

An Independent Review of the Effectiveness of the Lake Macquarie Improvement Project

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February 2005

The Integrated Catchment Assessment and Management Centre

ICAM Report 2005/18



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Reference

Newham, L.T.H., McLean, E., Norton, J.P. and Jakeman, A.J. (2005). An Independent Review of the Effectiveness of the Lake Macquarie Improvement Project. iCAM Report 2005/18 for the Office of the Lake Macquarie and Catchment Coordinator. Integrated Catchment Assessment and Management (iCAM) Centre, School of Resources, Environment and Society, The Australian National University, Canberra, Australia.

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Executive summary

1. This report presents an independent assessment of the past and current operations of the Lake Macquarie Improvement Project (LMIP).

2. Activities under the LMIP have been consistent with the recommendations of the Lake Macquarie Taskforce report (LMT 1999). The LMIP has been very successful in meeting its objectives. It has enabled the cost-effective implementation of a large and well focused environmental works program. The works implemented can be expected to yield much-needed improvements in water quality, and clear local aesthetic and amenity improvements.

3. All the evidence available to the review team points to the execution of the works program by the Office of the Lake Macquarie and Catchment Coordinator (OLMCC) being well managed, with:

- good consultation with affected members of the public prior to individual works;
- a transparent and efficient tendering procedure, with sufficient cost comparisons and spending control;
- energetic and effective distribution of relevant educational material through written and broadcast media;
- satisfactory performance by the contractors as far as can be seen on the ground in completed works;
- sensible evolution of designs (including thought about public acceptability) and of the detailed program, in the light of experience;
- a high proportion (approximately 77%) of expenditure used on works; and
- adherence to a schedule which will allow substantial completion of planned works by the end date, 30th June 2005, of the program.

4. The LMIP has evolved an effective management structure. This has been made possible by the long time scale of the LMIP, a consistent funding regime, recognition by the Lake Macquarie Project Management Committee (LMPMC) of the needs of the OLMCC (after some initial delay), and stable administrative arrangements, allowing employment continuity of specialist staff and sequential development of techniques for management and remediation. The LMIP has also benefited from the breadth of interest and continuity of senior-level representation in the LMPMC.

5. The LMPMC has generally managed the LMIP well, with the following exceptions:

- the OLMCC was initially under-resourced;
- there is a lack of specified performance measures;
- the current monitoring program has not so far been able to distinguish effectively between the improvement brought about by the remediation works and other changes within the Lake and catchment e.g. climatic variations;
- the LMPMC has been unable to sharpen the approvals process significantly; and

- there has been too little planning beyond the end of the present program.
6. The LMIP has effectively complemented the operations of various Local and State Government and community-based organisations. In our opinion, there appears to be no conflict between the LMIP and the HCR-CMA operations and objectives, rather the opposite.
 7. There is scope for substantial extension of the LMIP, with suitable funding. Such extension would be able to capitalise on the experience gained in the LMIP, and the established cooperation and goodwill of the project partners, continuing to improve the water quality and environmental health of Lake Macquarie.
 8. Overall, the LMIP has enabled the cost-effective implementation of a large works program that can be expected to provide substantial improvements in water quality in Lake Macquarie.

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1. Introduction

This report presents an independent assessment of the past and current operations of the Lake Macquarie Improvement Project (LMIP). The focus of the report is on assessing the performance of the LMIP against the Lake Macquarie Integrated Estuary and Catchment Management Framework. Improvements to the operations and structure of the organisation and how it should continue past its second term are suggested. Suggestions are also made on how the LMIP should evolve in response to changes in the structure of natural resource management in NSW.

This is a sensible time to undertake such a review, as:

- the organisation is nearing the end of its second three-year term and attempting to define its future role;
- considerable on-ground remediation activities have been implemented but their effectiveness has not yet been comprehensively assessed;
- there is increasing media and community interest in the activities of the organisation, including calls for a continuation of existing funding arrangements; and
- significant changes in the structure of related natural resource agencies, including the formation of the Hunter-Central Rivers Catchment Management Authority (HCR-CMA), have occurred recently and have the potential to influence the activities of any continuation of the program .

1.1. Outline

The report first recounts the establishment of the LMIP and the roles and structure of the Lake Macquarie Project Management Committee (LMPMC) and Office of the Lake Macquarie and Catchment Coordinator (OLMCC) as background. The approach of the review is then briefly described. This is followed by an evaluation of the LMIP against the objectives specified in the Lake Macquarie Taskforce report (LMT 1999). The evaluation is structured under several broad headings, viz. achievements in environmental remediation, funding and remediation prioritisation, monitoring, community education and participation, and LMPMC and OLMCC performance. Suggestions for the future direction of the organisation are then presented and a series of recommendations made.

2. Background

2.1. Lake Macquarie Integrated Estuary and Catchment Management Framework

The Premier of NSW established the Lake Macquarie Taskforce in April 1998 to address issues affecting the health of Lake Macquarie (LMT 1999). Its terms of reference were to:

- review the Lake Macquarie Estuary Management Plan and recommend a priority action plan and appropriate institutional arrangements for its implementation;
- review and recommend strategies to alleviate the impact of development and urbanisation on the lake;

- review evidence and seek expert advice to assess the likely causes of the problems requiring remediation under the priority action plan, as a basis for determining appropriate price sharing arrangements; and
- review the Lake Macquarie fisheries and recommend action in relation to conflict between recreational and commercial effort, and give consideration to marine reservation.

The Taskforce was able to draw on an extensive body of scientific knowledge of Lake Macquarie and its catchment. Subgroups were formed to develop action plans in several areas including water quality, monitoring, community education and integrated management. This information was synthesised to produce a three-year priority action plan for the Lake and its catchment. In developing the actions plan, it was recognised that sustainable management of the lake required balance between economic viability, environmental stewardship and social needs.

The key outcome of the Lake Macquarie Taskforce was funding for the establishment of the LMIP.

2.1.1. Lake Macquarie Improvement Project

The Lake Macquarie Project Management Committee (LMPMC) was established in 1999. As described in LMT (1999), its brief was to oversee implementation of the LMIP, i.e. address the factors contributing to the degradation of the Lake environment. The LMPMC reports to the Minister for Infrastructure and Planning and Minister for Natural Resources. It supplements the activities of the existing State Government agencies and Councils. A coordinator who heads the Office of the Lake Macquarie and Catchment Coordinator (OLMCC) carries out the program of the LMPMC.

The LMPMC and the establishment of the OLMCC are unique arrangements in Australian natural resource management. The close cooperation of State and local government, the nature of the funding of the organisation and the long-term planning cycle are particularly distinctive. The LMIP is funded as a partnership arrangement between NSW State Treasury and Lake Macquarie City and Wyong Shire Councils. In the case of Lake Macquarie City Council, the contribution is supported by a special rates levy, applied specifically for this purpose.

Figure 1 shows the organisational structure of the LMIP.

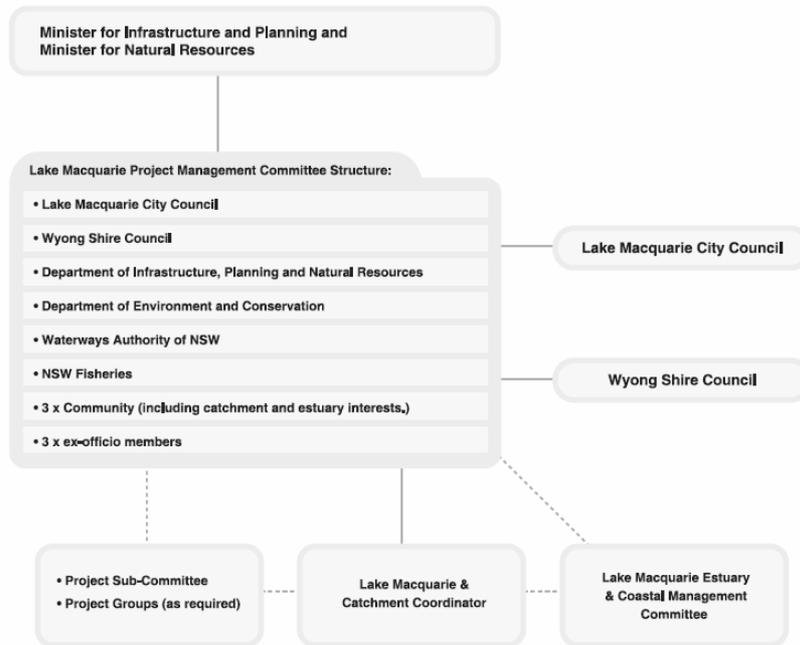


Figure 1 Organisational structure of LMIP (source: OLMCC Annual Report 2003/2004).

2.1.2. LMPMC

The membership of LMPMC is shown in Figure 1. It includes senior-level representatives from the four State government agencies, the Lake Macquarie City and Wyong Shire Councils and community representatives. The LMPMC meets at three-monthly intervals. It is free to instigate new activities and engage consultants or contractors.

A sub-committee was also established in 2001 to provide timely direction to the Coordinator. It is currently made up of representatives from the NSW Department of Infrastructure Planning and Natural Resources (DIPNR), NSW Maritime Authority, Lake Macquarie City Council and a community representative. The sub-committee meets monthly (unless lack of business makes it unnecessary). It has delegation to (i) vary any approved LMPMC activity of up to \$100k or 15% of total value, (ii) instigate new activities up to \$50k, and (iii) approve expenditure of up to \$300k for engagement of consultants and contractors.

2.1.3. OLMCC

The Coordinator is responsible to the LMPMC for implementing the LMIP. The role of the Coordinator is specified in LMT (1999) as to

- prepare an annual implementation plan and review progress for reporting requirements;
- develop a longer-term strategy (beyond the initial Action Plan);
- regularly review monitoring data and the effectiveness of actions, identify gaps and develop new strategies to address shortcomings and emerging issues;
- act as a point of contact for the community with regard to environmental management matters concerning the LMIP;

- examine the development of a lake model to strengthen environmental monitoring databases and to aid management and decision-making;
- establish an inventory of information and data systems relevant to the Lake;
- facilitate the coordination of the activities of agencies with interest in the Lake to ensure programs achieve the best outcomes;
- investigate and obtain supplementary capital and recurrent funding from other sources to implement Lake improvement programs;
- provide high quality and timely advice to the Minister and Lake Macquarie City and Wyong Shire Councils
- manage the operational budget;
- undertake program reporting to key stakeholders and the community;
- develop and maintain strong linkages with the Estuary and Coastal Management Committee and other relevant community groups; and
- ensure that all outcomes associated with the management of the Lake are consistent with Government policies for natural resource management.

The broad role of the OLMCC is to support the Coordinator to implement the planning, administration, public relations and on-ground works of the LMIP. The OLMCC currently has a staff of four:

- | | |
|--|------------------|
| ▪ Coordinator | Mr Jeff Jansson |
| ▪ Business Systems and Support Officer | Ms Loren Morgan |
| ▪ Project Management Officer | Mr Mark Saunders |
| ▪ Administration Officer | Ms Cheryl Drew |

With the exception of the Administration Officer, all staff are employed full-time. The employment of the Coordinator is administered by DIPNR. The Coordinator and Business Systems and Support Officer hold substantive positions in Lake Macquarie City Council. The OLMCC, through the Coordinator, holds delegation to (i) vary approved activity by 5% of budget or up to \$60k, and (ii) engage consultants and contractors to \$150k for approved works.

The OLMCC is located within the Lake Macquarie City Council offices. That body provides, in addition to the direct project funding, considerable administrative and technical support. DIPNR also lends considerable support to the OLMCC.

2.1.4. Relationship of the LMIP to other management instruments

The management of the Lake Macquarie environment has Federal, State and Local government agencies operating from the policy level through to works on the ground at the local level. The LMIP is one component of the structures and initiatives for the management of Lake Macquarie and its catchment. The main programs are listed below.

1. Local Government responsibilities, programs and studies

- a. Estuary Management Plan

- b. Stormwater Management Plans
 - c. Floodplain Management Plans
 - d. Local Environment Plan
 - e. Development consents
 - f. Local sewage, garbage and rubbish removal
 - g. Parks and gardens, construction and maintenance
2. *State Government agency programs*
- a. NSW Maritime Authority – navigation, boating infrastructure, mooring management plan
 - b. Department of Environment and Conservation – pollution control, stormwater plan development
 - c. Department of Infrastructure, Planning and Natural Resources – planning and management support
 - d. Department of Lands – Crown Land management and approval for works over Crown Land (including below high-water mark)
 - e. Hunter Water Corporation
 - f. NSW Department of Primary Industries – recreational fishing management
 - g. Hunter-Central Rivers CMA
3. *Federal Government programs*
- a. National Heritage Trust partnership program – funding support
 - b. National strategies for biodiversity, vegetation, etc.
4. *Specific plans and projects*
- a. LMIP
 - b. Local Landcare projects

2.1.5. Comparison of LMIP with similar projects

Similar projects such as the Tweed River Management Plan Implementation and Tuggerah Lakes Project have been funded entirely by Treasury grants, although in the Tweed case this was supplemented by royalties from sand and gravel dredging in the lower Tweed River. The activities in both cases were carried out within the local government structure. The Lake Illawarra Authority and Chipping Norton Authority were set up as statutory bodies. Staff for these statutory authorities are employed under the DIPNR umbrella and additional support is available from technical specialists in DIPNR.

In the case of Crown Land, a partnership arrangement with State government has been in place for over a decade, under which councils have taken operational responsibility for care and maintenance of Crown Land reserves, in return for use of these reserves to generate income through caravan parks and other uses. They are supported by 50% contributions from programs such as the NSW Coast and Estuaries programs, the NSW Maritime Authority

Waterways Asset Development and Management program (WADAMP) and special purpose grants from DEC (stormwater) and the former Planning NSW. Current State government funding for LMIP contributes 50% to the total funding but with the advantage of a longer period for the management and use of funds.

The LMIP represents a unique group, established for the particular purpose of implementing selected key strategies. It was established to carry out a works program over three years, but with all parties accepting that the task of remediation would not be complete after that period and that provision should be made for ongoing remedial work. Early experience indicated that the time frame was indeed insufficient for the scope of the work required and the project was extended for a further three years in 2002.

3. Review team and approach

An independent, interdisciplinary team from the Integrated Catchment Assessment and Management Centre of the Australian National University undertook this review. The review team comprises Dr Lachlan Newham (water quality and environmental management specialist), Mr Errol McLean (estuary processes and coastal management specialist), Professor John Norton (environmental modelling and control engineering specialist) and Professor Anthony Jakeman (integrated assessment and water resources modelling specialist).

The information that formed the basis of the review was obtained from a variety of sources including primary documentation, interviews with Committee members and government representatives and inspections of a selection of remediation sites. A list of reference material examined as part of the review is provided in Section 7; the majority of these publications are available from the OLMCC. Interviews were undertaken with the following people:

- Mr Jeff Jansson (Coordinator, OLMCC);
- Cr Greg Piper (Chairman LMPMC; Mayor, Lake Macquarie City Council);
- Mr Jack Garaty (community representative, LMPMC);
- Mr Tony Farrell (Lake Macquarie City Council representative, LMPMC);
- Mr Brian Gardoll (acting DIPNR representative LMPMC) and Mr Ric Slatter (DIPNR);
- Mr Peter Nelson (previous Chairman, LMPMC);
- Professor Bruce Thom (ex-officio representative, LMPMC; DIPNR)*;
- Mr Glen Evans (HRC-CMA)*.

* Telephone interview

4. LMIP Evaluation

4.1. Achievements in environmental remediation

4.1.1. Lake and catchment works

Over the course of the LMIP, \$1,716k and \$7,356k have been spent on lake and catchment works, respectively. This has enabled implementation of 15 km of foreshore restoration work (in a total of 173 km of foreshore) and the installation of 40 wetlands/stormwater devices up to February 2005. Minor foreshore work and the installation of five additional wetlands/stormwater treatment devices are planned for implementation by the end of Stage II of the program on 30th June, 2005.

4.1.2. Remediation site inspections

The review team, in the company of the Coordinator, undertook inspections of a selection of LMIP remediation sites on the afternoon of the 7th (boat) and the morning of the 9th February 2005 (land-based). Sites were selected to provide a range of engineering and ‘softer’ vegetative solutions and to illustrate the range of remedial, wetland construction and dredging actions undertaken. Inspections were necessarily brief and were not intended to provide detailed information on design or performance. The following comments are therefore general and restricted to observations on the nature of works and their general capabilities to achieve the stated objectives.

4.1.2.1. Wetlands

Design of constructed wetlands has evolved through experience gained over the duration of the LMIP. The design and construction of the wetlands are of high quality. In general, these works should have favourable local biological and ecological outcomes but will contribute most through their trapping of sediments that would otherwise enter the lake. Similarly, some trapping and reduction of nutrients and other sediment-attached pollutant inputs to the lake will have a local effect where stormwater would otherwise enter an embayment where flushing is limited. However, only in areas where continual monitoring by local schools or specialist studies (e.g. Geary et al., 2003) have taken place will data will be available to quantify the remediation performance at the sites. The cumulative, non-local effects of the establishment of wetlands may also be difficult to measure unless local treatments are substantially increased in number. Work adjacent to Fennell’s Bay, combined with a small dredging project to remove a sand bar at the entrance, may provide measurable and significant water-quality outcomes for that bay. However, it is not clear how far improvement in water quality will be observable from the current monitoring. This will not be known until the completion of the water quality review scheduled for May, 2005.

In addition to constructed wetlands, improvement of natural wetlands, e.g. immediately West of the Toronto business district, is in hand. The interest and cooperation of the adjacent local businesses has been elicited here.

Figure 1 shows a view of the Booragul wetland remediation site adjacent to the lake foreshore. This wetland is notable for its public visibility, being close to the Booragul Primary School and the Lake Macquarie Art Gallery.



Figure 2 Wetland remediation site, Booragul.

4.1.2.2. Foreshore treatments

A suite of foreshore treatments has evolved, with application of specific types depending on such factors as wave exposure (necessitating toe protection via rock placement in areas of high exposure and beach armouring with cobbles in less exposed areas), nature of bank and bed material and presence of seagrass wrack. It is clear that some works are a compromise between community pressure, visibility and ecological outcomes. This is especially evident at locations such as Pendlebury Park, where expensive removal of organic material deriving from seagrass in the near-shore area is accompanied by beach reprofiling and the re-establishment of vegetation along the foreshore strip. The high public usage here and subsequent community expectations have resulted in an extension to the work that is mainly justifiable on grounds of public amenity and raised awareness of the work of the LMIP. This compromise can be seen as providing a broad educational and community focus benefit, with an acknowledged possibility of increasing community expectations for near-shore removal of organic sediment in other areas.

4.1.2.3. Dredging

Dredging in Lake Macquarie, especially adjacent to the entrance channel at Swansea, has been largely to improve navigation but also to meet community expectations about this highly visible activity. However, it has been accompanied by serious efforts to educate the community on the issues associated with dredging. For example, the reasons for partial closing-off of Swan Bay have been explained in a leaflet mailed to community groups, and the smallness of the benefit in increased flushing to be gained from dredging is explained on the LMIP website. [Studies have shown little potential for improvement in water quality via increased flushing associated with channel dredging, as the tidal exchange is less than 1% of the volume of the Lake]. Other localised dredging has taken place to remove organic

sediments, for instance at Pendlebury Park and Swansea Flats. While studies commissioned by the LMIP (e.g. WBM Oceanics, 2004) have looked at the feasibility of local removal of sediments at a number of additional sites, these sites have not been added to a work program for further dredging. Other limited maintenance dredging is proposed for the future on a needs basis.

4.1.2.4. Tributary creek and stormwater channel remediation

Channel treatments vary considerably between locations. Treatments applied range from simple revegetation to extensive rock armouring. Where channel erosion during high catchment flows has been evident, engineering design dominates the works (e.g. at Edgeworth, Figure 3). In such cases, benefits to the lake largely consist of the reduction in sediment input associated with engineered channel stability and the formation of depositional areas. In other cases design has allowed for both channel and riparian re-vegetation (e.g. at Blackalls Park) in areas where water retention is unlikely to have any impact on local flooding and channels are sufficiently stable to allow protection by softer means. The tributary remediation works have sensibly included features consistent with natural geomorphic characteristics, e.g. pool-riffle sequences, but are successfully geared to existing structures in heavily built-up surroundings. The Edgeworth site was the furthest away from the lake of those inspected (4 km) and it is likely that any subsequent channel treatments will be mainly at similar or greater distances. This is a logical extension of the current program to reduce sediment and pollution as close as possible to their sources in the lake catchment.

In the absence of information on sources, it was not possible to develop a clear opinion on the appropriateness of the balance between channel remediation activity adjacent to the lake and higher in the catchment. Further investigation of critical pollutant source areas across the whole catchment is suggested to help the focus of future remediation activity.



Figure 3 Erosion control works and riffle pools sequences, Edgeworth.

4.1.2.5. Gross pollutant traps

A number of commercially available Gross Pollutant Traps (GPTs) have been installed near the lake, usually at 'end of pipe' locations. GPT are also often incorporated into the design of wetland projects. These treatments have value in trapping gross pollutants including coarse sediments and reducing visible pollution. GPTs are fairly expensive and require continuing maintenance to remove pollutants and sediments. They are a popular solution to stormwater pollution with benefits largely limited to gross pollutants. When used in conjunction with other treatments (e.g. sediment ponds and wetlands) and well maintained by the supervising authority, GPTs are quite effective in reducing a range of pollutants. The range of GPTs installed adjacent to Lake Macquarie has a likely spectrum of effectiveness, so medium-term monitoring of their performance has potential to aid future site selection and economic prioritisation. According to the Coordinator, the average quantity of coarse sediment removed by the GPTs is in the order of 34m³ annually. The volume varies greatly with rainfall as well as the size and condition of the catchment.

4.1.2.6. General observations

Most of the remediation sites observed were close to the lake. As such, they serve both an ecological and a demonstration function. By locating sites along foreshore areas, adjacent to public parks and along well used tributary creeks, the LMIP has been able to engage the community through education and perceived ownership of the works, while gaining habitat and water-quality improvements. This has been especially obvious and successful where local schools have been involved over a considerable period (e.g. at Booragul wetland).

The design and implementation of remediation works have evolved over the course of the LMIP. A strong feature of the resulting practices has been development of a good interface with the community, for instance through education in adjacent schools, and achievement of good acceptance by some local residents who were initially sceptical and worried. The wetlands have excellent explanatory signage that includes significant educational content: see Section 4.4.5. The OLMCC has taken trouble over the appearance of its remediation sites, and appears from the sites inspected to have succeeded in making most as attractive and inconspicuous as possible. An index of the effectiveness of the OLMCC in this respect is the fact that in spite of the size of the program, there has been very little community objection, with no legal challenges of LMIP designs.

The OLMCC also shows good awareness of the desirability of informal education of its contractors, for instance into good practices in modifying and not removing vegetation unnecessarily; all vegetated sites are planted almost exclusively with endemic species.

As noted earlier, some works represent compromise between community pressure, visibility and environmental importance, as in the clearing of organic ooze and reprofiling of the foreshore at Pendlebury Park. Similarly, some efforts have been invested in demonstration sites and meetings to educate the public to the undesirability of sea walls and other steep lakeshore structures (e.g. at LT Creek).

4.1.3. Performance against Lake Macquarie Integrated Estuary and Catchment Management Framework

The Lake Macquarie Integrated Estuary and Catchment Management Framework outlines a number of broad and detailed objectives (LMT 1999: 22-25). The three-year Action Plan Stage I and the later Stage II Action Plan were designed to direct the actions of the LMIP to undertake specific priority actions. It was stressed in the Framework document that 'it is not suggesting that the entire task of remediation of natural systems or works necessary to prevent further deterioration will be completed in that three-year period' (LMT 1999: 36). Similarly, the extension to Stage II will not completely satisfy the management objectives as stated in the report. For the purposes of this review, assessment of performance will be against the actions listed in the Action Plans. Further comment may be made with respect to the broader objectives as outlined in the Framework report when considering possible directions for future work.

The following summary indicates the current status of these tasks (as provided by the OLMCC) as well as other tasks introduced during the implementation period. Tasks are listed under the headings of the three-year action plan outlines.

4.1.3.1. Entrance Channel/Navigation

All studies and works have been completed, with the exception of the stabilisation of the sand spit at Naru (due to commence April, 2005). Monitoring activities and maintenance dredging are continuing. A project, in addition to that specified in the Action Plan, was undertaken in Black Ned's Bay from 2001 to 2003. A new project to partially close the rapidly eroding Southern entrance to Swan Bay has also been introduced. It is at the design stage and its implementation will extend beyond mid-2005.

4.1.3.2. Entrance channel erosion

All listed entrance channel erosion studies and works have been completed.

4.1.3.3. Lake general – catchment works

The listed foreshore stabilisation works have been completed, with the exception of the Swansea Flats area which is due for completion in March, 2005. A total of 27 stormwater devices have been installed and an additional five will be completed by the end of Stage II. Two additional wetland rehabilitation projects are yet to commence but will also be completed by the end of Stage II. Remediation work for problem tributaries is currently under way, including riparian rehabilitation work. All other minor studies and works have been completed and associated maintenance is continuing as required.

4.1.3.4. Lake Macquarie health monitoring

Monitoring activities under the LMIP are continuing and all associated studies have been completed. A review and analysis of the water-quality data is due in May, 2005; see Section 4.3 for further detail on monitoring activities.

4.1.3.5. Education and reporting

The community education and participation activities of the LMIP and its reporting activities are continuing; see Sections 4.4 and 4.5 for further details.

4.1.3.6. Specific localities (bays and catchments)

Fennell Bay/Edmunds Bay

Local dredging in Fennell and Edmunds Bays has been completed. A riparian vegetation restoration project is due for completion in March, 2005. Water quality and macroalgal monitoring will continue to June, 2005. The Fennell Bay work was a major sub-catchment improvement project which involved the preparation of a management plan and installation of eleven stormwater devices, as well as foreshore stabilisation and revegetation.

Cockle Bay

Works in this highly contaminated bay also included a comprehensive management plan and installation of approximately two kilometres of foreshore stabilisation and revegetation. Remaining rehabilitation works will be completed in Cockle Bay by May, 2005. Work has commenced on removal of the spit adjacent to the mouth of Cockle Creek. The project is due for completion in March, 2005. Monitoring activities will continue to June, 2005.

Warners Bay

All works have been completed with riparian vegetation for two creeks, two stormwater devices and approximately 1.5 km of lake foreshore stabilisation and vegetation.

Swansea Flats

All LMIP works projects have been completed for Swansea Flats. The projected development of a seagrass management plan by NSW Fisheries has not started, a decision of NSW Fisheries.

Manning Park to Gwandalan

The revegetation and foreshore stabilisation works in Manning Park and Gwandalan are nearing completion.

4.1.3.7. Evaluation

The tasks specified under the LMIP Action Plans for Stages I and II have been substantially completed. Comments on the environmental effectiveness of these works are made in Section 4.1. By mid-February, 2005 there were very few projects which had not commenced or for which detailed planning had not been completed.

This success in implementing a substantial program of works in a timely manner demonstrates careful management by the Coordinator and the capability of the staff of the OLMCC. That it has been achieved in spite of initial under-resourcing of the OLMCC is greatly to the credit of the OLMCC. The addition of a specialist staff member with project management skills and the use of a project progress-tracking system (Microsoft Project) has assisted.

4.2. Funding and remediation prioritisation

4.2.1. Background

The total expenditure on the LMIP to February 2005 has been approximately \$13.42M. Figure 4 shows expenditure over both stages over the LMIP. Expenditure on the LMIP peaked during the 2002/2003 financial year. The Figure demonstrates the considerable lead times required to implement works of this scale but also reflects initial under-resourcing of the OLMCC.

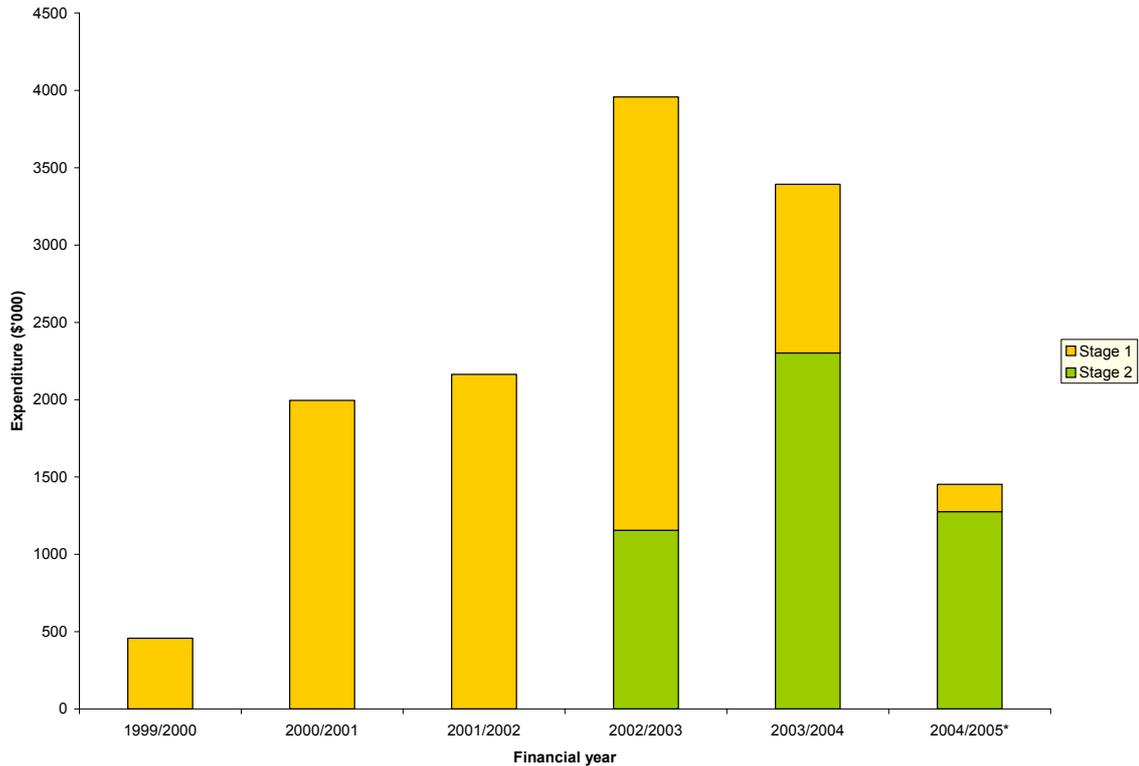


Figure 4 Total project expenditure (* to February 2005).

The proportions of expenditure allocated to catchment works, monitoring, administration, entrance channel works, education and lake works are shown in Figure 5. The balance of expenditure between these categories has been relatively constant over the course of the LMIP.

A relatively low proportion of total funds has been spent on direct administration. However, there are additional administrative expenses. Most notably, on-ground catchment works incorporate project management costs amounting typically to 5% of the capital value. There have also been substantial in-kind contributions to the project from the project partners, including human-resource management and provision of office space by Lake Macquarie City Council, and from all partners technical advice and time for senior representatives to take part in LMPMC meetings.

Maintenance of the installed works will be a significant and increasing burden on the councils' rates. Although the rate base rises, the maintenance burden will rise, but more slowly than the cost of completed works. Mr Farrell, as Group Strategy Manager for Lake Macquarie City Council, is well aware of the future implications, but at the time of our meeting had not yet projected the maintenance costs; the LMPMC meeting the following week was expected to provide them. As there will be no State funding of maintenance, it will have to come from general rates unless a new special rates levy is approved and implemented.

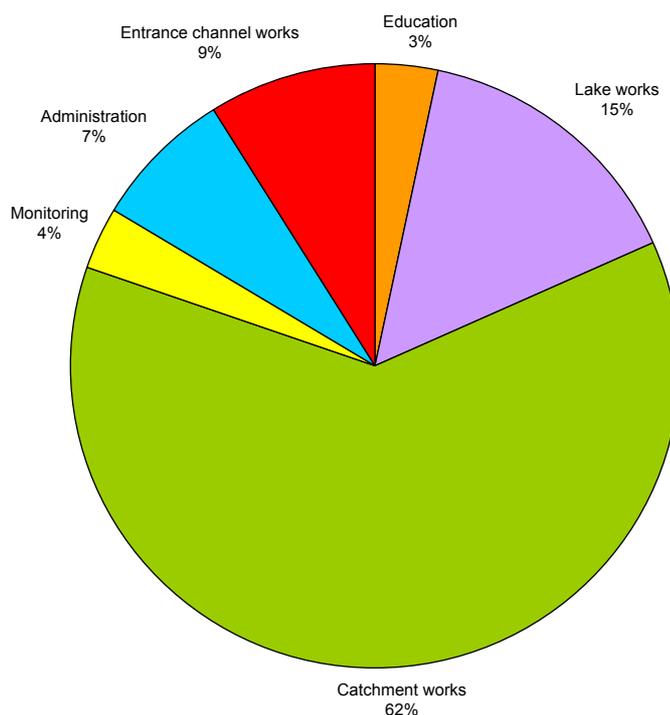


Figure 5 Proportion of expenditure by category.

4.2.2. Underlying drivers for remediation action

The activities of the LMIP have been necessarily constrained by the need to complete the specified tasks set out in the Action Plan of the LMT (1999). The original decisions made by the Premier's Taskforce as to the location and broad nature of works and other activities were informed by the Lake Macquarie Estuary Management Plan (EMP), which in turn took account of community perceptions and scientific and consultancy studies undertaken during its preparation. This mix is a common feature of the estuary plans developed along the NSW coast under the DIPNR (and former DLWC) Estuary Program. The Premier's Taskforce refined the EMP actions, extracting and further developing tasks it felt had high priority to achieve its objectives; the final Action Plan is the result of that review process.

The Coordinator of the LMIP was also given the scope to advise and comment on any new issues that might impact on or parallel the program. While this may have resulted in minor changes to the extent and nature of works, it does not seem to have resulted in major deviations from the Action Plan. On the advice of the LMPMC, an additional project at Black Ned's Bay was undertaken between 2001 and 2003. This project was closely associated with other works in the Swansea area and could be regarded as a complementary extension of an existing work program. Other minor works around the lake could be justified similarly.

While the larger works activities of LMIP have been accompanied by careful use of pre-works studies to determine detailed design, some concessions to community perceptions and pressure have been included in the design of works, especially in foreshore areas and their near-shore environments. This may be regarded as increasing public acceptance and local

ownership of the works, adding a high level of public amenity to the environmental outcomes of the work. Such an approach is entirely consistent with the “triple bottom line” philosophy adopted by the NSW State Government in its attempt to balance environmental, social and economic factors in making management and planning decisions.

Another feature of the LMIP actions has been the decision to study further some proposed actions before proceeding with implementation. Perhaps the best example of this is the commissioning of a study by WBM Oceanics into the feasibility of several dredging projects. These were then prioritised for future implementation according to the expected outcomes. This illustrates a sensible adaptive approach, evaluating the likely impacts and value for money of projects as more detail on the tasks originally prescribed becomes known. Where conflicts have arisen between the commissioned scientific studies and consultant reports on the one hand and community perceptions and expectations on the other, educational materials and media releases have been prepared to optimise acceptance of the altered decisions. The OLMCC has been crucial to the management of such issues, especially as the profile of the Coordinator has increased over the life of the LMIP.

4.3. Monitoring, past and future

The LMIP incorporates a substantial monitoring program with a total expenditure to February 2005 of approximately \$470k. The program includes ecological monitoring and mapping, community surveys, and physical and chemical water-quality monitoring. See Section 4.4.4 for details of the community surveys.

The ecological monitoring program has included a series of aquatic vegetation surveys of Lake Macquarie (see Gray and Wellington 2004; Wellington 2000). The surveys have been commissioned in conjunction with Delta Electricity and Eraring Energy. The aim of the studies has been to determine the distribution and relative abundance of the aquatic vegetation of the lake, including seagrass. The composition and distribution of aquatic vegetation has been observed along transects extending from the shoreline at intervals. From the transect observations, detailed vegetation maps have been drawn for the lake and the abundance of various aquatic vegetation categories estimated.

Results from the aquatic vegetation surveys show an increase in total seagrass cover and biomass across the lake between February 2000 and February 2004. The increase is apparent in both Northern and Southern sections of the lake. A 354 ha (35%) increase in seagrass cover has been observed. This includes an estimated 72% increase in *Posidonia australis* coverage, particularly in the Northern areas.

A macro-algal sampling program is also run as part of the LMIP at six sites. Quarterly transect sampling is undertaken to identify species occurrence and to measure biomass at a selection of sites.

The physical and water-quality monitoring program includes monthly chemical and bacteriological sampling at three sites in the main body of the lake. During the early stages of the LMIP, the monitoring program also included: (i) two-monthly chemical and bacteriological sampling at nine tributaries to the lake; and (ii) weekly sampling of bacteria levels over Summer at 15 bathing areas. Both elements of the monitoring program have since been discontinued. The first was designed only to provide a snapshot of catchment inputs and the second component has been substantially taken over by Lake Macquarie City Council.

A review of available water quality data from 1994 to 2001 was undertaken in 2002 (Eyre and Ferguson, 2002). Its major findings are summarised below:

- water quality in the main body of Lake Macquarie was generally good;
- water quality around the Lake margin was poorer, particularly in the northern part of the Lake;
- Northern creeks had the poorest water quality, with generally elevated nutrient concentrations, high suspended sediment loads, high bacterial levels and low dissolved oxygen concentrations; and
- nutrient loads to Lake Macquarie appeared constant despite increases in urbanisation; this was interpreted as probably reflecting the impact of nutrient reduction strategies.

Several recommendations were made by Eyre and Ferguson (2002) in an attempt to improve the utility of the results. In our opinion these recommendations are entirely appropriate. The next assessment of the monitoring, planned for May 2005, should build on this previous work. We recommend, for comparability, that the same group be commissioned for the study if feasible. In that study an assessment should be made of the effectiveness of the existing program and the needs of a future program.

Several specific questions are clear from the present situation:

- How can future monitoring distinguish large-scale improvements in the condition of the main body of the lake due to remediation work from the effects of climate variation and other influences independent of the LMIP? For example, increases in the extent of seagrass coverage between February 2000 and February 2004 have been registered but may be partially climate-induced. Similarly, improvements in water quality need to be apportioned as far as possible among reduction in industrial pollutant inputs, improved sewerage, and pollutant controls implemented through the LMIP works program.
- What local improvements resulting from remediation work can be demonstrated? The review team was given a good deal of anecdotal evidence that local improvements are substantial in various areas, but if the works program is to be properly evaluated, close examination of selected local monitoring results, and perhaps tailoring of future monitoring to local situations, are necessary, so that the effectiveness of individual wetlands, erosion control and stormwater interception can be assessed.
- How well have installed works coped with individual large rainfall events? Again careful and timely inspection of local monitoring results is needed.
- How much value has the LMIP had in terms of greater community awareness, and ultimately better community habits, for instance concerning sea walls on private land, minimising rapid runoff by refraining from hard surfacing, and avoiding pollution input to the lake? Although the OLMCC has commissioned regular telephone surveys of community attitudes, it may be necessary to extend them to increase confidence in the statistical significance of the results and to allow for the biases inherent in telephone and other surveys.

Some of these questions are not easy to answer, and some will require further monitoring over a number of years. **The scale of expenditure on the LMIP fully justifies the cost of determining properly how effective it has been, even when, as is often the case, monitoring over a long period and careful examination of results for specific purposes will be required.**

In the shorter term, the preparation of a new monitoring report is urgently required to assist in making informed decisions on the nature of continuation of the LMIP.

4.4. Community education and participation

A substantial component of the Lake Macquarie Integrated Estuary and Catchment Management Framework (LMT 1999) is a Community Education and Participation Action Plan. The underlying objectives of the program are to ‘foster community ownership’ of environmental problems and to ‘alter community behaviour and attitudes to local issues’ (LMT 1999). Education activities were suggested in the areas of stormwater pollution, management of litter, seagrass ecology, vegetation management, fish stock conservation and foreshore management. A set of broad actions was specified to meet the objectives of the Plan. They include preparation of newsletters; facilitation of Landcare and other environmental programs; reporting of monitoring results; and preparation of media releases.

The following sections describe the extent and success of elements of the community education and participation program.

4.4.1. Media coverage

The LMPMC and OLMCC have used media interest in their activities to meet their objectives under the Community Education and Participation Action Plan. Methods used include:

- advertisements in local newspapers to convey messages of the Action Plan (8-10 instances per year);
- preparation of media releases to generate news stories (8-10 instances per year), primarily informing the local community of forthcoming work and successful completion of other remediation activities;
- radio interviews in response to issues arising from activities of the OLMCC.

To illustrate the extent of media activity, Table 1 presents a summary of stories reporting activities of the LMIP in 2004. A comprehensive record for earlier years is archived by the OLMCC; a similar level of media coverage has been maintained throughout the LMIP.

Table 1 Summary of media activity in 2004

Month	Newspaper articles		Media releases	Radio
	Advertisement	General news		
January		4		4
February		5	1	4
March		3	2	
April		6		
May	4	7		
June	2	8		
July		5		
August		4	1	
September		7		4
October	2	4	2	
November		3		
December		1	1	

Most of the media coverage on the LMPMC and OLMCC is positive. This is attributable in part to the preparation of clearly written, factual and informative media releases. The production of media releases is handled by communication consultants, FordComm.

4.4.2. Website

The LMPMC and OLMCC have established a website <http://www.livinglakemacquarie.org> to assist in achieving their community education and participation objectives. It provides access to information including:

- background to the establishment of the LMIP;
- media releases;
- summary of the works program;
- biographies of staff of OLMCC and LMPMC members;
- information brochures;
- a glossary of terms used in describing lake and catchment remediation;
- detailed documentation e.g. community survey and consultants reports; and
- structured student and teacher resources.

Site visitors are invited to provide feedback on their understanding of a particular lake management issue, changed regularly, in the guise of a quiz (with modest numbers of responses in the cases examined).

The website is well designed and presented, easy to use, largely gimmick-free, factual and informative. The standard of writing in the detailed items is high. In the opinion of the review team it provides an excellent educational and community-awareness vehicle. The student support link is particularly informative and presented at an appropriate level. It describes issues affecting the sustainability of the lake, and provides summary statistics and links to additional information.

The website was established approximately six months after the start of the LMIP and was significantly overhauled in 2002. An average of 210 hits on the website occurred monthly during the period from June 2004 to January 2005. The website is hosted by FordComm and is regularly updated in conjunction with OLMCC. A screen view of the home page of the site is shown in Figure 6.



Figure 6 LMIP home page (as at 19/2/05).

4.4.3. Interaction with schools

The OLMCC has worked with several local schools to further the education and participation objectives of the LMIP. Of note is the involvement of:

- Lake Macquarie High School (Booragul) in a Waterwatch program for the Booragul wetland and creation of art work;
- Booragul Primary School in tree planting and the creation of art work for the Booragul wetland; and
- Callaghan College in annual boat tours of the lake.

The interaction with school groups has been focused on practical outcomes e.g. tree planting and art work creation, to create a sense of ownership in these projects and knowledge of the

broad objectives of the LMIP. The geographic focus of the program has so far been limited to schools in the North of the Lake catchment.

A Teacher Resource Kit has also been compiled, as a component of the Education and Participation Action Plan, by FordComm Consulting. The resource kit is very professionally packaged and incorporates a substantial quantity of background information for teachers and worksheet-style exercises for students. The information is presented at level appropriate for use in primary and junior secondary studies.

Overall, the value of interaction with schools appears high but the interaction is limited in geographic extent. It is suggested that it be extended to a greater number of schools. An assessment of the current use of the Teacher Resource Kit locally should be made and a strategy for promotion of the kit developed if necessary. The addition of some sample data sets from the monitoring program is suggested, to enable teachers to explore selected issues in greater detail with their students.

4.4.4. Community surveys

A series of surveys to measure change in community attitudes and behaviour has been commissioned by the OLMCC. They were conducted in April 2000, October 2001, July 2003 and December 2004. Each survey consisted of telephone interviews with approximately 600 residents of the Lake Macquarie area. The surveys aimed to (i) obtain information on the issues that concern local residents, (ii) gauge community perceptions about the local environment and (iii) gather information about community activities and impacts on the environment.

Survey results show an increasing rating of the overall environment of Lake Macquarie over the period of the LMIP (FordComm Consulting 2005). Noteworthy is a decline in the proportion of respondents rating the Lake environment as poor. Results show that respondents have also become more positive in their outlook on changes in the Lake. In 2004, 51.3% of respondents believed that quality of the environment had improved over the preceding five years, compared to 41.7% in 2000. The consistency of the trend between 2000 and 2004 gives some reassurance that sampling error in these small surveys does not dominate.

The series of surveys enables comparison between years and gauging of the success of the Community Education and Participation Action Plan. Results are encouraging, but it is suggested that the survey, in its current form, should continue and that consideration be given to increasing the sample size. At present it is barely large enough to identify with sufficient confidence changes of the size observed between successive surveys. Some minor revisions and alternative wording of questions may be needed to address identified limitations. The Lake Macquarie Integrated Estuary and Catchment Management Framework (LMT 1999) suggested surveys each three years (rather than the current 18-month interval). In the opinion of the review team, this reduction in frequency is undesirable as, although three-yearly surveys would be sufficient to gauge broad changes, they could not identify the influences of individual events or short programs. Moreover, reduction in frequency implies smaller total samples and lower confidence in the results.

4.4.5. Interpretive signs

Interpretive signs have been erected at the larger of the LMIP remediation sites. They perform an important education function and publicise some of the achievements of the LMIP. Sensibly, signs are particularly prominent in popular public areas and are sometimes accompanied by artwork produced by local school groups. The signs are factual, informative and of a high-quality design. At less prominent sites, a simple sign providing contact details of the OLMCC is generally provided.



Figure 7 Interpretive sign and artworks at a constructed wetland near Keith Barry Oval at Toronto West.

4.4.6. Publications

4.4.6.1. *Fact sheets*

A range of fact sheets, information pamphlets and boating stickers have been prepared by the OLMCC. These publications are concise and generally well written summaries of issues impacting on the lake. In most cases, practical ‘What can you do?’ summaries are presented. The fact sheets and information pamphlets have been distributed to schools and community groups and are also available from the OLMCC, the Lake Macquarie City and Wyong Shire Council offices and public libraries. In some instances, specific information is mailed to residents, especially about implementation of remediation works, e.g. the near-shore organic sediment removal and foreshore rehabilitation work at Village Bay. Boating stickers are distributed to boating retailers and are distributed by Waterways compliance officers.

4.4.6.2. Newsletters

A series of newsletters titled 'Living Lake Macquarie' has been produced over the course of the LMIP. The newsletters are written at roughly six-monthly intervals and describe the issues affecting the Lake and catchment and the activities of the LMIP. The newsletters form an important part of the community education and participation program.

The contents of the newsletter include a series of newspaper-style reports on issues affecting the Lake and on progress of remediation works. A list of completed and forthcoming projects is included in most newsletters. A regular column from the Chairman of the LMPMC provides a useful list of the highlights of the project and comment on key points. The newsletters effectively complement and reinforce messages of other publications of the OLMCC, particularly the fact sheets described above.

A consistent and pleasant layout has been used for the newsletters. All articles are generally well written and include relevant photos, diagrams and contact details for the OLMCC. Each edition is distributed to approximately 74,000 households in the Lake Macquarie area.

4.4.6.3. Annual reports

Annual reports for the financial years 1999-2000 to 2003-2004 have been presented by the LMIP. They provide (i) an overview of operations and comparison against objectives, (ii) committee membership (iii) performance highlights, and (iv) financial information and associated audit opinion.

The annual reports are concise summaries of the operations of the LMIP. They are clearly written and, like all publications of the LMIP, well presented. They enable tracking of the operation of the LMIP between years. However, some difficulty would be experienced in extracting financial information because of changes to the format.

4.4.7. Summary

The community interaction and education activities of the OLMCC have been energetic and, so far as can be gauged at present, successful. This is evidenced in part through the survey results but also indirectly by the quality of the community and educational material. Information is accessible to the community at a variety of levels, mostly focused on increasing understanding of issues affecting the health of the lake.

A substantial commitment of resources - approximately \$347k and up to 25% of the Coordinator's time - has been invested in education and participation activities over the term of the LMIP. This includes, for instance, responses to telephone enquiries from members of the public, which are time-consuming but likely to have a large influence on the individual's understanding and attitude and perhaps those of acquaintances. In our opinion, the Coordinator and Committee have been judicious in allocating time, effort and funding to community education and participation work. The Coordinator has shown a sophisticated and realistic appreciation of community attitudes and their importance for the success of such a program, and as a lifelong resident of the area has had the benefit of a very detailed knowledge of the local community and its concerns.

Any extension of the education and awareness program should continue the present tactics as far as resources allow. It could usefully aim also to raise awareness of the importance of the

less visible works in the catchment, and to distinguish the LMIP from the broader activities of the Lake Macquarie City Council.

4.4.8. Tender process

4.4.8.1. Scientific investigation and pre-works briefs

To assess the standard of briefs, three briefs for studies leading to works (T497, Q2222, T515) have been assessed. The briefs cover three types of projects:

- scoping and prioritisation of wetland rehabilitation works;
- feasibility study and works implementation plan for removal of organic sediment from bays and tributaries to Lake Macquarie; and
- investigation, design, specification and approval for navigation improvement works near the entrance channel.

All three briefs have a similar structure and are based on conventional project management outlines. The background, objectives and deliverable outcomes are clearly specified and consultant selection criteria and terms of engagement are presented in accordance with the DIPNR template. Proposed timing of activities is suggested and the addition of a number of hold points (beyond which no further work can be done before signing off by the Project Management Officer) ensures that the Project Management Officer can keep firm control of the project at critical times. The construction of these three briefs reveals an awareness of the requirements for engagement of consultants, as well as a thorough understanding of the background information leading to the issue of the briefs. The three briefs were prepared jointly by the Project Management Officer and the Coordinator.

4.4.8.2. Works briefs

Civil Lake, the Council commercial contracting arm, has generally undertaken the works on the ground for the LMIP. Civil Lake is externally audited and has a budget turnover of the order of \$50-60M p.a. It is subject to a formal policy determining when alternative tenders for work must be invited. While it includes a project fee in its quotations, it appears to be very competitive in its pricing. The LMPMC has requested that tenders be called for some larger works, and the value of using Civil Lake has been tested on at least two occasions through competitive tendering. In one case another contractor with specialist expertise and capabilities received the job. The design work carried out by LMC² Consulting Group (a business unit of Lake Macquarie City Council), has been assessed by an independent quantity surveyor and found to conform with industry norms and to be of good value.

The tender process is ultimately answerable to DIPNR as both the provider of funds and the nominal employer of the Catchment Coordinator. The Regional office of DIPNR indicated satisfaction with the processes undertaken during the LMIP. No information on the nature of evaluation of the process by DIPNR was obtained for this review. However, comments on the evolution of the project management seems to indicate a reasonable level of interaction and advice from DIPNR officers during the project. Further, the presence of the Regional Director, DIPNR on the LMPMC and management sub-group has allowed free information flow and close supervision.

4.5. Reporting and representation

Reporting to those responsible for the management of the LMIP has been straightforward because the directly interested parties have a seat on the committee and are represented at a senior level. No difficulties in communication between the LMPMC and the OLMCC were reported, and it was clear from the interviews that relations between the Office and Committee have been well informed, cooperative and effective.

Reporting by the management sub-committee has been written and monthly, in line with their intervals for meetings. No difficulties are evident in relations between the sub-committee and the LMPMC.

The split funding between the councils and state government makes close and frank relations between those bodies crucial. The close acquaintance of the Coordinator with Lake Macquarie City Council personnel and practices (as a former Environmental Manager of the council) and the good continuity of council representation on the LMPMC, have been strong points in ensuring good relations between the council, the LMPMC and the OLMCC. Wyong Shire Council has been much less well represented, with only sporadic attendance at LMPMC meetings, partly because of illness of their representative. Although the proportion of the LMIP involving Wyong shire is relatively small, that part of the program is quite large in absolute terms, so it is a little surprising that Wyong Shire Council has not been more heavily involved.

4.5.1. Technology transfer and knowledge dissemination

Considerable knowledge of the details of the factors affecting Lake Macquarie's environmental health, of remediation techniques, and of the delivery of a community education and participation program, has been developed during the LMIP. Delivery of this valuable body of experience to others who may be able to exploit it is a significant item in maximising the benefit of the program's expenditure. Several mechanisms have been used to transfer the knowledge generated in the LMIP, including:

- presentation of papers and posters explaining the LMIP and remediation techniques at technical meetings; this has included annual participation at the NSW Coastal Conference;
- encouragement of scientific publications by external researchers e.g. Geary et al. (2003);
- preparation of fact sheets describing remediation techniques (described in Section 4.4.6.1);
- public speaking engagements, particularly to service clubs e.g. the Coordinator was one of the main speakers at a full-day Environmental Forum hosted by the Local Federal Member of Parliament on Sunday 27 February 2005 at Swansea RSL;
- the coordinator provides advice to Lake Macquarie City Council on the directions of their modest (\$12k p.a.) research-support budget for the program. The budget receives bids for about 10 applications a year, primarily from postgraduate and Honours students.

Technology transfer to other bodies responsible for coastal lake environmental management is not specified in the LMIP and did not feature in the review team's discussions, but should be prominent in any plan for the future of the LMIP, as should continued support for promoting the achievements of the program.

4.6. LMPMC and OLMCC performance

The unusually long time scale of the LMIP, under a consistent funding regime and with little variation in administrative arrangements, has allowed employment continuity of specialist staff, pre-eminently the Coordinator. It has also allowed a substantial period over which to monitor and review the outcomes, and has allowed sequential development and improvement of techniques for management and restoration. Programs such as the NSW Estuary Program provide continuing support to local government, but not at the scale of the LMIP, and they do not have the budget to allow implementation to take place in such a timely and focused way as for the LMIP.

The LMPMC has also benefited from continuity of representation at a senior level. It has also been fortunate in the individuals representing important interests. For example, according to several of those interviewed, DIPNR representation has been exceptionally energetic and effective for much of the program, and was instrumental in the Committee recognising, well into the program and through commissioning of an independent review by Department of Public Works, the need for a larger establishment in the OLMCC. Another fortunate circumstance is that one of the community representatives has long experience of management at a senior level in the metal-refining industry, including a period with Pasminco, the zinc-smelting company running a smelter at the North end of the lake until its closure. He has thus been well placed to add to the LMPMC's knowledge of the associated management problems. Rather surprisingly, there is no Department of Lands representative on the LMPMC. There may be some advantage of inclusion of a high-level representative from the Department of Lands to assist in improving the approvals process for works to commence on Crown Lands.

The efficiency of the Office has to be assessed by reference to its areas of responsibility: execution of the program of works, dissemination and education, and, together with the LMPMC, prioritisation of items within the LMIP. The Office also plainly has an important de facto internal communication function of keeping all interested parties well informed of progress and forthcoming issues.

All the evidence available to the review team points to the execution of the works program thus far being well managed, with good consultation with affected members of the public prior to individual works; a transparent and efficient tendering procedure with sufficient cost comparisons and spending control; satisfactory performance by the contractors as far as can be seen on the ground in completed works; considerable thought put into public acceptability of work designs; sensible evolution of designs and of the detailed program in the light of experience; and good adherence to a schedule which will allow completion of the spending on time on 30th June, 2005.

Dissemination by the Office of news on the planned and completed works through written and broadcast media has been energetic and effective, as has distribution of material which is educational in the broadest sense (including well written explanations of environmental

problems and ways to mitigate them). Evidence for the value of this education and dissemination activity is provided by the results of the periodic telephone surveys (Section 4.4.4), by the very low level of unfavourable public reaction, which tellingly includes no adverse reaction to the special rates levy, and anecdotally by reversals in attitudes of some residents initially hostile to works because of local worries. The quality of the printed items and website material examined in the review was felt by the review team to be exemplary, both in content and in presentation.

Prioritisation of the work program by the LMPMC and OLMCC jointly has, in the opinion of the review team, achieved a good balance between visibility, amenity and environmental impact. It has also produced a wide spectrum of valuable experience on the conceptualisation, design, delivery and maintenance implications of remediation works. It is important that this experience should be made available to other management bodies with similar responsibilities, and thus that everything reasonably possible should be done to retain the Coordinator and Project Management Officer after the end of the current program.

The location of the OLMCC in Lake Macquarie City Council premises and the intimate knowledge of the Council's workings by the Coordinator through his previous employment by the Lake Macquarie City Council, together with the continuity of Lake Macquarie City Council representation on the LMPMC and the ability of the sub-committee to deal with short-term concerns, have ensured close and harmonious relations. Very high awareness of the issues and activities in the LMIP was clear among those interviewed, and all had uniformly positive and supportive attitudes to the Office and the LMIP. For these reasons the review team concludes that the internal communication function of the Office has been carried out very successfully.

The advantages of time scale and continuity in implementing the key strategies identified in the Lake Macquarie Estuary Management Plan are offset by uncertainties at the end of the funding period. A weakness of the Plan is omission of any requirement for forward planning beyond the present term. This appears to have been reflected by a surprisingly late start by the LMPMC to developing a consensus on what should follow the program, and to preparing a case for future funding. In the view of the review team, the time for the review was at least six months ago, so that its conclusions would be available to the LMPMC in planning beyond the end of the LMIP. Similarly, the forthcoming review of monitoring, covering the period since 2001, will be some months too late in informing consideration of future work. The review team did not detect a concerted view on how the program should be continued, beyond the strongly expressed opinion that it should continue in some substantial form. The Acting Regional Director of DIPNR outlined the main options for continuation to the team and some of the practical considerations in seeking funding, yet the impression was obtained from the members of the LMPMC interviewed that discussion in that direction had not yet progressed far. From the information available to us it appears that the LMPMC is currently not in a position to respond in detail to a formal request for a forward plan for the next three years. There are some practical reasons why forward planning is not straightforward; for instance, a channel-dredging plan has to await the Swan Bay partial closure to see its effects on shoaling. Uncertainty over the feasibility of a further special rates levy may also have inhibited planning, but initial program planning has to precede planning to fund it, if only to set the scale of the problem.

Lake Macquarie City Council has clearly already put considerable thought into future implications for the rates, but the council is working largely in the dark until the LMPMC's plans and how they hope to realise them are clearer. [The review team stresses that this comment originates not from the Lake Macquarie City Council but from the team]. The Lake Macquarie City Council has decided to ask for an extension of the LMIP at the present scale, which is consistent with the scope for further foreshore and catchment works.

Relations between the OLMCC and the LMPMC are, of course, critical for the effectiveness of the LMIP's implementation. The Coordinator indicated satisfaction with the degree of engagement and preparedness to work of the Committee. The Committee identified the inadequacy of the resources for implementation of works by the OLMCC early enough to allow the works program to be completed in good order by the end of the six years' funding. However, it took longer than one might reasonably hope (over two years) to identify this difficulty, and the delay may have contributed ultimately to the LMPMC's late addressing of what should follow the LMIP.

5. Relationships in an evolving natural resource management structure

5.1. Local Government

The broad relationship between the LMIP and the Lake Macquarie City Council has been relatively constant over the life of the LMIP. The Council has assisted in the development of efficiencies in staffing and work practices and has absorbed some of the administration costs involved in hosting the OLMCC. The Council's requirements for workplace safety, staff training and the like have been incorporated into the LMIP as they evolve. The availability of the special rates levy and the matching State Government contribution has allowed some financial independence from the Council, although accounts are processed through the Council system. The relationship with Wyong Shire Council is less interwoven and appears to be largely carried out through representation on the LMPMC and contact between the OLMCC and individual council officers.

5.2. Lake Macquarie Estuary Management Committee

The Lake Macquarie Estuary Management Committee is a committee of council, established under the DIPNR Estuary Management Program. It is a continuing committee and assists Lake Macquarie City Council to obtain limited funds available through the DIPNR Estuary Management Small Grants Program. These funds are made available each year (50% matching funds) on application by Council. This funding, however, is quite limited and highly competitive because of considerable demand by other local councils along the NSW coast. Difficulties in the timing of the availability of these funds and the mismatch with local government budget planning need to be resolved with this funding source. This is compounded by the single-year nature of the funding, making it difficult for local government to guarantee funding over the life of major projects, let alone a coordinated program such as that operated under the LMIP. It was partly for these reasons that the special arrangements for the LMIP were introduced by the Premier's Taskforce. The LMIP has operated alongside the Lake Macquarie Estuary Management Committee with a considerable overlap in committee membership. This has allowed the efficient implementation of major projects while retaining

the strong community links and involvement with the DIPNR Estuary Program. The two organisations are seen as complementary rather than competing.

5.3. State Government

The relationship with State government agencies has adapted over time, especially the interactions with DIPNR, who have facilitated the LMIP staffing developments. Interactions with other State government departments appear to have been constructive, helped by the presence of senior representatives from a number of agencies on the LMPMC or available on request. Over the life of the project, and partly because of the LMIP framework's stated aim of trying to streamline the approval process for on-ground works, it has become apparent that more permanent representation from the NSW Department of Lands would assist. The recent changes in DLWC (DIPNR being formed through amalgamation with Planning NSW), moving some functions to other departments and moving staff to the newly created Department of Lands, has probably heightened this need.

5.4. Hunter-Central Rivers Catchment Management Authority

The creation of the CMAs has introduced a most fundamental change in the structure of environmental management in NSW, as the CMAs are expected to take over much of the coordination of funding for on-ground remedial and conservation works in the State. The CMAs and their predecessors, the Catchment Boards, have been responsible for the preparation of Catchment Blueprints which will operate as broad policy documents to drive environmental management over the range of environments in their areas and to coordinate funding and works activities on both public and private land. They are currently developing Catchment Action Plans (CAPs) which will detail the actions over a three-year period for their catchments.

Some discussions between the OLMCC and the HCR-CMA have taken place but as the HCR-CMA has only recently been established, these have not progressed to the point where a defined relationship can be set out. Should the activities of the LMPMC and OLMCC continue in current or other form, these discussions will be essential to the efficient conduct of both organisations. The current development of the CAP should include such discussions. In the course of this review, contact was made with Mr Glen Evans, the CEO of the HCR-CMA. Mr Evans indicated that with only 21 core staff, the HCR-CMA will depend on the establishment of working partnerships with other organisations, particularly to manage and progress local projects. Projects such as the LMIP will be key players in this process and it is fortunate from the point of view of such cooperation that Cr. Neil Rose, a member of the LMPMC, is also a board member of the HCR-CMA.

The HCR-CMA activities will have their own priorities as outlined in the Blueprint and will probably focus on interaction with private landholders to gain more widespread outcomes. There is still a place for substantial extension of the current LMIP work program to catchment areas away from the lake frontage. Funding at a comparable level to that available during the last six years would be needed to progress this work over the short to medium term. With a significantly lower level of funding, it is likely that only repair and restoration works will be undertaken by the Council and will most probably be driven by community pressure where obvious problems exist. The Council would therefore be more likely to fund activities in built-up areas rather than the sparsely occupied rural sections of the catchment. This might

well result in only short-term work being undertaken, at the expense of more strategic conservation measures which would gain better environmental outcomes over the long term.

Current HCR-CMA priorities, as outlined in the Blueprint, include improvements in water quality in Lake Macquarie through the reduction in sediments and pollutants entering the water body, by rehabilitating and protecting riparian vegetation, improving stormwater management and reducing erosion. The LMIP program to mid-2005 will have partly addressed these goals, mostly close to the lake itself. As already indicated, there is a need to extend the activities into the catchment further from the lake, to increase control over pollutants nearer their sources.

It is our opinion that if the LMPMC and OLMCC are to be included in working partnerships with the HCR-CMA, it will be necessary either to continue the present funding and organisational arrangements or at least to provide for a transitional period to preserve the working arrangements in a modified form. If the HCR-CMA were informed that the LMIP was to continue, it could then include this process in the CAP for the next planning period. Such a decision is urgent if the CAP is to be developed within its planned time frame in early 2005.

There appears to be no conflict between the extension of the LMIP and the HCR-CMA operations and objectives, rather the opposite. The HCR-CMA could benefit from the LMIP activities over public and Crown land, allowing it to concentrate on other partnerships with private landowners and community groups to gain broader benefits over the Blueprint priority catchments of Dora Creek and Cockle Creek. Economies and additional funding for such activities could be gained through the HCR-CMA, and the LMIP could provide one of the principal mechanisms for the construction of remedial works in the catchment. Also, through their local planning function, the two councils could incorporate both the LMIP and HCR-CMA objectives into the local LEP, assisting the remediation and conservation works by providing planning protection.

6. Conclusions

The following is a brief summary of the strong and weak points of the LMIP and its implementation, as perceived by the review team.

6.1. Strong points of program

- The scale, duration and continuity of funding, including access to local funding base via the special rates levy, with minimal negative public reaction to its establishment and its Stage II continuation.
- Access to a scientifically robust yet flexible plan for effective implementation of remediation measures, viz. LMT (1999).
- The appointment of a Coordinator with excellent local knowledge and experience and with a broad and deep appreciation of local environmental issues, including the need for community education and participation.
- Broad, senior representation on the LMPMC, and the continuity of its membership.

- The opportunity, well taken especially by the OLMCC, to evolve techniques and change community attitudes and priorities in the direction of greater efficiency and stakeholder satisfaction.
- The evolution of an effective management structure and practices, in the shape of the management sub-committee, the Coordinator's office and their relations with the LMPMC and DIPNR.
- Enterprise and intelligence in engaging the public, in finding some non-obvious but very good solutions to local problems (e.g. restoration of a second creek inflow and very limited dredging, instead of larger-scale dredging, in Edmund's Bay), and in balancing visibility, amenity and environmental health.
- High visibility and expected effectiveness of remediation activities.
- The Coordinator representing a point of contact for the community, a CEO function for project management and an organised contact for coordination of agency inputs to the program.
- The support of well resourced, forward-looking councils (especially the hosting of the OLMCC by Lake Macquarie City Council).
- Clear excellent cooperation and individual enthusiasm among all the bodies encountered by the review team (including crucially Lake Macquarie City Council).
- Achievement of apparent improvements in community awareness and changes in community attitudes through good dissemination of information, early engagement of the community in individual works and issues, education, extensive use of media (including a good website) and the intention to get some issues (e.g. sea walls) addressed by residents themselves.
- Implementation of the works program, largely on schedule, within budget and substantially complete by the Stage II end date.
- Generation of valuable and potentially exportable experience and good practice.
- Involvement of university students and researchers in Lake-based projects.
- Support of Landcare projects by small grants (on projects in harmony with the LMPMC aims).

6.2. Weak points

- Very slow appreciation of resource needs, and more specifically of the need for a Project Management Officer, in view of the size of the works schedule and the requirement for the Coordinator to discharge a large and time-consuming range of other duties.
- Late planning for a successor to the LMIP, especially in (i) preparation of a prioritised works program for the future, (ii) commissioning of a review of water quality monitoring data collected post-2001, and (iii) preparing a case for further funding from the State Government or alternative non-council sources. This may result in a substantial hiatus in funding, risking the loss of critical staff (e.g. the OLMCC Project Management Officer, who is on a fixed-term contract).

- Lack of quantifiable performance measures, given the large intervals between monitoring reviews; reliance on anecdotal and individuals' comments as evidence, plus results of fairly small telephone survey of public satisfaction (biased by willingness to participate).
- Lack of provision for research into the scope and limitations of the remedial measures in improving water quality and ecological health, and into their long-term effects compared with other influences e.g. climatic variation and cessation of commercial fishing.
- The possibility of much reduced funding when only 15-20% (the Coordinator's rough estimate) of potentially useful works have been completed, and when the evidence is that public support for continuation is high.
- Potential waste of valuable experience and good practice if funding is only continued at a much reduced rate.
- Low level of formal dissemination of techniques and results of LMIP activities (e.g. published papers, conference presentations) and a lack of strategies for transfer of knowledge.

6.3. Overall appraisal

In our opinion the LMIP has been very successful. It has enabled the cost-effective implementation of a relatively large environmental works program that can be expected to provide substantial improvements in water quality in Lake Macquarie, particularly locally. The structures of the LMPMC and OLMCC have evolved over time and are now well-developed and particularly effective. Overall, the LMIP meets and in many cases surpasses the objectives and vision of the LMT (1999) report. There is scope for substantial extension of the LMIP, with suitable funding. Such extension would be able to capitalise on the established cooperation and goodwill of the project partners.

6.4. Recommendations

1. The LMIP should be continued at a similar scale of funding and personnel employed during Stage II.
2. The LMPMC, as a matter of urgency, should prepare a three-year action plan for Stage III. The plan should at a minimum specify:
 - i. priority remediation works (including, we suggest, an increase in the proportion of catchment-based treatments, and investigation of critical pollutant source areas to help focus future remediation activity);
 - ii. a refined monitoring program, able to assess improvements brought about by implementation of selected remediation works;
 - iii. a refined community education and participation program including further and wider interaction with local schools;
 - iv. arrangements to coordinate its activities with the HCR-CMA;

3. Approval should be sought by Lake Macquarie City Council for extension to the special rates levy and by the LMPMC for continuation of access to State Government funding.
4. Formal relationships should be established with the HCR-CMA to permit synergies between its activities and those of the LMIP. It is anticipated that a working partnership between the HCR-CMA and the LMIP would be very productive for both organisations. An assessment should be made of this relationship in the middle of Stage III to enable arrangements for the transfer of responsibilities and activities from the LMIP to the HCR-CMA if deemed appropriate.
5. The LMIP should seek to make its experiences, particularly of implementation of remediation works and community education and participation, available to other management bodies with similar responsibilities.
6. Representation from the NSW Department of Lands be sought on the LMPMC to assist in streamlining the approvals process.

7. References

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7.1. Briefs

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OLMCC (2004) T515: Brief for investigation, design, specification and approval of improvement works at the Swan Bay southern entrance.