inquiry reports and as used in the ANZECC water quality guidelines, to describe the value (reflected, in part, in uses) the community places on water in a particular location.[88] Evidence presented to this Inquiry includes the results of the 'interim environmental objectives setting process', which included a previous round of public consultation coordinated by the Environment Protection Authority. The environmental values shown in Table 7.1, together with the management goals in Table 7.2, should be adopted as the basis of determining river corridor, river flow and water quality objectives for the catchment, and for future management programs.

Submissions generally expressed support for these river health objectives, for example, "*the values ... will set an adequate basis to determine objectives for the catchment*"; "*supports the use of guideline trigger values for water quality and ecosystem management*"; and "*supports the objectives as being an excellent reference point from which to develop specific, measurable, accountable outcomes".*

One submission to HRC (2000a) questioned why environmental values were not nominated for groundwater. The Commission does not have sufficient information in relation to groundwater quality to recommend a particular goal for that water source. Recommendation BM 7 addresses the need to utilise existing information better in order to guide appropriate use and protection of the Botany Aquifer.

[88] Following an extended period of community consultation, the NSW Government, in October 1999, released its *'Water Quality and River Flow Interim Environmental Objectives'* for most of the state's rivers, including for the Cooks and Georges Rivers (the latter includes Botany Bay). Those objectives are to apply until the Government endorses the objectives recommended by the Healthy Rivers Commission, *and* the strategies to achieve them, resulting from this Inquiry. The 'interim process' included up to eleven water quality objectives (termed 'environmental values' in the ANZECC guidelines and in previous interim process material) and up to twelve river flow objectives. (HRC 2000a, p. 11 provides a full list.) This interim process was state-wide, accordingly, many objectives applicable to streams flowing through rural lands have limited relevance to a highly urbanised system such as the Georges River - Botany Bay. As an integral part of the Government's water reform agenda, the Commission has adopted the principles of this interim process, including the aim "*to provide the most cost-effective and practical mix of solutions to meet the individual needs of each river system and catchment."*

RHO 2 River corridor objectives

Lead Agency: ***Department of Land and Water Conservation***
Key Others: ***Local councils, Department of Urban Affairs and Planning***

The following river corridor objectives should be adopted as long term goals for streams throughout the catchment, with priorities determined by the management goals pursuant to Recommendation RHO 1:

- **retain channels and foreshores in near natural condition and, where opportunities arise, use the development process as a catalyst for improving already degraded areas;**
- **maintain or restore aquatic, riparian and foreshore vegetation;**
- **maintain or increase public ownership of and/or access[89] to foreshore land;**
- **control excessive erosion and sedimentation;**
- **replace non-native with native riverbank vegetation as opportunities arise.**

Rationale for recommendation RHO 2

These objectives, described more fully in HRC (2000a, p. 33), represent pre-conditions for the full achievement of the environmental values in Recommendation RHO 1. Some will be attainable only in the longer term, but all should be addressed as opportunity arises in the design and delivery of management programs. They should be accorded equal status, in that sense, with water quality and river flow objectives. Priorities should be determined by the management goals in Table 7.2 and matched to funds available.

One submission to the Inquiry pointed out that "*if this objective is to be achieved in the long term, there needs to be state government policy formulated on redevelopment of land adjacent to urban channels*". The Commission agrees with that view, and believes that need should be addressed by the urban component of the State Riverine Corridor Policy pursuant to Recommendation RC 1. Nevertheless, the Commission emphasises that it is critical to retain what remains of the natural areas, and where opportunities arise, to use the development process as a catalyst for improvement of already degraded sites as part of the stormwater improvement programs of state and local government.

[89] This is with the exception of the lands surrounding Woronora Dam, where public access is not permitted in order to protect the quality of water supply. Entry to these areas is regulated under the *Sydney Water Catchment Management (General) Regulation* 2000.

RHO 3 River flow objectives

Lead Agency: ***Department of Land and Water Conservation***
Key Others: ***Sydney Catchment Authority, Local councils***

The following river flow objectives should be adopted for the Georges River - Botany Bay system, with priorities determined by the management goals pursuant to Recommendation RHO 1:

- **mimic the natural pattern of flows;**
- **protect low flows;**
- **ameliorate the impact of instream structures on fish passage;**
- **delineate, protect and restore groundwater systems and their associated ecosystems**

Rationale for recommendation RHO 3

Achievement of the flow objectives is a critical step towards assuring the recommended environmental values in some streams. However, as discussed in HRC (2000a, p. 34), there would be little benefit in providing more natural flow regimes to highly modified or artificial channels. Accordingly, the management goals shown in Table 7.2 must inform the implementation of these river flow objectives. Priority should be given to streams with water storages and other structures. The management goals indicate that the Woronora River would most benefit from implementation of programs to achieve the river flow objectives, pursuant to Recommendation RF 2.

Woronora Dam significantly reduces the frequency and volume of downstream flows, with only major floods generally passing unaffected. Unlike other rivers, wherein major water supply storages are situated, the fresh water reaches of the Woronora River are not impacted by other water extractions downstream of the storage. Neither are they significantly affected by clearing or major pollution sources. Accordingly, a more natural pattern of low and medium flows should be restored as it will provide maximum benefit to an otherwise healthy river. Prospect Reservoir has a more limited effect because of its very small catchment area and other significant downstream impacts as discussed in the Rationale for recommendation RF 2.

One of the main impacts on the natural flow regime in urban areas has been the change in runoff and infiltration patterns in response to vegetation clearing and increases in sealed surfaces[90]. Accordingly, future urban and suburban development should not be permitted to increase runoff to streams, pursuant to Recommendation WM 2. The impacts of existing development on instream hydrology should be reduced via measures that retain stormwater on site and/or reduce the downstream impacts of increased stormwater runoff. All opportunities to do this should be taken when redevelopment is being considered. Urban 'rejuvenation' programs should be designed to improve river health significantly in previously degraded areas, pursuant to Recommendation RC 1.

[90] This changes the shape of the hydrograph, creating higher 'peaks' in storm runoff and less groundwater contribution to low flows in dry periods.

RHO 4 Water quality objectives

Lead Agency: ***Environment Protection Authority***
Key Others: ***Local councils, Department of Urban Affairs and Planning***

The 'guideline trigger values' contained in ANZECC Guidelines (2001) should be adopted and used as indicative values for the initial phases of an adaptive approach to water quality and ecosystem management, which should be guided by the management goals pursuant to Recommendation RHO 1.

The trigger values provided for nutrients may not be appropriate for parts of the Georges River – Botany Bay system. Site-specific studies should be undertaken in cases where those values are to form the basis of any regulatory program or nutrient trading scheme.

Rationale for recommendation RHO 4

These objectives form only part of the Commission's recommendations for protection of aquatic ecosystems and human health. All of the preceding recommendations, together, comprise an integrated management strategy for river and bay health, which includes improved water quality.

HRC (2000a, pp. 35-37) recommended a revised range of nutrient criteria for various parts of the catchment. Those criteria derived from efforts to define nutrient values with somewhat more rigour, in relation to the particular characteristics of this catchment, than is possible by applying the ANZECC Guidelines (2001). These guidelines have been developed in the light of information from many different catchments. (The Commission's methodology was fully explained and can inform future studies.) However, in light of the new and revised ANZECC Guidelines, the lack of detailed water quality and ecosystem data and concern expressed by the Environment Protection Authority that the recommended values were not sufficiently stringent, the Commission has determined to endorse the use of ANZECC (2001) for *all* water quality criteria.

The Commission reiterates that numeric water quality objectives for nutrients should not, as a general rule, be used for regulatory purposes. Any proposal to do so should be preceded by sufficiently detailed site-specific studies to enable a reasonable assessment of what the aquatic ecosystem would be able to sustain. For example, it is likely that the naturally turbid Georges River would be able to sustain higher nutrient loads without algal blooms developing than might be the case for some clear water streams. As one submission expressed it: "*there is no point setting a trigger level that is not taken seriously and that reflects a water quality standard that cannot be reached. It is agreed that further research and an adaptive approach are needed"*.[91]

[91] Appropriate nutrient concentrations are difficult to define and would need definition at many locations throughout the catchment. As well as existing nutrient levels and degree of algal growth, each site-specific study would also need to determine many factors including the abundance of algal 'graziers', the ability of algae to store phosphorus and/or the ability of some algae to fix atmospheric nitrogen. Also temperature, turbidity and P:N ratio significantly modify the way that ecosystems respond to elevated nutrient levels. In the Commission's judgment, such work could only be justified or considered necessary if a critical issue arose over which there was major disagreement.

In that context, the Commission believes that it would be better to rely on ANZECC guidelines and use them as conservative 'trigger levels' which, if they are being breached, *may* demonstrate the need to do site-specific studies. Even where such detailed studies may be justified, such as where pollution *sources* can be identified and managers held accountable for them, it may be more cost-effective to find and address the source rather than to narrow further the target *ambient* water quality. That is especially the case where there are multiple sources and accountability is therefore difficult to ascribe.

Most importantly, the Commission is convinced that the absence of precise water quality objectives should not be used to *postpone* the implementation of water quality improvement strategies, including those for stormwater. Guideline trigger values are useful to indicate priorities and directions for change, but precise numerical targets only need to be as precise as the models that will be used to determine catchment changes required to achieve them. Accordingly, an adaptive approach would comprise the following steps. Current models and information should be used to determine Sydney-wide priorities and, say, five-year water quality targets. Every five years, progress should be reviewed against those and broader river health targets, such as restoring natural channels and riverside vegetation. Progress in achieving the broader river health targets should be considered progressively in determining if more refined water quality targets are required. That approach would allow real progress to be made in improving overall river health, and further defining water quality objectives *at the same time.*

RHO 5 River and bay health data

Lead Agency: ***Environment Protection Authority***
Key Others: ***Department of Land and Water Conservation, Local councils, Department of Urban Affairs and Planning***

All river and bay health monitoring activities should be consolidated into an integrated program which satisfies contemporary standards for site selection, continuity (spatial and temporal) and quality assurance, and which is commensurate with the management needs and management efforts in the catchment/river/bay systems. Results of river and bay health monitoring should be publicly available and regularly reported.

One entity should be assigned responsibility for the program design and coordination of monitoring activities and for the integration and quality assurance of data collection and analyses. Pursuant to Recommendations RF 1 and WM 1, the entity responsible for integrated water and wastewater management in the metropolitan area should be given responsibility for integrated water quality data collection and analysis.

Rationale for recommendation RHO 5

As in other Inquiries, the Commission refers throughout this report to the need for adaptive management. This is because governments and communities must make judgements about 'standards' for river and bay health in circumstances where there are no 'absolutes'. As noted, information is frequently incomplete, both in relation to the causes of problems and the effectiveness of various management responses. In line with the precautionary principle, therefore, management effort to improve and protect river and bay health cannot wait until

precise knowledge is available. Judgements must be made with the best available knowledge now and appropriate action instigated, with ongoing monitoring to assess that the desired/predicted outcomes are achieved when the agreed actions have been implemented.

The role of science is obviously important to assist Governments and communities develop an understanding of causal linkages and so determine what are essentially acceptable risk management strategies. As one submission on the Draft Report stated, adaptive management *"necessitates identifying relevant and efficient variables that will respond to managerial action and which are tightly linked to the variable which defined the problem in the first place."* The same submission argues against *"routine programmes of measurement…* (involving) *the routine collection of imprecise estimates of inappropriate or irrelevant variables."* The Commission agrees with those views. It is critical to identify the most appropriate measures of river and bay health, which may not necessarily be water quality parameters. Recommendations for strategies to improve water quality and environmental flows *for aquatic ecosystem health* will also need to rely on measurement of the ecosystem itself, both the biota and its habitat.

Obviously for other purposes, such as for human health, water quality and seafood sampling are more appropriate. Credible water quality and sediment data will be required to evaluate the cumulative effect of the many wastewater programs currently being implemented. It follows that the entity charged with integrated water and wastewater management in the metropolitan area would be required to collect water quality data and ecosystem data (at strategic locations) as one measure of its performance

However, there is also a real need to measure the success of urban planning initiatives in terms of broader, often more significant, river health indicators such as stream channel condition and riverside vegetation, and, in the case of Botany Bay, changes in the temporal and spatial pattern of sand distribution. This is widely supported within the scientific community such as the CRC for Freshwater Ecology[92], and other management entities, including the Sydney Catchment Authority and some councils[93].

[92] Cullen (2001) is an example.

[93] A similar approach is being taken in the Hawkesbury Nepean catchment under the "Integrated Water Monitoring Framework" being developed by the Department of Land and Water Conservation.

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PART C

Appendices

A1 Inquiry process

This Inquiry process commenced with investigations into the Woronora River system, for which findings and draft recommendations (HRC 1999) were released in June 1999. Government then expanded that Inquiry to include the entire Georges River - Botany Bay catchment.

In October 1999 the Commission circulated a Discussion Paper on the expanded Inquiry, outlining its broader scope and inviting submissions. Public hearings were held in November of that year at four locations throughout the catchment. Over sixty written submissions were received and twenty-six verbal presentations were made at the public hearings on the expanded Inquiry.

The Commission released its findings and draft recommendations (HRC 2000a) for public comment in October 2000. The report was made available on the Commission's web site and copies were sent to those who had made comment on the Discussion Paper, who had attended or presented at the public hearings and others thought to be interested in the management of the Georges River - Botany Bay system. (Both that report and the earlier one on the Woronora River remain current and are available from the Commission.) Public briefing sessions at which the Commissioner presented his findings and draft recommendations were held at Sutherland, Campbelltown and Hurstville in November 2000. Seventy people attended those briefings, representing state and local government, community groups and individual citizens.

The Commission received a total of sixty written submissions in response to the Draft Report, of which thirteen were on the 'quick response form' circulated with the Report. Responses were received from citizens, environmental and community groups, industry interests, local, state and federal government agencies. A list of submissions is provided below. Responses to the Draft Report are incorporated into relevant sections of this Final Report.

Throughout the course of the Inquiry, the Commission held meetings with a number of key institutional stakeholders in the catchment and state Ministers about particular recommendations. The Commission also sought independent expert advice on particular technical issues[94], reviewed numerous documents, as set out in the reference list, and held specialist workshops with relevant stakeholders and agency operatives. The Commission also addressed a number of workshops and forums aimed at local environmental groups, councils and the scientific community that were facilitated by SSROC's Botany Bay Program.

[94] Studies undertaken on behalf of the Commission are listed below.

Submissions

The table below lists those who made written submissions on the Draft Report of the Georges River - Botany Bay Inquiry. A list of people who made submissions to previous stages of the Inquiry can be found in Appendix A2 of HRC (2000a, pp. 112-115).

WRITTEN SUBMISSIONS ON GEORGES RIVER – BOTANY BAY DRAFT REPORT RECEIVED FROM:			
A/Prof	P	Adam	Rockdale Wetlands Preservation Society
A/Prof	P	Adam	University of NSW
Mr	M	Armstrong	Department of Mineral Resources
Mr	J	Colman	Botany Bay Program
Mr	A	Caraco	Southern Property Group Pty Ltd
Mr	S	Corbett	NSW Health Department
Ms	L	Corbyn	Environment Protection Authority
Mr	J	Cowling	Rail Infrastructure Corporation
Mr	J	Cox	IPART
Ms	S	Cullis	Georges River Environment Alliance
Mr & Mrs	B & P	Durman	Residents
Ms	W	Davies	Macarthur Greens
Mr	A	Docking	NSW Agriculture
Mr	S	Dunn	NSW Fisheries
Dr	T M	Florence	
Dr	M	Ferson	South Eastern Sydney Public Health Unit
Ms	V	Fowler	Campbelltown City Council
Mr	D	Gathercole	Randwick City Council
Mr	J	Gray	Australian Conservation Foundation
Mr	G	Greenup	
Mr	M	Grice	Resident
Mr	B	Harvey	St. George Sport Fishing Club
Mr	J	Hayes	Sydney Ports Corporation
Ms	S	Holliday	Department of Urban Affairs and Planning
Dr	D	Keith	
Ms	C	Kerr	
Mr	P	Komidar	Environment Australia – Marine and Water Division
Mr	R	Leghissa	Resident
Mr	S	Lees	Upper Parramatta River Catchment Trust
Ms	L	McCormack	
Mr	A	McKerron	Resident
Mrs	B	Michie	Resident
Mr	M	Mouritz	Kogarah Council
Ms	H	Mulligan	National Parks and Wildlife Service
Dr	I	Mumme	Resident
Mr	T G	Parry	IPART
Mr	G	Peacock	For Gandangara LALC
Mr	K	Pearce	Resident
Ms	M	Peterson	Department of Defence
Dr	D	Pollard	NSW Fisheries
Mr	D	Rawlings	Sydney Metropolitan Fishermen's Pro-Am Committee
Mr	J	Rayner	Sutherland Shire Council
Mr	P	Ritchie	Holroyd City Council
Mr	N	Rogers	Community volunteer

Mr	G	Schoer	National Parks Association – Southern Sydney Branch
Mr	P	Shepherd	City of Botany Bay Council
Mr	KP	Sheridan	NSW Agriculture
Dr	B	Smith	Department of Land and Water Conservation
Mr	W	Smith	Resident
Mr	T	Stewart	Hurstville City Council
Mr	M	Taylor	Waterways
Mr	P	Tosi	Campbelltown City Council
Prof	A J	Underwood	Ecological Impacts of Coastal Cities, University of Sydney
Mr	H	Urriola	Atlantis Corporation Pty Ltd
Mr	A	Walker	Sydney Water Corporation
Mr	R	Walshe	Sutherland Shire Environment Centre
Mr	G	Whitelaw	Resident
Mr	G	Withycombe	Sydney Coastal Councils Group
Mr	J	Wright	Sydney Catchment Authority
			Botany Bay Program Non-Government Organisations Forum
			Southern Sydney Regional Organisation of Councils and Western Sydney Regional Organisation of Councils

CONSULTANCIES	
Greg Oliver, EPM Consulting	Integrated Management Arrangements for Botany Bay
Peter Cowell, Coastal Studies Unit, University of Sydney	Review of Changes to the Shores and Bed of Botany Bay: Past and Future
Gillespie Economics	Estimates of the Economic Value of Clay Extraction in the Upper Reaches of the Georges River Catchment

EXPERT PANELS	
Woronora River Expert Panel [95]	Expert Panel Report on Environmental Flow Requirements of the Woronora River
Woronora River calibration release Expert Panel[96]	Recommendations for Environmental Flows in the Woronora River, below Woronora Dam

MODELLING UNDERTAKEN FOR THE COMMISSION	
Sydney Catchment Authority	Effects of Environmental Releases from Woronora Dam on System Operation and Reliability

[95] The Woronora River Expert Panel consisted of Dr Bill Young, CSIRO Land and Water Division (facilitator); Dr Surrey Jacobs, Royal Botanic Gardens (instream vegetation); Dr Tim Entwistle, Royal Botanic Gardens (algae); Dr Ivor Growns, AWT (macroinvertebrates); Mr Warren Martin (hydrology / water supply infrastructure); Dr John Harris, NSW Fisheries (fish); and Dr Wayne Erskine, State Forests of NSW (geomorphology).

[96] The Woronora River calibration release Expert Panel consisted of Dr Bill Young, CSIRO Land and Water Division (facilitator); Dr Wayne Erskine, State Forests of NSW (geomorphology), Dr Surrey Jacobs, Royal Botanic Gardens (instream vegetation); Dr Ivor Growns, NSW Fisheries (macroinvertebrates); and Dr John Harris, consultant (fish).

Complementary consultation processes

In addition to the consultation processes undertaken by the Commission, Kogarah Council hosted a "Georges River Symposium" in December 1999 which was attended by 140 people from agencies, councils, environment groups, academia and the general public. The symposium was designed to facilitate widespread input to the Inquiry process, and Council summarised findings of associated workshops for the Commission. The workshop identified four themes for management of this catchment:

- coordinated management;
- planning, design and development control;
- community education and involvement; and
- catchment and waterway restoration.

The Commission sees each of these as very important and supports their implementation through the urban stream and stormwater management of all councils in the catchment. The recommendations in this Final Report target are directed largely at State agencies, with some being relevant to Commonwealth agencies. The recommendations are designed to support councils in their management at the local level by providing processes designed to lead to integrated and whole of government approaches to planning, community education and restoration programs[97].

The Local Government Forum *GRABB the future,* held on 1 February 2000 and organised by SSROC as part of its 'Botany Bay Program' was attended by 44 staff and councillors from catchment councils. The workshop outcome was a joint submission on the Draft Report.

[97] Examples of current and proposed State programs include the Department of Urban Affairs and Planning's *PlanFirst* initiative, and the Environment Protection Authority's Stormwater Management initiative (including its education and restoration components).

A2 Determination of environmental flows for Woronora River

A2.1 Context

In nominating the Hawkesbury Nepean, Shoalhaven and Woronora rivers for Inquiry by the Healthy Rivers Commission, the Government has assigned the Commission responsibility for determining appropriate environmental flow provisions for all the rivers affected by major storages owned and operated by the Sydney Catchment Authority. Throughout these three Inquiries, the Commission has maintained that the key elements of the water supply system, including provision of environmental flows, demand management and reuse of effluent, must be managed as one integrated system, across the three catchments. In determining appropriate environmental flows for the river systems, the Commission considers ecological requirements of the rivers, and balances these against the implications for the water supply authorities (and ultimately their customers) in terms of security and reliability of the water supply, costs, opportunities to reduce demand and alternate sources of supply (such as reuse of appropriately treated effluent).

Consideration of environmental flows in the Woronora River was initiated in 1998. Results of an expert panel investigation, undertaken as part of the Inquiry process, were reported in HRC (1999c). Following release of that report (and expansion of the Inquiry to cover the entire Georges River - Botany Bay catchment), the Sydney Catchment Authority conducted system modelling to investigate the effects of a range of environmental flows on the security and reliability of the water supply system[98]. The results informed the Commission's formulation of the flow regime recommended in the Draft Report of this Inquiry (HRC 2000a).

Since release of that Report, a number of Government decisions and agency actions have ensued with a direct bearing on this Inquiry. They have contributed to the Commission's final recommendations for environmental flows in the Woronora River. These decisions and actions are outlined briefly below.

[98] A summary of the modelling results is presented in HRC (2000a, Appendix A3.1, pp. 116-118). The model considers the implications of the environmental flows for the timing of system augmentation, the frequency of restrictions and operating costs. Since release of the Draft Report, the Sydney Catchment Authority has incorporated new climate data into the system modelling.

A 2.1.1 Government Decisions on Recommendations from the Commission's Hawkesbury Nepean and Shoalhaven Inquiries

The Government issued a *Statement of Joint Intent for the Hawkesbury Nepean River* (NSW Government 2001b) in March 2001 as its response to the recommendations of the Commission's Hawkesbury Nepean Inquiry (HRC 1998)[99]. As part of this statement, the Government established the Hawkesbury Nepean River Management Forum[100] to make recommendations to the Ministers for Land and Water Conservation and the Environment about environmental flow provisions for inclusion in the Water Management Licence for the Sydney Catchment Authority. In considering environmental flow provisions, the Forum will need to consider the Commission's recommendations, all other water users (including those that extract direct from the river), alternate sources of supply (including appropriately treated effluent) and the impact of the upper Nepean weirs. Additionally, the Minister for the Environment has appointed an independent expert panel to provide advice on environmental flows, in accordance with s9.4.3 of the Sydney Catchment Authority's Operating Licence. The panel will provide advice to the Minister on environmental flows in the three rivers, as well as advice to the Hawkesbury Nepean Water Forum.

The Government also issued a *Statement of Intent for the Shoalhaven River System* (NSW Government 2001c), in February 2001, outlining its response to the recommendations from the Commission's Shoalhaven Inquiry (HRC 1999b). The Government determined that the storages owned and operated by the Sydney Catchment Authority should be managed as components of a whole system. Environmental flow releases to one part of the system should not be offset, or compensated for, by increasing inter-valley transfers that could compromise the health of another part of the system.

The Statement of Intent notes that the Water Management Licence (more details follow) for the Sydney Catchment Authority should include the following, among other things:

- *"A requirement for the water supply system to be operated in such a way as to recognise the interrelationships between the environmental requirements of all four major river systems from which water is procured, that is the Upper Nepean, Warragamba, Shoalhaven and Woronora. No one system should be disadvantaged for the sake of another.*
- *Formal recognition of water sharing arrangements involving Sydney Catchment Authority, Shoalhaven Water, Eraring Energy[101], the environment and other users.*
- *Explicit operational policies and procedures governing the transfer of water from the Shoalhaven to the Sydney system."*

The SOI also requires that a drought management plan be developed, as part of the Water Management Plan for the Shoalhaven River. This plan will "*recommend protocols for the sharing of water under low flow conditions, not only between Sydney and Shoalhaven water supply*

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[99] A copy of the *Statement of Joint Intent* (SOJI) is available on the Commission's web site.

[100] The Forum consists of an independent chair and 17 representatives from the Sydney Catchment Authority, Sydney Water, Upper Nepean Water Users Association, Lower Nepean Hawkesbury Water Users Association, Shoalhaven/Illawarra Water Management Committee, NSW Seafood Industry Council, NSW Fishing Clubs Association, Crushed Stone and Sand Association, Nature Conservation Council, Local Government Association of NSW, Department of Aboriginal Affairs, Department of Land and Water Conservation, Environment Protection Authority, NSW Agriculture, NSW Fisheries, Department of Urban Affairs and Planning and National Parks and Wildlife Service.

[101] Generates electricity from the Shoalhaven Scheme.

systems but also between consumptive users and the environment. This plan will incorporate the criteria for decision making in the occasional, very dry conditions in which environmental flows may need to be reduced to provide essential town water supplies."

The Commission has built on these Government decisions in the course of its Georges River - Botany Bay Inquiry. The Commission asserts that criteria for decision - making during prolonged droughts must be expanded to encompass all of the river systems affected by the Sydney Catchment Authority storages, pursuant to Recommendation RF 1 from this Report.

A 2.1.2 Water Management Licence

The Department of Land and Water Conservation issued a Water Management Licence, under Part 9 of the *Water Act* 1912, to the Sydney Catchment Authority in April 2001. The licence is for a 20 year period with an initial review in September 2001 and then every five years.

The licence outlines, among other things, the Sydney Catchment Authority's water access rights and obligations in relation to all of its storages, riparian and environmental flow releases, and monitoring and reporting requirements. The licence defers to the Commission's Georges River - Botany Bay Inquiry process for the determination of environmental flows for the Woronora River, based on outcomes of the trial (calibration) release exercise. The licence contains *provisional* environmental flows for the Authority's storages on the Hawkesbury Nepean and Shoalhaven rivers (based on previous Commission Inquiries)[102].

A2.2 Woronora River calibration release

In response to the Commission's expert panel process and draft recommendations, the Sydney Catchment Authority agreed to undertake a calibration release to 'test' the effect of certain flow volumes on the river downstream of the reservoir (HRC 2000a, pp. 60-61 provides details). The calibration release was made over a four-day period in March 2001. Monitoring of flow and water quality was undertaken at selected sites, and an independent expert panel observed the effect on riverine ecology[103].

The exercise involved observing the effects of two planned releases: a low flow (20 ML/d) and a higher flow (200 ML/d) release on the extent and diversity of macroinvertebrate and fish habitat, riparian and instream vegetation and also water quality. Rainfall in the days preceding the controlled releases resulted in higher than planned flow volumes being recorded[104].

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[102] The Licence provides that these environmental flow releases will be refined over time, based on the endorsement of the Minister for Land and Water Conservation (on advice from the Hawkesbury Nepean River Management Forum for the Hawkesbury Nepean River and recommendations of the Shoalhaven/Illawarra Water Management Committee for the Shoalhaven River system).

[103] The report prepared by the panel is available from the Commission on request. Members of the expert panel are listed in Appendix A1.

[104] After release of 20 ML/d, the *actual* flow recorded was 42 ML/d at Gurra causeway (1.5 km downstream of the dam) and 67 ML/d at Eckersley Ford (5.3 kilometres downstream). To compensate for the natural flow (estimated at 20 ML/d), only 180 ML/d was released for the high flow. This achieved a total flow of 219 ML/d at the causeway. However, the flow at the ford was 173 ML/d, suggesting that the flow had not reached that point by the time of the panel's visit.

A 2.2.1 Low flow release

During the low flow release, the panel observed that there was an increase in extent and diversity of habitat for macroinvertebrates and fish, relative to the conditions observed by the Commission's expert panel in 1999. There was no obvious scouring of biofilms[105] and sediment, although some loose algae and biofilms in high velocity areas were dislodged, possibly causing the increase in turbidity observed at the commencement of the release. Some of the terrestrial vegetation that had colonised the old channel was inundated.

The panel concluded that the flow was substantially greater than a natural base-flow, and greater than would be required to provide sufficient instream habitat to improve low-flow refuge habitat. As a result, the panel recommended a small change to the previously recommended regime, namely:

- all inflows up to 5 ML/d be allowed to pass through the storage to provide connectivity of habitat in low flows; and
- fifty percent of flows between 5 ML/d and 50 ML/d be released to provide low flow variability, thereby increasing the extent and diversity of macroinvertebrate and fish habitat[106].

A 2.2.2 High flow release

The actual high flow was insufficient to provide fish passage through a number of natural waterfall-cascade features in the river. In addition, the panel observed that limited scouring of biofilms occurred, suggesting that much larger flows would be required to dislodge this material.

The high flow did not break down stratification in the Broula Pool (the only pool that was stratified prior to the release) and the panel concluded that a much larger flow, in the order of 3400 ML/d, would be required to destratify the deep pools[107]. Based on the limited hydrologic data, which includes records of dam spills and streamflows at the Engadine station early last century, it is estimated that a flow of this magnitude would occur once or twice a year on average.

Based on observation of the calibration releases, the Panel concluded that the flow of 200 ML/d was of insufficient magnitude to achieve the environmental objectives of a high flow release. The panel therefore recommended that a flow of 800 ML/d be made for three consecutive days once every year in the spring-summer period. The Panel believes that this flow would strip biofilms and 'reset' macroinvertebrate habitat and provide fish passage past substantial natural barriers.

The Panel cautioned that there are difficulties in defining flow volumes, because of the lack of information about the natural flow regime in the Woronora River. This is principally due to the absence of a daily flow model. Consequently, the panel recommended that an adaptive management approach be adopted, explaining *"it is more important to implement an*

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[105] 'Biofilms' are accumulations of algae, fungi, bacteria and detritus on underwater stones and other surfaces.

[106] The panel notes that the proportion is an initial estimate and may be altered on the basis of future monitoring.

[107] This figure was estimated by using 'mixing theory' to determine the amount of flow required to break down stratification in a deep pool with stratification at various levels. The amount of flow required is less if the stratification is closer to the surface of the pool. (W. Erskine pers. comm.)

environmental flow program that includes appropriate monitoring as soon as possible, than to invest substantial time and resources in refining the environmental flow rules before any environmental flows are implemented".

A 2.2.3 Monitoring of environmental flows

The Sydney Catchment Authority, with the assistance of the CRC for Freshwater Ecology, has developed a long term monitoring program to monitor the effects of the environmental flow program on the health of the Woronora River downstream of the dam. The results of such monitoring will provide the basis for an adaptive management regime to refine the flow recommendations. The Authority advises that this program will commence by the end of 2001 to allow collection of background data prior to the commencement of the flow release program by 1 January 2003, as per the Commission's recommendations.

A 2.2.4 Commission's assessment of the Expert Panel findings

The Commission agrees with the panel's assessment of the immediate need for an environmental flow regime, and therefore recommends that an initial regime based on the environmental flows shown in Table 2.1 pursuant to Recommendation RF 2 be implemented by 1 January 2003.[108]

The 'translucent dam' component of the environmental flow recommended by the expert panel (that 50% of inflows between 5 and 50 ML/d be released) varies from that recommended by the Commission in its Draft Report (that 50% of inflows between 5 and 30 ML/d be released). The expert panel recommended that the translucent flow range be as wide as possible to achieve the required variability. The Commission considers that, as a first step in an adaptive management process, the flows recommended in the Draft Report (and described in detail in Recommendation RF 2 of this Report) will provide the required variability and low flow protection to satisfy the objectives of the low flow regime (that is, to increase the quality and extent of habitat for macroinvertebrates and fish). This variability will be achieved provided that the release criteria specified in Recommendation RF 2 are adopted[109].

As outlined in the Commission's Draft Report, the Sydney Catchment Authority has modelled the impact of this flow release. In the Commission's judgement, based on information available at time of writing, it does not place intolerable stress on the security and reliability of the water supply system *so long as demand management targets are met*. If future monitoring of this release indicates that it is insufficient to meet the desired low flow objectives, then the flow should be increased to that of the expert panel at the next licence review, *subject to further modelling of system impacts.* Should the latter indicate an intolerable impact on security of water supplies, *additional* opportunities for reuse (of stormwater and effluent) should be explored.

After balancing the ecological and water supply requirements, the Commission is satisfied that the high flow of 800 ML/d for a period of three days each summer, as recommended by the expert panel, should fulfil the environmental objectives of providing fish passage and

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[108] This is in line with the recommendation in HRC (1999c) and HRC (2000a) that environmental flows be in place by December 2002.

[109] These criteria are designed to provide variability and avoid potential problems of long periods of constant flow.

stripping biofilms, although it will not generally achieve the objective of destratifying the pools.[110] The Sydney Catchment Authority has advised that the existing valve is able to release up to 440 ML/d, however stabilisation of the downstream area to prevent excessive scouring of the river bed would be required. The Authority also advises that release of up to 800 ML/d could be achieved by modification of existing valves. The Commission has not been provided with either costing, but assumes they are likely to be only a small proportion of overall operating costs.

Whilst the Commission judges, based on available information, that costs associated with the recommended flow regime from this Inquiry are tolerable, the economic and social implications of the environmental flows will need to be reviewed periodically. This would be part of the adaptive management regime that would refine the environmental flow provisions in all rivers affected by the Sydney Catchment Authority's storages over time.

The Commission advocates that the Sydney Catchment Authority use the intervening time prior to the commencement of flow releases in January 2003 to undertake necessary preparatory works and investigations including:

- baseline (or 'pre-release') monitoring of the riverine environment downstream of the dam;
- modification of the dam outlet infrastructure;
- installation of flow monitoring capabilities[111]; and
- development of a daily flow model for the river.

The environmental flow regime should be incorporated in the Sydney Catchment Authority's Water Management Licence and reviewed on a 5 yearly basis in light of results of monitoring of the ecological effects of the releases *and* impacts on the security of the water supply system. The results of all relevant monitoring should by reported to the Department of Land and Water Conservation as part of the Annual Monitoring and Compliance Report required under s6:4 of that Licence. This information should also be made available to the public through inclusion in the Authority's Annual Report. Future community consultation processes should include mechanisms through which community assessments and aspirations would inform decisions within the adaptive management framework.

[110] A flow of 3400 ML/d was identified by the expert panel as necessary to destratify deep pools in the river. However, the Commission considers that the reduction in frequency of such flows caused by the dam may not be sufficient to justify restoration of the 'natural' frequency. Under 'natural', that is pre-dam, conditions it is likely that the deep pools in the Woronora River would have stratified during summer anyway, and that stratification would quickly re-establish following a large flow event. (Environmental flow monitoring undertaken in the Hawkesbury Nepean found that large flows destratified weir pools, but that stratification re-established within a week of the flow event.)

[111] This could be through either installation of gauging equipment or development of a rainfall - runoff model for the catchment.

A3 State Riverine Corridor Policy: HRC approach

Government decisions on the Commission's Hawkesbury Nepean Inquiry charge the Department of Urban Affairs and Planning with chairing an interdepartmental committee for the development of a 'State Riverine Corridor Policy', to realign agency actions and assist all councils to develop appropriate and complementary development controls. The primary intention of that policy is to establish decision-making processes that would ensure that rivers and their tributary streams can fulfil their full range of ecological functions. At all levels, decision-making governing development should address explicitly the need for protection of riverine corridors[112]. The committee is to consider changes to planning processes that may be necessary to give effect to that intention including a review of existing programs, an investigation of potential zoning options and ways to raise awareness of existing mechanisms for protection of the riverine corridor.

As a result of its Georges River - Botany Inquiry the Commission has recommended that the state-wide policy incorporate a specific component addressing streams in urban areas. Historically, the management of urban streams has been associated with stormwater drainage and flood mitigation responsibilities of local councils, and the *ecological* functions of urban streams have received scant attention. *This situation must change if the community's nominated environmental value of aquatic ecosystem protection is to be achieved.*

Accordingly, the Commission has recommended the following approach to development of the state-wide policy, including an urban stream component. The approach results from the cumulative findings of several Commission Inquiries, including the Georges River – Botany Bay. In all cases to date, independent, multi-disciplinary expert panels have identified the condition of riverine corridors as a critical determinant of river health. In making these recommendations, the Commission recognises the many difficulties facing those with management responsibilities concerning urban streams. These include:

- multiple residential owners of small lots with differing aspirations;
- the conflicting urban development goal of maximising land availability;
- historic community acceptance of the use of streams for the management of wastes and floods, and only recent recognition of their ecological and urban amenity values;
- more recently, pressure for instream water detention and purification ponds (described somewhat euphemistically as 'linear wetlands').
- in more rural areas, impediments, such as tradition and financial constraints, to changes in farming practices that would enhance the riverine corridor condition.

Nevertheless, there are increasing opportunities to overcome such impediments. The Commission is convinced that a carefully designed policy, incorporating the following principles, with implementation actions (for councils and state agencies) as outlined in the subsequent sections, would initiate the essential reversal of current trends in the condition of rural and urban streams.

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[112] The Government's Statement of Joint Intent for the Hawkesbury Nepean system (NSW Government 2001b) provides detail and is available on the Commission's website.

A3.1 Policy principles [113]

- Manage rivers as whole systems.
- Treat rivers as productive assets, with decisions based on realistic assessment of their capabilities and limitations, and with internalisation of costs.
- Ensure management plans provide unambiguous goals and clear directions (but are not necessarily prescriptive).
- Ensure management entities are made accountable for the condition of rivers or at least for the implementation of agreed actions (where *external* factors prevail on river condition).
- Create government-community partnership agreements with defined roles and responsibilities.
- Apply an adaptive approach that identifies criteria for adjustment in response to the results of monitoring (whether of river condition or of implementation of processes).

The Commission notes that the riverine corridor policy will fill a policy void in the current water reform program, which to date has focused on protection of water quality and provision of environmental flows and fish passage. The policy should be consistent with, and provide clear linkages to, other mechanisms designed to improve various aspects of river health including:

- *PlanFirst* proposals, including capability assessments and regional plans;
- river flow protection;
- stormwater management;
- weed management;
- Greenhouse strategies; and
- NSW Fisheries policies and 'fish friendly' design criteria[114].

The State Riverine Corridor Policy should be translated promptly into a state riverine corridor *action plan*, which would specify the immediate and subsequent requirements/ actions, as part of an overall adaptive approach to management that would give effect to the policy. Some of those requirements and actions are listed under the recommended agency and council actions noted below.

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[113] See *Securing Healthy Coastal Rivers - A Strategic Perspective*, Healthy Rivers Commission, April 2000.

[114] For example, for road crossings, culverts etc, as well as for actual fishways.

A3.2 Actions for urban areas

Agencies

Implementation of the State Policy would necessitate the following (typical) state agency actions in urban areas:

- use existing instruments such as the *Rivers and Foreshores Improvement Act* 1948 (soon to be replaced by the *Water Management Act* 2000), the *Soil Conservation Act* 1938 and the *Native Vegetation Conservation Act* 1997 to support council endeavours to protect urban streams[115];
- use existing funding mechanisms and programs (including urban stormwater grants) to target urban stream restoration projects (such as was done for Clear Paddock Creek in Fairfield);
- identify opportunities to rehabilitate selected streams through application of environmental offsets;
- pilot new incentive structures such as custodian payments for provision of environmental services, (as per the Government's decision for the Orara River system, in the Clarence River Inquiry), carbon sink portfolios etc;
- remove ambiguity about possible compensation (if necessary, by amending the *Environmental Planning and Assessment Act* 1979) and thereby the potential to trigger compensation costs for acquisition by councils at residential market value (due to the currently narrow definition of 'drainage reserves' in some areas);
- use and / or align other relevant programs and instruments (such as the National Parks and Wildlife Service acquisition funds, voluntary conservation agreements, community title, s88B covenants etc) to achieve common outcomes (this is consistent with the proposed *PlanFirst* concepts);
- ensure that all boating plans are consistent with the protection of the ecological functions and values of rivers and their estuaries;
- ensure that criteria for State and Commonwealth flood mitigation funding is consistent with the state riverine corridor policy objectives of preserving and restoring ecological functions;
- ensure that agency management of other activities such as extractive industries, agriculture and mining is also consistent with the policy objectives;
- explore potential for lease fees on public lands to contribute towards stream restoration work or, alternatively, require appropriate obligations in lease agreements, for example stock management and revegetation;
- negotiate with Commonwealth land owners / managers mechanisms to ensure ongoing stream protection, including in cases where riverine corridors may become 'surplus to requirements' and so divested.

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[115] Some exemptions in the *Native Vegetation Conservation Act* 1997 may need to be reviewed in order to provide protection for stream bank vegetation in urban areas at least commensurate with that provided by earlier legislative provisions which that Act replaced (Recommendation RC 1 refers).

Councils

Implementation of the State Policy would necessitate the following (typical) actions by councils in urban areas:

- amend council policies and processes for the accounting of asset depreciation and maintenance, and for the funding of rehabilitation works, so that they better recognise streams (as distinct from constructed channels) as productive assets;
- include the objectives and strategies of the state riverine corridor policy into planning instruments such as REP, LEPs, DCPs, building codes *and* stormwater management plans (pursuant to Recommendation RC 1 of this report);
- factor rehabilitation of priority streams into council's strategic planning processes;
- desist from further channelisation of streams, whether by piping, concrete lining or by conversion to grassed swales;
- factor riverine corridor protection into landuse planning processes at the outset (including 'multiple purpose' environment protection zones where appropriate);
- explore the ecological and social benefits of 'designing with nature' (that does not necessarily mean loss of land available for development, especially if councils are encouraged to include riverine corridors in their definition of 'open space' requirements[116]);
- require 'off stream' water quality controls and more on-site detention; and
- use existing mechanisms to establish partnerships with the private sector to restore degraded stream channels as part of the development process (including environmental levies, s94 contributions and floor space ratio concessions).

A3.3 Actions for rural areas

The Commission believes the following actions would be involved in implementation of the policy for more rural areas. State agencies and councils should investigate how each of their management powers could be applied in ways that would create incentives for improved farming practices that would facilitate protection and rehabilitation of riverine corridors. Typical incentives include the following.

- Property agreements via *Native Vegetation Conservation Act* 1997 ($5m / year public funds).
- Carbon sinks program (explore portfolio potential across multiple farms).
- Weed management geared to circumstances, including risks, ecosystem values, resources, etc. HRC (1999a, pp. 208-213) provides detail.
- Water access concession for 'best management practices' (this should rely on the outcomes of the Government-endorsed pilot on the Williams River to inform future decisions). HRC (1996, pp. 37-38) provides detail.

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[116] Landcom advised the Commission that some councils insist that all 'open space' is flood free. This precludes the incorporation of riverine corridors which, in the urban residential context (as distinct from urban bushland), could be used for multiple purposes compatible with maintenance of their ecological functions.

- Review of road building standards including risks, ecosystem values, resources and opportunities. In particular, this would advance NSW Fisheries guidelines (HRC 1999, pp.182-184).
- Boating restrictions to protect sensitive riverbanks, seagrass beds and juvenile fish habitat.
- A strategic 'stressed river / conservation status' context to set management orientation, types of strategies and selection and alignment of management tools, including access to funding.
- Partnership agreements between state funding bodies and landowners based on identified outcomes rather than inputs.
- Local Environmental Planning provisions that are based on rapid assessments of stream capability rather than standard rules (such as defined set-backs).
- Permitting / encouraging councils to raise special rates for environment management.
- Providing rate discounts (such as through voluntary conservation agreements under *National Parks and Wildlife Service Act* 1974).

A4 Economic considerations in HRC Inquiries

The Commission's approach to economic issues is described in HRC (2000a, pp. 6-8). The economic concepts therein underpin the Commission's recommendations, which emphasise improved decision-making and more strongly integrated management of natural systems. The Commission believes that the changes it has recommended are essential if there is to be progress towards economic efficiency, that is, delivery of the most desirable outcomes in the most cost-effective ways.

Each of the Commission's Inquiries to date has shown that significant gains could be made by using *existing* funds in more integrated and effective ways. In the Georges River – Botany Bay catchment, especially in the highly urbanised areas, there are complex interrelationships, and many conflicts, between goals for river and bay health and the economic objectives that are served by the many and varied human activities that impact upon the natural systems. Those interactions and multiple cause-effect relationships are difficult to identify; impact on multiple users in different ways; and so, consequently, make it impractical to attempt to quantify their full implications. Thus the Commission has focussed on those areas where it is confident that more effective strategic planning and management would deliver better, and more sustainable, outcomes in the near future, as well as creating important opportunities for future restoration and rejuvenation through offsets, trade-offs and partnership arrangements. (In some cases, the Commission's recommendations may lead to a reduction in costs, in others, to more cost-effective outcomes[117].)

The Commission has not attempted to assign values to environmental outcomes, nor to determine what the community might be 'willing to pay' for improvements in river and bay health. Rather, it has taken it as given that the community *expects* improvements in river and bay health - those expectations are reflected clearly in the policy positions of the elected governments at all levels. The NSW Government's water reform program, of which the Healthy Rivers Commission is an integral part, is designed to give effect to those expectations through state policies and programs. The Commission's recommendations are directed towards further development and strengthening of those policies and programs.

Where recommendations relate to problems that can be considered more as 'stand alone', and where cause and effect linkages are relatively identifiable and less complex, estimations of the economic implications can be quantified with greater confidence, although still in an indicative rather than precise manner. Thus, as part of this Inquiry, economic assessments have been undertaken in relation to the provision of environmental flows from Woronora Dam, for the phasing out of clay mining in upland swamps in the headwaters of the O'Hares Creek subcatchment and for improvements to stormwater management. (HRC 2000a, pp. 116-121 provides summaries.) In the case of stormwater costs the Commission has recommended management arrangements that would help to promote maximum efficiency and containment of total costs whilst achieving an equitable distribution of those costs.

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[117] For example, the Commission has previously noted that there would be considerable savings in energy bills from water demand strategies via decreasing energy consumed in households, decreasing effluent volume by 25% leading to deferment of augmentation / reduction in size of infrastructure required. HRC (1999a, pp. 83-85) provides detail.

A4.1 Looking behind the economic environmental trade-offs: a conceptual model

In developing its recommendations, the Commission ensures that the real *scarcity* of riverine resources (in terms of ecological values and of water supply and drainage functions) is recognised in all public and private decision-making. Such recognition is critical to enable the inevitable trade-offs between economic, social and environmental goals to be made in a well informed manner, and to ensure that the true cost of actions / developments are factored into that decision-making process *from the outset*.

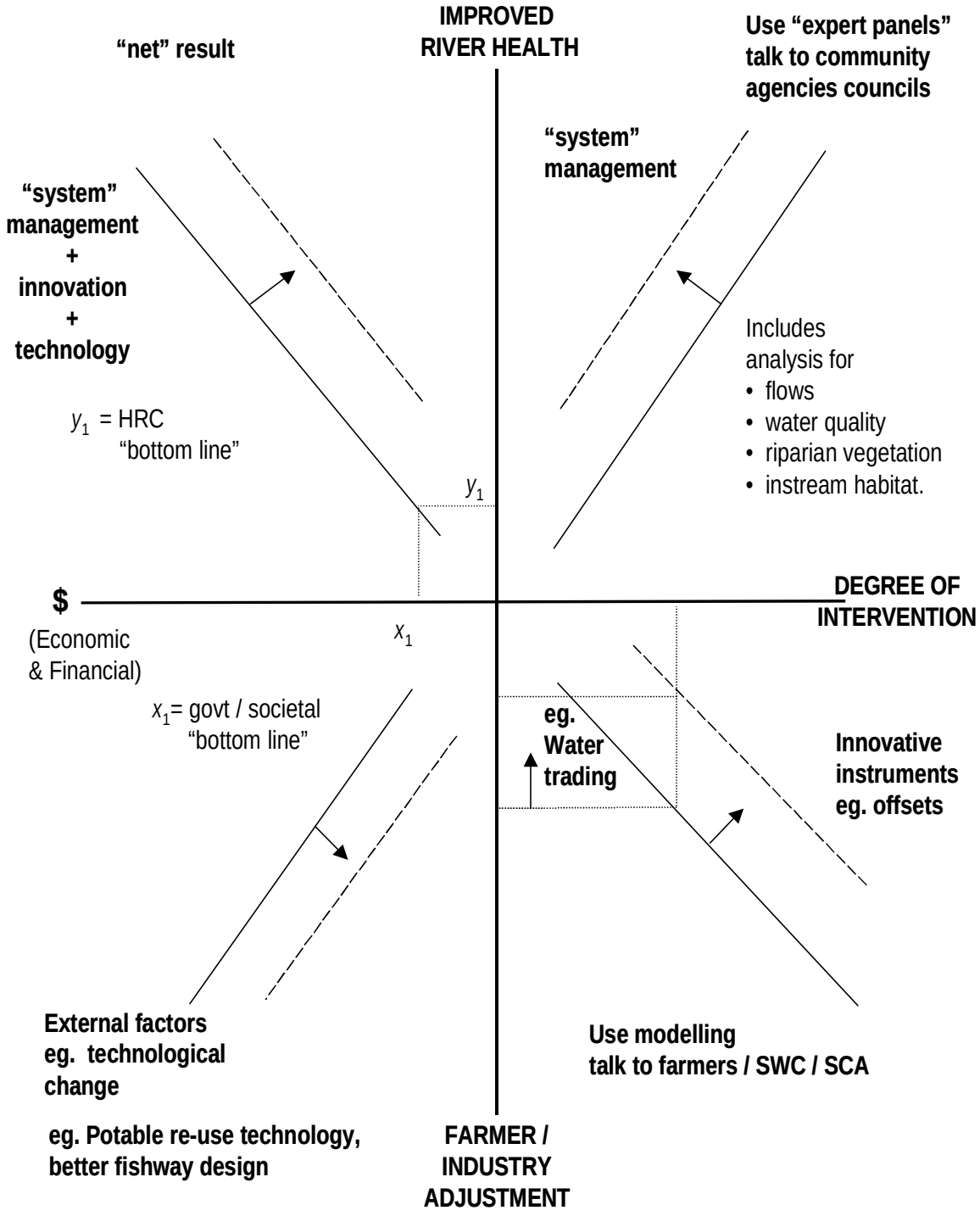
Figure A4.1 provides a diagrammatic representation of the many factors that the Commission considers in developing its recommendations for improved river health. In each of the four quadrants, the relationship represented by the curve is *not necessarily linear*. The actual shape of the curves depends on many factors as explained in the following descriptions of each quadrant. Much of the Commission's investigative work is concerned with gaining a better understanding of the relationships that underlie each of those curves.

The northeast quadrant is a representation how much river health improvement (in terms of a *combination* of water quality, flows, riverine vegetation, instream habitat etc) might be achieved for any degree of intervention or imposition of 'rules'. For example, a requirement to restrict water extraction for irrigation may lead to a degree of river health improvement. The *shape* of the curve will be different for different rivers and even different reaches of rivers. It will also depend on many other factors. (For example, in the upper Nepean, strong restrictions on water use may lead to little improvement in river health as that section of river contains nine weirs, the capacity of which has been significantly enlarged by dredging for construction sand in the past. Under those circumstances, the additional 'environmental' flows would increase the volume of water in the weir pools, which would provide limited river health improvement.) To ascertain the relationship represented by the curve, the Commission undertakes site inspections, uses 'expert panels' and talks to relevant agencies and interest groups. The Commission has found that, regardless of the shape of the curve, the greatest environmental improvements are to be gained by using an integrated, whole-of-system approach to assessment and management. For example, in the above illustration, if the weirs are not to be removed, it may be more beneficial to aerate the weir pools and provide effective fishways than provide environmental flows. Such an approach will move the curve upward.

The southeast quadrant represents how much farmers or industry must adjust to achieve the required degree of intervention. For example, a restriction on water extraction during low flows may require a farmer to construct a dam, or the Sydney Catchment Authority to build Welcome Reef. Again the shape of the curve will depend on the number and types of options available to the farmer / industry. Innovative tools such as trade-offs and offsets can provide more options and help shift the curve to the right. For example, if the farmer can buy water from another, the adjustment required may be much less. To ascertain the relationship represented by this curve, the Commission talks to farmers and assesses their mitigation options (for example in the Williams River, which is in a narrow valley, the area available for farm dams simply does not exist). In other cases, the Commission uses modelling by external groups such as ABARE, state agencies or private consultants.

The southwest quadrant represents the cost of any farm/industry adjustment. This is usually influenced by factors outside the Commission's Inquiry, such as changes in technology. For example, changes in water treatment technologies may allow more

Figure A4.1 Management trade-offs



widespread re-use and so continued deferment of Welcome Reef Dam. That would substantially reduce augmentation costs and so move the curve to the right.

The northwest quadrant represents the cost of any environmental improvement. It is used in traditional environmental economic analysis, which uses such tools as contingency evaluation. However, in the Commission's analysis, the northwest quadrant represents the 'net' result of analyses in the other three quadrants, and any upward movement in the curve represents 'increasing cost-effectiveness'.

That is:

- the move of the northeast curve upward, representing system management;
- the move of the southeast curve to the right, representing innovative instruments; and
- the move of the southwest curve to the right, representing improved technologies;

all add up to the best environmental outcome per unit of cost or effort. Under usual circumstances, the *degree* of environmental improvement is usually limited by the amount that government and society are willing to pay (or jobs to forego etc). The point $\mathbf{x_1}$ therefore, represents the 'government/societal bottom line'. The Commission's role is to set the river health boundary or 'environmental bottom line', or point $\mathbf{y_1}$, below which it judges that any further degradation in river health is unacceptable. The Commission is confident that for any one Inquiry, its recommendations, *in total,* will shift the curve upward and so provide a much better river health improvement for *any* level of expenditure.

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