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Basin Planning and Management: A Scorecard for Asia Pacific

Eva G. Abal, International WaterCentre, Ganesh Pangare, Regional Water & Wetlands Programme, IUCN, Bangkok, and Ian W Makin, Asian Development Bank



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Abstract

With rapid industrial and urban growth, increasing energy demands, the limited environmentally sound wastewater disposal in many Asia and the Pacific developing countries is rapidly becoming a serious social and human health issue. In a macro sense, a major challenge facing Asian developing countries is how quickly and how efficiently current wastewater management practices and processes can be substantially improved (ADB 2007). Increasing water pollution from accelerating domestic, industrial, and agricultural activities is a major issue for nearly all Asian developing countries. Without radical change in attitudes towards water quality management and responsibilities, it is likely that quality will be the most critical water problem of the future. The condition of water resources is dependent on the condition of the entire river basin.

The basis of Integrated Water Resources Management (IWRM) is that different uses of water are interdependent. Various models of river basin organizations (RBOs) are being called on to help manage rivers and other natural resources that must be shared among many parties. With the relatively rapid adoption of river basin management entities (RBME) as the key institutional element supporting the adoption and implementation of integrated water resources management (IWRM) in the region's river basins, there is a demand for systematic methods for identification of best practices in basin management. The paper presents tools to assist basin managers to improve the performance of the management entity and to measure the health of river ecosystems as one component of the triple bottom line objectives of economic, social and environmental improvement. Water quality and ecosystem health is considered here as a reliable and integrated indicator of the how effective IWRM is in the basin.

Benchmarking provides RBOs with tools to identify successful strategies, management approaches and that promote sharing of experiences in addition to learning from their own successes and failures. RBO benchmarking can improve the performance of the organization; however indicators are also required to measure the impact of that performance. As one component of such impact measures an integrated measure of the health of the water resources and waterways is required. River and waterway health Report Cards are proposed as tools to determine and reflect the response of rivers to management interventions. This paper presents case studies illustrating the use of Annual Report Cards and RBO benchmarking. Ongoing work to develop a river health index (RHI) is also presented for the Asia Pacific region. Like a School Report Card, the RHI provides ratings for 0 (fail) to 1 (excellent) for aggregations of waterways. A regular assessment of RHI would provide a timely reminder to government, industry and the broader community on how well the region's rivers are being managed and protected. Used in parallel with the RBO benchmarking and peer review processes these tools provide a framework to monitor and improve the performance outcomes in the management of the regions' basins.

A. Introduction

A need to manage rivers and river basins

1. Rivers provide goods and services to the human population. It is only fairly recently (1900s) that the delicate balance between people and rivers began to change – this was when the human population started to think of and treat rivers as agents of economic and social opportunity, waiting to be altered and utilized (www.nature.org). As such, due to pressures from human activities, most rivers are very vulnerable to the pressures they are subject to, including pollution, lack of environmental flows, watershed deterioration, climate change, and increasing population. There is a need to manage water resources and services and at the same, restore healthy rivers and their associated ecosystems. It is crucial to restore the vital river functions and ecosystems to ensure that rivers continue to provide the benefits that human beings enjoy and that form the basis for water security for all users.¹ Ecosystems can be considered (i) part of the basins' "infrastructure" that provides services and values; and (ii) as a good indicator of the overall performance of integrated water resources management and basin management actions.

2. The need for a coordinated approach to river basin planning and development has been increasingly evident (Downs et al 1991). As early as the 1980s, multiple objective approaches in managing rivers have resulted in the integrated approach to river basin management. The "...keep the water away from my door" became "... keep the water away from my door, clean up my waste, let me recreate on the river, keep my groundwater pure, reclaim my wetlands, provide water for my irrigation, and keep my lands free from erosion" (Coy 1981 – referenced by Downs et al 1991). Traditionally, river basin management has just been seen in terms of water supply. Many other functions of a river basin must be recognised, including agriculture, energy production, urbanization, tourism, nature conservation, and cultural values. It is now evident that river basins should be managed in an integrated way (Coccosis 2004).

River basin management and integrated water resources management

3. Integrated water resources management at the river basin level (referred to by some as integrated river basin management (IRBM) is considered to be the best tool, to increase water security in river basins. This recognition is illustrated in an agreement reached at the 3rd World Water Forum in Kyoto, Japan in the statement from the "IWRM and the Basin Management Theme" which states, inter alia, that

“the key issue confronting most countries today is that of effective governance, improved capacity, and adequate financing to address the increasing challenge of satisfying human and environmental requirements for water. We face a governance crisis, rather

¹ GWP summarize the environmental objective of IWRM as “The present use of the resource should be managed in a way that does not undermine the life-support system thereby compromising use by future generations of the same resource.” www.gwptoolbox.org/index.php?option=com_principle&id=7 (Accessed 30 September 2010)

than a water crisis. Water governance is about putting IWRM, with river and lake basin management and public participation as critically important elements, into practice.”

B. River Basin Management Issues in Asia and the Pacific

4. The nations of Asia and the Pacific are now facing new challenges in river basin management that have emerged over the past decades and for which traditional responses such as developing new structural interventions are unlikely to be available or adequate. They include the following:

- New and sharply increasing demands on water resources from industries, household uses, the environment, and fisheries;
- Rapid urbanization of population – estimated to reach 60% by 2025²;
- Rapidly growing water quality problems, from industry, agriculture and domestic return flows, erosion and sediment flows, and inadequate solid waste management (*Box ADB Water Outlook 2007*);
- New competition for water from biofuel production (e.g., for sugarcane or corn) and increased demand for energy production from hydropower and for cooling in thermal energy plants;
- Increasing exposure and vulnerability of urban populations, particularly the poor, to floods (*Meigh and Bartlett, 2010*);
- Growing impact of climate variability and climate change, including both more extreme events, higher temperatures, sea level rise, and increased demands on water resources (*box UNESCO*);
- Increasing awareness among civil society of social and environmental impacts of water abstractions and allocations, and changing land use on river health and environmental services;

5. Sound management of water resources is fundamental for sustainable development. Good water cycle management is vital for growth, social and economic development, poverty reduction and equity – all of which are essential to the achievement of the Millennium Development Goals (UNESCO 2009). GWP/INBO (2009) identify the need to link national policy setting and planning processes with basin management to lower risks and increase sustainability, while promoting economic growth; more equitable development and protection of the environment.. The path towards water security requires resolving tradeoffs to maintain a proper balance between meeting various sectors’ needs, and establishing adaptable governance mechanisms to cope with evolving environmental, economical and social circumstances. This is best achieved through basin scale planning and implementation of management actions.

6. UNESCO (*ibid*) promotes the use of a basin-level perspective to enable integration of downstream and upstream issues, quantity and quality, surface water and groundwater, and

² Asia Society, 2009. Asia’s next challenge: Securing the region’s water future. A report by the Leadership Group on water security. April 2009 New York.

land use and water resources in a practical manner. River basin management organizations³ (RBME), often some form of RBO, are intended to support the integration of physical and technical management of water resources and to manage the growing competition for water among agricultural, industrial, urban, and in-stream uses within basins. RBOs can help recognize the environmental impacts of water uses and water development at the basin scale.

7. Basin organizations are expected to facilitate a coordinated approach and to adopt the responsibility to provide regular reports on the status of planning and management, basin inventory and updates on the changes in the basin's water resources to local governments, private sectors, NGOs and other stakeholders, including civil society. UNESCO (ibid) recommends that a framework for regular self-assessment should be established, including the publication of annual 'state of the basin' reports to promote public accountability.

8. Performance benchmarking provides RBOs with tools to identify best practices and promote sharing of experiences in addition to learning from their own successes and failures. Hand in hand with River Basin Organization benchmarking need an integrated measure of the health of the water resources and waterways in their care. River and waterway health Report Cards are emerging as tools to determine and reflect responses of our rivers to management interventions.

Box 1

Climate change, including sea level rise, may result in increases in the number and severity of floods and droughts over current seasonal patterns. Climate change is the supply-side driver, which ultimately determines how much water is available, when and where – and ultimately how much we can use. (UNESCO 2009)

Box 2

In the Philippines, only about 33% of river systems are classified as suitable public water supply sources, and up to 58% of groundwater resources are contaminated. (ADB 2007)

C. Performance Measurement and Reporting

9. An effective framework for the monitoring, evaluating and reporting the performance and outcome of management efforts is a crucial component of IWRM in river basin management. Such a framework is required to not only to track the management and planning investments afforded in our rivers and basins, but to establish the responses of these complex systems to the pressures they are subject to and to specific any management interventions.

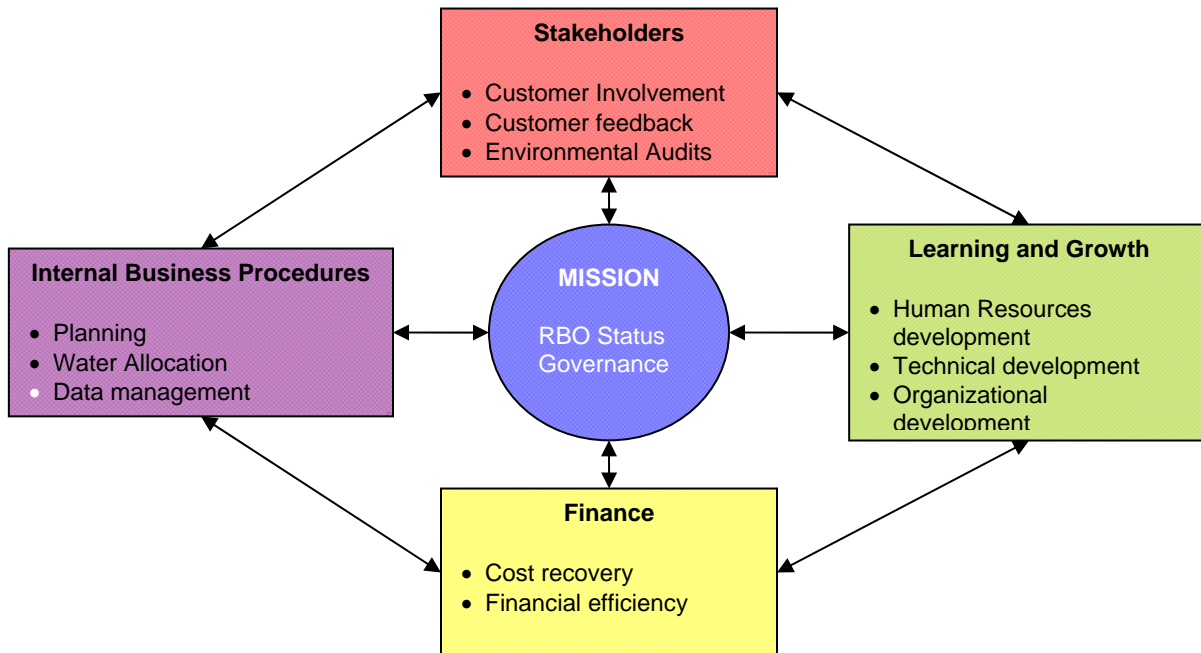
Benchmarking RBO performance

10. River basin organizations have emerged as the key institutional change in water sector governance in recent years. These new organizations are leading to increased involvement of

³ River basin organizations are used as a generic term for a range of formal and informal basin management and coordination arrangements. Various forms of river basin organizations are emerging, including inter alia: formal river basin organizations and commissions, councils, committees, or state-owned companies and organizations. The form of organizations for different scales of basin, such as small sub-watersheds, major tributaries, or international rivers require different institutional arrangements- see Shah et al 2006.

stakeholders and driving increased accountability of service providers across the public and private sector organizations involved in water resources management and water service delivery. As in many fields of business and service provision, both public and private sector, the recognition that increased accountability to the organizations stakeholder community is prompting the adoption of the principles of continuous performance improvement and total quality management, most often appearing as some form of benchmarking program. The Network of Asian River Basin Organizations (NARBO) has demonstrated how the concepts of benchmarking, originally developed by the commercial and corporate sector with a view to increasing operational efficiency to drive increased profitability have developed to support performance improvement in non-profit organizations such as public sector service organizations; mission led research groups; charities and NGOs. The application benchmarking through the NARBO benchmarking initiative has shown how these concepts can be applied in the context of river basin entities to help develop service oriented institutions, employing best-practice solutions to common problem and supporting the development of innovative solutions to less common situations.

Figure 1 Balanced Score Card - NARBO RBO Benchmarking Approach



11. The NARBO approach to performance benchmarking for RBOs was developed through a series of workshops with NARBO members to define 14 qualitative indicators. Each selected with the assumption that IWRM is a central mission (Figure 1) and with the indicators designed to reflect the development stage of an RBO in a particular area of performance. The objective is to enable individual RBOs to evaluate their performance in critical performance areas by comparison with the indicator guidelines. An example of the financial performance indicator is shown in Table1. The full list of indicators developed by NARBO is given in Appendix 1. As the organization matures the RBO can measure its performance both against the performance

targets it has set for itself and also against other similar basins to identify where its performance can be improved (Box Indonesia).

Table 1. Evaluation Guidelines for NARBO's "Cost Recovery" Indicator under Finance Performance Criteria

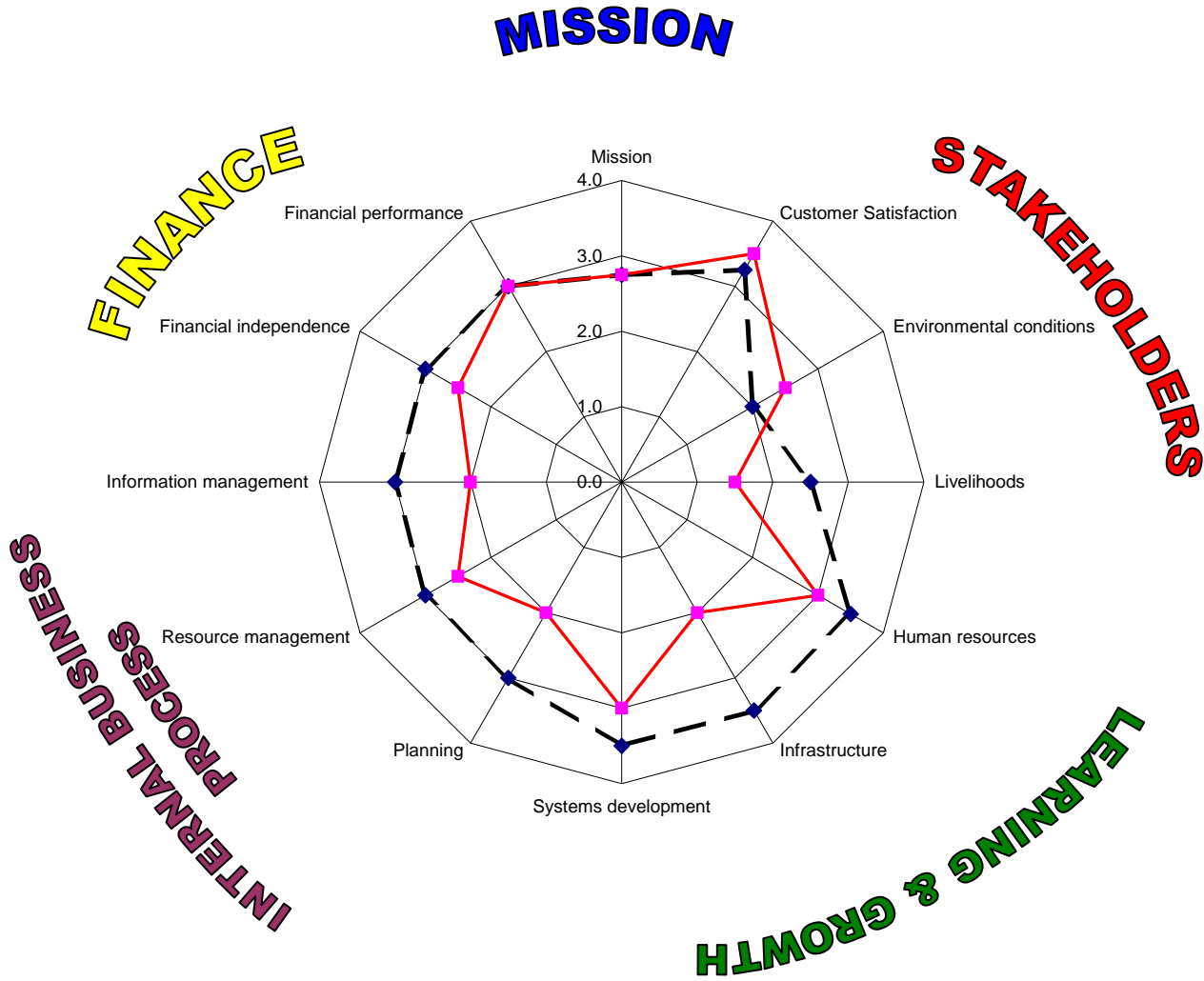
Indicator Values	How to evaluate RBO Performance
Operational costs recovered	<ul style="list-style-type: none"> • RBO income does not cover operational costs (Indicator value = 0.0) • RBO recovers about 40% of operational costs from water users (Indicator value = 0.5) • RBO recovers about 70% of operational costs from water users (Indicator value = 1.0)
Operational costs recovered from customers	<ul style="list-style-type: none"> • RBO recovers about 90% of operational costs from water users. Basic accounting procedures used do not show use of financial resources (Indicator value = 1.5) • RBO recovers 100% of operational costs from water users. There is a customer database and all users have license for water abstractions. There are clear processes for billing customers and accounts are audited annually and compliant with local financial regulations (Indicator value = 2.0)
Full operational costs and a proportion of development costs recovered from customers	<ul style="list-style-type: none"> • Operational costs plus some strategic maintenance costs are recovered from users. Fully audited accounts are available for review by stakeholders (Indicator value = 2.5) • Operational, maintenance, and some development costs included in financial plans are recovered through revenue. Budgeting and accounting are available to stakeholders (Indicator value = 3.0)
Basin operation and development costs fully covered by the operational revenue stream	<ul style="list-style-type: none"> • There are fully audited and compliant accounts. Internal financial management supports the development of plans typically including cost-benefit analysis and based on discounted cash flow. Financial management ensures the projected revenue covers the O&M and capital costs of Organizational plans to ensure sustainable IWRM in the basin (Indicator value = 4.0)

Box – RBO Benchmarking in Indonesia

Of the 133 RBOs in Indonesia some 27 RBOs are already participating in the Performance Benchmarking Program. The Directorate of WRM, (DGWR), Ministry of Public Works, Indonesia estimate it will take 5-7 years for all RBOs to be trained in the process and to have initiated benchmarking of their performance. .

An intrinsic part of the benchmarking program is the process for each RBO to formulate a strategy and action plan to improve its performance, including setting targets for the indicators. A team from the DGWR is implementing a program of continuous monitoring to assist the RBOs in the program to improve their performance. (Tjoek W Subijanto, President Director, Jasa Tirta I Public Corporation)

Figure 2 Comparison of Performance Indicators for Two Basin Organizations



Source: NARBO.

12. The form and functions of river basin management entities are different across the many countries and basins of the region. In some cases integrated management of river basins is replacing sector based management for the first time, and in many cases new water laws and regulations are being developed and implemented. Government agencies are devolving activities to new organizations, which include active participation of stakeholders from multiple sectors. In this changing environment the new organizations are developing their own processes to deliver the mandate they have been given to implement the new water governance structures, although limits in the available human and financial resources for these tasks are severe. However, in this period of evolution of basin management it is opportune to introduce the concepts of performance management to encourage these new entities to adopt continual performance improvement as a core management strategy.

13. To complement the performance benchmarking of the management entities, systematic methodologies for measuring the outcome of their actions on the condition of the water resources in their stewardship is required. The following section presents a case study of monitoring the health of rivers in Queensland, Australia and introduces a methodology being developed to assess the ecosystem health of the rivers of Asia and the Pacific.

Benchmarking the health of Asia and the Pacific's basins and rivers

14. In the last century, the human use of goods and service provided by rivers has changed the region's rivers significantly. These changes have impacted the river ecosystem, by dramatically reducing their species diversity and abundance (Admiral et al 1989) and the supply of goods and services, such as drinking water production, fisheries, and recreation (Lorenz et al 2001). Monitoring and evaluation provide valuable benchmark information that underpins the decision supports tools and provides real information to support the definition of quantifiable management targets. Monitoring also provides a measure of the relative success or other of implemented management actions.

15. Ecosystem health scorecards are an effective means of tracking and reporting the health of waterways at different scales. Scorecards have been increasing in popularity because they:

- Enable large and often complex amounts of information to be communicated to a broad audience, including the national and local political leaders and the media;
- Identify regions or issues of concern;
- Direct/focus management action: impetus for some costly (but environmentally important) intervention;
- Can provide accountability; measuring the success of a particular effort; and
- Provide a framework for monitoring, evaluation, reporting and communication activities

16. A scorecard can provide a transparent, timely and geographically relevant assessment of the health of waterways as a reflection of river basin management interventions. It is important for scorecards to reflect how community values the waterways and their basins. The Scorecard assists stakeholders to monitor how far conditions in the basin are from achieving targets that the community has set for its waterways. In the following section we introduce an example of the use of ecosystem health and score cards as a means to coalesce a broad partnership of stakeholders to bring about changes in basin management. The case study is from South East Queensland, however concerns about deteriorating river water quality have brought about similar efforts to change the management of river systems in Asia (box Nakdong River, Republic of Korea, Suzhou Creek, PRC).

Box Nakdong River Basin, Republic of Korea: Using water use fees to fund upstream river conservation

In the 1970s and early 1980s, Busan's drinking water source, the Nakdong river, faced pollution problems from upstream industrial activities. To reduce the impacts of pollution, the authorities in Busan added tertiary treatment processes in their water treatment plants, which resulted in increased operation costs that are then passed on to the

consumers.

However, studies show that the costs of protecting upstream water resources are much lower than existing downstream water treatment costs. The Busan authorities thus reshuffled their priorities to emphasize upstream protection, and established a River Basin Management Fund using water use fees.

The success of Busan's upstream water resource protection scheme has since prompted the central government to implement it across South Korea's major river basins.

Box Suzhou Creek, Shanghai People's Republic of China

Substantial pollution loads from industries, commercial establishments, and residential areas were discharged directly into rivers and waterways without treatment, causing environmental degradation, pollution of water resources, and public health hazards. Suzhou Creek is a major natural waterway that passes through Shanghai and in 1999 was considered the most severely polluted river in the city.

Following concerted efforts to improve water quality through a range of investments the community round the creek rated their satisfaction with urban environmental conditions increased from 12% at baseline survey to 71% in 2003. The level of satisfaction with water quality in Suzhou Creek was even higher, at 76% in 2003 compared with 12% in 1999.

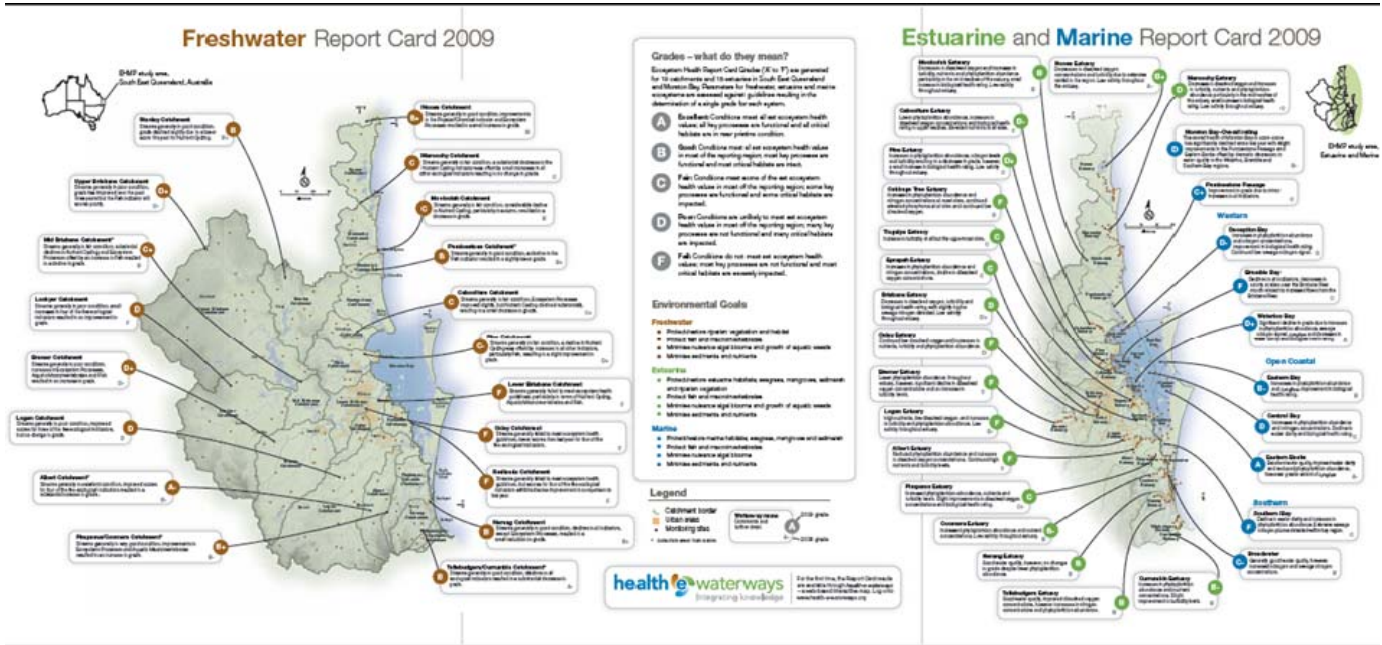
17. SEQ Healthy Waterways: A Case Study – The South East Queensland (SEQ) Healthy Waterways Partnership (the Partnership) framework illustrates a unique integrated approach to river basin and waterways management whereby scientific research, community participation, and policy/strategy development are done in parallel with each other. The Partnership represents a whole-of-government, whole-of-community approach to understanding, planning for, and managing the use of our waterways. The Partnership has led to significant cost savings by providing a clear focus on initiatives towards achieving the healthy waterways: healthy catchments vision which is: *By 2026, our waterways and catchments will be healthy ecosystems supporting the livelihoods and lifestyles of people in South East Queensland, and will be managed through collaboration between community, government and industry.*

18. One of the hallmarks of the Partnership has been the development of a comprehensive and defensible aquatic ecosystem health monitoring program (EHMP) to provide an objective assessment of the health of waterways throughout South East Queensland. The information collected in the EHMP is used to advise councils and land managers on areas of declining health, report on the effects of different land uses, and to evaluate the effectiveness of management actions aimed at improving and protecting aquatic ecosystems. EHMP forms an annual investment of approximately A\$2 million and delivers a regional assessment of the ambient ecosystem health of the region's waterways. The indicators used have been carefully selected and tested as either specific measures of the ecosystem assets or parameters that are known to have a direct influence on them (Bunn et al 2007).

19. The EHMP releases an Annual Report Card for SEQ's waterways (**Error! Reference source not found.**), which is the most important tool to communicate the health of the region's waterways, and to direct and provide an impetus for the protection and/or restoration of SEQ's waterways. Like a School Report Card, the waterways Report Card provides ratings for A (excellent) to F (fail) to the different waterways and regions of Moreton Bay. The Report Card

provides a timely reminder to local and State Governments and the broader community as to how well the waterways are being managed, protected, and restored to the desired healthy state.

Figure 3. Example of the Waterway Report Card the SEQ 2009 Ecosystem Health Report Card



20. Together with the Healthy Waterways Strategy, the Healthy Waterways Report Card has provided the impetus for A\$500 million of investment by local and state government bodies to upgrade sewerage treatment plants, reducing nitrogen loads entering the rivers and Moreton Bay by approximately 60%–70% with significant reductions in phosphorus levels also being achieved (HWP 2007). The initial investment of A\$2.0 million per annum has leveraged a commitment of over A\$500 million of management interventions to improve the waterways, not including investments addressing management of diffuse sources of sediment and pollutants in the basins.

21. The case study of Healthy waterways in Queensland demonstrates that an agreed monitoring program with a reporting system that is open and transparent is an effective tool in generating action to restore the status of the waterways covered by the report card. What lessons can be obtained of use in Asia and the Pacific?

D. A River Health Index for Asia

22. To provide a benchmark for assessing the state of the regions rivers the International Water Center (IWC), Brisbane, is collaborating with ADB to produce a River Health Index for Asia as one component of the next edition of the Asian Water Development Outlook (AWDO)

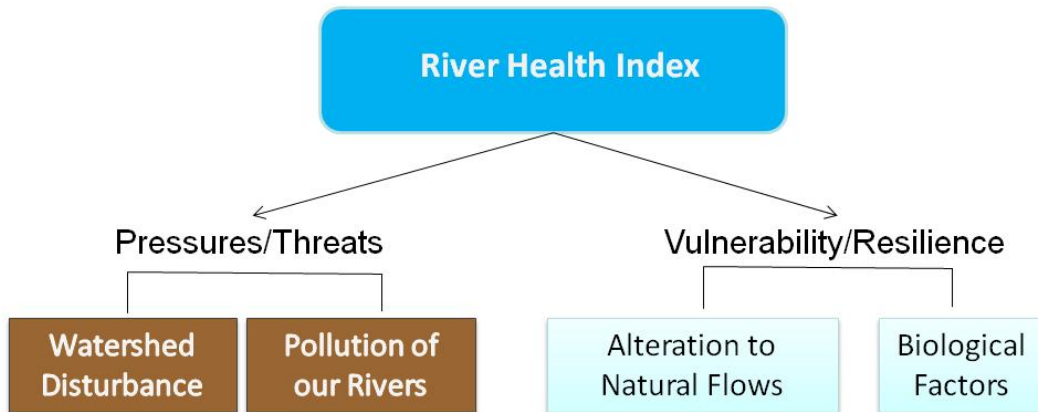
analysis of water security.⁴ The on-going analysis is revealing causes for considerable concern about the status of river health across the region.

23. The proposed River Health Index (RHI) is designed as a composite of indicators representing the capacity of river basins to maintain their designated functions, and associated goods and services for the Asia-Pacific Region.

24. The proposed set of 23 parameters that make up the RHI are evaluated (Figure 4) from a grid of indicator values in a geographic information system (GIS) based on a global spatial framework developed by Vorosmarty et al (2010). The indicators are then summarised by spatial aggregation to compute the River Health Index score for the river basin, region or country (**Figure 5**). Most rivers in this region appear to be very vulnerable to the pressures they are subject to, specifically in terms of

- (i) Watershed/catchment disturbance (4 parameters)
- (ii) Pollution (9 parameters)
- (iii) Water Resource development impacting on natural flow regimes (6 parameters)
- (iv) Biotic Factors (4 parameters)

Figure 4. Generating a River Health Index (Based on Pressure-Vulnerability Principle)



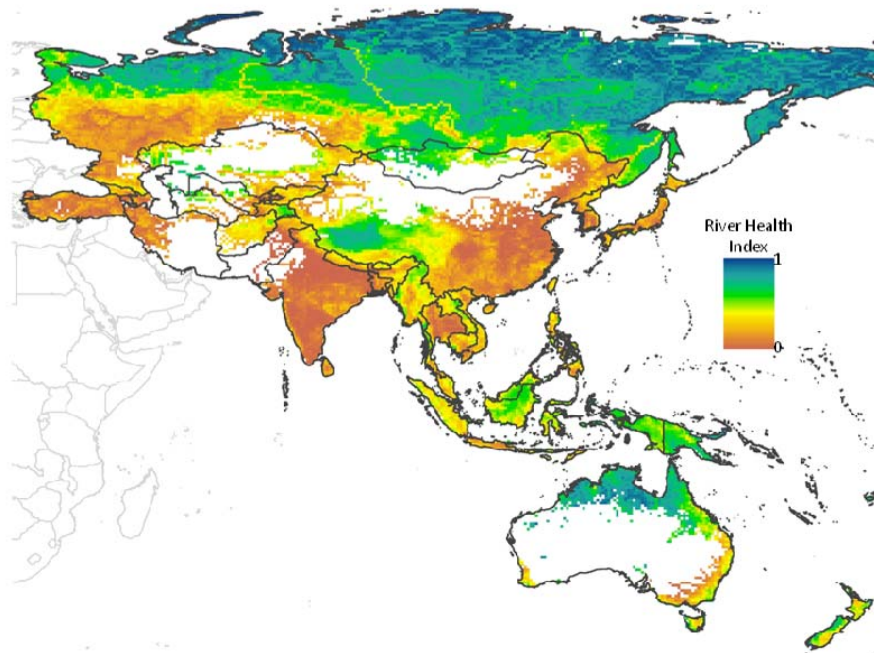
25. The River Health Index provides an assessment of river health based on a variety of drivers (pressures) and indicators of river health (resilience) (0-poor river health; 1- excellent river health). The River Health Index is the reverse of the Biodiversity Threat Index derived by Vorosmarty et al (2010). Over 80% of the rivers in Asia and the Pacific are assessed as having poor river health conditions when aggregated by country.

26. Of the four major drivers described above it appears the most significant impacts on river health across the region are the result of: (i) **watershed developments, including reservoirs**

⁴ A composite water security index (WSI) is being developed for AWDO that also captures both the social and economic status of national water resources. It is expected that the WSI will also be applicable at basin scale.

and land use changes, leading to alteration of natural river flows and impacting on environmental flows; and **(ii) pollution from agricultural, industrial, including extractive industries and associated processes, and domestic sources**. Increasing population densities and expansion of agricultural land comprise the major threats to the health of the region's rivers. The health of the rivers will continue to decline unless basin managers are able to commit resources to restore them.

Figure 5. Preliminary Assessment of River Health Index for the Rivers of Asia and the Pacific



27. The preliminary analysis indicates that there is an urgent need to manage water resources and services more effectively and at the same time restore rivers to more healthy conditions with viable ecosystems. Restoring the vital river functions and ecosystems is important to ensure that the rivers continue to provide the benefits that regions population currently enjoys.

E. Conclusions

Securing healthy rivers and water resources – Our responsibility to the future

28. There is increasing recognition that water and water resources management will be critical to the continued economic and social development in Asia and the Pacific. Most water services are dependent on effective basin management and the availability of adequate water resources of good quality water. The challenges of the Millennium Development Goals (MDGs) are currently in sharp focus with UNESCAP recently estimating that some 469 million people in Asia do not have access to safe drinking water and over 1.873 million do not have adequate

sanitation.⁵ A healthy river is an important foundation for the sustainable delivery of the services that are critical contributors to the reduction of poverty, sustaining food security and improving livelihoods for communities across the region. Poor water quality increases the cost of treatment or limits the safe uses of that the water.

29. Political will and demonstrated leadership is crucial to success of river basin management. Experience shows that community willingness and understanding and the efficacy of implementation are often strongly correlated to the level of institutional capacity and strength of the governance structures that underpin them. River basin health improvement requires a multi-sectoral governance approach that is dedicated, proactive and strategic (Brown and Clarke 2007). This need is amplified where there is no accepted 'crisis' or perceived need by the public to implement change. There is a growing literature on what the likely institutional impediments are to achieving sustainable water management (adapted from Brown and Clarke 2007), including

- fragmented administration frameworks, lack of coordination and poor definition of roles and responsibilities leading to an inability or unwillingness to consider their mandate relative to those of other organizations;
- insufficient skill and knowledge across the range of related disciplinary fields, particularly at local level as responsibilities are developed to basin and local government entities;
- lack of a shared vision

30. Management actions do not necessarily require huge financial investments but rather an investment in human capital, cooperation and leadership. Nonstructural solutions such as education, behavior change, capacity development, and policy and planning tools require relatively low financial investments but can produce large improvements in river health.

31. Improving the performance of river basin management organizations, to achieve the goal of healthy rivers, requires strong leadership from motivated individuals; supported by an enabling sociopolitical environment and key stakeholders. While changes may be required in the water sector in general, it will be down to individual basin management organizations to implement and take ownership of performance improvement programs, such as benchmarking, in their own organizations. It will largely be their commitment and performance that will drive the success or otherwise of the process of management changes (Malano et al 2004).

Forging a sustainable future for Asia and the Pacific rivers

32. It is crucial that the value of the region's rivers, and the goods and services they provide to the human population, is adequately recognized. The valuation of river ecosystem services provides a strong rationale for the need to protect the rivers in good health and restore the ones in poor health. The total value of the world's freshwater ecosystem services (which include fish production, retention of groundwater and climate regulation, amongst other functions), has been estimated to be up to US\$5 trillion annually. Global and per hectare values of ecosystems have

⁵ Update on progress towards MDGs - www.adb.org/Documents/Reports/Asia-Pacific-MDG-2010/mdg-paths-to-2015.pdf (Accessed 27 September 2010).

been calculated based on the estimation of the indirect values of the aquatic ecosystems in flood control, groundwater recharge, shoreline stabilization and shore protection, nutrition cycling and retentions, water purification, preservation of biodiversity, and recreation and tourism (Costanza et al 1997, Millennium Ecosystem Assessment 2005).

33. There is a need for urgent actions that can not be postponed until we have “enough” information to fully understand the health status of the river basins. These actions will require improved understanding of the means for dealing with resource management issues and the use of flexible approaches to cope with changing socio-economic or socio-ecological relationships. IWRM is a very good example of an adaptive management technique, illustrated in **Error! Reference source not found.**. Adaptive management and the UNESCO (2009) spiral process model encourage basin managers to focus on immediate basin issues and generate improvements with a triple bottom line of economic, social and environmental improvements. Basin organization benchmarking; the river health index and waterway scorecards provide important foundations for Asia and the Pacific to take up the challenge of securing the future of the regions water resources with healthy rivers.

Figure 6. Adaptive management framework that needs to underpin river basin management



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Appendix 1 NARBO RBO Performance Indicators in each of the five critical success factors

Indicator	Maximum Score	Remarks
MISSION		
RBO Status	4.0	A measure of the RBO development and extent of stakeholder involvement in, and quality of, the organization's decision making process.
RBO Governance	4.0	A measure of the national, regional, and organizational framework that support good governance.
STAKEHOLDERS		
Customer Involvement	4.0	A measure of the level of customer involvement in the decision making of RBO and, therefore, their acceptance of the organizational goals and operation.
Customer Feedback	4.0	A measure of the level of customer involvement in the decision making of RBO and, therefore, their acceptance of the organizational goals and operation.
Environmental Audits	4.0	A measure of the level of environmental awareness and intention to protect against environmental degradation.
Basin Livelihoods	4.0	A measure of the overall change in livelihoods in the basin
LEARNING AND GROWTH		
Human Resource Development	4.0	A measure of the maturity and effectiveness of HRD system within RBO reflecting its likely contribution to achievement of organizational objectives.
Technical Development	4.0	A measure of the level of commitment to adopt appropriate technology solutions that will aid in the delivery of the mission.
Organizational Development	4.0	A measure of the commitment to quality management through application of quality management system or similar management improvement tools.
INTERNAL BUSINESS PROCESS		
Planning Maturity	4.0	A measure of the level of planning operating within the RBO and its likely impact on delivery of mission.
Water Allocation	4.0	A measure of water resource allocations in the basin that determine delivery and performance of water services.
Data Sharing	4.0	A measure of the commitment to and implementation of effective data management and information dissemination.
FINANCE		
Cost Recovery	4.0	A measure of customer service and strength of budget management.
Financial Efficiency	4.0	A measure of the commitment to most efficient use of financial resources in pursuit of delivery of the mission.